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ORIGINAL ARTICLE

Evaluation of Mineral Indices Using Multi-variate Statistical Method in Qayen

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ABSTRACT
Geochemical survey of stream sediment is one of the most effective reconnaissance methods in most important exploration project nowadays. Studies on stream sediment have been done in a part of 1:100000 sheet of Qayen map, in relation to identify more potentially regions. 147 sample of stream sediment gathered in about 100 Km² regions in this project, and chemical analysis done for 44 elements, then Factor Analysis done after primary processes on them. 4 factors mentioned to containing 63.3 percent of all variations in the region. Factor 1 and 2 equals to lithology and factor 3 is for mineralization on the map of region.
Keywords*: Stream sediment, Geochemistry, Multi-variation analysis, Factor analysis, Qayen.*

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INTRODUCTION

The stream sediments geochemical used in mineral explorations and environmental studies extensively [1], but due to high element analyzed as well as large scale it is difficult to conclude the geochemical data [2]. In these cases, in order to better analyze of the normalized findings, a multivariate analysis techniques such as factor analysis is a suitable method [3]. Furthermore, the relative error of random variables reduced by the multivariate methods slightly [4].In mineral exploration, identification and mapping of surface geochemical data relationships at high volume is the most common method of multivariate analysis.With regard to basic assumptions and apply to the required accuracy multivariate statistical methods can be useful in providing a more accurate analysis [5]. Factor analysis with simple algebraic will provide reliable results for processor [6] and allows to simultaneous evaluation of several variables.

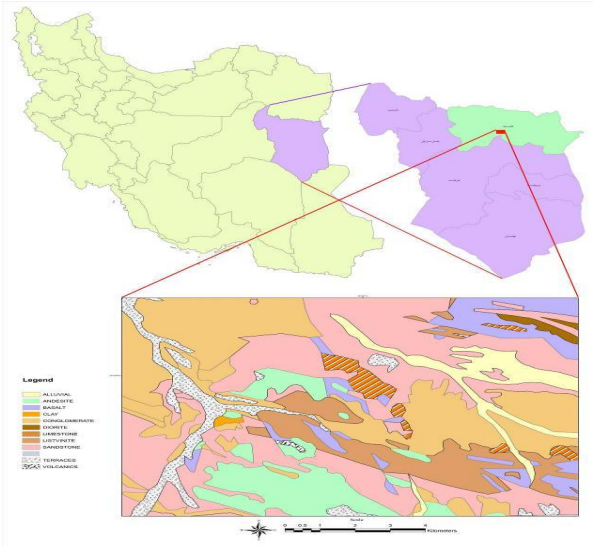

Fig 1: Geographic map of study area

Geographical location and geology of the study area:

As shown in Figure 1, the study area located in the southern Khorasan province, 25 km southeastern Qayen city, in the range of about 100 kilometers coordinates 59° 20' to 59° 30' Eastern and 33° 30' to 33° 35' Northern. The only way to get there is the Qayen-Esfeden asphalt way and then to Gorazan village.

Aspect to structural, this area located in flysch zone, east of Iran (7). The rockunits exposed in the area include Cretaceous peridotite-serpentinitecomplex, sedimentary rocks (Flysch sediments) with a combination of shale, sandstone and limestone of Paleocene- Eocene volcanic rocks of acidic to mafic composition dacite, andesite, tuff, basalt and basal conglomerate Oligo-Miocene and strong to weak Plioquaternaryalluviums. Thealteration of this scope was made by listvenite, impregnation of iron oxides and the argillic types. This alteration associated with considerable expansion list veniteperidotite rocks and flysch sediments are (geological map). Given that the cumulative thick of flyash deposits of area which have ophiolitic rock types that are related to ocean shell (6), the discoveries based of reserves were associated with ophiolite complexes.

MATERIALS AND METHODS

Considering the importance of stream sediment geochemical studies in the diagnosis and effective processes in mineral exploration, concentration and distribution of element in sediments and determination of trace elements [8], as well as, access to promising areas, geochemical exploration methods were chosen. Because stream sediment and rock upstream are considered as a good representative for the exploration plays an important role [1].Based on preliminary studies on regional stream sediments, sampling network was designed and 147 samples were taken and sent for 44 component test in Australia Amdel laboratory. After reviewing the tests accuracy and the replacement of censored and out of layerdata were test by Kolmogorov-Smirnov testand elements that were not normally distributed were normalized by logarithmic transformation [5].Given that a deposit is detected rarely by a specific element, so the studies should be focus on the set of elements instead specific element. Factor analysis is one of the best ways by which you can examine several elements to a specific purpose [9].

RESULT AND DISCUSSION

Factor analysis

Factor analysis widely used for evaluation of geochemical data by Geochemists [9]. Nikmanesh et al., [4] Hadizadeh et al [3] also used this method.The factor analysis; a method based on the eigenvalues when applied the large number of elements in the sample stream is reduced to a smaller number of factors (Rasa et al, 2010). In this way, the relationship between the variable P by a new factor of F, which are not correlated with each other, are examined. The purpose of factor analysis is to detect the main controlling factors from the lower (sub-) variables. This can be a factor with the least number of variables explains the maximum variation between the data and identified the relative contribution of each factor in explaining the variability of the variables. In summary, the purpose of factor analysis is that the P variables measured (under review) can be defined by a K variables factor (k <p) so that they can explain much of the variability.In this method the number of factors is an important step to do this, there were no certain mathematical methods [12]. In this study with a factor analysis of geochemical data, a total of 4 factors, 63/3% of the variability justified as an appropriate factor. The highest factor scores for the various elements are shown in Table 1, the rating of various factors can be described as follows:

F1 (Zr, Al, Ti):

Factor 1 included totally 25.6% of all data changes. These factors include the Zr, Al, Ti, Na, P elements. In accordance with the geological map of the study area and distribution map of factor 1, we discover that these factors emanate from that streams andesitic rocks and listvenite with high values. Due to the containing highlevel elements in factor 1, it could be find that this region relevant more with petrogenetic and the effect of certain mineralization are not visible. Factor scores map of Factor 1 are presented in Figure 2.

