Demir Kapija ophiolite: A snapshot of subduction initiation within a back-arc

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The Demir Kapija ophiolitic complex (Macedonia-FYROM) includes a mafic volcanic sequence (pillow lavas, diabases, and gabbros) that was intruded by intermediate to felsic and adakite-like rocks in an island arc setting.

The mafic volcanic sequence of the ophiolite complex formed in intra-oceanic back-arc setting. They are characterized by slightly increased LILE/HFSE, flat REE patterns, and radiogenic $^{143}Nd/^{144}Nd$ (up to 0.51272) and high TiO_2 contents, which reflect Pl+Ol+Cpx fractionation. The fractionation pattern between TiO_2 and MgO indicates that Ti saturation was reached and Ti-magnetite fractionated.

The intermediate to felsic and adakite-like intrusions are spatially and temporally closely related. The adakite-like volcanics show most of the features of typical adakites, i.e., low HREE, high Sr/Y, high LILE and LREE of whole-rock samples, as well as clinopyroxene major and trace element composition that are typical for adakite. The very high Th/La, Th/Yb and Ba/Yb ratios and the reduced $^{143}Nd/^{144}Nd$ values (around 0.51245) reflect contributions of sedimentary material to the mantle source of these melts. In analogy to adakites, these rocks are thought to be the product of slab melting in an unusually hot subduction zone. The intermediate to felsic volcanics show a broad range of SiO_2 content (51-75%) and more radiogenic Nd isotopic compositions than the adakite-like rocks. Their genesis is related to magma mixing of two different components; one is mantle derived, while the other one is a product of melting of an arc crust. The geochemistry of these rocks indicates that the melting of sedimentary rocks contributed to a variable extent to the source of these magmas.

During the Mid-Jurassic, opening of the short-lived Demir Kapija back-arc basin was initiated by slab roll back of the Western Vardar Ocean. Intra-oceanic subduction began within the collapsing ridge. As the subduced oceanic crust was young and hot, the thermal regime was favourable for slab melting and the formation of adakite-like rocks. Thus, the adakite-like rocks and the intermediate to felsic intrusions are related to the switch from an extensional to a compressional regime.

Testing crustal deformation and erosion-tectonic feedback models in the easternmost Himalaya using palaeo-Brahmaputra deposits

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Strain, uplift and exhumation of the Earth's surface impact on, and are impacted by, fluvial drainage evolution. An investigation of the latter therefore provides a key to understanding crustal deformation processes and erosion-tectonic-climate interactions. In the Himalaya, the unusual fluvial drainage configuration of the eastern syntaxial region has been interpreted either as distorted drainage resulting from crustal shortening (due to India-Asia convergence) and lateral extrusion of crustal material, or as the result of river capture events tectonically-induced by surface uplift. Determining if and when the Brahmaputra river captured the Yarlung Tsangpo is crucial to testing these models of crustal deformation. In addition, rapid fluvial incision potentially resulted in sufficient erosion by focused weakening of the crust, that deep seated ductile rocks were induced to flow upwards and be rapidly exhumed in the syntaxial region, providing a viable example of erosion-tectonic coupling. The first arrival of detritus carried by the Yarlung Tsangpo (draining the Jurassic-Paleogene Trans-Himalayan arc of the Asian plate) in the Neogene deposits of the palaeo-Brahmputra river in Bangladesh (that prior to capture would have drained the southern Himalayan slopes composed only of Precambrian-Palaeozoic Indian crust) should date the capture event, while input from the eastern syntaxis can be identified by the appearance of very young (<10 Ma) and rapidly exhumed mineral grains.

To address the river capture and the erosion-tectonic coupling hypotheses, U-Pb LA-MC-ICP-MS dating of detrital zircon grains (from palaeo-Brahmputra sediments as well as sands from modern rivers draining the Trans-Himalaya and Himalayan southern slopes) is integrated with microtextural analysis in a revised approach to the use of detrital zircon data as applied to provenance studies. In this ongoing multi-technique study, zircon data are complemented by the novel application of U-Pb dating to rutile detrital grains as well as by Ar-Ar dating of detrital white mica and zircon fission-track thermochronology.