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GEOLOGY OF WADI ATALLA - EL MISSIKAT AREA, EASTERN DESERT, EGYPT.

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ABSTRACT

Wadi Atalla-El Missikat area covers about 2,000 Km² in the central Eastern Desert of Egypt, between latitudes 26° 10′ and 26° 40′ N, and longitudes 33° 15′ and 33° 40′ E. The area is mainly formed of basement complex except its extreme south-western corner where it is covered by foreland sediments of Nubian sandstone. The area is structurally complicated where it has been subjected to various stages of successive tectonic movements since the Precambrian times. The basement complex in the study area is represented by a wide variety of igneous and metamorphic rocks belonging to seven major lithostratigraphic units namely: geosynclinal sediments, main geosynclinal volcanics, synorogenic plutonites, emerging geosynclinal volcanics, postgeosynclinal sediments, late orogenic plutonites and postorogenic volcanics. This alternating sedimentation, volcanicity and plutonism reflects the principal geotectonic evolution of this part of the orogenic belt in the Eastern Desert of Egypt.

The basement rocks exposed in the area under consideration are of different ages ranging from Precambrian to early Paleozoic. Accordingly, they display various degrees of metamorphism and structural deformation. The lithostratigraphy, mode of occurrence and petrography of these rock exposures, as well as their mutual relationships, are discussed in this paper.

INTRODUCTION

Wadi Atalla - El Missikat area is located in the central Eastern Desert between Qena-Safaga and Qift-Qusseir asphaltic roads. It covers an area of about 2000 Km² between latitudes 26° 10′ - 26° 40′ N and longitudes 30° 15′ - 33° 40′ E, Fig. (1).

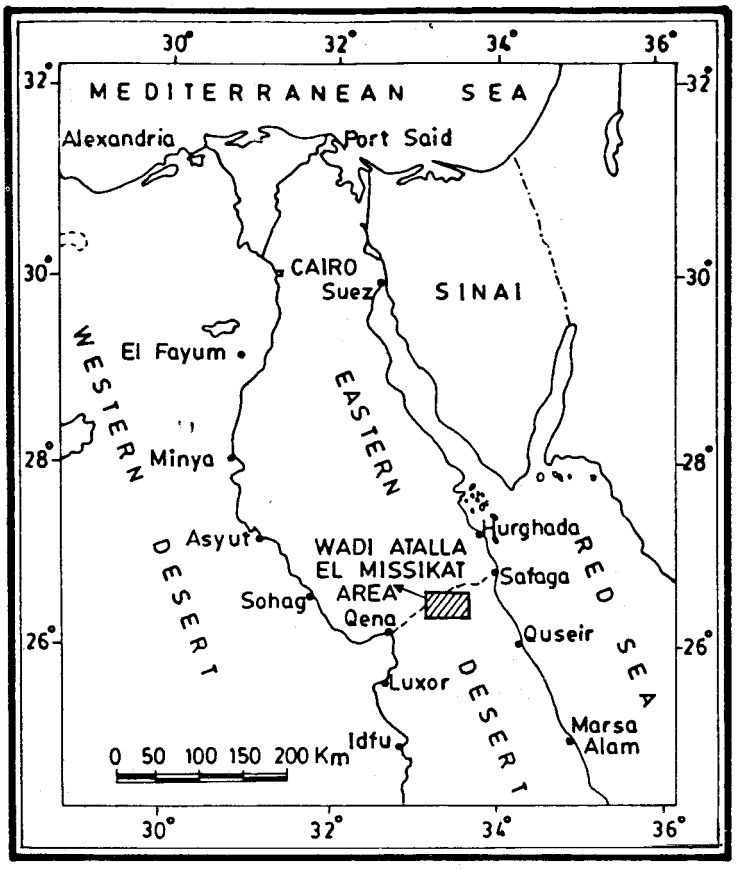

Fig. 1: Location map of Wadi Atalla-El Missikat area, central Eastern Desert of Egypt.

