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Investigation of structural distribution of gold mineralization in "Sefidsang" area (SE-Zahedan, Iran)

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Abstract

Sefidsang area is located 70 km to south east of Zahedan. This area is located in the eastern Iran flysch zone. It has been composed of Ophiolithic rocks and Flysch sediments. Zahedan granitoides of Oligocene age have intruded in these rocks with a NW-SE trend.It within shear zone lies structurally that is among two strike-slip fault (Zahedan and Nosratabad) in east and west respectively. The Zahedan fault with > 150 km length, almost N-S trend and reverse component is strike- slip. The Nosratabad fault with < 200 km length, NW-SE trend and reverse component is strike-slip. The lithic units of this area have been influenced by NE-SW trending of joints and faults. Sampling was considering factors such as stratigraphy, lithology, tectonic and alteration zones. The 60 lithogeochemical samples after preparation were analyzed by AAS method. For 6 selective elements (Au, Ag, Cu, Pb, Zn and As) factors such as frequency distribution, background, threshold, anomaly, enrichment index and mineralization index have been calculated individually and with the separation of lithic units, and the element distribution maps and joints map have been drawn. Therefore spatial location, structural and geochemical distribution and mineralization relationship with structural factors have been determined. The most enrichment index of Au with average 1.70 ppm in siliceous veins have been achieved that these veins emplaced within shear joints that its affected by movements of two Zahedan and Nosratabad main stike slip faults. The same strike of siliceous veins and the main strike of joints and faults in this area show that mineralization is in the control of structural parameters.

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Introduction

In Geochemical studies, how to dispersion of the various elements in lithic units, link and correlation between the elements together are important. With this relationships slightly, may be found to environment and effective processes in the formation of deposits (F.W. Wellmer, 1998). Find the correlation of elements, determination of the Gold tracer element, as well as calculation the limit of the background, threshold, anomaly elements, determination of enrichment and/ depletion elements in the different lithic units of region, drawing of anomaly maps for each element separately, the importance of structural control of mineralization veins, the link of strike and trend of original mineralization with tensional system of breccia zone that affected by Zahedan and Nosratabad faults are the main Motivation and aims of this study. In the past, similar studies have not been conducted.

Material and methods

Location and access roads

The study area (Sefidsang) as part of sheet 1:100000 Geological map of Zahedan, between the eastern Longitudes of60° 56' 15"to60° 58' 07" and the northern Latitudes 29° 09' 55" to 29° 10' 20" is located. Access to the this area is done through the Zahedan-Khash asphalt road and after out of Zahedan urban space go through 30 km in the Ghatar khanjack Post of duty region toward east detoured and after go through 18 km dirt road we enter the desired range (Fig. 1).

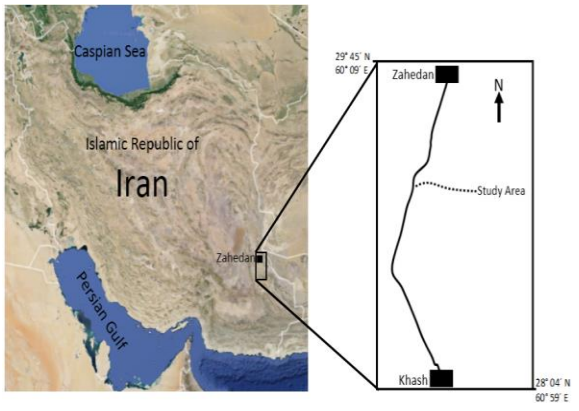

Fig. 1. Location and access roads to the study area.

Geology

The studied Area is located in the eastern Iran flysch zone. It has been composed of Ophiolithic rocks and Flysch sediments. Zahedan granitoides of Oligocene age have intruded in these rocks with a NW-SE trend.It within shear zone lies structurally that is among two strike-slip fault (Zahedan and Nosratabad) in east and west respectively (R. Tirul *et al.* 1983) The Zahedan fault with > 150 km length, almost N-S trend and reverse component is strike-slip. The Nosratabad fault with < 200 km length, NW-SE trend and reverse component is strike-slip (Fig 2) (M. Berberian *et al.* 2000). The lithic units of this area have been influenced by NE-SW trending of joints and faults.

Lithic units are almost everywhere in varying degrees silicified and in contact to granite masses converted to cordierite hornfels (A. Bagherifar2008). There are two series of dykes to trends of NE–SW and NW–SE which in location of mineralization the dykes to trend of NE – SW are with elongation & interruption and the dykes to trend of NW–SE were compacted and curved (Fig. 3 & 4).

