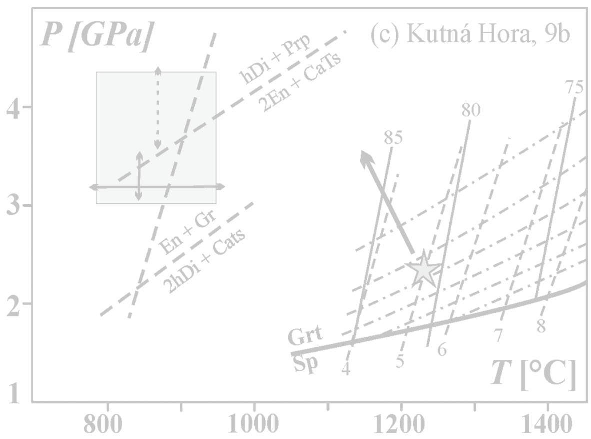


Kyanite-bearing eclogites within garnet peridotites (stop 7.1) yield using the calibration of Ravna and Terry (2004) a pressure of 3.3 GPa at 900–960 °C. The composition of reintegrated orthopyroxene indicates that primary orthopyroxene megacrysts crystallized at 1200–1250 °C and 2.2–2.5 GPa (Fig. 8). 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).

■ **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).

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

Coordinate: N49°48′57.3″ E15°35′49.4″

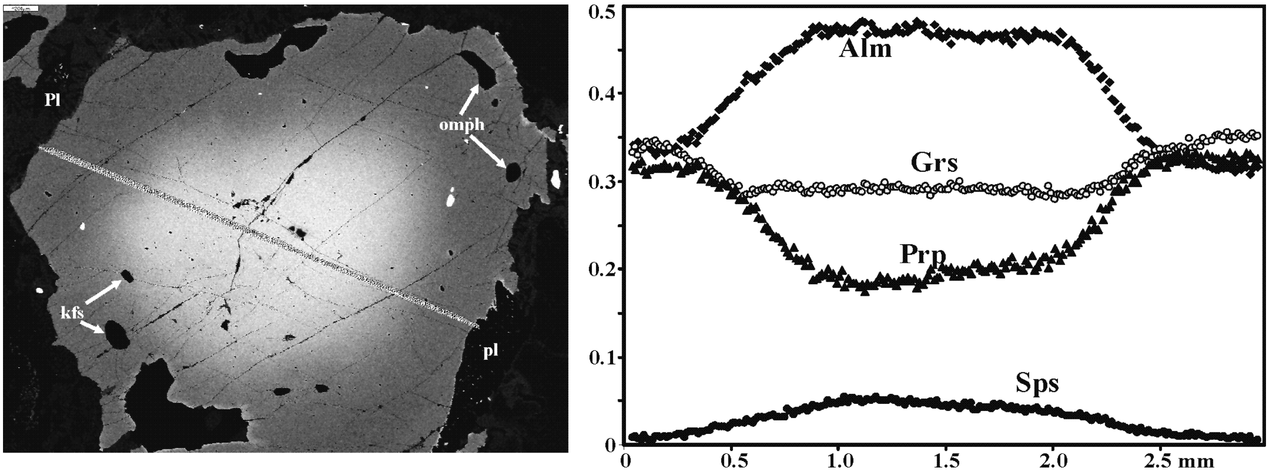
Eclogite and granulite

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.

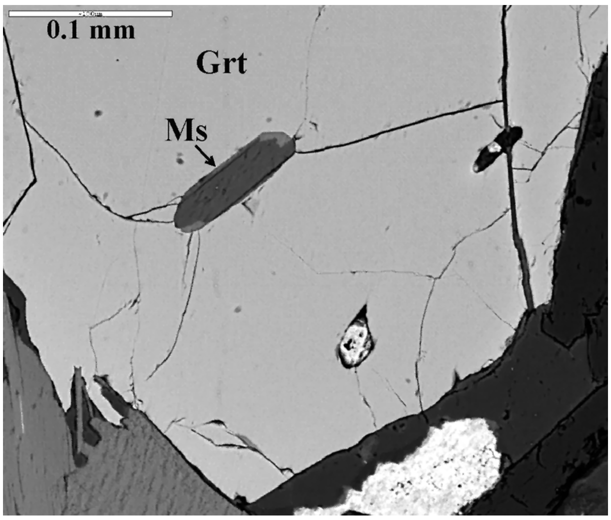
The eclogite is kyanite-bearing and has the composition of subalkaline to tholeiitic basalt (Medaris et al., 1998, 2006). It contains garnet and omphacite (40–60 vol% each), kyanite (up to 10 vol%), and accessory rutile. Variable amounts of diopsidic clinopyroxene, plagioclase, spinel, and amphibole 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.

