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**TÍTULO:** Estudio de tipos de textura en masas intrusivas en el noreste de Jiroft.

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**RESUMEN:** Varias masas intrusivas se encuentran en el noreste de Jiroft, región que fue parte de la batolita Jabal Barez con composición litológica que incluye Synogranite, Monzogranite, Granodiorite, Diorite, Quartz monzonite, Quartz monzodiorite. La textura visible en las rocas graníticas incluye: Granular, Granofire, Gráfico, Pertita, myrmekita, las cuales expresan las condiciones para la formación de minerales, su ubicación en rocas y cambios físico-químicos durante la cristalización o después de la cristalización del mineral. En el presente trabajo se aborda el tipo de textura en las rocas plutónicas del área, la presencia de Pegmatites, y la ausencia de biotita, lo que puede indicar la alta presión de vapor de agua y la baja profundidad de estas rocas.

**PALABRAS CLAVES:** Jabal Barez, masas intrusivas, tipos de textura, Urmia-Dokhtar, Jiroft.

**TITLE:** Study of types of texture in intrusive masses in Northeast of Jiroft.

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**ABSTRACT:** Several intrusive masses are found in the northeast of Jiroft, a region that was part of the Batolite Jabal Barez with lithological composition that includes Synogranite, Monzogranite, Granodiorite, Diorite, Quartz monzonite, Quartz monzodiorite. The visible texture in the granitic rocks includes: Granular, Granofire, Graph, Pertite, myrmekite, which express the conditions for the formation of minerals, their location in rocks and physical-chemical changes during crystallization or after crystallization of the mineral. In the present paper, the type of texture in the plutonic rocks of the area, the presence of Pegmatites, and the absence of biotite are addressed, which may indicate the high pressure of water vapor and the low depth of these rocks.

**KEY WORDS:** Jabal Barez, intrusive masses, types of texture, Urmia-Dokhtar, Jiroft.

**INTRODUCTION.**

The fines in granitoid are divided into three main categories: Magma, submagma and solid state (Blekinsop, 2000; Passchier et al., 1998, 2005; Vernon, 2000, 2004). Visible textural in granitoid rocks are divided into two: primary and secondary growth; in the primary textural: granite (granular), Granville, graphic and poeiclitic, and from secondary textural: pertite and myrmekite, one of the solid-state finishes is also the growth of myrmekite; there are various mechanisms for its formation. This is also a simpelictic growth of plagioclase and worm-shaped quartz that is massive and deformed granitoid, and also in metapelites, magmatic, ophelite and pegmatites (Menegon et al., 2006). In granophyre textural, quartz crystals grow in the branch of branch (similar to the line of the niche) in the field of orthoclase (Best and Christiansen, 2001; Vernon, 2004).

Graphic coherence is similar to Granofire coherence. Graphic coherence is greater than that of Granofire coherence, in which the amount of feldspar rich in potassium-rich sodium or potassium is greater than intermediate compounds (Barker, 1970).

**Geology of the area.**

The study area is located at a speed of 55 square km in the southeastern province of Kerman, in the city of Jiroft. The area is between latitude, 28°30` to 28°45` north, and 57° and 45` to 58°151 east. The area is East 1:100000 and 250:000 Sabzevaran and west 1:100000 Tabs are located on the Jebbal Barez (Figure 1).

The Jebbal Barez Complex is approximately 50 km long in the southern part of the Kerman copper belt. The rocks of this complex have granitoid compound. In the Jebbal Barrez area, magmatic activity has been found internally and externally. Generally, according to studies, the igneous activities of Jebbal Barrez region have occurred in four stages (Ghorbany, 1393). The third magma activity of the region occurred in Oligomiocene. This magma activity is widely responsible for the formation of intrusive rocks, and all the infiltration complexes examined in this article are also included in this droup. The third stage itself, the intrusive Magmatic Activity of the Oligomiocene, occurred during three phases (Ghorbany, 1393). The total volume of rocks in the region is granodiorite, synogranite, monzogranite, quartz monzonite, quartz monzodiorite and diorite.

