



Late-Variscan rare metal ore deposition and plume-related magmatism in the eastern European Variscides (D, CZ)

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Located at the northwestern border of the Bohemian Massif in the eastern part of the European Variscides, the Erzgebirge-Krušné hory is one of the most important metallogenic provinces in Europe with a 800-year history of mining. The following rare metal resources are associated with late-Variscan (315 – 280 Ma), postmagmatic mineralization pulses in the Erzgebirge-Krušné hory and surrounded areas: 900 kt Sn, 230 kt W, 10 kt Mo, 1 kt Ta, 300 kt Li, 200 kt Rb, 2 kt Cs, 1.5 kt In, 230 t Ge, 320 t Sc, 14 kt Sb, 10 kt Bi, and 3 kt Ag.

At the end of the Variscan Orogeny the regional tectonic regime in Central Europe changed, indicating the beginning of the break-up of the supercontinent. The Late Carboniferous-Early Permian in Europe was a period of widespread basin formation that was associated in many areas with mantle-derived magmatic activity. 300 Ma-old dike swarms in NE England and the Scottish Midland Valley, the Oslo Graben and Scania, radiate from a triple junction in the northernmost part of Jutland. This triple junction marked the axis of a deep-mantle plume centered in this area. In this context it is important to note that the mantle plume center is surrounded by significant lamprophyre intrusions which show in some districts spatial-time relationships to Sn-W-polymetallic, Ag-base metal, and U mineralization. During the Late Carboniferous and Early Permian an extensive magmatic province developed within the present northern and central Europe, intimately with extensional tectonics, in an area stretching from southern Scandinavia, through the North Sea, into Northern Germany. Peak magmatic activity was concentrated in a narrow time-span from 300 to 280 Ma. Simultaneously in Stephanian-Early Permian an intensive bimodal magmatism associated with intra-continental extensional setting occurs in the European Variscides. Permo-Carboniferous volcanism in the Spanish Central System, Iberian Ranges, Cantabrian Chain, Pyrenees and the French Massif Central includes a range of mafic calc-alkaline and shoshonitic rock types, and lamprophyres (spessartites and camptonites) with age data between 300-270 Ma. The Mid-European Variscides show a large number of Permo-Carboniferous magmatic complexes with similar ages (Halle Volcanic Complex, Saar-Nahe Basin, Thuringian Forest, Harz Mts., Northwest-Saxonian Volcanic Complexes, bimodal volcanic rocks of the Sub-Erzgebirge basin and the Rhyolite Complex of Tharandt as well as Li-F-Sn small intrusion granites and lamprophyric intrusions in the Erzgebirge.

It is important to note that the late-Variscan W-Mo, Sn-W-Mo, Ag-bearing Sn-In-base metal, Ag-Sb-base metal, and U mineralizations in the Erzgebirge-Krušné hory are spatially and temporal associated with intrusion centers of Permo-Carboniferous post-collisional mafic and rhyolitic (sub)volcanic bimodal magmatism (315-290 Ma) along deep-rooted NW-SE fault zones, especially at the intersections with NE-SW, E-W, and N-S major regional structural zones. The bimodal lamprophyre-rhyolite assemblage in the Erzgebirge / Sub-Erzgebirge basin area was formed during intracontinental rifting in a 'Fast Extension' setting by melting of a metasomatic enriched mantle source. The emplacement of fluid-enriched lamprophyres and F-rich rhyolitic intrusions at the same time is probably associated with decompression melting of updoming asthenosphere which is possibly associated with the above mentioned mantle plume.