The area has been one of the most actively explorated and mined regions in the Eastern Desert of Egypt. Since the Ancient Egyptians, the area was successively mined for its economic mineral deposits especially for gold and copper. Recently, systematic radioactive prospection carried out by the Nuclear Materials Corporation led to the first discovery of the two important localities bearing uranium mineralization at El Erediya and El Missikat (El-Kassas, 1974 and Bakhit, 1978) and the presence of primary uranium mineral, uraninite, at El Erediya locality is considered the most significant radioactive occurrence in Egypt up till now.

LITHOSTRATIGRAPHY AND PETROGRAPHY

The systematic description of the rock units covering the study area include nomenclature, lithostratigraphy position, regional set up, etc. arranged according

to their age of evolution and structural stages. Accordingly, the basement complex in the study area consists mainly of igneous and metamorphic rocks namely geosynclinal sediments, main geosynclinal volcanics, synorogenic plutonites, emerging geosynclinal volcanics, post geo-synclinal sediments, late orogenic plutonites, and postorogenic volcanics (Fig. 2).

1. Geosynclinal Sediments

This is the oldest major lithostratigraphic unit occurring at the base of the succession and includes gneisses, quartzites, metamudstones, schists and phyllites. Field relation between these units is well observed at Wadi Kab Um Abbas where a small exposure of pelitic to psammitic gneiss is in direct contact with metamudstones and schists. Along the eastern side of Wadi Kab El Absi, an extensive metamudstone belt is followed by some conformable beds of chlorite schist forming a thin narrow strip of about 2.5 km length. However, the different rock varieties of these geosynclinal sediments may occasionally pass gradually into one another without sharp differences. They are mostly of flysch characteristics and mainly formed of pelitic to psammopelitic, and greywacke to subgreywacke sediments. They show greatly variable colours which may be ranging from yellowish white to orange yellow, light grey to greyish green, dark grey to even black; depending mostly on their mineralogical composition and weathering effects.

A. Gneisses

These are exposed as a few outcrops in the investigated area and of a relatively limited distribution. Their main outcrops are along the northern reaches of Wadi Um Had, in the south-western part of the mapped area. Another small and minor occurrence is cropping out along Wadi Kab Um Abbas. They comprise various types of gneissic predominantly siliceous rocks, including the following main varieties, beginning with the oldest; psammitic and pelitic, biotite and hornblende gneisses, with some minor schists at the top.

B. Quarzites

These rocks are of a limited distribution in the mapped area, where they are exposed mainly in a small area between Wadi Atalla El Murr and Wadi Kab El Absi and to the north-east of Gebel Semna. They represent the upper unit of the gneisses, which was originally clastic sediments containing epiclastic quartz with some feldspar grains of about 3-4 mm in diameter. They are mainly composed of quartz, essentially devoid of micas, but may contain subordinate iron oxides which impart to the rocks their reddish tint. Feldspar grains may be found in very small amount, and in some bands diminishing completely.

