Exhumation Path of Retrogressed Eclogite from Biskupice, Gföhl Terrane

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Dealing with eclogites, important issues also include the kind of detailed P-T path they follow on their way to the surface and the kind of modifications the rocks experience as they are returned to the surface.

An eclogite lens up to 20 by 400 m in size occurs at the locality of Biskupice, in a marginal zone of a garnet peridotite body. The eclogite is a fine-grained rock, with individual garnet porphyroblasts (up to 1 cm in size) surrounded by elongated clinopyroxenes. It consists of garnet, clinopyroxene, rare orthopyroxene, ilmenite, rutile, apatite, hornblende, plagioclase and spinel. Retrograde metamorphism of the eclogite resulted in the development of plagioclase + clinopyroxene symplectites after sodic pyroxene, overgrowth of plagioclase (+ orthopyroxene) corona on garnet, replacement of garnet with anorthite + enstatite + spinel + amphibole kelyphite, and growth of matrix amphibole.

Microtextural relationships indicate that:

- The oldest paragenesis was composed of clinopyroxene + garnet + rare orthopyroxene. Garnet and clinopyroxene grains have relatively homogeneous cores, and retrograde zoning is confined to within ~150 μm, or less, from grain margins. The P-T conditions of 41.5 ± 2.5 kbar and 1,214 ± 35.7 °C are based on the average of temperature estimates for ten garnet–clinopyroxene pairs, combined with five orthopyroxene–clinopyroxene–garnet triads. These estimates are comparable to those of the host garnet peridotite.
- Primary orthopyroxene of the eclogite was consumed by reaction Grs + 6 Opx = 3 Di + Prp.
- The first post-eclogite-facies alteration was the transformation of clinopyroxene into the symplectitic intergrowths of diopside + plagioclase accompanied with the breakdown of anorthite component according to the reaction An = CaTs + Qtz.
- The plagioclase and orthopyroxene (+ amphibole) coronas partially replaced the garnet according to the reaction 1 Prp + 1 Di + 1 Qtz = 4 En + 1 An at about 1,100 °C, 20 kbar.
- The retrogression to the amphibolite facies at 900 °C, 15 kbar yield to the replacement of garnet with kelyphite according to the reaction Grs + Prp = An + En + Sp. The absence of Qtz and Cpx indicates that this reaction is isochemical.
- The retrogression to the epidote amphibolite stage at 500–600 °C, 4–5 kbar resulted in the occurrence of low-pressure muscovite in symplectite around garnet.

Therefore, exhumation of the eclogite from the upper mantle produced kelyphites and coronitic textures and was dominated by a pressure decrease followed by fast undercooling. Rapid exhumation to the lower crust, perhaps due to extensional collapse, must have closely followed a collisional event in order to preserve the high-temperature characteristics of the eclogite.

Evolution of Depocenter Geometries in the Most Basin: Implications for the Tectonosedimentary History of the Neogene Ohře Rift (Eger Graben), North Bohemia

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The Most basin is the largest of the sedimentary basins preserved in the Ohře Rift (Eger Graben), a major tectonic feature in the NW Bohemian Massif. The Ohře Rift is a part of the Central European Rift System, together with the Rhine Graben and other Cenozoic extensional structures (Kopecký 1978; Bergerat 1987; Ziegler 1990), and is characterised by a system of sedimentary basins and intense intraplate alkaline volcanism (Kopecký 1978).

The NE-trending fault systems which confine the Most Basin and other rift basins of the Ohře Rift as essentially erosional relicts in the present-day topography are relatively young compared to the basin fill (cf. Adamovič and Coubal 1999). Construction of isopach maps of the basin fill and revision of geological maps and cross-sections, together with a DTM (digital terrain model) study show that during the deposition of the sedimentary infill, the basin was controlled by E–W (WSW–ENE)-striking normal faults, which separated individual depocentres (sub-basins) of the Most Basin named after their position: the Žatec, Chomutov, Central, Teplice and Ústí sub-basins. In plan view, the faults were arranged in an en-echelon pattern and divided by relay ramps, which commonly functioned as pathways of clastic input, for example the Bílina Delta System or the clastic bodies on the NE (Krušné hory Mts.) side of the rift. The same en-echelon arrangement is observed in the depocentres, divided by transverse, NW-trending fault zones or accommodation zones. In case of the Žatec Delta system (main fill of the Žatec sub-basin and, partly, of the Chomutov sub-basin), the NW-striking faults controlled the direction of clastic input.

