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Deciphering active arc vs. post-collisional calc-alkaline magmatism trough B and radiogenic isotope data in Aegean-Anatolian region

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The Aegean-Anatolian region is characterized by a complex geodynamic system, including hard collision between the Arabian and Anatolia plates to the east and the opening of the Aegean back-arc to the west. The diachronous closure of the last vestiges of the Neotethys Ocean were associated, from Miocene to Holocene, to a diffuse magma emplacement, with volcanic rocks showing calc-alkaline to ultrapotassic affinity. Some of these magmas erupted during the last phases of Northward-directed Neotethys subduction beneath southern Anatolia, such as in Eastern Anatolia (Early-Middle Miocene) and the South Aegean Volcanic Arc (Pliocene-Holocene). On the other hand, Western and Central Anatolia show igneous activity that can be defined as post-collisional, being sourced from mantle previously modified by slab-released agents.

We investigated the geochemical and isotope characteristics of various volcanic sectors in the region by considering a large database with more than 8700 volcanic rock samples, with special emphasis on the behavior of elements with different mobility in fluids, to be used as sensitive tracers of slab inputs of volcanism.

In particular, the significant variability in B isotopes, together with Sr-Nd isotopic signatures, not only allows us to discriminate between fluids and melts released from different subducted domains, but also to trace the progressive dehydration of the downgoing slab(s). In addition, this investigation might also provide crucial insights into the nature of sediments involved in the metasomatic modification of the mantle sources.

The variations in subduction components are ultimately framed within the paleogeographic evolution of the Eastern Mediterranean basin that controlled the characteristics of sediment input of the subducted slab. Notably, the B-Sr isotope variations between the Middle Miocene and the Pliocene-Holocene volcanic arcs indicate a progressive increase in in-situ carbonate production after Middle Miocene, paralleled by a decrease of the siliciclastic riverine input. Indeed, from at least the mid-Upper Miocene (~10-6 Ma) onwards, the Nile River runoff had a negligible effect on sedimentation in both the Levantine basin and the Central Mediterranean slab, reinforcing the significance of local sedimentary processes in shaping the subduction system.