Ages of pre-mare magmatism recorded in zircons and baddeleyites of lunar meteorite NWA 4485

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The timing, distribution and composition of pre-mare magmatism is not well understood, since subsequent basin-forming events and mare volcanism overwrote most of lunar early magmatic record. *In situ* U-Pb and Pb-Pb age dating of zircons and baddeleyites in breccias provide temporal constraints on pre-mare magmatism.

Twelve zircon grains and one baddeleyite in breccia matrix and in lithic clasts of NWA 4485, KREEP-rich regolith breccia were studied. *In situ* U-Pb and Pb-Pb age dating was conducted by a sensitive high mass-resolution ion microprobe (SHRIMP II) at NIPR. Mineralogical analyses were done by EPMA and SEM at NIPR.

Pb-Pb ages of three zircons of a few tens μm in size in the KREEP basalt clast are 4154 ± 4 Ma, 4170 ± 26 Ma, and 4173 ± 6 Ma, with small discordance of U-Pb system (5-10%). A large isolated zircon (200×120 μm) shows an overgrowth. Four core analyses yielded an average Pb-Pb age of 4211 ± 7 Ma (2σ) with a U-Pb concordia age of 4208 ± 11 Ma (2σ). Two rim analyse were concordant, with an average Pb-Pb age of 3927 ± 23 Ma (2σ). Discrete two zircons show an average Pb-Pb age of 3929 ± 10 Ma (2σ) with a U-Pb concordia age of 3931 ± 18 Ma (2σ). Pb-Pb age of a discrete zircon is 4352 ± 10 Ma, and that of a baddeleyite is 3922 ±12 Ma. The above age range of 4352 Ma-3922 Ma is in line with that from Pb-Pb ages of phosphates in a paired meteorite NWA 4472 [2] and broadly covers zircon ages of the Apollo non-mare samples [e.g. 2-4].

[1] Joy *et al*. (2011) *GCA* **75,** 2420-2452. [2] Meyer *et al*. (1996) *MAPS* **31**, 370-387. [3] Nemchin *et al*. (2008) *GCA* **72,** 668-689. [4] Pidgeon *et al*. (2007) *GCA* **71**, 1370-1381.