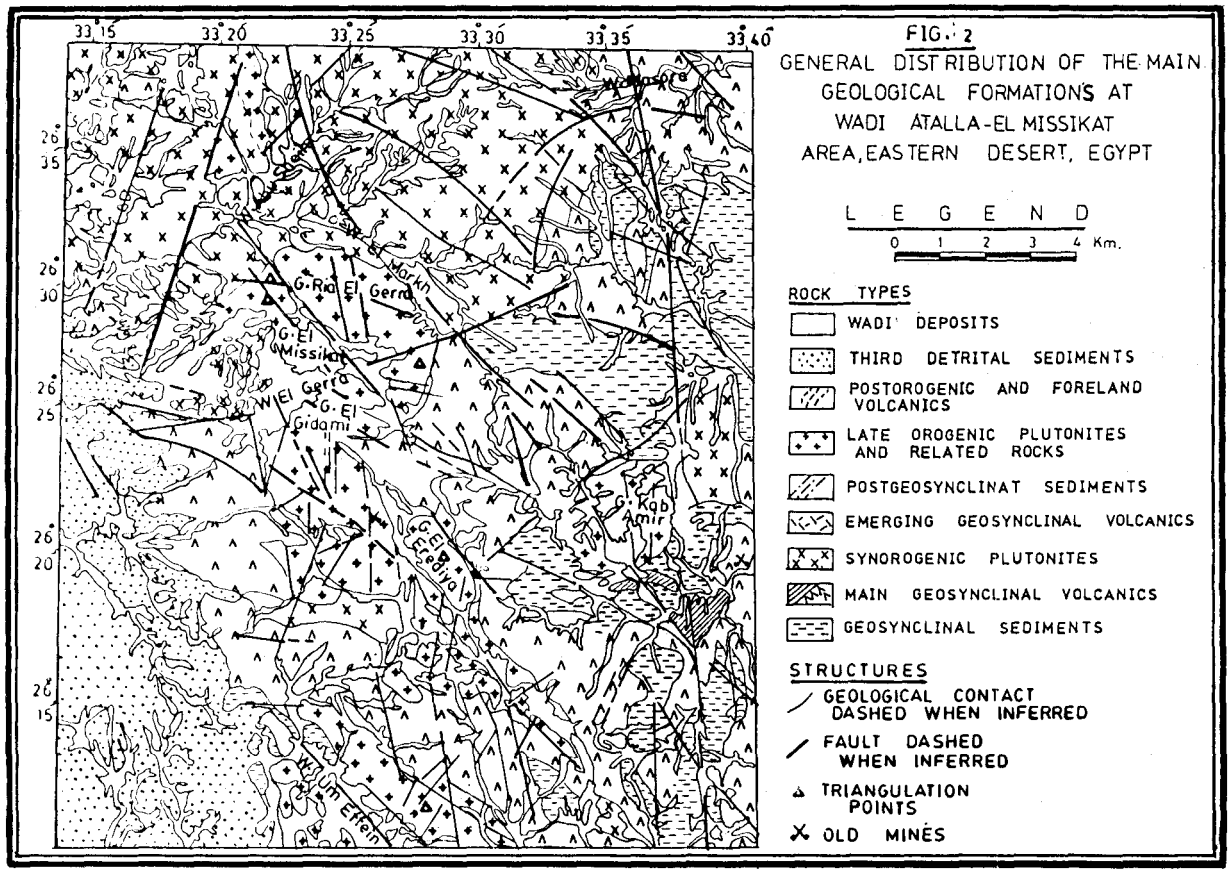

Fig. 2: General distribution of the geological formations at Wadi Atalla-El Missikat area, Eastern Sesert, Egypt.

C. Metamustones

These are of very wide distribution in the eastern and south eastern sector of the studied area. They form extensive outcrops of great thickness around Wadi Kab El-Absi and Wadi Abu Marwat, as well as some separate small masses exposed between Wadi Atalla El-Murr and the main Wadi Atalla. The metamudstones are usually interbedded with and invaded by basic and ultrabasic geosynclinal volcanics especially near their contacts. This is clearly observed in the area around Megal El Saqia, where the basic metavolcanic rocks (metabasalts and metadiabases) are commonly interbedded with the foliated metamudstones in such a manner that they acquire together the same prevailing structure. They were subjected to a low grade regional metamorphism of the green schist facies. According to their mode of occurrence, mineralogical composition, and structural features, the metamudstones in the studied area can be divided into two main units, the massive metamudstone at the base and the foliated or banded metamudstone on the top.

