

Cumulates and gabbros in southern Albanian ophiolites: their bearing on regional tectonic setting

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Abstract: The western belt of the southern Albanian ophiolites consists of six major ophiolite massifs (Voskopoja, Rehove, Morava, Devolli, Vallamara, Shpati) and two smaller ones (Luniku and Stravaj). Each massif has a distinct sequence of mantle tectonites, ultramafic cumulates (plagioclase-bearing peridotites and wehrlites), cumulate gabbros, troctolites and isotropic gabbros. Voskopoja, Rehove and Morava have predominantly lherzolites as mantle tectonites, Shpati lherzolites and harzburgites, and Devolli and Vallamara almost exclusively harzburgites. A volcanic section together with volcanogenic sediments occurs only in the Voskopoja and Rehove massifs as well as in the smaller Luniku and Stravaj massifs. Whole-rock geochemistry and mineral chemistry suggest a mid-ocean ridge setting for the origin of the cumulates and gabbros from the Voskopoja, Rehove and Morava massifs, with only a minor suprasubduction zone (SSZ) influence. The Shpati massif and the small Luniku massif show mid-ocean ridge (MOR) and SSZ signatures in their plutonic sequences. Cumulates and gabbros from Devolli and Vallamara formed in an SSZ setting. The predominance of MOR-generated crustal rocks and the relatively minor occurrence of SSZ-generated plutonic rocks together with the volcanogenic sediments in the Voskopoja and Rehove massifs are indicative of a back-arc basin origin of the western belt ophiolites above a westward-dipping subduction zone.

The Albanian ophiolites are part of a large NNW–SSE-striking ophiolite zone, which comprises the Dinaric ophiolites as well as some Greek ophiolites such as Pindos, Vourinos and Othris. The total length of this ophiolite zone is *c.* 1000 km, from Croatia in the NNW (e.g. Lugovic *et al.* 1991; Pamić *et al.* 2002) to Argolis (Greece) in the SSE (e.g. Robertson & Shallo 2000; Bortolotti *et al.* 2004). Their Jurassic age is constrained by palaeontological evidence from the sediments on top of the ophiolites, by the age of the metamorphic soles and by age determinations on the intrusive plagiogranite (Bortolotti *et al.* 2004; Dilek *et al.* 2005, and references therein).

The overall setting of these ophiolites in the regional geological framework in Albania has been discussed by earlier workers (Shallo *et al.* 1990; Shallo 1992, 1994; Frasheri *et al.* 1996; Meco & Aliaj 2000; Robertson & Shallo 2000; Bortolotti *et al.* 2004) and is shown in Figure 1,

which follows the tectonic zones outlined by Meco & Aliaj (2000). The tectonic zones located west and NW of the Albanian (Mirdita) ophiolites comprise a westward-directed stack of thrust sheets related to the Apulian continental platform. The Sazani and the Kruja zones represent the carbonate platform, and the Ionian zone an intra-continental rift area (Robertson & Shallo 2000). The Krasta (Cukali) zone (Pindos zone in Greece) is the deep-water passive margin of the Apulian platform. It is, in turn, overthrust by the Albanian Alps, the Vermoshi and Gashi zones, platform-related units to the east of the Krasta zone (Meco & Aliaj 2000; Robertson & Shallo 2000). The Korabi zone (Pelagonian zone in Greece), east of the ophiolites, represents a continental fragment comprising a pre-Alpine basement and a Triassic–Jurassic sedimentary cover.

The Albanian ophiolites form a link between the Greek and the Dinaric ophiolites. An