the Lhenice shear zone experienced amphibolite facies metamorphism similar to that in the Varied and Monotonous Units in Lower Austria, i.e. about 0.5 to 0.9 GPa and 700 to 840 °C (Petrakakis, 1986). Detailed gravity profiles of the Lhenice belt presented by Vrána (1979) and Vrána and Šrámek (1999) demonstrated that the Lhenice shear zone is a major N-S striking regional shear zone.

Fiala (1992) published an E-W profile of different lithological rock types across the Lhenice shear zone and assumed that the garnet-rich gneisses forms suite of the Lhenice shear zone metasediments.

Stop 4-2 (Day 4). Garnet-Rich Gneisses (Kinzigites), Ktiš Quarry, 1 km NNE of Ktiš Village

Coordinates: N48°55′25.33″ E14°8′24.15″

This locality (Fig. 1) was first described by Fiala (1992), who compared the compositions of iron- and aluminium-rich garnet-sillimanite-biotite and cordierite-bearing gneisses at Ktiš with other occurrences of kinzigites worldwide and applied the term kinzigite to the suite of Ktiš gneisses.

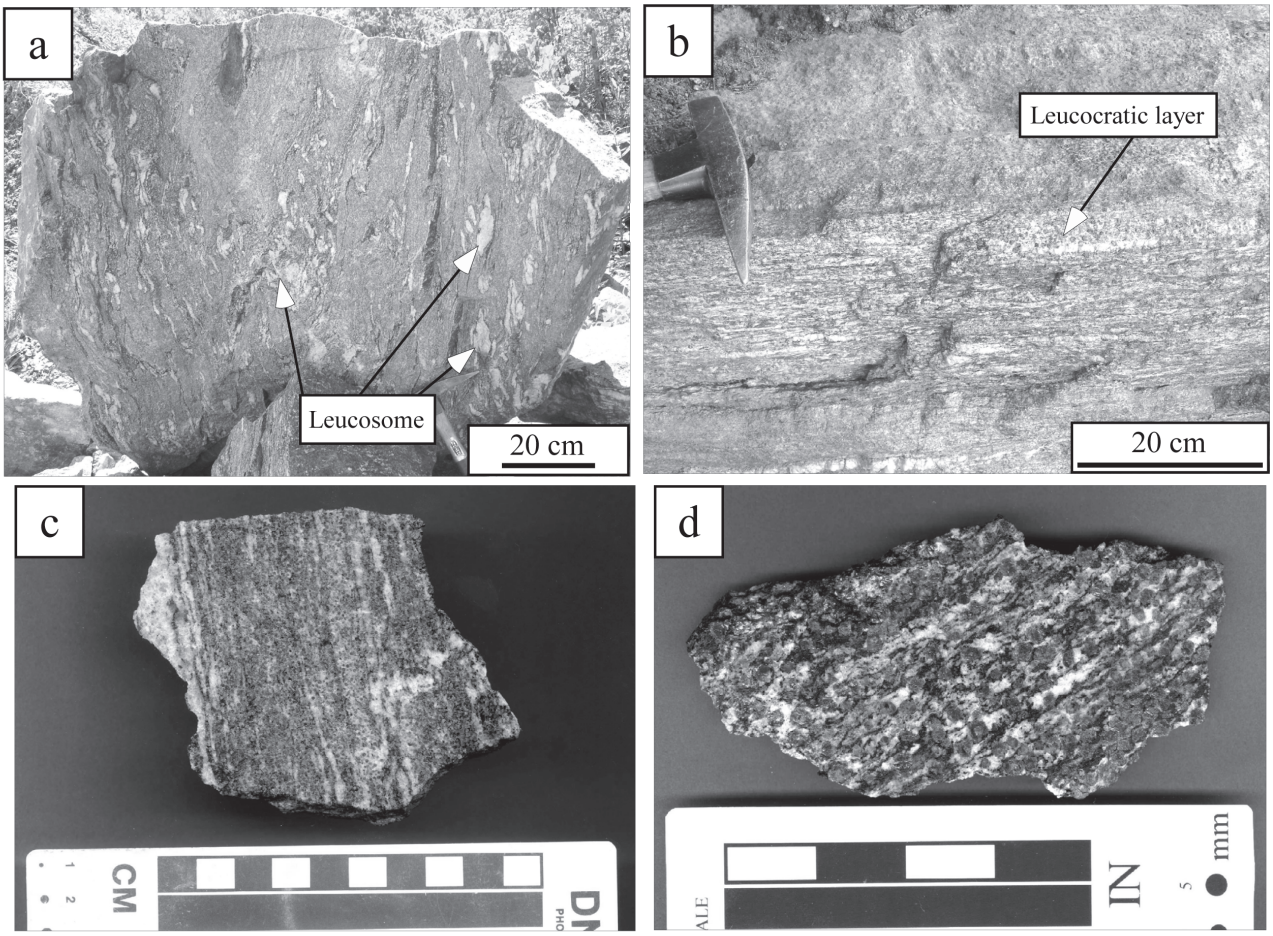
Ktiš kinzigites have a planar fabric (Fig. 2); they are granoblastic and have a coarse-grained to fine-grained matrix composed of cordierite, sillimanite, biotite, garnet, quartz, K-feldspar and plagioclase with accessory spinel, apatite and zircon. Biotite, sillimanite, plagioclase and kyanite occur as inclusions in garnet. Cordierite and spinel occur only in the matrix both as isolated grains and as reaction coronas around garnet.

