Alfarama Journal of Basic & Applied Sciences

Faculty of Science Port Said University

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April 2023, Volume 4 , Issue II

DOI:https://doi.org/10.21608/ajbas.2022.168620.1129

ISSN 2682-275X

Submitted: 14/10/2022
Accepted: 28/11/2022

Pages: 340 - 354

Petrographic investigation of the Precambrian basement rocks of Esh El Mallaha area, North Eastern Desert, Egypt

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ABSTRACT

The Esh El-Mallaha mountain range is located in the northwestern segment of the Arabian-Nubian Shield. The area encompassing it is of especial significance owing to its hydrocarbon resources. This works aims to present a comprehensive and detailed petrographic characterization of the major Precambrian basement rock units cropping out there, namely; the Dokhan Volcanics and Younger Granites. The Dokhan Volcanics are petrographically differentiated into basaltic andesite, andesite, and dacite lavas along with their pyroclastic equivalents. Their main volcanic textures include porphyritic, glomeroporphyritic, visecular, amygdalloidal and granophyric textures. Pyroclastics, particularly welded ignimbrites, are typified by eutaxitic texture. The Younger Granites of Um Dirrah and El-Esh are dominated by monzogranites and syenogranites, respectively, while those of Homra El Gerigab are mainly alkali feldspar granites. They are typically medium- to coarse-grained hypidiomorphic rocks, although porphyritic varieties are not uncommon.

Key Words:

Basement rocks, Dokhan volcanics, Petrography, Texture, Esh El-Mallaha.

1. INTRODUCTION

Basement rocks cover around 100,000 km^2 approximately 10 percent of Egypt's total area. Granitoids establish an essential rock group that covers extensive range of the Arabian Nubian shield. They occupy around 38% of Egypt's basement outcropping. They are restricted to synorogenic (older) and late to post-orogenic (younger) granites. Granitoid rocks make up around 61% of the basement complex of the landscape of the Eastern Desert. These granitoides highest are distinguished by Gebel Homra El Gerigab which is about

431 meters above sea level[1], Gebel Abu Girfan (339 m above sea level), Gebel Umm Dirra (256 m above sea level) as well as Gebel Esh (300 m above sea level) respectively from the North to the South. The western extension of the Arabian-Nubian shield is represented by the Esh El-Mallaha range, an uplifted rock block running from North-West to South-East, it creates an extended ridge that runs parallel to the Gulf of Suez. Precambrian basement rocks cover the whole area. The younger granites in the Esh El-Mallaha range are exposed as; Gabal Homr El Gerigab alkali feldspar granites, Gabal El-Esh syenogranites, and Gabal Um Dirra monzogranites (Fig. 1).

Fig (1): A. Intrusive contact between Homret El Girigab granites and the Dokhan volcanics Looking NNW.
B. Acidic dyke (granite porphyry) intruding the Dokhan volcanics andesite, southern flank of W. Bali, looking WSW.
C. Joint pattern in andesite of the Dokhan volcanics along W. Abu Had, looking NW.
D. Andesite porphyry of the D. Vol. with plagioclase laths, entrance of W. Bali, looking NE.

The study area is mainly covered by Precambrian basement (igneous and metamorphic) rocks overlain by Phanerozoic cover sediments (Cretaceous Nubian sandstones and Quaternary sediments)[2], The study area is marked by reasonable topography as well as highly demonstrated by several longitudinal and transverse dry valleys chiefly draining towards the Gulf of Suez. There are a few mineral deposits outcrops whatever can be treated as economic value such as follows: A. Amethyst: It is set up at G. Homrat El-Gerigab. B. Gold Vein Deposits: They are present nearby the peak of G. Dara, W. Dib, and W. Abu-Had. C. Molybdenum: It is associated with gold-copper-molybdenum and is detected at one of the sections of W. Dib, and W. Dara[2, 3]. True marble as well as metamorphosed calcareous rock appears at W.Dib. E. Phosphates: The petrographic study conducted to evaluate petrographic features of some rock samples collected at Esh El Mallaha region, (North Eastern Desert, Egypt) (Fig. 2).

Fig (2): Different panoramic views of the Wadi Mellaha.

2. GEOLOGIC OUTLINE

The proposed area is bounded by latitudes 27° 18' and 28° 02' N, and longitudes 33° 00' and 33° 40' E (Fig. 3). It is situated along the Red Sea shore, 37 kilometres north of Hurghada city, in the Northern Eastern Desert. The area represents a tectonic graben hosting rocks from Nubia Sandstone of Carboniferous-Devonian up to the middle Eocene Thebes Formation[4, 5], while the Miocene rocks are located to the southern and eastern part of the area resting unconformably over the basement rocks which form the major part of the range (Fig. 3). The study area is a potential region from the hydrocarbon point of view as it is similar to the Gulf of Suez region in geological and structural setting as well as its oil system.

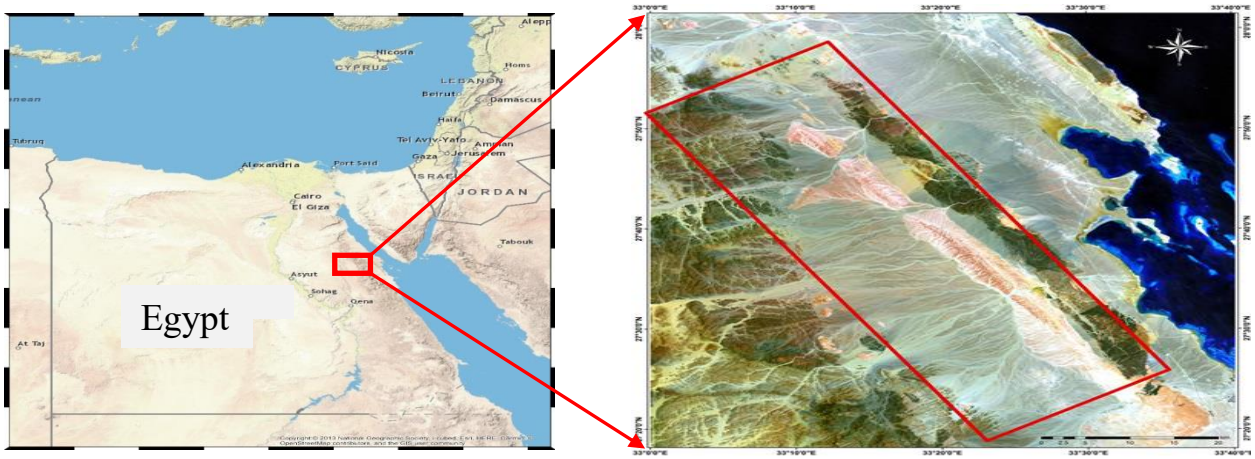


Fig (3): Location map of the study area with Landsat image.

