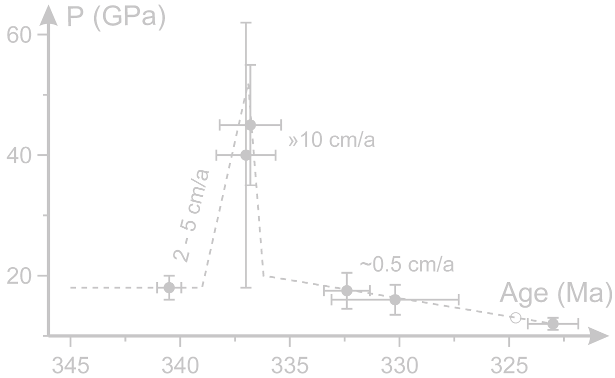
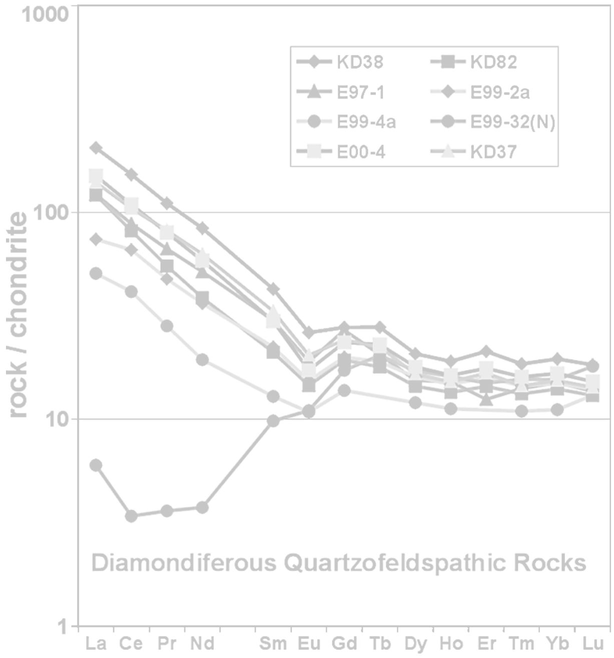


■ **Fig. 19.** Pressure-time diagram displaying a likely burial and exhumation course for saidenbachites from the Saxonian Erzgebirge during an episode of the Variscan orogeny (Massonne et al., 2007). Error bars for time are related to 1σ. The open circle represents the mean age acquired via EMP dating of monazite from saidenbachite by Massonne et al. (2007). The U-Pb zircon age at 340.5 Ma was dated by Kröner and Willner (1998) for sample E42x (at or close to stop 1-3D). The age at 323 Ma is a Rb-Sr biotite (cooling) age determined for a granulite from the nearby Granulitgebirge (see Fig. 1) by Romer and Rötzler (2001) The other ages are SHRIMP U-Pb ages of zircon and monazite from saidenbachite (Massonne et al., 2007).



■ **Fig. 20.** REE patterns of saidenbachites from the GEU of the Saxonian Erzgebirge taken from Massonne and Bautsch (2004). The data were obtained by ICP-MS analyses and subsequently normalized to chondrite according to Boynton (1984). The light REE depletion of sample E99-32(N) may be explained by the escape of a melt fraction before complete crystallization. For this reason, monazite is absent from saidenbachite E99-32(N), but present in all other saidenbachites plotted here.

deposited in the shrinking ocean basin before collision of the Laurussia and Gondwana continental plates (or microcontinents derived from Gondwana, e.g., Linnemann et al., 2000)

Subsequently, the protolith of the saidenbachite was likely deeply buried by a subduction event. In this context, Behn et al. (2011) suggested that pelitic material at the top of deeply subducted crust can form buoyant diapirs that ascend into the hot, overlying mantle wedge, where partial melting begins. This scenario may be applicable to the saidenbachites. Alternatively, the saidenbachite characteristics might be related to lithospheric delamination below the thickened Variscan crust, possibly tens of million years after the continent-continent collision (Willner et al., 2002; Massonne, 2005). If crustal material from the base of this thickened crust were already partially (?) eclogitized (see eclogite E174c from stop 1-2 and stage I of eclogite E99-24 from stop 1-3A, and see Leech, 2001), it could have foundered into the hot mantle to be melted there. In either case, buoyant diapirism or crustal delamination, melting of the saidenbachite protolith occurred in the mantle although no interaction with mantle material is discernible in the chemical composition of saidenbachite.

