PETROGENESIS OF LUNAR POIKILITIC IMPACT MELT METEORITE OUED AWLITIS 001. Axel Wittmann[1], Randy L. Korotev[1], Bradley L. Jolliff[1], and Anthony J. Irving[2]; [1]Department of Earth and Planetary Sciences, Washington University, St. Louis, MO 63130, axel.wittmann@yahoo.com; [2]Department of Earth and Space Sciences, University of Washington, Seattle, WA 98195.

Introduction: Oued Awlitis (OA) 001 is a brownish-gray lunar meteorite with a preserved fusion crust that was found as two fitting pieces in 2014 in Morocco/Western Sahara [1–2]. The main 382 g piece was excavated from shallow depth. We present petrographic descriptions and bulk rock chemical data for OA 001 and discuss its petrogenesis on the Moon.

Samples & Methods: We analyzed a 380 mm^2 thin section of OA 001 microscopically and with an electron microprobe, and determined major, minor and trace element concentrations of six 29–32 mg subsamples by INAA [2] and electron microprobe analysis on fused beads following the procedure outlined by [3].

Results: *Petrography and Mineral Chemistry.* OA 001 has a yellow-brown, ~0.5 mm thick, translucent fusion crust that displays a darker network of anastomozing wrinkle ridges; a cut face exhibits a fine-grained, wavy texture of gray minerals in a grayish-white groundmass (Fig. 1a).

Microscopically, Oued Awlitis 001 is a crystallized, clast-rich melt rock with a poikilitic texture of intensely fractured olivine ($Fa_{30–44}$), pigeonite ($En_{48–59}Fs_{26–40}Wo_{6–19}$) and augite ($En_{64–70}Fs_{20–24}Wo_{25–34}$) that fill interstitial spaces between 5 to 50 µm, blocky plagioclase phenocrysts ($An_{88–97}Ab_{3–12}Or_{0–0.3}$) (Fig. 1b). This crystallized groundmass envelops partly assimilated, strongly undulose, <1 mm plagioclase clasts ($An_{95–97}Ab_{3–5}Or_{0–0.2}$). Commonly these clasts display planar deformation features (PDF) and, in places, 10 µm, euhedral silica. Up to 10 µm kamacite (6.8–7.6 wt% Ni, 0.8–0.9 wt% Co) and taenite (11.5–24.1 wt% Ni, 0.7–1.2 wt% Co), and up to 70 µm troilite occur in both clasts and groundmass. Rare, euhedral, <10 µm ilmenite and Ti-Fe rich spinel [$(Mg_{0.07–0.11}Ti_{0.65–0.80}Fe_{0.08–0.26}Si_{0.01–0.05}Mn_{0.01})(Fe_{0.77–0.81}Al_{0.06–0.11}Cr_{0.08–0.17})_2O_4$] can contain tiny domains of FeNi metal. Vitric shock melt occurs in <0.1 mm pods (Fig. 1c), or <10 µm thick veins that offset the rock fabric. A ~10 µm wide, irregular fracture is filled with brown clay minerals, but no other terrestrial alteration phases were observed in the analyzed thin section.

Bulk rock chemistry: OA 001 is highly feldspathic (89 vol% normative plagioclase content); Figures. 2 a–c show compositional similarities to other lunar meteorites, including poikilitic impact melt rock Northwest Africa (NWA) 482; none of these stones exactly matches the composition of OA 001, though.

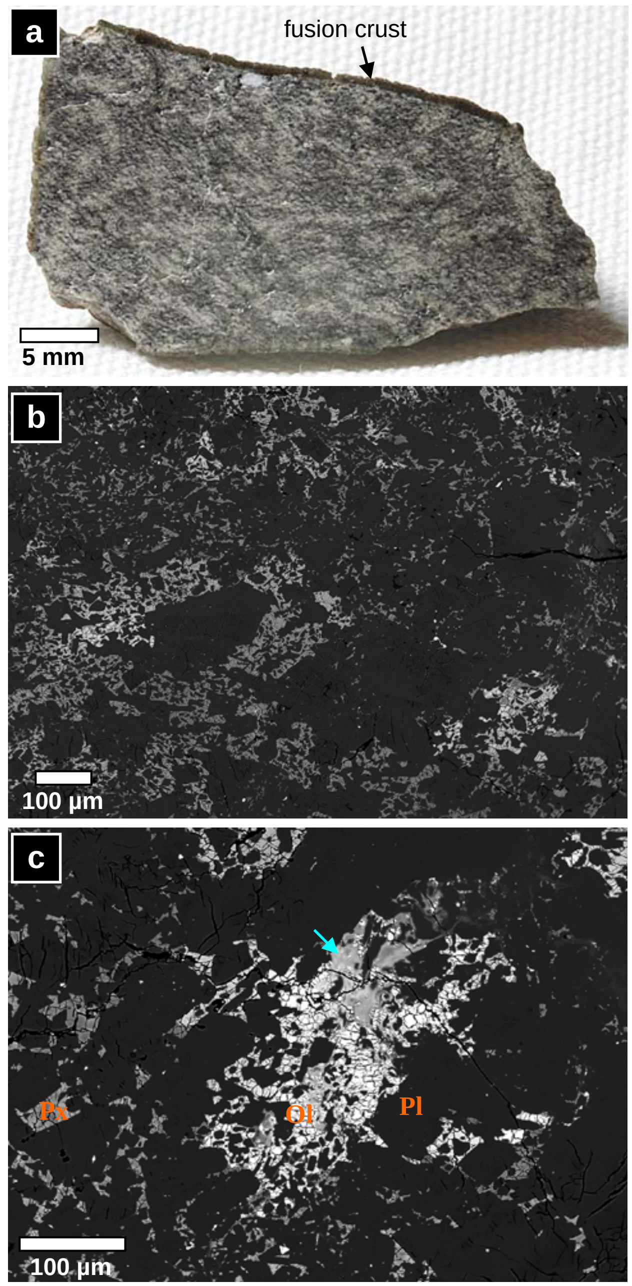

Fig. 1. Petrography of Oued Awlitis 001.
a) Sample specimen photograph, scale is in cm.
b) and c) Back-scattered electron images illustrating poikilitic texture; blue arrow points at shock melt pod; Pl-plagioclase, Ol-olivine, Px-pyroxene.

