ultrabasic body interacted with melts, which originated in the adjacent felsic gneisses. Perhaps the aforementioned delamination process, which involved crustal material and produced the saidenbachitic melts, could also be responsible for the crustal zircons found by Liati and Gebauer (2009) in the Zöblitz ultrabasic body.

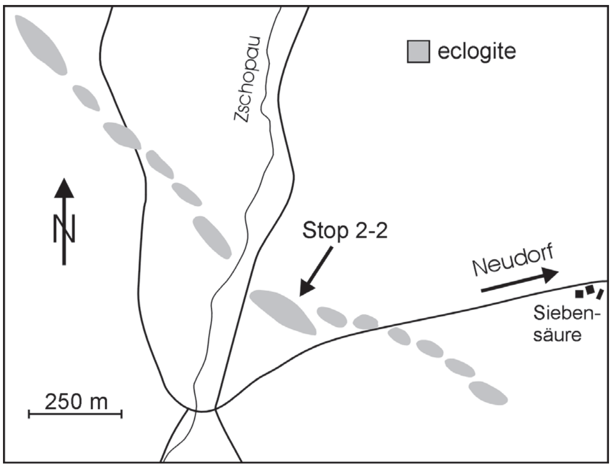
Stop 2-2 (Day 2). Eclogite at Siebensäure

Coordinates: N50°28′37.1″ E12°56′18.7″

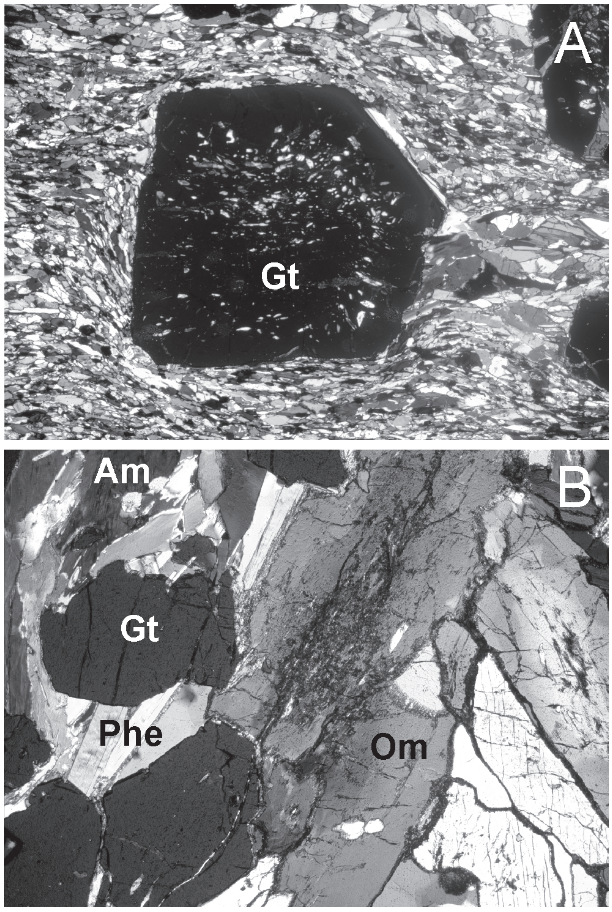
From the serpentinite quarry go back to Marienberg and continue via federal road B171 to the town of Wolkenstein to meet with federal road B101. Follow this road to the town of Annaberg-Buchholz. At the southern town exit leave B101 heading for the villages of Cranzahl and Neudorf. In the centre of Neudorf turn to the right into a small paved road, just before crossing the railroad tracks of the operating museum train, heading for the Forsthaus (forester's house) at the site Siebensäure. Pass the Forsthaus and stop on a parking lot for hikers. Walk for about 500 m in westerly direction and then move into the forest where cliffs expose eclogite and country rock (see Fig. 26).

