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THE COMPOSITION OF MESOZOIC PERIDOTITE TECTONITES OF THE EASTERN ALPS

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ABSTRACT

Numerous small ultramafic bodies are exposed in Mesozoic cover units of the central Eastern Alps. The major occurrences are restricted to the tectonic windows of the Penninic zone and their surroundings. In the Lower Engadin window, three different mantle peridotite groups have been investigated. The Idalp ophiolite, situated at the northern rim of the Engadin window, is believed to be of south Penninic origin (Trümpy, 1972), whereas the Ramosch ophiolite at the southwestern margin is assigned to the north Penninic area (Vuichard, 1984). The tectonic position of the ultramafics in the vicinity of Nauders, at the southern margin, is unknown. Ophiolite remnants of south Penninic affinity are also present in the Glockner nappe of the Tauern Window. At the eastern end of the Alpine orogen similar peridotites appear in the small Rechnitz window. Numerous, usually small and highly serpentinized bodies of ultramafic rocks can be traced in the Matrei zone along the southern margin of the Tauern window; the Matrei Zone comprises both, Penninic and Lower Austroalpine elements. The Reckner ophiolite complex, near the NW corner of the Tauern window, is part of the tectonically higher units of the Lower Austroalpine nappe.

Geochemical and petrological investigations reveal considerable differences between these mantle slices. The different ultramafic bodies are influenced by a pervasive regional metamorphism locally reaching amphibolite facies. Primary mineral assemblages of the peridotites have been mostly replaced by metamorphic parageneses. The products of metamorphism are dominantly serpentine minerals accompanied by various combinations of diopside, tremolite, chlorite, hydrogarnet and magnetite. In contrast to all other occurences, the samples from Nauders are characterized by a well preserved primary assemblage. Relic clinopyroxene and spinel can be found in peridotites of the Reckner and in the Matrei zone. Olivine and orthopyroxene pseudomorphed by serpentine minerals are present in less deformed areas only.

Preserved clinopyroxenes of these mantle peridotites have up to 7 wt% Al_2O_3 and 1.5-2.0 wt% Na_2O, which corresponds to a jadeite component of more than 10 %. The Cr_2O_3 content is generally high (up to 1 wt%). Clinopyroxene is frequently zoned with progressive depletion of Al, Na, Ti and Cr towards pure diopside. In samples from Nauders the Fo-content of olivine is about 90% and the NiO concentration varies between 0.4-0.5 wt%. The orthopyroxenes range in X_{Mg} from 91-92 and Al_2O_3 reaches up to 5 wt%. Titanian pargasite (X_{Mg} 0.88, about 3.5 wt% TiO_2) is a secondary phase in Nauders peridotites only.

Spinels from Nauders are different in composition to those of the Reckner complex. They are typically poor in Cr_2O_3 (about 7 wt%), high in Al_2O_3 (about 60 wt%) and develop rims which usually have lower Cr contents. Relics of spinel with significantly higher Cr values (Cr# 40-50, Cr_2O_3 35-40 wt%) are preserved in samples of the Reckner complex.

The dominant rock types of all Mesozoic ultramafic bodies are residual lherzolites and harzburgites (X_{Mg} 87-94). The serpentinized ultramafics of the southern Penninic realm (Idalpe, Tauern and Rechnitz windows) are generally harzburgites with low Al_2O_3 (<2 wt%) and CaO contents (Fig. 1).

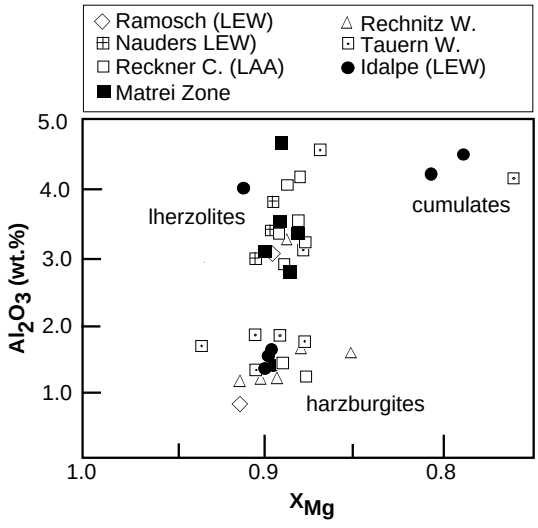

Fig. 1 - Chemical composition of the Mesozoic Ultramafic.

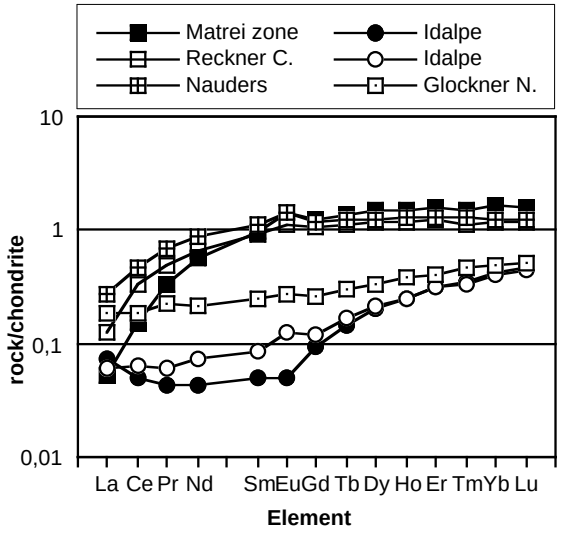

Fig. 2 - Chondrite normalized rare earth element concentrations of peridotites.

The HREE concentrations (0.3-0.5 times chondrite) display patterns of moderately depleted restitic mantle (Fig. 2). Lherzolites and cumulate rocks (X_{Mg} = 0.80) are restricted to a few occurrences within the main mass of harzburgites.

In contrast, more fertile lherzolites and harzburgites form ultramafic bodies of the Matrei zone, the Reckner complex, the Ramosch ophiolite and Nauders.The high abundances of Al_2O_3 (up to 4.6 wt%) and TiO_2 (up to 0.22 wt%) are consistent with the estimated composition of a primitive upper mantle. All samples display higher HREE concentrations (up to 2.5 times chondrite) and a significant LREE depletion trend (Figs. 1 and 2).

The Cr-Yb projection (Pearce and Parkinson, 1993) has been used to investigate the degree of mantle depletion. This diagram provides further evidence that the mantle material of the south Penninic region represents a more depleted source (about 15% melt depletion) than those of the Matrei zone and the Lower Austroalpine region (up to 5% melt depletion).

These data support the model of a slow spreading oceanic environment (Höck and Koller, 1992) for the ophiolites of the Idalpe, Tauern and Rechnitz window, whereas the ultramafics of the Reckner, Matrei Zone and Nauders were probably generated in a pre-oceanic stage.

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