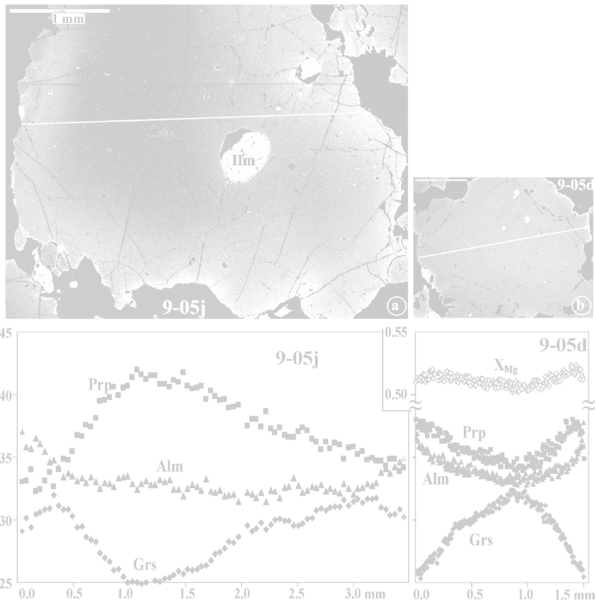


ite (type I) with garnet (40–60 wt%), omphacite (40–60 wt%), and accessory rutile and apatite, but kyanite-bearing eclogite (type II) also occurs. Garnet is rimmed by a corona of diopsidic clinopyroxene, plagioclase, and amphibole and kyanite is surrounded by a corona of plagioclase, amphibole, and spinel. Garnet from eclogite forms relatively large (1–4 mm) crystals and contains small, oriented rutile needles. Its composition varies from sample to sample (Prp_{37-50}, Grs_{15-34}, Alm_{18-37}) with <1 mol% spessartine and uvarovite contents. The most Mg-rich garnet comes from kyanite-bearing variety. Apart from a systematic rimward increase in Fe and decrease of in Ca in garnet from type I and II, compositional zoning in garnet from type II is different in the different samples (Fig. 6). In some cases, Ca shows an increase in the core with a decrease toward the rim. Omphacite forms up to 1-mm grains that may contain quartz rods. The jadeite content in omphacite ranges from 24 to 28 mol%. The most Jadeite-rich omphacite occurs in type II eclogite. Exsolution lamellae of garnet occur in omphacite from one sample of kyanite-bearing eclogite.

■ **Fig. 6.** Backscatter electron images illustrating contrasting compositional zoning patterns of garnets from eclogite (type II) within the garnet peridotites. In general, garnets (a) and (b) show the opposite sense of core to rim zoning for Grs and Prp.

Stop 7-2 (Day 7). Garnet Peridotite, Garnet Pyroxenite, Garnetite and Eclogite. West Bank of the Doubrava River, ca 2 South from the Village of Úhrov

Coordinates: N49°48′33.1″ E15°33′23.9″

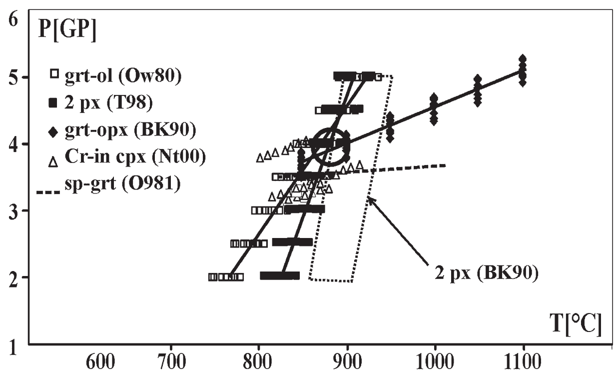
At Stop 7-2, outcrops of garnet peridotite and granulite are exposed along the banks of the Doubrava River. Garnet peridotite occurs in two ca. 100 × 30 m lens-shaped bodies surrounded by coarse-grained and retrogressed granulites. The **garnet peridotite** contains several eclogite bodies (ca. 10–60 cm × 1.8 m in size), but because of poor exposure and small outcrops it is not possible to discern the exact dimensions of these bodies. In contact with, or close to, the eclogites, parallel layers of garnet clinopyroxenite and rarely garnetite with garnet peridotites are present, which are oriented parallel to the shapes of the eclogite bodies. Contacts between garnet peridotite and clinopyroxenite layers are mostly sharp. Although garnet peridotite is strongly serpentinized, fine-grained relics of garnet, olivine, and clinopyroxene are preserved. Minerals in the peridotite at stop 7-2 have a slightly lower Mg/Fe ratio than do those in peridotite at stop 7-1.

