Volcán de Colima, an andesitic volcano fed by a dacitic reservoir. Is that typical of continental arc magmatism?

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Volcán de Colima, Mexico is the archetype of an andesitic arc stratovolcano and is one of the most active volcanoes in North America. All historically erupted magmas have bulk andesitic compositions, yet the melt inclusion and phenocryst compositions indicate that the melt crystallizing in the subvolcanic system is consistently dacitic in composition. Similar mismatches between whole rock and melt inclusion records are documented for several other andesitic volcanoes, which raises questions about the abundance of true liquids with andesitic composition.

Melt inclusions (MI) in phenocrysts of pyroxenes From Volcán de Colima magmas are distinctively more silicic than whole rock compositions (64-75 and 57-62 wt% SiO_2 respectively). A significant proportion of the melt inclusions have "exotic" compositions thought to be produced by grain boundary melting of co-genetic crystal-clots. The other MI show trends consistent with crystallization of the phenocryst assemblage observed in the magmas. Volatile content of these melt inclusions are distinctively low (≤2.5 wt% H_2O, ≤360 ppm CO_2) and indicate crystallization in a volatile-saturated system between 90 and 0 MPa (<7 km in depth). The magmas contain ubiquitous gabbroic fragments up to few mm in size. The whole-rock compositions of the andesites systematically lie on mixing lines between the gabbroic fragments and the less evolved melt inclusions, indicating that entrainment of these gabbroic fragments is the primary factor controlling the bulk andesitic composition and, importantly, that the melt inclusions effectively record the composition of the crystallizing melt. Overall, this implies that despite the monotonous andesitic composition of the erupted magmas, the magmatic system that feed Volcán de Colima comprise a shallow, variably crystallized dacitic magma reservoir and a pre-existing gabbroic plutonic body. It is therefore bimodal in composition, with no andesitic melt.

A compilation of published melt inclusion data for several other continental arc andesite volcanoes also shows a bimodal distribution with a marked minimum at andesite. This implies that andesitic melts are typically minor compoments of the upper crustal magmatic reservoir feeding arc volcanoes and that the abundance of erupted andesitic magmas reflects in large part effective mixing of these two components within the subvolcanic reservoir and/or on the way to the surface.

The building stones of the Khmer-temple at Angkor/Cambodia: A petrological and geochemical approach towards a conservation oriented characterisation of the inventory

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The Angkor Park /Cambodia, as a prominent member of the Unesco world heritage, is one of the outstanding cultural relics on earth. Countless Khmer temples were successively built between 9^{th} –13^{th} century.

During the preparation of interventions in individual temples the building stones were investigated concerning their most important properties in regard to conservation strategies. It turned out that there are considerable differences in weathering behavior between the sandstones used at different temples and that the composition and texture of the building stones are determining factors for the degree and the type of decay. The study presented aims at a detailed geochemical and mineralogical characterisation of the building stones starting with samples from some of the most prominent temples. Together with petrophysical data this shall provide a material oriented database for future conservation conceptions.

The material was characterised petrographically by optical microscopy, the components were analysed by electron microprobe and whole rock chemistry of main and some trace elements that were determined by XRF-analysis. X-ray diffraction was used for determining clay minerals in selected rocks.

On a petrographic base most of the rocks can be classified as feldspathic greywackes (according to Pettijohn *et al*. 1972), in one, the Banteay Srei temple, lithic greywackes were found. Inspite of this similarity the rocks display a distinct variability in regard to their chemical composition and texture. The combinations of the methods show clear accordances in the observed variability of the temples building stones. On the other hand the building stones from the Ta Keo (feldspathic greywackes) and the Banteay Srei temple (lithic greywackes) are distinctly different from the others. They also show no correlation with the samples of the ancient quarries.

Future investigations extend to temples (also smaller ones) and ancient quarries in the wider surrounding of the Angkor Park aiming at the set-up of a database on the variability and historical variations in the building stones used during the five centuries of construction.