Stop 1-3 – C (Day 1). Eclogite at the Eastern Shore

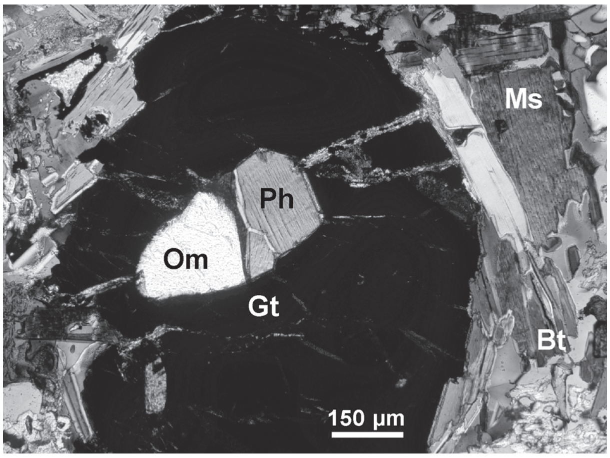
Coordinates: N50°43′52.5″ E13°14′35.5″

From the western end of the saidenbachite body (stop 1-3B) at the shore of the reservoir, continue walking in a south-westerly direction for 500 metres to a natural outcrop on the shore, which would be still discernible if the water level of the reservoir is at its maximum.

Exposed at this stop (Fig. 9) in the south-eastern portion of the reservoir is a homogeneous eclogite, which is partially penetrated by whitish schlieren and pegmatoid dykes. Thick, up to cm-sized white mica flakes occur in the pegmatoid and such mica also appears in eclogite directly adjacent to the pegmatoid.

The eclogite is characterized by abundant mm-sized garnet grains, which are homogeneously distributed in the rock as in the nearby saidenbachite. The eclogite matrix consists of a greenish-greyish material, which is mainly composed of relatively coarse-grained symplectite of plagioclase, Ca-amphibole and Na-poor clinopyroxene after former omphacite. Although matrix omphacite has been completely altered to symplectite, fresh omphacite has been preserved as relatively large inclusions in garnet (Fig. 21, Table 8) of samples E42-1d and E03-14 from stop 1-3C. This is also true for other natural exposures of this type of homogeneous eclogite along the shore of the Saidenbach reservoir. This type of eclogite also occurs as blocks and field stones in the forests and along field boundaries north of the Saidenbach reservoir (see also Fig. 9). Another important inclusion mineral is phengite, the composition (Table 8) of which is nearly identical to that of phengite enclosed in garnet of eclogite E99-24 at stop 1-3A. The same is true for potassic white mica in the matrix, with respect to the lower Si contents of this mica compared with that of the inclusion. Although Massonne and Bautsch (2004) determined P-T conditions somewhat above 30 kbar and 1000 °C by phengite geothermobarometry (as applied to eclogite from stop 1-1) based on the compositions of inclusion minerals and the core of the garnet host, it appears from the relations in the P-T pseudosection of Fig. 13 that these minerals did not necessarily coexist at an early metamorphic stage. It seems to be more likely that the homogeneous eclogites from stop 1-3C and elsewhere have experienced P-T conditions similar to those derived for eclogite E99-24. Unfortunately, no carbonate presently occurs in this homogeneous type of eclogite.

Polished, centre-cut zircon grains from eclogite sample E03-14 usually show an extended blurry core in cathodoluminescence images. In contrast, the rim zone of zircon is homogeneous with a cathodoluminescence significantly higher than



■ **Fig. 21.** Photomicrograph of a garnet (Gt) with inclusions of phengite (Ph) and omphacite (Om) in eclogite sample E42-1d (stop 1-3C) viewed under crossed nicols (Massonne and Bautsch, 2004). Muscovite (Ms), often surrounded by biotite (Bt), occurs outside garnet. Scale bar represents 150 µm.

