**The Meteoritical Bulletin, No. 106**

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**SUPPORTING INFORMATION**

Additional supporting information may be found in the online version of this article:

- Online supplement 1: Table of Data including Antarctic meteorites

- Online supplement 2: Table of Corrections

- Data S1. A complete copy of entire Meteoritical Society Bulletin can be found in the supplementary information of this article as well as on the Meteoritical Bulletin Archive page at http://meteoriticalsociety.org/?page\_id=57. Information about the approved meteorites can be obtained from the Meteoritical Bulletin Database (MBD) available online at https://www.lpi.usra.edu/meteor/.

**Abstract**

Meteoritical Bulletin 106 contains 1868 meteorites including 10 falls (Aiquile, Broek in Waterland, Degtevo, Dingle Dell, Dishchii'bikoh, Hradec Králové, Kheneg Ljouâd, Oudiyat Sbaa, Serra Pelada, Tres Irmaos), with 1386 Ordinary chondrites, 166 Carbonaceous chondrites, 119 HED achondrites, 48 Lunar meteorites, 37 Iron meteorites, 36 Ureilites, 19 Martian meteorites, 13 Enstatite chondrites, 12 Rumuruti chondrites, 9 Primitive achondrites, 8 Mesosiderites, 5 Enstatite achondrites, 4 Ungrouped achondrites, 4 Pallasites, and 1 Relict meteorite. 958 meteorites are from Africa, 405 from Antarctica, 245 from Asia, 228 from South America, 12 from North America, 8 from Europe, 5 from Mars, 4 from Oceania, 1 from an unknown location.

**1. Trends and specificities**

Meteoritical Bulletin 106 (MB106) reports the 1868 meteorites reported to and accepted by the Nomenclature Committee of the Meteoritical Society in 2017. This number is diminishing after a peak in MB102, reflecting mostly a decrease in the number of Antarctic meteorites being declared, and masking an increase in the numbers of meteorites from Northwest Africa (NWA) and from other non-Antarctic areas (Figure 1). Antarctic and NWA meteorites make up 22% and 33% of the total number of meteorites in MB106, respectively. As for the last few years, Chile (224 meteorites), Oman (129 meteorites), and Iran (98 meteorites) are now the main meteorite providers outside of NWA and Antarctica (Figure 2a and 2b), whereas meteorite falls continue to come from densely populated areas (Figure 2c).

The 1868 meteorites in MB106 total over 12 tons, including ~6 tons of iron meteorites (5 meteorites) detected at the surface of Mars by the Curiosity rover, and 2.8 tons of the Sericho pallasite (Kenya).

Of particular significance for 2017 is the large number of Lunar meteorites, with 48 meteorites totaling over 60 kg, with 11 stones over 1 kg and a large 15.46 kg stone (Figure 3). All these lunar meteorites are from NW Africa (Morocco, Western Sahara, Algeria) and coordinates are known for 8 of them from the Rabt Sbayta, Talhat Lihoudi and Tichiya dense collection areas. Many of these stones are likely paired.

A similar surge in Martian meteorites is observed with 19 meteorites totaling over 10 kg, including two meteorites over 2 kg (Figure 3). Again all these meteorites are from NW Africa. 16 are shergottites, and the remaining 3 (including Rabt Sbayta 003 for which coordinates are available) are basaltic breccias paired with NWA 7034.

**2. Notable meteorites**

Two non ordinary chondrite falls are reported: Oudiyat Sbaa (EH5), and Serra Pelada (Eucrite). Other notable meteorites include Sericho (pallasite from Kenya with total mass over 2.8 tons), Los Vientos 200 (a fresh CH3), iron meteorites from Mars (Aeolis Mons 001 and 002 and Aeolis Palus 001 to 003), Los Vientos 189 (a 70 kg anomalous IID iron), Rabt Sbayta 004 and Tichiya (lunar feldspathic breccia of 15 kg and 9 kg, respectively).

**3. Alphabetical text entries for non-Antarctic meteorites**

**Abarkouh 004**        31°15.808’N, 53°25.236’E

Fars, Iran

Find: 2016 Oct

Classification: Ordinary chondrite (L5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Abbans-Dessous**        47°7.905’N, 5°52.533’E

Franche-Comté, France

Find: 2015 Jul 25

Classification: Ordinary chondrite (LL6)

**History**: On 25 July 2015, while he was looking for fossils in the Franche-Comté region, geologist Quentin Louis discovered a small black stone in the vicinity of Abbans-Dessous village, and recognized it as a possible meteorite. On 3 August 2015, he contacted Fabien *Kuntz*, a meteorite hunter living nearby in Besançon, who confirmed the stone was a meteorite. Despite several days of hunting together in the area over the summer 2015, and a notice to the local population, no other stones were found.

**Physical characteristics**: A single, fully crusted, roughly cubic stone.

**Petrography**: Microscopic observations on a polished section show a recrystallized chondritic texture with chondrules making most of the volume. Plagioclase to 100 μm. Chromite to 150 μm. The bulk density (bulk volume from X-ray microtomography) is 3.15 g/cm3 in agreement with the average LL value (3.21±0.22, N=39 falls, see [Britt and Consolmagno, 2003](http://onlinelibrary.wiley.com/doi/10.1111/j.1945-5100.2003.tb00305.x/pdf)).

**Geochemistry**: Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.20. Saturation magnetization (measured on the full stone) is 3.74 Am2/kg. Other magnetic properties indicate that a significant fraction of the FeNi metal is tetrataenite. Olivine Fa29.0±0.1(N=2), Orthopyroxene Fs23.9±0.3Wo2.0±0.2(N=2).

**Classification**: LL6.

**Specimens**: Type specimen (including a polished section) at *CEREGE*. Main mass with the finder Quentin Louis.

**Acfer 045**        27.75°N, 4.7°E

Tamanghasset, Algeria

Find: 1989

Classification: Ordinary chondrite (LL5)

**History**: (P. Sipiera, *PSF*) This meteorite was part of a large number of specimens collected in 1989 from Tamanghasset, Algeria at 27.75°N 4.7°E.  The specimen was purchased from a Swiss dealer by the late James *DuPont* later that same year, and subsequently it was bequeathed to the *PSF*.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Mostly recrystallized with sparse chondrules and stained metal.

**Geochemistry**: Olivine (Fa30.0-31.8, N = 3), orthopyroxene (Fs23.6-24.6Wo1.8-1.7, N = 3), clinopyroxene (Fs8.4-9.1Wo44.9-43.9, N = 2).

**Classification**: Ordinary chondrite (LL5).

**Specimens**: The entire specimen including one polished thin section is at *PSF*.

**Aeolis Mons 001**        -4.70156176, 137.3560462

Mars

Find: 2016 Oct 30

Classification: Iron meteorite

**History**: The MSL rover Curiosity observed a very small rock informally named Egg Rock (Henceforth Aeolis Mons 001), on sol 1505. The rock was about 2.5 m from the rover, which was close enough to interrogate with Mastcam and ChemCam (LIBS chemical analysis and RMI). Aeolis Mons 001 is small (4-5 cm) rounded, and apparently hemispherical. It was seen only from one side. Another small fragment in the same rover location appears in MastCam imagery, identified by multispectral analysis (Wellington et al., 2017) but was not further investigated.

**Physical characteristics**: Aeolis Mons 001 has a lustrous blue-gray color and contains oval shaped depressions consistent with regmaglypts as well as elongated hollows that could result from ablation during entry or in situ differential erosion of less-resistant inclusions. At high resolution, the surface is smooth. The mass of the meteorite is estimated to be ~250 g.

**Geochemistry**: Mastcam color images reveal the presence of subtle surface patches on the surface, consistent with ferric materials, while other regions have reflectance spectra consistent with laboratory spectra of fresh iron meteorites (Johnson et al. 2016, Wellington et al. 2017). Chemistry and mineralogy consistent with iron meteorites are inferred from ChemCam analyses. Aeolis Mons 001 was interrogated using a 3x3 ChemCam Laser-Induced Breakdown Spectroscopy (LIBS) raster with accompanying Remote Micro-Imager (RMI) images. The ChemCam elemental spectra show both iron and nickel peaks at all nine points (Meslin et al., 2017). Comparison of these spectra with spectra measured on several iron meteorites with a replica of ChemCam in the laboratory at the Institut de Recherche en Astrophysique et Planétologie (IRAP) indicate that Aeolis Mons 001 is mostly made of kamacite and contains ~8 wt. % Ni. One point (#9) along the edge of an elongated cavity also exhibits P peaks and is enriched in Ni (Fig. 3). The colocation of Fe, Ni, and P in point #9 suggests the presence of schreibersite, (Fe,Ni)3P on the rim of this cavity.

**Classification**: Iron meteorite

**Specimens**: Left in situ on Mars

**Aeolis Mons 002**        -4.70767125, 137.3580139

Mars

Find: 2017 Jan 18

Classification: Iron meteorite

**History**: The MSL rover Curiosity observed a very small piece, informally named Ames Knob (henceforth Aeolis Mons 002), on sol 1577. The rock was about 3.4 m from the rover, and observed with Mastcam and ChemCam (LIBS chemical analysis and RMI). The Aeolis Mons 002 location is approximately 350 m south of [Aeolis Mons 001](https://www.lpi.usra.edu/meteor/metbull.php?code=66175) (Egg Rock).

**Physical characteristics**: The meteorite is a small (7.5 × 8.0 cm), irregularly shaped fragment seen only from one side. It has a blue-gray color, an overall massive appearance, with slight pitting, and without clear, well-preserved regmaglypts. The mass of the meteorite is estimated to be ~1.8 kg.

**Geochemistry**: The meteorite was probed with a 1x3 ChemCam Laser-Induced Breakdown Spectroscopy (LIBS) raster with accompanying Remote Micro-Imager (RMI) images. The LIBS spectra show prominent Fe and Ni peaks. The Fe and Ni peak intensities were nearly constant over the three probed points, which were spaced 14 mm apart across the raster. The Ni/Fe peak ratios for all three points are similar to Chinga, an ataxite with 16.7 wt.% Ni analyzed with a replica of ChemCam in the laboratory at the Institut de Recherche en Astrophysique et Planétologie (IRAP) (Wiens et al. 2017).

**Classification**: Iron meteorite.

**Specimens**: Left in situ on Mars

**Aeolis Palus 001**        -4.6408, 137.3986

Mars

Find: 2014 May 9

Classification: Iron meteorite

**History**: The MSL rover Curiosity observed 3 rocks, informally named Littleton (henceforth Aeolis Palus 001), Lebanon (henceforth [Aeolis Palus 002](https://www.lpi.usra.edu/meteor/metbull.php?code=66178)), and Lebanon-B (henceforth [Aeolis Palus 003](https://www.lpi.usra.edu/meteor/metbull.php?code=66179)), on Sol 634 and imaged them on Sols 637-641 using Mastcam and the Remote Micro-Imager (RMI) on ChemCam. Aeolis Palus 002 and 003 were observed from as close as ~11 m, and Aeolis Palus 001 from ~34.5 m. Aeolis Palus 001 and Aeolis Palus 002 are large (>1 m) boulders separated by ~20 m; Aeolis Palus 003 is a smaller (0.3 m) piece next to Aeolis Palus 002.

**Physical characteristics**: The Aeolis Palus 002 and 003 fragments are partially buried in the surrounding soil. The rocks have a lustrous blue-gray color and contain mm- to cm-sized irregularly shaped holes likely created by differential weathering. At high resolution, the surfaces are smooth with mm-scale, intermittent pockmarks. The mass of the Aeolis Palus 001 above ground is estimated to be ~3300 kg.

**Geochemistry**: All pieces/rocks exhibit surface textures and visible/near-infrared spectra (445-1012 nm) consistent with iron meteorites, similar to those observed by the Mars Exploration Rover (MER) missions. Aeolis Palus 002 (at ~12 m distance) and Aeolis Palus 001 (at ~36 m distance) were imaged with Mastcam at 3 times of day. This included multispectral images of Aeolis Palus 002 along with a 6-frame RMI mosaic and a single position on Aeolis Palus 001. Mastcam reflectance spectra of these rocks are red-sloped, with variations <550 nm related to specular reflections, similar to laboratory spectra of iron meteorites (and MER spectra of similar rocks) (Johnson et al., 2014; Schröder et al., 2008). The Aeolis Palus 001 and 002 rocks do not exhibit the patchy coatings associated with meteorites observed by MER.

**Classification**: Iron meteorite.

**Specimens**: Left in situ on Mars.

**Aeolis Palus 002**        -4.6408, 137.3986

Mars

Find: 2014 May 9

Classification: Iron meteorite

**History**: The MSL rover Curiosity observed 3 rocks, informally named Littleton (henceforth [Aeolis Palus 001](https://www.lpi.usra.edu/meteor/metbull.php?code=66177)), Lebanon (henceforth Aeolis Palus 002), and Lebanon-B (henceforth [Aeolis Palus 003](https://www.lpi.usra.edu/meteor/metbull.php?code=66179)), on Sol 634 and imaged them on Sols 637-641 using Mastcam and the Remote Micro-Imager (RMI) on ChemCam. Aeolis Palus 002 and 003 were observed from as close as ~11 m, and Aeolis Palus 001 from ~34.5 m. Aeolis Palus 001 and Aeolis Palus 002 are large (>1 m) boulders separated by ~20 m; Aeolis Palus 003 is a smaller (0.3 m) piece next to Aeolis Palus 002.

**Physical characteristics**: The Aeolis Palus 002 and 003 fragments are partially buried in the surrounding soil. The rocks have a lustrous blue-gray color and contain mm- to cm-sized irregularly shaped holes likely created by differential weathering. At high resolution, the surfaces are smooth with mm-scale, intermittent pockmarks. The mass of the Aeolis Palus 002 above ground is estimated to be ~2800 kg.

**Geochemistry**: All pieces/rocks exhibit surface textures and visible/near-infrared spectra (445-1012 nm) consistent with iron meteorites, similar to those observed by the Mars Exploration Rover (MER) missions. Aeolis Palus 002 (at ~12 m distance) and Aeolis Palus 001 (at ~36 m distance) were imaged with Mastcam at 3 times of day. This included multispectral images of Aeolis Palus 002 along with a 6-frame RMI mosaic and a single position on Aeolis Palus 001. Mastcam reflectance spectra of these rocks are red-sloped, with variations <550 nm related to specular reflections, similar to laboratory spectra of iron meteorites (and MER spectra of similar rocks) (Johnson et al., 2014; Schröder et al., 2008). The Aeolis Palus 001 and 002 rocks do not exhibit the patchy coatings associated with meteorites observed by MER.

**Classification**: Iron meteorite.

**Specimens**: Left in situ on Mars.

**Aeolis Palus 003**        -4.6408, 137.3986

Mars

Find: 2014 May 9

Classification: Iron meteorite

**History**: The MSL rover Curiosity observed 3 rocks, informally named Littleton (henceforth [Aeolis Palus 001](https://www.lpi.usra.edu/meteor/metbull.php?code=66177)), Lebanon (henceforth [Aeolis Palus 002](https://www.lpi.usra.edu/meteor/metbull.php?code=66178)), and Lebanon-B (henceforth Aeolis Palus 003), on Sol 634 and imaged them on Sols 637-641 using Mastcam and the Remote Micro-Imager (RMI) on ChemCam. Aeolis Palus 002 and 003 were observed from as close as ~11 m, and Aeolis Palus 001 from ~34.5 m. Aeolis Palus 001 and Aeolis Palus 002 are large (>1 m) boulders separated by ~20 m; Aeolis Palus 003 is a smaller (0.3 m) piece next to Aeolis Palus 002.

**Physical characteristics**: The Aeolis Palus 002 and 003 fragments are partially buried in the surrounding soil. The rocks have a lustrous blue-gray color and contain mm- to cm-sized irregularly shaped holes likely created by differential weathering. At high resolution, the surfaces are smooth with mm-scale, intermittent pockmarks. The mass of the Aeolis Palus 003 is estimated to be ~95 kg.

**Geochemistry**: All pieces/rocks exhibit surface textures and visible/near-infrared spectra (445-1012 nm) consistent with iron meteorites, similar to those observed by the Mars Exploration Rover (MER) missions. Aeolis Palus 002 (at ~12 m distance) and Aeolis Palus 001 (at ~36 m distance) were imaged with Mastcam at 3 times of day. This included multispectral images of Aeolis Palus 002 along with a 6-frame RMI mosaic and a single position on Aeolis Palus 001. Mastcam reflectance spectra of these rocks are red-sloped, with variations <550 nm related to specular reflections, similar to laboratory spectra of iron meteorites (and MER spectra of similar rocks) (Johnson et al., 2014; Schröder et al., 2008). The Aeolis Palus 001 and 002 rocks do not exhibit the patchy coatings associated with meteorites observed by MER.

**Classification**: Iron meteorite.

**Specimens**: Left in situ on Mars.

**Aioun el Atrouss 002**        16°26’N, 9°35’W

Hodh el Gharbi, Mauritania

Purchased: June 2015

Classification: Iron meteorite (IIAB)

**History**: Found by a nomad ~20 km south of Aioun El Atrous, close to the villages of Bou Esfeya and Arweityl, not far from the road to Koubeni.

**Physical characteristics**: The 17.2 kg mass has an exterior with sharp ridges and exxagerated regmaglypts, and a red-brown surface coated by well developed desert patina.

**Petrography**: Polished sections show no Widmannstätten pattern; kamacite contains Neumann bands and rhabdite inclusions. No fusion crust or heat-affected zone was observed.

**Geochemistry**: ICP-MS data, using sample of [North Chile](https://www.lpi.usra.edu/meteor/metbull.php?code=17001) (Filomena) as standard (C. Herd and G. Chen *UAb*): Ni = 6.0, Co = 0.47 (both wt%); Ir = 17.2, Ga = 80, Ge = 283, Re = 1.4, Os = 5.8, Cu = 173, Ru = 23.1, Pd = 1.6, Pt = 29.6 (all μg/g).

**Classification**: (C. Herd, *UAb*): IIAB iron, hexahedrite.

**Specimens**: Type specimen consisting of a 83 g representative slice at *UAb*. Main mass with S. Buhl.

**Aiquile**        18°17’4"S, 65°8’39"W

Cochabamba, Bolivia

Confirmed fall: 2016 Nov 20

Classification: Ordinary chondrite (H5)

**History**: A bright fireball appeared over Aiquile, Cochabamba district of Bolivia, on 20 November 2016, 17:57 local time (UTC-4). Stones fell in a strewn field of at least 12 × 2 km (northeasterly direction) in the following Aiquile communities: Tablamayu, Panamá, Chawar Mayu, Chaqo K’asa, Barbechos and Cruz Loma. The main bolide fragmentation occurred over the Tablamayu community, 12 km north of Aiquile. In the Cruz Loma community, C. Veizaga witnessed the fall of the largest stone (36.3 kg) about 500 m from him. He recovered the stone and in the following day the local Aiquile government (Luiz L. Arnez, Marco Cardona, Franz Navia, William Rodriguez, Jesus Yave) took the stone to the city museum. In the Panamá community, Roberto Soto witnessed the fall and recovered two other fragments (565 g, 2.2 kg). SERGEOMIN (Miguel A. Muriel, G. Villca, A. Perez), UMSA (Gonzalo Pereira), Brazil NM collaborators (Andre R. Moutinho, José M. Monzon) and S. Medina found additional fragments in the Panamá community. A. Moutinho found a 98 g fragment which was used for classification.

**Physical characteristics**: The 36.3 kg stone was almost fully covered with fusion crust and remaglypts, with only small pitted corners (47 × 17 × 26 cm); the 2.26 kg stone is semi-prismatic and almost fully covered with fusion crust; the 565 g piece is a fragment mostly without fusion crust.

**Petrography**: Medium shock stage (S3), chondritic texture and mineralogy and mineral compositions of an equilibrated ordinary chondrite. Porphyritic olivine and radial pyroxene chondrules dominate.

**Geochemistry**: Microprobe analyses show an equilibrated olivine and pyroxene composition of Olivine (Fa18.3±0.5; n=53), low-Ca pyroxene (Fs15.7±0.7; n=37). Mean Cr2O3 of olivine is 0.048 wt.% for both matrix and clasts areas.

**Classification**: H group classification based on: chondrule mean apparent diameter (~0.3 mm), content of metallic Fe,Ni + FeS (9.9 vol%), Co content of kamacite (0 - 0.3 wt%). Petrologic type 5 classification based on chondritic texture, and plagioclase <50 μm. Shock S3 based on undulatory extinction, irregular fractures of olivine. Most fragments show no brecciation, but some have slightly darker gray clasts with boundaries indiscernible under the microscope. Although both areas show identical composition, the darker areas show apparently well defined chondrules. Cathodoluminescence images also are very similar in the two areas. Some isolated melt pockets and small dark inclusions were observed.

**Specimens**: 36.3 kg, 2.26 kg, 565 g in Museu Municipal del Charango (Aiquile), 45 g *MNRJ*, 39 g Universidad Autonoma de San Andrés (UASA), 40 g Andre Moutinho, 38 g José Maria Monzon

**Al Haggounia 005**        27.299°N, 12.141°W

Saguia el Hamra, Western Sahara

Find: 2014 Feb

Classification: HED achondrite (Eucrite, unbrecciated)

**History**: The stones were found in February 2014, 120 km NW of Laayoune in Western Sahara. They were bought in October 2016 by Jean Redelsperger from Mohamed Elguirah.

**Physical characteristics**: Brown pitted stones without fusion crust. Cut surface reveals grayish interior.

**Petrography**: Igneous rock with unbrecciated subophitic texture. Main minerals are pyroxene and plagioclase. Accessory silica polymorph, ilmenite. Rare metal. Barite from terrestrial weathering.

**Geochemistry**: Pyroxene: low-Ca pyroxene Fs63.9±0.1Wo1.8±0.0(N=2), high-Ca pyroxene Fs29.6±2.7Wo44.3±0.6(N=4), FeO/MnO=29.7. Plagioclase An89.9±1.3Ab9.8±1.3Or0.4±0.1(N=3).

**Classification**: Eucrite, unbrecciated. Weathering strong. Likely paired with [Al Haggounia 003](https://www.lpi.usra.edu/meteor/metbull.php?code=62650).

**Specimens**: 22 g at *CEREGE*. Main mass with Jean Redelsperger.

**Al Haggounia 008**        27°22.110’N, 12°6.400’W

Laayoune/Assaquia Al Hamra, Western Sahara-Morocco

Find: 20 Dec 2013

Classification: Ordinary chondrite (H5)

**History**: Found during a meteorite searching in Chwichiya area around 120 NE of Laayoune by a group of 4 Moroccan hunters on Dec. 20, 2013. 1240 g found by El Hocine Bini and Ali Boumerzaf (Tata), 5030 g found by Moha Bohayate and Bouhat (Tata).

**Physical characteristics**: Many small and deeply weathered pieces without fusion crust, the biggest piece 2200 g.

**Geochemistry**: Fa20.3±1.7N=6, Fs18.7±1.0N=4

**Classification**: H5

**Specimens**: one piece 22.9 g and one thick section at *FSAC*

**Al Haggounia 009**        27°17.849’N, 12°7.548’W

Laayoune/Assaquia Al Hamra, Western Sahara-Morocco

Find: 24 April 2013

Classification: HED achondrite (Eucrite)

**History**: A meteorite hunting expedition to the was organised by J. Redelsperger, Claude Roy and guided by Ali Oulmaleh on April 2013. They met Lahcen Oukhouya, who found a 332.85 g meteorite in Chwichiya area, around 120 NE of Laayoune. He was prospecting in this area because of the report of a 219 g eucrite in the same area. Then the other pieces were found by Lahcen and other hunters.

**Physical characteristics**: Several uncrusted, coarse-grained stones. The interior is brecciated with clear clasts embedded in a dark matrix, showing a doleritic texture.

**Petrography**: Breccia with coarse basaltic clasts in a fine-grained matrix. The matrix has a doleritic texture with plagioclase grain size of several mm. Dominant minerals are exsolved pyroxene and mm-sized calcic plagioclase laths. Minor phases include chromite, silica, Ca-Phosphate, troilite and metal.

**Geochemistry**: Pyroxenes: Low-Ca Fs59.9±2.5Wo3.7±1.8(Fs58.2-62.7Wo1.7-5.6N=6 FeO/MnO=33.4±2.8); Ca-Px Fs26.7±1.3Wo42.3±2.1(N=2 FeO/MnO=33.8±3.6). Plagioclase: An89.2±0.7, N=2.

**Classification**: Eucrite, breccia.

**Specimens**: One piece 22.0 g and one thick section at *FSAC*.

**Al Hawaya 009**        19° 30' 4"N,  48° 1' 48"E

Ash Sharqiyah, Saudi Arabia

Find: 16 Feb 2013

Classification: Ordinary chondrite (H3)

**History**: Found by Hassan Al Marsouki during a search for meteorites on February 15, 2013.

**Physical characteristics**: Single dark brown stone, wind-ablated, no fusion crust preserved.

**Petrography**: Homogeneous chondritic texture, mean chondrule size 0.24±0.14 mm (n= 107)

**Geochemistry**: (N. Greber, *Bern*, B. Hofmann, *NMBE*, E. Gnos MGNGE) Olivine compositions are Fa0.5-25.7(mean 16.8±7.1, n=28), pyroxene compositions are Fs3.1-25.7Wo0.2-4.9(mean Fs13.3±7.2Wo1.6±1.5, n=27). Cathodoluminescence colors indicate petrographic grade approx. 3.8. Bulk Fe/Mn ratio (XRF) is 104±4, typical for weathered H chondrites (same method yields mean of 105±11, n=22)

**Classification**: H3 chondrite based on mineral compositions, mean chondrule size and bulk Fe/Mn. Unshocked (S1), weathering degree W3.

**Specimens**: *MHNGE* 9.68 g, main mass *SGS*.

**Al Huwaysah 018**        22°43’42.12"N, 55°22’57.09"E

Az Zahirah, Oman

Find: 2014

Classification: Ordinary chondrite (L4)

**Physical characteristics**: A brown stone without fusion crust. Cut surface reveals well-defined large chondrules set in a brownish matrix.

**Petrography**: Closely-packed well delineated chondrules. Orthopyroxene is unequilibrated.

**Geochemistry**: Fs18.7-25.4(N=4)

**Classification**: L4

**Alatage Mountain 005** (AM 005)        41°41’6.1"N, 92°56’29.4"E

Xinjiang, China

Find: 1 May 2013

Classification: Ordinary chondrite (L5)

**History**: An expedition found 42 meteorites between 30 April and 1 May 2013 in a 2.7 × 1.4 km area 80 km east of Alatage Mountain. The expedition included Bingkui Miao, Yangting Lin, Shijie Li, Deqiu Dai, Wenjie Shen, Sen Hu, Lei Kesi, Peng Wang, and Zhipeng Xia.

**Physical characteristics**: Total mass: 36.4 g (only 1 piece) no fusion crust, gray surface

**Petrography**: Shock-induced metal-sulfide veins and melt pockets are pervasive. Many mineral grains are heavily fractured. Ringwoodite was observed in some shock veins and pockets.

**Geochemistry**: Minerals are uniform. Olivine: Fa21.9±0.7(n=6); low-Ca pyroxene: Fs19.9±0.6Wo1.9±0.3(n=5)

**Classification**: Ordinary chondrite (L5); S5; W2.

**Specimens**: 3 g sample and one thin section are deposited in *GUT*; 30 g deposited in *GIGCAS*.

**Alatage Mountain 009** (AM 009)        41°41’14.1"N, 92°56’18.5"E

Xinjiang, China

Find: 1 May 2013

Classification: Ordinary chondrite (L5, melt breccia)

**History**: An expedition found 42 meteorites between 30 April and 1 May 2013 in a 2.7 × 1.4 km area 80 km east of Alatage Mountain. The expedition included Bingkui Miao, Yangting Lin, Shijie Li, Deqiu Dai, Wenjie Shen, Sen Hu, Lei Kesi, Peng Wang, and Zhipeng Xia.

**Physical characteristics**: Total mass: 6.2 g (only 1 piece) no fusion crust, gray surface

**Petrography**: The meteorite shows a porphyritic structure. The opaque matrix is composed of glass with traces of granular silicates and metal. The metal and sulfide are dispersed in circular droplets, except in the oxidized metallic veins. Remnant chondrules are preserved.

**Geochemistry**: Minerals are uniform. Olivine: Fa21.6±0.5(n=7); low-Ca pyroxene: Fs17.4±2.6Wo2.5±0.9(n=13)

**Classification**: L5, S5, W2

**Specimens**: 3 g sample and one thin section are deposited in *GUT*.

**Alatage Mountain 013** (AM 013)        41°41’14.1"N, 92°56’16.8"E

Xinjiang, China

Find: 1 May 2013

Classification: Ordinary chondrite (L5)

**History**: An expedition found 42 meteorites between 30 April and 1 May 2013 in a 2.7 × 1.4 km area 80 km east of Alatage Mountain. The expedition included Bingkui Miao, Yangting Lin, Shijie Li, Deqiu Dai, Wenjie Shen, Sen Hu, Lei Kesi, Peng Wang, and Zhipeng Xia.

**Physical characteristics**: Total mass: 93.1 g (only 1 piece) no fusion crust, gray surface

**Petrography**: Consists of olivine, orthopyroxene, and feldspar, associated with comparatively minor amounts of clinopyroxene, Fe-Ni, diopside, troilite, chromite and phosphate. The matrix is fine-grained and feldspar grain size is >2 μm. Many mineral grains are heavily fractured. The wide shock veins (>200 μm) and presence of ringwoodite indicate shock stage S5.

**Geochemistry**: Minerals are uniform. Olivine: Fa22.9±0.9(n=7); low-Ca pyroxene: Fs19.8±1.1Wo1.6±0.3(n=11)

**Classification**: Ordinary chondrite L5; S5; W2.

**Specimens**: 3 g sample and one thin section are deposited in *GUT*; 83 g is deposited at *GIGCAS*.

**Alatage Mountain 014** (AM 014)        41°41’14.1"N, 92°56’16.8"E

Xinjiang, China

Find: 1 May 2013

Classification: Ordinary chondrite (L5)

**History**: An expedition found 42 meteorites between 30 April and 1 May 2013 in a 2.7 × 1.4 km area 80 km east of Alatage Mountain. The expedition included Bingkui Miao, Yangting Lin, Shijie Li, Deqiu Dai, Wenjie Shen, Sen Hu, Lei Kesi, Peng Wang, and Zhipeng Xia.

**Physical characteristics**: Total mass: 18.3 g (only 1 piece) no fusion crust, gray surface

**Petrography**: The matrix is fine-grained and the feldspars have sizes over 2 μm. Shock-induced metal-sulfide veins and melt pockets are pervasive. Many mineral grains are heavily fractured. More than 40% of metal and sulfide are oxidized. Possibly paired with Alatage Mountain 013. The wide shock veins (>200 μm) and ringwoodite indicate shock stage S5.

**Geochemistry**: Minerals are uniform. Olivine: Fa23.0±1.1(n=7); low-Ca pyroxene: Fs18.9±0.4Wo1.7±0.3(n=7)

**Classification**: Ordinary chondrite L5; S5; W2.

**Specimens**: 3 g sample and one thin section are deposited in *GUT*; 14 g at Hunan University of Science and Technology, China.

**Alatage Mountain 020** (AM 020)        41°41’16.0"N, 92°56’16.4"E

Xinjiang, China

Find: 1 May 2013

Classification: Ordinary chondrite (L5)

**History**: An expedition found 42 meteorites between 30 April and 1 May 2013 in a 2.7 × 1.4 km area 80 km east of Alatage Mountain. The expedition included Bingkui Miao, Yangting Lin, Shijie Li, Deqiu Dai, Wenjie Shen, Sen Hu, Lei Kesi, Peng Wang, and Zhipeng Xia.

**Physical characteristics**: Total mass: 10.3 g (only 1 piece) no fusion crust, gray surface

**Petrography**: Chondrule types in AM 020 mainly include barred olivine chondrule. The matrix is fine-grained and the feldspars have sizes over 2 μm. Shock-induced metal-sulfide veins and melt pockets are pervasive. Many mineral grains are fractured seriously. More than 40% metal and sulfide are oxidized.

**Geochemistry**: Minerals are uniform. Olivine: Fa22.5±0.6(n=10); low-Ca pyroxene: Fs18.5±5Wo2.6±1(n=10)

**Classification**: Ordinary chondrite L5; S5; W2.

**Specimens**: 3 g sample and one thin section are deposited in *GUT*.

**Alatage Mountain 030** (AM 030)        41°41’19.9"N, 92°56’32.5"E

Xinjiang, China

Find: 1 May 2013

Classification: Ordinary chondrite (L5)

**History**: An expedition found 42 meteorites between 30 April and 1 May 2013 in a 2.7 × 1.4 km area 80 km east of Alatage Mountain. The expedition included Bingkui Miao, Yangting Lin, Shijie Li, Deqiu Dai, Wenjie Shen, Sen Hu, Lei Kesi, Peng Wang, and Zhipeng Xia.

**Physical characteristics**: Total mass: 49.7 g (only 1 piece) no fusion crust, gray surface

**Petrography**: The meteorite consists of olivine, orthopyroxene, and feldspar, associated with comparatively minor amounts of clinopyroxene, Fe-Ni, diopside, troilite, chromite and phosphate. In the section, the sizes of mineral are mostly <100 μm, and the sample shows a recrystallization texture. More than 40% of metal and sulfide are oxidized.

**Geochemistry**: Minerals are uniform. Olivine: Fa21.8±0.7(n=24); low-Ca pyroxene: Fs19.1±2.1Wo3.4±1.5(n=20)

**Classification**: Ordinary chondrite (L5); S5; W2

**Specimens**: 11 g sample and one thin section are deposited in *GUT*.

**Alatage Mountain 037** (AM 037)        41°41’17.0"N, 92°56’50.1"E

Xinjiang, China

Find: 1 May 2013

Classification: Ordinary chondrite (L5)

**History**: An expedition found 42 meteorites between 30 April and 1 May 2013 in a 2.7 × 1.4 km area 80 km east of Alatage Mountain. The expedition included Bingkui Miao, Yangting Lin, Shijie Li, Deqiu Dai, Wenjie Shen, Sen Hu, Lei Kesi, Peng Wang, and Zhipeng Xia.

**Physical characteristics**: Total mass: 18.9 g (only 1 piece) no fusion crust, gray surface

**Petrography**: The meteorite consists of olivine, orthopyroxene, and feldspar, associated with comparatively minor amounts of clinopyroxene, Fe-Ni, diopside, troilite, chromite and phosphate. In this section, the sample shows a recrystallization texture. More than 40% metal and sulfide are oxidated.

**Geochemistry**: Minerals are uniform. Olivine: Fa24.1±1.2(n=7); low-Ca pyroxene: Fs18.8±2.0Wo3.1±2.0(n=12)

**Classification**: Ordinary chondrite (L5); S5; W2

**Specimens**: 3 g sample and one thin section are deposited in *GUT*; 14 g deposited at *GIGCAS*.

**Assaquia Al Hamra 001**        26°19’51"N, 12°29’53"W

Saguia el Hamra, Western Sahara

Find: 2016 May 05

Classification: Ordinary chondrite (L6)

**History**: Collected in May 2016 by scientific party organized by University of Casablanca and *CEREGE*.

**Physical characteristics**: A single rounded specimen with little fusion crust

**Petrography**: Recrystallized chondritic texture. Plagioclase average grain size is above 50 μm.

**Specimens**: Type specimen at *CEREGE*.

**Awsserd**        22°32’11"N, 14°17’09"W

Dakhla, Western Sahara/Morocco

Find: 2017 Jan 10

Classification: Rumuruti chondrite (R4)

**Physical characteristics**: Crusted stone. Cut surface reveals a dark interior with small light-colored chondrules.

**Petrography**: (J. Gattacceca, *CEREGE*): Discernible chondrules set in abundant recrystallized matrix. Olivine is the main mineral. Abundant sulfides, no metal.

**Geochemistry**: Olivine Fa40.9±1.7, PMD 4.1%, range Fa39.3-Fa43.1, NiO=0.32±0.11 wt%, FeO/MnO=89 (N=5). Ca-pyroxene Fs12.2Wo44.7(N=1)

**Classification**: R4. Minimal weathering.

**Specimens**: 22.4 g including a polished secton at *CEREGE*. Main mass with Marc Henry.

**Bayin Gobi 001** (BG 001)        41°19.03’N, 105°20.57’E

Nei Mongol, China

Find: 1 May 2015

Classification: Ordinary chondrite (L5)

**History**: On May 1, 2015, Xueming Tang, a Chinese amatuer, and his companions found this sample in the Bayin Gobi desert. He then sent a 20 g sample, cut from the main rock, to *GUT* for classification and description. The finder retained the main mass.

**Physical characteristics**: Total mass: 35 kg (1 piece), no fusion crust, black-brown surface, smoky-gray colored interior.

**Petrography**: The meteorite consists mainly of a medium-grained granular aggregate of olivine, low-Ca pyroxene and feldspar, with minor amounts of Fe-Ni alloy and troilite. The chondrules are moderately abundant and are readily defined.

**Geochemistry**: Minerals are uniform. Olivine: Fa=26.1±0.7 (n=12); low-Ca pyroxene: Fs=21.9±0.3Wo=1.6±0.3 (n=11).

**Classification**: Ordinary chondrite (L5); S2; W1.

**Specimens**: About 20 g sample and one thin sections are deposited in *GUT*.

**Bayin Gobi 002** (BG 002)        41°06.67’N, 105°09.38’E

Nei Mongol, China

Find: 18 Oct 2011

Classification: Ordinary chondrite (L5)

**History**: The meteorite was found by Taojirigele on 18 Oct 2011, in the Gobi Desert around Yingensumu city in Neimenggu province, China. The meteorite was found by a person hunting for agate and gobi stones.

**Physical characteristics**: The meteorite was a single piece, half covered by black fusion crust.

**Petrography**: (S. Hu and Y. Lin, *IGGCAS*. Z. Xia and B. Miao, *GUT*) Some relict chondrules without sharp boundaries were found in the matrix of fine-grained silicates, metal and troilite. The meteorite is mainly composed of olivine, pyroxene, plagioclase,Fe-Ni metal (kamacite and taenite) and troilite, with minor chromite and apatite. Fe-Ni metal displays strong terrestrial weathering.

**Geochemistry**: Mineral compositions and geochemistry: (S. Hu and Y. Lin, *IGGCAS*. Z. Xia and B. Miao, *GUT*) Olivine (Fa25.3±0.5) and low-Ca pyroxene (Fs21.3±0.5Wo1.6±0.2) are homogeneous in chemical composition.

**Classification**: (S. Hu and Y. Lin, *IGGCAS*. Z. Xia and B. Miao, *GUT*) L5

**Specimens**: The main mass was held by Taojirigele and 224 g was deposited at *IGGCAS*.

**Birkat Aghurmi 001**        29°13’N, 25°31’E

Marsa Matruh, Egypt

Find: 2 Jan 2012

Classification: Ordinary chondrite (L6)

**History**: Found by Faisal Mohammed Ghadeer in January 2012 near the Siwa oasis one day after he had seen a fireball. He brought the stone back home to Nuweiba/Sinai where it was later acquired by Rolf Müller. Based on the weathering and wind-ablation, this cannot be a fresh fall.

**Physical characteristics**: Rounded individual, approx. 12 × 12 × 3.5 cm, strongly wind-ablated, fusion crust only partially preserved.

**Petrography**: (B. Hofmann, *NMBE*): Homogeneous chondritic texture with weakly delineated chondrules. Typical size of plagioclase grains is 40-60 μm. Metallic iron is partly weathered (~50%), troilite is only locally altered.

**Geochemistry**: (N. Greber, *Bern* and B. Hofmann, *NMBE*) Olivine compositions are Fa23.6±0.4(N=32), pyroxene compositions (n=19) are Fs20.0±0.3Wo1.5±0.4.

**Classification**: Ordinary chondrite (L6), shock stage S2, low weathering (W2). Possibly paired with Siwa.

**Specimens**: 24.0 g plus one polished thin section at *NMBE*, main mass: Rolf Müller, Zurich, Switzerland.

**Bou Kra 009**        26°36’56"N, 12°31’28"W

Saguia el Hamra, Western Sahara-Morocco

Find: 2016 May 03

Classification: Ordinary chondrite (H5)

**History**: Collected in May 2016 by scientific party organized by University of Casablanca and *CEREGE*.

**Physical characteristics**: A single rounded and fully fusion crusted specimen

**Specimens**: Type specimen at *CEREGE*.

**Broek in Waterland**        52°26’N, 4°59’E

Noord-Holland, Netherlands

Confirmed fall: 11 Jan 2017

Classification: Ordinary chondrite (L6)

**History**: A fireball was widely seen in Belgium and The Netherlands on 11 January 2017, at 17:09 CET, in a bright blue twilight sky. One dashcam movie was obtained in Belgium. The next day, the owners of a house near Broek in Waterland, just north of Amsterdam, noted damage to the roof of a garden shed. They recovered a 0.5 kg stone. After they reported their find to Niek de Kort of the Royal Dutch Astronomy & Meteorology Association (KNVWS), it was identified as a meteorite on 3 February during an on-site visit by the classifiers. The stone was given on temporary loan to Naturalis and 20 g was cut off with permission of the owners for research purposes.

**Physical characteristics**: The stone is a solid, fist-sized mass 99% covered by a thin, fresh fusion crust. The stone has faceted sides (pointing to in-flight fragmentation) covered by fusion crust as well as more rounded parts. The major flat surface shows regmaglypts. The interior is light grayish in color. The surface is slightly scratched by the impact and in 4 small spots the fusion crust has come off.

**Petrography**: (L.M. Kriegsman and M. Langbroek, *NBC*) The meteorite has a dense, equilibrated texture in which chondrules can be distinguished under the microscope. Chondrule types include porphyritic olivine-pyroxene and barred olivine. In addition, single olivine grains up to 1 mm are present. The interstitial space between olivine grains is mostly occupied by plagioclase, with minor clinopyroxene (augite) and low-Ca pyroxene. The outlines of chondrules are blurred and merged with the matrix, which prevents their recognition in hand specimen. Metal (kamacite, taenite) and sulfide (troilite) co-exist. The smallest grains are dispersed homogeneously through the rock. Larger grains (up to 2 mm) are also common. Other phases are chromite, merrillite, and one large grain of chlorapatite. The large olivine grains show undulatory extinction and are transected and locally offset by small fractures reflecting shock effects. Most pyroxenes and plagioclase also show undulatory extinction. In view of these observations, we infer a shock state S3.

**Geochemistry**: Mineral compositions and geochemistry: Bulk Composition (all in wt%) from 58 micro-XRF spot analyses, integrated with microprobe and image analysis. SiO2 = 39.2 ± 0.3, MgO = 29.2 ± 0.5, Al2O3 = 3.0 ± 0.1, CaO = 1.07 ± 0.02, Na2O = 1.4 ± 0.3, Cr2O3 = 0.40 ± 0.01, S = 1.9 ± 0.3, Ni = 0.43 ± 0.05, FeO = 17.4 ± 1, Fe = 6.1 ± 1. Mineral data (EMPA) are Fa24.9±0.4(n=3) for olivine, Fs21±1Wo2.0± 0.3(low-Ca pyroxene, n=3); Fs8.6±0.2Wo44.2 ± 0.8(augite, n=2) for pyroxenes.

**Classification**: ordinary chondrite (L6)

**Specimens**: Main mass (504 g) with anonymous finder. Several small fragments and powder totaling 20 g at *NBC*. The type specimen is a fragment of 14.42 g.

**Cactus Springs**        36.57098°N, 115.80987°W

Nevada, United States

Find: 2008 May 23

Classification: Ordinary chondrite (L6)

**History**: Found 7.4 Km from Cactus Springs. The stone was found along the US-95 freeway between Creech Air Force Base and the Mercury test site.

**Petrography**: The stone is very recrystallized, but relict PO, POP and BO chondrules can be discerned. Chondrule diameters range from 450-2500 μm. The olivine grains exhibit weak mosaic extinction, but no maskelynite is present. There are small irregular grains of troilite inside larger grains of metallic Fe-Ni. There are rare tiny grains (0.5 × 1 μm) of metallic Cu at the interface of metallic Fe-Ni and troilite. The troilite is polycrystalline. Chromite gains are extensively fractured. There is a 4-5-mm-long dark shock vein traversing the rock; the vein contains troilite surrounding fragmented silicate grains. Also present are chromite-plagioclase assemblages and rare chromite veinlets. Plagioclase grains range from 30 - 200 μm in diameter. Olivine and orthopyroxene are homogeneous. In addition, there are grains of Ca-pyroxene (Fs6.6Wo46.5).

**Calate 002**        21°34.72’S, 69°36.96’W

Antofagasta, Chile

Find: 26 Oct 2016

Classification: Ordinary chondrite (L6)

**Physical characteristics**: one individual sample was broken in hundreds pieces.

**Petrography**: A breccia with impact melt and fragments of different shock stage, S4-S6.

**Classification**: ordinary chondrite with impact melt, and fragments of chondrites of L6, S4-S6, W3. Ivanova M. A. (*Vernad*)

**Specimens**: 3 pieces, 407 g in total and a thin section are deposited in *Vernad*. Main mass with anonymous owner

**Catalina 187**        ~25°14’S, ~69°43’W

Antofagasta, Chile

Find: 2015 Sep 12

Classification: Ordinary chondrite (L3)

**Geochemistry**: Olivine Fa24.6±5.2, range Fa12.3-29.3, PMD 15% (N=8). Orthopyroxene Fs16.0±8Wo0.9±0.6.2, range Fs2.5-23.8, PMD 43%, (N=9). Magnetic suscpetibility log χ (× 10-9 m3/kg)=4.72.

**Classification**: L3. Suggested subtype 3.8/3.9 based on the scatter of olivine composition.

**Catalina 234**        ~25°14’S, ~69°43’W

Antofagasta, Chile

Find: 2010 Jul 04

Classification: Ordinary chondrite (H4)

**Petrography**: (J. Gattacceca, *CEREGE*) Chondrite with well delineated chondrules.

**Geochemistry**: Olivine Fa17.8±0.6, PMD=3.4%, orthopyroxene Fs17.4±0.6Wo3.4±1.2(range Fs16.9-18.4, PMD Fs40%, N=4).

**Chwichiya**        27°16’46.56"N, 11°50’19.02"W

Laayoune/Assaquia Al Hamra, Morocco-Western Sahara

Find: 2014 Feb 26

Classification: Ordinary chondrite (LL3)

**History**: Found during a meteorite search in the Chwichiya area around 120 NE of Laayoune by a group of four Moroccan hunters on February 24, 2014.

**Physical characteristics**: Weathered piece, without fusion crust

**Petrography**: Well formed chondrules up to 2 mm diameter; sparse matrix with altered metal.

**Geochemistry**: Fa27.92±13.2(Fa13.41-60.83) N=10 Fe/Mn=49.94±28.69; Fs20.33±9.3(Fs3.3-33) and Wo1.8±1.1(Wo0.2-3.4) N=8 Fe/Mn=28±11

**Classification**: LL3, possible sub-type 3.4.

**Specimens**: one piece and one thick section in *FSAC*

**Synonym**: Chwichiya 001

**Cloppenburg**        52°50.262’N, 7°59.769’E

Niedersachsen, Germany

Find: 15 March 2017

Classification: Ordinary chondrite (H4-5)

**History**: (D. Heinlein) The rock was found by the facility manager of a school while collecting rocks for the school garden, lying on a rock pile next to a potato field. The stone was kept by the finder, because of its unusual appearance and its magnetic properties.

**Physical characteristics**: D. Heinlein and A. Bischoff, *IfP*: The sample has a total mass of 141 g. Two slices were cut from the piece and some material was removed for bulk chemical analysis. From the remaining type specimen of 20.5 g, three polished thin sections were prepared. The actual main mass of 117.6 g has a density of 3.33±0.03 g/cm3. The fusion crust is absent due to weathering.

**Petrography**: S. Ebert, J. Storz, A. Bischoff, *IfP*: The meteorite is heavily weathered (W3). The remaining metal grains have thick rims of terrestrial alteration products (Fe-oxides and -hydroxides). The rock is a breccia containing fragments of petrologic type 4 and 5. The planar fractures in olivine indicate that the breccia is weakly shocked (S3); shock veins are also present. The occurrence of vivianite indicates that the sample was weathered in a very wet environment consistent with the find location in Lower Saxony having abundant moors.

**Geochemistry**: Mineral compositions and geochemistry: S. Ebert and J. Storz: The mean composition of olivine is Fa18.5±0.3with a compositional range of Fa17.7-19.1(n=34). The low-Ca pyroxenes have a mean composition of Fs16.4±0.6(n= 31) with a range of Fs15.6-20.6.

**Specimens**: Type specimen: *IfP*; main mass of 117.6 g with *Heinlein*.

**Cragin Reservoir**        34°34’33.14"N, 111°10’34.50"W

Arizona, United States

Find: 24 Nov 2014

Classification: Ordinary chondrite (H5)

**History**: While turkey hunting, Jake Michaelson noticed the rock lying on top of the leaf litter and thought it was curious.

**Physical characteristics**: The meteorite is oriented with flow lines and exhibits a fresh fusion crust. It is 4 × 4.5 × 1-2 cm. The cut face reveals a 1-mm wide metal vein along with fractures and pores.

**Dar al Gani 1068** (DaG 1068)        27°40.634’N, 16°14.269’E

Al Jufrah, Libya

Find: Nov 1999

Classification: Carbonaceous chondrite (CR)

**History**: A single stone weighing 31 g was found by Romano Serra, *OAM*, during an expedition to search for meteorites.

**Physical characteristics**: A small single stone, partly covered by fusion crust.

**Petrography**: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*): The thin section displays a texture composed of separated, well-formed chondrules (ranging in diameter from 500 to 2000 μm) of different kinds, many surrounded by metal, in a fine-grained matrix. The most abundant types are PO, with minor POP, BO and RP types. Main minerals are olivine, orthopyroxene, Ca-rich plagioclase and a fassaitic clinopyroxene. CAIs are visible on the cut surface of the type specimen. Opaques are mainly consisting of troilite and altered kamacite.

**Geochemistry**: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*): Olivine in PO and POP chondrules (Fa2.5±0.2, Fe/Mn = 8.6±1.1, N = 15); Olivine in BO chondrules (Fa33.9±0.6, Fe/Mn = 46.5±1.1, N = 7), orthopyroxene (Fs2.1±0.3Wo0.9±0.2, Fe/Mn = 10.8±1.1, N = 7); fassaite (Fs9.5±0.4En62.6±0.3Wo27.9±0.9, Al2O3 = 15.4 Wt.%, N = 5). Feldspar An95.5Or4.4.Oxygen isotopes: (I.Franchi, R.Greenwood, *OU*) δ17O = -0.84 ‰, δ18O = 2.28 ‰, Δ17O = -2.03 ‰;.

**Classification**: Carbonaceous chondrite (CR). Moderate weathering.

**Specimens**: A total of 6.3 g specimen is on deposit at MSN-Fi. The main mass is on deposit at *OAM*.

**Degtevo**        49°09.6’N, 40°39.7’E

Rostovskaya oblast’, Russia

Confirmed fall: 20 March 2016

Classification: Ordinary chondrite (H5)

**History**: Imamkulov Toir Mamazoirovich was working on a farm near Degtevo when he heard a whistling sound and saw a stone falling. Slezhuk Dmitry Vasilyevich, working on the same farm, also heard a loud whistling sound from the sky, went to the place of the fall and saw the piece. Several other people working on the farm confirm having heard a whistling sound and a trace in the sky. The first two aforementioned witnesses live in the town of Millerovo. A single piece of 2092 g and a fragment of 5.85 g were retrieved. Find information collected by Dmitry Sadilenko, Russian Academy of Sciences. The complete mass was purchased at the Ensisheim show 2016 by Marc Jost, Switzerland.

**Physical characteristics**: Single stone with dimensions 19.3 × 13.5 × 6.5 cm. This is an oriented meteorite with well-developed regmaglypts on the cone-shaped front side and an irregular back side. Nearly completely covered by fusion crust. Fusion crust shows a thickened rim 2-10 mm wide around the edge of the back side. On one edge, a fracture surface of approx. 7 × 4 cm exposing the interior is present; another edge shows a fresh fracture surface of approx. 3 × 2 cm, exposing a pre-existing fracture with a surface reminiscent of a shatter cone. These broken edges indicate that about 50 to 100 g are missing and probably were not recovered. Some brownish coloration around metal grains. Some regmaglypts contain traces of brown organic material, probably cattle manure.

**Petrography**: (B. Hofmann, *NMBE*, Å. Rosén, *UBE*/*NMBE*): Mean chondrule size 0.52±0.28 mm (n=125). Typical size of plagioclase grains is 10-20 μm. Troilite is polycrystalline. Shock stage is S2, some shock veins and shock-blackened areas are visible, no weathering (W0), some rusty coloration around metal grains. Fusion crust melt is invading fractures near the surface.

**Geochemistry**: Electron microprobe analysis yielded: olivine Fa17.9±0.5(Fa17.4-19.5; n=28), pyroxene Fs15.7±0.3Wo1.2±0.2(Fs15.4-16.6Wo0.4-1.9; n=27). Cosmogenic radionuclides: (Å. Rosén, GEMSE): Gamma-spectroscopy performed in September 2016 showed the presence of the following short-lived radionuclides: 46Sc, 56Co, 54Mn, 58Co, 7Be, 57Co, 22Na, 44Ti, 26Al and 60Co. Recalculated to 15 March 2016, 22Na was 65.0(+8.9,-4.8) dpm/kg and 26Al 48.5(+7.8,-3.7) dpm/kg. The 22Na/26Al activity ratio of 1.3(+0.3,-0.1) is consistent with a fall in March 2016.

**Classification**: Ordinary chondrite (H5), shock stage S2, no weathering (W0).

**Specimens**: 25.3 g and two polished thin sections at *NMBE*. Main mass with Marc Jost.

**Dhofar 2038** (Dho 2038)        18°57.598’N, 54°23.062’E

Zufar, Oman

Find: 13 Feb 2014

Classification: Ordinary chondrite (H3-6)

**History**: Found by Edwin Gnos, Beda Hofmann, Thomas Burri, and Marianna Mészáros during a search for meteorites on February 13, 2014.

**Physical characteristics**: Wind-ablated dark brown individual with fractures, 6410 g, and detached fragment of 54.2 g.

**Petrography**: (B. Hofmann, *NMBE* and E. Gnos, *MHNGE*) Mean apparent chondrule size 0.33±0.16 mm (n=60). Brecciated texture dominated by petrologic types 5 and 6. One large clast with PO chondrule texture and irregular shape has glassy mesostasis.

**Geochemistry**: (N. Greber, *Bern*) Olivine compositions are Fa18.4±0.2(n=17). Orthopyroxene compositions (n=17) are Fs16.4±0.5Wo1.5±0.4).

**Classification**: Based on mineral compositions and chondrule size this is an H chondrite breccia with petrologic types 3-6, unshocked (S1), weathering W3.

**Specimens**: All at *NMBE*

**Dhofar 2065** (Dho 2065)        18°40.943’N, 54°12.601’E

Zufar, Oman

Find: 8 Feb 2008

Classification: Carbonaceous chondrite (CO3)

**History**: The meteorite was found in 2008 during a field trip in the Oman desert.

**Petrography**: The dark-brownish meteorite is composed of abundant small chondrules, CAIs, and mineral fragments set into a fine-grained matrix. Chondrules are typically 0.1-0.2 mm in diameter; some regions show brownish staining due to terrestrial weathering.

**Dhofar 2066** (Dho 2066)        19°3.728’N, 54°44.665’E

Zufar, Oman

Find: 2010

Classification: Carbonaceous chondrite (Ungrouped)

**Physical characteristics**: Dark irregular stone. Cut surface reveals a dark-gray interior with well-defined chondrules.

**Petrography**: Well-defined chondrules (average apparent diameter 620±280 μm, N=25) set in abundant fine-grained iron-rich matrix. Olivine is the dominant mineral. No orthopyroxene was found. Opaque are mostly sulfides. Magnetite and metallic FeNi are also present. XRD of a 95 mg powdered sample (D. Borschnek, B. Devouard, *CEREGE*) does not reveal the presence of hydrous phases (serpentine, tochilinite) typically observed in type 2 chondrites using the same experimental setup.

**Geochemistry**: Olivine in the range Fa0.3-8.7, average Fa1.7±2.3(N=10), CaO 0.30±0.14 wt%, Cr2O3 0.27±0.10 wt%. Olivine is zoned. Oxygen isotopic composition (J. Gattacceca, C. Sonzogni, *CEREGE*) from analysis of one acid-washed 1.6 mg aliquot of a powdered 60 mg bulk sample is δ17O=10.91, δ18O=21.97 , Δ17O=-0.55 per mil (linearized, slope 0.5247, analytical uncertainties 0.08, 0.12, 0.03 per mil respectively).

**Classification**: Carbonaceous chondrite (C-ung). Moderate weathering. The anomalous designation is based on oxygen isotopes, and unusual mineralogy (absence of orthopyroxene, olivine composition, metal abundance). Possibly paired with [Dhofar 955](https://www.lpi.usra.edu/meteor/metbull.php?code=30535) and [Dhofar 735](https://www.lpi.usra.edu/meteor/metbull.php?code=7488), found within 1 and 3 km, respectively.

**Specimens**: Type specimen and polished section at *CEREGE*. Main mass with ArtMet collection, Poland.

**Dingle Dell**        -29.20608, 116.21547E

Western Australia, Australia

Confirmed fall: 31 Oct 2016

Classification: Ordinary chondrite (LL6)

**History**: The Dingle Dell fireball was imaged by multiple observatories of the Desert Fireball Network, and was reported by observers via the Fireballs in the Sky app, as it blazed through the skies near Morowa, Western Australia, around 8:05 pm local time on Halloween night (31 Oct 2016). The object entered the atmosphere 80.4 km above the Earth’s surface with a velocity of 15.5 km/s, and stopped ablating at an altitude of 19.5 km after decelerating to 3.5 km/s. Its darkflight and fall position were modeled using a WRF climate model. A team was dispatched on November 6 to search on foot and mountain bike. The rock was found the next morning in a paddock of the Dingle Dell farm, a few meters short of the Koolanooka hills bush land. The very hard ground showed no evident trace of the impact. Weather history shows that no rain has fallen between the fall and the recovery 6 days later.

**Physical characteristics**: Dingle Dell is a single stone (mass = 1.15 kg) measuring approximately 16 × 9 × 4 cm. The mass was originally slightly wedge-shaped. It is entirely covered with fusion crust, both primary and secondary, signifying a break up as it was passing through the atmosphere. A low resolution CT scan was acquired of the sample within a day of recovery. The scan reveals a heterogeneous distribution of metal and sulfide. In addition, some large circular objects are discernible due to their lower density. The CT scan allowed us to pinpoint where to cut to examine these. One small wedge and slice will be used for min/pet studies. The cut surface reveals a spectacularly pristine meteorite with no evidence of alteration despite the exterior redness, which is due to impact into fine particulate red dirt.

**Petrography** is based on investigations of polished thick and thin sections. The overall texture is typical of a type 5-6 ordinary chondrite with poorly defined chondrules in a clear crystalline matrix. Chondrule types include PO, C and BO. One large BO chondrule has a double rim structure and chondrule mesostasis is crystalline. Sizes range from 1.15-4.11 mm with a mean of 2.12 mm (n=11). Mineralogy consists of olivine, pyroxene, feldspar, chromite, and sulphide and metal blebs. Olivine and pyroxene have undulose extinction. Feldspars are coarse (>50 μm). All metal and sulfides are pristine.

**Geochemistry**: Olivine composition ranges from Fa24.7to Fa27.8(Avg = Fa26.3±0.8). Orthopyroxene ranges from Fs22.2Wo1.5to Fs23.4Wo1.4(Avg = Fs22.7±0.3Wo1.3±0.1).

**Classification**: The mineral compositions are consistent with classification as a type LL ordinary chondrite. The texture, feldspar grain size, along with the Wo composition of OPX (as per [Scott et al., 1986](http://onlinelibrary.wiley.com/doi/10.1029/JB091iB13p0E115/full)) indicates a petrologic type of 6. The lack of any alteration of any kind (metal/sulfide or silicates) indicates a weathering grade of W0. Shock stage is S2 due to slightly undulatory extinction seen in olivine.

**Specimens**: Main mass, *CUWA*, but will be accessioned into *WAM* collection

**Dishchii’bikoh**        33°53’0.48"N, 110°38’8.20"W

Arizona, USA

Confirmed fall: 2 Jun 2016

Classification: Ordinary chondrite (LL7)

**History**: (D. Dunlap, M. Fries, R. Garcia, L. Garvie, M. Hankey, R. Matson, P. Mane, M. Miller, R. Ward) At 3:56:34 MST (10:56:34 UTC) on 2 June 2016, a bright fireball was widely observed throughout the southwestern US. The fireball was recorded in imagery from the NOAA NEXRAD weather radar network, on the KFSX radar in Flagstaff, Arizona. Radar reflections consistent with falling meteorite material were first recorded at 10:57:12 UTC at an altitude of 9.7 km above sea level (ASL). Two additional radar sweeps recorded the event, at 11:01:14 UTC (5.1 km ASL) and 11:02:30 UTC (5.1 km ASL). The mass of meteorites for these detections was estimated at 3.7 kg, 2.15 g, and 0.54 g respectively, using M. Fries’ dark-flight model Jörmungundr (v.42) and wind velocity data from a radiosonde launched from Flagstaff at 00:00 UTC. The fireball was also recorded on US Department of Defense orbital sensors, leading to a total radiated energy of 17.2 × 1010 J, with energy equivalent to 0.49 kiloton of TNT. The air-blast shockwave was recorded on the earthquake seismic network from the Payson-Strawberry station. Analysis of the Doppler radar data showed stones likely on the ground on the southwestern corner of the White Mountain Apache tribal (WMAT) lands. With the help of Jacob Moore (Assistant Vice-president of Tribal Relations, *ASU*), permission was granted by Ronnie Lupe, the WMAT Tribal Chairman, to enter the tribal lands and search for and collect meteorites. Laurence Garvie, Daniel Dunlap, and Prajkta Mane of *ASU*, and private meteorite hunters Robert Ward, Mike Miller, and Ruben Garcia searched for meteorites starting 22 June 2016. Robert Ward found the first stone, 0.93 g, at 33°53’19.7 N and 110°37’55.0’ W. A total of 15 fusion-crusted stones weighing from 0.9 to 28.6 g, for a total of 79.46 g, were found on 22 and 23 June, 2016. The stones were found along a 1.7 km transect, with a 10.16 g stone found at 33°53’0.48"N and 110°38’8.20"W near the center of the finds, though this location is likely at the small end of a large strewnfield that extends to the SW.

**Physical characteristics**: (L. Garvie, D. Dunlap, P. Mane, *ASU*; R. Ward, M. Miller, R. Garcia). Fifteen fusion-crusted stones for a total mass of 79.46 g. Fusion crust is dominantly shiny black, though on two stones it is brown, matte, and powdery. Five of the stones broke upon impact. Interiors are whitish gray, with uneven distribution of darker clasts to 5 mm, and troilite to 3 mm. Stones are dominantly soft with a sugary texture.

**Petrography**: (L. Garvie, *ASU*) Pieces of four stones were mounted in epoxy and polished. Sections show a breccia of clasts dominated by granoblastic textures in a cataclastic matrix. Granoblastic areas: areas with this texture occur as rounded clasts with a sharp boundary to the cataclastic material. No easily recognizable chondrules were visible, though one 200-μm-sized grain may be a remnant BO chondrule, and two rounded 500 μm-sized areas with finer-grained pyroxene than enclosing material may represent former PO chondrules. Silicates typically <400 μm. Feldspars coarse grained, commonly >50 μm, some grains to 300 μm. Troilite and taenite <400 μm across, rounded to subhedral. Troilite ~2 areal%, taenite ~1 areal% and trace kamacite. Troilite is single crystal and lacks shock lamellae. Native copper is sparse, to 30 μm. Accessory chromite to 200 μm. Cataclastic areas: Angular silicates to 200 μm. Troilite grains with feathery margins, though still single crystal and lacking shock lamellae. One section is traversed by several shock veins, with the sulfide dominantly fine-grained anastomosing network. Sulfide-rich clasts, to 2.5 mm, with FeS finely dispersed as small grains or as anastomosing network.

**Geochemistry**: (L. Garvie *ASU*, P. Mane, *UAz*) Olivine, low-Ca pyroxene, and plagioclase dominate the sections. Microprobe results from the cataclastic and granoblastic regions are the same. Olivine Fa31.0±0.3, FeO/MnO=59.6±3.4, n=14; low Ca-pyroxene Fs25.0±0.3Wo1.8±0.3, FeO/MnO=35.6±2.0, n=9; high Ca-pyx Fs11.2Wo43.1, FeO/MnO=46.6, n=1; plagioclase Ab85.8±1.6An10.9±0.5, n=10; taenite - Ni 50.0±3.1 wt%, Co 1.9±0.2 wt%, Cu 0.18±0.06, n=10; kamacite - Ni 3.7±0.5 wt%, Co 11.8±0.7 wt%, n=10; chromite - Cr/(Cr+Al) = 0.85±0.01, Fe/(Fe+Al) = 0.79±0.03, n=10; and, phosphates dominated by apatites with F 1.1±0.3 wt% and Cl 4.4±0.3 wt%, n=7.

**Classification**: Ordinary chondrite, LL7, S3, W0.

**Eboliang 001**        38°17.91’N, 92°56.71’E

Qinghai, China

Find: 24 Oct 2015

Classification: Ordinary chondrite (L5)

**History**: Some amateur Chinese meteorite collectors found the stones in the Gobi desert.

**Physical characteristics**: mass: 12087 g (2 pieces, 10548 and 1539 g) no fusion crust, black-brown surface.

**Petrography**: The thin section shows a typical chondritic texture. The dominant silicate phases are olivine and pyroxene. The main opaque minerals are Fe-Ni metal (kamacite and taenite) and troilite (FeS). Accessory phases are chromite and apatite.

**Geochemistry**: Minerals are uniform. Olivine: Fa=25.49±0.42 (n=12); low-Ca pyroxene: Fs21.64±0.90Wo1.65±0.31(n=10).

**Classification**: Ordinary chondrite (L5); S2; W2.

**Specimens**: About 123 g sample and two thin sections are deposited in *GUT*.

**El Boludo**        23.01978°N, 99.90917°W

Tamaulipas, Mexico

Find: 2013

Classification: Ordinary chondrite (H5)

**History**: Numerous fragments and several whole stones, totaling 19.62 kg, were found by an American prospector, Greg Bruce, and his hunting partners in 2013 in Sonora, Mexico, while metal detecting for gold nuggets. The first piece (and the largest), a complete individual weighing 2396 g, was found on the surface in a sandy area on the eastern side of a large dry wash, a few kilometers northwest of the town of El Boludo. A search with metal detectors of the surrounding area produced numerous additional fragments and a few smaller whole stones. All known pieces were purchased by Aerolite Meteorites.

**Physical characteristics**: Deposit sample saw cut reveals relatively small chondrules and abundant opaque grains set in a dark brown groundmass.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows numerous equilibrated chondrules; plagioclase grains up to ~50 μm.

**Geochemistry**: (C. Agee, *UNM*) Olivine Fa19.3±0.3, Fe/Mn=40±1, n=9; low-Ca pyroxene Fs17.1±0.5Wo1.1±0.1, Fe/Mn=24±1, n=10.

**Classification**: Ordinary chondrite (H5)

**Specimens**: 22 g including a probe mount on deposit at *UNM*, Aerolite Meteorites holds the main mass.

**El Médano 350** (EM 350)        ~24°51’S, ~70°30’W

Antofagasta, Chile

Find: 2013 Nov 10

Classification: HED achondrite (Eucrite, polymict)

**History**: The meteorite was found in the Atacama desert by Jihed Dridi on 2013 November 10

**Physical characteristics**: The stone was found broken in three fitting pieces. It is an almost full oriented stone with fresh glassy fusion crust and flow lines. Cut surface reveals a grey brecciated interior.

**Petrography**: (J. Gattacceca *CEREGE*, A. Jambon UPMC) Brecciated magmatic rock composed mostly of plagioclase and pyroxenes, with accessory chromite, silica, olivine, ilmenite, troilite, metal. There three main lithologies: 1) a macroscopically light lithology with fractured ophitic texture and plagioclase and pyroxene grain size to 600 μm; 2) a macroscopically darker lithology with finer grains (typical size 150 μm), more metal and evidence for strong shock; 3) a cataclastic lithology with large plagioclase and pyroxene clasts (to 5 mm), and both exsolved (augite exsolution in pigeonite) and zoned pyroxenes, set in a comminuted matrix of the same minerals. In the dark lithology, brecciation has obliterated the original magmatic teture. Shock evidence include the presence of melt pockets with quenched texture and shock darkening by small metal and sulfide blebs.

**Geochemistry**: Low-Ca pyroxenes Fs29.8-59.1, average Fs47.1±11.1Wo4.5±1.2, FeO/MnO 30.9±3.4 (N=11). Plagioclase An89.1±4.0Ab10.5±4.0Or0.4±0.2(N=9). One olivine from a quenched clast is Fa84.9.Magnetic susceptibility log χ (× 10-9 m3/kg) = 3.79 is much higher than the average eucrite (log χ (× 10-9 m3/kg) = 2.95±0.30, measured on 70 falls by [Rochette et al. 2009)](http://onlinelibrary.wiley.com/doi/10.1111/j.1945-5100.2009.tb00741.x/abstract), pointing to an anomalous rich metal content at the level of the Brient polymict eucrite.

**Classification**: Achondrite (polymict eucrite, metal-rich). Minimal weathering.

**Specimens**: Type specimen and main mass at *CEREGE*.

**El Médano 351** (EM 351)        ~24°51’S, ~70°30’W

Antofagasta, Chile

Find: 2014 Nov 15

Classification: Ordinary chondrite (LL3-6)

**Petrography**: Brecciated chondrite with equilibrated host (type 6) containing unequilibrated clasts (type 3).

**Geochemistry**: Type 6 host: olivine Fa29.9(N=1), orthopyroxene Fs25.7Wo5.0(N=1). Type 3 clasts: olivine Fa22.0; Fa25.7; Fa30.5(N=3), orthopyroxene Fs11.5Wo0.5(N=1).

**Classification**: LL3-6

**El Médano 356** (EM 356)        ~24°51’S, ~70°30’W

Antofagasta, Chile

Find: 2014 Nov 13

Classification: Ordinary chondrite (L(LL)6)

**Physical characteristics**: Small full stone

**Petrography**: Recrystallized chondritic texture with average plagioclase size above 50 μm.

**Classification**: L(LL)6. Magnetic susceptibility is low for a L chondrite with weathering W1, but high for an LL6 chondrite. The small stone size makes magnetic classification not very robust in this case.

**El Médano 360** (EM 360)        24.717211°S, 70.347958°W

Antofagasta, Chile

Find: 2014 Nov 04

Classification: Ordinary chondrite (L3)

**Petrography**: Densely packed chondrules, some rimmed by opaques. Olivine is chemically zoned.

**Geochemistry**: Olivine Fa16.4±7.6, range Fa0.8-24.4, PMD 36%, N=7. Cr2O3 in ferroan olivine 0.07±0.03 wt% (N=6). Orthopyroxene Fs12.1±9.0Wo1.8±2.0(N=5), range Fs4.3-27.7.

**Classification**: L3

**El Médano 362** (EM 362)        24°51’S, 70°32’W

Antofagasta, Chile

Find: 2016 Nov

Classification: Carbonaceous chondrite (CO3)

**History**: The stones were found on the surface in the Atacama desert.

**Physical characteristics**: Brownish stones. Cut surface reveals homogeneous dark brown interior with small chondrules and metal grains.

**Petrography**: Chondrules and small CAIs set in an iron rich fine grained matrix. Mean apparent chondrule diameter 190±900 μm (N=45). Modal abundances: chondrules and chondrule fragments 64 vol%, matrix 36 vol%. Abundant FeNi metal.

**Geochemistry**: Olivine Fa22.6±21.5, range Fa0.7-60.6, PMD 88%, N=15. Cr2O3 in ferroan olivine is 0.07±0.03 wt% (N=12). Orthopyroxene Fs8.7Wo0.9(N=1). Magnetic susceptiblity log χ (× 10-9 m3/kg) = 4.47.

**Classification**: CO3. Moderate weathering

**Specimens**: Type specimen and polished sections at *CEREGE*. Main mass with ArtMet collection, Poland.

**El Médano 369** (EM 369)        24°37’59.7"S, 70°18’30.2"W

Antofagasta, Chile

Find: 2013 Apr 06

Classification: Ordinary chondrite (H4)

**Petrography**: (J. Gattacceca, H. Pourkhorsandi, *CEREGE*): Well-delineated chondrules, some rimmed with metal and sulfides.

**Geochemistry**: Olivine Fa19.3(N=1), orthopyroxene Fs16.8±1.3Wo1.0±0.5(Fs14.4-18.5, Fs PMD=5.8%, N=5)

**El Médano 370** (EM 370)        ~24°51’S, ~70°32’W

Antofagasta, Chile

Find: 2015 Jan 03

Classification: Ordinary chondrite (L6)

**Petrography**: (J. Gattacceca, H. Pourkhorsandi, *CEREGE*): Recrystallized chondritic texture. Average plagioclase size above 50 μm. Shock veins, melt pockets. Probably paired with [El Médano 156](https://www.lpi.usra.edu/meteor/metbull.php?code=57189).

**Gandom Beryan 003**        31°1.133’N, 58°1.367’E

Kerman, Iran

Find: 2013 Oct

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Chromite and plagioclase assemblages.

**Gandom Beryan 004**        31°12.567’N, 58°8.783’E

Kerman, Iran

Find: 2016 March

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Alteration of troilite to pyrite/marcasite.

**Gandom Beryan 005**        31° 51.983’N, 57° 3.567’E

Kerman, Iran

Find: 2017 January

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. The presence of a clasts with higher modal abundance of chondrules than the rest of the meteorite indicates its brecciated nature.

**Gandom Beryan 006**        31° 53.650’N, 57° 2.833’E

Kerman, Iran

Find: 2017 January

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Gandom Beryan 007**        31° 52.783’N, 57° 6.583’E

Kerman, Iran

Find: 2017 January

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Gandom Beryan 008**        31°53’15.24"N, 57° 2’28.08"E

Kerman, Iran

Find: 5 Jan 2017

Classification: Ordinary chondrite (H5)

**History**: The meteorite was found 5 January 2017 by the *UrFU* meteorite expedition-2017 in Iran (Pastukhovich A.Yu., Larionov M.Yu., Kruglikov N.A., Zamyatin D.A.) in the northern sandy part of the Lut desert. The smaller pieces were collected up to 20 m away from the larger stones.

**Physical characteristics**: All fragments of the meteorite have angular to roughly rounded shape. The surface and interior of the meteorite is light to dark brown in color due to abundant Fe-hydroxides. Some parts have glassy-like surface due to desert weathering. No fusion crust was observed. Abundant cracks (1-2 mm in thickness) are common of large meteorite fragments. Some are totally filled with either sandy minerals (quartz, K-feldspar, muscovite, albite, fluorapatite), which are cemented by calcite or anhydrite, or Fe-hydroxides.

**Petrography**: Classification (V. V. Sharygin, *SIGM* and *UrFU*). Petrographic observation of a polished section shows chondrules in a recrystallized matrix. Chondrules are readily delineated and their sizes vary from 200 to 800 µm. They have barred or porphyritic texture, rarely cryptocrystalline, and consist of Ol+Pl, Opx+Pl, Ol+Opx+Cpx+Pl or Opx+Cpx+Pl. Olivine, low-Ca-pyroxene and plagioclase are main minerals in matrix. Plagioclase grains are less than 50 µm. This indicates a petrological type of 5 for the meteorite. Undulatory extinction and irregular fractures in olivine, as well as the absence of opaque shock veins and melt pockets, indicate a shock stage of S2. Relics of fresh FeNi metals (kamacite, taenite, tetrataenite, up to 40 µm) and troilite (up to 200 µm) are very rare due to intensive alteration. Weathering products (goethite, "hydrogoethite", akaganeite, rarely anhydrite) occur as veins and in situ alteration of FeNi-metals and troilite and fill all microfractures in minerals from matrix and chondrules. The replacement of olivine and low-Ca pyroxene by serpentine/chlorite is sometimes fixed in outer zones of grains (weathering grade W3 to W4). Clinopyroxene, chromite, chlorapatite and merrillite (up to 200 μm) occur locally in the matrix. Pyrrhotite and smythite (alteration of troilite?) form grains up to 100 µm. Violarite appears as an alteration product of smythite. In addition, rounded inclusions of SiO2 phase (quartz?) was found in smythite and goethite.

**Geochemistry**: EDS-WDS analyses (V. V. Sharygin, *SIGM* and *UrFU*). The primary chondrite paragenesis includes olivine Fa18.42±0.45(N=41), orthopyroxene Fs16.31±0.52Wo1.05±0.19(N=43), plagioclase Ab83.43An9.44Or7.13(N=11), Cr-bearing clinopyroxene En46.9Fs8.9Wo44.2(N=6), chromite, chlorapatite, merrillite and FeNi-metals. Two types of chromite are indicated: Crt81.0±1.78Spl13.66±0.39 (N=27, dominant) and Crt48.97±0.46Spl47.99±0.84 (N=5, accessory). Chlorapatite sometimes contains F (up to 0.9 wt.%); Cl 5.79±0.19 wt.% (N=13). Merrillite is poor in FeO (0.8-1.6 wt.%). Composition of metals (in wt.%): kamacite (N=4) Fe 94.31±0.88, Ni 4.95±0.88, Co 0.44±0.07; taenite (N=13)  Fe 66.35±2.91, Ni 33.59±3.31, Co 0.16±0.20; tetrataenite (N=6) Fe 48.64±1.75; Ni 50.87±1.97, Co 0.17±0.14. Rare troilite is close to ideal FeS. Composition of other sulfides (in wt.%): pyrrhotite (N=14) Fe 59.09±1.77, Ni 1.30±1.30; Co 0.18±0.21; S 39.43±0.65; smythite (N=13) Fe 36.54±5.65, Ni 21.43±5.34, Co 1.21±0.33, S 40.72±0.34; violarite (N=1)  Fe 20.16, Ni 35.51, Co 1.74; S 42.33. Fe-rich serpentine-group mineral is sometimes rich in NiO (up to 6 wt.%). Goethite and "hydrogoethite" contain 1.2-11.7 wt.% NiO, up to 0.8 wt.% CoO. Akaganeite is rich in NiO (10.4-13.2) and CoO (0.5-0.6 wt.%); Cl 4.3-4.9 wt.%.

**Classification**: (Victor V. Sharygin, *SIGM* and *UrFU*). Ordinary chondrite. H5, S2, W3-4. In chemical composition of olivine and low-Ca pyroxene this meteorite seems to be similar to nearby meteorites: [Gandom Beryan 002](https://www.lpi.usra.edu/meteor/metbull.php?code=65558), [005](https://www.lpi.usra.edu/meteor/metbull.php?code=65812), [006](https://www.lpi.usra.edu/meteor/metbull.php?code=65813), and [Ravar 001](https://www.lpi.usra.edu/meteor/metbull.php?code=64338)

**Specimens**: 2635.14 g (5 samples: 1561, 640, 197.35, 202.71, 34.08 g)  *UrFU*; 38.22 g and a thin section, *SIGM*; main mass Kerman University, Iran (Mr. Majid Khatami).

**Gandom Beryan 009**        31°52’50.10"N, 57°10’54.06"E

Kerman, Iran

Find: 4 Jan 2017

Classification: Ordinary chondrite (H5)

**History**: A 217.9 g meteorite was found 4 January 2017 by the *UrFU* meteorite expedition-2017 in Iran (Pastukhovich A.Yu., Larionov M.Yu., Kruglikov N.A., Zamyatin D.A.), 5.3 km northeast of the middle part of the Ravar road near Dige-e-Rostam hot springs, Tabas (northern sandy part of the Lut desert). This meteorite was observed on the hard surface and was initially broken into two fragments.

**Physical characteristics**: Both fragments have roughly rounded shape. The surface and interior of the meteorite is light to dark brown in color due to abundant Fe-hydroxides. Some parts have a glassy-like surface due to desert weathering. No fusion crust was observed. Cracks (up to 0.5 mm in thickness) occur in meteorite fragments. Some are totally filled with natrojarosite or aggregate of natrojarosite and anhydrite.

**Petrography**: Classification (V.V. Sharygin, *SIGM* and *UrFU*). Petrographic observation of a polished section shows chondrules in a recrystallized matrix. Chondrules are readily delineated and their sizes vary from 300 to 800 μm. They have barred or porphyritic texture, rarely cryptocrystalline, and consist of Ol+Pl, Opx+Pl, Ol+Opx+Cpx+Pl or Opx+Cpx+Pl. Olivine, low-Ca-pyroxene and plagioclase are the main minerals in the matrix. Plagioclase grains are less than 50 μm. This indicates a petrologic type of 5 for the meteorite. Undulatory extinction and irregular fractures in olivine, as well as the absence of opaque shock veins and melt pockets, indicate a shock stage of S2. Some grains of pyroxene show polysynthetical twinning. Fresh FeNi metals and troilite (up to 10 μm) very rarely occur in recrystallized matrix due to intensive alteration. Individual grains/blebs (5-10 μm) of kamacite (± tetrataenite ± troilite) and troilite are observed only in some cryptocrystalline chondrules. Weathering products (goethite, "hydrogoethite", natrojarosite, rarely anhydrite) occur as veins and in situ alteration of FeNi-metals and troilite. In addition Fe-hydroxides fill all microfractures in minerals from matrix and chondrules. The replacement of olivine and low-Ca pyroxene by Fe-rich serpentine is sometimes fixed in outer zones of grains (weathering grade W3 to W4). Clinopyroxene, chromite, chlorapatite and merrillite (up to 200 μm) occur locally in the matrix. Micron-sized ilmenite was found in some chondrules. Rare magnetite occurs as rim around some chromite grains. Ni-rich pyrrhotite/smythite and pyrite (alteration of troilite?) is sometimes present in goethite aggregate.

**Geochemistry**: EDS-WDS analyses (V. V. Sharygin, *SIGM* and *UrFU*). The primary chondrite paragenesis includes olivine Fa19.85±0.11(N=41), orthopyroxene Fs17.20±0.26Wo1.14±0.24(N=47), plagioclase Ab82.2An12.2Or5.6(N=27), Cr-bearing clinopyroxene En47.8Fs6.9Wo45.3(N=13), chromite Crt80.68±0.71Spl14.41±0.80 (N=9), chlorapatite and merrillite. Chlorapatite contains F (up to 0.6 wt.%); Cl 5.63 wt.% (N=5). Merrillite is poor in FeO (0.9-1.3 wt.%, N=4). Composition of kamacite (in wt.%, N=23): Fe 89.59±0.23, Ni 9.7±0.36, Co 0.42±0.06. Rare troilite is close to ideal FeS. Composition of pyrrhotite/smythite (in wt.%): Fe 55.0-60.1; Ni 0.4-4.5; Co up to 0.3; S 38.4-40.3. Fe-rich serpentine-group mineral is sometimes rich in NiO (up to 2.6 wt.%). Goethite contains 0.7-16.9 wt.% NiO and up to 0.7 wt.% CoO. Natrojarosite NaFe3(SO4)2(OH)6 (in wt.%, N=9): Fe2O3 46.47; Na2O 5.18; K2O 0.69; SO3 33.86.

**Classification**: V. V. Sharygin, *SIGM* and *UrFU*). Ordinary chondrite. H5, S2, W3-4. In chemical composition of olivine and low-Ca pyroxene this meteorite seems to be similar to nearby meteorites: [Gandom Beryan 002](https://www.lpi.usra.edu/meteor/metbull.php?code=65558), [005](https://www.lpi.usra.edu/meteor/metbull.php?code=65812), [006](https://www.lpi.usra.edu/meteor/metbull.php?code=65813), [007](https://www.lpi.usra.edu/meteor/metbull.php?code=65814) and [Ravar 001](https://www.lpi.usra.edu/meteor/metbull.php?code=64338).

**Specimens**: 210.92 g (2 samples: 195.8 and 13.12) at *UrFU*; 7.0 g cut-offs and thin section at *SIGM*.

**Gheriat 004**        30.607804E, 13.438359N

Gharyan, Libya

Find: 2009

Classification: Iron meteorite (IID)

**History**: In December 2009, a single dark redish-brown metallic stone was found in the Zamzem valley of Libya by brothers Mohammed and Abbas Alazhari and used as a hammer for several years before Abbas recognized it as a meteorite. In 2016, a small piece of the stone was sent to *ROM* for preliminary analysis, and later that year the remainder of the stone was sent to Dustin Dickens who submitted it for official classification at *UWO*.

**Petrography**: (A. Bouvier) Fresh interior, medium octahedrite texture. No inclusions were observed in the repository specimen.

**Geochemistry**: (A. Bouvier, *UWO*) Elemental composition of the metal in wt%: Ni = 9.8, Co=0.64; and in ppm: Cr=36.9, Cu=269, Ga73.2, As=6.5, W=2.6, Ir=9.8 and Au=0.55. Data checked against [North Chile](https://www.lpi.usra.edu/meteor/metbull.php?code=17001) Filomena as an external standard.

**Classification**: Iron, IID

**Specimens**: Two slices totalling 92.1 g at *UWO*.

**Grein 005**        20°6’N, 10°37’E

Agadez, Niger

Purchased: 22 Dec 2015

Classification: Iron meteorite (IIIAB)

**History**: Found in November 2015 exposed on the surface by artisanal miners while prospecting for gold between Tehmet and Djado in the Tènéré Tafassasset. This is reportedly the second iron meteorite from the area. Six other masses with a total weight of 554 kg are likely from the same area, but neither find data nor sample material of these could be obtained, thus they are excluded from the reported mass.

**Physical characteristics**: The 52 kg mass is 39 × 25 × 18 cm and has the shape of a longitudinally split cone with the cone section showing minor concavity while the opposite surface is distinctly convex. Numerous regmaglypts measuring 1-3 cm across and 1-1.5 cm deep are present, and at least one troilite inclusion is observed. The specimen is coated with a thick layer of dark brown desert varnish.

**Petrography**: Polished sections display a well-developed Widmannstätten pattern of a medium octahedrite with a mean kamacite bandwidth of 1.0±0.2 mm. Neumann bands are visible within kamacite. Schreibersite and graphite are absent in the sections observed. Troilite is present in the form of rounded and bar-shaped inclusions ranging from 2-20 mm across the longest axis, partly surrounded by thin swathing kamacite. Fractures up to 1 mm wide penetrate the meteorite along the kamacite lamellae and are filled with terrestrial oxides, otherwise the interior weathering is very moderate. Fusion crust and heat-affected zones are mostly absent.

**Geochemistry**: ICP-MS data, using sample of [North Chile](https://www.lpi.usra.edu/meteor/metbull.php?code=17001) (Filomena) as standard (C. Herd and G. Chen *UAb*): Ni = 8.0, Co = 0.51 (both wt%); Ir = 13.9, Ga = 22, Ge = 83, W = 1.4, Re = 1.4, Os = 7.3, Cu = 210, Ru = 12.7, Pd = 2.0, Pt = 15.7 (all μg/g).

**Classification**: (C. Herd, *UAb*): IIIAB iron, medium octahedrite.

**Specimens**: Type specimen consisting of two representative slices (67.6 and 49.4 g) at *UAb*. Main mass with S. Buhl.

**Grove Mountains 090018** (GRV 090018)        72°46’45.3"S, 75°19’23.5"E

Antarctica

Find: 8 Jan 2010

Classification: Iron meteorite (ungrouped)

**History**: During 2009/2010 field season, 1618 meteorite samples have been collected by CHINARE in Grove Mountains, East Antarctica.

**Physical characteristics**: This iron meteorite has black fusion crust with total mass 1.46 g. The sample is a piece of iron without silicate inclusions.

**Petrography**: In polished section, under reflected light, metal and troilite can be seen clearly. There are some dark areas filled with small minerals. Cracks can be seen in these gray minerals.

**Geochemistry**: The concentrations of trace elements (by ICP-MS) show the iron is ungrouped. The Ni = 8.75%; Co = 0.34%; Ga = 12.2 ppm; Ge = 2.41 ppm; Ir = 3.26 ppm; Au = 0.92 ppm. The Ni-Ga, Ni-Ge, and Ni-Ir diagrams don’t plot in any area of any chemical group.

**Classification**: Ungrouped iron meteorite

**Specimens**: The main mass and one thin section are on deposited at *PRIC*.

**Grove Mountains 090327** (GRV 090327)        72°49’31.1"S, 75°21’19.6"E

Antarctica

Find: 15 Jan 2010

Classification: Iron meteorite (IAB-ungrouped)

**History**: During the 2009/2010 field season, 1618 meteorite samples have been collected by CHINARE in Grove Mountains, East Antarctica.

**Physical characteristics**: This iron meteorite is covered with dark brown to black fusion crust, with total mass 43.63 g. The sample is a piece of iron with almost half troilite inclusions, apparent to the naked eye. Dimensions:3.3 × 1.5 × 2.5 mm

**Petrography**: In polished section, there are many veined fissures spread in the metal matrix. Gray minerals fill the veined fissures. A Widmanstaetten pattern is present.

**Geochemistry**: The concentration of trace elements show the iron meteorite belongs to the IAB meteorites: Co = 0.57%; Ni = 10.9%; Ga = 27.5 ppm; As = 13.4 ppm; Ge = 39.3 ppm; Ir = 0.11 ppm; Au = 1.2 ppm. The Ni-Ga, Ni-Ge, and Ni-Ir diagrams indicate that the iron is a member of the IAB chemical group.

**Classification**: Iron meteorite, IAB-ungrouped

**Specimens**: The main mass and one polished section are on deposited at *PRIC*.

**Grove Mountains 090333** (GRV 090333)        72°49’31.1"S, 75°21’19.6"E

Antarctica

Find: 15 Jan 2010

Classification: Iron meteorite (IAB-sLM)

**History**: During 2009/2010 field season, 1618 meteorite samples have been collected by CHINARE in Grove Mountains, East Antarctica.

**Physical characteristics**: This iron meteorite is covered with dark gray to black fusion crust, with total mass 38.02 g. The whole iron meteorite is nearly an ovoid. Some brown to dark-red traces appear in the cut face. Silicate inclusions cannot be observed by naked eye. Dimensions:2.8 × 1.2 × 2.1 mm.

**Petrography**: In polished section, there are some dark, long bars of kamacite that are mixed with taenite and cracked minerals. Some small, dark minerals also can be seen in the matrix. A Widmanstaetten patter is visible.

**Geochemistry**: The concentrations of trace elements show the iron meteorite belongs to the IAB chemical group: Co = 0.51%; Ni = 13.45%; Ga = 33.7 ppm; As = 17.7 ppm; Ge = 78.4 ppm; Ir = 0.83 ppm.

**Classification**: IAB iron meteorite

**Specimens**: The main mass and one section are on deposited at *PRIC*.

**Hami 006**        42°8.09’N, 93°26.24’E

Xinjiang, China

Find: 8 Apr, 2014

Classification: Ordinary chondrite (L5)

**History**: The meteorite was found by Y. Wang in April, 2014, in the Gobi Desert of south Hami. A group of meteorite hunters with four persons drove from *Beijing* to Neimenggu, Gansu and Xinjiang provinces. Eight meteorite specimens were found in that trip, with total weight of ~15 kg and Hami 006 is the largest, with weight ~7.87 kg.

**Physical characteristics**: The meteorite was a single piece with part surface covered by dark-brown fusion crust.

**Petrography**: (S. Hu and Y. Lin, *IGGCAS*) The meteorite is mainly composed of olivine, pyroxene, plagioclase,Fe-Ni metal (kamacite and taenite) and troilite, with minor chromite and apatite. Fe-Ni metal displays strong terrestrial weathering. Relict chondrules are identifiable on the sections.

**Geochemistry**: Mineral compositions and geochemistry: (S. Hu and Y. Lin, *IGGCAS*) Olivine (Fa25.2±0.2) and low-Ca pyroxene (Fs21.3±0.9Wo2.0±1.4) are homogeneous in chemical composition.

**Classification**: (S. Hu and Y. Lin, *IGGCAS*) L5

**Specimens**: The main mass was held by Y. Wang and 200 g was deposited at *IGGCAS*

**Hammadah al Hamra 345** (HaH 345)        29°48.440’N, 12°55.242’E

Gharyan, Libya

Find: 2 Oct 2016

Classification: Ordinary chondrite (H3-6)

**History**: The meteorite was found in 2016 during a field trip in the Libyan desert.

**Petrography**: The brownish meteorite is a chondritic breccia composed of H3 to H6 clasts set into a fine-grained clastic matrix. Plagioclase grain size in H6 clasts is about 60 µm.

**Geochemistry**: olivine in type 6: Fa18.7±0.3, n=10; olivine in type 3: Fa11.1±9.0(Fa0.6-22.6, n=16); pyroxene in type 6: Fs16.9±0.1Wo1.2±0.2, n=10; pyroxene in type 3: Fs10.9±7.0Wo0.8±0.5(Fs1.8-23.3Wo0.2-1.9, n=42)

**Hocheppan**        46°29.1’N, 11°12.75’E

Trentino-Alto Adige, Italy

Find: 2016 Oct 16

Classification: Ordinary chondrite (H5)

**History**: Dieter Janek discovered the meteorite during a mountain hike on a dolomitic hillsite at Gantkofel, 2.5 km WSW of Hocheppan castle on October 16, 2016.

**Physical characteristics**: One nearly complete stone of 1136 g, covered with dark-brown fusion crust and minor, small broken faces. Cut face shows dark-gray matrix with lighter inclusions, chondrules and abundant fresh metal.

**Petrography**: (R. Bartoschewitz, *Bart*) Microscopic examination of a thin section shows dark matrix with very fine-grained groundmass and various types of chondrules of 0.1-1 mm (average 0.4 mm) in diameter. Lighter inclusions with coarser groundmass and various chondrule types of 0.3 - 1.2 mm (average 0.6 mm) are embedded in the dark matrix. Metal is homogenously distributed in both lithologies.

**Geochemistry**: (R. Bartoschewitz, *Bart*, P. Appel and B. Mader, *Kiel*) Olivine Fa17.6±0.3(n=35); pyroxene Fs15.6±0.4Wo1.5±0.4(n=8). Kamacite Ni=6.3, Co=0.6 wt.-%). Magnetic susceptibility (R. Bartoschewitz, *Bart*) log χ (× 10-9 m3/kg) = 5.34.

**Classification**: Ordinary chondrite (H5)

**Specimens**: 20.0 g on deposit at *Kiel*, main mass (1126.6 g) Dieter Janek, Eppan

**Hradec Králové**        50°18.03’N, 15°43.67’E

Královéhradecký, Czech Republic

Confirmed fall: 17 May 2016

Classification: Ordinary chondrite (LL5)

**History**: (P. Spurný, *CzAS*). A slow moving, -11.5 absolute magnitude, bolide was recorded photographically and photoelectrically by digital all-sky fireball observatories at three Czech stations of the European Fireball Network (other stations had bad weather) and by two web cameras of the Czech Hydrometeorological Institute on May 17, 2016, at 1:04:01.2-7.3 UT. Based on these instrumental data, precise results on atmospheric trajectory, heliocentric orbit, and fragmentation history were quickly determined. It was evident that this event terminated with a multiple meteorite fall and the impact area of possible meteorite masses was modeled. However, a systematic search was very complicated because the fall occurred in an agriculturally cultivated area during the high vegetation season. Nevertheless, the impact area was announced in the *CzAS* official press release and the public was asked for a help with the search. After dedicated search activities of several teams (including *CzAS* team) and individual hunters, one freshly looking meteorite was recovered by a private hunter in the predicted location for a given mass. It was found in the oil seed grape field just after the harvest on July 30, 2016 and the finder informed P. Spurný(*CzAS*) about his find in March 2017. The sample was immediately analyzed by J. Haloda (*CzGS*).

**Physical characteristics**: (P. Spurný, *CzAS*). Hradec Kralove is a single, 133 g, slightly wedge-shaped stone measuring approximately 6 × 3.5 × 2 cm with bulk density 3.23 g/cm3. About half of its surface is covered by a thick, black, primary fusion crust, where one side contains well-developed regmaglypts. The second half of its surface is covered by a very thin secondary crust signifying a break up of the meteoroid in the last moment of its ablation phase. Only a few small rusty spots are visible on its surface. One small 1.1 g fraction was chipped from this sample and was used for mineralogical/petrological analyses. Another 22.2 g was cut later and it serves as the repository mass (*CzAS*).

**Petrography**: (J. Haloda, *CzGS*), The meteorite shows only weakly defined chondrules; sizes vary from around 0.5 mm to 5 mm. Thin section shows a complete recrystallization of a fine-grained matrix. An undulose extinction of olivine and orthopyroxene and presence of irregular fractures indicate a very weak shock stage (S2).

**Geochemistry**: Mineral compositions and geochemistry: (J. Haloda, *CzGS*), Chondrule relicts consist mostly of olivine (Fa25-33) mean Fa29.7, Fa PMD 3.5%, n=50; low-Ca pyroxene (Fs21-27Wo0.8-2.4) mean Fs24.0Wo1.7, Fs PMD 4.7%, Wo PMD 5.7%, n=50. Feldspar grains <10 mm, chromite, chlorapatite, troilite, kamacite and taenite are also present.

**Classification**: (J. Haloda, *CzGS*), Ordinary chondrite, LL5 (S2). Weathering grade W0

**Specimens**: Type specimen 22.2 g + 0.5 g, *CzAS*; the main mass (110 g) is with the finder

**Huoyanshan**        43°2.55’N, 89°51.51’E

Xinjiang, China

Find: 2016 Oct 6

Classification: Iron meteorite (IAB-sLH)

**History**: The first piece was found on Oct. 6, 2016, by Mr. Yanzheng Wang and Jifa Li, workers from a nearby oil field, who were searching for wind-eroded stones on the desert. The find site is 15 km NE of the Mountain Huoyanshan, which was noted in the famous 16th century novel, "A Journey to the West," as having emerged from pieces of charcoal on fire falling from Heaven. 18 more pieces were collected from a strewn field of 2 × 1.5 km2 during the following days. These irons weigh from 100 g up to 8.9 kg, with a total mass of ~45 kg. The news was leaked soon, and people rushed the desert to search for the irons with metal detectors. It is estimated that thousands pieces with a total mass of ~700 kg have been collected.

**Physical characteristics**: Physical characteritics: Rusted only on the bottom.

**Petrography**: finest octahedrite, with kamacite (band width <0.035 mm) and taenite forming a Widmanstätten pattern. Minor schreibersite occurs within kamacite. Mineral compositions: Kamacite (3.4-7.3 wt % Ni), Taenite (typical M-type zoning with Ni content decreasing from 47.3 wt % at the rims to 16.5 wt % at the cores), and minor schreibersite (46.2-53.9 wt % Ni, 12.9-16.4 wt % P) (N. Wang and Y. Lin, *IGGCAS*).

**Geochemistry**: Ni 21.1 wt % (by ICP-AES), and trace elements of (by ICP-MS, in µg/g) Ir 0.02, Ge 1.73, Ga 2.0, Au 1.81 (G. Wang, *GIGCAS*)

**Classification**: Iron (IAB-sLH)

**Specimens**: 1.0 kg in *IGGCAS*, ~400 kg with Mr. Wang, Li and 3 others; ~300 kg with unknown owners.

**Jiddat al Harasis 818** (JaH 818)        19°44.439’N, 55°40.591’E

Al Wusta, Oman

Find: 11 Jan 2012

Classification: Carbonaceous chondrite (CV3)

**History**: Found by Edwin Gnos, Beda Hofmann, Karl Wimmer, Elise Wimmer and Florian Zurfluh during a search for meteorites on January 11, 2012.

**Physical characteristics**: Single wind-ablated stone of 19.36 g, no fusion crust preserved.

**Petrography**: (E. Gnos, *MHNGE* and B. Hofmann, *NMBE*) The meteorite consists of up to 1.5 mm sized chondrules (approx. 45 vol%; average size 0.75±0.33 mm n=48) with partially recrystallized glass, CAIs (0.2-3.0 mm; approx. 5 vol%), and dark matrix (approx. 50 vol%). Magnetite is rather rare, troilite is largely oxidized. Some Fe-hydroxides probably resulted from oxidation of iron metal.

**Geochemistry**: (N. Greber, *Bern*) Olivine compositions are Fa11.2-50.1, median Fa30.0(n=4), pyroxene compositions are Fs0.8-5.7Wo0.9-5.7, median Fs1.0Wo1.3(n=9). Oxygen isotopes: (R. Greenwood, *OU*) gave δ18O=5.43, δ17O=0.35, Δ17O= -2.47 (all per mil).

**Classification**: CV3 based on petrography, matrix abundance, mean chondrule size, presence of large CAIs and oxygen isotopes.

**Specimens**: All at *NMBE*.

**Jiddat al Harasis 936** (JaH 936)        19°8.977’N, 55°15.631’E

Zufar, Oman

Find: 19 Jan 2012

Classification: Ordinary chondrite (L3)

**History**: Found by Edwin Gnos, Beda Hofmann, Elise Wimmer, Karl Wimmer, Florian Zurfluh during a search for meteorites on January 19, 2012.

**Physical characteristics**: Dark brown weathered stone of 1687 g plus ten fragments ranging from 45 g to less than one gram. No fusion crust preserved.

**Petrography**: (B. Hofmann, *NMBE*) Homogeneous chondritic texture, mean apparent chondrule diameter is 1.03±0.48 mm (n=85). Metal and troilite are largely weathered.

**Geochemistry**: (N. Greber, *Bern* and B. Hofmann, *NMBE*) Olivine compositions are Fa24.5±1.4(Fa19.2-27.4, n=38), pyroxene compositions (n=18) are Fs17.6±2.8Wo1.4±0.9(Fs10.4-21.5Wo0.3-4.6). Bulk Fe/Mn (XRF) is 70±4 (n=7).

**Classification**: L chondrite based on mineral compositions. Low degree of shock (S2), weathering grade W4.

**Specimens**: All at *NMBE*.

**Jiddat al Harasis 937** (JaH 937)        19°37.584’N, 55°43.657’E

Al Wusta, Oman

Find: 25 Jan 2013

Classification: Ordinary chondrite (H3)

**History**: Found by Ali Al-Kathiri during a search for meteorites on January 28, 2013.

**Physical characteristics**: 25 dark brown fragments found in close proximity.

**Petrography**: ( B. Hofmann, *NMBE* and E. Gnos, *MHNGE*) Mean apparent chondrule size 0.98±0.36 mm (n=73), clear glass is present. Contains 1 × 2.5 mm sized inclusion consisting of equal amounts of opx and cristobalite (grain size 0.1-0.4 mm).

**Geochemistry**: (N. Greber, *Bern*) Mineral compositions: Fa18.1±2.5(range Fa15.9-23.6, n=19), Fs13.3±4.5Wo1.0±0.4(range Fs3.3-15.6Wo0.3-1.4); pyroxene in cristobalite-px-clast has Fs22.1±8.0Wo1.2±1.0(range Fs12.6-33.7Wo0.1-3.2).

**Classification**: Based on mineral compositions this is an H3 chondrite, shock grade S2, weathering W4.

**Specimens**: All at *NMBE*

**Jiddat al Harasis 1089** (JaH 1089)        19°48’22.42"N, 56°28’37.39"E

Al Wusta, Oman

Find: 2014 Nov 13

Classification: Ordinary chondrite (L6)

**Physical characteristics**: A dark brown stone. Cut surface reveals a dark brown interior with poorly delineated chondrules.

**Petrography**: Recrystallized chondrite with average plagiocalse size above 50 μm.

**Specimens**: type specimen and polished section at *CEREGE*. Main mass with anonymous finder.

**Jiddat al Harasis 1090** (JaH 1090)        19°50’3.43"N, 56°27’11.47"E

Al Wusta, Oman

Find: 2011

Classification: Ordinary chondrite (L4)

**Petrography**: Closely packed, well delineated chondrules. Orthopyroxene is unequilibrated.

**Geochemistry**: Fs16.1-21.6(N=4)

**Kerman 126**        30°47.516’N, 57°47.850’E

Kerman, Iran

Find: 2013 Nov

Classification: Ordinary chondrite (H5)

**Physical characteristics**: Fusion crust is partly preserved. FeNi metal grains can be seen easily on the broken surface.