Garnet pyroxenite is medium-grained and contains clinopyroxene (90–95 vol%), garnet (5–10 vol%), and small amounts of olivine and accessory spinel. Contacts between the pyroxenite layers and serpentinized garnet peridotites are sharp, and no deformation or metasomatic textures occur along their boundaries. Garnet in pyroxenite has a slightly lower Mg content compared to that in peridotite, (Fig. 3). In clinopyroxenite, olivine occurs interstitially between clinopyroxene grains and as inclusions in garnet and clinopyroxene.

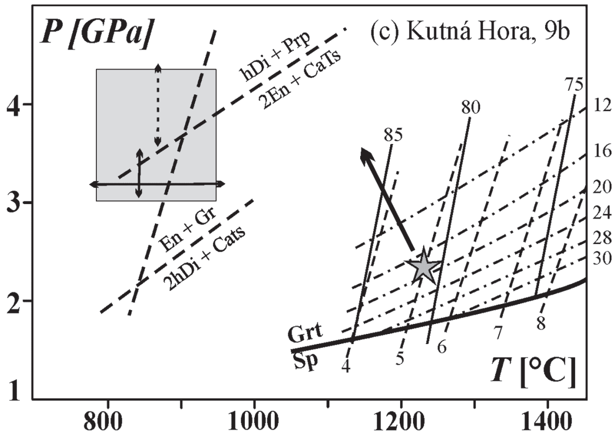
Garnetite with up to 98 vol% garnet and small amounts of apatite and clinopyroxene, locally altered to amphibole, occurs adjacent to garnet pyroxenite. In addition, magnesiotaramite and associated quartz and biotite occur as inclusions in garnet. Apatite contains exolution lamellae of monazite.

Eclogite at this locality is largely bimineralic, consisting of omphacite (Jd_{33}), garnet $Prp_{37}Grs_{16}Alm_{45}$), and accessory rutile, and symplectites of amphibole (diopside) + plagioclase.

P-T estimates were made for garnet peridotites using the Fe-Mg garnet-olivine exchange geothermometer (O'Neill and Wood, 1981), two two-pyroxene geothermometers (Tailor, 1998, Brey and Köhler, 1990), the Al-in-Opx and Cr-in-Cpx geobarometers (Brey and Köhler, 1990), and the spinel-garnet transition (O'Neill and Wood 1980). The results are approximately 4.0 GPa and 850–900 °C for garnet peridotite at stop 7-1 (Fig. 7) and 3.0 at 900 °C for stop 7-2 (not illustrated).



■ **Fig. 7.** Results of PT calculations for garnet peridotite at stop 7-1 (Faryad, 2009) obtained using different thermo-barometers: BK90 – Brey and Kohler (1990), T98 – Taylor (1998), NT00 – Nimis and Taylor (2000), OW80 – O'Neill and Wood (1980) and O81 – O'Neill (1981).



■ **Fig. 8.** P-T plot illustrating garnet-clinopyroxene-orthopyroxene equilibria for reintegrated and exsolved orthopyroxenes in the system CaO-MgO-Al_2O_3-SiO_2. (Faryad et al., 2009). Dash-dotted curves labeled 12 through 30 are isopleths of Al content in pyroxene expressed in cation per cent per six oxygen formula unit. Thin solid and dashed curves are isopleths of Ca contents in clinopyroxene (75 through 85) and orthopyroxene (4 through 8), respectively, expressed in cation per cent per six oxygen formula unit (Gasparik, 2000, 2003). Pressure-temperature ranges calculated for exsolved pyroxenes are shown by gray rectangles and double headed arrows (calculated at 800 and 950 °C), computed using the clinopyroxene, orthopyroxene and garnet compositions and the internally consistent thermodynamic data of Gasparik (2000) and non-ideal mixing models of Gasparik (2003).

