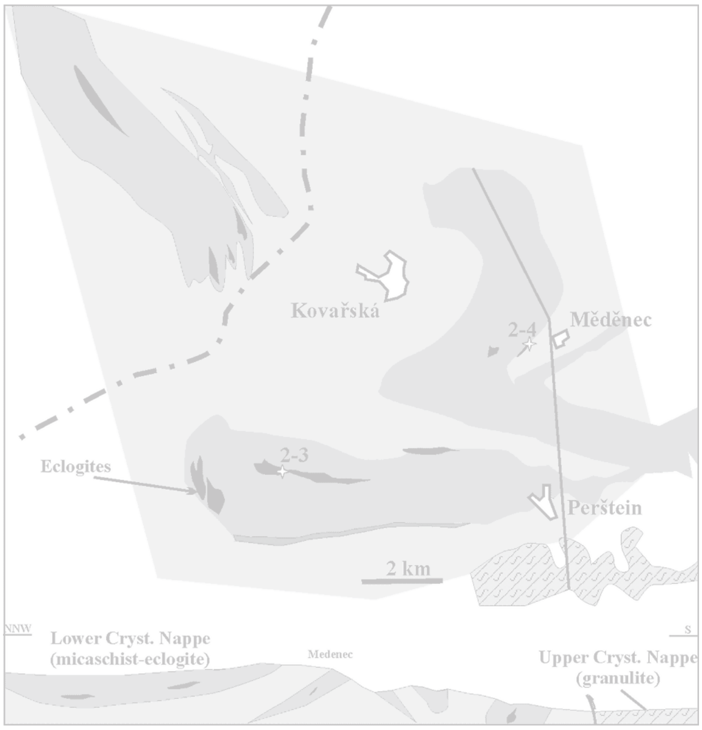
Alterrnatively, Konopásek et al. (2001) propose that metamorphic grade increases from bottom to top in the nappe stack. Based on the position of granulite at the Ohra River on the Czech side, they propose that the high-grade rocks over-lie the medium grade (lower crystalline nappe, Fig. 2), and the blueschist facies phyllites are interpreted as part of the parautochthonous unit.



■ **Fig. 2.** Geological map of the central part of the Krušné hory Mts.; eclogite occurrences shown in black (Klápová et al. 1998; Konopásek et al. 2001). Numbers 2-3 and 2-4 are locations of excursion stops.