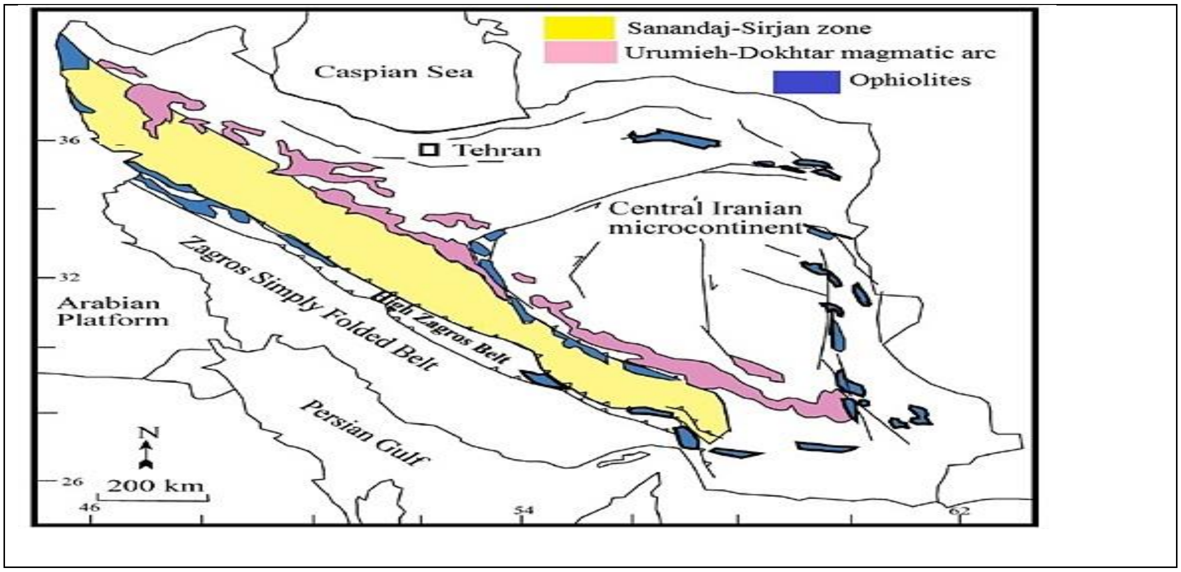



**Figure 1.** The study area in the structural map of Iran (Ghasemi & Talbot, 2006).

**Petrography.**

After extensive field survey and accurate sampling of different lithological units of intrusive units of intrusive bodies, more than 100 microscopic sections were prepared and examined. After microscopic studies of internal rocks and determination of the percentage of quartz, feldspar alkaline and plagioclase and to each one of them, the Eshtericayzen diagram was used to determine their name (Figure 2).

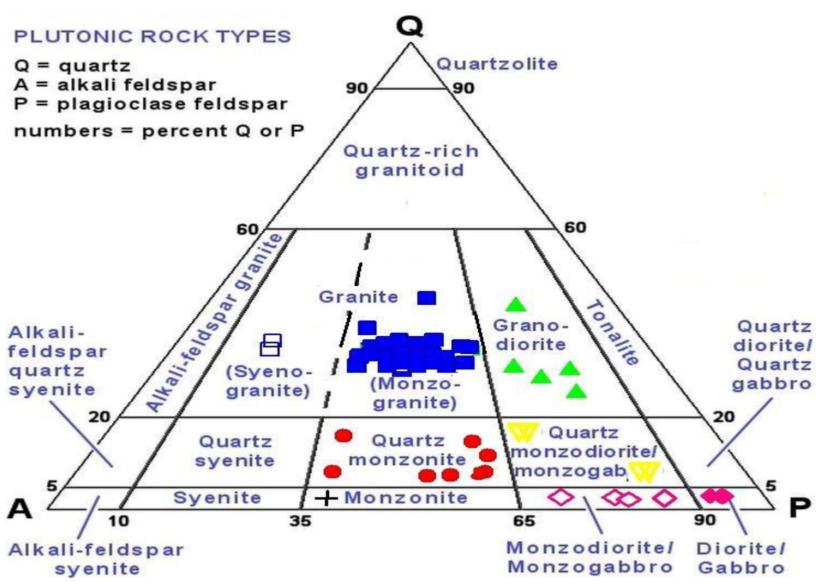



**Figure 2.** Types of intrusive rocks of the region according to their modal composition.

**A. Synogranite and monzogranite.**

In the samples, granular, graphic, vein pertite and secondary texture (derived from alteration) can be seen (Fig. 3a. and Figs. 4a. to c.) and plagioclase crystals are often sub-utomated and serrated. In plagioclase, sinews Carlsbad and polysyntheteic mats are observes with oscillating zing. The main constituent minerals are frequent in frequency range, including quartz (30-35%), potassium feldspar (25-20%), plagioclase (20-25%) and amphibole and their minor minerals include esfen, zircon, apatite, Biotite and Ops minerals (primary and secondary) (Fig. 3a) and from secondary minerals to sericite, iron oxide (hematite) and chlorite.