**Petrography**: Chromite and plagioclase assemblages. Plagioclase maximum size 30 μm. Polycrystalline troilite.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 127**        30°56.878’N, 57°39.283’E

Kerman, Iran

Find: 2014 Oct

Classification: Ordinary chondrite (H5)

**Petrography**: Chromite and plagioclase assemblages.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 128**        30°47.317’N, 57°54.017’E

Kerman, Iran

Find: 2013 Oct

Classification: Ordinary chondrite (H5)

**Petrography**: Plagioclase maximum size 40 μm.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 129**        30°47.650’N, 57°45.333’E

Kerman, Iran

Find: 2014 Jan

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 130**        30°49.109’N, 57°49.218’E

Kerman, Iran

Find: 2013 Nov

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 131**        30°50.199’N, 57°51.417’E

Kerman, Iran

Find: 2014 Jan

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 132**        30°45.583’N, 57°49.383’E

Kerman, Iran

Find: 2013 Nov

Classification: Ordinary chondrite (H5)

**Petrography**: Chromite and plagioclase assemblages. Shock veins.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 133**        30°45.499’N, 57°47.600’E

Kerman, Iran

Find: 2014 Oct

Classification: Ordinary chondrite (H5)

**Petrography**: Chromite and plagioclase assemblages. Shock veins.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 134**        30°53.482’N, 58°1.250’E

Kerman, Iran

Find: 2014 Oct

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 135**        30°48.938’N, 57°41.007’E

Kerman, Iran

Find: 2016 April

Classification: Ordinary chondrite (H5)

**Physical characteristics**: Fusion crust is preserved. Well-defined chondrules and metals grains are visible in the cut surface.

**Petrography**: Microscopic observations of a polished mount reveal a well-preserved chondritic texture. The average chondrule size diameter is 458 ± 310 µm (N=105) and it ranges from 60 to 2000 µm. Troilite rims are preserved. Plagioclase average size is less than 40 μm.

**Kerman 136**        30°45.117’N, 57°46.047’E

Kerman, Iran

Find: 2016 April

Classification: Ordinary chondrite (H5)

**Physical characteristics**: Dark brown in color with desert patina. Fresh parts with FeNi metal grains/troilite can be seen on the cut suface.

**Petrography**: Microscopic observations of a polished mount reveals that based on the presence of a region with higher metal content and chondrule metal rims it is probably a breccia. Chromite and plagioclase assemblages. Rare plagioclase grains with an average size of less than 40 μm.

**Kerman 137**        30°39.632’N, 57°51.754’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (L5)

**Physical characteristics**: Covered by a black fusion crust. Dark color cut surface shows some chondrules.

**Petrography**: Microscopic observations of a polished mount reveal a well-preserved chondritic texture. FeNi metal and troilite are well-separated. Troilite weathering to pyrite/marcasite.

**Kerman 138**        30°39.262’N, 57°52.023’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (L5)

**Physical characteristics**: Fresh looking cut surface shows readily delinated chondrules and few FeNi metal and troilite grains.

**Petrography**: Microscopic observations of a polished mount reveal a well-preserved chondritic texture. FeNi metal and troilite are well-separated. Troilite weathering to pyrite/marcasite.

**Kerman 139**        30°38.441’N, 57°52.750’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (L5)

**Physical characteristics**: Covered by a black fusion crust. Relatively big chondrules and some FeNi metal/troilite grains visible in the cut surface.

**Petrography**: Microscopic observations of a polished mount reveal a well-preserved chondritic texture. The average chondrule size diameter is 1080 ± 560 μm (N=45) and it ranges from 380 to 3570 μm. Troilite rims are preserved. Plagioclase average size is less than 40 μm.

**Kerman 140**        30°40.136’N, 57°52.540’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (L5)

**Physical characteristics**: Covered by a black fusion crust. Relatively big chondrules and some FeNi metal/troilite grains visible in the cut surface.

**Petrography**: Microscopic observations of a polished mount reveal a well-preserved chondritic texture. FeNi metal and troilite are well-separated. Plagioclase maximum size 80 μm.

**Kerman 141**        30°40.233’N, 57°48.670’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (L5)

**Physical characteristics**: Fresh looking cut surface shows readily delinated chondrules and few FeNi metal and troilite grains.

**Petrography**: Microscopic observations of a polished mount reveal a well-preserved chondritic texture. The average chondrule size diameter is 810 ± 360 μm (N=86) and it ranges from 350-2325 μm. FeNi metal and troilite are well-separated. Plagioclase average size is less than 50 μm. The modal abundace of chromite is more than metal.

**Kerman 142**        30°39.707’N, 57°49.403’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (L5)

**Physical characteristics**: Fresh looking cut surface shows readily delinated chondrules and few FeNi metal and troilite grains.

**Petrography**: Microscopic observations of a polished mount reveal a well-preserved chondritic texture. FeNi metal and troilite are well separated. Plagioclase average size is less than 50 μm.

**Kerman 143**        30°47.836’N, 57°46.317’E

Kerman, Iran

Find: 2016 April

Classification: Ordinary chondrite (H5)

**Physical characteristics**: Dark brown in color with desert patina. Few chondrule and rare FeNi metal/troilite grains can be seen on the cut suface.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 144**        30°47.411’N, 57°45.318’E

Kerman, Iran

Find: 2016 April

Classification: Ordinary chondrite (H5)

**Physical characteristics**: The meteorite is strongly weathered and gets easily fragmented.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 60 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Chromite and plagioclase assemblages.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 145**        30°47.618’N, 57°47.463’E

Kerman, Iran

Find: 2016 April

Classification: Ordinary chondrite (H5)

**Physical characteristics**: The meteorite is strongly weathered and gets easily fragmented.

**Petrography**: Plagioclase average size is less than 50 μm.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 146**        30°47.516’N, 57°46.812’E

Kerman, Iran

Find: 2016 April

Classification: Ordinary chondrite (H5)

**Petrography**: Plagioclase average size is less than 50 μm.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 147**        30°46.716’N, 57°46.119’E

Kerman, Iran

Find: 2016 April

Classification: Ordinary chondrite (H5)

**Physical characteristics**: Dark brown with desert patina partly covered by sand grains.

**Petrography**: Chromite and plagioclase assemblages. Plagioclase average size is less than 40 μm.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 148**        30°45.816’N, 57°46.611’E

Kerman, Iran

Find: 2016 April

Classification: Ordinary chondrite (H5)

**Petrography**: Plagioclase average size is less than 40 μm.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 149**        30°47.219’N, 57°46.431’E

Kerman, Iran

Find: 2016 April

Classification: Ordinary chondrite (H5)

**Petrography**: Chromite and plagioclase assemblages. Shock veins.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 150**        30°45.391’N, 57°46.812’E

Kerman, Iran

Find: 2016 April

Classification: Ordinary chondrite (H5)

**Petrography**: Shock veins and melt pockets containing troilite veins.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 151**        30°47.881’N, 57°46.319’E

Kerman, Iran

Find: 2016 April

Classification: Ordinary chondrite (H5)

**Physical characteristics**: Metal and troilite grains in the cut surface.

**Petrography**: Plagioclase average size is less than 40 μm.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 152**        30°45.431’N, 57°46.716’E

Kerman, Iran

Find: 2016 April

Classification: Ordinary chondrite (H5)

**Petrography**: Chromite and plagioclase assemblages. Plagioclase average size is less than 40 μm. Shock veins.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 153**        30°40.439’N, 57°47.504’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (L5)

**Physical characteristics**: Fragmented pieces showing partly showing the fusion crust. Fresh looking cut surface shows readily delinated chondrules.

**Petrography**: Plagioclase average size is less than 50 μm.

**Kerman 154**        30°39.353’N, 57°48.454’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (L5)

**Physical characteristics**: Fragmented pieces showing partly showing the fusion crust. Fresh looking cut surface shows readily delinated chondrules.

**Petrography**: Microscopic observations of a polished mount reveal a well-preserved chondritic texture. FeNi metal and troilite are well-separated. Plagioclase average size is less than 50 μm.

**Kerman 155**        30°41.225’N, 57°48.969’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (L5)

**Physical characteristics**: Partly covered by a black fusion crust. Fresh looking cut surface shows readily delinated chondrules and few FeNi metal and troilite grains.

**Petrography**: Microscopic observations of a polished mount reveal a well-preserved chondritic texture. FeNi metal and troilite are well-separated. Plagioclase average size is less than 50 μm. Troilite weathering to pyrite/marcasite.

**Kerman 156**        30°40.719’N, 57°48.941’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (L5)

**Physical characteristics**: Covered by fusion crust. Some chondrules and metal grains can be seen on the cut surface.

**Petrography**: Microscopic observations of a polished mount reveal a well-preserved chondritic texture. FeNi metal and troilite are well-separated. Plagioclase average size is less than 50 μm. Troilite weathering to pyrite/marcasite.

**Kerman 157**        30°45.486’N, 57°47.661’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**History**: Found in the corridors of Kalout region of the Lut Desert during a systematic search for meteorites.

**Physical characteristics**: Fusion crust is partly preserved. FeNi metal grains can be seen easily on the broken surface.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. Weathering products occur as veins and in situ alteration of the primary minerals. FeNi metal is completely weathered and only troilite is preserved.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 158**        30°44.219’N, 57°46.171’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**History**: Found in the corridors of Kalout region of the Lut Desert during a systematic search for meteorites.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Chromite and plagioclase assemblages. Pollycrystalline troilite.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 159**        30°47.971’N, 57°56.462’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**History**: Found in the corridors of Kalout region of the Lut Desert during a systematic search for meteorites.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 160**        30°45.877’N, 57°48.312’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**History**: Found in the corridors of Kalout region of the Lut Desert during a systematic search for meteorites.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 161**        30°45.417’N, 57°47.729’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**History**: Found in the corridors of Kalout region of the Lut Desert during a systematic search for meteorites.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Chromite and plagioclase assemblages.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 162**        30°45.511’N, 57°47.936’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**History**: Found in the corridors of Kalout region of the Lut Desert during a systematic search for meteorites.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Plagioclase average size is less than 50 μm. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Melt pockets are present.

**Kerman 163**        30°45.520’N, 57°48.265’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**History**: Found in the corridors of Kalout region of the Lut Desert during a systematic search for meteorites.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 164**        30°44.712’N, 57°46.118’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**History**: Found in the corridors of Kalout region of the Lut Desert during a systematic search for meteorites.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Chromite and plagioclase assemblages. Shock veins are present.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 165**        30°44.716’N, 57°45.216’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**History**: Found in the corridors of Kalout region of the Lut Desert during a systematic search for meteorites.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 166**        30°45.693’N, 57°47.221’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**History**: Found in the corridors of Kalout region of the Lut Desert during a systematic search for meteorites.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 167**        30°45.788’N, 57°48.304’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**History**: Found in the corridors of Kalout region of the Lut Desert during a systematic search for meteorites.

**Physical characteristics**: Dark color surface containing cracks filled with sediments.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Weathering veins filled by calcite grains.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 168**        30°44.533’N, 57°48.593’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**History**: Found in the corridors of Kalout region of the Lut Desert during a systematic search for meteorites.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Shock veins are present.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 169**        30°45.952’N, 57°47.880’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**History**: Found in the corridors of Kalout region of the Lut Desert during a systematic search for meteorites.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Chromite and plagioclase assemblages. Only troilite is preserved.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 170**        30°45.118’N, 57°48.473’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**History**: Found in the corridors of Kalout region of the Lut Desert during a systematic search for meteorites.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. Weathering products occur as veins and in situ alteration of the primary minerals. FeNi metal is completely weathered and only troilite is preserved. Chromite and plagioclase assemblages.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 171**        30°45.218’N, 57°47.661’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**History**: Found in the corridors of Kalout region of the Lut Desert during a systematic search for meteorites.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. Weathering products occur as veins and in situ alteration of the FeNi metal and troilite. Chromite and plagioclase assemblages. Weathering cracks filled with the quartz grains.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 172**        30°47.816’N, 57°46.374’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**History**: Found in the corridors of Kalout region of the Lut Desert during a systematic search for meteorites.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 173**        30°43.942’N, 57°47.882’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**History**: Found in the corridors of Kalout region of the Lut Desert during a systematic search for meteorites.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Calcite veins fills the cracks.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 174**        30°45.721’N, 57°46.107’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**History**: Found in the corridors of Kalout region of the Lut Desert during a systematic search for meteorites.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Troilite rim remnants.

**Kerman 175**        30°45.321’N, 57°47.809’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**History**: Found in the corridors of Kalout region of the Lut Desert during a systematic search for meteorites.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Plagioclase and chromite assemblages. Quartz grains filling the cracks.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 176**        30°45.408’N, 57°48.133’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**History**: Found in the corridors of Kalout region of the Lut Desert during a systematic search for meteorites.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 177**        30°45.437’N, 57°47.738’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**History**: Found in the corridors of Kalout region of the Lut Desert during a systematic search for meteorites.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Shock veins. Plagioclase and chromite assemblages.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 178**        30°45.712’N, 57°47.413’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**History**: Found in the corridors of Kalout region of the Lut Desert during a systematic search for meteorites.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Classification**: H5. Likely paired with [Kerman 004](https://www.lpi.usra.edu/meteor/metbull.php?code=63368).

**Kerman 179**        30°48.033’N, 57°50.067’E

Kerman, Iran

Find: 2013 Nov

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Central parts of the sample are less weathered (W1), while the outer parts are showng weathering degree W2. Troilite weathering to pyrite/marcasite.

**Kerman 180**        30°46.900’N, 57°50.433’E

Kerman, Iran

Find: 2013 Nov

Classification: Ordinary chondrite (H5)

**Physical characteristics**: Fusion crust is partly preserved. FeNi metal grains can be seen easily on the broken surface.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Some troilite rims remenants are present. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Chromite and plagioclase assemblages.

**Kerman 181**        30°47.883’N, 57°52.450’E

Kerman, Iran

Find: 2014 Feb

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Some troilite rims remenants are present. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Chromite and plagioclase assemblages. Troilite weathering to pyrite/marcasite.

**Kerman 182**        30°41.133’N, 57°50.017’E

Kerman, Iran

Find: 2014 Oct

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Chromite and plagioclase assemblages. Shock veins.

**Kerman 183**        30°48.067’N, 57°50.050’E

Kerman, Iran

Find: 2014 Feb

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Kerman 184**        30°44.283’N, 57°50.200’E

Kerman, Iran

Find: 2014 Oct

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Chromite and plagioclase assemblages.

**Kerman 185**        30°46.517’N, 57°52.450’E

Kerman, Iran

Find: 2014 Oct

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Kerman 186**        30°49.000’N, 57°50.467’E

Kerman, Iran

Find: 2015 Jan

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Shock veins.

**Kerman 187**        30°46.467’N, 57°52.500’E

Kerman, Iran

Find: 2014 Jan

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Troilite weathering to pyrite/marcasite.

**Kerman 188**        30°42.067’N, 57°48.467’E

Kerman, Iran

Find: 2014 April

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Some troilite rims remenants are present. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Kerman 189**        30°48.500’N, 57°55.183’E

Kerman, Iran

Find: 2014 Feb

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Kerman 190**        30°53.933’N, 57°59.250’E

Kerman, Iran

Find: 2014 Nov

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Kerman 191**        30°53.817’N, 57°58.183’E

Kerman, Iran

Find: 2014 Nov

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins (mostly) and in situ alteration of FeNi metal and troilite.

**Kerman 192**        30°51.500’N, 57°48.417’E

Kerman, Iran

Find: 2014 Jan

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Chromite and plagioclase assemblages. Shock veins.

**Kerman 193**        30°57.717’N, 58°2.133’E

Kerman, Iran

Find: 2014 Oct

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. Weathering products occur as veins (mostly) and in situ alteration of FeNi metal and troilite.

**Kerman 194**        30°59.983’N, 58°1.483’E

Kerman, Iran

Find: 2014 Jan

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Alteration of troilite to pyrite/marcasite.

**Kerman 195**        30°53.333’N, 57°58.867’E

Kerman, Iran

Find: 2014 Nov

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Shock veins.

**Kerman 196**        30°53.800’N, 57°42.700’E

Kerman, Iran

Find: 2014 Nov

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Alteration of troilite to pyrite/marcasite. Cracks are filled by sand grains.

**Kerman 197**        30°47.067’N, 57°47.983’E

Kerman, Iran

Find: 2015 Feb

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Remnants of troilite rims.

**Kerman 198**        30°45.801’N, 57°47.911’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**Physical characteristics**: Fusion crust is partly preserved.

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Kerman 199**        30°47.218’N, 57°46.923’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. Weathering products occur as veins and in situ alteration of FeNi metal and troilite.

**Kerman 200**        30°39.739’N, 57°48.915’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (L5)

**Physical characteristics**: Majority of the surfaces of the samples are covered by fusion crust. Fresh looking cut surface shows readily delinated chondrules.

**Petrography**: Microscopic observations of a polished mount reveal a well-preserved chondritic texture. FeNi metal and troilite are well-separated. Plagioclase average size is less than 50 μm.

**Kerman 201**        30°54.283’N, 58°1.233’E

Kerman, Iran

Find: 2015 March

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Some parts show higher weathering degress (W3). Remnants of troilite rims. Alteration of troilite to pyrite/marcasite.

**Kerman 202**        30°54.917’N, 57°59.600’E

Kerman, Iran

Find: 2014 Nov

Classification: Ordinary chondrite (H5)

**Petrography**: Microscopic observations of a polished mount reveal a chondritic texture with recrystallized matrix. Chondrules are readily delineated. Plagioclase average size is less than 50 μm. FeNi metal and troilite are well separated. Weathering products occur as veins and in situ alteration of FeNi metal and troilite. Remnants of troilite rims.

**Kerman 203**        30°45’14.76"N, 57°48’1.32"E

Kerman, Iran

Find: 9 Jan 2017

Classification: Ordinary chondrite (H5)

**History**: The meteorite was found on 9 January 2017 by the *UrFU* meteorite expedition-2017 in Iran (Pastukhovich A.Yu., Larionov M.Yu., Kruglikov N.A., Zamyatin D.A.) in the northwest part of the Kalout region of the Lut desert.

**Physical characteristics**: Total mass is 59.32 g. All fragments of the meteorite have angular to roughly rounded shape. The surface and interior of the meteorite is light to dark brown in color due to abundant Fe-hydroxides. Some parts have glassy-like surface due to desert weathering. No fusion crust was observed. Some small cracks are totally filled with with natrojarosite or aggregate of anhydrite+natrojarosite and Fe-hydroxides.

**Petrography**: Classification (V. V. Sharygin, *SIGM* and *UrFU*). Petrographic observation of a polished section shows chondrules in a recrystallized matrix. Chondrules are readily delineated and their sizes mostly vary from 300 to 600 μm. They have barred or porphyritic texture and consist of Ol+Opx+Cpx+Pl±Crt or Ol+Opx+Pl±Crt. Large chondrules (1.5-5 mm) also occur. Olivine, low-Ca-pyroxene and plagioclase are main minerals in matrix. Plagioclase grains are less than 50 uµm. This indicates a petrological type of 5 for the meteorite. Undulatory extinction and irregular fractures in olivine, as well as the absence of opaque shock veins and melt pockets, indicate a shock stage of S2. Relics of fresh FeNi metals (kamacite, taenite, tetrataenite, up to 100 μm) and troilite (up to 70 µm) are rare due to intensive alteration. Weathering products (goethite, "hydrogoethite", akaganeite, droninoite ? and other Fe-hydroxides, rarely anhydrite) occur as veins and in situ alteration of FeNi-metals and troilite and fill all microfractures in minerals from matrix and chondrules. The replacement of olivine and low-Ca pyroxene by serpentine/chlorite is ocasionally fixed in outer zones of grains (weathering grade W3 to W4). Clinopyroxene, chromite, chlorapatite and merrillite (up to 500 μm) occur locally in the matrix. Pyrrhotite and hydrated sulfide (alteration of troilite?) form grains up to 100 uµm. The relics of Cu-rich sulfide (chalcopyrite or bornite) were observed in goethite aggregate. The secondary association (anhydrite + natrojarosite ± goethite ± celestine ± monazite-(Ce)) is common in the meteorite.

**Geochemistry**: EDS-WDS analyses (V. V. Sharygin, *SIGM* and *UrFU*). The primary chondrite paragenesis includes olivine Fa19.49±0.38(N=61), orthopyroxene Fs17.06±0.47Wo1.34±0.17(N=52), plagioclase Ab82.8An11.1Or6.1(N=39), Cr-bearing clinopyroxene En47.1Fs7.6Wo45.3(N=15), chromite Crt80.4Spl14.4 (N=35), chlorapatite, merrillite, FeNi-metals and troilite. Chlorapatite contains F (up to 1.2 wt.%); Cl up to 5.9 wt.% (N=13), but some grains are richer in F (2.0-2.8 wt.%) and poorer in Cl (2.0-3.8 wt.%) to be fluorapatite. Merrillite is poor in FeO (0.4-1.6 wt.%, N=28). Composition of metals (in wt.%): kamacite (N=20)  Fe 92.51±1.09, Ni  7.12±1.08, Co  0.41±0.04; taenite (central part, N=10)  Fe 68.09±3.94, Ni 31.71±3.96, Co 0.20±0.16; tetrataenite (N=9) Fe 49.75±1.26; Ni 50.27±1.31, Co 0.07±0.10. Troilite is close to ideal FeS. Composition of pyrrhotite (in wt.%, N=7): Fe 58.82±1.42, Ni 1.36±1.0; Co 0.12±0.11; S 39.36±0.57. Fe-rich serpentine-group mineral contains NiO (up to 1.1 wt.%). Goethite and "hydrogoethite" contain 1.3-15.0 wt.% NiO, up to 0.8 wt.% CoO. Akaganeite is rich in NiO (5.6-6.2) and CoO (0.6-0.7 wt.%); Cl 5.7-6.1 wt.%. Natrojarosite NaFe3(SO4)2(OH)6 (in wt.%, N=9): Fe2O3  46.29; Na2O  4.32; K2O 1.93; SO3 32.95.

**Classification**: (Victor V. Sharygin, *SIGM* and *UrFU*). Ordinary chondrite. H5, S2, W3. In chemical composition of olivine and low-Ca pyroxene this meteorite seems to be similar to nearby H5 meteorites: [Kerman 001](https://www.lpi.usra.edu/meteor/metbull.php?code=60838), [Kerman 003](https://www.lpi.usra.edu/meteor/metbull.php?code=61626), up to [Kerman 203](https://www.lpi.usra.edu/meteor/metbull.php?code=66247).

**Specimens**: 6 samples (8.15, 16.86, 8.76, 15.7, 3.98, 0.15 g) at *UrFU*; 5.72 g and thin section at *SIGM*.

**Khawr al Fazra 022** (KaF 022)        19° 44' 30"N,  50° 23' 25"E

Ash Sharqiyah, Saudi Arabia

Find: 15 Feb 2013

Classification: Ordinary chondrite (L3)

**History**: Found by Khalid al Wagdani during a search for meteorites on February 15, 2013.

**Physical characteristics**: Single medium brown stone, wind-ablated, no fusion crust preserved.

**Petrography**: Homogeneous chondritic texture, mean chondrule size 0.61±0.31 mm (n= 51). Iron metal (partly oxidized) is present as rounded inclusions. Troilite showing only minor oxidation forms rims around chondrules.

**Geochemistry**: (N. Greber, *Bern*, B. Hofmann, *NMBE*, E. Gnos MGNGE) Olivine compositions are Fa15.3-33.5(mean Fa24.9, n=24), pyroxene compositions (n=11) are Fs6.1-30.1Wo0.4-2.3(mean Fs17.2±8.0Wo1.2±0.55). Cathodoluminescence colors indicate petrographic grade 3.8-3.9.

**Classification**: L3 chondrite based on mineral compositions and mean chondrule size. Unshocked (S1), weathering degree W3.

**Specimens**: *MHNGE* 0.58 g.

**Kheneg Ljouâd**        28°59’03.3"N, 8°24’38.7"W

Guelmime Es Smara, Morocco

Probable fall: 2017 July 12

Classification: Ordinary chondrite (LL5/6)

**History**: (H. Chennaoui Aoudjehane, *FSAC*) On Wednesday, 12 July 2017, around 23:13 Summer Moroccan time (GMT+1,) a bright fireball was widely seen throughout southern Morocco, traveling from the NE to the SW, with termination of the fireball southwest of Tata. The fireball lasted for several " and was followed by a series of sonic booms heard throughout southern Morocco. This event was subsequently [reported on the national TV news station](https://www.youtube.com/watch?v=CbMuLhF580E)). The authorities of the area including soldiers reported the fireball. The fall site is in a militarized area within Morocco, but close to the border with Algeria. Military and nomads where the first to arrive at the fall site and the first piece was found within 12 hours of the fireball, on 13 July. A field mission was organized by H. Chennaoui Aoudjehane (*FSAC*), M. Aoudjehane, A. Bouferra and H. El Harbi on Saturday, 15 July to collect the fall information and samples for classification and the submission. The team were granted authorization to enter the militarized area, and on 16 July traveled to the fall site. The team meet several hunters with fresh, black, fusion crusted stones. The largest complete piece that they have seen was about 850 g. Coordinates for three smaller stones are a complete 15 g stone (28°59’03.3"N, 8°24’38.7"W) and two pieces totalling 22 g (28°57’28.3"N, 8°25’39.6"W), and a stone of ~1 g (28°59’55.1"N, 8°24’25.5"W). Total mass collected to date is near 10 kg.

**Physical characteristics**: Many fusion crusted stones ranging from <1 g to 1.2 kg. Fusion crust is matte black. Interior of the stones is largely whitish gray, with a few thin shock veins, and studded with pods (to 1 cm) and veinlets of troilite.

**Petrography**: (L. Garvie, *ASU*) Optical and SEM imaging of a polished mount shows range of chondrule types, though largely recrystallized and integrated with the matrix, the chondrules still recognizable including a large BO (to 5 mm), PO and PP. Feldspar shows a range of sizes, some grains to 200 μm, though majority <50 μm. Metal and troilite heterogeneously distributed across the mount, largest grains to 100 μm. Metal dominated by tetrataenite, with only two small (20 μm) grains of kamacite found. Metallic Cu rare, as three grains (~5 μm) found at tetrataenite/troilite boundary. Metal+troilite occupy <2 vol% of the section. Troilite single crystal with rare twin lamellae. Pentlandite, <20 μm, is rare occurring as subhedral grains within troilite. Chromite is common as large, to 200 μm, anhedral grains and small, <5 μm, subhedral and euhedral grains in feldspar. A few small melt pockets observed in the mount are consistent with shock stage S3 .

**Geochemistry**: (L. Garvie, *ASU*) Olivine Fa31.0±0.2, FeO/MnO=61.0±3.4, n=15; low Ca pyroxene Fs25.0±0.4Wo2.1±0.2, FeO/MnO=37.0±1.7, n=7; high Ca pyroxene Fs10.7Wo43.1and Fs11.0Wo43.0; Feldspar Ab84.4±2.2An10.6±0.3Or5.0±2.3, n=4; tetrataenite (at%) Fe42.9±0.2Co2.1±0.1Ni54.9±0.2, n=4; pentlandite Fe38.6±1.0Ni13.8±1.0 Co0.6±0.6S46.9±0.3, n=5. Magnetic susceptibility (P. Rochete, *CEREGE*) log χ (× 10-9 m3/kg) = 3.70.

**Classification**: The chondrules largely integrated with the matrix are consistent with high petrologic type; the predominance of feldspars <50 μm across is consistent with type 5. Silicate mineral and metal chemistry consistent with LL, W0, S3.

**Specimens**: A 57 g piece partially covered by fusion crust was provided to *FSAC* by the Moroccan "Association des Amateurs et Collectionneurs de Météorites" for classification. 34 g at *ASU*.

**Lake Eliza**        53°48.5’N, 111°9.5’W

Alberta, Canada

Find: 2003

Classification: Ordinary chondrite (H5)

**History**: The single, 340 g specimen was found by Mr. Alan Zalaski of St. Paul, Alberta, on one of several meteorite/artifact hunting excursions on family farmland in one of the fields north, east, or south of Lake Eliza, Alberta, in the summer of 2003.

**Physical characteristics**: The single, rectangular specimen has a reddish brown exterior, partial (~50%) fusion crust, and is cross-cut by numerous fractures.

**Petrography**: Minor brecciation is present. Shock effects include veining. Weathering grade according to [Zurfluh et al. (2016)](http://onlinelibrary.wiley.com/wol1/doi/10.1111/maps.12690/full).

**Geochemistry**: (C. Herd, *UAb*) Data obtained by EMP examination of carbon-coated thin section: Olivine Fa19.3±0.3(n=31); Low-Ca Pyroxene Fs16.7±0.2Wo1.5±0.1(n=19).

**Classification**: Ordinary chondrite, H5. Petrologic type 5 based on well-delineated chondrules and plagioclase grain size (2-50 μm).

**Specimens**: A 30.4 g specimen, including one thin section, is at *UAb*. Main mass is with the owner.

**Los Vientos 150** (LoV 150)        ~24°41’S, ~69°46’W

Antofagasta, Chile

Find: 2016 March

Classification: Carbonaceous chondrite (CO3)

**History**: The stone was found lying at the surface in the Atacama desert.

**Physical characteristics**: A single, angular, brown stone with smooth surface and few remnants of fusion crust. Cut surface reveals a brown interior with small chondrules.

**Petrography**: Well-defined chondrules (average apparent diameter 190±100 μm, N=34) mostly of type I, and small CAIs set in fine-grained iron-rich matrix. Modal abundances: chondrules+fragments 67 vol%, matrix 33% (point counting, N=138). Abundant metal and sulfides.

**Geochemistry**: Olivine in the range Fa2.2-23.9(mean Fa18.1±6.2, PMD=29%, N=16). Cr2O3 in ferroan olivine 0.09±0.07 wt.% (N=16). Low-Ca pyroxene Fs6.4±5.0Wo2.8±1.7(N=5). Magnetic susceptibility log χ (× 10-9 m3/kg)=5.01.

**Classification**: Carbonaceous chondrite (CO3). Estimated subtype >=3.2 based on olivine Fa PMD and Cr2O3 content.

**Specimens**: 22 g at *CEREGE*. Main mass with ArtMet collection, Poland.

**Los Vientos 154** (LoV 154)        ~24°41’S, ~69°46’W

Antofagasta, Chile

Find: 2013 Nov 06

Classification: Ordinary chondrite (H3)

**Physical characteristics**: Full crusted stone

**Geochemistry**: Olivine Fa18.2±9.3, PMD=47%, Cr2O3 = 0.07±0.07 wt% (N=10). Orthopyroxene Fs14.0±10.4(PMD=71%) Wo1.9±1.8(N=5).

**Classification**: H3. Estimated subtype 3.2 to 3.5 based on Cr2O3 content of olivine and PMD of olivine Fa.

**Los Vientos 159** (LoV 159)        ~24°41’S, ~69°46’W

Antofagasta, Chile

Find: 2013 Nov 06

Classification: Ordinary chondrite (H, melt breccia)

**Petrography**: Chondrule-bearing clasts set in a quenched melt host with pervasive shock darkening and composite metal/sulfide grains. Porosity in the form of 50-100 μm sub-spherical cavities makes up 10 vol% of the sample (point counting, N=370). The petrologic type of the chondritic clasts could not be determined because the texture has been obliterated by the shock features.

**Classification**: H-melt breccia

**Los Vientos 160** (LoV 160)        ~24°41’S, ~69°46’W

Antofagasta, Chile

Find: 2013 Nov 06

Classification: Mesosiderite

**History**: A single stone was found in the Atacama desert by Matthieu Gounelle on 2013 November 6.

**Physical characteristics**: A small irregular brown stone. Cut surface reveals a brownish interior with abundant mm size metal grains.

**Petrography**: Main minerals are pyroxene (to 1 mm), plagioclase, and FeNi metal. Accessory troilite, silica,, chromite, merrilite. Modal abundances: pyroxene 61 vol%, plagioclase 20 vol%, opaques 19 vol% (point counting, N=142).

**Geochemistry**: Orthopyroxene Fs29.5±0.5Wo2.6±0.1, FeO/MnO=31.0 (N=4). Plagioclase An87.7±2.8Ab12.1±2.8Or0.2±0.0(N=5). Magnetic susceptibility log χ (× 10-9 m3/kg) = 5.28.

**Classification**: Mesosiderite

**Specimens**: Type specimen and main mass at *CEREGE*

**Los Vientos 171** (LoV 171)        24°41’S, 69°46’W

Antofagasta, Chile

Find: 2016 Nov

Classification: Ordinary chondrite (LL3.1)

**History**: Five stones were found within about 50 m, lying at the surface in the Atacama desert.

**Physical characteristics**: Fully crusted stones. Cut surface reveals a gray interior with well delineated chondrules up to several mm.

**Petrography**: Closely packed chondrules with mean apparent diameter 630±280 μm (N=45). FeNi metal and troilite show almost no weathering.

**Geochemistry**: Olivine Fa16.6±7.9(Fa1.0-27.7), PMD 40%, N=9. Cr2O3 in ferroan olivine is 0.13±0.1 wt%. Orthopyroxene Fs6.4±6.3Wo2.5±2.5(Fs1.6-20.2), N=6. Magnetic susceptiblity log χ (× 10-9 m3/kg) = 4.51. Saturation magnetization is 1.68 Am2/kg, in the range of LL3 falls (5.28±2.02 Am2/kg, N=5) and well below the range of L3 falls (21.7±3.1 Am2/kg, N=3), see [Gattacceca et al. 2014](http://onlinelibrary.wiley.com/doi/10.1111/maps.12268/abstract). Based on the structural order of the polyaromatic matter assessed by Raman spectroscopy (Lydie Bonal, *IPAG*), this meteorite appears to be more metamorphosed than [Semarkona](https://www.lpi.usra.edu/meteor/metbull.php?code=23487) (LL3.0) and slightly less metamorphosed than [Bishunpur](https://www.lpi.usra.edu/meteor/metbull.php?code=5060) (LL3.1). The Raman spectroscopy parameters of interest are FWHM-D (cm-1)=191.4 ± 8.3, ID/IG= 1.04 ±0.02 [(see Bonal et al., 2016, figure 7](http://www.sciencedirect.com/science/article/pii/S0016703716303477)).

**Classification**: LL3.1. Sub-type based structural order of polyaromatic organic matter assessed by Raman spectroscopy. LL versus L classification based on saturation magnetization.

**Specimens**: Type specimen and polished sections at *CEREGE*. Main mass with ArtMet collection, Poland.

**Los Vientos 175** (LoV 175)        ~24°41’S, ~69°46’W

Antofagasta, Chile

Find: 2011 Jul 03

Classification: Ordinary chondrite (L6)

**Petrography**: Recrystallized chondritic texture. Average plagioclase size above 50 μm. Shock veins to 1 mm thickness, melt pockets. Probably paired with [Los Vientos 014](https://www.lpi.usra.edu/meteor/metbull.php?code=57199).

**Los Vientos 188** (LoV 188)        24°40’03.7’’S, 69°55’37.3’’W

Antofagasta, Chile

Find: 2017 Feb 20

Classification: Iron meteorite (IIAB)

**History**: Found at 10:20 am on fine grained grano-diorite pediment. The flat, disk-shaped mass was stuck vertically in the ground, one third of the mass protruding from the soil.

**Physical characteristics**: A single, shield-shaped mass with brown and black colors. Cut face reveals a metallic unweathered interior.

**Petrography**: (J. Gattacceca, H. Pourkhorsandi, *CEREGE*): The etched section shows a polycristalline kamacite aggregate with crystal size to 550 μm. Abundant euhedral schreibersite 10-20 μm in size.

**Geochemistry**: (M. D’Orazio, *DST-PI*): Composition of the metal (ICP-MS) is Co=0.455, Ni=5.54 (both in wt%), Cr=76, Cu=125, Ga=67, Ge=191, As=4.4, Mo=6.2, Ru=25.8, Rh=2.72, Pd=1.67, W=3.33, Re=1.94, Ir=22.6, Pt=29.0, Au=0.39 (all in ppm).

**Classification**: Iron, IIAB

**Specimens**: 23.95 g and a polished section at *CEREGE*, main mass with finder.

**Los Vientos 189** (LoV 189)        ~24°41’S, ~69°46’W

Antofagasta, Chile

Find: 2016 Mar

Classification: Iron meteorite (IID-an)

**History**: The stone was found lying on the surface in the Atacama desert in March 2016.

**Physical characteristics**: A single flat shield-shaped mass with dimensions ~55 × 39 × 14 cm. Outer surface is brownish and shows some Widmanstätten-like patterns. Cut surface reveals an unweathered metallic interior.

**Petrography**: (J. Gattacceca, H. Pourkhorsandi, *CEREGE*): The etched section shows well-developed Widmanstätten patterns with kamacite bandwith 800 to 1200 μm, making it a medium octahedrite. Kamacite displays abundant Neumann bands. Zoned taenite grains are present. Plessite is found as comb plessite, and dark etching plessite.

**Geochemistry**: (J.T. Wasson, *UCLA*): INAA data, Ni = 109, Co = 6.50 (both mg/g), Cu = 240, Ga = 61, As = 5.04, W=2.95, Re=1939, Ir =18.9, Pt=23.7 Au = 0.498 (all μg/g).

**Classification**: Iron, IID-an. The Au content of this iron is 13% lower than that of other classified IID iron meteorites and extend the chemical trends with the lowest Au content. On most element-Au diagrams the metal compositions plot near an extrapolation towards a lower Au content. Co and W plot near an extrapolation, Ga and Ir plot about 30% lower than the extrapolated values, and Ni plots about 10% higher than the extrapolation. The high Co and Ga values are the strongest indicators of a relationship to IID.

**Specimens**: 23 g and a polished section at *CEREGE*. 500 mg sample used for INAA at *UCLA*. Main mass with ArtMet Collection.

**Los Vientos 200** (LoV 200)        ~24°41’S, ~69°46’W

Antofagasta, Chile

Find: 2016 Apr 8

Classification: Carbonaceous chondrite (CH3)

**History**: The meteorite was found in April 2016 in the Atacama desert by Rodrigo Martinez while he was looking for meteorites.

**Physical characteristics**: A single fully crusted stone. Fusion crust has a dull, porous appearance. Cut surface reveals a very dark interior with abundant metal.

**Petrography**: (J. Gattacceca, *CEREGE*) Packed tiny chondrules (mostly cryptocrystalline, and mostly smaller than 30 μm), mineral fragments, and rare small CAIs. There is no matrix in between these components. Main minerals are olivine and orthopyroxene. Abundant rounded FeNi metal (kamacite) to 500 μm. Some fine-grained rounded clasts to 250 μm (but usually a few tens of μm) containing framboidal and platy magnetite are interpreted as CI-like material. Small lumps of matrix are present as clasts. Grain density measured on a 21 g sample is 3.68 g/cc.

**Geochemistry**: Olivine in the range Fa1.4-34.1(mean Fa15.2±13.9, PMD=86%, N=8). Low-Ca pyroxene Fs13.1±14.0Wo2.1±1.8(N=19). Ca-pyroxene Fs2.1±0.8Wo42.8±3.9(N=5). Oxygen isotopic composition (J. Gattacceca, C. Sonzogni, *CEREGE*) from analysis of two acid-washed 1.5 mg aliquot of a powdered 150 mg bulk sample is δ17O=-0.21, -0.42, δ18O=2.22, 1.93, Δ17O=-1.38, -1.43, all per mil (linearized, slope 0.5247, analytical uncertainties 0.08‰, 0.12‰, 0.03‰ respectively). Magnetic susceptibility log χ (× 10-9 m3/kg) = 5.40.

**Classification**: Carbonaceous chondrite (CH3).

**Specimens**: 22 g and two polished sections at *CEREGE*. Main mass at *MMC*.

**Lut-e-Zangi Ahmad 001** (LZA 001)        29°48.667’N, 59°11.667’E

Kerman, Iran

Find: 2016 Nov

Classification: Ordinary chondrite (H5)

**Physical characteristics**: Covered by fusion crust. Some chondrules and metal grains can be seen on the cut surface. Troilite grains are big. An angular fresh troilite grain ~3.1 mm in size is visible.

**Petrography**: Microscopic observations of a polished mount reveal a recrytallzied chondritic texture. Chromite and plagioclase assemblage. Plagioclase average size is less than 40 μm. The large troilite grain shows a vermicular internal texture.

**Lut-e-Zangi Ahmad 002** (LZA 002)        29°41.708’N, 59°5.813’E

Kerman, Iran

Find: 24 Mar 2013

Classification: Ordinary chondrite (L3)

**History**: Found during a desert fied trip.

**Physical characteristics**: Dark brown, wind-ablated stone, 20 × 18 × 14 cm, with deep fractures due to weathering

**Petrography**: Mean chondrule size is 0.71±0.38 mm (n=117). Glass is common, often partly recrystallized. The meteorite is shock-blackened. Iron is mostly weathered, pyrrhotite partly unaltered, especially fine-grained troilite impregnating silicates. Many veins of terrestrial iron hydroxides and carbonates.

**Geochemistry**: Olivine Fa22.2±2.2(range Fa16.3-23.7), n=19; pyroxene: Fs16.7±5.8Wo1.8±1.7(Fs5.6-21.7Wo0.5-4.2), n=8.

**Classification**: L chondrite based on mineral composition and mean chondrule size.

**Specimens**: 34.4 g plus one polished thin section at *NMBE*. Main mass: Mehrdad Ghazvinian, Tehran.

**Lut 012**        30°56.318’N, 58°45.421’E

Kerman, Iran

Find: 2016 May

Classification: Ordinary chondrite (L6)

**Physical characteristics**: Covered by a black desert patina. Cut surface shows two different lithologies: a) brown color crystalline with few FeNi metal grains and b) black shock melted regions with the occurrence of shock melt veins and pockets.

**Petrography**: The melted zone contains troilite melt droplets and veinlets. Plagioclase maximum size 160 μm.

**Maghidet 001**        26°46.156’N, 10°06.825’E

Awbari, Libya

Find: August 23, 2016

Classification: Ordinary chondrite (L6, melt breccia)

**History**: The meteorite was found in 2016 during a field trip in the Libyan desert near the Wadi Maghidet.

**Petrography**: The meteorite is composed of abundant melt regions characterized by recrystallized shock melt containing FeNi metal and sulfide globules. Some regions still display chondritic textures with relict chondrules and mineral fragments. Olivine and pyroxene therein show strong mosaicism attesting to a high degree of shock metamorphism.

**Magwe**        ~20°11’N, ~94°58’E

Magwe, Burma

Find, doubtful fall: 2004 June 18

Classification: Ordinary chondrite (L5)

**History**: (R. Bartoschewitz, *Bart*, Wang Jun) On 2004 June 18 at 12:30 pm local time, a fireball was witnessed from Mandalay moving in a southwesterly direction. At an unknown date, a 1.5 kg stone was discovered in the northeastern area of Magwe, some 230 km to the SW. The stone was sold by the finder to Wang Jun in 2014.

**Physical characteristics**: (R. Bartoschewitz, *Bart*) One 1.5 kg stone, covered by >80% fusion crust with some rusty specks. Cut face presents fresh metal specks in gray-brown matrix.

**Petrography**: (R. Bartoschewitz, *Bart*) recrystallized matrix of olivine, pyroxene and secondary feldspar bear various types (BO, PO, POP, RP) of poorly developed chondrules (0.5 to 1.1 mm, av. 0.7 mm), metal, troilite and chromite.

**Geochemistry**: Mineral compositions and geochemistry: (R. Bartoschewitz, *Bart*, P. Appel/B. Mader *Kiel*) olivine: Fa24.6(Fa23.9-25.7, n=24); pyroxene: Fs20.7Wo1.6(Fs20.0-22.5Wo1.2-1.8, n=15); feldspar: An8Or9(An6-10Or4-19; n=3); merrillite; chromite: CRAL 87, FMM 81. Kamacite Ni 5.5 (2.7 - 6.1, n=14), Co 0.97; taenite 41.5 (36-47, n=5) (all in wt.%); tetrataenite. Magnetic susceptibility (R. Bartoschewitz, *Bart*) log χ (× 10-9 m3/kg) = 4.89. Cosmogenic radionuclides: (M. Laubenstein, *LNGS*) 22Na <57, 60Co <8.7, 44Ti 2±1, 26Al 54.6±4.3 (all in dpm/kg).

**Classification**: (R. Bartoschewitz, *Bart*) L chondrite (L5, S4, W0/1)

**Specimens**: main mass of about 1.45 kg Wang Jun; type specimen 20.1 g *Kiel*.

**Mohave Mountains**        34°40.177’N, 114°17.078’W

Arizona, United States

Find: 2016

Classification: Ordinary chondrite (L6)

**History**: During October 2016, Myke Steighler was searching for meteorites on the bajada of the Mohave Mountains northeast of Havasu Heights in northwestern Arizona. A 5.00 g fusion-crusted meteorite was found. Since then an additional 42 stones have been found ranging from 1 to 181.4 g, for a total mass of 613.15 g within a limited area surrounding the initial find.

**Physical characteristics**: All stones are similar looking, with well-developed black to olivine-green fusion crust. Broken surfaces are light-colored though some show minor orange staining. Cut surfaces are white to grey with even distribution of metal and troilite; only a few chondrules visible. No shock veins visible.

**Petrography**: (L. Garvie *ASU*) Dominantly recrystallized texture with chondrules difficult to recognize and largely integrated into the matrix. Largest chondrule (PO) to 2 mm, though most <1 mm. Fusion crust to 1-mm thick, well-developed, with an anastomosing network of Fe sulfide extending to 2-mm below the crust. Feldspar mostly >50 μm. Troilite single crystal, though a few show weakly developed shock lamellae. Native Cu is rare, to 50 μm, found within kamacite, and rarely at metal-troilite interface. Metal and troilite, both <2 mm across, scattered uniformly across the cut surfaces. Majority of kamacite with holly-leafed-shaped outlines. Metal grains dominated by single-crystal kamacite, showing weakly developed Neumann bands. A few scattered grains of taenite/tetrataenite and rounded grains with dark-etch plessitic cores. Accessory chromite, <100 μm, heavily fractured. Olivine grains show undulatory extinction and fractures, consistent with shock stage S2. Stones fresh, with only very minor signs of metal alteration consistent with W0/1.

**Geochemistry**: (L. Garvie *ASU*) Olivine Fa24.7±0.3, FeO/MnO = 50.0±2.5, n=6; Low Ca-pyroxene Fs20.9±0.1Wo1.4±0.3, FeO/MnO=28.7±0.5, n=5.

**Classification**: Ordinary chondrite, L6, S2, W0/1.

**Specimens**: Ten stones for a total mass of 45.41 g at *ASU*. Rest with finder.

**Mont Sujet**        47°7.898’N, 7°8.510’E

*Bern*, Switzerland

Find: 24 Sept 2016

Classification: Ordinary chondrite (H5)

**History**: Found at a depth of 10 cm in soil during a search for [Twannberg](https://www.lpi.usra.edu/meteor/metbull.php?code=24088) meteorites using a metal detector.

**Physical characteristics**: Complete, dark brown individual, 41.7 × 31 × 29 mm. On the surface, patches of silty soil characteristic for Mont Sujet are firmly adhering.

**Petrography**: Typical chondritic texture, unbrecciated. Typical feldspar size is 5-10 μm. Chromite grains up to 0.6 mm. Rare native copper in iron. Weathering is relatively strong in an outermost zone just 0.8 mm thick, most of the meteorite shows low weathering with <10% of iron and troilite oxidized, consistent with weathering grade W1. Mean chondrule size is 0.42±0.17 mm (n=63). Bulk density by immersion in isopropanol is 3.48 g/cm3.

**Geochemistry**: Olivine Fa18.3±0.3(range Fa18.7-19.9), n=12; pyroxene: Fs16.6±0.2Wo1.4±0.2(range Fs16.3-17.1Wo1.1-1.6), n=13. Two analyses of Ca-rich pyroxene yielded Fs6.4Wo44.7and Fs6.9Wo45.9.

**Classification**: This is a H chondrite based on mineral composition and mean chondrule size. Petrographic type 5 based on feldspar size. Shock stage S2. Weathering grade W1.

**Specimens**: 63.1 g and one polished thin section at *NMBE*.

**Monteview**        44°01’1.92"N, 112°29’6"W

Idaho, United States

Find: 2014 Oct 13

Classification: Iron meteorite (IAB-MG)

**History**: Found October 13, 2014 by Matt Bird on a fence line in an agricultural area, about 6.4 km from the town of Monteview, Idaho.

**Physical characteristics**: The specimen has a mass of roughly 25.9 kg with well-developed regmaglypts and subspherical surface cavities. Surfaces are mostly rusty but have a metallic appearance in places.

**Petrography**: (A. Ruzicka, *Cascadia*): Etched and polished cut surfaces show that sample largely consists of kamacite crystals in a Widmanstatten pattern. Elongate crystals of cohenite up to 0.5 cm long parallel the kamacite plates. Small amounts of zoned taenite, plessite, schreibersite, and weathering products are present. Texture and mineralogy resembles cohenite-rich pieces of the [Wichita County](https://www.lpi.usra.edu/meteor/metbull.php?code=24257) coarse octahedrite.

**Geochemistry**: (G. Chen, C. Herd, *UAb*): trace elements in μg/g except where noted: Co 4.89 mg/g, Ni 70.6 mg/g, Cu 156, Ga 102, Ge 454, Ru 6.17, Rh 1.49, Pd 3.17, W 0.99, Re 0.20, Os 0.72, Ir 2.12, Pt 6.82, Au 1.49.

**Classification**: (A. Ruzicka, *Cascadia*): IAB main group based on trace element composition; somewhat higher in Ga, Ge and Co and lower in W, Re and Ir than other IAB main group irons including [Wichita County](https://www.lpi.usra.edu/meteor/metbull.php?code=24257), [Odessa (iron)](https://www.lpi.usra.edu/meteor/metbull.php?code=17985), [Canyon Diablo](https://www.lpi.usra.edu/meteor/metbull.php?code=5257), and [Campo del Cielo](https://www.lpi.usra.edu/meteor/metbull.php?code=5247).

**Specimens**: *Cascadia* holds 173.6 g in four pieces as well as a large vial of rusty surface fragments. The main mass is held by the family of Matt and Michelle Bird.

**Northeast Africa 007** (NEA 007)

Libya

Purchased: 2016 Nov

Classification: Iron meteorite (IIAB)

**History**: Purchased by the owner in Zagora in November 2016. Reportedly found by the seller in Libya.

**Physical characteristics**: The main mass is elongate and shaped like an axeblade. It has a dark brown, dimpled exterior.

**Petrography**: Polished and etched surfaces display equant grains of kamacite up to ~0.5 cm in diameter, with 120° junctions. Equilibrated texture is also present at the <50 μm scale. Inclusions of euhedral schreibersite up to 0.5 mm are present throughout. One cut surface shows a vein of schreibersite ~0.7 cm wide and 4 cm long, offset by planar shear surfaces.

**Geochemistry**: ICP-MS data, using sample of North Chile (Filomena) as standard (C. Herd and G. Chen *UAb*): Ni = 6.3, Co = 0.47 (both wt%); Ir = 0.02, Ga = 53, As = 9.45, W = 0.7, Re < 0.008, Os < 0.04, Cu = 97, Au = 1.3 (all μg/g).

**Classification**: (C. Herd, *UAb*): IIAB iron. Composition is consistent with the low-Ir end of the IIAB group. Texture suggests recrystallization as a result of shock heating.

**Specimens**: Type specimen consisting of a representative slice (15.2 g) and several small pieces (total 20.5 g) at *UAb*. Main mass with *Kuntz*.

**Northwest Africa 788** (NWA 788)

(Northwest Africa)

Purchased: 2001 Mar

Classification: Ordinary chondrite (L5/6)

**History**: Purchased by Michael Farmer in March 2001 from a dealer in Casablanca, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*; A. Rubin, *UCLA*) Some well-formed chondrules occur within a recrystallized matrix containing altered metal and merrillite. An exotic ellipsoidal clast (1.7 mm long) in the studied thin section is composed of labradorite containing myriad, oriented inclusions of Cr-pleonaste and ilmenite with accessory baddeleyite and troilite; this is mantled by a reaction rim against the matrix composed mainly of sodic plagioclase wth minor olivine and kamacite.

**Geochemistry**: Olivine (Fa25.0-25.8, N = 3), orthopyroxene (Fs21.1-22.1Wo1.7-1.6; N = 2), clinopyroxene (Fs7.7-9.8Wo44.4-44.0, N = 2), plagioclase in ellipsoidal clast (An58.9Or0.7), plagioclase in reaction rim on clast (An11.0Or5.5).

**Classification**: Ordinary chondrite (L5/6). An unusual feature of this specimen is the presence of an exotic plagioclase-rich object containing oriented grains of oxide phases.

**Specimens**: 190 g including one polished thin section at *UCLA*; 203.7 g at *PSF*; remainder with *MFarmer*.

**Northwest Africa 1290** (NWA 1290)

(Northwest Africa)

Purchased: 2002

Classification: Ordinary chondrite (L4)

**History**: Purchased by Adam and Greg Hupé in 2002 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*; T. Bunch, *NAU*) Well-formed chondrules occur in a recrystallized matrix containing altered metal.

**Geochemistry**: Olivine (Fa24.2-24.6, N = 3), orthopyroxene (Fs3.8-5.2Wo3.0-1.3; Fs18.5Wo0.4; N = 3), subcalcic augite (Fs10.5-10.8Wo31.6-33.1, N = 2).

**Classification**: Ordinary chondrite (L4).

**Specimens**: 22.8 g including one polished thin section at *UCLA*; 3.67 g at *PSF*; remainder with *AHupé*.

**Northwest Africa 2630** (NWA 2630)

Northwest Africa

Purchased: 2004

Classification: Ordinary chondrite (H5)

**History**: Purchased by Michael Farmer in 2004 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*; T. Bunch & J. Wittke, *NAU*) Sparse chondrules are present in a recrystallized matrix containing altered metal.

**Geochemistry**: Olivine (Fa19.5-19.6, N = 3), orthopyroxene (Fs16.6-16.7Wo1.3-1.2, N = 3), clinopyroxene (Fs8.4-10.1Wo44.1-43.3, N = 2).

**Classification**: Ordinary chondrite (H5).

**Specimens**: 89 g including one polished thin section at *PSF*; remainder with *MFarmer*.

**Northwest Africa 2631** (NWA 2631)

(Northwest Africa)

Purchased: 2004

Classification: Ordinary chondrite (H5)

**History**: Purchased by Michael Farmer in 2004 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*; T. Bunch, *NAU*) Sparse chondrules occur in a recrystallized matrix containing lightly stained metal.

**Geochemistry**: Olivine (Fa19.5-19.7, N = 3), orthopyroxene (Fs16.5-16.7Wo1.9-1.4; N = 2), clinopyroxene (Fs5.6-6.1Wo45.7-44.9, N = 2).

**Classification**: Ordinary chondrite (H5).

**Specimens**: 25.8 g plus one polished thin section at *PSF*; remainder with Farmer.

**Northwest Africa 2636** (NWA 2636)

Northwest Africa

Purchased: 2004

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased by Adam Hupé in 2004 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*; T. Bunch & J. Wittke, *NAU*) Granular chondrules (some rimmed, apparent diameter 600±300 μm) and CAI occur in a fine grained matrix (~35 vol.%, orange-brown in thin section).

**Geochemistry**: Olivine (Fa0.5-54.6, N = 3), orthopyroxene (Fs1.5-11.9Wo1.3-1.8, N = 3), clinopyroxene (Fs1.7Wo37.6; Fs0.7Wo46.8; N = 2).

**Classification**: Carbonaceous chondrite (CV3).

**Specimens**: 10.3 g including one polished thin section at *PSF*; remainder with *AHupé*.

**Northwest Africa 2640** (NWA 2640)

(Northwest Africa)

Purchased: 2004

Classification: Ordinary chondrite (LL6)

**History**: Purchased by Blaine *Reed* in 2004 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*; T. Bunch and J. Wittke, *NAU*) Rare chondrule remnants occur in a recrystallized matrix containing altered metal.

**Geochemistry**: Olivine (Fa30.5-31.6, N = 3), orthopyroxene (Fs24.7-25.1Wo2.0-2.4, N = 3), clinopyroxene (Fs9.4-10.0Wo43.8-43.7, N = 2).

**Classification**: Ordinary chondrite (LL6).

**Specimens**: 22.1 g including one polished endcut at *PSF*; remainder with *Reed*.

**Northwest Africa 4894** (NWA 4894)

(Northwest Africa)

Purchased: 2007

Classification: HED achondrite (Eucrite, brecciated)

**History**: The meteorite was bought in 2007 from a local meteorite dealer in Zagora, Morocco.

**Physical characteristics**: Four small individuals partly covered by fusion crust.

**Petrography**: The meteorite is a breccia composed of basaltic and impact melt fragments up to 4 mm in size set into abundant clastic matrix. Basaltic clasts and matrix are dominated by exsolved pyroxene and calcic plagioclase up to 2 mm in size. Minor phases are silica, ilmenite, FeS, fayalite, and metallic Fe. The meteorite contains rare carbonaceous C1/2 clasts.

**Geochemistry**: low-Ca pyroxene: Fs60.5±0.8Wo2.3±0.4(Fs59.3-61.5Wo1.9-3.4, n=15, FeO/MnO=28-34); Ca-pyroxene: Fs25.4±3.2Wo44.1±0.8(Fs19.2-28.4Wo43.1-45.7, n=13, FeO/MnO=25-35); calcic plagioclase: An90.6±2.6(An87.5-95.5, n=14)

**Northwest Africa 4915** (NWA 4915)

(Northwest Africa)

Purchased: 2007

Classification: Carbonaceous chondrite (CV3)

**History**: The meteorite was bought in 2007 from a Moroccan meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Two brownish individuals lacking any fusion crust.

**Petrography**: Carbonaceous chondrite composed of up to 2 mm sized chondrules, CAIs and olivine amoeboids all set into a fine-grained almost black matrix. No type II chondrules were encountered. Some chondrules show reddish staining due to terrestrial weathering.

**Northwest Africa 4916** (NWA 4916)

(Northwest Africa)

Purchased: 2007

Classification: Ureilite

**History**: The meteorite was bought in 2007 from a Moroccan meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Brownish individual lacking any fusion crust.

**Petrography**: The meteorite shows a characteristic cumulate texture of coarse up to 1.8 mm sized Cr-rich olivine and pigeonite crystals. It contains flaky graphite; olivine displays characteristic reduced rims.

**Geochemistry**: reduced rims in olivine: Fa6.7-10.8; Cr2O3 in ol: ~0.5 wt%

**Northwest Africa 5195** (NWA 5195)

Morocco

Purchased: 2005

Classification: Ordinary chondrite (L6)

**History**: A single stone weighing 690 g was found in Morocco and subsequently purchased in Agadir, Morocco. Thomas *Webb* acquired the sample from a meteorite prospector in 2005.

**Physical characteristics**: The stone is mottled orangish-brown and has a rounded, triangular shape. The stone is 25% covered by a weathered fusion crust. The cut face of the interior of the stone shows a few chondrules and shiny FeNi and FeS grains.

**Petrography**: Description and classification (Anthony Love, *App*): Sample displays recrystallized chondritic texture. Droplet chondrules, which survived recrystallization, have an average diameter of 1366 µm (n=6). Porphyritic chondrules are indistinct and have crystalline mesostasis.

**Geochemistry**: (A. Love, *App*) Olivine Fa24.7±0.2, N=8; low Ca pyroxene Fs2.7±0.2Wo1.2±0.1, N=8; high Ca pyroxene Fs8.2Wo44.9, N=1.

**Classification**: Based on mineral compositions, chondrule size and texture, this is an L6, S3, W2 ordinary chondrite.

**Specimens**: An endcut and one slice weighing 21.53 g, and a polished thin section are currently on deposit at *App*. Thomas *Webb* holds the main mass.

**Northwest Africa 5473** (NWA 5473)

(Northwest Africa)

Purchased: 2008

Classification: HED achondrite (Eucrite, polymict)

**History**: The meteorite was bought in 2008 from a Moroccan meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Small grayish individual lacking any fusion crust.

**Petrography**: The meteorite is a fragmental breccia composed of rare basaltic, impact melt, and mineral clasts with different grain sizes set into a clastic matrix. Clasts and matrix are dominantly composed of exsolved pyroxene and plagioclase up to 600 μm in size. Several matrix pyroxenes display magmatic zoning. Minor phases include chromite, ilmenite, pyrrhotite, silica, barite, zircon, and metallic iron. The meteorite contains some shock melt veins.

**Geochemistry**: low-Ca pyroxene: Fs27.5±7Wo2.5±0.5(Fs21.8-49.7Wo1.5-3.3, n=15, FeO/MnO=30-35); Ca-pyroxene: Fs21.9±2.4Wo43.3±0.8(Fs18.6-25.1Wo41.3-44.3, n=18, FeO/MnO=19-33); calcic plagioclase: An90.3±1.1(An88.7-92.0, n=12)

**Northwest Africa 5474** (NWA 5474)

(Northwest Africa)

Purchased: 2008

Classification: HED achondrite (Eucrite, polymict)

**History**: The meteorite was bought in 2008 from a Moroccan meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Grayish individual lacking any fusion crust.

**Petrography**: The meteorite is a breccia composed of basaltic, dark impact melt, and mineral clasts set into a fine-grained clastic matrix. Clasts and matrix are dominantly composed of exsolved pyroxene and plagioclase up to 1 mm in size. Minor phases include chromite, fayalite, pyrrhotite, silica, and metallic iron.

**Geochemistry**: Low-Ca pyroxene: Fs26.8±1.6Wo3.4±0.7(Fs21.5-28.7Wo2.0-4.2, n=15, FeO/MnO=29-36); Ca-pyroxene: Fs26.1±1.4Wo42.4±0.8(Fs23.8-28.2Wo40.4-43.0, n=18, FeO/MnO=30-39); calcic plagioclase: An90.3±3.8(An79.4-95.8, n=17)

**Northwest Africa 5475** (NWA 5475)

(Northwest Africa)

Purchased: 2008

Classification: Carbonaceous chondrite (CK5)

**History**: The meteorite was bought in 2008 from a Moroccan meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Grayish individual lacking any fusion crust.

**Petrography**: The meteorite displays a dark greenish to grayish interior and is composed of several clearly defined chondrules and rare CAIs set into abundant recrystallized matrix dominantly composed of ferroan olivine. Minor phases include feldspar, low-Ca pyroxene and Cr-bearing magnetite. Metal was not detected.

**Northwest Africa 5476** (NWA 5476)

(Northwest Africa)

Purchased: 2008

Classification: HED achondrite (Eucrite, polymict)

**History**: The meteorite was bought in 2008 from a Moroccan meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Grayish individual partly covered by fusion crust.

**Petrography**: The meteorite is a fine-grained breccia composed of lithic and mineral fragments set into a clastic matrix. Lithic fragments include basaltic and dark impact melt clasts. Dominant minerals in clasts and matrix are exsolved pyroxene and calcic plagioclase up to 400 µm in size. Some matrix pyroxenes display magmatic zoning. Minor phases include chromite, ilmenite, silica, pyrrhotite and metallic iron. The meteorite contains shock melt veins.

**Geochemistry**: low-Ca pyroxene: Fs33.2±9.7Wo2.9±0.9(Fs23.3-45.6Wo1.4-4.5, n=21, FeO/MnO=29-39); Ca-pyroxene: Fs20.8±1.7Wo40.5±2.7(Fs17.5-27.4Wo34.7-44.5, n=18, FeO/MnO=26-33); calcic plagioclase: An85.9±4.0(An77.3-91.9, n=15)

**Northwest Africa 5478** (NWA 5478)

(Northwest Africa)

Purchased: 2008

Classification: HED achondrite (Eucrite, polymict)

**History**: Three individuals were bought in 2008 from a Moroccan meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Three dark grayish individuals partly covered by fusion crust.

**Petrography**: The meteorite is a coarse-grained breccia composed of basaltic, melt and mineral clasts set into a more fine-grained matrix. Exsolved pyroxene and calcic plagioclase are the dominant mineral phases. Shock melt is abundant. Minor phases include silica, ilmenite, troilite, and chromit. No metallic iron has been found.

**Geochemistry**: low-Ca pyroxene: Fs59.7±1.1Wo3.4±1.2(Fs57.6-61.6Wo2.0-6.6, n=15, FeO/MnO=31-36); Ca-pyroxene: Fs28.4±1.9Wo42.2±1.4(Fs26.4-32.5Wo39.2-43.9, n=15, FeO/MnO=32-36); calcic plagioclase: An89.3±0.5(An88.6-90.3, n=15)

**Northwest Africa 5505** (NWA 5505)

(Northwest Africa)

Purchased: 2008

Classification: Carbonaceous chondrite (CO3)

**History**: The meteorite was bought in 2008 from a meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Light brownish individual lacking any fusion crust.

**Petrography**: The meteorite exhibits a chondritic texture of abundant small chondrules, CAIs, and mineral fragments set into a fine-grained matrix. Chondrules are dominantly porphyritic type I and typically 0.1-0.2 mm in diameter. Contains sulfides and FeNi metal in matrix and chondrules. Several calcite-filled cracks were detected.

**Northwest Africa 5508** (NWA 5508)

(Northwest Africa)

Purchased: 2008

Classification: Carbonaceous chondrite (CV3)

**History**: The meteorite was bought in 2008 from a meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Brownish individual lacking any fusion crust.

**Petrography**: The meteorite displays a dark-brownish interior and is composed of up to 2.5 mm sized chondrules, whitish CAIs, and olivine amoeboids set into a fine-grained, almost opaque matrix. Many chondrules show brownish staining due to terrestrial alteration. No type II chondrules were encountered.

**Northwest Africa 5668** (NWA 5668)

(Northwest Africa)

Purchased: 2008

Classification: Carbonaceous chondrite (CV3)

**History**: The meteorite was bought in 2008 from a Moroccan meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Small brownish individual with some fusion crust.

**Petrography**: Carbonaceous chondrite composed of up to 1.5 mm sized chondrules, CAIs and olivine amoeboids all set into a fine-grained almost black matrix. Type II chondrules are absent. Many chondrules show reddish staining due to terrestrial weathering.

**Northwest Africa 5703** (NWA 5703)

(Northwest Africa)

Purchased: 2009

Classification: Carbonaceous chondrite (CO3)

**History**: Eight individulas were bought in 2009 from a Moroccan meteorite on a mineral fair in Berlin, Germany.

**Physical characteristics**: Eight brownish individuals lacking any fusion crust.

**Petrography**: The meteorite exhibits a chondritic texture of abundant small chondrules, CAIs, and mineral fragments set into a fine-grained brownish matrix. Chondrules are dominantly porphyritic type I and typically 0.1-0.2 mm in diameter. Sulfides and FeNi metal are present in matrix and chondrules.

**Northwest Africa 5704** (NWA 5704)

(Northwest Africa)

Purchased: 2009

Classification: Carbonaceous chondrite (CK5)

**History**: The meteorite was bought in 2009 from a Moroccan meteorite dealer on a mineral fair in Berlin, Germany.

**Physical characteristics**: Grayish individual partly covered by fusion crust.

**Petrography**: The meteorite is composed of recrystallized olivine-dominated matrix with scattered chondrules still being discernable. Cr-rich magnetite is abundant. More minor phases include intermediate plagioclase, low-Ca pyroxene, and troilite. Metal is virtually absent.

**Northwest Africa 5753** (NWA 5753)

(Northwest Africa)

Purchased: 2008 Oct

Classification: HED achondrite (Howardite)

**Petrography** (K. Metzler, *IfP*): Fine-grained breccia, consisting of equilibrated eucrite clasts (subophitic to ophitic textures) and diogenitic pyroxene fragments (about 15 vol%), set in a fine-grained matrix of related debris. Melt rock clasts (clast-rich and clast-poor) occur and some shock veins are visible. Accessories are silica, ilmenite, chromite, iron sulfide and (mostly oxidized) metal.

**Geochemistry**: Mineral compositions and geochemistry: Eucrite clasts: Low-Ca pyroxene (n=20) Fs45.9±9.0Wo4.8±2.5(Fs32-55Wo1-10). High-Ca pyroxene (n=6) Fs27.1±4.1Wo36.4±5.3(Fs22-34Wo27-43). Diogenitic pyroxene (n=11) Fs26.5±1.4(Fs24-28). Plagioclase (n=10) An87.8±4.4(An80-94).

**Northwest Africa 5756** (NWA 5756)

(Northwest Africa)

Purchased: 2008 Jun 16

Classification: Ordinary chondrite (LL3-4)

**History**: Purchased from a Moroccan dealer at the meteorite fair in Ensisheim, France.

**Petrography**: (K. Metzler, *IfP*) Genomict breccia, consisting of unequilibrated (LL3) clasts and clasts with unequilibrated low-Ca pyroxene and equilibrated olivine (LL4), embedded in related fine-grained clastic material.

**Geochemistry**: Mineral chemistry of type 3 clasts: Fa27.0±8.2(Fa11.0-38.8; n=22); Fs14.6±7.5(Fs4.3-31.9; n=19); Mineral chemistry of type 4 clasts: Fa31.7±1.2(Fa30.5-33.9; n=6); Fs18.3±5.7(Fs13.1-30.1; n=8)

**Northwest Africa 5760** (NWA 5760)

(Northwest Africa)

Purchased: 2008 Jun 25

Classification: Ordinary chondrite (L3-5)

**History**: Purchased from a Moroccan dealer at the meteorite fair in Sainte-Marie-aux-Mines, France.

**Petrography**: (K. Metzler, *IfP*) Genomict breccia, dominated by equilibrated clasts (L5) with small amounts of unequilibrated clasts (L3), embedded in related fine-grained clastic material.

**Geochemistry**: Mineral chemistry of type 3 clasts: Fa22.8±2.1(Fa20.1-25.7; n=8); Fs15.9±4.9(Fs5.4-20.9; n=16); Mineral chemistry of type 5 clasts: Fa22.3±0.6(Fa21.6-23.3; n=19); Fs18.9±0.4(Fs18.6-19.7; n=10)

**Northwest Africa 5761** (NWA 5761)

(Northwest Africa)

Purchased: 2005 Dec 9

Classification: Ordinary chondrite (L3-6)

**History**: Purchased from a Moroccan dealer at the mineral fair (CCH) in Hamburg, Germany.

**Petrography**: (K. Metzler, *IfP*) Genomict breccia, consisting of unequilibrated (L3) and equilibrated clasts (L6), embedded in related, fine-grained, clastic material.

**Geochemistry**: Mineral chemistry of type 3 clasts: Fa24.7±4.2(Fa21.5-38.6; n=18); Fs16.2±4.3(Fs12.4-20.8; n=4); Mineral chemistry of type 6 clasts: Fa24.0±0.7(Fa22.9-24.9; n=13); Fs19.8±0.3(Fs19.2-20.3; n=11)

**Northwest Africa 5766** (NWA 5766)

(Northwest Africa)

Purchased: 2005

Classification: Mesosiderite (anomalous)

**History**: Purchased by Fabien *Kuntz* in 2005 from a dealer in Midelt, Morocco.

**Physical characteristics**: A group of small brown stones (total weight 298 g). Fresher interiors are gray with visible partly altered metal.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Aggregate of predominantly calcic plagioclase (~35 vol%), unexsolved pigeonite and altered kamacite (25 vol.%) with minor orthopyroxene, augite, silica polymorph, taenite and rare schreibersite. Thin iron hydroxide veinlets are present.

**Geochemistry**: Pigeonite (Fs37.4-37.7Wo10.3-8.7, FeO/MnO = 26-27, N = 3, orthopyroxene (Fs36.1Wo1.4, FeO/MnO =21), augite (Fs20.6Wo39.3, FeO/MnO = 19), plagioclase An931.3-92.4Or0.4(N=2).

**Classification**: Mesosiderite, anomalous . The dominant pyroxene is relatively magnesian pigeonite, which is anomalous for mesosiderites.

**Specimens**: 20.9 g including one polished piece at *PSF*; remaining material with *Kuntz*.

**Northwest Africa 5884** (NWA 5884)

(Northwest Africa)

Purchased: 2009

Classification: Ureilite

**History**: The meteorite was bought in 2009 from a Moroccan meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Brownish individual lacking any fusion crust.

**Petrography**: The meteorite shows a cumulate texture of coarse up to 1.5 mm sized Cr-rich olivine and pigeonite crystals. It contains flaky graphite; olivine displays characteristic reduced rims.

**Geochemistry**: reduced rims in olivine: Fa5.8-8.5; Cr2O3 in ol: ~0.6 wt%

**Northwest Africa 5885** (NWA 5885)

(Northwest Africa)

Purchased: 2009

Classification: Enstatite achondrite (Aubrite)

**History**: The meteorite was bought in 2009 from a local meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: A single, brownish individual without fusion crust was purchased.

**Petrography**: The meteorite displays a medium- to coarse-grained texture dominantly composed of up to 2 mm sized enstatite crystals. Often, adjoining grains show triple junctions. Less abundant are albitic feldspar and kamacite. Perryite is found as exsolution phase in the metal. The meteorite contains several weathering veins.

**Geochemistry**: Feldspar: An4.1Ab91.7Or4.2(N=2); metal contains 3.2-3.8 wt Ni and about 3.2 wt% Si; oxygen isotopes (N. Assayag, P. Cartigny, and D. Rumble, *IPGP*): δ18O=5.335, 5.585; δ17O=2.849, 2.875; Δ17O= 0.057, -0.048 (all per mil).

**Classification**: Aubrite. Pairing with [NWA 6675](https://www.lpi.usra.edu/meteor/metbull.php?code=53586) seems likely.

**Northwest Africa 5886** (NWA 5886)

(Northwest Africa)

Purchased: 2008

Classification: Enstatite chondrite (EL6)

**History**: The meteorite was bought in 2008 from a Moroccan meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Light brownish individual lacking any fusion crust.

**Petrography**: The meteorite displays a fine-grained, recrystallized texture of predominantly enstatite. Minor phases include daubreelite, troilite, and albitic feldspar; it contains about 1 wt.% Si in the FeNi metal.

**Geochemistry**: albitic feldspar: An15.3Ab80.9Or3.8(N=12); Si in FeNi-metal is about 1 wt.% (N=3)

**Northwest Africa 5887** (NWA 5887)

(Northwest Africa)

Purchased: 2009

Classification: HED achondrite (Eucrite, brecciated)

**History**: The meteorite was bought in 2009 from a Moroccan meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Two small grayish individuals lacking any fusion crust.

**Petrography**: The meteorite is a breccia composed of basaltic, impact melt, and mineral clasts set into a clastic matrix. Major mineral phases are exsolved pyroxene and plagioclase up to 500 µm in size. Minor phases include chromite, ilmenite, pyrrhotite, silica, and metallic iron.

**Geochemistry**: low-Ca pyroxene: Fs54.7±1.8Wo5.9±2.1(Fs51.7-57.4Wo2.9-9.7, n=13, FeO/MnO=31-36); Ca-pyroxene: Fs28.4±1.9Wo38.4±2.1(Fs25.3-32.1Wo34.2-41.9, n=16, FeO/MnO=30-38); calcic plagioclase: An89.6±1.4(An85.9-91.3, n=14)

**Northwest Africa 5921** (NWA 5921)

(Northwest Africa)

Purchased: 2009

Classification: Ureilite

**History**: The meteorite was bought in 2009 from a Moroccan meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Brownish individual lacking any fusion crust.

**Petrography**: The meteorite shows a cumulate texture of coarse-grained up to 2 mm sized Cr-rich olivine and orthopyroxene crystals. It contains flaky graphite; olivine displays characteristic reduced rims.

**Geochemistry**: reduced rims in olivine: Fa5.4-9.9; Cr2O3 in ol: ~0.7 wt%

**Northwest Africa 5925** (NWA 5925)

(Northwest Africa)

Purchased: 2009

Classification: Ureilite

**History**: The meteorite was bought in 2009 from a Moroccan meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Dark grayish individual lacking any fusion crust.

**Petrography**: The meteorite shows a cumulate texture of blocky, up to 1 mm sized Cr-rich olivine and pigeonite crystals. It contains some flaky graphite; olivine displays characteristic reduced rims.

**Geochemistry**: reduced rims in olivine: Fa3.0-11.2; Cr2O3 in ol: ~0.7 wt%

**Northwest Africa 6007** (NWA 6007)

(Northwest Africa)

Purchased: 2009 Oct

Classification: Ordinary chondrite (L3)

**Petrography**: (K. Metzler, *IfP*) Ordinary chondrite of low petrologic type consisting of about 90 vol% chondrules of various textural types, set in a fine-grained interchondrule matrix. Accessory phases are FeNi metal and troilite, mostly residing outside of chondrules.

**Geochemistry**: The mean olivine composition is Fa17.7±11.0(Fa1-37; n=15); the mean low-Ca pyroxene composition is Fs10.0±8.4(Fs3-34; n=19)

**Classification**: L chondrite based on apparent chondrule size (~0.6 mm; n=49) and moderate metal content. Petrologic type <3.5 based on the variability of olivine composition (Fayalite PMD >50)

**Northwest Africa 6009** (NWA 6009)

(Northwest Africa)

Purchased: 2009 Oct

Classification: Carbonaceous chondrite (CK5)

**Petrography**: (K. Metzler, *IfP*) Chondrules and CAIs are embedded in a fine-grained brownish matrix. The matrix consists mostly of equilibrated Fe-rich olivine grains, interspersed with opaque nodules of Cr-bearing magnetite. The mean grain size of secondary feldspar is around 10µm.

**Geochemistry**: Random measurements of olivine grains revealed Fa32.3±0.5(Fa31-33); n=20. The mean Ni content in olivine is 0.38 wt%. Random measurements of low-Ca pyroxene grains revealed Fs27.2±1.2Wo1.0±0.6(Fs25-30Wo1-3; n=19). One measurement of Ca-pyroxene shows En47Fs10Wo43.The compositional range of feldspar is An34-65(n=5).

**Classification**: CK chondrite based on mineral chemistry. Petrologic type 5 based on the equilibrated state of olivine and pyroxene and the fact that chondrules are still visible.

**Northwest Africa 6015** (NWA 6015)

(Northwest Africa)

Purchased: 2009 Oct

Classification: Carbonaceous chondrite (CO3)

**Petrography**: (K. Metzler, *IfP*) Chondrules, chondrule fragments, and CAIs are embedded in a fine-grained brownish matrix (about 30 vol% matrix). Most chondrules have apparent diameters between 50 and 250 μm.

**Geochemistry**: Random measurements of olivine grains revealed Fa23.6±22.2(Fa1-76); n=21. Random measurements of low-Ca pyroxene grains revealed Fs2.3±1.3Wo0.6±0.4(Fs1-6Wo0-2); n=20.

**Classification**: CO chondrite based on CAI occurrence, small chondrule size, chondrule-matrix ratio, and mineral chemistry. Petrologic type 3 based on the chemical variability of olivine and pyroxene.

**Northwest Africa 6065** (NWA 6065)

(Northwest Africa)

Purchased: 2009

Classification: Ungrouped achondrite

**History**: The meteorite was bought in 2009 from a local meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: A single brownish individual without fusion crust was purchased.

**Petrography**: The meteorite shows an equilibrium texture dominantly composed of 200-600 µm sized olivine (77 vol%) and Ca-pyroxene (10 vol%) grains that often share 120° grain boundaries. Minor phases include Cl-rich apatite, chromite, troilite, and FeNi metal which is often altered to iron hydroxides. Neither low-Ca pyroxene nor plagioclase has been found in the two thin sections studied.

**Geochemistry**: olivine: Fs29.4±0.2(Fs29.2-29.7, n=17, FeO/MnO=57); Ca-pyroxene: Fs9.7±0.7Wo44.5±0.5(Fs9.3-12.3Wo43.5-44.9, n=18, FeO/MnO=26, Cr2O3 = 0.74wt%, Al2O3 = 0.71wt%); oxygen isotopes (R. Tanaka and D. Rumble, Institute for Study of the Earth’s Interior, *OkaU*): δ18O=5.558, 5.598; δ17O=2.830, 2.873; Δ17O= -0.095, -0.073 (all per mil).

**Classification**: Achondrite, ungrouped (brachinite-like). Pairing with [NWA 5400](https://www.lpi.usra.edu/meteor/metbull.php?code=47712) seems likely.

**Northwest Africa 6256** (NWA 6256)

(Northwest Africa)

Purchased: 2009

Classification: Mesosiderite

**History**: The meteorite was bought in 2009 from a meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Many small brownish individuals totalling 500 g.

**Petrography**: The silicate portion (about 60 vol%) of the meteorite dominantly consists of magmatically zoned up to 1.5 mm sized low-Ca pyroxene and less abundant olivine, Ca-pyroxene and calcic plagioclase. Minor phases include silica, chromite and merrillite. The metal portion has been completely altered to iron oxides and hydroxides.

**Geochemistry**: olivine: Fa41.4±0.3(Fa41.1-42.0, n=11, FeO/MnO=45-50); low-Ca pyroxene: Fs26.6±6.5Wo3.3±1.1(Fs15.7-41.1Wo0.7-5.0, n=41, FeO/MnO=27-38); Ca-pyroxene: Fs43.8±2.4Wo8.7±1.3(Fs39.1-46.8Wo6.8-11.4, n=10, FeO/MnO=24-27); calcic plagioclase: An87.7±0.5(An87.1-88.8, n=15)

**Northwest Africa 6446** (NWA 6446)

Morocco

Find: 2010

Classification: Carbonaceous chondrite (CO3)

**History**: Purchased by Fabien Kuntz in October 2012 from a dealer in Zagora, Morocco.

**Petrography**: (T. Bunch and J. Wittke, *NAU*; A. Irving, *UWS*) Small chondrules (average apparent diameter ~200 μm) and CAIs in a dark brown matrix.

**Geochemistry**: Olivine (Fa0.5-71.0, N = 3), orthopyroxene (Fs1.3-8.0Wo1.0-4.8, N = 3), subcalcic ferroaugite (Fs50.1-52.0Wo37.6-33.1, N = 2).

**Classification**: Carbonaceous chondrite (CO3).

**Specimens**: Type specimen plus one polished thin section at *PSF*; main mass with *Kuntz*.

**Northwest Africa 6703** (NWA 6703)

(Northwest Africa)

Purchased: 2011 Jan

Classification: Carbonaceous chondrite (CK6)

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Very sparse recrystallized chondrules (some with magnetite-rich rims) in a recrystallized matrix. Olivine, clinopyroxene, intermediate plagioclase, Cr-bearing magnetite and pentlandite. Fa contents and Fs contents in clinopyroxene are mutually consistent with this being an equilibrated chondrite.

**Geochemistry**: Ca-pyroxene Fs9.4-10.Wo47.3-48.1(N =2)

**Northwest Africa 6708** (NWA 6708)

(Northwest Africa)

Purchased: 2011 Mar

Classification: Carbonaceous chondrite (CK5)

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Sparse granular chondrules (some with magnetite-rich rims). Olivine, orthopyroxene, pigeonite, augite, intermediate plagioclase and Cr-bearing magnetite.

**Geochemistry**: Olivine Fa29.9-31.3, mean Fa30.5±0.6, N = 4, orthopyroxene Fs22.9Wo0.5(N=1), pigeonite Fs28.1Wo8.7(N=1), augite Fs9.3-10.1Wo45.4-45.1.

**Classification**: Carbonaceous chondrite, CK5.

**Northwest Africa 6870** (NWA 6870)

(Northwest Africa)

Purchased: 2011 May

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased by Greg Catterton in May 2011 from a dealer in Ouarzazate, Morocco.

**Physical characteristics**:

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Round to irregular-shaped chondrules (mostly granular, some rimmed) and fine grained CAIs are set in a dark brown matrix.

**Geochemistry**: Olivine (Fa1.0-32.7), orthopyroxene (Fs0.9-1.1Wo1.1-0.8), augite (Fs1.0Wo38.5); diopside in one CAI is Fs0.2Wo50.2.Oxygen isotopes of acid-washed subsamples: d17O -6.880, -7.446; d18O -2.347, -3.062; D17O -5.665, -5.858 per mil (Ryoji Tanaka, Okayama University).

**Classification**: Carbonaceous chondrite (CV3).

**Specimens**: 20 g including one polished thin section at *UWB*; remainder with Mr. G. Catterton.

**Northwest Africa 6870** (NWA 6870)

Northwest Africa

Purchased: 2011 May

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased by Greg Catterton in May 2011 from a dealer in Ouarzazate, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Round to irregular-shaped mm-sized chondrules (mostly granular, some rimmed) and fine grained CAIs are set in a dark brown matrix.

**Geochemistry**: Olivine (Fa1.0, Fa32.7, N=2), orthopyroxene (Fs0.9Wo1.1, Fs1.1Wo0.8, 0.8, N=2), augite (Fs1.0Wo38.5, N=1); diopside in one CAI is Fs0.2Wo50.2(N=1). Oxygen isotopes of acid-washed subsamples: δ17O -6.880, -7.446; δ18O -2.347, -3.062; Δ17O -5.665, -5.858 per mil (Ryoji Tanaka, *OkaU*).

**Classification**: Carbonaceous chondrite (CV3).

**Specimens**: 20 g including one polished thin section at *UWB*; 26.6 g and two polished mounts at *App*; remainder with Mr. G. Catterton.

**Northwest Africa 7165** (NWA 7165)

(Northwest Africa)

Purchased: 2011

Classification: Ordinary chondrite (L/LL3)

**History**: Purchased by Marcin Cimala in 2011 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Closely-packed, well-formed chondrules (apparent diameter 0.2-1.8 mm) are set set within a finer grained matrix.

**Geochemistry**: Olivine (Fa8.9-60.8, Cr2O3 in ferroan examples = 0.06-0.13 wt.%, mean 0.10±0.03 wt.%, N = 7), orthopyroxene (Fs2.5-14.2Wo0.3-0.2, N = 3), subcalcic augite (Fs28.3Wo23.5), augite (Fs2.6Wo40.0).

**Classification**: Ordinary chondrite (L/LL3).

**Specimens**: 17.2 g including one polished thin section at *PSF*; main mass with Mr. M. Cimala.

**Northwest Africa 7318** (NWA 7318)

Northwest Africa

Purchased: 2012 Apr

Classification: Ureilite

**History**: Purchased in Temara, Morocco by Adam *Aaronson* in April 2012.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Protogranular aggregate of olivine (~70 vol.%) and pigeonite (~30 vol.%), exhibiting some preferred orientation of grains of both phases. Fine grained metal occurs in irregular zones along olivine grain boundaries (and as blebs in their magnesian, reduced margins).

**Geochemistry**: Olivine (cores Fa20.1-22.0; Cr2O3 = 0.71-0.74 wt.%; N = 3), pigeonite (Fs18.0-18.1Wo9.4-9.5, N = 2)

**Classification**: Ureilite.

**Specimens**: 20 g including one polished thin section at *UWB*. The remaining material is held by *Aaronson*.

**Northwest Africa 8134** (NWA 8134)

(Northwest Africa)

Purchased: 2013 Oct

Classification: Ordinary chondrite (H4)

**History**: Purchased by Adam Aaronson in Temara, Morocco in October 2013.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Well-formed, relatively small chondrules (apparent diameter predominantly 350±250 μm, but some chondrules are in the 1.5-2.2 mm range) in a dark reddish-brown matrix containing altered metal. Glass is present in some chondrules. Minerals are olivine, orthopyroxene, augite, sodic plagioclase, altered kamacite, chromite and troilite.

**Geochemistry**: Olivine (Fa16.9-17.3, N = 3), orthopyroxene (Fs14.5-14.6Wo0.4-2.7, cores Fs4.6.Wo0.4; N = 3), augite (Fs6.3-13.5Wo38.8-43.3, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg)=4.88.

**Classification**: Ordinary chondrite (H4).

**Specimens**: 25.4 g including one polished thin section at *UWB*. The remainder is held by *Aaronson*.

**Northwest Africa 8230** (NWA 8230)

(Northwest Africa)

Purchased: 2013 Dec

Classification: Ordinary chondrite (H3)

**History**: Purchased by Adam Aaronson in Temara, Morocco in December 2013.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Well-formed, relatively small chondrules (apparent diameter 500±300 µm) and relatively abundant altered metal. Minerals are olivine, orthopyroxene, augite, sodic plagioclase, altered kamacite, merrillite, chromite and troilite.

**Geochemistry**: Olivine (Fa11.1-23.8; N = 4; Cr2O3 in ferroan examples = 0.04 wt.%), orthopyroxene (Fs7.4-35.5Wo0.2-1.9, N = 3), augite (Fs7.3Wo41.7). Magnetic susceptibility log χ (× 10-9 m3/kg) = 5.12.

**Classification**: Ordinary chondrite (H3). Subtype estimated to be H3.8 based on the limited range in fayalite content of olivine and paucity of Cr2O3 in ferroan olivine [(Grossman and Brearley, 2005)](http://articles.adsabs.harvard.edu/full/2005M%26PS...40...87G).

**Specimens**: 20.2 g including one polished thin section at *UWB*. The remainder is held by *Aaronson*.

**Northwest Africa 8333** (NWA 8333)

(Northwest Africa)

Purchased: 2014 Jan

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased from a mineral dealer in Berlin, Germany, who bought the sample in Morocco.

**Petrography**: (K. Metzler, *IfP*) Chondrules, CAIs and AOAs are embedded in a fine-grained dark matrix (about 30 vol% matrix). The matrix is Allende-like, mainly consisting of tiny (<5-20 µm) elongated olivine grains. Most chondrules have apparent diameters between 0.5 and 2 mm, the largest up to 4 mm. CAIs with sizes up to 1.2 cm and dark inclusions up to 1.5 cm in size are observed. A directional fabric is visible due to the parallel orientation of elongated CAIs and AOAs.

**Geochemistry**: Composition of small olivine grains in matrix is Fa40.5±1.5(Fa37-41); n=10. Random measurements of olivine grains revealed Fa17.8±12.0(Fa1-46); n=23. Random measurements of low-Ca pyroxene grains revealed Fs2.0±1.3Wo2.2±1.8(Fs1-4Wo1-5, n=13).

**Classification**: CV chondrite based on CAI and AOA occurrence, size of chondrules and CAIs, chondrule-matrix ratio, and mineral chemistry. Petrologic type 3 based on the chemical variability of olivine and pyroxene.

**Northwest Africa 8335** (NWA 8335)

(Northwest Africa)

Purchased: 2013

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased from Aras Jonikas (USA) who bought the sample from a Moroccan dealer.

**Petrography**: (K. Metzler, *IfP*) Chondrules, CAIs and AOAs are embedded in a fine-grained dark matrix (about 30 vol% matrix). Most chondrules have apparent diameters between 0.3 and 1.8 mm, some up to 4.2 mm. Several chondrules show reddish staining due to terrestrial weathering. CAIs with sizes up to 5 mm and dark inclusions up to 2.5 cm are observed.

**Geochemistry**: Random measurements of olivine grains revealed Fa9.4±10.1(Fa1-42); n=23. Random measurements of low-Ca pyroxene grains revealed Fs1.4±0.6Wo1.3±0.9(Fs1-4Wo1-4); n=19.

**Classification**: CV chondrite based on CAI and AOA occurrence, size of chondrules and CAIs, chondrule-matrix ratio, and mineral chemistry. Petrologic type 3 based on the chemical variability of olivine and pyroxene.

**Northwest Africa 8355** (NWA 8355)

(Northwest Africa)

Purchased: 2014 Feb

Classification: Ordinary chondrite (L3)

**History**: Purchased by Marcin Cimala in February 2014 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Closely-packed, medium-sized (apparent diameter 600±200 μm), well-formed chondrules. Minerals are olivine, orthopyroxene, subcalcic augite, sodic plagioclase, altered kamacite, troilite, chromite and taenite.

**Geochemistry**: Olivine (Fa15.8-25.5, N = 5; Cr2O3 content of ferroan olivine <0.02 wt.%), orthopyroxene (Fs11.9-35.4Wo0.4-4.3, N = 3), subcalcic augite (Fs11.0-26.6Wo34.8-27.0, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.65.

**Classification**: Ordinary chondrite (L3). Subtype estimated to be L3.8 based on the limited range in fayalite content of olivine and paucity of Cr2O3 in ferroan olivine [(Grossman and Brearley, 2005)](http://articles.adsabs.harvard.edu/full/2005M%26PS...40...87G).

**Specimens**: 20.2 g including one polished thin section at *UWB*. The remainder is held by M. Cimala.

**Northwest Africa 8360** (NWA 8360)

Northwest Africa

Purchased: 2013 Nov

Classification: Rumuruti chondrite (R5)

**History**: Purchased by Matthew Martin in November 2013 from a dealer in Lake Station, Indiana, who had obtained the material from a Moroccan source.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Fresh specimen containing some well-formed, mostly granular chondrules in a relatively coarse grained matrix containing Ti-bearing chromite, pentlandite, pyrrhotite and sodic plagioclase.

**Geochemistry**: Olivine (Fa39.4-40.0, N = 3), orthopyroxene (Fs29.4-30.5Wo0.8-1.4, N = 2), augite (Fs10.2-11.9Wo46.3-45.1, N = 2).

**Classification**: R5 chondrite.

**Specimens**: 23 g including one polished thin section at *UWB*. The remaining material is held by Mr. M. Martin.

**Northwest Africa 8680** (NWA 8680)

(Northwest Africa)

Purchased: 2014 May

Classification: Carbonaceous chondrite (CO3)

**History**: Purchased by John Higgins in May 2014 from a dealer in Laayoune, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Small chondrules, mineral fragments and irregularly shaped CAI occur in a fairly sparse, red-brown matrix containing minor altered metal.

**Geochemistry**: Olivine (Fa0.3-40.6; Cr2O3 in ferroan olivine 0.09-0.19 wt.%, mean 0.12±0.04 wt.%, N = 7), orthopyroxene (Fs0.6-10.4Wo1.1-0.4, N = 3), clinopyroxene (Fs1.7Wo45.2), diopside in CAI (Fs0.5Wo48.9).

**Classification**: Carbonaceous chondrite (CO3).

**Specimens**: 20.1 g including one polished thin section at *UWB*. The remaining material is held by Mr. J. Higgins.

**Northwest Africa 8745** (NWA 8745)

(Northwest Africa)

Purchased: 2014 Jun

Classification: HED achondrite (Eucrite, brecciated)

**History**: Purchased by Darryl Pitt in June 2014 from a dealer in Mauritania.

**Physical characteristics**: Single stone (5220 g) composed of pale clasts in a dark-brown matrix. Felsic lithic clasts exposed on the exterior have been eroded by desert ablation.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of diabasic eucrite clasts in a matrix of related debris plus some subcalcic augite grains. Clasts consist predominantly of exsolved pigeonite (some of which appears red-brown in thin section) and calcic plagioclase (polycrystalline) with accessory silica polymorph, ilmenite and troilite. Calcite is present in small vugs and barite is a minor constituent.

**Geochemistry**: Orthopyroxene host (Fs59.3-61.6Wo4.3-2.0, FeO/MnO = 32-33, N = 3), clinopyroxene exsolution lamellae (Fs25.8-26.6Wo44.2-43.6, FeO/MnO = 34-35, N = 3), subcalcic augite (Fs32.8Wo37.8, FeO/MnO = 32).

**Classification**: Eucrite (breccia, diabasic, shocked).

**Specimens**: 27.8 g including one polished thin section at *UWB*; the remainder is held by *DPitt*.

**Northwest Africa 8747** (NWA 8747)

(Northwest Africa)

Purchased: 2014 Apr

Classification: Carbonaceous chondrite (CK5)

**History**: Purchased by Darryl Pitt in April 2014 from a dealer in Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Sparse mm-sized chondrules containing Cr-magnetite occur within a matrix containing magnetite with some rusty alteration.

**Geochemistry**: Olivine (Fa31.3-32.8, FeO/MnO = 115-120, N = 3), orthopyroxene (Fs25.9-26.1Wo0.7-0.6, N = 3), augite (Fs3.5Wo39.2; Fs12.0Wo46.2, N = 2).

**Classification**: Carbonaceous chondrite (CK5).

**Specimens**: 18.8 g including one polished thin section at *UWB*; the remainder is held by *DPitt*.

**Northwest Africa 8751** (NWA 8751)

(Northwest Africa)

Purchased: 2014 Jun

Classification: Carbonaceous chondrite (CK5)

**History**: Purchased by Darryl Pitt in June 2014 from a dealer in Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Separated, round mm-sized chondrules (one 4.3 mm in diameter) containing Cr-magnetite occur within a matrix containing red-brown, stained magnetite.

**Geochemistry**: Olivine (Fa31.0-31.1, FeO/MnO = 106-117, N = 3), orthopyroxene (Fs25.8-25.9Wo0.6-0.7, N = 3), augite (Fs8.6-10.1Wo47.2-45.1; N = 2).

**Classification**: Carbonaceous chondrite (CK5).

**Specimens**: 22.8 g including one polished thin section at *UWB*; the remainder is held by *DPitt*.

**Northwest Africa 8774** (NWA 8774)

(Northwest Africa)

Purchased: 2014 Oct

Classification: Carbonaceous chondrite (CO3)

**History**: Purchased by Stefan *Ralew* in October 2014 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Relatively small (average apparent diameter ~200 μm), round chondrules occur within a metal-bearing matrix (~15 vol.%). Main minerals are olivine and orthopyroxene, subordinate subcalcic augite and augite, plus accessory altered kamacite, taenite, troilite, merrillite and calcic plagioclase. Rare grains of Al-Ti-rich clinopyroxene are present in the matrix, and are associated with gehlenite, spinel and calcite.

**Geochemistry**: Olivine (Fa0.9-59.7, N = 3), orthopyroxene (Fs1.0-6.2Wo0.9-0.8, N = 3), subcalcic augite (Fs1.2Wo32.8), augite (Fs0.8Wo44.1).

**Classification**: Carbonaceous chondrite (CO3). This specimen is unusually metal-rich among CO chondrites.

**Specimens**: 8.5 g including one polished thin section at *UWB*; main mass with *Ralew*.

**Northwest Africa 8776** (NWA 8776)

(Northwest Africa)

Purchased: 2014 Oct

Classification: Carbonaceous chondrite (CK3)

**History**: Purchased by Stefan Ralew in October 2014 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Separated, well-formed mm-sized chondrules containing Cr-magnetite together with sparse CAI occur within a stained matrix. Other minerals are olivine (some with very forsteritic cores), orthopyroxene, clinopyroxene, intermediate plagioclase, plus minor barite, calcite and pyrite.

**Geochemistry**: Olivine (relict core Fa1.2; predominantly Fa20.5-21.6, N = 4), orthopyroxene (Fs19.9-23.9Wo1.4-0.5, N = 3), clinopyroxene (Fs9.5Wo41.6).

**Classification**: Carbonaceous chondrite (CK3).

**Specimens**: 11.3 g including one polished thin section at *UWB*; main mass with *Ralew*.

**Northwest Africa 8780** (NWA 8780)

(Northwest Africa)

Purchased: 2014 Dec

Classification: Carbonaceous chondrite (CK4)

**History**: Purchased by Greg Hupé in December 2014 from a Moroccan dealer in Paris, France.

**Physical characteristics**: Two pieces (286 g and 61 g) which fit together as a single stone.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Separated, well-formed mm-sized chondrules containing Cr-magnetite together with sparse CAI are set within a finer grained, stained matrix. Minerals are olivine, orthopyroxene, subcalcic augite, intermediate plagioclase, Cr-magnetite and altered Ni-poor kamacite.

**Geochemistry**: Olivine (Fa30.5-30.9, FeO/MnO = 101-134, N = 3), orthopyroxene (Fs24.3-24.4Wo0.6-0.7, N = 3), subcalcic augite (Fs14.4-14.6Wo32.5-33.4, N = 2).

**Classification**: Carbonaceous chondrite (CK4).

**Specimens**: 20.1 g including one polished thin section at *UWB*; the remainder is held by *GHupé*

**Northwest Africa 8782** (NWA 8782)

(Northwest Africa)

Purchased: 2014 Jun

Classification: Carbonaceous chondrite (CK3/4)

**History**: Purchased by Darryl Pitt in June 2014 from a dealer in Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Separated, well-formed mm-sized chondrules occur within a finer grained matrix containing Cr-magnetite.. Other minerals are olivine (some with very forsteritic cores), orthopyroxene, clinopyroxene, sodic plagioclase and intermediate plagioclase.

**Geochemistry**: Olivine (relict core Fa1.5; predominantly Fa25.7-26.9, N = 4), orthopyroxene (Fs23.2-23.8Wo5.4-0.6, N = 2), clinopyroxene (Fs15.7-23.8Wo47.9-48.5, N = 2).

**Classification**: Carbonaceous chondrite (CK3/4).

**Specimens**: 20.2 g including one polished thin section at *UWB*; main mass with *DPitt*.

**Northwest Africa 10122** (NWA 10122)

(Northwest Africa)

Purchased: 2015 Jan

Classification: Carbonaceous chondrite (CO3)

**History**: Purchased by Darryl Pitt in January 2015 from a dealer in Zagora, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Small chondrules (average apparent diameter ~200 μm), mineral fragments and small CAIs occur in an abundant black matrix. Accessory minerals include chromite, troilite and rare kamacite.

**Geochemistry**: Olivine (Fa0.5-71.2, N = 3), orthopyroxene (Fs1.2-8.0Wo3.9-3.4, N = 2), subcalcic augite (Fs2.7Wo36.0), augite (Fs1.1Wo43.2).

**Classification**: Carbonaceous chondrite (CO3).

**Specimens**: 20.1 g including one polished thin section at *UWB*. The remainder is held by *DPitt*.

**Northwest Africa 10125** (NWA 10125)

(Northwest Africa)

Purchased: 2014 Jul

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased by Darryl Pitt in July 2014 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Granular mm-sized chondrules plus iregularly shaped, fine-grained CAI (up to 2.5 mm across, some hibonite-bearing) are set in a fairly fresh, finer grained matrix (clove brown in thin section). Some chondrules contain stained metal and others have concentric dust rims.

**Geochemistry**: Olivine (Fa0.9-42.9, N = 3), orthopyroxene (Fs1.7-5.1Wo0.8-2.0, N = 2), clinopyroxene (Fs1.6-7.8Wo43.1-40.0, N = 2).

**Classification**: Carbonaceous chondrite (CV3).

**Specimens**: 20.2 g including one polished thin section at *UWB*. The remainder is held by *DPitt*.

**Northwest Africa 10129** (NWA 10129)

(Northwest Africa)

Purchased: 2015 Jan

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased by Darryl Pitt in January 2015 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Granular chondrules (average size about 800 μm, up to 2.8 mm in diameter) plus CAI (up to 2.9 mm across) are set in a fairly fresh, black matrix (~50 vol.%). The grainsizes of the CAI range from fine to coarse, and some contain grossmanite and zirconolite.

**Geochemistry**: Olivine (Fa0.7-48.9, N = 5), orthopyroxene (Fs0.7-1.8Wo0.9-0.8, N =2), subcalcic augite (Fs1.3Wo30.9; Fs1.1Wo39.0).

**Classification**: Carbonaceous chondrite (CV3).

**Specimens**: 21.9 g including one polished thin section at *UWB*. The remainder is held by *DPitt*.

**Northwest Africa 10131** (NWA 10131)

(Northwest Africa)

Purchased: 2014 Sep

Classification: HED achondrite (Diogenite, polymict)

**History**: Purchased by John Curchin in September 2014 from a dealer at the Denver Mineral Show.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Fragmental breccia composed of mineral clasts of several types of orthopyroxene with subordinate olivine, clinopyroxene, anorthite and minor exsolved pigeonite and troilite in a finer grained matrix.

**Geochemistry**: Olivine (Fa38.9-39.4, FeO/MnO = 47-50, N = 2), orthopyroxene (Fs18.3Wo0.9; Fs20.8Wo1.3; Fs30.1Wo2.0; FeO/MnO = 29-33; N = 3), clinopyroxene (Fs46.7Wo42.0, FeO/MnO = 32).

**Classification**: Diogenite (polymict). The range of low-Ca pyroxene composition is too large for the breccia to be derived from a single diogenite precursor, hence the polymict attribution.

