Geochemical and age of collision-related volcanism following the closure of the Neotethys Ocean (Lesser Caucasus, Armenia)

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In the Lesser Caucasus in Armenia, collision of the South-Armenian Block (SAB) and Eurasia started during the Paleocene and was forming the Amasia-Sevan-Akera Suture zone (ASASZ). Magmatism covering the suture zone occurred during this collision and is particularly widespread since Middle Eocene. Moreover magmatism occurred after the Arabian plate collision with Eurasia since Miocene. In order to add constraints to the geodynamic context of these magmatisms, an extensive geochemical study (major & trace elements, isotopes) and geochronological study has been developped on 19 magmatic rocks. Only scarce geochemical and geochronological data are available on the Middle to Late Eocene volcanism which is associated to calc-alkaline to alkaline mildly alkaline compositions.

12 zircon grains extracted from a rhyodacite sample from SAB have been dated by U-Pb laser ICP-MS ablation which gives a well-concordant middle Miocene age of 14.6±0.2 My.

The rocks are overall characterized by enrichment in large ion lithophile elements (LILE) and show significant enrichment in light rare earth elements (LREE) compared to heavy rare earth elements (HREE) with $(La/Sm)_N$ evolving from 2.2-7.3 and $(La/Yb)_N$ ratios ranging between 2.5 and 16 and up to 47 for the rhyodacite. Extended rock-patterns of the ASASZ samples show positive anomalies in Pb, Sr, Ba associated to negative Nb and Ta spikes typical of subduction or back-arc environments. A more continental character is evidenced for trachyandesites of late Eocene and rhyodacite of middle Miocene ages due to possible slab retreat, a break off and continental crust heating by rising of the astenospheric mantle (Sosson *et al*. 2010).

[1] Sosson *et al*. (2010) *Geological Society of London, Special publication* **340**, 328–350.

Geochemical reactivity of submarine tailings from the Batu Hijau Mine

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Batu Hijau is an open pit mine, located in south-western Sumbawa, Indonesia, with economic mineral recovery achieved through sulphide flotation and copper-gold concentrate production. Mine tailings are discharged to Senunu Submarine Canyon via an engineered deep sea tailings placement (DSTP) system. The tailings pipeline terminus is at a water depth of 125 meters from which solid tailings flow down the canyon slope to settle at depths approximately 2,000-4,000 meters. The ore processed at Batu Hijau is categorized as fresh ore from the pit, medium and low grade, with the majority of the latter two reporting to the ore stockpile where they may be stored for several years prior to processing. The fresh ore tailings contain primarily unreactive gangue material and residual sulphides. Extensive global scientific research as well as site-specific data has conclusively demonstrated that fresh sulphidic tailings are geochemically stable when permanently stored under a water cover due to greatly reduced sulphide oxidation rates arising from the limited availability and diffusibility of oxygen in water as compared to air. Conversely, the stockpiled ore is exposed to oxygen and rain prior to processing resulting in the partial oxidation of precursor sulphides and formation of secondary weathering and oxidation products. Disposal of oxidized minerals within the tailings to the marine environment may result in the reductive dissolution of oxide and oxyhydroxide phases potentially resulting in an increase in mobility of metals to overlying seawater. Field experiments were conducted in 2010 to assess the geochemical reactivity of tailings derived from processing of fresh and partially oxidized ore in the marine environment. Redox sensitive parameters and trace metals in tailings porewater and the overlying seawater were measured at high spatial resolution through the use of dialysis arrays (peepers). Mobility of contaminants of concern and the geochemical reactions governing the reactivity of submarine tailings were assessed from the porewater geochemical data. Copper efflux rates of less than 0.7 $\mu g/cm^2$/year were calculated for both types of tailings from the porewater chemical profiles.