**B. Granodiorites.**

These rocks are less widely distribution in the region than other types. The bright minerals of these rooks include plagioclase (55-45%), quartz (22- 20%) and feldsparic (18-10%) in small amounts and minor minerals include biotite, amphibole, esfen and opaque. Chloride, epidote and serisite minerals are secondary minerals. Their microscopic texture is subgranular (semi- arranged grains), poeiclitic and graphic, and also in these rocks, it is also observed due to alteration of secondary textures (Fig. 3c).

**C. Diorites.**

The texture of the diorite index are granular, micro-granular and secondary textural derived from duitric alteration. Plagioclase is an average microcrystal with a frequency of 50 to 60% in diorites, and according to the angle of extinction (10°), oligoclase is up to (20°) for andesine. Microcrystalline phenocryst-micro (ores) are present in porpharly textural samples). Quartz with a frequency of less than 10% and the space between the plagioclase fill the coarse crystalline minerals. In same cases, amphiboles have encleated opaque minerals and can formulate a textural substrate. Aguite can be found in a form of semi-shaped mineral, and the twins Carlsbad, Augites show a hybrid-Apatite and

Esfen are of minor and important minerals (Figure 3-d), and secondary minerals include chlorite, epidote, sericite and clay minerals.

**D. Quartz monzodiorite and monzodiorite.**

These rocks are all crystalline and medium it fine grains, in which they can be found in Hornblende and Feldespar minerals. In microscopic sections, that dominate textural are porphyric, intergranular, and granular (medium to coarse grains), and sometimes show clay poetic texture. Main minerals include plagioclase (50-45%), feldspar alkaline (22- 15%). Hornblende and Quartz (less than 10%), minor minerals include pyroxene, apatite and apical minerals and secondary minerals including esfen, Chlorite. Epidote, sericite and clay minerals (Fig. 3).

**E. Quartz monzonites.**

The main texture of these rocks is granular, intergranular and poeiclitic. The mineral content of plagioclase is between 50-45% and feldspar alkaline 25% and quartz is about 10%. Hornblende varies from 10% to 20% and its approximate size varies from 0.2 to 2 mm. Apatite, esfen and OPC minerals, parapetty minerals and secondary minerals include sericite, Chlorite, Epidote and Calcite (Fig. 3e).

