

## Distribution of magnesite deposits in South-Birjand ophiolitic mélangé

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### Abstract

*Ophiolitic mélangé of south Birjand in east of Iran, composed of serpentized peridotite, gabbro, spilitic basalt and radiolarite. Occurrence of compressional regime in Cretaceous and activation of strike slip and thrust faults in southeast of birjand, sheared mentioned rock unites. Distribution of magnesite deposits in this area consistent with serpentized peridotite suits.*

*Deformation style in southeast of Bagheran mountain controlled by N-S and E-W striking active fault systems. Interaction of N-S striking right lateral faults and E-W striking left lateral faults, created a compressional area in south east of Bagheran mountain in south of birjand. Many thrust sheets are recognition in this part and limited by N-S and E-W striking faults.*

*Magnesite deposits suchas: Howz sefid, Chahkandook, Kalate abdollah, Razgh ,Minakhan,spigi, Nowkaj,Holudar,Kuch. are concentrated in this part of mountaine. Because of tectonic characteristics and activation of thrust faults we expect to have more potential of magnesite mineralization in this part of mountain that situated in thrust sheets.*

**Key word :** East Iran, strike slip fault, Thrust fault, Deformation,Ophiolite, Magnesite,Birjand..

### Introduction

This area is located in the East of Iran in north part of Sistan subzone and contain many magnesite deposits that located in the ophiolitic rocks(Bagheran mountain in the south of Birjand). We can introduce many of magnesite indices such as: Howz sefid, chahkandook, kalateh abdollah, minakhan, holudar, nowkaj, kuch and spigi (Fig.1). Although there are many of magnesite indices that aren't in economic situation but we can use them as evidences for emplacement of magnesite deposits.

All of the mentioned magnesite deposits and also listvinitization in the southeast of Birjand, are belong to fault interaction in the southeast of Birjand. Activation of these fault systems formed special situation for hydrothermal mineralization in the ophiolitic rocks.

### Geometry of structures

Major fault zones in south and southeast of Birjand have east-west, northwest-southeast and north –south strike. In the south of Birjand, east–west left lateral striking fault zones (Khalilzade,et al.,2007) are dominated and the vertical component has a important role. Toward the southeast, the striking of fault zones tend to the northwest-southeast and these kind of fault zones have right lateral mechanism.Toward the southeast area, the mentioned fault zones are connected to the north-south right lateral striking fault zones. Mechanism of

these fault zones and relation between N-S striking , NW-SE and E-W striking fault zones , show that shear component is dominated in the N-S striking fault zones and toward the E-W striking fault zones vertical component is dominated.

Base on fault plane solutions in the southeast of Birjand we demonstrated that the compressional component has NE-SW trend.

Effect of the NE-SW compressional component on the three kind of fault zones caused the contractional deformation in the southeast of Bagheran mountain that located between N-S and NW-SE striking fault zones. Because of contractional deformation in the mentioned area, thrusting are dominated and caused exhumation of pridotitic unites. Younging of deformation from east to west (Fakhari,2006), thrusting in Cretaceous-Tertiary unites and shortening of Neogene sedimentary unites along N-S trends shows the progressive deformation in this area (Walker and Khatib,2006).

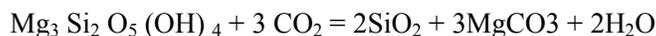
In the south of Birjand , boudinage and fracture cleavage has NW-SE to E-W trend and toward the south east, these trends tend to N-S trend that show the dominant of shearing toward the south. Walker and Khatib(2006) demonstrated that parallelism of outcrops of Neogene sedimentary unites with the outcrop of ophiolitic rocks is reason that the all fault zones have been activated in the pre-existing structures.

Structural elements had principle role on magnesite formation . Activity of nebandan fault – major fault in eastern iran – and related splays such as: osghool, afzal abad , chahkhoo, howz sefid , nowkaj ,... cause that formed suitable place , migration and replacement of hydrothermal solutions. Vein state of magnesite , existence of breccia on it , special geometry of magnesite lenses ( boudinage in vertical and horizontal direction ) show that tectonic parameters had important role on formation and setting of magnesite veins .

### **Petrography**

The studies show that magnesite veins had placed in certain lithological assemblages. All of magnesite mines formed inter or on contact of ultramafic units . ultramafics that are important member of lithological units , are include of : Harzburgit(Fig.2) , Dunite(Fig.3) , wehrlite . Existence of joint sets , caused to extending of serpentization(Fig.4) .