**Specimens**: 4.93 g including one polished thin section at *UWB*. The remaining material is held by Mr. J. Curchin.

**Northwest Africa 10234** (NWA 10234)

(Northwest Africa)

Purchased: 2009 May

Classification: Ordinary chondrite (LL3)

**History**: Purchased by Marcin Cimala in May 2009 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Fairly closely-packed, well-formed chondrules (apparent diameter 0.1-1.7 mm, one 4.3 mm) are set within a finer grained matrix.

**Geochemistry**: Olivine (Fa0.7-62.6, Cr2O3 in ferroan examples 0.03-0.11 wt.%, mean 0.08±0.03 wt.%, N = 7), orthopyroxene (Fs1.6-24.3Wo0.2-1.5, N = 3), augite (Fs9.6Wo44.7), subcalcic augite (Fs16.1Wo29.0). Magnetic susceptiblity logX = 4.17.

**Classification**: Ordinary chondrite (LL3).

**Specimens**: 20.2 g plus one polished thin section at *PSF*; main mass with Mr. M. Cimala.

**Northwest Africa 10267** (NWA 10267)

(Northwest Africa)

Purchased: 2013 Sep

Classification: Ordinary chondrite (LL4-7)

**History**: Purchased by Aras Jonikas in February 2015 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Complex breccia composed of relatively large (up to 2.4 mm), well-formed chondrules, angular mineral fragments and a variety of lithic clasts set in a finer grained matrix containing altered metal. Some lithic clasts contain relict chondrules (LL6) whereas others are completely recystallized (LL7). Rare clast types include very dark, fine grained indeterminate lithologies, fragmental breccias, and an aggregate dominated by K-feldspar. Minerals are olivine (equilibrated), orthopyroxene (unequilibrated, except in type 6 and type 7 clasts), augite, sodic plagioclase, chromite, altered kamacite, taenite, calcite and barite. Some chondrules contain very calcic plagioclase (bytownite).

**Geochemistry**: Olivine (Fa29.0-29.5, N = 3), orthopyroxene (Fs5.4-22.8Wo0.4-3.5, N = 3), clinopyroxene (Fs9.5-9.8Wo44.5-43.3, N = 2).

**Classification**: Ordinary chondrite (LL4-7 breccia).

**Specimens**: 25 g including one 2" by 1.5" polished thin section at *PSF*. The main mass is held by Mr. A. Jonikas.

**Northwest Africa 10286** (NWA 10286)

(Northwest Africa)

Purchased: 2005

Classification: Ordinary chondrite (H3-5)

**History**: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently donated to the *PSF*.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Predominantly an unequilibrated specimen consisting of well-formed chondrules (apparent diameter up to 1.2 mm) in a finer grained matrix rich in stained metal, but one type 5 recrystallized clast is present in the studied thin section.

**Geochemistry**: Olivine (Fa0.7-48.5, Cr2O3 in ferroan examples 0.06-0.53 wt.%, mean 0.23 wt.%, N = 7), orthopyroxene (Fs3.8-38.4Wo0.2-1.9, N = 3), augite (Fs5.6-7.9Wo47.3-46.0, N = 2).

**Classification**: Ordinary chondrite (H3-5 breccia).

**Specimens**: The entire specimen plus one polished thin section made from it are reposited at *PSF*.

**Northwest Africa 10359** (NWA 10359)

(Northwest Africa)

Purchased: 2015 May

Classification: Ordinary chondrite (LL3)

**History**: Purchased by Fabien *Kuntz* in May 2015 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Closely-packed, well-formed chondrules (apparent diameter 1.3±0.9 mm, one 2.7 mm) in a sparse fine-grained matrix containing altered metal.

**Geochemistry**: Olivine (Fa0.5-59.0, Cr2O3 in ferroan examples 0.01-0.06 wt.%, N = 6), orthopyroxene (Fs2.1-11.9Wo0.2-1.6, N = 3), augite (Fs7.9-13.6Wo38.3-41.5, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.15.

**Classification**: Ordinary chondrite (LL3). LL group designation based on magnetic susceptibility.

**Specimens**: 20.03 g including one polished thin section at *PSF*; main mass with *Kuntz*.

**Northwest Africa 10360** (NWA 10360)

(Northwest Africa)

Purchased: 2015 May

Classification: HED achondrite (Eucrite, polymict)

**History**: Purchased by Fabien *Kuntz* in May 2015 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Relatively fresh, shocked fragmental breccia composed of some gabbroic to microgabbroic eucrite clasts plus related mineral debris. All pyroxene is yellow-brown in thin section and calcic plagioclase is polycrystalline. Accessory minerals include silica polymorph, ilmenite, Ti-bearing chromite, ferroan olivine and minor barite.

**Geochemistry**: Orthopyroxene host (Fs66.5Wo1.7, FeO/MnO = 30, N = 1), augite exsolution lamella (Fs30.0Wo42.8, FeO/MnO =32), augite host (Fs25.8Wo44.4, FeO/MnO = 28, N = 1), orthopyroxene exsolution lamella (Fs61.5Wo2.4, FeO/MnO = 32), orthopyroxene (Fs47.9Wo2.3, FeO/MnO = 35, N = 1), olivine (Fa64.4; Fa75.4; FeO/MnO = 42-46, N = 2).

**Classification**: Eucrite (polymict breccia, shocked).

**Specimens**: 18.98 g including one polished thin section at *PSF*; main mass with *Kuntz*.

**Northwest Africa 10361** (NWA 10361)

(Northwest Africa)

Purchased: 2015 May

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased by Fabien *Kuntz* in May 2015 from a dealer in Rissani, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Separated chondrules (apparent diameter 1.1±0.8 mm, some rimmed) plus fine-grained CAI (up to 2.8 mm) are set in a fine-grained, red-brown matrix (~40 vol.%).

**Geochemistry**: Olivine (Fa1.6-47.6, N = 3), orthopyroxene (Fs2.9Wo0.8; Fs0.9Wo5.5, N = 2), augite (Fs0.7-2.5Wo48.3-43.4, N = 2).

**Classification**: Carbonaceous chondrite (CV3).

**Specimens**: 10.4 g including one polished thin section at *PSF*; main mass with *Kuntz*.

**Northwest Africa 10362** (NWA 10362)

(Northwest Africa)

Purchased: 2014 Jul

Classification: HED achondrite (Diogenite)

**History**: Purchased by Bob Falls in July 2014 from a dealer in Zagora, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of angular mineral grains and some polycrystalline fragments in a finer grained, orange-stained matrix. The predominant mineral is orthopyroxene with subordinate silica polymorph (some exhibiting primary contacts with orthopyroxene), accessory Al-bearing chromite, stained Ni-free metal and rare clinopyroxene and troilite.

**Geochemistry**: Orthopyroxene (Fs28.2-28.4Wo2.8-3.8, FeO/MnO = 26-29, N = 3), clinopyroxene (Fs10.6Wo44.1, FeO/MnO =22, N = 1).

**Classification**: Diogenite (monomict breccia).

**Specimens**: 21.2 g including one polished thin section at *UWB*; main mass with Mr. R. Falls.

**Northwest Africa 10364** (NWA 10364)

(Northwest Africa)

Purchased: 2015 May

Classification: HED achondrite (Eucrite, unbrecciated)

**History**: Purchased by Fabien *Kuntz* in May 2015 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Fresh unbrecciated specimen with intersertal texture composed of calcic plagioclase, exsolved pigeonite, silica polymorph, Ti-chromite, ilmenite, troilite and minor zircon. Although unbrecciated, the specimen has cross-cutting microfaults.

**Geochemistry**: Orthopyroxene host (Fs56.6Wo1.7, FeO/MnO = 34, N = 1), augite exsolution lamella (Fs26.8Wo37.9, FeO/MnO = 30, N = 1), augite host (Fs23.4Wo43.4, FeO/MnO = 31, N = 1), orthopyroxene exsolution lamella (Fs56.6Wo1.7, FeO/MnO = 35, N = 1).

**Classification**: Eucrite (unbrecciated).

**Specimens**: 20.2 g including one polished thin section at *PSF*; main mass with *Kuntz*.

**Northwest Africa 10366** (NWA 10366)

(Northwest Africa)

Purchased: 2015 May

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased by Fabien *Kuntz* in May 2015 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Separated chondrules (apparent diameter 1.7 ± 1.2 mm, some rimmed) plus fine-grained CAI are set in a deep brown matrix (~40 vol.%).

**Geochemistry**: Olivine (Fa1.5-75.1, N = 3), orthopyroxene (Fs0.8-2.19Wo1.2-1.5, N = 3), subcalcic augite (Fs0.8Wo31.6, N = 1), augite (Fs1.5Wo40.2, N = 1).

**Classification**: Carbonaceous chondrite (CV3).

**Specimens**: 18.02 g including one polished thin section at *PSF*; main mass with *Kuntz*.

**Northwest Africa 10367** (NWA 10367)

(Northwest Africa)

Purchased: 2015 May

Classification: Carbonaceous chondrite (CK4)

**History**: Purchased by Fabien *Kuntz* in May 2015 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Separated well-formed chondrules (apparent diameter 1.4 ± 1.0 mm) containing stained Cr-magnetite are set in a recrystallized matrix.

**Geochemistry**: Olivine (Fa32.2-32.5, FeO/MnO = 117-138, N = 3), orthopyroxene (Fs26.1-26.9Wo0.8-0.7, N = 3), augite (Fs9.1-11.0Wo47.1-46.3, N = 2).

**Classification**: Carbonaceous chondrite (CK4).

**Specimens**: 19.56 g including one polished thin section at *PSF*; main mass with *Kuntz*.

**Northwest Africa 10368** (NWA 10368)

(Northwest Africa)

Purchased: 2015 May

Classification: Primitive achondrite (Lodranite)

**History**: Purchased by Fabien *Kuntz* in May 2015 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Coarse grained fragmental breccia composed of clasts (up to 3.8 mm) of single mineral phases plus some composite clasts in a sparse matrix. Major minerals are olivine, clinopyroxene and orthopyroxene with accessory Cr-rich chromite, altered kamacite and pyrrhotite. Olivine contains relatively abundant round blebs composed of kamacite + pentlandite. Grain boundaries are stained by secondary iron hydroxides.

**Geochemistry**: Olivine (Fa10.6-10.7, FeO/MnO = 22-23, N = 3), clinopyroxene (Fs3.7-3.9Wo45.3-45.2, FeO/MnO = 9-10, N = 2), orthopyroxene (Fs9.7-9.8Wo1.2-2.5, FeO/MnO = 14-16, N = 2).

**Classification**: Lodranite breccia.

**Specimens**: 20.43 g including one polished thin section at *PSF*; main mass with *Kuntz*.

**Northwest Africa 10648** (NWA 10648)

(Northwest Africa)

Purchased: 2015 Dec

Classification: Ordinary chondrite (LL3)

**History**: Purchased by Fabien *Kuntz* in December 2015 from a dealer in Agadir, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Well-formed chondrules (apparent diameter 700±400 μm, one 4.2 mm) are set in a fine grained matrix (~15 vol.%).

**Geochemistry**: Olivine (Fa6.1-73.2; Cr2O3 in ferroan examples 0.04-0.09 wt.%, mean 0.06±0.01 wt.%, N = 6), orthopyroxene (Fs4.2-30.3Wo0.2-1.1, N = 3), subcalcic augite (Fs10.0Wo33.6), augite (Fs6.3Wo43.2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.17.

**Classification**: Ordinary chondrite (LL3). LL designation supported by magnetic susceptibility.

**Specimens**: 23.35 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 10650** (NWA 10650)

(Northwest Africa)

Purchased: 2015 Oct

Classification: Ordinary chondrite (LL3.15)

**History**: Purchased by Fabien *Kuntz* in October 2015 from a dealer in Laayoune, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Well-formed, fairly closely packed chondrules (apparent diameter 500 ± 400 µm) are set in a fine-grained matrix.

**Geochemistry**: Olivine (Fa1.1-62.2; Cr2O3 in ferroan examples 0.07-0.75 wt.%, mean 0.17±0.18 wt.%, N = 17), orthopyroxene (Fs1.4-15.9Wo0.4-2.4, N = 3), pigeonite (Fs14.4Wo10.8), subcalcic augite (Fs11.7-14.6Wo33.5-31.3, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.11.

**Classification**: Ordinary chondrite (LL3.15). LL designation supported by magnetic susceptibility. The mean and standard deviation for Cr2O3 contents of ferroan olivine occurring as rims and as matrix grains indicate a subtype of 3.15 based on the method of [Grossman and Brearley (2005, Figure 15a)](http://articles.adsabs.harvard.edu/full/2005M%26PS...40...87G).

**Specimens**: 25.17 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 10652** (NWA 10652)

(Northwest Africa)

Purchased: 2015 Nov

Classification: Primitive achondrite (Lodranite)

**History**: Purchased by Fabien *Kuntz* in November 2015 from a Moroccan dealer at the Munich Show.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Matrix-poor breccia with clasts composed predominantly of protogranular olivine (to 8 mm), with subordinate clinopyroxene, plus accessory chromite, Ni-free metal and pyrrhotite. Minor secondary calcite is present along fractures.

**Geochemistry**: Olivine (Fa10.6-11.3, FeO/MnO = 28-37, N = 3), clinopyroxene (Fs4.0-4.6Wo44.5-44.2, FeO/MnO = 12, N = 3).

**Classification**: Lodranite breccia.

**Specimens**: 21.84 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 10655** (NWA 10655)

(Northwest Africa)

Purchased: 2015 Dec

Classification: Ordinary chondrite (L3.05)

**History**: Purchased by Fabien *Kuntz* in December 2015 from a dealer in Agadir, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Well-formed, medium-sized chondrules (apparent diameter 400 ± 200 µm mm) set in a fine-grained matrix.

**Geochemistry**: Olivine (Fa2.9-70.7; Cr2O3 in ferroan examples 0.16-0.62 wt.%, mean 0.39±0.11 wt.%, N = 30), orthopyroxene (Fs1.0Wo1.1), pigeonite (Fs9.9Wo9.5), augite (Fs2.9-3.2Wo40.0-41.9, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.74.

**Classification**: Ordinary chondrite (L3.05). L designation supported by magnetic susceptibility. The mean and standard deviation for Cr2O3 contents of ferroan olivine occurring as rims and as matrix grains indicate a subtype of 3.05 based on the method of [Grossman and Brearley (2005, Figure 15a)](http://articles.adsabs.harvard.edu/full/2005M%26PS...40...87G).

**Specimens**: 6.63 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 10661** (NWA 10661)

(Northwest Africa)

Purchased: 2016 Feb

Classification: HED achondrite (Eucrite, monomict)

**History**: Purchased in Temara, Morocco by Adam *Aaronson* in February 2016.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of gabbroic eucrite clasts and related crystalline debris. Minerals are exsolved pigeonite, calcic plagioclase (with undulose extinction), silica polymorph, Ti-chromite, ilmenite, rare baddeleyite, and secondary calcite and barite.

**Geochemistry**: Orthopyroxene host (Fs59.9-65.3Wo3.8-2.7, FeO/MnO = 27-30, N = 3), clinopyroxene exsolution lamellae (Fs29.7-32.1Wo42.6-41.7, FeO/MnO = 28-30, N = 3), plagioclase (An90.3-91.1Or0.6-0.4, N = 2).

**Classification**: Eucrite (gabbroic breccia, shocked).

**Specimens**: 20.3 g including one polished thin section at *UWB*; remainder with *Aaronson*.

**Northwest Africa 10663** (NWA 10663)

(Northwest Africa)

Purchased: 2016 Mar

Classification: Ureilite

**History**: Purchased in Temara, Morocco by Adam *Aaronson* in March 2016.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Protogranular aggregate of olivine and twinned pigeonite. Olivine has reduced magnesian rims associated with blebby Fe metal. Minor secondary calcite is present.

**Geochemistry**: Olivine (cores Fa19.2-19.3; rims Fa10.9-15.1, N = 4), pigeonite (Fs16.0-16.4Wo6.4-6.8, N = 3).

**Classification**: Ureilite.

**Specimens**: 9.6 g including one polished thin section at *UWB*; remainder with *Aaronson*.

**Northwest Africa 10666** (NWA 10666)

(Northwest Africa)

Purchased: 2015 Oct

Classification: HED achondrite (Diogenite)

**History**: Purchased by Gary Fujihara in October 2015 from a Moroccan dealer.

**Physical characteristics**: A single fusion crusted stone (46.83 g); the fresh interior is mostly beige with some white and black grains visible.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Coarse-grained aggregate of predominantly orthopyroxene with ~6 vol.% calcic plagioclase and accessory clinopyroxene, chromite, troilite and rare ilmenite. Both orthopyroxene (which is notably ferroan) and plagioclase exhibit marked undulose extinction.

**Geochemistry**: Orthopyroxene (Fs35.1-35.2Wo2.2-1.9, FeO/MnO = 29, N = 3), clinopyroxene (Fs14.3-14.4Wo43.5-43.3, FeO/MnO = 21-24, N = 2), plagioclase (An81.3Or3.0; An86.3Or0.6; N = 2).

**Classification**: Diogenite (feldspathic).

**Specimens**: 9.56 g including one polished thin section at *UWB*; remainder with Mr. G. Fujihara.

**Northwest Africa 10685** (NWA 10685)

(Northwest Africa)

Purchased: 2016 Mar

Classification: Carbonaceous chondrite (CK4)

**History**: Purchased in Temara, Morocco by Adam *Aaronson* in March 2016.

**Petrography**: (A. Irving, *UWS*) Separated chondrules containing Cr-magnetite are set in a dominant, relatively coarse grained matrix. Minerals are olivine, clinopyroxene, intermediate plagioclase and Cr-magnetite, plus minor orthopyroxene, chlorapatite and calcite.

**Geochemistry**: (P. Carpenter, *WUSL*; S. Kuehner, *UWS*) Olivine (Fa25.0-26.7, FeO/MnO=70-76, N = 4), orthopyroxene (Fs23.2-25.2Wo0.4-1.9, N = 4), clinopyroxene (Fs6.7-8.0Wo47.8-47.0, N = 2), plagioclase (An40.3Or1.6).

**Classification**: Carbonaceous chondrite (CK4). The composition of olivine and pyroxene is unusual for a CK, although other CKs are in this range.

**Specimens**: 6.8 g including one polished thin section at *UWB*; remainder with *Aaronson*.

**Northwest Africa 10695** (NWA 10695)

(Northwest Africa)

Purchased: 2016 Feb

Classification: HED achondrite (Howardite)

**History**: Purchased by Aras Jonikas in February 2016 from a Moroccan dealer at the Tucson Gem and Mineral Show.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed mainly of diogenite lithic clasts and related debris plus ~20 vol.% of basaltic eucrite clasts and ~3 vol.% of altered kamacite grains (up to 1 mm in size) in a finer grained matrix. Diogenitic orthopyroxene exhibits a range in composition. Other minerals are olivine, exsolved pigeonite, calcic plagioclase, silica polymorph, chromite, ilmenite, troilite, taenite and rare forsterite.

**Geochemistry**: Olivine (Fa28.1-31.0, FeO/MnO = 42-53, N = 2), diogenitic orthopyroxene (Fs23.0Wo1.9; Fs39.1Wo3.1; FeO/MnO = 29-30, N = 2), orthopyroxene host (Fs65.0Wo3.4, FeO/MnO = 31), clinopyroxene exsolution lamella (Fs32.4Wo39.9, FeO/MnO = 31), orthopyroxene host (Fs38.6Wo3.2, FeO/MnO = 29), clinopyroxene exsolution lamella (Fs18.2Wo40.9, FeO/MnO = 24), forsterite (Fa9.4, FeO/MnO = 43).

**Classification**: Howardite (anomalous, olivine-bearing, metal-rich). NWA 10695 is anomalous in having an unusually high content of metal.

**Specimens**: 20.0 g including one polished thin section at *PSF*; remainder with Mr. A. Jonikas.

**Northwest Africa 10752** (NWA 10752)

(Northwest Africa)

Purchased: 2015 Feb

Classification: HED achondrite (Diogenite)

**History**: Purchased by Dr. David Gregory in February 2015 from a Moroccan dealer at the Tucson Gem and Mineral Show.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Coarse grained aggregate of predominantly orthopyroxene (exhibiting undulose extinction and recrystallized cataclastic zones) with accessory olivine and chromite.

**Geochemistry**: Orthopyroxene (Fs23.3-23.7Wo1.4-1.5, FeO/MnO = 23-25, N = 3), olivine (Fa27.8-27.9, FeO/MnO = 41-42, N = 3). Oxygen isotopes (K. Ziegler, *UNM*): analysis of acid-washed subsamples by laser fluorination gave, respectively, δ17O 1.361, 1.279, 1.540; δ18O 3.159, 3.006, 3.449; Δ17O -0.307, -0.308, -0.281 per mil.

**Classification**: Diogenite.

**Specimens**: 14 g plus one polished thin section at *ROM*; remainder with *Gregory*.

**Northwest Africa 10758** (NWA 10758)

(Northwest Africa)

Purchased: 2016 Mar

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased by Aras Jonikas in March 2016 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Irregularly-shaped, granular chondrules (some rimmed) plus elongate, amoeboid, very fine grained AOA and coarser grained CAI (containing gehlenite, diopside, perovskite and spinel) are set in a brown matrix (~20 vol.%).

**Geochemistry**: Olivine (Fa0.6-74.3, N = 3), orthopyroxene (Fs0.8-1.1Wo0.9-3.6, N = 3), clinopyroxene (Fs1.4-1.5Wo32.1-32.0, N = 2), Al-Ti-diopside (Fs0.3Wo57.0, Al2O3 = 16.6 wt.%, TiO2 = 2.3 wt.%).

**Classification**: Carbonaceous chondrite (CV3).

**Specimens**: 22.29 g including one polished thin section at *PSF*; remainder with Mr. A. Jonikas.

**Northwest Africa 10767** (NWA 10767)

(Northwest Africa)

Purchased: 2016 Mar

Classification: Ureilite

**History**: Purchased by Roger Jones in March 2016 from a dealer in Boujdour, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Protogranular texture. Composed of olivine (with thick, dark reduced rims rich in fine, blebby Fe metal) and pigeonite. Modal abundances: olivine ~85 vol%, pigeonite ~15 vol%.

**Geochemistry**: Olivine (cores Fa24.4-24.6; rim Fa5.1; N = 3), pigeonite (Fs17.2-18.4Wo10.6-10.5, N = 3).

**Classification**: Ureilite.

**Specimens**: 23 g including one polished thin section at *UWB*; remainder with Mr. R. Jones.

**Northwest Africa 10859** (NWA 10859)

(Northwest Africa)

Purchased: 2016 May

Classification: Ungrouped achondrite

**History**: Purportedly found near Tan Tan, Morocco, and purchased by Ben Hoefnagels in May 2016 from a dealer in Ouarzazate, Morocco.

**Physical characteristics**: A group of small , dark reddish-brown stones, mostly lacking fusion crust (total weight 215 g). Fresh interiors are gray with tiny grains of visible shiny metal.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Triple grain junction texture. Grainsize mostly 0.1-0.2 mm, but some larger grains up to 0.4 mm. Minerals are olivine, clinopyroxene, intermediate plagioclase, troilite, chromite, kamacite and taenite.

**Geochemistry**: Olivine (Fa31.8-31.9, FeO/MnO = 75-77, N = 3), clinopyroxene (Fs11.4-11.5Wo43.6-43.4, FeO/MnO = 37-40, N = 3). Oxygen isotopes (K. Ziegler, *UNM*): analysis of acid-washed subsamples by laser fluorination gave, respectively, δ17O -3.706, -3.702, -3.634, -3.817; δ18O -0.567, -0.835, -0.737, -0.943; Δ17O -3.407, -3.261, -3.245, -3.319 per mil.

**Classification**: Ungrouped achondrite, paired with NWA 10503.

**Specimens**: 20.2 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 10881** (NWA 10881)

(Northwest Africa)

Purchased: 2015

Classification: Carbonaceous chondrite (CO3.0)

**History**: Purchased by Mohammed *Hmani* in 2015.

**Physical characteristics**: Single stone. Weathered fusion crust exterior. A saw cut reveals many very small chondrules and a few small CAIs set in a dark brown matrix.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows numerous chondrules, many fragmental or irregular, most in the size range 50-200 μm. Scattered matrix olivines and CAIs were observed throughout. Fine grained matrix makes up approximately 50% of this meteorite. The metal abundance is low. The CAIs are small and scattered.

**Geochemistry**: (C. Agee and M. Spilde, *UNM*) All olivine Fa11.0±15.3, n=30; coarse ferroan olivine Fa28.7±11.6, Fe/Mn=119±66, Cr2O3=0.38±0.08 (wt%), n=11; enstatite Fs2.4±1.9Wo1.3±0.7, n=8; diopside Fs3.6±3.8Wo41.4±6.0, n=3; (K. Ziegler, *UNM*) Oxygen isotope mean values of analyses on 3 acid-washed fragments of bulk sample, 1.2, 1.5, 1.5 mg, gave δ17O= -7.053, -4.062, -4.822, δ18O= -2.269, 1.814, -0.062, Δ17O= -5.855, -5.020, -4.789, (linearized, all permil). One of the fragments had O-isotopes near the CO field, the other two were more in the CV/CK field.

**Classification**: Carbonaceous chondrite (CO3.0), type 3.0 based on mean value and sigma of Cr2O3 in ferroan olivine [(Grossman and Brearley, 2005)](http://articles.adsabs.harvard.edu/full/2005M%26PS...40...87G), the values are similar to [ALHA77307](https://www.lpi.usra.edu/meteor/metbull.php?code=1616).

**Specimens**: 29.8 g including a probe mount on deposit at *UNM*, Mohammed *Hmani* holds the main mass.

**Northwest Africa 10907** (NWA 10907)

Morocco

Purchased: 2016

Classification: Carbonaceous chondrite (CM2)

**Petrography**: The sample consists of about 20-30% chondrules, chondrule fragments, some small CAIs and 70-80% of a phyllosilicate-rich matrix (as indicated by low analytical totals) and opaques (mainly sulfides and minor metals). Most chondrules have a size of about 200-400 μm and many are surrounded by fine-grained, phyllosilicates-rich dust rims. Randomly selected olivines analyzed in chondrules and chondrule fragments revealed a mean composition of Fa17.2±19.5with a range of Fa0.4-59.0.Most low-Ca pyroxene is enstatite (Fs<2), but also some low Ca-pyroxene with high Fs-content exists (e.g., Fs16). The olivine shows undulatory extinction. Thus, the rock is very weakly shocked (S2). The sample is moderately weathered and about half of the metal has been oxidized.

**Northwest Africa 10908** (NWA 10908)

Morocco

Purchased: 2016

Classification: Carbonaceous chondrite (CM2)

**Petrography**: The sample consists of about 20% chondrules, chondrule fragments and some small CAIs. The matrix is rich in phyllosilicates. Most chondrules have a size of about 200-500 μm and many are surrounded by fine-grained, phyllosilicate-rich dust rims. Randomly selected olivines analyzed in chondrules and chondrule fragments revealed a mean composition of Fa13.7±19.5with a range of Fa0.4-73.7.Most low-Ca pyroxene is enstatite (Fs<2), but also some low Ca-pyroxene with somewhat higher Fs-content exists (e.g., Fs8). The olivine shows undulatory extinction. Thus, the rock is very weakly shocked (S2). The sample is strongly weathered and most of the metal has been oxidized.

**Northwest Africa 10953** (NWA 10953)

(Northwest Africa)

Purchased: 2016 May

Classification: Lunar meteorite (feldspathic breccia)

**History**: Purchased by Ben Hoefnagels in May 2016 from a dealer in Ouarzazate, Morocco.

**Physical characteristics**: A single, dark gray stone (55 g) lacking fusion crust. The fresh interior exhibits sparse, small whitish clasts in a very fine grained, dark gray matrix containing tiny grains of metal and sparse vesicles.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Very fine grained and relatively plagioclase-rich breccia composed of small angular mineral clasts plus some polymineralic clasts. Minerals are anorthite, pigeonite, augite, exsolved pigeonite, olivine, kamacite, ilmenite and Ti-chromite, with minor secondary calcite and barite.

**Geochemistry**: (P. Carpenter, *WUSL*) Olivine (Fa25.3-28.7, FeO/MnO = 86-94, N = 3), pigeonite (Fs37.5Wo5.4, FeO/MnO = 61; Fs41.3Wo9.9, FeO/MnO = 54; N = 2), augite (Fs12.7Wo40.4, FeO/MnO = 48), plagioclase (An95.6-97.1Or0.1, N = 2).

**Classification**: Lunar (feldspathic breccia).

**Specimens**: 11.2 g including one polished endcut at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 10954** (NWA 10954)

(Northwest Africa)

Purchased: 2005

Classification: Ordinary chondrite (L4)

**History**: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently acquired by the Hollis Collection.

**Physical characteristics**: (P.Sipiera, *PSF*) Rounded "6 sided" individual stone (14056 g) with approximate dimensions of 17 cm by 18 cm by 26 cm. The chocolate-brown exterior has a rough appearance caused by uniformly distributed small bumps, but lacks any "thumb-print" features. The fresh interior is dark gray with relatively abundant bright metal grains and small round chondrules.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Very fresh specimen. Well-formed chondrules (apparent diameter 300±200 µm) are set in a relatively coarse grained matrix containing unaltered metal.

**Geochemistry**: Olivine (Fa21.3-22.1, N = 3), orthopyroxene (Fs18.1-18.3Wo1.3-1.1, N = 3), clinopyroxene (Fs6.3-8.5Wo44.9-44.5, N = 2). Oxygen isotopes (K. Ziegler, *UNM*): analysis of acid-washed subsamples by laser fluorination gave, respectively, δ17O 3.071, 3.399, 2.868; δ18O 4.009, 4.663, 3.485; Δ17O 0.954, 0.937, 1.024 per mil. Magnetic susceptibility log χ (× 10-9 m3/kg) =4.81.

**Classification**: Ordinary chondrite (L4, highly shocked).

**Specimens**: 189 g including one polished thin section at *PSF*; remainder in the Hollis Collection.

**Northwest Africa 10961** (NWA 10961)

(Northwest Africa)

Purchased: 2016 Sep

Classification: Martian meteorite (Shergottite)

**History**: Purchased by Ben Hoefnagels in September 2016 from a dealer in Taliouine, Morocco.

**Physical characteristics**: A single mass (2220 g) with a brown, weathered exterior. The fresh interior is mostly pale green with small dark brown patches and black grains visible.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Poikilitic texture. Large, twinned, essentially unzoned pyroxene oikocrysts (with undulose extinction) enclose chadacrysts of olivine (some brownish in thin section) and Cr-rich chromite. Very sparse maskelynite (~2 vol.%) occurs as interstitial grains. Other accessory minerals are Ti-bearing chomite, ilmenite and rare Mg-merrillite. Pockets of dark, quenched shock glass are present.

**Geochemistry**: Olivine (Fa29.5-31.2, FeO/MnO = 41-46, N = 3), orthopyroxene (Fs19.4-20.7Wo2.7-3.6, FeO/MnO = 20-28, N = 3), augite (Fs13.0-13.8Wo38.2-35.0, FeO/MnO = 22-24, N = 2), maskelynite (An53.8-55.6Or1.1-1.0, N = 2).

**Classification**: Martian meteorite (shergottite, poikilitic, ultramafic).

**Specimens**: 22 g including two polished thin sections at *PSF*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 10968** (NWA 10968)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Diogenite, polymict)

**History**: Purportedly found near Zaida, Morocco, and purchased by Ben Hoefnagels in April to June 2016 from a dealer in Ouarzazate, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed predominantly of angular grains of diogenitic orthopyroxene (exhibiting undulose extinction) with a few percent shocked basaltic eucrite clasts, plus accessory chromite, anorthitic plagioclase, Ti-chromite, troilite and taenite. Eucrite clasts consist of exsolved pigeonite, calcic plagioclase (polycrystalline and in part maskelynite), silica polymorph, chromite, ilmenite and Ni-free metal.

**Geochemistry**: Orthopyroxene (Fs25.1-27.1Wo1.9-1.2, FeO/MnO =24-30; rim Fs39.4Wo2.6, FeO/MnO = 31; N = 3), orthopyroxene host (Fs48.1Wo2.8, FeO/MnO = 29), clinopyroxene exsolution lamellae (Fs21.2-28.5Wo41.7-41.5, FeO/MnO = 22-26, N = 2), plagioclase (An83.6Or1.0; An93.1Or0.2).

**Classification**: Diogenite (polymict, shocked).

**Specimens**: 24.23 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 10969** (NWA 10969)

(Northwest Africa)

Purchased: 2016 Aug

Classification: Carbonaceous chondrite (CV3)

**History**: Puchased in Temara, Morocco by Adam *Aaronson* in October 2016.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Granular chondrules (some with multiple, concentric rims; apparent diameter 600±500 µm) and very fine-grained CAI are set within a very fine grained matrix (~25 vol.%, orange in thin section, indicating oxidation).

**Geochemistry**: Olivine (Fa0.6-53.3, N = 3), orthopyroxene (Fs0.5-3.5Wo1.0-3.1, N = 3), clinopyroxene (Fs0.5Wo35.1; Fs0.5Wo40.2).

**Classification**: Carbonaceous chondrite (CV3, oxidized).

**Specimens**: 21.2 g including one polished thin section at *UWB*; remainder with *Aaronson*.

**Northwest Africa 10970** (NWA 10970)

(Northwest Africa)

Purchased: 2005

Classification: Ordinary chondrite (H3/4)

**History**: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently acquired by the Hollis Collection.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Unequilibrated with highly magnesian cores in olivine and orthopyroxene. Well-formed, relatively small chondrules (apparent diameter 300±200 μm) are set in a recrystallized matrix containing abundant stained metal.

**Geochemistry**: Olivine (predominantly Fa16.5-17.1, magnesian core Fa1.2, Cr2O3 <0.04 wt.%, N = 7), orthopyroxene (Fs4.2-42.2Wo0.3-2.6, N = 3), clinopyroxene (Fs1.1-1.2Wo39.4-44.3, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.98.

**Classification**: Ordinary chondrite (H3/4).

**Specimens**: 36 g including one polished thin section at *PSF*; remainder in the Hollis Collection.

**Northwest Africa 10983** (NWA 10983)

(Northwest Africa)

Purchased: 2016 Aug

Classification: Rumuruti chondrite (R4)

**History**: Puchased in Temara, Morocco by Adam *Aaronson* in October 2016.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Very fresh specimen composed of relatively small, separated chondrules (apparent diameter 300±200 μm) in a finer grained matrix. Minerals are olivine, clinopyroxene, sodic plagioclase, pentlandite, troilite and rare sperrylite; orthopyroxene was not observed. One small inclusion consists of Cr-pleonaste + sodalite + ilmenite + Cr-rich hercynite + albite.

**Geochemistry**: Olivine (Fa44.2-44.5, N = 3), clinopyroxene (Fs9.9-10.1Wo45.7-45.6, N = 3). Magnetic susceptibility log χ (× 10-9 m3/kg)=3.13. Oxygen isotopes (K. Ziegler, *UNM*): analyses of acid-washed subsamples by laser fluorination gave, respectively δ17O 5.174, 5.950; δ18O 4.602, 5.560; Δ17O 2.744, 3.014 per mil.

**Classification**: R4 chondrite. The olivine is more ferroan than in typical R chondrites. This meteorite extends the known compositional range for R chondrites olivine.

**Specimens**: 16 g including one polished thin section at *UWB*; remainder with *Aaronson*.

**Northwest Africa 10993** (NWA 10993)

(Northwest Africa)

Purchased: 2015

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased by Jay Piatek in Morocco, 2015.

**Physical characteristics**: Fresh black fusion crust. A saw-cut surface reveals chondrules, CAIs, and scattered metal grains set in a light green-gray groundmass.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows distinct chondrules, many of them porphyritic, abundant Fe-Ni metal and Fe-sulfide in a fine-grained matrix, the matrix makes up about 50% of this meteorite. Diopside and Al-diopside were observed.

**Geochemistry**: (C. Agee and N. Muttik, *UNM*) Olivine Fa30.7±15.1, Fe/Mn=130±37, Cr2O3=0.11±.14 (wt), NiO=0.03±0.04 (wt), n=50; enstatite Fs3.4±2.5Wo1.2±1.0, Fe/Mn=26±12, n=17. Oxygen isotopes (K. Ziegler, *UNM*): 3 acid-washed fragments analyzed by laser fluorination gave an average composition δ17O=-4.34, δ18O=0.17, Δ17O=-4.44 (linearized, all per mil, TFL slope=0.528).

**Classification**: Carbonaceous chondrite CV3 (reduced subgroup). Possibly paired with NWA 723.

**Specimens**: 20.9 g including a probe mount on deposit at *UNM*, Jay Piatek holds the main mass.

**Northwest Africa 11004** (NWA 11004)

Morocco

Purchased: 2013

Classification: Ordinary chondrite (L7)

**History**: Purchased by Ke Zuokai in 2013 from an anonymous Moroccan dealer.

**Physical characteristics**: An irregular stone with a partial fusion crust.

**Petrography**: Petrographic microscope examination of a thin section shows a granular texture with medium grain sizes (mostly 0.1–1.0 mm). It contains 55% olivine, 25% orthopyroxene, 5% augite, 5% plagiocase and 10% opaque minerals (Fe-sulfides, Fe-Ni metals and chromite).

**Geochemistry**: Olivine (Fa26.0-26.9, FeO/MnO=55.7-68.4, n=18), Plagioclase (An9.2-12.9Or1.6-4.2, n=15; average: An10.3±1.4Or2.6±0.8), augite (Fs7.0-11.4Wo34.5-45.0, FeO/MnO=23.0-30.8,n=11), orthopyroxene (Fs21.4-22.3Wo2.6-4.0, FeO/MnO=31.9-39.1,n=16)

**Classification**:

**Northwest Africa 11012** (NWA 11012)

(Northwest Africa)

Purchased: 2016 Sep

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased by Darryl Pitt in September 2016 from a Moroccan dealer at the Denver Show.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Relatively closely-packed, well-formed large granular chondrules (some irregularly-shaped, some rimmed) plus sparse fine grained CAI are set in an abundant finer grained matrix (light brown in thin section).

**Geochemistry**: Olivine (Fa1.8-40, N = 4), orthopyroxene (Fs0.9-1.5Wo0.8-0.9, N = 3), clinopyroxene (Fs8.7-12.7Wo44.9-35.9, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 3.53.

**Classification**: Carbonaceous chondrite (CV3).

**Specimens**: 22.2 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11018** (NWA 11018)

(Northwest Africa)

Purchased: 2016 Jun

Classification: Ureilite

**History**: Purchased by Fabien *Kuntz* in June 2016 from a dealer in Zagora, Morocco, and subsequently sold to Ni Luh Wayan Elisa Gonzales.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Protogranular aggregate of ~90 vol.% olivine (with dark, more magnesian rims containing blebs of Fe metal) and ~10 vol.% pigeonite.

**Geochemistry**: Olivine (cores Fa14.0-14.4; rim Fa2.3; N = 3), pigeonite (Fs11.8-12.0Wo10.2-10.3, N = 2).

**Classification**: Ureilite (magnesian). This specimen is unusual in having relatively magnesian silicate compositions in comparison with most ureilites.

**Specimens**: 21.23 g including one polished thin section at *PSF*; remainder with Ms. Ni Luh Wayan Elisa Gonzales.

**Northwest Africa 11019** (NWA 11019)

(Northwest Africa)

Purchased: 2016 Aug

Classification: Carbonaceous chondrite (CV3)

**History**: Puchased in Temara, Morocco by Adam *Aaronson* in October 2016.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Mostly granular and some POP large chondrules plus irregularly shaped, very fine-grained CAI are set in an abundant very fine-grained matrix (deep red-brown in thin section).

**Geochemistry**: Olivine (Fa0.5-52.7, N = 3), orthopyroxene (Fs0.9-1.1Wo0.7-1.7, N = 3), clinopyroxene (Fs1.7-2.4Wo41.9-37.5, N = 2).

**Classification**: Carbonaceous chondrite (CV3).

**Specimens**: 20.4 g including one polished thin section at *UWB*; remainder with *Aaronson*.

**Northwest Africa 11024** (NWA 11024)

(Northwest Africa)

Purchased: June 2014

Classification: Carbonaceous chondrite (CM, anomalous)

**History**: One stone of 4.69 g was purchased in Ensisheim from a Moroccan dealer in June 2014 by Sergey Vassiliev.

**Petrography**: S. Ebert, A. Bischoff (*IfP*), D. Harries (*UJena*): The chondrite consists of 32% chondrules and chondrule fragments (mainly PO and POP), about 54% fine-grained opaque matrix, 9.5% fine-grained dust rims, and 1.2% refractory inclusions (CAIs). Most chondrules have a size of about 150-300 µm and many are surrounded by fine-grained dust rims. Most CAIs are fine-grained, fluffy, spinel-rich inclusions. Many are rimmed by fine-grained dust. Sulfide and some metal present. Most of the metal grains have been destroyed by terrestrial alteration. Carbonate grains are absent. TEM investigations (D. Harries, *UJena*) of several areas and lithologies (fine-grained dust rims, matrix portions) do not show any phyllosilicates. Instead, the fine-grained inter-chondrule materials mainly consist of nano-crystalline Fe-rich olivine and troilite and small Ni-rich Fe,Ni-metals, which are unaffected by aqueous alteration.

**Geochemistry**: Mineral composition and geochemistry: S. Ebert, A. Bischoff (*IfP*) A. Pack (*UGött*): Most chondrule olivines have Fa<4, but also chondrules and chondrule fragments with olivine of higher Fa-content (up to Fa63) exist. Similarly, most low-Ca pyroxenes are enstatites (Fs<2), but also some low Ca-pyroxenes with somewhat higher Fs-contents exist (e.g., Fs5-13), and  a compound chondrule with abundant low-Ca pyroxene of ~Fs45was observed. The remaining unweathered large metal grains are Ni-poor (~6 wt% Ni). Two bulk measurements of oxygen isotopes plot with δ18O = 6.85 ‰ and δ17O = -1.6‰ and δ18O = 6.07 ‰ and δ17O = -1.44 ‰, respectively, at the 16O- and 18O-rich edge of the CM-field, clearly distinct from the O-isotope field of the CO3 chondrites.

**Classification**: The textural observations suggest a CM classification of this rock. This is supported by the O-isotope composition. The lack of hydrous minerals and carbonates suggests a type 3 petrologic type. The olivines do not show undulatory extinction. Thus, the rock is unshocked (S1). Since most of the Ni-poor metal has been destroyed, the sample is strongly weathered (W3).

**Specimens**: *IfP* holds the main mass (2.5 g remaining of the 4.7 g) and 2 thin sections.

**Northwest Africa 11027** (NWA 11027)

(Northwest Africa)

Purchased: 2016 Aug

Classification: HED achondrite (Eucrite, polymict)

**History**: Puchased in Temara, Morocco by Adam Aaronson in October 2016.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed predominantly of lithic eucrite clasts and related crystalline debris, with subordinate (<10 vol.%) diogenitic orthopyroxene grains (exhibiting magnesian cores and more ferroan reaction rims). Textures in lithic clasts range from intersertal to variolitic; some symplectite clasts composed of fayalite+hedenbergite+silica polymorph also are present. Other minerals are clinopyroxene, anorthitic plagioclase, silica polymorph, sodic bytownite, ilmenite, troilite, rare baddeleyite and Ni-free metal.

**Geochemistry**: Diogenitic orthopyroxene (cores Fs23.3-26.9Wo0.8-4.1; rims Fs47.0-54.0Wo0.8-1.9; FeO/MnO = 30-38, N = 2), clinopyroxene (Fs34.6-45.4Wo42.1-35.5, FeO/MnO = 28-29, N = 2), fayalitic olivine (Fa77.4-77.9, FeO/MnO = 43-44, N = 2), anorthite (An90.1Or0.3), bytownite (An76.4Or1.5).

**Classification**: Eucrite (polymict breccia).

**Specimens**: 13.2 g including one polished thin section at *UWB*; remainder with *Aaronson*.

**Northwest Africa 11028** (NWA 11028)

(Northwest Africa)

Purchased: 2016 Jun

Classification: Carbonaceous chondrite (CO3)

**History**: Purchased by Fabien Kuntz in June 2016 from a dealer in Tan Tan, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Well-formed, small chondrules (apparent diameter 250±150 μm) together with angular mineral grains and sparse, small CAI and AOA are set in a fine grained matrix (~30 vol.%, deep reddish-brown in thin section).

**Geochemistry**: Olivine (Fa0.4-73.1, Cr2O3 in ferroan examples 0.10-0.56 wt.%, mean 0.19±0.18 wt.%, N = 7), orthopyroxene (Fs0.9Wo1.7; Fs59.5Wo4.2; N = 2), clinopyroxene (Fs2.3Wo44.2; Fs4.6Wo35.6).

**Classification**: Carbonaceous chondrite (CO3).

**Specimens**: 21.06 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11029** (NWA 11029)

(Northwest Africa)

Purchased: 2016 Jun

Classification: Lunar meteorite (feldspathic breccia)

**History**: Purchased by Ben Hoefnagels in June 2016 from a dealer in Taliouine, Morocco.

**Physical characteristics**: A single stone (75 g) lacking fusion crust and exhibiting whitish to beige clasts in a medium-gray matrix.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of angular clasts of anorthite, olivine, pigeonite, subcalcic augite, augite, silica polymorph and ilmenite in a finer, fragmental matrix of the same minerals plus minor kamacite and barite.

**Geochemistry**: Olivine (Fa19.8-50.6, FeO/MnO = 68-83, N = 3), pigeonite (Fs24.9-39.8Wo8.4-9.6, FeO/MnO = 48-54), subcalcic augite (Fs27.6Wo29.0, FeO/MnO = 53), augite (Fs7.8Wo43.4, FeO/MnO = 30), plagioclase (An96.1-96.3Or0.1, N = 2).

**Classification**: Lunar (feldspathic breccia).

**Specimens**: 15.1 g including a polished endcut at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11030** (NWA 11030)

(Northwest Africa)

Purchased: 2016 Sep

Classification: Ordinary chondrite (L4)

**History**: Purchased by John Higgins in September 2016 from a dealer in Nouakchott, Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Closely packed, well-formed chondrules are set in a sparse matrix containing altered metal.

**Geochemistry**: Olivine (Fa24.5-26.0, N = 3), orthopyroxene (Fs5.7-44.4Wo0.2-3.2, N = 3), subcalcic augite (Fs11.8Wo34.2), augite (Fs8.9Wo42.0). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.51.

**Classification**: Ordinary chondrite (L4).

**Specimens**: 20.8 g including one polished thin section at *UWB*; remainder with Mr. J. Higgins.

**Northwest Africa 11031** (NWA 11031)

(Northwest Africa)

Purchased: 2016 Jun

Classification: HED achondrite (Eucrite, polymict)

**History**: Purchased by Fabien Kuntz in June 2016 from a dealer in Ouarzazate, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of sparse ophitic eucrite clasts and abundant related crystal debris in a finer grained matrix. Minerals are unexsolved low-Ca pyroxene (pigeonite), high-Ca pyroxenes, calcic plagioclase, silica polymorph, fayalitic olivine, chromite, ilmenite (with included baddeleyite), troilite and Ni-free metal. Some grains of hedenbergite+fayalite+silica symplectite (after pyroxferroite) are present.

**Geochemistry**: Low-Ca pyroxene (Fs33.9-36.5WoWo5.6-7.0, FeO/MnO = 28; Fs59.0Wo5.1, FeO/MnO = 31; N = 2), high-Ca pyroxene (Fs43.3Wo24.6, FeO/MnO = 29; Fs55.4Wo32.8, FeO/MnO = 34; N = 2), fayalitic olivine (Fa85.4, FeO/MnO = 42).

**Classification**: Eucrite (polymict breccia).

**Specimens**: 24.59 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11032** (NWA 11032)

(Northwest Africa)

Purchased: 2016 Jun

Classification: Ureilite

**History**: Purchased by Fabien Kuntz in June 2016 from a dealer in Zagora, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Protogranular aggregate of predominantly olivine (~80 vol.%, with thin opaque rims) and pigeonite (~20 vol.%). Fe metal is present as blebs and along grain boundaries (partly altered to Fe hydroxides).

**Geochemistry**: Olivine (cores Fa17.1-17.4Cr2O3 0.71-0.7 wt%; rim Fa8.0; N = 3), pigeonite (Fs14.5-14.7Wo6.4-6.3, N = 2).

**Classification**: Ureilite.

**Specimens**: 21.61 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11033** (NWA 11033)

(Northwest Africa)

Purchased: 2016 Jun

Classification: HED achondrite (Diogenite, polymict)

**History**: Purchased by Fabien Kuntz in June 2016 from a dealer in Zagora, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of >90 vol.% angular diogenitic orthopyroxene clasts along with subordinate exsolved pigeonite, calcic plagioclase, olivine, silica polymorph and chromite in a finer grained matrix containing the same minerals plus troilite and Ni-free metal. Sparse eucritic clasts composed of intergrown low-Ca pyroxene, high-Ca pyroxene and calcic plagioclase are present.

**Geochemistry**: Diogenitic orthopyroxene (Fs23.7-23.8Wo2.0-1.8, FeO/MnO = 27-29, N = 3), orthopyroxene host (Fs29.5Wo1.6, FeO/MnO = 25), clionopyroxene exsolution lamella (Fs16.6Wo41.7, FeO/MnO = 20), low-Ca pyroxene in intergrowth (Fs58.4Wo5.5, FeO/MnO = 25), high-Ca pyroxene in intergrowth (Fs27.8Wo41.9, FeO/MnO = 26), olivine (Fa37.6-37.9, FeO/MnO = 46-47, N = 2), plagioclase (An89.8Or0.6; An93.4Or0.2).

**Classification**: Diogenite (polymict breccia).

**Specimens**: 9.49 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11034** (NWA 11034)

(Northwest Africa)

Purchased: 2016 Oct

Classification: Ordinary chondrite (LL3)

**History**: Purchased by John Higgins in October 2016 from a dealer in Nouakchott, Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Closely packed, well-formed chondrules (apparent diameter 600±400 μm, some up to 2 mm) are set in a sparse matrix containing altered metal.

**Geochemistry**: Olivine (Fa0.6-84.3, Cr2O3 in ferroan examples 0.06-0.23 wt.%, mean 0.11±0.07 wt.%, N = 6), orthopyroxene (Fs3.1-31.4Wo0.2-2.0, N = 3), subcalcic augite (Fs10.2-20.1Wo29.0-31.9, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 3.99.

**Classification**: Ordinary chondrite (LL3).

**Specimens**: 11.8 g including one polished thin section at *UWB*; remainder with Mr. J. Higgins.

**Northwest Africa 11040** (NWA 11040)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Eucrite, unbrecciated)

**History**: A complete stone was purchased from Sean Tutorow’s eBay operation by Jason Utas

**Physical characteristics**: One rough-surfaced, fusion crusted individual stone.

**Petrography**: The texture is subophitic and unbrecciated. The mineralogy is typical eucritic (pyroxene and plagioclase with minor ilmenite, silica, Cr-spinel, troilite and trace olivine), except for an unusually high proportion of pure-Fe metal, originally roughly 0.6 vol%, although roughly 1/3 of that original metal has been replaced by Fe-oxides. Plagioclase is up to 4.8 mm in length (4.8 × 0.2 mm). Metal occurs dominantly as blocky grains, typically 0.1-0.2 mm across. Manifestations of thermal annealing, such as exsolution lamellae in pyroxene, are nearly undetectable, and about 30 vol% of the rock is mesostasis, so fine-grained as to appear opaque in transmitted light. The shock class is intermediate based on undulose extinction and planar fractures in pyroxene.

**Geochemistry**: Pyroxenes are compositionally diverse and complex. For the most part, major-element compositions show a pattern typical of low-thermal-metamorphism eucrites (cf. Pasamonte), fanning out from a tight cluster at Fs29Wo5(cores of larger grains) in the general direction of Fs45Wo30(rims and fine-grained areas). However, in a few locales, pyroxene in fine-scale intergrowth with silica (pyroxene widths typically 1-3 microns) consists of a remarkably low-Ca variety, Fs49-51Wo1.0-1.5, along with a far lesser proportion of high-Ca composition (near Fs39Wo44). Also, curvy veinlike patches of oddly low-Ca composition (notably bright in backscattered electron images) are sprinkled within the cores of large pyroxenes. The average measured pyroxene composition (n=258) is Fs37Wo16with FeO/MnO = 29±1.5. Plagioclase (n=23) is An79-91, average An84.6±3.4, excluding one anomalous analysis, An98.Olivine (n=5) is Fa69-71.Spinel (9 analyses of a single 0.6-mm grain) has Cr/(Al+Cr) ranging from 0.59-0.76. The Fe-metal has undetectable Ni (less than 0.1 wt%) and 0.15-0.23 wt% Co. INAA bulk-rock results include Na = 4.1 mg/g, Sc = 28 μg/g, Cr = 1.9 mg/g, Fe = 138 mg/g, Sm = 3.2 μg/g.

**Classification**: The meteorite is an unbrecciated eucrite.

**Northwest Africa 11041** (NWA 11041)

(Northwest Africa)

Purchased: 2015

Classification: Rumuruti chondrite (R3-6)

**History**: The meteorite was bought in 2015 from a Moroccan meteorite dealer at the mineral fair in Munich, Germany.

**Petrography**: The meteorite is a breccia with light and dark colored lithic fragments of all petrological types (3 to 6) and impact-melt clasts set into a fine-grained, clastic groundmass. Olivine is the dominant mineral phase in all lithologies and particular Fe-rich in type 6 clasts. Orthopyroxene displaying typical patchy zoning is only found in unequilibrated lithologies. Minor phases include albitic feldspar, augite, chromite, pentlandite and pyrrhotite. FeNi metal is virtually absent.

**Geochemistry**: Olivine in type 6 lithology: Fa38.1±0.2, n=14; olivine in type 3 lithology: Fa25.3±8.5(1Fa1.6-44.6, n=75); low-Ca pyroxene in type 3 lithology, Fs16.0±7.8Wo1.1±0.9(Fs1.1-26.9Wo0.1-5.0, n=51)

**Northwest Africa 11042** (NWA 11042)

Mauritania

Purchased: 2016

Classification: Primitive achondrite

**History**: Purchased by Abdelhadi Aithiba in Morocco, 2016.

**Physical characteristics**: Single complete stone covered in black fusion crust. Broken surface reveals a phaneritic mix of pale-yellow olivine grains, light-green pyroxene grains, glassy maskelynite patches, and dark-colored shock melt pockets. A single, fine, dark shock melt vein was also observed in hand sample.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of two polished mounts shows an ultramafic rock with approximately 46% olivine, 38% pyroxene, 15% maskelynite and 1% chromite. Fe-sulfide is a minor but ubiquitous phase. Trace amounts of Fe-Ni metal and chlorine-rich apatite are present. Dominant igneous texture consists of poikilitic olivine and pyroxene grains most in the size range 500-1500 μm. Plagioclase has been completely transformed to maskelynite. Maskelynite domains appear smooth and glassy, and are associated with radiating fractures into surrounding olivine and pyroxenes. Shock melt pockets are scattered throughout, some up to ~500 μm in diameter, also surrounded by radiating fractures.

**Geochemistry**: (C. Agee, M. Spilde, Z. Vaci, *UNM*) olivine Fa24.6±0.2, Fe/Mn=50±2, n=20; low-Ca pyroxene Fs20.2±0.4Wo4.0±0.4, Fe/Mn=30±2, n=29; augite Fs10.5±0.1Wo39.5±0.1, Fe/Mn=22±1, n=2; maskelynite Ab83.4±1.7An11.9±1.8Or4.8±0.4, n=10. LA-ICPMS (M. Humayun, *FSU*) Bulk rock: SiO2 46.35, TiO2 0.11, Al2O3 2.34, Cr2O3 0.36, FeO 17.93, MnO 0.43, MgO 28.61, CaO 2.39, Na2O 1.01, K2O 0.07, P2O5 0.08, S 0.31 (all wt%); La 0.40, Ce 1.27, Pr 0.16, Nd 0.84, Sm 0.28, Eu 0.10, Gd 0.41, Tb 0.08, Dy 0.544, Ho 0.12, Er 0.37, Tm 0.06, Yb 0.36, Lu 0.06, Ni 102, Co 26, Th 0.060, U 0.036 (all ppm). Noble gases (D. Weimer, H. Buseman, ETHZ) results on two sample fragments without fusion crust, 20 and 100 mg, gave 129Xe/132Xe= ~1.8, 36Ar/132Xe= ~600, 84Kr/132Xe= 3 (100 mg) and 6 (20 mg); U,Th-He age ~0.2 Ga. Oxygen isotopes (K. Ziegler, *UNM*): 8 acid-washed fragments analyzed by laser fluorination gave, respectively δ18O= 4.33, 4.45, 4.36, 4.54, 4.64, 4.42, 4.49, 4.46; δ17O= 3.33, 3.38, 3.34, 3.42, 3.52, 3.35, 3.41, 3.36; Δ17O= 1.04, 1.04, 1.04, 1.03, 1.07, 1.02, 1.03, 1.00 (linearized, all per mil, TFL slope=0.528); weighted average δ18O= 4.46; δ17O= 3.34; Δ17O= 1.03.

**Classification**: Primitive achondrite. Δ17O values coincide with the L-chondrite field. The bulk rock pattern is LREE-depleted as expected for an igneous cumulate rock. Possibly related to [NWA 4284](https://www.lpi.usra.edu/meteor/metbull.php?code=35407), but not paired, as NWA 4284 has no shock melt pockets, no maskelynite, and a higher modal abundance of plagioclase.

**Specimens**: 18.5 g, including a probe mount, on deposit at *UNM*, Abdelhadi Aithiba holds the main mass.

**Northwest Africa 11043** (NWA 11043)

Mauritania

Purchased: 2016

Classification: Martian meteorite (Shergottite)

**History**: Purchased by Abdelhadi Aithiba in Mauritania, 2016, reportedly found in Mali.

**Physical characteristics**: One piece, no fusion crust, significant amount of the exterior is covered with light-orange desert soil; some scattered patches of green silicates are exposed. Fresh broken surface reveals medium to coarse grains of predominantly olivine and pyroxene.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of polished mount shows approximately 80 % of this sample consisting of poikilitic olivine and pyroxene grains most in the size range 500-1000 μm. Plagioclase appears to have been completely transformed to maskelynite.

**Geochemistry**: (C. Agee, B. Ha, *UNM*) olivine Fa36.4±1.2, Fe/Mn=49±1, NiO=0.06±0.02 (wt%), n=7; pigeonite Fs28.2±2.0Wo11.0±2.0, Fe/Mn=28±1, n=9; augite Fs18.3±1.0Wo30.6±2.6, Fe/Mn=25±1, n=13; maskelynite Ab37.6±1.2An60.7±1.3Or1.6±0.2, n=7.

**Classification**: Martian (shergottite), petrologically equilibrated ultramafic rock, poikilitic shergottite group. No known pairings, but pyroxene and olivine compositions are similar to [RBT 04262](https://www.lpi.usra.edu/meteor/metbull.php?code=44665), [NWA 7755](https://www.lpi.usra.edu/meteor/metbull.php?code=57166), and [NWA 8161](https://www.lpi.usra.edu/meteor/metbull.php?code=58489).

**Specimens**: 20.5 g, including a probe mount, on deposit at *UNM*, Abdelhadi Aithiba holds the main mass.

**Northwest Africa 11044** (NWA 11044)

(Northwest Africa)

Purchased: 2016

Classification: Martian meteorite (Shergottite)

**History**: Two stones weighing 95.3 and 9.4 g were found and subsequently purchased in Zagora in 2016. Don Cline and John Sinclair acquired the samples from a meteorite prospector at the Tucson Gem and Mineral Show in February 2016.

**Physical characteristics**: Sample is ovoid in shape and contain small patches of vesicular, black impact melt material (some of which contains embedded sand grains). The exterior surface is dark green and displays an igneous texture.

**Petrography**: Description and classification (A. Love, *App*): Sample has an ophitic texture composed of ~73 vol% prismatic pyroxenes surrounding irregular-lath shaped, isotropic grains (maskelynitized plagioclase) and opaque grains. The sample is crosscut by vesicular melt veins and pools. Minerals are augite, pigeonite, maskelynite, ilmenite, pyrrhotite, merrillite, and silica polymorph.

**Geochemistry**: (A. Love, *App*): Pyroxene crystals are complexly zoned with augite cores (Fs23.8±4.4Wo33.6±2.0, N=11; Fe/Mn=29.4±2.1) and subcalcic augite rims (Fs58.3±5.6Wo21.9±2.7, N=9; Fe/Mn=38.3±0.7) and pigeonite rims (Fs56.1±11.6Wo14.5±1.2, N=11; Fe/Mn=36.7±3.5). Oxygen isotopes (K. Ziegler, *UNM*): analyses of 3 acid-washed mineral separates by laser fluorination gave, respectively, ?17O = 2.875, 2.948, 2.850; ?18O = 4.886, 5.033, 4.826; ?17O = 0.295, 0.291, 0.302 (data are linearized all per mil).

**Classification**: Martian (shergottite, diabasic). Likely paired with [NWA 8656](https://www.lpi.usra.edu/meteor/metbull.php?code=61220).

**Specimens**: *PARI* holds the main masses (71.44 and 9.4 g). A 20 g type specimen and one polished thin section are on deposit at *App*

**Northwest Africa 11045** (NWA 11045)

(Northwest Africa)

Purchased: 2011

Classification: Ordinary chondrite (L3-6)

**History**: One mostly crusted stone with a mass 24.8 g was found and purchased in Morocco in 2011. The sample was acquired from prospector David Holden in 2011.

**Physical characteristics**: A dark-brown weathered fusion crust covers approximately 98% of the stone. The stone is oriented with an obvious nose cone leading edge and trailing edge with with roll-over lipping and frothing.

**Petrography**: Description and classification (T. Anderson, *App*): Sample is a breccia composed of equilibrated clasts (ranging from type 5 to type 6) set within a host of unequilibrated, well-defined CC, BO, PP, GOP, Poik OP, POP, PO and RP chondrules and fragments with an average diameter of 746 μm (n=44). Accessory minerals are apatite, chromite, troilite and ~7 vol% Fe-Ni metal. Some unequilibrated chondrules contain isotropic glassy mesostasis.

**Geochemistry**: (T. Anderson, *App*) Host: Olivine Fa21.5±12.4(4.8-32.9 N=7); Low Ca pyroxene Fs11.2±4.4Wo3.6±5.7(Fs4.8-19.3Wo0.64-17.4, N=10), Clasts: Olivine Fa23.6±0.4, N=8; Low Ca pyroxene Fs19.8±0.8Wo1.9±0.4, N=12.

**Classification**: Based on textures and mineral compositions this is an ordinary chondrite breccia composed of type 5 and 6 clasts set within a host on unequilibrated chondrules (L3-6, S4, W2).

**Specimens**: Two endpieces whose masses total 17.27 g and one polished thin section are on deposit at *App*.

**Northwest Africa 11046** (NWA 11046)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Eucrite, melt breccia)

**History**: One stone weighing 182.1 g was found by a meteorite prospector in Morocco. Thomas Webb acquired the sample from a meteorite prospector in 2016.

**Physical characteristics**: Sample is an irregularly shaped fragment that contains a dark brown patina with circular depressions not resembling regmaglypts. The interior surface is dark green and displays a clastic texture composed of lithic and mineral fragments.

**Petrography**: (A. Love, *App*) Sample is a breccia composed of clasts of cumulate and basaltic eucrites and associated debris of mineral fragments hosted in a quenched melt matrix. Cumulate clasts show incomplete recrystallization textures composed of inverted host Opx with augite exsolution lamellae containing rims of very fine-grained polygonal subgrains of pigeonite. Basalt has a subophitic texture with zoned pigeonite cores with subcalcic augite rims. Accessory minerals are: Si polymorphs, chromite, ilmenite and rare zircon.

**Geochemistry**: (A. Love, *App*) Low-Ca pyroxene Fs62.0±2.8Wo3.4±1.2(Fs57.1-65.8Wo1.6-5.2, FeO/MnO=31.5-32.4, N=13); Pigeonite host Fs57.2±5.5Wo11.5±5(Fs48.1-71.4Wo5.6-22.5, Fe/Mn=28.4-35.6, N=14); high-Ca pyroxene exsolution lamellae Fs29.1±2.0Wo42.6±2.6(Fs13.6-41.6Wo22.5-44.9, FeO/MnO=28.0-32.4, N=13); plagioclase An90.5±1.5Or0.5±0.2(An87.2-92.1, N=5).

**Classification**: HED achondrite (eucrite, melt breccia)

**Specimens**: *Webb* holds the main mass. A polished thin section and 3 slices weighing 20.70 g are on deposit at *App*.

**Northwest Africa 11047** (NWA 11047)

Northwest Africa

Purchased: 2015

Classification: Ureilite

**History**. On 2015, meteorite specimens were purchased by José Antonio Sanchez Santana in the Saharawi refugee camps in Tindouf, Algeria.

**Physical characteristics**. Rounded reddish-brown single stone with a mass of 51 g with black fusion crust covering 15% of the stone was found in the desert. A saw cut reveals dark polycrystalline texture.

**Petrography**: Petrographic description (R. P. Lozano, *IGME*). Polished section shows typical ureilitic equigranular texture with interlocked euhedral to subhedral olivine and pigeonite grains, 0.5 to 2 mm in size and abundant 120° triple junctions. Grain boundaries are marked by a concentration of carbonaceous material and trace amounts of troilite, nickel-iron (partly altered to terrestrial oxides), Ca-rich pyroxene and schreibersite. Olivines surrounded by reduction rims depleted in Fe (50 to 100 μm in thickness).

**Geochemistry**: Mineral compositions (Rafael Pablo Lozano, *IGME*). Microprobe analyses show pigeonite ranges from Fs1-17Wo1-8with a mean of Fs9.8±9.7Wo6.8±1.9and Fe/Mn=6-34 (mean Fe/Mn=13.8±11.3) (n=18). Olivine range is: Fo77-81(mean: Fo78.2±2.4; n=15) with Fe/Mn=38-70 (mean Fe/Mn=50.3±5.0). Ca-rich pyroxene ranges are Fs2-4Wo23-37(means: Fs2.5±1.0Wo33.4±5.6) and Fe/Mn=3-5 (mean: Fe/Mn=4.0±0.7) (n=5). The metal is kamacite with Ni=4.3-6.8 and Co=0.4-0.5 (all in wt.%; n=12). Troilite contains Cr (0.9-4.6), Mn (0.1-0.6) and Ni (0.1-0.5) (all in wt.%; n=9). Bulk chemistry (J. Reyes, *IGME*). 0.5 grams of sample for analysis. XRF of subsample gave abundances of (in wt.%): SiO2=38.5, TiO2<0.30, Al2O3=<0.60, Fe2O3=20.8, MgO=33.5, CaO=1.11 and K2O<0.40. Na2O= 0.09 wt.% by AAS. Trace elements were measured with ICP-MS (all in ppm): Be<0.1, V=83, Cr=3864, Co=113, Ni=1570, Cu=15.1, Zn=246, As=0.37, Se=2, Mo<0.5, Ag<0.1, Cd<0.5, Sb<0.1, Ba=20.2, Tl<0.1, Pb=2.77, Th=0.1 and U<0.1.

**Classification** (R.P. Lozano, *IGME*). Achondrite, ureilite. Terrestrial weathering is moderate with partial oxidation of metal.

**Specimens**. Type specimen (10.2 g) and a probe mount are on deposit at *IGME*, and 12.0 g at *UCLA*. José Antonio Sánchez Santana holds the main mass (Private address: C/ Río Añamaza, nº 4, Torremolinos, 29620, Málaga, Spain).

**Northwest Africa 11048** (NWA 11048)

(Northwest Africa)

Purchased: 2005 Jun

Classification: Primitive achondrite (Acapulcoite)

**History**: Purchased from a Moroccan dealer at the mineral show in Sainte-Marie-aux-Mines, France.

**Petrography**: (K. Metzler, *IfP*) Recrystallized rock with abundant 120° triple junctions, consisting of low-Ca pyroxene, olivine, Ca-rich pyroxene, troilite, metallic Fe,Ni and plagioclase. Accessory phases are chromite and phosphates. Grain sizes of silicates mostly below 0.5 mm with some metal grains up to 1 mm.

**Geochemistry**: Mineral compositions and geochemistry: Olivine Fa10.8±0.2(Fa10.6-11.1); n=8. Low-Ca pyroxene Fs10.4±0.1Wo1.9±0.6(Fs10.3-10.6Wo1.1-2.8, n=8). Ca-rich pyroxene Fs4.6±0.4Wo43.2±1.2(Fs3.9-5.1Wo41.4-45.0, n=9). Cr2O3 in Ca pyroxene 1.5 wt%. Plagioclase An16.8±0.7Or3.0±0.4(An15.1-17.4Or2.3-3.6, n=8).

**Classification**: Acapulcoite, based on mineral chemistry and mean grain size of silicates.

**Northwest Africa 11049** (NWA 11049)

(Northwest Africa)

Purchased: 2006 Jun

Classification: HED achondrite (Diogenite)

**History**: Purchased from a moroccan dealer at the mineral fair in Sainte-Marie-aux-Mines, France

**Petrography**: (K. Metzler, *IfP*) Monomict breccia consisting of polycristalline and monocrystalline pyroxene fragments up to several millimeters in size set in a fine-grained clastic matrix of related debris. Accessories are a silica polymorph, chromite, troilite, and (partly oxydized) Ni-poor metal.

**Geochemistry**: Compositions of randomly chosen pyroxene grains Fs25.9±0.4Wo3.3±0.6(Fs25-27Wo2-4, n=16). Chromium spinel (n=1): Atomic Cr/(Cr+Al)=0.78; Mg/(Mg+Fe)=0.16; TiO2=0.7 wt%

**Northwest Africa 11050** (NWA 11050)

(Northwest Africa)

Purchased: 2006 Jun

Classification: HED achondrite (Eucrite, monomict)

**History**: Purchased from a Moroccan dealer at the mineral fair in Sainte-Marie-aux-Mines, France.

**Physical characteristics**: Many fragments with remnants of fusion crust.

**Petrography**: (K. Metzler, *IfP*) Monomict breccia consisting of eucritic lithic clasts with ophitic to subophitic textures set in a fine-grained clastic matrix of related debris. Pyroxene crystals with thin augite exsolution lamellae. Lithic clasts frequently contain melt pockets consisting of a silica polymorph, ilmenite, and troilite.

**Geochemistry**: Mineral compositions and geochemistry: Eucritic pyroxene (host): Fs57.3±0.6Wo2.9±0.2(Fs56.4-58.0Wo2.7-3.2, n=11). Eucritic pyroxene (exsolution lamellae) Fs27.4±0.6Wo41.5±0.7(Fs26.6-28.5Wo40.4-42.4, n=9). Plagioclase An86.0±2.9Or0.7±0.6(An80.3-89.1Or0.0-2.1, n=10).

**Northwest Africa 11051** (NWA 11051)

(Northwest Africa)

Purchased: 2006 Nov

Classification: Ordinary chondrite (H3-5)

**History**: Purchased from a Moroccan dealer at the mineral show in Munich, Germany.

**Petrography**: (K. Metzler, *IfP*) Genomict breccia, dominated by equilibrated clasts (H5) with lesser amounts of unequilibrated clasts (H3), embedded in related fine-grained clastic material.

**Geochemistry**: Mineral chemistry of type 3 clasts: Fa17.7±9.1(Fa1.9-41.4; n=18); Fs6.6±4.0(Fsa2.9-14.9; n=15); Mineral chemistry of type 5 clasts: Fa18.7±0.5(Fa17.7-20.0; n=19); Fs18.9±0.4(Fs18.6-19.7; n=10)

**Northwest Africa 11052** (NWA 11052)

(Northwest Africa)

Purchased: 2006 Dec

Classification: Ordinary chondrite (L5)

**History**: Purchased from a Moroccan dealer at the mineral show (CCH) in Hamburg, Germany

**Physical characteristics**: Rounded individual with ablated fusion crust. About 10% relict fusion crust with regmaglypts. A shock vein (thickness ~1 mm) is visible.

**Petrography**: (K. Metzler, *IfP*) Ordinary chondrite with clearly visible chondrules of various petrologic types. Primary chondrule textures (phenocrysts, mesostasis) are preserved.

**Geochemistry**: Mineral compositions and geochemistry: (K. Metzler, *IfP*) The mean olivine composition is Fa24.3±0.4(Fa23.7-25.5); n=22; the mean low-Ca pyroxene composition is Fs20.1±0.4(Fs19.3-20.9); n=23

**Classification**: L chondrite based on mineral chemistry. Petrologic type 5 due to the equilibrated state of olivine and pyroxene but still clearly visible chondrules.

**Northwest Africa 11053** (NWA 11053)

(Northwest Africa)

Purchased: 2016 Nov

Classification: Pallasite

**History**: Purchased by Darryl Pitt in November 2016 from a dealer in Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Composed predominantly of large grains of olivine (up to 1 cm) and heavily altered metal (Cr-bearing kamacite, present as remnant grains) with accessory schreibersite and Cr-bearing troilite. Terrestrial alteration products of primary metal are heterogeneous iron hydroxides with minor amounts of indeterminate K- and Ca-bearing phases.

**Geochemistry**: Olivine Fa12.9-13.3, FeO/MnO=36-37 (N = 3).

**Classification**: Pallasite.

**Specimens**: 21.9 g including a polished endcut at *UWB*; remainder with *DPitt*.

**Northwest Africa 11054** (NWA 11054)

(Northwest Africa)

Purchased: 2016 Oct

Classification: Ordinary chondrite (LL(L)3)

**History**: Purchased by John Higgins in October 2016 from a dealer in Nouakchott, Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Closely packed, well-formed chondrules (apparent diameter 500±200 μm) are set in a sparse, fine grained matrix containing altered metal.

**Geochemistry**: Olivine (Fa1.7-45.0, Cr2O3 in ferroan examples 0.06-0.39 wt.%, mean 0.12±0.13 wt.%, N = 7), orthopyroxene (Fs2.9-15.4Wo0.2-1.5, N = 3), pigeonite (Fs23.3Wo9.9), diopside (Fs3.3Wo47.9). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.36.

**Classification**: Ordinary chondrite (LL(L)3).

**Specimens**: 21.95 g including one polished thin section at *UWB*; remainder with Mr. J. Higgins.

**Northwest Africa 11055** (NWA 11055)

(Northwest Africa)

Purchased: 2016 Jun

Classification: HED achondrite (Diogenite, polymict)

**History**: Purchased by Fabien Kuntz in June 2016 from a dealer in Agadir, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed predominantly of angular clasts of diogenitic orthopyroxene and anorthite (~10 vol.%) together with sparse lithic diogenite clasts and <10 vol.% eucrite debris. Diogenite clasts contain variable amounts of plagioclase, and range from orthopyroxenitic to feldspathic to noritic. Orthopyroxene exhibits several different compositions and some grains have more magnesian cores. Accessory minerals are silica polymorph, exsolved pigeonite, bytownite, ilmenite (containing rare zircon inclusions), chromite, troilite and minor barite.

**Geochemistry**: Diogenitic orthopyroxene (Fs22.4Wo2.0; Fs31.4Wo4.7; FeO/MnO = 26-27, N = 2), orthopyroxene host (Fs50.8Wo3.3, FeO/MnO = 32), clinopyroxene exsolution lamellae (Fs25.5-26.7Wo39.2-38.7, FeO/MnO = 28-29, N = 2), olivine (Fa62.1, FeO/MnO = 45), plagioclase (An88.6Or0.4; An94.7Or0.2).

**Classification**: Diogenite (polymict breccia, feldspathic).

**Specimens**: 23.2 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11056** (NWA 11056)

(Northwest Africa)

Purchased: 2016 Oct

Classification: Ordinary chondrite (LL3)

**History**: Purchased by John Higgins in October 2016 from a dealer in Nouakchott, Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Fairly closely packed, well-formed chondrules (apparent diameter 500±300 μm) are set in a sparse, fine-grained matrix containing altered metal.

**Geochemistry**: Olivine (Fa0.4-47.3, Cr2O3 in ferroan examples 0.05-0.11 wt.%, mean 0.08±0.03 wt.%, N = 7), orthopyroxene (Fs2.5-22.7Wo0.2-2.2, N = 3), pigeonite (Fs31.0Wo16.8), augite (Fs11.2Wo45.3). Magnetic susceptibility log χ (× 10-9 m3/kg) = 3.73.

**Classification**: Ordinary chondrite (LL3).

**Specimens**: 23.95 g including one polished thin section at *UWB*; remainder with Mr. J. Higgins.

**Northwest Africa 11057** (NWA 11057)

(Northwest Africa)

Purchased: 2016 Jun

Classification: Martian meteorite (Shergottite)

**History**: Purchased by Darryl Pitt in June 2016 from a dealer in Agadir, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Medium-grained igneous assemblage of predominantly zoned clinopyroxene and maskelynite with accessory ilmenite (containing rare inclusions of baddeleyite and K-bearing glass), ulvöspinel, pyrrhotite, merrillite and chlorapatite. Zoned clinopyroxene consists of pigeonite and subcalcic augite with rims of ferropigeonite. Pockets and thin veinlets of shock-produced vesicular glass (deep brown in thin section) are present.

**Geochemistry**: Pigeonite (Fs43.9-60.6Wo14.3-13.5, FeO/MnO = 27-35, N = 3), subcalcic augite (Fs22.4-43.8Wo35.8-30.7, FeO/MnO = 27-35, N = 5), ferropigeonite rims (Fs55.0Wo19.8; Fs72.3Wo14.5; FeO/MnO = 34-37), maskelynite (An46.0-56.3Or1.8-0.7, N = 2).

**Classification**: Martian meteorite (shergottite, mafic, diabasic).

**Specimens**: 20.4 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11058** (NWA 11058)

(Northwest Africa)

Purchased: 2016 Jun

Classification: HED achondrite (Eucrite, unbrecciated)

**History**: Purchased by Darryl Pitt in June 2016 from a dealer in Ouarzazate, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Very fine grained, subophitic assemblage of exsolved pigeonite and calcic plagioclase with accessory silica polymorph, ilmenite, Ti-chromite, merrillite and zircon. The specimen is crosscut by thin, dark shock veins and some veinlets of secondary calcite.

**Geochemistry**: Orthopyroxene host (Fs60.7-61.7Wo2.7-1.8, FeO/MnO = 31, N = 3), clinopyroxene exsolution lamellae (Fs27.2-28.5Wo43.5-41.9, FeO/MnO = 32, N = 2), plagioclase (An89.5-89.6Or0.5-0.4, N = 2).

**Classification**: Eucrite (unbrecciated).

**Specimens**: 25.4 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11059** (NWA 11059)

(Northwest Africa)

Purchased: 2016 Nov

Classification: Ordinary chondrite (L6)

**History**: Purchased by Darryl Pitt in November 2016 from a dealer in Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Largely recrystallized with rare relict chondrules and altered metal.

**Geochemistry**: Olivine (Fa24.8-25.7, N = 3), orthopyroxene (Fs20.7-21.1Wo1.6-1.5, N = 3), clinopyroxene (Fs7.5-7.9Wo45.4-44.3, N = 2).

**Classification**: Ordinary chondrite (L6).

**Specimens**: 23.5 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11060** (NWA 11060)

(Northwest Africa)

Purchased: 2016 Jul

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased by Darryl Pitt in July 2016 from a dealer in Agadir, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Granular chondrules and irregularly-shaped, fine grained CAI are set in a black matrix (~30 vol.%). An extremely fine grained dark inclusion consists of dust-sized grains (mostly olivine, pyroxene and taenite) plus sparse larger grains of forsterite, enstatite and more ferroan olivine.

**Geochemistry**: Olivine (Fa0.5-91.2, N = 3), orthopyroxene (Fs0.8-0.9Wo0.9-3.7, N = 3), diopside (Fs1.1-2.2Wo37.3-42.4, N = 2).

**Classification**: Carbonaceous chondrite (CV3).

**Specimens**: 20.4 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11061** (NWA 11061)

(Northwest Africa)

Purchased: 2016 Nov

Classification: Lunar meteorite (feldspathic breccia)

**History**: Purportedly found near the Algeria/Mali border in October 2016, and purchased by Darryl Pitt in November 2016 from a dealer in Mauritania.

**Physical characteristics**: A single stone (1040 g) lacking fusion crust. The fresh interior exhibits rounded, whitish anorthositic clasts (up to 1.8 cm across) and crystalline debris set in a medium-gray matrix containing obvious small vesicles.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of angular mineral clasts of anorthite, exsolved pigeonite, olivine, orthopyroxene, pigeonite, ilmenite, Ti-chromite, Ti-free chromite, troilite and rare zircon, plus some lithic anorthosite clasts, in a finer grained, partly vesicular matrix of the same minerals.

**Geochemistry**: Olivine (Fa19.4-52.9, FeO/MnO = 68-91, N = 5), orthopyroxene (Fs23.6Wo3.5, FeO/MnO = 53), pigeonite (Fs36.7Wo15.4, FeO/MnO = 53), low-Ca pyroxene host in exsolved pigeonite (Fs44.5Wo7.1, FeO/MnO = 53), high-Ca pyroxene host in exsolved pigeonite (Fs24.6Wo36.4, FeO/MnO = 52), plagioclase (An97.1-97.6Or0.1, N = 2). Bulk composition (R. Korotev, *WUSL*) INAA of subsamples gave the following mean abundances (in wt.%) FeO 3.4, Na2O 0.32; (in ppm) Sc 6.6, Ni 100, La 1.8, Sm 0.79, Eu 0.78, Yb 0.64, Lu 0.09, Hf 0.58, Th 0.30. Magnetic susceptibility log χ (× 10-9 m3/kg) = 2.61.

**Classification**: Lunar (feldspathic regolith breccia).

**Specimens**: 20.7 g including a polished endcut at *UWB*; remainder with *DPitt*.

**Northwest Africa 11062** (NWA 11062)

(Northwest Africa)

Purchased: 2016 Nov

Classification: Ordinary chondrite (H5)

**History**: Purchased by Darryl Pitt in November 2016 from a dealer in Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Mostly recrystallized with sparse chondrules and stained metal. The specimen is crosscut by anastomozing shock veinlets composed of extremely fine grained, indeterminate black material.

**Geochemistry**: Olivine (Fa18.4-19.1, N = 3), orthopyroxene (Fs16.5-17.5Wo1.6-1.3, N = 3), clinopyroxene (Fs6.2-7.9Wo45.3-43.2, N = 2).

**Classification**: Ordinary chondrite (H5).

**Specimens**: 21.4 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11063** (NWA 11063)

(Northwest Africa)

Purchased: 2016 Nov

Classification: HED achondrite (Eucrite, unbrecciated)

**History**: Purchased by Darryl Pitt in November 2016 from a dealer in Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Very fine grained, subophitic assemblage of exsolved pigeonite and calcic plagioclase with accessory silica polymorph, ilmenite, Ti-poor chromite and troilite.

**Geochemistry**: Host orthopyroxene (Fs59.4-61.8Wo4.6-2.3, FeO/MnO = 30-31), clinopyroxene exsolution lamellae (Fs26.5-26.8Wo43.9-43.2, FeO/MnO = 28-30), plagioclase (An85.6-88.4Or0.6-0.5, N = 2).

**Classification**: Eucrite (unbrecciated).

**Specimens**: 21.2 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11064** (NWA 11064)

(Northwest Africa)

Purchased: 2016 Nov

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased by Darryl Pitt in November 2016 from a dealer in Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Granular, large rimmed chondrules (containing stained metal grains) and irregularly-shaped, fine grained CAI are set in a red-brown matrix (~30 vol.%).

**Geochemistry**: Olivine (Fa0.9-78.4, N = 3), orthopyroxene (Fs0.7-0.8Wo0.7-3.0, N = 3), diopside (Fs0.6-2.6Wo45.3-39.2, N = 2).

**Classification**: Carbonaceous chondrite (CV3).

**Specimens**: 10.3 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11065** (NWA 11065)

(Northwest Africa)

Purchased: 2016 Sep

Classification: Martian meteorite (Shergottite)

**History**: Purportedly found in southern Morocco near Bir Anzarane, and purchased by Ben Hoefnagels in September 2016 from a dealer in Ouarzazate, Morocco.

**Physical characteristics**: A single broken stone (76.9 g) with shiny black fusion crust on all sides except for the weathered exposed interior side. The fresh interior exhibits larger pale greenish, prismatic grains and smaller pale yellowish-green grains with interstitial lath-like grains of glassy maskelynite.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Larger prismatic clinopyroxene oikocrysts (some consisting of multiple subgrains) enclose small chadacrysts of olivine and Ti-chromite. These are accompanied by smaller, stubby grains of pyroxene and olivine, plus ~12 vol.% interstitial maskelynite (as elongate lath-shaped grains intergrown with clinopyroxene) and accessory ilmenite, ulvöspinel, Mg-poor merrillite and pyrrhotite. Melt inclusions composed of glass or clinopyroxene+glass are present in some olivine grains, as well as rare inclusions of orthopyroxene.

**Geochemistry**: Olivine (Fa40.3-43.2, FeO/MnO = 46-50, N =4), pigeonite (Fs25.8-34.3Wo5.4-9.6, FeO/MnO = 26-28, N = 3), subcalcic augite (Fs18.9-20.9Wo35.0-29.6, FeO/MnO = 25-28, N = 3), orthopyroxene inclusion in olivine (Fs36.4Wo2.7, FeO/MnO = 34), maskelynite (An56.0-56.6Or1.3-1.2, N = 2).

**Classification**: Martian meteorite (shergottite, poikilitic).

**Specimens**: 17.93 g including one polished thin section at *UWB*; 0.3 g at *CEREGE*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11066** (NWA 11066)

(Northwest Africa)

Purchased: 2016 Nov

Classification: Ureilite

**History**: Purchased by Darryl Pitt in November 2016 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Relatively coarse grained aggregate of ~85 vol.% olivine and ~12 vol.% low-Ca pyroxene (both orthopyroxene and pigeonite) with accessory graphite and minor calcite. Olivine has reduced magnesian rims containing fine grained, blebby Fe metal. Both olivine and pyroxene have been completely recrystallized to myriad subgrains.

**Geochemistry**: Olivine (cores Fa22.9-23.9; rim Fa6.5), orthopyroxene (Fs15.0Wo3.6), pigeonite (Fs19.7Wo6.6).

**Classification**: Ureilite (olivine-rich, recrystallized).

**Specimens**: 23.5 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11067** (NWA 11067)

(Northwest Africa)

Purchased: 2016 Nov

Classification: Ordinary chondrite (L6)

**History**: Purchased by Darryl Pitt in November 2016 from a dealer in Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Largely recrystallized with rare relict chondrules and altered metal.

**Geochemistry**: Olivine (Fa24.9-25.4, N = 3), orthopyroxene (Fs21.0-21.3Wo1.8-1.2, N = 3), clinopyroxene (Fs8.0-8.1Wo44.5-44.1, N = 2).

**Classification**: Ordinary chondrite (L6).

**Specimens**: 20.4 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11068** (NWA 11068)

(Northwest Africa)

Purchased: 2016 Sep

Classification: HED achondrite (Eucrite, monomict)

**History**: Purchased by Bob Falls in September 2016 from a Moroccan dealer at the Denver Show.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Monomict breccia composed of relatively coarse (up to 3 mm), angular grains of predominantly exsolved pigeonite and calcic plagioclase with accessory unexsolved orthopyroxene, unexsolved clinopyroxene, Ti-chromite and troilite. The specimen appears to represent a disaggregated gabbroic eucrite.

**Geochemistry**: Orthopyroxene host (Fs43.6Wo2.7, FeO/MnO = 29), clinopyroxene exsolution lamellae (Fs20.0Wo40.2, FeO/MnO = 25), orthopyroxene (Fs35.0Wo4.5, FeO/MnO = 30), clinopyroxene (Fs17.2Wo42.8, FeO/MnO = 26), plagioclase (An89.6-90.0Or0.5, N = 2).

**Classification**: Eucrite (monomict gabbroic breccia).

**Specimens**: 21.6 g including one polished thin section at *UWB*; remainder with Mr. R. Falls.

**Northwest Africa 11069** (NWA 11069)

(Northwest Africa)

Purchased: 2016 Sep

Classification: Ordinary chondrite (LL(L)3)

**History**: Purchased by Fred Olsen in September 2016 from a Moroccan dealer at the Denver Show.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Fairly closely packed, well-formed chondrules (apparent diameter 500±400 μm, one 4 mm) are set in a fine-grained matrix containing altered metal.

**Geochemistry**: Olivine (Fa0.4-49.7, Cr2O3 in ferroan examples 0.02-0.44 wt.%, mean 0.16±0.14 wt.%, N = 8), orthopyroxene (Fs1.5-21.8Wo0.4-1.0, N = 3), subcalcic augite (Fs19.4-22.7Wo23.0-29.6, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.20.

**Classification**: Ordinary chondrite (LL(L)3).

**Specimens**: 21.0 g including one polished thin section at *UWB*; remainder with Mr. F. Olsen.

**Northwest Africa 11070** (NWA 11070)

(Northwest Africa)

Purchased: 2016 Apr

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased by Darryl Pitt in April 2016 from a dealer in Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Granular chondrules (apparent diameter 900 ± 700 µm) and relatively abundant irregularly-shaped, fine grained CAI (some containing grossmanite) are set in a red-brown matrix (~25 vol.%).

**Geochemistry**: Olivine (Fa1.2-66.7, N = 3), orthopyroxene (Fs0.7-1.1Wo1.3-0.8, N = 3), Al-Ti-diopside in CAI (Fs0.3Wo53.3, Al2O3 = 6.7 wt.%, TiO2 = 0.47 wt.%), grossmanite in CAI (Fs0.0Wo67.2, Al2O3 = 20.5 wt.%, TiO2 = 8.6 wt.%).

**Classification**: Carbonaceous chondrite (CV3).

**Specimens**: 20.4 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11071** (NWA 11071)

(Northwest Africa)

Purchased: 2016 Jul

Classification: Enstatite achondrite (Aubrite)

**History**: A batch of small brownish stones was purchased by Roger Jones in July 2016 from a dealer in Guelmim, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Aggregate of predominantly enstatite (to 1.6 mm) with accessory albite, oligoclase, silica polymorph, daubreelite, altered kamacite, schreibersite and perryite. Grain boundaries are stained with iron hydroxides from alteration of primary metal.

**Geochemistry**: Enstatite (Fs0.0-0.1Wo0.5-0.7, N = 2), albite (Ab92.4An1.6Or6.0), oligoclase (An16.0Or2.5), metal (Si 1.6-3.3 wt.%, Ni 2.0-3.6 wt.%, Co 0.4 wt.%).

**Classification**: Aubrite.

**Specimens**: 4.8 g including one polished mount at *UWB*; remainder with Mr. R. Jones.

**Northwest Africa 11072** (NWA 11072)

(Northwest Africa)

Purchased: 2016 Nov

Classification: Ordinary chondrite (LL3)

**History**: Purportedly found near Adrar, Algeria, in October 2016, and purchased by Darryl Pitt in November 2016 from a dealer in Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Fairly closely packed, well-formed chondrules (apparent diameter 400±300 µm) are set in a fine grained matrix containing altered metal.

**Geochemistry**: Olivine (Fa2.8-60.1, Cr2O3 in ferroan examples 0.04-0.12 wt.%, mean 0.11±0.05 wt.%, N = 7), orthopyroxene (Fs2.5-11.2Wo0.4-1.5, N = 3), subcalcic augite (Fs2.1Wo30.3), diopside (Fs2.8Wo39.1). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.06.

**Classification**: Ordinary chondrite (LL3).

**Specimens**: 20.4 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11073** (NWA 11073)

(Northwest Africa)

Purchased: 2016 Nov

Classification: Martian meteorite (Shergottite)

**History**: Two stones found together near the Algeria-Mali border were purchased by Darryl Pitt in November 2016 from a dealer in Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Medium-grained igneous assemblage of predominantly zoned clinopyroxene (pigeonite plus subcalcic augite) and maskelynite with accessory pyrrhotite, ulvöspinel, ilmenite, baddeleyite, merrillite, chlorapatite and K-Si-Al-bearing glass. Sparse pockets and thin veinlets of shock-produced vesicular glass (deep brown in thin section) are present.

**Geochemistry**: Pigeonite (Fs40.2-58.1Wo13.8-15.7, FeO/MnO = 29-35, N = 4), subcalcic augite (Fs21.9-47.8Wo36.5-26.7, FeO/MnO = 28-34, N = 4), maskelynite (An46.6-47.8Or2.7-2.0, N = 2).

**Classification**: Martian meteorite (shergottite, aphyric, diabasic).

**Specimens**: 22.4 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11074** (NWA 11074)

(Northwest Africa)

Purchased: 2016 Nov

Classification: Ordinary chondrite (LL3)

**History**: Purchased by Darryl Pitt in November 2016 from a dealer in Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Fairly closely packed, well-formed chondrules (apparent diameter 450 ± 300 µm) are set in a fine grained matrix containing altered metal.

**Geochemistry**: Olivine (Fa2.2-82.6, Cr2O3 in ferroan examples 0.07-0.52 wt.%, mean 0.18±0.17 wt.%, N = 7), orthopyroxene (Fs1.1-33.8Wo0.7-1.7, N = 3), clinopyroxene (Fs4.0-32.4Wo37.4-37.9, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 3.61.

**Classification**: Ordinary chondrite (LL3).

**Specimens**: 20.1 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11075** (NWA 11075)

(Northwest Africa)

Purchased: 2016 Nov

Classification: Ordinary chondrite (LL7)

**History**: Purchased by Darryl Pitt in November 2016 from a dealer in Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia consisting of angular clasts exhibiting poikiloblastic textures. Chadacrysts of olivine are enclosed in oikocrysts of orthopyroxene accompanied by accessory clinopyroxene, sodic plagioclase (to 200 μm), chromite, chlorapatite, kamacite and troilite. No chondrules were observed in the studied section.

**Geochemistry**: Olivine (Fa28.3-29.8, N = 3), orthopyroxene (Fs22.9-23.2Wo3.4-3.3, N = 3), clinopyroxene (Fs11.0-11.5Wo41.3-40.3, N = 2).

**Classification**: Ordinary chondrite (LL7 breccia).

**Specimens**: 24.5 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11076** (NWA 11076)

(Northwest Africa)

Purchased: 2016 Nov

Classification: Ordinary chondrite (LL(L)3)

**History**: Purchased by Darryl Pitt in November 2016 from a dealer in Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Fairly closely-packed, well-formed chondrules (apparent diameter 500±400 μm) are set in a fine grained matrix containing altered metal.

**Geochemistry**: Olivine (Fa2.6-76.8, Cr2O3 in ferroan examples 0.05-0.14 wt.%, mean 0.09±0.03 wt.%, N = 7), orthopyroxene (Fs1.0-17.0Wo0.9-1.3, N = 3), diopside (Fs0.9Wo35.8), subcalcic augite (Fs17.4Wo29.5). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.22.

**Classification**: Ordinary chondrite (LL(L)3).

**Specimens**: 11.7 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11077** (NWA 11077)

(Northwest Africa)

Purchased: 2016 Nov

Classification: Lunar meteorite (feldspathic breccia)

**History**: Purportedly found near Adrar, Algeria in October 2016, and purchased by Darryl Pitt in November 2016 from a dealer in Mauritania.

**Physical characteristics**: A single medium gray stone (1139.7 g) lacking fusion crust but exhibiting a shiny desert patina on exterior surfaces. Very sparse, small whitish clasts are visible within a dominant very fine grained, vesicular matrix.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Extremely fine-grained breccia consisting mainly of very tiny mineral grains plus devitrified glass (some with swirly texture visible in thin section) plus sparse lithic clasts, which are themselves melt rocks with intersertal texture and sparse relict clasts. Minerals large enough to be quantitatively analyzed are anorthite, olivine and subcalcic augite; accessory minerals include kamacite, troilite and minor barite.

**Geochemistry**: Olivine (Fa15.9-39.7, FeO/MnO = 73-77, N = 4), subcalcic augite (Fs20.1Wo34.1, FeO/MnO = 40), plagioclase (An96.1-96.8Or0.3-0.1, N = 2). Bulk composition (R. Korotev, *WUSL*) INAA of subsamples gave the following mean abundances (in wt.%) FeO 3.7, Na2O 0.40; (in ppm) Sc 7.4, Ni 160, La 3.1, Sm 1.45, Eu 0.80, Yb 1.1, Lu 0.15, Hf 1.1, Th 0.41. Magnetic susceptibility log χ (× 10-9 m3/kg) = 2.38.

**Classification**: Lunar (feldspathic vitric regolith breccia).

**Specimens**: 21.7 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11078** (NWA 11078)

(Northwest Africa)

Purchased: 2016 Nov

Classification: Enstatite achondrite

**History**: Purchased by Darryl Pitt in November 2016 from a dealer in Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Recrystallized, relatively metal-rich assemblage of predominantly enstatite with accessory kamacite, forsterite, diopside, albitic plagioclase, troilite, daubreelite, alabandite and schreibersite. No chondrules were observed in the studied thin section.

**Geochemistry**: Enstatite (Fs0.3-0.4Wo0.6-0.5, N = 3), forsterite (Fa0.2-0.4, N = 2), diopside (Fs0.2-0.3Wo46.9-47.4, N = 2), albitic plagioclase Ab83.3An12.0Or4.7, kamacite (Si 0.01 wt.%, Ni 4.0-4.2 wt.%, Co0.42-0.43 wt.%, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 5.66

**Classification**: Enstatite achondrite.

**Specimens**: 21 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11079** (NWA 11079)

(Northwest Africa)

Purchased: 2016 Sep

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased by Bob Falls in September 2016 from a Moroccan dealer at the Denver Show.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Granular chondrules (apparent diameter 700±500 μm; some spherical, some with concentric rims, some more irregular in shape) plus abundant irregularly-shaped, fine grained CAI and sparse aggregates of fine grained olivine+pentlandite are set in a deep brown matrix (~35 vol.%). Minerals identified in CAI include hedenbergite, pleonaste, perovskite, sodalite, Ca-K-bearing nepheline, awaruite, troilite and rare ilmenite.

**Geochemistry**: Olivine (Fa0.4-46.7, N = 3), orthopyroxene (Fs0.8-1.1Wo1.2-4.0, N = 3), clinopyroxene (Fs0.9-1.6Wo32.2-37.8, N = 2), ferroan augite (Fs48.1Wo50.5).

**Classification**: Carbonaceous chondrite (CV3).

**Specimens**: 29.6 g including one polished thin section at *UWB*; remainder with Mr. R. Falls.

**Northwest Africa 11080** (NWA 11080)

(Northwest Africa)

Purchased: 2016

Classification: Carbonaceous chondrite (CV3)

**History**: A stone weighing 91.23 g was found in Morocco in 2010. John Sinclair and J. Donald Cline acquired the sample from a meteorite prospector in Erfoud, 2015.

**Physical characteristics**: The windowed stone is dark gray, irregular in shape and has visible red-colored chondrules surrounded by black rims. The stone lacks fusion crust.

**Petrography**: (A. Love, *App*): Sample displays chondritic texture composed of chondrules, AOAs and CAIs in a mottled, light grey and dark opaque matrix (35 vol%). Most chondrules are defined and have an average diameter of 630.7 μm (69-2578 μm, n=187). Porphyritic chondrules have turbid to recrystallized mesostasis. A 3.2-mm type B CAI containing melilite, spinel, hibbonite and fassaite dominates a portion of the thin section. Larger chondrules (~1 mm dia.) are light red in color in plain light and are surrounded by darker regions composed of fine-grained, opaque clastic matrix devoid of sulfides. Matrix surrounding unoxidized chondrules contains abundant coarser grained sulfides.

**Geochemistry**: (A. Love, *App*) Fa15.1±18.1(0.5-51.8), Fe/Mn=52.2 N=38; Low Ca pyroxene Fs2.0±0.7Wo1.8±1.2, N=13.

**Classification**: Carbonaceous Chondrite (CV3, S3, W2)

**Specimens**: *PARI* holds the main mass. One slice and several fragments weighing 18.43 g and one polished thin section are on deposit at *App*.

**Northwest Africa 11081** (NWA 11081)

Northwest Africa

Purchased: 2016

Classification: HED achondrite (Eucrite, unbrecciated)

**History**: Purchased from Moroccan finder September 2016.

**Physical characteristics**: Single stone, weathered fusion crust, a saw cut reveals an unbrecciated, medium to fine-grained mix of plagioclase and pyroxene grains. One very thin (<1 mm) shock melt veinlet was observed.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows approximately 60% pyroxene and 40% plagioclase. Many of the pyroxene grains show exsolution lamellae.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) Low-Ca pyroxene Fs63.1±0.8Wo1.9±0.3, Fe/Mn=32±1, n=6; clinopyroxene Fs48.8±9.7Wo19.4±11.2, Fe/Mn=32±1, n=7; plagioclase An85.6±4.3, n=4.

**Classification**: Unbrecciated eucrite

**Specimens**: 20.9 g including a probe mount on deposit at *UNM*, Aerolite Meteorites holds the main mass.

**Northwest Africa 11082** (NWA 11082)

Mauritania

Find: 2016

Classification: Ureilite

**Physical characteristics**: A dark-gray stone with desert varnish. Cut surface reveals an aggregate of mm size crystals.

**Petrography**: Unbrecciated aggregate of blocky mm size silicates grains (mostly olivine and pigeonite) with triple junctions. Olivine has reduced margins. Metal is present as alignements of μm size grains in silicates. Carbon material is found between the silicate grains.

**Geochemistry**: Olivine: core Fa20.3(N=1), rim Fa10.1(N=1). Pigeonite Fs18.0±0.3Wo7.7±0.2(N=4).

**Classification**: Ureilite. Moderate weathering.

**Specimens**: 54.9 g and a polished section at *CEREGE*.

**Northwest Africa 11083** (NWA 11083)

Western Sahara

Purchased: 2016

Classification: HED achondrite (Eucrite, polymict)

**Physical characteristics**: Light grey stone. Cut surface reveals dark-gray interior with lighter clasts to 5 mm.

**Petrography**: Brecciated igneous rock with basaltic (ophitic to sub-opthitic texture) and cumulate clasts in a clastic matrix. Main minerals are low-Ca pyroxenes (with augite exsolution) and plagioclase. rare metal. Clasts of diogenitic composition are found but amount to less than 10 vol% of the rock.

**Geochemistry**: low-Ca pyroxene: basaltic material Fs59.1±2.5Wo5.0±1.6(N=3), cumulate material Fs40.6±7.6Wo5.0±3.0(N=3), diogenite material Fs26.0Wo3.0(N=1), FeO/MnO=31.8±2.4 (N=7). Plagioclase An92.4±2.2Ab7.3±2.1Or0.3±0.1(N=2). Magnetic susceptiblity log χ (× 10-9 m3/kg) = 3.22.

**Classification**: Eucrite, polymict. Weathering low.

**Specimens**: 1.4 g at *CEREGE*. Main mass with Michel Franco.

**Northwest Africa 11084** (NWA 11084)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Eucrite, unbrecciated)

**Physical characteristics**: Very fresh thin fusion crust. Cut surface reveals light-gray, fine-grained homogeneous interior.

**Petrography**: Unbrecciated basaltic rock with ophitic teture. Main minerals are exsolved pyroxenes and plagiocalse, with average grain size 500 μm. Accessory minerals: ilmenite, chromite. Rare metal.

**Geochemistry**: Low Ca-pyroxene Fs62.8±0.2Wo2.6±0.6, FeO/MnO=32.0 (N=2). Augite exsolution Fs29.4Wo41.4(N=1). Plagioclase An82.3±1.8Ab16.9±1.5Or0.8±0.3(N=2). Chromite Cr/(Cr+Al)=0.85.

**Classification**: Eucrite, unbrecciated. Almost no weathering.

**Specimens**: 7.4 g at *CEREGE*.

**Northwest Africa 11085** (NWA 11085)

(Northwest Africa)

Purchased: 2015

Classification: Carbonaceous chondrite (CO3.0)

**Physical characteristics**: Dark brown stones. Cut surface reveals a brownish interioe.

**Petrography**: Chondrules (some with dust rims, average apparent diameter 270 μm, N=47), small CAIs in a fine-grained matrix. Opaques are metal (mostly replaced by weathering products) and sulfides. Modal abundances: chondrules and fragments 46 vol%, matrix 38 vol%, opaques 16 vol% (from point counting, N=104).

