Tectonometamorphic Scenario

Based on elemental and isotopic compositions and P-T conditions, the Mohelno peridotite is interpreted as suboceanic lithospheric and, possibly, asthenospheric mantle, and the Nové Dvory peridotite most likely represents subcontinental lithospheric mantle (Medaris et al., 2005). It was proposed that the Mohelno peridotite originated in Devonian (Frasnian) time in a small ocean basin between Bohemia (Tepla-Barrandia) and Moldanubia (northern Gondwana). With Carboniferous (Tournaisian) closure of the ocean basin and collision of Bohemia and Moldanubia, imbrication of lithospheric/asthenospheric mantle, oceanic crust, and continental crust may have occurred in the vicinity of a subducted spreading center, giving rise to the lithologic association of the Gföhl Nappe and elevating temperatures in the crustal rocks. Further Carboniferous (Viséan) subduction produced the high pressure assemblages in ultramafic (garnet peridotite), mafic (eclogite), and felsic (HP granulite) rocks. Subduction-related melts penetrated the overlying mantle wedge, producing lenses of garnet pyroxenite and eclogite in the Nové Dvory peridotite. Slab breakoff then released the subducted Moldanubian terrane and locally attached fragments of mantle wedge, allowing rapid exhumation and cooling, during which the HP rocks were retrograded to varying degrees over a range of decreasing temperatures and pressures.

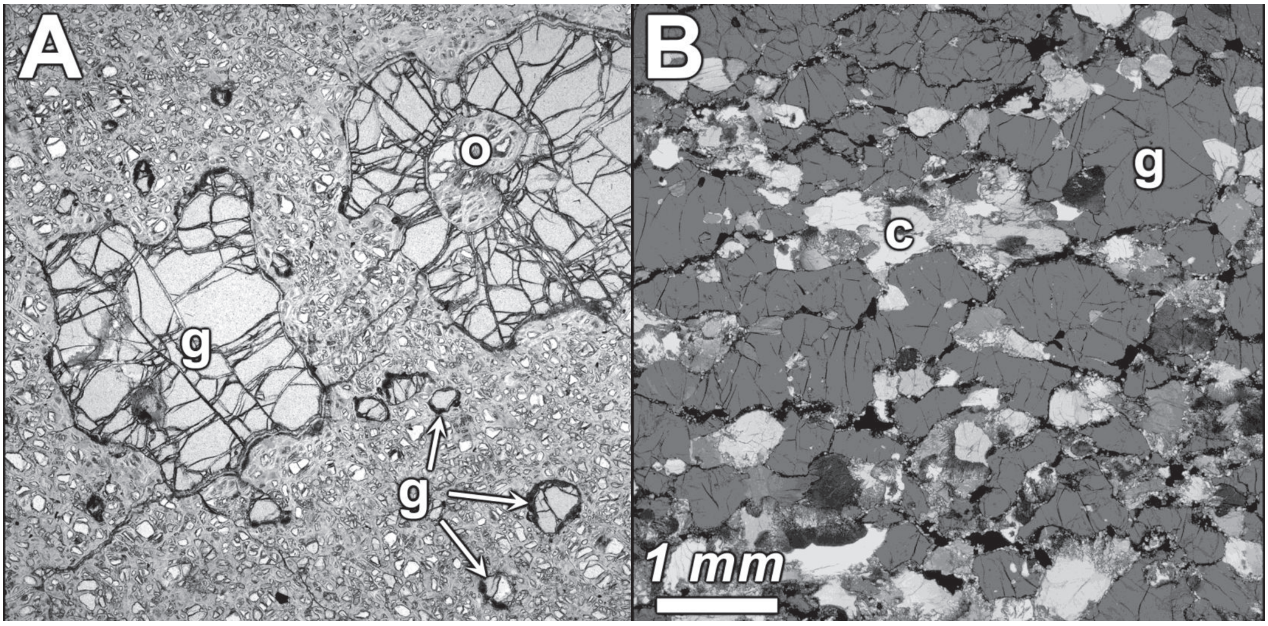
Alternatively, the Mohelno peridotite and associated lithologies may have originated in a Devonian back-arc basin between Saxothuringia and Tepla-Barrandia, which was subsequently subducted beneath Tepla-Barrandia (Schulmann et al., 2005; Dörr and Zulauf, 2010). Carboniferous closure of the thermally weakened back-arc basin, due to convergence and eventual collision of Brunia, led to crustal thickening and high-pressure and high-temperature metamorphism in deeper crustal levels, which was followed by orogenic collapse and delamination of mantle lithosphere, leading to rapid exhumation during transpression or elevator tectonics.

Sm-Nd mineral isochrons for nine samples of peridotite-hosted pyroxenite and eclogite in the Gföhl Unit yield a Viséan mean age of 336 ±7 Ma (Medaris et al., 2006a). So, in either tectonometamorphic scenario, exhumation following high-temperature and high-pressure metamorphism must have been rapid, as demonstrated by the presence of Gföhl detritus in Viséan sediments of the Culm foreland basin (Hartley and Otava, 2001).