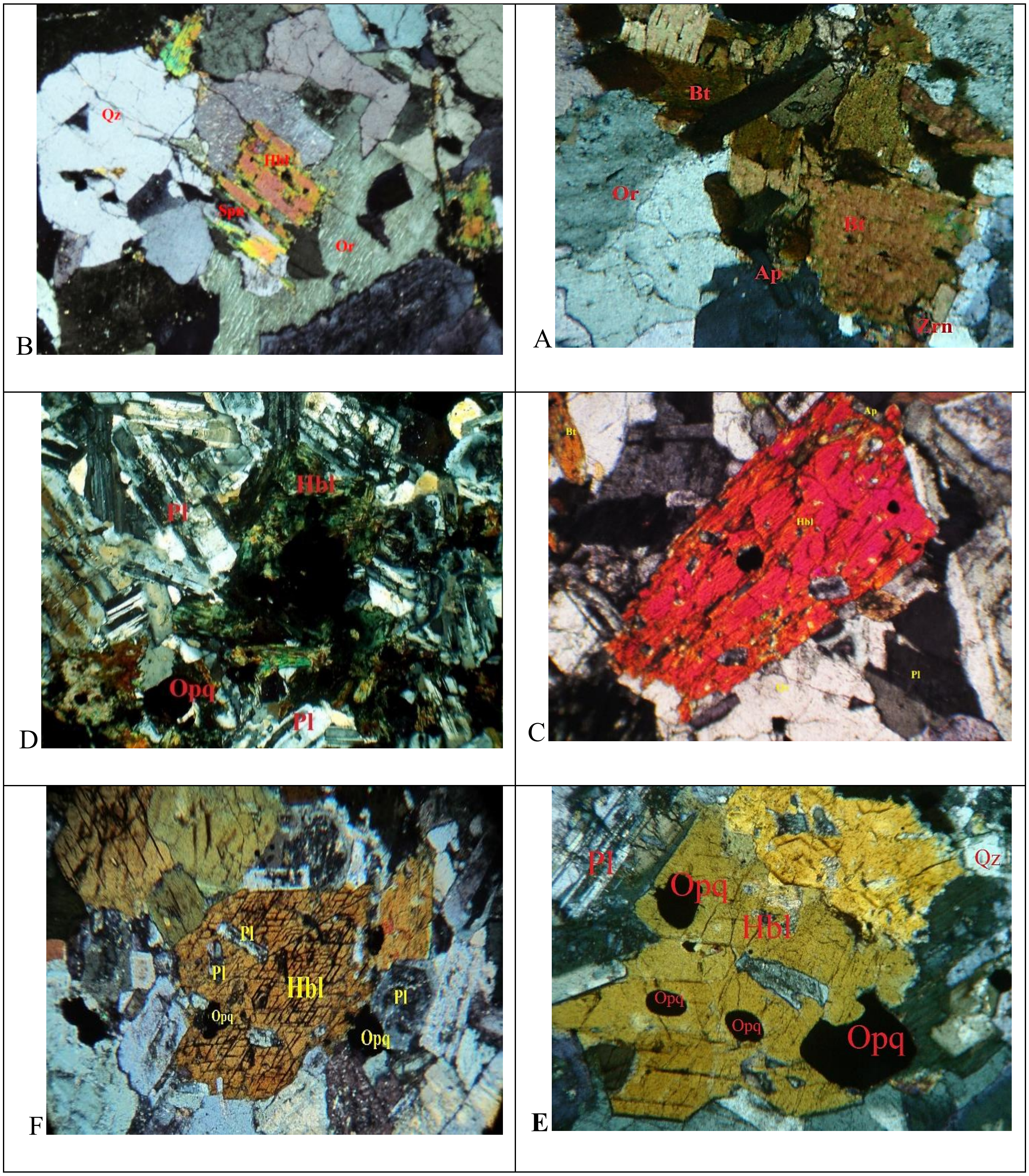



**Figure 3.** A. Granular texture and the presence of primary biotite mineral, apatite and zircon in monzogranite (40x, XPL), B. Granular texture and pertities orthoses in Monzogranite (40x, XPL). C. Granular texture and the presence of Hornblende coarse minerals in granodiorite (100x, XPL). D. Granular texture and hornblende chlorination in diorite (40x, XPL). E. Granular and poeiclitic texture

in quartz monzonite (40x, XPL). F. poeiclitic T granular texture and plagioclase in the hornblende, epiphytes of hornblende along their Cleavage in quartz monzonite (100x. XPL).

**Types of textures.**

In general, the most important texture observed in the rocks of the region are divided into two categories.

**1. Primary textures:** granular, graphene, graphic and poeiclitic.

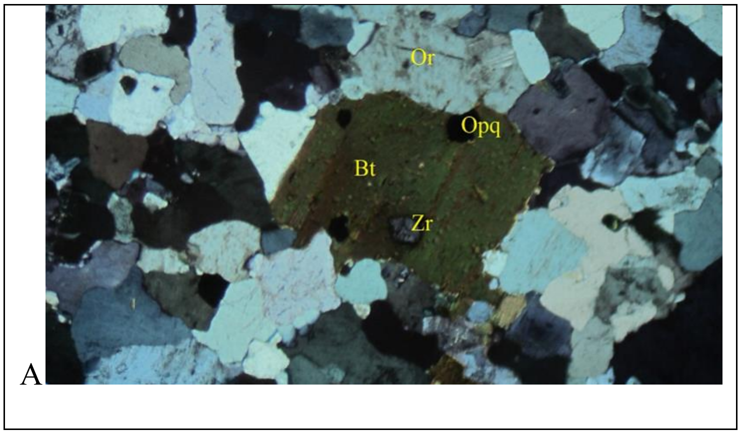
**a.** Granite texture: this texture is the last step of bonding minerals that, at the end of crystallization, is a mixture of more or less uniform and uniform minerals with different rebar, formed and unformed (Figure 4.a).