**Geochemistry**: Olivine Fa range 0.8-48.6, average Fa27.6±17.9, PMD 59%, FeO/MnO=98 (N=14), Cr2O3 on ferroan olivine 0.29±0.13 wt% (N=11). Orthopyroxene Fs1.8±0.4Wo1.5±0.5(N=5). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.84.

**Classification**: CO3.0. Subtype from olivine Fa PMD, range, and Cr2O3 content. Strong weathering. Possibly paired with NWA 7892.

**Specimens**: Type specimen at *CEREGE*. Main maiss with*Kuntz*.

**Northwest Africa 11086** (NWA 11086)

Morocco

Find: 2016 May

Classification: Carbonaceous chondrite (CM, anomalous)

**History**: Reportedly found near Foum Zguid, Morocco.

**Physical characteristics**: Dark brown stones. Cut surface reveals a lighter brown interior with small chondrules.

**Petrography**: Well delineated chondrules set in a iron-rich fine grained matrix. Matrix 58 vol%, chondrules and chondrule fragments 42 vol% (from point counting, N=293). Average apparent chondrule diameter 240±120 μm (N=38). Rare metal as ~1 μm spherical inclusions in silicates. X-ray diffraction does not reveal the presence of phyllosilicates.

**Geochemistry**: Olivine Fa0.9-32.7, average Fa14.2±12.2, PMD 81%, FeO/MnO = 79 (N=13), Cr2O3 on ferroan olivine 0.36±0.09 wt% (N=10). Orthopyroxene Fs1.4±0.1Wo1.1±0.1(N=2). Oxygen isotopic composition (J. Gattacceca, C. Sonzogni, *CEREGE*) from analysis of one acid-washed 1.5 mg aliquot of a powdered homogenized 475 mg bulk sample is δ17O=-0.40‰, δ18O=6.17‰ , Δ17O=-3.63‰ (linearized, slope 0.5247, analytical uncertainties 0.08‰, 0.12‰, 0.03‰ respectively). Magnetic susceptibility log χ (× 10-9 m3/kg) = 3.41.

**Classification**: Carbonaceous chondrite (CM-an). Severe weathering.

**Northwest Africa 11087** (NWA 11087)

(Northwest Africa)

Purchased: 2013

Classification: Carbonaceous chondrite (CV3)

**History**: The stone was bought by Jean Redelsperger from Abdellah Afiniss in Agadir in 2013.

**Physical characteristics**: A crusted fragment. Cut surface reveals large chondrules and CAIs set in abundant dark brown matrix.

**Petrography**: Chondrules (average apparent diameter 990±340 μm, N=27) and irregular CAIs (to 2 mm) set in an abundant fine-grained iron-rich matrix. Opaques are mostly metal and sulfides, and their terrestrial weathering products.

**Geochemistry**: Olivine Fa range 0.4-50.4, average Fa11.5±14.9, PMD 102%, (N=7). Orthopyroxene Fs1.2±0.1Wo1.0±0.1(N=2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 3.43.

**Classification**: Carbonaceous chondrite (CV3). Reduced subgroup. Strong weathering.

**Specimens**: 10 g at *CEREGE*. Main mass with Jean Redelsperger.

**Northwest Africa 11089** (NWA 11089)

Mauritania

Find: 2016

Classification: Ordinary chondrite (LL6)

**Physical characteristics**: A brown stone with remanents of fusion crust. Cut surface reveal a light brown interior with darker clasts to 4 mm.

**Petrography**: Recrystallized texture with triple junctions. One relict chondrule was found in the studied polished section. Contains dark granulitic clasts.

**Geochemistry**: Plagioclase An10.8±0.4Ab84.6±0.6Or4.7±0.2(N=2). Ca-pyroxene Fs10.6Wo42.7(N=1). Chromite Cr/(Cr+Al)=0.86. Magnetic susceptibility log χ (× 10-9 m3/kg)=2.84.

**Classification**: LL6

**Specimens**: 33.8 g and a polished section at *CEREGE*

**Northwest Africa 11090** (NWA 11090)

Mauritania

Find: 2016

Classification: Ordinary chondrite (L6, melt breccia)

**Physical characteristics**: A dark dull stone without fusion crust. Cut surface reveals a brecciated texture, with chondrule-bearing clasts set in a dark matrix.

**Petrography**: Ordinary chondrite clasts (to cm) set in a melt matrix with microcrystalline quench texture and abundant FeS/metal droplets. Most clasts are equilibrated, with plagioclase size to 200 μm. Some clasts are shock darkened, with abundant troilite veinlets, larger plagioclase (to 300 μm), and large chromite grains (to 300 μm).

**Geochemistry**: Clasts: Olivine Fa24.8±0.02(N=2), Orthopyroxene Fs20.5Wo0.7(N=1). Shock darkened clasts: Olivine Fa24.3±0.05(N=2), Orthopyroxene Fs21.0Wo1.4(N=1). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.99.

**Classification**: L6 melt breccia

**Specimens**: 15 g and a polished section at *CEREGE*

**Northwest Africa 11092** (NWA 11092)

Morocco

Purchased: 2016 May

Classification: Carbonaceous chondrite (CO3)

**Physical characteristics**: A partially crusted brownish stone. Cut surface reveals brownish interior.

**Petrography**: Chondrules and small CAIs set in fine-grained iron-rich matrix. Average apparent chondrule diameter 190±90 μm (N=56). Opaques are metal and troilite (and their weathering products), present as 50-100 μm blebs in the matrix and chondrules. Modal abundances: chondrules and fragments 56 vol%, matrix 37 vol%, opaque blebs 7 vol% (by point counting, N=135).

**Geochemistry**: Olivine Fa22.9±13.7, range Fa0.6-39.7, PMD=54%, FeO/MnO=93.8, N=17. Cr2O3 in ferroan olivine is 0.06±0.05 (N=14). Orthopyroxene Fs4.3Wo0.9(N=1). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.44.

**Classification**: Carbonaceous chondrite (CO3). Moderate weathering.

**Specimens**: Type specimens at *CEREGE* and *FSAC*.

**Northwest Africa 11093** (NWA 11093)

Morocco

Purchased: 2016 May

Classification: Carbonaceous chondrite (CO3)

**Physical characteristics**: A single brownish stone. Cut surface reveals brownish interior.

**Petrography**: Chondrules and small CAIs set in fine-grained, iron-rich matrix. Average apparent chondrule diameter 220±130 μm (N=51). Opaques are metal and troilite (and their weathering products), present as 50-100 μm blebs in the matrix and chondrules. Modal abundances: chondrules and fragments 58 vol%, matrix 39 vol%, opaque blebs 6 vol% (by point counting, N=167).

**Geochemistry**: Olivine Fa24.6±3.85, range Fa16.7-28.3, PMD=14%, FeO/MnO=126.9, N=10. Cr2O3 in ferroan olivine is 0.18±0.19 (N=10). Orthopyroxene Fs1.±0.8Wo1.1±0.2(N=4). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.37.

**Classification**: Carbonaceous chondrite (CO3). Moderate weathering.

**Specimens**: Type specimens at *CEREGE* and *FSAC*.

**Northwest Africa 11094** (NWA 11094)

Morocco

Purchased: 2016 May

Classification: Rumuruti chondrite (R5)

**Physical characteristics**: A single brownish stone. Cut surface reveals brownish interior.

**Petrography**: Indistinct chondrules in a recrystallized matrix. Olivine is the dominant mineral. Opaque are sulfides and their terrestrial weathering products.

**Geochemistry**: Olivine Fa39.8±1.0, NiO=0.21±0.04 wt%, FeO/MnO=90.8 (N=4). Ca-pyroxene Fs11.1Wo44.5(N=1). Magnetic susceptibility log χ (× 10-9 m3/kg) = 2.84.

**Classification**: Rumuruti chondrite (R5). Severe weathering.

**Specimens**: Type specimens at *CEREGE* and *FSAC*.

**Northwest Africa 11096** (NWA 11096)

(Northwest Africa)

Purchased: 2015

Classification: Ordinary chondrite (LL7)

**History**: Bought in Morocco

**Physical characteristics**: A crusted stone. Cut surface reveals a gray interior with brownish staining.

**Petrography**: Recrystallized texture with triple junctions. Plagioclase to 200 μm, troilite to 600 μm, metal to 300 μm, chromite. No chondrule visible in the 1.5 cm2 section.

**Geochemistry**: Olivine Fa30.8(N=1). Orthopyroxene Fs25.7±0.1Wo1.7±0.3(N=2), Ca-Px Fs12.6Wo41.6(N=1). Plagioclase An10.2Ab83.0Or6.9(N=1). Magnetic susceptibility log χ (× 10-9 m3/kg) = 3.00.

**Classification**: LL7

**Specimens**: 30 g and a polished section at *CEREGE*. Main mass with Luc *Labenne*.

**Northwest Africa 11097** (NWA 11097)

Morocco

Purchased: 2016 Dec

Classification: Ordinary chondrite (LL3)

**History**: Purchased by Ke Zuokai in Dec. 2016 from a Moroccan dealer.

**Physical characteristics**: The meteorite has a brown fusion crust. Chondrules and clasts ranging from white to dark gray are visible.

**Petrography**: The thin section shows abundant well-defined chondrules ranging from 0.1 to 1.5 mm, with a few up to 3 mm. Chondrules with porhyritic and barred textures set in a fine-grained matrix. Olivine grains within chondrules often exhibit chemical zonation with Mg-rich cores and Fe-rich rims. Metallic phase accounts for ~2 vol%. Mineral and chondrule clasts are also present.

**Geochemistry**: Silicates are unequilibrated. Olivine Fa3.1-53.5(Fa19.4±11.2, PMD=44.1%, n=79); low-Ca pyroxene Fs1.8-31.3Wo0-4.9(Fs12.3±8.8Wo0.8±1.2, Fs PMD=59.8%, n=35); minor pigeonite Fs17.9-25.5Wo6.0-20.3and augite Fs10.7-14.0Wo30.2-37.7.

**Classification**: LL3. classification based on relatively large chondrules and low metal abundance.

**Northwest Africa 11098** (NWA 11098)

Morocco

Purchased: 2016 Dec

Classification: Ordinary chondrite (L3)

**History**: Purchased by Ke Zuokai in Dec. 2016 from a Moroccan dealer.

**Physical characteristics**: The meteorite has a brown fusion crust and partially covered by rusty products. Chondrules and clasts ranging from white to dark gray are visible.

**Petrography**: The thin section shows abundant well-defined chondrules (up to 1.9 mm) of different kinds, such as PO, PP, POP, BO, BP and minor CC. The matrix is fine-grained silicates with minor metal and troilite. Mineral and chondrule clasts are also present. Metallic phase accounts for ~4 vol%.

**Geochemistry**: Silicates are unequilibrated. Olivine Fa1.0-52.0(Fa23.2±15.1, PMD=52.1%, n=24); low-Ca pyroxene Fs1.2-24.0Wo0-1.3(Fs14.2±8.5Wo0.6±0.5, Fs PMD=52.6%, n=32); minor Ca-rich pyroxene Fs8.4-7.8Wo44.4-44.9).

**Classification**: L3 classification based on metal abundance and moderate sized chondrules with varies textures.

**Northwest Africa 11099** (NWA 11099)

Morocco

Purchased: 2016 Dec

Classification: Ordinary chondrite (LL3)

**History**: Purchased by Ke Zuokai in Dec. 2016 from a Moroccan dealer.

**Physical characteristics**: The meteorite has a yellow weathered surface. Chondrules and clasts ranging from white to gray are visible.

**Petrography**: The thin section shows numerous well-defined chondrules ranges from 0.2 to 1.2 mm. Chondrules exhibit various textures including porhyritic, granular, barred and radial texture. A glassy mesostasis is present in some PO or POP chondrules showing quenched texture. Olivine grains within chondrules often exhibit chemical zonation with Mg-rich cores and Fe-rich rims. Some Mg-rich olivine grains have overgrowth of Ca-rich pyroxene rims. Dusty olivine is present with μm-sized metalic inclusions. The matrix is fine-grained silicates and minor metal, troilite and chromite. Mineral and chondrule clasts are also present. Metallic phase accounts for ~2 vol%.

**Geochemistry**: Silicates are unequilibrated. Olivine Fa0-34.6(Fa17.2±11.2,PMD=56.4%, n=44); low-Ca pyroxene Fs3.2-29.3Wo0-4.7(Fs19.1±6.6Wo1.5±1.4, Fs PMD=26.8%, n=32); minor pigeonite Fs20.5-28.9Wo6.0-8.4and Ca-rich pyroxene Fs7.1Wo29.9.

**Classification**: LL3.classification based on low metal abundance.

**Northwest Africa 11100** (NWA 11100)

Morocco

Purchased: 2016 Dec

Classification: Ordinary chondrite (LL6)

**History**: Purchased by Ke Zuokai in Dec. 2016 from a Moroccan dealer.

**Physical characteristics**: The meteorite has a black fusion crust and partially covered by yellow weathering products. Chondrules and clasts ranging from white to dark grey are visible.

**Petrography**: The section shows a granular texture with a few relic porphyritic chondrules with vague boundaries (0.5-2 mm). Most recrystallized minerals in the matrix shows triple junctions, and plagioclase grains size up to ~70 μm. Chromite, troilite, metal and phosphate are also present.

**Geochemistry**: The composition of olivine, orthopyroxene and plagioclase are quite uniform. Olivine Fa28.8-30.1(Fa29.4±0.4, PMD=1.1%, n=17); orthopyroxene Fs22.6-25.2Wo2.2-2.6(Fs23.6±0.6Wo2.4±0.1, Fs PMD=1.7%, n=12); plagioclase Ab86.8-88.5Or1.5-3.0(Ab87.6±0.5Or2.2±0.4, n=11). A few Ca-rich pyroxene is also present Fs9.7-11.6Wo35.4-42.5.

**Classification**: LL6 based on homogenized composition and metamorphic texture.

**Northwest Africa 11101** (NWA 11101)

Morocco

Purchased: 2016 Dec

Classification: Ordinary chondrite (L3)

**History**: Purchased by Ke Zuokai in Dec. 2016 from a Moroccan dealer.

**Physical characteristics**: The meteorite is covered by a brown/black fusion crust. Round chondrules ranging from white to dark gray are visible.

**Petrography**: The thin section exhibits numerous well-defined chondrules (up to 1.1 mm) set in a fine-grained matrix. PO, PP, POP, BO, BP, and minor RP chondrules are identified. Accessory phases are metal, troilite and Fe-oxides. Metallic phase accounts for ~4 vol%.

**Geochemistry**: Silicates are unequilibrated. Olivine Fa0.8-35.1(Fa20.2±8.5, PMD=35.1%, n=33); low-Ca pyroxene Fs2.5-22.7Wo0-4.2(Fs12.4±6.6Wo1.0±1.1, Fs PMD=48.4%, n=32); minor augite Fs3.8Wo36.9.

**Classification**: L3. L classification based on metal abundance and moderate sized chondrules with varies textures.

**Northwest Africa 11102** (NWA 11102)

Morocco

Purchased: 2016 Dec

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased by Ke Zuokai in Dec. 2016 from a Moroccan dealer.

**Physical characteristics**: The meteorite is covered by a dark-brown fusion crust. Abundant round chondrules ranging from white to dark gray are visible.

**Petrography**: The thin section shows abundant well-defined chondrules (ranging from 0.3 to 1.5 mm with most being mm-sized) set in a fine-grained matrix. Most of the chondrules have porhyritic texture, and some of them are surrounded by igneous rims or opaque minerals. Fe-rich augite is identified within fine-grained inclusions associated with fayalitic olivine, orthopyroxene and altered minerals. A few fragments of CAIs consisting of Al, Ca-pyroxene and saponite were identified in this thin section. The matrix abundance is approximately 42%. Other accessory phases include metal, troilite and Fe-oxides.

**Geochemistry**: Silicates are unequilibrated. Olivine Fa0.7-51.3(Fa16.8±13.6; PMD=67.1%, n=48); low-Ca pyroxene Fs2.5-31.1Wo0-4.9(Fs13.7±8.9Wo1.3±1.4, Fs PMD=51.5%, n=27); pigeonite Fs23.6-29.8Wo5.1-13.0; minor augite Fs17.8Wo30.3.

**Classification**: CV3 classification based on mm-sized chondrules with mostly porhyritic textures and the presence of AOA and altered minerals.

**Northwest Africa 11103** (NWA 11103)

Morocco

Purchased: 2016 Dec

Classification: Ordinary chondrite (H5)

**History**: Purchased by Ke Zuokai in Dec. 2016 from a Moroccan dealer.

**Physical characteristics**: The meteorite is covered by a black fusion crust with flowlines.

**Petrography**: The thin section shows numerous chondrules ranging from 0.25 to 1 mm with relatively vague boundaries. The matrix experienced extensive recrystallization with diameters ranging from 10 to 30 ?m. Most chondrules are porhyritic with a few being barred. Major phases are olivine, low-Ca pyroxene and plagioclase. Minor phases include troilite, chromite, FeNi metal and phosphate. Fractures are widespread in this thin section. Shock melt veins are present.

**Geochemistry**: Silicates are equilibrated. Olivine Fa14.2-15.1(Fa14.6±0.2; PMD=1.2%, n=21); orthopyroxene Fs12.4-13.9Wo0.8-2.2(Fs13.2±0.5Wo1.0±0.2Fs PMD=2.8%, n=16); Ca-rich pyroxene Fs4.7-5.6Wo42.2-44.3; plagioclase Ab80.9-89.4Or2.8-7.2(Ab87.6±2.4Or5.3±1.3, n=13).

**Northwest Africa 11104** (NWA 11104)

Morocco

Purchased: June 2016

Classification: Iron meteorite (IAB, anomalous)

**History**: Originally obtained by Rachid Chaoui of Ouarzazate, subsequently purchased by F. *Kuntz* at the Ensisheim show in June 2016.

**Physical characteristics**: The main mass has a dark brown exterior and is irregular in shape.

**Petrography**: Polished surfaces display abundant inclusions of silicates and sulfides. Etched surfaces show few kamacite lamellae ~0.5 mm across; otherwise, kamacite and taenite grains have irregular shapes and are interstitial to the inclusions.

**Geochemistry**: ICP-MS data, using sample of [North Chile](https://www.lpi.usra.edu/meteor/metbull.php?code=17001) (Filomena) as standard (C. Herd and G. Chen *UAb*): Ni = 10.8, Co = 0.46 (both wt%); Ir = 3.3, Ga = 73, Ge = 322, W = 0.9, Re = 0.3, Os = 1.3, Cu = 471, Ru = 4.9, Pd = 4.2, Pt = 5.4 (all μg/g).

**Classification**: (C. Herd, *UAb*): IAB anomalous. Ni content is intermediate for the IAB complex of [Wasson and Kallemeyn (2002)](http://www.sciencedirect.com/science/article/pii/S0016703702008487); however, Ga and Ge are too high to be considered part of the sLM subgroup.

**Specimens**: Type specimen consisting of two representative slices (22.4 and 1.2 g) at *UAb*. Main mass with *Kuntz*.

**Northwest Africa 11105** (NWA 11105)

Algeria

Purchased: April 2016

Classification: Iron meteorite (IAB-MG)

**History**: Two specimens weighing 378 g and 176 g reportedly found in Algeria.

**Physical characteristics**: The main masses have elongate, flattened shapes with dark brown to light red-brown exterior surfaces. Terrestrial alteration, including oxidation and presence of caliche are evident covering approximately half of each rock.

**Petrography**: Polished and etched surfaces show an irregular pattern with rare kamacite laths approximately 1 mm across. Veins of iron oxides extend into the interior. No fusion crust or heat-affected zone was observed.

**Geochemistry**: ICP-MS data, using sample of [North Chile](https://www.lpi.usra.edu/meteor/metbull.php?code=17001) (Filomena) as standard (C. Herd and G. Chen *UAb*): Ni = 6.4, Co = 0.45 (both wt%); Ir = 2.4, Ga = 66, Ge = 331, W = 2.3, Re = 0.2, Os = 0.4, Cu = 183, Ru = 13.0, Pd = 1.8, Pt = 17.3 (all μg/g).

**Classification**: (C. Herd, *UAb*): IAB-MG, although concentrations of W and Pt seem to be anomalously high.

**Specimens**: Type specimen consisting of a 12.1 g representative slice and a 14.5 g end piece at *UAb*. Main mass with *Kuntz*.

**Northwest Africa 11106** (NWA 11106)

Morocco

Purchased: February 2016

Classification: Iron meteorite (IAB-MG)

**History**: According to the seller, a single large specimen were found in a place called Souhada, close to Lmahbes (El Mahbes).

**Physical characteristics**: The main mass has a dark brown exterior with patches of rusty red and light brown, and is irregular in shape.

**Petrography**: Polished and etched surfaces show kamacite grains up to 4 cm across with an equilibrated (120 junction) texture and containing schreibersite up to 1.5 cm in longest dimension. Neumann lines are evident. Veins of iron oxides extend into the interior along grain boundaries. No fusion crust or heat-affected zone was observed.

**Geochemistry**: ICP-MS data, using sample of [North Chile](https://www.lpi.usra.edu/meteor/metbull.php?code=17001) (Filomena) as standard (C. Herd and G. Chen *UAb*): Ni = 6.8, Co = 0.49 (both wt%); Ir <0.015, Ga = 67, Ge = 219, W = 0.6, Re <0.008, Os <0.04, Cu = 155, Ru = 3.0, Pd = 2.6, Pt = 3.1 (all μg/g).

**Classification**: (C. Herd, *UAb*): IAB-MG, although concentrations of Re, Ir, W and Pt seem to be anomalously low. Similar to IAB-MG irons such as [La Serena](https://www.lpi.usra.edu/meteor/metbull.php?code=12404) or [Zaffra](https://www.lpi.usra.edu/meteor/metbull.php?code=30383) [(Wasson and Kallemeyn, 2002)](http://www.sciencedirect.com/science/article/pii/S0016703702008487).

**Specimens**: Type specimen consisting of a 73.6 g representative slice and numerous small fragments (from <0.1 g to 22.6 g) at *UAb*. Main mass with *Kuntz*.

**Northwest Africa 11107** (NWA 11107)

(Northwest Africa)

Purchased: 2015

Classification: HED achondrite (Eucrite, melt breccia)

**History**: Purchased by Larry Atkins from Morocco in June 2015.

**Physical characteristics**: Single stone, partial weathered fusion crust. A saw cut reveals breccia with basaltic clasts up to 2 cm bounded by dark shock melt veins, some of which are up to 7 mm wide.

**Petrography**: (C. Agee, *UNM*) This meteorite is a fragmental breccia of pyroxene grains, basaltic clasts and a few feldspar grains. Shock melt is present throughout, some parts with vesicles. Many pyroxenes show exsolution lamellae. Accessory troilite and ilmenite were observed.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) low Ca pyroxene Fs60.8±1.5Wo3.9±1.2, Fe/Mn=31±1, n=8; high Ca pyroxene Fs42.2±13.2Wo28.6±17.5, Fe/Mn=31±2, n=4; plagioclase An89.3±1.1Ab10.3±1.2Or0.4±0.1, n=7.

**Classification**: Monomict eucrite melt breccia with a single population of pyroxene compositions.

**Specimens**: 48.8 g including a probe mount on deposit at *UNM*, Larry Atkins holds the main mass.

**Northwest Africa 11108** (NWA 11108)

(Northwest Africa)

Purchased: 2015

Classification: HED achondrite (Howardite)

**History**: Purchased by Larry Atkins from Morocco in November 2015.

**Physical characteristics**: Single stone, no fusion crust. A saw cut reveals a fragmental breccia with clasts up to 4 mm.

**Petrography**: (C. Agee, *UNM*) This meteorite is a polymict breccia consisting of ~60% eucritic material and ~40% diogenitic material. Accessory Fe-metal, troilite and ilmenite were observed.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) diogenite olivine Fa38.7±8.7, Fe/Mn=48±1, n=3; diogenite low Ca pyroxene Fs26.5±2.9Wo2.9±0.4, Fe/Mn=29±2, n=7; eucrite low Ca pyroxene Fs54.5±8.5Wo4.6±2.6, Fe/Mn=32±2, n=5; eucrite high Ca pyroxene Fs40.4±11.2Wo24.7±15.4, Fe/Mn=32±5, n=4; plagioclase An90.4±3.0Ab9.2±2.9Or0.4±0.2, n=7.

**Classification**: Howardite

**Specimens**: 12.8 g including a probe mount on deposit at *UNM*, Larry Atkins holds the main mass.

**Northwest Africa 11109** (NWA 11109)

Morocco

Find: 2016

Classification: Lunar meteorite

**History**: Purchased by Ke Zuokai in Dec. 2016 from a Moroccan dealer.

**Physical characteristics**: The meteorite has a black fusion crust and is partially covered with weathering products.

**Petrography**: Mineral fragments with minor lithic clasts (0.1 to 1.5 mm) set in a poorly recrystallized anorthositic matrix. Vesicular shock melt veins and pockets are present.The lithic clasts include rocks of anorthositic, gabbroic and noritic composition. Mineral fragments consists of pyroxene, olivine, plagioclase grains, and minor quartz grains. Other accessory minerals include chromite, ilmenite and troilite.

**Geochemistry**: Plagioclase An90.5-97.0Ab2.8-9.1Or0.4; pigeonite Fs23.1-57.0Wo4.9-21.2, Fe/Mn=46.6-74.6; augite Fs13.6-55.1Wo27.0-43.7, Fe/Mn=43.3-85.4; olivine Fa31.1-45.7, Fe/Mn=81.1-108.4.

**Classification**: Lunar, breccia

**Northwest Africa 11110** (NWA 11110)

Morocco

Find: 2016

Classification: Lunar meteorite (feldspathic breccia)

**History**: Purchased by Ke Zuokai in Dec. 2016 from a Moroccan dealer.

**Physical characteristics**: The meteorite has a black fusion crust and is partially covered by weathering products.

**Petrography**: Fine-grained mineral debris (0.01-0.6 mm), including anorthitic plagioclase, low-Ca pyroxene (Fs19.1-40.7Wo2.4-4.8) and olivine clasts (Fa30.0-38.7), are embedded by very fine-grained recrystallized matrix with anorthositic composition. Few polycrystalline igneous clasts are present. Compared to the clasts, the recystallized olivine and pyroxene are more Fe-rich (Fa40.4-42.8) and Ca-rich (Fs23.0-31.7Wo15.4-33.6), respectively. Minor unrecrystallized shock melt veins (~50 μm) are also present, which crosscut the recrystallized matrix. Accessory ilmenite, troilite and chromite are present.

**Geochemistry**: Plagioclase An93.6-97.6Ab2.2-6.1Or0.1-0.3; orthopyroxene Fs19.1-40.7Wo2.4-4.8, Fe/Mn=52.4-62.0; pigeonite Fs23.0-31.7Wo15.4-33.6, Fe/Mn=50.0-70.8; olivine in clast Fa30.0-38.7, Fe/Mn=86.0-109.6; olivine in matrix Fa40.4-42.8, Fe/Mn=89.7-117.0.

**Classification**: Lunar feldspathic melt breccia

**Northwest Africa 11111** (NWA 11111)

Morocco

Find: 2016

Classification: Lunar meteorite (feldspathic breccia)

**History**: Purchased by Ke Zuokai in Dec. 2016 from a Moroccan dealer.

**Physical characteristics**: No fusion crust; covered by weathering products.

**Petrography**: Fine-grained mineral (plagioclase, low-Ca pyroxene and olivine) clasts and anorthositic rock debris (0.01-0.6 mm) are set in the very fine-grained recrystallized matrix. Compared to those in clasts (Fa27.6-45.6), the recystallized olivines are more Mg-rich (Fa21.4-32.0). Minor unrecrystallized shock melt veins (~50 μm) are also present, which crosscut the recrystallized matrix. Accessory Fe-Ni metal, troilite, and chromite were observed.

**Geochemistry**: Plagioclase An96.4-99.4Ab0.5-3.5Or0.4; olivine in clast Fa27.6-45.6, Fe/Mn=77.7-111.3; olivine in matrix Fa21.4-32.0, Fe/Mn=70.9-113.5; orthopyroxene Fs22.5-51.7Wo2.0-4.8, Fe/Mn=49.9-80.8; augite Fs12.4-24.0Wo38.2-45.1, Fe/Mn=39.5-51.9; pigeonite Fs22.1-37.0Wo5.6-9.2, Fe/Mn=44.3-65.0.

**Classification**: Lunar feldspathic melt breccia

**Northwest Africa 11114** (NWA 11114)

Morocco

Find: 2016

Classification: Ordinary chondrite (LL6)

**History**: Purchased by Ke Zuokai in Dec. 2016 from a Moroccan dealer.

**Physical characteristics**: The meteorite has a black fusion crust and partially covered by weathering products.

**Petrography**: The section exhibits a granular texture with a few relict porphyritic chondrules with vague boundaries (0.5-2 mm). It is mainly composed of olivine, pyroxene and plagioclase. The minerals in the matrix are recrystallized and show triple junctions. Plagioclase grains size is larger than 50 μm. Chromite, troilite and metal are also present.

**Geochemistry**: The compositions of olivine, pyroxene and plagioclase are quite uniform. Olivine Fa28.3-30.0(Fa28.9±0.5, PMD=1.4%, n=16); orthopyroxene Fs22.7-24.6Wo1.2-2.2(Fs23.9±0.5Wo1.9±0.2, Fs PMD=1.6%, n=15); augite Fs9.0-13.8Wo39.2-43.3(Fs11.5±1.1Wo41.2±1.0, n=15), plagioclase An9.6-10.5(An10.3±0.4, n=15).

**Classification**: LL6 based on homogenized composition and metamorphic texture.

**Northwest Africa 11115** (NWA 11115)

Morocco

Find: 2016

Classification: Martian meteorite (Shergottite)

**History**: Purchased by Terry *Boudreaux*.

**Physical characteristics**: Completely covered with smooth fusion crust; rounded shape with no regmaglypts.

**Petrography**: (M. Melwani Daswani, *UChi*) SEM/EDS analyses of a polished epoxy mount revealed basalt with large (up to 2 mm) olivine phenocrysts. Shock stage is high: all plagioclase has been converted to maskelynite, and some pyroxene + maskelynite melt pockets are visible. Fractures and voids are abundant throughout the sample, especially across olivine grains and along olivine grain boundaries, where spaces are filled by abundant secondary calcite.

**Geochemistry**: Mineral compositions and geochemistry: SEM/EDS mineral mode (UChicago and *FMNH*): ~ 9 % olivine, ~ 32 % pyroxene, ~ 56 % maskelynite. Remaining minerals are spinel (mainly chromite), phosphate, silica, and secondary calcite infilling cracks. Mineral composition: olivine Fa51.5±14.2, Fe/Mn=53.2±6.3 (N=56) shows strong zonation from core (Fa29.2) to rim (Fa54.7) in large grains and also compositional differences between large grains and smaller grains. Pyroxenes: low-Ca Wo4.4±0.2Fs25.8±0.3, Fe/Mn=28.8±2.8 (N=8); pigeonite Wo11.1±2.9Fs34.5±6.2, Fe/Mn=30.4±2.8 (N=24); augite Wo24±5.5Fs28.4±3.4, Fe/Mn=28.5±3.2 (N=2); maskelynite An49.3±4.4Ab48.7±3.9Or2.0±0.6(N=74). LA-ICP-MS whole rock chemistry: four measurements of one glass bead revealed very low K/Th (K/Th=746.6±69.7) compared to other martian meteorites, but bulk Fe/Mn=44.7±0.6 and Rb/K=0.0057±0.0016 are consistent with other shergottites. Oxygen isotopes, laser fluorination (R. Greenwood, *OU*): analyses on 2 aliquots gave values of δ17O=2.829, 2.817, δ18O=4.821, 4.770, Δ17O=0.322, 0.337 (given), Δ17O=0.302, 0.316 (linearized, all permil).

**Classification**: Achondrite (Martian basalt), basaltic shergottite with olivine phenocrysts. Large olivine grains show core to rim iron-enrichment trend.

**Specimens**: 34.2g at *FMNH*.

**Northwest Africa 11116** (NWA 11116)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Eucrite, monomict)

**History**: Two stones weighing 875.4 and 163.7 g were found and subsequently purchased in Morocco in 2015. J. Donald Cline and John Sinclair acquired the samples from a meteorite prospector at the Tucson Gem and Mineral Show in February of 2016.

**Physical characteristics**: Sample is irregularly shaped, with a pitted surface (similar to a regmaglypted surface). Sample lacks fusion crust. The sample is mottled brownish-white in color. The exterior surface displays a distinctive basaltic texture of light-colored, lath-shaped minerals with dark colored, interstitial mafic silicates and oxides. Some pits contain terrestrial material.

**Petrography**: Description and classification (A. Love, *App*): Sample has a subophitic texture of 600-800 μm exsolved Ca-rich and Ca-poor pyroxenes surrounded by ~1000 μm plagioclase laths. The sample is transected by shock veins and fault-bounded zones that show brecciated and recrystallization textures. Accessory minerals are: Si-Polymorph, Zircon, troilite, chromite, ilmenite.

**Geochemistry**: (A. Love, *App*): Low-Ca Pyroxene: Fs64.4±0.8Wo2.3±0.7, Fe/Mn=42, n=12; Ca-Pyroxene: Fs28.7±1.1Wo43.1±1.4, Fe/Mn=41, n=9,); Calcic plagioclase: An89.2±0.5Or0.4±0.1, n=5).

**Classification**: HED (Eucrite, monomict)

**Specimens**: *PARI* holds the main masses (875.4 g and 136.9g ). A slice and an end cut weighing 20.82 g and one polished thin section are on deposit at *App*.

**Northwest Africa 11117** (NWA 11117)

Northwest Africa

Purchased: 2016

Classification: Ordinary chondrite (L3)

**History**: One partially crusted stone weighing 68 g was purchased by Thomas Webb from a prospector in Morocco in January 2016.

**Physical characteristics**: The oriented sample is irregularly shaped and contains minor amounts of weathered fusion crust. There are a few cracks in the fusion crust that expose light-colored chondrules surrounded by a dark-colored matrix.

**Petrography**: Description and classification (A. Love, *App*): Sample is dark-colored and displays numerous close-packed unequilibrated chondrules of varying size (avg. dia. 433 μm (78-1361 μm), n=74). Porphyritic chondrules display well-developed zoning. Chondrule mesostasis is turbid and isotropic glass is common. Some chondrules contain relict grains. Many chondrules display fine-grained rims composed of clastic and amorphous silicate and metal materials. Some fine-grained chondrule rims contain porphyritic-textured microchondrules (diameters as small as 50 μm) occurring within clastic material.

**Geochemistry**: Olivine: Fa13.2±7.6(Fa1.1-29.3) N=34, Fe/Mn=47.1±16, ferroan olivine - Fa17.5±4.8, Cr2O3 in ferroan olivines is 0.5±0.1 wt% (0.3-0.8) n=17; low Ca-pyroxene: Fs19.0±12.1Wo1.6±1.3(Fs2.4-44.9, N=20).

**Classification**: Ordinary Chondrite (L3) S2 W1. Based on Fe/Mn=47 in olivines, sample is an L chondrite. Based on Fa values and range of Cr2O3 contents within ferroan olivines, the sample is L≥3.00 [(Grossman and Brearley, 2005)](http://articles.adsabs.harvard.edu/full/2005M%26PS...40...87G). Abundant porphyritic chondrules display yellow CL, olivines with bright red CL and red CL of matrix materials suggests sample is L<3.1, (Huss et al., 2006). Common isotropic glass in mesostasis is indicate petrologic grade of L<3.3.

**Specimens**: *Webb* holds the main mass. Two slices weighing 12.74 g and a polished thin section are on deposit at *App*.

**Northwest Africa 11118** (NWA 11118)

Western Sahara

Purchased: 2016

Classification: Carbonaceous chondrite (CM2)

**History**: The meteorite was bought in 2016 from a Moroccan meteorite dealer.

**Physical characteristics**: A single, black individual partly covered with fusion crust was recovered from the desert near Dakhla City, Western Sahara. The rock is unusually light and diffuses an organic smell.

**Petrography**: (A. Greshake, *MNB*) The meteorite appears to be a loosely consolidated aggregation of chondrules, chondrule and mineral fragments and rare CAIs virtually all surrounded by fine-grained dust rims of variable thickness. The different components seem to stick directly together at their respective rims forming a perfect accretionary texture. The meteorite lacks matrix-dominated areas but shows unusually high porosity. Often the fine-grained rims are found empty with the object they had previously surrounded missing. BSE imaging as well as µ-CT scanning of an 1 cm3 volume yield porosities ranging from 30 to up to 38%; the bulk density (volume determined by 3D-scanning) of the meteorite is 1.95 g/cm3. Chondrules are about 60-550 μm in diameter (mean: 171±93 μm, n=43) and dominantly of PO and POP types. Although olivine is highly unequilibrated in chondrules and mineral fragments with Fa0.3-75.8, low-Ca pyroxene is generally far less Fe-rich with Fs1.0-4.3.In several chondrules the glassy mesostasis is partly preserved attesting to a rather low degree of alteration. The latter is also confirmed by the low abundance of phyllosilicates and carbonates. Opaque phases include chromite, FeNi-metal (4-6 wt.% Ni), pentlandite and pyrrhotite.

**Geochemistry**: Oxygen isotopes (K. Ziegler, *UNM*): material analyzed by laser fluorination gave: δ18O=6.764; δ17O=0.670; Δ17O= -2.901 (all per mil).

**Northwest Africa 11119** (NWA 11119)

Mauritania

Purchased: 2017

Classification: Ungrouped achondrite

**History**: Purchased by Abdelhadi Aithiba in Mauritania 2017, reportedly found December 2016.

**Physical characteristics**: Single stone, partially covered in light green fusion crust, broken surface reveals scattered bright green pyroxene crystals up to 3 mm set in a finer grained matrix with some light-green and gray crystals. Spherical vugs and irregular shaped cavities (lined with crystal faces) were observed, some up to 4 mm. The sample is highly friable.

**Petrography**: (P. Srinivasan, *JSC*/*UNM*) Microprobe examination of a polished mount gives a calculated volume mineralogy of 38% plagioclase, 22% silica phase, 21% high-Ca pyroxene, 18% low-Ca pyroxene, 0.7% oxides (ulvospinel, ilmenite), and 0.3% sulfides. The silica phase, which makes up about 22% by volume of this meteorite, is a mix of tridymite and cristobalite with minor quartz, in proportions of approximately 60% tridymite, 37% cristobalite, 3% quartz. No metal was detected. The major phases occur as subhedral, porphyritic grains surrounded by a fine-grained matrix. The matrix has many acicular and compositionally heterogeneous grains resembling quench melt crystals or exsolution intergrowths. Rare fayalitic olivine was detected in one area of the matrix. The high reported alumina content from the micropropbe data is probably due to tiny oxide inclusions which seem to be abundant. Numerous inclusions with exsolution textures were observed.

**Geochemistry**: (P. Srinivasan, *JSC*/*UNM*) Plagioclase An84.9±9.9Ab14.8±9.5Or0.3±0.5, n=60; silica phase SiO2=96.2±0.6, Al2O3=1.2±0.4 (wt%), n=41; clinoenstatite Fs10±1.3Wo4.6±0.1, Fe/Mn=6.8±0.2, Fe/Mg=0.1±0.02, n=8; Pigeonite Fs52.7±24.6Wo15.8±3.3, Fe/Mn=7.7±1.1, Fe/Mg=8.1±9.5, n=20; augite Fs22.9±20.4Wo33.3±5.7, Fe/Mn=6.8±1.8, Fe/Mg=1.6±3.6, n=167. Porphyritic plagioclase grains contain Na-rich rims. Matrix pyroxene grains are highly zoned, with ~5-35 wt% FeO in a single grain. Major element bulk composition based on modal mineralogy: (all in wt%) SiO2 57.0, TiO2 1.6, Al2O3 12.9, Cr2O3 0.3, FeO 8.6, MnO 1.0, MgO 7.0, CaO 11.0, Na2O 0.7, K2O 0.03, S 0.2. Oxygen isotopes (K. Ziegler, *UNM*): 4 acid-washed fragments analyzed by laser fluorination gave δ18O= 8.226, 7.781, 8.121, 7.671; δ17O= 3.364, 3.133, 3.398, 3.046; Δ17O= -0.979, -0.975, -0.890, -1.004 (linearized, all per mil, TFL slope=0.528).

**Classification**: Ungrouped achondrite. This appears to be a unique ungrouped achondrite, It shares similar oxygen isotope values with [NWA 7325](https://www.lpi.usra.edu/meteor/metbull.php?code=55627) and ureilites, however it has a distinct mineralogy with abundant silica phase and an extremely wide range of pyroxene compositions.

**Specimens**: 23 g, plus a probe mount, on deposit at *UNM*, Abdelhadi Aithiba holds the main mass.

**Northwest Africa 11120** (NWA 11120)

Marrakech, Morocco

Purchased: Sept 2016

Classification: Ordinary chondrite (H4/5)

**History**: Purchased mid-September 2016 by Pr M. Lazrek from the Tahiri fossils and minerals shop in Erfoud, Morocco.

**Physical characteristics**: One weathered piece still partially covered by fusion crust

**Petrography**: Plagioclase average size around 20 μm, troilite globular, metal is present, many different types of chondrules

**Geochemistry**: Fa18.9±2.7N=11 (Fa15.6-26.2); Fs13.5±4.8(Fs7.3-17.9) N=7

**Classification**: H4/5

**Specimens**: One thick section and 27.3 g in *FSAC*

**Northwest Africa 11121** (NWA 11121)

(Northwest Africa)

Purchased: 2004 Feb

Classification: Ordinary chondrite (H3-6)

**History**: A single stone was obtained by Edwin *Thompson* from a Moroccan Trader in Tucson, Arizona, at the February 2004 Tucson Gem and Mineral Show; a portion (53 g) was donated to *Cascadia* on Feb. 28, 2004.

**Physical characteristics**: Weathered patina, dust, and fusion crust partly cover exterior. Cut faces reveal a light brown to grey interior with chondritic texture (abundant metal, chondrules, fragments) as well as two types of clasts up to 2 cm across, including light, partly reddish stained clasts with coarser metal, and darker clasts with finer metal.

**Petrography**: (A. Ruzicka and K. Farley, *Cascadia*) A breccia composed of a mixture of mineral and chondrule fragments and some larger clasts, including a partly fragmented type 6 clast with feldspar often >50 μm across corresponding to the larger light clasts seen in cut faces, and a type 3 clast with well-defined chondrules (some glass-bearing) corresponding to the larger dark clasts seen in cut faces. Host areas between these larger clasts contain chondrule fragments of various textures down to progressively smaller sizes.

**Geochemistry**: Mineral compositions and geochemistry: (K. Farley and A. Ruzicka) Larger type 6 clast includes olivine (Fa19.1±0.6, N=33), low-Ca pyroxene (Fs17.6±0.6Wo1.5±0.3, N=22), and feldspar (Ab79.7±1.5Or6.6±1.2, N=15); larger type 3 clast includes olivine (Fa15.0±8.2, N=23) and low-Ca pyroxene (Fs15.3±8.7Wo2.2±1.4, N=23); host includes olivine (Fa17.6±5.5, N=27), low-Ca pyroxene (Fs16.3±4.1Wo1.6±0.7, N=22), and feldspar (Ab84.3±6.0Or4.8±2.0, N=5).

**Classification**: H3-6 genomict breccia. Larger clasts consist both of type 3 and 6 lithologies and the host appears to be composed of an intimate mixture of smaller fragments of the same type of material.

**Specimens**: *Cascadia* holds three pieces (32.0, 16.6, 0.8 g), a polished thin section, and a potted butt. *Thompson* holds the main mass.

**Northwest Africa 11122** (NWA 11122)

(Northwest Africa)

Purchased: 2016 Dec

Classification: Ordinary chondrite (L5)

**History**: Found in Mauritania in 2016, acquired by Rachid Chaoui, classified at *UWS* for *PSF*, and subsequently purchased by Bob Falls.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Sparse chondrules are set in a recrystallized matrix containing altered metal.

**Geochemistry**: Olivine (Fa24.8-25.4, N = 3), orthopyroxene (Fs20.9-21.0Wo1.2-1.3, N = 3), clinopyroxene (Fs6.5-8.4Wo46.1-44.5, N = 2).

**Classification**: Ordinary chondrite (L5).

**Specimens**: 77 g including one polished thin section at *PSF*; remainder with Mr. R. Chaoui.

**Northwest Africa 11123** (NWA 11123)

(Northwest Africa)

Purchased: 2015 Apr

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased by Roger Jones in April 2016 from a dealer in Guelmim, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Well-formed granular chondrules (some rimmed, apparent diameter 450±300 µm) and fine grained, amoeboid CAI are set in a very fine grained, oxidized matrix (orange in thin section) containing some veinlets of calcite.

**Geochemistry**: Olivine (Fa0.3-47.0, N = 3), orthopyroxene (Fs0.7-0.80Wo0.8-4.2, N = 3), clinopyroxene (Fs0.6-1.4Wo36.9-36.24, N = 2).

**Classification**: Carbonaceous chondrite (CV3).

**Specimens**: 23.8 g including one polished thin section at *UWB*; remainder with Mr. R. Jones.

**Northwest Africa 11124** (NWA 11124)

(Northwest Africa)

Purchased: 2005

Classification: Ordinary chondrite (L3)

**History**: Purchased by an anonymous collector from a dealer at the Munich Show in 2005 and subsequently acquired by the Hollis Collection.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Fairly closely-packed, well-formed chondrules (apparent diameter 450±300 µm) are set in somewhat recrystallized matrix containing variably altered metal, chlorapatite and minor merrillite.

**Geochemistry**: Olivine (Fa5.3-44.2, Cr2O3 in ferroan examples <0.04 wt.%, N = 7), orthopyroxene (Fs7.1-25.0Wo0.2-1.6, N = 3), clinopyroxene (Fs6.9-8.0Wo44.1-45.4, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.91.

**Classification**: Ordinary chondrite (L3).

**Specimens**: 727 g including one polished thin section at *PSF*; remainder in the Hollis Collection.

**Northwest Africa 11125** (NWA 11125)

(Northwest Africa)

Purchased: 2015 Feb

Classification: HED achondrite (Eucrite, polymict)

**History**: Purchased by Aras Jonikas in February 2015 from a Moroccan dealer at the Tucson Gem and Mineral Show.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed mainly of disaggregated eucritic debris, rare grains of diogenitic orthopyroxene, and some lithic eucrite clasts. Textures in lithic clasts range from fine intersertal to diabasic to equigranular, and one example of the last variety contains shocked polycrystalline plagioclase. Minerals include anorthite, ferropigeonite, exsolved pigeonite, fayalite, silica polymorph, ilmenite, troilite, chromite and minor barite.

**Geochemistry**: Low-Ca pyroxene host (Fs54.5Wo7.2, FeO/MnO = 32), high-Ca pyroxene exsolution lamella (Fs28.2Wo39.8, FeO/MnO = 37); orthopyroxene host (Fs37.9Wo2.9, FeO/MnO = 23), clinopyroxene exsolution lamella (Fs16.05Wo43.3, FeO/MnO = 31); ferropigeonite (Fs80.8Wo17.1, FeO/MnO = 42), diogenitic orthopyroxene (Fs31.9Wo5.1, FeO/MnO = 30), plagioclase (An90.3-92.1Or0.6-0.3, N = 2), fayalite (Fa90.2-94.8, FeO/MnO = 41-42, N =2).

**Classification**: Eucrite (polymict breccia).

**Specimens**: 21.16 g including one polished thin section at *PSF*; remainder with Mr. A. Jonikas.

**Northwest Africa 11126** (NWA 11126)

(Northwest Africa)

Purchased: 2015 Mar

Classification: Ordinary chondrite (H4/5)

**History**: Purportedly found in February 2015 near Bou Jerif Guelmim, Morocco by a snake charmer, who sold it to Mbark Arjdal in Guelmim in March 2015.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Some well-formed, relatively small chondrules are present in a recrystallized matrix containing altered metal.

**Geochemistry**: Olivine (Fa19.2-19.3, N = 3), orthopyroxene (Fs15.5-16.5Wo0.7-1.8, N = 3), clinopyroxene (Fs6.1-6.5Wo45.5-45.1, N = 2).

**Classification**: Ordinary chondrite (H4/5).

**Specimens**: 72 g including one polished thin section at *UWB*; remainder with Mr. M. Arjdal.

**Northwest Africa 11127** (NWA 11127)

(Northwest Africa)

Purchased: 2016 Apr

Classification: Lunar meteorite (feldspathic breccia)

**History**: Purchased by Darryl Pitt in April 2016 from a dealer in Mauritania.

**Physical characteristics**: A single stone (474.6 g) lacking fusion crust and consisting of diffuse white to pale brownish clasts in a medium gray, very fine-grained matrix containing small vesicles.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of lithic clasts and angular mineral grains of anorthite, olivine, orthopyroxene, pigeonite and exsolved pigeonite with accessory kamacite, Ti-chromite, ilmenite and minor troilite in a sparse finer grained, partly devitrified matrix (exhibiting "swirly" texture). The majority of the lithic clasts are fine grained melt rocks. Veinlets of shock glass plus secondary calcite and minor barite are present.

**Geochemistry**: Olivine (Fa8.9-45.0, FeO/MnO = 74-79, N = 3), orthopyroxene (Fs20.9Wo4.6, FeO/MnO = 64), pigeonite (Fs40.9Wo19.2, FeO/MnO = 56), high-Ca pyroxene host (Fs17.3Wo41.1, FeO/MnO = 79), low-Ca exsolution lamella (Fs36.4Wo5.3, FeO/MnO = 61), plagioclase (An96.4-96.5Or0.2, N = 2). Bulk composition (R. Korotev, *WUSL*) INAA of subsamples gave the following mean abundances (in wt.%) FeO 3.7, Na2O 0.34; (in ppm) Sc 14.5, Ni 90, La 4.4, Sm 1.76, Eu 0.75, Yb 1.5, Lu 0.22, Hf 1.4, Th 0.57.

**Classification**: Lunar (feldspathic breccia).

**Specimens**: 20.6 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11128** (NWA 11128)

(Northwest Africa)

Purchased: 2016 Jul

Classification: Ordinary chondrite (H4)

**History**: Purportedly found in April 2016 near Tifariti, Morocco by a soldier, and subsequently purchased by Mbark Arjdal in July 2016 from a dealer in Smara.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Well-formed, relatively small chondrules are set in a recrystallized matrix containing altered metal.

**Geochemistry**: Olivine (Fa19.3-20.3, N = 3), orthopyroxene (Fs16.4-16.7Wo1.3-1.6, N = 3), clinopyroxene (Fs5.9-6.3Wo45.8-45.6, N = 2).

**Classification**: Ordinary chondrite (H4).

**Specimens**: 168 g including one polished thin section at *UWB*; remainder with Mr. M. Arjdal.

**Northwest Africa 11129** (NWA 11129)

(Northwest Africa)

Purchased: 2016 Sep

Classification: Primitive achondrite (Lodranite)

**History**: Purchased by Aras Jonikas in September 2016 from a Moroccan dealer. The find site for paired stones including NWA 8251 has been reported to be near Jrifiya.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of angular mineral grains of olivine, orthopyroxene, clinopyroxene with accessory Cr-rich chromite, altered low-Ni kamacite and troilite in a sparse finer grained matrix.

**Geochemistry**: Olivine (Fa11.3-11.5, FeO/MnO = 32-33, N = 3), orthopyroxene (Fs9.8-9.9Wo1.7-2.3, FeO/MnO = 25-31, N = 3), clinopyroxene (Fs4.4-4.5Wo44.1-43.2, N = 2).

**Classification**: Lodranite (breccia). Paired with [NWA 8118](https://www.lpi.usra.edu/meteor/metbull.php?code=58351), [NWA 8216](https://www.lpi.usra.edu/meteor/metbull.php?code=59408) and [NWA 8251](https://www.lpi.usra.edu/meteor/metbull.php?code=58768).

**Specimens**: A 10.8 g polished endcut is at *PSF*; remainder with Mr. A. Jonikas.

**Northwest Africa 11130** (NWA 11130)

(Northwest Africa)

Purchased: 2013 Jul

Classification: Ordinary chondrite (H4)

**History**: Purportedly found in May 2013 near Assa, Morocco by a camel herder, and subsequently purchased by Mbark Arjdal in July 2013 from a dealer in Assa.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Well-formed, relatively small chondrules are set in a recrystallized matrix containing altered metal and minor calcite veinlets.

**Geochemistry**: Olivine (Fa18.9-19.0, N = 3), orthopyroxene (Fs16.3-17.0Wo1.0-0.8, N = 3), clinopyroxene (Fs6.2-6.8Wo47.1-42.8, N = 2).

**Classification**: Ordinary chondrite (H4).

**Specimens**: 48 g including one polished thin section at *UWB*; remainder with Mr. M. Arjdal.

**Northwest Africa 11131** (NWA 11131)

(Northwest Africa)

Purchased: 2016

Classification: Carbonaceous chondrite (CK4)

**History**: Purchased by Dustin Dickens in 2016 from a dealer in Amellagou Ksar Ait’ Youb, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Separated, well-delineated chondrules containing Cr-magnetite are set in a finer grained matrix composed mainly of mafic silicates with Cr-magnetite, altered metal, pyrite and minor barite. One CAI composed of anorthite+olivine+pleonaste was observed in the studied thin section.

**Geochemistry**: Olivine (Fa32.6-32.7, FeO/MnO = 116-120, N = 3), orthopyroxene (Fs26.7-26.8Wo0.6, N = 3), clinopyroxene (Fs8.8-10.2Wo46.8-46.9, N = 2).

**Classification**: Carbonaceous chondrite (CK4).

**Specimens**: 6.1 g including one polished thin section at *UWB*; remainder with Mr. D. Dickens.

**Northwest Africa 11156** (NWA 11156)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Eucrite, monomict)

**History**: The meteorite was bought in 2016 from a meteorite dealer in Morocco.

**Physical characteristics**: Grayish individual with patches of fusion crust.

**Petrography**: The meteorite displays a characteristic basaltic texture of up to 1 mm sized exsolved pyroxenes and up to 1.5 sized often lath-shaped calcic plagioclase. Minor phases include FeS, chromite, and silica. No metallic iron was found.

**Geochemistry**: low-Ca pyroxene: Fs60.9±0.4Wo2.0±0.4(Fs60.2-61.4Wo1.6-3.0, n=14, FeO/MnO=30-33); Ca-pyroxene: Fs27.0±0.7Wo43.2±0.7(Fs24.7-28.0Wo42.2-45.1, n=13, FeO/MnO=27-34); calcic plagioclase: An88.9±1.6(An84.4-90.4, n=16)

**Northwest Africa 11157** (NWA 11157)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Eucrite, brecciated)

**History**: The meteorite was bought in 2016 from a Moroccan meteorite dealer at a mineral fair in Munich, Germany.

**Physical characteristics**: Dark grayish individual lacking any fusion crust.

**Petrography**: The meteorite is a fragmental breccia composed of rare basaltic clasts with different grain sizes and impact melt clasts set into a clastic matrix. Basaltic clasts and matrix are dominantly composed of exsolved pyroxene and plagioclase grains of variable grain sizes ranging from 30 to 500 μm. Several matrix pyroxenes display magmatic zoning. Minor phases include chromite, ilmenite, pyrrhotite, silica and metallic iron.

**Geochemistry**: low-Ca pyroxene: Fs38.4±7.7Wo6.2±0.6(Fs29.7-50.8Wo5.1-7.1, n=20, FeO/MnO=25-32); Ca-pyroxene: Fs29.0±4.6Wo38.4±1.1(Fs19.4-34.1Wo37.0-41.2, n=12, FeO/MnO=25-34); calcic plagioclase: An87.0±4.1(An73.5-89.5, n=14)

**Northwest Africa 11158** (NWA 11158)

(Northwest Africa)

Purchased: 2015

Classification: HED achondrite (Eucrite, monomict)

**History**: The meteorite was bought in 2016 from a Moroccan meteorite dealer at a mineral fair in Munich, Germany.

**Physical characteristics**: Small individual almost completely covered by fusion crust.

**Petrography**: Monomict eucrite displaying a fine-grained basaltic texture dominantly composed of exsolved pyroxene and up to 1 mm sized calcic plagioclase laths. Minor phases include silica, ilmenite, chromite, pyrrhotite and metallic iron. The meteorite contains shock melt veins.

**Geochemistry**: low-Ca pyroxene: Fs60.7±1.5Wo4.3±1.8(Fs58.3-62.9Wo2.3-7.5, n=13, FeO/MnO=30-33); Ca-pyroxene: Fs32.3±1.0Wo39.2±0.7(Fs30.1-33.4Wo38.5-40.8, n=13, FeO/MnO=29-34); calcic plagioclase: An88.2±0.8(An87.0-89.6, n=14)

**Northwest Africa 11159** (NWA 11159)

(Northwest Africa)

Purchased: 2016

Classification: Lunar meteorite (feldspathic breccia)

**History**: The meteorite was bought in 2016 from a meteorite dealer in Morocco.

**Physical characteristics**: Small dark-gray to black individual without fusion crust.

**Petrography**: The meteorite is a fragmental breccia composed of lithic and mineral clasts cemented by a vesicular vitreous groundmass. Lithic clasts include gabbroic, basaltic and melt clasts; mineral clasts are dominantly anorthite, ferroan olivine, pigeonite, Ca-pyroxene and low-Ca pyroxene. Minor phases include ilmenite, fayalite, and FeS.

**Geochemistry**: olivine: Fa38.4±9.4(Fa32.3-59.4, n=20, FeO/MnO=107±15); low-Ca pyroxene: Fs50.3±12.3Wo3.4±0.7(Fs30.3-60.9Wo2.3-4.7, n=10, FeO/MnO=35±9); pigeonite: Fs31.2±9.7Wo11.7±4.1(Fs20.9-58.3Wo5.8-19.5, n=22, FeO/MnO=58±5); Ca pyroxene: Fs7.9±1.6Wo31.5±2.8(Fs15.6-21.4Wo25.5-35.4, n=10, FeO/MnO=45±4); calcic plagioclase: An97.3±0.5(An96.4-98.1, n=13)

**Northwest Africa 11160** (NWA 11160)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Eucrite, brecciated)

**History**: The meteorite was bought in 2016 from a meteorite dealer in Morocco.

**Physical characteristics**: Small brownish individual without fusion crust.

**Petrography**: Brecciated eucrite composed of basaltic and melt clasts set into clastic mineral matrix. Dominant minerals are exsolved pyroxene and calcic plagioclase. Minor phases include silica, chromite, ilmenite, FeS, FeNi metal; no metallic Fe was found. Contains shock melt veins.

**Geochemistry**: low-Ca pyroxene: Fs45.7±14.3Wo3.2±0.4(Fs27.6-61.1Wo2.3-3.6, n=14, FeO/MnO=24-34); Ca-pyroxene: Fs23.8±2.3Wo39.0±1.0(Fs21.4-29.7Wo36.6-41.3, n=16, FeO/MnO=24-33); calcic plagioclase: An92.5±1.6(An90.6-95.6, n=12)

**Northwest Africa 11161** (NWA 11161)

(Northwest Africa)

Purchased: 2016

Classification: Ureilite

**History**: The meteorite was bought in 2016 from a meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Large brownish individual lacking any fusion crust.

**Petrography**: The meteorite shows a cumulate texture of blocky, up to 1.5 mm sized Cr-rich olivine and pigeonite crystals. It contains some flaky graphite; olivine displays characteristic reduced rims.

**Geochemistry**: reduced rims: Fa5.1-10.0; Cr2O3 in olivine: ~0.6wt%

**Northwest Africa 11162** (NWA 11162)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Eucrite, polymict)

**History**: The meteorite was bought in 2016 from a Moroccan meteorite dealer at a mineral fair in Munich, Germany.

**Physical characteristics**: Dark grayish individual with some patches of fusion crust.

**Petrography**: Polymict breccia with basaltic and up to 1 mm sized black melt clasts set into a clastic mineral matrix. Dominant minerals are exsolved pyroxenes and calcic plagioclase. Minor phases are silica, chromite, FeS, ilmenite and some diogenetic pyroxenes. No metallic Fe has been found.

**Geochemistry**: low-Ca pyroxene: Fs29.8±3.3Wo3.7±0.6(Fs23.7-42.1Wo2.6-4.6, n=27, FeO/MnO=25-33); Ca-pyroxene: Fs40.6±13.0Wo31.2±5.8(Fs20.3-65.4Wo25.4-40.7, n=12, FeO/MnO=24-38); calcic plagioclase: An92.1±1.9(An88.0-95.0, n=17)

**Northwest Africa 11163** (NWA 11163)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Eucrite, polymict)

**History**: The meteorite was bought in 2016 from a Moroccan meteorite dealer at a mineral fair in Munich, Germany.

**Physical characteristics**: Dark grayish individual partly covered by fusion crust.

**Petrography**: The meteorite is a polymict breccia composed of lithic and mineral clasts set into a more fine grained clastic matrix. Lithic fragments include basaltic and impact melt clasts. Mineral fragments are dominantly exsolved pyroxenes and calcic plagioclase. Minor components include diogenitic orthopyroxene, silica, chromite, ilmenite, and metallic Fe.

**Geochemistry**: low-Ca pyroxene: Fs31.3±6.1Wo3.1±0.5(Fs24.0-44.5Wo2.5-4.5, n=25, FeO/MnO=27-31); Ca-pyroxene: Fs21.3±0.5Wo38.9±0.6(Fs20.2-21.8Wo37.5-39.4, n=14, FeO/MnO=24-28); calcic plagioclase: An89.7±1.7(An86.7-93.4, n=20); olivine: Fa57.4±0.6(Fa56.5-58.6, n=20)

**Northwest Africa 11164** (NWA 11164)

(Northwest Africa)

Purchased: 2016

Classification: Carbonaceous chondrite (CV3)

**History**: The meteorite was bought in 2016 from a Moroccan meteorite dealer at a mineral fair in Munich, Germany.

**Physical characteristics**: Dark grayish individual without fusion crust. Chondrules and large CAIs are visible at the surface.

**Petrography**: Carbonaceous chondrite composed of up to 1.5 mm sized chondrules, CAIs and olivine amoeboids all set into a fine-grained almost black matrix. One CAI about 1 cm in diameter has been observed. Type II chondrules are absent.

**Northwest Africa 11165** (NWA 11165)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Eucrite, brecciated)

**History**: The meteorite was bought in 2016 from a Moroccan meteorite dealer at a mineral fair in Munich, Germany.

**Physical characteristics**: Many dark-brownish individuals without fusion crust.

**Petrography**: The meteorite is a breccia composed of basaltic and impact melt fragments set into abundant clastic matrix. Basaltic clasts and matrix are dominated by exsolved pyroxene and calcic plagioclase up to 1mm in size. Minor phases are silica, chromite, FeS, FeNi metal, and ilmenite. No metallic Fe was found. The meteorite is cut by several shock melt veins.

**Geochemistry**: low-Ca pyroxene: Fs43.2±14.6Wo2.8±0.6(Fs21.7-60.0Wo1.8-4.5, n=39, FeO/MnO=26-32); Ca-pyroxene: Fs28.6±0.5Wo41.3±0.5(Fs27.9-29.7Wo40.6-42.1, n=15, FeO/MnO=28-31); calcic plagioclase: An92.0±1.1(An90.7-93.3, n=19)

**Northwest Africa 11166** (NWA 11166)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Eucrite, brecciated)

**History**: The meteorite was bought in 2016 from a Moroccan meteorite dealer at a mineral fair in Munich, Germany.

**Physical characteristics**: Small individual partly covered by fusion crust.

**Petrography**: The meteorite is a breccia composed of fine- and coarse-grained basaltic clasts set into a clastic matrix. Exsolved pyroxene and calcic plagioclase are the most abundant minerals in all lithologies. In the clasts their grain sizes vary between about 30-400 µm. Exsolution lamellae in pyroxene are ~1 µm wide. Minor phases include silica, chromite, FeS, FeNi metal, ilmenite, and fayalite. No metallic Fe was found.

**Geochemistry**: pyroxene: Fs49.8±2.6Wo15.4±3.6(Fs44.7-53.8Wo6.9-22.9, n=26, FeO/MnO=30-34); calcic plagioclase: An86.8±2.3(An82.2-90.2, n=12)

**Northwest Africa 11167** (NWA 11167)

(Northwest Africa)

Purchased: 2014

Classification: HED achondrite (Howardite)

**History**: The meteorite was bought in 2016 from a meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Fourteen grayish fragments with some fusion crust.

**Petrography**: The meteorite is a breccia composed of abundant mineral and subordinate lithic clasts (basaltic and impact melt clasts) set into a finer grained matrix. Main minerals are exsolved pyroxene, diogenetic orthopyroxene (10-15%) and calcic plagioclase. Accessory phases include silica, chromite, FeS, FeNi-sulfides, and metallic Fe.

**Geochemistry**: pyroxene host to augite lamellae: Fs59.5±2.4Wo3.6±1.6(Fs55.7-62.2Wo2.0-6.0, n=11, FeO/MnO=29-34); Ca-pyroxene: Fs25.9±2.4Wo41.8±2.4(Fs24.1-33.9Wo33.6-43.0, n=13, FeO/MnO=29-36); diogenitic pyroxene: Fs24.1±0.4Wo2.2±0.2(Fs23.5-24.7Wo1.9-2.4, n=11, FeO/MnO=26-30); calcic plagioclase: An88.6±3.5(An83.5-94.8, n=18)

**Northwest Africa 11168** (NWA 11168)

(Northwest Africa)

Purchased: 2016

Classification: Mesosiderite

**History**: The meteorite was bought in 2016 from a meteorite dealer in Morocco.

**Physical characteristics**: Four small, brownish individuals without fusion crust totalling 321 gram.

**Petrography**: The meteorite is a breccia composed of silicate and metallic regions of highly variable portions. The metallic lithology consists of kamacite and taenite, the silica fraction is dominated by up to 0.5 µm sized low-Ca pyroxene, less abundant olivine, calcic plagioclase and minor silica and merrillite.

**Geochemistry**: olivine: Fa12.2±0.1(Fa12.0-12.4, n=11, FeO/MnO=36-45); low-Ca pyroxene: Fs27.7±1.5Wo2.6±0.9(Fs25.3-29.6Wo1.2-4.0, n=13, FeO/MnO=22-29); calcic plagioclase: An88.6±3.5(An83.5-94.8, n=18)

**Northwest Africa 11169** (NWA 11169)

(Northwest Africa)

Purchased: 2016

Classification: Carbonaceous chondrite (CK5)

**History**: The meteorite was bought in 2016 from a meteorite dealer in Morocco.

**Physical characteristics**: Small grayish individual partly covered by fusion crust.

**Petrography**: The meteorite is composed of recrystallized olivine-dominated matrix with scattered chondrules still being discernable. Cr-rich magnetite is abundant. More minor phases include intermediate plagioclase, low-Ca pyroxene, Ca-pyroxene and troilite. Metal is virtually absent.

**Geochemistry**: olivine: Fa29.8±0.3, n=12 FeO/MnO=103.1±7.0; low-Ca pyroxene:Fs24.6±0.4Wo3.8±1.1, n=5; Ca-pyroxene: Fs8.9±0.2Wo47.0±0.2, n=6

**Northwest Africa 11170** (NWA 11170)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Eucrite, brecciated)

**History**: The meteorite was bought in 2016 from a meteorite dealer in Morocco.

**Physical characteristics**: Light grayish individual lacking any fusion crust.

**Petrography**: The meteorite is a breccia composed of fine-grained basaltic clasts with mineral grains of 50-400 μm set into a less abundant clastic matrix. Dominant minerals in clasts and matrix are pyroxene with fine exsolution lamellae and calcic plagioclase. Minor phases include chromite, SiO2 polymorphs, troilite and metallic iron.

**Geochemistry**: low-Ca pyroxene: Fs60.1±0.5Wo2.5±0.5(Fs59.0-61.2Wo2.0-3.5, n=16, FeO/MnO=29-32); Ca-pyroxene: Fs27.0±0.7Wo43.0±0.6(Fs25.8-28.5Wo41.7-44.0, n=25, FeO/MnO=28-34); calcic plagioclase: An87.8±1.3(An84.9-89.7, n=19)

**Northwest Africa 11171** (NWA 11171)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Diogenite)

**History**: The meteorite was bought in 2016 from a Moroccan meteorite dealer at a mineral fair in Hamburg, Germany.

**Physical characteristics**: Small, fragile, individual without fusion crust.

**Petrography**: The meteorite displays a greyish to slightly orange interior and shows a cumulate texture of blocky up to 1.5 cm sized orthopyroxenes. Minor phases include silica, chromite and rare metallic iron. Neither plagioclase nor olivine have been found in the section studied.

**Geochemistry**: low-Ca pyroxene:Fs26.2±0.2Wo3.5±0.3, n=12, FeO/MnO=23-27

**Northwest Africa 11172** (NWA 11172)

(Northwest Africa)

Purchased: 2016

Classification: Carbonaceous chondrite (CK5)

**History**: The meteorite was bought in 2016 from a Moroccan meteorite dealer at a mineral fair in Hamburg, Germany.

**Physical characteristics**: Small greenish-gray individual lacking any fusion crust.

**Petrography**: The meteorite displays a light greenish interior and is composed of several clearly defined chondrules and rare CAIs set into abundant recrystallized matrix. Ferroan olivine is the most abundant mineral phase; more minor phases include feldspar, Ca-pyroxene and Cr-bearing magnetite. Metal was not detected.

**Geochemistry**: olivine: Fa32.7±0.1, n=12, FeO/MnO=110.3±13.2; Ca-pyroxene: Fs9.3±0.4Wo46.8±0.2, n=11

**Northwest Africa 11173** (NWA 11173)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Eucrite, brecciated)

**History**: The meteorite was bought in 2016 from a meteorite dealer in Morocco.

**Physical characteristics**: Dark grayish indidual partly covered with fusion crust.

**Petrography**: The meteorite is a breccia composed of fine- and coarse-grained basaltic clasts both dominated by exsolved pyroxene and lath shaped calcic plagioclase. Grain sizes vary from few µm in fine-grained lithologies to up to 300 μm in coarse-grained clasts. Minor phases include silica, chromite, ilmenite, and FeS. No metallic iron was found. The meteorite contains shock melt veins.

**Geochemistry**: low-Ca pyroxene: Fs65.9±0.8Wo5.4±1.0(Fs65.0-67.5Wo3.6-6.2, n=11, FeO/MnO=29-32); Ca-pyroxene: Fs40.7±3.1Wo33.7±3.7(Fs33.9-44.7Wo29.4-41.7, n=12, FeO/MnO=30-37); calcic plagioclase: An78.8±2.7(An74.4-82.9, n=13)

**Northwest Africa 11174** (NWA 11174)

(Northwest Africa)

Find: 2010

Classification: Ordinary chondrite (H5)

**History**: A small strewnfield comprising 21 complete stones was found by nomads in 2010, purportedly in eastern Morocco. The stones were acquired by a dealer in Erfoud, Morocco, and subsequently by Aerolite Meteorites Inc of Tucson, Arizona. The stones range in size from 51.4 to 1289 g, with a total combined mass of 7411.1 g.

**Physical characteristics**: All stones display brownish fusion crust, in places still black and well-preserved, and some show small, well-formed regmaglypts. Several stones were sawn in half; all display a similar pattern of small chondrules and even distribution of small metal and sulfide grains. One stone contains a 4-mm-thick vein of metal and troilite. Interior is light colored with patchy iron-oxide staining. No shock veins visible.

**Petrography**: (K. Domanik, *UAz*, L Garvie, *ASU*) Microprobe examination of a polished thin section shows a few well-delineated, equilibrated chondrules set in a matrix composed of indistinct chondrules, recrystallized chondrules, and larger (to 500 μm) kamacite and troilite grains. Recognizable chondrules include BO, PP, PO, CC, and RP. Feldspar abundant, many grains to 60 μm. Kamacite fresh showing only minor oxidation. Troilite are polycrystalline and many show a "frothy" texture, with abundant sub-micron inclusions. Kamacite is single crystal with most grains showing Neumann bands: many of these bands show distinct curvature. Less common grains with tetrataenite rims and dark-etched plessitic cores. Other minerals include chromite, Cl-apatite, merrillite, and minor taenite.

**Geochemistry**: Olivine Fa19.1±0.4, Fe/Mn=38±2, n=20, low-Ca pyroxene Fs16.5±0.4Wo1.3±0.1, Fe/Mn=23±1, n=17, Plagioclase Ab84±0.7An10.8±0.6Or5.2±0.9, n=5, Kamacite 6.87 wt% Ni±0.08, n=8.

**Classification**: Ordinary chondrite (H5), W1, S3

**Specimens**: 382 g stone at *ASU*.

**Northwest Africa 11175** (NWA 11175)

(Northwest Africa)

Purchased: 2015

Classification: Ordinary chondrite (L5)

**History**: A 34.4 g partially fusion crusted stone was acquired at the 2015 Tucson Gem and Mineral show from a Moroccan meteorite dealer.

**Physical characteristics**: Angular, sand blasted stone displaying patches of fusion crust on all sides with iron oxide stains. The sawn surface is dark and shows an even distribution of troilite grains for a total of about 5 aerial %, with most grains 50 and 100 μm. Sparse metal grains, with most being ~50 μm and rarely to 700 μm. The sawn surface is vesicular and a few of the vesicles contain euhedral crystals. A few thin shock veins traverse the sample; however, they are difficult to discern because the rock is dark colored. No recognizable chondrules present in the hand sample.

**Petrography**: (J. Barkl, L. Garvie, *ASU*) Sample largely recrystallized. Chondrules difficult to discern in the microprobe mount. Rare barred olivine chondrules to 500 μm, though difficult to recognize. Abundant feldspar with a range of sizes, with 20 to 50 μm being most common. Locally abundant chromite (typically 150 to 200 μm), typically heavily fractured. Troilite polycrystalline. The thin section is traversed by shock veins up to 90 μm wide and troilite rich. The polished mount shows weathered metal, though it is still less abundant than the troilite. Sparse rounded metal grains with Ni-rich rim and dark stained plessitic cores.

**Geochemistry**: (A. Wittmann, L. Garvie *ASU*) Olivine Fa26.1±0.7, FeO/MnO = 53.7, NiO = 0.2±0.1 wt%, n=8. Low Ca-pyroxene Fs22.5±1.4Wo1.4±0.3, FeO/MnO=31.4±1.9, n=5. One high Ca-pyroxene grain Fs10Wo45, FeO/MnO = 21.6. Plagioclase is An12.4±1.2Or6.1±0.9, n = 3. No kamacite found. Taenite composition is 31.0±9.5 at% Ni, with Co of 0.5±0.2 at% and 0.16±0.02 at% Si, n=12. The taenite shows a linear relationship (R2 = 0.8) between Ni and Co from 43.9 at% Ni and 0.22 at% Co to 14.1 at% Ni and 0.8 at% Co.

**Classification**: Ordinary Chondrite (L5, W3, S3). Petrologic grade 5 based on the size of the feldspar grains.

**Northwest Africa 11176** (NWA 11176)

(Northwest Africa)

Purchased: 2015

Classification: Ordinary chondrite (LL5)

**History**: A 114.6 g meteorite was acquired from a Moroccan meteorite dealer at the 2015 Tucson Gem and Mineral show.

**Physical characteristics**: Angular stone, one side shows well-developed fusion crust. The sawn surface is light colored with patches of iron-oxide staining. Even distribution of metal grains approximately 0.5-mm in size, troilite grains most approximately 1 mm in size, with some to 3 mm, and well developed chondrules, with average diamieter of 1.16 mm based on measurements of 32 chondrules. Metal and troilite are sparse at approximately one aerial percent of the sample.

**Petrography**: (J. Barkl, L. Garvie *ASU*) Range of chondrule types visible in the thin section, including radial olivine, RP, BO, PO, and CC; several in the 3 to 4 mm size range. Matrix fine-grained and recrystallized with abundant feldspar to 50 μm. Accessory angular and fractured chromite to 150 μm. Rare tetrataenite grain to 150 μm. Troilite typically polycrystalline and occasionally twined. Kamacite frequently rimmed by tetrataenite showing weakly developed Newman bands. Kamacite shows only minor weathering.

**Geochemistry**: (A. Wittmann, J. Barkl, L. Garvie *ASU*) Olivine Fa30.1±0.8, FeO/MnO = 61.6±7.8, n=10; Low Ca-pyroxene Fs25.2±1.7Wo1.8±0.1, FeO/MnO=37.4±6.9, n=4. Plagioclase An12.6±0.6Or5.9±1.1, n = 3. Two kamacite analyses: Ni 4.8 at%, Co 3.3 at%; and, Ni 3.8 at%, Co 3.6 at%. Taenite, Ni 35.8±2.6 at%, Co 1.7 at%, n=10.

**Classification**: Ordinary chondrite (LL5), S3, W2.

**Northwest Africa 11177** (NWA 11177)

(Northwest Africa)

Purchased: 2016

Classification: Ordinary chondrite (H6)

**History**: Purchased from Moroccan dealer in Denver.

**Physical characteristics**: Single stone with weathered fusion crust, some patches of reddish-orange oxidation present. A saw cut shows abundant metal/sulfide grains set in a dark-colored matrix.

**Petrography**: (C. Agee, *UNM*) This meteorite consists primarily of faint, equilibrated chondrules and recrystallized olivines and pyroxenes. Plagioclase grains up to 150 μm were observed.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) Olivine Fa19.1±0.1, Fe/Mn=38±3, n=7; low-Ca pyroxene Fs16.8±0.1Wo1.6±0.1, Fe/Mn=22±1, n=7.

**Classification**: Ordinary chondrite (H6)

**Specimens**: 20 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

**Northwest Africa 11178** (NWA 11178)

Morocco

Purchased: 31 Mar 2014

Classification: Ordinary chondrite (L4)

**History**: the meteorite was purchased in Germany by Mt. S. V. Petukhov on 31 Mar 2014, from Alexander Müller in the Mineral Shope in Dietingen

**Classification**: ordinary chondrite L4, S1, W2

**Specimens**: 3 sections (26,887 g, 46,47 g, 28,12 g) of 101.5 g in total and a thin section are located at *Vernad*; the main mass is located at the Museum of the History of the Univers (Dedovsk, Moscow region, Russia)

**Northwest Africa 11179** (NWA 11179)

Morocco

Purchased: 2015

Classification: Carbonaceous chondrite (CM2)

**History**: the meteorite was purchased in the Tucson Mineral Show, January 2015 from a Moroccan meteorite dealer

**Physical characteristics**: 25 samples of meteorite and their fragments weighing 337.6 g. The samples have dark-brown fusion crust, a surface of section has a gray-greenish color.

**Petrography**: (M. A. Ivanova, *Vernad*): The meteorite consists of the altered matrix, POP, rare BO chondrules and their fragments, olivine aggregates with a fine-grained matrix rim around, and refractory inclusions. Main minerals are olivine and pyroxene; minor minerals are very rare sulfides, Fe,Ni-metal and chromite. The phyllosilicate matrix contains isolated grains of olivine and pyroxene. The meteorite is weathered, only rare kamacite, taenite and sulfide were preserved.

**Geochemistry**: Mineral compositions and geochemistry (EMPA, *Vernad*): Olivine: Fa0.3-68.4, CaO 0.28 wt.%, Cr2O3 0.31 wt.% (n=45). Orthopyroxene Fs0.8-3.9Wo0.2-3.8(n=18), augite Fs0.8-2.8Wo31.3-46.6(n=7), pigeonite Fs14.3Wo20.2, and diopside Fs1.3Wo57.9.Oxygen isotopes (Laser fluorination, *OU*): δ17O 0.721, δ18O 7.901, Δ17O -3.388; δ17O 0.585, δ18O 7.796, Δ17O -3.469 per mil.

**Classification**: carbonaceous chondrite, CM2

**Specimens**: 15 samples with their fragments of the meteorite (4.7+5.4+4.6+2.3+0.3+0.07+ 1.9+0.3+0.06+0.9+0.1+ 1.2+3.3+0.5+0.8+4+0.7+2.2+ 2.6+0.4+1.44+1.03+1.65+0.281 g) of 40.7 g in total and a polished section are located at *Vernad*, the main mass with anonymous owner.

**Northwest Africa 11180** (NWA 11180)

Morocco

Purchased: 2015

Classification: Carbonaceous chondrite (CM2)

**History**: the meteorite was purchased at the Tucson Mineral Show, January 2015, from a Moroccan meteorite dealer

**Physical characteristics**: 5 samples of meteorite and their fragments weighing 37.45 g. The samples have dark-brown fusion crust.

**Petrography**: (M. A. Ivanova, *Vernad*): The meteorite consists of the olivine aggregates, POP and BO chondrules and their fragments, with a fine-grained matrix rim of isolated grains of olivine and pyroxene, and refractory inclusions. These objects are embedded in the phyllosilicate matrix. Main minerals are olivine and pyroxene; minor minerals are spinel, sulfides, Fe,Ni-metal, chromite, and tochilinite.

**Geochemistry**: Mineral compositions and geochemistry (EMPA, *Vernad*): Olivine (n=66): Fa0.37-69.4, CaO 0.27 wt.%, Cr2O3 0.37 wt.%. Orthopyroxene Fs0.8-3.9Wo0.2-3.8, pigeonite Fs1.0Wo17.7, augite Fs0.8-14Wo31.3-46.6, and diopside Fs1.3Wo57.9.

**Classification**: carbonaceous chondrite, CM2

**Specimens**: 4 samples with their fragments (2.6+0.48+0.07+2.6+0.5+0.7+1.4 g) of 8.35 g in total and a polished section are located at *Vernad*, the main mass with anonymous owner.

**Northwest Africa 11181** (NWA 11181)

Algeria

Find: 2015

Classification: Iron meteorite (IAB, ungrouped)

**History**: Discovered in the Algerian Sahara.

**Physical characteristics**: One iron piece of about 5 × 3 × 2.5 cm and 190 g.

**Petrography**: The meteorite shows a fine Widmanstätten pattern dominantly with bandwidth of 0.5-1 mm and width-length ratio of 0.2 with Neumann lines, plus some areas of granular kamacite up to 3 mm. Schreibersite occurs on kamacite boundaries.

**Geochemistry**: Mineral compositions and geochemistry ((M. Humayun, *FSU*, by LA-ICP-MS): The composition of the metal is Co = 0.48, Ni = 10.68 (both in wt.%); Cu = 507, Ga = 73, Ga = 207, Ge = 207, As = 12, Sb = 043, Ir = 1.56, Au = 1.52 (all in ppm); standards were [Odessa](https://www.lpi.usra.edu/meteor/metbull.php?code=17985), [Toluca](https://www.lpi.usra.edu/meteor/metbull.php?code=24018), [Staunton](https://www.lpi.usra.edu/meteor/metbull.php?code=23716), [Dungannon](https://www.lpi.usra.edu/meteor/metbull.php?code=7747).

**Classification**: (R. Bartoschewitz, *Bart*): Iron (IAB complex, ungrouped, fine octahedrite).

**Specimens**: 24.0 g on deposit at *Kiel*, main mass of 126.1 g with Alan Mazur and 28.6 g with *Bart*.

**Northwest Africa 11182** (NWA 11182)

(Northwest Africa)

Purchased: 2017

Classification: Lunar (feldsp. breccia)

**History**: Purchased by Ruben Garcia from Said Haddany in Tucson, 2017.

**Physical characteristics**: Single stone, no fusion crust. A saw cut reveals a fragmental breccia with numerous white feldspathic clasts and fine-grained lithic fragments, set in a dark-gray ground mass.

**Petrography**: (C. Agee, *UNM*) This meteorite consists of primarily feldspathic clasts, microgabbro clasts, and shock melt, some containing vesicles.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) pigeonite Fs28.9±1.6Wo11.8±7.0, Fe/Mn=56±3, n=2; high Ca pyroxene Fs22.7±11.7Wo28.6±5.9, Fe/Mn=52±2, n=2; two olivine grains were found: Fa16.9and Fa34.6with Fe/Mn=91 and 98 respectively; plagioclase An92.9±3.2Ab6.8±3.2Or0.3±0.1, n=4

**Classification**: Lunar feldspathic breccia

**Specimens**: 12 g plus a probe mount on deposit at *UNM*, Ruben Garcia holds the main mass.

**Northwest Africa 11183** (NWA 11183)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Eucrite, monomict)

**History**: Purchased by Dustin Dickens in 2016 from a Moroccan dealer.

**Physical characteristics**: Single stone, partial fusion crust. A saw cut reveals a fragmental breccia with clasts up to 3 mm, set in a blue-gray groundmass.

**Petrography**: (C. Agee, *UNM*) This meteorite consists of approximately 70% pyroxene and 20% plagioclase, there are fragmental pyroxene grains throughout. Accessory chromite, troilite, silica, clinopyroxene and Fe-metal were observed.

**Geochemistry**: (C. Agee and M. Spilde, *UNM*) Low Ca pyroxene Fs39.2±2.0Wo2.9±0.9, Fe/Mn=33±2, n=11; plagioclase An88.9±1.3, n=5.

**Classification**: Monomict cumulate eucrite

**Specimens**: 20.5 g including a probe mount on deposit at *UNM*, Dustin Dickens holds the main mass.

**Northwest Africa 11184** (NWA 11184)

(Northwest Africa)

Purchased: 2015

Classification: HED achondrite (Howardite)

**History**: Purchased by Larry Atkins from Morocco in December 2015.

**Physical characteristics**: Single stone, no fusion crust. A saw cut reveals a breccia with green, white, and dark-gray clasts.

**Petrography**: (C. Agee, *UNM*) This meteorite is a polymict breccia consisting of ~75% diogenitic material and ~25% eucritic material, mostly in the form of cumulate eucrite clasts 500-1500 μm. Accessory kamacite, chromite and ilmenite are present.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) diogenite olivine Fa38.7±4.0, Fe/Mn=52±1, n=3; diogenite low Ca pyroxene Fs22.2±1.3Wo1.9±0.7, Fe/Mn=30±0, n=3; eucrite pigeonite Fs52.6±5.7Wo11.1±8.2, Fe/Mn=30±2, n=4; plagioclase An89.0±0.6Ab10.5±0.6Or0.5±0.1, n=4.

**Classification**: Howardite

**Specimens**: 16.8 g including a probe mount on deposit at *UNM*, Larry Atkins holds the main mass.

**Northwest Africa 11185** (NWA 11185)

(Northwest Africa)

Purchased: 2016 Jun

Classification: Lunar meteorite (feldspathic breccia)

**History**: Purchased by Ben Hoefnagels in June 2016 from a dealer in Taliouine, Morocco.

**Physical characteristics**: Four stones (total weight 94.02 g) of very similar appearance purchased together from the same dealer exhibit the same types of white clasts in a dark-gray matrix.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of angular mineral grains of anorthite, olivine, pigeonite, exsolved pigeonite, subcalcic augite, augite, Ti-Al-chromite, ilmenite and fayalite in a finer grained matrix containing low-Ni kamacite, taenite, troilite, baddeleyite and Mg-ilmenite. A quench-textured melt rock clast was also observed.

**Geochemistry**: Olivine (Fa34.1, FeO/MnO = 107; Fa91.2, FeO/MnO = 82; N = 2), pigeonite (Fs22.4-28.6Wo15.0-8.1, FeO/MnO = 64-68, N = 2), subcalcic augite (Fs20.7Wo30.7, FeO/MnO = 58), augite (Fs50.2Wo37.5, FeO/MnO = 65), plagioclase (An93.5Or0.4; An85.5Or1.2; N = 2). Bulk composition (R. Korotev, *WUSL*): INAA of subsamples of two stones gave INAA of subsamples gave the following mean abundances (in wt.%) FeO 10.0, Na2O 0.43; (in ppm) Sc 18.9, Ni 300, La 8.3, Sm 3.86, Eu 0.98, Yb 2.64, Lu 0.37, Hf 2.8, Th 1.2.

**Classification**: Lunar (feldspathic breccia).

**Specimens**: 19.1 g including a 10.3 g polished endcut from one stone at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11186** (NWA 11186)

(Northwest Africa)

Purchased: 2016 May

Classification: Ordinary chondrite (H4)

**History**: Purchased by Roger Jones in May 2016 from a dealer in Talsint, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Well-formed, relatively small chondrules are set in a fairly coarse grained matrix containing altered metal.

**Geochemistry**: Olivine (Fa20.4-20.8, N = 3), orthopyroxene (Fs17.7-18.0Wo3.8-1.2, N = 3), clinopyroxene (Fs6.5-6.8Wo45.7-44.8, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.78.

**Classification**: Ordinary chondrite (H4).

**Specimens**: 21.69 g plus one polished thin section at *UWB*; remainder with Mr. R. Jones.

**Northwest Africa 11187** (NWA 11187)

(Northwest Africa)

Purchased: 2016 Oct

Classification: Ungrouped achondrite

**History**: Purchased by John Higgins in October 2016 from a dealer in Nouakchott, Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Relatively coarse grained with poikilitic texture. Large (up to 6 mm) oikocrysts of exsolved magnesian pigeonite (consisting of low-Ca pyroxene host and crystallographically-irrational diopside exsolution lamellae) enclose smaller (up to 1.3 mm) chadacrysts of Cr-poor forsteritic olivine (which exhibit narrow, more magnesian rims). Accessory phases are bladed graphite and kamacite.

**Geochemistry**: Forsterite (Fa5.4-5.6, FeO/MnO = 11-14, Cr2O3 = 0.4 wt.%; rim Fa2.0, FeO/MnO = 5, Cr2O3 = 0.3 wt.%; N = 4), low-Ca pyroxene host (Fs4.8-4.9Wo4.9-4.8, FeO/MnO = 7-8, N = 2), diopside exsolution blebs and stringers (Fs2.9-3.0Wo36.7-36.8, FeO/MnO = 6, N = 2). Oxygen isotopes (K. Ziegler, *UNM*): analyses of acid-washed subsamples by laser fluorination gave, respectively, δ17O 1.450, 1.544, 1.581; δ18O 6.003, 6.198, 6.318; Δ17O -1.720, -1.729, -1.755 per mil.

**Classification**: Ungrouped achondrite. Although oxygen isotope values plot near the trend for ureilites, they also plot near (but below) the wide field of values for acapulcoites and lodranites. In contrast with ureilites, the olivine in this specimen is not Cr-rich, and although there are slightly more magnesian rims they are not accompanied by fine grained Fe metal blebs. Additionally the presence of Ni-bearing metal (kamacite), exsolved pigeonite and forsteritic olivine are not characteristic of ureilites, nor is the poikilitic texture.

**Specimens**: 7.4 g including one polished thin section at *UWB*; remainder with Mr. J. Higgins.

**Northwest Africa 11188** (NWA 11188)

(Northwest Africa)

Purchased: 2016 Sep

Classification: Ordinary chondrite (LL3)

**History**: Purchased by Fred Olsen in September 2016 from a Moroccan dealer at the Denver Show.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Closely-packed, well-formed chondrules (apparent diameter 500±400 µm) are set in a sparse, fine grained matrix containing iron hydroxides (after primary metal), troilite, calcite and rare anorthite. Both sodic plagioclase and glass are present as interstitial components of chondrules.

**Geochemistry**: Olivine (Fa0.5-48.7, Cr2O3 in ferroan examples 0.08-0.10 wt.%, N = 5), orthopyroxene (Fs4.4-39.4Wo0.3-3.0, N = 3), pigeonite (Fs19.8Wo16.0), augite (Fs6.2Wo46.6). Magnetic susceptibility log χ (× 10-9 m3/kg) = 3.31.

**Classification**: Ordinary chondrite (LL3).

**Specimens**: 11.67 g including one polished thin section at *UWB*; remainder with *Olsen*.

**Northwest Africa 11189** (NWA 11189)

(Northwest Africa)

Purchased: 2016 Nov

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased by John Higgins in November 2016 from a dealer in Laayoune, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Granular chondrules (apparent diameter 600±200 µm) and irregularly-shaped, fine grained CAI are set in a fine grained matrix (~40 vol.%, deep brown in thin section).

**Geochemistry**: Olivine (Fa0.6-44.0, N = 3), orthopyroxene (Fs0.5-2.4Wo0.9-1.0, N = 2), augite (Fs14.2Wo40.7), Al-Ti-diopside (Fs2.1Wo39.0, TiO2 = 8.0 wt.%, Al2O3 = 6.3 wt.%), ferroaugite (Fs48.3Wo50.1, TiO2 and Al2O3 < 0.05 wt.%).

**Classification**: Carbonaceous chondrite (CV3).

**Specimens**: 14.65 g including one polished thin section at *UWB*; remainder with Mr. J. Higgins.

**Northwest Africa 11190** (NWA 11190)

(Northwest Africa)

Purchased: 2017 Jan

Classification: Ordinary chondrite (L4)

**History**: Purchased by Adam *Aaronson* in Temara, Morocco, in January 2017.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Well-formed chondrules (apparent diameter 450±200 μm, one 3.8 mm) are set in a fairly coarse grained matrix containing stained metal.

**Geochemistry**: Olivine (Fa25.2-25.8, N = 6; Fa21.2, N = 1), orthopyroxene (Fs5.6Wo0.2), pigeonite (Fs11.7Wo19.7; Fs18.6Wo7.0; N = 2), augite (Fs3.4Wo43.3).

**Classification**: Ordinary chondrite (L4).

**Specimens**: 21 g including one polished thin section at *UWB*; remainder with *Aaronson*.

**Northwest Africa 11191** (NWA 11191)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Eucrite, brecciated)

**History**: Purchased by Dustin Dickens in 2016 from Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Gabbroic eucrite clasts and related debris are set in a very fine grained, partly vitric and vesicular quenched matrix. The major minerals are pigeonite (pale orange in thin section; some exsolved and some unexsolved) and polycrystallline calcic plagioclase, together with accessory silica polymorph, ilmenite, Ti-chromite, Cr-rich chromite, zircon, troilite and barite.

**Geochemistry**: Orthopyroxene host (Fs59.1-62.3Wo4.1-2.2, FeO/MnO = 32-33, N = 2), clinopyroxene exsolution lamellae (Fs27.0-27.9Wo43.3-42.5, FeO/MnO = 32-35, N = 2), plagioclase (An89.9-90.7Or1.4-0.4, N = 2).

**Classification**: Eucrite breccia (gabbroic, shock melted).

**Specimens**: 21 g including one polished thin section at *UWB*; remainder with Mr. D. Dickens.

**Northwest Africa 11192** (NWA 11192)

(Northwest Africa)

Purchased: 2017 Jan

Classification: Ordinary chondrite (L5/6)

**History**: Purchased by Adam *Aaronson* in Temara, Morocco in January 2017.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Sparse chondrules are present in a recrystallized matrix containing accessory merrillite and chlorapatite. Grain boundaries are stained orange by terrestrial iron hydroxides.

**Geochemistry**: Olivine (Fa24.4-24.5, N = 3), orthopyroxene (Fs20.3-20.4Wo1.3-1.6, N = 3), clinopyroxene (Fs7.7-12.7Wo44.0-42.1, N = 2).

**Classification**: Ordinary chondrite (L5/6).

**Specimens**: 24.89 g including one polished thin section at *UWB*; remainder with *Aaronson*.

**Northwest Africa 11193** (NWA 11193)

(Northwest Africa)

Purchased: 2016 Jun

Classification: Lunar meteorite (feldspathic breccia)

**History**: Purchased by Ben Hoefnagels in June 2016 from a dealer in Taliouine, Morocco.

**Physical characteristics**: A single stone (155 g) composed of angular white and light-gray clasts in a fine-grained gray matrix containing visible small grains of metal.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of angular mineral grains of anorthite, olivine, orthopyroxene, zoned pigeonite, subcalcic augite, ferropigeonite, chromite, Ti-chromite, ilmenite and fayalite in a finer grained matrix containing kamacite, troilite, baddeleyite, Zr-Ca-Cr-bearing titanate and calcite.

**Geochemistry**: Olivine (Fa26.7-47.5, FeO/MnO = 94-98, N = 3), orthopyroxene (Fs21.5Wo4.5, FeO/MnO = 84), pigeonite (core Fs35.7Wo11.4; rim Fs47.2Wo13.4; FeO/MnO = 61-70), ferropigeonite (Fs69.6-69.9Wo21.6-24.6, FeO/MnO = 71-77, N = 2), subcalcic augite (Fs15.4Wo33.4, FeO/MnO = 65), plagioclase (An95.3-97.1Or0.6-0.2, N = 2). Bulk composition (R. Korotev, *WUSL*): INAA of subsamples gave the following mean abundances (in wt.%) FeO 7.7, Na2O 0.44; (in ppm) Sc 17.1, Ni 340, La 6.2, Sm 2.47, Eu 0.77, Yb 1.97, Lu 0.28, Hf 2.0, Th 1.4.

**Classification**: Lunar (feldspathic breccia).

**Specimens**: 20.3 g including a polished endcut at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11194** (NWA 11194)

(Northwest Africa)

Purchased: 2016 Nov

Classification: Carbonaceous chondrite (CO3)

**History**: Purchased by John Higgins in November 2016 from a dealer in Laayoune, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Relatively small chondrules (apparent diameter 200±100 μm), sparse CAI and angular mineral fragments are set in a fine grained matrix (~25 vol.%, deep brown in thin section).

**Geochemistry**: Olivine (Fa0.3-72.2, Cr2O3 in ferroan examples 0.26-0.46 wt.%, N = 7), orthopyroxene (Fs1.3-6.0Wo0.9-2.4, N = 3), augite (Fs7.2Wo36.7), Al-Ti-diopside (Fs0.3Wo47.8, TiO2 = 1.0 wt.%, Al2O3 = 4.1 wt.%).

**Classification**: Carbonaceous chondrite (CO3).

**Specimens**: 22.1 g including one polished thin section at *UWB*; remainder with Mr. J. Higgins.

**Northwest Africa 11195** (NWA 11195)

(Northwest Africa)

Purchased: 2015

Classification: Iron meteorite (IAB-MG)

**Petrography**: Bandwidth is ~1.8 mm, corresponding to a coarse octahedrite. Very little taenite, present at some, not all, kamacite-kamacite boundaries and in uncommon plessite fields; no troilite is visible. There are a few small (~3 × ~1 mm) hieroglyphic schreibersites and many tiny rhabdites. Sample has a thin (0.3-0.5 mm) weathering rind. It seems to show a reheated zone with splotchy dark areas extending in ~2 mm from weathering rind. This zone may reflect reheating after the fall.

**Geochemistry**: Composition: Co, 4.52 mg/g; Ni, 70.1 mg/g; Ga, 89.9 μg/g; Ge, 435.0; As, 11.6 μg/g; W, 1.26 μg/g; Ir 2.62 μg/g; Au, 1.474 μg/g. The meteorite is compositionally a member of IAB-MG. Its composition is relatively close to that of the [NWA 854](https://www.lpi.usra.edu/meteor/metbull.php?code=17879)shower. The Ir in this meteorite is 2.62 μg/g, that in NWA 854 is 2.10 (based on three different specimens). Such a large range is seen in [Canyon Diablo](https://www.lpi.usra.edu/meteor/metbull.php?code=5257) and [Campo del Cielo](https://www.lpi.usra.edu/meteor/metbull.php?code=5247), but it may be an independent fall.

**Classification**: The meteorite is a IAB-MG based on composition and structure.

**Northwest Africa 11196** (NWA 11196)

(Northwest Africa)

Purchased: 2015

Classification: Iron meteorite (IAB-sLL)

**Petrography**: Sample has a high (25 vol%) FeS content. The troilite has squiggly shape with typical maximum dimensions in outcrop between 4 and 11 mm. Etching reveals well-defined kamacite, taenite and plessite but, in the section investigated, the metallic areas are too small (impinged by FeS) to define an octahedral structure. A rough estimate is that the kamacite bandwidth is in the range 0.5 to 0.8 mm.

**Geochemistry**: Chemical composition: Co, 4.72 mg/g; Ni, 84.6 mg/g; Cr 1380 μg/g, Ga, 57.8 μg/g; Ge, 283; As, 15.6 μg/g; W, 0.52 μg/g; Ir, 0.176 μg/g; Au, 1.538 μg/g.

**Classification**: The iron is compositionally a member of IAB-sLL-US. It has one near relative, [GRO 06050](https://www.lpi.usra.edu/meteor/metbull.php?code=46087); their elemental concentrations are mostly the same within experimental error; Ir in the NWA specimen ia about 14% higher, outside analytical error but within sampling error range for AB showers. GRO 06050 has abundant silicates and minor troilite, this new iron has abundant troilite and rare silicates. Both irons have >1000 μg/g Cr, much higher than those in other IAB-sLL-US members ([Wasson and Kallemeyn, 2002](http://www.sciencedirect.com/science/article/pii/S0016703702008487); [Wasson, 2011](http://www.sciencedirect.com/science/article/pii/S0016703710006915)).

**Northwest Africa 11197** (NWA 11197)

(Northwest Africa)

Purchased: 2016

Classification: Primitive achondrite (Lodranite)

**History**: Two stones weighing 186 and 1424 g were found in Morocco and subsequently purchased in 2015. J. Donald Cline and John Sinclair acquired the samples from a meteorite prospector at the Tucson Gem and Mineral Show in February 2016.

**Physical characteristics**: Sample has an irregular, weakly conical shape. Orange caliche covers 75% of the stone, which may have originally been buried. In small areas, a dark-colored relict fusion crust is visible underneath the caliche. The other side of the stone is crystalline and composed of dark gray and green interlocking crystals.

**Petrography**: Description and classification (A. Love, *App*): Sample is a protogranular breccia of up to 4 cm long clasts and related debris composed of 1.5-3.5 mm, finely exsolved Ca-pyroxene and olivine. Accessory minerals are: FeNi metal, chromite and troilite. Olivine occurs as grains and melt inclusions within cpx. Some areas of the sample contain symplectic intergrowths olivine and chromite.

**Geochemistry**: (A.Love, *App*) Fa11.6±0.2, Fe/Mn=46.0 N=8; Ca pyroxene Fs4.7±0.2Wo44.0±1.7, N=10.

**Classification**: Primitive achondrite (lodranite). Texture, grain size and mineral compositions indicate sample is a lodranite breccia.

**Specimens**: *PARI* holds the 155.48 g and 1424 g masses. A 20.87 g type specimen composed of 2 slices, several small fragments and one polished thin section are on deposit at *App*.

**Northwest Africa 11199** (NWA 11199)

Algeria

Purchased: June 2016

Classification: Iron meteorite (IIIAB)

**History**: A single specimen weighing 1069 g, reported found near Tamanghasset, Algeria.

**Physical characteristics**: The main mass has a dark brown exterior and is irregular in shape, with a single, spherical depression approximate 10 cm across.

**Petrography**: (C. Herd, *UAb*) Polished and etched surfaces show a regular Widmanstätten pattern with an average bandwith of 1.0±0.2 mm (n=18), consistent with a medium octahedrite. Areas of plessite are visible. Few sulfide or phosphide inclusions were observed; however, only a relatively small cut surface was examined.

**Geochemistry**: ICP-MS data, using sample of [North Chile](https://www.lpi.usra.edu/meteor/metbull.php?code=17001) (Filomena) as standard (C. Herd and G. Chen *UAb*): Ni = 10.4, Co = 0.52 (both wt%); Cu = 129, Ga = 19, As = 14.2, Ru = 1.5, W = 0.25, Ir = 0.04, Pd = 3.7, Pt = 2.2, Au = 1.4 (all μg/g).

**Classification**: IIIAB, medium octahedrite.

**Specimens**: Type specimen consisting of a 27.9 g representative end piece at *UAb*. Main mass with *Kuntz*.

**Northwest Africa 11200** (NWA 11200)

Morocco

Purchased: December 2015

Classification: Iron meteorite (IIAB)

**History**: Originally purchased by Mirko Graul in 2011 or 2012 from a Moroccan dealer.

**Physical characteristics**: The fist-sized main mass is approximately equant, with a dark brown to light red-brown exterior.

**Petrography**: (C. Herd, *UAb*) Polished and etched surfaces reveal large (>2 cm) kamacite crystals, portions of which are cloudy; Neumann lines are evident on reflective surfaces. Schreibersite inclusions up to 1 cm in diameter are present. Terrestrial oxidation extends along some fractures, but is relatively low.