The Esh El-Mallaha area was exposed to consecutive tectonic phenomena. Therefore, this area is divided by assorted faults trends and shear zones. Various faults parameters such as fault gauge, slicken sides, fault breccia, mylonite furthermore displacement of vertical dykes and joints are recorded. The faults are characterized by NNW-SSE and NW-SE trends, which are roughly parallel to the earlier late Proterozoic Pan-African lineaments, where NE-SW is the intersection of the late Proterozoic. According to [7], the NNW-SSE fault set is the newest, whereas the NW-SE fault set is the oldest. The Miocene sedimentary rocks primarily provide records of normal faults. (Fig.4).

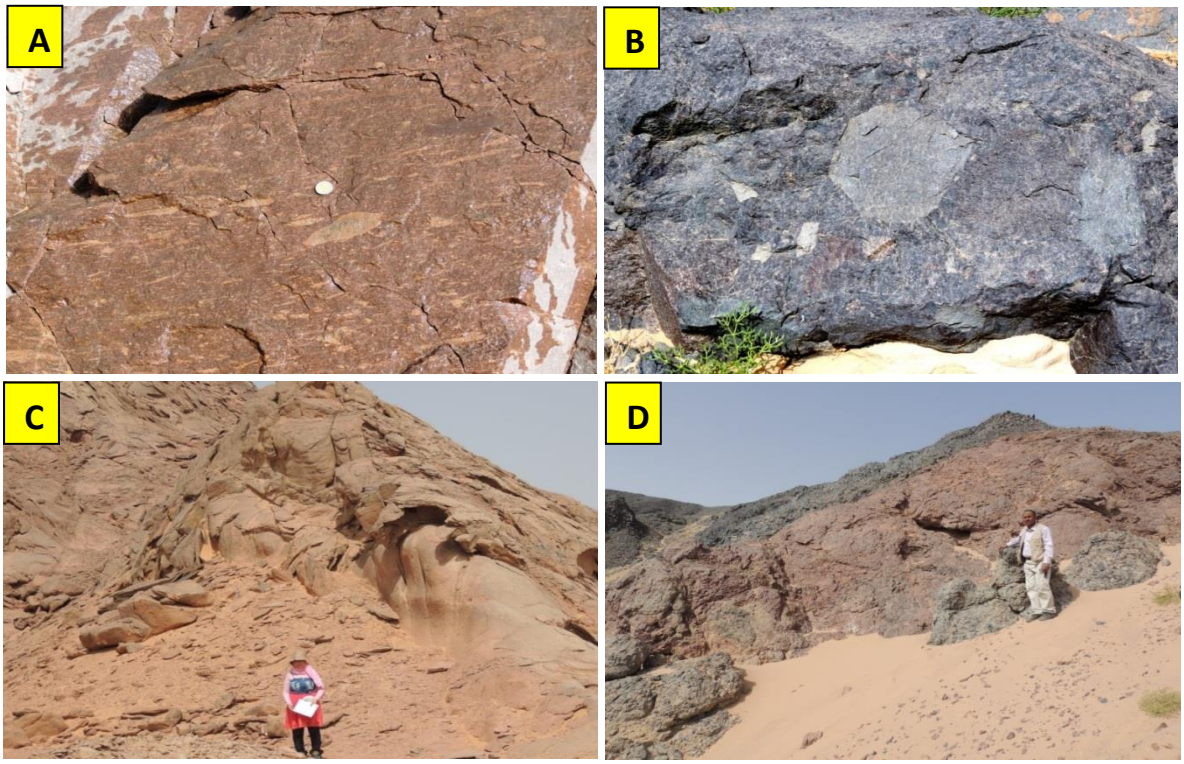


Fig (4): A. Ignembrite (Acidic wellded tuffs) of the Dokhan volcanics along the northern flank of W. Bali, Looking North.
B. Agglomerate of the Dokhan Volcanics mainly composed of andesite and dacite angular fragments, looking NE.
C. Homrat El Gerigab younger pink granites with characteristic joint pattern and exfoliation, looking WestD.
D. Arm or off-shoot of Homrat El Girigab younger granites intruded through Dokhan vol, looking SW

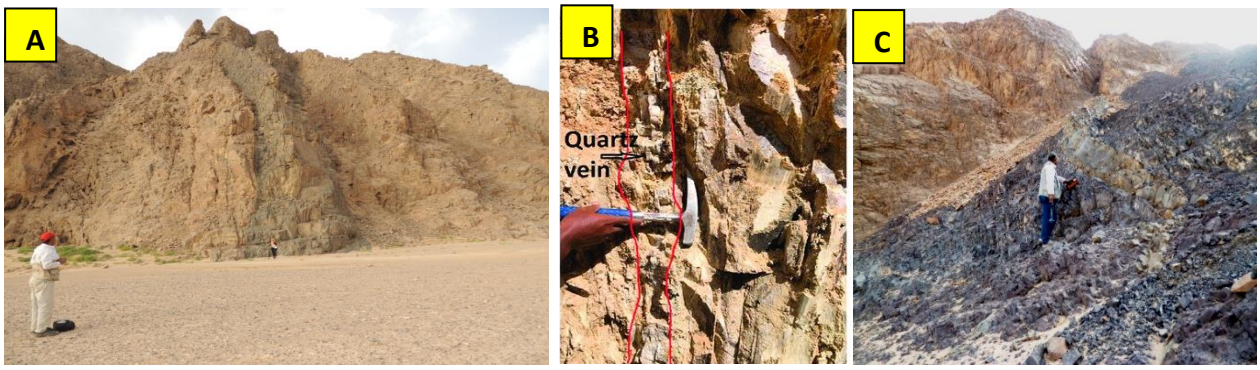


Fig (5): A. Basic Dykes cut and intrude through W. Um Dirrah Granite, the southern flank of W. Um Dirrah, looking SW.
B. Showing a set of quartz veins cut through the younger pink granites of G. Esh, looking NW.
C. Basic Dyke (younger) cut and intrude through the acidic dyke (older) and both intrude.