Mineral	Omphacite	Phengite	Garnet		Phengite	Phengite	
	inclusion	inclusion	core	rim	rim	core	rim
Anal.-No.	1868/4	1868/38	1868/18	1868/24	1868/12	1771/13	1771/8
Sample	E42-1d	E42-1d	E42-1d	E42-1d	E42-1d	E42-1e	E42-1e
SiO_2	54.70	51.70	38.80	38.66	48.06	50.21	50.56
TiO_2	0.34	3.74	0.21	0.08	2.62	2.77	2.30
Al_2O_3	14.05	27.17	21.86	21.90	28.61	29.01	29.76
Cr_2O_3	0.00	0.08	0.00	0.06	0.05	0.00	0.01
FeO	4.06	1.72	18.80	21.96	2.36	3.10	2.60
MnO	0.02	0.04	0.37	0.53	0.00	0.01	0.01
MgO	6.95	4.09	6.93	7.84	2.74	3.35	3.21
CaO	12.57	0.01	12.63	8.50	0.00	0.00	0.00
BaO		0.36			0.18	0.20	0.20
Na_2O	6.92	0.24			0.29	0.23	0.18
K_2O		10.42			10.70	9.25	8.90
Total	99.62	99.57	99.60	99.53	95.61	98.13	97.72
Si	1.945	6.591	5.909	5.906	6.438	6.451	6.468
Al^{IV}	0.055	1.409			1.562	1.549	1.532
Ti	0.009	0.358	0.025	0.010	0.264	0.267	0.221
Al^{VI}	0.534	2.674	3.924	3.942	2.955	2.843	2.955
Cr	0.000	0.008	0.000	0.007	0.005	0.000	0.001
Fe^{3+}	0.000		0.076	0.051			
Fe^{2+}	0.121	0.184	2.319	2.754	0.264	0.333	0.278
Mn	0.001	0.005	0.047	0.069	0.000	0.001	0.001
Mg	0.368	0.777	1.573	1.785	0.548	0.641	0.611
Ca+Ba	0.479	0.019	2.061	1.392	0.010	0.010	0.010
Na	0.477	0.060			0.076	0.057	0.044
K		1.694			1.829	1.516	1.453

■ **Tab. 8.** Electron microprobe analyses (in wt.%) of minerals from eclogite E42-1d and pegmatoid E42-1e taken from stop 1-3 C (Massonne and Bautsch, 2004). The two inclusion minerals were found in garnet of the eclogite. Structural formulae were calculated as given in Table 1.

the core. SHRIMP II analyses of both zircon domains at Curtin University, Perth WA, (for analytical conditions see Massonne et al., 2007) yielded the following results: A) mean of 12 core analyses: 278 ppm U, 187 ppm Th, 342.0 ± 2.4 (95% confidence level) Ma and B) mean of 12 rim analyses: 71 ppm U, 24 ppm Th, 337.1 ±4.8 (95% confidence level) Ma. Thus, zircon from sample E03-14 is as old as that from saidenbachite (see above). Interestingly, the occurrence of former K-cymrite from inclusions of K-feldspar-quartz intergrowths in garnet of eclogite from stop 1-3C was reported by Massonne et al. (2000), but perhaps this feature points instead to melt inclusions, as deduced for similar inclusions in omphacite of eclogite exposed a few kilometres north of the Saidenbach reservoir (stop 1-2).

The composition of phengite in the pegmatoid from stop 1-3C indicates crystallization pressures between 1.5 and 1.8 GPa at temperatures between 700 °C and 750 °C (Massonne and Bautsch, 2004). This pressure interval also applies to the late matrix stage of the eclogite, at which potassic white mica and biotite coexist (see Fig. 21). Again, the P-T conditions of this late metamorphic stage are very similar to that derived for stage III in eclogite E99-24. In addition, the composition of the extended garnet core in sample E42-1d is as rich in Ca (Table 8) as that of eclogite E99-24. In fact, the Mg content of the garnet core (Table 8) is lower than that of E99-24 but the Mg content (as well as the Mg/Fe ratio) of the bulk rock of E42-1d is also significantly lower than that of E99-24. It is thus conceivable that eclogites from stops 1-3A and 1-3C and, consequently, from the entire northern and eastern portion of the Saidenbach reservoir and its vicinity have experienced a similar P-T evolution, as shown in Fig. 14. Furthermore, the P-T evolution of saidenbachite is similar. Thus, it is conceivable that the eclogite exposed at stop 1-3C was also partially molten, as was the protolith of saidenbachite. This idea arises from the homogeneous and similar distribution of garnet in both eclogite and saidenbachite from several bodies at and near the Saidenbach reservoir. Possibly, the granitic melts appearing in schlieren and pegmatoid dykes at stop 1-3C represent remaining melts of the postulated melting (and crystallization) at UHP conditions. However, external melts, derived from the adjacent migmatitic country rocks, could have produced the whitish schlieren, as well. Contrary to the invoked melting of basic material at UHP, the carbonate (-rich?) eclogite(s) at stop 1-3A might not have been molten at UHP, either due to high CO_2 partial pressures or maximum temperatures lower than those experienced by the eclogite type from stop 1-3C.

