^{40}Ar-^{39}Ar AGE for GABBROIC LUNAR METEORITE NORTHWEST AFRICA 5000

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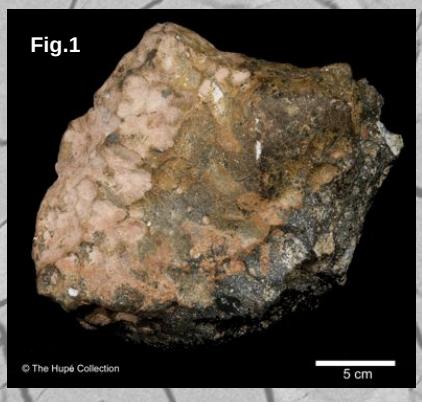
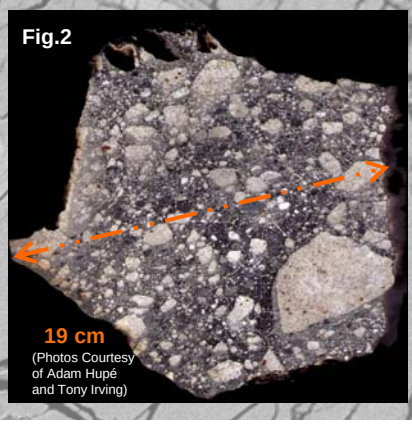
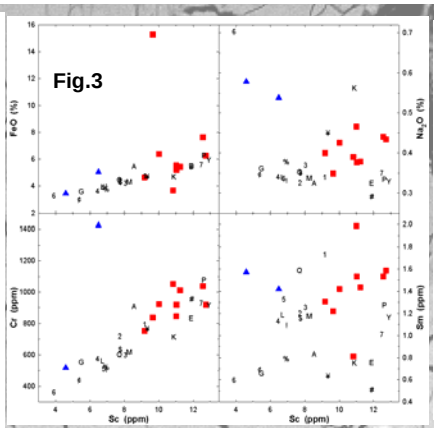


Lunar meteorite Northwest Africa 5000 (NWA 5000) is large (11.528 kg) and fresh lunar meteorite (Fig.1) found in southern Morocco in summer 2007 represents the second largest known lunar specimen (the largest is Kalahari 009). NWA 5000 is a feldspathic near-monolithologic breccia composed predominantly of metal-bearing leucogabbroic to gabbroic clasts (Fig.2) in a gray, partly glassy matrix, with some shock melt-injection veins [1].

The high metal content observed in the clasts has been attributed to the impactor, suggested to be processed material from the inner Solar System [2]. The existence of exotic metals within the otherwise apparently igneous-textured gabbroic clasts may signify large-scale impact melting and differentiation.

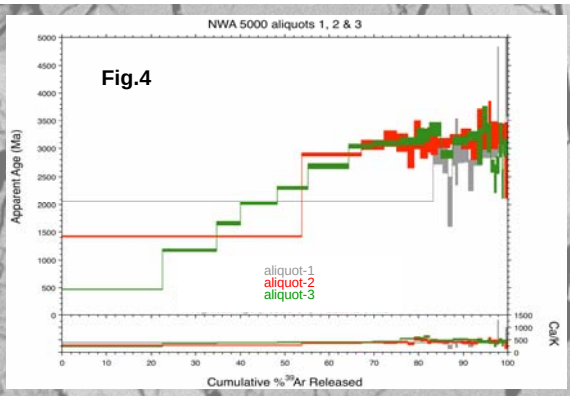


Petrology: as described by [1], most clasts consist of coarse grained (0.5-2.7 mm) calcic plagioclase ($An_{96-98.0}Or<0.1$), pigeonite ($Fs_{32-65}Wo_{7-13}$, FeO/MnO = 51.1-62.0, some with fine exsolution lamellae) and olivine (Fa_{24-59}, FeO/MnO = 81-100) with accessory kamacite (up to 2 mm), merrillite, Mg-ilmenite, Ti-chromite, baddeleyite, rare zirconolite, silica polymorph, K-feldspar and troilite. Some gabbro clasts have shock injection veins composed mostly of glass with fine troilite blebs and engulfed mineral fragments. Black, vitreous-appearing clasts consist of sporadic, small angular fragments (apparently surviving relics) of gabbro and related mineral phases in a very fine grained, non-vesicular matrix of thin pigeonite laths (up to 20 µm long x 2 µm wide) and interstitial plagioclase with tiny kamacite spheres, irregular grains of schreibersite and rare troilite.