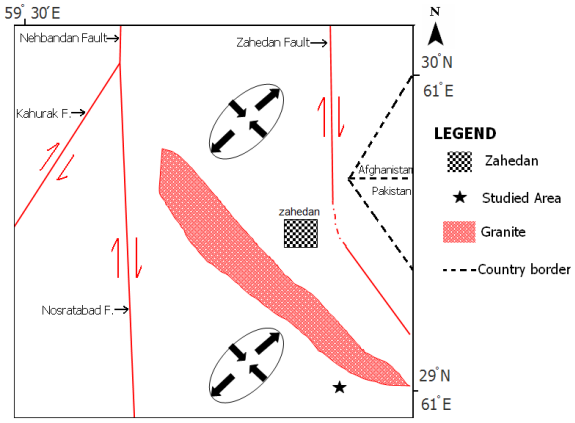

Fig. 2. View of Zahedan and Nosratabad faults.

Litho-geochemical sampling

Due to the existent structural trend in region (Faults & joints) which predominantly is NE – SW and it seems along the trend main component stretch of region (S_1) and also, the existence mineralizer silica veins In the study area ,as well as the lack of a great variety of lithic units, Systematic sampling network

isn't designed. Due to the nearly invariable composition of flysch, dykes and veins of mineralizer used the random sampling method. Since, the purpose was the veiny gold exploration in the site of silica veins, the most samples from veins and its margins were selected. Although sampling method was random, the samples were taken mostly along the perpendicular veins.

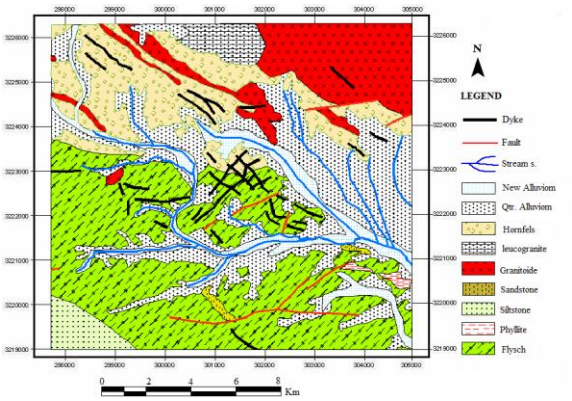

Fig. 3. Geology map.

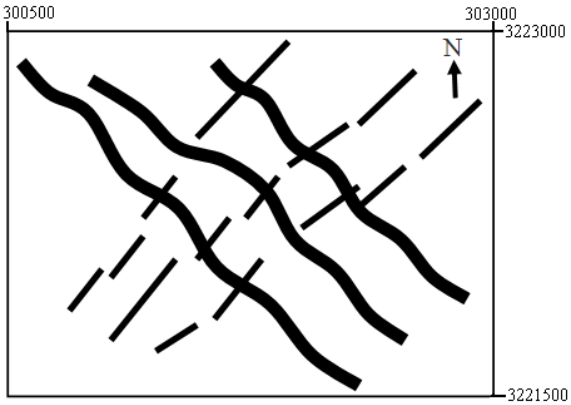

Fig. 4. View of two series of dykes in mineralized area.

Analysis method and statistical calculations

Of the 60 rock samples taken from the region, 6 elements As, Zn, Pb, Cu, Ag, Au, to AAS were analyzed and elements were reported in ppm. After statistical data normalizing, background values, threshold, anomaly and correlation of the elements are obtained (Tab. 1).

Table 1. Background, threshold and anomaly of selective elements.

Elements / Limit	Au(ppm)	Ag(ppm)	Cu(ppm)	Pb(ppm)	Zn(ppm)	As(ppm)
background	<0.12	<11.4	<430	<170.30	<240	<55.40
threshold	0.12-0.34	11.4-13.22	430-520	170-330	240-320	55.4-75.6
anomaly	>0.34	>13.22	>520	>330	>320	>75.6

Result and discussion

The relationship of elements correlation in lithic units

In order to determination of the correlations and their relationship to lithic units in the area, the correlation coefficients are calculated separately for each lithic unit is presented (tab. 2).

Table 2. Correlation in lithic units.