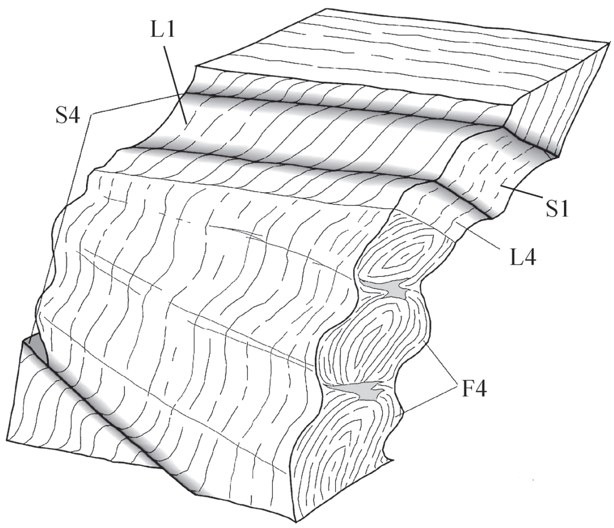
Stop 2-3 (Day 2). Eclogite, Meluzína

Coordinate N50°23′25.3″ E13°00′21.9″

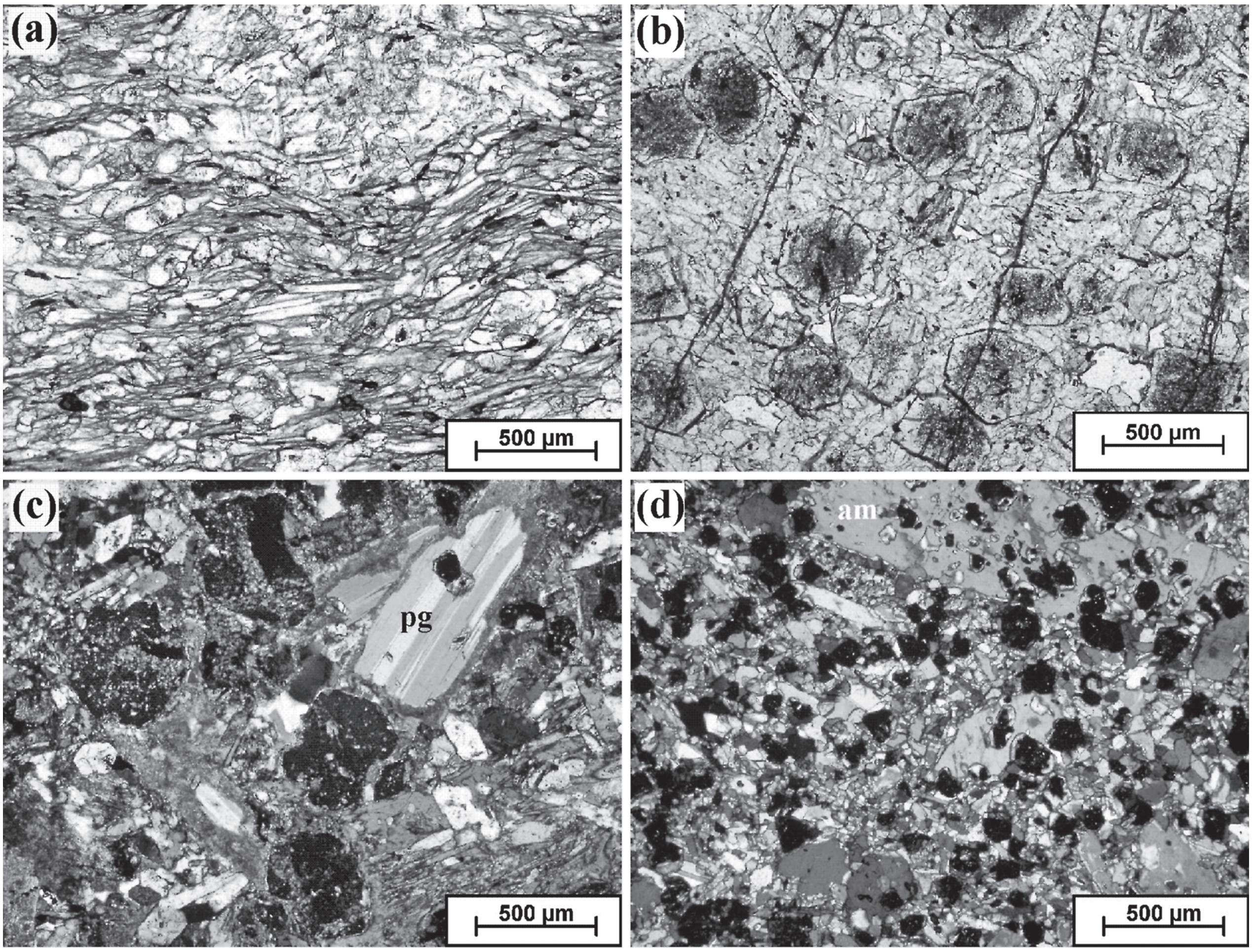
The Meluzína hill is a huge natural exposure of eclogite that forms an E–W elongated lens several kilometres in length and up to 250 m thick (Fig. 2). The strongly foliated, eclogite facies fabrics were formed by two deformation events, D1 and D2, which are both defined as syn-eclogitic (Klápová et al., 1998). In spite of two post-eclogitic deformations, D3 and D4, the eclogite is fresh and exhibits a well-developed foliation, S1, containing stretching and mineral lineations, L1 (Fig. 3). S1 is formed by the planar arrangement of platy minerals such as paragonite, phengite, and omphacite. A mineralogical layering characterised by alternations of garnet-rich and garnet-poor/omphacite-rich bands is also present. The late set (D3 and D4) of structures was developed under brittle-ductile conditions. These structures are represented mainly by asymmetrical intrafoliation boudinage, shear bands, and brittle cracks, which are filled by Qtz with Rt and Amp.

The eclogites have MORB composition (Klápová, 1990). U-Pb SHRIMP dating of 490 ±14 Ma on zircon and single-zircon U-Pb dating of 342.5 ±1.6 Ma are taken to be the ages of protolith and high-pressure metamorphism, respectively (von Quadt and Gebauer, 1998).

