LUNAR VOLCANISM DURING THE ERASTOTHENIAN I: KALAHARI 009

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Kalahari 009 was found in the Kalahari desert, in Botswana, as a single grey rock of about 13.5 kg [1] and is compatible with a VLT lunar mare basalt [2]. It is a breccia consisting of fragments of basaltic lithologies embedded in a fine-grained matrix. The basaltic clasts have a coarse-grained subophitic texture. Clasts and matrix display the same composition. The main constituent minerals are pyroxene and plagioclase, with lesser olivine. Accessory minerals are ilmenite, chromite, troilite, ulvöspinel, and Fe,Ni metal (having about 0.6 wt% Ni). Pyroxene grains are zoned and have compositions of pigeonite and augite (En_{14-46} Fs_{42-76} Wo_{7-44}) and display exsolution lamellae of <5 µm. On a Mn vs. Fe plot the pyroxenes plot along the lunar fractionation line. Kalahari 009 is significantly shocked, suggesting pressures of at least 15 – 20 GPa [1] according to the calibration scheme of Stöffler et al. [3] for ordinary chondrites (S4). Veins are present and contain up to ~4.3 wt% K_2O.

The **Ar-Ar** spectrum (Fig. 1a) shows a disturbed Ar release indicating that a significant disturbance occurred at ~0 Ma ago. This minimum apparent age is associated with Ar release from a high K/Ca component (Fig. 1b), likely the K-rich veins and related with terrestrial contamination. At intermediate and high temperature Ar release apparent ages range between 1.4-2.7 Ga. The highly disturbed Ar release of Kalahari 009 means that the minimum crystallisation age of the lunar basalt is estimated from the highest apparent age of 2.67±0.06 Ga (2σ). Also, it may have undergone an impact on the lunar surface at 1.40±0.01 Ga (2σ). Integrating the age and composition of this meteorite with crater counting ages by [4,5] and chemical maps by [6,7], the likely source area is within the Mare Imbrium.

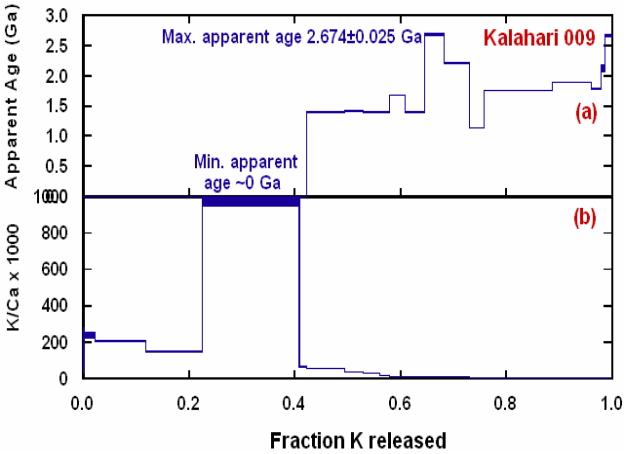

Fig.1 Ar-Ar step heating results for lunar basalt Kalahari 009: a) Age spectrum vs. %K release; b) K/Ca x 1000 vs. %K.

Refs.: [1] Russell et al (2005) Met. Bull. 89, *MAPS* **40**, A201-A263. **[2]** Sokol and Bischoff. (2005) *MAPS* 40: A177-A184. **[3]** Stöffler, Keil and Scott (1991) GCA 55: 3845 – 3867. **[4]** Hiesinger et al. (2000) JGR 105: 29,239-29,275. **[5]** Hiesinger H. Et al. (2003) JGR 108: 5065, doi:10.1029/2002JE001985. [6] Elphic et al. (2002) JGR 107:(E4), 8-1, 10.1029/2000JE001460. [7] Gillis et al (2004) GCA 68:3791–3805.