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Geochemistry and tectonic significance of the Koçali ophiolite and the related Koçali melange, Adiyaman region, SE Turkey

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The Koçali complex includes the Koçali Ophiolite and the volcanic-sedimentary Koçali melange. The ophiolitic rocks form E-W trending thrust sheets in which all of the components of a complete ophiolite sequence are present, although mainly separated by tectonic contacts; i.e. (from bottom to top), serpentinised harzburgite, layered cumulates, isotropic gabbros, sheeted dykes, pillow lavas, radiolarian and metalliferous sediments. Microgabbro-diabase dykes intrude various levels of the ophiolite pseudostratigraphy. The sheeted dykes and pillow lavas locally exhibit Cyprus-type hydrothermal mineralisation. The Koçali melange is a tectonic slice complex that structurally underlies the ophiolite on a regional scale, although ophiolite and melange are structurally intercalated in places related to emplacement onto the Arabian continental margin.

The geochemistry of the crustal rocks of the Koçali ophiolite and the Koçali melange, taken together, shows that are all tholeiitic in composition except for the volcanic rocks which show both tholeiitic and alkaline features. New geochemical data from the ophiolitic isotropic gabbros, sheeted dikes, isolated dikes and volcanics indicate that there are three main types of parental basic magmas: (i) IAT series, comprising isotropic gabbros, sheeted dikes and the Group I isolated dikes; (ii) E-MORB series, characterized by the Group I volcanics and Group II isolated dikes; (iii) OIB series represented by the Group II volcanic rocks. The presence of highly magnesian olivines (Fo84-74), clinopyroxenes (Mg#92-65), orthopyroxenes (Mg#86-75), together with Ca-rich plagioclases (An95-86) in the cumulate rocks suggests that the plutonic suite was derived from an island arc tholeiitic (IAT) source rather than a mid-ocean ridge-type magmatic source. The Koçali Complex is interpreted to have formed during opening of the southern Neotethys, whereas the the Koçali ophiolite formed above a north-dipping intraoceanic subduction zone during ocean basin closure.

Taking account of evidence from comparable ophiolites and melanges in Baer-Bassit (N-Syria) and the Mamonia Complex (SW Cyprus), the southern Neotethyan oceanic basin is interpreted to have rifted during the Late Triassic. The Koçali melange restores as the north-facing passive margin of the Arabian plate. The South Neotethyan ocean oceanic floor was covered by Jurassic-Lower Cretaceous continental margin-derived and pelagic/hemipelagic deep-sea sediment. Northward subduction began during the Late Cretaceous and the ophiolite formed above a northward-dipping subduction zone. The subduction trench collided with the Arabian margin during latest Cretaceous, driving southward emplacement of the Koçali, Hatay and Baer-Bassit ophiolites, finally during Maastrichtian time.