Stop 6-1 (Day 6). Nové Dvory Garnet Peridotite and Eclogite, ~400 m SW of the Nové Dvory Farmhouse, 2 km WNW of the Town of Rouchovany

Coordinates: N49°04′36.4″ E16°04′56.6″)

This locality is in the southeastern part of the Nové Dvory body, where a low ridge is supported by a large eclogite layer (Fig. 1). Garnet peridotite is exposed along the dirt track leading to the ridge and in outcrop at the western end of the ridge; eclogite is exposed along the top of the ridge and in fallen blocks at the base of the ridge.



■ **Fig. 10.** Photomicrographs of Nové Dvory samples; the scale in each panel is the same. A. Inequigranular garnet peridotite; plane polarized light. Note the two grain size populations of garnet. B. Medium-grained, granoblastic eclogite; partly crossed polarizers. Abbreviations: c, clinopyroxene; g, garnet; o, olivine.

Garnet peridotite (assemblage ND1) has an inequigranular texture, in which large, irregular garnet grains (≤7 mm) are set in a fine-grained matrix (0.5–1.0 mm) of equant olivine, orthopyroxene, clinopyroxene, and garnet (Fig. 10A). Except for extensive serpentinization, post-garnet recrystallization is limited, consisting of thin kelyphite rims of fibrous spinel and amphibole around garnet (assemblage ND2, visible as dark fringes around garnet in Fig. 10A). Mg #'s are 90.3–91.1 for olivine, 91.0–91.4 for orthopyroxene, 90.0–91.1 for clinopyroxene, and garnet contains 69.9–72.9 mol% pyrope. Pyroxenes are much less aluminous than those in the Mohelno peridotite (Fig. 6), due to equibration with garnet at significantly higher pressures.

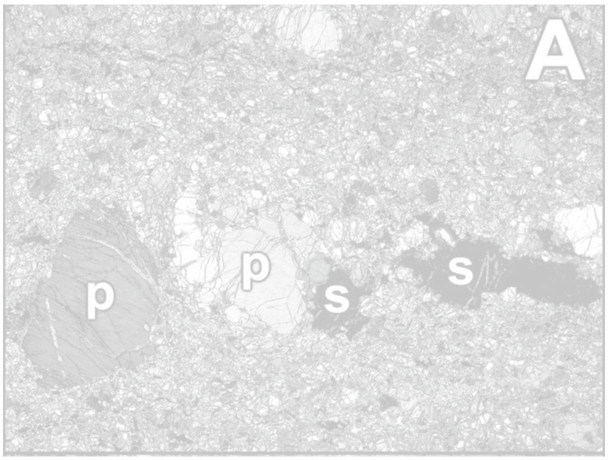
Eclogite typically has a medium-grained, granoblastic, slightly foliated texture (Fig. 10B), and some samples display prominent layering of garnet and clinopyroxene (see Fig. 2 in Medaris *et al*., 2006a), which is parallel to foliation in the surrounding peridotite. The most common assemblage in eclogite is garnet, clinopyroxene and accessory rutile, although some samples also contain orthopyroxene or kyanite. Garnet is intermediate in composition, varying among samples from $Prp_{55}Alm{+}Sps_{20}Grs_{25}$ to $Prp_{30}Alm{+}Sps_{40}Grs_{30}$, and clinopyroxene has a wide range in jadeite content, 10-50 mol%. P-T estimates for orthopyroxene eclogite, garnet websterite, and kyanite eclogite range from ~30 kbar, 800 °C to 47 kbar, 1100 °C (Nakamura et al. 2004; Medaris et al., 2006a), which lie within the field gradient defined by Nové Dvory garnet peridotite (Fig. 9).

Eclogite and garnet pyroxenite layers in the Nové Dvory and similar peridotite bodies have a wide range in elemental (major and trace) and isotopic (Nd, Sr, and O) compositions. Based on geochemical modelling, Medaris et al. (1995) demonstrated that such variation could be explained by high-pressure crystal accumulation (± trapped melt) from transient melts in a mantle wedge above a subduction zone, with a component of such melts being subducted, hydrothermally altered oceanic crust. In contrast, Obata et al. (2006) suggested that kyanite eclogite in the Nové Dvory body represents oceanic crust (cumulus gabbro) that was subducted, transformed to eclogite, and tectonically juxtaposed with garnet peridotite.

Stop 6-2 (Day 6). Mohelno Spinel Peridotite, Outcrop along the North Bank of the Jihlava River, ~870 m Upstream from the Highway 392 Bridge

Coordinates: N49°06′21.0″ E16°11′12.9″

This outcrop is representative of spinel peridotite that constitutes the interior and bulk of the Mohelno body. Although not visited during the excursion, note that the large Biskoupky peridotite to the east (Fig. 1) is a companion to the Mohelno peridotite and shares all the same characteristics.



■ **Fig. 11.** Photomicrographs of Mohelno peridotite samples; the scale in each panel is the same. A. Porphyroclastic spinel peridotite; crossed polarizers. B. Porphyroclastic garnet peridotite; note spinel inclusions in garnet; plane polarized light. C. Garnet surrounded by an outer, fine-grained kelyphite (assemblage M3, spl+opx+cpx) and an inner, symplectitic kelyphite (assemblage M4, spl+opx+amp); plane polarized light. Abbreviations: c, clinopyroxene; g, garnet; k_i, inner kelyphite; k_o, outer kelyphite; p, orthopyroxene; s, spinel.