Testing the internally consistent age information of U-series disequilibria in rhyolites: Inyo Domes, CA

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Introduction

The determination of magma differentiation rates for rhyolites using isotope systematics is generally limited by the age resolution of the specific isotope system and the geological complexity (i.e. melting, assimilation). In Recent rhyolites, however, the presence of ^{238}U-^{230}Th-^{226}Ra, ^{235}U-^{231}Pa disequilibria offers the potential to investigate in more detail age relationships within the U decay system itself. Here, we present a new U-series data set of the 0.6 and ~ 6 ka old Inyo Domes, the youngest expression of rhyolitic volcanism of the Long Valley magmatic system.

Results

Combined geochemical data for the characteristic coarsely and finely porphyritic (CP, FP) lavas suggest a common long-term open system evolution (Heumann and Davies, 1997). In an U-Th equiline diagram, the CP and FP lavas plot to the left of the equiline and define two different linear trends with similar initial ($^{230}Th/^{232}Th$) ratios between 0.98 and 1.02. The slopes of these arrays are equivalent to ages of 65-70 ka. The trend of CP lavas is defined together with a 6 ka lava and plots close to the equiline near older postcaldera rhyolites. This could imply that the CP lavas have an old magma differentiation age similar to zircons from these lavas (Reid et al., 1997a). In contrast, FP lavas define a sub parallel mixing trend at higher ($^{230}Th/^{232}Th$) ratios, similar to other older postcaldera rhyolites (Heumann et al., 2002). These linear arrays could have been produced by mixing of older, partially crystallized magma with newly arriving melt. Alternatively, the whole-rock trends could be the result of allanite fractionation which would also suggest old magma formation ages for the FP lavas. The Pa and Ra isotope data show similar distinctive characteristics between the two lava series and will be discussed during the presentation.

References

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Ancient landscapes in wet tropical Highlands, Sri Lanka

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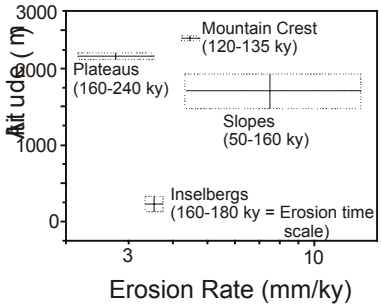
Conventional wisdom would predict rapid weathering rates for the Sri Lankan Highlands on all counts: the mountains are located in the center of a humid tropical island, elevations are as high as 2500 m, the mean relief is 5-20°, monsoonal rainfall is high (upwards of 5000 mm/y), temperatures are tropical, and there was a dense forest cover before large-scale clearance during the colonisation.

We have used *in-situ* produced cosmogenic nuclides from bedrock surfaces, topsoils, and small catchment stream sediments to determine erosion rates and weathering time scales across a wide geomorphological range. The rates essentially provide the long-term, pre-deforestation landscape evolution. Erosion rates are surprisingly low, only 2-10 mm/ky. Correspondingly, erosion time scales are long, from 50-240 ky.



The unexpectedly low erosion rate is attributed to the geologically stable situation of Sri Lanka, which results in minimal tectonic rejuvenation of the landscape. It appears that bedrock is protected from weathering by a thick regolith as evidenced by dissolved river loads, which are within the low range of the cosmogenic denudation rates.

The very long-term stability of this phenomenon was assessed by comparing our erosion rates with apatite fission track-derived exhumation rates in adjacent (pre-Gondwana break-up) southern India and southern Madagascar (Seward et al., 1999; Gunnell and Louchet, 2000). The average exhumation rate (Carboniferous to present) is similarly low at ca. 10 mm/ky. We speculate that Sri Lanka displays ancient topography, possibly as old as 400 My.

Seward, D., Grujic, D. and G. Schreurs, (1999) *Gondwana Research*, 2-3, 353-354

Gunnell, Y. and A. Louchet (2000) *Z. Geomorphologie*, 44-1, 35-37