The Precambrian basement rocks that crop out in the study area are divided into four groups: A-Metavolcanics (the oldest), B- Dokhan volcanics, C-Hammamat sedimentary rocks, and D-Younger granites (youngest). The basement rocks cover an area of around 300 km^2. They are intruded by dykes, which primarily striking NE-SW trend (Fig. 5).

The metavolcanic rocks are remarkable by metadolerite rocks and composed of dispersed moderately low hilly outcrops that are extended in the NW-SE trends in the western part of wadi Um Dirra. These rocks are fine-grained, hard, massive, highly foliated, and strongly jointed, also they have a blackish-green color. They are cutted by Gabal Um Dirra granites with sharp invasive contact [8].

Dokhan volcanics represents south and central parts of Esh El Mallaha. These rocks are covered unconformably by Hammamat and Miocene sediments at the centre and south, respectively. The volcanic outcrops can be found east of Gabal Homra El-Gerigab and south of Wadi Um Dirra. The younger granites intrude these rocks. They are cutted by different faults and joints at the NW-SE, N-S and NE-SW direction.

Dokhan volcanics reported andesites and pyroclastics content having variability in color from greenish-grey to purple in Esh El Mallaha. they are remarkabled by younger granitic and basaltic dykes giving ENE-WSW and NE-SW orientations, furthermore intruded by NW-SE, N-S and NE-SW faults also joints.

3. MATERIALS AND METHODS

Various techniques have been advanced for the geological maps investigation that ultimately instructs their quantitative interpretation. The succeeding is some of these quantitative techniques, which are used to depict the geology and lithology of the region under examination with better efficiency. A total of (24) samples of selected rocks were collected and made into thin sections at Assuit University, after that they were examined under the microscope at Cairo University. These thin sections were examined, classified and grouped for the purpose of collective description made in the form of plates.

4. PETROGRAPHIC INVESTIGATIONS

Modal analysis for a number of samples of different types of granitic rocks is carried out using a swift point counter and adopting the- Dickenson method[9]. Each of the studied fundamental rock types has been subdivided to identify the different rock assemblages component them. The petrographic examinations provided the classification of rocks in the current study area (Table 1):

Table 1. Shows the classification of rock units in the Esh El Mellaha Area

Rock Type	Rock Unit		
Basement	I.Dokhan Volcanics	I.1: Lava Flows	Basaltic andesite
			Andesites
			Andesite porphyry
			Dacites
		I.2: Pyroclastics	Lapilli
			Lapilli tuffs
			Tuffs
			Purple tuffs
			Ignimbrite
	II.Younger Granites	Biotite Granites	
		Perthitic Leucogranite	

I. Dokhan Volcanics

I.1: Lava Flows: The Dokhan volcanics Lava flows are petrographically identified as basaltic andesite, andesite, andesite porphery and dacite. The main petrographic features, observed in these varieties, are their porphyritic nature, porphyritic textures, equigranular textures, granoblastic textures and eutaxitic textures of their groundmass. The common volcanic textures as vesicular, amygdaloidal and granophyric texture are also present.

I.1.1: Basaltic andesite: In hand specimen, the basaltic andesite is characterized by its dark green to dark gray color in addition to fine grained sometimes porphyritic with faintly advanced slaty cleavage.

Microscopically the rock is composed of plagioclase feldspar, amphibole, chlorite, carbonates and iron granules at an intergranular texture (Plat. 1, Fig.1-B). Slight amounts of Epidote companied with plagioclase feldspars are present (Plat. 1, Fig. 1-C). The plagioclase takes euhedral to subherdral prisms in form with 2mm long that organizing interlocked texture. Besides, Albite law twinned varieties there are zoned plagioclase. The plagioclase anorthite contents reach An10-33percentage. The plagioclase is partially converted into sericite and epidote where the second forming pistachio green granules. Additionally, the plagioclase lathes show subparallel alignment. Hornblende is remarkabled by subhedral to anhedral brownish green prismatic crystals which reveals strong birefringence and it give the extension angle Z^C

= 15°also, this hornblende showing occasionally albite twinning. Chlorite show a green color accompanied with very weak birefringence and it serves as anhedral, scaly and vermicular crystals, furthermore, it produced fan shaped crystal aggregates, it present in association with the hornblende also. Regarding to accessory minerals there are Calcite and iron oxides linked to this Chlorite. The pre-existing relict intergranular texture is distinguished this rock. Amygdalloidal texture is very characteristic for the basaltic abdesite where carbonate represents the main filler of the visicules (Plat. 1, Fig.1-A).

I.1.2: Andesite porphyry:

In the hand specimen, the Dokhan volcanics andesites have dark green matrix and milky white plagioclase porphyries. Microscopically, the andesites are composed from plagioclase phenocrysts which are fixed in a groundmass of hornblende, plagioclase, chlorite, epidote and sericite (plat. 2, Fig 2-A and 2-B). Quartz amount is scarce with clacite and opaques accessories. The length of Prismatic Plagioclase phenocrysts ranges from 50 to 100 µm and displays albite twinning and zoning. Plagioclase is composed of andesite with An = 40% and is lightly sericitized and epidotized. The fine-grained groundmass is primarily showing various generations of plagioclase microlathes that give somewhat flow textures (plat. 2 Fig.2-B). These microlathes are associated with chlorite and actinolitic hornbende microfibrolites as well as the epidote and sericite. The hornblende is described by light green colour actinolitic variation and fibrous structure. It is associated with light green diminutive chlorite crystals. It is commonly anhedral and it takes the place of the actinolites. The epidote declares as microcrystals in the groundmass and performs alteration for the phenocrystals of plagioclase accompanying with the sericite. These rocks are identified by the porphyritic textures and they are outlined periodically by the trachytic textures (plat. 1, Fig.1-E).