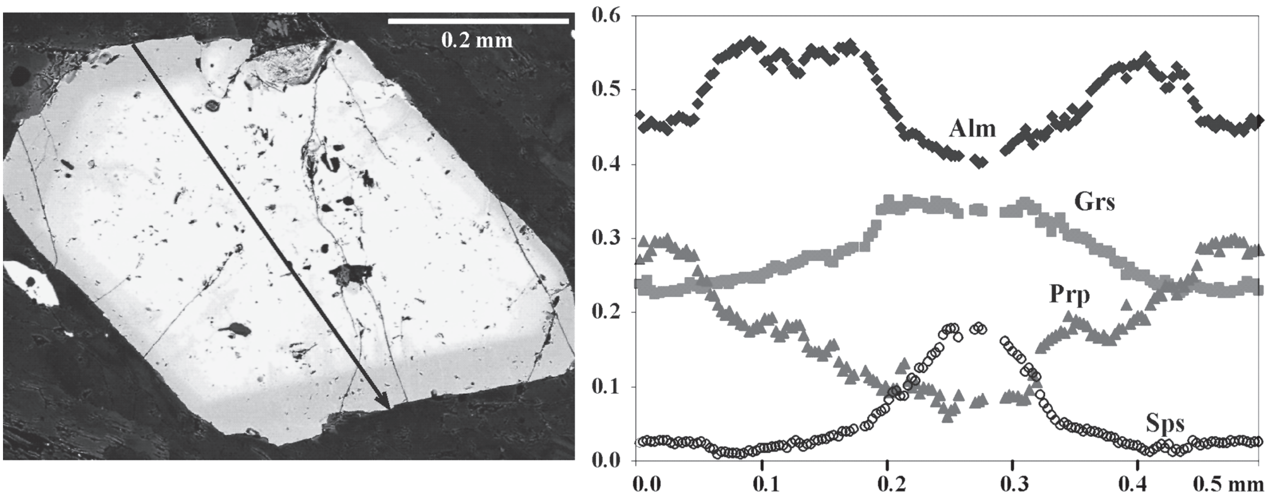
Based on their textures and mineral compositions, the Krušné hory eclogites can be subdivided into three types. The most frequent, dark-coloured, fine-grained type (type 1) has a layered structure, in which garnet-omphacite layers alternate with amphibole-rich layers. The garnet-omphacite layers may contain quartz, rarely also amphibole, paragonite, phengite, and epidote. Light-coloured, more coarse-grained eclogite (type 2) contains white lenses or discontinuous bands of epidote, several millimetres thick. It may also contain talc. Both types (1) and (2) show strong foliation, and there is a gradual transition between these two types. The last type (3) is unfoliated eclogite with a regular distribution of garnet and omphacite. It may contain eclogite facies carbonate minerals (Klápová, 1990).



■ **Fig. 3.** Three-dimensional sketch of planar and linear structures in mafic eclogites at the Meluzína locality, central Erzgebirge (Klápová et al. 1998).

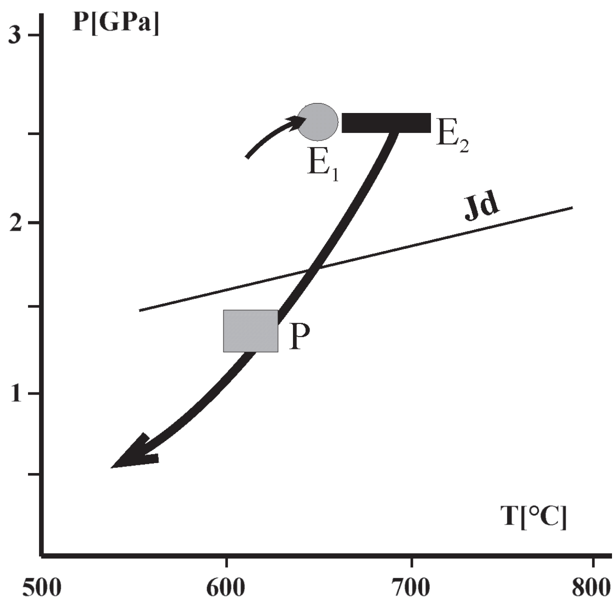


■ **Fig. 4.** Photomicrographs of textural varieties of eclogite from Meluzina hill (Krušné Hory complex). a and b- garnet in finegrined matrix with omphacite, paragonite and zoisite. c- paragonite rimmed by symplectites of albite + chlorite. d-barroisitic amphibole overgrowing eclogite facies minerals.



■ **Fig. 5.** Profile (rim to rim) of garnet showing compositional zoning in eclogite.