Au-As	Au-Zn	Au-Pb	Au-Cu	Au-Ag	Correlation / Lithic units
0.25	-0.44	-0.33	-0.38	0.82	flysch
0.62	0.01	-0.04	0.031	0.75	dykes
0.72	0.26	0.68	-0.13	0.14	Quartz veins

In Flysch unit the most positive correlation is relate to Au - Ag that this note in existent dykes was shown that of course in dykes after correlation of Au- Ag, Au-As shown a good correlation also indicates the same act of the Au, Ag and As in the epithermal environments. Au, pb both into flysch and dykes indicate negative correlation, while, there is the most negative correlations Au-Zn into dykes it shows that the elements such as, Cu, Pb and Zn which are the basic elements in deeper areas, and are away from the superficial representation veins and dykes (Frank. *et al.* 2006).

Within quartz veins except Au-Cu relationship that Cu have the farthest distance deposition depth to Au,

the rest of elements have the positive correlation together that the correlation Au-As, is seen stronger.

The coefficient of elements mineralization

By the coefficient of elements mineralization can be realized which of the elements studied in the area have their independent ore (Frank *et al.* 2006). According to calculation the total number of samples and the samples having anomaly grade for Cu the most coefficients and Zn, zero coefficients is obtained. The existence Cu oxides such as Malachite into the existent joints and fractures as well as, the old slag which confirms the extraction of Cu from the rocks confirmed the calculations of Cu mineralization. The coefficient of Zn mineralization is 0. This means that the expected value of the Zn ore in the area was very minimal and therefore expected in Computation of anomaly maps it will not show a peak anomaly (Frank *et al.* 2006).

Changes of elements concentration in lithic units

Due to the importance of Au, changes of Au concentration along the sample profile are shown (Fig. 5).

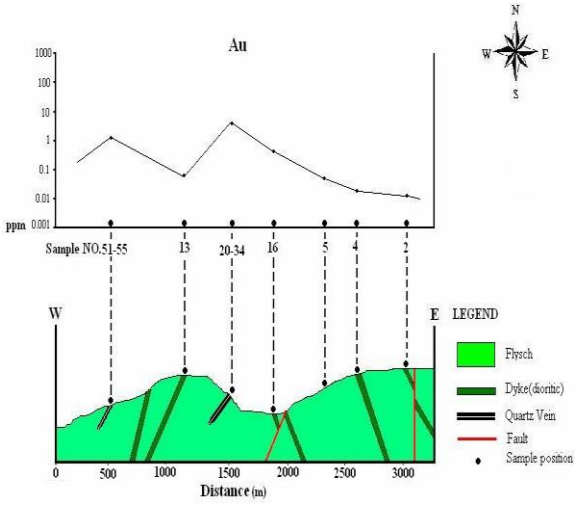

Fig. 5. Changes of elements concentration in lithic units.

In this profile the most **Au** density was relate to silica veins and sharp drop of Au value into flysch covering of dykes and veins is seen that it seems effective Physicochemical process in carry and deposition of silica control in hydrothermal fluids is associated and since the dominant trend of regional joints & silica veins aligned can realize to importance of structural controls on **Au** concentrate (A. H. Barbares, 2007).

Contouring distribution of element

To determine the anomaly points, the anomaly map elements relate to each element separately is obtained. In order to fully description the geochemical and structural distribution and density of element maps each one of the elements separately is drawn. Also to comparison these maps with distribution and dispersion map existent joints in area good conformity between mineralization trend and fracture zone is seen. In Figs 6, 7 & 9 views of Au contouring distribution, faults and joints distribution and grade in lithic units, are displayed respectively.

Among all the elements in geochemical studies of the area have been considered, As has the most similar behavioral or has the most correlation to Au. Therefore it is expected the trend changes As concentration has been the most similar to Au trend. The comparison of trend changes and enrichment indices of Au, As clearly indicate there are that the most concentration of As based on Au concentrations and where the most density of joints and veins in area.

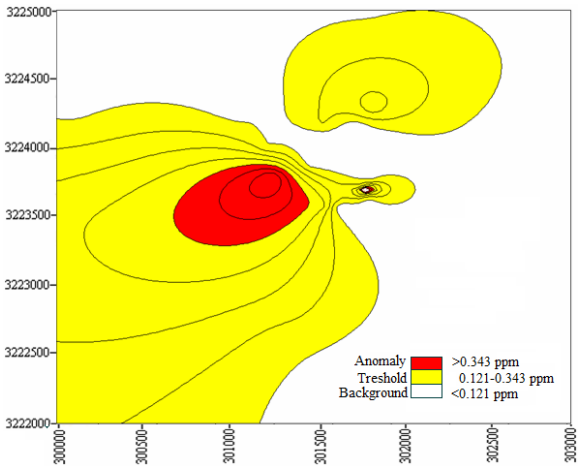

Fig. 6. Au contouring distribution.