D. Schists

These form the upper part of the metamorphosed geosynclinal sediments cropping out in the studied area. They are characterised in the field by their pronounced schistosity and cleavage. Usually they break along cleavage planes resulting in smooth even plates with shiny appearance. Original bedding is occasionally still preserved and can be distinguished usually parallel to the foliation. Schists are fine to medium grained rocks, of yellowish grey to greyish green and dark grey colours. They are found associated with the metamudstone varieties or forming some separate elongated belts but of limited extension. Two main types of schists are met within the investigated area namely mica schists and chlorite schists.

2. Main Geosynclinal Volcanics

The main geosynclinal volcanics, commonly known as metavolcanics, are widely distributed allover the mapped area. They constitute a very important group of metamorphic rocks of igneous origin, forming large extensive outcrops in the investigated area. These main geosynclinal volcanic rocks appear to be either partly contemporaneous with or immediately younger than the geosynclinal sediments, with which they are normally interbedded in the form of sills, sheets and lenses. Sometimes, they are also found in the form of a succession of sills or minor intrusions among which some outcrops are occuring as separate and approximately continuous massive belts. They may also be present as large xenoliths in the later plutonic igneous rocks of granodiorites and granites.

The main geosynclinal volcanics are generally fine to medium grained rocks, massive and compact, dark green to greyish green or dark grey in colour. Yellowish cream and light greyish colours are usually displayed by the more acidic varieties and the granitized parts of some outcrops near granite intrusions. They are

intruded by younger granite plutons as that of Gebel El Erediya and Gebel Kab Amiri, where they are extensively faulted and fractured. They are commonly injected by numerous quartz veins and several younger dykes of acidic, alkaline and basic composition.

The main geosynclinal volcanics are essentially of three main groups of rock associations namely intermediate, basic and ultrabasic. However, a fourth association could also be distinguished, that is the acid volcanics, but they are of relatively limited occurrence (Table 1).

Table 1
The main geosynclinal volcanic rocks at Wadi Atalla-El Missikat Area.

Main Association	Representative Rock Type
A - Acid	— Metamorphosed pyroclastics — Metadacites
B - Intermediate	— Meta-andesites
C - Basic	— Sheared metadiabase — Metadolerite, metabasalts and spilites — Amphibolites
D - Ultrabasic	— Serpentinites — Antigoritites — Talc - carbonate rocks — Ultrabasic schists

3. Synorogenic Plutonites

The synorogenic plutonites comprise a complex of various rock units grading from diorites to granites, but generally they are in average of a granodioritic composition. The association of these synorogenic plutonites is synonymous with the older granitic rocks so far known in Egypt and normally called "grey granite" (Noweir and Takla, 1976). They are mostly of basic composition associated with some intermediate varieties, including mainly diorites and quartzdiorites. These rocks are of an apparently autochthonous nature, and they have been associated with the previously metamorphosed volcanics forming hybrid rocks under some particular conditions. The synorogenic plutonities are generally characterised by their predominating grey colour with the common development of exfoliation structure. Usually, they form low-lying countries and they are easily weathered into

rounded large boulders with friable greyish to dirty brownish weathered surface. The contacts of their intrusive masses with the older rocks are sometimes affected by the contact metamorphism as indicated by some granitized zones. The rocks of this group are generally medium to coarse grained, mainly composed of plagioclase feldspars with microcline and/or orthoclase.

A. **Diorites**

These are represented by several exposures, such as that along Wadi Hammama, NW of Wadi Um Had, north Gebel El Missikat, and north and NW of Gebel El Gerra. There, they intrude the enveloping metamorphosed geosynclinal sediments and volcanics, and they are cut by the neighbouring younger pink granites of the late orogenic plutonites. They are generally massive hard rocks, although cataclastic structure is developed in some occurrences especially along their peripheral zones. The diorites are mostly medium to coarse grained rocks, of light grey to greenish grey colour. They are composed essentially of plagioclase feldspars, mostly oligoclase, quartz and biotite, with subordinate amounts of hornblende and potash feldspars of orthoclase and/or microcline. Opaque grains of magnetite with some zircon and epidote are present in accessory amounts disseminated in the rock. Some diorites are partly altered where the plagioclase feldspars are sericitzed and saussuritized, while the biotite flakes are somewhat chloritized. The quartz grains usually show wavy extinction, and they may replace partially the edges of some plagioclase crystals.