I.1.3:Andesite:

The andesite, in hand specimen, recorded light green to greenish-gray color. Furthermore, it shows fine-grained porphyritic plagioclase including white lathes. Microscopically, the contents of this rock are plagioclase feldspar phenocrystes, which are implanted within amphiboles groundmass that is represented by hornblende, chlorite, biotite flacks and epidote (Plat. 1, Fig. 1-C). While the accessories of this rock are distinguished as sphene, calcite and an abundance of opaques. There are two generations of Plagioclase feldspars that are represented by the porphyritic crystals or establishing considerable components of the groundmass. The albite twining and oscillatory zoning identified porphyritic long lathes. The plagioclase defined andesite with An=40% that encompasses inclusions of apatite and iron oxide granules. Likewise, Hornblende exists as phenocrystes in fine-grained groundmass, which forms green to brownish green subhedral prisms. This hornblende is outlined by Albite twin lamella and the abundant inclusions of opaques from apatite and zircon. The groundmass contents are from plagioclase and hornblende microlites second generation with interstitial cryptofelsitic matrix constituting a pilotaxitic texture. In addition, Biotite and minute biotite flackes are present. At the same time, Quartz is scattered in the groundmass accompanied with biotite that customarily anhedral with undulose extinction. The mentioned rock is marked by the relict texture inherited from the original volcanics. These textures are indicated by porphyritic textures inclusive of vesicular and amygdaloidal textures.

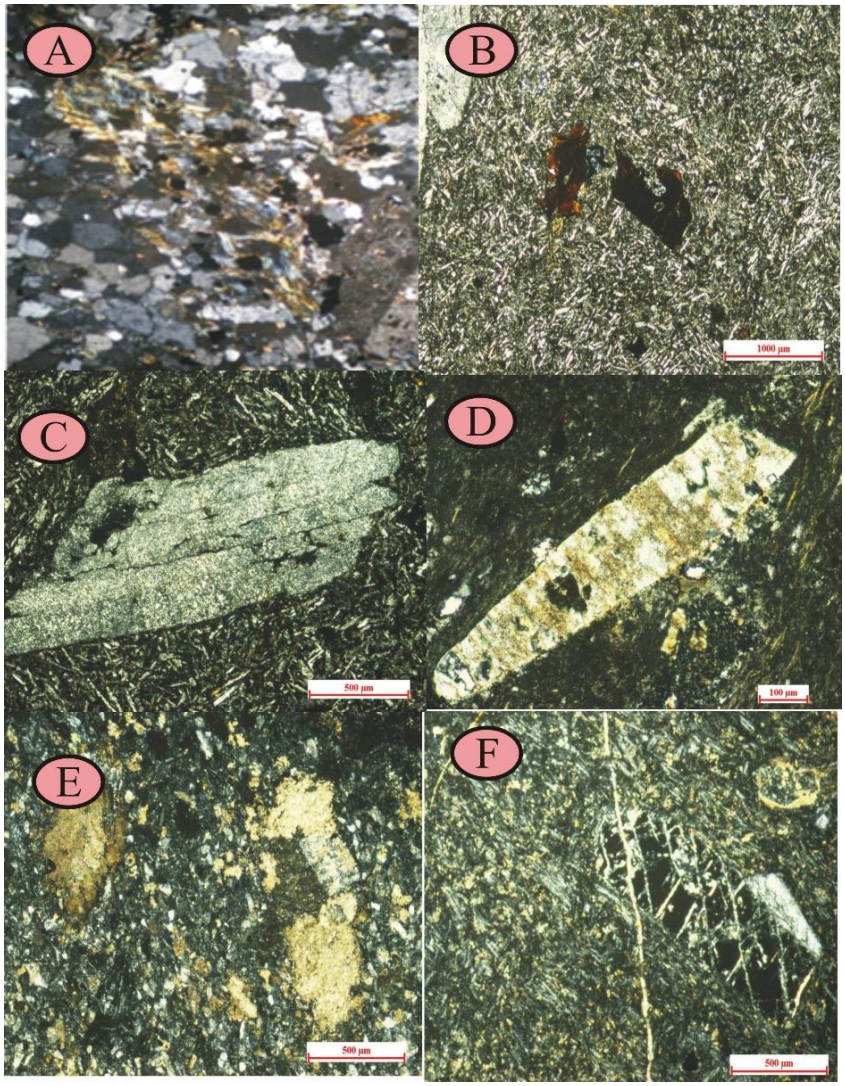


Plate (1)

1-A: Ignembrite (Acidic welded tuffs), Dokhan volcanics, **xpl.1-B:** Andesite porphyry with Amygdales filled with hematite, Dokhan volcanics, **xpl.1-C:** Andesite porphyry With two generation of the magma crystallization, Dokhan volcanics, **xpl.1-D:**Altered andesite porphyry, Dokhan volcanics, **xpl.1-E:**Altered andesite with plagioclase altered to sericite, Dokhan volcanics, **xpl.1-F:** Sheared and altered porphyritic trachyte or trachy-andesite, Dokhan volcanics, xpl.