**b. Granophire texture:** these textures are a result of the coincident and irregular growth of quartz and orthoclase (Figure 4b). In this type of texture, quartz crystals grow in the branches of the branch (similar to the line of the niche) in the field of orthoclase (Best and Christiansen, 2001; Vernon 2004). In this texture, the crystalline crystals of the relatively euhedral alkali feldspar grown in a thick granitic melt and formed by enriching the molten silica and alkaline elements of the quartz-feldspar conjugate around them (Best and Christiansen, 2001).

In this texture, quartz mineralization is more often seen as dendritic and at relatively low temperatures about 650°c and when magmatic water content is low, it is formed by rapid nucleation (Vernon, 2004). There are different opinions about the formation of this texture (Vogt, 1930; Smith, 1974) and suggest the kotektic crystallization of quartz and feldspar alkaline as the result of the emergence of granofilous texture. In other words, the reason for the formation of these types of convulsions is the presence of fluids (Shelly, 1993). The mechanism of the formation of the granophyre texture is explained by the fact that, as the temperature decreases, feldspar begins to nucleate. The primary growth of feldspar creates a supersaturated fluid of $H_2O$ rich in silica and, as a result of this process, feldspar formed skeletally and quartz fills the space between feldspars (Shelley, 1993).

**c. Graphic texture.**

Graphic coherence is similar to Granville`s conjugation. The name of the graph is adapted from the similarity of the interlocking branches of quartz graph is adapted from the similarity of the interlocking branches of quartz to the hieroglyph or crimson line. Graphic mentality is greater than Granofire conjugation, and the amount of feldspar rich in potassium-rich sodium or potassium is higher than intermediate compounds (Barker. 1970). Basically, this is also a development in the granite of the pegmatites and its formation is due to the presence of a lot of fluids. But it may be the result of the initial crystallization of feldspar and the kinetic effect of the growth process on the system (Fenn, 1974) (Figure, 4c).



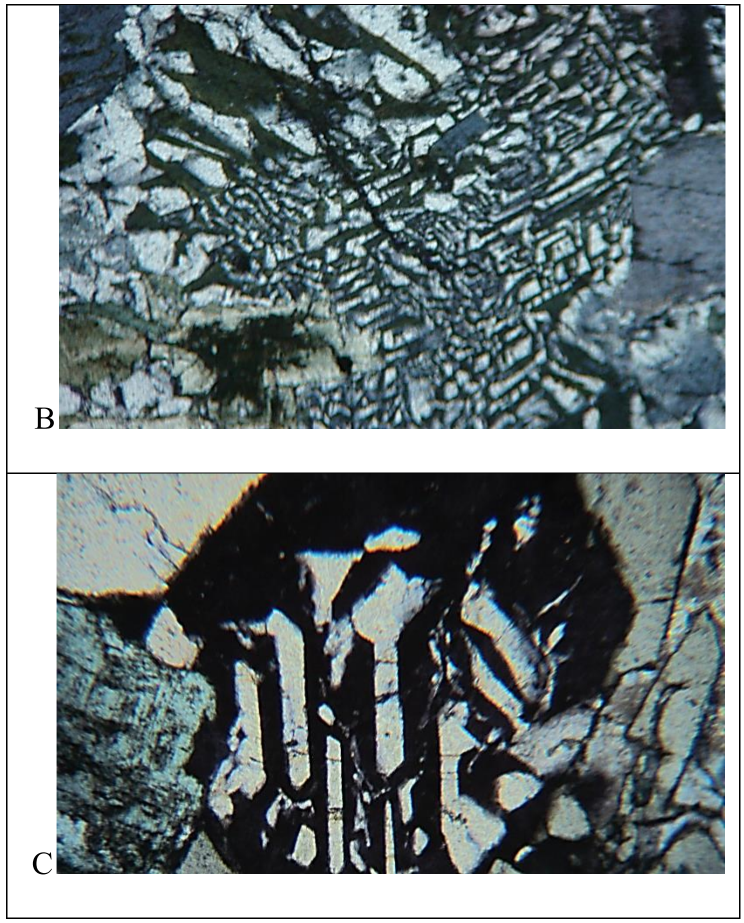



**Figure 4:** a. Granular texture in monzogranite (40x, XPL). b. Granofiri texture in monzogranite (40x, XPL). C. Graphic texture in granodiorite (40x. XPL).