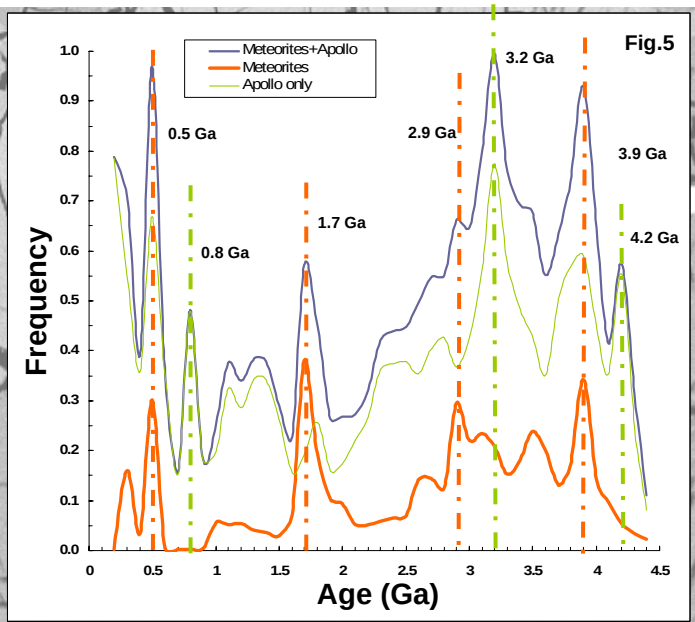
Bulk composition: preliminary INAA clast analyses[1], Fig.3 (red squares = gabbro and matrix subsamples; blue triangles = black impact melt clast; keyboard symbols= other feldspathic lunar meteorite). gave mean abundances of: (in wt. %) FeO 5.30, Na2O 0.43; (in ppm) Sc 10.0, Cr 915, Co 19.6, Ni 240, Hf 1.0, Th 0.44, Ba 290, La 3.11, Ce 8.4, Sm 1.42, Eu 0.89, Tb 0.29, Yb 1.11, Lu 0.156, with considerable scatter. The REE pattern has a moderate positive Eu anomaly; a grain of apparently igneous metal has 15.4 wt.% FeO, 6060 ppm Ni, 388 ppm Co, 300 ppb Ir and 102 ppb Au (with Ni/Co like in some irons); the black impact melt clast has higher Na contents [and higher Cr] than the gabbroic subsamples; this may reflect a sampling effect both in the original production of shock melt and in modal heterogeneity between subsamples.

^{40}Ar-^{39}Ar age: ^{40}Ar-^{39}Ar spectra for three bulk subsamples (Fig.4) of a gabbroic clast are highly discordant and suggest a partial re-setting of the K/Ar system manifest in the initial ~70% of the ^{39}Ar released. This was likely the result of a thermal event such as an impact at ~500 Ma, and possibly when the material composing this meteorite was excavated and became exposed on the lunar surface. This interpretation is in agreement with cosmogenic radionuclide results [3] and also with some petrologic observations suggesting that some of the clasts were breccias implying multiple impact and mixing events to have affected the leucogabbroic anorthosite protolith.



The last ~30% of ^{39}Ar release shows more consistent apparent ages, though not meeting standard plateau criteria, suggestive an age of 3.2±0.1 Ga, possibly the age of the larger impact that created a substantial melt sheet which then differentiated. The ^{38}Ar/^{36}Ar for all temperature steps shows the typical cosmogenic value of ~1.54 indicating negligible contribution from trapped or solar argon.

Similar re-setting ages of 3.2-3.3 Ga have been observed for Apollo 16 soil samples collected from the North Crater ejecta [4-6] and also coincide with a peak in Apollo 14 [7] impact melt spherule ages, Fig.5.



REFS: [1] Irving et al. (2008) 39th LPSC, abst.#2168. [2] Humayun & Irving (2008) GCA 72, 12S, A402. [3] Nishiizumi et al. (2009) 40th LPSC, abst.# 1476. [4] Fernandes et al. (2008) Workshop ESSIB, abst.#3028. [5] Shuster et al. (2008) Eos Trans. AGU 89(53), Fall Meet. Suppl., Abs.# V51H-05. [6] Shuster et al (2009) this conference) [7] Culler et al. (2000) Science 287, 1785-1788. **Acknowledgements**: Special thanks to Dr. Tony Irving and Adam Hupé for making this meteorite available for study.