B. **Granodiorites**

They are found in a common association with the diorites and grey granites in their occurrences in Wadi Atalla - El Missikat area. Some large and wide masses, as that to the northwest of Wadi Bohlog, are of heterogenous formation made up of dioritic to grey granitic rocks, but generally of granodioritic composition. These masses usually enclose numerous xenoliths of older metamorphosed rocks of the geosynclinal sediments and volcanics. Such xenoliths usually show the various stages of transformation from the original rock to approximately normal granodioritic rock and even to grey granite. Gradations between the granodiorites and the enveloping older rocks on one hand, and the younger pink granitic rocks on the other hand, are of the characteristic features to most of their occurrences. However, rocks of the normal granodiorites are also encountered in the studied area, such as at the northern upper reaches of Wadi Atalla, along Wadi Um Gemal, along Wadi Abu Sheikh and NE of Wadi El Markh. The granodiorites are generally medium to coarse grained rocks, greyish in colour with some different shades of green or brown.

Petrographically, they comprise different varieites ranging from quartz diorites to tonalites. Generally, their essential mineral constituents include plagioclase

feldspars, quartz and potash feldspars, with biotite and hornblende. Subordinate amounts of chlorite and epidote are also present, in addition to some grains of sphene and apatite as accessories.

C. Grey Granites

These rocks are of a grantiic composition having a predominantly grey colour, rarely they may show a faint pink colour. They are usually found in a complete association with the diorites and the granodiorites, and commonly include black xenolitic masses of the older metamorphic rocks. They are generally medium to coarse grained, intensely jointed and highly weathered rocks, forming low-lying countries showing a characteristic exfoliation structure. In the studied area, the grey granites are mainly exposed at Gebel Abu Qarahish; north of Wadi Bohlog and northwest of Gebel Maghrabiya. At Gebel Abu Qarahish occurrence, they are surrounded by the older metavolcanic rocks from which some xenoliths are enclosed in the granite, especially along the contact zone. A younger red granite porphyry dyke, cutting the grey granite, is standing up in relief forming a conspicuous high ridge in contrast to the surrounding weathered rocks. Also, the grey granite is cut by a group of nearly parallel basic dykes with their disintegration fragments covering the slopes of the surrounding hills. At the NW of Gebel Maghrabiya, grey granites are exposed at the foothills of the younger pink granites which are predominating in the surrounding area. This occurrence represents the most southern boundary of large grey granite masses which are outcropping extensively northwards along Wadi El Gerra (Bakhit, 1978). At the NW of Wadi Bohlog, the grey granites cover somewhat circular area surrounded by a highly rugged mountainous country of metavolcanic rocks.

Petrographically the grey granites are essentially composed of orthoclase, microcline, quartz, plagioclase feldspars and biotite with or without hornblende. Magnetite, sphene and apatite are the common accessory minerals in the grey granites.

4. Emerging Geosynclinal Volcanics

Before the emergence from the geosynclinal stage, some volcanic rocks were emplaced along the previously developed weak structural zones especially those trending NNW-SSE. The emerging geosynclinal volcanic rocks represent the oldest unmetamorphosed to slightly metamorphosed volcanics among the basement rocks, and they are commonly known as Dokhan Volcanics. They are mainly of intermediate to acidic composition including some varieties of porphyries, dacites, and rhyolites. They are generally fine to medium grained massive rocks of reddish, purple and greenish colours.