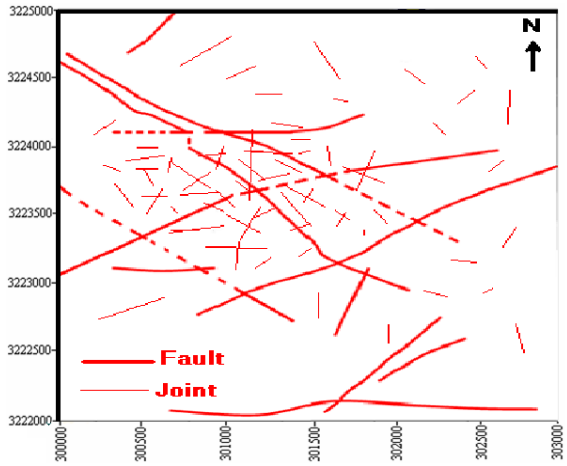

Fig. 7. View of faults and joints in mineralized area.

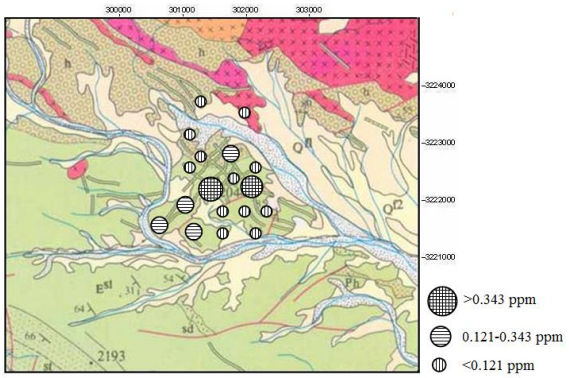

Fig. 9. Grade distribution in lithic units.

Conclusions

The field studies of fault structures and existent joints was shown NE –SW trend that affected by breccia movements located between two strike slip faults of Zahedan and Nosratabad. As well as the conformity of the dominant trend of mineralizer of silica veins with structural zone trend shows that mineralization and the dykes to trend of NE – SW that were elongation & interruption are affected of the main extensional stress in region (S_1 component), and the dykes to trend of NW–SE were compacted and curved are affected of the main compressional stress in region (S_3 component).

Highest concentration of Au in intersection of joints are displayed that it is same trend with S_1 component. The small veins contain Fe and Mn oxides that there are into silica veins as well as this trend is followed. The mineralized areas have same trend of Fracture Zone.

In the Geochemical studies the works taken to indicate the most concentration such as, Au- As is matched on silica veins, while, these two elements in calculation of correlation coefficient determination have the highest positive correlation coefficient together. By away from of silica veins and entry to flysch lithic units. The existence positive and strong correlation between Au & As, suggested As, as a main tracer of Au.

The elements that shown high enrichment in corresponding lithic units (i.e. Au and As in silica veins) can be result the impact of hydrothermal fluids contain the elements during the alteration process of related to lithic units. In future exploration activities, for review and estimation and assessment of probable reserves Placer gold and heavy mineral studies of exploration activities can also focus on stream sediments.

Reference

Bagherifar A. 2008. Gold lithogeochemical exploration in Dargiaban area, SE-Zahedan, The Dissertation of M.Sc. in Economic geology, usb.ac.ir.

Barbares AH. 2007. Geology, gold deposits, and mining history of the southern Mother lode: [Online], National association of geology teachers – Far west section, fall meeting guidebook.

Berberian MJA, Jackson M, Qorashi M, Talebian M, Khatib M, Priestly K. 2000. The 1994 Sefidabeh earthquakes in eastern Iran: blind thrusting and active tectonics of the Sistan suture zone, geo – phys. J. Int **142**, 283 – 299.

Fran P, Bierlin David I, Groves Richard J, Goldfarb Benoit Dube. 2006. Lithospheric controls on the formation of provinces hosting giant orogenic gold deposits. Letter, Springer 875-883.

Frank P, Bierlein Finbarr C, Murphy Roberto F, Weinberg Terry Lees. 2006. Distribution of orogenic gold deposits in relation to fault zones and gravity gradients: targeting tools applied to the eastern goldfiels, Yilgarn craton, Western Australia.Article, Springer 109-124.

Tirul RIR, Bell RJ, Griffis VE, Camp. 1983. The Sistan suture zone of eastern Iran, Geol. Soc. Am. Bull **94**, 134-150.

Wellmer FW. 1998. Statistical evaluations in exploration for mineral deposits. Article, Springer New York.