

A 3D subsurface model of the Erzgebirge for 3D mineral potential mapping of Sn-W deposits with Artificial Neural Networks

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Since the 12th century, the Erzgebirge has been an important center of metal mineral mining, especially for Ag, Fe, Cu, Sn, W and later U. Because of the long mining history and the large amount of geological, geochemical, geophysical and mineral data, the Erzgebirge was selected as the test case for developing advanced mineral predictive mapping approaches. The developed 3D model covers an area of 9500 sqkm to a depth of 3000 m below sea level, providing an excellent framework for predictive mapping of minerals mineable in the near future. It focusses on the ore controlling litho-stratigraphic and tectonic framework with detailed consideration of intrusives and the close integration of known Sn and W occurrences. Geological primary (bore holes) and derived (maps, sections) datasets, as well as geophysical and geochemical data were used for geological modeling. Hidden granite intrusions were constrained by 3D inverse gravimetry modeling. Enveloping bodies of known Sn-W occurrences were modeled using data either from literature or provided by exploration companies. They are classified according to commodity content and genetic type for later use as training data in the neural network. Secondly, a software utilizing voxel datasets for artificial neural network based predictive mapping (advangeo® 3D Prediction Software) was developed. The 3D model software was used in generating a voxel-based Sn-W predictive model for the Central Saxonian Lineament with its underlying hidden granite intrusive. Key to predictive modelling is the creation of separate models according to the genetic types of deposits (e.g. Sn in skarns or pneumatolytic veins) to fully account for the different geological factors controlling different types of ore genesis. Field reconnaissance led to the discovery of Sn-W-mineralisations in predicted areas. The model is the starting point for new discoveries supporting the Saxon mineral exploration sector and the development of advanced mineral predictive mapping technologies.