**Geochemistry**: ICP-MS data, using sample of [North Chile](https://www.lpi.usra.edu/meteor/metbull.php?code=17001) (Filomena) as standard (C. Herd and G. Chen *UAb*): Ni = 6.5, Co = 0.46 (both wt%); Cu = 135, Ga = 67, Ge = 223, Ru = 4.1, W = 0.71, Ir < 0.015, Pd = 2.3, Pt = 4.3, Au = 1.0 (all μg/g).

**Classification**: IIAB, hexahedrite.

**Specimens**: Type specimen consisting of a 13.9 g slice and a 30.3 g end piece at *UAb*. Main mass with A. Koppelt.

**Northwest Africa 11201** (NWA 11201)

(Northwest Africa)

Purchased: Mar 2016

Classification: Ordinary chondrite (LL4)

**History**: Purchased by Brahim Tahiri in Morocco and sent to his partner Sean Tutorow for analysis.

**Physical characteristics**: Weathered fusion-crusted exterior. Saw cuts reveals light ground mass with chondrules and fine-grained metal/sulfide grains.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows a brecciated texture with scattered porphyritic chondrules, some with mesostasis.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) Olivine Fa28.1±0.9, Fe/Mn=55±3, n=6; low-Ca pyroxene Fs18.5±6.0Wo1.9±1.3, Fe/Mn=38±18, n=6.

**Classification**: Ordinary chondrite (LL4)

**Specimens**: 24.56 g including a probe mount on deposit at *UNM*, Sean Tutorow holds the main mass.

**Northwest Africa 11202** (NWA 11202)

(Northwest Africa)

Purchased: Mar 2016

Classification: Ureilite

**History**: Purchased by Brahim Tahiri in Morocco and sent to his partner Sean Tutorow for analysis.

**Physical characteristics**: Weathered, dark-colored exterior; saw cut reveals dark gray mosaic of silicate grains, most in the size range ~0.5 mm.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows a texturally equilibrated mix of polygonal olivine and pyroxene grains bounded by metal and oxidized metal veinlets. Ubiquitous, lens shaped graphite grains were observed. Olivines did not have dramatic reduction rims.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) Olivine Fa15.0±0.9, Fe/Mn=55±3, Cr2O3=0.51±0.03 (wt%), n=7; pigeonite, Fs14.1±1.7Wo4.7±0.1, Fe/Mn=20±4, n=3; augite, Fs9.4±3.8Wo37.0±1.4, Fe/Mn=17±8, n=7.

**Classification**: Augite bearing ureilite

**Specimens**: 20.1 g including a probe mount on deposit at *UNM*, Sean Tutorow holds the main mass.

**Northwest Africa 11203** (NWA 11203)

(Northwest Africa)

Purchased: March 2016

Classification: Carbonaceous chondrite (CK6)

**History**: Purchased by Brahim Tahiri in Morocco and sent to his partner Sean Tutorow for analysis.

**Physical characteristics**: Weathered exterior with some chondrule outlines. Saw cut reveals chondrules, a few small CAIs or white feldspars set in gray groundmass.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows a few equilibrated chondrules, significant recrystallized matrix, feldspars up to 200 μm, abundant magnetite, and scattered Fe-Ni sulfides.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) Olivine Fa31.3±0.2, Fe/Mn=109±8, NiO=0.49±0.06 (wt%), n=6; low-Ca pyroxene Fs29.3±3.3Wo1.5±1.4, Fe/Mn=80±18, n=3; high-Ca pyroxene Fs15.5±6.0Wo32.9±15.7, Fe/Mn=66±9, n=4; plagioclase Ab68.1±7.5, n=3.

**Classification**: Carbonaceous chondrite (CK6). CK based on olivine Fa-content, Fe/Mn, and high Ni content, also presence of abundant magnetite. Type 6 based on low sigma for Fa, large plagioclase grain size, abundant recrystallized matrix and sparse chondrules all of which were texturally equilibrated.

**Specimens**: 22.33 g including a probe mount on deposit at *UNM*, Sean Tutorow holds the main mass.

**Northwest Africa 11204** (NWA 11204)

(Northwest Africa)

Purchased: March 2016

Classification: Ordinary chondrite (LL4)

**History**: Purchased by Brahim Tahiri in Morocco and sent to his partner Sean Tutorow for analysis.

**Physical characteristics**: Weathered, dark colored exterior; saw cut reveals dark-brown groundmass with scattered chondrules of variable size.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows a few well-formed chondrules, some porphyritic and also chondrule fragments. Many iron oxide weathering veins observed throughout.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) Olivine Fa27.8±4.2, Fe/Mn=53±14, n=6; low-Ca pyroxene Fs22.7±1.5Wo1.9±0.5, Fe/Mn=33±3, n=7.

**Classification**: Ordinary chondrite LL4

**Specimens**: 20.81 g including a probe mount on deposit at *UNM*, Sean Tutorow holds the main mass.

**Northwest Africa 11205** (NWA 11205)

(Northwest Africa)

Purchased: March 2016

Classification: Ordinary chondrite (L5)

**History**: Purchased by Brahim Tahiri in Morocco and sent to his partner Sean Tutorow for analysis.

**Physical characteristics**: Weathered exterior; saw cut reveal numerous chondrules and fine metal/sulfide grains set in a dark colored matrix.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows equilibrated chondrules and some recrystallized matrix.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) Olivine, Fa25.1±0.2, Fe/Mn=47±2, n=5; low-Ca pyroxene, Fs22.0±1.8Wo1.6±0.4, Fe/Mn=29±3, n=7.

**Classification**: Ordinary chondrite (L5)

**Specimens**: 95.72 g including a probe mount on deposit at *UNM*, Sean Tutorow holds the main mass.

**Northwest Africa 11206** (NWA 11206)

(Northwest Africa)

Purchased: March 2016

Classification: Ordinary chondrite (L5)

**History**: Purchased by Brahim Tahiri in Morocco and sent to his partner Sean Tutorow for analysis.

**Physical characteristics**: Weathered exterior; saw cut reveal numerous chondrules and fine metal/sulfide grains set in a dark-reddish colored matrix.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows equilibrated chondrules and some recrystallized matrix.

**Geochemistry**: C. Agee and B. Ha, *UNM*) Olivine Fa25.5±0.5, Fe/Mn=50±3, n=7; low-Ca pyroxeneÊFs22.6±1.6Wo1.6±0.3, Fe/Mn=31±3, n=7.

**Classification**: Ordinary chondrite (L5)

**Specimens**: 58.03 g including a probe mount on deposit at *UNM*, Sean Tutorow holds the main mass.

**Northwest Africa 11207** (NWA 11207)

Western Sahara

Purchased: 2016 May 25

Classification: CK5-an

**History**: Purchased from Abdeltif Mechaguen

**Physical characteristics**: A dark irregular stone. Cut surface reveals dark interior with mm-sized chondrules.

**Petrography**: Chondritic texture with abundant recrystallized matrix and mm-sized chondrules. Plagioclase average size in the matrix is below 50 μm. Magnetite is the dominant opaque mineral in the matrix and as large euhedral grains up to 100 μm in the chondrules. Sulfide is present as small grains.

**Geochemistry**: Olivine Fa24.9±0.3, NiO 0.43±0.07 wt% (N=6), orthopyroxene Fs23.6Wo0.7(N=1), plagioclase An24.0Ab72.5Or3.6(N=2). Magnetite has Cr2O3 2.7±0.3 wt%, Al2O3 1.1±0.6 wt%, NiO 0.17±0.10 wt% (N=3). Magnetic susceptibility log χ (× 10-9m3/kg) = 4.81.

**Classification**: CK5-an. Anomalous designation from the unusually Fe-poor olivine. Out of 230 equilibrated CK chondrites with available olivine analyses (data from Meteoritical Bulletin Database as of March 2017), only three have similar or lower Fa content: [GRA 98102](https://www.lpi.usra.edu/meteor/metbull.php?code=11094) (CK4, Fa24), [NWA 7615](https://www.lpi.usra.edu/meteor/metbull.php?code=56646) (CK6, 24.7±0.4), [NWA 5580](https://www.lpi.usra.edu/meteor/metbull.php?code=49279) (CK4-an, Fa25.2).

**Specimens**: Type specimen and polished sections at *CEREGE*. Main mass with Pierre-Marie Pelé.

**Northwest Africa 11208** (NWA 11208)

Western Sahara

Purchased: 2016 May 25

Classification: Carbonaceous chondrite (CO3.0)

**History**: Purchased from Abdeltif Mechaguen

**Physical characteristics**: A dark irregular stone. Cut surface reveals dark interior with small chondrules.

**Petrography**: Chondrules (mostly type I) and small CAIs in a dark brown matrix. Chondrule mean apparent diameter 170±90 μm (N=40). Abundant metal and associated terrestrial weathering products.

**Geochemistry**: Olivine Fa18.2±15.7, range 1.1-40.3, PMD 79% (N=8). Ferroan olivine has Cr2O3 0.34±0.05 wt% (N=5). Orthopyroxene Fs3.5±2.5Wo1.0±0.3.Magnetic susceptibility log χ (× 10-9 m3/kg)=4.82.

**Classification**: CO3.0. Subtype is from the Cr2O3 content of ferroan olivine.

**Specimens**: type specimen and polished sections at *CEREGE*. Main mass with Pierre-Marie Pelé.

**Northwest Africa 11209** (NWA 11209)

Mali

Purchased: 2015

Classification: HED achondrite (Eucrite, unbrecciated)

**History**: Purchased from El Moktar Ait Hiba at the 2015 Munich meteorite show.

**Physical characteristics**: A stone with fresh fusion crust. Broken surface reveals homogeneous grey interior.

**Petrography**: Igneous rock with ophitic texture. Low-Ca pyroxenes have augite exsolution. Average grain size 400 μm. Accessory silica polymorph, ilmenite, chromite. Rare metal.

**Geochemistry**: Low-Ca pyroxene Fs60.2±0.2Wo1.7±0.2, FeO/MnO=30.9±2.3 (N=5). Augite exsolution Fs30.5Wo38.1(N=1). Plagioclase An79.2Ab17.7Or3.1(N=4).

**Classification**: Eucrite, unbrecciated

**Specimens**: type specimen and polished sections at *CEREGE*. Main mass with Pierre-Marie Pelé.

**Northwest Africa 11211** (NWA 11211)

(Northwest Africa)

Purchased: 2017

Classification: Ordinary chondrite (LL3.10)

**History**: Purchased by Darryl Pitt from a Moroccan meteorite dealer in February 2017 at the Tucson Gem and Mineral Show.

**Physical characteristics**: Single stone with fusion crust. A sawn surface reveals many densely packed chondrules of variable size.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows numerous unequilibrated chondrules, apparent mean diameter 750±450 μm (n=25), many with porphyritic, igneous-zoned olivines and pyroxenes, most with glass or mesostasis. Fine-grained matrix was observed throughout.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) All olivine range Fa0.7-33.2, mean value Fa16.5±7.9, Fe/Mn=47±20, Cr2O3=0.42±0.22 (wt%), n=33; mean values for ferroan olivine Fa18.0±6.5, Fe/Mn=49±18, Cr2O3=0.43±0.23 (wt%), n=30; low-Ca pyroxene Fs10.7±8.7Wo0.9±0.9, Fe/Mn=26±20, n=21.

**Classification**: Ordinary chondrite (LL3.10), type 3.10 based on ferroan olivine mean Cr2O3 content and sigma from Grossman and Brearley (2005) and by the presence of opaque, S-rich matrix. Cr2O3 versus sigma value plots very close to the boundary between type 3.10 and 3.05 in figure 13 of G&B (2005), midway between EET 90161 (L3.05) and the cluster with RC 075 (H3.10), MET 96503 (L3.10), NWA 1756 (LL3.10), NWA 3127 (LL3.10).

**Specimens**: 20.7 g including a probe mount on deposit at *UNM*, *DPitt* holds the main mass.

**Northwest Africa 11212** (NWA 11212)

(Northwest Africa)

Purchased: 2016 Nov

Classification: Lunar meteorite (feldspathic breccia)

**History**: Purportedly found buried in soil in the strewnfield near Gataa Sfar and purchased by Fabien *Kuntz* in November 2016 from a dealer in Zagora, Morocco.

**Physical characteristics**: A group of small stones (total 197.5 g) lacking fusion crust. Fresh interiors exhibit white to beige clasts in a dark gray matrix.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of angular mineral grains of anorthite, olivine, pigeonite, ferropigeonite, subcalcic augite, augite, Ti-chromite and ilmenite in a finer grained, partly vesicular matrix containing kamacite, troilite, pentlandite, Mg-ilmenite and minor barite. Small bubbles are concentrated in groups within the matrix.

**Geochemistry**: Olivine (Fa28.7-36.1, FeO/MnO = 102-116, N = 3), orthopyroxene (Fs53.4Wo1.7, FeO/MnO = 78), pigeonite (Fs20.6Wo7.8, FeO/MnO = 67), ferropigeonite (Fs56.3Wo21.1, FeO/MnO = 66), subcalcic augite (Fs29.4Wo26.4, FeO/MnO = 71), augite (Fs9.9Wo37.0, FeO/MnO = 68), plagioclase (An94.2-96.7Or0.3, N = 2).

**Classification**: Lunar (feldspathic breccia). Likely paired with [Rabt Sbayta 002](https://www.lpi.usra.edu/meteor/metbull.php?code=64680) and [Rabt Sbayta 004](https://www.lpi.usra.edu/meteor/metbull.php?code=64993).

**Specimens**: 20.28 g including one polished endcut at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11213** (NWA 11213)

(Northwest Africa)

Purchased: 2016 May

Classification: Ordinary chondrite (L6)

**History**: Purchased by Ben Hoefnagels in May 2016 from a dealer in Agadir, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Rare chondrule remnants occur in a recrystallized matrix containing altered metal.

**Geochemistry**: Olivine (Fa24.2-24.8, N = 3), orthopyroxene (Fs21.0-21.4Wo1.9-2.1, N = 3), clinopyroxene (Fs9.1-10.0Wo45.0-43.6, N = 2).

**Classification**: Ordinary chondrite (L6).

**Specimens**: 24.6 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11214** (NWA 11214)

(Northwest Africa)

Purchased: 2017 Jan

Classification: Martian meteorite (Shergottite)

**History**: Purchased by Adam *Aaronson* in Temara, Morocco in January 2017.

**Petrography**: (A. Irving, *UWS* and P. Carpenter, *WUSL*) Poikilitic texture. Large pyroxene oikocrysts (exhibiting undulose extinction) enclose chadacrysts of olivine (also exhibiting undulose extinction) and Ti-free, Al-poor chromite. Accessory phases are ~5 vol.% interstitial maskelynite and minor pyrrhotite. Pockets of dark brown shock glass containing acicular microlites of olivine and pyroxene are prevalent in this specimen, and these are crosscut by anastomozing veinlets of a second generation of shock glass that is much paler brown in thin section.

**Geochemistry**: (P. Carpenter, *WUSL*; S. Kuehner, *UWS*) The mafic silicates have very narrow ranges in composition. Olivine (Fa25.5-27.6, FeO/MnO = 47-52, N = 2), orthopyroxene (Fs20.6-21.2Wo3.2-3.9, FeO/MnO = 29, N = 2), maskelynite (An50.9-53.7Or1.4-1.3, N = 2).

**Classification**: Martian (shergottite, poikilitic).

**Specimens**: 20.2 g including one polished thin section at *UWB*; remainder with *Aaronson*.

**Northwest Africa 11215** (NWA 11215)

(Northwest Africa)

Purchased: 2017-Feb

Classification: Ordinary chondrite (H4)

**History**: Purchased by Darryl Pitt in February 2017 from a Moroccan dealer at the Tucson Gem and Mineral Show.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Relatively small, well-formed chondrules occur in a recrystallized matrix containing abundant altered metal.

**Geochemistry**: Olivine (Fa17.5-17.8, N = 3), orthopyroxene (Fs15.2-16.3Wo1.3-1.0, N = 3), clinopyroxene (Fs5.6-7.3Wo47.5-42.7, N = 2).

**Classification**: Ordinary chondrite (H4).

**Specimens**: 28.9 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11216** (NWA 11216)

(Northwest Africa)

Purchased: 2017 Feb

Classification: Lunar meteorite (feldspathic breccia)

**History**: Purchased by Aras Jonikas in February 2017 from a dealer in Agadir, Morocco.

**Physical characteristics**: A group of small stones (total 222.34 g) with brown weathered exterior surfaces. Interiors are fresh, and consist of small whitish to pale yellowish clasts in a dark-gray matrix containing vesicles.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of angular mineral grains of anorthite, olivine, pigeonite, subcalcic ferroaugite, Ti-free chromite, Ti-Cr-Fe spinel, ilmenite (with rare inclusions of baddeleyite) and fayalite in a finer grained, vesicular matrix containing kamacite, troilite and minor celestite.

**Geochemistry**: Olivine (Fa17.5-27.9, FeO/MnO = 94-118, N = 3), orthopyroxene (Fs22.6Wo4.0, FeO/MnO = 72), pigeonite (Fs24.4Wo8.1; Fs33.3Wo16.4; FeO/MnO = 62-73; N = 2), subcalcic ferroaugite (Fs73.5Wo25.6, FeO/MnO = 66), plagioclase (An94.8-96.8Or0.4, N = 2).

**Classification**: Lunar (feldspathic breccia).

**Specimens**: 20.17 g including one polished endcut at *PSF*; remainder with Mr. A. Jonikas.

**Northwest Africa 11219** (NWA 11219)

(Northwest Africa)

Purchased: 2016

Classification: Carbonaceous chondrite (CV3)

**History**: Two stones totaling 157.6 g were purchased in 2016 by Sergey Vasiliev in St. Marie-aux-Mines from a dealer from Morocco.

**Physical characteristics**: The two brownish fragments show large chondrules on the cut surface.

**Petrography**: (A. Bischoff, *IfP*). Numerous mostly porphyritic chondrules were observed embedded in a fine-grained matrix, which makes up approximately 30-40% of the meteorite. AOAs and fine-grained, spinel-rich CAIs were frequently observed. The chondrules are quite large (~1 mm) typical for CV chondrites.

**Geochemistry**: (K. Klemm, A. Bischoff, *IfP*) Mean olivine: Fa8.5(n=39); mean low-Ca pyroxene: Fs1.5Wo2.1(n=33); very few Fa-rich olivines occur as fragments in the matrix. Chondrules and AOAs have Fa<9 (Fa4.6±2.3).

**Classification**: Carbonaceous chondrite (CV3), weathering grade strong (W3)

**Specimens**: 22.05 g including a polished thin section are at *IfP*. Sergey Vasiliev holds the main mass.

**Northwest Africa 11220** (NWA 11220)

(Northwest Africa)

Purchased: Jan 2017

Classification: Martian meteorite (basaltic breccia)

**History**: Purportedly recovered in Esbeta Bir Anzarane in November 2016 and purchased in Zagora, Morocco in January 2017.

**Physical characteristics**: A single stone with smooth black surface showing some depressions and protrusions. CT scanning indicates brecciation with heterogeneous distribution of several clast types both spheroidal and angular, as well as phenocrysts in dark matrix.

**Petrography**: (A. M. Krzesinska, N. V. Almeida, *NHM*) Imaging (SEM and micro-CT) shows a polymict breccia with a variety of lithic and igneous clasts. Matrix composed of euhedral phenocrysts and fragments of plagioclase, low-Ca pyroxene, pigeonite, augite and hedenbergite set in very fine-grained groundmass rich in Fe-oxides and pyrrhotite. Accessory minerals include: potassium feldspars, Cl-apatite, ilmenite, magnetite, Ti,Cr-magnetite and chromite. Among lithic clasts are protobreccia fragments of similar petrography and mineralogy but with their groundmass enriched in Fe-oxides. Fine-grained, devitrified impact spherules with layered textures and mantles of accreted debric and vitrophyre, fine-grained pyroxene-feldspathic glass clasts also present. Igneous clasts (basaltic, andesitic) composed of pigeonite and plagioclase with granulitic and subophitic textures. Trachyandesite clasts composed of poikilitic potassium feldspar and anorthoclase plagioclase accompanied by augitic pyroxene. Accessory Fe-Ti-P- rich clasts dominated by euhedral ilmenite, magnetite and Cl-apatite, set in feldspathic glass.

**Geochemistry**: Mineral compositions and geochemistry: All analyses by EPMA. Matrix: Low-Ca pyroxene, Fs31.7±8.8Wo2.8±0.8, Fe/Mn (afu) = 34.9±3.1 (n = 50). Pigeonite, Fs40.8±5.7Wo8.4±2.5, Fe/Mn (afu) = 36.8±2.6 (n = 10). Augite, Fs22.5±4.3Wo39.5±4.6, Fe/Mn (afu) = 32.4±4.7 (n = 35). Hedenbergite, Fs41.1±4.1Wo37.1±11.4, Fe/Mn (afu) = 35.1±7.7 (n = 3). Plagioclase, Or2.6±0.7An40.5±7.2(n = 89). Alkali feldspar, Or70.7±18.4An3.9±3.0(n = 24). Ilmenite, 3.7±1.1 wt% MgO, 1.7 ± 0.7 wt% MnO (n = 32). Magnetite with up to 2.5 wt% TiO2, up to 1.9 wt% Cr2O3 and up to 0.4 wt% NiO (n = 7). Ti-magnetite, 7.4±3.5 wt% TiO2, with up to 0.5 wt% Cr2O3, up to 0.4 wt% NiO (n = 16). Cr-magnetite and chromite, 25.8±9.9 wt% Cr2O3, up to 1.8 wt% TiO2, up to 0.1 wt% NiO (n = 23). Cl-apatite, 0.7±0.1 wt% F, 4.9±0.3 wt% Cl (n = 62). Basaltic and andesitic clasts: Plagioclase, Or2.4±0.8An38.9±7.6(n = 26). Pigeonite, Fs33.1±4.4Wo9.7±5.0, Fe/Mn (afu) =33.7±2.9 (n = 39). Some augite also present. Trachyandesitic and monzonitic clasts: Potassium feldspars, Or73.9±11.3An3.2±1.2(n = 14). Anorthoclase, Or6.1±1.5An2.3±0.7(n = 6). Plagioclase, Or3.2±0.1An28.3±10.9(n = 4). Augite, Fs18.7±5.7Wo44.4±3.7, Fe/Mn (afu) = 30.3±9.9 (n = 14). Protobreccia clasts, impact spherules and vitrophyre clasts also present, with chemical compositions of pyroxene and plagioclase similar to matrix and phenocrysts. In general, protobreccia clasts are enriched in Fe compared with the matrix groundmass, due to the presence of sub-micron Fe-oxides.

**Classification**: Martian (basaltic breccia). Likely paired with [NWA 7034](https://www.lpi.usra.edu/meteor/metbull.php?code=54831), [NWA 7533](https://www.lpi.usra.edu/meteor/metbull.php?code=56550), [NWA 7475](https://www.lpi.usra.edu/meteor/metbull.php?code=56132), as similar in texture, mineralogy and clast types.

**Specimens**: 7.46 g including a 7.27 g piece and one thin section on deposit at the *NHM* London. M. Goff holds the main mass.

**Northwest Africa 11221** (NWA 11221)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Eucrite, brecciated)

**History**: The meteorite was bought in 2016 from a meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Dark-grayish individual, partly covered with fusion crust.

**Petrography**: The meteorite is a fragmental breccia composed of angular to subrounded basaltic clasts dominated by exsolved pyroxene and lath shaped calcic plagioclase, dark melt clasts and fine-grained clastic matrix. Minor phases include silica, ilmenite, FeS and metallic iron.

**Geochemistry**: low-Ca pyroxene: Fs51.8±3.2Wo3.5±0.8(Fs48.3-58.9Wo2.2-4.9, n=12, FeO/MnO=30-34); Ca-pyroxene: Fs33.3±5.7Wo33.7±5.5(Fs26.8-41.7Wo24.1-40.3, n=9, FeO/MnO=29-32); calcic plagioclase: An89.9±1.4(An87.3-92.0, n=15)

**Northwest Africa 11222** (NWA 11222)

(Northwest Africa)

Purchased: 2016

Classification: Carbonaceous chondrite (CV3)

**History**: The meteorite was bought in 2016 from a meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Dark-browish individual without fusion crust.

**Petrography**: Carbonaceous chondrite composed of up to 2.5 mm sized chondrules, CAIs and olivine amoeboids all set into a fine-grained almost black matrix. Type II chondrules are absent. Many chondrules show reddish staining due to terrestrial weathering.

**Northwest Africa 11223** (NWA 11223)

Morocco

Purchased: 2017

Classification: Lunar meteorite

**Physical characteristics**: Physical Characteristics: The *ROM* specimen is one of many pieces found by a meteorite hunter in Morocco. The largest fragments are over 2 kg, with many smaller pieces adding to a total of approximately 10 kg. All specimens observed lacked fusion crust and most were covered in a very thin surface coating of white caliche. However two specimens, which were apparently exposed to the desert winds, showed no caliche, exposing a dark-gray interior with obvious lithic clasts.

**Petrography**: (*ROM*; K. Hewson, V. Di Cecco, I Nicklin, *ROM*) In hand sample and thin section the specimen shows lithic and mineral clasts set in a dark-gray, glassy matrix. No vesicles were observed. The largest lithic clast in the *ROM* specimen is light gray in color and measures 1 × 0.5 cm. Two other relatively large clasts are of a more mixed mineralogy.

**Geochemistry**: (K. Hewson, V. Di Cecco) Feldspar grains have highly anorthitic composition (An90.9-98.6Ab0.0-7.4Or0.1-2.1, n = 94), which is consistent both in the clasts and the matrix. Olivine grains, although rare, are forseritic (Fa28.0-44.5, FeO/MnO = 84.8-119.2, n=15). Pyroxene grains are more common than olivine and are variable in composition. They include augite (En30.2-48.4Fs23.7-26.6Wo2.5-26.6, FeO/MnO = 52.4-61.1, n=5), pigeonite (En40.4-68.0Fs23.3-49.0Wo6.0-19.1, FeO/MnO = 51.8-63.6, n=14) and enstatite (En64.0-65.5Fs31.6-32.1Wo2.5-3.9, FeO/MnO = 57.6-62.9 n=3).

**Classification**: Lunar (feldspathic impact-melt breccia). The largest lithic clast noted has an anorthitic composition, as given by the geochemistry. The two other relatively large clasts have noritic and olivine-noritic compositions based on geochemistry and mineral modality. Mineral fragments are anorthite, clino and orthopyroxenes and rare olivine. Both the lithic and mineral clasts show extensive shock features including mosaicism, planar fracturing and, in the lithic clasts, granularization of the component minerals. Despite the generally uniform caliche coating on most of the specimens the weathering is minimal being confined largely to the exterior but with some very few, very fine fractures containing material similar to the caliche coating which is predominantly barite.

**Specimens**: The *ROM* holds the main mass of this sample, which originally weighed 28 g. It is now composed of 2 pieces weighing 17.52 and 4.83 g, a thin section, a thin section billet, and 0.20 g of cutting dust.

**Northwest Africa 11224** (NWA 11224)

(Northwest Africa)

Purchased: 2016

Classification: Carbonaceous chondrite (CK3)

**History**: 1 stone weighing 816.7 g was found in Morocco prior to 2016. J. Donald Cline and John Sinclair acquired the sample from a meteorite dealer at the Tucson Gem and Mineral Show in February 2016.

**Physical characteristics**: Windowed sample has an ovoid shape with a few shallow regmaglypts. Sample is covered (~7%) by a lightly weathered, orange to dark-black, flow-lined fusion crust which contains contraction cracks. Small cracks in the fusion crust show the sample is dark-green in the interior. Cut face shows a dark-green interior with dark-gray chondrules, dark-green clasts, and metallic gray grains.

**Petrography**: Description and classification (A. Love, *App*): Sample has a chondritic texture composed of ~60 vol%, well-formed chondrules (with an average diameter of 1059 μm, n=28) and CAIs in a fine-grained matrix dominated by olivine and plagioclase and Cr-magnetite. Olivines within matrix and chondrules show strong compositional zoning with Mg-rich cores and FeO-rich rims. Many chondrules are surrounded by thick concentric igneous and clastic rims.

**Geochemistry**: (A. Love, *App*) Fa23.8±11.6(Fa1.2-35.7), N=24; low Ca pyroxene Fs3.1Wo0.5, N=1; Ca pyroxene Fs1.6Wo38.0, N=1.

**Classification**: Carbonaceous chondrite (CK3). Texture and mineral compositions indicate sample is a CK3

**Specimens**: *PARI* holds the 778.32 g main mass. A 24.95 g type specimen and one polished thin section are on deposit at *App*.

**Northwest Africa 11225** (NWA 11225)

(Northwest Africa)

Purchased: 2016

Classification: Ordinary chondrite (L6)

**History**: One stone weighing 125.5 g was found and subsequently purchased in Morocco in 2016. Damian Belghali acquired the sample from a meteorite prospector in 2016.

**Physical characteristics**: The stone lacks fusion crust. Chondrules and flecks of metal are visible on the dark-yellow weathered exterior of this flattened stone.

**Petrography**: Description and classification (A. Love, *App*): Sample is recrystallized. Relict chondrules have an average diameter of 1016 μm (n=37). Chondrule olivines display sharp optical extinction and contain planar to irregular fractures. Porphyritic chondrules contain turbid to recrystallized mesostasis. Sample contains irregular shaped FeS grains and metallic copper where FeNi and FeS are co-joined within FeNi. It has ~6vol% FeNi metal.

**Geochemistry**: Olivine: Fa23.9±0.2N=8; Low-Ca pyroxene: Fs23.4±0.2Wo1.4±0.2N=7.

**Classification**: Ordinary chondrite: L6, S2, W1.

**Specimens**: A polished thin section and 22.02 g comprise the type specimen are on deposit at *App*. Damian Belghali holds the main mass.

**Northwest Africa 11226** (NWA 11226)

Morocco

Purchased: 2015 Sept 15

Classification: Ordinary chondrite (H4)

**History**: This meteorite was bought from Aziz and Rachid Adnane in Morocco during the HK jewellry exhibition, on 15 Sept 2015.

**Physical characteristics**: total mass: 16.7 g (only 1 piece) having fusion crust light black surface

**Petrography**: The meteorite consists of olivine, orthopyroxene, and feldspar, associated with comparatively minor amounts of clinopyroxene, Fe-Ni, diopside, troilite, chromite and phosphate. The sizes of mineral are almost ~200 μm. Most metal and sulfide are fresh.

**Geochemistry**: Mineral compositions and geochemistry: Minerals are uniform. Olivine: Fa20.8±0.6(n=11); low-Ca pyroxene: Fs19.6±6.7Wo1.0±1.0(n=12).

**Classification**: Ordinary chondrite, H4; S2; W1.

**Specimens**: Two thin sections are deposited in *GUT*.

**Northwest Africa 11227** (NWA 11227)

Morocco

Purchased: 2015 Sept 15

Classification: Ordinary chondrite (H4)

**History**: This meteorite was bought from Aziz and Rachid Adnane in Morocco during the HK jewellry exhibition, 15 Sept 2015.

**Physical characteristics**: total mass: 18.5 g (only 1 piece) having fusion crust light black surface.

**Petrography**: The meteorite consists of olivine, orthopyroxene, and feldspar, associated with comparatively minor amounts of clinopyroxene, Fe-Ni, diopside, troilite, chromite and phosphate. The sizes of mineral are almost ~200 μm. Most metal and sulfide are fresh.

**Geochemistry**: Mineral compositions and geochemistry: Minerals are uniform. Olivine: Fa17.0±0.7(n=19); low-Ca pyroxene: Fs15.5±0.8Wo1.3±0.2(n=17).

**Classification**: Ordinary chondrite, H4; S2; W1.

**Specimens**: Two thin sections are deposited in *GUT*.

**Northwest Africa 11228** (NWA 11228)

(Northwest Africa)

Purchased: 20 Mar 2017

Classification: Lunar meteorite (feldspathic breccia)

**History**: Purchased by Dustin Dickens, March 20, 2017, from Mohamed Maulud.

**Physical characteristics**: Many irregular shaped fragments, dark sand-blasted exterior, no fusion crust.

**Petrography**: (C. Agee, *UNM*) This meteorite is a fragmental breccia with pyroxene, plagioclase, and olivine grains set in fine grained groundmass. Scatttered micro-gabbro fragments were also observed. Ubiquitous, fine grained, accessory Fe-metal and sulfide are present. Minor amount of shock melt was observed in the microprobe section. All pyroxene grains probed were pigeonite, no augite was detected.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) Olivine Fa40.2±13.6, Fe/Mn=93±9, n=10; pigeonite Fs36.1±7.9Wo11.6±3.5, Fe/Mn=57±6, n=11; plagioclase An94.4±1.1Ab5.0±1.0Or0.6±0.2, n=5; shock melt (proxy for bulk composition) Al2O3=26±1, TiO2=0.14±0.09, MgO=12±6, FeO=3±2 (all wt%), n=2.

**Classification**: Lunar (feldspathic breccia)

**Specimens**: 20.3 g including a probe mount on deposit at *UNM*, Dustin Dickens holds the main mass.

**Northwest Africa 11229** (NWA 11229)

(Northwest Africa)

Purchased: 2014 Apr

Classification: Ordinary chondrite (L6)

**History**: A NWA specimen was donated to *Cascadia* by Dick Pugh, who purchased it from Patrick *Thompson*/ET Meteorites in April 2014.

**Physical characteristics**: A single, faceted and regmaglypted individual has brownish-black exterior with partially weathered fusion crust. Cut surfaces reveal chondritic texture with prominent shock veins.

**Petrography**: In thin section granoblastic texture predominant and chondrules are barely recognizable, consistent with type 6. Contains ~5-6% metal and ~3-4% troilite (visual estimates). Shock stage S4 (conventional), S3.8±0.9 (weighted), with abundant maskelynite and a prominent, branching shock melt vein over 1 mm wide in places.

**Geochemistry**: Olivine Fa26.2±0.8(N=26); low-Ca pyroxene Fs22.3±1.7Wo1.6±0.5(N=24); high-Ca pyroxene Fs8.0±1.6Wo45.7±2.0(N=15); maskelynite Ab80.6±1.4Or7.6±1.5(N=17)

**Classification**: L6 chondrite based on texture, metal content and composition of olivine and low-Ca pyroxene.

**Specimens**: *Cascadia* holds the entire sample (type specimen), which consists of ~499 g in 6 pieces, one potted butt, and 1 thin section.

**Northwest Africa 11230** (NWA 11230)

(Northwest Africa)

Purchased: 2005

Classification: Ordinary chondrite (L6)

**History**: Two thick slices donated to *Cascadia* by Pete Zemeckas who purchased an unclassified NWA from Dean *Bessey* circa 2005.

**Physical characteristics**: Greyish brown individual contains patches of caliche on exterior surfaces. Prominent dark shock veins visible in cut faces.

**Petrography**: In thin section granoblastic texture with mostly indistinct chondrules visible, consistent with type 6. Most metal and some troilite weathered consistent with weathering grade W3, weathering product constitutes ~5-7% of rock (visual estimate). Shock stage S4 (conventional), S4.2±0.5 (weighted), with abundant maskelynite and a branching shock vein over 1 mm wide in places.

**Geochemistry**: Olivine Fa26.2±0.5(N=19), low-Ca pyroxene Fs22.1±1.4Wo1.7±0.4(N=14), high-Ca pyroxene Fs10.2±2.0Wo46.6±1.4(N=16), maskelynite Ab81.8±0.9Or7.9±0.8(N=17).

**Classification**: L6 chondrite based on texture, amount of weathering product derived from metal, olivine and pyroxene composition.

**Specimens**: *Cascadia* holds the type specimen which consists of 39.5 g, a polished thin section, and a mounted stub.

**Northwest Africa 11231** (NWA 11231)

(Northwest Africa)

Purchased: 2017 March

Classification: Carbonaceous chondrite (CO3)

**Petrography**: (K. Metzler, *IfP*) Chondrules, chondrule fragments, and CAIs are embedded in a fine-grained brownish matrix (about 20 vol% matrix). Most chondrules belong to chemical type I. Mean apparent chondrule size: 130±100 μm (40-830 μm; n=83).

**Geochemistry**: Random measurements of olivine grains revealed Fa8.6±15.5(1-58); n=26. Random measurements of low-Ca pyroxene grains revealed Fs2.2±1.9Wo1.0±0.3(Fs1-6Wo0-2); n=17.

**Classification**: CO chondrite based on CAI occurrence, small chondrule size, chondrule-matrix ratio, and mineral chemistry. Petrologic type 3 based on the chemical variation of olivine and pyroxene.

**Northwest Africa 11232** (NWA 11232)

(Northwest Africa)

Purchased: 2016 Nov

Classification: Ordinary chondrite (L(LL)3)

**History**: Purchased by Fabien *Kuntz* in November 2016 from a dealer in Nouakchott, Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Closely packed, well-formed chondrules (apparent diameter 500±300 μm) are set in a sparse, fine-grained matrix containing merrillite and chlorapatite.

**Geochemistry**: Olivine (Fa0.5-30.2, Cr2O3 in ferroan examples < 0.5 wt.%, N = 7), orthopyroxene (Fs1.0-51.8Wo0.4-1.4, N = 3), subcalcic augite (Fs18.8Wo30.6), augite (Fs10.9Wo37.0). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.50.

**Classification**: Ordinary chondrite (L(LL)3).

**Specimens**: 24.9 g including one polished thin section at *PSF*; remainder with Mr. F. *Kuntz*.

**Northwest Africa 11233** (NWA 11233)

(Northwest Africa)

Purchased: 2017 Jan

Classification: Rumuruti chondrite (R4-5)

**History**: Purchased by Adam *Aaronson* in Temara, Morocco in January 2017.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia consisting of equilibrated chondrule-bearing clasts of types 4 and 5 set in a fine-grained matrix containing chromite, troilite and pentlandite but no metal. Portions of the studied specimen exhibit much more terrestrial weathering than other much fresher portions.

**Geochemistry**: Olivine (Fa38.6-39.1, N = 3), orthopyroxene (Fs30.0-30.1Wo1.5-3.3, N = 3), clinopyroxene (Fs11.1-11.7Wo45.5-44.5, N = 2).

**Classification**: R4-5 chondrite breccia.

**Specimens**: 13.7 g including one polished thin section at *UWB*; remainder with *Aaronson*.

**Northwest Africa 11234** (NWA 11234)

(Northwest Africa)

Purchased: 2016 Nov

Classification: Ordinary chondrite (LL3)

**History**: Purchased by Fabien *Kuntz* in November 2016 from a dealer in Nouakchott, Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Closely packed, well-formed chondrules (apparent diameter 700±400 µm) are set in a sparse, fine-grained matrix containing chlorapatite. An autolithic clast is present in the studied thin section.

**Geochemistry**: Olivine (Fa0.5-50.9, Cr2O3 in ferroan examples = 0.02-0.44 wt.%, N = 7), orthopyroxene (Fs0.8-23.9Wo0.9-1.4, N = 3), clinopyroxene (Fs7.3-7.9Wo35.1-45.7, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.32.

**Classification**: Ordinary chondrite (LL3).

**Specimens**: 22.02 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11235** (NWA 11235)

(Northwest Africa)

Purchased: 2016 Jun

Classification: HED achondrite (Diogenite)

**History**: Purchased by Fabien *Kuntz* in June 2016 from a Moroccan dealer at the Ensisheim Show.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia consisting of angular mineral grains of predominantly orthopyroxene with subordinate olivine, anorthite and accessory silica polymorph, merrillite, chromite and troilite in a sparse matrix. Grains of both orthopyroxene and olivine exhibit more ferroan rims.

**Geochemistry**: Low-Ca pyroxene (core Fs24.0Wo2.3, FeO/MnO = 35, N = 1; rim Fs32.2Wo6.6, FeO/MnO = 28, N = 1), olivine (core Fa33.2, FeO/MnO = 45, N = 1; rim Fa35.0, FeO/MnO = 48, N = 1), plagioclase (An93.0-93.6Or1.6-1.7, N = 2).

**Classification**: Diogenite breccia.

**Specimens**: 4.74 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11236** (NWA 11236)

Mauritania

Purchased: 2014 Dec

Classification: Ordinary chondrite (H4-6)

**History**: Purportedly found in 2014 near Tidjikja, Mauritania, and purchased by Jesper Grønne in December 2014 from a dealer in Agadir, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia consisting of angular ordinary chondrite clasts of types 3/4 to 6 set in a finer-grained matrix containing relatively abundant altered metal.

**Geochemistry**: Olivine (Fa17.3-20.0, N = 4), orthopyroxene (Fs7.6-18.6Wo3.4-1.1, N = 3), clinopyroxene (Fs6.0-6.5Wo45.9-45.6, N = 2).

**Classification**: Ordinary chondrite (H4-6 breccia).

**Specimens**: 20.0 g including one polished slice at *UWB*; remainder with Mr. J. Groenne.

**Northwest Africa 11237** (NWA 11237)

(Northwest Africa)

Purchased: 2017 Jan

Classification: Lunar meteorite (feldspathic breccia)

**History**: Purchased by Adam *Aaronson* in January 2017 from a Moroccan dealer at the Tucson Gem and Mineral Show.

**Physical characteristics**: A single stone (583 g) lacking fusion crust. The fresh interior exhibits white to beige clasts in a medium-gray matrix.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of angular mineral grains of anorthite, olivine, pigeonite, exsolved pigeonite, augite, ilmenite, Ti-chromite and troilite, plus sparse glass fragments, set in a finer-grained matrix containing small vesicles and minor barite.

**Geochemistry**: Olivine (Fa30.5-36.8, FeO/MnO = 99-106, N = 3), pigeonite (Fs20.8-33.2Wo6.2-8.4, FeO/MnO = 64-69, N = 2), orthopyroxene host (Fs52.7Wo1.6, FeO/MnO = 71), augite exsolution lamella (Fs21.3Wo43.0, FeO/MnO = 66), augite (Fs19.5Wo42.6, FeO/MnO = 67), anorthite (An96.5-97.6Or0.2-0.3, N = 2).

**Classification**: Lunar (feldspathic breccia).

**Specimens**: 20.3 g including one polished endcut at *UWB*; remainder with *Aaronson*.

**Northwest Africa 11238** (NWA 11238)

(Northwest Africa)

Purchased: 2017 Feb

Classification: Ordinary chondrite (H6)

**History**: Purchased by Aras Jonikas in February 2017 from a dealer in Agadir, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Fresh specimen containing very sparse chondrules and chondrule remnants within a recrystallized, relatively metal-rich matrix.

**Geochemistry**: Olivine (Fa18.9-19.0, N = 3), orthopyroxene (Fs16.8-16.9Wo1.6-1.5, N = 3), clinopyroxene (Fs5.7-6.3Wo44.6-45.7, N = 2).

**Classification**: Ordinary chondrite (H6).

**Specimens**: 23.5 g including one polished thin section at *PSF*; remainder with Mr. A. Jonikas.

**Northwest Africa 11239** (NWA 11239)

(Northwest Africa)

Purchased: 2016 Dec

Classification: Enstatite achondrite

**History**: Purchased by Roger Jones in December 2016 from a dealer in Guelmim, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Triple grain junction texture. The predominant mineral is enstatite with subordinate relatively sodic plagioclase (oligoclase-andesine) plus accessory Cr-troilite and Si-bearing kamacite. Minor terrestrial alteration has produced orange iron hydroxides distributed along grain boundaries.

**Geochemistry**: Enstatite (Fs0.1Wo0.3-0.5, N = 2), plagioclase (An28.7-32.8Or1.7-1.6, N = 2), metal (Si 1.5 wt.%, Ni 5.6-5.7 wt.%, Co 0.46 wt.%, N = 3).

**Classification**: Enstatite achondrite. This specimen differs from aubrites in having a metamorphic, triple grain junction texture, and it also lacks the typical sulfide minerals present in most aubrites. A careful search revealed only Cr-troilite in addition to Si-bearing kamacite as the obvious accessory phases; no daubreelite, alabandite or oldhamite were found.

**Specimens**: 20.5 g including one polished thin section and one polished mount at *UWB*; remainder with Mr. R. Jones.

**Northwest Africa 11240** (NWA 11240)

(Northwest Africa)

Purchased: 2005

Classification: Ordinary chondrite (H4)

**History**: Purchased by an anonymous collector from a dealer at the Munich Show in 2005, subsequently acquired by the Hollis Collection and donated to *PSF*.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Fairly closely packed, well-formed, relatively small chondrules are set in a finer grained matrix containing altered metal.

**Geochemistry**: Olivine (Fa17.6-17.8, N = 3), orthopyroxene (Fs15.7-15.8Wo0.9-0.8, N = 2), subcalcic augite (Fs9.8Wo34.4), diopside (Fs4.9Wo47.1).

**Classification**: Ordinary chondrite (H4).

**Specimens**: The entire specimen including one polished thin section is at *PSF*.

**Northwest Africa 11241** (NWA 11241)

(Northwest Africa)

Purchased: 2016 Nov

Classification: Carbonaceous chondrite (CV3)

**History**: Two identical stones were purchased by Gary Fujihara in November 2016 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Granular chondrules (some relatively coarse grained, apparent diameter 600±300 μm) plus fine-grained elongate amoeboid CAIs (to 1.7 mm in the thin section, to 3 mm in the slices, but most are smaller) are set in a fine grained matrix (medium brown in thin section).

**Geochemistry**: Olivine (Fa0.4-39.2, N = 3), orthopyroxene (Fs0.7-1.0Wo1.1-0.9, N = 2), diopside (Fs1.3Wo45.1; Fs0.5Wo49.3; Fs9.5Wo50.8; N = 3).

**Classification**: Carbonaceous chondrite (CV3). CAIs are unusually small for a CV3.

**Specimens**: 20.28 g including one polished thin section at *UWB*; remainder with Mr. G. Fujihara.

**Northwest Africa 11242** (NWA 11242)

(Northwest Africa)

Purchased: 2017 Feb

Classification: HED achondrite (Eucrite, unbrecciated)

**History**: Purchased in Agadir, Morocco by Aziz Habibi in February 2017.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Microgabbroic texture. Composed predominantly of very finely exsolved pigeonite and calcic plagioclase (almost completely converted to maskelynite) with accessory silica polymorph, Ti-chromite, Ni-poor kamacite, taenite and stained troilite. Some thin, dark shock veinlets crosscut the specimen.

**Geochemistry**: Orthopyroxene (Fs44.7-45.4Wo2.7-2.9, FeO/MnO = 30-31, N = 3), clinopyroxene (Fs20.1-21.2Wo40.4-39.9, FeO/MnO = 27-28, N =3), maskelynite (An89.5-90.0Or0.3, N = 2).

**Classification**: Eucrite (unbrecciated, microgabbroic, highly shocked). This is an unusual example of an unbrecciated eucrite containing maskelynitized plagioclase.

**Specimens**: 13.4 g including one polished thin section at *UWB*; remainder with Mr. A. Habibi.

**Northwest Africa 11243** (NWA 11243)

(Northwest Africa)

Purchased: 2016 Dec

Classification: Lunar meteorite (feldspathic breccia)

**History**: Purchased by Ken Regelman in December 2016 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of angular mineral fragments and sparse olivine noritic lithic clasts in a finer grained matrix. Minerals are anorthite, olivine, orthopyroxene, pigeonite, ferropigeonite, fayalite, silica polymorph, Al-Ti-chromite, kamacite, ilmenite, troilite and calcite.

**Geochemistry**: Olivine (Fa23.3, FeO/MnO = 101), orthopyroxene (Fs12.9-26.3Wo4.2-2.4, FeO/MnO = 60-74, N = 2), pigeonite (Fs30.1Wo8.7, FeO/MnO = 66), ferropigeonite (Fs61.1Wo24.4, FeO/MnO = 64), fayalite (Fa87.4, FeO/MnO = 80), anorthite (An97.7-98.3Or0.3-0.1, N = 2).

**Classification**: Lunar (feldspathic breccia).

**Specimens**: 16.24 g including one polished slice at *UWB*; remainder with Mr. K. Regelman.

**Northwest Africa 11244** (NWA 11244)

(Northwest Africa)

Purchased: 2017 Feb

Classification: Pallasite

**History**: Purchased by Gary Fujihara in February 2017 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Composed mainly of relatively large grains of olivine and iron hydroxides (from terrestrial weathering of primary metal). Some residual grains of kamacite and tetrataenite remain, along with accessory chromite, merrillite and troilite.

**Geochemistry**: Olivine (Fa12.8-13.4, FeO/MnO = 61-62, N = 3).

**Classification**: Pallasite.

**Specimens**: 24.69 g including one polished endcut at *UWB*; remainder with Mr. G. Fujihara.

**Northwest Africa 11245** (NWA 11245)

(Northwest Africa)

Purchased: 2016 Oct

Classification: HED achondrite (Eucrite, monomict)

**History**: Purchased by Eric *Twelker* in October 2016 from a dealer in Agadir, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Monomict breccia composed of clasts with intersertal texture. Minerals are exsolved pigeonite, calcic plagioclase, silica polymorph, ilmenite, Ti-bearing chromite and troilite.

**Geochemistry**: Orthopyroxene host (Fs62.1-63.2Wo1.8-2.1, FeO/MnO = 31-38, N = 3), clinopyroxene exsolution lamellae (Fs25.4-27.4Wo45.2-43.6, FeO/MnO = 34-37, N =3), plagioclase (An89.0-90.6Or0.9-1.2, N = 2).

**Classification**: Eucrite (monomict breccia).

**Specimens**: 22 g plus one polished thin section at *UWB*; remainder with Mr. E. *Twelker*.

**Northwest Africa 11246** (NWA 11246)

(Northwest Africa)

Purchased: 2005

Classification: Ordinary chondrite (L3)

**History**: Purchased by an anonymous collector from a dealer at the Munich Show in 2005, subsequently acquired by the Hollis Collection and donated to the Planetary Studies Foundation.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Fairly closely packed, well-formed chondrules (apparent diameter 400±300 μm) are set in a finer grained matrix containing altered metal.

**Geochemistry**: Olivine (Fa4.5-43.1, Cr2O3 in ferroan examples <0.02 wt.%, N = 7), orthopyroxene (Fs2.1-20.0Wo0.3-0.7, N = 3), clinopyroxene (Fs2.9-8.9Wo43.9-41.8, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.91.

**Classification**: Ordinary chondrite (L3).

**Specimens**: The entire specimen including one polished thin section is at *PSF*.

**Northwest Africa 11247** (NWA 11247)

(Northwest Africa)

Purchased: 2017 Jan

Classification: HED achondrite (Eucrite, unbrecciated)

**History**: Purchased by Eric *Twelker* in January 2017 from a Moroccan dealer at the Tucson Gem and Mineral Show.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Medium grained (average 0.5 mm) with equigranular texture, and composed predominantly of exsolved pigeonite and calcic plagioclase with accessory silica polymorph, ilmenite (with rutile exsolution lamellae), chromite and stained Ni-free metal.

**Geochemistry**: Orthopyroxene host (Fs60.0-60.3Wo1.9-1.8, FeO/MnO = 30, N = 3), clinopyroxene exsolution lamellae (Fs26.8-27.8Wo42.1-40.7, FeO/MnO = 29-33, N =3), plagioclase (An89.3-90.3Or0.0-0.6, N = 3).

**Classification**: Eucrite (unbrecciated, microgabbroic).

**Specimens**: 22.5 g plus one polished thin section at *UWB*; remainder with Mr. E. *Twelker*.

**Northwest Africa 11248** (NWA 11248)

(Northwest Africa)

Purchased: 2017 Feb

Classification: Ordinary chondrite (LL5-6)

**History**: Purchased by Ben Hoefnagels in February 2017 from a dealer in Ouarzazate, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Annealed breccia exhibiting poikiloblastic texture and containing type 5 and 6 clasts with discernible chondrules.

**Geochemistry**: Olivine (Fa32.2-32.7, N = 3), orthopyroxene (Fs25.6-25.9Wo1.8-2.3, N = 2), subcalcic augite (Fs9.9-10.1Wo44.7-44.0, N = 2).

**Classification**: Ordinary chondrite (LL5-6 breccia).

**Specimens**: 20.3 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11249** (NWA 11249)

(Northwest Africa)

Purchased: 2017 Jan

Classification: Lunar meteorite (feldspathic breccia)

**History**: Purchased by Ben Hoefnagels in January 2017 from a dealer in Zagora, Morocco.

**Physical characteristics**: A single stone (73.6 g) with a brownish weathered exterior and a fresh, mostly very dark gray interior with some whitish clasts.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of angular mineral fragments and sparse, fragmented glass spheres in a finer grained matrix containing some vesicles. Minerals are anorthite, olivine, pigeonite, ferropigeonite, fayalite, kamacite, Al-Cr-Fe-Mg spinel, zircon and minor barite. The specimen is crosscut by some glass-rich shock veins.

**Geochemistry**: Olivine (Fa15.5-50.5, FeO/MnO = 75-91, N = 4), pigeonite (Fs25.5-35.2Wo10.6-18.8, FeO/MnO = 58-69, N = 4), ferropigeonite (Fs63.2Wo24.4, FeO/MnO = 72), anorthite (An93.9-96.6Or0.3, N = 2).

**Classification**: Lunar (feldspathic regolith breccia).

**Specimens**: 15.1 g including a polished endcut and one polished mount at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11250** (NWA 11250)

(Northwest Africa)

Purchased: 2016 May

Classification: Ordinary chondrite (L6)

**History**: Purchased by Ben Hoefnagels in May 2016 from a dealer in Agadir, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Largely recrystallized with a few chondrule remnants.

**Geochemistry**: Olivine (Fa24.6-25.0, N = 3), orthopyroxene (Fs20.9-21.0Wo1.7-1.6, N = 3), clinopyroxene (Fs7.4-8.2Wo44.9-44.0, N = 2).

**Classification**: Ordinary chondrite (L6).

**Specimens**: 28.3 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11251** (NWA 11251)

(Northwest Africa)

Purchased: 2016 Jan

Classification: Martian meteorite (Shergottite)

**History**: Purchased by Adam *Aaronson* in Temara, Morocco in January 2016.

**Physical characteristics**: A single stone (266 g) almost completely covered by black fusion crust. The fresh interior has an overall yellowish-green color.

**Petrography**: (A. Irving, *UWS* and P. Carpenter, *WUSL*) Aphyric, medium-grained microgabbroic texture. Minerals are olivine, zoned pyroxene (pigeonite + augite), maskelynite, ilmenite, Ti-bearing chromite, pyrrhotite, Na-Mg-Fe-bearing merrillite and chlorapatite.

**Geochemistry**: (P. Carpenter, *WUSL*; S. Kuehner, *UWS*) Olivine (Fa46.5-47.4; FeO/MnO = 50-54, N = 3), pigeonite (Fs27.0-35.8Wo5.9-10.2, FeO/MnO = 30-34, N = 5), subcalcic augite (Fs21.8Wo32.6, FeO/MnO = 33), augite (Fs20.4Wo37.5, FeO/MnO = 30), maskelynite (An52.1-52.6Or2.1, N = 2).

**Classification**: Martian (shergottite, microgabbroic, olivine-bearing). This mafic aphyric shergottite is unusual in containing significant amounts of olivine.

**Specimens**: 20.2 g including one polished thin section at *UWB*; remainder with *Aaronson*.

**Northwest Africa 11252** (NWA 11252)

(Northwest Africa)

Purchased: 2017 Jan

Classification: Lunar meteorite (troctolitic anorthosite)

**History**: Purchased by Khalid Boushaba in January 2017 from a dealer in Erfoud, Morocco.

**Physical characteristics**: A single, small beige-colored stone (22.9 g) lacking fusion crust, but with visible grains of maskelynite and some cross-cutting, dark glassy veinlets.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Very fine grained assemblage dominated by anorthite (maskelynite) with olivine, pigeonite, subcalcic augite, augite, chromite (with a range of Ti contents), ilmenite, troilite, taenite and minor glass (in veins).

**Geochemistry**: Olivine (Fa22.4-45.1, FeO/MnO = 98-112, N = 3), pigeonite (Fs15.0-16.9Wo13.9-10.2, FeO/MnO = 51-66, N = 3), subcalcic augite (Fs16.6Wo34.4, FeO/MnO = 52), augite (Fs10.3Wo41.7, FeO/MnO = 49), maskelynite (An96.9-98.3Or0.2, N = 2).

**Classification**: Lunar (feldspathic troctolitic granulitic breccia).

**Specimens**: 4.6 g including one polished mount at *UWB*; remainder with Mr. K. Boushaba.

**Northwest Africa 11253** (NWA 11253)

(Northwest Africa)

Purchased: 2017 Mar

Classification: Ordinary chondrite (L, melt rock)

**History**: Purchased by Aras Jonikas in March 2017 from a Moroccan dealer.

**Physical characteristics**: A single pale brown stone (40 g) with small vesicles and sparse partly weathered, subspherical metal grains.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Annealed microgabbroic texture (grainsize 0.1-0.4 mm) with vesicles. Some prismatic pyroxene grains are present, but grain boundaries between other grains exhibit triple junctions. Minerals are olivine, very finely exsolved pyroxenes (both low-Ca and high-Ca), oligoclase, chromite, merrillite, chlorapatite, troilite, very sparse but irregularly distributed kamacite (overall <0.2 vol.%, some as partly altered subspherical grains) and minor barite.

**Geochemistry**: Olivine (Fa25.2-25.6, FeO/MnO = 47-50, N = 3), low-Ca pyroxene (Fs20.7-20.9Wo4.5-4.4, FeO/MnO = 32-35, N = 3), high-Ca pyroxene (Fs10.9-11.5Wo38.8-36.8, FeO/MnO = 26-30, N = 3), plagioclase (An10.1-13.7Or5.0-2.9, N = 2). Oxygen isotopes (K. Ziegler, *UNM*): analyses of acid-washed subsamples by laser fluorination gave, respectively, δ17O 3.843, 4.145, 4.029; δ18O 5.192, 5.734, 5.524; Δ17O 1.102, 1.117, 1.112 per mil.

**Classification**: L-melt rock (vesicular). This specimen apparently has affinities with L chondrites, but the paucity of metal and the presence of exsolution lamellae in pyroxenes are anomalous features.

**Specimens**: 8.2 g including one polished thin section at *PSF*; remainder with Mr. A Jonikas.

**Northwest Africa 11255** (NWA 11255)

(Northwest Africa)

Purchased: 2017 Mar

Classification: Martian meteorite (Shergottite)

**History**: Purchased by Ben Hoefnagels in March 2017 from a dealer in Zagora, Morocco.

**Physical characteristics**: A single stone (1099 g) partially covered with black fusion crust.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Relatively fine grained, equigranular aphyric texture. Composed predominanty of zoned clinopyroxene (~60 vol.%) and maskelynite (~40 vol.%) with accessory ilmenite, titanomagnetite, pyrrhotite and Fe-bearing merrillite, along with rare baddeleyite and potassic feldspathic glass.

**Geochemistry**: High-Ca pyroxene (Fs23.2-39.5Wo33.3-29.6, FeO/MnO = 31-34, N = 4), low-Ca pyroxene (Fs41.2-55.4Wo11.3-16.6, FeO/MnO = 31-33 , N = 4), maskelynite (An37.9-52.3Or4.5-2.1, N = 2).

**Classification**: Martian (shergottite, aphyric).

**Specimens**: 21.2 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11256** (NWA 11256)

(Northwest Africa)

Purchased: 2016 Oct

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased by Dustin Dickens in October 2016 from a dealer in Laayoune, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Ellipsoid-shaped granular chondrules (apparent diameter 900±600 μm) and irregularly shaped, fine-grained CAI are set in a fine-grained matrix (~35 vol.%, sepia brown in thin section) containing rare Zr-Pt-bearing nuggets. The long axes of chondrules show preferred orientation.

**Geochemistry**: Olivine (Fa0.2-61.8, N = 3), orthopyroxene (Fs0.9-1.3Wo1.1-1.2, N = 3), clinopyroxene (Fs0.6Wo34.6; Fs1.1Wo37.4; N = 2).

**Classification**: Carbonaceous chondrite (CV3). Probably paired with NWA 11265.

**Specimens**: 32.2 g including one polished thin section at *UWB*; remainder with Mr. D. Dickens.

**Northwest Africa 11257** (NWA 11257)

(Northwest Africa)

Purchased: 2017 Feb

Classification: Ureilite

**History**: Purchased by Ben Hoefnagels in February 2017 from a dealer in Ouarzazate, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Protogranular aggregate of ~70 vol.% olivine and ~30 vol.% pigeonite. Olivine grains have reduced magnesian rims containing blebs of Fe metal.

**Geochemistry**: Olivine (cores Fa22.3-22.4, rim Fa9.1, N = 3), pigeonite (Fs13.1Wo9.6; Fs17.2Wo14.1; Fs5.7Wo21.1; N = 3).

**Classification**: Ureilite.

**Specimens**: 23 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11258** (NWA 11258)

(Northwest Africa)

Purchased: 1996

Classification: Ordinary chondrite (LL(L)3)

**History**: Purchased by Ken Regelman in 1996 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Very closely packed, well-formed chondrules (apparent diameter 600±300 μm) with little matrix.

**Geochemistry**: Olivine (Fa1.6-29.1, Cr2O3 in ferroan examples <0.02 wt.%, N = 7), orthopyroxene (Fs0.2-25.3Wo0.6-1.6, N = 3), clinopyroxene (Fs1.0Wo34.8; Fs22.1Wo29.8; N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.43.

**Classification**: Ordinary chondrite. LL(L)3. LL designation is favored based on magnetic susceptibility.

**Specimens**: 23 g including one polished thin section at *UWB*; remainder with Mr. K. Regelman.

**Northwest Africa 11259** (NWA 11259)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Eucrite, polymict)

**History**: Purchased by Ken Regelman in 2016 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of lithic eucrite clasts with a variety of textures plus angular mineral grains in a finer grained matrix. Subophitic, quench-textured and very fine grained granulitic clasts were observed in a single thin section. Minerals are exsolved pigeonite, calcic plagioclase (exhibiting undulose extinction), unexsolved low-Ca pyroxene, silica polymorph, ilmenite, chromite and troilite.

**Geochemistry**: Orthopyroxene host (Fs59.2Wo3.2, FeO/MnO = 31, N = 1), clinopyroxene exsolution lamella (Fs32.0Wo38.2, FeO/MnO = 32, N = 1), low-Ca pyroxene (Fs31.2Wo5.6, FeO/MnO = 28, N = 1), plagioclase (An86.1-92.2Or0.7-0.2, N = 3).

**Classification**: Eucrite (polymict breccia).

**Specimens**: 20.1 g including one polished thin section at *UWB*; remainder with Mr. K. Regelman.

**Northwest Africa 11260** (NWA 11260)

Northwest Africa

Purchased: 2005

Classification: Ordinary chondrite (H4/5)

**History**: Purchased by Ben Hoefnagels in 2005 from Luc *Labenne*, who had acquired the stone from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Some well-formed, relatively small chondrules are set in a recrystallized matrix containing relatively abundant stained metal and merrillite.

**Geochemistry**: Olivine (Fa19.2-20.0, N = 3), orthopyroxene (Fs16.5-16.7Wo1.5-1.6, N = 3), clinopyroxene (Fs5.1-5.6Wo46.5-45.9, N = 2).

**Classification**: Ordinary chondrite (H4/5).

**Specimens**: 33 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11261** (NWA 11261)

(Northwest Africa)

Purchased: 2017 Mar

Classification: Martian meteorite (Shergottite)

**History**: Purchased by Ben Hoefnagels in March 2017 from a Moroccan dealer.

**Physical characteristics**: A single rounded ellipsoidal stone (114.2 g) coated with red-brown weathering products, but with a fresher, green interior.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Olivine-rich with predominantly an olivine-orthocumulate texture, although there are also sparse pigeonite oikocrysts (up to 3 mm) containing olivine chadacrysts. Other minerals are intercumulus pigeonite (~15 vol.%) and maskelynite (~6 vol.%), plus accessory chromite (with a range of Ti contents), ilmenite, pentlandite, pyrrhotite, Mg-bearing merrillite, rare baddeleyite and minor barite. The mafic silicate phases have very limited compositional variation. Polycrystalline melt inclusions surrounded by radial expansion cracks are present in olivine. Secondary calcite is present in the form of very thin cross-cutting veinlets and grain boundary coatings on maskelynite grains.

**Geochemistry**: Olivine (Fa36.0-37.3, FeO/MnO = 48-50, N = 3), pigeonite (Fs29.3-30.3Wo8.6-6.8, FeO/MnO = 27-32, N = 3), maskelynite (An51.2-51.8Or1.4-1.7, N = 2).

**Classification**: Martian (shergottite, olivine-orthocumulate).

**Specimens**: 25 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11262** (NWA 11262)

Morocco

Purchased: Mar 2007

Classification: Mesosiderite

**History**: A single stone of 30 g was purchased by Romano Serra at the Bologna Mineral Show in March 2007.

**Physical characteristics**: The main mass is partially covered by a black fusion crust.

**Petrography**: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*): The thin section analyzed displays a medium-grained texture consisting of orthopyroxene, calcic plagioclase, olivine, kamacite, taenite, ilmenite and chromite. Opaque phases constitute ~53 vol.% of the specimen

**Geochemistry**: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) Orthopyroxene (Fs28.3±1.2Wo2.7, FeO/MnO = 24, N = 5), olivine (Fa14.8±0.9, FeO/MnO = 40, N = 3), plagioclase (An90.7Or0.5, N = 5).

**Classification**: Mesosiderite

**Specimens**: A total of 6.5 g specimen and one thin section is on deposit at MSN-Fi. *OAM* owns the main mass.

**Northwest Africa 11263** (NWA 11263)

Morocco

Purchased: Feb 2016

Classification: Rumuruti chondrite (R3)

**History**: Purchased by Giorgio Tomelleri from a Moroccan dealer.

**Physical characteristics**: Several small fragments with black fusion crusts (total weight 281 g).

**Petrography**: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*): The thin section displays a texture consisting of separated, well-formed chondrules (ranging in diameter 0.3-0.9 mm), sometimes rimmed with pentlandite. Chondrules types are mainly PO, PP and POP; a forsterite-rich PO chondrule is present as well as an enstatite PP chondrule; the matrix is fine and contains olivine, orthopyroxene, clinopyroxene. Among opaque phases the most abundant is pentlandite although Ti-bearing chromite can be occasionally found.

**Geochemistry**: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*): Olivine in POP chondrules (Fa26.8±15.6, N = 15), orthopyroxene (Fs13.3±6.3Wo1.2±0.2, N = 8), clinopyroxene (Fs10.8±0.2Wo44.9±0.8, N = 4). Oxygen isotopes: (I.Franchi, R.Greenwood, *OU*) δ17O = 5.24 ‰, δ18O = 5.99 ‰, Δ17O = 2.12 ‰.

**Classification**: R3 chondrite

**Specimens**: 20 g including one polished thin section at MSN-Fi; main mass with Tomelleri.

**Northwest Africa 11264** (NWA 11264)

Morocco

Purchased: Feb 2016

Classification: HED achondrite (Eucrite)

**History**: A single stone of 137 g was found by an anonymous finder in Western Sahara and purchased in February 2016 in Erfoud by Giorgio Tomelleri.

**Physical characteristics**: The main mass is covered by a black fusion crust.

**Petrography**: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*): The thin section analyzed displays a basaltic texture. The major phase is orthopyroxene, with crystals 95-140 μm in width, minor clinopyroxene and anorthitic plagioclase. Several exsolved low-Ca pyroxene crystals are visible, with fine (5-7 μm) pigeonite exsolution lamellae. Minor phases are ilmenite, troilite, chromite, and FeNi metal.

**Geochemistry**: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) Calcic plagioclase An73.8±1.1Or2.3±0.6, n=7; low-Ca pyroxene (Fs59.8±1.3En38.0±1.1Wo2.2±0.1; n=7; Fe/Mn=30.9±0.3); diopside exsolution lamellae in orthopyroxene (Fs26.6±1.4,En31.7±1.1Wo41.6±0.3; n=8; Fe/Mn = 29.1±0.2). Oxygen isotopes: (I. Franchi, R. Greenwood, *OU*) δ17O = 1.93 ‰, δ18O = 4.13 ‰, Δ17O = -0.22 ‰.

**Classification**: Eucrite with medium degree of shock and medium degree of weathering.

**Specimens**: A total of 21.2 g specimen and one thin section is on deposit at *MSN-FI*. Tomelleri owns the main mass.

**Northwest Africa 11265** (NWA 11265)

(Northwest Africa)

Purchased: 2017 Jan

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased by Martin Goff in January 2017 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Ellipsoid-shaped granular chondrules (apparent diameter 730±500 µm, N=38) and elongate CAI (both showing preferred orientation) are set in a fine grained, fractured matrix (~45 vol.%, sepia brown in thin section). One CAI contains the assemblage corundum+gehlenite+spinel+perovskite.

**Geochemistry**: Olivine (Fa1.7-48.2, N = 3), orthopyroxene (Fs0.5-1.0Wo1.0-0.7, N = 3), subcalcic augite (Fs3.3Wo32.1; Fs15.5Wo25.3; N = 2)

**Classification**: Carbonaceous chondrite (CV3). Chondrule size and matrix abundance are slightly anomalous features. Probably paired with [NWA 11256](https://www.lpi.usra.edu/meteor/metbull.php?code=65553).

**Specimens**: 59.1 g including one polished thin section and one polished mount at *UWB*; remainder with Mr. M. Goff.

**Northwest Africa 11266** (NWA 11266)

(Northwest Africa)

Purchased: 2017 Apr

Classification: Lunar meteorite (feldspathic breccia)

**History**: Material excavated from a site near Tindouf, Algeria was purchased by John Higgins in April 2017 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of mineral clasts of anorthite, olivine, exsolved pigeonite, orthopyroxene, augite, fayalite, Ti-chromite, kamacite, taenite and troilite in a finer grained matrix containing small vesicles.

**Geochemistry**: Olivine (Fa20.8-54.4, FeO/MnO = 87-105, N = 3), orthopyroxene (Fs17.0Wo2.9, FeO/MnO = 53), orthopyroxene host (Fs37.9Wo4.8, FeO/MnO = 55), clinopyroxene exsolution lamella (Fs16.9Wo41.9, FeO/MnO = 41), augite (Fs8.6Wo43.1, FeO/MnO = 41), plagioclase (An96.4-96.9Or0.1-0.2, N = 2).

**Classification**: Lunar (feldspathic regolith breccia).

**Specimens**: 21 g including one polished endcut at *UWB*; remainder with Mr. J. Higgins.

**Northwest Africa 11267** (NWA 11267)

(Northwest Africa)

Purchased: 2016 Aug

Classification: HED achondrite (Eucrite, unbrecciated)

**History**: Purchased by Ben Hoefnagels in August 2016 from a dealer in Ouarzazate, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Intersertal texture, with some localized variations in grainsize. Minerals are exsolved pigeonite, maskelynite, silica polymorph, ilmenite, chromite, troilite and minor calcite.

**Geochemistry**: Orthopyroxene host (Fs58.9-59.9Wo1.9-1.8, FeO/MnO = 33-35, N = 3), clinopyroxene exsolution lamellae (Fs26.1-27.9Wo43.1-40.7, FeO/MnO = 30-33, N = 2), maskelynite (An84.2-84.3Or0.6, N = 2).

**Classification**: Eucrite (unbrecciated, intersertal, highly shocked).

**Specimens**: 12.6 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11268** (NWA 11268)

(Northwest Africa)

Purchased: 2011 Dec

Classification: Ordinary chondrite (L5/6)

**History**: Two stones were found by a shepherd near Zag, Morocco, in December 2011 and purchased by Mbark Arjdal.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Sparse chondrules occur in a recrystallized matrix containing stained metal, merrillite and chlorapatite.

**Geochemistry**: Olivine (Fa24.7-24.8, N = 2), orthopyroxene (Fs20.7-20.9Wo1.7-1.8, N = 2), clinopyroxene (Fs6.8-8.4Wo45.5-43.6, N = 2).

**Classification**: Ordinary chondrite (L5/6).

**Specimens**: 21 g including one polished thin section at *UWB*; remainder with Mr. M. Arjdal.

**Northwest Africa 11269** (NWA 11269)

(Northwest Africa)

Purchased: 2017 Apr

Classification: Lunar meteorite (feldspathic breccia)

**History**: A stone excavated from a site near Tindouf, Algeria was purchased by Ken Regelman in April 2017 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of mineral clasts of anorthite, olivine, exsolved pigeonite, pigeonite, augite, Ti-chromite, ilmenite, Cr-Al-Ti-Fe spinel, kamacite and troilite in a finer grained matrix containing small vesicles.

**Geochemistry**: Olivine (Fa7.9-48.4, FeO/MnO = 94-98, N = 4), orthopyroxene (Fs19.2-31.3Wo2.5-4.1, FeO/MnO = 61-63, N = 2), augite (Fs7.2-17.8Wo44.3-40.7, FeO/MnO = 38-43, N = 2), plagioclase (An96.3-97.3Or0.1-0.2, N = 2).

**Classification**: Lunar (feldspathic regolith breccia).

**Specimens**: 20.05 g including one polished endcut at *UWB*; remainder with Mr. K. Regelman.

**Northwest Africa 11270** (NWA 11270)

(Northwest Africa)

Purchased: 2006

Classification: Ordinary chondrite (H3)

**History**: Purchased by Ben Hoefnagels in 2006 from Greg Hupé, who had acquired the stone from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Relatively small, well-formed chondrules (apparent diameter 300 ± 200 μm) are set in a fine grained matrix containing altered metal and merrillite.

**Geochemistry**: Olivine (Fa0.4-32.1, Cr2O3 in ferroan examples <0.02 wt.%, N = 7), orthopyroxene (Fs2.6-16.6Wo0.4-2.8, N = 3), augite (Fs6.4-8.3Wo45.6-37.1, N = 2).

**Classification**: Ordinary chondrite (H3).

**Specimens**: 32.9 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11271** (NWA 11271)

(Northwest Africa)

Purchased: 2017 Feb

Classification: HED achondrite (Eucrite)

**History**: Purchased by Aras Jonikas in February 2017 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia consisting of closely-packed microgabbroic clasts with sparse matrix. Minerals are exsolved pigeonite, calcic plagioclase (exhibiting undulose extinction), silica polymorph, ilmenite, chromite, troilite and minor calcite.

**Geochemistry**: Orthopyroxene host (Fs59.7-62.6Wo6.1-2.1, FeO/MnO = 30-32, N = 3), clinopyroxene exsolution lamellae (Fs28.0-28.3Wo42.9-42.4, FeO/MnO = 34, N = 2), plagioclase (An88.3-90.3Or0.7, N = 2).

**Classification**: Eucrite (monomict breccia, microgabbroic).

**Specimens**: 20.72 g including one polished thin section at *PSF*; remainder with Mr. A. Jonikas.

**Northwest Africa 11272** (NWA 11272)

(Northwest Africa)

Purchased: 1995

Classification: Ordinary chondrite (LL4)

**History**: Purchased by Ken Regelman in 1995 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) The specimen contains closely packed, well-formed and equilibrated chondrules with little matrix.

**Geochemistry**: Olivine (Fa27.4-28.1, N = 3), orthopyroxene (Fs20.8-22.7Wo0.6-1.1, N = 2), pigeonite (Fs11.8Wo6.8; Fs19.7Wo16.0; N = 2), subcalcic augite (Fs14.0Wo29.8).

**Classification**: Ordinary chondrite (LL4).

**Specimens**: 24 g including one polished thin section at *UWB*; remainder with Mr. K. Regelman.

**Northwest Africa 11273** (NWA 11273)

(Northwest Africa)

Purchased: 2017 Apr

Classification: Lunar meteorite (feldspathic breccia)

**History**: Material excavated from a site near Tindouf, Algeria was purchased by a consortium of collectors (Rob Wesel, Eric *Twelker* and Jason Phillips) in April 2017 from Moroccan dealers.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of mineral clasts of anorthite, olivine, exsolved pigeonite, pigeonite, augite, chromite, Ti-Cr-Fe spinel, kamacite, taenite and troilite in a finer grained matrix containing small vesicles and minor barite. Rare basalt clasts and glass fragments are also present.

**Geochemistry**: Olivine (Fa8.7-59.7, FeO/MnO = 89-111, N = 4), pigeonite (Fs28.8Wo11.2, FeO/MnO = 56), clinopyroxene host (Fs15.3Wo40.9, FeO/MnO = 44), orthopyroxene exsolution lamella (Fs34.0Wo2.7, FeO/MnO = 56), augite (Fs16.8Wo41.7, FeO/MnO = 62), plagioclase (An95.9-96.5Or0.2, N = 2).

**Classification**: Lunar (feldspathic regolith breccia).

**Specimens**: 37 g including one polished slice at *UWB*; remaining pieces shared by Mr. R. Wesel, Mr. E. *Twelker* and Mr. J. Phillips.

**Northwest Africa 11274** (NWA 11274)

(Northwest Africa)

Purchased: 2015 Apr

Classification: Ordinary chondrite (L5/6)

**History**: Purchased by Mbark Arjdal in April 2015 from a farmer in Zagora, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Sparse chondrules occur in a recrystallized matrix containing stained metal, merrillite and chlorapatite.

**Geochemistry**: Olivine (Fa24.8-24.9, N = 2), orthopyroxene (Fs20.9-21.2Wo1.6-1.2, N = 2), clinopyroxene (Fs7.7-8.2Wo45.1-44.4, N = 2).

**Classification**: Ordinary chondrite (L5/6).

**Specimens**: 22 g including one polished thin sectiont at *UWB*; remainder with Mr. M. Arjdal.

**Northwest Africa 11278** (NWA 11278)

(Northwest Africa)

Purchased: 2017

Classification: Ordinary chondrite (H, melt rock)

**History**: The meteorite was purchased from a local meteorite dealer in Erfoud, Morocco.

**Petrography**: The meteorite displays a dark, almost black interior and consists of abundant and partly recrystallized shock melt regions with characteristic FeNi metal and sufide spherules. Relict mineral fragments are present; no chondrules and also no metal or sulfide veins are observed.

**Northwest Africa 11280** (NWA 11280)

Morocco

Purchased: 2007

Classification: HED achondrite (Howardite)

**History**: The meteorite was purchased in 2007 from a meteorite dealer in Erfoud, Morocco

**Physical characteristics**: The main mass is oriented, with flow lines visible on the dome-shaped side. It is mostly covered in fusion crust, which shows evidence of some terrestrial oxidation. The yellowish grey interior is visible where some fusion crust has flaked off. Cut surfaces reveal numerous, mostly gray clasts set in a fine-grained, yellow-grey matrix. Some terrestrial oxidation is evident.

**Petrography**: (C. Herd, *UAb*) Well-consolidated breccia of clasts up to 11 mm in longest dimension of diogenitic orthopyroxene (~30 vol%), coarse gabbroic or fine-grained intergranular plagioclase + (exsolved) clinopyroxene ± silica ± chromite ± ilmenite ± sulfide (~20 vol%), impact melt, olivine, pigeonite, orthopyroxene, chromite, and FeNi metal.

**Geochemistry**: (C. Herd, *UAb*) Diogenite orthopyroxene Fs24±1Wo2.3±0.6, Fe/Mn=30±1, n=31, eucrite pigeonite Fs58±5Wo6±2, Fe/Mn=29±1, n=12, eucrite augite Fs32±5Wo38±4, Fe/Mn=30±1, n=10; olivine Fo38.9±0.1, Fe/Mn=52±2, n=5; plagioclase An90.0±1.2Ab9.7±1.1Or0.4±0.1, n=18; high-Ti (4.3 wt% TiO2) and low-Ti (0.8 wt% TiO2) chromite.

**Classification**: Achondrite (howardite)

**Specimens**: Type specimen of 24.3 g, including one thin section, is at *UAb*. Main mass at *JTESM*.

**Northwest Africa 11281** (NWA 11281)

Morocco

Purchased: 2007

Classification: Ordinary chondrite (L6, melt breccia)

**History**: The meteorite was purchased in 2007 from a meteorite dealer in Erfoud, Morocco

**Physical characteristics**: The main mass has no visible fusion crust and red-brown staining across its surface.

**Petrography**: (C. Herd, *UAb*) Cut surfaces reveal a light-gray interior with red-brown staining along fractures. About 2/3 of the thin section investigated is matrix, consisting of very fine-grained (10-50 μm) euhedral olivine and pyroxene crystals with interstitial plagioclase and disseminated sulfide grains. Clasts within this material are 200-1000 μm across and consist of microcrystalline pyroxene and olivine; similar sulfide and Fe-Ni metal clasts are also present. The remaining ~1/3 of the thin section consists of relict chondrules set in a dark, very fine-grained matrix rich in sulfide blebs. Chondrules are poorly delineated (indicative of petrologic type 6), although textures (such as BO) are preserved. Shock effects include strong mosaicism and recrystallization. Most Fe-Ni metal appears to have been replaced by terrestrial oxidation. No ringwoodite is evident, although the presence of wadsleyite cannot be ruled out.

**Geochemistry**: Geochem: (C. Herd, *UAb*) Olivine and pyroxene compositions in matrix and relict chondrules are indistinguishable from one another, within uncertainties. Olivine Fa24.3±1.1(n=29); Low-Ca Pyroxene Fs19.8±1.4Wo2.1±0.9(n=17).

**Classification**: L-melt breccia

**Specimens**: Type specimen of 22.5 g, including one thin section, is at *UAb*. Main mass at *JTESM*.

**Northwest Africa 11282** (NWA 11282)

(Northwest Africa)

Purchased: 2017 Feb

Classification: Carbonaceous chondrite (CK6)

**History**: The meteorite was purchased from a local meteorite dealer in Agadir, Morocco.

**Physical characteristics**: Small brownish individual with grayish interior lacking any fusion crust.

**Petrography**: The meteorite is dominantly composed of recrystallized olivine-rich matrix with scattered chondrules still being discernable. Cr-rich magnetite is abundant. More minor phases include intermediate plagioclase, Ca-pyroxene and troilite. Metal was not detected.

**Northwest Africa 11283** (NWA 11283)

(Northwest Africa)

Purchased: 2017 Jan

Classification: Carbonaceous chondrite (CK6)

**History**: The meteorite was purchased from a local meteorite dealer in Guelmin, Morocco.

**Physical characteristics**: Small black to dark grayish individual partly covered fusion crust.

**Petrography**: The meteorite is largely composed of fine-grained recrystallized matrix mainly consisting of ferrous olivine. Chondrules are only rarely encountered. Minor phases include intermediate plagioclase, low-Ca pyroxene, Ca-pyroxene and troilite. Cr-rich magnetite is abundant, metal is virtually absent.

**Northwest Africa 11284** (NWA 11284)

(Northwest Africa)

Purchased: 2017 Jan

Classification: Ureilite

**History**: The meteorite was purchased from a local meteorite dealer in Guelmin, Morocco.

**Physical characteristics**: Brownish individual lacking any fusion crust.

**Petrography**: The meteorite shows a cumulate texture of up to 1.5 mm sized olivine and orthopyroxene grains. It contains flaky graphite; olivine displays characteristic reduced rims.

**Geochemistry**: reduced rims in olivine: Fa0.8-6.8; Cr2O3 in ol: ~0.6 wt%

**Northwest Africa 11288** (NWA 11288)

(Northwest Africa)

Purchased: 2015 Jan 19

Classification: Martian meteorite (Shergottite)

**History**: Purchased by Marc Jost Agadir, Morocco, from Aziz Habibi

**Physical characteristics**: Greenish gray, heterogeneous looking stones (five fragments of 7.14 to 332.5 g) with partially preserved fusion crust.

**Petrography**: (B. Hofmann, *NMBE* and Å. Rosén, *Bern*) The meteorite consists of dominant calcic pyroxene occurring as elongated crystals 2-3 mm in length and maskelynite typically 1-2 mm in size. Rare free silica intergrown with maskelynite. The meteorite shows a high abundance of vesicular glasses, a dark one is shock melt and a lighter one possibly fusion crust intruded into preexisting cavities.

**Geochemistry**: (Å. Rosén, *Bern* and B. Hofmann, *NMBE*) Pyroxene compositions are Fs36.4±10.9Wo25.3±8.7(Fs20.6-65.5Wo9.2-35.6), mean FeO/MnO = 33.3±5.4 (n=120). Maskelynite has An50.1±3.7Or2.3±1.2(An40.7-54.7Or1.3-6.2). Dark/green glass has SiO250.8/49.3, Al2O3 8.06/8.15, CaO 11.5/11.3, MgO 7.7/7.6, FeO 18.1/18.3, MnO 0.48/0.49, Na2O 1.04/1.53, K2O 0.18/0.07, TiO2 0.88/0.92, Cr2O3 0.16/0.16, FeO/MnO 38.1/37.7 (n= 16/20). Oxygen isotopes: (R. Greenwood, *OU*) δ18O=4.932, δ17O=2.902, Δ17O= 0.337 (all ‰).

**Classification**: Based on petrography, mineral compositions (including Fe/Mn-ratios) and oxygen isotopes this is a strongly shocked shergottite.

**Specimens**: 31.1 g plus one polished thin section at *NMBE*. Main mass: Marc Jost, *SJS*.

**Northwest Africa 11289** (NWA 11289)

Morocco

Purchased: 2012 Oct

Classification: Iron meteorite (IIIE)

**History**: The meteorite was purchased in Temara from a dealer who bought it in Beni Melal.

**Petrography**: (A. Bouvier, *UWO*) Weathered interior, medium octaedrite texture. No inclusions were observed in the repository specimen. Rust formed during storage, after it was cut 4 to 5 years before classification.

**Geochemistry**: (A. Bouvier, *UWO*) Elemental composition in wt%: Ni = 9.7, Co=0.46; and in ppm: Cr=3.8, Cu=131.1, Ga=21.7, As=13.8, W=0.53, Pt=3.2, Ir=0.076 and Au=1.6.

**Classification**: Iron, IIIE based on Ir, Co, Ga, and Au abundances [(Malvin et al., 1984](http://www.sciencedirect.com/science/article/pii/0016703784901017)).

**Specimens**: One slice of 93 g at *UWO*.

**Reclassification of Northwest Africa11289**  
  
The NWA 11289 iron meteorite is reclassified as IIIAB instead of IIIE based on new INAA data, measured by J.T. Wasson, *UCLA*. A major concern for classification was Co, now measured at 5.48 ppm by INAA, vs. 4.6 ppm by ICPMS, which led to the initial classification. With the revised data, NWA 11289 fits IIIAB trends well, especially Ni, Cu, Ga, As, Pt, Ir, and Au.

**Northwest Africa 11290** (NWA 11290)

(Northwest Africa)

Purchased: 2013

Classification: Pallasite (Main group)

**History**: The finder sold the meteorite to Brahim Tahiri in Erfoud. The meteorite was then acquired by Sean Tutorow.

**Physical characteristics**: The hand specimen is made of fresh Fe-Ni metal enclosing cm-sized olivine crystals.

**Petrography**: Olivine, as well as pyroxene, chromite, and iron-rich sulfide were identified by EDS within the polished mount.

**Geochemistry**: Mineral composition and geochemistry: Pyroxenes: opx Fs17.9±0.5Wo1.1±0.4(N=2); low-Ca Fs12.7Wo23.8(N=1); high-Ca: Fs6.4±0.5Wo45.6±1.4(N=5). Olivine Fa20.9±0.1and Fe/Mn = 53.4±8.5 (N=8). Metal elemental analysis by quadrupole ICPMS (*UWO*), using the North Chile (Filomena) iron meteorite as an external standard: in mg/g Co = 3.7; Ni = 140.9, and in ppm: Cr = 2.0, Cu = 283, Ga = 26.3, Ge = 9.1, As = 18.1, Ru = 1.9, Rh = 1.1, Pd = 6.9, Ir = 0.21, Pt = 1.7, and Au = 2.7.

**Classification**: Pallasite, main group.

**Specimens**: 15.2g including a polished section at *UWO*. Remaining mass with Sean Tutorow.

**Northwest Africa 11291** (NWA 11291)

(Northwest Africa)

Purchased: 2015 Aug

Classification: Ordinary chondrite (LL3)

**Physical characteristics**: Stone has no fusion crust, brown color.

**Petrography**: Numerous chondrules, up to 4 mm in diameter. Metal is partially oxidized. Metal abundance ~2 vol%.

**Geochemistry**: Olivine 21.6±8.4 (N=10), FeO/MnO (molar) 54.1±19.1 (N=10), Pyroxene Fs21.5±9.4Wo3.3±3.7(N=10).

**Classification**: LL3

**Specimens**: 46.7 g including a thin section and probe mount at *UWO*. Main mass with S. Tutorow.

**Northwest Africa 11292** (NWA 11292)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Eucrite, polymict)

**History**: One stone weighing 146 g was found and subsequently purchased from the finder in Agadir in 2016. Thomas *Webb* acquired the sample in 2016.

**Physical characteristics**: Physical Characteristics: Sample is an irregular-shaped fragment that is ~35% covered by a black fusion crust. The fusion crust contains contraction cracks and a few small areas with relict flow lines. The interior is dark-grey and displays a clastic texture composed of lithic and mineral fragments.

**Petrography**: Description and classification (A. Love, *App*): Sample is a breccia composed: of <=1 cm rounded to angular clasts with ophitic basaltic and cumulate textures with exsolved pyroxenes; vitrophyric textured melt clasts; brecciated clasts containing cumulate debris and 1mm clasts of exsolved pyroxenes that are crosscut by veins of fayalitic olivine (Fa84) and mineral fragments set within a fine-grained matrix of fragmental debris. Accessory minerals are Si polymorphs, ilmenite, FeS.

**Geochemistry**: (A. Love, *App*) Low-Ca pyroxene Fs65.5±2.8Wo2.1±-0.7(Fs60.8-70.8Wo1.3-4.0, FeO/MnO=30.5-35.1, N=21); Pigeonite host Fs61.2±2.3Wo8.1±1.4(Fs58.2-64.6Wo5.4-9.9, Fe/Mn=30.0-31.8, N=6); high-Ca pyroxene exsolution lamellae Fs35.2±3.7Wo38.5±5.9(Fs32.1-42.2Wo27.0-44.4, FeO/MnO=33.0-34.8, N=12); plagioclase An90.7±2.3Or0.3(An88.5-93.0, N=7); Fayalitic veins Fa84.3±0.3, N=6.

**Classification**: HED Achondrite (eucrite, polymict)

**Specimens**: Thomas *Webb* holds the 123.3 g main mass. A 21.1 g type specimen and one polished thin section are on deposit at *App*.

**Northwest Africa 11293** (NWA 11293)

(Northwest Africa)

Purchased: 2016

Classification: Ordinary chondrite (H6)

**History**: 1 stone weighing 39.4 g was found in Morocco in 2016. David Holden acquired the sample from a meteorite prospector in Erfoud 2016.

**Physical characteristics**: Sample is a triangular-shaped oriented stone (with rollover lipping), dark brown weathered fusion crust (covers about 40% of stone) with a few shallow regmaglypts, moderately magnetic.

**Petrography**: Description and classification (A. Love, *App*): Poorly-defined chondrules with an average diameter of 656 μm (n=55) in a recrystallized matrix. Porphyritic chondrules contain turbid-recrystallized mesostasis.

**Geochemistry**: Olivine: Fa17.4±0.2N=6; Low-Ca pyroxene: Fs15.2±0.2Wo1.1±0.1N=6.

**Classification**: Ordinary Chondrite (H6, S3, W3). Mineral compositions suggest this is an H condrite.

**Specimens**: One polished thin section and a 8.20 g type specimen are on deposit at *App*. David Holden holds the main mass.

**Northwest Africa 11294** (NWA 11294)

(Northwest Africa)

Purchased: 2011

Classification: Ordinary chondrite (H6)

**History**: A stone weighing 30.3 g was found in Morocco in 2011. David Holden acquired the sample from a meteorite prospector in Erfoud 2011.

**Physical characteristics**: The oriented stone displays a defined rollover lip and has an irregular shape and is covered (~60%) by a weathered brown fusion crust. The crust has several sand-filled cracks. The cut surface displays weather and fresh flake of metal and chondrules on the interior of the stone.

**Petrography**: Description and classification (A. Love, *App*): Sample shows a recrystallized chondritic texture composed of some distinct chondrules within a recrystallized matrix. Relict chondrules have an average diameter of 739 μm, n=14.

**Geochemistry**: Olivine: Fa18.7±0.2N=6; Low-Ca pyroxene: Fs16.0±0.4Wo1.7±0.2N=6.

**Classification**: Ordinary Chondrite (H6, S3, W2). Mineral compositions suggest this is an H chondrite.

**Specimens**: Three slices weighing 10.3 g and one polished thin section are on deposit at *App*. David Holden holds the main mass.

**Northwest Africa 11295** (NWA 11295)

(Northwest Africa)

Purchased: 2016

Classification: Ordinary chondrite (L6)

**History**: A stone weighing 18.5 g was found in Morocco in 2016. David Holden acquired the sample from a meteorite prospector in Erfoud 2016.

**Physical characteristics**: The oriented stone displays a defined rollover lip, has a rounded nose-cone shape and is covered (~65%) by a black-dark brown fusion crust. The interior of the stone is dark brown and shows numerous small chondrules and weathered and fresh flakes of metal.

**Petrography**: Description and classification (A. Love, *App*): Sample is heavily recrystallized. All relict chondrules are droplet varieties of RP, BO. chondrules are and have an avg. diam. of 1495 μm, N=8. The sample contains yellow-stained silicates, maskelynite is present in the mesostasis of most chondrules, troilite is polycrystalline, and ringwoodite and rounded sulfide droplets are present within some shock veins.

**Geochemistry**: Olivine: Fa23.4±0.3N=9; Low-Ca pyroxene: Fs19.9±0.8Wo1.4±0.3N=8.

**Classification**: Ordinary Chondrite (L6, S6, W2). Mineral compositions suggest this is an L chondrite.

**Specimens**: Two slices weighing 5.21 g and one polished thin section are on deposit at *App*. David Holden holds the main mass.

**Northwest Africa 11296** (NWA 11296)

(Northwest Africa)

Purchased: 2016

Classification: Ordinary chondrite (L6)

**History**: A stone weighing 53 g was found in Morocco in 2016. David Holden acquired the sample from a meteorite prospector in Erfoud 2016.

**Physical characteristics**: The oriented stone has a dark brown weathered fusion crust with rollover lipping and a flattened triangular shape. The interior of the stone is tan to orange, shows chondrules and fresh and weather flakes of metal.

**Petrography**: Description and classification (A. Love, *App*): Sample is dark-orange in color and displays a recrystallized chondritic texture composed of indistinct chondrules with an average diameter of 808 μm, n=48 set within a recrystallized matrix. All Ca-poor pyroxene is orthorhombic and accessory apatite is present. FeNi metal comprises ~ 2 vol% of the specimen.

**Geochemistry**: Olivine: Fa23.2±0.2N=6; Low-Ca pyroxene: Fs19.3±0.4Wo1.5±0.3N=6.

**Classification**: Ordinary Chondrite (L6, S6, W2). Mineral compositions suggest this is an L chondrite.

**Specimens**: An endcut and one slice weighing 10.63 g, and a polished thin section are currently on deposit at *App*. David Holden has the main mass.

**Northwest Africa 11297** (NWA 11297)

(Northwest Africa)

Purchased: 2016

Classification: Ordinary chondrite (H6)

**History**: 1 stone weighing 51.2 g was found in Morocco in 2016. David Holden acquired the sample from a meteorite prospector in Erfoud 2016.

**Physical characteristics**: The oriented stone has a well-defined convex face and irregularly shaped trailing edge. The stone is 55% covered by a weathered fusion crust. There is a discontinuous rollover lip covering the trailing edge of the stone. The Interior is dark reddish-brown and shows numerous small chondrules and weathered and fresh flakes of metal.

**Petrography**: Description and classification (A. Love, *App*): Sample shows a recrystallized chondritic texture composed of rare distinct chondrules and fragments which have an average diameter of 62 μm set within a recrystallized matrix.

**Geochemistry**: Olivine: Fa18.0±0.3N=6; Low-Ca pyroxene: Fs15.6±0.2Wo1.7±1.1N=6.

**Classification**: Ordinary Chondrite (H6, S3, W2). Mineral compositions suggest this is an H chondrite.

**Specimens**: Two slices weighing 10.64g and one polished thin section are on deposit at *App*. David Holden holds the main mass.

**Northwest Africa 11298** (NWA 11298)

(Northwest Africa)

Purchased: 2016

Classification: Ordinary chondrite (H5)

**History**: A stone weighing 12.6 g was found in Morocco in 2016. David Holden acquired the sample from a meteorite prospector in Erfoud 2016.

**Physical characteristics**: The stone is dark brown in color, irregularly shaped, and covered by a weathered fusion crust that contains shallow regmaglypts on one face. The interior is dark brown and shows well-formed chondrules and fresh flakes of metal.

**Petrography**: Description and classification (A. Love, *App*): Sample is dark-orange colored and displays chondritic texture composed of indistinct chondrules and fragments with an average diameter of 529 μm, n=42. Sample contains rare clinoenstatite and ~8 vol% FeNi metal.

**Geochemistry**: Olivine: Fa17.5±0.3N=6; Low-Ca pyroxene: Fs15.3±0.3Wo1.3±0.4N=6.

**Classification**: Ordinary Chondrite (H6, S3, W2). Mineral compositions suggest this is an H chondrite.

**Specimens**: A 2.56g type specimen and one polished thin section are on deposit at *App*. David Holden holds the main mass.

**Northwest Africa 11299** (NWA 11299)

(Northwest Africa)

Purchased: 2017

Classification: Carbonaceous chondrite (CK5)

**History**: A single stone weighing 969.7 g was found in Morocco and subsequently purchased by Blaine *Reed* at the 2017 Tucson Gem and Mineral show.

**Physical characteristics**: The stone is dark-orangish-brown in color, has a flattened ovoid shape, lacks fusion crust and has a weathered exterior with some chondrules protruding through the surface. The cut face showing the interior of the stone is dark greenish-brown and shows readily discernible dark-colored chondrules and irregular to circular dark-gray metallic grains.

**Petrography**: Description and classification (A. Love, *App*): Sample is recrystallized and has a texture composed of distinct chondrules with an average diameter of 693 μm, chondrule fragments, irregularly shaped CAIs within a fine, transparent crystalline matrix. Olivine chondrules are dominant. Sample contains minor pyroxene, and plagioclase (<50 μm in length) and Cr-magnetite.

**Geochemistry**: Olivine: Fa24.58±0.34NiO 0.47±0.17, n=20; low Ca pyroxene Fs21.29±0.67Wo1.02±2.17, n=9; high Ca pyroxene Fs4.77±3.11Wo41.94±6.97, n=2; plagioclase Ab65.01±7.67Or5.93±0.23, n=8; magnetite= Cr2O3 3.40±0.11wt%, Al2O3 0.48±0.23wt%, NiO 0.1±0.07wt% (n=5).

**Classification**: CK5. CK based on dark coloring, presence of CAIs and ubiquitous Cr-magnetite. Petrologic type 5 based on textures and equilibrated mineral compositions. Specimen has low FeO compositions compared to more highly oxidized CK chondrites, but shares compositional similarities to: [Graves Nunataks 98102](https://www.lpi.usra.edu/meteor/metbull.php?code=11094) (CK4 Fa24); [NWA 5580](https://www.lpi.usra.edu/meteor/metbull.php?code=49279) (CK4 Fa25.2); [NWA 7615](https://www.lpi.usra.edu/meteor/metbull.php?code=56646) (CK6 Fa24.7) and [NWA 11207](https://www.lpi.usra.edu/meteor/metbull.php?code=65381) (CK5 Fa24.9).

**Specimens**: Two slices weighing 39.05 g and one polished thin section are on deposit at *App*. Blaine *Reed* holds the main mass.

**Northwest Africa 11300** (NWA 11300)

(Northwest Africa)

Purchased: 2017 Mar

Classification: Martian meteorite (Shergottite)

**History**: Purchased by Darryl Pitt in March 2017 from a Mauritanian dealer.

**Physical characteristics**: A single dark stone (71.6 g) partly coated by black fusion crust. The fresh interior exhibits long prismatic grains of grayish-green pyroxene with subordinate interstitial glassy maskelynite and sporadic pockets of black vesicular glass.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Large (up to 12 mm long) prismatic, zoned and twinned pyroxene grains are accompanied by interstitial sheaf-like masses of thin maskelynite laths associated with Fe-bearing merrillite, chlorapatite, ilmenite, titanomagnetite, chromite and fayalite. Some intergrowths of ferrosilite+silica+pyrrhotite are also present.

**Geochemistry**: Orthopyroxene (Fs23.9Wo3.8, FeO/MnO = 33), pigeonite (Fs28.7Wo7.9, FeO/MnO = 29), subcalcic augite (Fs22.2-38.2Wo31.2-25.6, FeO/MnO = 28-34, N = 3), ferroan pigeonite (Fs51.7-80.7Wo11.7-13.9; Fs69.2Wo19.7; FeO/MnO = 44-49; N = 3), ferrosilite (Fs92.1Wo2.9, FeO/MnO = 87), fayalite (Fa95.2, FeO/MnO = 49), maskelynite (An43.3-43.4Or2.4-2.9, N = 2).

**Classification**: Martian (shergottite, gabbroic).

**Specimens**: 14.39 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11301** (NWA 11301)

(Northwest Africa)

Purchased: 1995

Classification: Ordinary chondrite (LL3)

**History**: Purchased by Ken Regelman in 1995 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Fairly closely packed, well-formed chondrules (apparent diameter 700±400 μm, N = 15) occur in a sparse matrix.

**Geochemistry**: Olivine (Fa1.4-53.0, Cr2O3 in ferroan examples 0.02-0.07 wt.%, mean 0.03±0.02 wt.%, N = 8), orthopyroxene (Fs4.6-25.3Wo0.4-3.4, N = 3), clinopyroxene (Fs1.3-2.8Wo46.7-46.5, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.32.

**Classification**: Ordinary chondrite (LL3).

**Specimens**: 21.8 g including one polished thin section at *UWB*; remainder with mr. K. Regelman.

**Northwest Africa 11302** (NWA 11302)

Mali

Purchased: 2016 Dec

Classification: HED achondrite (Eucrite, unbrecciated)

**History**: Purportedly found near Erg Chech, Mali, and puchased by Ben Hoefnagels in December 2016 from a dealer in Marrakech, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Microgabbroic texture. Minerals are exsolved pigeonite, calcic plagioclase, silica polymorph, Ni-free metal, ilmenite, chromite and troilite.

**Geochemistry**: Orthopyroxene host (Fs60.4-60.7Wo2.1-1.8, FeO/MnO = 28, N = 2), clinopyroxene exsolution lamellae (Fs27.9-28.6Wo41.8-40.8, FeO/MnO = 26-29, N = 2), plagioclase (An89.0-89.4Or0.6-0.4, N = 2).

**Classification**: Eucrite (unbrecciated, microgabbroic).

**Specimens**: 18.2 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11305** (NWA 11305)

(Northwest Africa)

Purchased: 2017 Feb

Classification: HED achondrite (Eucrite, brecciated)

**History**: Purchased by Darryl Pitt in February 2017 from a Moroccan dealer at the Tucson Gem and Mineral Show.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of lithic eucrite clasts (exhibiting both fine-intersertal and gabbroic textures) plus related mineral debris in a fine grained matrix. Minerals are exsolved pigeonite (orange in thin section), calcic plagioclase (polycrystalline), silica polymorph, Ti-chromite, troilite and fayalite.

**Geochemistry**: Orthopyroxene host (Fs61.0-62.4Wo3.1-3.0, FeO/MnO = 31-36, N = 2), clinopyroxene exsolution lamellae (Fs28.1-28.2Wo42.0-42.9, FeO/MnO = 27-31, N = 2), fayalite (Fa71.2-78.0, FeO/MnO = 38-45, N = 2), plagioclase (An89.8-90.6Or0.6-0.7, N = 2).

**Classification**: Eucrite (breccia).

**Specimens**: 21.2 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11306** (NWA 11306)

(Northwest Africa)

Purchased: 2017-Mar

Classification: Ordinary chondrite (LL6)

**History**: Purchased by Darryl Pitt in March 2017 from a Mauritanian dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Largely recrystallized with rare chondrule remnants.

**Geochemistry**: Olivine (Fa31.5-31.9, N = 2), orthopyroxene (Fs25.2-25.5Wo2.4-2.3, N = 2), clinopyroxene (Fs10.2-10.5Wo43.4-43.1, N = 2).