The cliffs in the forest nearest to the road are orthogneisses, whereas those further north consist of eclogite, which is either a single, elongated lens or, as shown on the map (Fig. 26), a number of smaller lenses. These lenses are situated in the MEU only a few kilometres west of the boundary with the GEU (Fig. 2). The eclogite here is foliated and fine-grained. Strongly deformed portions contain mm-sized garnet embedded in a matrix of small oriented crystals, mainly of epidote and amphibole (Fig. 27A). In coarser-grained portions, cm-scale portions an earlier fabric is preserved, in which mm-sized garnet and omphacite occur with relatively large phengite grains (Fig. 27B). Epidote and amphibole are also present in the coarser-grained portions, where amphibole appears to replace omphacite.

Omphacite and garnet in the non-foliated rock portions of eclogite 18342 are strongly chemically zoned (Fig. 28, Table 11). The latter mineral, independent of its occurrence in deformed and non-deformed domains, shows prograde zoning with significantly decreasing Mn and increasing Mg contents from core to



■ **Fig. 26.** Simplified geological map showing the occurrence of eclogite bodies in an area of the MEU in the Saxonian Erzgebirge a few kilometres west of the village of Neudorf, which is located south of the town of Annaberg-Buchholz. These bodies are shown as mapped by Sauer (1884).



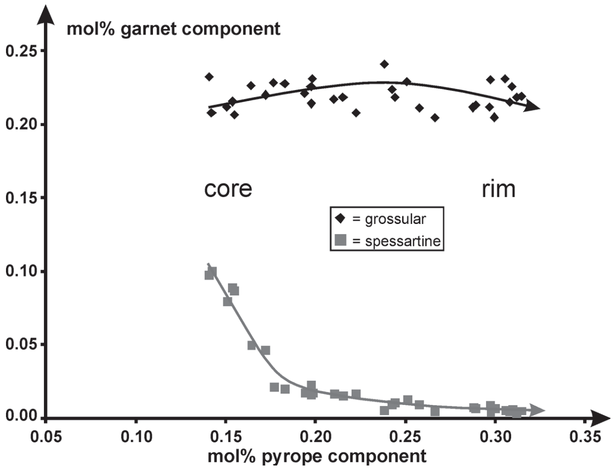
■ **Fig. 27.** Photomicrographs of eclogite sample 18342, taken from a cliff west of the forester’s house at the Siebensäure site (stop 2-2). Image widths are 4 mm each. (A) Large garnet, seen under crossed polarizers, in a foliated matrix consisting mainly of amphibole and clinozoisite. The many inclusions in garnet are mainly quartz and rutile. (B) A preserved portion of palaeocrysts, especially of omphacite, under crossed polarizers. The dirty rims of omphacite are due to a late replacement by fine-grained symplectites of amphibole + plagioclase.

rim. Phengite in non-foliated domains has Si contents between 3.3 and 3.5 pfu (see Table 11) and exhibits gradational zoning.

On the basis of a calculated P-T pseudosection for eclogite 18342, a P-T path was deduced for the prograde metamorphic evolution (Massonne, 2011b; Fig. 29) that is similar to that suggested by Massonne and Bautsch (2004). These authors estimated 2.4 GPa and 500 °C for an early metamorphic stage and 2.6 GPa and 650 °C for the peak stage. In a similar way, Massonne and Kopp (2005) derived a nearly identical P-T path for an eclogite from the cliffs of the Stümpelfelsen, ca. 5 km SE of stop 2-2. All three prograde P-T paths typically show nearly isobaric heating at 2.6 ± 0.2 GPa, reaching maximum temperatures between 650 °C and 720 °C. Such P-T conditions are slightly higher than those proposed by Schmädicke et al. (2002) for eclogites from the western Erzgebirge.

