

A NEW SHERGOTTITE FROM OMAN, Dhofar 378. Y. Ikeda¹, H. Takeda², M. Kimura¹, and A. Suzuki³.
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Introduction: The new shergottite Dhofar 378 was recently recovered from the Oman desert with fresh black fusion crust. It has a doleritic or microgabbroic texture, and the grain sizes of the main minerals are about 1 mm in length and a few hundreds of microns in width. Dhofar 378 is one of the most ferroan shergottite and may represent a late stage fractional crystallization product of a Martian magma.

Petrology: Dhofar 378 consists mainly of ferroan clinopyroxenes (augite and pigeonite) and plagioclase glass with minor minerals of hedenbergite, pyroxferroite, fayalite, silica, titanomagnetite, ilmenite, sulfide, phosphate, and rhyolitic glass. The modal composition of the stone is; clinopyroxenes (49 vol.%), plagioclase glass (47 vol.%), titanomagnetite including ilmenite (3 vol.%) and phosphates (1 vol.%).

Subcalcic clinopyroxene grains often show an exsolution texture, consisting of augite and pigeonite lamellae, and the widths range from less than 1 μ m up to 10 μ m. The Fe/(Mg+Fe) ratios of clinopyroxenes range from 0.4 to more than 0.9, those of hedenbergite from 0.97 to 0.99, and those of fayalite from 0.87 to 0.97 (Fig. 1).

Plagioclase glass has a quenched rim, which consist mainly of fibrous plagioclase. Anorthite mole contents of the plagioclase glassy core and the quenched plagioclase rim are An₃₃₋₅₃ and An₄₁₋₅₆, respectively. The quenched rim is overlapped in composition to, but slightly more calcic than, the glassy core, and the orthoclase contents of the former (Or₂) are lower than the latter (Or₁₋₁₂). This meteorite experienced an intense impact shock, and the original plagioclase grains transformed to plagioclase melt. After that, the plagioclase melt has quenched fibrous plagioclase at the boundaries between the plagioclase melt and other minerals. These rim completely surrounded the plagioclase melt, which finally quenched as plagioclase glass at the core. The width of the quenched plagioclase rim ranges from a few tens of microns up to one hundred microns.

Titanomagnetite in Dhofar 378 is enriched in TiO₂ (23-26 wt%) and includes ilmenite lamellae, about 10 μ m wide, which exsolved out in the host titanomagnetite. The averaged Ti/(Ti+Fe) atomic ratios of the host titanomagnetite and the exsolved ilmenite are 0.23 and 0.48, respectively. On an assumption that the titanomagnetite consists mainly of magnetite and ulvöspinel end components and that the ilmenite consists mainly of ilmenite and hematite end components, the coexisting pair of titanomagnetite and ilmenite

in the new shergottite gives a temperature of about 900 °C and oxygen fugacity of 10⁻¹⁴ atmosphere, using the iron-titaniferous oxide system [1]. The oxygen fugacity is consistent with the assemblage of fayalite, quartz, and magnetite.

Phospates are mainly whitlockite with minor apatite. The former often occurs as large grains up to a few hundred μ m across and contains 5-6 wt% of FeO and less than 1 wt% of MgO.

Oxygen isotopes; The oxygen isotopic composition of the stone was obtained by T.K.Mayeda and R.N.Clayton. The result is: $\delta O^{18} = +4.46$ permil, and $\delta O^{17} = +2.52$ permil, indicating that this stone is within the range of previously analyzed Martian meteorites.

Pairing; Dhofar 378 was recovered from an area near the Dhofar 019 basaltic shergottite. Dhofar 019 is doleritic, but it may not be a pair with the new shergottite. It is because Dhofar 019 contains olivine grains with Fe/(Mg+Fe) ratios of 0.4-0.75 [2], although Dhofar 378 does not contain such magnesian olivine except for fayalite. Pyroxenes in Dhofar 019 are more magnesian than those in the new shergottite. Dhofar 378 is rather similar in lithology to Northwest Africa 480, but the latter has a homogeneous maskelynite (An₄₆₋₅₀) and lacks in pyroxferroite [3].

References: [1] Buddington, A. F. and Lindley D. H. (1964) Jour. Petr., 5, 310-357. [2] Grossman, J. N. (2000) MAPS, The Meteor. Bull., No. 84, A201. [3] Grossman J. N. (2001) MAPS, The Meteor. Bull., No. 85, A299.

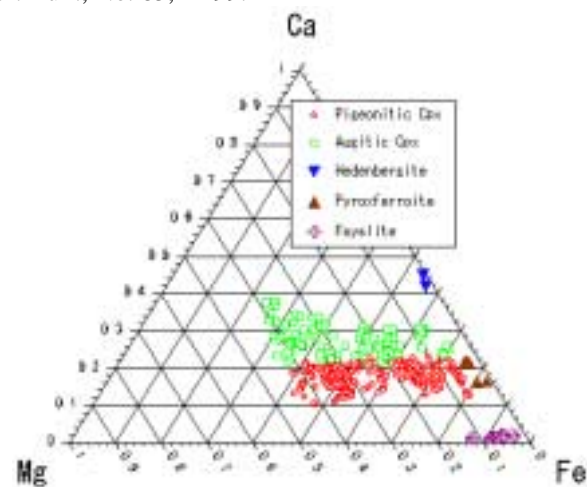


Fig. 1. Clinopyroxene (Clin), Pyroxferroite and Fayalite in Dhofar 378