**Classification**: Ordinary chondrite (LL6).

**Specimens**: 20.1 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11307** (NWA 11307)

(Northwest Africa)

Purchased: 2017 Feb

Classification: Mesosiderite

**History**: Purchased by Ben Hoefnagels in February 2017 from a dealer in Zagora, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Annealed polymict breccia consisting predominantly of orthopyroxene, anorthite, metal (~25 vol.%; kamacite + minor taenite), exsolved pigeonite and troilite, with accessory silica polymorph, chromite and ilmenite.

**Geochemistry**: Orthopyroxene (Fs24.1-29.3Wo2.2-1.3, FeO/MnO = 30-35, N = 4), orthopyroxene host (Fs61.3Wo1.1, FeO/MnO = 30), clinopyroxene exsolution lamellae (Fs28.1-29.9Wo41.6-39.8, FeO/MnO = 29-30, N = 2), plagioclase (An91.3-92.6Or0.3-0.2, N = 2).

**Classification**: Mesosiderite (eucrite bearing). The abundance of metal, orthopyroxene, anorthite and troilite is consistent with the mineralogy of mesosiderites; however, the amounts of exsolved pigeonite, silica polymorph and ilmenite are indicative of a significant eucrite component. Furthermore, the compositions of the host orthopyroxene and clinopyroxene lamellae in exsolved pigeonite are typical of those in most eucrites.

**Specimens**: 124.8 g including one polished endcut at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11308** (NWA 11308)

(Northwest Africa)

Purchased: 2017 Mar

Classification: Ordinary chondrite (LL7)

**History**: Purchased by Darryl Pitt in March 2017 from a Mauritanian dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Recrystallized breccia with pervasive poikiloblastic texture and devoid of remnant chondrules. Orthopyroxene oikocrysts enclose small olivine chadacrysts and are accompanied by kamacite, chromite, troilite and chlorapatite.

**Geochemistry**: Olivine (Fa27.7-29.0, N = 3), orthopyroxene (Fs22.8-23.4Wo3.1-2.6, N = 3), clinopyroxene (Fs9.3-9.4Wo43.43.3-43.2, N = 2).

**Classification**: Ordinary chondrite (LL7 breccia).

**Specimens**: 21.2 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11309** (NWA 11309)

(Northwest Africa)

Find: 2016

Classification: Ureilite

**History**: Discovered by local people in 2016, purchased from M. Graul/Bernau in 2017.

**Physical characteristics**: One black-brown fragment of 22 g, partly covered by fusion crust. Polished face shows brown patches in dark matrix; some grain boundaries show vugs.

**Petrography**: (R. Bartoschewitz, *Bart*) Microprobe examination of a thin section shows olivine and minor pyroxene crystallites (grain size ~1.0 mm). Graphite abundant, diamonds and metal interstitial to silicates.

**Geochemistry**: (R. Bartoschewitz, *Bart*, P. Appel and B. Mader, *Kiel*) Olivine: Fa17.9±7.1; Cr2O3=0.6-0.8 wt.% (n=19); reduced rims present. Pyroxene: Fs4.1Wo4.9; Cr2O3=0.6 wt.% (n=1). Ca-pyroxene: Fs7En69Wo24; Cr2O3=1.2 wt.% (n=1). Magnetic susceptibility (R. Bartoschewitz, *Bart*) log χ (× 10-9 m3/kg) = 4.70.

**Classification**: Ureilite

**Specimens**: 4.6 g on deposit at *Kiel*, main mass Alan Mazur

**Northwest Africa 11310** (NWA 11310)

Morocco

Purchased: 2016

Classification: HED achondrite (Howardite)

**History**: A single piece of 369 g was purchased by S. Decker 2016 from a Moroccan dealer.

**Petrography**: (A. Bischoff, *IfP*) This meteorite is a polymict breccia consisting of ~80% diogenitic material and ~20% eucritic lithologies. Chromite, ilmenite, kamacite, and a SiO2-phase were also found.

**Geochemistry**: (S. Lentfort, A. Bischoff, *IfP*) Diogenitic low-Ca pyroxene Fs29.5±1.8Wo3.3±1.2, n=6; eucrite low Ca pyroxene Fs57.3±7.7Wo3.8±2.7, n=7. FeO/MnO=32±6, n=13. Eucrite high-Ca pyroxene: Fs28.9±0.5Wo43.5±0.8; n=4; plagioclase: An88.6±3.4Ab10.9±2.9Or0.6±0.5; n=4

**Classification**: HED achondrite (howardite)

**Specimens**: Specimen: 21.5 g and one polished thin section are at *IfP*.

**Northwest Africa 11311** (NWA 11311)

Algeria

Purchased: 2016

Classification: HED achondrite (Howardite)

**History**: One piece with a total mass of 180 g was purchased by S. Decker 2016 from a Moroccan dealer. Based on the information from the dealer the sample was found in Algeria.

**Petrography**: (A. Bischoff, *IfP*) This meteorite is a polymict breccia consisting of ~85% diogenitic material and ~15% eucritic lithologies. Most plagioclase has been transformed to maskelynite. Chromite, ilmenite, kamacite, and a SiO2-phase were also found.

**Geochemistry**: (M. Patzek, A. Bischoff, *IfP*) Diogenitic low-Ca pyroxene Fs27.3±3.9Wo2.9±1.6, n=6; eucrite low Ca pyroxene Fs52.8±6.6Wo5.7±1.4, n=6. FeO/MnO=33±5, n=12. Eucrite high-Ca pyroxene: Fs28.7Wo40.5and Fs28.0Wo41.7; n=2; plagioclase: An83.5Ab15.8Or0.6.

**Classification**: HED achondrite (howardite)

**Specimens**: Specimen: 20.0 g and one polished thin section are at *IfP*

**Northwest Africa 11313** (NWA 11313)

Morocco, (Northwest Africa)

Purchased: Mar 2016

Classification: Ordinary chondrite (L5, melt breccia)

**History**: A single stone of 2102 g was found by an anonymous person in Western Sahara and purchased 2016 in Erfoud by Hichame Mimaghador.

**Physical characteristics**: Partially covered by a black fusion crust.

**Petrography**: (V.Moggi Cecchi, G.Pratesi, S.Caporali, *UniFi*): Recrystallized shock-melt regions with scattered grains of metal and rounded troilite blebs are visible in the polished thin section. Some regions still display chondrules and mineral fragments.

**Geochemistry**: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) Olivine (Fa25.6±0.5, N=7), orthopyroxene (Fs21.1±0.6Wo1.8±0.1, N = 6).

**Classification**: Ordinary Chondrite (L5-melt breccia); S3; W2.

**Specimens**: A total of 46 g and one thin section are on deposit at *MSN-FI*. Mimaghador owns the main mass.

**Northwest Africa 11317** (NWA 11317)

Morocco, (Northwest Africa)

Purchased: Mar 2016

Classification: Ordinary chondrite (LL6, melt breccia)

**History**: Purchased by Hichame Mimaghador at the Erfoud Market in March 2016.

**Physical characteristics**: Single stone weighing 179 g with a dark-brown crust. Several metal spots in a black matrix are visible in a sawn surface. No evident chondrules.

**Petrography**: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*). Abundant melt regions containing scattered grains of metal and rounded troilite blebs are visible in the polished thin section. Rare remnant chondrules and mineral fragments are visible in other regions. The chondritic portion appears weakly shocked (S1).

**Geochemistry**: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) Olivine (Fa29.4±1.3, N=6), orthopyroxene (Fs23.7±0.7Wo1.9±0.3, N = 7).

**Classification**: Ordinary Chondrite (LL6-melt breccia); S1; W1

**Specimens**: A total of 36 g and one thin section is on deposit at *MSN-FI*. Mimaghador holds the main mass.

**Northwest Africa 11319** (NWA 11319)

Morocco, (Northwest Africa)

Purchased: Mar 2016

Classification: HED achondrite (Eucrite, polymict)

**History**: A single stone of 74 g was found by an anonymous finder in Western Sahara and purchased 2016 in Erfoud by Hichame Mimaghador

**Physical characteristics**: The main mass is partly covered by a black fusion crust.

**Petrography**: The thin section analyzed displays a fragmental breccia composed of lithic eucrite clasts and angular mineral grains in a finer grained matrix. Mineral grains account for 10% of the total volume and are mainly consisting of unexsolved diogenitic orthopyroxene crystals 70-150 μm in width. Eucrite clasts are consisting of exsolved orthopyroxene crystals with fine pigeonite exsolution lamellae, 4-6 μm in width, calcic plagioclase, ilmenite, chromite, troilite and FeNi metal.

**Geochemistry**: EMP (V.Moggi Cecchi, G.Pratesi, S.Caporali *UniFi*) Diogenitic portion: orthopyroxene (Fs26.2±1.2En71.2±1.5Wo2.7±0.3; n=7; Fe/Mn=34.1±0.3); Eucritic portion: orthopyroxene host (Fs59.4±1.2En37.4±1.5Wo3.2±0.3, FeO/MnO = 32.3±0.3, N = 3); augite (Fs28.7±1.1En30.7±1.2Wo40.7±0.1; n=6; Fe/Mn=33.3±0.2); pigeonite exsolution lamellae in orthopyroxene (Fs60.7±1.2,En33.8±1.3Wo5.5±0.2; n=6; Fe/Mn = 36.4±0.1); Plagioclase An84.5±1.5Or0.7±0.1, n=7.

**Classification**: Polymict eucrite with medium degree of shock and medium degree of weathering.

**Specimens**: A total of 18 g specimen and one thin section are on deposit at *MSN-FI*. Compagnucci owns the main mass.

**Northwest Africa 11320** (NWA 11320)

(Northwest Africa)

Purchased: 2017 Feb

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased in Morocco by Habib Naji in February 2017.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Ellipsoidal chondrules (mostly granular, but some BO and PO types; apparent diameter 800±500 μm, N = 12) and relatively abundant, elongate, irregularly shaped, fine-grained CAI occur in a relatively sparse matrix (~35 vol.%, orange in thin section). Chondrules and CAI exhibit some preferred orientation of their long axes.

**Geochemistry**: Olivine (Fa0.1-42.6, N = 3), orthopyroxene (Fs0.8-0.9Wo0.9-1.1, N = 2), clinopyroxene (Fs0.3Wo34.0; Fs0.7Wo41.6; N = 2), clinopyroxene in CAI (Fs49.6Wo49.4).

**Classification**: Carbonaceous chondrite (CV3).

**Specimens**: 21.79 g including one polished thin section at *UWB*; remainder with H. Naji.

**Northwest Africa 11321** (NWA 11321)

(Northwest Africa)

Purchased: 2017 Mar

Classification: HED achondrite (Eucrite, unbrecciated)

**History**: Purchased by Darryl Pitt in March 2017 from a Mauritanian dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) The specimen has an overall subophitic igneous texture, but domains of different grainsize are juxtaposed as a result of cross-cutting microfaults. Minerals are exsolved pigeonite, calcic plagioclase, silica polymorph, Ti-chromite, ilmenite and troilite.

**Geochemistry**: Orthopyroxene host (Fs60.6-63.0Wo3.7-2.3, FeO/MnO = 31-32, N = 2), clinopyroxene exsolution lamellae (Fs27.6-27.7Wo42.7-42.9, FeO/MnO = 33-34, N = 2), plagioclase (An84.5-87.8Or0.7-0.6, N = 2).

**Classification**: Eucrite (unbrecciated, subophitic).

**Specimens**: 20.1 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11322** (NWA 11322)

(Northwest Africa)

Purchased: 2017 Mar

Classification: Carbonaceous chondrite (CM1/2)

**History**: Purchased by Ben Hoefnagels in March 2017 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Very small serpentinized chondrules (apparent diameter 300±200 μm, N = 12), sparse olivine-bearing chondrules, angular olivine fragments and some fine grained CAI occur in an indeterminate, extremely fine grained matrix (black in thin section). No pyroxene was found despite a careful search, but rare grains of pentlandite and calcite were identified.

**Geochemistry**: Olivine (Fa0.5-4.3, N = 3).

**Classification**: Carbonaceous chondrite (CM1/2).

**Specimens**: 20.3 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11323** (NWA 11323)

(Northwest Africa)

Purchased: 2005

Classification: Ordinary chondrite (L4/5)

**History**: Purchased by an anonymous collector from a dealer at the Munich Show in 2005, subsequently acquired by the Hollis Collection and donated to *PSF*.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Some well-formed chondrules occur in a recrystallized matrix.

**Geochemistry**: Olivine (Fa24.9-25.5, N = 3), orthopyroxene (Fs20.5-21.4Wo1.9-1.4, N = 2), clinopyroxene (Fs6.6-8.1Wo45.7-43.7, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.61.

**Classification**: Ordinary chondrite (L4/5).

**Specimens**: The entire specimen including one polished thin section is at *PSF*.

**Northwest Africa 11324** (NWA 11324)

(Northwest Africa)

Purchased: 2016 Aug

Classification: Carbonaceous chondrite (CO3)

**History**: Purchased by Ben Hoefnagels in August 2016 from a dealer in Ouarzazate, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Small, relatively closely packed chondrules (apparent diameter 350±200 μm, N = 12), angular mineral fragments and some very fine-grained, rimmed CAI occur in a sparse orange-brown matrix (~15 vol.%) containing kamacite, troilite and taenite.

**Geochemistry**: Olivine (Fa0.1-56.4, Cr2O3 in ferroan examples 0.02-0.11 wt.%, mean 0.06±0.03 wt.%, N = 7), orthopyroxene (Fs0.6-7.8Wo0.9-3.4, N = 3), pigeonite (Fs9.1Wo6.1), diopside (Fs0.3-0.6Wo43.5-45.0, N = 2).

**Classification**: Carbonaceous chondrite (CO3). Chondrules are much more closely packed and the proportion of matrix is lower than in typical CO chondrites. The relatively low chromium contents in ferroan olivine signify a subtype >3.5.

**Specimens**: 16.8 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11325** (NWA 11325)

(Northwest Africa)

Purchased: 2017 Feb

Classification: HED achondrite (Eucrite)

**History**: Purchased by Ben Hoefnagels in February 2017 from a dealer in Ouarzazate, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Monomict breccia consisting of subophitic-textured clasts in a sparse matrix. Minerals are exsolved pigeonite, calcic plagioclase, silica polymorph, ilmenite, Ti-chromite and troilite.

**Geochemistry**: Orthopyroxene host (Fs61.3-61.4Wo2.0, FeO/MnO = 30-32, N = 2), clinopyroxene exsolution lamellae (Fs25.8-26.0Wo44.0-44.1, FeO/MnO = 32-34, N = 2), plagioclase (An85.3-85.4Or0.6-0.7, N = 2).

**Classification**: Eucrite (monomict breccia, subophitic).

**Specimens**: 16.9 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11326** (NWA 11326)

(Northwest Africa)

Purchased: 2005

Classification: Ordinary chondrite (L3)

**History**: Purchased by an anonymous collector from a dealer at the Munich Show in 2005, subsequently acquired by the Hollis Collection and donated to *PSF*.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Fairly closely packed chondrules (apparent diameter 500±400 μm, N = 12) occur within a reddish-brown matrix.

**Geochemistry**: Olivine (Fa2.2-46.8, Cr2O3 in ferroan examples 0.04-0.13 wt.%, mean 0.07±0.03 wt.%. N = 8), orthopyroxene (Fs1.7-40.3Wo0.1-3.1, N = 3), pigeonite (Fs17.4Wo21.8), augite (Fs9.7Wo35.4). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.72.

**Classification**: Ordinary chondrite (L3).

**Specimens**: The entire specimen including one polished thin section is at *PSF*.

**Northwest Africa 11327** (NWA 11327)

(Northwest Africa)

Purchased: 2017 Apr

Classification: Rumuruti chondrite (R3)

**History**: Acquired by a Moroccan dealer in April 2017 and subsequently purchased by Ke Zuokai.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia consisting of unequilibrated type-3 chondrite clasts plus separate well-formed chondrules (apparent diameter 450±400 μm, N = 12) in an orange-brown, stained matrix (~20 vol.%). Some angular enstatite clasts are present. Accessory minerals include pentlandite, iron sulfide, sodic plagioclase, Ti-bearing chromite and merrillite; metal is absent.

**Geochemistry**: Olivine (Fa3.7-47.7, mean Fa33.4±20.1, N = 5), orthopyroxene (Fs2.4-11.6Wo0.8-0.5, N = 3), subcalcic augite (Fs14.0Wo30.0), augite (Fs10.8Wo45.8).

**Classification**: R3 chondrite.

**Specimens**: 20.6 g including one polished thin section at *UWB*; remainder with Mr. Ke Zuokai.

**Northwest Africa 11328** (NWA 11328)

(Northwest Africa)

Purchased: 2005

Classification: Ordinary chondrite (L5)

**History**: Purchased by an anonymous collector from a dealer at the Munich Show in 2005, subsequently acquired by the Hollis Collection and donated to *PSF*.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Sparse chondrules (stained by iron hydroxides) occur with highly altered metal grains in a relatively coarse grained, recrystallized matrix.

**Geochemistry**: Olivine (Fa24.8-25.6, N = 3), orthopyroxene (Fs20.7-20.9Wo1.2-1.6, N = 2), clinopyroxene (Fs8.3-12.1Wo44.0-42.3, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.22.

**Classification**: Ordinary chondrite (L5).

**Specimens**: The entire specimen including one polished thin section is at *PSF*.

**Northwest Africa 11329** (NWA 11329)

(Northwest Africa)

Purchased: 2014 Feb

Classification: HED achondrite (Eucrite, melt breccia)

**History**: Purchased by Darryl Pitt in February 2014 from a Moroccan dealer at the Tucson Gem and Mineral Show.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) The studied specimen contains some small gabbroic clasts and related angular grains of exsolved pigeonite (pale orange in thin section) and calcic plagioclase (polycrystalline), but is dominated by fine grained, melt-textured matrix containing small vesicles. The matrix consists mainly of lath-like calcic plagioclase and prismatic low-Ca pyroxene (strongly zoned to ferropigeonite rims), together with accessory ilmenite, Ti-chromite, Ni-free metal and minor barite.

**Geochemistry**: Gabbro clasts: orthopyroxene host (Fs62.3Wo2.2, FeO/MnO = 31), clinopyroxene exsolution lamella (Fs27.4Wo3.8, FeO/MnO = 33), anorthite (An91.1-91.2Or0.3-0.4, N = 2). Melt matrix: low-Ca pyroxene core (Fs44.0Wo3.8, FeO/MnO = 28), ferropigeonite rims (Fs75.4-75.9Wo22.7-16.9, FeO/MnO = 35-38, N = 2).

**Classification**: Eucrite (melt-breccia).

**Specimens**: 25.5 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11330** (NWA 11330)

(Northwest Africa)

Purchased: 2017 Feb

Classification: Ordinary chondrite (LL5)

**History**: Purchased by Darryl Pitt in February 2017 from a Moroccan dealer at the Tucson Gem and Mineral Show.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Largely recrystallized with sparse chondrules. The studied slice has a cross-cutting dark shock vein enclosing angular clasts of the main lithology.

**Geochemistry**: Olivine (Fa27.3-29.8, N = 3), orthopyroxene (Fs22.2-24.4Wo0.8-1.1, N = 3), clinopyroxene (Fs7.5-8.0Wo46.0-44.8, N = 2).

**Classification**: Ordinary chondrite (LL5).

**Specimens**: 35.4 g in the form of a polished slice at *UWB*; remainder with *DPitt*.

**Northwest Africa 11331** (NWA 11331)

(Northwest Africa)

Purchased: 2017 Apr

Classification: Lunar meteorite (feldspathic breccia)

**History**: Material excavated from a site near Tindouf, Algeria was purchased by Pierre-Marie Pelé in April 2017 from a dealer in Rissani, Morocco.

**Physical characteristics**: The stones (total weight 318 g) have distinctive reddish-brown, clay-rich exterior coatings. Fresh interiors exhibit whitish clasts in a dark-gray matrix.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of angular mineral clasts of olivine, anorthite, exsolved pigeonite, orthopyroxene, unexsolved pigeonite, augite, chromite and ilmenite, plus sparse glass fragments, in a finer grained partly vesicular matrix.

**Geochemistry**: Olivine (Fa20.1-53.8, FeO/MnO = 94-109, N = 3), orthopyroxene (Fs30.6Wo3.4, FeO/MnO = 54), low-Ca pyroxene host in exsolved pigeonite (Fs41.6Wo5.5, FeO/MnO = 57), pigeonite (Fs25.4Wo9.8, FeO/MnO = 54), augite (Fs10.0Wo42.9, FeO/MnO = 40), plagioclase (An96.4-96.7Or0.2, N = 2).

**Classification**: Lunar (feldspathic regolith breccia).

**Specimens**: 20.07 g in the form of a polished endcut at *PSF*; remainder with P. Pelé.

**Northwest Africa 11332** (NWA 11332)

(Northwest Africa)

Purchased: 2005

Classification: Ordinary chondrite (H4/5)

**History**: Purchased by an anonymous collector from a dealer at the Munich Show in 2005, subsequently acquired by the Hollis Collection and donated to the Planetary Studies Foundation.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Some well-formed chondrules occur in a fairly coarse grained, recrystallized matrix containing relatively abundant stained metal.

**Geochemistry**: Olivine (Fa18.4-18.5, N = 3), orthopyroxene (Fs16.3-17.0Wo1.1-1.0, N = 2), clinopyroxene (Fs6.6-9.0Wo46.4-43.4, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 5.20.

**Classification**: Ordinary chondrite (H4/5).

**Specimens**: The entire specimen including one polished thin section is at *PSF*.

**Northwest Africa 11334** (NWA 11334)

(Northwest Africa)

Purchased: 2005

Classification: Ordinary chondrite (L3/4)

**History**: Purchased by an anonymous collector from a dealer at the Munich Show in 2005, subsequently acquired by the Hollis Collection and donated to the Planetary Studies Foundation.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Well-formed chondrules occur in a recrystallized matrix containing stained metal. Olivine is mostly equilibrated but magnesian cores are present.

**Geochemistry**: Olivine (core Fa6.9; Fa23.5-25.5, Cr2O3 <0.02 wt.%, N = 7), orthopyroxene (Fs2.8-17.0Wo0.9-0.3, N = 3), clinopyroxene (Fs7.7-8.9Wo45.9-43.8, N = 2). Magnetic suceptibility log χ (× 10-9 m3/kg) = 4.70.

**Classification**: Ordinary chondrite (L3/4).

**Specimens**: The entire specimen including one polished thin section is at *PSF*.

**Northwest Africa 11335** (NWA 11335)

(Northwest Africa)

Purchased: 2016 June

Classification: Carbonaceous chondrite (CO3)

**History**: Purchased by Ben Hoefnagels in June 2016 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Relatively small chondrules (apparent diameter 600±400 μm, N = 10), angular mineral fragments and some very fine grained CAI occur in a fine grained matrix (~40 vol.%, sepia brown in thin section).

**Geochemistry**: Olivine (Fa0.2-82.5, Cr2O3 in ferroan examples 0.12-0.31 wt.%), orthopyroxene (Fs0.7-1.1Wo0.7-3.3, N = 3), subcalcic augite (Fs0.6Wo29.2), augite (Fs0.8Wo36.4).

**Classification**: Carbonaceous chondrite (CO3). Chondrules are larger than in typical CO3.

**Specimens**: 20.3 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11336** (NWA 11336)

(Northwest Africa)

Purchased: 1996

Classification: Ordinary chondrite (LL3)

**History**: Purchased by Ken Regelman in 1996 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Fairly closely packed, well-formed chondrules (apparent diameter 700±400 μm, N = 12) are accompanied by a finer grained matrix containing altered metal.

**Geochemistry**: Olivine (Fa0.4-41.3, Cr2O3 in ferroan examples <0.04 wt.%, N = 7), orthopyroxene (Fs3.6-15.3Wo0.3-0.7, N = 3), subcalcic augite (Fs10.5Wo34.1; Fs21.7Wo27.5, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.07.

**Classification**: Ordinary chondrite (LL3).

**Specimens**: 22.7 g including one polished thin section at *UWB*; remainder with Mr. K. Regelman.

**Northwest Africa 11337** (NWA 11337)

(Northwest Africa)

Purchased: 1997

Classification: HED achondrite (Eucrite, polymict)

**History**: Purchased by Ken Regelman in 1997 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia containing some lithic eucrite clasts (with intersertal and microgranular textures) plus related mineral debris and <5 vol.% diogenitic orthopyroxene set in a finer grained, slightly stained matrix. Other minerals are exsolved pigeonite, calcic plagioclase, silica polymorph, ilmenite, troilite and rare zircon. Some calcite veinlets were observed.

**Geochemistry**: Low-Ca pyroxene (Fs29.1Wo5.0; Fs47.7Wo2.6; FeO/MnO = 27-33; N = 2), orthopyroxene host (Fs58.4Wo3.7, FeO/MnO = 24), clinopyroxene exsolution lamella (Fs32.1Wo35.4, FeO/MnO = 25), clinopyroxene host in exsolved pigeonite (Fs33.9Wo33.6, FeO/MnO = 25), plagioclase (An90.7-91.9Or0.3-0.4, N = 2).

**Classification**: Eucrite (polymict breccia).

**Specimens**: 21.3 g including one polished thin section at *UWB*; remainder with Mr. K. Regelman.

**Northwest Africa 11338** (NWA 11338)

(Northwest Africa)

Purchased: 2017 Mar

Classification: Carbonaceous chondrite (CK4)

**History**: Purchased by Aras Jonikas in March 2017 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Separated, well-formed chondrules (apparent diameter 500±200 μm, N = 10) containing Cr-magnetite occur in a finer grained matrix containing stained magnetite, intermediate plagioclase and minor barite.

**Geochemistry**: Olivine (Fa24.6-25.0, FeO/MnO = 88-102, N = 3), orthopyroxene (Fs3.5-20.0Wo1.4-1.1, N = 3), low-Ca pyroxene (Fs21.5Wo5.0), augite (Fs21.9Wo49.2).

**Classification**: Carbonaceous chondrite (CK4). Olivine is unusually Fe-poor for an equilibrated CK chondrite.

**Specimens**: 24.42 g including one polished thin section at *PSF*; remainder with Mr. A. Jonikas.

**Northwest Africa 11339** (NWA 11339)

(Northwest Africa)

Purchased: 2017 Apr

Classification: Martian meteorite (Shergottite)

**History**: Purchased by Ben Hoefnagels in April 2017 from a dealer in Zagora, Morocco.

**Physical characteristics**: A single stone (161 g) partially covered by black fusion crust. The fresh interior is greenish-gray with sporadic small dark glass pockets and thin black, glassy veinlets.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) The specimen is composed predominantly (~70 vol.%) of stubby prismatic grains of zoned clinopyroxene (grainsize 0.3-0.5 mm) with ~30 vol.% maskelynite plus accessory ilmenite, titanomagnetite, pyrrhotite, merrillite and K-Al-Si-rich glass. Some thin cross-cutting veinlets of black shock glass are present.

**Geochemistry**: Pigeonite (Fs34.3-60.5Wo10.8-15.5, FeO/MnO = 32-38, N = 4), subcalcic augite (Fs24.4-40.8Wo33.3-28.4, FeO/MnO = 32-36, N = 4), maskelynite (An42.0-47.7Or3.9-3.3, N = 2).

**Classification**: Martian (shergottite, pyroxene-rich).

**Specimens**: 20.4 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11340** (NWA 11340)

(Northwest Africa)

Purchased: 2017

Classification: Ordinary chondrite (L3.15)

**History**: Purchased by Dustin Dickens in Morocco, March 2017.

**Physical characteristics**: Single stone with weathered exterior. Saw cut shows many densely packed chondrules set in dark-brown matrix.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows numerous porphyritic chondrules, most with mesostasis or glass. Abundant opaque matrix. Apparent mean chondrule diameter 586±318 μm, n=21.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) Chondrule olivine Fa17.9±9.7, Cr2O3=0.21±0.22 (wt%), n=29; chondrule low-Ca pyroxene Fs9.7±6.7Wo0.5±0.4, n=7.

**Classification**: Ordinary chondrite (L3.15), subtype 3.15 based on mean values of Fa and Fs and 1-sigma standard deviation, and on the ferroan olivine mean value of Cr2O3 and 1-sigma standard deviation [(Grossman and Brearley, 2005)](http://articles.adsabs.harvard.edu/full/2005M%26PS...40...87G).

**Specimens**: 20.7 g including a probe mount on deposit at *UNM*, Dustin Dickens holds the main mass.

**Northwest Africa 11341** (NWA 11341)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Eucrite, polymict)

**History**: Purchased by Dustin Dickens in Morocco, January 2016.

**Physical characteristics**: Seven identical appearing stones with weathered exteriors. Saw cuts show a breccia with black shock melt domains, a few vesicles were observed.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows fragmental breccia of basaltic clasts, feldspars clasts, pyroxene clasts, and vesicular shock melt pockets. Accessory silica, ilmenite and chromite are present.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) Diogenitic pyroxene Fs22.6Wo2.1, Fe/Mn=31, n=1; cumulate eucritic pyroxene Fs35.1±2.9Wo5.3±2.6, Fe/Mn=29±2, n=4; basaltic eucritic pyroxene Fs50.2±4.5Wo8.3±4.3, Fe/Mn=30±1, n=7; basaltic sub-calcic augite Fs37.8Wo23.5, Fe/Mn=29, n=1; plagioclase An92±1.9, n=9.

**Classification**: Polymict eucrite based on the volume percent lithologies: ~62% basaltic eucrite, 31% cumulate eucrite, and ~8% diogenite.

**Specimens**: 20.0 g including a probe mount on deposit at *UNM*, Dustin Dickens holds the main mass.

**Northwest Africa 11342** (NWA 11342)

(Northwest Africa)

Purchased: 2017

Classification: HED achondrite (Diogenite)

**History**: A single stone was purchased by Aerolite Meteorites from a Moroccan meteorite dealer in February, 2017.

**Physical characteristics**: Single stone, weathered, sandblasted exterior. A saw cut reveals a yellow-orange interior with medium to fine-grained crystals.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows dominant pyroxene grains up to 2 mm, ubiquitous olivine was also observed. Opaques include troilite and oxidized iron.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) Low-Ca pyroxene Fs20.6±0.7Wo2.4±0.2, Fe/Mn=28±1, n=5; olivine Fa23.7±0.2, Fe/Mn=49±1, n=5.

**Classification**: Olivine-bearing diogenite

**Specimens**: 29.2 g including a probe mount on deposit at *UNM*, Aerolite Meteorites holds the main mass.

**Northwest Africa 11343** (NWA 11343)

(Northwest Africa)

Purchased: 2015

Classification: Carbonaceous chondrite (CV3)

**History**: 53 pieces comprising a few small, whole stones and multiple fragments were purchased from a Moroccan dealer in September, 2015 by a third party and later acquired by Geoffrey Notkin (Aerolite Meteorites).

**Physical characteristics**: 53 identically appearing stones, weathered, sandblasted, dark exterior. A saw cut reveals a numerous chondrules, some up to 3 mm, scattered small CAIs observed throughout.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows porphyritic chondrules, many of which are Type I. Fine grained matrix makes up ~40% of this meteorite. Opaques include troilite, Fe-Ni metal and oxidized iron.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) All olivine Fa3.9±4.3, Fe/Mn=46±23, n=15; ferroan olivine Fa10.2±2.6, Fe/Mn=68±33, Cr2O3=0.05±0.02, n=4 Low-Ca pyroxene Fs8.0±6.2Wo1.4±1.5, Fe/Mn=53±43, n=8.

**Classification**: Carbonaceous chondrite (CV3)

**Specimens**: 20.2 g including a probe mount on deposit at *UNM*, Geoffrey Notkin (Aerolite Meteorites) holds the main mass.

**Northwest Africa 11344** (NWA 11344)

(Northwest Africa)

Purchased: 2016 Oct

Classification: Ordinary chondrite (L3-4)

**Petrography**: (K. Metzler, *IfP*) Ordinary chondrite breccia, consisting of well-preserved chondrules of various textural types, set in a finer-grained matrix. The mean apparent chondrule size is 630 μm (240-1800 μm; n=49). Accessory phases are FeNi metal and troilite, mostly residing outside of chondrules. Olivine in the majority of components is equilibrated, but some components (chondrules, chondrule fragments) of petrologic type 3 are admixed.

**Geochemistry**: The mean olivine and low-Ca pyroxene compositions of the type 4 host are Fa25.3±0.4(Fa25-26; n=11) and Fs18.6±4.1(Fs9-22; n=12). The mean compositions in the type 3 fragments are Fa10.2±6.2(Fa3-29; n=16) and Fs6.0±3.4(Fs1-14; n=13).

**Classification**: L chondrite based on apparent chondrule size. Petrologic types based on the chemical variation of olivine and pyroxene.

**Northwest Africa 11345** (NWA 11345)

(Northwest Africa)

Purchased: 2016 Nov

Classification: Carbonaceous chondrite (CM2)

**Physical characteristics**: Irregular dark stone. Cut surface reveals a dark interior with lighter chondrules to mm size.

**Petrography**: Chondrules (some with dust rims) and chondrule fragments (33 vol%) set in a fine-grained matrix (67 vol%). Modal abundances from point counting (N=296). Chondrule average apparent diameter 230±110 μm (N=32). XRD over a several mm2area on a polished section (D. Borschnek, B. Devouard, *CEREGE*) reveals the presence of phyllosilicates as typically observed in type 2 chondrites using the same experimental setup.

**Geochemistry**: Olivine Fa46.1±10.4, range Fa33.0-58.0(N=6). Orthopyroxene Fs3.0±0.9Wo1.9±0.8, range Fs2.1-4.5(N=5). Oxygen isotopic composition (J. Gattacceca, C. Sonzogni, *CEREGE*) from analysis of one acid-washed 1.5 mg aliquot of a powdered 320 mg bulk sample is δ17O=2.13‰, δ18O=8.95‰, Δ17O=-2.55‰ (linearized, slope 0.5247, analytical uncertainties 0.08, 0.12, 0.03 all ‰ respectively). Magnetic susceptibility log χ (× 10-9 m3/kg)=4.46.

**Classification**: CM2

**Specimens**: Type specimen at *CEREGE*. Main maiss with *Kuntz*.

**Northwest Africa 11346** (NWA 11346)

(Northwest Africa)

Purchased: 2016 Nov

Classification: Carbonaceous chondrite (CM, anomalous)

**Physical characteristics**: Irregular dark stone. Cut surface reveals a dark interior with small chondrules.

**Petrography**: Chondrules, mineral and chondrule fragments in a fine-grained Fe-rich matrix. Matrix abundance 53 vol% (from point counting, N=226). Chondrule average apparent diameter 208±121 μm (N=39). Opaques are magnetite, FeNi metal and sulfides. XRD over a several mm2 area on a polished section (D. Borschnek, B. Devouard, *CEREGE*) does not reveal the presence of hydrous phases (serpentine, tochilinite) typically observed in type 2 chondrites using the same experimental setup.

**Geochemistry**: Olivine Fa26.7±19.2, range Fa3.3-50.4(N=5). Orthopyroxene Fs5.88Wo0.3Fs1.7Wo1.0(N=2). Oxygen isotopic composition (J. Gattacceca, C. Sonzogni, *CEREGE*) from analysis of one acid-washed 1.5 mg aliquot of a powdered 75 mg bulk sample is δ17O=0.69‰, δ18O=9.38‰, Δ17O=-4.21‰ (linearized, slope 0.5247, analytical uncertainties 0.08, 0.12, 0.03 all ‰ respectively). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.09.

**Classification**: CM-an. The absence of phyllosilicates is an anomalous feature for a CM chondrite.

**Specimens**: Type specimen at *CEREGE*. Main maiss with *Kuntz*.

**Northwest Africa 11347** (NWA 11347)

(Northwest Africa)

Purchased: 2017

Classification: Ordinary chondrite (LL3)

**History**: Purchased by Morten Bilet from a meteorite dealer in Quarzazate, Morocco, April 2017.

**Physical characteristics**: Single stone, brown exterior, no fusion crust. Saw cut shows many densely packed chondrules set in a brown matrix.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows numerous porphyritic chondrules, most with mesostasis or glass, opaque matrix. Apparent mean chondrule diameter 660±280 μm, n=16.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) All olivine Fa10.9±9.3, Cr2O3=0.11±0.06 (wt%), n=12; Ferroan olivine Fa15.7±7.4, Cr2O3=0.08±0.08 (wt%), n=8; low-Ca pyroxene Fs9.6±6.0Wo0.7±0.7, n=6.

**Classification**: Ordinary chondrite (LL3), estimated subtype ~3.2-3.3 based on mean values of Fa and Fs and 1-sigma standard deviation, and on the ferroan olivine mean value of Cr2O3 and 1-sigma standard deviation [(Grossman and Brearley, 2005)](http://articles.adsabs.harvard.edu/full/2005M%26PS...40...87G).

**Specimens**: 20.6 g including a probe mount on deposit at *UNM*, Morten Bilet holds the main mass.

**Northwest Africa 11348** (NWA 11348)

(Northwest Africa)

Purchased: 2017

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased by Morten Bilet from a meteorite dealer in Quarzazate, Morocco, March 2017; reported found during winter of 2016-2017.

**Physical characteristics**: Singe stone, irregular, black exterior with chondrule pits. A saw cut reveals numerous chondrules, some up to 2 mm, many CAIs observed throughout, matrix is dark gray.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows porphyritic chondrules, many of which are irregular in shape. Fine grained matrix makes up ~40% of this meteorite. Opaques include troilite, Fe-Ni sulfide, and oxidized iron. Aluminous diopside was detected.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) Olivine Fa22.4±26.7, Fe/Mn=116±79, Cr2O3=0.11±0.06, n=7; low-Ca pyroxene Fs1.5±6.2Wo3.6±4.8, Fe/Mn=23±18, n=3.

**Classification**: Carbonaceous chondrite (CV3)

**Specimens**: 16 g including a probe mount on deposit at *UNM*, Morten Bilet holds the main mass.

**Northwest Africa 11349** (NWA 11349)

(Northwest Africa)

Find: 2016

Classification: Ordinary chondrite (H5)

**History**: Purchased by Dave Gheesling from a meteorite dealer, reportedly found in Morocco, 2016.

**Physical characteristics**: Single, angular shaped stone, dark weathered fusion crust, with many regmaglypts. Saw cut shows scattered small chondrules and abundant fine-grained metal/sulfide set in a brown matrix.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows textually equilibrated chondrules and recrystallized matrix. Plagioclase grain size is up to ~25 μm.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) Olivine Fa19.6±1.5, n=8; low-Ca pyroxene Fs16.9±0.8Wo1.4±0.1, n=6.

**Classification**: Ordinary chondrite (H5)

**Specimens**: 25.23 g including a probe mount on deposit at *UNM*, Dave Gheesling holds the main mass of 9.1 kg.

**Northwest Africa 11350** (NWA 11350)

(Northwest Africa)

Find: 2017

Classification: Ordinary chondrite (L6)

**History**: Purchased by Brian Caress from a meteorite dealer, reportedly found in Morocco, 2017.

**Physical characteristics**: Single stone with weathered fusion crust, oriented with regmaglypts, the specimen appears to be a fragment from a much larger stone (not recovered). Saw cut shows faint chondrules and fine-grained metal/sulfide set in a brown to light colored matrix. A few shock melt veins are present.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows textually equilibrated chondrules and recrystallized matrix. Plagioclase grain size is up to ~150 μm.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) Olivine Fa26.1±1.2, n=7; low-Ca pyroxene Fs22.2±2.0Wo1.6±0.3, n=6.

**Classification**: Ordinary chondrite (L6)

**Specimens**: 20.4 g including a probe mount on deposit at *UNM*, Brian Caress holds the main mass of 3624.9 g.

**Northwest Africa 11351** (NWA 11351)

(Northwest Africa)

Purchased: 2013 Apr 26

Classification: Ordinary chondrite (LL3-6)

**History**: John Shea purchased a single stone from Big Kahuna meteorites on April 26, 2013 .

**Physical characteristics**: A black shiny fusion crust surrounded the entire stone. Three distinctly different lithologies are apparent on the cut face: Lithology A having packed, well-defined chondrules; lithology B having some well-defined chondrules surrounded by finer-grained material; and lithology C with poorly defined chondrules.

**Petrography**: Metal abundance is low (1-2 area %) in all three lithologies. Troilite exceeds metal in lithologies A (14 area%) and C (7 area 5), and is roughly the same (3 area%) in lithology B. In all lithologies, metal has been minimally weathered (<10% replacement). Troilite is weathered along fractures and adjacent silicates are discolored. Lithology A is composed of crisp, well defined, closely-spaced chondrules, many of which are rimmed by metal and troilite. Other chondrules are surrounded by a fine-grained matrix made of olivine and albite grains, similar to the matrix described for [Lut 005](https://www.lpi.usra.edu/meteor/metbull.php?code=60236) (LL3). The texture of lithology A is similar to that of a cluster chondrite (as described by Metzler, 2012). Lithology B is composed of chondrules and chondrule fragments, and resembles a fragmental breccia. Both lithology A and lithology B contain numerous glassy or cryptocrystalline chondrules with bleached rims. Chondrule mesostases in both lithologies contain brown isotropic glass as well as devitrified glass. Much of the low-Ca pyroxene in both lithologies is monoclinic. A single large grain of silica polymorph was found in lithology B. Lithology C contains large angular clasts. In the largest clast, chondrules are defined by the presence of trolite within the chondrules. Feldspars in this clast are typically 10-40 µm in diameter. Many smaller clasts in lithology C contain abundant coarse merrillite and diopside, and coarse (>50 μm) plagioclase feldspar grains. Olivine deformation in lithologies A and B consistent with shock stage S4. Olivine grains in the various clasts of lithology C all indicate higher (S5) shock deformation.

**Geochemistry**: Lithology A: Olivine (Fa=27.9±0.9, n=56), low-Ca pyroxene (Fs=17.6±4.7Wo=1.0±1.3, n=32) and feldspathic glass (Ab=71.5±19.7Or=3.4±3.3, n=18, with Ab27.3-92.4). Lithology B: Olivine (Fa=27.6±0.6, n=40), low-Ca pyroxene (Fs=21.5±5.4Wo=1.5±1.2, n=29) and feldspathic glass (4 analyses have Ab13.8-86.0). Lithology C: Olivine (Fa=30.9±1.0, n=40), low-Ca pyroxene (Fs=25.6±1.3Wo=2.1±0.7, n=29) and plagioclase feldspar (Ab=82.6±1.5Or=5.6±2.0, n=12).

**Classification**: Olivine compositions for all three clasts are consistent with an equilibrated LL chondrite. The sizes of feldspar grains in lithology C indicate that it contains petrographic type 6 material. Although the olivine compositions in lithologies A and B are equilibrated, the pyroxene compositions are not, and along with abundant clinoenstatite, and isotropic calcic glass, suggests that lithologies A and B are samples of a high type 3 (or borderline 3-4) chondrite.

**Specimens**: 36.5 g, three epoxy butts and three one-inch round doubly polished thin sections are held at *Cascadia*. The remaining material is held by John Shea.

**Northwest Africa 11352** (NWA 11352)

Morocco

Purchased: Feb. 2017

Classification: Lunar feldspathic breccia

**History**: Purchased by Ke Zuokai in Feb. 2017 from a Moroccan dealer.

**Physical characteristics**: The meteorite has a black fusion crust. Small white clasts are visible.

**Petrography**: Lithic clasts and mineral fragments (0.1 to 1.1 mm) set in a fine-grained anorthositic matrix. The lithic clasts has a gabbroic, anorthositic, or minor noritic composition. Mineral fragments are dominated by anorthite and pyroxene grains with minor olivine. Some pigeonite grains exhibit exsolved lamella of augite. Vesicles occur in the matrix and some clasts. Other accessory minerals include chromite, ilmenite and troilite.

**Geochemistry**: Plagioclase An95.7-97.9Or0.01-0.3(average: An96.8±0.6Or0.1±0.1, n=16); Olivine Fa0.9-31, Fe/Mn (cation ratio)=92.9-116.3 (average=98.2±8.6); pigeonite Fs19.9-46.6Wo6.2-18.0; minor orthopyroxene Fs33.1-47.9Wo1.9-3.1and augite Fs11.4-52.4Wo28.8-41.8, pyroxene Fe/Mn (cation ratio)=47.0-68.4 (average=58.4±6.0).

**Classification**: Lunar feldspathic breccia classification based on texture and composition.

**Northwest Africa 11353** (NWA 11353)

Morocco

Purchased: Feb. 2017

Classification: Carbonaceous chondrite (CR2)

**History**: Purchased by Ke Zuokai in Feb. 2017 from a Moroccan dealer.

**Physical characteristics**: The meteorite has a black fusion crust. Chondrules and clasts ranging from white to dark gray are visible.

**Petrography**: The thin section shows abundant well-defined FeNi-metal rich chondrules (0.1 to 1.9 mm) with porphyritic textures. Most chondrules are magnesian (type I) with a few being type II. The matrix is fine-grained silicates, phyllosilicates and FeNi metal. Mineral and chondrule clasts are also present. Metal grains up to ~500 μm are observed in chondrules and in the matrix. A small fragment of CAI was identified composed of Al, Ca-rich pyroxene and anorthite.

**Geochemistry**: Silicates are unequilibrated. Olivine Fa6.0±6.8, PMD=80.3%, n=44 (Fa0.7-31.0, mostly Fa0.7-5), rich in Cr2O3 (0.19-0.82 wt%, average=0.55 wt%); low-Ca pyroxene Fs1.9-14.5Wo0-2.6(Fs7.3±4.9Wo1.1±0.7, Fs PMD=58.3%, n=18); minor Ca-rich pyroxene Fs1.9-7.4Wo30.6-42.9; Plagioclase are Ca-rich Ab0-15.5An84.5-100(Ab6.6±5.5An93.4±5.5, n=6).

**Classification**: CR2 classification based on composition, altered matrix and abundant FeNi metals.

**Northwest Africa 11355** (NWA 11355)

Morocco

Purchased: Feb. 2017

Classification: Ordinary chondrite (L6)

**History**: Purchased by Ke Zuokai in Feb. 2017 from a Moroccan dealer.

**Physical characteristics**: The meteorite has a yellow weathered surface.

**Petrography**: The section shows chondrules (0.4-1 mm, one large chondrule up to 2.6 mm) with vague boundaries. The matrix experienced extensive recrystallization (30 to 300 μm) with a few regions in the matrix show triple junctions. Plagioclase grains size up to ~80 μm. Chromite, troilite, metal and phosphate are also present. Fractures are widespread in this thin section. Shock melt veins are present.

**Geochemistry**: Silicates are equilibrated. Olivine Fa22.8-25.1(Fa23.8±0.7, PMD=2.2%, n=18); low-Ca pyroxene Fs19.2-21.6Wo0-1.5(Fs20.0±0.8Wo1.0±0.4, Fs PMD=3.0%, n=15); minor Ca-rich pyroxene Fs6.9-18.5Wo37.9-44.3; plagioclase Ab79.8-86.9Or4.0-10.4(Ab83.5±1.9Or6.3±1.7, n=14).

**Classification**: L6 classification based on homogenized composition, recrystallizied matrix and regional triple junctions.

**Northwest Africa 11356** (NWA 11356)

Morocco

Purchased: Feb. 2017

Classification: Ordinary chondrite (L4)

**History**: Purchased by Ke Zuokai in Feb. 2017 from a Moroccan dealer.

**Physical characteristics**: The meteorite has a black fusion crust and partially covered by weathering products.

**Petrography**: Chondrules are relatively well-defined with diameters of 0.2-0.6 mm, and display porphyritic olivine-pyroxene/olivine/pyroxene textures. The matrix is recrystallized, and secondary feldspar grains have sizes less than 10mm. Silicate minerals include olivine, pyroxene and feldspar There are abundant metal veins with extensively weathered; few metal grains remain.

**Geochemistry**: Olivine Fa21.3-22.7(Fa22.0±0.4, PMD Fa=1.4%, n=14); orthopyroxene Fs17.3-19.9Wo1.1-2.1(Fs18.8±0.7Wo1.6±0.3, PMD Fs=2.9%, n=15); augite Fs6.8-11.9Wo40.9-44.4(Fs8.0±1.3Wo43.1±0.9, n=12; feldspar An9.7-13.0(An10.7±1.0, n=11).

**Classification**: L4 based on relatively well-defined chondrules and tiny secondary feldspar

**Northwest Africa 11357** (NWA 11357)

(Northwest Africa)

Purchased: 2006 Sept

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased in 2012 by Ronnie McKenzie at the Denver show.

**Petrography**: Section composed of large chondrules (up to 3 mm in diameter), AOAs and CAIs set in a fine-grained matrix. The matrix makes up about 40% of the thin section area. Olivine is commonly zoned, with Mg-rich cores and Fe-rich rims. Many olivine grains show weak mosaicism and 2 sets of planar fractures, indicating shock stage S4. Metal abundance is <1%; the six analyzed were all awaruite. Sulfides lack Ni, and are moderately weathered. Small patches and minor veins of calcium sulfate are present. Phyllosilicates are replacing edges of olivine and pyroxene grains in or adjacent to matrix

**Geochemistry**: Olivine (Fa6.72±4.13, range = Fa0-14.6, N=53). Low-Ca pyroxene (Fs1.75±1.43Wo1.89±1.89, range = Fs0-5.6Wo0-9.2, N=35). Oyxgen isotopes (K. Ziegler, UNM): 4 analyses, with δ17O = -4.290, -3.513, -7.649, -4.434 and δ18O = 0.725, 0.926, -3.555, -0.011 (linearized values).

**Classification**: Large chondrule size with abundant AOAs and CAIs indicates CV chondrite class, which is confirmed with oxygen isotopes. Zoned grains and mineral chemistry indicates type 3.

**Specimens**: *Cascadia* holds a 22.7 g piece, a polished thin section, and a potted butt. Mr. McKenzie holds the main mass

**Northwest Africa 11358** (NWA 11358)

(Northwest Africa)

Purchased: 2013 July 12

Classification: Carbonaceous chondrite (CO3.6)

**History**: Purchased in 2013 by John Shea from Aziz Habibi who acquired it from Morocco.

**Physical characteristics**: Exterior shows weathering patina. Cut face shows 2-5 mm thick alteration zone. Fine-grained gray-brown interior.

**Petrography**: Chondrules are abundant and relatively small (average = 0.26±14 mm, N=36). Olivine has slight undulatory extinction; but only a few single sets of planar fractures, indicating shock stage S2. Contains approximately 2% metal, of which about half has been converted to weathering products. AOAs and CAIs are abundant comprising ~10 % of the thin section.

**Geochemistry**: Olivine (Fa27.1±13.5, range Fa0-41.7, N=35). Low-Ca pyroxene (Fs2.7±2.5Wo1.7±1.1, range Fs0-9.5Wo0-4.3, N=22). Oxygen isotopes (K. Ziegler, UNM): 4 analyses, with δ17O = -7.492, -6.173, -5.322, -4.385 and δ18O = -4.704, -2.736, -1.691, -0.452 (linearized values).

**Classification**: Chondrule size and abundance consistent with CO class. CO class confirmed with O isotopes. Mean Fa (mol%) of 27.1 and D(Fa)/mean Fa(%) of 49.9 are both consistent with subtype 3.6 (Sears et al., 1991).

**Specimens**: *Cascadia* holds a 46.4 g piece, a 2.0 g piece, a polished thin section, and a potted butt. John Shea holds the main mass.

**Northwest Africa 11359** (NWA 11359)

(Northwest Africa)

Purchased: 2016

Classification: Ordinary chondrite (L6)

**History**: The stone was purchased by Mohamed salem El Wali El alaoui.

**Physical characteristics**: The stone is unusually porous. It contains 5-10 vol.% pores with diameters ranging from 50 - 250 µm.

**Petrography**: The stone is very recrystallized and has poorly defined chondrules. plagioclase grains range up to 50 × 120 µm. Diopside is more abundant than low-Ca pyroxene. Diopside compositions average Fs7.3±0.4Wo45.0±0.5(n=15). Plagioclase compositions average Ab82.9±1.0Or5.7±0.9(n=10). The rock appears to have relict shock features including small, irregular troilite grains within metallic Fe-Ni, chromite-plagioclase assemblages and thin veinlets of chromite. Olivine grains exhibit undulose extinction.

**Northwest Africa 11360** (NWA 11360)

Morocco

Purchased: Aug 2016

Classification: Ordinary chondrite (H5)

**History**: Purchased by Guonian Ding in August 2016 from a Moroccan dealer

**Physical characteristics**: The meteorite is brown in color with minor black fusion crust

**Petrography**: This meteorite contains porphyritic olivine chondrules, granular olivine-pyroxene chondrules, and radial pyroxene chondrules. The boundary between most chondrules and recrystallized matrix is difficult to distinguish. Metal and sulfide are common in this meteorite. However, the metal grains have been largely weathered. Irregular fractures filled with Fe-oxide/hydroxide are widespread in the whole sample.

**Geochemistry**: The composition of olivine, orthopyroxene and plagioclase are quite uniform. Olivine (Fa18.2±0.3, N=11). Low-Ca pyroxene (Fs15.9±0.2Wo1.2±0.1, N=11).

**Northwest Africa 11361** (NWA 11361)

Morocco

Purchased: Aug 2016

Classification: Ordinary chondrite (H5)

**History**: Purchased by Guonian Ding in August 2016 from a Moroccan dealer

**Physical characteristics**: Most of the black fusion crust remains. The surface regions without fusion crust are brown in color

**Petrography**: The meteorite contains porphyritic and granular chondrules. The boundary between most chondrules and recrystallized matrix is difficult to distinguish. Metal and sulfide are common in this meteorite. However, the metal grains have been extensively weathered. Irregular fractures filled with Fe-oxide/hydroxide are widespread in the whole sample.

**Geochemistry**: The composition of olivine, orthopyroxene and plagioclase are quite uniform. Olivine (Fa18.2±0.5, N=14). Low-Ca pyroxene (Fs15.9±0.3Wo1.1±0.3, N=14).

**Northwest Africa 11362** (NWA 11362)

Morocco

Purchased: Aug 2016

Classification: Ordinary chondrite (H5)

**History**: Purchased by Jianzhong Yu in August 2016 from a Moroccan dealer

**Physical characteristics**: Most of the black fusion crust remains

**Petrography**: The meteorite contains porphyritic and granular chondrules. A few chondrules show sharp boundaries from surrounding materials. No fine-grained matrix was observed. Metal and sulfide are common in this meteorite. However, the metal grains have been extensively weathered. Irregular fractures filled with Fe-oxide/hydroxide are widespread in the whole sample.

**Geochemistry**: The composition of olivine, orthopyroxene and plagioclase are quite uniform. Olivine (Fa17.6±0.3, N=14). Low-Ca pyroxene (Fs15.9±0.2Wo1.2±0.3, N=14).

**Northwest Africa 11363** (NWA 11363)

Morocco

Purchased: Aug 2016

Classification: Ordinary chondrite (H5)

**History**: Purchased by Jianzhong Yu in August 2016 from a Moroccan dealer

**Physical characteristics**: Most of the fusion crust remains

**Petrography**: The meteorite contains porphyritic and granular chondrules. The outlines of most chondrules are difficult to distinguish. No fine-grained matrix was observed. Metal and sulfide are common in this meteorite. The metal grains were weathered mainly along rims. Irregular fractures filled with Fe-oxide/hydroxide are common in recrystallized matrix.

**Geochemistry**: The composition of olivine, orthopyroxene and plagioclase are quite uniform. Olivine (Fa18.1±0.4, N=11). Low-Ca pyroxene (Fs16.3±1.4Wo1.2±0.2, N=12).

**Northwest Africa 11364** (NWA 11364)

Morocco

Purchased: Aug 2016

Classification: Ordinary chondrite (H5)

**History**: Purchased by Jianzhong Yu in August 2016 from a Moroccan dealer

**Physical characteristics**: Most of the fusion crust remains

**Petrography**: The meteorite contains porphyritic and granular chondrules. The outlines of most chondrules are difficult to distinguish. No fine-grained matrix was observed. Metal and sulfide are common in this meteorite. The metal grains were largely weathered. Irregular fractures filled with Fe-oxide/hydroxide are common in recrystallized matrix.

**Geochemistry**: The composition of olivine, orthopyroxene and plagioclase are quite uniform. Olivine (Fa18.0±0.6, N=14). Low-Ca pyroxene (Fs15.9±0.6Wo1.2±0.4, N=11).

**Northwest Africa 11365** (NWA 11365)

Morocco

Purchased: Aug 2016

Classification: Ordinary chondrite (L6)

**History**: Purchased by Jianzhong Yu in August 2016 from a Moroccan dealer

**Physical characteristics**: Most of the fusion crust remains

**Petrography**: The meteorite was highly recrystallized, with chondrule outlines difficult to distinguish. Most plagioclase grains in recrystallized matrix are large than 50 µm in size. Metal and sulfide are common in this meteorite. The metal grains were largely weathered. Some large olivine grains contain irregular and planar fractures.

**Geochemistry**: The composition of olivine, orthopyroxene and plagioclase are quite uniform. Olivine (Fa24.1±1.0, N=13). Low-Ca pyroxene (Fs20.7±1.1Wo1.4±0.2, N=13).

**Northwest Africa 11366** (NWA 11366)

Morocco

Purchased: Aug 2016

Classification: Ordinary chondrite (H5)

**History**: Purchased by Jianzhong Yu in August 2016 from a Moroccan dealer

**Physical characteristics**: The meteorite is brown in color with only minor black fusion crust

**Petrography**: The meteorite contains porphyritic and granular chondrules. The outlines of most chondrules are difficult to distinguish. No fine-grained matrix was observed. Metal and sulfide are common in this meteorite. The metal grains were weathered mainly along rims. Irregular fractures filled with Fe-oxide/hydroxide are common in recrystallized matrix. Some large olivine grains contain irregular and planar fractures.

**Geochemistry**: The composition of olivine, orthopyroxene and plagioclase are quite uniform. Olivine (Fa17.9±0.4, N=12). Low-Ca pyroxene (Fs15.9±0.3Wo1.1±0.3, N=10).

**Northwest Africa 11367** (NWA 11367)

(Northwest Africa)

Purchased: April 2017

Classification: Lunar meteorite

**History**: Purchased from a meteorite dealer by the owner, in Erfoud, April 2017.

**Physical characteristics**: Two stones (127 and 178 g) with no fusion crust. The fresh interior exhibits white angular clasts in a medium-gray matrix.

**Petrography**: Breccia composed of angular mineral fragments and some olivine noritic clasts in a finer grained matrix. Minerals are anorthite, olivine, low-Ca pyroxenes, chromite, troilite and kamacite.

**Geochemistry**: Anorthite clasts An96.0±0.2(N=6). The compositions of the phases from a noritic clast are: olivine Fa53±0.3, Fe/Mn=112±13 (N=9), anorthite An95.0-95.8, and pigeonite with augite exsolutions (respectively Fs43.2±0.6Wo4.8±0.8, Fe/Mn=65±5 (N=11), and Fs20.8±0.8Wo39.8±1.8, Fe/Mn=60±16 (N=3).

**Classification**: lunar (feldspathic breccia)

**Specimens**: 21.5 g including a polished thick section

**Northwest Africa 11368** (NWA 11368)

(Northwest Africa)

Purchased: Feb 2001

Classification: Ureilite

**History**: Purchased in Rissani from a meteorite dealer (2001) by Bruno and Carine *Fectay*.

**Petrography**: Protogranular aggregate of olivine and pigeonite. Olivine grains have reduced magnesian rims containing blebs of Fe metal. Grain boudaries are marked by carbonaceous material and trace amounts of troilite and metal (partly altered to terrestrial oxides).

**Geochemistry**: Olivine cores Fa9.7±0.4, Fe/Mn=20.8±0.9, Cr2O3=0.64±0.02 wt%, CaO= 0.32±0.01 wt% (N=10), Olivine rims (Fa5-3), pigeonite Fs8.7±0.3Wo8.8±0.2(N=6)

**Classification**: ureilite

**Specimens**: 14 g including a polished thick section

**Northwest Africa 11369** (NWA 11369)

(Northwest Africa)

Purchased: Feb 2001

Classification: Ureilite

**History**: Purchased in Rissani from a meteorite dealer (2001) by Bruno and Carine *Fectay*.

**Petrography**: Protogranular aggregate of olivine and pigeonite. Olivine grains have reduced magnesian rims containing blebs of Fe metal. Grain boudaries are marked by carbonaceous material and trace amounts of troilite and metal (partly altered to terrestrial oxides).

**Geochemistry**: Olivine cores Fa23.8±0.2, Fe/Mn=53.9±0.7, Cr2O3=0.72±0.01 wt%, CaO=0.38±0.01 wt% (N=10). Pigeonite Fs19.5±0.2Wo9.4±0.2(N=10)

**Classification**: ureilite

**Specimens**: 1.3 g including a polished thick section

**Northwest Africa 11370** (NWA 11370)

(Northwest Africa)

Purchased: Feb 2001

Classification: Ureilite

**History**: Purchased in Rissani from a meteorite dealer (2001) by Bruno and Carine *Fectay*.

**Petrography**: Protogranular aggregate of olivine and pigeonite. Olivine grains have reduced magnesian rims containing blebs of Fe metal. Grain boudaries are marked by carbonaceous material and trace amounts of troilite and metal (partly altered to terrestrial oxides).

**Geochemistry**: Olivine cores Fa21.3±0.3, Fe/Mn=47.9±0.8, Cr2O3 0.72±0.01 wt%, CaO 0.38±0.01 wt% (N=10), pigeonite Fs18±0.2Wo8±0.1(N=10).

**Classification**: ureilite

**Specimens**: 18 g including a polished thick section

**Northwest Africa 11371** (NWA 11371)

(Northwest Africa)

Purchased: Feb 2001

Classification: Ureilite

**History**: Purchased in Rissani from a meteorite dealer (2001) by Bruno and Carine *Fectay*.

**Petrography**: Protogranular aggregate of olivine (75 vol%) and pigeonite (25 vol%). It contains interstitial metal. The rock is poor in C. Olivine displays very thin reduced rims (<10 μm).

**Geochemistry**: Olivine cores Fa13.9±0.1, Fe/Mn=31.3±0.4, Cr2O3 0.57±0.01 wt%, CaO=0.35±0.01 wt% (N=10), olivine rims Fa6, Pigeonite Fs12.9±0.2Wo10.7±0.1(N=10)

**Classification**: ureilite

**Specimens**: 21 g including 3 polished thick section

**Northwest Africa 11372** (NWA 11372)

(Northwest Africa)

Purchased: Feb 2001

Classification: Ureilite

**History**: Purchased in Rissani from a meteorite dealer (2001) by Bruno and Carine *Fectay*, and given to Jean-Alix Barrat (*IUEM*) in 2003. The purchased chip is from a larger mass of unknown current location.

**Physical characteristics**: One fragment from a larger stone.

**Petrography**: Protogranular aggregate of olivine and pigeonite. Olivine grains have reduced magnesian rims containing blebs of Fe metal. Grain boudaries are marked by carbonaceous material and trace amounts of troilite and metal (partly altered to terrestrial oxides).

**Geochemistry**: Olivine cores Fa22.2±0.1, Fe/Mn=50.7±0.5, Cr2O3 0.54±0.01 wt%, CaO=0.31±0.01 wt% (N=10), olivine rims Fa=11 (N=1), pigeonite Fs13.6±0.2Wo8.0±0.2(N=5).

**Classification**: ureilite

**Specimens**: 3.5 g including a polished thick section

**Northwest Africa 11373** (NWA 11373)

(Northwest Africa)

Purchased: Feb 2001

Classification: Ureilite

**History**: Purchased in Rissani from a meteorite dealer (2001) by Bruno and Carine *Fectay*, and given to Jean-Alix Barrat (*IUEM*) in 2003. The purchased chip is from a larger mass of unknown current location.

**Physical characteristics**: One fragment from a larger stone.

**Petrography**: Protogranular aggregate of olivine and pigeonite. Olivine grains have reduced magnesian rims containing blebs of Fe metal. Grain boudaries are marked by carbonaceous material and trace amounts of troilite and metal (partly altered to terrestrial oxides).

**Geochemistry**: Olivine cores Fa18.7±0.1, Fe/Mn=41.5±0.7, Cr2O3 0.67±0.01 wt%, CaO=0.32±0.01 (N=10), olivine rims Fa8-10(N=3), pigeonite Fs16.1±0.2Wo7.9±0.1(N=7).

**Classification**: ureilite

**Specimens**: 3.2 g including a polished thick section

**Northwest Africa 11374** (NWA 11374)

(Northwest Africa)

Purchased: 2005

Classification: Ordinary chondrite (H5)

**History**: Purchased by an anonymous collector from a dealer at the Munich Show in 2005, subsequently acquired by the Hollis Collection and donated to *PSF*.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Sparse chondrules occur in a recrystallized matrix containing relatively abundant stained metal.

**Geochemistry**: Olivine (Fa18.9-19.0, N = 3), orthopyroxene (Fs16.4-16.7Wo1.4-1.5, N = 2), clinopyroxene (Fs5.4-5.5Wo46.5-46.1, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 5.32.

**Classification**: Ordinary chondrite (H5 breccia).

**Specimens**: The entire specimen including one polished thin section is at *PSF*.

**Northwest Africa 11375** (NWA 11375)

(Northwest Africa)

Purchased: 2017 May

Classification: HED achondrite (Diogenite, polymict)

**History**: Purchased by Eric *Twelker* in May 2017 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of angular mineral grains and rare pyroxene-chromite symplectite clasts in a sparse matrix. The predominant mineral is low-Ca pyroxene (exhibiting undulose extinction) with subordinate olivine (of several different compositions), chromite, metal, fayalite, and minor (<2 vol.%) exsolved pigeonite.

**Geochemistry**: Olivine (Fa9.7; Fa17.7; FeO/MnO = 36-40; N = 2), low-Ca pyroxene (Fs30.6Wo6.2, FeO/MnO = 28), orthopyroxene host (Fs45.8Wo1.6, FeO/MnO = 28), clinopyroxene exsolution lamella (Fs16.8Wo44.3, FeO/MnO = 21), orthopyroxene in symplectite with chromite (Fs14.1Wo0.8, FeO/MnO = 23), clinopyroxene in symplectite with chromite (Fs8.1Wo41.6, FeO/MnO = 21), fayalite (Fa85.2, FeO/MnO = 38), plagioclase associated with fayalite (An56.1Or2.0).

**Classification**: Diogenite (polymict breccia).

**Specimens**: 21.9 g plus one polished thin section at *UWB*; remainder with *Twelker*.

**Northwest Africa 11376** (NWA 11376)

(Northwest Africa)

Purchased: 2005

Classification: Ordinary chondrite (H4)

**History**: Purchased by an anonymous collector from a dealer at the Munich Show in 2005, subsequently acquired by the Hollis Collection and donated to *PSF*.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Well-formed chondrules are set in a relatively coarse grained, recrystallized matrix containing relatively abundant stained metal.

**Geochemistry**: Olivine (Fa17.8-17.9, N = 3), orthopyroxene (Fs15.3-15.7Wo0.8-0.9, N = 2), clinopyroxene (Fs5.6Wo42.4; Fs8.2Wo35.8; N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 5.30.

**Classification**: Ordinary chondrite (H4).

**Specimens**: The entire specimen including one polished thin section is at *PSF*.

**Northwest Africa 11377** (NWA 11377)

Mauritania

Find: 2017 May

Classification: Enstatite achondrite (Aubrite)

**History**: Purportedly found near Ouadane, Mauritania, in May 2017 and subsequently purchased by Habib Naji in Zouerat, Mauritania.

**Physical characteristics**: The single stone (982 g) is partly coated by black fusion crust, but the interior is white to pale gray in color with some small, stained black grains.

**Petrography**: (A. Irving and S. Kuehner, UWS) Cataclastic texture (mean grainsize 2.2 mm). Composed predominantly of anhedral grains of pure enstatite with accessory pure forsterite, pure diopside, alabandite (mostly Fe-free but some Fe-bearing), troilite, daubreelite, schreibersite, Si-poor kamacite and taenite.

**Geochemistry**: Enstatite (Fs0.0Wo0.1-0.3, N = 3), forsterite (Fa0.0), diopside (Fs0.0Wo44.6). Kamacite Si 0.04-0.05 wt.%, Ni 3.3-3.8 wt.%, Co 0.32-0.34 wt.% (N = 3).

**Classification**: Aubrite.

**Specimens**: 28.7 g including one polished mount at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11378** (NWA 11378)

(Northwest Africa)

Purchased: 2005

Classification: Ordinary chondrite (L5)

**History**: Purchased by an anonymous collector from a dealer at the Munich Show in 2005, subsequently acquired by the Hollis Collection and donated to *PSF*.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Sparse chondrules occur in a recrystallized matrix.

**Geochemistry**: Olivine (Fa25.4-25.5, N = 3), orthopyroxene (Fs20.6-20.8Wo1.6-1.8, N = 2), clinopyroxene (Fs8.6Wo42.0; Fs11.0Wo35.8; N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.54.

**Classification**: Ordinary chondrite (L5).

**Specimens**: The entire specimen including one polished thin section is at *PSF*.

**Northwest Africa 11379** (NWA 11379)

(Northwest Africa)

Purchased: 2017 May

Classification: Lunar meteorite (feldspathic breccia)

**History**: Purchased by Bob Falls in May 2017 from a dealer in Zagora, Morocco.

**Physical characteristics**: This fresh stone (150.87 g) lacks fusion crust and consists of angular white to beige clasts in a dark-gray matrix.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia consisting of mineral clasts of anorthite, olivine, orthopyroxene, pigeonite, exsolved pigeonite, augite, ilmenite, chromite, plus some polymineralic lithic clasts, within a fine grained, partly vesicular matrix of the same minerals with minor kamacite, taenite, troilite, pentlandite, calcite and barite.

**Geochemistry**: Olivine (Fa5.6-54.0, FeO/MnO = 77-109, N = 3), orthopyroxene (Fs24.4-46.0Wo4.6-3.4, FeO/MnO = 56-67, N = 3), pigeonite (Fs49.5Wo19.7, FeO/MnO = 58), augite (Fs22.2Wo40.7, FeO/MnO = 64), plagioclase (An92.7-97.8Or0.5-0.2, N = 2).

**Classification**: Lunar (feldspathic breccia).

**Specimens**: 20.2 g in the form of a polished slice at *UWB*; remainder with Mr. R. Falls.

**Northwest Africa 11380** (NWA 11380)

(Northwest Africa)

Purchased: 2005

Classification: Ordinary chondrite (H4/5)

**History**: Purchased by an anonymous collector from a dealer at the Munich Show in 2005, subsequently acquired by the Hollis Collection and donated to *PSF*.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Some well-formed chondrules occur in a recrystallized matrix containing relatively abundant altered metal.

**Geochemistry**: Olivine (Fa19.0-19.1, N = 3), orthopyroxene (Fs16.3-16.4Wo1.4-1.3, N = 2), clinopyroxene (Fs5.5-6.25Wo46.0-45.2, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.92.

**Classification**: Ordinary chondrite (H4/5).

**Specimens**: The entire specimen including one polished thin section is at *PSF*.

**Northwest Africa 11381** (NWA 11381)

(Northwest Africa)

Purchased: 2016 Feb

Classification: HED achondrite (Eucrite, polymict)

**History**: Purchased by Eric *Twelker* in February 2016 from a Moroccan dealer at the Tucson Gem and Mineral Show.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of sparse lithic eucrite clasts (with fine-intersertal, microgabbroic and diabasic textures) and related crystalline debris, plus ~5 vol.% polycrystalline diogenite and diogenitic orthopyroxene clasts, in a finer matrix. Minerals include exsolved pigeonite, calcic plagioclase, silica polymorph, ilmenite and chromite.

**Geochemistry**: Diogenitic orthopyroxene (Fs27.7Wo2.0, FeO/MnO = 38), orthopyroxene host (Fs42.9-48.8Wo2.6-1.7, FeO/MnO = 28-36, N = 2), clinopyroxene exsolution lamellae (Fs18.2-20.1Wo44.1-42.1, FeO/MnO = 25, N = 2), plagioclase (An89.9-92.2Or0.5-0.4, N = 2).

**Classification**: Eucrite (polymict breccia).

**Specimens**: 9.4 g including one polished thin section at *UWB*; remainder with *Twelker*.

**Northwest Africa 11382** (NWA 11382)

(Northwest Africa)

Purchased: 2005

Classification: Ordinary chondrite (L5)

**History**: Purchased by an anonymous collector from a dealer at the Munich Show in 2005, subsequently acquired by the Hollis Collection and donated to *PSF*.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Sparse chondrules occur in a recrystallized matrix.

**Geochemistry**: Olivine (Fa25.1-25.4, N = 3), orthopyroxene (Fs20.7-21.0Wo1.6-1.7, N = 2), clinopyroxene (Fs7.2-9.4Wo45.5-43.8, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.71.

**Classification**: Ordinary chondrite (L5).

**Specimens**: The entire specimen including one polished thin section is at *PSF*.

**Northwest Africa 11383** (NWA 11383)

(Northwest Africa)

Purchased: 2017

Classification: Carbonaceous chondrite (CV3)

**History**: The meteorite was bought in 2017 from a meteorite dealer in Morocco.

**Physical characteristics**: Brownish individual without fusion crust.

**Petrography**: Carbonaceous chondrite composed of up to 6 mm sized chondrules, CAIs, and olivine amoeboids all set into a fine-grained brownish to greenish matrix. Type II chondrules are absent. Several chondrules show reddish staining due to terrestrial weathering.

**Northwest Africa 11387** (NWA 11387)

(Northwest Africa)

Purchased: 2017

Classification: Carbonaceous chondrite (CV3)

**History**: The meteorite was bought in 2017 from a meteorite dealer in Morocco.

**Physical characteristics**: Dark grayish individual without fusion crust.

**Petrography**: The meteorite displays a grayish interior and is composed of up to 3 mm sized chondrules, whitish CAIs, and olivine amoeboids set into a fine-grained almost opaque matrix. Chondrules rarely show brownish staining due to terrestrial weathering; type II chondrules are absent.

**Northwest Africa 11389** (NWA 11389)

(Northwest Africa)

Purchased: 2017

Classification: Carbonaceous chondrite (CM2)

**History**: The meteorite was bought in 2017 from a meteorite dealer in Morocco.

**Physical characteristics**: Small black individual without fusion crust.

**Petrography**: The meteorite displays a black interior and is composed of small (about 0.1-0.4 mm in diameter) chondrules, chondrule pseudomorphs, mineral fragments and rare CAIs most of which are surrounded by fine-grained dust rims set into an abundant fine-grained matrix. Matrix constituents include phyllosilicates, carbonates, and pyrrhotite.

**Northwest Africa 11395** (NWA 11395)

(Northwest Africa)

Purchased: 2017

Classification: HED achondrite (Howardite)

**History**: A single stone weighing 389 g was found in Morocco prior to 2016. Steve Arnold acquired the sample from a meteorite dealer at the Tucson Gem and Mineral Show in February of 2017.

**Physical characteristics**: Sample is tan in color, subrounded, and lacks fusion crust. The cut face shows a brecciated texture composed of up to 1 cm-sized light, orange- and dark-colored clasts.

**Petrography**: Description and classification (A. Love, *App*): Sample is a polymict breccia composed of dominant subrounded, irregularly shaped, clasts of diogenite and cataclastic diogenite (~35 vol%), basaltic and cumulate eucrite (~10 vol%) containing exsolved and inverted pyroxenes, impact melt clasts, minor Fe-rich symplectites (silica + chromite and silica + plagioclase + FeS) set within fragmental mineral debris composed of these lithologies. Several of the diogenite clasts display clean clastic rims composed and heavily brecciated interiors with a transected by orange-colored FeO-rich veins. Minerals: Ca-poor and Ca-rich pyroxenes, olivine, plagioclase, FeS grains, ilmenite, chromite, Si-polymorph, apatite, FeNi metal.

**Geochemistry**: (A. Love, *App*) Eucrite: Low-Ca pyroxene Fs39.6±7.6Wo3.6±-0.8(Fs29.3-54.4Wo2.0-5.6, FeO/MnO=27.2-36.5, N=15); Pigeonite host Fs48.3±3.9Wo8.4±1.7(Fs40.7-51.3Wo5.6-10.2, Fe/Mn=30.8-32.7, N=5); high-Ca pyroxene exsolution lamellae Fs22.2±5.2Wo41.5±1.2(Fs12.6-30.1Wo38.8-42.1, FeO/MnO=29.1-43.0, N=11); plagioclase An83.6.7±4.2Or0.9±0.5(An72.9-88.7Or0.5-2.2, N=12); Diogenite: low-Ca pyroxene Fs20.5±2.5Wo2.4±0.8(Fs12.7-25.7Wo1.1-4.3, Fe/Mn=24.8-34.1, N=21); Olivine Fa27.9±10.0(Fa14.1-37.4, Fe/Mn=50.03, N=3).

**Classification**: HED (Howardite). Sample is a howardite based on the abundance of diogenite and eucrite within the sample. Textures, mineralogy and Fe/Mn ratios of pyroxenes and olivines within clastic components are consistent HED eucrites and diogenites.

**Specimens**: Steve Arnold holds the main mass. The 20 g type specimen (two slices and several small fragments) and one polished thin section are on deposit at *App*.

**Northwest Africa 11396** (NWA 11396)

(Northwest Africa)

Purchased: 2017

Classification: HED achondrite (Eucrite, melt breccia)

**History**: One stone weighing 953 g was found by a meteorite prospector in Morocco. Blaine *Reed* purchased the specimen at the 2017 Tucson Gem and Mineral Show.

**Physical characteristics**: The stone is dark-brownish-gray in color, has a flattened ovoid shape, lacks fusion crust and has a weathered exterior. The cut face of the interior is dark greenish-gray and shows a brecciated texture composed of lithic clasts and mineral fragments.

**Petrography**: Description and classification (A. Love, *App*): Sample is a polymict breccia composed of two lithologies: a lighter-colored breccia composed of rounded to irregularly shaped, up to 5 mm, cumulate clasts and related mineral debris sintered together and a markedly darker colored lithology composed of similar cumulate clasts contained within a finer-grained melt matrix composed of sulfide and plagioclase laths. Rare pyroxene grains show exsolution lamellae but, most appear to have been recrystallized into fine-grained mosaics. Rare plagioclase crystals show equilibrium textures with 120º grain boundaries. Clasts show albite twinning in plagioclase. One clast is an impact melt composed of larger pyroxenes set within vesicular melt matrix of fine plagioclase laths and sulfides. Pyroxenes are cross-cut by darker regions that may be relict shock veins form another event. Accessory minerals are Si-rich polymorph, ilmenite, chromite and rare zircon.

**Geochemistry**: (A. Love, *App*) Pigeonite host Fs55.91±1.43Wo7.72±0.92(Fs54.79-57.72Wo6.31-9.26, FeO/MnO=27.40-34.23, N=9); high-Ca pyroxene exsolution lamellae Fs26.83±0.24Wo43.49±0.37(Fs26.51-27.12Wo42.97-43.99, N=4); plagioclase An89.20±1.63(An86.35-91.21, N=8).

**Classification**: Textural and compositional data indicate this is an HED Achondrite (equilibrated polymict eucrite melt breccia).

**Specimens**: Blaine *Reed* holds the main mass. A polished thin section, epoxy mount and 2 slices weighing 36.01g are on deposit at *App*.

**Northwest Africa 11397** (NWA 11397)

Western Sahara

Find: Aug 2015

Classification: HED achondrite (Eucrite, polymict)

**History**: In July 2015, Hamid Maatallaa, collaborator of *MCM*, recovered five pieces of the meteorite, which were sent to *MCM* for study. After the first observations, a sample for analysis was sent to Dr. Llorca, who carried out the classification.

**Physical characteristics**: Fragile rocks, gray in color, partly covered by a darker crust.

**Petrography**: Breccia composed of disaggregated eucritic debris and some lithic eucrite clasts in a light matrix. Minerals include anorthite, pigeonite, augite, fayalite, silica polymorph, ilmenite, troilite and chromite. Minor Fe metal.

**Geochemistry**: Low-Ca pyroxene (Fs54.5±3.0Wo5.3±1.2, FeO/MnO=32-38, n=12), high-Ca pyroxene (Fs25.2±2.6Wo40.8±1.1, FeO/MnO=27-32, n=14); orthopyroxene host (Fs34.5±3.2Wo3.2±0.8, FeO/MnO=24-27, n=18), clinopyroxene exsolution lamella (Fs15.8±1.1Wo42.3±0.9, FeO/MnO=28-31, n=15), plagioclase (An90.3±3.3, n=22), fayalite (Fa92.2±2.0, FeO/MnO=41-42, n=11).

**Classification**: Eucrite, polymict.

**Specimens**: 20.4 g at *UPC*, and 15g in *MCM*. Javier Franco holds the main mass.

**Northwest Africa 11398** (NWA 11398)

Algeria

Purchased: 2016 Aug

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased from Abdeltif Mechaguen in Mauritania in August 2016.

**Physical characteristics**: The 27 g specimen is unfractured, with homogeneous appearance, no fusion crust, having rounded and rough surfaces.

**Petrography**: Around twenty AOA were observed at each cm2 with size 0.35 -1.6 mm. Several CAIs were also present, together comprising 22% of the sample. Chondrules with roughly the same spatial density as the CAIs are present, average size 0.8 mm (0.3-1.9 mm, 34% of the sample); matrix is about 45%. Main minerals: olivine and pyroxene, with accessories feldspar, melilite, spinel, and perovskite. void-filling alteration products: iron oxides, carbonates (calcite, ankerite, siderite-rhodocrosite), sulfates (barite, mixed coelestine); opaque minerals <3% in the sample: troilite, pentlandite, magnetite. At the S3 shock level the minerals are fractured and mechanical twins are present in pyroxenes, but the olivines do not show mosaicism. 70-90% of troilite and metal in opaque chondrules are oxidized, opaque veins are transformed to iron oxides (W3).

**Geochemistry**: Fa8.2±6.7(Fa0-26.1, N=44), Fs7.7±8.1Wo30.9±8.1(Fs2.6-29.0Wo13.5-41.0, N=13)

**Classification**: CV3, S2

**Specimens**: Many specimens, in all 340 g. 27 g at *CSFK*, remainider with owner Zs. Kereszty, private collection.

**Northwest Africa 11399** (NWA 11399)

(Northwest Africa)

Purchased: 2017 June

Classification: Ordinary chondrite (LL4-6)

**History**: The meteorite was bought from a Moroccan meteorite dealer on the mineral fair in Sainte Marie aux Mines, France.

**Petrography**: Chondritic breccia consisting of clastic LL4 type matrix and abundant LL5 and LL6 clasts. Plagioclase grain size in LL5 clasts is about 30 μm, in LL6 clasts about 90 ym. Chondrule mean diameter about 0.9 mm.

**Geochemistry**: type 4 lithology: olivine: Fa27.2±0.3, n=11; pyroxene: Fs20.0±4.3Wo1.9±1.1, (Fs10.7-24.1Wo0.5-3.9, n = 41); type 6 lithology: olivine: Fa27.3±0.4, n=10; pyroxene: Fs23.7±0.3Wo2.3±0.1, n=7

**Northwest Africa 11400** (NWA 11400)

(Northwest Africa)

Purchased: 2017 June

Classification: Ordinary chondrite (LL5-6)

**History**: The meteorite was bought from a Moroccan meteorite dealer on the mineral fair in Sainte Marie aux Mines, France.

**Petrography**: Chondritic breccia consisting of intermingled LL5 and LL6 clasts. Plagioclase grain size in LL5 clasts is about 30 μm, in LL6 clasts about 90 μm.

**Northwest Africa 11402** (NWA 11402)

(Northwest Africa)

Purchased: 2017 June

Classification: Ordinary chondrite (L6, melt breccia)

**History**: The meteorite was bought from a Moroccan meteorite dealer on the mineral fair in Sainte Marie aux Mines, France.

**Petrography**: The meteorite is composed of regions displaying chondritic textures with relict chondrules adjacent to large melt regions characterized by recrystallized shock melt containing characteristic FeNi metal and sulfide globules. Olivine and pyroxene show strong mosaicism. Chondritic portions of type (type 6, plagioclase grain size is about 70 μm) are crosscut by shock melt veins.

**Northwest Africa 11403** (NWA 11403)

(Northwest Africa)

Purchased: 2017 June

Classification: Ordinary chondrite (LL4-6)

**History**: The meteorite was bought from a Moroccan meteorite dealer on the mineral fair in Sainte Marie aux Mines, France.

**Petrography**: Chondritic breccia consisting of an LL4 host and intermingled LL5 and LL6 clasts. Plagioclase grain size in LL5 clasts is about 40 μm, in LL6 clasts about 80 μm. Chondrule mean diameter about 0.9 mm.

**Geochemistry**: type 4 lithology: olivine: Fa27.6±0.3, n=7; pyroxene: Fs20.2±3.6Wo1.3±0.7(Fs13.9-24.0Wo0.3-2.1, n=11); type 6 lithology: olivine: Fa27.5±0.2, n=7; pyroxene: Fs23.7±0.2Wo1.7±0.2, n=8

**Northwest Africa 11404** (NWA 11404)

(Northwest Africa)

Purchased: June 2016

Classification: Iron meteorite (IC)

**History**: Bought in Zagora in June 2016.

**Petrography**: (J. Gattacceca, H. Pourkhorsandi, *CEREGE*): The etched section shows a fine-scaled struture of interlocking ~2 μm thick curved metal spindles. This indicates decompositon of the original metal into alpha+gamma phases, and heavy plastic deformation. The Widmanstätten structure has been entirely obliterated by these processes. Abundant schreibersite as euhedral grains (2-5 μm, to 10 μm) or needles up to 200 μm long.

**Geochemistry**: (M. D’Orazio, *DST-PI*): Composition of the metal (ICP-MS; D’Orazio and Folco, 2003) is Co=0.464, Ni=6.32 (both in wt%), Cr=14.6, Cu=142, Ga=61, Ge=254, As=5.0, Mo=6.3, Ru=14.2, Rh=2.32, Pd=2.09, W=2.16, Re=0.16, Ir=2.42, Pt=16.6, Au=0.527 (all in ppm).

**Classification**: Iron, IC

**Specimens**: 25 g and a polished section at *CEREGE*, main mass with *Labenne*.

**Northwest Africa 11405** (NWA 11405)

(Northwest Africa)

Purchased: 2017

Classification: Rumuruti chondrite (R3-4)

**History**: One partially crusted stone weighing 54.5 g was found in Morocco prior to 2017. J. Donald Cline and John Sinclair acquired the sample from a meteorite dealer at the Tucson Gem and Mineral Show in February 2017.

**Physical characteristics**: Sample is tabular in shape, dark brownish-green in color and contains one patch (~25% of surface) of weakly magnetic fusion crust that appears to be the bubbled trailing edge of an oriented stone. The interior is brownish-orange in color and has a clastic texture composed of chondritic clasts (some dark-colored) within a host of chondrules and fragments. No metal or sulfide is visible on the surface.

**Petrography**: Description and classification (A. Love, *App*): Sample is a breccia composed of up to 15 mm clasts set within a host of well-defined chondrules (avg. dia. 353 μm) and fragments. Unequilibrated clasts contain chondrules with zoned olivine and pyroxene set within fine-grained matrix. Olivine chondrules display normal extinction and irregular fractures. Clinoenstatite is present. Within equilibrated clasts: olivines have uniform compositions; low and high Ca-pyroxenes are present; plagioclase occurs as isolated intergrowths and as networks similar to those found in type 4 and 5 R-chondrites. These components are hosted within a recrystallized matrix. Fine-grained FeS grains occur within some chondrules. Sulfides where present within matrix, are corroded and rare. Accessory minerals chromite.

**Geochemistry**: (A. Love, *App*) Olivine (Host: Fa0.4-43.0, mean Fa23.7±13.7CV=58%, N=21; Equilibrated clasts Fa38.5±0.1, N=6), Fe/Mn=75.6, NiO=0.1±0.2; Orthopyroxene (Host: Fs5.7-30.1Wo0.3-13.5, mean Fs17.9±8.2Wo2.6±3.1, N=16; Equilibrated clast Fs22.8Wo2.33, N=1); High-Ca pyropxene (Equilibrated clasts: Fs10.2±0.5Wo46.4±0.6, N=5).

**Classification**: Rumuruti chondrite (R3-4, S1, W2). Based on Fa, Fe/Mn and Ni-bearing compositions of olivines, chondrule diameter and texture this sample is a Rumuruti chondrite. Based on the coefficient of variation of olivines within unequilibrated clasts, the petrologic subtype is estimated at 3.4.

**Specimens**: *PARI* holds the main mass. One 11.04 g endcut and a polished thin section are on deposit at *App*.

**Northwest Africa 11406** (NWA 11406)

Algeria

Purchased: 2016

Classification: Carbonaceous chondrite (CO3)

**History**: The meteorite was found in Algeria in 2014 by nomads. Zs. Kereszty purchased it in the Munich Show 2016 from Adam Aithiba (Moroccoan meteorite seller) and made 3 thin sections.

**Physical characteristics**: The meteorite contains up to 500 μm sized chondrules, CAI and AOA grains embedded in dark, poorly transparent matrix that makes up around half of the meteorite. Some chondrules are fragmented. The whole meteorite is substantially weathered.

**Petrography**: Minerals: 80% olivine(above 60 μm Fe-rich olivine, and olivine with Fe-rich rim and Mg rich core are also present), 10% px (10-20 μm-sized, at the rim of chondrules and AOAs), opaque mineral 4%: goethite, pentlandite, pyrite, chromite, troilite, kamacite, taenite, other accessories: 6% (wollastonite, jadeite, feldspar). CAI-AOA: 12% (up to 300 μm-sized, coarse-grained, with sinusoidal, multi-cored with fine-grained rims), matrix: 38% (including 10-20 µm olivine crystals, submicroscopic px, opaque minerals, chondrules: 49% (size: up to 400 μm, average: 200 μm). Weathering: clay around chondrules and between larger olivine grains, and iron-oxide veins. Shock effects: intergranular fractures and brecciation.

**Geochemistry**: olivine:: Fa36.7±18(Fa0-72.7, N=93); cpx: Fs15.5±15.7Wo38.0±10.6(Fs0.0-54.8Wo8.5-48.3N=20); and opx: Fs2.3±1.3Wo1.8±1.7, (Fs0.0-5.3Wo0.0-4.8, N=13

**Classification**: CO3

**Specimens**: 3 slices of 23 g at *CSFK*

**Northwest Africa 11407** (NWA 11407)

Algeria

Purchased: 2017

Classification: Lunar meteorite (feldspathic breccia)

**History**: Some pieces totaling 700 g were found in Algeria. 207 g were purchased by Decker Meteorite-Museum in 2017 from a Moroccan dealer.

**Petrography** characteristics: (A.-K. Kraemer and A. Bischoff, *IfP*) Breccia composed of angular anorthite-rich lithic and mineral fragments embedded in a fine-grained clastic matrix. The sample also contains shock-melted areas. Observed minerals include anorthite, olivine, low-Ca pyroxene, Ca-rich pyroxene, silica polymorph, Al-Ti-chromite, kamacite, ilmenite, troilite, and pendlandite. Some Ba-sulfates indicate terrestrial alteration.

**Geochemistry**: Mineral compositions and geochemistry: Olivine (mean: Fa28.8, Fe/Mn = 93; N = 49), low-Ca pyroxene (mean Fs25.8Wo7.6, Fe/Mn = 59, N = 30), Ca-rich pyroxene (mean: Fs17.0Wo39.4; Fe/Mn = 58; N = 12), anorthite (mean An96.0Or0.1, N = 25).

**Classification**: Lunar (feldspathic breccia).

**Specimens**: 20.7 g including one polished thin section, *IfP*; 207 g with Decker Meteorite-Museum.

**Northwest Africa 11408** (NWA 11408)

Morocco

Purchased: February 2013

Classification: Ureilite

**History**: Purchased from Moroccan meteorite dealer in 2013.

**Physical characteristics**: Physical Characteristics: Single stone, black rough irregular exterior. Saw cut shows mostly dark grains with a few exhibiting greater light reflectance. Stone was difficult to cut.

**Petrography**: (K. Domanik and F. Stephan, *UAz*) Microprobe examination of a polished mount shows approx. 45% olivine, 45% pigeonite, and 8% low-Ca pyroxene, all with an average grain size of approx. 800 - 1000 μm. Fe-Ni veins, now mostly oxidized by desert weathering, occupy grain boundaries and also crosscut some grains. The veins contain numerous, irregularly shaped patches of graphite, partially altered to diamond, mainly 50-200 μm in length but with a few up to 1000 μm. Olivine grains in contact with metal veins or diamond commonly display Mg-rich alteration rims (70-300 μm) containing small (<2 μm), metal blebs either randomly distributed or in linear arrays. Pigeonite and low-Ca pyroxene occasionally show narrow patches of Mg-rich pyroxene along contacts with metal veins or diamond.

**Geochemistry**: Mineral compositions and geochemistry: (K. Domanik and F. Stephan, *UAz*) Olivine cores Fa10.3±0.6, Fe/Mn=22.5±2.7, Cr2O3=0.52±0.04 wt%, n=22; olivine rims Fa1.4±1.0, Fe/Mn=3.2±1.7, Cr2O3=0.34±0.15 wt%, n=7; pigeonite Fs9.7±0.2Wo8.6±0.1, Fe/Mn=14.4±1.0, Cr2O3=0.91±0.06 wt%, n=25; low-Ca pyroxene Fs9.5±0.4Wo4.9±0.1, Fe/Mn=15.7±1.8, Cr2O3=0.88±0.07 wt%, n=19; pyroxene rims Fs0.9±0.2Wo2.8±1.9, Fe/Mn=1.6±0.3, Cr2O3=0.29±0.09, n=7.

**Classification**: Achondrite (ureilite)

**Specimens**: 14.6 g including probe mount on deposit at *UAz*, Fredric Stephan holds the main mass.

**Northwest Africa 11409** (NWA 11409)

Morocco

Purchased: February 2013

Classification: Ureilite

**History**: Purchased from Moroccan meteorite dealer in 2013.

**Physical characteristics**: Physical Characteristics: Three stones exhibiting black irregular surfaces. Saw cut shows dark greenish-brown coarse grains separated by thin reflective veins.

**Petrography**: (K. Domanik and F. Stephan, *UAz*) Microprobe examination of a polished mount shows approx. 80% olivine and 15% pyroxene. The average grain size of both olivine and pyroxene is approx. 1-2 mm. Numerous oxidized Fe-Ni veins 5-30 μm wide occupy grain boundaries and also crosscut some grains. The veins contain a number of large irregularly shaped lenses of graphite, partially altered to diamond, 500-1500 μm long and 30-100 μm wide. In a few cases olivine grain boundaries in contact with larger metal veins or with diamond display a thin, discontinuous, Mg-rich rim, 2-10 μm wide, containing scattered, tiny (<2um) metal blebs. Pyroxene consists entirely of a patchy, mottled mixture of pigeonite and low-Ca pyroxene containing abundant void spaces, scattered Fe-metal blebs, and small Si-rich inclusions.

**Geochemistry**: Mineral compositions and geochemistry: (K. Domanik and F. Stephan, *UAz*) Olivine cores Fa21.3±1.5, Fe/Mn=46.4±6.7, Cr2O3=0.64±0.10 wt%, n=16; olivine rims Fa2.2±0.8, Fe/Mn=7.3±2.7, Cr2O3=0.42±0.14 wt%, n=11; pigeonite Fs17.2±2.3Wo7.9±0.9, Fe/Mn=24.9±4.5, Cr2O3=1.16±0.05 wt%, n=9; low-Ca pyroxene Fs13.5±0.7Wo2.7±0.4, Fe/Mn=24.7±5.7, Cr2O3=0.94±0.09 wt%, n=4.

**Classification**: Achondrite (Ureilite)

**Specimens**: 5.2 g plus three probe mounts on deposit at *UAz*, *UAz* holds the main mass.

**Northwest Africa 11410** (NWA 11410)

Morocco

Purchased: February 2013

Classification: Ureilite

**History**: Purchased from Moroccan meteorite dealer in 2013.

**Physical characteristics**: Physical Characteristics: Single large stone, black irregular surface with remnant fusion crust. Saw cut shows dark mosaicized interior with dark green and smaller white grains. Stone was extremely difficult to cut.

**Petrography**: (K. Domanik and F. Stephan, *UAz*) Microprobe examination of a polished mount shows approx. 80% olivine and 15% pyroxene. The average grain size of both olivine and pyroxene is approx. 1-2 mm. Fe-Ni veins, now mostly oxidized by desert weathering, occupy grain boundaries and also crosscut some grains. The veins contain irregularly shaped patches of graphite, partially altered to diamond, 200-1000 μm in length. In rare cases olivine grain boundaries in contact with larger metal veins or with graphite display a thin, reduced rim, 2-10 μm wide, containing scattered, tiny metal blebs. Pyroxene consists of a patchy, mottled mixture of pigeonite and low-Ca pyroxene containing abundant void spaces, scattered Fe-metal blebs, and small Si-rich inclusions.

**Geochemistry**: Mineral compositions and geochemistry: (K. Domanik and F. Stephan, *UAz*) Olivine cores Fa20.9±1.6, Fe/Mn=44.3±4.4, Cr2O3=0.66±0.07 wt%, n=17; olivine rims Fa3.6±1.4, Fe/Mn=8.6±4.6, Cr2O3=0.57±0.10 wt%, n=8; pigeonite Fs16.4±0.4Wo9.6±1.0, Fe/Mn=24.7±1.9, Cr2O3=1.22±0.07 wt%, n=12; low-Ca pyroxene Fs14.2±0.6Wo2.9±0.4, Fe/Mn=26.7±3.4, Cr2O3=1.01±0.04 wt%, n=14.

**Classification**: Achondrite (ureilite)

**Specimens**: 20.2 g plus two probe mounts on deposit at *UAz*, Fredric Stephan holds the main mass.

**Northwest Africa 11411** (NWA 11411)

Morocco

Purchased: February 2013

Classification: Ureilite

**History**: Purchased from Moroccan meteorite dealer in 2013.

**Physical characteristics**: Physical Characteristics: Single stone with black/brown irregular weathered surface with small area of fusion crust. Saw cut shows dark interior with scattered reflective grains. Stone was extremely difficult to cut.

**Petrography**: (K. Domanik and F. Stephan, *UAz*) Microprobe examination of a polished mount reveals approx. 70% olivine, 26% pigeonite, with an average grain size of approx. 600-800 μm. Fe-Ni veins occupy grain boundaries most of which have been oxidized by desert weathering. Graphite, partially altered to diamond, is present along some grain boundaries as small domains 50-200 μm in size. Olivine grain boundaries in contact with metal veins or diamond are Mg-rich and contain extremely densely-packed tiny metal blebs, often coalescing into wide, mossy-textured haloes along vein edges, 100-150 μm in width.

**Geochemistry**: Mineral compositions and geochemistry: (K. Domanik and F. Stephan, *UAz*) Olivine cores Fa20.8±0.9, Fe/Mn=42.2±4.5, Cr2O3=0.69±0.07 wt%, n=13; olivine rims Fa2.6±1.0, Fe/Mn=5.3±2.0, Cr2O3=0.72±0.25 wt%, n=6; pigeonite Fs17.8±0.2Wo8.4±0.1, Fe/Mn=26.6±1.9, Cr2O3=1.15±0.03 wt%, n=12.

**Classification**: Achondrite (ureilite)

**Specimens**: 42.7 g plus one probe mount on deposit at *UAz*, Fredric Stephan holds the main mass.

**Northwest Africa 11412** (NWA 11412)

Morocco

Purchased: February 2014

Classification: Ureilite

**History**: Purchased from Moroccan meteorite dealer in 2014.

**Physical characteristics**: Physical Characteristics: Single stone, black rough irregular surface. Saw cut reveals mosaic of dark green and brown grains, a few minor terrestrial calcite veins. Stone was difficult to cut.

**Petrography**: (K. Domanik and F. Stephan, *UAz*) Microprobe examination of a polished mount shows approx. 75% olivine, 21% pigeonite, with an average grain size of approx. 1000-1500 μm. Fe-Ni veins occupy grain boundaries, most of which have been oxidized by desert weathering. Graphite, partially altered to diamond, is common along grain boundaries, occurring mainly as small domains 100-200 μm in size but with a few patches up to 1000 μm in length. Olivine grain boundaries in contact with metal veins or graphite are reduced and contain an abundance of tiny metal blebs forming rims approx. 100-150 μm in width. A few scattered, vein-like patches of lower-Ca pigeonite associated with voids, Fe-metal blebs, and small Si-rich inclusions are observed cross-cutting individual pigeonite grains.

**Geochemistry**: Mineral compositions and geochemistry: (K. Domanik and F. Stephan, *UAz*) Olivine cores Fa21.7±0.7, Fe/Mn=49.7±5.6, Cr2O3=0.56±0.15 wt%, n=20; olivine rims Fa2.3±0.5, Fe/Mn=4.1±0.8, Cr2O3=0.55±0.03 wt%, n=3; pigeonite cores Fs18.3±0.3Wo10.6±0.2, Fe/Mn=29.0±3.0, Cr2O3=1.24±0.06 wt%, Al2O3=1.43±0.10 wt%, n=14; pigeonite (patches and veins) Fs14.3±1.2Wo5.3±0.7, Fe/Mn=24.1±2.6, Cr2O3=1.19±0.08 wt%, Al2O3=0.28±0.05 wt%, n=5.

**Classification**: Achondrite (Ureilite)

**Specimens**: 21.3 g including probe mount on deposit at *UAz*, Fredric Stephan holds the main mass.

**Northwest Africa 11413** (NWA 11413)

Morocco, Laayoun, (Northwest Africa)

Purchased: May 2014

Classification: Enstatite chondrite (EL6)

**History**: Collected by nomads in Western Sahara and purchased by Nicola Castellano at the Genova Mineral Fair in May 2014 from a Moroccan dealer.

**Physical characteristics**: A single piece weighing 28 g with no fusion crust.

**Petrography**: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*); The thin section texture consists of a fine-grained, pyroxene-dominant matrix, with minor plagioclase. No chondrules are visible. The main opaque phases are kamacite and troilite, partially weathered to iron oxides. Blades of alabandite and daubreelite are occasionally visible in troilite. The presence of alabandite, An content of plagioclase and Si content of kamacite point to a classification as EL chondrite;

**Geochemistry**: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) Orthopyroxene (Fs0.4En98.2Wo1.4), plagioclase (An15.0Or4.4); Si in kamacite = 0.6 wt.%, Ti in troilite = 6.1 wt.%

**Classification**: Enstatite chondrite (EL6); S1; W3

**Specimens**: A total of 7.0 g specimen is on deposit at *MSN-FI*. Castellano holds the main mass.

**Northwest Africa 11414** (NWA 11414)

Morocco, Laayoun, (Northwest Africa)

Purchased: May 2014

Classification: Enstatite chondrite (EL6)

**History**: Collected by nomads in Western Sahara and purchased by Nicola Castellano at the Genova Mineral Fair in May 2014 from a Moroccan dealer.

**Physical characteristics**: A single piece weighing 53 g with no fusion crust.

**Petrography**: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*); A fine-grained texture, with a pyroxene-dominant matrix and minor plagioclase is visible in thin section. No relic chondrules are visible. The main opaque phases are kamacite and troilite, partially weathered to iron oxides. Blades of alabandite are occasionally visible in troilite. A classification as EL chondrite is suggested by the presence of alabandite, An content of plagioclase and Si content of kamacite;

**Geochemistry**: EMP (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) Orthopyroxene (Fs0.6En97.9Wo1.5), plagioclase (An15.4Or4.1); Si in kamacite = 0.7 wt.%, Ti in troilite = 6.4 wt.%

**Classification**: Enstatite chondrite (EL6); S1; W3

**Specimens**: A total of 11.0 g specimen is on deposit at Museo di Storia Naturale dell’Università di Firenze (*MSN-FI*). Castellano holds the main mass.

**Northwest Africa 11415** (NWA 11415)

Morocco, Laayoun, (Northwest Africa)

Purchased: May 2014

Classification: Enstatite chondrite (EL6)

**History**: Collected by nomads in Western Sahara and purchased by Nicola Castellano at the Genova Mineral Fair in May 2014 from a Moroccan dealer.