In the studied area, the emerging geosynclinal volcanics are represented by a small strip along the southwestern side of Gebel Atalla, running generally in a NW-SE

trend mostly parallel to the younger felsite intrusion. This occurrence is extending further southwards beyond the mapped area forming an elongate belt of about 14-15 km length and about 3.5 km maximum width at its central part (Essawy and Aby Zeid, 1972). This belt is generally formed of two parallel bodies of volcanic flows and tuffs which have a rhyolitic composition. These rhyolitic rocks are usually fine grained, of yellowish buff to reddish pink colour, with abundant reddish and brown grains and patches of iron oxides. They are characterised by having a well developed and pronounced banding structure trending generally in the NW-SE direction, mostly parallel to the elongation of the volcanic belt. On the other hand, they show clearly flow structure where their elongated mineral grains especially biotite, iron oxides and other mineral forming flakes, laths or plates are oriented generally parallel to the outcrop. The contact between these rhyolitic flows and tuffs is gradational where the tuffs are commonly interbedded with the flows. The central part of the rhyolitic tuffs is unconformably overlain by a small occurrence of the Hammamat sediments. This belt of the emerging geosynclinal volcanics is clearly cut by the late orogenic granites of Wadi Um Effein on the western side. On the other hand, they are intruded by the younger felsite intrusion of Gebel Atalla on the east.

There are also some relatively minor occurrences of prophyry rocks, pertaining to the Dokhan Volcanics, but of rather very limited distribution in the studied area. They form a small mass intervening the gneisses in the southwestern corner of the area, and extending southwards along the western tributaries of Wadi Um Effein. Some prophyries are also found in the form of small dyke bodies intruded in the various older rocks including the synorogenic plutonites and their related rocks.

5. **Postgeosynclinal Sediments**

The postgeosynclinal sediments, commonly known as Hammamat sediments, are represented by relatively minor occurrences in the southern periphery of the mapped area and in the NE of Gebel Semna. At the southern periphery they form a thin strip of about 400-500 m width and extending for about 2 km beyond the mapped area in the southeast direction. This occurrence is actually a small basin trending generally NW - SE, nearly parallel to the general structure of the area and to the elongation of Gebel Atalla, but of a relatively low relief. The Hammamat sediments forming this outcrop may represent the remnants of the basal beds after extensive erosion of the upper beds. They rest unconformably over the central part of the rhyolitic tuffs, of the emerging geosynclinal volcanics, and they are, on the other hand, intruded by some felsite dykes of the late orogenic plutonites. This occurrence is of a paramount importance especially to assure the stratigraphic position of the underlying volcanic tuffs and flows as related to the emerging geosynclinal volcanics (Dokhan Volcanics).

The other occurrence, located to the northeast of Gebel Semna, also form a thin strip of about 400-500 m width and about 4 km length. This occurrence represents an isoclinal fold, trending generally N-S. The sediments here rest unconformably over the metavolcanics and characterised by a basal conglomertate at the contact, with elongated pebbles in the same direction of the isoclinal fold (Bakhit, 1978).

The Hammamat sediments cropping out in Wadi Atalla - El Missikat area, form a relatively thin succession of well defined clastic sediments having a general molasse character. They are formed generally of almost unmetamorphosed sediments consisting essentially of arenites to subarenites, with subordinate greywackes, possessing a characteristic colour being reddish purple or greyish green with their common intercalations. These sediments are composed mainly of hard massive purple sandstone at the base, and shiny greenish grey foliated slaty siltstone with pebbles, associated with greywacke at the top. The rocks of these sediments are mostly well bedded and the upper beds are usually foliated. The foliation is almost concordant with the bedding in both strike and dip, and so it can be regarded as bedding cleavage. Meanwhile, the pebbles generally show a certain trend of elongation which is more or less parallel to the general trend of bedding and foliation of the enclosing beds.