The main foliation planes dip to the west at 35–60°, and fold axes of quartz-K-feldspar lenses trend 190° and plunge at 60°. Kinzigites were intruded by biotite-bearing granite dykes (up 1.5 m) in the eastern and central parts of the quarry.

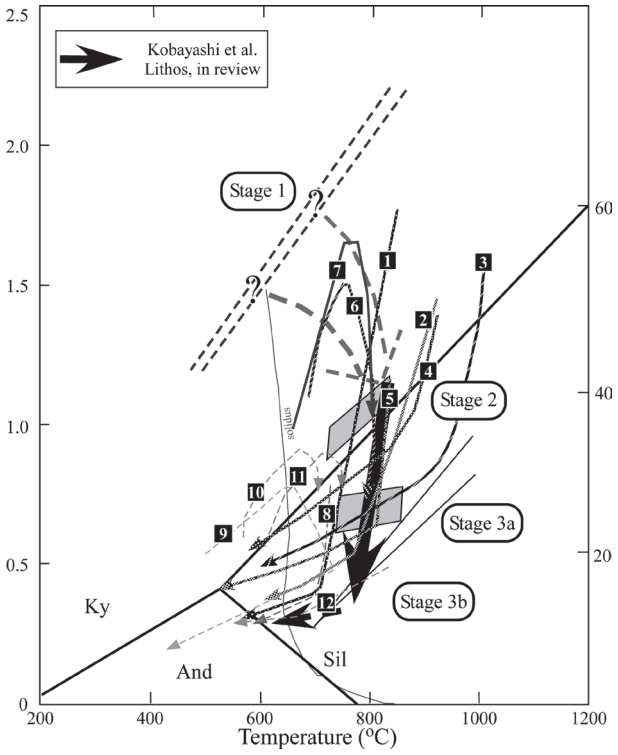
Geological studies of the Ktiš locality

U-Pb dating of the Ktiš garnet-rich gneisses (Wendt, 1989) revealed two populations of detrital zircons. The rounded heterogeneous zircon population (ca. 1.6–2.0 Ga) indicated repeated sedimentary reworking during the Precambrian, and younger

■ **Fig. 1.** Free blocks of garnet-rich gneisses in abandoned Ktiš quarry (photo by M. Svojtka).



■ **Fig. 2.** Photographs (photo by T. Kobayashi) of garnet-rich gneiss at Ktiš showing various types of partial melting structures, (a) leucosomes developed parallel with the main foliation. (b) leucocratic layers defining the main foliation. (c) melanocratic layer with fine-grained garnet (0.1–1 mm) with intercalations of leucosome, and (d) melanocratic layer with coarse-grained (3–5 mm) garnet. From Kobayashi et al, 2011.



