Evaluation of recrystalization limestone in Laybid mine, Esfahan, Iran

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Abstract

Mining zone of Laybid with 94 exploration and extraction faces, considered as one of the oldest building stone mines, is located next to Laybid village, 185 KMs north west of Esfahan. The reserves of this mine are in light gray to white recrystalized Marmarite and Dolomitic Limestone.

This mining unit is actually a collection of Dolomitic limestone sediments, sandstone and silt stone which contain volcanic eruptions as interbedded lavas in geosynclines while they were precipitate.

The lavas are transformed into Boudinage during folding in Orogeny phases and in regional metamorphic process have absorbed the heat. Then acted as heat center and altered the color of Marmarite adjacent them by releasing heat. These lava were called Metasomatized dike in previous reports. One of the common difficulties in mining is existence of hard lavas.

Because the lavas are interbedded if mining and extraction of Marmarite do along the layers or in place with thick layers, we have the least possibility of facing them.

Key words: Laybib mine, Decorative stone, Tremolite-actinolite, Recrystalization

1. Introduction

The first step of mining process is entering the plan and doing the exploration stage. As the term (Exploration procedure) clarifies it refers to all processes which lead to identifying, estimating and measuring the size and amount of reserve based on efficient economics and time.

All activities in this stage is necessarily toward statistical aspect which includes complicated technical analysis. In this aspect some issues such as geological subjects, related fields to mention strategies best usages removing standards, estimating of extraction situation in future, job marketing, machinery, and skilful man were considered. It is necessary to care about geological basic regulation as the base of exploration and eventually extraction of decorative stone.

2. Material and methods

A. Study area

Mining area of Laybid as the oldest Iran Marmarite mines located near to the Laybid village and 185 km north west of Esfahan. Reserves of this mine is Marmarite with light grey to white color. This area as the biggest Marmarite mine in Esfahan province, consist of 94 exploration and extraction faces with the approximate geographic coordinate 33,27 to 33,29 N and 50, 37 to 50, 47 E (fig 1)
B. Geomorphology of the region

This area has the mean altitude of 2100 meters from sea level and has scattered high locals which are located in recent alluvial plains (Sharify, 1386).

C. Geology of the region

As the structural geology, Laybid is a part of eastern Sanandaj-Sirjan zone. Sanandaj-Sirjan is the most active zone in Iran that in Golpayegan is divided in 2 northern and southern parts. The northern part includes Kimerian (late Cretaceous Orogeny) and has a lot of intrusive such as Alvand, Boroojerdi, Arak and Malayer. While the southern part consisted of Precambrian and middle Triassic Orogeny, and has intrusive rocks such as Haji abad granit, Sirjan, Eghlid and Esfandaghe basic masives (Darvishzade, 1383).

This region had different Orogenic phases, that are from past to recent, late Kimerian, early Kimerian, Austrian, Laramid and Pasadenaian, in respectively (Berberian, M, 1972, Berberian, M, and Alavi, M, 1977).

In this area we see the metamorphism and magmatism of middle Triassic, Jurassic, and late cretaceous. Intrusive rocks in this region includes amphibole and pyroxene diorites that convert to Gabbro. The volume of this intrusive is small but they are a variety of them in the region. This intrusive usually eroded by hydrothermal activities and belong to early tertiary and probably contemporaneous with Eocene volcanism or a short time after that (Darvishzade, 1383).

D. Petrography

In this part, thin sections of various lithostratigraphic explained:

1- Marmarite: tremolite marmarite that its main mineral is calcite with granoblastic texture and its minor mineral is tremolite phenocrystal (fig 2). Tremolite crystals change to calcite form and therefore reaction with acid. Talc crystals are exist a few that shows tremolite altered to calcite and talc, some quartz saw as free in rock texture too (fig 3).

2- Quartz biotite calc schist: Calcite, quartz and biotite are main components in calc schist. Clear schistosity shows in calcite and biotite minerals, quartz crystals collect in some regions and form granoblastic texture. In calcite crystal saw transformation effects. There are some tremolite-actinolite as minor crystal. Some biotite in
retrograde reactions change to chlorite, opaque minerals are iron oxides and graphic under microscope, phenoblasts are collection from quartz, calcite and fine opaque (fig 4).