Omphacite comprises 30 to 50 vol% of eclogite and generally forms elongated crystals that follow foliation of the rock (Fig. 4a). Jadeite content mostly varies from 35 to 52 %. Garnet amounts to between 15 and 50 vol% and forms idioblastic crystals up to 2.5 mm in diameter. Garnet grains exhibit clouded, inclusion-rich cores and wide, euhedral, inclusion-free rims



■ **Fig. 6.** Estimated PT conditions for Variscan eclogite (E) in the Krušné Hory Complex (E_2 after Klápová et al. 1998). P indicates PT conditions of Pre-Variscan metamorphic event obtained for the parautochthonous metapelitic rocks (Konopásek 1998).

(Fig. 4b). They show prograde compositional zoning with an increase of Mg/Fe from cores to rims (Fig. 5). Paragonite is partly replaced by a symplectite of albite and chlorite (Fig. 4c). Amphibole ranges from 5 to 20 vol%, and it overgrows the eclogite facies foliation and minerals (Fig. 4d). Chemically, amphibole corresponds to barroisite and winchite. Epidote forms colourless, subhedral to euhedral, prismatic, frequently corroded crystals up to 5 mm in size. Its modal content varies between 5 and 10% in the light eclogite type.

Metamorphic PT conditions

Temperatures and pressures estimated using the garnet-clinopyroxene Fe-Mg exchange thermometer (Ellis and Green, 1979; Ravna, 2000) and garnet-omphacite-phengite barometer (Ravna and Terry, 2004) are 600–650 °C and 2.5–2.6 GPa. Similar pressures were also obtained for eclogites by Klápová et al. (1998) and for micaschists by Konopásek (2001).

Stop 2-4 (Day 2). Eclogite, Měděnec

Coordinate N50°25′10.7″ E13°06′38.8″

At the locality near Měděnec Village (Fig. 2) , we will examine eclogite with a discrete zone that contains atoll garnet formed under eclogite facies conditions. Atoll garnets occur in several localities, but their relations to eclogites lacking atoll garnet are not always clear (Faryad et al., 2010). The presence of atoll garnet is not restricted to a specific rock type but occurs in a variety of metabasites, including quartz-rich types, which probably represent a mixture of mafic rocks and sediments. The eclogite consists of omphacite, garnet, quartz, and small amounts of rutile, amphibole, and albite ± phengite. When different size varieties are compared, it is found that atoll garnets occur mostly in the fine-grained varieties (see Fig. 7a). The atoll garnets consist of a garnet annulus surrounding quartz and/or amphibole. If the atolls are occupied by quartz, their interfaces are sharp and regular (Fig. 7b) and correlate with crystallographic planes of garnet. On the other hand, where amphibole overgrows the atoll, boundaries with the garnet ring are irregular.

Backscattered electron images and compositional profiles (Figs. 8) from whole garnet grains demonstrate that garnet cores (garnet I) and rims (garnet II) have different compositions. The core I, with idiomorphic outlines, has a higher Ca content and lower Fe content compared with its rim (II (Fig. 8a1). Garnet I shows prograde zoning with a decrease of Mn towards the rim. Figure 8b shows a whole garnet with a dark, Ca-rich core and a peninsula connected to the rim. The peninsula and the rim have similar image contrast and, hence, similar compositions (Fig. 8b1).

Figure 9a shows that the dark, low-Fe zone of garnet has microveins with a similar image contrast to that of the outermost rim of the garnet. These microveins connect garnet core I with the rim, but the core garnet shows a strong compositional gradient at the points of contact between sub-grains with Fe content. Compositional zoning of sub-grains and microveins in garnet I change by substitution of Fe and Mg, while Ca remains almost constant in garnet. Compared with the narrow white veins in the dark rim, sub-grains in the core are separated by wide grey zones and channels with larger Mg contents.

Formation of the atoll garnet is interpreted as resulting from fluid infiltration and element exchange between the garnet core and matrix, a process that was facilitated by temperature increase during eclogite facies metamorphism up to 600 °C/ 2.4 GPa (Fig. 10). In addition to fluid access, the primary textures, mainly grain size, were also effective for the atoll garnet formation. Small grain fractions with thin rims were easily infiltrated by fluid, which used the short distance for element exchange between core and matrix. The core garnet was gradually dissolved and replaced by new garnet having the same crystallographic orientation as the rim or relicts in the core.

If we assume equilibrium of the garnet rim with matrix omphacite, these results suggest that garnet growth continued after the peak of metamorphism, at least in a rock of effectively constant bulk composition. The fact that substantial growth of garnet II happened at a late stage is presumably related to the modification of the local reactive bulk compositions caused by