

SIMS Pb/Pb DATING OF ZR-RICH MINERALS FROM NWA 4734 AND LAP 02205/02224: EVIDENCE FOR THE SAME CRATER ON THE MOON

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Introduction: Mare basalts NWA 4734 and LAP 02205/02224/02226/02436/03632/04841 share many chemical and petrologic similarities and are potentially paired [1-3]. The existing age data for NWA 4734 are limited and vary from 2720 ± 40 (2σ) [3] to 3190 ± 190 Ma (2σ) [4], which are marginally compatible with the age of LAP meteorites (~ 3.0 Ga) [5-7]. To obtain a better constraint on their genetic relationship, we carried out an *in situ* Pb/Pb dating of baddeleyite and zirconolite from NWA 4734 and LAP 02205/02224.

Analytical methods: Micron-sized Zr-rich minerals were located with a Hitachi 3400 II SEM. Pb/Pb dating was conducted with the Cameca IMS-1280 ion microprobe at the Institute of Geology and Geophysics, Chinese Academy of Sciences, following the procedure of [8].

Results and Discussion: Twenty-two analyses were made on one zirconolite and five baddeleyite grains in NWA 4734. Their $^{207}\text{Pb}/^{206}\text{Pb}$ ages are almost identical within analytical errors, yielding a weighted mean of 3074 ± 16 (2σ) Ma. In LAP 02205/02224, twenty-one analyses were made on four baddeleyite grains, yielding a similar Pb/Pb age of 3044 ± 12 (2σ) Ma. But six analyses on one baddeleyite in LAP 02224 display systematically older and spatially variable ages, from 3351 ± 62 to 3614 ± 62 (2σ) Ma. This is similar to another baddeleyite grain in LAP 02224, which exhibits a Pb/Pb age variation from 3109 ± 29 to 3547 ± 21 (2σ) Ma [9].

The Pb/Pb age of NWA 4734 is consistent with the age of monazite by EMP dating [4] but with a better precision. The Pb/Pb age (3044 ± 12 Ma) of LAP 02205/02224 is almost identical to ages previously obtained by U-Pb (2929 ± 150 Ma) [5], Rb-Sr (2990 ± 36 Ma) [6], Sm-Nd (2992 ± 170 Ma) [6], and Ar-Ar (2985 ± 16 Ma) [7] dating methods. It is evident that NWA 4734 and LAP 02205/02224 have the same crystallization age, which indicates that these basalts crystallized almost concurrently. Coupled with mineralogical and petrologic observations, we suggest that NWA 4734 and LAP meteorites were likely launched from the same crater on the moon.

Some baddeleyite grains in LAP 02224 have older ages than the whole rock ages previously determined with different techniques [this work, 9]. They are probably not an endogenous phase crystallized from the evolved parental magma, but rather xenocrysts that were trapped during multi-stage magmatic assimilation processes.

References: [1] Connolly Jr. H. et al. 2007. *Meteoritics & Planetary Science* 43:571–632. [2] Chennaoui A. H. and Jambon A. 2008. *Meteoritics & Planetary Science* 43:A32. [3] Fernandes V. A. et al. 2009. Abstract #1045. 40th Lunar & Planetary Science Conference. [4] Jambon A. and Devidal J. 2009. *Meteoritics & Planetary Science* 44:A99. [5] Anand M. et al. 2006. *Geochimica et Cosmochimica Acta* 70:246–264. [6] Rankenburg K. et al. 2007. *Geochimica et Cosmochimica Acta* 71:2120–2135. [7] Fernandes V. A. et al. 2009. *Meteoritics & Planetary Science* 44:805–821. [8] Li X. et al. 2009. *Geochemistry Geophysics Geosystems* 10, Q04010. [9] Zhang A. et al. 2010. *Science in China Earth Science* 53:327–334.