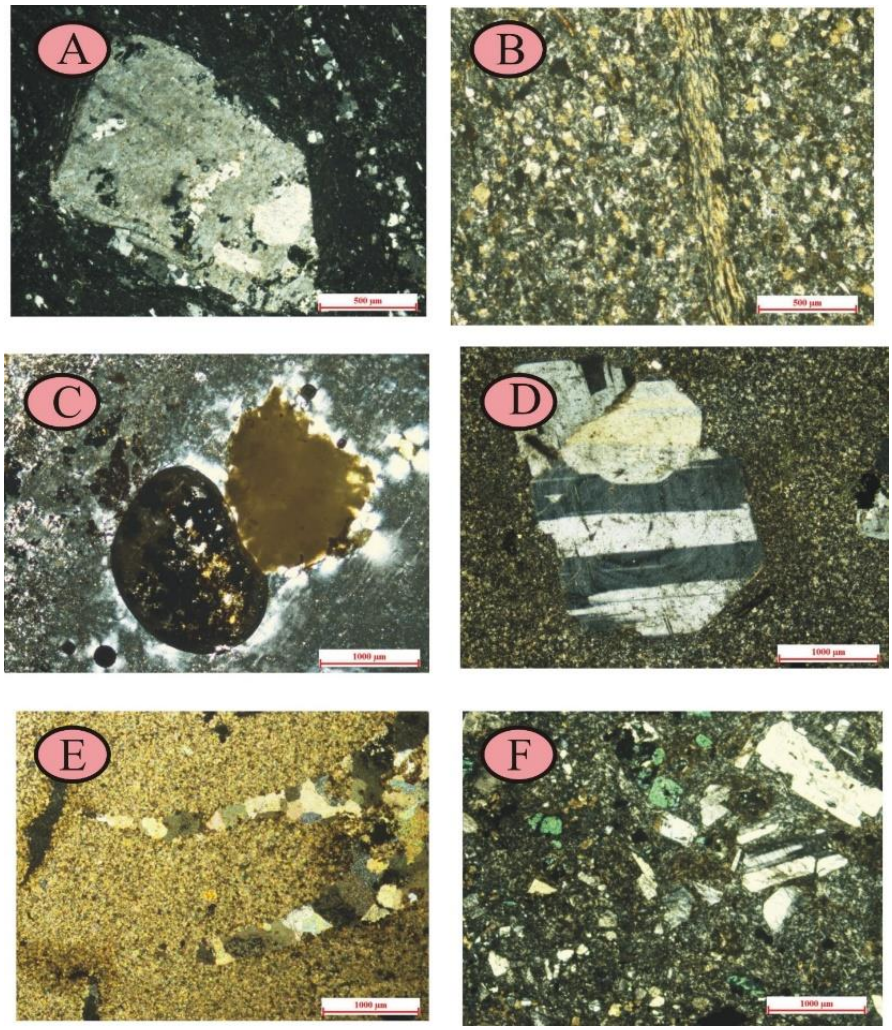
I.1.4: Dacites

In the hand specimen, dacite gets a light greenish gray in color and it has porphyritic characters. Microscopically, the dacite consists of phenocrysts of plagioclase and quartz in addition to plagioclase, quartz, k-feldspar, and biotite groundmass. Sericite and chlorite are related to biotite (Plat. 2, Fig. A). Plagioclase established euhedral to subhedral prismatic crystals that give 0.7 cm long. It is possessed oligoclase with An = 20% in cooperation with few albites. Plagioclase prisms show an alteration from its core and its rims to sericite and epidote. Quartz phenocrysts are nearly equant subhedral to anhedral crystal form. Quartz has tough undulate extinction. Furthermore, it show seldom phenocrysts of k-feldspars form and it has essentially orthoclase perthite. It shows 0.6 cm long. Perthitized orthoclase is generally reported as an alteration to kaolin that occurs as a brownish cloudy surface with holocrystalline fine-grained

groundmass as well as produces about 65% of the rock volume. It consists of feldspars (plagioclase and orthoclase), quartz, and biotite together with chlorite minimal crystals. These ingredients are interlinked with each other, and these have principally anhedral phenocrysts and also exhibited some reaction with them. This rock is symbolized by porphyritic as a consequence glomerioporphyritic textures.

Rhyolite, in the hand specimen, is characterized by its reddish pink to buff colors and it shows a very fine-grained to glassy nature. Its components are from Very rare porphyritic of quartz and k-feldspar. Under the microscope, the rhyolite consists of k-feldspars and quartz as major components, in addition to a small amount of plagioclase and biotite. Sericite and hematite are also observed. K-feldspars are mainly composed of orthoclase perthite, which presents as euhedral to subhedral prismatic crystals and sometimes forms phenocrysts. They reported perthite patchy type while in the matrix it displays with the quartz micrographic texture. Quartz is remarkable by euhedral to subhedral phenocrysts with a six-sided basal section. Moreover, They appear as anhedral globular crystals with undulose extinction. The groundmass is mainly granophyric and highly silicified and composed of quartz, k-feldspar and rare plagioclase as well as sericite. The most characteristic textures are porphyritic, micrographic and myrmikitic

Plate (2)



2-A: Dacite with Na-rich plagioclase in fine grained groundmass, Dokhan volcanics, **xpl.2-B:** Shear band straversing dacite, Dokhan volcanics, **xpl.2-C:** Glassy dacite with visicular and amygdalloidal texture,

Dokhan volcanics, xpl.3-D: Dacite with zoned and lamellar plagioclase phenocrysts in fine grained groundmass of the Dokhan volcanics, **xpl.2-E:** Acidic volcanics (rhyolite to rhyodacite) related to the Dokhan volcanics, Dokhan vol, **xpl.2-F:** Rhyodacite porphyry with amygdalls of chlorite, Dokhan volcanics, xpl.

I.2: Pyroclastics

I.2.1: Lapilli

The schistosity and slaty cleavage evolution marked the lapilli rocks; these rocks diverge from light gray, slight green to yellowish gray in color besides being essentially fine-grained with unusual coarse fragments. Beneath the examination of the microscope, the lapilli gives small quartz and feldspars fragments (<2mm diameter), actinolite hornblende micaceous crystals as well as precise hornfelsic biotite flacks (Plat. 3, Fig C). Furthermore, the opaque Fragments reported accompayination with the foliation planes., the actinolite, biotite and chlorite marked the distinctive foliations that advanced by their parallel adjustment and their alternation with the quartzo feldspathic minerals. These mafic minerals reported green to brownish green anhedral to subhedral flackes which their c-axes are approximately aligned in subparallel order that composed penetrating S0//S1 foliations. Moreover, these mafics paragenetic sequence suggests that the actinolite and chlorite are metastable structure progressing all at the initial hornblende metamorphism. At the same time, the Biotite shows post-tectonic in later phase in addition the groundmass consists of quartz and feldspars that are displayed by very fine-grained. The quartz fragments give intensive undulose extinction nonetheless; the feldspars reported unclear surface owing to their alterations into sericite and epidote. Frequently, the quartzo-felspathic layer consists from fine hornfelsic biotite giving intersect texture. The schistose texture is featured this rock developed by mafic and quartzo-feldspathic minerals parallel orientation. Equilibrium, decussate and hornblende textures are advanced because of the zonal overprinting thermal metamorphism.

