EARLY TECTONOMETAMORPHIC EVOLUTION OF THE SOUTHERN ZONE ERBENDORF–VOHENSTRAUSS (ZEV) — A MULTI-ROCK TYPE GEOCHEMICAL APPROACH

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The chemical composition of basalts or granitoids is widely used to deduce their tectonic origin. We attempt to use the geochemistry of metabasalts, metagabbros, metagranitoids, and metasediments to obtain information on the early tectonometamorphic evolution of the southern Zone Erbendorf–Vohenstrauss (ZEV; NE Bavarian part of the Bohemian Massif). Tectonic discrimination diagrams for clastic sediments point to a considerable volcanic influence on paragneiss composition of the southern ZEV with Ti and Fe + Mg contents similar to sediments derived from modern oceanic island arcs; some samples show influences of a continental arc. The continental influence is higher for samples of nearby Moldanubian and the eastern ZEV, implying that these formed closer to a continent. Rb/Sr isochrons, interpreted as minimum sedimentation ages, give about 530 Ma.

Amphibolites and calc-silicate amphibolites of the southern ZEV yield similar Rb/Sr ages and are thought to correspond to metavolcanic rocks. Amphibolites occur in small lenses and concordant as well as discordant layers, amphibolites with calc-silicate layers form elongated bodies up to several km thick. Geochemically the amphibolites and the calc-silicate amphibolites classify mainly as sub-alkaline basalts. The amphibolites show geochemical characteristics similar to modern N-MORB and VAB, the amphibolites with calc-silicate layers are close to WPB. Amphibolites of the nearby Moldanubian unit clearly indicate a within-plate setting. Metagabbros occur in small stock-like bodies and have compositions similar to the amphibolites. Intrusion ages of the metagabbros are about 480 Ma.

Metagranitoids, with intrusion ages ranging from 480 Ma to 380 Ma, crop out as dykes or lenses, that are up to several hundreds metres thick. They classify as high-K calc-alkaline granites. Morphological and typological investigations of zircon reveal a significant amount of crustal components and show that the granites are of anatectic origin rather than differentiates from basic magmas. Discrimination diagrams classify the metagranites as VAG of an evolved island arc or active continental margin. Younger (ca. 400 Ma) syn-metamorphic granites classify as VAG, despite their obvious collisional setting. This probably can be attributed to a dominantly basic source of the magma. Cooling ages in the southern ZEV between 380 and 370 Ma indicate a very rapid cooling rate of 30 °C/Ma. Published metamorphic PT paths show that cooling was connected to 13 kb decompression.

The interpreted tectonic development of the southern ZEV began with the sedimentation of greywackes and basic volcanism in the Late Cambrian (at about 530 Ma). It can be attributed to the formation of a volcanic arc with minor rifting. Sediments of the eastern ZEV and the Moldanubian unit were deposited closer to a continental arc. The sedimentation was followed by LP–HT metamorphism. Subduction at about 480 Ma (early Ordovician) led to intrusion of gabbros and burial to high pressure/high temperature metamorphic conditions. Eclogite facies metamorphism prevailed at about 480 to 380 Ma and caused anatectic formation of granites. The rapid uplift of the ZEV between 380 and 370 Ma is attributed to the collision of the ZEV terrane with Moldanubian. The process that led to the rapid uplift, is interpreted as obduction at an accretionary wedge.

The tectonic development of ZEV could be deduced from geochemical data of various rock types. The preferred scenario invokes a late Cambrian volcanic arc, early Ordovician subduction, early Ordovician to mid-Devonian anatexis combined with eclogite metamorphism, and mid-Devonian terrane collision and obduction.