Rates of magmatic processes from U-series in historical eruptions at Askja and Krafla volcanoes, Iceland

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Following our recent study on late Holocene rhyolite melt generation processes and their rates at Torfajökull Central Volcano in Iceland's Southern Flank Zone [1], we now present data from the actively rifting Eastern Rift Zone. There, Askja and Krafla Central Volcanoes have produced rhyolites in historic times. At Askja, we studied major, trace and U-Th-Ra isotope geochemistry of the 1875 bimodal deposits and the possibly cogenetic [2] Sveinagja lava flow, and of the 1929 and 1961 basalts. At Krafla, we focussed on the Myvatn Fires eruptions, studying major, trace and the U-Th-Ra isotope geochemistry of the 1724 bimodal Viti deposits and the 1727-29 Myvatnseldar basalt lava.

At Askja and Sveinagja, all WR samples plot in Th excess, with $1.04 \leq (^{230}Th/^{232}Th) \leq 1.07$ and $0.91 \leq (^{238}U/^{232}Th) \leq 0.92$ for basalts compared to $(^{230}Th/^{232}Th) \approx 0.96$ and $(^{238}U/^{230}Th) \approx 0.89$ for the 1875 rhyolite. At Krafla, the basalt and rhyolite $(^{230}Th/^{232}Th)$ activity ratios are ~ 1.10 and ~ 0.99, respectively, but basalts plot closer to the equiline with $1.08 \leq (^{238}U/^{232}Th) \leq 1.09$ compared to the rhyolite with $(^{238}U/^{230}Th) \approx 0.91$. Askja samples display ^{226}Ra-^{230}Th equilibrium or slight ^{226}Ra excesses, and the Sveinagia lava flow yields $(^{226}Ra/^{230}Th) \approx 1$. At Krafla, $(^{226}Ra/^{230}Th)$ activity ratios are ~ 1.2 and ~ 1.0 for the Myvatnseldar basalt and the Viti rhyolite, respectively. In order to constrain rhyolite melt generation and crystallization ages, we are in the process of analysing U-Th-Ra isotopes of px and mt separates from the 1875 Askja rhyolite and of mt and plag separates from the 1724 Viti rhyolite. A px mineral separate from the 1875 Askja rhyolite yields a zero age U-Th isochron with its WR, providing preliminary evidence that there, as in Torfajökull Central Volcano [1], melting produced evolved compositions during the Holocene.

[1] Zellmer *et al*. (2008) *EPSL* **269**, 387-397. [2] Sigurdsson & Sparks (1978) *Bull. Volc.* **41**, 149-167.

Earth-Moon impacts over ~4.5 Ga

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Lunar Impact Glasses

Lunar impact glasses offer the potential for providing compositional information about local and remote areas of the Moon [1, 2, 3] and may also place constraints on the impact history in the Earth-Moon system.

Previous studies have reported $^{40}Ar/^{39}Ar$ ages on lunar samples (i.e., rock fragments, meteorites) in order to provide evidence as to whether or not a lunar cataclysm occurred ~3.9 Ga (e.g., [4, 5]). We present $^{40}Ar/^{39}Ar$ ages on Apollo 14, 16, and 17 impact glasses to show differences in impact events, when time and space (i.e. sample provenance) are considered.

Results

Of the 65 lunar impact glasses for which these authors have found an age, samples with ages >4000 Ma are rare or absent, as is true for Apollo impact rocks [6], impact melts from lunar meteorites [5], and other lunar impact glass data sets [e.g. 7]. Additionally, few show ages consistent with a recent increase in the impact flux, as reported in (e.g. [7]).

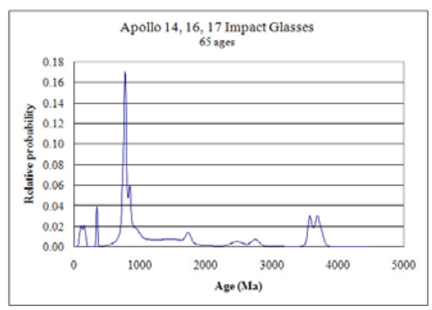

Figure 1: Ideogram of lunar impact glass ages. Each age is represented by a Gaussian distribution of unit area; precisely determined ages appear as tall spikes and poorly determined ages appear as low, broad humps.

By integrating geochemistry and age [3], multiple impact samples formed at the same time in the same terrain can be removed from the data set. The challenge comes in trying to distinguish among the impact events, including determining which samples (impact glasses, melt rock, meteorites) were formed during the same impact event and which were not, so that the impact flux is not artificially inflated.

[1] Delano (1991) *GCA* **55**, 3019-3029. [2] Zellner *et al*. (2002) *JGR* **107(E11)** 5102, doi:10.1029/2001JE001800. [3] Delano *et al*. (2007) *MAPS* **42** (6), 993-1004. [4] Tera *et al*. (1974) *EPSL*, **22**, 1021. [5] Cohen *et al*. (2005) MAPS 40, 755-777. [6] [11] Bogard (1995) *Meteoritics* **30**, 244-268. [7] Levine *et al*. (2005) *GRL* **32**, L15201.