Fig 2. Tremolite phenoblast that change to talc and calcite

Fig 3. Quartz as intercrystal in calcite background with granoblastic texture

Fig 4. Collection of quartz and calcite in schist
E- Igneous rocks

This unit consists of millonited gneiss which is in north of central section of this mine (fig.3), Gabbro with coarse crystal pyroxenes which is scattered in background and feldspar as interbedded crystals, pink to light brown pegmatite Granit contains aplite veins are another igneous rocks in the region. (Falcan, N, 1974).

3. Study methods

A. Remote sensing and photogeology

To study of this area part of frame, no 164/37 from ETM data from the Landsat with 6 colored band, 2 heat band and one pan band and the ability of 15 meters local separation evaluated.

To need more accurate study in mining regions for recognize of fractures and layers contacts, beside satellite images some other aerial photos with scale of 1/20000 are also used. to process the satellite data in this research ER Mapper 7/0 software is used (Modiry, M, 2009).

B. Field study

Field study has been done in several surveys. In these visits 79 faces from 99 faces workshops are registered.

C. GIS

Some parts of geological map 1/100,000 Dehaghan mountain (Mousavi, 1384), 2 topography maps 1/5000, of lower Hasanrobat (national geographical center, 1352). And Laybid (geographical department of the army, 1379), which consists of the study area are digits in ArcGis 9.2 software.

Geological map used as primary reference, satellite images and field surveys are used to correct and draw the Laibid mining region.(fig.4)

4. Discussion and conclusion

Unfortunately despite of spending huge budget on exploration and the survey, just a few of these mines are financially efficient. the common problems in extraction are listed below.

1- Existence of igneous layers with high resistance which are introduced as metamorphic dikes in reports and maps.(fig.4)

2- Existence of high fractures and joints which sometimes results cancelling the mine

3- In some cases, low qualities, black layers and impurities in rocks cause in decreasing the value of mine.

In studying the aerial photos of the region, it is clear that some layers which were called metamorphic dikes have same trend with existence layers as their surrounding them. It means that they have strike direction 120 which in some parts shift to 90 because of faults function and are vertical or high dip to the north. These layers are continuous in all of surrounding layers, they can not be seen in any of older or younger units. According to these situation the hypothesis of dikes is rejected and another possibility came through, that this igneous layers are Permian interbedded lavas with metamorphism and Andesit composition which solidified contemporaneous with primary limestone deposition as a result of volcanic activities. Then because of the later Orogenic phases, they have changed their horizontal condition and became metamorph. Around these layers, There are white haloes which show the heat effect of these layers on the marginal Marmarites.

Researches on thin sections revealed that just the color of haloes is brighter and different from the main part of Marmarites, but grain sizes did not change. so according to these signs we can call these layers as interbedded lavas.
Because of regional metamorphism, existence of interbedded lavas in Marmarites and due to their composition they appear like heat center and absorb more heat and then release this heat gradually. Because the layers have effects in long period on their side Marmarites, more organic matter disappeared and the light color appeared.

5. Suggestions

1- With due attention to, interbedded lavas and expanding throughout the mining unit and with similar strike and almost vertical dip, if mining doing in 90-120 strike and parallel to local strike of layers, we have the least possibility of encountering the lavas.

2- The section in which Marmarite layers are thin and there is much lava and in alternative condition, mining are not economically efficient, and because of the interbedded lavas, it is recommended to avoid having faces the mines.

3- Because of continuous the top and bottom contacts of the mine unit and decreasing quality of the rock due to impurity in this sections. It would be better do not have faces near the contacts of the layers.

4- Based on decreasing metamorphism grade toward east, mining in this part is not financially efficient.

5- Although metamorphism grade and the quality of rocks increasing, because of the high topography in the region, most of the faces are opened in accessible regions which are mostly the place of passing faults. So for expand the mines in this region we need to have more study and research.

6. References


5. Geographical center of Iran Arm, 2001, Topography map of Laybid, 1/50,000


8. National geographical survey of Iran, 1975, topography map of lower Hasanrobat, 1/50,000