**Secondary textures.**

In addition to the primary texture mentioned about, there are also secondary textures in granitoid rocks that divide them into three general groups (Shelly, 1993).

- The textures resulting from subsequent cooling or transformation do not produce a major change in mineralogy. This group contains pertite in potassium feldspar, the development of the boundary of material exchange at the boundaries of potassium feldspar and miermicite. In the thin sections of the rocks, the peritoneum and miermicite texture are seen.

- Textures that are caused by ditic or hydrothermal activities that cause changes in the main rock minerals. From this group, we can mention alterations of sericitzation, sosoritization, epidization and kailonization of feldspars, which are abundantly observed in sections.
- Textures that indicate the presence of strains during the change.

**A. Peritatum texture.**

One of the granite indices in the studded area is the presence of peritate textural (Figure 6b). This texture is the result of the incompatibility of phases rich in sodium and potassium in feldspar alkaline. Some physical and chemical factors contribute to the formation of peritate. One of these factors is the pressure of the fluid (vapor, carbon dioxide, etc), the temperature and depth of the magma. Parsons & Brown (1984) attributes large coarse grains to newer hydrothermal activities at temperatures below 400°C, but some researchers have linked large coarseness to replacement activities (Smith and Brown, 1988). In addition, the tectonic strain may be intermittent and affect the preferential orientation of the pertion blodes. In most coarse porocity, there is a reciprocal replacement in closed systems, that is to say, existing peritate has been extensively mixed in the chemical composition, but in a open system, due to the rotation of the solutions, there is a significant chemical change coarse perlite in the pegmatitis (Martine et al., 1995).

From the Salvous Feldspar chart, we can use the gemstones with peritoneum for thermometry (Kretz, 1994). According to the crystalline curve and alkali Feldspar oxidation, the freezing temperature of alkali feldspar (TS) in granite rocks of the region is estimate at a pressure between 1-1kilobar and a temperature of about 900-800°C and the temperature of the formation of peritate in (Tx) is about 650°C is estimated (Figure 5).