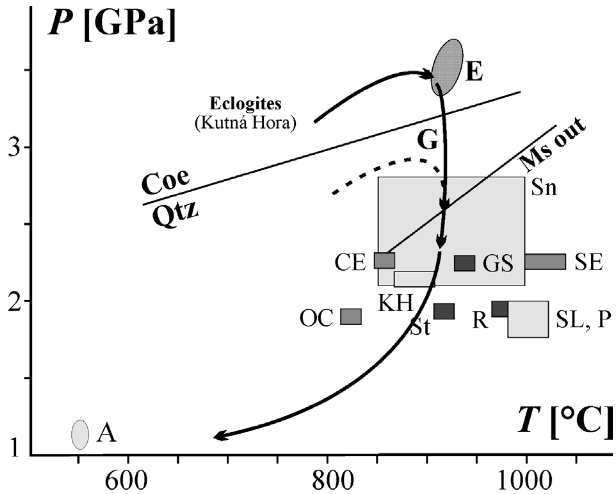
P-T conditions of 3.2 GPa and 910 °C (Fig. 11) were obtained using the method of Ravna and Terry (2004) for the Spačice kyanite eclogite enclosed in granulite (Faryad, 2009).



■ **Fig. 9.** Back-scattered electron image and compositional zoning profile of garnet from kyanite-bearing eclogite within granulite (stop 7.3), indicating a prograde metamorphic evolution. Abbreviations: kfs, K-feldspar; omph, omphacite; pl, plagioclase.



■ **Fig. 10.** Back-scattered electron image of garnet with inclusion of Ti-rich phengite from the Běstvina felsic granulite.



■ **Fig. 11.** PT paths and peak pressure and temperature conditions for kyanite-bearing eclogite (E) in HP felsic granulite near Spačice village (stop 7.3) (Faryad, 2009). Area A: PT conditions for formation of Ca-rich garnet (II) in eclogite. The bold letter, G, indicates the transition from eclogite to granulite facies conditions, calculated for felsic granulites of the Kutná Hora complex. Pressure-temperature estimates for other high-pressure granulites from the central European Variscides are plotted for comparison. Abbreviations for the Moldanubian Zone (light gray fields): KH – Kutná Hora Complex (Vrána et al., 2006), BL – Blanský Les Massif (O'Brien, 1999), SL – St. Leonhard Massif (Carswell and O'Brien, 1993; Cooke, 2000), P – Prachatice Massif (Kröner et al., 2000), St – Strážek Unit (Tajčmanová et al., 2006); Saxothuringian Zone (dark gray fields): SE – Saxonian Erzgebirge (Rötzler et al., 2004), CE – Central Erzgebirge (Willner et al., 1997), OC – Ohře Crystalline Complex (Kotková, 1993); Sudetes (medium gray fields): Sn – Snieznik (Kryza et al., 1996; Klemd and Bröcker, 1999), GS – Gory Sowie (Kryza et al., 1996), R – Rychleby (Štípská et al., 2004). The P-T path inferred for the Kutná Hora granulite (dashed curve) is compared to that of the kyanite eclogite lens (E) (Faryad, 2009).

A pressure of 1.1 GPa at 720 °C was obtained for Ca-rich (type II) garnet that rims eclogite facies garnet (Type I) and occurs with diopside and plagioclase in the matrix. For felsic granulite, P-T conditions of 2.2 GPa and 900 °C GPa were obtained using GASP thermobarometry (Vrána et al., 2005). The results of thermodynamic calculations and phase equilibrium experiments indicate that granulite experienced eclogite facies metamorphism in or near the coesite stability field, and that the modal layering was a result of high-pressure partial melting at 2.2 GPa and 900 °C during decompression to granulite facies conditions (Faryad et al., 2010). Both the thermodynamic calculations and phase equilibrium experiments suggest that the partial melt was produced by the dehydration melting reaction: muscovite + omphacite + quartz = melt + K-feldspar + kyanite (Nahodilová et al., 2010).