**Physical characteristics**: A single piece weighing 78 g with no fusion crust.

**Petrography**: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*); The thin section texture consists of a fine-grained, pyroxene-dominant matrix, with minor plagioclase. No relic chondrules are visible. Kamacite and troilite are the main opaque phases, partially weathered to iron oxides. Accessory phases are alabandite and daubreelite as blades in troilite. The presence of alabandite, An content of plagioclase and Si content of kamacite point to a classification as EL chondrite;

**Geochemistry**: EMP (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) Orthopyroxene (Fs0.4En98.0Wo1.5), plagioclase (An15.3Or4.3); Si in kamacite = 0.4 wt.%, Ti in troilite = 6.6 wt.%

**Classification**: Enstatite chondrite (EL6); S1; W3

**Specimens**: A total of 15.6 g specimen is on deposit at *MSN-FI*. Castellano holds the main mass.

**Northwest Africa 11416** (NWA 11416)

Morocco, Laayoun, (Northwest Africa)

Purchased: May 2014

Classification: Enstatite chondrite (EL6)

**History**: Collected by nomads in Western Sahara and purchased by Nicola Castellano at the Genova Mineral Fair in May 2014 from a Moroccan dealer.

**Physical characteristics**: A single piece weighing 62 g partially covered by fusion crust.

**Petrography**: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*); The thin section texture consists of a fine-grained, pyroxene-dominant matrix, with minor plagioclase. Rare RP relic chondrules are visible. Kamacite and troilite are the main opaque phases and display minor weathering. Accessory phases are alabandite and daubreelite as blades in troilite. The presence of alabandite, An content of plagioclase and Si content of kamacite point to a classification as EL chondrite;

**Geochemistry**: EMP (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) Orthopyroxene (Fs0.4En98.2Wo1.4), plagioclase (An15.8Or4.1); Si in kamacite = 0.4 wt.%, Ti in troilite = 5.7 wt.%

**Classification**: Enstatite chondrite (EL6); S2; W1

**Specimens**: A total of 13.0 g specimen is on deposit at *MSN-FI*. Castellano holds the main mass.

**Northwest Africa 11420** (NWA 11420)

Morocco

Find: 2016

Classification: Iron meteorite (IIAB)

**History**: One piece of iron was collected in 2016 in an unknown area, Morocco, and purchased in Tucson in February 2017 from a Moroccan dealer.

**Physical characteristics**: The write up specimen is a 2350 g, partly crusted, regmaglypted, slightly weathered by naturally sandblasting.

**Petrography**: Etched section shows a normal hexahedrite structure with bright kamacite and several sets of Neumann lines. Schreibersite occurs as numerous rhabdites and small patches.

**Geochemistry**: SEM-EDX spot analyses: kamacite Fe94.9±0.5Ni5.1±0.5 (N=11); Bulk composition: ICP-MS data, Ni 54 mg/g, Co 4.5 mg/g, Cu 139 μg/g, Ga 59 μg/g, Ge 221 μg/g, W 1.7 μg/g, Re 0.9 μg/g, Ir 7.6 μg/g, Pt 5.1 μg/g, Pd 1.7 μg/g, Ru 15.7 μg/g, Os 5.5 μg/g and Au 0.5 μg/g.

**Classification**: Iron, IIAB, hexahedrite.

**Specimens**: 31 g at *UPC*, 2.3 kg with anonymous owner, 2 stones of 22 kg and 59 kg with *Aaronson*.

**Northwest Africa 11421** (NWA 11421)

(Northwest Africa)

Purchased: 2017

Classification: Lunar meteorite

**History**: The meteorite was bought in 2017 from a meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Many small grayish individuals lacking any fusion crust. White to beige clasts in greyish matrix are visible at the surface.

**Petrography**: The meteorite is a breccia composed of angular to subrounded whitish clasts up to 1 cm in size set into a greyish vitreous groundmass. Mineral fragments are also present in the matrix. Dominant mineral phases are low-Ca pyroxene, Ca- pyroxene, olivine and calcic plagioclase. Minor phases include chromite, ilmenite, fayalite, pyrrhotite, FeNi metal, and barite. Contains some melt regions displaying quenching textures of dendritic pyroxene and plagioclase.

**Geochemistry**: olivine: Fa30.1±10.4(Fa18.4-52, n=16, FeO/MnO=79-112); low-Ca pyroxene: Fs33.3±2,8Wo2.5±1.0(Fs30.4-36.4Wo1.4-3.8, n=10, FeO/MnO=55-64); Ca-pyroxene: Fs16.1±4.0Wo40.0±4.2(Fs8.9-23.2Wo31.3-45.1, n=14, FeO/MnO=36-64); calcic plagioclase: An96.4±0.8(An95.4-98.0, n=16)

**Classification**: Lunar (feldspathic breccia)

**Northwest Africa 11422** (NWA 11422)

(Northwest Africa)

Purchased: June, 2017

Classification: H3-7

**History**: The meteorite was bought June 2017 from a Moroccan meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Brownish individual lacking any fusion crust

**Petrography**: Chondritic breccia consisting of clastic H3 type matrix with embedded H4-7 clasts. Plagioclase grain size in H5 clasts is about 30 μm, in H6 clasts about 60 μm. Chondrules are about 0.15 to 0.4 mm in diameter. The type 7 clasts show a thoroughly recrystallized texture with abundant 120 degree grain boundaries. Grain sizes are about 100-400 μm. In some regions olivine is poikilitically enclosed by low-Ca pyroxene. Albitic feldspar is abundant and contains K-feldspar exsolution lamellae. No relict chondrules and no metal veinlets were observed in type 7 clasts.

**Geochemistry**: Type 3 lithology: olivine: Fa17.5±7.0(Fa3.5-25.1, n=26); pyroxene: Fs12.9±5.2Wo1.6±1.0(Fs2.3-16.8Wo0.3-3.9, n = 17); type 6 lithology: olivine: Fa18.4±0.1, n=12; pyroxene: Fs16.3±0.2Wo2.8±0.4, n=12; type 7 lithology: olivine: Fa19.3±0.1, n=12; pyroxene: Fs16.2±0.1Wo4.2±0.2, n=13; Na-feldspar host: An2.1Ab91.7Or6.2(n=5); K-feldspar lamellae: An2.1Ab34.0Or63.9(n=2)

**Northwest Africa 11423** (NWA 11423)

(Northwest Africa)

Purchased: 2017 Jun

Classification: Ordinary chondrite (LL4-6)

**History**: Purchased by Ben Hoefnagels at the Ensisheim Show in June 2017 from a dealer who had obtained the stone from a Moroccan source.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of predominantly type 6 clasts containing rare chondrules, but also separate clasts containing well-formed chondrules with equilibrated olivine and unequilibrated pyroxenes.

**Geochemistry**: Olivine (Fa32.4-33.6, N = 5), orthopyroxene (Fs23.6Wo3.4, N = 1), pigeonite (Fs25.0Wo8.6; Fs20.4Wo20.0; N = 2), subcalcic augite (Fs16.7-16.9Wo30.4-32.7, N = 2).

**Classification**: Ordinary chondrite (LL4-6). The ferroan mafic silicate compositions (with some olivine Fa>33.5, similar to e.g., NWA 6588 and NWA 10462) slightly extend the LL composition range.

**Specimens**: 41.1 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11424** (NWA 11424)

(Northwest Africa)

Purchased: 2017 Apr

Classification: HED achondrite (Diogenite)

**History**: Purchased by Fabien *Kuntz* in April 2017 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Metamorphic aggregate of interlocking orthopyroxene grains with accessory chromite, clinopyroxene, Ni-free metal and troilite.

**Geochemistry**: Orthopyroxene (Fs25.2-25.4Wo3.4-3.7, FeO/MnO = 27-28, N = 3), clinopyroxene (Fs8.7-8.9Wo45.5-45.1, FeO/MnO = 18-20, N = 2).

**Classification**: Diogenite.

**Specimens**: 20.18 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11425** (NWA 11425)

(Northwest Africa)

Purchased: 2017 Apr

Classification: HED achondrite (Eucrite, monomict)

**History**: Purchased by Fabien *Kuntz* in April 2017 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of subophitic eucrite clasts within a sparse matrix of related crystalline debris. Minerals are exsolved pigeonite, calcic plagioclase, silica polymorph, chromite, ilmenite, troilite, zircon and low-Ni metal.

**Geochemistry**: Orthopyroxene host (Fs62.4Wo1.7, FeO/MnO = 33), clinopyroxene exsolution lamella (Fs28.5Wo40.4, FeO/MnO = 37), clinopyroxene host (Fs26.5Wo43.1, FeO/MnO = 34), orthopyroxene exsolution lamella (Fs61.9Wo1.9, FeO/MnO = 33), plagioclase (An87.2-88.9Or0.8, N = 2).

**Classification**: Eucrite (monomict breccia).

**Specimens**: 23.21 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11426** (NWA 11426)

(Northwest Africa)

Purchased: 2017 May

Classification: Ordinary chondrite (L3-6)

**History**: Purchased by Wen Chang Chen in May 2017 from a Moroccan dealer at the Hunan Show.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) The specimen consists of abundant well-formed chondrules (apparent diameter 600±300 µm), some unequilibrated, plus sparse angular mineral and lithic clasts in a finer grained matrix containing chlorapatite and merrillite. Clasts include more equilibrated L5 and L6 chondrites, plus rare large (up to 7 mm) stained, angular troilite grains.

**Geochemistry**: Olivine (Fa12.6-28.3, Cr2O3 < 0.02 wt.%, N = 6), orthopyroxene (Fs2.2-23.8Wo0.2-1.8, N = 3), subcalcic augite (Fs11.7Wo27.0; Fs29.0Wo35.1; N = 2), augite (Fs10.6Wo44.6). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.65.

**Classification**: Ordinary chondrite (L3-6 breccia).

**Specimens**: 99.1 g including one polished thin section at *UWB*; remainder with Mr. W. Chen.

**Northwest Africa 11427** (NWA 11427)

(Northwest Africa)

Purchased: 2017 Apr

Classification: HED achondrite (Eucrite, monomict)

**History**: Purchased by Fabien *Kuntz* in April 2017 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Melt-matrix breccia consisting of shocked gabbroic eucrite clasts in a sparse heterogeneous matrix exhibiting quench and flowage textures. Gabbroic eucrite clasts are composed mainly of microcrystalline clinopyroxene (pale orange in thin section) and polycrystalline calcic plagioclase with accessory silica polymorph, chromite, ilmenite, troilite and barite. Clinopyroxenes (formerly exsolved pigeonite) now consist of diffuse heterogeneous lamellae of pigeonite within host augite, and appear to have been thermally annealed. Secondary calcite and barite are present.

**Geochemistry**: High-Ca pyroxene host (Fs28.9-31.4Wo43.7-41.1, FeO/MnO = 32-33, N = 2), low-Ca pyroxene exsolution lamellae (Fs59.3Wo17.3; Fs48.6Wo20.1; FeO/MnO = 31-32; N = 2), plagioclase (An87.8-87.9Or1.2-0.8, N = 2).

**Classification**: Eucrite (gabbroic, melt matrix breccia).

**Specimens**: 23.05 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11428** (NWA 11428)

(Northwest Africa)

Purchased: 2017 Aug

Classification: Lunar meteorite (feldspathic breccia)

**History**: Purchased by Bob Falls in July 2017 from dealer in Zagora, Morocco.

**Physical characteristics**: The stones lack fusion crust but are thinly coated by reddish-brown weathering products. The fresh interiors exhibit white to beige, angular clasts in a medium gray matrix.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of angular mineral clasts of anorthite, exsolved pigeonite, olivine, ilmenite, Ti-chromite, troilite and kamacite in a finer matrix containing sporadic small vesicles.

**Geochemistry**: Olivine (Fa18.8-56.2, FeO/MnO = 87-96, N = 3), pigeonite (Fs37.8Wo7.6, FeO/MnO = 54), augite (Fs7.5Wo44.2, FeO/MnO = 29), augite host (Fs24.2Wo40.7, FeO/MnO = 66), low-Ca pyroxene exsolution lamella (Fs51.0Wo5.0, FeO/MnO = 65), plagioclase (An97.1-97.2Or0.2, N = 2).

**Classification**: Lunar (feldspathic breccia).

**Specimens**: 20.71 g including one polished endcut at *UWB*; remainder with Mr. B. Falls.

**Northwest Africa 11429** (NWA 11429)

(Northwest Africa)

Purchased: 2017 Apr

Classification: HED achondrite (Diogenite, polymict)

**History**: Purchased by Fabien *Kuntz* in April 2017 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of angular grains of zoned orthopyroxene, olivine and sparse subophitic eucrite clasts in a fine grained matrix. Accessory minerals are silica polymorph, ilmenite, chromite, troilite and zircon.

**Geochemistry**: Diogenitic orthopyroxene (core Fs23.4Wo1.5; rims 31.6-32.2Wo2.1-2.2; FeO/MnO = 31-33; N = 3), eucritic orthopyroxene host (Fs56.9Wo2.4; Fs49.3Wo2.5; FeO/MnO = 27-32; N = 2), clinopyroxene exsolution lamellae (Fs24.0-27.0Wo42.1-40.1, FeO/MnO = 30-31, N = 2), olivine (Fa41.4-46.5, FeO/MnO = 51-56, N = 2), plagioclase (An87.8-92.1Or0.9-0.5, N = 2).

**Classification**: Diogenite (polymict breccia).

**Specimens**: 25.28 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11430** (NWA 11430)

(Northwest Africa)

Purchased: 2017 Jun

Classification: Ordinary chondrite (LL4/5)

**History**: Purchased by Ben Hoefnagels in June 2017 from a dealer in Guelmim, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Very fresh specimen. Some well-formed chondrules occur within a relatively coarse grained, recystallized matrix containing unaltered kamacite and chlorapatite.

**Geochemistry**: Olivine (Fa32.5-33.0, N = 4), orthopyroxene (Fs25.4-25.5Wo2.3-2.4, N = 3), clinopyroxene (Fs10.6-10.7Wo43.2-43.1, N = 2).

**Classification**: Ordinary chondrite (LL4/5).

**Specimens**: 86.8 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11431** (NWA 11431)

Mauritania

Find: 2017 Jun

Classification: Martian meteorite (Shergottite)

**History**: Found in June 2017 in Mauritania in a region directly south of the NWA 6963 strewnfield (located near Fej Arrih to the north in adjacent Morocco), and puchased by Ben Hoefnagels in July 2017 from a Moroccan dealer.

**Physical characteristics**: A single stone (524 g) with a flat prismatic shape almost completely coated by black fusion crust. The interior is gray with evident glassy maskelynite.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Medium-grained, diabasic texture. Composed predominantly of zoned clinopyroxene and maskelynite with accessory Fe-bearing merrillite, titanomagnetite, ilmenite (with rare baddeleyite inclusions), silica polymorph, fayalite and pyrrhotite.

**Geochemistry**: Pigeonite (Fs36.2-51.6Wo8.1-12.8, FeO/MnO = 31-37, N = 4), subcalcic augite (Fs21.6-42.0Wo30.1-31.3, FeO/MnO =30-42, N = 4), fayalite (Fa85.5, FeO/MnO = 60), maskelynite (An38.4-42.3Or4.5-3.0, N = 2). The most ferroan subcalcic augite rims are notably aluminous (Al2O3 = 2.2-2.5 wt.%) and yield low oxide sums plus high cation totals indicative of the presence of minor ferric iron. Magnetic susceptibility (P. Rochette, *CEREGE*) log χ (× 10-9 m3/kg) = 3.22.

**Classification**: Martian (shergottite, diabasic). This specimen has many similarities to the [NWA 6963](https://www.lpi.usra.edu/meteor/metbull.php?code=54565) stones and evidently comes from an extension of the same strewnfield into Mauritania.

**Specimens**: 26.5 g including one polished thin section and one polished tick section at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11432** (NWA 11432)

(Northwest Africa)

Purchased: 2017 Apr

Classification: Ordinary chondrite (L6)

**History**: Purchased by Fabien *Kuntz* in April 2017 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Rounded chondrite clasts containing rare remnant chondrules occur within a dark, fragmental matrix.

**Geochemistry**: Olivine (Fa24.2-24.5, N = 3), orthopyroxene (Fs20.0-20.5Wo1.8-1.7, N = 2), clinopyroxene (Fs6.8-7.6Wo45.3-44.3, N = 2).

**Classification**: Ordinary chondrite (L6 breccia, shocked).

**Specimens**: 35.62 g including one polished thin section at *PSF*; remainder with Mr. F. *Kuntz*.

**Northwest Africa 11433** (NWA 11433)

(Northwest Africa)

Purchased: 2016 Sep

Classification: Ordinary chondrite (LL6)

**Petrography**: (K. Metzler, *IfP*) Ordinary chondrite with strongly recrystallized texture and only few chondrule relicts. Secondary feldspar grains >50 µm.

**Geochemistry**: Mineral compositions and geochemistry: Mean olivine composition Fa31.0±0.4; (n=13). Mean low-Ca pyroxene composition Fs24.9±0.3, Wo1.6±0.2(n=12)

**Classification**: LL chondrite based on mineral chemistry. Petrologic type 6 based on the equilibrated state of olivine and pyroxene and grain size of secondary plagioclase.

**Northwest Africa 11434** (NWA 11434)

(Northwest Africa)

Purchased: 2016 Feb

Classification: Ordinary chondrite (L5)

**Petrography**: (K. Metzler, *IfP*) Shock-darkened ordinary chondrite with moderately recrystallized texture, showing clearly visible chondrules of various petrologic types. Secondary feldspar grains <50 μm.

**Geochemistry**: Mineral compositions and geochemistry: Mean olivine composition Fa24.0±0.3; (n=13). Mean low-Ca pyroxene composition Fs19.8±0.3Wo2.6±0.8(n=11)

**Classification**: L chondrite based on mineral chemistry. Petrologic type 5 based on the equilibrated state of olivine and pyroxene, clear visibility of chondrules and grain size of secondary plagioclase.

**Northwest Africa 11435** (NWA 11435)

(Northwest Africa)

Purchased: 2017 May

Classification: Carbonaceous chondrite (CK5)

**Petrography**: (K. Metzler, *IfP*) Chondrules with apparent diameters up to 1.3 mm and CAIs are embedded in a fine-grained brownish matrix. Opaques are Cr-bearing magnetite and pentlandite. No metal was found .

**Geochemistry**: Mineral compositions and geochemistry: Olivine composition Fa31.7±0.2(31.5-32.2; n=15). Composition of low-Ca pyroxene Fs26.2±0.5(25.4-27.5); Wo0.8±0.3(0.5-1.6; n=15). Composition of Ca-rich pyroxene Fs9.9; Wo45.7(n=2).The compositional range of feldspar (n=2) is An38-40.One plagioclase grain in a CAI shows An86.Most abundant opaques are Magnetite and Pentlandite. No metal was found. Magnetite shows significant concentrations of elements other than Fe (n=4): MgO 0.4 wt%; Al2O3 1.9 wt%; Cr2O3 5.4 wt%.

**Classification**: CK chondrite based on mineral chemistry. Petrologic type 5 based on the equilibrated state of olivine and pyroxene and clear visibility of chondrules.

**Northwest Africa 11436** (NWA 11436)

(Northwest Africa)

Purchased: 2017 July

Classification: Rumuruti chondrite (R3-6)

**Petrography**: (K. Metzler, *IfP*) Chondritic breccia, consisting of light and dark chondritic clasts, embedded in a matrix of isolated chondrules and chondritic debris. Most dark clasts represent chondritic lithologies of type 3, but some shock-darkened chondritic clasts also occur. Light clasts are strongly metamorphosed and belong to the petrologic type 6.

**Geochemistry**: Mineral compositions and geochemistry: Clasts of petrologic type 3: mean olivine composition Fa25.5±15.3(0.4-50.0); n=20; mean low-Ca pyroxene composition Fs7.4±5.5(1.1-17.8), Wo1.1±0.9(0.1-3.4), n=15. Clasts of petrologic type 6: mean olivine composition Fa38.9±0.5(38.0-39.7); n=11; mean pyroxene composition Fs11.7±0.5(10.9-12.4), Wo44.4±0.7(43.4-45.6), n=9. Accessories are pentlandite and chromite; no metal was found.

**Classification**: R chondrite based on mineral chemistry. Genomict breccia, consisting of clasts of petrologic type 3 (unequilibrated olivine and pyroxene) and type 6 (equilibrated olivine and pyroxene; plagioclase grains >50 µm)

**Northwest Africa 11437** (NWA 11437)

(Northwest Africa)

Purchased: 2007 June

Classification: Ordinary chondrite (H4)

**History**: Purchased from a Moroccan dealer at the meteorite fair in Ensisheim, France

**Physical characteristics**: Single rounded stone of medium brown color without fusion crust. Partly covered by desert varnish.

**Geochemistry**: Mineral compositions and geochemistry: (K. Metzler, *IfP*) The mean olivine composition is Fa20.3±0.3(Fa19.8-20.9); n=15. The mean low-Ca pyroxene composition is Fs14.3±4.9Wo0.6±0.2(Fs4.0-17.6Wo0.2-0.9), n=13.

**Classification**: H chondrite based on olivine chemistry. Petrologic type 4 based on the equilibrated state of olivine and unequilibrated state of pyroxene.

**Northwest Africa 11438** (NWA 11438)

(Northwest Africa)

Purchased: 2007 June

Classification: Ordinary chondrite (L6)

**History**: Purchased from a Moroccan dealer at the meteorite fair in Ensisheim, France

**Physical characteristics**: Single stone of dark brown color with remnants of fusion crust.

**Geochemistry**: Mineral compositions and geochemistry: (K. Metzler, *IfP*) The mean olivine composition is Fa24.8±0.3 (24.4-25.1); n=13. The mean low-Ca pyroxene composition is Fs20.6±0.2 (20.1-20.9), Wo1.6±0.3 (1.2-2.2), n=13.

**Classification**: L chondrite based on mineral chemistry. Petrologic type 6 based on the equilibrated state of olivine and pyroxene and the large grain size of secondary plagioclase (>50 µm).

**Northwest Africa 11439** (NWA 11439)

(Northwest Africa)

Purchased: 2005 Dec

Classification: Ordinary chondrite (L4)

**History**: Purchased from a Moroccan dealer at the mineral fair (CCH) in Hamburg, Germany

**Geochemistry**: Mineral compositions and geochemistry: (K. Metzler, *IfP*) The mean olivine composition is Fa22.8±0.5(Fa22.2-24.3); n=16. The mean low-Ca pyroxene composition is Fs15.9±3.7Wo1.0±1.0(Fs9.1-21.6Wo0.1-3.7), n=17.

**Classification**: L chondrite based on olivine chemistry. Petrologic type 4 based on the equilibrated state of olivine and unequilibrated state of pyroxene.

**Northwest Africa 11440** (NWA 11440)

(Northwest Africa)

Purchased: 2007 June

Classification: Ordinary chondrite (L4)

**History**: Purchased from a Moroccan dealer at the meteorite fair in Ensisheim, France

**Physical characteristics**: Single rounded stone of brown color without fusion crust.

**Petrography**: Mean apparent chondrule size 0510±270 μm (N=208, to 2 mm). Some olivine grains with relict Mg-rich cores are present.

**Geochemistry**: Mineral compositions and geochemistry: (K. Metzler, *IfP*) The mean olivine composition is Fa21.4±0.5(Fa20.6-22.8); n=14. The mean low-Ca pyroxene composition is Fs13.3±5.8Wo0.5±0.2(Fs3.7-21.7Wo0.2-0.9), n=13

**Classification**: L4. Although olivine composition is intermediate between H and L, chondrule size favors L. Petrologic type 4 based on the equilibrated state of olivine and unequilibrated state of pyroxene.

**Northwest Africa 11441** (NWA 11441)

(Northwest Africa)

Purchased: 2007 June

Classification: Ordinary chondrite (L6, melt breccia)

**History**: Purchased from a Moroccan dealer at the meteorite fair in Ensisheim, France

**Physical characteristics**: Single rounded stone of brown color without fusion crust.

**Petrography**: (K. Metzler, *IfP*) Ordinary chondrite melt breccia, dominated by subrounded mm- to cm-sized chondritic clasts. The clasts are embedded in a matrix of black crystallized melt, containing tiny metal and sulfide beads. Clasts are strongly recrystallized with relict chondrule outlines. Secondary feldspar grains >50 µm.

**Geochemistry**: Mineral compositions and geochemistry: (K. Metzler, *IfP*) The mean olivine composition is Fa24.3±0.3(Fa23.9-24.7); n=14. The mean low-Ca pyroxene composition is Fs20.5±0.3Wo1.6±0.3(Fs20.0-21.1Wo1.1-2.0), n=15.

**Classification**: Melt breccia based on texture and the existence of melt matrix. L chondrite based on mineral chemistry of clasts. Petrologic type of clasts based on the equilibrated state of olivine and pyroxene and the large grain size of secondary plagioclase (>50 µm).

**Northwest Africa 11442** (NWA 11442)

(Northwest Africa)

Purchased: 2005 Dec

Classification: Ordinary chondrite (L5/6)

**History**: Purchased from a Moroccan dealer at the mineral fair (CCH) in Hamburg, Germany

**Geochemistry**: Mineral compositions and geochemistry: (K. Metzler, *IfP*) The mean olivine composition is Fa25.2±0.4(Fa24.5-25.8); n=10. The mean low-Ca pyroxene composition is Fs21.1±0.3Wo1.4±0.3(Fs20.5-21.7Wo1.0-1.9), n=12.

**Classification**: L chondrite based on mineral chemistry. Petrologic type 5/6 based on the equilibrated state of olivine and pyroxene, the clear visibility of chondrule outlines and the large grain size of secondary plagioclase (>50 µm).

**Northwest Africa 11443** (NWA 11443)

Morocco

Purchased: 2015 Oct

Classification: Ureilite

**History**: Purportedly found near Bouarfa, Morocco. Purchased from a Moroccan dealer in October 2015.

**Petrography**: (H. Downes, Birkbeck) SEM imaging shows a typical ureilite texture and fabric with inequigranular, abundant reversely zoned olivines and lesser amounts of low-Ca pyroxene. Some metal and significant amounts of carbon present on grain boundaries.

**Geochemistry**: Mineral compositions and geochemistry: (N. Rai, N. V. Almeida, *NHM*). All analyses by EPMA. Olivine cores Fa22.7±0.8(n= 20), 0.40 to 0.46 wt% MnO, 0.52 to 0.58 wt% Cr2O3, 0.27 to 0.31 wt% CaO, <0.01 wt% Ni. Pyroxene Fs17.5±2.9Wo11.9±1.6(n=8), 0.37 to 0.43 wt% MnO, 0.40 to 1.71 wt% Cr2O3.

**Classification**: Normal main group ureilite.

**Specimens**: 94.6 g on deposit at *NHM*. M. Bilet holds the main mass.

**Northwest Africa 11444** (NWA 11444)

Mauritania

Find: 2017

Classification: Lunar, melt breccia

**History**: Sample was collected at an unknown locality, with hearsay evidence suggesting that this was somewhere in Mauritania. The sample material was purchased by Graham Ensor from Ali El Wali. A large number of fragments collected in the same area. Some fragments were found on the surface, which have a dark, pitted surface colouration due to desert weathering. Other pieces were recovered from within the soil layer and are lighter in color with patches of reddish soil and relatively unpitted.

**Physical characteristics**: The sample comprises approximately 200 pieces, with a total mass of 1323 g. Some of these pieces have a dark appearance, possibly the result of wind abrasion. Fragments with a lighter-colored outer surface are also present and these often have variable amounts of adhering sand. It is presumed that these were at least partially buried at the time of recovery. In hand specimen, all the pieces display prominent angular to sub-rounded, feldspar-rich, clasts, up to 1.5 cm in diameter, enclosed in a dark matrix, laden with smaller, angular fragments.

**Petrography** (R. Greenwood, *OU*): The sample is a complex breccia, containing a wide variety of fragments and variable amounts of flow-banded glass. Fragments are generally angular and include coarse-grained to aphanitic gabbros and basalts and a wide range of single-crystal types. There are many examples of clasts consisting of brown, devitrified basaltic glass with acicular plagioclase microlites. Angular, crystal fragments can be up to 0.5 mm in diameter and consist predominantly of plagioclase, pyroxene (often displaying well-developed exsolution lamellae), and olivine. Both high and low Ca pyroxenes are present in the gabbroic clasts, with both often showing prominent exsolution lamellae. The specimen contains a few percent of anhedral Fe,Ni metal grains (kamacite), up to 150 μm in diameter. The glass is often highly vesicular, flow-banded and contains a diverse range of crystals and lithic fragments.

**Geochemistry**: Mineral compositions and geochemistry: Pyroxenes show wide compositional variation, with both high and low Ca varieties present. Average composition: Fs35.1±11.4Wo16.1±14.2(N=15, range Fs30Wo4to Fs18Wo42). Olivine, average composition: Fa37.1±16.9(N = 21, range Fa7-67). Well-developed exsolution lamallae are commonly present. Plagioclase shows limited compositional variation: An96.5±0.5(N=11). Fe, Ni Metal grains (up to 150 microns in diameter) are kamacite (7 to 8 wt.% Ni) (N = 6). All mineral compositions determined by EDS analysis. Oxygen isotopes: δ17O 3.28 per mil; δ18O 6.28 per mil; Δ17O 0.01 per mil (using standard formula: Δ17O = δ17O - 0.52 δ18O) (Analysis is consistent with the oxygen isotopic composition of other lunar meteorites).

**Classification**: Lunar, melt breccia. Moderate weathering

**Specimens**: Main mass with Graham Ensor

**Northwest Africa 11445** (NWA 11445)

(Northwest Africa)

Purchased: 2017

Classification: Ordinary chondrite (LL6)

**History**: A single stone weighing 29 g was found in Morocco prior to 2016. J. Donald Cline and John Sinclair acquired the sample from a meteorite dealer at the Tucson Gem and Mineral Show in February of 2017.

**Physical characteristics**: Sample has a rounded pyramidal shape with 3 faces that intersect at a 120º angle. Sample is coated in a dull, dark-brownish black, contraction cracked fusion crust that coats ~97% of the stone. Sample is weakly magnetic. The interior of the stone is visible in a small window where the crust fractured. The stone has a light-greenish-gray, recrystallized chondritic texture.

**Petrography**: Description and classification (A. Love, *App*) Sample is a breccia composed of up to 10 mm, angular-shaped, recrystallized, poikoblastic textured clasts in a comminuted matrix of similar materials. Sample contains a single recognizable barred olivine chondrule and troilite, FeNi metal, clinopyroxene, apatite and Na plagioclase (with average grain size >50 µm).

**Geochemistry**: (A. Love, *App*) Olivine Fa30.4±0.2, N=16; low Ca pyroxene Fs25.7±0.1Wo1.9±0.1, N=14; high Ca pyroxene Fs11.6Wo39.3, N=1; Na plagioclase Ab84.2±0.5Or4.9±0.5, N=6.

**Classification**: Based on textures and mineral compositions this is an LL ordinary chondrite breccia composed of type 6 clasts set within a host of similar material.

**Specimens**: *PARI* holds the main mass. One endcut weighing 5.9 g and a polished thin section are on deposit at *App*.

**Northwest Africa 11446** (NWA 11446)

(Northwest Africa)

Purchased: 2015 Jan 08

Classification: Iron meteorite (IIAB)

**History**: no writeup

**Petrography**: Iron is a hexahedrite. It contains three round FeS nodules in an area of ~150 cm2. Fragmental schreibersites 0.2 to 1 mm long are in rough arrays. There is discoloration indicating some reheating in the event that fragmented the schreibersites. In regions not discolored there are many tiny rhabdites 0.2 to 0.1 mm in length. Weathering is minor. but no reheated zone was recognized.

**Geochemistry**: Composition: Co, 4.50 mg/g; Ni, 56.1 mg/g; Ga, 58.0 μg/g; Ge, ~153 μg/g; As, 4.16 μg/g; W, 3.12 μg/g; Ir 11.4 μg/g; Au, 0.548 μg/g.

**Classification**: Meteorite is a IIAB iron, towards the upper end of the Ir range. Based on its composition, it is paired with [NWA 3202](https://www.lpi.usra.edu/meteor/metbull.php?code=33526).

**Northwest Africa 11447** (NWA 11447)

(Northwest Africa)

Purchased: 2017 Apr

Classification: HED achondrite (Howardite)

**History**: Purchased by Fabien *Kuntz* in April 2017 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of ~50 vol.% eucrite material, ~50 vol.% diogenite material and sparse, dark carbonaceous chondrite clasts (containing small fosterite-bearing chondrules) set in a finer grained matrix. Eucrite material consists mostly of crystalline debris of exsolved pigeonite, calcic plagioclase, silica polymorph, troilite, chromite, ilmenite and rare baddeleyite, with some subophitic lithic clasts. Diogenite material is mainly orthopyroxene (exhibiting undulose extinction and ferroan reaction rims) plus some polycrystalline clasts. Sparse grains of intermediate olivine and ferroan augite are also present.

**Geochemistry**: Diogenitic orthopyroxene (core Fs18.4Wo1.2; rim Fs53.9Wo5.0; FeO/MnO = 30-31), host orthopyroxene (Fs50.6Wo2.1, FeO/MnO = 33), clinopyroxene exsolution lamella (Fs24.7Wo38.8, FeO/MnO = 25), augite (Fs52.9Wo44.7, FeO/MnO = 31), olivine (Fa54.5-57.3, FeO/MnO = 45-53, N = 2), plagioclase (An86.8-89.7Or0.7-0.6, N = 2).

**Classification**: Howardite.

**Specimens**: 12.75 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11448** (NWA 11448)

(Northwest Africa)

Purchased: 2017 Apr

Classification: Ureilite

**History**: Purchased by Fabien *Kuntz* in April 2017 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Aggregate of elongate grains of olivine (~70 vol.%) and pigeonite (~30 vol.%) exhibiting some preferred shape orientation, plus interstitial finer grained, dark brown zones. Olivine has reduced magnesian rims associated with blebby Fe metal.

**Geochemistry**: Olivine (cores Fa22.4-22.6; rim Fa11.8; N = 3), pigeonite (Fs17.7-18.0Wo10.3-10.1, N = 2).

**Classification**: Ureilite.

**Specimens**: 12.86 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11449** (NWA 11449)

(Northwest Africa)

Purchased: 2017 Apr

Classification: HED achondrite (Eucrite, polymict)

**History**: Purchased by Fabien *Kuntz* in April 2017 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed predominantly of diabasic eucrite clasts and related debris plus ~2 vol.% diogenite clasts. Minerals are exsolved pigeonite (with several different bulk compositions), calcic plagioclase, orthopyroxene, silica polymorph, ilmenite, troilite and rare zircon.

**Geochemistry**: Orthopyroxene host (Fs56.2-56.4Wo3.3-1.7, FeO/MnO = 31-35, N = 2), clinopyroxene exsolution lamella (Fs23.5Wo43.5, FeO/MnO = 34), orthopyroxene host (Fs44.8Wo1.5, FeO/MnO = 39), clinopyroxene exsolution lamella (Fs14.4Wo44.5, FeO/MnO = 24), plagioclase (An74.8-81.6Or2.0-1.2, N = 2).

**Classification**: Eucrite (polymict breccia).

**Specimens**: 22.02 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11450** (NWA 11450)

(Northwest Africa)

Purchased: 2017 Apr

Classification: HED achondrite (Diogenite, polymict)

**History**: Purchased by Fabien *Kuntz* in April 2017 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed predominantly of angular diogenitic orthopyroxene grains, minor olivine and rare eucrite debris in a finer grained matrix. Other minerals are exsolved pigeonite, calcic plagioclase, silica polymorph, chromite, ilmenite and troilite.

**Geochemistry**: Diogenitic orthopyroxene (Fs18.9Wo1.3; Fs23.5Wo2.6, FeO/MnO = 27-29; N =2), clinopyroxene host (Fs28.8Wo42.2, FeO/MnO = 31), orthopyroxene exsolution lamella (Fs59.7Wo5.8, FeO/MnO = 32), olivine (Fa45.747.0, FeO/MnO = 49-55, N =2), subcalcic ferroaugite (Fs64.5Wo27.1, FeO/MnO = 39), plagioclase (An92.2Or0.3; An72.2Or2.3; N = 2).

**Classification**: Polymict diogenite breccia.

**Specimens**: 21.11 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11451** (NWA 11451)

(Northwest Africa)

Purchased: 2017 Apr

Classification: HED achondrite (Eucrite, polymict)

**History**: Purchased by Fabien *Kuntz* in April 2017 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia consisting of shocked and altered eucrite clasts (with differing textures) plus related debris in a finer grained matrix. Pyroxene (exsolved pigeonite) is pale orange in thin section and calcic plagioclase is polycrystalline; accessory minerals include fayalite, ilmenite, troilite, Ni-free metal and barite.

**Geochemistry**: Orthopyroxene host (Fs67.9Wo2.0, FeO/MnO = 29), clinopyroxene exsolution lamella (Fs31.1Wo42.9, FeO/MnO = 33), orthopyroxene host (Fs58.7Wo3.5, FeO/MnO = 33), clinopyroxene exsolution lamella (Fs26.5Wo43.2, FeO/MnO = 33), fayalite (Fa81.2-81.8, FeO/MnO = 43), plagioclase (An90,7-90.9Or0.5-0.2, N = 2).

**Classification**: Eucrite (polymict breccia, shocked).

**Specimens**: 22.37 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11452** (NWA 11452)

(Northwest Africa)

Purchased: 2017 Apr

Classification: Ordinary chondrite (LL4-6)

**History**: Purchased by Fabien *Kuntz* in April 2017 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Equilibrated breccia consisting predominantly of closely packed type 6 chondrite clasts containing rare chondrule remnants plus sparse well-formed chondrules set in a clastic matrix.

**Geochemistry**: Olivine (predominantly Fa30.3-31.3, N = 3; one Fa20.3core was found), orthopyroxene (Fs24.7Wo1.6; Fs14.6Wo0.5; N = 2), clinopyroxene (Fs10.1-10.4Wo43.7-44.3, N = 2).

**Classification**: Ordinary chondrite (LL4-6 breccia).

**Specimens**: 21.53 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11453** (NWA 11453)

(Northwest Africa)

Purchased: 2017 Apr

Classification: HED achondrite (Eucrite, polymict)

**History**: Purchased by Fabien *Kuntz* in April 2017 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed predominantly of gabbroic and diabasic eucrite clasts plus coarse related debris in a sparse finer grained matrix. Some diogenitic orthopyroxene (~2 vol.%) is also present. Other minerals are exsolved pigeonite, calcic plagioclase, unexsolved pigeonite, augite, silica polymorph, ilmenite, chromite, troilite, merrillite and stained Ni-free metal.

**Geochemistry**: Diogenitic orthopyroxene (Fs23.3-24.1Wo2.3-2.2, FeO/MnO = 28-32, N = 2), host orthopyroxene (Fs56.0-60.3Wo4.4-4.3, FeO/MnO = 24-30, N = 2), clinopyroxene exsolution lamella (Fs26.1Wo41.5, FeO/MnO = 29), augite (Fs9.8Wo44.3; Fs16.3Wo43.5; FeO/MnO = 23; N = 2), pigeonite (Fa36.5Wo21.3, FeO/MnO = 26), plagioclase (An77.5-79.0Or1.5, N = 2).

**Classification**: Eucrite (polymict breccia).

**Specimens**:15.31 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11454** (NWA 11454)

(Northwest Africa)

Purchased: 2017 Apr

Classification: HED achondrite (Diogenite, polymict)

**History**: Purchased by Fabien *Kuntz* in April 2017 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia consisiting mostly of angular grains of diogenitic orthopyroxene (exhibiting undulose extinction) plus sparse harzburgitic diogenite clasts and rare subophitic eucrite clasts set in a sparse finer grained matrix. Other minerals are exsolved pigeonite, calcic plagioclase, silica polymorph (some rimmed by orthopyroxene+olivine), chromite, ilmenite, merrillite and troilite.

**Geochemistry**: Diogenitic orthopyroxene (Fs26.3Wo5.2; Fs31.9Wo3.70; FeO/MnO = 28-30; N = 2), host orthopyroxene (Fs52.5-53.1Wo3.1-3.2, FeO/MnO = 28-29, N = 2), clinopyroxene exsolution lamellae (Fs21.7-26.3Wo43.7-42.0, FeO/MnO = 26-28, N = 2), orthopyroxene rim on silica grain (Fs32.5Wo1.1, FeO/MnO = 34), olivine rim on silica grain (Fa44.5, FeO/MnO = 55), olivine (Fa51.8-52.5, FeO/MnO = 49, N = 2), plagioclase (An90.1-93.7Or0.6-0.4, N = 2).

**Classification**: Polymict diogenite breccia.

**Specimens**: 21.11 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11455** (NWA 11455)

(Northwest Africa)

Purchased: 2017 Apr

Classification: HED achondrite (Eucrite, unbrecciated)

**History**: Purchased by Fabien *Kuntz* in April 2017 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Microgabbroic texture. Major minerals are exsolved pigeonite and calcic plagioclase (as equant grains, mean grainsize ~0.7 mm); accessory minerals include silica polymorph, ilmenite, chromite, troilite and Ni-poor metal.

**Geochemistry**: Host orthopyroxene (Fs59.1Wo2.6, FeO/MnO = 29), clinopyroxene exsolution lamella (Fs27.5Wo41.3, FeO/MnO = 28), host clinopyroxene (Fs27.6Wo42.5, FeO/MnO = 28), orthopyroxene exsolution lamella (Fs60.7Wo2.3, FeO/MnO = 30), plagioclase (An89.7-89.8Or0.5-0.6, N = 2).

**Classification**: Unbrecciated eucrite (microgabbroic).

**Specimens**: 20.55 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11456** (NWA 11456)

(Northwest Africa)

Purchased: 2016 Sep

Classification: Carbonaceous chondrite (CV3)

**History**: Purchased by Gary Fujihara in September 2016 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Well-formed, spherical to irregularly shaped chondrules (mostly granular, some PO, some rimmed, apparent diameter 650±400 μm) plus irregularly shaped, elongate, very fine grained CAI occur in a black, opaque matrix (~40 vol.%).

**Geochemistry**: Olivine (Fa1.8-71.3, N = 3), orthopyroxene (Fs0.9-1.0Wo1.0-5.0, N = 2), diopside (Fs0.6Wo45.4), augite (Fs45.4Wo47.5). Oxygen isotopes (K. Ziegler, *UNM*): analyses of acid-washed subsamples by laser fluorination gave, respectively, δ17O -4.233, -4.013, -11.359; δ18O 0.299, 0.441, -7.338; Δ17O -4.391, - 4.246, -7.485 per mil.

**Classification**: Carbonaceous chondrite (CV3).

**Specimens**: 7.3 g including one polished thin section at *UWB*; remainder with Mr. G. Fujihara.

**Northwest Africa 11457** (NWA 11457)

Algeria

Purchased: May 2016

Classification: Lunar meteorite (feldspathic breccia)

**History**: Seven pieces with a total mass of 273 g were purchased form a Moroccan dealer in Ouarzazate, Morocco May 2016. The sample may have been found in Algeria and brought by nomads to a dealer in Zwirate in the north of Mauritania.

**Physical characteristics**: Physical Characteristics: The susceptibility values (J. Gattacceca, *CEREGE*) for the four largest samples are as follows: log χ (× 10-9 m3/kg) = 3.31 (117.7g sample); log χ (× 10-9 m3/kg) = 3.56 (88.64 g sample); log χ (× 10-9 m3/kg) = 3.25 (39.91 g sample); log χ (× 10-9 m3/kg) = 3.25 (15.34 g sample).

**Petrography**: (A.-K. Kraemer and A. Bischoff, *IfP*) Breccia composed of angular anorthite-rich lithic and mineral fragments embedded in a fine-grained clastic matrix. Observed minerals include anorthite, olivine, low-Ca pyroxene, Ca-rich pyroxene, silica polymorph, Al-Ti-chromite, kamacite, ilmenite, troilite, pendlandite and schreibersite. Calcite veins indicate moderate degree of weathering.

**Geochemistry**: Mineral compositions and geochemistry: Olivine (mean: Fa48.2, Fe/Mn = 101; N = 199), low-Ca pyroxene (mean Fs35.4Wo12.4, Fe/Mn = 62, 22,9 N = 199), Ca-rich pyroxene (mean: Fs30.7Wo35.2; Fe/Mn = 69; N = 73), anorthite (mean An92.7Or0.3, N = 201).

**Classification**: Lunar (feldspathic breccia)

**Specimens**: 22.9 g and thin sections. Main Mass with Ben Hoefnagels.

**Northwest Africa 11458** (NWA 11458)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Eucrite, brecciated)

**Physical characteristics**: Fully crusted stone. Cut surface reveals a light-gray interior with darker clasts (to 5 mm).

**Petrography**: (J. Gattacceca, *CEREGE*): Strongly brecciated igneous rock. The original texture is almost entirely obliterated by brecciation. Main minerals are orthopyroxenes, some with augite exsolution and plagioclase. Chromite, ilmenite, silica polymorph, troilite, rare metal.

**Geochemistry**: Pyroxenes: orthopyroxene Fs58.2±0.3Wo2.1±0.6(N=7), augite exsolution Fs40.1Wo22.9(N=1), FeO/MnO=37.3. Plagioclase An87.6±3.0Ab12.0±3.0Or0.3±0.1(N=3). Magnetic susceptibility log χ (× 10-9 m3/kg) = 2.70.

**Classification**: Eucrite-br.

**Specimens**: 26 g and a polished section at *CEREGE*. Main mass with R. Lenssen.

**Northwest Africa 11460** (NWA 11460)

(Northwest Africa)

Purchased: 2017

Classification: Lunar meteorite

**History**: The meteorite was bought from a Moroccan meteorite dealer at the meteorite fair in Ensisheim, France.

**Physical characteristics**: Several small, grayish individuals without fusion crust but adhering reddish Sahara sand.

**Petrography**: The meteorite is a polymict breccia composed of lithic and mineral clasts consolidated in a mostly molten and recrystallized matrix. The up to 1 cm sized lithic clasts are dominantly basaltic and gabbroic, mineral clasts include up to 200 μm sized olivine, exsolved pyroxene, and feldspar grains. Accessories are Ti-chromite, ilmenite, FeNi metal, fayalite, and barite.

**Geochemistry**: olivine: Fa31.6±9.7(Fa17.9-55.7, n=26, FeO/MnO=66-112); low-Ca pyroxene: Fs29.2±11.7Wo4.0±1.1(Fs14.1-50.8Wo2.8-6.5, n=14, FeO/MnO=47-65); Ca-pyroxene: Fs25.1±9.6Wo34.1±7.4(Fs12.7-44.4Wo23.1-42.6, n=17, FeO/MnO=34-67); calcic plagioclase: An96.7±0.8(An94.6-97.8, n=15)

**Classification**: Lunar (feldspathic breccia)

**Northwest Africa 11461** (NWA 11461)

(Northwest Africa)

Purchased: 2017

Classification: Carbonaceous chondrite (CM2)

**History**: The meteorite was bought from a Moroccan meteorite dealer at the meteorite fair in Ensisheim, France.

**Physical characteristics**: Small dark-grayish individual lacking any fusion crust.

**Petrography**: The meteorite displays a black interior and is composed of chondrules (average apparent size 250 μm), chondrule pseudomorphs and rare CAIs most of which are surrounded by dust rims set into an abundant fine-grained matrix. Phyllosilicates (as indicated by low analytical totals), carbonates, and (altered) pyrrhotite dominate the matrix.

**Northwest Africa 11462** (NWA 11462)

(Northwest Africa)

Purchased: 2017

Classification: Carbonaceous chondrite (CM2)

**History**: The meteorite was bought from a Moroccan meteorite dealer at the meteorite fair in Ensisheim, France.

**Physical characteristics**: Dark grayish to black individual with desert varnished surface.

**Petrography**: Carbonaceous chondrite composed of chondrules (average apparent size 220 μm), CAIs, mineral fragments and their respective pseudomorphs mostly surrounded by fine-grained dust rims and all set into abundant fine Fe-rich matrix. Carbonates, sulfides and pyhllosilicates (as indicated by low analytical totals) are most abundant matrix phases.

**Northwest Africa 11464** (NWA 11464)

(Northwest Africa)

Purchased: 2017

Classification: Rumuruti chondrite (R3)

**History**: The meteorite was bought from a Moroccan meteorite dealer on the meteorite fair in Ensisheim, France.

**Physical characteristics**: Dark brownish idividual without fusion crust.

**Petrography**: The meteorite displays a light brownish to orange interior and is composed of type 3 clasts and matrix. Fe-rich olivine is the dominant mineral phase in the matrix. Chondrules average apparent size is about 400 µm. Minor phases include pentlandite, sodic plagioclase, and Ti-bearing chromite; no metal has been detected.

**Northwest Africa 11465** (NWA 11465)

(Northwest Africa)

Purchased: 2017

Classification: Carbonaceous chondrite (CM2)

**History**: The meteorite was bought from a Moroccan meteorite dealer on the meteorite fair in Ensisheim, France.

**Physical characteristics**: Black individual partly covered with fusion crust.

**Petrography**: The meteorite is a brecciated CM chondrite consisting of small chondrules (average apparent size 230 μm), mineral fragments, rare CAIs, and their respective pseudomorphs set into a fine-grained matrix. CAIs are mostly spinel-pyroxene-rich types; chondrules and CAIs are often surrounded by dust rims. Matrix minerals are phyllosilicates (as indicated by low analytical totals), carbonates, pyrrhotite, and rare FeNi metal.

**Northwest Africa 11467** (NWA 11467)

(Northwest Africa)

Purchased: 2017

Classification: Carbonaceous chondrite (CV3)

**History**: The meteorite was bought from a Moroccan meteorite dealer at the meteorite fair in Ensisheim, France.

**Physical characteristics**: Almost black individual with desert varnished surface and adhering desert sand.

**Petrography**: The meteorite displays a black interior and is composed of up to 2 mm sized chondrules (average apparent size about 1 mm), whitish CAIs, and olivine amoeboids set into a fine-grained almost opaque matrix. Chondrules rarely show brownish staining due to terrestrial weathering; type II chondrules are absent.

**Northwest Africa 11468** (NWA 11468)

(Northwest Africa)

Purchased: 2017

Classification: Carbonaceous chondrite (CM2)

**History**: The meteorite was bought from a Moroccan meteorite dealer at the meteorite fair in Ensisheim, France.

**Physical characteristics**: Dark greyish individual with desert varnished surface.

**Petrography**: The meteorite is composed of chondrules (average apparent size 240 μm), chondrule pseudomorphs and rare CAIs set into an abundant fine-grained Fe-rich matrix of mainly phyllosilicates (as indicated by fibrous appearance), carbonates, and pyrrhotite. Most components are surrounded by fine-grained accretionary rims. Several chondrules show brownish stainig due to terrestrial alteration.

**Northwest Africa 11469** (NWA 11469)

Algeria

Purchased: 2016 Aug

Classification: Carbonaceous chondrite (CO3)

**History**: Purchased from Abdeltif Mechaguen in August of 2016 in Mauritania. Reportedly found in Algeria in 2016.

**Physical characteristics**: Many identical appearing fragments in the range 4-52 g. Weathered exterior; saw cuts reveal numerous small chondrules set in a brown groundmass.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows may porphyritic chondrules, most in the size range 50-300 μm. Fine grained matrix makes up ~40% of this meteorite.

**Geochemistry**: (C. Agee and A. Santos, *UNM*) Olivine Fa24.1±16.7, Mn/Fe=97±32, Cr2O3=0.10±0.15 wt%, n=40; low Ca pyroxene Fs9.3±13.5Wo1.3±1.2, n=11; high Ca pyroxene Fs1.3±0.5Wo46.5±0.6, n=3.

**Classification**: Carbonaceous chondrite (CO3), subtype >3.2 based on the Cr2O3 in olivine, [Grossman and Brearley (2005)](http://articles.adsabs.harvard.edu/full/2005M%26PS...40...87G).

**Specimens**: 20 g on deposit at *CSFK*, Zsolt Kereszty holds the main mass.

**Northwest Africa 11470** (NWA 11470)

Western Sahara

Purchased: August 2017

Classification: Ordinary chondrite (L3)

**History**: Purchased from Aadel Bouzada in August of 2017 in Morocco. Reportedly found in Western Sahara in December 2016. Nomads found the specimen while they were searching between Anzarane and Dakhla for the NWA 7034 strewn field.

**Physical characteristics**: Single stone, weathered exterior with many chondrules exposed. Saw cut reveals numerous densely packed chondrules in a dark-gray groundmass. Scattered, irregular, light colored clasts were also observed.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows may porphyritic chondrules, average apparent chondrule diameter 610±340 μm (n=20). Opaque, fine grained matrix present.

**Geochemistry**: (C. Agee and A. Santos, *UNM*) Olivine Fa15.9±7.8, Mn/Fe=60±25, Cr2O3=0.08±0.06 wt%, n=19; low Ca pyroxene Fs9.2±8.0Wo0.8±1.0, n=8.

**Classification**: Ordinary chondrite (L3), estimated subtype ~3.3.

**Specimens**: 20 g on deposit at *CSFK*, Zsolt Kereszty holds the main mass.

**Northwest Africa 11471** (NWA 11471)

Mali

Purchased: February 2017

Classification: Ordinary chondrite (LL3)

**History**: Purchased from Aziz Habibi in February of 2017 in Morocco. Reportedly found in Mali in early 2017.

**Physical characteristics**: Six identical appearing pieces. Weathered exterior with many chondrules exposed. Saw cut reveals numerous densely packed chondrules in a dark brown groundmass.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows may porphyritic chondrules, average apparent chondrule diameter 790±450 μm (n=15). Opaque, fine grained matrix present.

**Geochemistry**: (C. Agee and A. Santos, *UNM*) Olivine Fa12.9±7.7, Mn/Fe=45±18, Cr2O3=0.16±0.09 wt%, n=21; low Ca pyroxene Fs10.8±12.4Wo1.4±1.6, n=6.

**Classification**: Ordinary chondrite (LL3), subtype>3.2 based on Cr2O3 in ferroan olivine, [Grossman and Brearley (2005)](http://articles.adsabs.harvard.edu/full/2005M%26PS...40...87G).

**Specimens**: 30.5 g on deposit at *CSFK*, Zsolt Kereszty holds the main mass.

**Northwest Africa 11472** (NWA 11472)

(Northwest Africa)

Find: 2017

Classification: Lunar meteorite (feldspathic breccia)

**History**: A single stone was found in March 2017 by a nomad in an undisclosed region of the Sahara. The stone was later purchased by Luc *Labenne*.

**Physical characteristics**: A single grayish stone. Cut surface reveals a gray interior with mm sized light gray and white clasts.

**Petrography**: (J. Gattacceca, H. Pourkhorsandi, *CEREGE*): Brecciated igneous rock.Clasts of anorthite (to 5 mm), olivine, pyroxene set in a feldspathic matrix. Opaque minerals: ilmenite, chromite, troilite, metal (to 40 μm).

**Geochemistry**: Olivine Fa39.7±13.2, range Fa19.6-55.1, FeO/MnO=101.0±19.1 (N=8). Pyroxene Fs33.1±9.3Wo12.7±10.5, FeO/MnO=65.9±10.7 (N=8). Plagioclase An96.1±1.0Ab3.8±0.9Or0.1±0.1(N=6). Chromite Cr/(Cr+Al)=0.56, TiO2=11.4wt%, Al2O3=15.4wt%, Cr2O3=28.4wt% (N=2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 2.82.

**Classification**: Lunar, feldspathic breccia.

**Specimens**: 22 g at *CEREGE*. Main mass with Luc *Labenne*.

**Northwest Africa 11473** (NWA 11473)

(Northwest Africa)

Purchased: March 2017

Classification: Ordinary chondrite (LL(L)3)

**History**: Purchased from a Moroccan meteorite dealer in Quarzazate, Morocco.

**Physical characteristics**: Single stone, weathered exterior with many chondrules exposed. Saw cut reveals numerous densely packed chondrules in a brown-orange groundmass.

**Petrography**: (C. Agee, *UNM*) Microprobe examination of a polished mount shows may porphyritic chondrules, average apparent chondrule diameter 670±430 μm (n=18). Opaque, fine grained matrix present.

**Geochemistry**: (C. Agee and A. Santos, *UNM*) Olivine Fa14.5±8.0, Mn/Fe=53±36, Cr2O3=0.12±0.11 wt%, n=17; low Ca pyroxene Fs14.3±7.7Wo3.3±3.1, n=8.

**Classification**: Ordinary chondrite (LL(L)3), estimated subtype ~3.3.

**Specimens**: 24.2 g on deposit at *UNM*, Morten Bilet holds the main mass.

**Northwest Africa 11474** (NWA 11474)

(Northwest Africa)

Purchased: 2017

Classification: Lunar meteorite (feldspathic breccia)

**History**: Purchased by Dustin Dickens and Mendy Ouzillou from a Mauritanian meteorite dealer May 10, 2017.

**Physical characteristics**: Many identical appearing pieces, no fusion crust. A saw cut reveals a fragmental breccia with numerous white feldspathic clasts set in a dark-gray ground mass.

**Petrography**: (C. Agee, *UNM*) This meteorite consists of primarily feldspathic clasts and shock melt with lesser amounts of fragmental pyroxene and olivine.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) olivine Fa19.3±0.6, Fe/Mn=86±1, n=2; pigeonite Fs24.8±0.5Wo4.3±0.3, Fe/Mn=60±9, n=2; high Ca pyroxene Fs27.4Wo34.4, Fe/Mn=58, n=1; plagioclase An97.8±0.7Ab2.0±0.6Or0.2±0.1, n=6; Shock melt (20 μm defocused electron beam, proxy for bulk meteorite composition): SiO2=44.4±0.8, TiO2=0.21±0.01, Al2O3=27.5±1.1, Cr2O3=0.07±0.02, MgO=5.7±1.4, FeO=4.2±1.3, MnO=0.07±0.02, CaO=16.2±0.5, Na2O=0.42±0.04, K2O=0.01±0.02 (all wt%), Fe/Mn=63±1, Mg#=70.1±1.1, n=3.

**Classification**: Lunar feldspathic breccia

**Specimens**: 20 g including a probe mount on deposit at *UNM*, Dustin Dickens and Mendy Ouzillou hold the main mass.

**Northwest Africa 11476** (NWA 11476)

(Northwest Africa)

Purchased: 2017

Classification: Rumuruti chondrite (R3-4)

**History**: The meteorite was bought from a local meteorite dealer in Morocco.

**Physical characteristics**: Three individuals partly covered by fusion crust and three sand blasted fragments lacking any fusion crust.

**Petrography**: The meteorite displays a dark-grayish interior and is composed of up to 4-cm sized mostly angular type 3 clasts and matrix; some clasts are dark brownish. The matrix is dominated by Fe-rich olivine and less abundant partly unequilibrated low-Ca pyroxene, augite and sodic feldspar. Olivine and low-Ca pyroxene in the clasts are highly unequilibrated. Chondrules are 100 to 900 µm with an average of about 400 µm. One spinel-rich chondrule has been found. Minor phases include pentlandite, sodic plagioclase, and Ca-pyroxene; no metal has been detected. The meteorite contains shock melt veins.

**Geochemistry**: olivine in matrix: Fa40.9±0.4, n=10; low-Ca pyroxene in matrix: Fs22.3±8.3Wo0.8±0.5(Fs8.5-33.2Wo0.3-1.6, n=11); olivine in type 3 clasts: Fa29.5±12.3(Fa1.1-45.1, n=26); low-Ca pyroxene in type 3 clasts: Fs16.6±10.2Wo2.0±1.1(Fs4.5-34.2Wo0.5-4.4, n=22)

**Northwest Africa 11479** (NWA 11479)

Morocco

Purchased: September 2017

Classification: Lunar meteorite (feldspathic breccia)

**History**: Purchased by Ke Zuokai in Sept. 2017 from a Moroccan dealer.

**Physical characteristics**: The meteorite has no fusion crust with an irregular shape. Small white clasts are visible.

**Petrography**: Lithic clasts and mineral fragments (10 to 500 μm) are set in a fine-grained anorthositic matrix. Mineral fragments are dominated by anorthite and pyroxene grains with minor olivine. Some pyroxene grains exhibit exsolved lamella structures. Maskelynite is present. Other accessory minerals include taenite, chromite, ilmenite and troilite.

**Geochemistry**: Plagioclase An94.1-97.9Or0.0-0.7, (average: An96.9±1.1Or0.2±0.2, n=13); Olivine Fa17.8-44.9, Fe/Mn (cation ratio) = 77.7 - 124.7, (average = 99.2±15.3, n=13 ); pigeonite Fs29.8-59.4En35.0-52.5Wo5.6-21.5, Fe/Mn (cation ratio) =57.4-74.4 (average=64.7±5.7, n=8); augite Fs7.4-27.6En29.1-49.1Wo38.4-43.5, Fe/Mn (cation ratio) =37.3-75.1 (average=58.4±12.1, n=10); minor orthopyroxene Fs36.3En61.0Wo2.7, Fe/Mn (cation ratio)=54.7, n=1

**Classification**: Lunar feldspathic breccia based on texture and composition.

**Northwest Africa 11480** (NWA 11480)

(Northwest Africa)

Purchased: 2016

Classification: Ordinary chondrite (H6)

**History**: Purchased in Erfoud in April 2016.

**Physical characteristics**: One perfectly oriented stone with an ablation lip along the entire perimeter with fusion crust ~2 mm thick. A saw cut reveals a surface with many fine grains of metal or sulfide and scattered faint chondrules.

**Petrography**: Microprobe examination of a polished mount shows small, equilibrated chondrules, and abundant kamacite and troilite.

**Geochemistry**: (C. Agee and M. Spilde, *UNM*) Olivine Fa18.1±0.2, Fe/Mn=37±1, n=12; low-Ca pyroxene Fs16.0±0.5Wo1.7±1.4, Fe/Mn=22±1, n=6.

**Classification**: Ordinary chondrite (H6, S3, W1).

**Specimens**: 24 g including a probe mounts on deposit at *UNM*, *DPitt* holds the main mass.

**Northwest Africa 11481** (NWA 11481)

Mauritania

Purchased: 2016

Classification: HED achondrite (Diogenite)

**History**: Purchased in September, 2016 in Mauritania. Recovered in Spring 2016 from the Dayet el Aam area in Mauritania, in the border region with Algeria south of Tindouf.

**Physical characteristics**: One stone with patches of glossy-black fusion covering 85% of the exterior. Saw cut reveals a fragmental breccia with light-green clasts set in a light gray groundmass.

**Petrography**: Microprobe examination of a polished mount shows numerous pyroxene fragments. Ubiquitous troilite and chromite were observed. Plagioclase, silica, olivine and metal not detected.

**Geochemistry**: (C. Agee, *UNM*) low-Ca pyroxene Fs24.3±9.5Wo3.5±1.4, Fe/Mn=28±2, n=11; high-Ca pyroxene Fs48.7±3.7Wo20.5±11.1, Fe/Mn=30±2, n=3.

**Classification**: Diogenite

**Specimens**: 32.8 g including a probe mounts on deposit at *UNM*, *DPitt* holds the main mass.

**Northwest Africa 11482** (NWA 11482)

(Northwest Africa)

Purchased: 2017

Classification: Ordinary chondrite (H5)

**History**: Purchased February 2017, in Guelmim, Morocco.

**Physical characteristics**: Weathered exterior, chondrules are visible and set in reddish-brown groundmass.

**Petrography**: (C. Agee, *UNM*) Equilibrated chondrules observed, very little Fe-Ni metal is present, most has weathered to iron oxide.

**Geochemistry**: (C. Agee) olivine Fa18.3±0.3, Fe/Mn=37±1, n=6; low-Ca pyroxene Fs15.9±0.2Wo1.4±0.2, Fe/Mn=21±0, n=3.

**Classification**: Ordinary chondrite H5

**Specimens**: 44 g including a probe mount on deposit at *UNM*, Zouhair Fettouh holds the main mass.

**Northwest Africa 11483** (NWA 11483)

(Northwest Africa)

Purchased: May 2016

Classification: Ureilite

**History**: Purchased at the Verona Mineral Fair from a meteorite dealer by Lucian Cojocaru

**Petrography**: (V. Moggi Cecchi, G.Pratesi, S.Caporali, *UniFi*) The thin section analyzed displays a protogranular aggregate of olivine and pigeonite, with olivine grains displaying reduced magnesian rims and blebs of Fe-Ni alloys metal. Carbonaceous material is visible at grain boundaries.

**Geochemistry**: (V. Moggi Cecchi, G. Pratesi, S. Caporali, *UniFi*) Olivine cores Fa21.5±0.2, Cr2O3=0.71±0.02 wt%, CaO=0.34±0.02 wt% (N=10), olivine rims Fa10.8±0.1(N=7), pigeonite Fs12.9±0.3En81.2±1.1Wo5.8±0.2(N=11); Oxygen isotopes: (I.Franchi, R.Greenwood, *OU*) δ17O = 3.58 permil, δ18O = 8.45 permil, δ17O = -0.81 permil.

**Classification**: Ureilite

**Specimens**: A total of 4.2 g specimen and one thin section is on deposit at *MSN-FI*. Cojocaru owns the main mass.

**Northwest Africa 11484** (NWA 11484)

Morocco

Purchased: Nov 2015

Classification: Ordinary chondrite (LL3)

**History**: Purchased at the Verona Mineral Fair by Lucian Cojocaru from a Moroccan dealer.

**Physical characteristics**: Single stone weighing 21.1 g without fusion crust.

**Petrography**: (V. Moggi Cecchi, G. Pratesi, S. Caporal, *UniFi*) The thin section consists of separated, well-formed chondrules up to 2 mm in diameter, sometimes rimmed with altered metal. Chondrules types are various: PO, GO, poikilitic-PP-poikilitic, POP, B, C; Olivine in PO chondrules is Fa-rich and equilibrated; olivine in GO chondrules is Fa-poor and unequilibrated; the matrix is fine and contains olivine, orthopyroxene and clinopyroxene. Scattered troilite grains, no unaltered metal grains are visible.

**Geochemistry**: All olivine (Fa25.9±8.2, N = 17), Cr2O3=0.14±0.09 (wt%), Fa-rich olivine in PO chondrules (Fa35.5±8.2, N = 11); Fa-poor olivine in GO chondrules (Fa11.3±6.1, N = 6); low-Ca pyroxene (Fs18.9±5.3Wo1.3±0.2, N = 11); clinopyroxene (Fs15.4±0.3Wo31.5±0.8, N = 4);

**Classification**: LL3

**Specimens**: 5.3 g including one polished thin section at MSN-Fi; main mass with Cojocaru.

**Northwest Africa 11486** (NWA 11486)

Western Sahara

Purchased: June 2016

Classification: HED achondrite (Eucrite)

**History**: A single stone of 7.2 g was found by an anonymous finder in Western Sahara and purchased 2016 in Erfoud by Lucian Cojocaru

**Physical characteristics**: The main mass is partly covered by fusion crust.

**Petrography**: (V. Moggi Cecchi, G. Pratesi, S. Caporal, *UniFi*) The thin section shows a brecciated texture composed of lithic eucrite clasts in a finer grained matrix. Clasts consists of exsolved orthopyroxene crystals with fine pigeonite exsolution lamellae, 5-7 μm in width, augite, calcic plagioclase, ilmenite, chromite, troilite and FeNi metal.

**Geochemistry**: Eucritic clasts: orthopyroxene host (Fs54.9±1.1Wo2.6±0.3, FeO/MnO = 26.3±0.2, n=4); augite (Fs30.1±1.2Wo44.2±1.5.; n=7; Fe/Mn=22.9±0.2); pigeonite exsolution lamellae in orthopyroxene (Fs62.6±1.3Wo7.6±0.4; n=7; Fe/Mn = 24.7±0.2); Plagioclase An86.3±1.4Or0.7±0.1, n=7; Oxygen isotopes: (I.Franchi, R.Greenwood, *OU*) δ17O = 1.83 permil, δ18O = 3.93 permil, δ17O = -0.22 permil.

**Classification**: Monomict eucrite. Medium degree of shock and medium degree of weathering.

**Specimens**: A total of 2.2 g specimen and one thin section are on deposit at *MSN-FI*. Cojocaru owns the main mass.

**Northwest Africa 11488** (NWA 11488)

Morocco

Purchased: 2017

Classification: HED achondrite (Diogenite)

**History**: A single stone weighing 22 g was found in Morocco prior to 2016. J. Donald Cline and John Sinclair acquired the sample from a meteorite dealer at the Tucson Gem and Mineral Show in February of 2017.

**Physical characteristics**: Sample is weakly tabular in shape, dark brownish-green has a patchy brown fusion crust which covers ~ 10% of the specimen. Sample is weakly magnetic and the broken and uncrusted sides show crystalline texture.

**Petrography**: Description and classification (A. Love, *App*): Sample is an unbrecciated, crystalline rock composed of cumulate-textured, coarse-grained (average grainsize: 2570 µm), interlocking, light green orthopyroxene crystals (many of which have a preferred orientation). Additional minerals are: chromite, troilite, Fe-metal and Si-polymorph.

**Geochemistry**: (A. Love, *App*) Opx Fs26.4±0.4Wo2.3±0.5(FeO/MnO=25.1-31.9, N=18).

**Classification**: HED (diogenite). Mineral textures and compositions suggest this is an unbrecciated orthopyroxenitic diogenite.

**Specimens**: *PARI* holds the main mass. An endcut and several small fragments weighing 4.93 g and a polished thin section are on deposit at *App*.

**Northwest Africa 11489** (NWA 11489)

Morocco

Purchased: 2017

Classification: HED achondrite (Eucrite)

**History**: A single stone weighing 19.7 g was found in Morocco prior to 2016. J. Donald Cline and John Sinclair acquired the sample from a meteorite dealer at the Tucson Gem and Mineral Show in February of 2017.

**Physical characteristics**: The stone has a flattened tabular shape, is light orange in color and ~60% of the sample is covered in a patchy, dark black, flow-lined fusion crust. A broken face shows a light-gray, crystalline interior.

**Petrography**: Description and classification (A. Love, *App*): Crystalline rock composed of granoblastic-textured plagioclase and exsolved pyroxene (with an average grain size of 590 µm). Portions of the sample are crosscut by zones of granular debris composed of host rock. Additional minerals are chromite and Si-polymorph.

**Geochemistry**: (A. Love, *App*) Low-Ca pyroxene host Fs45.0±0.7Wo3.2±1.0(Fs44.1-46.2Wo1.6-4.8, FeO/MnO=28.1-28.9, N=12); high-Ca pyroxene exsolution lamellae Fs16.0±0.3Wo47.0±0.2(Fs15.4-16.4Wo46.5-47.4, N=10); plagioclase An97.0±0.3(An96.5-97.4, N=10).

**Classification**: HED (equilibrated monomict cumulate eucrite breccia). Textures and compositions show this specimen has experienced thermal equilibration. Mineral compositions suggest this is a cumulate eucrite.

**Specimens**: *PARI* holds the main mass. Two slices weighing 4.82 g and a polished thin section are on deposit at *App*.

**Northwest Africa 11490** (NWA 11490)

(Northwest Africa)

Purchased: 2017 Apr

Classification: HED achondrite (Howardite)

**History**: Purchased by Fabien *Kuntz* in April 2017 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of ~60 vol.% diogenitic orthopyroxene (as angular grains exhibiting undulose extinction), ~35 vol.% eucritic material and ~5 vol.% dark carbonaceous chondrite clasts. Most eucritic material consists of disaggregated grains of exsolved pigeonite, unexsolved pigeonite, subcalcic augite and calcic plagioclase, but some lithic clasts with subophitic and microgabbroic textures are also present. Accessory minerals include silica polymorph, chromite, ilmenite, fayalite, baddeleyite, troilite, pentlandite and Ni-poor metal.

**Geochemistry**: Diogenitic orthopyroxene (Fs27.6-29.7Wo3.6-3.8, FeO/MnO = 32, N = 2), orthopyroxene host (Fs64.0Wo1.9, FeO/MnO = 31), orthopyroxene host (Fs42.3Wo1.9, FeO/MnO = 35), clinopyroxene exsolution lamella (Fs15.4Wo45.4, FeO/MnO = 30), pigeonite (Fs45.9Wo9.1; Fs52.5Wo11.7; Fs55.9Wo23.3; FeO/MnO = 30-35; N = 3), subcalcic augite (Fs34.4Wo32.2, FeO/MnO = 28), fayalite (Fa85.4, FeO/MnO = 40), plagioclase (An91.1-92.8Or0.4-0.3, N = 2), forsterite in carbonaceous chondrite clast (Fa0.9), enstatite in carbonaceous chondrite clast (Fs0.6Wo0.9).

**Classification**: Howardite.

**Specimens**: 20.29 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11491** (NWA 11491)

(Northwest Africa)

Purchased: 2017 Apr

Classification: HED achondrite (Eucrite, polymict)

**History**: Purchased by Fabien *Kuntz* in April 2017 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed mainly of eucritic debris with minor (~2 vol.%) diogenitic orthopyroxene and olivine. Other minerals are exsolved pigeonite (pale orange in thin section), shocked calcic plagioclase (now maskelynite with peculiar vesicle-rich cores), silica polymorph, chromite and troilite.

**Geochemistry**: Low-Ca pyroxene host (Fs53.2-54.0Wo5.4-5.7, FeO/MnO = 28-29, N = 2), high-Ca pyroxene exsolution lamellae (Fs19.5Wo43.7; Fs28.4Wo38.9; FeO/MnO = 23-26; N = 2), diogenitic orthopyroxene (Fs24.3Wo2.2, FeO/MnO = 28), olivine (Fa47.1-50.3, FeO/MnO = 53-55, N = 2), maskelynite (An88.4-92.2Wo0.4-0.2, N = 2).

**Classification**: Eucrite (polymict breccia, shocked).

**Specimens**: 22.9 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11492** (NWA 11492)

(Northwest Africa)

Purchased: 2017 Apr

Classification: Ordinary chondrite (L4)

**History**: Purchased by Adam *Aaronson* in Temara, Morocco in April 2017.

**Petrography**: (A. Irving, *UWS* and P. Carpenter, *WUSL*) Well-formed, closely packed chondrules occur in a finer grained matrix containing altered metal.

**Geochemistry**: Olivine (Fa21.9-24.5, Cr2O3 < 0.02 wt.%, N = 6), orthopyroxene (Fs19.9-20.1Wo1.0-1.5, N = 2), pigeonite (Fs16.9Wo15.8), subcalcic augite (Fs12.7Wo31.2), augite (Fs12.8Wo38.3).

**Classification**: Ordinary chondrite (L4).

**Specimens**: 20.6 g including one polished thin section at *UWB*; remainder with *Aaronson*.

**Northwest Africa 11493** (NWA 11493)

(Northwest Africa)

Purchased: 2017 Apr

Classification: HED achondrite (Eucrite, monomict)

**History**: Purchased by Fabien *Kuntz* in April 2017 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Sparse microgabbroic eucrite clasts plus related debris are set in a fine grained, quench-textured matrix containing patches of calcite and minor barite. Minerals are exsolved pigeonite (pale orange in thin section), calcic plagioclase (polycrystalline), silica polymorph, ilmenite, chromite (with variable Ti content) and troilite.

**Geochemistry**: Orthopyroxene host (Fs63.0-63.1Wo1.9-2.6, FeO/MnO = 31-34, N = 2), clinopyroxene exsolution lamellae (Fs27.1-29.0Wo43.4-41.6, FeO/MnO = 31-34, N = 2), plagioclase (An90.4-91.5Or0.5, N = 2).

**Classification**: Eucrite (monomict microgabbroic melt-matrix breccia, shocked).

**Specimens**: 28.27 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11494** (NWA 11494)

(Northwest Africa)

Purchased: 2017 Aug

Classification: Primitive achondrite (Lodranite)

**History**: Purchased by Adam *Aaronson* in Temara, Morocco in August 2017.

**Petrography**: (A. Irving, *UWS* and P. Carpenter, *WUSL*) Protogranular texture. The mineralogy is dominated by orthopyroxene with accessory chromite, clinopyroxene, olivine, merrillite, kamacite and pentlandite. Olivine present as inclusions within orthopyroxene is more ferroan than olivine associated with chromite grains.

**Geochemistry**: Orthopyroxene (Fs14.0-14.3Wo2.2-2.5, FeO/MnO = 17-19, N = 2), clinopyroxene (Fs6.3-6.5Wo43.2-42.3, FeO/MnO = 11-16, N = 2), olivine associated with orthopyroxene Fa16.1-16.4, N = 2), olivine associated with chromite (Fa11.4-12.8; FeO/MnO = 25-30, N = 2).

**Classification**: Lodranite (orthopyroxene-rich).

**Specimens**: 5.0 g in the form of a polished endcut at *UWB*; remainder with *Aaronson*.

**Northwest Africa 11495** (NWA 11495)

(Northwest Africa)

Purchased: 2017 Apr

Classification: HED achondrite (Eucrite, polymict)

**History**: Purchased by Fabien *Kuntz* in April 2017 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed mainly of eucritic debris with some lithic eucrite clasts exhibiting diverse textures (intersertal, vitrophyric, variolitic, diabasic) and rare diogenitic orthopyroxene and olivine. Other minerals are exsolved pigeonite, calcic plagioclase, unexsolved pigeonite, silica polymorph, ilmenite, chromite, Ni-poor metal, troilite and rare composite grains of kamacite+taenite.

**Geochemistry**: Orthopyroxene host (Fs50.5Wo1.6, FeO/MnO = 28), clinopyroxene exsolution lamella (Fs21.6Wo41.5, FeO/MnO =27), pigeonite (Fs41.7Wo21.3, FeO/MnO = 31), diogenitic orthopyroxene (Fs21.0Wo1.0, FeO/MnO = 44), olivine (Fa64.6-77.2, FeO/MnO = 47-51, N = 2), plagioclase (An86.2-86.3Or0.5, N = 2).

**Classification**: Eucrite (polymict breccia).

**Specimens**: 18.38 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11504** (NWA 11504)

Algeria

Find: 15 Apr 2016

Classification: HED achondrite (Eucrite, monomict)

**History**: Reportedly fell in western Algeria on April 15, 2016, however no coordinates or other information are available. Purchased by Michael Farmer in Morocco, 2017.

**Physical characteristics**: Several identical appearing pieces found together, shiny black fusion crust exterior, broken surfaces reveal a very fresh, fine-grained breccia of white and gray grains.

**Petrography**: (C. Agee, *UNM*) This meteorite is a fine-grained breccia of primarily pyroxene and plagioclase grains.

**Geochemistry**: (C. Agee, *UNM*) pigeonite Fs60.0±2.0Wo4.7±2.2, Fe/Mn=33±2, n=11; high Ca pyroxene Fs35.5Wo33.1, Fe/Mn=34, n=1; plagioclase An86.2±5.0Ab12.9±4.5Or0.9±0.5, n=3.

**Classification**: Monomict eucrite

**Specimens**: 23 g including a probe mount on deposit at *UNM*, 4.15 g on deposit at *PSF*, *MFarmer* holds 1 kg, *Aaronson* holds 700 g, Aras Jonikas holds 142 g.

**Northwest Africa 11505** (NWA 11505)

Algeria

Purchased: 2017 Jun

Classification: Carbonaceous chondrite (CV3)

**History**: Purportedly found near the Algeria/Libya border and purchased by Darryl Pitt in June 2017 from a dealer in Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Irregularly-shaped to rounded chondrules (mostly granular but some BO, some rimmed; apparent diameter 1.18±0.70 mm, N = 21) plus ovoid CAI (both fine grained and coarse grained, up to 5 mm across) occur in a fine grained, calcite-bearing matrix (~30 vol.%, red-brown in thin section). Grossmanite is present in one CAI.

**Geochemistry**: Olivine (Fa0.2-63.2, N = 3), orthopyroxene (Fs0.6-4.7Wo1.2-1.3, N = 2, diopside (Fs0.6Wo43.5), grossmanite (Fs2.4Wo66.5, Al2O3 = 21.3 wt.%, TiO2 = 10.2 wt.%).

**Classification**: Carbonaceous chondrite (CV3).

**Specimens**: 12.1 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11506** (NWA 11506)

(Northwest Africa)

Purchased: 2017 Apr

Classification: HED achondrite (Eucrite, brecciated)

**History**: Purchased by Fabien *Kuntz* in April 2017 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia consisting mainly of eucritic debris plus some subophitic eucrite clasts exhibiting variable grainsize. Minerals are exsolved pigeonite, calcic plagioclase, subcalcic augite, silica polymorph, ilmenite, troilite, merrillite, minor calcite and rare zircon.

**Geochemistry**: Orthopyroxene host (Fs61.9-63.0Wo1.9-1.6, FeO/MnO = 33-35, N = 2), clinopyroxene exsolution lamellae (Fs28.0-31.4Wo42.3-38.9, FeO/MnO = 34-36, N = 2), subcalcic augite (Fs37.2Wo23.3, FeO/MnO = 33), plagioclase (An83.5-85.1Or0.6, N = 2).

**Classification**: Eucrite (breccia).

**Specimens**: 12.79 g including one polished thin section at *PSF*; remainder with *Kuntz*.

**Northwest Africa 11507** (NWA 11507)

(Northwest Africa)

Purchased: 2017 Jul

Classification: Ordinary chondrite (L4)

**History**: Purchased by Darryl Pitt in July 2017 from a dealer in Erfoud, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Well-formed chondrules occur in a finer grained matrix containing stained metal and merrillite.

**Geochemistry**: Olivine (Fa23.4-23.9, N = 3), orthopyroxene (Fs19.0-19.2Wo1.0-0.8, N = 2), clinopyroxene (Fs7.6-9.4Wo41.4-37.4, N = 2).

**Classification**: Ordinary chondrite (L4).

**Specimens**: 38.4 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11508** (NWA 11508)

Algeria

Purchased: 2017 Jun

Classification: HED achondrite (Eucrite, polymict)

**History**: Purportedly found near the Algeria/Libya border and purchased by Darryl Pitt in June 2017 from a dealer in Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia consisting mainly of fairly coarse grained eucritic debris with minor diogenitic orthopyroxene plus some vitrophyric eucrite clasts and eucritic breccia clasts. Other minerals are exsolved pigeonite, calcic plagioclase, ferroan pigeonite, silica polymorph, fayalite, ilmenite, Ti-free chromite, troilite and Ni-free metal.

**Geochemistry**: Orthopyroxene host (Fs57.3Wo4.0, FeO/MnO = 33), clinopyroxene exsolution lamella (Fs27.3Wo40.2, FeO/MnO = 31), diogenitic orthopyroxene (Fs21.2Wo1.3; Fs30.7Wo4.5; FeO/MnO = 27-30; N = 2), ferroan pigeonite (Fs51.4Wo22.0; Fs74.7Wo14.3; FeO/MnO 21-32; N = 2), fayalite (Fa77.3, FeO/MnO = 45), plagioclase (An85.0-86.0Or0.4, N = 2).

**Classification**: Eucrite (polymict breccia).

**Specimens**: 20.1 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11509** (NWA 11509)

(Northwest Africa)

Purchased: 2017 Sep

Classification: Martian meteorite (Shergottite)

**History**: Found in Mali and purchased in Agadir, Morocco by Aziz Habibi in September 2017. Subsequently the stone was acquired by Ben Hoefnagels.

**Petrography**: (A. Irving and S. M. Kuehner, *UWS*; P. Carpenter, *WUSL*) Relatively coarse grained specimen consisting of relatively equant grains of clinopyroxene and olivine (grainsize 1.4- 3 mm) with vesicular, plagioclase-rich interstitial regions. The mineral mode determined from a large back-scattered electron mosaic is 50.5 vol.% clinopyroxene, 20.1 vol.% plagioclase, 17.1 vol.% olivine, 11.1 vol.% vesicles, 1.0 vol.% oxides (chromite + ilmenite) and 0.2 vol.% pyrrhotite. Clinopyroxene and olivine exhibit limited compositional zoning; olivine has been recrystallized into aggregates of ultra fine grained polygonal subgrains. Plagioclase has a curved lath-like habit; it is not maskelynite, but is birefringent and polycrystalline. Both Ti-rich and Ti-poor chromite are present and some pyrrhotite contains minor Ni. No phosphates were observed despite a careful search.

**Geochemistry**: Olivine (Fa37.9-57.0, FeO/MnO = 50-55, N = 5), pigeonite (Fs26.3-35.7Wo6.4-16.1; Fs36.1Wo21.7; FeO/MnO = 26-34, N = 5), subcalcic augite (Fs19.8-27.2Wo33.3-32.9, FeO/MnO = 25-32, N = 2), plagioclase (An56.0-56.8Or1.8-0.7, N = 2).

**Classification**: Martian meteorite (shergottite, olivine gabbroic).

**Specimens**: 20.1 g including one polished thin section at *UWB*; remainder with Ben Hoefnagels.

**Northwest Africa 11510** (NWA 11510)

(Northwest Africa)

Purchased: 2017 Jan

Classification: Ordinary chondrite (L4/5)

**History**: Purchased by Darryl Pitt in June 2017 from a dealer in Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Relatively well-formed chondrules occur in a recrystallized matrix containing stained metal. Portions of the specimen are cross-cut by much finer grained shock veins containing the same mineral assemblage as the majority of the specimen.

**Geochemistry**: Olivine (Fa25.1-25.2, N = 2), orthopyroxene (Fs20.2-20.6Wo1.4-1.3, N = 2), clinopyroxene (Fs8.1-9.2Wo45.1-43.9, N = 2).

**Classification**: Ordinary chondrite (L4/5).

**Specimens**: 30.57 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11512** (NWA 11512)

Morocco

Purchased: 2017 Aug

Classification: HED achondrite (Eucrite, unbrecciated)

**History**: Purportedly found in southern Morocco and purchased by Darryl Pitt in June 2017 from a dealer in Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Microgabbroic texture. Composed predominantly of exsolved pigeonite and calcic plagioclase (mean grainsize 0.8 mm) with subordinate silica polymorph and accessory ilmenite, Ti-poor chromite, Ti-rich chromite, troilite, baddeleyite and Ni-free metal.

**Geochemistry**: Orthopyroxene host (Fs59.1-59.2Wo2.3-2.2, FeO/MnO = 29-30, N = 2, clinopyroxene exsolution lamellae (Fs27.4-28.1Wo41.3-40.3, FeO/MnO = 28-31, N = 2), plagioclase (An87.89.7Or0.5-0.3, N = 2).

**Classification**: Eucrite (unbrecciated, microgabbroic).

**Specimens**: 30.87 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11513** (NWA 11513)

(Northwest Africa)

Purchased: 2017

Classification: Ordinary chondrite (L5)

**History**: A batch of identical stones was purchased by Ben Hoefnagels in 2016 from a Moroccan dealer.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Sparse chondrules (some well-formed) occur in a recrystallized matrix containing lightly stained metal.

**Geochemistry**: Olivine (Fa25.3-25.6, N = 2), orthopyroxene (Fs20.1-20.3Wo1.2-1.9, N = 2), subcalcic augite (Fs10.5Wo34.5), augite (Fs7.9Wo43.7).

**Classification**: Ordinary chondrite (L5).

**Specimens**: 21.55 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11514** (NWA 11514)

Algeria

Purchased: 2017 Jun

Classification: Carbonaceous chondrite (CV3)

**History**: Purportedly found near the Algeria/Libya border and purchased by Darryl Pitt in June 2017 from a dealer in Mauritania.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Irregularly-shaped to rounded chondrules (mostly granular but some BO, some rimmed; apparent diameter 0.87 ± 0.50 mm, N = 21) plus CAI (both fine grained and coarse grained, up to 2.2 mm across) occur in a fine grained, calcite-bearing matrix (~40 vol.%, orange-brown in thin section).

**Geochemistry**: Olivine (Fa0.3-14.9, N = 3), orthopyroxene (Fs0.7-1.1Wo0.4-0.9, N = 2, diopside (Fs1.0Wo40.9), subcalcic augite (Fs7.7Wo34.5).

**Classification**: Carbonaceous chondrite (CV3).

**Specimens**: 4.6 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Northwest Africa 11515** (NWA 11515)

(Northwest Africa)

Purchased: 2017

Classification: Lunar meteorite

**History**: The fragments were bought from a local meteorite dealer in Morocco.

**Physical characteristics**: Several greyish fragments lacking any fusion crust and partly covered by reddish Sahara sand.

**Petrography**: Feldspathic breccia consisting of lithic and mineral clasts set into a partly glassy or recrystallized matrix often showing flow structures. Lithic clasts include up to 1.2 mm sized angular to subrounded basaltic, noritic, and gabbroic types; mineral clasts are feldspar, olivine, and exsolved pyroxenes. Minor phases are Ti-chromite, ilmenite, troilite, FeNi metal, metallic iron and fayalite. Some cracks are filled with calcite due to terrestrial weathering.

**Geochemistry**: olivine: Fa33.6±12.5(Fa19.2-54.1, n=16, FeO/MnO=72-119); low-Ca pyroxene: Fs43.3±4.8Wo4.5±1.3(Fs31.2-48.8Wo3.0-7.7, n=17, FeO/MnO=53-67); Ca-pyroxene: Fs24.4±3.1Wo31.9±9.3(Fs12.7-44.4Wo20.3-27.5, n=10, FeO/MnO=52-76); calcic plagioclase: An96.2±1.1(An92.8-97.5, n=15)

**Classification**: Lunar (feldspathic breccia)

**Northwest Africa 11516** (NWA 11516)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Eucrite, polymict)

**History**: Eight uncrusted stones weighing a total of 1234.65 g were found in Morocco prior to 2016. Blaine *Reed* acquired the samples from a meteorite dealer at the Denver Gem and Mineral Show in September of 2016.

**Physical characteristics**: Specimen is dark brownish-black-colored, irregularly shaped, pitted, lacks fusion and is weakly magnetic. Samples have a discontinuous coating of light orange caliche. Interior shows a brecciated texture and some flecks of Fe-metal are visible on the surface.

**Petrography**: Description and Classification (A. Love, *App*): Sample is a breccia composed of angular to subrounded clasts (up to 2 cm) of: vitrophyric basalt; ophitic basalt; cumulate (equilibrated cumulate); diogenite (<10 vol%), secondary breccias, rare glassy fragments and a shock melt clast. Many pyroxenes are exsolved, while one basaltic clast contains zoned pyroxenes. Eucrite clasts are dominant. Accessory minerals are: ilmenite, Si-polymorph, FeNi and Ni-free metal, chromite, FeS, fayalite, olivine, barite.

**Geochemistry**: (A. Love, *App*) Low-Ca pyroxene (Fs59.3-60.7Wo2.0-5.4, FeO/MnO=28.7-29.3, N=2); pigeonite (Fs37.5-56.1Wo6.6-19.3, FeO/MnO=26.0-29.5, N=6); high-Ca pyroxene (Fs29.1-34.6Wo35.0-38.4, N=6); plagioclase (An86.2-95.4Or0.0-0.5, N=11); diogenitic orthopyroxene (Fs23.6-35.9Wo2.3-3.5, FeO/MnO=26.5-32.8, N=8); olivine (Fa42.8-79.2, FeO/MnO=40.3-50.2, N=2).

**Classification**: HED (polymict eucrite breccia). Textures and mineral compositions suggest this is a polymict eucrite.

**Specimens**: Blaine *Reed* holds the main mass. A slice and an endcut weighing 38.62g and a polished mount and thin section are on deposit at *App*.

**Northwest Africa 11520** (NWA 11520)

(Northwest Africa)

Purchased: 2017

Classification: HED achondrite (Eucrite, brecciated)

**History**: The meteorite was bought from a local meteorite dealer in Erfoud, Morocco.

**Physical characteristics**: Dark-grayish individual with patches of fusion crust.

**Petrography**: The meteorite is a fine-grained breccia composed of basaltic and dark impact melt clasts set into a basaltic matrix. Dominant minerals in basaltic lithologies are pyroxene with fine exsolution lamellae and calcic plagioclase laths up to 300 µm in length. Minor phases include silica, chromite, ilmenite, fayalite, troilite, and metallic iron. The meteorite contains several shock melt veins.

**Geochemistry**: low-Ca pyroxene: Fs63.4±3.3Wo7.3±3.5(Fs58.0-67.5Wo2.9-13.3, n=15, FeO/MnO=29-34); Ca-pyroxene: Fs44.8±3.7Wo28.7±4.3(Fs40.2-50.7Wo21.4-34.1, n=16, FeO/MnO=29-37); calcic plagioclase: An82.9±1.9(An78.9-86.5, n=15)

**Northwest Africa 11522** (NWA 11522)

(Northwest Africa)

Purchased: 2013 Nov

Classification: Martian meteorite (basaltic breccia)

**History**: A single, dark stone was purchased from Darryl Pitt in November 2013.

**Physical characteristics**: The irregularly shaped stone showed no obvious fusion crust and had a very dark, desert varnished appearance. On the surface of the stone, some light coloured clasts could clearly be seen. X-ray micro-X-ray computer tomography (CT) was carried out at the *NHM* on receipt of the sample, both to validate that the sample appeared similar to other martian breccias i.e. [NWA 7034](https://www.lpi.usra.edu/meteor/metbull.php?code=54831), and to provide information to guide sub-sampling decisions.

**Petrography**: (C. Smith, *NHM* and B. Cohen, *SUERC*) SEM and microprobe investigaton of a polished block shows the specimen has a brecciated, polymict texture with mineral and lithic clasts set in an angular, fine grained matrix. Lithic clasts in the section studied are predominantly basaltic, although CT data showed the presence of impact melt clasts and spherules as have been previously described for e.g. NWA 7034. Main mineral phases observed are pyroxene, feldspar, Fe-Ti oxides and Fe-oxides with minor apatite.

**Geochemistry**: Mineral Compositions and Geochemistry: (C. Smith, *NHM*) plagioclase Ab53.7±6.0An44.1±0.7Or2.2±6.6n=26; albitic feldspar Ab71.5±6.5An7.2±2.3Or21.2±8.7n=5; potassium feldspar Ab31.0±4.5An6.2±2.3Or62.5±4.7n=5; low-Ca pyroxene Fs32.3±6.4Wo7±4.4.Fe/Mn=32.0±4.6 n=35; augite Fs21.4±5.7Wo40±5.9Fe/Mn=30.3±c2.9 n=17. A single olivine grain was analysed Fa57.1.

**Classification**: Martian meteorite (basaltic breccia)

**Specimens**: 948.2 mg main mass and type specimen at *NHM*. A probe block is held at *SUERC*.

**Northwest Africa 11523** (NWA 11523)

(Northwest Africa)

Purchased: 2017

Classification: Lunar meteorite (feldspathic breccia)

**History**: Purchased in March 2017 from Aziz Habibi in Erfoud, Morocco

**Physical characteristics**: Single stone. A saw cut reveals a breccia dominated by white felspathic clasts set in a dark-gray groundmass, some desert caliche is present along cracks.

**Petrography**: (C. Agee, *UNM*) Microprobe examination shows fragmental breccia of olivine, pyroxene, and plagioclase. Melt veins and vesicles are present throughout. Augite and pigeonite show subparallel iron-enrichment trends. There appears to be only one population of augite and pigeonite pairs suggesting that this is a monomict breccia. Plagioclase is uniform in composition at 98.5±0.2% anorthite. Ubiquitous minor ilmenite, chromite, and Fe-Ni metal were observed.

**Geochemistry**: (C. Agee, *UNM*) Olivine Fa26.2±7.1, Fe/Mn=89±5, n=9; pigeonite Fs32.6±5.5Wo6.5±4.1, Fe/Mn=60±5, n=8; augite Fs26.6±8.6Wo36.4±4.6, Fe/Mn=55±8, n=8; plagioclase An98.5±0.2Ab1.4±0.2Or0.1±0.0, n=8; shock melt vein (proxy for bulk composition) SiO2=43.3±0.7, TiO2=0.16±0.03, Cr2O3=0.10±0.05, Al2O3=25.9±3.6, MgO=8.7±4.2, FeO=6.0±2.3, MnO=0.07±0.02, CaO=15.0±2.1, Na2O=0.30±0.07, K2O=0.03±0.01 (all wt%), n=5.

**Classification**: Lunar, monomict feldspathic breccia

**Specimens**: 20.6 g on deposit at *UNM*, *DPitt* holds the main mass.

**Northwest Africa 11524** (NWA 11524)

(Northwest Africa)

Purchased: 2017

Classification: Lunar meteorite (basaltic breccia)

**History**: Purchased in June 2017 from Aziz Habibi in Erfoud, Morocco

**Physical characteristics**: Single stone consisting of approximately 50% green-brown, fine-grained basalt and 50% brecciated clasts of distinct basaltic lithologies set in a fine grained darker matrix. Contact between the basalt and the breccia is very sharp with markedly different fusion crust textures. The strikingly different rock textures on either side of the sharp contact give the appearance of two different meteorites fused together.

**Petrography**: (C. Agee, *UNM*) Microprobe examination was performed on polished slabs of both the basalt and breccia portions of the meteorite. The basalt portion consists of prismatic to acicular pigeonite and augite (50%), plumose plagioclase (25-35%), ubiquitous ilmenite (5-10%), and minor Fe-sulfide and Fe-metal. A significant shock melt vein was observed in the basalt portion. The composition and textures of the silicates and abundance of ilmenite in the basalt portion is typical of pyroxene-phyric, lunar mare basalt, hereafter Mare Basalt Lithology (MBL). The breccia consists of four distinct basalt lithologies (L1-L4) set in a fine-grained mix of pyroxene, plagioclase, and opaque fragments. L1 is an olivine-pigeonite basalt. L2 is an augite-pigeonite basalt with a strong pyroxene iron-enrichment trend. L3 is an olivine-pigeonite-augite basalt with a strong pyroxene iron-enrichment trend. L4 is an olivine-augite-pigeonite basalt with well-defined compositional separation between pigeonite and augite.

**Geochemistry**: (C. Agee, *UNM*) MBL: pigeonite Fs28.3±1.3Wo10.8±4.7, Fe/Mn=56±6, n=10; augite Fs24.1±1.5Wo31.5±3.5, Fe/Mn=56±6, TiO2=1.2±0.2, Cr2O3=1.2±0.2, Al2O3=3.4±0.4 (all wt%), n=4; ilmenite TiO2=52.4±0.6, FeO=46.3±0.3 (all wt%), Fe/Mn=146±11; plagioclase An86.9±1.3Ab12.4±1.2Or0.7±0.6, n=7. Shock melt vein (proxy for bulk composition) SiO2=45.7±1.1, TiO2=3.2±0.6, Cr2O3=0.4±0.2, Al2O3=11.1±2.9, MgO=6.9±1.9, FeO=18.9±1.1, MnO=0.25±0.02, CaO=11.3±0.5, NiO=0.02±0.01, Na2O=0.36±0.14, K2O=0.19±0.10 (all wt%), n=4. L1: olivine Fa30.2±0.1; Fe/Mn=92±7; pigeonite Fs22.6±2.4Wo15.2±5.4, Fe/Mn=50±2, n=4; plagioclase An87.9±0.9Ab10.1±0.3Or1.9±0.6, n=3. L2: pigeonite Fs42.7±10.7Wo15.4±4.6, Fe/Mn=60±10, n=7; augite Fs38.5±24.5Wo29.1±4.2, Fe/Mn=58±11, n=3; plagioclase An93.6±1.4Ab6.2±1.4Or0.3±0.1, n=4. L3: olivine Fa39.4±6.4; Fe/Mn=96±6; pigeonite Fs34.4±12.3Wo12.8±2.6, Fe/Mn=58±5, n=2; augite Fs41.7±13.8Wo27.9±4.0, Fe/Mn=64±9, n=8; plagioclase An92.9±1.9Ab6.5±1.5Or0.6±0.4, n=4. L4: olivine Fa36.4±1.3; Fe/Mn=97±8; pigeonite Fs25.8±1.7Wo13.8±3.7, Fe/Mn=53±4, n=2; augite Fs16.2±0.6Wo34.0±2.9, Fe/Mn=47±9, n=7; plagioclase An89.2±2.8Ab9.7±2.5Or1.1±0.3, n=4.

**Classification**: Lunar, Basalt Breccia

**Specimens**: 25.1 g on deposit at *UNM*, *DPitt* holds the main mass.

**Northwest Africa 11525** (NWA 11525)

(Northwest Africa)

Purchased: 2017

Classification: Ordinary chondrite (L4, melt breccia)

**History**: Purchased in June 2017 from Aziz Habibi in Erfoud, Morocco

**Physical characteristics**: Microprobe examination of a polished mount shows relict, equilibrated chondrules and a fine grained recrystallized groundmass.

**Petrography**: (C. Agee) Microprobe examination of a polished mount shows relict, equilibrated type 4 chondrite clasts in a fine grained groundmass recrystallized from a melt.

**Geochemistry**: (C. Agee, *UNM*) Olivine Fa23.2±3.7, Fe/Mn=52±2, n=8; low-Ca pyroxene Fs21.2±1.3Wo2.1±0.9, Fe/Mn=31±2, n=7; Ab73.8±1.2An21.9±1.4Or4.2±0.3, n=3.

**Classification**: L4-melt breccia

**Specimens**: 24.5 g including a probe mounts on deposit at *UNM*, *DPitt* holds the main mass.

**Northwest Africa 11526** (NWA 11526)

Algeria

Purchased: 2017

Classification: Ordinary chondrite (LL3)

**History**: Reportedly found in Al Hamada, Algeria, near the Mali border region in May 2017 and purchased in Mauritania in June 2017.

**Physical characteristics**: Single stone, weathered exterior; saw cut reveals numerous chodrules set in an orange-brown groundmass.

**Petrography**: (C. Agee) Microprobe examination of a polished mount shows numerous porphyritic, most with mesostasis or glass.

**Geochemistry**: (C. Agee, *UNM*) Olivine Fa29.3±3.5, Fe/Mn=63±17, n=21; low-Ca pyroxene Fs18.4±6.8Wo2.4±2.5, Fe/Mn=37±10, n=11.

**Classification**: Ordinary chondrite LL3, estimated LL3.7-3.9.

**Specimens**: 24 g including a probe mounts on deposit at *UNM*, *DPitt* holds the main mass.

**Northwest Africa 11527** (NWA 11527)

Algeria

Purchased: 2017

Classification: HED achondrite (Eucrite, monomict)

**History**: Reportedly found in Al Hamada, Algeria, near the Mali border region in May 2017 and purchased in Mauritania in June 2017.

**Physical characteristics**: Single stone, saw cut reveals light colored, fine grained surface.

**Petrography**: (C. Agee) Microprobe examination of a polished mount shows approxiamately 60% pyroxene and 35% plagioclase, some brecciation observed.

**Geochemistry**: (C. Agee, *UNM*) Augite Fs42.3±2.4Wo25.1±2.7, Fe/Mn=32±1, n=4; low-Ca pyroxene Fs60.2±3.7Wo3.9±4.2, Fe/Mn=32±0, n=3; plagioclase An94.6±0.2, n=3.

**Classification**: Eucrite, monomict

**Specimens**: 22 g including a probe mounts on deposit at *UNM*, *DPitt* holds the main mass.

**Northwest Africa 11528** (NWA 11528)

Western Sahara

Purchased: 2017

Classification: Ordinary chondrite (LL6)

**History**: Found in the region of Leagad, Western Sahara, near the Moroccan military wall in May 2017; purchased in June 2017.

**Physical characteristics**: Single stone; saw cut reveals faint chondrules set in a brown-orange groundmass.

**Petrography**: (C. Agee, *UNM*) Microprobe examination shows texturally equilibrated, recrystallized chondrules. Plagioclase grain size up to 200 μm in diameter.

**Geochemistry**: (C. Agee, *UNM*) Olivine Fa28.1±0.3, Fe/Mn=57±2, n=7; low-Ca pyroxene Fs23.1±0.1Wo3.5±0.4, Fe/Mn=33±1, n=6; plagioclase An20.1±6.2Ab74.8±4.4Or5.1±1.8, n=3.

**Classification**: Ordinary chondrite (LL6)

**Specimens**: 22.7 g on deposit at *UNM*, *DPitt* holds the main mass.

**Northwest Africa 11530** (NWA 11530)

(Northwest Africa)

Purchased: June 2016

Classification: Iron meteorite (ungrouped)

**History**: Purchased by the owner at Sainte Marie-aux-Mines in June 2016.

**Physical characteristics**: The main mass has an irregular shape with one flat, pitted side; the other side is more rounded. The surface is dark brown and the rounded side shows a bright patina.

