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Migration and sources of calc-alkaline magmatic centres in the Aegean subduction zone

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Subduction zones are dynamic plate boundaries that can migrate with time and where magmas with variable compositions form, largely reflecting changes of the subducting lithospheric plate. Magmatic activity in the Aegean subduction zone migrated since about 30 Ma by some 350 km to the SW with five young volcanic centres forming the South Aegean Volcanic Arc (SAVA). We show that the magmatic activity apparently migrated along five tracks with the fastest migration occurring between 20 and 10 Ma. The acceleration of migration may be due to the change from subduction of the continental Hellenic external carbonate platform to the Ionian oceanic lithosphere at about 25 Ma. Magmatic rocks range from mafic to felsic in composition and belong to the calc-alkaline, high-K calc-alkaline, and shoshonitic series. Mafic magmas show highly variable Sr and Nd isotope ratios implying variable sediment subduction. The Sr isotope compositions in magmatic rocks increase from 0.706 to 0.710 and Nd isotope ratios decrease from 0.5126 to 0.5122 between 25 and 10 Ma, indicating increasing input of sediment into the subduction zone. The eastern arc appears to have received less sediment than the western arc because the magmatic rocks show less variation of Sr and Nd isotope ratios with time. This is in agreement with reconstructions showing a wider carbonate platform in the west. Rocks from the active SAVA show have similar compositions to those older than 25 Ma suggesting a decrease in sediment addition to the mantle after 5 Ma. This change in compositions probably resulted from the replacement of material from the subducted carbonate platform by the Ionic oceanic lithosphere in the melting zone of the SAVA. Single magmatic centres have average diameters of 10 kilometres and appear to be active for some 4 million years, implying that partial melting in the mantle occurs over a similar period of time, possibly in rising diapirs. Significant geochemical variations of rocks from single magmatic centres indicate small-scale heterogeneities within the mantle.