Kontinentales Tiefbohrprogramm der Bundesrepublik Deutschland

Oberpfalz, Geochemie/Petrologie der Ultramafitite

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1. The Moldanubian gneisses in NE Bavaria - but also most other geological units around the KTB site - contain a number of small serpentinized peridotite bodies with tectonic contacts (fig. 1). Similar bodies emplaced in the NNW trending fault zone of Rozvadov (CSSR) were interpreted as alpine-type peridotites by Vejnar. The primary nature of the ultramafitites was still an open question. Are they relics of former oceanic crust indicating the presence of a former ocean, or not? How old are they? This type of study should also be performed on similar rocks which are expected in the KTB cores.

2. On the basis of a petrographic study of the serpentinites, the relics of pre-serpentine minerals were studied in detail structurally and especially chemically by electron microprobe. Their geochemical characteristics were compared with the numerous literature data available for ultramafitites of known origin. An attempt was made to decipher the metamorphic history of these bodies. The best outcrop rich in pre-serpentine mineral relics was the Galgenberg quarry at Winklarn near Oberviechtach in the Moldanubicum.

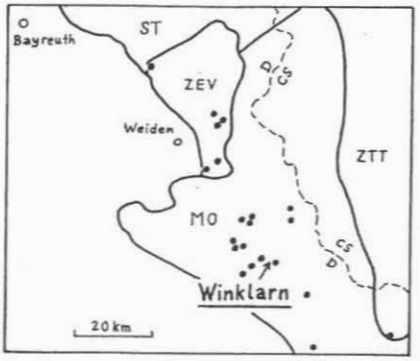

Fig. 1. Simplified geological map of part of NE Bavaria. Black dots = serpentinite localities studied. ST = Saxothuringicum, MO = Moldanubicum, ZEV = Zone of Erbendorf-Vohenstrauss (including low-grade nappe), ZTT = Zone of Tepla-Taus (Domažlice); granites and cover omitted; left = foreland (sediments).

3. Among the 'primary' minerals, olivine predominates. Because of re-equilibration, only the NiO content indicates derivation from tectonite peridotites in ophiolites. Orthopyroxene composition corresponds to that in type III alpinotype peridotites of Dick and Bullen. Amphibole (magnesio-hornblende to tremolite) is a later metamorphic product. Chlorite formed still later. No indications of a former presence of garnet were found. The only mineral which has partially retained its primary composition is spinel. There are several types of spinel with different color, form and composition (fig. 2); the earliest spinels are chromites, the later spinels were formed successively during various metamorphic stages.

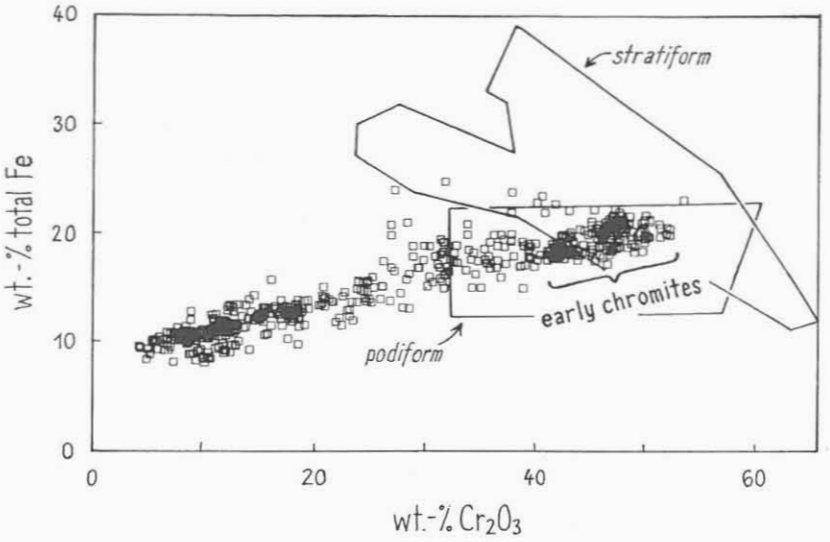

Fig. 2. Fe/Cr_2O_3 plot of Thayer (1970) showing compositions of all spinels analyzed from serpentinites around Winklarn; range of 'primary' chromites indicated. Field of stratiform chromites from fig. 11 in Bliss + MacLean (1975), field of podiform chromites from fig. 5 in Mussallam et al. (1981).

The chromites are hypidiomorphic and dark red in thin section. In a Fe/Cr diagram after Thayer (fig. 2), their compositions plot in the 'podiform chromite' field. Also the TiO_2 and Fe_2O_3 contents are those of alpine-type podiform chromites. The compositions are similar to those of definitely ophiolitic accessory chromites in dunites and harzburgites at Brezovica and Raduša/Yugoslavia (fig. 3). Also other criteria indicate sub-oceanic uppermost mantle as the ultimate source.

4. The primary ultramafitites were predominantly layered harzburgites and dunites with accessory chromites. These rocks are typical constituents of ophiolites. Because of the harzburgites and the chromite compositions, they cannot be parts of layered intrusions. For the same and additional reasons, they cannot be parts of sub-continental mantle. Thus, the Winklarn serpentinites were originally parts of sub-oceanic uppermost mantle although the ocean was probably narrow.

The Oberpfalz serpentinites are partly accompanied by, although tectonically separated from, 'eclogite-amphibolites'. If these were formerly parts of the same dismembered ophiolite sequence, the oceanic crust+mantle must have been older than the HP metamorphism M 1 of Blümel. As no indications of a former presence of garnet were found in the serpentinites, the pressure reached during HP metamorphism must then have been between 11 and 36 kbar where eclogite formed from amphibolites but the ultramafitites not yet reached the garnet peridotite field (lower limit about 36 kbar for the Cr-rich composition, after O'Neill and Webb + Wood).

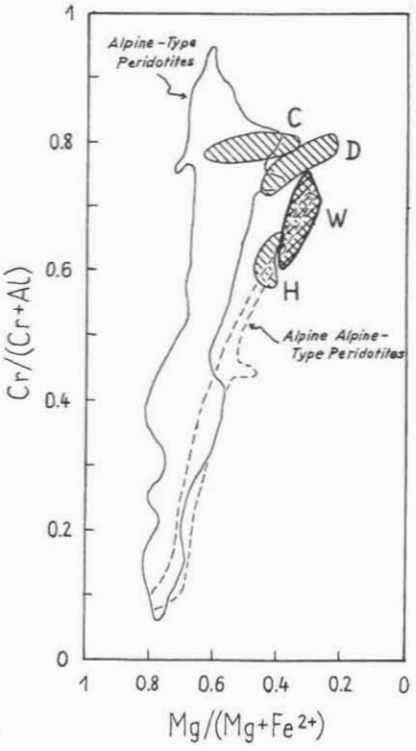

Fig. 3. Irvine plot of accessory chromite compositions in serpentinites around Winklarn (W; 'primary') as well as of accessory chromites in harzburgites (H), in dunites (D), and chromites in massive chromitites (C) last three from Brezovica and Raduša. type peridotite fields (not shaded) 4 in Dick + Bullen (1984).