EGU22-9255
https://doi.org/10.5194/egusphere-egu22-9255
EGU General Assembly 2022

Tectonometamorphic and geochronological evolution of the metasediments of the Erzgebirge orogenic wedge (Saxothuringian Domain, Bohemian Massif)

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Although they provide an important link between deep subduction and mid-crustal processes in the Saxothuringian Domain (Bohemian Massif), the medium to low-grade metasediments surrounding the well-documented (U)HP rocks of the Erzgebirge crystalline complex are scarcely studied. To constrain the Variscan evolution, the transition from the low-grade phyllites to the footwall medium-grade micaschists was investigated. Detailed geochronological (monazite U–Pb and mica ^{40}Ar–^{39}Ar dating), structural and petrological investigations, accompanied by thermodynamic modelling, were performed. We constrained the P–T conditions and timing of four deformation events (D1–D4) identified by structural analysis.

The first M1-D1 event is characterized by HP–LT minerals (garnet, chloritoid, phengite, paragonite, and rutile) defining the S1 foliation. The calculated peak P–T conditions for M1 increase from 13 kbar and 520°C in phyllites to 25 kbar and 560°C in micaschists, suggesting a geothermal gradient of 6–11°C/km, typical for subduction environments. The M2-D2 event corresponds to the deformation and metamorphic overprint of the previous fabric during partial decompression. The M3-D3 event is mainly developed in micaschists and intensifies towards the footwall. It is accompanied by a subhorizontal S3 cleavage characterized by MP–MT assemblage bearing biotite, staurolite and ilmenite. The inferred peak P–T conditions for M3 are 5–9 kbar and 595°C representing a barrovian-type geothermal gradient from 17–30°C/km. Finally, all metamorphic fabrics were heterogeneously affected by the low-grade M4-D4 upright folding.

Nine samples have been analyzed by *in-situ* monazite LASS ICP-MS geochronology. In phyllites, there is a prominent single group of ages around 350–340 Ma. In micaschists with intense M3 metamorphism, there are two groups of ages. The monazites located in the M3 matrix were dated at 330 Ma, while few grains in the garnet cores and within locally preserved M1 assemblages are older, around ~340 Ma. ^{40}Ar–^{39}Ar geochronology on micas was used to date 16 samples using step-heating and *in-situ* UV-laser ablation. The results are consistent with the monazite dating. The phyllites preserve ages spreading between 343–328 Ma, while in micaschists the ages cluster to

~330 Ma. The geochronological data revealed that at least part of the phyllites experienced burial and exhumation between 350–340 Ma, while the burial phase of micaschists is slightly younger (340–335 Ma). The strong M3 metamorphic overprint is restricted to micaschists and is dated around 330 Ma and interpreted as the exhumation, ductile thinning and final cooling of the wedge.

The D1-D2 events (350–335 Ma) are interpreted to record the growth and evolution of the Saxothuringian orogenic wedge while its present-day architecture resulted from significant vertical shortening D3 associated with barrovian type metamorphism M3 (330 Ma) and ductile thinning. Altogether, a new tectonic model is proposed, in which the Erzgebirge part of the Saxothuringian Domain reveals a spectacular example of active margin evolution from the formation of accretionary prism to the building of the orogenic wedge by accretion of subducted continental crust and finally its extensional collapse.