The E–W fault pattern is strongly overprinted in the present-day topography by NE-trending fault systems formed under later NW extension and represented by the Krušné hory Fault and Ohře Fault systems.

Current research on the geometries of individual depocentres and depositional patterns within the basin of the Ohře Rift shows that during the main phase of the rift sedimentation, the whole Ohře Rift was dominated by oblique, approximately NNE–SSW extension. The extension vector was derived from comparison of the orientations and geometries of rift faults and depocentres with analogue models of Tron and Brun (1991) and McClay and White (1995).

This palaeostress interpretation is close to that of Peterek et al. (1997) from the Fichtelgebirge Mts., and is in partial agreement with the results of Adamovič and Coubal (1999) who interpreted a N–S extension dominating the emplacement of volcanic rocks between c. 32–24 Ma in parts of the rift system.

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Variscan Granite Plutons along the West Bohemian Shear Zone

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The boundary between the Teplá–Barrandian unit and the Moldanubian Zone is filled in area of the West Bohemian Shear Zone by large Variscan granitic plutons, which close the process of ductile shearing. The largest granite massif in the area of the West Bohemian Shear Zone is the Bor pluton. This pluton forms a SSE–NNW-extending, 35 km long magmatic body parallel to the West Bohemian Shear Zone. In the area of Mariánské Lázně Spa, a small and poorly exposed magmatic body of the Mariánské Lázně granite massif is present in the northern continuation of shear structures. In addition, a small body of the Babylon granite lies in the southern end of the West Bohemian Shear Zone. The Bor pluton is the largest late Variscan granite body within the western Czech part of the Bohemian Massif. The Moldanubian country rocks underwent low-P–high-T metamorphism in late Variscan times, followed by regional cooling at about 330–320 Ma, as evident from K–Ar mineral data. Western part of the Teplá–Barrandian Unit, which passed through amphibolite-facies conditions during the Early Devonian, has a considerable role in gravitational collapse of the Teplá–Barrandian Unit triggered by the process of overthickening. Extensional movements, which accompanied this collapse, are thought to have been synchronous with the intrusion of the Bor pluton. After intrusion of the main magmatic phase of the Bor pluton, extensional, predominantly SSE–NNW-trending zones developed in this magmatic body. These younger shear structures were filled by different types of dyke granites and aplites. A similar system of granite and aplite dykes is also developed in the Marianské Lázně granite massif. The youngest shear zone system is developed on the western border of the Bor pluton. This shear zone, as much as 30 m wide, is filled with uranium mineralization at the Vítkov II and Zadní Chodov uranium ore deposits.

The oldest magmatic rock types of the Bor pluton are granodiorites, tonalites to quartz diorites, which occur mainly in the northern part of this magmatic body. Occasionally, they form xenoliths in the main magmatic phase of the Bor pluton. Hornblende-biotite to biotite granodiorites, tonalites and quartz diorites have massive, at places plane-parallel structure. The texture is hypidiomorphic granular. These rocks, obviously compared with redwitzites in the Oberpfalz, contain biotite, plagioclase (An_{35-45}), K-feldspar and very variable amount of quartz. Magnetite and apatite are abundant accessory minerals, zircon, leucoxene, sphene, rutile, allanite and limonite are rare. The most voluminous rocks in the Bor pluton are coarse-grained, usually porphyritic monzogranites to granodiorites. They contain essentialy K-feldspar, plagioclase (An_{10-35}), biotite (Fe/(Fe+Mg) = 0.57–0.61), quartz and sparse muscovite. Accessory minerals include apatite, zircon and monazite. Dyke granites are fine- to medium-grained biotite-muscovite to muscovite-biotite monzogranites, which are most abundant in the central part of the Bor pluton. The rocks show hypidiomorphic to xenomorphic textures although they occasionally contain smaller phenocrysts of K-feldspar. The matrix consists of variable proportion of K-feldspar, plagioclase (An_{3-10}), quartz, biotite (Fe/Fe+Mg = 0.70), ± muscovite and sillimanite. Accessory minerals include tourmaline, apatite, zircon, garnet (almandine), magnetite and andalusite.

The main magmatic phase of the Mariánské Lázně granite massif is porphyritic monzogranite containing euhedral phenocrysts of microcline–perthite. Medium-grained groundmass contains plagioclase (An_{24-27}), quartz, biotite and accessory minerals (apatite, zircon, ilmenite). Older granodiorites, tonalites to diorites build variable-sized irregular bodies in the Mariánské Lázně granite massif. Their composition is similar to that