Geophysical Research Abstracts
Vol. 15, EGU2013-604-1, 2013
EGU General Assembly 2013

Formation of a cold ophiolitic sole at the base of the Devonian Balkan Carpathian Ophiolite (Romania, Serbia, Bulgaria)

Gaëlle Plissart, Hervé Diot, Christophe Monnier, Marcel Maruntiu, Vinciane Debaille, and Franz Neubauer
France (gaelle.plissart@univ-lr.fr)

Our study concerns deformed gabbroic rocks from the Balkan Carpathian Ophiolite (BCO - Romania, Serbia, Bulgaria). The BCO consists of four ophiolitic massifs dismembered during Alpine tectonic and displaying together a complete classical oceanic lithosphere. Our new Sm-Nd dating on fresh lower gabbroic rocks give an accretion age for the BCO crust at 409 ± 38 Ma, in agreement with a previous age of 405 ± 3 Ma (Zakariadze et al. 2012). After removing the Alpine tectonic, the BCO appears as an elongated E-W body tilted to the south. At the base of the ophiolitic complex occurs a thin deformed zone (< 800m) of metagabbroic rocks underlined by Cambro-Ordovician metasediments.

Petrostructural observations on metagabbroic rocks coupled with mineralogical and geochemical data indicate that their protoliths were mainly upper gabbros statically metamorphosed in the Greenschist/Amphibolite facies (event 1 = ocean-floor metamorphism at the ridge axis). These rocks have been affected by a second circulation of fluids (event 2), contemporaneous to a deformation and inducing local K-enrichment (formation of Cr-muscovite). Temperature estimates for this event indicate a range of 450°C - 280°C, with the lower values observed for the more intensively metasomatized rocks. ^{40}Ar - ^{39}Ar dating on two Cr-muscovites from slightly and highly deformed metagabbros gives plateau ages of 372.6 ± 1.3 Ma and 360.6 ± 1.2 Ma respectively. We interpret the first age as a mimimum age for the beginning of the event 2, observed into preserved rocks, and the second one as linked to (neo-/)recrystallisation due to localisation of the metasomatism/deformation.
The interval of 30 Ma between oceanic crust accretion and initiation of metasomatism/deformation involves that the upper oceanic crust had cooled down to temperatures close to 100°C before the beginning of event 2. Consequently, a temperature increase is required to observe the greenschist facies assemblage. We have tested by tectono-thermal modelling the hypothesis that these rocks could correspond to a slice of upper crust dragged down during intra-oceanic subduction: temperatures of 450°C are reached at a depth of 17 km (5 kbar). These PT conditions are in agreement with the mineralogical assemblage formed during event 2 meanwhile the intense fluids circulation and the K-rich metasomatism (up to 5% K2O for bulk rock analyse) could be explained by the destabilization of deep oceanic sediments. To initiate the subduction of a 30 Ma old oceanic lithosphere, we propose a zone of weakness alongside a transform fault that juxtaposes oceanic lithospheres of different ages and thicknesses, supported by microstructural criteria that evidence a highly oblique tectonic obduction.

Our study emphasizes that ophiolitic soles could develop away from the ridge in a context of intra-oceanic subduction along a transform fault. In that case, the hanging wall will not be hot enough to produce classical high-grade metamorphic sole and the resulting rocks could be referred as “cold ophiolitic soles”.