Injection of hydrothermal fluids at the fault zones and hydration of olivin caused serpentization and prepared conditions for magnesite formation. Movement of phreatic waters and forming of hot –water cycle that contain co2 cause that ore-bearing solution created. In this way , magnesite had deposited in fault zones.Important reactions for magnesite mineralization followed:



### **Discussion and conclusion**

Study area is located in the North Eastern Lut plain that major structures have N-S , NW-SE and E-W trends.

Right lateral shear between Central Iran and Afghanistan caused activity of N-S,NW-SE and E-W fault zones in eastern Iran(Walker , Jackson 2002 , 2004, Vernant et all, 2004, Parson et

al, 2006). Faults interaction effect on creation of contractional area and out-crop of ophiolitic rocks along thrust zones. Study of geometric and kinematic of structures, changing in displacement and compression along fault zones approach to recognition of structural evolution in fault zones of north part of Sistan structural zone. from point of view of structural geology the study area could be divided into these main parts:

Activity of N-S strike slip right-lateral fault zones. Fault zones with NW-SE trend, have right-lateral shear with compressional component mechanism and Fault zones with E-W trend, have left-lateral shear with compressional component mechanism that has resulted to a broad and continuous out-crops of ophiolitic rocks.

There are two fault zones one of them has N-S trend in the east of Baghera mountain and another has NW-SE trend that connect to the E-W trends.

Base on geometric and kinematic analysis of faults, folds, lineation and foliations we demonstrated the contemporaneous activity in N-S trending (more shear) and NW-SE trending (more compression) structures. These fault zones have been activated in the pre-existing structures.

NE-SW compressional axes have sheared NW-SE trend due to N-S trend, which has formed contractional area in southeastern Birjand in Sistan structural zone.

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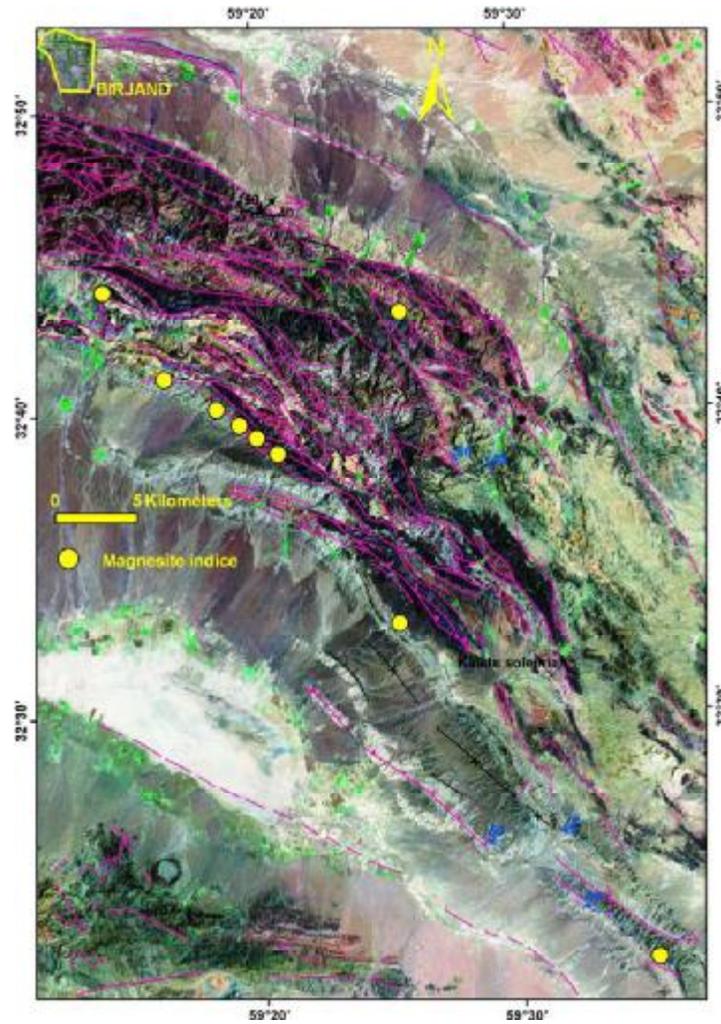


Fig. 1: Magnesite indices on landsat image-SE Birjand



Fig.2: Olivine and orthopyroxene in harzburgites (XPL, Nowkaj area).



**Fig.3: Thin section of Dunite in Abdollah area(XPL,).**



**Fig.4: Serpentinization of harzburgites (XPL, Nowkaj area).**