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Petrogenetic and Geotectonic Study of Early Formed (Triassic?) Volcanics in Ophiolitic Complexes in Central Greece: Examples from Koziakas, Othris, Iti and Kallidromo Regions

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The early formed volcanics occurring in ophiolitic complexes in Central Greece are suggested to be mostly of Triassic age. They occur within Triassic sedimentary sequences as well as in mélange formations, being interpreted to be parts of the Pindos Ocean, which formed after breakup of a Gondwana continental margin. In the studied regions of Koziakas, Othris, Iti and Kallidromo the volcanic rocks consist mainly of pillow lavas with extreme variable geochemical affinities (alkaline, tholeiitic and calc-alkaline) and in rare cases ultramafic lavas. The igneous sequence is complemented by another wide compositional range rocks consisting of wehrlites, mafic subvolcanic rocks (picrites, transitional boninites, dolerites) and pyroclastic tuffs compositionally intermediate to felsic.

The alkaline lavas are present in Othris in close association with tholeiitic pillow lavas and within mélange formations in the regions of Koziakas, Iti and Kallidromo. In the Triassic formations of Othris most of the igneous rocks are represented by pillow lavas which are mainly tholeiitic, ranging in composition from E-MORB (most lavas) to IAT types. Similar E-MORB volcanic rocks are not present in Koziakas, Iti and Kallidromo regions. The calc-alkaline lavas have a broad composition which varies from basaltic to trachyandesitic and felsic. They occur sandwiched between middle Triassic sedimentary formations in Koziakas, in melange formations in central Othris, while they are missing in Iti and Kallidromo. The ultramafic lavas, which are accompanied by picrites, transitional boninites and dolerites, are found in Othris only, intruding the E-MORB pillow lavas.

Geochemical and mineralogical data evaluation as well as petrogenetic modelling show the formation of the studied compositionally wide, unusual rock association can be explained through complex and multistage events, which have taken place in a rift- and subduction-related geotectonic environment of the Pindos Ocean in Middle-Late Triassic. In particular, the presence of alkaline basalts in central Greece implies that they were generated after partial melting of a deep, spinel-garnet bearing mantle source during early rifting. Alkaline lavas seem to have been formed by variable degrees of partial melting ranging from 5 to 10% of an enriched source compositionally equivalent to the Western Anatolian Mantle, with the Koziakas alkaline lavas having been derived by higher degrees of partial melting. On the other hand, E-MORB volcanics are interpreted to have been produced at about 15% melting of the same source. The tholeiitic lavas with IAT affinities may indicate a change of the early rifting environment, with the development of an intra-oceanic subduction of the young and hot oceanic crust. The ultramafic lavas are interpreted to have formed from accumulation of olivine from a primary picritic magma generated within the mantle wedge above the infant subducted slab, whereas en route to the surface their magma may have mixed with an upwelling asthenospheric more evolved melt, as the presence of quench less Mg# clinopyroxenes in the ultramafic lavas suggests. Transitional boninites and dolerites represent fractional crystallization melts of the same picritic magma. Finally, the calc-alkaline lavas were probably produced as late differentiate products when the subduction became more mature and the slab approached the western Pelagonian continental margin.