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Determination of Cr geochemistry anomaly zones in the Orzooiyeh area, Hormozgan province using Analytical Hierarchy Process (AHP)

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Introduction

Using stream sediment geochemical exploration has been considered as a useful approach to explore the good potentials for many years. Problems might come up in the course of implementing resolving which may requires the use of more recent findings or auxiliary methods.

One of the areas which has faced special problems during the conducting geochemical exploration is the Orzooiyeh region on the border of Kerman and Hormozgan provinces. Stream sediment exploration was carried out in the area in the scale of 1: 100,000. This region includes two different geological zones that are the Sanandaj-Sirjan in the northern part and the Zagros in the southern part. During the statistical analysis and method of eliminating the effects of the upstream rock it was determined that most of the element of chromium's anomalies are in compliance with the Bakhtiari and Aghajari units which are lacking in the economic importance in the chromium ore. Current geochemical exploration methods often extract the anomalies based on classical statistical methods (Yazdi, 2002). In these methods, the range of the anomaly is just determined based on simple numerical calculations and except for grade, any of the other parameters do not have a significant role in determining the anomaly areas. However, procedures such as fuzzy logic, neural system, regression and hierarchical analysis process enable the users to involve more parameters in data processing (Oh and Lee, 2010; Kumar and Hassan, 2013; Carranza, 2008).

For instance, using special algorithms has made parameters such as lithology and tectonic, geophysics and geochemistry effective in processing and determining the anomaly zones, and ranking each of the affective parameters in the anomaly based on their importance, and eventually achieving the maps and valuable anomaly areas possible (Bonham-carter, 1994; Carranza, 2008). This study was conducted to identify the significant anomalies zones using AHP and GIS techniques.

Materials and methods

AHP (Analytical Hierarchy Process) is the most comprehensive system designed for multi-criteria decision-making. This method was offered firstly by Sati in 1980, and has carried out numerous applications in different sciences until now. This technique also shows the consistency and inconsistency of the decision that is the outstanding benefit of this technique in multi-criteria decision-making and has been proposed for complex and fuzzy problems based on human brain analysis, and consists of three stages: basic, involving the creation of a hierarchy, determining priorities and logical consistency (Macharis et al., 2004).

In AHP, the factors are compared with each other in pairs and the highest weight is given to the layer that makes the maximum impact on determining the goal (Carranza, 2008). So in this research, after the detection of the effective factors in determining the anomaly areas in the study area, the factors have been weighed for prioritizing the criteria in their order of importance and the paired

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comparison matrix is formed based on the characteristics of the area and comparative studies for criteria and sub-criteria. After the formation of paired comparison matrices using approximate arithmetic average, the relative weight of parameters was calculated. Then, the researcher carried out the various stages of preparing and the extracting data layer deals with each of these factors in the GIS environment and finally the layers were integrated with each other and the entire range of the anomaly was ranked based on appropriate models.

Results

The results of calculating the final weight criteria show that among the study groups, groups Geochemistry .0.45, lithology 0.45 and tectonic 0.1, respectively, are more significant. The ratio of consistency between these groups is 0.02 and is acceptable and the map prepared by the integration of these groups in the GIS environment according to calculated weights shows that a significant proportion of the false anomalies in the region have been eliminated, and the chromium anomalies associated with ophiolites and peridotites of the region show their best. Therefore, this method can be used for providing the mineral prospecting map that the abandoned mines located in the upstream of anomaly areas confirmed the efficiency of this method in the determination of the anomaly areas.

Discussion

In the present study, the hierarchical process analysis method was utilized to eliminate the false anomalies caused by small and non-significant placer deposits related to the detrital formations in the region. The effective factors in determining the anomaly zones were determined and the final map was constructed by integrating groups, lithology, elemental geochemistry and tectonics that is, the anomaly zones map was drawn in the GIS environment. The results show that the region anomalies are related to ophiolite and ultrabasic and a little bit the region detrital. Therefore, a significant percentage of false anomalies associated with the regional detrital of the area was eliminated by this method and the real anomalies showed their best. This discussion indicates the efficacy of the method of AHP and GIS technique, and they can be considered to be effective methods to reduce the impact of Singenetic factors and naturally to eliminate false anomalies.

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