

Volatile element zoning in Apatite from the Moon and implications for the water inventory in the Moon (and Mars)?

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Apatite is used for determining water inventories on the Moon and Mars, due to it being one of the few OH-bearing phases in these precious extraterrestrial samples. Recent work on partitioning of volatile elements in late-stage melts has shown that apatite is sensitive to the proportions of F, Cl, and OH in the melt [1]. This work suggests that as F is depleted in late-stage lunar melts, the partitioning of Cl and OH into apatite will change dramatically, and might help explain why some lunar apatites have OH contents similar to apatite from terrestrial andesites [2]. It may also bear on Martian apatite grains. Here we present work on volatile element zoning (F, Cl, OH) in apatite from lunar and martian basalts using 2D ion imaging on the Hokudai modified Cameca ims 1270 ion microprobe, with SCAPS (Scanning CMOS-type Activated Pixel Sensor) detector. We also measured ion microprobe spot analyses for H and D using established methods [2]. This work is combined with FEG electron microprobe and cathodoluminescence to allow visualization and quantification of minor and trace element zoning in apatite. We use these results to evaluate water budgets in the mantles of the Moon and Mars.

[1] Boyce J. W. *et al* this meeting [2] Greenwood J. P. *et al* (2011) *Nature Geosci.*, **4**, 79-82.