The lapilli are characterized by weakly and massive banded inclusive of greenish gray color, which give fine-grained, lapilli rock and crystal fragments including 1 cm diameter. In the microscope analysis, this lapilli consists of plagioclase crystal fragments, subordinate quartz fragments that have percent (< 10 percent) and a small amount of andesite rock fragments (Plat. 3 Fig. D). Moreover, these fragmental ingredients are embedded and floated in a matrix that show plagioclase, quartz and sericite fine-grained portions. Plagioclase is remarkable as subhedral and anhedral crystal fragments; these fragments reported lamellar twinning, and zoning in addition to varying in components from andesine to oligoclase. These fragments show angular to subangular in shape and characterized by cracking in addition to moderately sorted including some reworking degree. The quartz fragments are composed of crystal fragments that have 0.8 cm diameter as well as it is subangular to subround also oval shape displaying wavy destruction. Andesitic rock fragments are subangular fragments that give the porphyritic andesites inclusive of plagioclase lathes and deep fine-grained groundmass at the time these fragments reported angular to subrounded outline and they are surrounded by the matrix. This matrix marked fine-grained generations of plagioclase, quartz, chlorite and sericite which give lapilli size in some parts.

I.2.2: Lapilli tuffs

The lapilli tuffs rocks represented by the schistosity and slaty cleavages development. It ranges in color from light gray, light green to yellowish gray and show fine-grained together with occasional coarse fragments. Under the microscope treatment, the lapilli tuffs show small quartz and feldspars fragments (<2mm diameter), micaceous actinolite hornblende crystals and minimal hornfelsic biotite flacks (Plat. 3, Fig. F). The opaques fragments are accompanied with the foliation planes. Along with, the actinolite, biotite and chlorite marked the distinctive foliations that advanced by their parallel adjustment and their alternation with the quartzofeldspathic minerals. These mafic minerals reported green to brownish green anhedral to subhedral flackes whose c-axes are approximately aligned in subparallel order and composed

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I.2.3: Tuffs

The tuffs are characterized by weakly and massive banded inclusive of greenish gray color, which give fine-grained, tuffacous rock and crystal fragments including 1 cm diameter. In the microscope analysis, these tuffs consist from plagioclase crystal fragments, subordinate quartz fragments that have percent (< 10 percent) and a small amount of andesite rock fragments (Plat. 4, Fig. A). Moreover, these fragmental ingredients are embedded and floated in a matrix that shows plagioclase, quartz and sericite fine-grained portions. Plagioclase is remarkable by as subhedral and anhedral crystal fragments; these fragments reported lamellar twinning, and zoning in addition to varying in components from andesine to oligoclase. These fragments show angular to subangular in shape and characterized by cracking in addition to being moderately sorted including some reworking degree. The quartz fragments composed from crystal fragments that have 0.8 cm diameter as well as it is subangular to subround and also oval shape displaying wavy destruction. Andesitic rock fragments are subangular fragments that give the porphyritic andesites inclusive of plagioclase lathes and deep fine-grained groundmass at the time these fragments reported angular to subrounded outline and they are surrounded by the matrix. This matrix marked fine-grained generations of plagioclase, quartz, chlorite and sericite which give lapilli size in some parts.

