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DISTRIBUTION OF MESOZOIC HARZBURGITES AND LHERZOLITES IN THE EASTERN ALPS

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ABSTRACT

Within some tectonic units of the Eastern Alps serpentinized peridotites are rather common and define together with their associated rocks such as metabasalts and overlying metasediments fragments of a former oceanic crust. Such ultramafic rocks occur in the Eastern Alps in the Penninic and the Lower Austroalpine zones; furthermore in the Rhenodanubian Flyschzone ascribed to the Penninic realm (e.g. Oberhauser, 1995).

Most widespread are serpentinized peridotites in the Penninic zone, exposed in three tectonic windows, which are from the west to the east: the Lower Engadine Window (LEW), the Tauern Window (TW) and the Rechnitz Window Group (RWG), the latter form a group of several small windows at the eastern end of the Alps. Stratigraphically, the metamorphic rocks in the Mesozoic Penninic units range from the Trias (?) to the Paleogene. They contain Triassic quarzites, marbles and dolomites as well as Jurassic and Cretaceous phyllites, micaschists, calc micaschists and other metasediments. In addition several well developed Jurassic(?) MORB-type ophiolites and non-ophiolitic volcanics occur throughout all Penninic windows. The ophiolites form an important member of the general tectonic succession of the Mesozoic Penninic Units. They consist of serpentinites, metagabbro and former MOR basalts (Höck and Koller, 1989; Koller and Höck, 1990) and show an average thickness up to 550 m. The ophiolites are believed to have formed in the former South Penninic ocean.

Most ultramafics of the ophiolites show a mantle composition and only rare relics of former minerals such as chromite. Low Al_2O_3 contents in the range of 1-1.5 wt% and high X_{Mg} values of 0.94-0.86 allow to classify these serpentinites as former harzburgites. Only form relics of orthopyroxene are occasionally preserved in less deformed samples. Only in the LEW and TW few ultramafic cumulates with Al_2O_3 values around 4-4.5 wt% and a X_{Mg} of 0.81-0.76 were found so far together with gabbros and rodingites. A well preserved clinopyroxen in cumulate samples was only found in an ultramafic cumulate of the Idalp ophiolite complex (LEW). It is interpreted as cumulate lherzolite derived from a basaltic melt.

In the LEW occur also some other ophiolitic fragments with a reduced thickness. One of these complexes is the Ramosch ophiolite (Vuichard, 1985), which is part of a deeper structural unit of the LEW and is thought to be related to the former North Penninic ocean. The succession contains mainly ultramafic, ophicarbonates and only few gabbros and metabasalts. The ultramafic are serpentinized lherzolites and contain 3-4 wt% Al_2O_3 as well as a limited X_{Mg} of 0.89-0.91. An other complex but with unclear tectonic relationships is the only partly serpentinized peridotite body (lherzolite) of Nauders, which contains primary olivine, cpx, opx, and green spinell. All mineral phases indicate a clear mantle composition.

The Lower Austroalpine unit overlying the Penninic zone in the TW contains a larger number of serpentinized ultramafic bodies. Examples are reported from the NW rim of the Tauern Window ("Tarntal" mountains) and from the south in the so-called Matrei zone. One of the best described example is the Reckner complex in the Tarntal mountains defined by Dingeldey et al. (1997). It is built up by a rather restricted sequence of serpentinites, representing a less depleted mantle fragment, and a thin (few meters only) blueschist and/or ophicarbonate horizon. The ultramafics exhibit a large variety of lherzolites, harzburgites and also dunites with X_{Mg} values of 0.90-0.88 combined with a variable Al_2O_3 content. It ranges in the lherzolites from 4.5 - 2.9 wt%, in the harzburgites from 1.2-1.4 wt% and is restricted in the dunites below 0.5 wt% (Koller et al., 1996). Well preserved primary clinopyroxene can be found in the most of the lherzolites.

Summarizing, in all well developed N-type MORB ophiolite fragments of the Penninic zone only harzburgites were found so far. They represent a rather depleted mantle source well documented by Al, Cr and REE contents. Lherzolites occur in these units only as ultramafic cumulates generated in an oceanic crustal environment. In contrast, in all ophiolitic fragments with a reduced thickness and unusual sequences with ophicarbonates lherzolites with commonly preserved primary clinopyroxene are the dominant rock type. They show general higher Al values and different REE patterns, resembling a less depleted mantle source. The best examples are the Ramosch ophiolite and the ophiolites in the Lower Austroalpine unit. Both occur in entirely different tectonic levels.

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