Geophysical Research Abstracts
Vol. 21, EGU2019-7964, 2019
EGU General Assembly 2019

Ordovician orogeny in the Saxothuringian Domain of the European Variscides

Stephen Collett (1), Karel Schulmann (1,2), Pavla Štípská (1,2), and Jitka Míková (3)

(1) Centre for Lithospheric Research, Czech Geological Survey, Klarov 131/3, Prague, Czech Republic (stephen.collett@geology.cz), (2) EOST, IPGS, CNRS UMR7516, Université de Strasbourg, 1 rue Blessig, F-67084, France, (3) Laboratories of the Czech Geological Survey, Geologická 577/6, Prague, Czech Republic

Geochronological and geochemical analyses provide new insights into the origin and pre-Variscan development of high-grade rocks of the Erzgebirge (Saxothuringian Domain, European Variscan Belt). The Erzgebirge is composed of a crystalline ‘Cadomian’ basement overlain by a complex nappe pile of ortho- and paragneisses, schists, and metabasites, which locally preserve HP or UHP metamorphic conditions. A representative suite of meta-sedimentary and orthogneiss samples from the Czech part of the Erzgebirge have undergone U-Pb zircon geochronological study and whole rock geochemical characterisation.

Samples of paragneiss, quartzite, and white schist reveal similar detrital zircon patterns, with a large peak at c. 530-750 Ma, and smaller peaks at c. 1700-2200 Ma, and 2400-2600 Ma. A meta-greywacke sample containing abundant leucocratic bands or veins shows a similar detrital zircon record, but, also additional peaks at the Cambro-Ordovician, Siluro-Devonian, and Devono-Carboniferous boundaries associated with structure-less zircon rims and systematically lower Th/U ratios. A further two quartzite samples with Cambro-Ordovician maxima show only Cambrian-Ediacaran inheritance with no concordant ages >1000 Ma.

Notably, while zircons from orthogneiss also show strong inheritance; concordant ages older than 700 Ma are absent. Augen orthogneiss associated with eclogite-facies lithologies display discrete inherited maxima between 650 and 520 Ma and emplacement ages of 500-480 Ma. A general trend of decreasing Th/U ratios in zircon is observed to c. 500 Ma, after which significant increases in both the trend and variability of values are noted. In contrast, orthogneiss from the structurally lowest portion of the Erzgebirge show only limited inheritance and older emplacement ages (540-500 Ma). These orthogneiss, which locally contain ptygmatically folded leucocratic bands, also exhibit discrete zircon rims that yield younger (c. 480-490 Ma) ages associated with low (<0.1) Th/U ratios.

With the exception of two outliers, all of the samples show compositions comparable to Upper Continental Crust compositions with a small Nb-Ta negative anomaly. The two outlier samples, one orthogneiss and one paragneiss, show strong depletion in Ba, Sr, Ti, Eu and minor enrichment in Ta. Geochemical data for the meta-sedimentary rocks all show ‘continental island arc’ affinity and ‘active margin’ signatures are preserved in all orthogneiss samples except the outlier, which shows a ’within plate’ signature. However, the limited chemical variation between different lithologies of different ages suggests significant recycling and that the geochemical signature is more likely controlled by country rock than tectonic environment.

It is therefore proposed that the Erzgebirge represents a giant accretionary complex; the transition from a ‘Cadomian’ active margin setting to an extensional regime occurred in the Early Cambrian, coinciding with significant sedimentary input and repeated magmatic pulses triggering a hot geothermal gradient, recycling of fertile crust, high-temperature metamorphism, and cratonisation of relatively young material. This transition is further reflected in the detrital Th/U record in zircon which shows significant increase in both absolute values and variation during the Late Cambrian/Early Ordovician reflecting the change to a higher temperature environment.