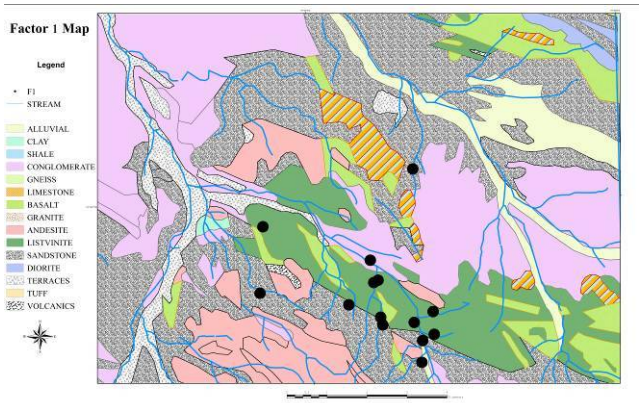

Fig 2: Factor value map of F1

F2 (Ce, U, La):

Factor 2 totally included 18.4% of all data changes. This factor includes the elements of Ce, U, La. Concentration onthese three elements in Factor 2 indicate relatively good performance of factor analysis of the paragenesis expression in the region.

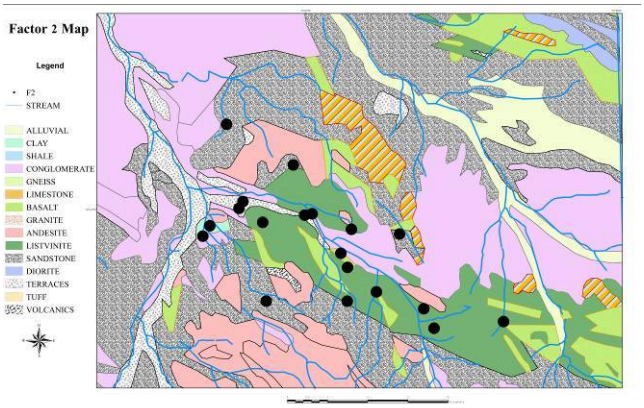

Fig 3: Factor value map of F2

F3 (Cu, Fe, Sc):

Factor 3 included 10 percent of all data changes. This factor includes the elements Cu, Fe, Sc. The results show that about 10% of the total variations associated with ultrabasic rocks. This factor is considered in terms of iron and copper minerals.

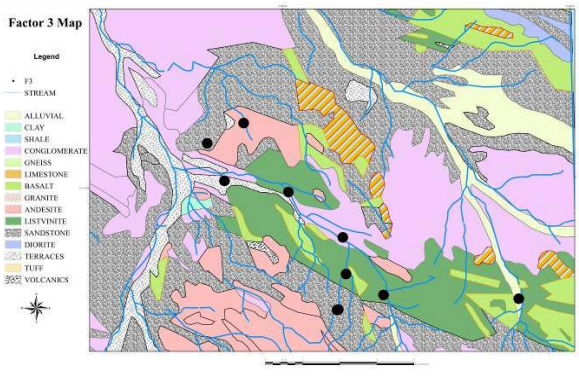

Fig 4: Factor value map of F3

F4 (Sb, Cs, Li, As):

Factor 4, totally included 9.3% of all data changes. This factor include the elements of Sb, Cs, Li, As. Due to the variation in this factor, it can be attributed to the Syngenetic effects which this phenomenon not justify certain mineralization in the region.

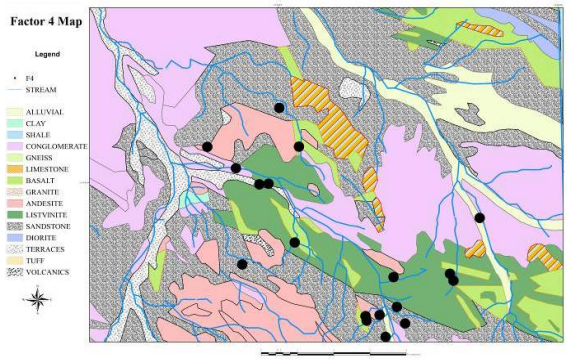

Fig 5: Factor value map of F4

Table 1: Upper factor value of rotated matrix

	Component			
	1	2	3	4
Zr	0.903			
Al	0.903			
Na	0.882			
Ni	0.862			
P	0.846			
Ce		0.836		
U		0.829		
La		0.816		
Sc			0.754	
Cu			0.728	
Fe			0.725	
Sb				0.872
W				0.754
Li				0.734
As				0.731

CONCLUSIONS

The use of multivariate statistical methods such as factor analysis on the data of the study area, more than 60% variety in this area is justified by a 4 factor reduced model, will help to the interpretation of elementsvariation in this area. Of the factors, the third clearly show the existence of iron and copper mineralization. According to the association of these two metals together, for more accurate discovery suggest togeophysical operations as terrestrial magnetism and resistivity- self potential in the region that is very successful in identifying mineral deposits.

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