Kyanite-bearing eclogites within garnet peridotites (stop 7.1) yield using the calibration of Ravna and Terry (2004) a pressure of 3.3 GPa at 900–960 °C. The composition of reintegrated orthopyroxene indicates that primary orthopyroxene megacrysts crystallized at 1200–1250 °C and 2.2–2.5 GPa (Fig. 8). Unmixing and exsolution of garnet and clinopyroxene occurred in response to cooling and pressure increase before the peak pressure of 4.5 GPa was reached at approximately 900 °C. This scenario is consistent with burial of hot upper-mantle ultramafics into a cold subcratonic environment, followed by exhumation through $T = 900$ °C and $P = 2.2$–3.3 GPa, when the pyroxenites were partly recrystallized during tectonic incorporation into eclogites and felsic granulites (Faryad et al. 2009).

Stop 7-3 (Day 7). Eclogite and Granulite, Spačice

Coordinate: N49°48′57.3″ E15°35′49.4″

Eclogite and granulite

The eclogite forms a ca. 10- × 50-m body within granulite that is exposed along the northern bank of the Doubrava River near the village of Spacice (Fig. 1). The eclogite shows isoclinal folding that is defined by alternating thin, fine-grained garnet-rich layers and coarse-grained layers of clinopyroxene and porphyroblastic garnet. In the Spačice eclogite, clinopyroxene LPOs show an LS-type fabric in the coarse-grained layers and an S-type fabric in the fine-grained layers. Foliations in both microstructural types are parallel to the limbs of upright, tight-to-isoclinal folds, the axial plane of which is parallel to the S_1 fabric. A stretching lineation, defined by a maximum in the distribution of clinopyroxene [001] axes, rotates from a sub-vertical position in the coarse-grained layers to a gently plunging orientation in the fine-grained layers, parallel to the fold hinge.

The eclogite is kyanite-bearing and has the composition of subalkaline to tholeiitic basalt (Medaris et al., 1998, 2006). It contains garnet and omphacite (40–60 vol% each), kyanite (up to 10 vol%), and accessory rutile. Variable amounts of diopsidic clinopyroxene, plagioclase, spinel, and amphibole in symplectites around garnet or coronae around kyanite depend upon the degree of retrogression. The eclogite contains two textural and compositional varieties of garnet. The first variety, coexisting with omphacite and kyanite, forms large crystals (garnet I) and is rich in Mg (Prp_{39}, Grs_{26}, Alm_{30}, Sps_5). It shows prograde compositional zoning with relatively flat core profiles and a rimward decrease in Mn and Fe and increase in Mg and Ca (Fig. 9). The second variety (garnet II) forms small grains that either occur in the plagioclase + diopsidic clinopyroxene ± amphibole matrix or overgrows the large garnet I grains. It has high Ca and low Mg contents ($Grs_{55\text{-}66}$, $Prp_{10\text{-}15}$), but its Alm is similar to that in garnet I ($Alm_{28\text{-}30}$). The Mn content is 2–3 times higher than that in garnet I rims. Omphacite has a jadeite content of 24–29 mol%, Ca-tschermak of ca. 6–12 mol%, and the remainder is diopside $Di_{50\text{-}54}$ and hedenbergite Hd_7. The jadeite content decreases at the rims of clinopyroxene grains. Plagioclase (up to An_{99} in symplectite after kyanite) and pargasitic amphibole are common secondary phases in retrogressed eclogite.

The **HP felsic granulite** with lenses of eclogite in stop 7-3 and with garnet peridotites in stop 7-2 are fine- to medium-grained, with a foliation that is highlighted by modal layering of quartzofeldspathic layers alternating with garnet-rich layers. The granulite consists of ternary feldspar, quartz, garnet, kyanite, and rutile. Rarely, inclusions of phengite with a high Ti content (TiO_2=3.0–3.1 wt.%) occur in garnet (Fig. 10). Similar to other granulites, it has a layered structure, in which light-coloured, 1- to 10-cm-wide layers enriched in quartz and feldspar, as result of melt infiltration, alternate with grey-coloured granulite layers. Garnet shows a zoning profile that is characterized by a decrease of Ca and an increase of Mg from the core (Grs_{41} $Prp_{08}Alm_{47}$) toward the rim ($Grs_{29}Prp_{15}Alm_{47}$); Mn content is very low (less than 1 mol%) and decreases slightly toward the rim.

P-T conditions of 3.2 GPa and 910 °C (Fig. 11) were obtained using the method of Ravna and Terry (2004) for the Spačice kyanite eclogite enclosed in granulite (Faryad, 2009).