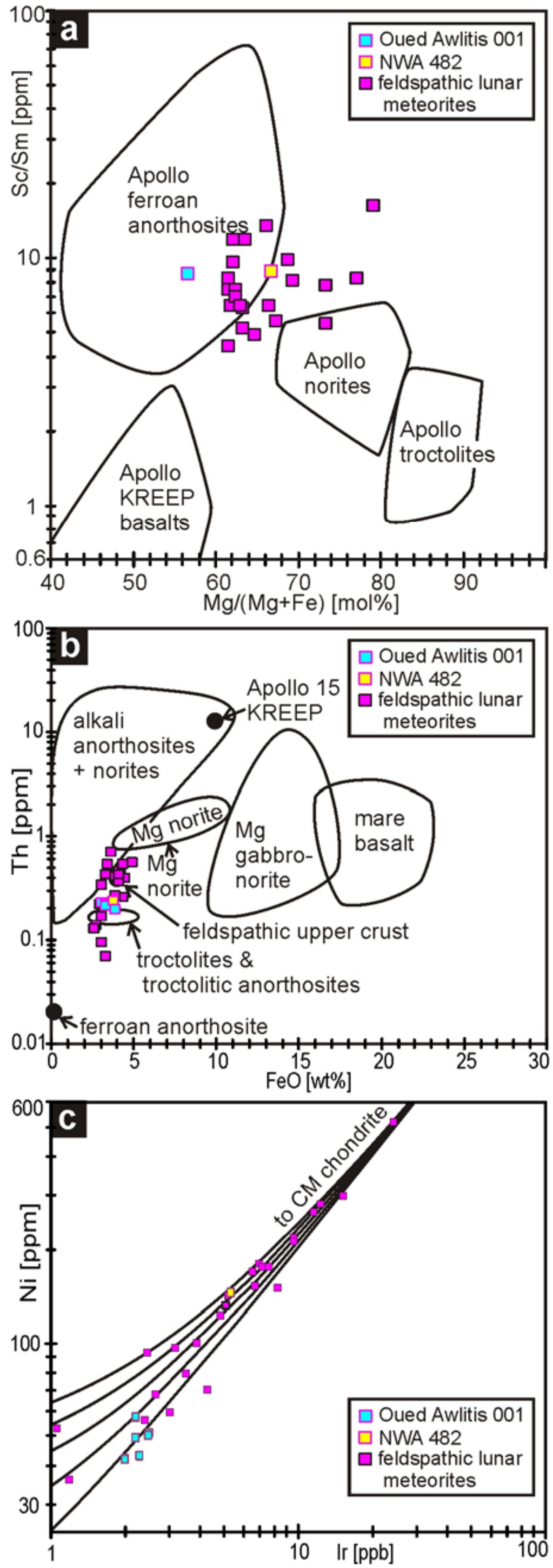

Fig. 2. Chemical Composition of Oued Awlitis 001. *a) & b) Diagrams after [4] and references therein. c) Diagram after [5]; five curved lines are mixing lines between CM-chondrites and low-siderophile lunar silicates that originate at off-scale silicate compositions of 0.01 ppb Ir and 5, 15, 25, 35, and 45 ppm Ni.*

Discussion: *Petrogenesis of OA 001.* Texturally equivalent melt lithologies to OA 001 occur in NWA 482 [6,7], and as clasts in regolith breccia meteorites Shişr 161 [4] and Pecora Escarpment 02007 [8]. By analogy with an 80 m thick impact generated anorthositic melt body of Mistastin Crater, Labrador, that crystallized an incipient poikilitic texture [9], we have argued [1] that OA 001 may have formed as a poikilitic impact melt rock in a >0.01 to <1 km thick lid of debris-choked melts that overlie extensive volumes of impact melt on the Moon [4]. If a poikilitic texture in feldspathic impact melt requires melt volumes on the order of at least 0.1 km thick, scaling relationships then suggest that such a melt sheet thickness is associated with lunar impact craters >50 km Ø [10]. To excavate a poikilitic impact melt rock from the center of such a 100 m thick impact melt volume, an impact is required that produces a >500 m Ø crater [11]. Thus, the launch site of OA 001 on the Moon could be characterized by a recent impact crater ≥500 m Ø in the Moon's feldspathic highlands. This event should have launched petrogenetically related lithologies (Fig. 2a–c) such as crystallized feldspathic impact melt rocks or "granulites", which likely also represent impact melt rocks [4].

Outlook: Cosmic ray exposure (CRE) data can test our hypothesis for the petrogenesis of OA 001. Comparison to the CRE constraints for the texturally and compositionally similar stone NWA 482 that was launched from a depth >2.8 m [12] will be interesting.

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