The retrograde path is characterized by cooling within the eclogite facies P-T field (see Fig. 29). During the retrograde evolution and possible beginning at peak temperature conditions either porphyroblasts (Stümpelfelsen eclogite; Massonne and Kopp, 2005) or fine-grained, oriented epidote and barroisitic amphibole (Table 11) formed. Paragonite (Table 11) is a late phase (Massonne and Kopp, 2005) that possibly grew at the expense of amphibole. Eclogite of stop 2-2 has a MORB-type chemical composition (Table 2) virtually identical to that of the Stümpelfelsen eclogite, where Massonne and Kopp (2005) found talc. Although this phase was likely present in the early prograde evolution stage of eclogite of stop 2-2, the absence of talc may be due to pervasive deformation during the retrograde evolution.

The mineralogical evolution of eclogite during its prograde and retrograde P-T path is the result of (1) a subduction of oce-

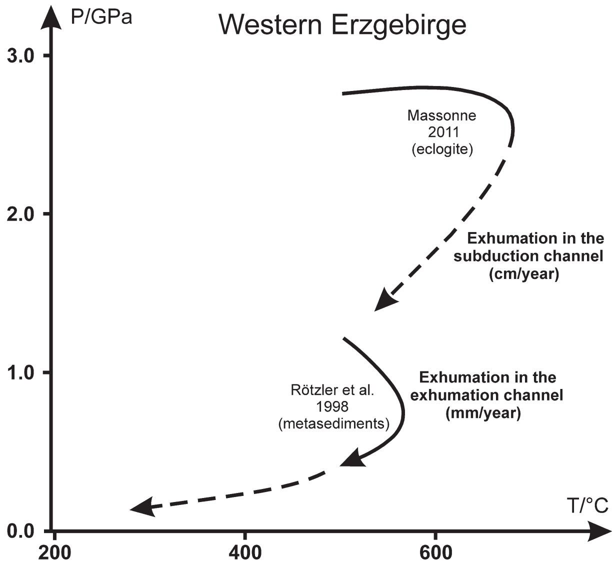


■ **Fig. 28.** Analyses of garnet in eclogite sample 18342 (stop 2-2) in terms of molar fractions of pyrope, grossular and spessartine components, taken from Massonne (2011b). Trend lines show the compositional change from core to rim of garnet.

Mineral	garnet inner core	garnet outer rim	omphacite core	omphacite rim	phengite core	phengite rim	paragonite	amphibole	epidote early	epidote blast
Anal. No.	230402	230414	230429	230435	2304112	2304102	2304114	230437	230440	230420
SiO_2	37.93	39.32	55.93	56.65	52.97	51.04	47.61	51.36	38.71	39.21
TiO_2	0.13	0.02	0.02	0.03	0.22	0.24	0.09	0.10	0.12	0.04
Al_2O_3	20.86	22.12	9.29	10.37	25.86	27.85	38.92	9.59	28.89	31.63
Cr_2O_3	0.04	0.04	0.02	0.01	0.00	0.00	0.00	0.01	0.06	0.05
FeO_{tot}	26.08	22.88	6.09	3.253	1.38	1.72	0.37	11.15	5.72	1.87
MnO	4.46	0.25	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.03
MgO	3.66	8.24	8.57	9.62	4.66	3.77	0.33	13.57	0.12	0.04
CaO	8.42	8.67	13.63	14.36	0.01	0.03	0.21	7.66	23.88	24.42
Na_2O	0.03	0.00	7.15	6.69	0.53	0.88	6.93	4.36	0.02	0.00
K_2O			0.00	0.01	10.73	10.40	1.17	0.13		
BaO					0.16	0.12	0.02	0.00		
Total	101.63	101.53	100.69	100.99	96.52	96.05	95.63	98.04	97.52	97.30
Si	5.857	5.868	1.976	1.982	6.949	6.752	6.061	7.227	2.993	3.005
Ti	0.015	0.002	0.000	0.001	0.022	0.024	0.008	0.010	0.007	0.002
Al	3.797	3.890	0.387	0.428	3.998	4.342	5.839	1.590	2.632	2.858
Cr	0.004	0.004	0.001	0.000	0.000	0.000	0.000	0.002	0.004	0.003
Fe	3.368	2.855	0.180	0.095	0.151	0.190	0.039	1.312	0.370	0.120
Mn	0.584	0.031	0.000	0.000	0.000	0.000	0.000	0.013	0.000	0.002
Mg	0.844	1.834	0.451	0.502	0.910	0.744	0.062	2.846	0.014	0.005
Ca	1.394	1.386	0.516	0.538	0.002	0.004	0.028	1.155	1.978	2.006
Na	0.010	0.000	0.490	0.454	0.136	0.227	1.710	1.189	0.003	0.000
K			0.000	0.001	1.796	1.755	0.190	0.023		
Ba					0.008	0.006	0.001	0.000		

