Geochemistry of Paleocene volcanism and oceanic island arc affinities of the Chagai Arc, Balochistan, Pakistan

REHANUL HAQ SIDDIQUI[1], MUHAMMAD ASIF[2] KHAN AND MUHAMMAD QASIM JAN[3]

[1]GeoscienceAdvance Research Laboratories, Geological Survey of Pakistan, Shahzad Town, Islamabad Pakistan
[2]National Centre of Excellence in Geology University of Peshawar, Pakistan
[3]National Centre of Excellence in Geology University of Peshawar, Pakistan

The main exposures of the Paleocene lava flows occur in an east-west trending subduction related magmatic belt known as Chagai arc in the western part of Pakistan.

The Paleocene lava flows are mainly represented by basalts (49.22-52.46 wt. % SiO_2) and basaltic-andesite (52.75-53.90 wt. % SiO_2. The petrochemical studies show that these are mainly medium to low -K oceanic island arc tholeiites. The trace element patterns show enrichment in LILE and depletion in HFSE relative to N-MORB. The primordial mantle-normalized trace element patterns show marked negative Nb anomalies with positive spikes on Ba and Sr which strongly confirm their island arc signatures, which is further supported by flate-slightly LREE enriched chondrite-normalized REE patterns. These volcanics have lower average $^{87}Sr/^{86}Sr$ ratio (0.70446), which is more consistent with a depleted mantle source and closely correlate with oceanic island arcs rather than continental margin type arcs. The average trace element ratios including Zr/Y (2.25), Ti/V (15.47), La/Yb_N (1.62), Ta/Yb (0.03) and Th/Yb (0.24) of these volcanics are more consistent with oceanic island arc tholeiite rather than analogous rocks of the continental margins type arcs.

Eruptive history and chemical evolution of the Acigöl volcanic field, central Anatolia, Turkey, based on geochemical and isotopic (Sr-Nd-Pb, $\delta^{18}O$) constraints and ion microprobe zircon analysis

W. SIEBEL[1], A.K. SCHMITT[2], M. DANIŠÍK, [3] F. AYDIN[4] AND E. KIEMELE[1]

[1]University of Tübingen, Germany
[2]UCLA, USA
[3]University of Waikato, New Zealand
[4]University of Nigde, Turkey

The Acigöl volcanic field has been interpreted as a thermally growing system, where smaller magma pulses coalesced into a large, interconnected silicic magma reservoir [1]. We established a high temporal resolution chrono-stratigraphic framework for rhyolitic volcanism at Acigöl from zircon U-Th disequilibrium and (U-Th)/He dating combined with thermometry and O-Sr-Nd-Pb isotopic data. In contrast to previous dating [2], we found that zircon crystallized in only two pulses corresponding to separate eruptions in the eastern and western Acigöl field during Mid- (~150–200 ka, group I) and Late Pleistocene (~20–25 ka, group II) times, respectively. For group II zircons, resolvable differences exist between interior (average: 30.7±0.9 ka; 1σ error) and rim (21.9±1.3 ka) crystallization ages. These translate into radial crystal growth rates of ~10^{-13} – 10^{-14} cm/s. Rim crystallization ages and (U-Th)/He eruption ages (24.2±0.4 ka) overlap within age uncertainty. Compositionally, group I lavas are less evolved (SiO_2 = 71–73 wt.%), than group II lavas (SiO_2 = 74–75 wt.%). Within each group, compositional variability is small, and Nd-Pb isotope ratios are fairly homogeneous. Group II rhyolites have $\delta^{18}O$(zircon) overlapping mantle values (5.56 ± 0.16 ‰), whereas group I rhyolites are slightly more enriched in ^{18}O, consistent with some crustal material input. By contrast, group II rhyolites have markedly more radiogenic $^{87}Sr/^{86}Sr$ ratios (0.7065–0.7091) compared to those of group I (0.7059–0.7065). The correlation between hydration (loss on ignition data) and $^{87}Sr/^{86}Sr$ in the group II lavas indicates that Sr was added during post-eruption alteration by wind-blown material. Isotope constraints preclude the possibility that the rhyolite magmas formed by partial melting of any known regional crystalline basement rocks. Despite the longevity of rhyolite volcanism at Acigöl, and trends from group I to group II rhyolites of progressive depletion in compatible trace elements and decreasing zircon saturation temperatures, evidence for brief zircon residence is consistent with autochthonous crystallization in small discrete magma batches rather than in a fully interconnected magma reservoir.

[1] Druitt TH et al. (1995), *J Geol Soc, London* **152**, 655-667
[2] Bigazzi G, et al. (1993), *Bull Volcanol* **55**, 588-595