In addition to the different bulk-rock compositions of eclogites at the Saidenbach reservoir compared to those from elsewhere in the Saxonian Erzgebirge, the peak temperatures of the Saidenbach eclogites were significantly higher (at least 1000 °C), compared to those of other areas in the central Erzgebirge. For the latter eclogite group, peak temperatures between 730 °C and 840 °C and around 850 °C (see Fig. 8G) were reported by Massonne (1994) and Schmädicke et al. (1992), respectively. In addition, Zack and Luvizottow (2006) estimated peak temperatures of 850 °C at 3.5 GPa for an eclogite occurrence a few kilometres north of the Saidenbach reservoir. However, these temperature estimates are very likely too high, because the pressures were significantly overestimated, as demonstrated by the new determination of metamorphic P-T conditions for eclogite E174c from stop 1-2 (see Fig. 8G).

The chemical bulk rock compositions of eclogites at stop 1-3C are somewhat variable (see the three analyses in Table 2), despite their similar aspect in the field. Massonne and Czambor (2007) concluded on the basis of trace-element signatures that the protoliths of these eclogites were possibly within-plate igneous rocks, similar to the eclogites at stop 1-3A (see above). These authors previously suggested that these rocks were formed by melting of crustal material in the deep mantle. However, if the protoliths of eclogites from the northern and eastern portion of the Saidenbach reservoir were once (marly) sediments, the relatively high bulk-rock contents of V, Cr, and Ni (see Table 2) would be unexpected. On the other hand, such relatively high contents of the transition metals could be due to minor interaction with mantle material during the melting and crystallization processes in the deep mantle.

Stop 1-3 – D (Day 1). Layered Granulitic Gneiss, Former Small Quarry

Coordinates: N50°43′41.4″ E13°14′49.0″

Continue to walk along the shore of the Saidenbach reservoir in a south-easterly direction. After walking ca. 400 metre another natural exposure of rocks appears (actually a former small quarry before the Saidenbach dam was constructed), which is well recognizable even if the level of the Saidenbach reservoir is at its maximum.

Layered granulitic gneisses crop out at this stop (Fig. 9). Greenish and reddish layers represent more basic *vs.* more acidic rock compositions, respectively. All different rock types at this stop contain abundant up to mm-sized garnet, potassic white mica and biotite. Biotite tends to be a late stage phase, replacing potassic white mica (Fig. 22). Kyanite occurs in some layers, but is commonly replaced by potassic white mica (Fig. 22).

Omphacite was formerly present in the greenish layers, but is now entirely transformed to symplectites of plagioclase, amphibole, and Na-poor clinopyroxene. The same feature is also discernible in some reddish layers although the ratio of amphibole + Na-poor clinopyroxene to plagioclase is significantly lower compared to that in the greenish layers. This contrast is explained by a higher jadeite content in former clinopyroxene in the reddish layers compared to that in the greenish layers. Locally, in these gneisses a few, mm-thick garnet-rich layers alternate with layers consisting almost exclusively of quartz, plagioclase and subordinate K-feldspar.

Peak P-T conditions for the granulitic gneisses were reported by Willner et al. (1997) to be as high as 2.0 GPa and 800 °C with no indications of higher pressure. The rocks at stop 1-3D might again represent eclogitized crustal material formed at the base of crust thickened by the Variscan orogeny. Whether this thickening event happened 340 Ma ago, indicated by U-Pb