PETROLOGY, MINERALOGY AND IN SITU U-PB DATING OF NORTHWEST AFRICA 11042.

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Introduction: Northwest Africa (NWA) 11042 is a unique ungrouped meteorite. Its mineralogy and petrology closely resemble those of martian meteorites but its oxygen isotopic compositions fall on the L-chondrite fractionation line [1]. Here we present *in situ* U-Pb dating of apatite on the basis of detailed MinPet study to better understand the formation of NWA 11042.

Petrology and Mineralogy: The sections regionally display poikilitic texture of olivine chadacrysts and pyroxene oikocrysts ranging from 0.26 to 1 mm. The rock contains subhedral olivine (43 vol.%), pyroxene (37.5%) and anhedral plagioclase (19.1%). Plagioclase was completely converted to maskelynite. Minor phases (1.9%) include chlorine-apatite, chromite, Fe-sulfide and FeNi metal. Some apatite grains are associated with melt pockets. Melt inclusions in olivine phenocrysts are composed of melt glass as well as mineral assemblages such as dentric pyroxene and phosphate. Glass within inclusions has a higher K_2O content (up to 1.24 wt%) relative to maskelynite. Vermicular chromite grains associated with pyroxenes occur at olivine grain boundaries.

Major silicates are well equilibrated: olivine $Fa_{25.1\pm0.8}$ (molar Fe/Mn=50.6±3.6); low-Ca pyroxene $Fs_{20.6\pm0.9}Wo_{4.0\pm0.3}$ (Fe/Mn=30.1±1.9); pigeonite $Fs_{20.3\pm2.5}Wo_{9.7\pm6.4}$ (Fe/Mn=27.6±1.3); Ca-rich pyroxene $Fs_{11.4\pm0.6}Wo_{38.1\pm1.5}$ (Fe/Mn=23.0±1.8); maskelynite $Ab_{80.2\pm2.1}Or_{4.9\pm0.7}$. The apatite grains display a relatively large variation of F and Cl with most being chlorine-rich (Fig.1). Mineral chemistry of NWA 11042 is very similar to that of L-melt rock NWA 7251 [2]. A glassy fusion crust with crystallites and vesicles was analysed. The average Mg# (0.76) and CaO (2.69 wt.%) content of the fusion crust plots in the ultramafic field on the compositional diagram shown in [3].

Shock metamorphism: The rock was heavily shocked as indicated by complete maskelynization and the presence of high pressure phases (ringwoodite, jadeite, and hollandite) (Fig.2).

U-Pb dating: The U-Pb concordia diagram of apatite (Fig.3) reveals an upper intercept age of 4479±43 Ma, and a lower intercept age of 465±47 Ma. These ages are remarkably similar to the impact ages recorded in L-related meteorites [2,4]. The upper intercept age reflects a massive collisional event associted with the Moon-forming giant impact (4.4-4.5 Ga), while the lower intercept age is in excellent agreement with the timing of catastrophic disruption (467 Ma) of the L chondrite parent body [2,4].

Discussion: The O isotopic compositions, the An content of maskelynite, and the bulk chemistry of NWA 11042 could exclude its Matian origin but display a close affinity to L-chondrites. It is likely that NWA 11042 crystallized early from a magma chamber produced by massive impacts on the L-chondrite parent body. It was later suffered another major impact during the disruption event of the L chondrite parent body. It follows that NWA 11042 is an L-melt rock, not a Martian meteorite.

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References: [1] Vaci Z. et al. (2017) *LPS XLVIII*, Abstract #2016. [2] Li Y. and Hsu W. (2016) *Meteoritics & Planetary Science*, 51 (Supplement), 6043. [3] Irving A. J. et al. (2010) *41st LPSC*, Abstract #1547. [4] Yin Q. et al. (2014) *Meteoritics & Planetary Science*, 49, 1426-1439.

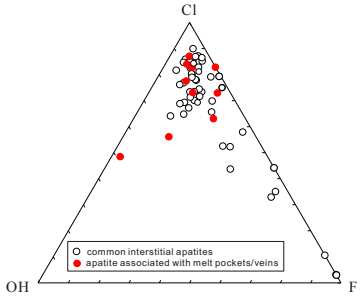

Fig. 1 Ternary plot of the X-site components of apatites.

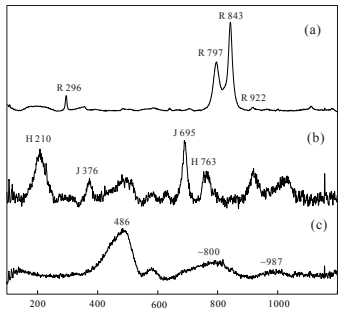

Fig.2 Raman spectra of (a) ringwoodite, (b) jadeite(J) mixed with hollandite(H), (c) maskelynite

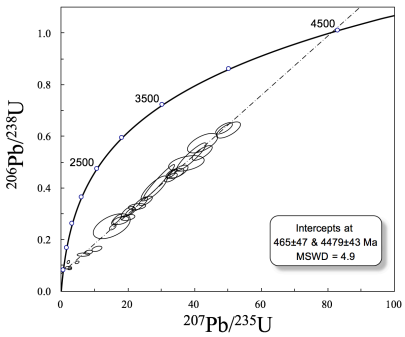

Fig. 3 U-Pb dating of apatite