High Pressure granulites from the Münchberg Massif

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Granulites formed under high pressure (> 15 kbar) at temperatures of about 800 °C are reported from several localities of the Variscan orogen. These rocks are associated with medium to high- grade homogeneous para-gneisses or with a heterogeneous assemblage of metasediments, orthoamphibolites and leptynites. In addition, mantle derived ultrabasites may accompany the high pressure granulites (Pin & Vielzeuf 1983, 1988).

In the Bernecker Gneiskeil (Münchberg Massif)a lense of spinel-peridotite occurs. This peridotite was metasomatised at about 800°C by fluids and possibly melts, leading to the formation of pargasite and some exotic rock suites which are incorporated in the peridotite (Gayk 1994).

In contrast to other occurences of ultrabasites in the Hangend- and Liegendserie of the Münchberg Massif the hanging wall of the peridotite is visible. Rocks from the hanging wall suite exposed along a footpath display a concordant foliation, striking about NE-SW and a more or less pronounced stretching lineation trending NNE-SSW and plunging weakly towards the NNE. Several lithologies (section 1-4 in fig. 1,3)) can be distinguished by means of petrographic and chemical criteria (fig. 2).

Section 1 is build up of acid garnet and mica bearing augengneisses formed at medium pressures (fig.4).

Section 2 represents a series of garnet bearing basic to intermediate banded hornblende gneisses. In parts of section 2 rocks occure which show quartz fabrics probably formed at high temperatures. The presence of strongly deformed clasts of kyanite and Na-augite(Jd 20) in symplectitic textures points to a higher pressure origin of these rocks than indicated by GASP geobarometry using garnet porphyroclasts and recrystallized feldspars (fig.4).

Intermediate banded hornblende gneisses of section 3 are characterised by relatively high Fe-contents (fig.2). Typical macroscopic features are garnet-rich layers and feldspar porphyroclasts.

Intermediate to acid garnet-clinopyroxene(Jd 20-40)-kyanite bearing granulites formed at high pressure (fig. 4) are the constituents of section 4.

The foliation in each section is the product of strong non-coaxial deformation and segments from different lithospheric levels are welded together during this deformation.

In the level of the HP/HT granulites, deformation causes the recrystallization of the HP/HT mineral assemblage. Still during high temperatures these deformation fabrics are annealed, documented by coarse grained polygonal quartz fabrics in parts of the HT-HP mylonites. A lower temperature deformation is concentrated in amphibolite facies rocks of section 2 and 3. Quartz fabrics show elongated and undulating recrystallized grains of up to 200µm length. Amphiboles and feldspars are recrystallized with grainsize of up to 100µm. This argues for deformation during lower amphibolite facies conditions. Deformation at still lower temperatures is concentrated in the gneisses of section 1, where quartz fabrics suggest that deformation continued below greenschist facies conditions (deformation bands, strongly undulatory extinction etc.).

The concordant foliation throughout the profile documents continuous deformation in a major thrust/detachment zone starting at HP/HT conditions and juxtaposing parts from lower to upper levels of the crust. Asymmetric hornblende and feldspar porhyroclasts indicate a constant top to the NNE directed transport in this zone.

REFERENCES

BERMAN, R.G., 1988. J. Petrol. 29, 445-522.
BERMAN, R.G., 1990. Am. Mineral. 75, 328-344.
ELLIS, D.J. & GREEN, E.H., 1979. Contrib. Min. Petrol. 71, 13-22.
FUHRMAN, M.L. & LINDSLEY, D.H., 1988. Am. Mineral. 73, 201-215.
GANGULY, J. & SAXENA, S.K., 1984. Am. Mineral. 69, 88-97.
GAYK, T., 1994. Unpubl. Ph.D. Thesis, Koln,145p.
PIN, C. & VIELZEUF, D., 1983. Tectonophys. 93, 47-74.
PIN, C. & VIELZEUF, D., 1988. Bull. Geol. Soc. France 8, 13-20.

