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Petrogenetic implications from ultramafic rocks and pyroxenites in ophiolitic occurrences of East Othris, Greece

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Ultramafic rocks and pyroxenites in east Othris are included within ophiolitic units near the villages of Vrinena, Karavomilos, Pelasgia, Eretria, Agios Georgios, Aerino and Velestino. The first five ophiolitic occurrences are estimated to have been emplaced between the Oxfordian and Tithonian-Berriasian[1,2,3], while the latter two have been emplaced during the Eocene[4]. Ultramafic rocks include variably serpentinized harzburgites and lherzolites. Pyroxenites are usually found in the form of crosscutting veins within the harzburgites.

Ultramafic rocks include depleted lherzolites, with Al_2O_3 ranging from 1.12 to 1.80 wt% and Cr from 3250 to 3290 ppm, as well as moderate to highly depleted serpentinized harzburgites, with Al_2O_3 ranging from 0.69 to 1.98 wt% and Cr from 2663 to 5582 ppm. Pyroxenites have generally higher Al_2O_3 ranging from 1.91 to 3.08 wt% and variable Cr ranging from 1798 to 3611 ppm.

Lherzolites mostly include olivines (Fo=87.07-89.23) and clinopyroxenes (Mg#=85.71-90.12). Spinels from Eretria lherzolite (TiO_2=0.02-0.08 wt%, Al_2O_3=36.06-42.45 wt%, Cr#=31.67-36.33) are compositionally similar with those of MORB peridotites[5], while those from Vrinena lherzolite (TiO_2=0.16-0.43 wt%, Al_2O_3=6.90-22.12 wt%, Cr#=57.69-76.88) are similar to SSZ peridotites[5]. Serpentinized harzburgites include few olivines (Fo=90.51-91.15), enstatite porphyroclasts (Mg#=87.42-88.91), as well as fine grained enstatites of similar composition. Harzburgites from Pelasgia, Eretria and Agios Georgios include spinels (TiO_2=0.03-0.08 wt%, Al_2O_3=23.21-31.58 wt%, Cr#=45.21-56.85) which do not clearly show if they are related with MORB or SSZ peridotites[5]. Spinels from Karavomilos harzburgite (TiO_2=0.02-0.05 wt%, Al_2O_3=45.71-50.85 wt%, Cr#=16.84-22.32) are compositionally similar with MORB peridotites[5], whereas spinels from Vrinena harzburgite (TiO_2=0.15-0.19 wt%, Al_2O_3=1.42-1.86 wt% Cr#=91.64-93.47) with SSZ peridotites[5]. Pyroxenites include clinopyroxenes (Mg#=84.25-91.78) but also enstatites (Mg#=88.37-91.47). Spinels have been analysed in pyroxenites from Aerino and Velestino (TiO_2=0.79-1.07 wt%, Al_2O_3=10.88-18.46 wt% Cr#=60.74-70.78), indicating SSZ settings. Application of the olivine-spinel[6], olivine-augite[7], Cpx-Opx[8,9] geothermometers, yield equilibration temperatures of 961-1075 ^oC for lherzolites, 895-1084 ^oC for harzburgites and 990-1011 ^oC for pyroxenites.

Our data indicate that the ophiolitic occurrences of Vrinena, Aerino and Velestino include ultramafic rocks and pyroxenites related to SSZ processes, while the other ophiolitic occurrences embrace ultramafic rocks which originated from a MORB-like setting, similar to west Othris ophiolites. It should be noted that even lherzolites have Cr and Y values similar to those of a highly depleted mantle source. A supra-subduction zone origin of the east Othris ophiolites, possibly with a slab rollback in the Pindos oceanic basin, may explain the different geotectonic environment affinities of the studied rocks.

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