Petrographically, the purple sandstones are essentially composed of ill-sorted assemblage of medium to coarse grained jasperoid fragments, feldspars and quartz in a fine grained matrix of hematitic clays and carbonates. Some grains of micro-crystalline acid volcanics are present disseminated in the rock. The slaty siltstones, on the other hand, are of fine grained texture and their characteristic light greenish colour is mainly due to the abundance of chlorite flakes. The elongated pebbles encountered in the slaty beds are mostly of dolomitic composition with some fine quartz grains.

6. Late Orogenic Plutonites and Related Rocks:

The late orogenic plutonites and related rocks are widely distributed in the studied area and their exposures are extensively developed nortwards. They are mainly represented by various types of red and pink granitic rocks associated with pegmatites, aplites, felsites and quartz veins cutting and intruding the older rock formations with relatively sharp contacts.

The late orogenic plutonites and related rocks have been emplaced over a lengthy span of time, however, the majority of them are believed to be formed mainly at the end of the late Precambrian times (El-Shazly, 1964). Nevertheless, some granite plutons are probably of Eocambrian or younger ages (El-Shazly, 1970). The emplacement of granite bodies in the late orogenic phase was followed by the formation of some pegmatite veins and aplite dykes representing their immediate successors. The other later derivatives of the same original magmatic evolution,

related to these late orogenic plutonites, are the felsite rocks forming some intrusive masses and dykes, and quartz veins which are frequently found cutting all the different rocks of the earlier formations. These pegmatites, aplites, felsites and quartz veins are found usually associated with the late orogenic granites, and to a lesser extent, with the older rock formations especially the main geosynclinal volcanics according to their abundances. The extensive granite exposure in the mapped area is generally formed of a continuous series of elongated oval-shaped plutons extending roughly in NW-SE direction, i.e., nearly parallel to Red Sea structural trend. On the other hand, the associated rocks forming dykes and veins are usually found extending in sets of two main directions, the NW-SE and the NE-SW. These fractures may reflect the influence of the regional structures on the emplacement of the late orogenic plutonites and their associated rocks.

The late orogenic granites cropping out in the studied area include different rock varieties which could be easily distinguished in the field as they show considerable variations in structure, minerology, colour, mode of occurrence and they are differentiated in the following groups according to their lithologies: granodiorite and hornblende granites, white granites, and red and pink granites.

A. **Granodiorites**

The granodiorites are usually found as isolated scattered outcrops dispersed in wide sand wastes with no sharp relief. When forming masses, they are commonly of moderate height with gentle slopes. The granodiorites are usually medium to coarse grained rocks, of greyish colour, with faint yellowish brown or pink tone. Some varieties are coarse grained prophyritic of buff to pink colour, while others are medium equigranular rocks of almost grey colour. Generally, the granodiorites show a darker tone than the hornblende granites but the difference between the two is not always clear, except for the granite mostly forming a higher relief and that the scree is usually darker than that of the granites.

Petrographically, these granodiorites show a considerable variation in minerological composition ranging from quartz diorite to adamellite. Generally, they are composed essentially of plagioclase feldspars, subordinate potash feldspars and quartz, with biotite and hornblende as the main ferromagnesians. Some chlorite, epidote, sphene and iron oxides are also present. The plagioclase feldspars are commonly saussuritized yielding large epidote granules. They are usually associated with few epidote and sphene granules as accessories, together with some fine disseminations of reddish brown iron oxides.

B. **Hornblende Granites**

These granites are predominant and well exposed especially at Gebel Maghrabiya, while they are recorded only as small masses along Wadi Atalla El-Murr among the granodioritic masses. They are generally medium grained rocks, commonly

porphyritic, of light grey colour with faint pink tone. They are essentially formed of microcline and orthoclase microperthite as phenocrysts embedded in a medium groundmass of quartz, potash feldspars, plagioclase feldspars, bluish green hornblende, with subordinate few grains of brownish biotite, zircon, sphene, apatite and dark brown iron oxides, mostly magnetite, are the main accessory minerals.