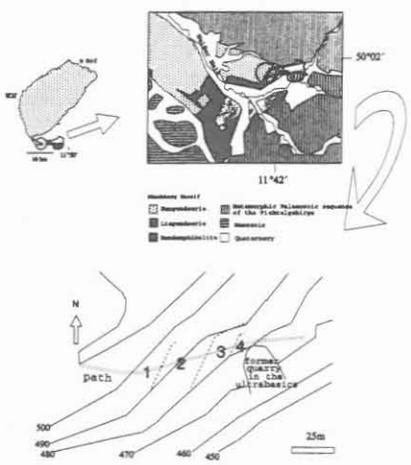

Fig. 1: Location of the working area

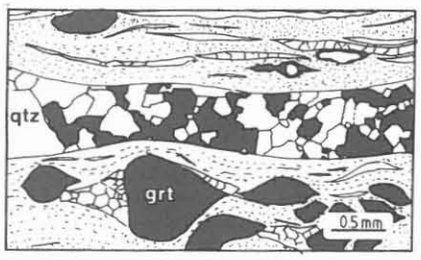

Fig. 3a: HT-mylonite with coarse grained, well equilibrated qtz-lamella, free of later overprint from HP/HT-granulites.

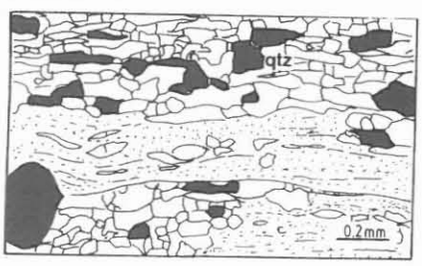

Fig. 3b: Amphibolite fazies overprint on banded gneisses from section 3. Dynamically recrystallized qtz-fabrics (upper half) with enlongate recrystallized grains within finegrained feldspar matirx (center).

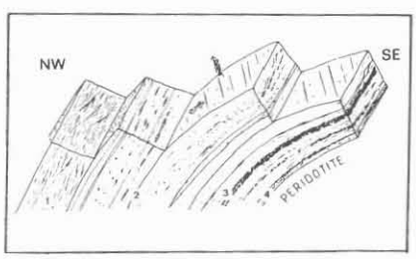

Fig. 3d: Schematic block diagram of gneisses and granulites in the hanging wall of the spinel-peridotite.Not to scale.

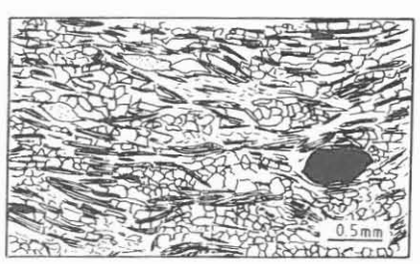

Fig. 3c: LT overprint on augengneisses from Section 1. Sheet silicates are predominantly chlorite. Qtz is recrystallized and later deformed with strong undulatory extinction and deformation lamellae.

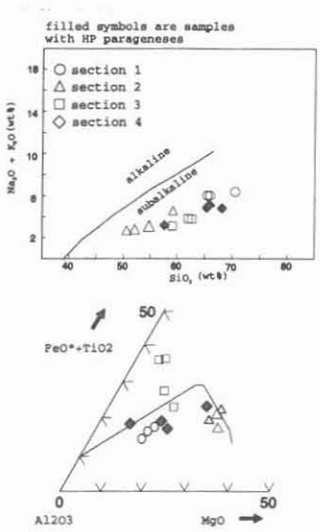

Fig. 2: Na2O+K2O/SiO2 and Fe-Ti-Al-Mg diagrams for samples of the working area

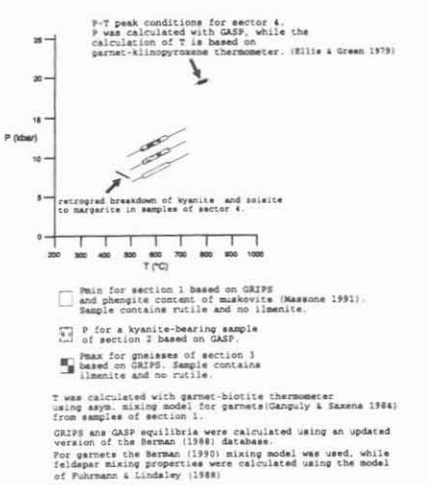

Fig. 4: P-T diagram for the working area.