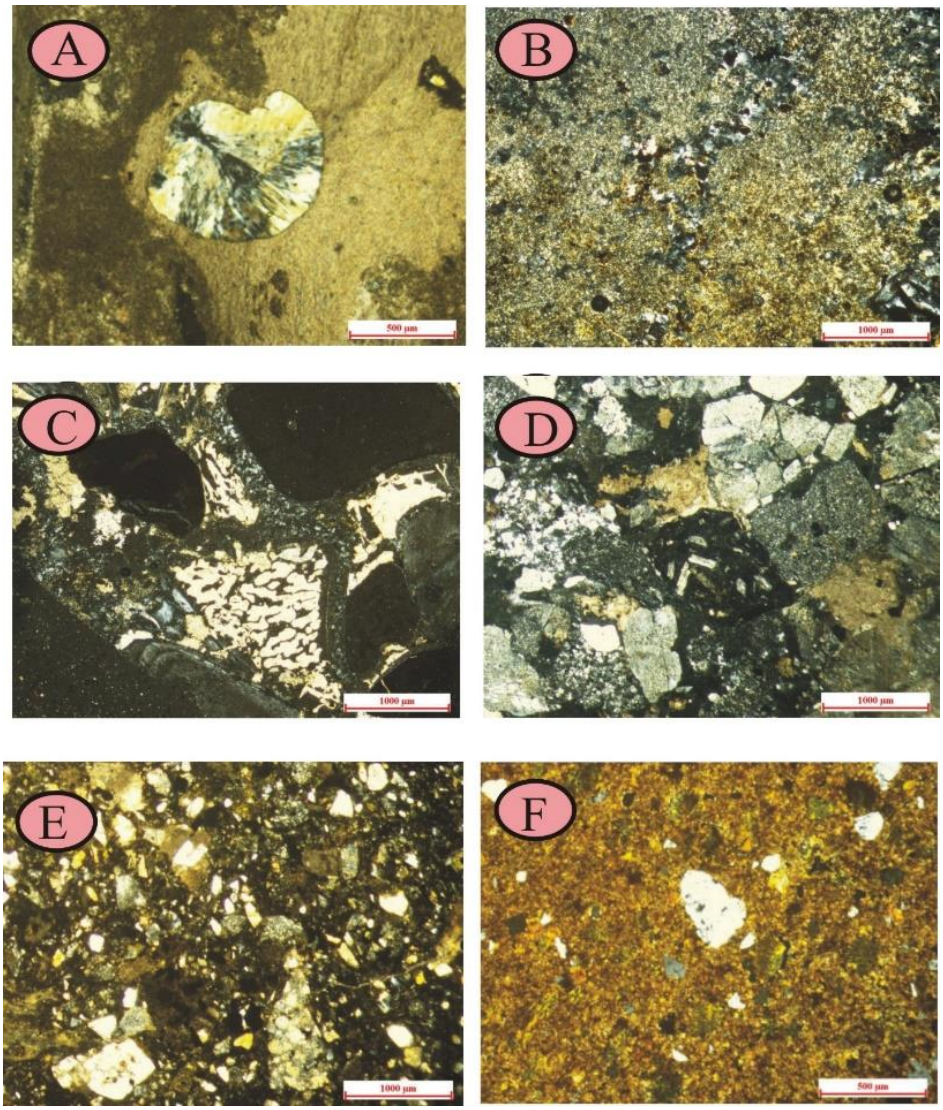
I.2.4: Purple tuffs

The banded iron ore combined with the purple tuff rocks including these rocks shows slight gray color, and metallic luster in addition to high definite gravity also interesting to the hand-magnet. Alternating bands that are characterized by 0.5 to 3 cm are developed. Consequently, the iron-bearing tuffs comprised of magnetite fine fragments marked in lamina that give an alternation with quartz and chlorite under the microscope (Plat. 4, Fig. C). During this time, common epidote granules were observed in the interstitial spaces. The magnetite-rich bands differ from 1 to 5 mm in thickness and show minute fragments of particularly square outlines, consistently of globular form. The magnetite layer is accompanied by quartz-feldspathic and epidote granules; It seems under the crossed nicols also in polarized light, like black spots with reddish brown crystal boundaries owing to its alteration to hematite. The magnetite rich-lamina gives alternation with quartz, feldspars, epidote, chlorite and actinolite layer. The quartz and feldspars occur as anhedral grains virtually moderately sorted with the feldspars and partially transformed into sericite. Actinolite is sometimes displayed as the light green color and it is associated with micaceous chlorite. Epidote is exists at the magnetite lamina also together with the quartzo-feldspathic bands. These tuffs are characterized by lamination and banding textures. These fragmental rocks are composed of quartz crystals, alkali feldspar as well as plagioclase of different bulks and comprises glassy rhyolite segments and fine-grained tuff pieces; whole confined in affine-grained banded ash matrix that primarily present as glassy. Cryptocrystalline texture is prevalent in tuffs. The matrix encompassed fragments of shale and quartz crystals.

I.2.5: Ignimbrite

The ignimbrite is so distinctive rock showing variations for the Dokhan Volcanics. It is reported reddish brown to violet color together with special banding as well as white plagioclase and k-feldspar fragments are prevalent in these ignimbrites. Under the microscope, the angular crystal fragments present this rock from plagioclase, orthoclase and quartz. These fragments scattered in the rock and were recognized as fiammies. These fiammies are included within the tuff laminations also, they are irritating them and they vary in size from 0.3 to 0.7 cm diameters along with angular with sharp lengthy edges. Furthermore, they are marked by orthoclase perthite, microcline, and twinned plagioclase with full-grown lamella and quartz. At that time, biotite crystals seldom exist also they show high alteration to chlorite. The matrix that reported fine-grained laminated is represented from sericite, chlorite, minuscule silica grains consequently hematitic fine-grained ash and dust. Furthermore, this laminated matrix marked the lamina pinching out as well as the plagioclase; k-feldspars and quartz crystal fragments (Plat. 1, Fig. A) interrupted the lamination. This disturbance of lamination occurs because of the impaction and/ or the crystal fragments compactions**.**

Plate (3)



3-A: Spheriolitic texture in rhyolite, Dokhan volcanics**, xpl.3-B:** Glassy Rhyolite with some degree of devitrification and iron oxide alteration, Dokhan volcanics, **xpl.3-C:** Agglomerates With different types of

angular fragments, Dokhan volcanics, **xpl.3-D:** Intermediate agglomerates of the pyroclastics related to the Dokhan volcanics of the Dokhan volcanics, **xpl.3-E:** Pyroclastics (Arkosic lapilli), Dokhan vol, **xpl.3-F:** Lapilli tuffs with crystal fragments of qz, Dokhan volcanics, xpl.

II. Younger Granites

II.1: Biotite Granites

Biotite granite was found at G.Um Dirra Granites, G. Esh El Mallaha Granites and G. Homra El Gergab Granites. In the hand specimen, this rock has pink in color and it reported porphyritic medium to coarse-grained. Microscopically, these granites are typified by hypidiomorphic and equiangular texture in addition to the presence of K-feldspars large crystals. Moreover, these performed with abundant quartz and opaques as plagioclase, biotite and magnetite but the K-feldspars are remarkable by perthitic orthoclase and microcline. They present euhedral to subhedral prisms as well as equant crystals arrived at 1.5 cm length and they are characterized by porphyritic together with other components. The K-feldspar crystals show an alteration of brownish gray kaolin. Furthermore, these phynocrysts give string, flame and spindle-shaped perthitic textures; Plagioclase crystals take euhedral prismatic crystals that are remarkable by 0.5 cm in length. It reported well-developed albite twinning and composed less than 30% of the outright feldspars. It has the construction of oligoclase-albite with An= 8-11 %. A few plagioclases are rimmed with quartz, including alteration to sericite. Quartz has anhedral in shape and exists in mosaic aggregates that pervade and erodes the plagioclase and orthoclase transmitting them as inclusions. Biotite is converted partially into chlorite and hematite, which enclose large inclusions of zircon crystals that show zonation. The porphyritic biotite granites of Show at its northern side leucocratic of pink to pinkish white color marked medium to coarse-grained, porphyritic of plagioclase and orthoclase phenocrysts. Under the microscope, these granites involved plagioclase and K-feldspars elongated crystals that established in a groundmass of medium-grained equigranular quartz, orthoclase, plagioclase, and biotite (Plat. 4, Fig. A). Apatite is existing as elongated acute accessory minerals accompanied with biotite. There are secondary alteration minerals as Sericite and chlorite after the feldspars and mafics. Fine-grained plagioclase is reported in the groundmass. These grains are characterized by euhedral prisms in shape with 0.6 cm length including porphyritic texture. The plagioclase large crystals are distinguished by normally zoned, associated with more calcic altered cores and sodic rims. The fine-grained generation is commonly twinned and it has the oligoclase composition (An = 18 %) inclusive of albite as well as the K-feldspars are form principally orthoclase and orthoclase perthite showing large porphyritic euhedral to subhedral crystals with length > 0.5 cm. At the same time, these are generally found in the medium-grained groundmass reported equant crystals and give alteration to kaolin. Quartz marked anhedral outline additionally worked out as drop-like grains in the groundmass with continuous large crystals performed with abundant inclusions. Furthermore, it displays intense wavy extinction also; it is intergrown with the K-feldspars graphic texture. Biotite reported a noticeable amount in addition to euhedral to subhedral prisms, therefore it obtains strong pleochroism from dark brown to yellowish brown. It concludes apatite crystals that partially altered to green chlorite and iron oxides. Textures are marked by perthitic in orthoclase, poikilitic in quartz and all rock is portrayed by porphyritic texture.