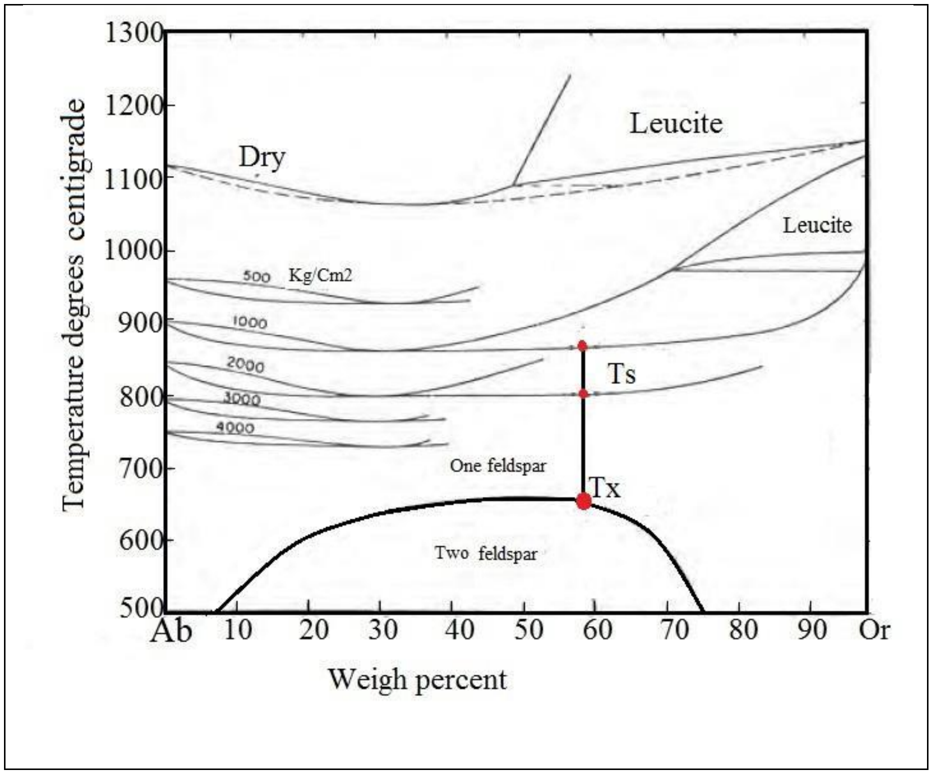



**Figure 5.** shows the dual system of potassium and sodium feldspar at a pressure of 1 atmosphere of a dry state and various moisture pressures (Tuttle& Bowen, 1958).

**b. Miermicite textures.**

Miermicite is the branching branch of quartz in the plagioclase. Miermicite grow from the grain boundary to the inside and replace the feldspar. These, the plagioclase, which has a perfect crystalline shape, takes in the appearance of the onion. For the formation of Miermicite, two processes are presented by the researchers: 1- Solid state succession with deformation (Ahadnejad et al., 2011), 2. Origin of magma. In the latter case, two types of miermicite are created (Vernon, 1991).

One is a marginal remnant, which develops between potassium feldspar and plagioclase, and another granular miermicite, which forms as a blister between adjacent potassium feldspar grains. Since the miermicite has been described for the first time by Michel levy (1874). Several hypotheses have been proposed for miermicite. Phillips, (1974) classifies these hypotheses into six categories: 1- Crystallization either simultaneously or directly. 2- Plagioclase substitution by potassium feldspar. 3-

Replacement of potassium feldspar by plagioclase, 4- Separation in solid state. 5- Recrystallization of quartz incubation in albite isolated from potassium feldspar growing and **6-** Miscellaneous recently hypotheses include a combination of the above hypotheses. A new hypothesis has been introduced that states that the reaction of formation of miermicite begins with a combination of two stress/ strain concentration factors and fluid influx during deformation. Based on the fact that the miermicite does not form in low- grade metamorphic rocks and its outcrop is limited to moderate and high grade metamorphic rocks and formed in solid state granites after crystallization, the temperature necessary for forming it may be between 500-650°C (less than granite rocks salsidos). Cataclastic`s stones, formed by deformation at lower temperatures, can not be formed. As Vernon (1991) has pointed out, tension may be a major indirect contributor to the growth of miermicite by facilitating fluid access for growth. Miermicite is systematically developed during shear deformation in places with high normal pressure (Simpson & Wintsch, 1989).

In the presence of a low fluid/ rock ratio, it seems that nucleic miermicite nucleation can only begin by focusing stress/ strain (Menegon et al., 2006). Formation of miermicitie can create a new micro-permeability that facilitates fluid access to the reaction sites where miermicite grow there. According to studies done in the rocky regions of the miermicite region, the source of magma is more than the type of margin created by the substitution of potassium feldspar by plagioclase (Figure 6a).

