**CHEMICAL COMPOSITION AND Lu-Hf AGE OF THE LUNAR MARE BASALT METEORITE KALAHARI 009**

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**Introduction:** Kalahari 009 is a lunar mare basalt breccia consisting of fragments of basaltic lithologies embedded in a fine-grained matrix [1]. Based on its mineralogy, this meteorite can be classified as a VLT mare basalt. Compared to other mare basalts Kalahari 009 has an unusual young Ar-Ar age of ~1.7 Ga [2]. In order to place this meteorite into the context of lunar magmatism, we analyzed selected major- and trace elements on whole-rock powders using XRF and INAA. Additionally we obtained a Lu-Hf isochron age on whole-rock, ilmenite, and pyroxene separates.

**Results:** The chemical composition of Kalahari 009 is given in the table. The Lu-Hf isochron yields an age of ~4.2 Ga.

Table: Chemical composition of Kalahari 009

| **Major** | **[wt.%]** | **Trace** | **[ppm]** | **trace** | **[ppm]** |
|---|---|---|---|---|---|
| $SiO_2$ | 46.04 | P | 227 | Er | <9 |
| $TiO_2$ | 0.67 | Sc | 45 | Tm | <0.3 |
| $Cr_2O_3$ | 12.70 | V | 143 | Yb | 1.6 |
| $Al_2O_3$ | 0.36 | Co | 23.3 | Lu | 0.3 |
| FeO | 18.50 | Ni | <20 | Hf | 0.7 |
| MnO | 0.23 | Ga | 1.0 | Ta | 0.1 |
| MgO | 7.88 | As | 0.4 | W | 0.3 |
| CaO | 11.17 | La | 0.94 | Re | 0.03 |
| $Na_2O$ | 0.44 | Ce | 3.7 | Ir | <0.004 |
| $K_2O$ | 0.19 | Nd | 3.4 | Th | 0.10 |
| | | Sm | 0.74 | U | 0.14 |
| *Total* | 98.18 | Eu | 0.4 | | |
| | | Gd | 2.0 | | |
| Fe/Mn | 79.7 | Tb | 0.2 | | |
| Mg/Cr | 19.3 | Dy | 4.0 | | |
| | | Ho | 0.36 | | |

**Discussion:** Fe/Mn and Mg/Cr ratios of Kalahari 009 are similar to other lunar mare basalts and the $TiO_2$ content is one of the lowest among all basaltic lunar meteorites. Kalahari 009 has a flat chondrite-normalized REE pattern, similar to that observed in NEA-003 [3], but unlike that observed in all other mare basalts. Therefore these two meteorites probably sample a common but so far unidentified lunar reservoir.

The Lu-Hf age is similar to ages of other very-low Ti basalts but is significantly older than the Ar-Ar age [2]. Such a young Ar-Ar age is also observed for NEA-003 [3]. We propose that the Lu-Hf age most likely dates crystallization, whereas the Ar-Ar ages record probably an impact related degassing event.

**References:** [1] Sokol A.K. and Bischoff A. 2005. *MAPS* 40, A177-A184. [2] Fernandes V.A. et al. 2007. Abstract #1611. *38th Lunar & Planetary Science Conference.* [3] Haloda et al. 2006. Abstract #2269. *37th Lunar & Planetary Science Conference*.