PETROLOGY AND MINERALOGY OF THE NORTHWEST AFRICA 11005 MESOSIDERITE.

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Introduction: Mesosiderite is one of the two subtypes of stony-iron meteorites, the other being pallasite. Compared with pallasite, mesosiderite has more complicated texture, composition, and petrogenesis[1]. Mesosiderites are polymict breccias composed of roughly equal proportions of metals and silicates. The formation processes of mesosiderites include early differentiation of chondritic asteroids and subsequent magmatism, brecciation of silicates, metal-silicate mixing, and secondary alterations. Lines of evidence have shown that the silicate part of mesosiderites is genetically related to HED meteorites, and the metallic part has similar compositions to IIIAB irons[1-3]. However, when and how the metal-silicate mixing had occurred are still under debate[1-4]. To understand the time and mechanism of metal-silicate mixing that produced mesosiderites, we carried out petrologic and mineralogic studies of the NWA 11005 mesosiderite. Here reported are preliminary results.

Results and Discussion: NWA 11005 was found in Morocco in 2016. The whole rock weighs 1.5 kg and is partially covered by a fusion crust. Modal analyses show that NWA 11005 is composed of ~55 vol% of silicates and ~45 vol% of metals. Micron- to centimeter-sized lithic and mineral clasts are embedded in a matrix composed of fine-grained metal-silicate intergrowths (Fig. 1). Most lithic clasts are basaltic and gabbroic with angular and sharp boundaries. Mineral clasts are dominated by pyroxene and plagioclase. Accessory minerals include olivine, chromite, ilmenite, silica, merrillite, rutile, and baddeleyite. Metal phases are mostly kamacite and taenite, with minor troilite and schreibersite. Metal oxide veins are present along mineral fractures, indicating a moderate degree of terrestrial weathering. Considering the relatively high modal abundance of plagioclase (~40 vol%) and the partially recrystallized texture of matrix, NWA 11005 is classified as a type 2A mesosiderite[1].

Minerals in NWA 11005 have similar chemical compositions to those in other mesosiderites. Pyroxene is mostly orthopyroxene ($Fs_{15.6\text{-}59.9}Wo_{1.2\text{-}4.8}$), with minor pigeonite ($Fs_{27.2\text{-}56.9}Wo_{5.4\text{-}14.5}$) and augite ($Fs_{25.8\text{-}33.6}Wo_{38.6\text{-}40.3}$). Subsolidus exsolution of augite and orthopyroxene lamellae is ubiquitous in gabbroic clasts. Compositions of plagioclase ($An_{80.5\text{-}95.4}$) and olivine ($Fo_{45.5\text{-}87.1}$) vary among different clasts and matrix. The lithology and mineral chemistry of the silicate part of NWA 11005 exhibit high affinities with those of HEDs, consistent with a genetic link between mesosiderites and HEDs[1-2].

We have found numerous merrillite (>100 μm) and baddeleyite (~20 μm) grains in NWA 11005 (Fig. 2), which are good candidates for U-Pb dating. To constrain the formation time of NWA 11005, chronological works are underway.

References: [1] Mittlefehldt D. W. et al. (1998) In *Planetary Materials* (ed. J.J. Papike) pp. 4-140-4-160. [2] Greenwood R. C. et al. (2006) *Science* 313: 1763-1765. [3] Hassanzadeh J. et al. (1990) *Geochimica et Cosmochimica Acta* 54: 3197-3208. [4] Quitté G. et al. (2005) *Geochimica et Cosmochimica Acta* 69: 1321-1332.

Acknowledgement: This work was supported by the National Natural Science Foundation of China (Grant No. 41573060, 41573059), Macau FDCT (005/2017/A1, 119/2017/A3, 0079/2018/A2), and the Minor Planet Foundation of Purple Mountain Observatory.

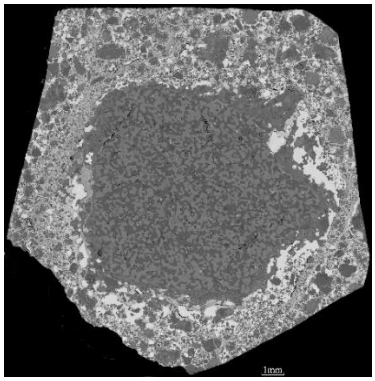

Fig. 1 A BSE image of a polished section of NWA 11005. Note the gabbroic clast (~13×14 mm) in the center.

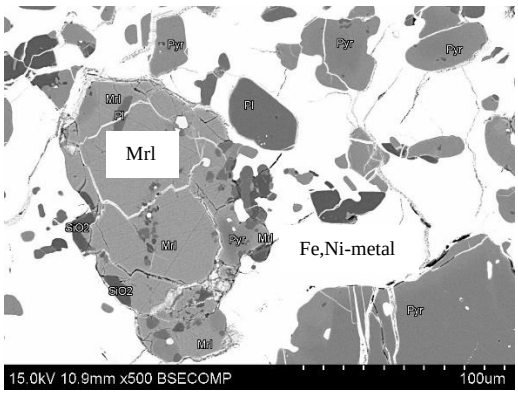

Fig.2 A BSE image of a merrillite (Mrl) grain in the matrix of NWA 11005.