CAUSE-AND-EFFECT ANALYSIS AND ITS APPLICATIONS IN PREDICTION OF MINERAL RESOURCES

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Most of data characterizing geological bodies and structures consist of texts and various cartographic representations. To process that kind of data with the purpose of predicting mineral resources, pattern recognition methods were often used. Cause-and-effect analysis represents, however, a more effective approach to solving this problem on the basis of qualitative data, for it simulates a way of prediction peculiar to metallogenic investigations and enables to draw the geological knowledge in automated reasoning. In particular, according to one of main metallogenic ideas, a mineral deposit is an effect of the interaction of several geological phenomena which precede and accompany the mineralization process. This concept of causes plurality and causes interaction as well as some other metallogenic concepts are expressed in the form of mathematical logic formulas which can be converted into a single Boolean equation. The latter describes a general form of interrelations between the mineralization and other geological phenomena and features. Data processing consists of revealing the logical dependencies which coincide with this theoretical model. They express cause-and-effect relations between a concrete mineralization and geological features under study. Obtained Boolean function formulas are used then in prediction. Program realization of cause-and-effect analysis is an artificial intelligence expert system.

There are two trends of using cause-and-effect analysis in prediction of mineral resources. The first of them consists of revealing regularities in the spatial distribution of known mineral deposits and occurrences with the following outlining perspective domains. Prediction of mineral resources is performed by introducing a quantitative measure expressing an economic importance of the perspective domains. The second trend is based on the evaluation of separate mineral occurrences within a territory with fixed boundaries. To predict mineral resources, obtained values of occurrences sizes are integrated in a single quantitative characteristic. Both trends have been used in practice for prediction of the gold mineralization.