■ **Tab. 11.** Analyses with the wave-length dispersive systems of a CAMECA SX100 electron microprobe (in wt.%) of minerals in eclogite sample 18342 (previously called E22h) from stop 2-2. Structural formulae were calculated as given in Table 1 and as follows: epidote - 25 valencies. Contents of F were below the detection limit.

anic crust (see MORB signature of eclogites from the MEU; Massonne and Czambor, 2007), (2) lateral mass flow towards the hot wall of the subduction channel (isobaric heating), and (3) exhumation within the subduction channel. The hydrous fluid necessary to transform omphacite to clinozoisite and amphibole during exhumation could have originated by dehydration of



■ **Fig. 29.** P-T evolution of HP rocks from the MEU of the western Erzgebirge. The P-T conditions of the solid paths were derived from eclogite (Massonne, 2011b; see also text) and surrounding metasediments (Rötzler et al., 1998). Broken lines refer to not well-constrained exhumation paths. According to Massonne (2011b), exhumation either occurred in a subduction channel or was mainly due to surface erosion of a rather mountainous area, after continent-continent collision. The latter process led to exhumation rates in the mm-range.

the oceanic crust (garnet formation) in the downgoing portion of this crust close to the subduction channel (Massonne, 2011b).

The above P-T path and scenario for eclogite of the western Erzgebirge (Massonne and Kopp, 2005; Massonne, 2011b) and associated lenses of marbles (Gross et al., 2008) are clearly different from those of the Saidenbach eclogites, as outlined above. As previously recognized by Massonne (2004), rocks from two different (near)UHP environments exist, which are also exposed in the Saxonian Erzgebirge.

The country rocks, in which the eclogite of stop 2-2 is embedded, can be seen by walking to the nearby Zschopau creek (see map of Fig. 26), where pebbles mainly of mica-schist with mm-sized garnets occur. This phengite-rich rock commonly contains chloritoid. Rötzler et al. (1998) estimated for the mica-schist pressures of 12 kbar and more and temperatures around 525°C for the pressure climax, and 8 kbar and 560 °C for the subsequent temperature peak (Fig. 29). These P-T results differ significantly from those derived for the adjacent eclogites. Willner et al. (2000, 2002) explained this pressure contrast by a model involving rapid exhumation of high-pressure rocks from the root zone of a collisional orogen. It remains unknown whether the low-temperature eclogites of the western Erzgebirge were metamorphosed at the same time as those of the central Erzgebirge. Schmädicke et al. (1995) determined ages as old as 355 Ma for eclogites from the western Erzgebirge and $^{40}Ar/^{39}Ar$ ages older than 340 Ma were reported by Werner and Lippolt (2000).

Granite-like segregations at the contact between eclogite and country rock are another interesting feature in the outcrop of stop 2-2. The composition of this granitoid is characterized by high Na_2O (>10 wt.%, see Massonne and Bautsch, 2004) and, thus, high plagioclase contents. The reason for the formation of these melts remains unclear. One possibility is shear-heating when eclogite and metapelite were tectonically juxtaposed (see also Fig. 29).

Walk back to the parking lot near the forester's house and go back to Neudorf. Turn to the right when meeting with the main road. After 5 km turn to the right and follow national route B95 to the ski resort of Oberwiesenthal. South of this village, cross the border to the Czech Republic.

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