

Lineament Analysis as a Method of Mineral Deposit Exploration

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Abstract : Lineaments form complex grids on Earth's surface. Currently, one particular object of study for many researchers is the analysis and geological interpretation of maps of lineament density in an attempt to locate various geological structures. But lineament grids are made up of global, regional and local components, and this superimposition of lineament grids of various scales (global, regional, and local) renders this method less effective. Besides, the erosion processes and the erosional resistance of rocks lying on the surface play a significant role in the formation of lineament grids. Therefore, specific lineament density map is characterized by poor contrast (most anomalies do not exceed the average values by more than 30%) and unstable relation with local geological structures. Our method allows to confidently determine the location and boundaries of local geological structures that are likely to contain mineral deposits. Maps of the fields of lineament distortion (residual specific density) created by our method are characterized by high contrast with anomalies exceeding the average by upward of 200%, and stable correlation to local geological structures containing mineral deposits. Our method considers a lineament grid as a general lineaments field – surface manifestation of stress and strain fields of Earth associated with geological structures of global, regional and local scales. Each of these structures has its own field of brittle dislocations that appears on the surface of its lineament field. Our method allows singling out local components by suppressing global and regional components of the general lineaments field. The remaining local lineament field is an indicator of local geological structures. The following are some of the examples of the method application: 1. Srednevyuiskoye gas condensate field (Yakutia) - a direct proof of the effectiveness of methodology; 2. Structure of Astronomy (Taimyr) - confirmed by the seismic survey; 3. Active gold mine of Kadara (Chita Region) - confirmed by geochemistry; 4. Active gold mine of Davenda (Yakutia) - determined the boundaries of the granite massif that controls mineralization; 5. Object, promising to search for hydrocarbons in the north of Algeria - correlated with the results of geological, geochemical and geophysical surveys. For both Kadara and Davenda, the method demonstrated that the intensive anomalies of the local lineament fields are consistent with the geochemical anomalies and indicate the presence of the gold content at commercial levels. Our method of suppression of global and regional components results in isolating a local lineament field. In early stages of a geological exploration for oil and gas, this allows determining boundaries of various geological structures with very high reliability. Therefore, our method allows optimization of placement of seismic profile and exploratory drilling equipment, and this leads to a reduction of costs of prospecting and exploration of deposits, as well as acceleration of its commissioning.

Keywords : lineaments, mineral exploration, oil and gas, remote sensing

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