**Petrography**: Polished and etched surfaces show no Widmanstatten pattern, with troilite nodules up to 2 mm. SEM examination reveals kamacite laths ~30 × 200 μm containing ~20 μm schreibersite inclusions. Taenite is present interstitial to kamacite laths.

**Geochemistry**: ICP-MS data, using sample of [North Chile](https://www.lpi.usra.edu/meteor/metbull.php?code=17001) (Filomena) as standard (C. Herd and G. Chen *UAb*): Ni = 15.8, Co = 0.46 (both wt%); Ir = 23.6, Ga = 52, As = 16, W = 1.1, Re = 1.5, Os = 18.9, Cu = 535, Pd = 4.0, Pt = 13.3, Au = 2.0 (all μg/g).

**Classification**: (C. Herd, *UAb*): Iron, ungrouped. Ga, Pt, Cu, and Au concentrations too high for the high-Ni groups. Texture suggests recrystallization as a result of shock heating.

**Specimens**: Type specimen consisting of a 16.6 g representative slice at *UAb*. Main mass with *Kuntz*.

**Northwest Africa 11531** (NWA 11531)

(Northwest Africa)

Purchased: 2016

Classification: HED achondrite (Diogenite)

**History**: A single stone weighing 35.2 g was found in Morocco prior to 2016. J. Donald Cline and John Sinclair acquired the sample from a meteorite dealer at the Tucson Gem and Mineral Show in February of 2017.

**Physical characteristics**: Sample is mottled dark-greenish-gray colored, non-magnetic and tabular in shape. Sample has an obvious brecciated texture composed of light-colored clasts in a darker groundmass. One side of sample has an orange coating and is notably more flattened than the opposite side which is quite irregular.

**Petrography**: Description and classification (A. Love, *App*): Sample is a breccia composed of dominant sub-rounded to angular fragments of orthopyroxene (up to 1650 µm, average length 880 µm), olivine (~2 vol%), plagioclase, glass, chromite, FeS, FeNi, minor phosphate and Si-polymorph metal set in matrix of similar finer-grained Opx, olivine and interstitial plagioclase. Some Opx grains contain olivine melt inclusions. Sample is transected by networks of opaque shock veins.

**Geochemistry**: (A. Love, *App*) Low Ca-Opx (Fs21.4±0.7Wo2.5±0.4, FeO/MnO=26.3-28.4, N=18), Olivine (Fa22.8±0.4, FeO/MnO=46.8-49.3, N=8), plagioclase An85.7±1.3Or0.2±0.0, N=5).

**Classification**: HED (diogenite).

**Specimens**: *PARI* holds the main mass. A slice and several small fragments weighing 7.1 g and a polished thin section are on deposit at *App*.

**Northwest Africa 11532** (NWA 11532)

Algeria

Purchased: 2017

Classification: Lunar meteorite (feldspathic breccia)

**History**: Several small pieces totaling 70 g were found in Algeria. They were purchased by Decker Meteorite-Museum in 2017 from a Moroccan dealer.

**Petrography**: (A.-K. Kraemer and A. Bischoff, *IfP*) Breccia composed of small angular anorthite-rich lithic and mineral fragments embedded in a fine-grained clastic matrix. The sample also contains abundant impact melt clasts and some areas with maskelynite. Observed minerals include anorthite, olivine, low-Ca pyroxene, Ca-rich pyroxene, silica polymorph, Al-Ti-Cr-spinel, kamacite, ilmenite, and troilite.

**Geochemistry**: Mineral composition and geochemistry: (A.-K. Kraemer and A. Bischoff, *IfP*) Olivine (mean: Fa36.1, range: Fa8.4-99.8, Fe/Mn = 87; N = 20), low-Ca pyroxene (mean Fs31.4Wo10.8, range: Fs20.6-64.3Wo2-24, Fe/Mn = 57, N = 18), Ca-rich pyroxene (mean: Fs38.2Wo41.2; Fe/Mn = 69; N = 6), anorthite (mean: An95.4Or0.2, N = 20).

**Northwest Africa 11533** (NWA 11533)

(Northwest Africa)

Purchased: 2017

Classification: Carbonaceous chondrite (CV3)

**Physical characteristics**: Brownish stone. Cut surface reveals well-defined chondrules and CAIs set in a dark matrix.

**Petrography**: (J. Gattacceca, H. Pourkhorsandi, *CEREGE*) Chondrules and CAIs (up to 2.6 mm) set in an abundant iron rich fine-grained textured matrix. Opaque are troilite and magnetite. No Fe,Ni metal observed.

**Geochemistry**: Olivine Fa5.4and Fa9.4(N=2). Orthopyroxene Fs1.4±0.8Ws1.0±0.3 (N=7).

**Classification**: Carbonaceous chondrite (CV3). Oxidized sub-group.

**Specimens**: Type specimen at *CEREGE*. Main mass with *Kuntz*.

**Northwest Africa 11534** (NWA 11534)

(Northwest Africa)

Purchased: 2017

Classification: Ordinary chondrite (LL3)

**Physical characteristics**: Brownish stone. Cut surface reveals closely packed, well-defined chondrules.

**Petrography**: (J. Gattacceca, H. Pourkhorsandi, *CEREGE*) Large packed chondrules, some rimmed. Olivine is chemically zoned. Opaque minerals are metal and troilite.

**Geochemistry**: Olivine Fa24.6±13.3, PMD 44%, range 11.0-46.8, Cr2O3 0.16±0.13 (N=5). Orthopyroxene Fs13.4±9.0Wo1.2±0.7, Fs PMD 71% (N=6).

**Classification**: LL3

**Specimens**: Type specimen at *CEREGE*. Main mass with *Kuntz*.

**Northwest Africa 11535** (NWA 11535)

(Northwest Africa)

Purchased: 2017

Classification: Carbonaceous chondrite (CK6)

**Physical characteristics**: Dark-brown stone. Cut surface reveals a dark-gray interior with poorly defined chondrules.

**Petrography**: (J. Gattacceca, H. Pourkhorsandi, *CEREGE*) Equilibrated chondrite with average chondrule size 820 μm (N=12). Opaque are mostly magnetite (euhedral and sub-euhedral), accessory troilite.

**Geochemistry**: Olivine Fa25.8±0.4, NiO 0.58±0.16 wt% (N=4). Orthopyroxene Fs23.6Ws0.8 (N=1). Magnetite has 3.0 wt% Cr2O3 (N=1).

**Classification**: Carbonaceous chondrite (CK6)

**Specimens**: Type specimen at *CEREGE*. Main mass with *Kuntz*.

**Northwest Africa 11536** (NWA 11536)

(Northwest Africa)

Purchased: 2017

Classification: Carbonaceous chondrite (CO3)

**Physical characteristics**: Dark brown stone. Cut surface reveals a dark-brown interior with small chondrules.

**Petrography**: (J. Gattacceca, H. Pourkhorsandi, *CEREGE*) Small chondrules set in a fine-grained, iron-rich matrix. Chondrules 48 vol%, matrix 50 vol% (by point counting, N=127). Small CAI are present.

**Geochemistry**: Olivine Fa21.1±13.0, PMD 57%, range 2.4-36.3, Cr2O3 0.12±0.09 (N=13). Orthopyroxene Fs4.5Wo2.3(N=1).

**Classification**: Carbonaceous chondrite (CO3)

**Specimens**: Type specimen at *CEREGE*. Main mass with *Kuntz*.

**Northwest Africa 11537** (NWA 11537)

(Northwest Africa)

Purchased: 2017

Classification: Carbonaceous chondrite (CV3)

**Physical characteristics**: Dark stone. Cut surface reveals large, well-defined chondrules and CAIs set in a dark matrix.

**Petrography**: (J. Gattacceca, H. Pourkhorsandi, *CEREGE*) Chondrules (mm-sized) and CAIs (up to 1.6 mm) set in a fine-grained Fe-rich matrix. Abundant troilite, rare metal.

**Geochemistry**: Olivine Fa11.8±10.1, range Fa4.0-35.0(N=7). Orthopyroxene Fs1.8±0.5Wo1.1±0.4(N=4).

**Classification**: Carbonaceous chondrite (CV3)

**Specimens**: Type specimen at *CEREGE*. Main mass with *Kuntz*.

**Northwest Africa 11538** (NWA 11538)

(Northwest Africa)

Purchased: 2017

Classification: Ordinary chondrite (LL3)

**Physical characteristics**: Brownish stone. Cut surface reveals well defined, closely packed chondrules. A 5 mm fine-grained dark clast is visible.

**Petrography**: (J. Gattacceca, H. Pourkhorsandi, *CEREGE*) Unequilibrated ordinary chondrite. Chondrule mesostasis is devitrified. Olivines are zoned.

**Geochemistry**: Olivine Fa7.6±7.1, range 1.0-16.9, PMD 91% (N=5), Cr2O3 in ferroan olivine 0.14±0.10 wt% (N=3). Orthopyroxene Fs18.1±8.2Wo1.0±0.2(N=3).

**Classification**: LL3

**Specimens**: Type specimen at *CEREGE*. Main mass with *Kuntz*.

**Northwest Africa 11539** (NWA 11539)

(Northwest Africa)

Purchased: 2017

Classification: Ordinary chondrite (LL3)

**Physical characteristics**: Dark brown stone. Cut surface reveals large, well-defined chondrules.

**Petrography**: (J. Gattacceca, H. Pourkhorsandi, *CEREGE*) Packed large chondrules. Main opaques are troilite and metal.

**Geochemistry**: Olivine Fa15.7±7.0, range 2.5-23.1, PMD 37% (N=6). Orthopyroxene Fs13.9±9.7Wo1.5±0.6(N=5).

**Classification**: LL3

**Specimens**: Type specimen at *CEREGE*. Main mass with *Kuntz*.

**Northwest Africa 11540** (NWA 11540)

(Northwest Africa)

Purchased: 2017

Classification: Carbonaceous chondrite (CO3)

**Physical characteristics**: Brownish fragments

**Petrography**: (J. Gattacceca, H. Pourkhorsandi, *CEREGE*) Small chondrules set in a fine-grained iron-rich matrix. Chondrules 50 vol%, matrix 50 vol% (point counting, N=136). Small CAI are present.

**Geochemistry**: Olivine Fa13.7±18.5, range 0.7-48.4, PMD 101% (N=13), Cr2O3 in ferroan olivine 0.08±0.05 wt% (N=9). Orthopyroxene Fs1.4±0.3Wo1.9±1.2(N=4).

**Classification**: Carbonaceous chondrite (CO3)

**Specimens**: Type specimen at *CEREGE*. Main mass with *Kuntz* and PM. Pelé.

**Northwest Africa 11541** (NWA 11541)

(Northwest Africa)

Purchased: 2017

Classification: Carbonaceous chondrite (CV3)

**Physical characteristics**: Dark brown irregular fragments

**Petrography**: (J. Gattacceca, H. Pourkhorsandi, *CEREGE*) Chondrules (mm-sized) and CAIs set in a fine-grained iron-rich matrix.

**Geochemistry**: Olivine Fa12.1±16.9, range 1.6-45.5, PMD 111% (N=5). Orthopyroxene Fs0.8Wo0.9(N=1).

**Classification**: Carbonaceous chondrite (CV3)

**Specimens**: Type specimen at *CEREGE*. Main mass with F. *Kuntz* and PM. Pelé.

**Northwest Africa 11542** (NWA 11542)

(Northwest Africa)

Purchased: 2017

Classification: Carbonaceous chondrite (CO3.0)

**Physical characteristics**: Brownish fragments

**Petrography**: (J. Gattacceca, H. Pourkhorsandi, *CEREGE*) Small chondrules set in a fine-grained iron-rich matrix. Chondrules 60 vol%, matrix 40 vol% (point counting, N=156). Small CAI are present.

**Geochemistry**: Olivine Fa22.8±23.4, range 0.8-66.9, PMD 94% (N=18), Cr2O3 in ferroan olivine 0.30±0.12 wt% (N=9).

**Classification**: Carbonaceous chondrite (CO3.0). Cr2O3 content of ferroan olivine suggest a low petrographic subtype (similar to [Colony](https://www.lpi.usra.edu/meteor/metbull.php?code=5407)).

**Specimens**: Type specimen at *CEREGE*. Main mass with *Kuntz*.

**Northwest Africa 11543** (NWA 11543)

(Northwest Africa)

Purchased: 2017

Classification: Carbonaceous chondrite (CV3)

**Physical characteristics**: Dark stone. Cut surface reveals large well defined chondrules and CAIs set in a dark matrix.

**Petrography**: (J. Gattacceca, H. Pourkhorsandi, *CEREGE*) Chondrules (average apparent diameter 1.4 mm, N=20), mostly of type I, and CAIs (to 800 μm) set in a fine-grained iron-rich matrix.

**Geochemistry**: Olivine Fa6.4±3.1, range Fa2.8-11.3, PMD 45% (N=8). Orthopyroxene Fs1.5±0.1Ws1.2±0.2 (N=2).

**Classification**: Carbonaceous chondrite (CV3).

**Specimens**: Type specimen at *CEREGE*. Main mass with *Kuntz*.

**Northwest Africa 11544** (NWA 11544)

(Northwest Africa)

Purchased: 2017

Classification: Ordinary chondrite (LL3)

**Physical characteristics**: Brownish stone. Cut surface reveals well defined, closely packed chondrules.

**Geochemistry**: Olivine Fa25.4±14.1, range Fa7.6-49.4, PMD 49% (N=7), Cr2O3 in ferroan olivine 0.11±0.08 wt% (N=7). Orthopyroxene Fs12.1±13.2Wo1.2±0.4, Fs PMD 89%, N=4.

**Classification**: LL3. Subtype estimated between 3.2 and 3.5 based on Cr2O3 content of olivine and Fa PMD.

**Specimens**: Type specimen at *CEREGE*. Main mass with *Kuntz*.

**Northwest Africa 11545** (NWA 11545)

(Northwest Africa)

Purchased: 2017

Classification: Carbonaceous chondrite (CV3)

**Physical characteristics**: Dark brown stone. Cut surface reveals large well defined chondrules and CAIs set in a dark matrix.

**Petrography**: (J. Gattacceca, H. Pourkhorsandi, *CEREGE*) Well-defined mm-sized chondrules (mostly type I) and CAIs set in a fine-grained iron-rich abundant matrix.

**Geochemistry**: Olivine Fa4.3±4.0, range 0.6-11.1, PMD 85% (N=8). Orthopyroxene Fs2.4±1.7Wo2.2±1.5(N=3).

**Classification**: Carbonaceous chondrite (CV3).

**Specimens**: Type specimen at *CEREGE*. Main mass with *Kuntz*.

**Northwest Africa 11546** (NWA 11546)

(Northwest Africa)

Purchased: 2017

Classification: Carbonaceous chondrite (CV3)

**Physical characteristics**: Dark irregular fragments.

**Petrography**: (J. Gattacceca, H. Pourkhorsandi, *CEREGE*) Well-defined chondrules (mostly type I, average apparent diameter 860 μm, N=18) and CAIs (to 2 mm) set in a fine-grained iron-rich abundant textured matrix. Opaque minerals are mostly sulfides and magnetite.

**Geochemistry**: Olivine Fa3.6±4.0, range 0.7-11.2, PMD 106% (N=6). Orthopyroxene Fs1.4±0.6Wo4.0±1.0(N=3).

**Classification**: Carbonaceous chondrite (CV3). Oxidized subgroup.

**Specimens**: Type specimen at *CEREGE*. Main mass with *Kuntz*.

**Northwest Africa 11547** (NWA 11547)

(Northwest Africa)

Purchased: 2017

Classification: Carbonaceous chondrite (CO3)

**Physical characteristics**: Brownish fragments

**Petrography**: (J. Gattacceca, H. Pourkhorsandi, *CEREGE*) Small chondrules and CAIs set in a fine-grained iron-rich matrix. Chondrules 63 vol%, matrix 37 vol% (point counting, N=167).

**Geochemistry**: Olivine Fa16.5±14.5, range 1.1-35.1, PMD 82% (N=7), Cr2O3 in ferroan olivine 0.32±0.07 wt% (N=8). Orthopyroxene Fs2.1±0.4Wo0.7±0.0(N=2).

**Classification**: Carbonaceous chondrite (CO3).

**Specimens**: Type specimen at *CEREGE*. Main mass with *Kuntz*.

**Northwest Africa 11548** (NWA 11548)

(Northwest Africa)

Purchased: 2006

Classification: HED achondrite (Eucrite)

**History**: A slice of an unclassified NWA specimen was donated to *Cascadia* by Mr. Fred *Olsen* in July, 2012

**Physical characteristics**: Exterior surfaces covered by weathering patina. Cut surfaces show minor weathering stains and brecciated texture with clasts up to 2.7 cm across.

**Petrography**: Thin section shows a breccia with numerous lithic, mineral, impact melt, and melt breccia clasts dominated by pyroxene and plagioclase; clasts range in size from 1.2 cm to 50 microns or smaller. Original igneous textures are not easily discernible. Pyroxene grains often but not always show micron-scale exsolution lamellae. Calcite-filled fractures are present.

**Geochemistry**: Low-Ca pyroxene Fs57.9±1.2Wo4.3±0.9(N=25); augite Fs33.2±4.5Wo41.5±2.5(N=21); bulk inverted pigeonite Fs48.9±6.9Wo15.7±8.6, taken as average of all pyroxene with Wo5.5-35(N=66), plagioclase An86.5±4.9Ab13.3±4.0(N=66).

**Classification**: Monomict, largely equilibrated, brecciated eucrite based on texture and mineral composition

**Specimens**: *Cascadia* holds a 25.8 g slice, polished thin section, and potted butt all derived from slice RM#7. The main mass is held by Mr. Ronnie McKenzie

**Northwest Africa 11549** (NWA 11549)

(Northwest Africa)

Purchased: 2013

Classification: HED achondrite (Eucrite)

**History**: Donated to *Cascadia* by Mr. John A. Shea, who purchased the sample in 2013 from Mr. Steve Witt who in turn had acquired the specimen in a lot of NWA meteorites from an unknown trader.

**Physical characteristics**: Remnant fusion crust and broken surfaces with light orange weathering patina visible on two pieces. Cut surfaces reveal light-gray interior with minimal weathering staining, including coarser portions and finer portions. Coarser areas are dominated by grey pyroxene and lighter colored plagioclase up to ~1 mm across

**Petrography**: Contains clasts rich in plagioclase and pyroxene with textures that range from ophitic to subpohitic to granular. Pyroxene grains sometimes show micron-scale exsolution lamellae. Minor weathering product.

**Geochemistry**: Bulk pigeonite Fs55.1±5.8Wo12.0±6.7, taken as average of all pyroxene with Wo5.5-35(N=150), low-Ca pyroxene in fusion crust Fs48.4±3.0Wo4.3±0.6(N=4); augite Fs37.1Wo35.3(N=1); plagioclase An85.2±2.3Ab14.4±2.0(N=91). Fusion crust glass (average of 14 analyses, wt. %): SiO2 47.4±0.6, TiO2 1.0±0.2, Al2O3 11.0±0.3, Cr2O3 0.25, FeO 20.6±0.4, MnO 0.69±0.1, MgO 6.8±0.1, CaO 9.9±0.4, Na2O 0.53±0.04, total 98.1±0.7.

**Classification**: Monomict eucrite based on texture and mineral composition. Composition of fusion crust glass, proxy for bulk rock composition, is similar to non-cumulate eucrites such as Juvinas

**Specimens**: *Cascadia* holds 2 pieces (5.7 g, 1.7 g), a polished thin section, and a potted butt. Mr. John A. Shea (201 East Rose Valley Rd, Wallingford PA, 19086) holds the main mass

**Northwest Africa 11553** (NWA 11553)

Morocco

Purchased: 2010 Feb

Classification: Ordinary chondrite (LL4)

**Physical characteristics**: Specimen has no visible fusion crust and has a brown-red oxidized outer appearance. Cut surface reveals gray to brown interior with visible chondrules and low abundance of metal. Chondrules are up to 5 mm in diameter.

**Petrography**: Chondrules show a large size variance, ranging from 200 µm to 5 mm, with a mean diameter of 764±412 µm (N=45). Chondrules are well defined in a dark devitrified matrix. Some FeNi metal shows signs of oxidation.

**Geochemistry**: Olivine Fa30.4as determined by pXRD.

**Classification**: Chondrules are well defined.

**Northwest Africa 11554** (NWA 11554)

Morocco

Purchased: Sept 2013

Classification: Carbonaceous chondrite (CV3)

**Physical characteristics**: No fusion crust present. Reddish-brown dust covers surface of the sample. Millimeter-sized chondrules and CAIs visible from hand sample.

**Petrography**: Sample contains about 40% matrix, 50% Chondrules, and 10% CAIs. Matrix is mostly opaque and cryptocrystalline. <1% metal inclusions within the sample, mostly found in chondrules. Chondrules have an average diameter of 1 mm. Chondrules include plagioclase laths and interstitial plagioclase within porphyritic olivine or pyroxene chondrules.

**Geochemistry**: EMPA: Olivine is heterogeneous in the sample, with olivine in the matrix being more fayalitic (Fa45.8) than the chondrules (Fa15.8). Orthopyroxene was Mg2Si2O6 (enstatite) in composition, and clinopyroxene ranged from augite - diopside, with the average composition being augite. This sample includes relatively abundant >5% modal feldspar with a composition of An85.9±7.2, N = 16. Plagioclase within the CAIs is anorthitic, however the average composition is bytownite for the bulk rock.

**Specimens**: Type sample is housed at *ROM* as sample M57471

**Northwest Africa 11557** (NWA 11557)

(Northwest Africa)

Purchased: 2016

Classification: Ordinary chondrite (H5)

**History**: Purchased by Ben Hoefnagels in 2017 from a dealer in Guelmim, Morocco.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Sparse chondrules (some well-formed) occur in a recrystallized matrix containing relatively abundant altered metal.

**Geochemistry**: Olivine (Fa18.9-19.3, N = 2), orthopyroxene (Fs16.4-16.6Wo1.9-1.2, N = 2), subcalcic augite (Fs26.9Wo32.9), augite (Fs5.6-6.6Wo44.0-44.7, N = 2).

**Classification**: Ordinary chondrite (H5).

**Specimens**: 20.27 g including one polished thin section at *UWB*; remainder with Mr. B. Hoefnagels.

**Northwest Africa 11566** (NWA 11566)

(Northwest Africa)

Purchased: 2016

Classification: Ordinary chondrite (L6)

**History**: The stone was purchased by Mohamed salem El Wali El alaoui.

**Physical characteristics**: The stone is unusually porous. It contains 5-10 vol.% pores with diameters ranging from 50 - 250 µm.

**Petrography**: The stone is very recrystallized and has poorly defined chondrules. Plagiolcase grains range up to 50x120 µm. Diopside is more abundant than low-Ca pyroxene. Diopside compositions average Fs7.3±0.4Wo45.0±0.5(n=15). Plagioclase compositions average Ab82.9±1.0Or5.7±0.9(n=10). The rock appears to have relict shock features including small, irregular troiltie grains within metallic Fe-Ni, chromite-plagioclase assemblages and chromite veinlets. Olivine grains exhibit undulose extinction.

**Northwest Africa 11568** (NWA 11568)

(Northwest Africa)

Purchased: March 2017

Classification: Ordinary chondrite (H3)

**History**: Purchased by Sean Tutorow and Brahim Tahiri from several diferent meteorite hunters in Morocco.

**Petrography**: The rock contains sharply defined chondrules and polysynthetically twinned low-Ca pyroxene. The chondrule mesostases are not composed of isotropic glass; they are devitrified. The types of chondrules include BO, PO, PP, POP, RP and C. Some chondrules have dusty relict olivine grains within them. The rock has experienced extensive weathering; some clay is present that formed from altered mafic silicate grains.

**Northwest Africa 11569** (NWA 11569)

(Northwest Africa)

Purchased: March 2017

Classification: Ordinary chondrite (LL6)

**History**: Purchased by Sean Tutorow and Brahim Tahiri from several diferent meteorite hunters in Morocco.

**Petrography**: Ca-pyroxene: Fs10.6±0.5Wo42.3±0.3(n=5). The rock is very recrystallized. Plagioclase grains range from 70 to 110 µm in size.

**Nossa Senhora do Livramento**        15°59’S, 56°18’W

Mato Grosso, Brazil

Find: 2016 Aug

Classification: Iron meteorite (IIIAB)

**History**: Found by a prospector, Valmir P. Scarabeli, while he was searching for gold with a metal detector. The finder sent samples to Andre Moutinho who performed preliminary tests that confirmed the sample’s meteoritic origin. Samples were then provided to Dr. Zucolotto for a complete analysis and classification.

**Physical characteristics**: A weathered mass weighing 1120 g and measuring about 110 × 80 × 30 mm. The examined section was highly corroded with a thick oxide crust, the corrosion penetrating deeply to the very center of the meteorite, particularly along grain boundaries.

**Petrography**: (M.E. Zucolotto, *MNRJ*/UFRJ) The meteorite is a medium octahedrite containing kamacite, taenite and few plessite fields. Kamacite bandwidth is 0.90±0.15 mm. Kamacite shows Neumann bands with microhardness of HV 205±15. Plessite fields include degenerated comb and net plessite with dark taenite wedges. Also present in some grains are decorated Neumann bands and numerous micrometer-sized gamma precipitates on the kamacite. A small troilite-daubreelite (0.5 × 1.0 mm) nodule was observed with iron sulfide eutectic and small subangular daubreelite grains.

**Geochemistry**: (J.T. Wasson, *UCLA*): INAA data, Ni = 74.6, Co = 5.00 (both mg/g), Cr=58, Cu = 204, Ga = 20.7, As = 4.86, W=1.34, Re=1481, Ir =12.8, Pt=18.1 Au = 0.654 (all μg/g). (A. Tosi, IGEO/UFRJ): kamacite 7.24 % Ni, 0.48 % Co, taenite and tetrataenite.

**Classification**: Iron, IIIAB. The meteorite plots in the IIIAB field and differs in composition from all Brazilian Irons.

**Specimens**: Main mass with Rodrigo Guerra, 70 g *MNRJ*, 90 g Andre Luiz R Moutinho, 62 g Carlos Augusto Di Pietro.

**Nova 017**

United States?

Find: unknown

Classification: Ordinary chondrite (H5)

**History**: A single specimen was handed down to the owner by his great aunt in the 1960s. Likely originated in the southwest US.

**Physical characteristics**: The ~7 cm-wide, equant specimen is mostly covered with a dark-brown fusion crust. Some red-brown oxidation is evident.

**Petrography**: (C. Herd, *UAb*) Cut surfaces reveal light and dark areas consistent with brecciation. Consists of well-delineated chondrules of a variety of textural types. Plagioclase grains are up to 20 μm across. Shock effects include minor veining. Weathering grade according to [Zurfluh et al. (2016)](http://onlinelibrary.wiley.com/wol1/doi/10.1111/maps.12690/full).

**Geochemistry**: (C. Herd, *UAb*) Data obtained by EMP examination of carbon-coated thin section: Olivine Fa19.0±0.3(n=29); Low-Ca Pyroxene Fs16.8±0.9Wo1.1±0.1(n=29). Two data points are consistent with a type L (Fs19.8), indicative of a polymict breccia.

**Classification**: Ordinary chondrite, H5, breccia. Petrologic type 5 based on well-delineated chondrules and plagioclase grain size (2-50 μm).

**Specimens**: Type specimen of 26.4 g, including one thin section, is at *UAb*. Main mass is with the owner.

**Nova 018**

(unknown)

Purchased: 2014

Classification: Ureilite

**History**: Purchased by D. *Gregory* at the Denver mineral show in September 2014.

**Physical characteristics**: (S.Korchinos, *UTorG*,*ROM*; V.Di Cecco, *ROM*) Total mass of pieces is 2.1 kg, with the largest piece having mass of 1.79 kg. Remainder of mass is divided among 12 smaller fragments. The sample is mostly covered by a dark, regmalypted fusion crust. Cracks and exposed surfaces are weathered and rusty. Specimen is very hard and difficult to cut with a diamond saw.

**Petrography**: (S. Korchinos, *UTorG*,*ROM*; V. Di Cecco, *ROM*) The thin section is composed mostly of coarse-grained olivine with medium-grained, mm to sub-mm pigeonite grains. The silicates exhibit clear reduction rims surrounding their cores. The interstitial matrix and veins are carbon-rich and composed mostly of graphite and numerous nano-diamonds, confirmed using Raman, EPMA and SEM imaging. The interstitial phases appear very dark to opaque when viewed under both plane-polarized and cross-polarized transmitted light.

**Geochemistry**: Mineral compositions and geochemistry: Oxygen isotopes: analyses of two subsamples were conducted at *OkaU* by R. Tanaka and E. Nakamura. The analyses gave δ17O = 4.224, 4.161; δ18O = 8.648, 8.512; and Δ17O = -0.331, -0.323 (all values in per mil). Bulk Composition: The olivine cores have Fa24.1±2.3(N=43) and their bulk chemistry includes CaO = 0.35 ± 0.12 (N=43), Cr2O3 = 0.65 ± 0.23 (N=43), and MnO = 0.42 ± 0.03. The pyroxene cores have Fs20.6±1.0Wo10.2±0.2(N=24) and their bulk chemistry includes CaO = 5.18 ± 0.09 (N=24), Cr2O3 = 1.24 ± 0.09 (N=24), MnO = 0.39 ± 0.02

**Classification**: Achondrite (ureilite). High shock, low weathering.

**Specimens**: One thin section and the smaller fragments are held at the *ROM*. The main mass is held by *Gregory*.

**Nova 019**

Purchased in USA

Purchased: 2016

Classification: Iron meteorite (IVA)

**History**: Purchased by Raymond Klein in Hammonton, NJ in 2016 from an antique shop.

**Physical characteristics**: The original mass has a roughly triangular shape measuring about 28 × 20 × 16.5 cm. It has a dark brown, in parts shiny, exterior and is locally rusty red to light orange. Mass before cutting = 19867.3 g. Mass after cutting = 19421.2 g.

**Petrography**: J. Gross and S. Stevenson, *Rut*. Optical and Electron Microprobe (EPMA) investigation and bandwidth measurement of a 2 × 3.5 cm polished and etched slice reveals a well-developed Widmanstatten pattern consistent with a fine octahedrite (average bandwidth = 0.325 ±0.075 mm, n = 20). Plessite is common. One Iron sulfide inclusion was observed that seemed to be zoned from core to rim.

**Geochemistry**: J. Gross and S. Stevenson, *Rut*. Bulk composition obtained by solution ICP-MS and LA-ICP-MS using Hoba, Gibeon, and NIST glasses as a calibration standard: Ni = 7.95 wt%, Co = 3.64 mg/g; Ir = 1.6, Pt = 5.1, Os = 2.0, Ru = 2.5, Au = 1.1, Ga = 1.8, Ge = 0.4, As = 3.0, Re = 0.2, Cu = 202.1, Mn = 0.5, P = 315.4, Mo = 4.3, Cr = 191.6 (all μg/g). Iron Sulfide inclusion by EPMA. Core: Fe = 57.4, S = 36.6, Cr =4.0, Ni = 0.05 (n = 15; all in element wt%); Rim: Fe = 73.9, S = 20.4, Cr = 1.4, Ni = 3.0 (n= 10; all in element wt%).

**Classification**: Iron, IVA, fine octahedrite.

**Specimens**: A total of 19323 g (one stone). Type specimen of 20.7 g at *AMNH*. 77.5 g remains at *Rut* for analyses; Raymond Klein holds the main mass.

**Oudiyat Sbaa**        25.546°N, 12.418°W

Western Sahara/Morocco

Confirmed fall: 2016 Nov 18

Classification: Enstatite chondrite (EH5)

**History**: On November 18, 2016, at 4:40 pm local time, a bright fireball was witnessed traveling in a southerly direction by many observers in Morocco over an area extending from Tiznit to Guelmim, Tan Tan and Smara. Sonic booms were heard by Mbarek Bouilid, Aitoussi Redwan and three camel shepherds of the Aitboussoula family (who thought that perhaps the sound was caused by explosion of a mine trodden on by a camel). A search for fallen stones was begun, and on November 23 another shepherd (Bachir Alamine) found three black fusion-crusted stones on light brown sandy soil near Oudiyat Sbaa.

**Physical characteristics**: The stones are completely coated in thin, black fusion crust. The fresh interiors are overall medium gray in color with abundant shiny grains of metal and sulfides. When first found the stones emitted a sulfurous odor.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Some well-formed chondrules (apparent diameter 300±100 μm) are present within a recrystallized matrix containing abundant metal and sulfides. Apart from dominant enstatite, the specimen contains alkali feldspar, Si-bearing kamacite, niningerite, oldhamite, Cr-bearing troilite and schreibersite. A spherical crystalline object (apparent diameter 1.1 mm) observed in one thin section is composed predominantly of fluororichterite associated with a silica polymorph, enstatite and sulfides.

**Geochemistry**: Enstatite (Fs0.4-0.6Wo0.1-0.3, N = 3), alkali feldspar (Ab88.7-93.1An1.1-0.9Or10.2-6.0, N = 2), metal (Ni 6.2-6.3 wt.%, Co 0.4 wt.%, Si 3.3 wt.%, N = 2). Cosmogenic radionuclides: (Å. Rosén, *UBE*/*NMBE*, GeMSE): Gamma-spectroscopy performed in February 2017 showed the presence of the following cosmogenic radionuclides: 46Sc, 56Co, 54Mn, 58Co, 7Be, 48V, 51Cr, 57Co, 22Na, 44Ti and 26Al. Recalculated to 18 November 2016 and assuming average EH chondrite density and composition, 48V was 43.0 (+7.8,-5.2), 22Na was 60.8 (+8.1,-4.6) dpm/kg and 26Al 53.6 (+7.9,-3.4) dpm/kg. The 22Na/26Al activity ratio of 1.1 (+0.2,-0.1) and detected activity of 48V (t1/2=16 d) are consistent with a fall in November 2016. Magnetic susceptibility log χ (× 10-9 m3/kg) = 5.74.

**Classification**: Enstatite chondrite (EH5).

**Specimens**: 173.7 g including one polished thin section and a polished thick section at *UWB*; 17.3 g plus one polished thin section at *NMBE*; remainder with *DPitt*.

**Parkajoki**        67°47’9.4’’N, 23°21’34.8’’E

Norrbottens, Sweden

Find: 2014

Classification: Iron meteorite (IVA)

**History**: Found by Thomas Österberg in 2014 while searching with metal detectors for [Muonionalusta](https://www.lpi.usra.edu/meteor/metbull.php?code=16873) specimens near the stream Parkajoki in Norbotten län, Sweden. The meteorite was purchased by Ewa and Uwe Eger (Space Rocks, Germany) at the mineral show in Sainte-Marie-aux-Mines, France, in 2016.

**Physical characteristics**: Single mass of irregular shape with a light to dark brown weathered exterior.

**Petrography**: (K. Metzler, *IfP*) Octahedrite structure with kamacite and taenite lamellae, together with plessite fields. Large troilite nodules with sizes up to 7x5 cm occur. Apparent band width (µm) of kamacite is 180±100 (50-380; n=16), compared to 400 µm for Muonionalusta (Goldstein 1969; in Meteorite Research, ed. P.M. Millman, Reidel Publishing Company, Dordrecht-Holland).

**Geochemistry**: Mineral compositions and geochemistry: Bulk Ni content is 9.4 wt% (SEM-EDX), compared to 8.4 wt% in Muonionalusta (Goldstein 1969). Bulk trace element concentration was determined on 3 samples by dissolution ICP-MS (M. Matthes, *IfP*). Additionally, 3 samples from the Muonionalusta (Muo) meteorite were analyzed by the same method for comparison (shown in parenthesis): Co wt% 0.42-0.43 (Muo 0.37-0.40). Following data in ppm: Cu 248-254 (Muo 109-122); Ge 0.16-0.19 (Muo 0.12-0.16); W 0.26-0.36 (Muo 0.31-0.37); Ga 1.50-1.52 (Muo 1.93-2.23); As 7.1-7.5 (Muo 10.3-11.2); Mo 4.2-4.4 (Muo 5.5-6.1); Ru 1.53-1.69 (Muo 2.40-2.66); Ir 0.54-0.76 (Muo 1.08-1.17); Pt 2.25-2.48 (Muo 3.53-3.93).

**Classification**: Structure and bulk chemical data are consistent with a IVA iron meteorite (finest to fine octahedrite). Obvious chemical and structural differences to the Muonionalusta meteorite.

**Pinawa**        50°12.746’N, 95°57.058’W

Manitoba, Canada

Find: 1998 or 1999

Classification: Iron meteorite (IAB-MG)

**History**: The meteorite was found in 1998 or 1999 by Derek Erstelle in a probable moraine deposit approximately 8.5 km NW of the town of Pinawa. It was purchased in 2017 by R. Hennie.

**Physical characteristics**: (S. Kissin, *LHU*) The meteorite has a lenticular shape, and a red-brown exterior. Oxidation has exposed the kamacite lamellae, although it has not affected the interior of the specimen except along some major fractures.

**Petrography**: (S. Kissin, *LHU*) The meteorite is an octahedrite, although its kamacite lamellae have been stretched and likely do not preserve original bandwidths. The bandwidth is greater than 1 mm in general, so the meteorite is likely a coarse octahedrite. Neumann lines are irregularly distributed and seem to be present only in areas where there is less mechanical deformation. There is good preservation of taenite lamellae, although the taenite bands are very narrow. Net plessite is sporadic, and it, as in the case of the taenite bands, is deformed. Globular schreibersite is fairly abundant, and although it displays fracturing, the rounded forms do not show evidence of deformation, with kamacite lamellae wrapping around the schreibersite.

**Geochemistry**: (S. Kissin, *LHU*) Ni=75.7, Co=3.75 (both mg/g); As=11.7, Au=1.52, Cu=139, Ga=65, Ge=200, Ir=1.59, Pt=8.3, Sb=0.17, W=0.96 (all μg/g). Obtained by neutron activation analysis (Actlabs).

**Classification**: (S. Kissin, *LHU*) IAB-MG, probable coarse octahedrite, with evidence of mechanical deformation.

**Specimens**: Type specimen consisting of one specimen of 48.6 g and ~2 g of fragments at *UAb*. Main mass with the owner.

**Plainview (f)**        34.089°N, 101.84°W

Texas, USA

Find: 1950

Classification: Ordinary chondrite (H4-5)

**History**: Found in 1950 by Mr. M. Gibson (now deceased) while plowing his field located 1.5 miles northeast of Hale Center, Texas. The specimen lay for many years in a flower garden until it was purchased from Mrs. Gibson by an anonymous local citizen. Mr. Alan Standen of Austin, Texas, a friend of the current owner, arranged for the meteorite to be tested and classified.

**Physical characteristics**: A single brown stone (10.251 kg) lacking fusion crust. The interior exhibits variable ° of weathering of primary metal and staining of silicates.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed mainly of type 5 clasts containing sparse chondrules, but some type 4 clasts containing fairly well-formed chondrules and less equilibrated pyroxenes are also present. Both clasts and the sparse matrix contain relatively abundant altered metal, chlorapatite and merrillite. Weathering grade varies from W1 to W3.

**Geochemistry**: Olivine (Fa18.6-19.4, N = 5), orthopyroxene (Fs16.0-16.5Wo1.5-1.4; magnesian core Fs10.7Wo0.5; N = 3), subcalcic augite (Fs11.8Wo33.0), augite (Fs6.9Wo44.3).

**Classification**: Ordinary chondrite (H4-5 breccia). This specimen may be paired with other similar H chondrite stones named Plainview found in the same region.

**Specimens**: 46.1 g plus one polished thin section at *UWB*; remainder with anonymous owner.

**Quitovac**        31.426°N, 112.696°W

Sonora, Mexico

Find: 12 Oct 2017

Classification: Ordinary chondrite (L5)

**History**: A team searching for gold with metal detectors near the village of Quitovac, Mexico, found five stones buried at shallow depth. All stones were subsequently acquired by Jason Phillips.

**Physical characteristics**: The stones (total weight 9112 g) are an overall reddish-brown color. Partial coatings that may represent weathered fusion crust are present on some of them, and interiors exhibit some fresh metal.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of clasts with sparse chondrules in a recrystallized matrix containing altered metal, merrillite and chlorapatite.

**Geochemistry**: Olivine (Fa24.9-26.4, N = 3), orthopyroxene (Fs21.0-23.4Wo1.8-1.4, N = 3),clinopyroxene (Fs8.5-8.7Wo43.9-43.8). Magnetic susceptibility log χ (× 10-9 m3/kg)=4.54.

**Classification**: Ordinary chondrite (L5 breccia).

**Specimens**: 51 g including one polished thin section at *UWB*; remainder with Mr. J. Phillips.

**Rabt Sbayta 002**        24.241°N, 14.701°W

Rio de Oro, Western Sahara

Find: 2016-Aug

Classification: Lunar meteorite (feldspathic breccia)

**History**: Found by Mbarek Laghfiri and Mohamed Chikh Boy near Gataa Sfar in August 2016 and shortly thereafter. Purchased by Darryl Pitt from a Morrocan dealer in Agadir.

**Physical characteristics**: A single large stone (6371.9 g) lacking fusion crust but with a thin desert patina on exterior surfaces. The fresh interior exhibits pale gray to whitish clasts set in a dark gray, fine grained matrix.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of angular minerals clasts of anorthite, orthopyroxene, olivine, pigeonite, exsolved pigeonite, ilmenite, chromite, fayalite and Ti-chromite in a fine grained, partly vesicular matrix of the same minerals plus troilite and minor barite. Rare quench-textured lithic clasts are present.

**Geochemistry**: Olivine (Fa23.4, FeO/MnO = 64; Fa43.9, FeO/MnO = 100), orthopyroxene (Fs58.6-60.4Wo2.4-1.9, FeO/MnO = 57-72, N = 2), pigeonite (Fs44.6Wo7.9, FeO/MnO = 54; Fs27.8Wo21.3, FeO/MnO = 47), augite host in exsolved pigeonite (Fs20.9Wo38.4, FeO/MnO = 54), fayalite (Fa78.1, FeO/MnO = 81), plagioclase (An96.5-97.2Or0.2, N = 2). Bulk composition (R. Korotev, *WUSL*) INAA of subsamples gave the following mean abundances (in wt.%) FeO 3.5, Na2O 0.37; (in ppm) Sc 7.2, Ni 90, La 1.1, Sm 0.57, Eu 0.82, Yb 0.50, Lu 0.07, Hf 0.35, Th 0.14. Magnetic susceptibility log χ (× 10-9 m3/kg) = 2.49.

**Classification**: Lunar (feldspathic breccia).

**Specimens**: 22.9 g in the form of a single polished slice at *UWB*; remainder with *DPitt*.

**Rabt Sbayta 003**        24.122°N, 14.772°W

Rio de Oro, Western Sahara

Find: 2016 Nov

Classification: Martian meteorite

**History**: Found in the same area as [NWA 7034](https://www.lpi.usra.edu/meteor/metbull.php?code=54831) and paired stones in November 2016, and shortly thereafter purchased by Ben Hoefnagels from a dealer in Taliouine, Morocco.

**Physical characteristics**: A single black, roughly equidimensional stone (20.57 g) with a glossy exterior and some areas of degraded fusion crust with remnant expansion cracks. Small whitish to yellowish-green clasts are visible within a black, fine grained matrix.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Polymict breccia composed mainly of various angular mineral clasts plus rare polymineralic clasts in a finer grained matrix. Mineral clasts include orthopyroxene, labradorite, ilmenite, Ti-bearing magnetite, ulvöspinel, altered pyrite, Na-K feldspar, chlorapatite and rare zircon.

**Geochemistry**: Orthopyroxene (Fs19.6-46.7Wo3.1-4.6, FeO/MnO = 32-41, N = 3), subcalcic augite (Fs27.3-32.6Wo40.4-36.9, FeO/MnO = 15-33, N = 2), plagioclase (An35.3-45.2Or2.8-2.1, N = 2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.48.

**Classification**: Martian (polymict regolith breccia). Paired with [NWA 7034](https://www.lpi.usra.edu/meteor/metbull.php?code=54831), [NWA 7475](https://www.lpi.usra.edu/meteor/metbull.php?code=56132), [NWA 7533](https://www.lpi.usra.edu/meteor/metbull.php?code=56550), [NWA 10922](https://www.lpi.usra.edu/meteor/metbull.php?code=64405) and others from the same area.

**Specimens**: 4.2 g including one polished thin section at *UWB*; main polished endcut mass with Mr. B. Hoefnagels.

**Rabt Sbayta 004**        24.242°N, 14.675°W

Rio de Oro, Western Sahara

Find: 2016 Oct

Classification: Lunar meteorite (feldspathic breccia)

**History**: Found in October 2016 by Oubnaamar Salem in the lunar meteorite strewnfield near Gataa Sfar, and subsequently purchased by Darryl Pitt in December 2016 from a Moroccan dealer.

**Physical characteristics**: The single large stone (15464 g) was found sitting on the desert surface. The exterior is wind-ablated and lacks fusion crust; the fresh interior consists of angular whitish clasts in a dark gray matrix containing sparse small vesicles.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia consisting of angular mineral grains of anorthite, orthopyroxene, pigeonite (some exsolved), augite, olivine, ilmenite, Cr-rich chromite, Ti-chromite, silica polymorph, fayalite, kamacite and troilite in a finer grained matrix of the same minerals. Portions of the matrix are vesicular and minor calcite is present.

**Geochemistry**: Olivine (Fa38.5-84.1, FeO/MnO = 70-86, N = 5), low-Ca pyroxene (Fs32.7-38.9Wo2.2-5.3, FeO/MnO = 58-73, N = 4), augite (Fs8.5-20.3Wo45.7-40.7, FeO/MnO = 70-71, N = 3), plagioclase (An94.6-97.3Or0.4-0.22, N = 3).

**Classification**: Lunar (feldspathic breccia). Likely paired with [NWA 8222](https://www.lpi.usra.edu/meteor/metbull.php?code=59414) and [Rabt Sbayta 002](https://www.lpi.usra.edu/meteor/metbull.php?code=64680) found in the same area.

**Specimens**: 24.4 g in the form of a two polished endcuts at *UWB*; remainder with *DPitt*.

**Rabt Sbayta 005**        24°16’57.6"N, 14°42’53.6"W

Rio de Oro, Western Sahara

Find: 2016 Aug

Classification: Lunar meteorite (feldspathic breccia)

**History**: The four fragments were found on a deflation surface by Salem Ben Amar and Amar Zerwal in August 2016. They were purchased from Mohamed Elguirah by Jean Redelsperger in Tan Tan in September 2016.

**Physical characteristics**: Uncrusted, irregular, dark stones with whitish clasts. Cut surface reveals dark interior with white clasts up to 2 mm.

**Petrography**: Brecciated with lithic and mineral clasts (olivine, pigeonite, plagioclase) in a very fine grained plagioclase matrix. Numerous vesicles with diameter 10-20 μm. are present in the matrix. Accessory minerals include chromite, ilmenite. Rare kamacite.

**Geochemistry**: Olivine Fa33.9±3.3, range Fa31.4-41.2, FeO/MnO = 85.8±9.7 (range 67-98), N=6. Pigeonite Fs40.5±0.8Wo10.2±3.1, FeO/MnO=54.0±6.5 (N=5). Plagioclase An96.5±0.6Ab3.4±0.6Or0.1±0.0(N=4). Chromite Cr#=Cr/(Cr+Al)=0.64-0.67 (N=2). Magnetic susceptibilty log χ (× 10-9 m3/kg) = 2.58.

**Classification**: Lunar (feldspathic breccia). Likely paired with [Rabt Sbayta 002](https://www.lpi.usra.edu/meteor/metbull.php?code=64680) and [Rabt Sbayta 004](https://www.lpi.usra.edu/meteor/metbull.php?code=64993) found in the same area.

**Specimens**: 4.44 g and polished section at *CEREGE*. Main mass with Jean Redelsperger.

**Rabt Sbayta 006**        24.24°N, 14.75°W

Rio de Oro, Western Sahara

Find: 2016

Classification: Lunar meteorite (feldspathic breccia)

**History**: Found in the lunar meteorite strewnfield near Gataa Sfar in 2016. Purchased by Terry Boudreaux from a Moroccan meteorite dealer in 2017.

**Physical characteristics**: Four identical appearing uncrusted pieces found together. A saw cut reveals a fragmental breccia with numerous white feldspathic clasts set in a dark-gray ground mass.

**Petrography**: (C. Agee, *UNM*) This meteorite consists of primarily feldspathic clasts and shock melt with lesser amounts of fragmental pyroxene and olivine.

**Geochemistry**: (C. Agee and B. Ha, *UNM*) olivine Fa45.8±5.7, Fe/Mn=97±8, n=7; pigeonite Fs42.1±7.5Wo6.9±5.2, Fe/Mn=59±6, n=8; high Ca pyroxene Fs28.3±11.7Wo33.7±6.8, Fe/Mn=56±13, n=5; plagioclase An96.1±0.8Ab3.7±0.8Or0.2±1.0, n=6; Shock melt (20 μm defocused electron beam, proxy for bulk meteorite composition): SiO2=43.9±0.3, TiO2=0.13±0.06, Al2O3=33.2±1.9, Cr2O3=0.05±0.04, MgO=2.1±1.2, FeO=2.8±1.4, MnO=0.05±0.02, CaO=18.2±0.9, NiO=0.03±0.04, Na2O=0.39±0.03, K2O=0.03±0.01 (all wt%), n=12.

**Classification**: Lunar feldspathic breccia

**Specimens**: 21.74 g including a probe mount on deposit at *UNM*, *Boudreaux* holds the main mass.

**Rabt Sbayta 007**        24.394°N, 14.123°W

Rio de Oro, Western Sahara

Find: 2016-Aug

Classification: Lunar meteorite (feldspathic breccia)

**History**: Purportedly found NE of Bir Anzarane and purchased by Ben Hoefnagels in February 2017 from a dealer in Ouarzazate, Morocco.

**Physical characteristics**: A single elongate stone (4432 g) exhibiting whitish mineral and lithic clasts in a medium gray, very fine-grained matrix.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of numerous mineral clasts plus some lithic clasts (themselves breccias) in a finer grained matrix. Minerals include anorthite, olivine, orthopyroxene, pigeonite, subcalcic augite, ilmenite, chromite, troilite and taenite.

**Geochemistry**: Olivine (Fa11.0-33.3, FeO/MnO = 71-101, N = 6), orthopyroxene (Fs18.2-19.4Wo4.6-4.1, FeO/MnO = 51-56, N = 2), pigeonite (Fs31.2Wo7.3; Fs48.6Wo5.5; FeO/MnO = 58-61), subcalcic augite (Fs51.7-59.5Wo27.0-29.3, FeO/MnO = 67-72, N = 2), plagioclase (An93.0-95.7Or1.0, N = 2). Bulk composition (R. Korotev, *WUSL*) INAA of subsamples gave the following mean abundances (in wt.%) FeO 4.9, Na2O 0.35; (in ppm) Sc 9.3, Ni 140, La 3.8, Sm 1.83, Eu 0.83, Yb 1.4, Lu 0.20, Hf 1.3, Th 0.63.

**Classification**: Lunar (feldspathic breccia). Although this lunar specimen was found in the same dense collection area as the Rabt Sbayta 002, Rabt Sbayta 004, Rabt Sbayta 005 and Rabt Sbayta 006 stones (but at a different location from Gataa Sfar), it differs from those stones in both petrologic and bulk compositional characteristics and thus is not paired with them (nor with Rabt Sbayta 008).

**Specimens**: 35.1 g including a polished slice at *UWB*; remainder with Mr. B. Hoefnagels.

**Rabt Sbayta 008**        24.166°N, 14.507°W

Rio de Oro, Western Sahara

Find: 2016-Nov

Classification: Lunar meteorite (feldspathic breccia)

**History**: Purportedly found at a location NE of Bir Anzarane and purchased by Ben Hoefnagels in January 2017 from a dealer in Ouarzazate, Morocco.

**Physical characteristics**: A single broken, pale beige-colored, roughly prismatic-shaped stone (229 g) with degraded fusion crust coating three sides.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Leucocratic, clast-rich breccia composed predominantly of anorthite, olivine, pigeonite and subcalcic augite with accessory ilmenite, chromite, troilite and kamacite.

**Geochemistry**: Olivine (Fa24.4-60.5, FeO/MnO = 84-89, N = 3), orthopyroxene (Fs20.6Wo3.2, FeO/MnO = 51), pigeonite (Fs21.29Wo7.7, FeO/MnO = 46), subcalcic augite (Fs21.0Wo23.6; Fs29.5Wo32.1; FeO/MnO = 41-54), plagioclase (An95.6-96.3Or0.2, N = 2).

**Classification**: Lunar (feldspathic breccia). Although this lunar specimen was found in the same dense collection area as the [Rabt Sbayta 002](https://www.lpi.usra.edu/meteor/metbull.php?code=64680), [Rabt Sbayta 004](https://www.lpi.usra.edu/meteor/metbull.php?code=64993), [Rabt Sbayta 005](https://www.lpi.usra.edu/meteor/metbull.php?code=65387) and [Rabt Sbayta 006](https://www.lpi.usra.edu/meteor/metbull.php?code=65716) stones (but at a different location from Gataa Sfar), it differs from those stones in both petrologic and bulk compositional characteristics and thus is not paired with them (nor with [Rabt Sbayta 007](https://www.lpi.usra.edu/meteor/metbull.php?code=65804)).

**Specimens**: 24.3 g including a polished slice at *UWB*; remainder with Mr. B. Hoefnagels.

**Ramlat as Sahmah 517** (RaS 517)        20°08.14’N, 55°36.451’E

Al Wusta, Oman

Find: 12 Feb 2015

Classification: Ureilite

**History**: A single stone was found during a search for meteorites.

**Physical characteristics**: Greenish dark brown stone with well preserved fusion crust.

**Petrography**: (Å. Rosén, *Bern*, B. Hofmann, *NMBE*, E. Gnos, *MHNGE*): The stone consists mainly of olivine, augite and low-Ca pyroxene (with inclusions of augite and olivine). The stone has a characteristic ureilitic texture. Olivine has reduced Fe-poor rims with minute inclusions of Fe metal. Metal at grain boundaries is only partly weathered. Carbon platelets (to 0.9 mm length) consist of dominant graphite and minor diamond. Few large (to 1.7 mm) skeletal zonated chromite grains are surrounded by a thin rim of silica- and aluminium-rich glass containing idiomorphic chromite (sub-micron to 20 μm), the small grains being concentrated at the border to the surrounding silicates. Thin glass rims also surround matrix silicates in association with secondary pyroxene.

**Geochemistry**: (Å. Rosén, *Bern*) Olivine cores Fa22.7±0.2, Fe/Mn=46±1, Cr2O3=0.36±0.03 wt% (N = 33), reduced rims have Fa>4. Augite Fs12.2±0.2, Wo34.2±0.5(N = 22). Low Ca pyroxene Fs18.9±0.2, Wo4.1±0.1(N = 10). Mean reduced chromite composition is Cr2O3=55.9, Al2O3=19.8, FeOtotal=3.9, MnO=0.6, MgO=19.6, TiO2=0.7 wt% (N = 8), less reduced subgrain has composition Cr2O3=50.6, Al2O3=18.4, FeOtotal=19.0, MnO=0.2, MgO=9.8, TiO2=0.7 wt% (N = 1).

**Classification**: Based on texture and mineralogy this is an augite-bearing, monomict ureilite. Low weathering.

**Specimens**: All at *NMBE*

**Ramlat Fasad 028**        18°40.478’N, 53°09.797’E

Zufar, Oman

Find: 05.02.15

Classification: Ordinary chondrite (L3)

**History**: A single stone was found during a search for meteorites.

**Physical characteristics**: Dark-brown single stone, wind-ablated with protruding chondrules, partly preserved fusion crust.

**Petrography**: (B. Hofmann, *NMBE*, Å. Rosén, *Bern* and E. Gnos, *MHNGE*) Typical chondritic texture with very well defined chondrules. Mean apparent chondrule size 0.78±0.40 mm (N = 103).

**Geochemistry**: (Å. Rosén, *Bern*) Olivine compositions are Fa23.6±7.2, range Fa7.0-41.1(N = 64). Fa by XRD is 27.5. Orthopyroxene compositions are Fs14.9±8.1Wo1.4±1.3, range Fs2.6-29.1Wo2-4.5(N = 37). Cathodoluminescence (E. Gnos, *MHNGE*) shows dominant blue colors, with some chondrules showing red and yellow luminescence. Olivines in red-yellow luminescent chondrules have Fa0.5-5.1(N = 68).

**Classification**: Based on mineral compositions and chondrule size this is an L chondrite. The petrologic type is ~3.5-3.7 based on silicate heterogeneity but the sample contains some lower petrographic grade material. Shock grade S1, weathering W3.

**Specimens**: All at *NMBE*

**Ramlat Fasad 029**        18°44.318’N, 53°13.547’E

Zufar, Oman

Find: 05 Feb 2015

Classification: Ureilite

**History**: A single stone was found during a search for meteorites.

**Physical characteristics**: Brownish, wind-ablated stone, no fusion crust preserved.

**Petrography**: (B. Hofmann, *NMBE*, Å. Rosén, *Bern*, E. Gnos, *MHNGE*): The stone consists of dominant olivine and minor pigeonite (~3:1) with rare augite inclusions. Both olivine and pyroxene are, with few exceptions, recrystallized, showing a granular texture with mosaicism, having an average grain size of 50 μm (N = 160). The shape of primary silicate grains is discernable. Recrystallized primary olivine grains preserve reduced Fe-poor rims with minute inclusions of Fe metal, mostly oxidized due to weathering. Larger metal at grain boundaries is completely weathered. Carbon platelets (to 1 mm length) consist of dominant diamond and some graphite.

**Geochemistry**: (Å. Rosén, *Bern*) Non-reduced olivines are Fa23.3±2.2, Cr2O3 0.64±0.13 wt%, (N = 81) remnant reduced areas are Fa9.7±3.2(N = 11). Pigeonite has Fs11.7±1.4Wo9.2±2.5, Cr2O3 1.32±0.10 wt% (N = 41).

**Classification**: Based on texture and mineralogy this is a strongly shocked and annealed, unbrecciated ureilite. Strongly weathered.

**Specimens**: All at *NMBE*

**Ramlat Fasad 055**        18°35.301’, 53°03.392’

Zufar, Oman

Find: 07 Feb 15

Classification: Ordinary chondrite (LL6)

**Geochemistry**: Oxygen isotopes: (R. Greenwood, *OU*) δ18O=5.87, δ17O=4.31, Δ17O= 1.26 (all permil).

**Ramlat Fasad 056**        18°42.01’N, 53°25.13’E

Zufar, Oman

Find: 2009 Apr 03

Classification: Relict meteorite (Relict iron)

**History**: In 2009, a brown lump was discovered at a sabha shore at the foot of a dune in the Ramlat Fasad area, about 55 km NNW of Shisr.

**Physical characteristics**: Fragile, lamellar, fissured, brown lump, stained light brown and light blue-green. The brown lamellae are 1.0-1.5 mm wide.

**Petrography**: (R. Bartoschewitz, *Bart*) Microscopic examination of a polished section shows red-brown matrix with a few broken grains with metallic luster and rare, tiny metal specks.

**Geochemistry**: (R. Bartoschewitz, *Bart*, P. Appel and B. Mader, *Kiel*) Oxidized matrix: Fe 43±7, Ni 8±4, Co 0.5, P 0.7, S 0.1 wt.% (n=14). Kamacite: Ni 6.7, Co 0.8, P 0.1 wt.-% (n=2). Phosphide: Fe 49±5, Ni 39±4, P 12±1, Co 0.2 wt.% (n=7).

**Classification**: (R. Bartoschewitz, *Bart*): relict iron (medium octahedrite)

**Specimens**: Main mass *Bart*; type specimen of 21 g *Kiel*.

**Sahara 98012**

Sahara

Find: 1998

Classification: Ordinary chondrite (L3)

**History**: Sample was found 1998 by the *Labenne*-group. The coordinates are unknown.

**Petrography**: Shock vein-bearing rock having a chondritic texture with abundant chondrules, typically about 500 µm in apparent size

**Geochemistry**: Olivine compositions are Fa18.9-25.3(mean 23.2±1.6, n=18), pyroxene compositions are Fs10.8-26.4Wo0.5-3.5(mean Fs19.5±3.7Wo1.7±0.8, n=18

**Classification**: L3 chondrite based on mineral compositions and chondrule size. Moderadely shocked (S24), weathering degree: W1.

**Sahara 98014**

Sahara

Find: 1998

Classification: Ordinary chondrite (H3-6)

**History**: Sample was found 1998 by the *Labenne*-group. The coordinates are unknown.

**Petrography**: The sample is a breccia and contains fragments of different petrologic type, most fragments are recrystallized (types 5 and 6) and some are unequilibrated.

**Geochemistry**: Olivine compositions are Fa9.-0-21.4(mean 16.7±4.3, n=16), pyroxene compositions are Fs10.3-28.5Wo0.2-5.7(mean Fs16.2±3.8Wo1.8±1.5, n=17). The equilibrated clasts have olivine compositions of Fa18.3±0.4(n=9) and pyroxene compositions of Fs15.8±0.4Wo1.2±0.5(n=9).

**Classification**: Brecciated H chondrite (H3-6) based on mineral compositions and chondrule size. Very weakly shocked (S2), weathering degree: W2

**Sahara 98048**

Sahara

Find: 1998

Classification: Ordinary chondrite (H3-6)

**History**: Sample was found 1998 by the *Labenne*-group. The coordinates are unknown.

**Petrography**: The sample is a breccia and contains fragments of different petrologic type, most fragments are recrystallized (types 5 and 6) and some are unequilibrated.

**Geochemistry**: Olivine compositions are Fa15.8-19.9(mean 17.3±1.4, n=6), pyroxene compositions are Fs5.7-31.2Wo0.3-1.6(mean Fs16.4±8.2Wo1.2±0.5, n=6). The equilibrated clasts have olivine compositions of Fa17.2±0.2(n=3) and pyroxene compositions of Fs15.5±0.3Wo1.4±0.2(n=3).

**Classification**: Brecciated H chondrite (H3-6) based on mineral compositions and chondrule size. Very weakly shocked (S2), weathering degree: W2

**Sahara 98509**

Sahara

Find: 1998

Classification: Ordinary chondrite (H4)

**History**: Sample was found 1998 by the *Labenne*-group. The coordinates are unknown.

**Petrography**: Chondritic texture with abundant chondrules, typically <400 µm

**Geochemistry**: Olivine compositions are Fa17.2-18.8(mean 17.5±0.4, n=21), pyroxene compositions are Fs10.5-19.9Wo0.2-4.0(mean Fs15.3±0.8Wo1.0±0.9, n=17)

**Classification**: H4 chondrite based on mineral compositions and chondrule size. Very weakly shocked (S2), weathering degree: W2.

**Sahara 98536**

Sahara

Find: 1998

Classification: Ordinary chondrite (H3)

**History**: Sample was found 1998 by the *Labenne*-group. The coordinates are unknown.

**Petrography**: Chondritic texture with abundant chondrules, sometimes brecciated and typically <400 µm in apparent size

**Geochemistry**: Olivine compositions are Fa16.2-21.6(mean 19.7±1.4, n=18), pyroxene compositions are Fs15.1-18.3Wo0.4-1.4(mean Fs16.2±0.8Wo0.9±0.3, n=20

**Classification**: H3 chondrite based on mineral compositions and chondrule size. Very weakly shocked (S2), weathering degree: W2.

**Sahara 98549**

Sahara

Find: 1998

Classification: Ordinary chondrite (H3)

**History**: Sample was found 1998 by the *Labenne* group and te coordinates are unknown.

**Petrography**: Chondritic texture with abundant chondrules, typically <400 μm

**Geochemistry**: Olivine compositions are Fa14.7-19.7(mean Fa18.1±1.2, n=20), pyroxene compositions are Fs4.5-23.4Wo0.1-1.9(mean Fs14.9±4.1Wo0.9±0.5, n=20)

**Classification**: H3 chondrite based on mineral compositions and chondrule size. Very weakly shocked (S2), weathering degree: W3.

**Sahara 98571**

Sahara

Find: 1998

Classification: Ordinary chondrite (H3)

**History**: Sample was found 1998 by the *Labenne* group and the coordinates are unknown.

**Petrography**: Homogeneous chondritic texture with abundant chondrules, typically <400 μm

**Geochemistry**: Olivine compositions are Fa17.2-23.4(mean Fa19.1±1.4, n=29), pyroxene compositions are Fs6.3-22.7Wo0.2-4.1(mean Fs16.6±3.2Wo1.2±0.8, n=30)

**Classification**: H3 chondrite based on mineral compositions and chondrule size. Very weakly shocked (S2), weathering degree: W2.

**Sahara 99362**

Sahara

Find: 1999

Classification: Ordinary chondrite (L5, melt breccia)

**Petrography**: The studied thin section consists of about 70 vol% of fine-grained melt lithology and ~30% of large shock-darkened L-chondrite clasts. Relict chondrules are visible within these large shock-darkened clasts, indicating the occurrence of metamorphosed fragments of about type 5/6. The melt lithology basically consists of a very fine-grained intergrowth of different phases and also contains abundant small fragments of the target rock as well as isolated metal-sulfide assemblages (often rounded). The metal shows only weak effects of terrestrial weathering (W1).

**Geochemistry**: Olivine from the fragments is Fa24.3±0.3(n=5) and low-Ca pyroxene is Fs20.1±0.3Wo2.5±1.1(n=4).

**Sahara 99414**

Sahara

Find: 1999

Classification: Ordinary chondrite (H3-6)

**History**: Sample was found 1999 by the *Labenne* group and the coordinates are unknown.

**Petrography**: The sample is a breccia and contains fragments of different petrologic types; most fragments are recrystallized (types 5 and 6) and some are unequilibrated.

**Geochemistry**: Olivine compositions are Fa7.7-26.2(mean Fa17.9±4.7, n=25), pyroxene compositions are Fs4.1-16.8Wo0.1-2.6(mean Fs15.3±2.9Wo1.1±0.5, n=24). The equilibrated clasts have olivine compositions of Fa18.8±0.5(n=15) and pyroxene compositions of Fs16.4±0.4Wo1.2±0.5(n=14).

**Classification**: Brecciated H chondrite (H3-6) based on mineral compositions and chondrule size. Weakly shocked (S3), weathering degree: W3.

**Sayh al Uhaymir 598** (SaU 598)        20°21.454’N, 56°35.587’E

Al Wusta, Oman

Find: 14 Feb 2014

Classification: Ordinary chondrite (H4, anomalous)

**History**: Found by Edwin Gnos, Beda Hofmann, Thomas Burri, and Marianna Mészáros during a search for meteorites on February 14, 2014.

**Physical characteristics**: Wind-ablated dark brown individual of 939 g plus one fragment of 3.8 g.

**Petrography**: (B. Hofmann, *NMBE* and E. Gnos, *MHNGE*) Mean apparent chondrule size 0.40±0.21 mm (n=163). Metal and troilite are nearly completely oxidized.

**Geochemistry**: (N. Greber, *Bern*) Olivine compositions are Fa14.0±0.2(n=17). Orthopyroxene compositions (n=5) are Fs13.4±1.6Wo0.5±0.2). Fa by XRD 13.4.

**Classification**: Based on Fe-contents in silicates below Fa16/Fs14.5this meteorite is classified as H4-an. Weakly shocked (S2), weathering grade W4.

**Specimens**: All at *NMBE*

**Sericho**        1°5’41.16"N, 39°6’8.30"E

Eastern, Kenya

Find: 2016

Classification: Pallasite

**History**: In 2016, two brothers were searching for their camels and came across several large, dense stones west of the village of Habaswein and south of Sericho, Kenya. There are no rocks in this area, so they decided they were meteorites. They spent several weeks collecting them with engine hoists and moving them to their homes in Habaswein. Though recognized as meteorites in 2016, the masses had been known to camel-herders for decades. One village elder said that as a child, he and his brothers would play on top of the stones. In early January 2017, Michael Farmer received an email showing a photo of “giant pallasite” weighing 107 kg. He traveled to Nairobi and purchased this stone. Two weeks later he returned to Kenya with Moritz Karl and traveled to Habaswein. Here they were shown more than one ton of specimens stacked in the courtyards of two house compounds. To date, more than 2800 kg has been found.

**Physical characteristics**: To date, masses ranging from <1 to 500 kg have been found in a strewnfield >45 km long, starting several km west of Habaswein and south of Sericho in Isiolo County. The smaller pieces were found nearer to Habaswein, but still in Isiolo County. The villagers continue to find pieces, mostly on the surface. The majority of the pieces are >50 kg. The meteorites found on the surface show minimal weathering, with patches of fusion crust on the metal. Most stones are blocky, exhibiting a few broad regmaplypts. Several flight-oriented specimens were found, including a 129 kg and two 16 kg stones.

**Petrography**: Slices from several stones show similar metal/olivine ratio, averaging near 70 areal% olivine and <1 areal % chromite. One 15 × 21 cm slice shows regions with ~95 areal% olivine. Olivine grains are largely rounded, less commonly euhedral, and gemmy green to orange. Grains are typically 0.5 to 1 cm across, though a few range up to 4 cm. One slice shows a 5-cm cruciform-shaped chromite. Metal is dominated by swathing kamacite around the olivine, with pockets of dark-etching plessite. Rare metal-rich regions show well-developed Widmanstätten pattern. Accessory troilite and schreiberstite. No large metal veins or metallic masses have been seen.

**Geochemistry**: (L. Garvie, A. Wittmann, D. Schrader, *ASU*) Olivine Fa12.3±0.1, FeO/MnO=57.4±5.4, Cr2O3=0.03±0.01, n=15; kamacite Ni=7.1±0.6 wt%, Co=0.81±0.02 wt%, P=0.06±0.02 wt%, n=17; and schreibersite (Fe1.51Ni1.45Co0.01)P, n=3.

**Classification**: Pallasite, low weathering.

**Specimens**: 48 g at *ASU*; >1600 kg with Michael Farmer, Thomas *Strope*, and Moritz Karl; 143 g, 129 kg, and 23 kg stones at the Maine Mineral and Gem Museum; 1344 g at *MNHNP* (two stones of 694 and 650 g); another 82 kg with an anonymous owner.

**Serra Pelada**        5°57.135’S, 49°39.238’W

Para, Brazil

Confirmed fall: 2017 June 29

Classification: HED achondrite (Eucrite)

**History**: (A. L. R. Moutinho, D. Rios, M. Cardoso Rocha, W. Carvalho) A fireball appeared over the southeastern region of Pará state, Brazil, on June 29, 2017, around 10:35 local time (UTC-3). It was traveling in an apparent NE to SW direction. Loud detonations were heard in towns including Marabá, Eldorado dos Carajás and Paraopebas. People from these towns thought it could have been an airplane crash. In the the village of Serra Pelada (a famous gold-mining location), some students and a watchman, Mr. Manuel da Silva, of Rita Lima de Souza school heard a series of four to six detonations and a few mins later witnessed a rock falling on a roadside near the school. A smoke trail was observed and also some dust caused by the impact. The rock was broken by the impact, collected and shared among local people just after the fall. Another 5.4 kg piece was witnessed to fall few meters from an electrician while working. This piece was sold to an anonymous buyer. A geologist from Serra Pelada, Marcilio Cardoso Rocha, was contacted, and he made preliminary analysis and sent a sample to *MNRJ* for study and classification.

**Physical characteristics**: Two stones were recovered. The exact weight of the stone that fell neaby the school is hard to predict because it broke during impact and shared among locals. It had approximately 40 cm major axis and around 6 kg. The stone that fell nearby the electrician weighs 5.4 kg and is about 80% fusion crusted showing both primary and secondary crust it measures approximately 25 cm by 12.5 cm by 12 cm.  There is one broken face that measures about four by four inches revealing a fresh non-oxidized interior.

**Petrography**: (M.E. Zucolotto and C.V.N. Villaça, UFRJ) Optical petrographic examination of a thin section shows a brecciated texture with many clasts set in a fine-grained matrix and a fusion crust ~50-200 μm thick. Some clasts contains both ophitic, subophitic texture and are surrounded by pulverized rocks of the same phase. Some clasts are separated by impact shock melt veins. The size of the plagioclase needles and pyroxene varies between the different clasts and exhibit about 700 μm in the coarse-grained clasts and less than 70 μm in the fine-grained clasts. All the different clasts are from the same compositional group, the sample has undergone extensive thermal equilibration with some larger low-Ca pyroxene grains showing coarse exsolution of augite which typifies type 5. Accessory minerals are silica, ilmenite, chromite, troilite, and Fe-metal (low Ni). Mineral grains show the effects of shock as undulatory extinction and mosaicism, some sparse melt pockets and impact melt veins but no maskelynite. Minor phases include ilmenite, with silica, iron sulfide, and Fe,Ni metal. Magnetic susceptibility (A.M.S Gomes and V.M.T.S Barthem, IF/UFRJ):

**Geochemistry**: (A. Tosi, UFRJ and D. Rios, GPA/UFBA) Microprobe examination of a polished mount shows at least six lithologies with a very similar pyroxene and plagioclase composition. Low-Ca pyroxene Fs52.5±2.6Wo11.3±1.7, Fe/Mn 31.8±1, n=37; Ca-rich Pyroxenes Fs31.0±0.5Wo39.4±0.5plagioclase An87.6±5.8Ab12.2±3.4, n=20. (mean value from EMPA with 20 μm beam) SiO2=47.5±0.1, TiO2=0.45±0.15, Al2O3=10.6±0.4, FeO=23.7±1.8, MnO=0.91±0.09, MgO=7.5±1.2, CaO=8.3±1.1, Na2O=0.5±0.1 (all wt%).

**Classification**: Achondrite (eucrite, monomict breccia); medium shock (no maskelynite), no weathering.

**Specimens**: *MNRJ* 50 g; 5.4 kg main mass with anonymous buyer; Andre L. R. Moutinho 1.1 kg; Mendy Ouzillou 2.1 kg; some fragments of the stone that fell nearby the school with anonymous owners.

**Skoura**        31°07’45"N, 6°38’14"W

Souss-Massa, Morocco

Find: 1998 June 18

Classification: HED achondrite (Eucrite)

**Petrography**: Texture is brecciated. Plagioclase (An93-90), pigeonite, augite, ferrosilite, quartz, ilmenite, chromite, troilite, metaric iron, apatite.

**Geochemistry**: Pyroxene: Fs48.1±0.8Wo13.5±0.9(N=6), host phase of exsolution phase: Fs56.9±0.8Wo2.1±0.3(N=8), exsotution lamella: Fs23.7±0.3Wo43.2±0.6(N=10). FeO/MnO of pyroxene: host: 33.7±1.4 (N=24), lamella: 32.7±1.7, bulk: 31.0±1.1.

**Sueilila 003**        24°34’54.00’’N, 14°08’58.72’’W

Rio de Oro, Western Sahara

Purchased: 2016 Aug

Classification: Carbonaceous chondrite (CV3)

**History**: The two stones were found by Mbark Ben Amar and Amar Azerwal. They were bought by Jean Redelsperger from Mohamed Elguirah in Tan Tan in August 2016. These two stones are likely part of ~3.7 kg of carbonaceous chondrite that were found in the area.

**Physical characteristics**: Two black stones without fusion crust. Cut surface reveals large chondrules and small CAIs set in an abundant dark matrix.

**Petrography**: Chondrules (average apparent diameter 740±380 μm, N=34)and irregular CAIs (to 6 mm) set in an abundant fine-grained iron-rich matrix. Opaque phases are mostly sulfides and rare metal and magnetite.

**Geochemistry**: Olivine Fa range 0.3-39.8, average Fa10.1±12.9, PMD 97%, (N=7). Orthopyroxene Fs2.8±1.6Wo1.5±0.5(N=2). Magnetic susceptibility log χ (× 10-9 m3/kg) = 4.29.

**Classification**: Carbonaceous chondrite (CV3, oxidized subgroup). Weathering is low.

**Specimens**: 20 g at *CEREGE*. Main mass with Jean Redelsperger.

**Sueilila 004**        24°42.674’N, 14°02.977’W

Rio de Oro, Western Sahara

Find: 2016 Jul

Classification: Ordinary chondrite (L6)

**History**: The stones were found by Sid Ahmed Bouchama in July 2016. They were bought by Jean Redelsperger from Mohamed Elguirah in September 2016. The meteorite maybe linked to a fall witnessed by sherperds in 2013.

**Physical characteristics**: The fragments are covered with fresh fusion crust. Broken surface show a light grey interior.

**Classification**: L6. Likely paired with [NWA 10889](https://www.lpi.usra.edu/meteor/metbull.php?code=64059).

**Specimens**: 20.5 g at *CEREGE*. Main mass with Jean Redelsperger.

**Tabas 001**        33°39.12’N, 56°59.77’E

Khorasan, Iran

Find: 15 Jan 2016

Classification: Ordinary chondrite (L5)

**History**: The meteorite was found in the desert of Iran by Mr. Zacharchuk and Mr. Kryachko in January 15, 2016.

**Physical characteristics**: The meteorite is broken into 14 pieces. A dark-brownish, partly eroded fusion crust is present.

**Petrography**: The meteorite has brecciated chondritic texture. The main mass (host) composes of chondrules fragments, mineral grains and minor well formed chondrules of 300-900 µm in diameter of BO, RP, PO, PP, POP, rare of C types, troilite (~3 vol%), minor metal FeNi, iron hydroxides, accessory chromite. The main mass contains of ~15 vol% of the angular rock clasts of 5-15 mm in size. Some of them are composed of brecciated chondritic material, similar to that of the host. The clasts of another type are comprised by recrystallized medium-grained aggregates of pyroxene, feldspar (up to 400 µm in size) and olivine, minor troilite and metal grains.

**Geochemistry**: Mineral compositions and geochemistry: the host and fine-grained clasts are composed of olivine Fa24.9±0.3(N=15) and pyroxene Fs20.5±0.1Wo1.5±0.2(N=15); the medium-grained clasts are composed of Fa20.4±0.2(N=15) and Fs17.4±0.2Wo2.6±0.8(N=13).

**Classification**: Based on the texture and composition, the meteorite is classified as ordinary chondrite breccia composed of L5 host with L5 and H7 clasts (L5 polymict breccia).

**Specimens**: A type specimen of 962 g total weight and thin section are on deposit at *Vernad*, the finders hold the main mass.

**Talhat Lihoudi**       24.842°N, 13.952°W

Rio de Oro, Western Sahara

Find: 2016 Aug

Classification: Lunar meteorite (feldspathic breccia)

**History**: Found in Morocco in August 2016 and purchased by Ben Hoefnagels in October 2016 from a dealer in Ouarzazate, Morocco.

**Physical characteristics**: A single gray stone (61.5 g) exhibiting small whitish clasts in a darker matrix.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed of angular mineral clasts of anorthite, olivine, orthopyroxene, pigeonitic pyroxene, augite, Al-chromite, ilmenite, Cr-pleonaste and troilite in a fine grained partly vesicular matrix of the same minerals plus minor secondary barite, calcite and gypsum.

**Geochemistry**: Olivine (Fa10.9-86.7, FeO/MnO = 64-90, N = 4), low-Ca pyroxene (Fs18.9-45.4Wo5.4-2.9, FeO/MnO = 41-56, N = 3), augite (Fs14.0-19.1Wo42.7-41.3, FeO/MnO = 35-46, N = 3), anorthite (An96.5Or0.3), labradorite (An56.4Or3.1). Bulk composition (R. Korotev, *WUSL*) INAA of subsamples gave the following mean abundances (in wt.%) FeO 5.4, Na2O 0.38; (in ppm) Sc 10.4, Ni 130, La 5.4, Sm 2.44, Eu 0.85, Yb 1.9, Lu 0.27, Hf 2.0, Th 1.1.

**Classification**: Lunar (feldspathic regolith breccia).

**Specimens**: 12.87 g including one polished slice at *UWB*; main polished endcut mass with Mr. B. Hoefnagels.

**Talsint**       32.5940°N, 3.4475°W

Eastern, Morocco

Find: 2017 March

Classification: Mesosiderite

**History**: The meteorite was found by Nourddine Azelmat.

**Petrography**: (K. Metzler, *IfP*) Achondritic breccia, consisting of monomineralic (low-Ca pyroxene) and polymineralic (low-Ca pyroxene + plagioclase) clasts up to 5 mm, set in a finer grained recrystallized matrix. Metal (mostly kamacite, some taenite and tetrataenite) is evenly dispersed between the clasts with modal amounts of about 10-15 vol%.

**Geochemistry**: Mineral compositions and geochemistry: Mean low-Ca pyroxene composition Fs24.8±0.8Wo2.5±0.5(Fs23.4-25.7Wo1.6-3.5); Fe/Mn 28±3; n=13. Plagioclase composition An92.4±2.2(An90.0-95.2); n=8. Accessories are merrillite, troilite, and schreibersite.

**Classification**: Mesosiderite, based on texture, mineral paragenesis and mineral chemistry.

**Tazzarine**        30°35’11"N, 5°23’36"W

Souss-Massa, Morocco

Find: 1998 June 13

Classification: HED achondrite (Eucrite)

**Petrography**: Texture is brecciated and basaltic. Plagioclase (An: 93-69), K-feldspar (Or99-95), pigeonite, augite, ferrosilite, quartz, tridymite, ilmenite, chromite, troilite, apatite, zircon

**Geochemistry**: Pyroxene: Fs51.1±6.6Wo15.5±8.3(N=14), host pyroxene Fs61.6±0.9Wo1.9±0.3(N=24) and exsotution lamella: Fs27.1±1.0Wo43.0±1.1(N=15). FeO/MnO of pyroxene: host: 33.7±1.4 (N=24), lamella: 32.7±1.7, bulk: 31.0±1.1

**Tichit 001**        18°26.258’N, 10°20.587’W

Tagant, Mauritania

Find: 12 May 2014

Classification: Ordinary chondrite (H5)

**History**: A main mass of 66 kg plus less than 2 kg of small fragments was collected from a suspected impact pit.

**Physical characteristics**: The cuboid main mass shows elongated regmaglypts with remnant fusion crust on two sides. The other sides represent fractured surfaces coated with a dark brown desert patina.

**Petrography**: (B. Hofmann, *NMBE*): Homogeneous chondritic texture. Mean size of plagioclase grains is 5-10 μm. Metallic iron is partly weathered (~40%).

**Geochemistry**: (Å. Rosén, *Bern* and B. Hofmann, *NMBE*) Olivine compositions (N=19) are Fa17.6±1.4(Fa17.1by XRD), pyroxene compositions (n=10) are Fs15.7±1.1Wo1.0±0.2.

**Classification**: Ordinary chondrite (H5), shock stage S2, low weathering (W2).

**Specimens**: 36.1 g plus polished thin section at *NMBE*, 240.0 g with Svend Buhl, main mass: Cheikhalhoussein Toueirjenne.

**Tichiya**        24.244°N, 13.308°W

(Northwest Africa)

Purchased: 2016 Sep

Classification: Lunar meteorite (feldspathic breccia)

**History**: Two similar stones were found about 90 m apart at a location called Tayertand subsequently purchased by *DPitt* in September 2016 from a dealer in Ouarzazate, Morocco.

**Physical characteristics**: Two identical dark stones (total weight 9354 g) lacking fusion crust, but with a shiny exterior patina. The fresh interior is very dark and mostly fine grained, but some larger, diffuse beige-colored clasts are visible.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Breccia composed predominantly of mineral clasts of anorthite, olivine, exsolved pigeonite, ilmenite, chromite, Cr-ulvöspinel, silica polymorph, troilite, baddeleyite and kamacite, plus some basalt clasts and glass fragments, in a finer grained matrix.

**Geochemistry**: Olivine (Fa4.6-56.0, FeO/MnO = 81-93, N = 4), orthopyroxene (Fs39.2Wo1.9, FeO/MnO = 59), pigeonite (Fs23.0Wo9.2, FeO/MnO = 43; Fs41.1Wo15.2, FeO/MnO = 55), subcalcic augite (Fs23.2-32.9Wo33.2-33.9, FeO/MnO = 43-47, N = 2), plagioclase (An94.8-95.9Or0.4-0.6; An58.4Or2.0; N = 3).

**Classification**: Lunar (feldspathic breccia).

**Specimens**: 20.4 g including one polished thin section at *UWB*; remainder with *DPitt*.

**Tindouf 005**        27º21’37.2’’N, 7º45’11.0’’W

Tindouf, Algeria

Find: 17 Apr 2013

Classification: HED achondrite (Eucrite, polymict)

**History**: On April 17, 2013, Mulay Ahmed found three stones near to the secondary school "12 de Octubre" in the Saharawi refugee camps in Tindouf, Algeria. The main stone was recognized as a possible achondrite specimen by meteorite collector José Antonio Sanchez Santana.

**Physical characteristics**: Three pieces of 126, 8 and 2 g. Irregular exterior, no fusion crust. A saw cut reveals a polymict breccia with numerous fragmental light and dark clasts.

**Petrography**: (J. Llorca, *UPC*). The meteorite is a microbreccia of clasts in a semi-opaque, dark-brown, microcrystalline, impact-melt matrix. The matrix is heterogeneous and is composed of mono and polymineralic fragments. Clast/matrix ratio is approximately 70/30. The larger clasts (maximum dimension 4 mm) are mainly of anorthositic and ophitic basalt lithologies; many have been shocked and partly granulated. The smaller clasts (minimum dimension less than 0.1 mm) are individual mineral grains (mainly pyroxene and plagioclase). Minerals are anorthite, pigeonite and augite (some with fine exsolution lamellae). Accessory minerals are ilmenite, silica polymorph and Al-Ti-bearing chromite. The section is notable for the absence of olivine.

**Geochemistry**: (R. Pablo Lozano, *IGME*). Microprobe analyses show plagioclase ranges from An94-96with a mean of An95.4±0.5(n=23). Pyroxene is variable in composition: pigeonite (Fs53-59Wo2-11; Fe/Mn=28-42) with a mean of Fs57.1±0.3(n=15) and augite (Fs24-28Wo41-45; Fe/Mn=28-39) with a mean of Fs25.8±0.9(n=12). Pigeonite and augite grains have Fe/(Fe+Mg)=0.647–0.780 with Ti/(Ti+Cr)=0.35–0.98. Chromite has Cr/(Cr+Al)=0.90. Impact melt glassy matrix composition is SiO2=49.49, Al2O3=17.05, FeO=13.33, MnO=0.18, MgO=5.09, CaO=12.56, Na2O=0.82, K2O=0.07, TiO2=0.49, Cr2O3=0.27 and P2O5= 0.04 (all in wt.%). Bulk chemistry (J. Reyes, *IGME*). We used 0.5 grams of sample for analysis. XRF of subsample gave abundances of (in wt.%): SiO2=46.17, TiO2=0.55, Al2O3=12.47, Fe2O3=20.51, MgO=6,38, CaO=10.72 and K2O<0.10. Na2O= 0.43 wt.% by AAS. Trace elements were measured with ICP-MS (all in ppm): Be=0.25, V=49.1, Cr=1001, Co=8.65, Ni=26.4, Cu=13, Zn=21.3, As=0.72, Se=2.77, Mo<0.5, Ag<0.1, Cd=2.61, Sb=0.38, Ba=1090, Tl<0.1, Pb<2, Th=0.33 and U=0.22. Oxygen isotopes (R. Greenwood, *OU*). δ17O=1.89; δ18O=4.05; Δ17O=-0.21 (all values in ‰).

**Classification** (R. Pablo Lozano, *IGME*). Achondrite, polymict eucrite. Terrestrial weathering is moderate. Tindouf 005 is similar to [Dhofar 1626](https://www.lpi.usra.edu/meteor/metbull.php?code=54491) but the first one has fewer anorthosites than the second one and the exolution lamellaes are quite frequent in Tindouf 005.

**Specimens**. Type specimen (16.9 g), two co-type specimens (1.8 + 1.3 g) and a probe mount are on deposit at Museo Geominero (*IGME*). A thin section is on deposit at *UPC*. José Antonio Sánchez Santana holds the main mass.

**Touat 003**        27°21.617’N, 0°07.017’W

Adrar, Algeria

Find: 1 Nov 2006

Classification: Ordinary chondrite (LL6)

**History**: Found by shepherd Mohamed Abdulaziz Ould Wahid on an erosion surface between two dunes, 6 km S of Al Mahbes, in November 2006.

**Physical characteristics**: The stone of 3579 g is covered with a black fusion crust. The color of the interior is greenish gray with rusty specks.

**Petrography**: (B. Hofmann, *NMBE*, M. Eggimann, *Bern*): Strongly brecciated texture with clasts up to 5 mm (monomict breccia). Only relictic, very weakly delineated chondrules are present. Mean size of plagioclase grains is ~50 μm and ranges up to 150 μm. Iron and troilite grains show signs of minor weathering (W1). Troilite forms small nodules and veinlets. Accessories include chromite and ilmenite.

**Geochemistry**: (Å. Rosén, *Bern* and B. Hofmann, *NMBE*) Olivine compositions (N=19) are Fa29.1±0.4(Fa30.3by XRD), pyroxene compositions (n=13) are Fs25.1±0.5Wo2.40±0.07.

**Classification**: Ordinary chondrite (LL6), shock stage S2, low weathering (W1).

**Specimens**: 33.3 g plus polished thin section at *NMBE*, main mass: Svend Buhl, Hamburg, Germany.

**Tres Irmaos**        14° 7' 1"S,  43° 3' 51"W

Bahia, Brazil

Confirmed fall: 2017

Classification: Ordinary chondrite (L6)

**History**: On May 26, 2017, about 11:30 am local time, a stone fell in the rural area of Palmas de Monte Alto, Bahia, Brazil. It was a clear sunny day; the residents heard some loud detonations, but thought it might be from a train line construction or a quarry. Mrs. Euzani Pais also heard a whistle and the sound of something hitting the soil. She went to the door and saw a small sand swirl. Her daughter and granddaughter, Sirlene da Silva Pais and Márcia Eduarda Pais, looked around and found a pit on the farm’s sandy road, with a black stone about 6 m away. A history professor, Nilton A. Azevedo, became aware of the fact and, with a broadcaster, published a video on the Internet. Andre L. R. Moutinho, M. E. Zucolotto (*MNRJ*) and Wilton Carvalho (GPA/UFBA leaded by Debora Rios) went to the site, certified the authenticity of the meteorite and purchased it in a consortium with the City Mayor on June 2.

**Physical characteristics**: Single stone with dimensions 9 × 6 × 5 cm. Nearly completely covered by fusion crust with thickeness of 0.2-1 mm. On one edge, a piece of approx. 7 × 4 cm was sawed off, exposing the light-gray interior.

**Petrography**: (M. E. Zucolotto, *MNRJ* and C. Villaça, IGEO/UFRJ) Polished thin and microprobe sections show a high degree of recrystallization of the matrix with few recognizable chondrules. Plagioclase grains are abundant and exceed 50 μm in size. Metal grains include kamacite, zoned taenite and zoneless plessite. Monocrystalline chromite. The presence of melt pockets in addiction to irregular fractures in olivine and undulatory extinction of olivine and plagioclase indicate a shock stage of S3. Some thin veins cross the meteorite. No weathering products were observed.

**Geochemistry**: Electron microprobe analysis yielded: olivine Fa25.5±0.7(Fa24.7-27.4; n=21), pyroxene Fs21.6±0.4Wo1.5±0.7(Fs21.1-22.6Wo1.0-3.2; n=18).

**Classification**: Ordinary chondrite (L6), shock stage S3, no weathering (W0).

**Specimens**: Palmas de Monte Alto city: 450 g, *MNRJ* : 50 g.

**Uakit**        55°29’47.50"N, 113°33’47.98"E

Respublika Buryatiya, Russia

Find: summer 2016

Classification: Iron meteorite (IIAB)

**History**: The meteorite was found in the summer of 2015 by a gold prospector group during excavation on a river terrace (stream Mukhtunnyi, left feeder of the Uakit River) 4 km west of the Uakit settlement (Baunt Evenk district, Respublika Buryatiya). At present, one sample (~4 kg) of meteorite was identified. However, information about the discovery of a larger meteorite mass (~50x50 cm) is known among prospectors around Uakit. The date of fall is unknown.

**Physical characteristics**: The 3.96 kg mass is oval (10 × 10 × 7 cm) with brown to yellow-brown exterior.

**Petrography**: Classification (G.S. Ripp, BGI, Victor V. Sharygin, *SIGM*). Polished and then etched surfaces indicate large (~2 cm) kamacite crystals and show no Widmannstatten pattern; Neumann lines are evident. Weathering and fusion crusts are less than 1 mm thick. Sometimes they extend together along some fractures, but their abundance is low. The meteorite contains kamacite (>98 vol.%), schreibersite (rhabdite), nickelphosphide, taenite, cohenite, daubreelite, kalininite, troilite, carlsbergite, sphalerite, phase VN, cooper, awaruite-nickel, Ni-rich magnetite, pentlandite, heazlewoodite, Ni-rich goethite and other Fe-hydroxides (sometimes with Cl). Cohenite occurs locally (near exterior) and forms crystals up to 0.5 mm. Ni-poorer taenite (<33 wt% Ni), Ni-rich kamacite (>6.3 wt% Ni) and nickel phosphide are most common of the cohenite-containing associations. Schreibersite (20-100 μm) and carlsbergite (1-10 μm) crystals are commonly oriented in one direction in the kamacite matrix. Round isolations (up to 100 μm) of daubreelite (± troilite ± VN ± copper) occur rarely. Magnetite, pentlandite, awaruite-nickel and heazlewoodite are related to the fusion crust, whereas goethite and other Fe-hydroxides are weathering products.

**Geochemistry**: Mineral composition and Geochemistry: Chemistry of the main metals (EMPA-WDS analyses, V.V. Sharygin and E.N. Nigmatulina, *SIGM*): kamacite (N=25; Fe = 93.38±0.56; Ni = 6.18±0.48; Co = 0.49±0.05); taenite (N=13; Fe = 68.19±6.62; Ni = 31.62±6.79; Co = 0.14±0.05); cohenite (N=14; Fe = 91.60±0.31; Ni = 1.59±0.05; Co = 0.07±0.02, all in wt%). Geochemistry for kamacite (LA-ICP-MS data using sample of Sikhote-Alin as a standard, 50 µm beam, A.L. Ragozin, *SIGM* - NSU and V.V. Sharygin, *SIGM*): N=13; Cr = 15-138; Cu = 144-191; V = 0.04-0.52; Zn = 5.0-29.8; Ga = 46-58; Ge = 188-233; As = 4.1-6.1; Mo = 1.7-6.0; Ru = 5.1-18; Rh = 1.6-2.4; Pd = 2.0-2.8; In = 0.003-0.009; Sb = 0.001-0.054; W = 1.6-2.6; Re = 1.4-2.0; Ir =10.3-22.7; Pt = 21.2-33.4; Au = 0.48-0.70 (all in µg/g). Bulk composition of the meteorite (solution ICP-MS data using sample of Sikhote-Alin as a standard, I.V. Nikolaeva, S.V. Palessky and O.A. Kozmenko, *SIGM*): N=2; Ni = 5.47; Co = 0.45 (both in wt%); Si =732-886; P = 989-1063; Cr = 127-139; Cu = 149-294; V = 0.10-0.24; Zn = 6-68; Ga = 49-50; Ge = 203-215; As = 2.4-3.0; Mo = 5.1-5.9; Ru = 18.7; Rh = 2.0; Pd = 1.26-1.40; Sn = 6.9-44; Sb = 0.064-0.10; W = 3.0; Re = 1.67-1.76; Ir <20; Pt = 24; Au = 0.51-0.53 (all in µg/g). The broad variations for some elements in kamacite and bulk are evidenced about their heterogeneous distribution in the meteorite, may be due to local abundance of minor and accessory minerals (cohenite, daubreelite, kalininite, carlsbergite, sphalerite, etc.).

**Classification**: (G.S. Ripp, BGI, Victor V. Sharygin, *SIGM*). Iron, IIAB (with tendency to IIA)

**Specimens**: 70.3 g type specimen (*SIGM*), 18 g cut-off fragments (Mineralogical Museum at BGI), main mass (O.Yu. Korshunov, V.O. Korshunov, Ulan-Ude)

**Watson 019**        30°34’33.3"S, 131°37’19.3"E

South Australia, Australia

Find: 11 Apr 2015

Classification: Ordinary chondrite (L6)

**History**: One stone fragment found broken, face down, by S. Nutku. Sub-sectioned for biology experiment in the field.

**Physical characteristics**: Single orientated stone with full fustion crust on orientated side. Stone appeared to be broken in half.

**Petrography**: (A. Tait, *Monash* U.) Relict chondrules are rare, those that exist have edges that are poorly defined and hard to differentiation from the olivine dominated recrystallized matrix. Relict chondrules types include POP, OP, all others have been recrystallized. Oxidation of FeNi alloys and troilite is minimal (~10%), some grains exhibit halos of oxidation but most do not. Linear veins of FeNi and troilite are seen cross cutting the sample on scales up to <1cm in length, these are on occasion intermixed with silicate cataclasis. These veins are also the regions of most oxidation. Olivine shows conjugate-pairs (shock feature that exhibits 60/120 degree cross cutting lamella in the olivine) and weak mosaicism, plagioclase grains are large (50-100 μm) but do not show the transition to maskelynite.

**Geochemistry**: (A. Tait, *Monash*) EPMA analysis show olivine and pyroxene compositions are uniform: Olivine Fa24.5-25.8, mean = Fa25.1±0.31, n = 17; Low-Ca pyroxene Fs20.6-22.5Wo1.0-1.9, mean = Fs21.2±0.41Wo1.5±0.2, n = 21.

**Classification**: Ordinary Chondrite (L6, S3, W1)

**Specimens**: Main mass and one thin section curated at *Monash*.

**Watson 020**        30°33’49.9"S, 131°37’26.3" E

South Australia, Australia

Find: 11 Apr 2015

Classification: Ordinary chondrite (L5)

**History**: Three broken fragments foundover an area of ~20 m2 by A. Tomkins. Sub-sectioned for biology experiment in the field.

**Physical characteristics**: Three brown fragments with visible, well-formed chondrules on broken surfaces, minor fusion crust.

**Petrography**: (S. Alkemade, *Monash*) Chondrules are readily defined in recrystallised matrix. Chondrule types include BO, RP, PO, PP, POP, C, Poikilitic chondrules. Mineralogy includes olivine crystals olivine, pyroxene, plagioclase, Fe-Ni metal, troilite. Metal and troilite. Olivine displays both sharp and undulose extinction, and irregular fractures. Minimal weathering of the sample has occurred with some metal grains exhibiting minor oxide rims (however most have none), small percentage of troilite is oxidised. No weathering veins are present.

**Geochemistry**: (A. Tait, *Monash*) EPMA analysis show olivine and pyroxene compositions are uniform: Olivine Fa24.9-25.9, mean = Fa25.4±0.3, n = 17; Low-Ca pyroxene Fs20.9-26.0Wo1.2-2.0, mean = Fs21.7±1.1Wo1.6±0.2, n = 19.

**Classification**: Ordinary Chondrite (L5, S1-S2, W1)

**Specimens**: Fragments, Main mass and one thin section curated at *Monash*.

**Watson 022**        30°35’29.2"S, 131°33’49.0"E

South Australia, Australia

Find: 12 Apr 2015

Classification: Ordinary chondrite (L6)

**History**: Single stone found among limestone gibber by A. Tomkins. Sub-sectioned for biology experiment in the field.

**Physical characteristics**: A black-brown oriented individual stone with subtle roll-over lip over the broken back face.

**Petrography**: (S. Alkemade, *Monash*) Poorly defined chondrules with indistinct edges reside in fine- to coarse-grained matrix. Chondule types include GOP, POP, BO, RP, PO, Poikilitic. Mineralogy consists of olivine, pyroxene, plagioclase, minor Fe-Ni metal and troilite. Strong shock features are observed. Olivine and pyroxene display undulose and weak mosaic extinction show planar lamellae. An isotropic pseudotachylite vein cross cuts the sample and numerous sulfide droplets reside in opaque shock viens and melt pockets. Moderate weathering of the sample has occurred with troilite ~60% oxidized (Fe-Ni metal rare in sample).

**Geochemistry**: (A. Tait, *Monash*) EPMA analysis show olivine and pyroxene compositions are uniform: Olivine Fa25.0-26.1, mean = Fa25.6±0.3, n = 17; Low-Ca pyroxene Fs20.8-24.6Wo1.2-2.1, mean = Fs21.7±0.8Wo1.6±0.2, n = 22.

**Classification**: Ordinary Chondrite (L6, S4, W2)

**Specimens**: Main mass and one thin section curated at *Monash*.

**Xincheng**        36°10.445’N, 103°25.60’E

Gansu, China

Find: 2015-7-26

Classification: Ordinary chondrite (L3)

**History**: Found by Xing Baoyu in July 26, 2015, in the Gobi desert close to Xincheng town, Lanzhou city.

**Petrography**: The thin section exhibits abundant well-defined chondrules (up to 1.2 mm) of different kinds, such as PO, PP, POP, BO, and minor RP. Interstitial glass is observed within some barred and porphyritic chondrules. The matrix is fine-grained silicates with minor metal, troilite and Fe-oxides. Mineral and chondrule clasts are also present. Metallic phases account for ~5 vol%.

**Geochemistry**: Silicate grains are unequilibrated with chemical zoning. Olivine Fa9.3-24.2(Fa21.2±3.6, PMD=11.5%, n=34); low-Ca pyroxene Fs2.2-25.2Wo0-2(Fs12.9±7.9Wo0.7±1.2, Fs PMD=47.4%, n=30); minor pigeonite (Fs16.3-33.4Wo5.9-14.2) and Ca-rich pyroxene (Fs2.1-6.5Wo28.7-42.9). Plagioclase is Na-rich (Ab52.4-95.6An26.4-4.4, average Ab75.8±18.1An15.6±9.2, n=8).

**Classification**: L3 classification based on metal abundance and moderate sized chondrules with varies textures. Petrological type is determined based on unequilibrated silicates (PMD 5%).

**Specimens**: 690 g at *PMO*.

**Yu Wei Liang 001** (YWL 001)        41.250°N, 91.144°E

Xinjiang, China

Find: 2016 Dec 16

Classification: Ordinary chondrite (L4-6)

**History**: More than 90 pieces were found by a Chen Peng Li and Zhao Yu Xian on December 6, 2016, near Ruoqiang, Xinjing, China.

**Petrography**: (A. Irving and S. Kuehner, *UWS*) Equilibrated breccia composed of clasts with well-formed chondrules (apparent diameter 500±300 μm) as well as type 5 and type 6 clasts in a recrystallized matrix containing stained kamacite and chlorapatite.

**Geochemistry**: Olivine (Fa24.1-24.9, N = 3), orthopyroxene (Fs20.0-20.1Wo1.6-1.5, N = 3), clinopyroxene (Fs7.1-7.4Wo46.4-45.4, N = 2).

**Classification**: Ordinary chondrite (L4-6).

**Specimens**: 129.8 g including one polished thin section at *UWB*; remaining material with Chen Peng Li.

**4. New Dense Collection Areas (DCA):**

The following 28 Dense Collection Areas, listed by alphabetical order of country, have been approved in 2017.

Algeria: Ouargla

Chile: Calate, Coya Sur

China: Yu Wei Liang

Egypt: Birkat Aghurmi, Great Sand Sea (reconfiguration)

Iran: Chadormalou, Lut-e-Zangi Ahmad, Naybandan, Rafsanjan, Tabas

Libya: Al Khuwaymat, Gheriat, Jabal Zaltan, Maghidet

Mauritania: Tichit

Morocco: Aydar, Errachidia, Talhraicht, Talsint, Tazzarine, Tisserdmine

Saudi Arabia: Ad-Dammam

Western Sahara / Morocco: As Saquia Al Hamra, Awsserd, Chwichiya, Talhat Lihoudi, Tichiya

Two DCAs have been approved for Mars: Aeolis Mons, Aeolis Palus

**5. Listing of institutes and collections**

An up-to-date index of collections and approved repositories (next to a green check mark) cited in the Meteorite Bulletin can be found here:

https://www.lpi.usra.edu/meteor/MetBullAddresses.php?grp=country

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