The application of concentration gradient of zonality coefficient for indicator elements as a criterion in mining geochemistry

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The concentration gradient of indicator elements (g) in a geochemical field was calculated based on the variations in the indicator elements relative to survey interval of successive samples. The calculated g value for indicator elements and their zonality coefficient (g_c) in lithogeochemical anomalies were used to devise a new approach for separating non-economic mineralization from economical anomalies.

Modeling in geochemical exploration by use of g_c has four advantages over the other exploration approaches: (1) It presents a simplistic quantitative model for lithogeochemical explorations in order to distinguish between supra-ore halos from sup-ore ones. (2) It introduces a special approach to enhance weak geochemical halos and to extend their size. (3) It reduces the interfering effect of the background content in calculating geochemical anomalies. (4) It is quantitative method used to distinguish between blind mineralization from zone dispersed mineralization. The usefulness of this model is demonstrated by a small detailed lithogeochemical survey for porphyry copper-molybdenum deposits in NW Iran. g_c was found to be the most useful quantitative model for exploration of the Sungun porphyry copper deposit. Cu and Mo contents of rocks and soils can detect the border zone of such a target of copper mineralization away from the center of mineralization (geochemical field). g_c ratios in surface can distinguish the BM from ZDM with Cu and Mo.

Geochemical and mineralogical pattern recognition and modeling with a Bayesian approach to migmatitic–hydrothermal tin deposits

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Most primary tin mineralization in the world has a magmatic–hydrothermal origin and is associated with granitic intrusive rocks. The geochemistry of trace elements has been widely used to develop models of metallogensis and mineral exploration for various types of hydrothermal ore deposits. Tourmaline compositions have long been used as a useful exploration guide in several types of economically important ore deposits. The Bayesian approach is an effective method of identifying the probability of mineralogical and geochemical type (MGT) mineralization of trace elements in tourmaline ore mineralization. Monomineralic samples have been identified using a computer-based Bayes' method and exploration geochemical techniques of tin deposits for MGT. In order to employ the method, a data bank was used consisting of the results of analyzing more than 500 monomineralic samples collected from the main migmatitic–hydrothermal tin deposits in a territory of CIS. The Bayes approach applied to geochemical data, such as posteriori probabilities and discriminant analysis, provide numerical and graphical means through which the relationships between the trace elements and samples can be studied. The method used here, along with GIS, to find MGT that can be used as geochemical indicators of regions with tin mineralization.

The Yunlong deposit is one of the important tin deposits in Yunnan province of south China. It occurs mainly as cassiterite–quartz–tourmaline ore veins that are hosted in a suite of highly metamorphosed rocks that are migmatitic rocks. Generally, two models have been proposed for the Yunlong tin deposit. The genesis of the ore deposit has been hotly debated and various models have been proposed including granite-related magmatic–hydrothermal and migmatitic–hydrothermal origins (Jiang S. *et al.* 2004).

The results of analyzing 20 monomineralic samples of tourmaline from the Yunlong tin deposit, show a multi-MGT anomaly of superposition which is a combination of two MGT: (1) tin-cassiterite-silicate type (65 %), (2) tourmaline-metamorphic type (16 %). Mineralogical and geochemical maps (MGM) can be drawn based on results of MGT anomalies in a GIS environment. These maps can replace traditional metallogenic maps. To conclude, this method: (1) identifies tourmaline as the mineral that can be selected from both tin ores and non-ores, (2) provides an efficient modeling tool for metallogenic mapping, and (3) leads to the automation of tin mining in the mine-scale.