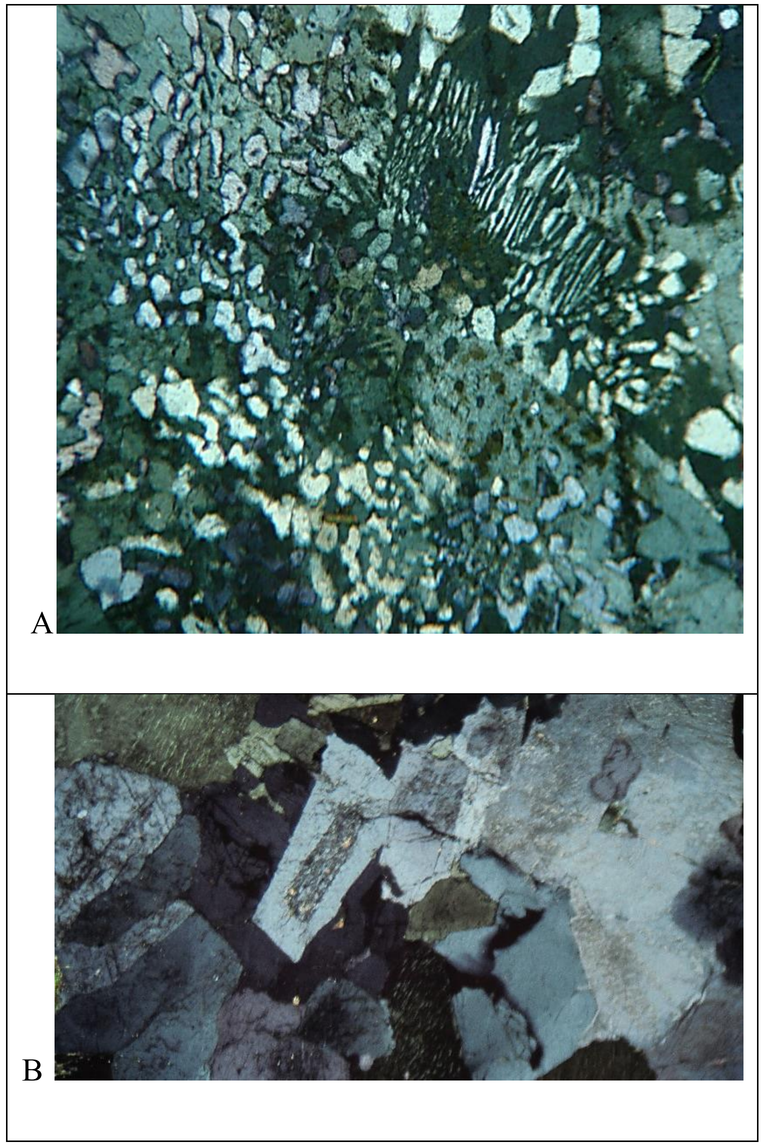



**Figure 6.**a. Miermicite in synthetic granite (40x,XPL), b. Granular and peritinous textures, and plagioclase sulaturization in monzogranites (40 x, XPL).

**C. Textural from doitric alterations.**

Water-rich mixtures that are themselves the ultimate crystalization product, make the igneous masses, which have already been cold and frozen (Shelley, 1993), to this kind of alteration, in particular along the margin of the masses or along the gaps is called Dietrich alteration. In thin sections, Plagioclase crystals have become several serisite. The growth of sericite requires an increase in water and $K^+$. Therefore, this will progress of water-rich solutions are present. An important source of potassium ion is biotite chloritization. As a result, this action of the potassium ion reacts with the plagioclase anorticist and releases $Ca^{2+}$, and hence, the portion of anorthite rich in a plagioclase can easily be serisitied. Seritization is characterized by the excretion of the elements Mg, Ca, and Na silicates, which results in the elimination of anuminosilicates, especially plagioclase, instead of micro-grains and sometimes fibrils (seritied), which range from 300 to 350°C occurs.

Sosuritization is another secondary process observed in thin sections (Figure 3 and Figure 6b). Sosurit is another product of alteration of plagioclase, during which the anthritis develops to the epidote with increasing water, and the remaining plagioclase becomes albite. Sosurite is formed under the green schist facies (equivalent to its low pressure) and often comes with epidote, albite, calcite and sericite. The existence of a sulfurite indicates the concentration of hydrothermal reaction products in particular solutions, so that epidote appears selectively in the plagioclase-rich anthritis regions.

## CONCLUSIONS.

The total volume of rocks in the region is granodiorite, synogranite, monzogranite, quartz monzonite, quartz monzodiorite and diorite. The main minerals are granitic rocks of the region, orthoses, plagioclase, quartz and to a lesser extent hornblende and biotite. The minerals minor found in these rocks include apatite, zircon and esfen. Visible textures in the granitic rocks of the region include granular, graphene, graphic and miermicite.

The presence of granophyre texture reflects a low depth and perotate texture indicating the condition of hyperosculosis at the time of the formation of these granites. The existence of granophyre texture in the rocks of the region, the absence of a metamorphic aureole between the plutonic rocks with surrounding volcanic rocks, the presence of pegmatite and the presence of a primitive biotite are indicative of the shallowness of these plutonic masses and high water vapor pressure. Depending on the type of texture and the approximate temperature (900-850 °C), the rocks are located in a deep water- rich magma.

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