

METEORS AND METEORITE RECOVERY IN MOROCCO. H. Chennaoui Aoudjehane^{1,2}, N. Larouci^{1,2}, D. Baratoux³, A. Jambon², F. Colas⁴, Z. Benkhaldoun⁵, S. Bouley⁴, J. Vaubaillon⁴, A. Laroussi¹ and S. Makhoukhi¹, ¹GAIA Laboratory, Faculty of Sciences, Hassan II University Casablanca, BP 5366 Maârif Casablanca Morocco h.chennaoui@fsac.ac.ma, chennaoui_h@yahoo.fr, ²ISTEP Université Pierre et Marie Curie Paris6, Case 110 4 Place Jussieu, Paris5^{ème} France, ³Université de Toulouse, UPS-OMP; IRAP; Toulouse, France, ⁴Observatoire de Paris, Institut de Mécanique Céleste et de Calcul des Ephémérides, Paris, France. ⁵Laboratoire de Physique des Hautes Energies et d'Astrophysique, Université Cadi Ayad, Marrakech, Maroc.

Introduction: Morocco is one of the most important place in the world concerning meteorite collection. Their recovery is essentially done by nomads living and moving across the north-african desert all year-round. Their exact provenance however is not properly recorded and a fraction of these objects eventually come from neighbouring countries. In this context, the Nomenclature Committee of the Meteoritical Society has implemented a nomenclature for all samples from this provenance. Meteorites are given a name in the format NWA xxxx, the acronym NWA standing for Northwest Africa. This situation is a real issue for meteorites in Morocco, and especially for rare objects such as angrites, martian, lunar or HED, for which attribution of a prestigious Moroccan name is not possible. During the last decade, we tried to document all meteorite falls in Morocco [1,2,3,4].

Benguerir: Observed fall on November 22th 2004 at 11:45 am local time in Benguerir area [1], about 50 km north of Marrakech. The fall occurred in a place with many villages. Eyewitnesses reported the sound, like thunder, and the fall occurred near two people. The meteorite was collected immediately after the fall. It was classified as a LL6 ordinary chondrite, shock stage S3 and weathering W0, the TKW (Total Known Weight) is over 100 kg.

Tamdakht: Observed fall on December 20th, 2008 at 22:45 local time by many people from Agadir, Marrakech, Ouarzazate [2]. Searches started in the Tichka area. They were challenged in the season by a thick snow layer covering the high-Atlas mountains. It took about 5 weeks to find the first sample far in the South of Tichka pass, about 20 km North of Ouarzazate. It was classified as an H5 ordinary chondrite, S3, W0; TKW exceeds 300 kg.

Tissint: Observed fall on July 18th, 2011 at 2:00 am local time [3] by some nomads and people from Tata city. The first sample was collected at the end of October, a few weeks after the fall that occurred in the desert in a military area with very few nomads. It was classified as a Martian meteorite [5], the fifth Martian fall ever observed. The meteorite is very fresh which is of great importance for characterization of primary and secondary phases on the red planet. It is strongly shocked, W0, the TKW is at least 20 kg.

Nzala: Observed fall on November 13th, 2009 at 21:00 local time. Many people from SE of Morocco (Erfoud, Errachidia, Errich) observed the meteor and heard three sonic booms. Meteorite hunters searched for weeks but no sample has been found except one report from a dealer about nomads who found two pieces of about 108 and 500 gr (Ordinary chondrite?) There was no submission of these samples to the Nomenclature Committee of the Meteoritical Society.

Breja: Observed fall on May 1st, 2010 at 3:00 am local time East of Zag city. First samples have been recovered on May 9th. Approximate information on the fall place is available, but we have samples. It is an LL6 ordinary chondrite, S3, W0 and TKW about 16 kg.

Taouz/Taghit: Observed meteor on May 19th, 2010 at 4:00 am local time in Taouz area, a few eyewitness reported the high brightness meteor, with three sonic booms and a sound like many rocks fall. At the same date and hour, people from Taghit in Algeria reported a similar observation. No sample has been recovered so far.

Conclusion: All last Moroccan falls have been recovered by hunters that spend a lot of time searching meteorites especially in the desert. As the meteors observations are not precise, the research is not always successful and they can spend weeks and months in the field without recovering the meteorite. The contribution of hunters to the meteoritics science is at present essential as a fall like Tissint would never been recovered without their perseverance. However, this is not a satisfying situation, as falls are not all recovered, and fall coordinates are sometimes lost. Many meteors observation are made every year in Morocco and no samples are recovered. We therefore support the development of a network for meteor observations in Morocco, and in the Mediterranean countries.

References: [1] Chennaoui Aoudjehane et al (2006) *Meteoritics & Planet. Sci.*, 41, Nr 8, 231-238, [2] Chennaoui Aoudjehane et al (2009) *Meteoritics & Planet. Sci.*, 44, Nr 7, A50, Abstract 5038 [3] Garvie et al (2011) Meteoritical Bulletin 99, *Meteoritics & Planet. Sci.*, 46, [4] Chennaoui Aoudjehane (2011) 23rd colloquium of African Geology volume abstracts, p75, [5] Irving et al (2012) 43rd LPSC, Abstract 2510.