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Hybrid mineral predictive mapping with self-organizing maps and a multilayer perceptron applied to tin deposits in the Erzgebirge, Germany

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Self-organizing maps (SOM) are a useful tool to analyse and interpret gridded datasets like potential field or stream sediment geochemistry data. The data are transformed from geographic space to SOM space where they can be clustered according to overall similarity. By transforming the clusters back to geographic space, geological interpretation of the clusters is facilitated. We present the application of a multilayer perceptron (MLP) in SOM space to produce mineral predictive maps. The reduced number of grid cells in SOM space greatly enhances the performance of the MLP and the tolerance to noise in the input data, compared to an application of the MLP to the original data. By clustering the training data locations with the most similar locations (in terms of model input data) in the same codebook vector of the SOM grid an elegant solution for data augmentation is realized within the workflow.

The method is applied to tin skarn deposits in the German part of the Erzgebirge. The training and validation data required for the MLP are compiled from mining and exploration records. The input data for the SOM are reprocessed gravimetric, magnetic, stream sediment geochemistry, geologic and tectonic data sets. Potentially ore-controlling spatial relationships, such as the distance to different types of partly covered granite intrusions, are derived from a regional scale 3D geological model. The resulting mineral prediction map allows the definition of exploration zones for detailed studies. In particular a linear, probably tectonically controlled zone near Schwarzenberg with little previous skarn exploration is recognised as a new target for further work.

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