■ **Fig. 3.** Comparison of P-T paths of garnet-rich gneiss at Ktiš with those of HP-granulites from the Gföhl Unit and those of gneisses from the Varied and Monotonous Units (For cited references, cf. Fig. 11 in Kobayashi et al, 2011). 1 – Strážek Unit (Tajčmanová et al. 2006), 2 – South Bohemian granulites (Vrána 1992; Kotková and Harley 1999), 3 – granulites of the Lower Austria (Carswell and O'Brien 1993; Cooke and O'Brien 2001), 4 – Lišov granulite massif (Kotková 1998), 5 – Eastern Bohemian granulites; conglomerates (Kotková et al. 2007), 6 – Raabs Unit (eclogite and migmatite; Racek et al. 2006), 7 – granulite massif of the Gföhl Unit (Štípská and Powell 2005; Racek et al. 2008), 8 – Varied Unit (Petrakakis 1986), 9 – Monotonous Unit (Linner 1994, Büttner and Kruhl 1997), 10 – Varied Unit (Racek et al. 2006), 11 – Monotonous Unit (Racek et al. 2006), 12 – Monotonous Unit (Tropper et al. 2006).

prismatic euhedral zircons (549±5 Ma) probably went through only one sedimentary cycle, whose age likely corresponds to Cadomian (Panafrican) intrusive activity in the source area. The latter value is interpreted as a maximum age for early Paleozoic deposition of the Ktiš gneiss sedimentary precursor (Wendt, 1989; Fiala and Wendt, 1995).

Šreinová and Šrein (2000) described the petrography and mineralogy of several varieties of kinzigite from the Ktiš quarry and surrounding localities (e.g. Kozí Kámen, Ktišská Hora, Smědeč, and Lhenice). In addition to these locaties, several occurrences of kinzigites occur outside Lhenice shear zone, mainly in the margins of the Prachatice and Křišťanov granulite massifs.

Recently, multiple equilibrium stages were identified in the Ktiš garnet-rich gneisses in a detailed petrological study by Kobayashi et al. (2011). Garnet shows two different grain sizes (fine-grained up to 0.8 mm and coarse-grained up to 3–5 mm) and compositional heterogeneity in major and trace elements. While fine-grained garnets are mostly homogeneous in composition, some coarse-grained garnets are compositionally zoned, with Grs content{Xgrs = Ca/(Ca + Mg + Fe + Mn)} decreasing from 0.27 in the grain center to 0.02 at the grain margin. Pyrope (Prp)-content varies inversely with Grs, with Prp being low and constant {Xprp = Mg/(Ca + Mg + Fe + Mn) = 0.03} in the center of the grain and gradually increasing towards the margin (up to Xprp = 0.28), (cf. Fig. 5 in Kobayashi et al, 2011). The contours of Grs and Prp contents show symmetrical hexagonal shapes (Kobayashi et al., 2011). The distribution pattern of phosphorous, however, shows a striking contrast with Grs-content. The core of the grain is characterized by a low phosphorous content, almost below the detection limit of the EPMA analysis, but it is surrounded by a high-phosphorous rim, followed by local development of a phosphorous-poor outermost rim. The outline of the phosphorous-poor core shows a hexagonal shape, which is symmetrical to those of Grs and Prp contours, but it is located outside of the higher Grs (Xgrs = 0.27) and lower Prp (Xprp = 0.03) contours (cf. Fig. 6 in Kobayashi et al, 2011, Lithos in print). These observations suggest that the outline of the phosphorous-poor core may indicate the original shape of Grs-rich garnet developed during an early stage of metamorphism.

Based on a combination of Grt-Bt and Grt-Crd geothermometers with Grt-Als-Qtz-Pl (GASP) and Grt-Crd geobarometers, Kobayashi et al. (2011) defined the following equilibrium stages (Fig. 3): Stage 1, 1.5–2.3 GPa at 700–900 °C; Stage 2, 730–830 °C and 1.0–1.3 GPa; and Stage 3, 740–850 °C and 0.6–0.8 GPa. The *P-T* conditions for the Stage 2 are slightly higher than the peak *P-T* conditions for gneisses of the Varied/Monotonous Units in the literatures and the *P*-conditions for the Stage 1 are similar to those of H*P*-granulite in the Gföhl Unit. The inferred *P-T* conditions of the studied rock and a model petrogenetic grid suggest that the studied rock experienced the isothermal decompression at least from the Grt rim stage (Stage 2, 1.0–1.3 GPa) to the matrix stage (Stage 3, 0.6–0.8 GPa). This decompression path would overstep following dehydration melting reactions at different depths: Ms + Qtz = Grt + Bt + Sil + Kfs + Liq at 1.0–1.2 GPa and Bt + Sil + Qtz = Grt + Crd + Kfs + Liq at 0.3–0.6 GPa. The high-phosphorous Grt rim should be formed through these reactions, in other words, higher-phosphorous content of Grt can be used as an indicator of partial melting of the host rock (Kobayashi et al., 2011).

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