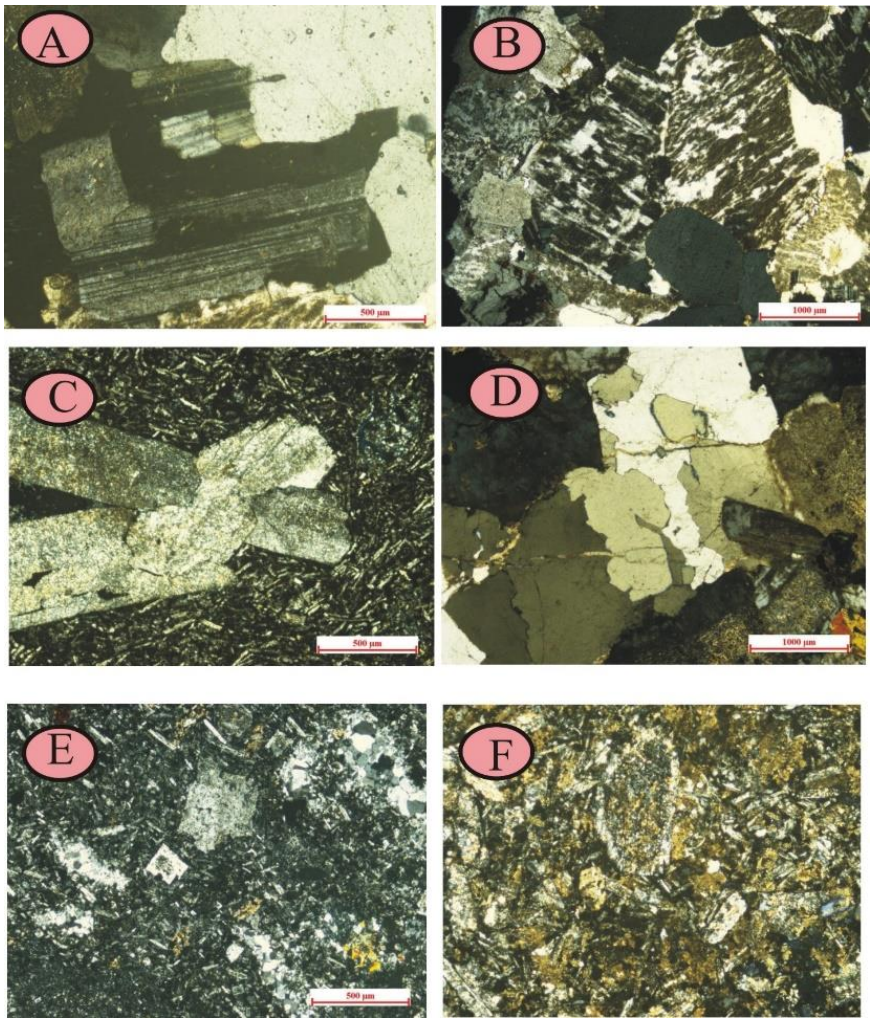
II.2: Perthitic Leucogranite

In the hand specimen, the rock displayed by medium-grained, leucocratic with light pink colour giving almost low mafics content.

In Petrographic classification, the perthitic granites involved a holocrystalline, equigranular hypidiomorphic textures together with a composition of K-feldspars, quartz, plagioclase including a scarce quantity of biotite flakes, counting zircon, apatite and magnetite accessories (Plat. 4, Fig. B). The K-feldspars have equant euhedral brownish-gray crystals beyond 0.6 cm along with they reported much

perthite and perthitic orthoclase. Perthites show patchy, lenticular, flame and string shapes. The perthitic orthoclase is altered lightly to kaolin as well as it carries short prisms inclusions of plagioclase. At that time, it gives more than 80% of the whole feldspar composition. Consistently microcline perthite is combined with orthoclase. Plagioclase crystals are remarkable by euhedral prisms and it consists of albite and oligoclase with An = 9 %. These crystals give partially alteration to sericite in addition they are represented by albite-type twinning. It is possible to outline the perthitic leucogranites as "subsolvus granites" due to the existence of plagioclase as isolated crystal phase and also as intergrowth with perthite. Not to mention, the plagioclase crystals show alteration to sericite specifically at their cores. Quartz marked immensely anhedral mosaic aggregates giving undulose extinction as well as it acquires inclusions of biotite and apatite at the same time

Plate (4)



4-A: Monzo-granite notes the abundant plagioclase compared with the other types, younger granite, **xpl.4-B:** Prethitic Alkali feldspar granite with different paertite types, younger granite, **xpl.4-C**: Intersecting Plagioclase lathes forming phenocrysts embedded in a fine-grained groundmass Perthitic, younger granite, **xpl.4-D:** Perthitic lecuogranite showing the equigranular texture of the younger granite, **xpl.4-E:** Andesite Dyke of the dyke swarms, Dykes, **xpl.4-F:** Dolirite of diabase of the basic dykes with plagioclase and altered pyroxine, Dykes, xpl.

5. CONCLUSION

This work suggests that the Esh El Mallaha has a NW-SE orientation and takes the shape of an extended ridge parallel to the Gulf of Suez. Moreover, this study depends on the examination of thin sections under the microscope to know the petrographic description. The sector is covered by magmatic and metamorphic rocks; these rocks are remarkable by Granitoid and Dokhan volcanics for the first one and metavolcanic for the second. The younger granites in the study region classified as the following; monzogranites (which represent Gabal Um Dirra), syenogranites (which corresponding to Gabal El-Esh) and alkali feldspar granites (which indicated to Gabal Homr El-Gerigab).

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