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The evolution of high-pressure chloritoid-bearing micaschists of the Elstergebirge (Saxothuringian zone of the NW Bohemian Massif) and its geodynamic significance

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The Saxothuringian unit (SU) of the Variscan Bohemian Massif in central Europe contains different kinds of high-pressure (HP) metamorphic rocks from low to high grade. These rocks witness collisional events of the complex history of the Variscan orogenesis. New occurrences of such rocks in the SU were detected in the northern Fichtelgebirge and the adjacent Elstergebirge. We investigated micaschists sampled a few kilometres northeast of the town of Asch/Aš in the northern Elstergebirge. The micaschists are mainly composed of quartz, plagioclase, potassic white-mica, chlorite, biotite, and several-mm sized subhedral-euhedral garnets. Some micaschist samples contain Fe-rich chloritoid (XFe=Fe/(Fe+Mg)=0.90-0.92) coexisting with chlorite (XFe=0.66-0.68) and garnet, which show, according to a study with the electron microprobe (EMP), a prograde concentric zonation from core to rim. The grossular and spessartine components decrease and the pyrope component increases from the inner core towards the outermost rim. Typical compositions are Alm75.5Grs9.5Prp3.5Sps11.5 for the inner core and Alm86Grs2.5Prp6.5Sps5 for the outermost rim. In potassic white-mica, the highest Si contents together with relatively high Mg contents (3.3 and 0.24 per formula unit) occur in cores of mica flakes. Mica rims show Si contents close to the ideal value of 3 pfu. Pressure-temperature (P-T) pseudosections were calculated for the pelitic bulk-rock compositions of chloritoid-bearing micaschists using the PERPLE_X computer software package. On the basis of the contouring of these pseudosection with various mineral parameters and the chemically zoned garnet, phengite-muscovite and other minerals, these schists experienced peak P-T conditions around 16 kbar at 530 °C and a subsequent nearly isothermal exhumation with intermediate conditions of 540 °C and 10 kbar and final P-T conditions around 3.8 kbar and 580°C. To understand the timing of this metamorphic evolution, U-Th-Pb dating was performed on up to 100 μm sized monazite grains with the EMP. The ages obtained from 113 monazite analyses range between 315 and 480 Ma with the most prominent maxima and side maxima at 346.0 $\pm$ 1.1 (2σ), 357.3 $\pm$ 2.3, and 368.3 $\pm$ 1.7 Ma. Several ages older than 380 Ma were related to detrital monazite and, thus, to the provenance area. Consequently, the protoliths of the micaschists should have been Late Devonian sediments. Several ages younger than 335 Ma were assigned to late Variscan events such as plutonism in the vicinity of our study area. We relate the ages close to 370 Ma to the high-pressure event being the result of the continent-continent collision of Laurussia and Gondwana after closure of the Rheic ocean. This collision caused significant crustal thickening. The subsequent exhumation to upper crustal levels was already accomplished in the Visean.