C. **White Granites**

These rocks are of a rather localized distribution in comparison with the other varieties of the late orogenic granites. White granites are exposed only in the northeastern upper reaches of Wadi Um Had. This occurrence forms a relatively small oval-shaped mass extending generally in a NW-SE direction for about 3 km strike length and of about 1.2 km average width.

Petrographically, they are generally fine grained leucocratic rocks of white to very light pink colour. They are of nearly equigranular texture and show a marked homogeneity in composition as compared with the other varieties of the late orogenic granites. They are essentially composed of potash feldspars, quartz and plagioclase feldspars, and they are characteristically devoid of any ferromogesian minerals. The predominant alkali feldspars are composed mainly of perthitic orthoclase and microcline crystals with rectangular outline. The plagioclase of the perthitic intergrowth is commonly subordinate and of albitic nature, but some oligoclase crystals are also present showing corrosion by alkali feldspars as well as by quartz.

D. **Red and Pink Granites**

The red and pink granites are the most dominant rock types among the late orogenic plutonites cropping out in the studied area. Coarse grained pink granites with little mica, and porphyritic red varieties with large feldspars always occur together in the same occurrence with a gradual passage from one variety to the other. These red and pink granites constitute mainly five plutons in the studied area; that is El Erediya, Kab Amiri, El Gedami, El Gerra and El Missikat which form conspicuous high mountains in the area. Moreover, some minor occurrences of the red and pink granites are also exposed along Wadi El Saqia and at Gebel Abu Qarahish.

The different varieties of the pink granite rocks are generally pink to whitish-pink in colour, and commonly have a cataclastic structure. Petrographically, they are coarse grained rocks showing a somewhat gneissose texture with some mylonitized parts in the fractured zones. They are greatly variable in composition ranging mineralogically from adamellite to alaskite (El-Kassas, 1974). In general, they are composed of light-grey quartz, pink potash feldspars, in addition to some plagioclase feldspars and subordinate biotite, with or without hornblende. Patches

and spots of iron oxides, minute crystals of zircon, sphene and apatite may present as accessories. The plagioclase feldspars are commonly represented by albite or oligoclase. The biotite and hornblende, when present, are partly chloritized, or associated with some muscovite flakes and small sericite shreds. Secondary quartz, carbonates and iron oxides may form thin veinlets or disseminated spots filling the intersticies.

E. **Granite Porphyries**

They occur in the mapped area as extensive dykes and minor intrusive masses invading nearly all the older country rocks including the red and pink granites, mostly running along the tectonic weak zones such as faults, joints and foliation planes. They are well developed particularly in the granitic countries of El Gedami, El Missikat, Abu Qarahish, El Erediya, Um Effein and Wadi El Markh. There, they stand out above the general surface of the surrounding country, forming a series of nearly parallel ridges trending generally in the NE-SW direction. Most of the granite porphyry dykes have a greater hardness and more resistance to weathering agents than the granites into which they are injected. They are mostly standing nearly vertical or having very steep dipping angles.

Petrographically, the granite porphyries are generally coarse grained rocks of reddish buff colour. They are essentially composed of feldspars phenocrysts embedded in a fine-grained ground mass of quartz, feldspars and biotite. The feldspars are mostly plagioclases with subordinate orthoclase crystals and they are commonly altered to be entirely kaolinized or rarely sericitized. Quartz occurs as cryptocrystalline or very fine-grained aggregates and/or occassionally as phenocrysts. Clusters of epidote granules and scattered reddish hematite grains and small zircon and apatite crystals are present as accessory minerals.

F. **Pegmatites**

Pegmatite veins are not commonly observed in the studied area. They are found as small lenticular and vein-like bodies encountered mainly in the red and pink granite bodies of the late orogenic plutonites, The pegmatites are generally very coarse rocks of pinkish colour. They are mainly composed of an inter-growth of vitrous quartz and reddish pink orthoclase and some microcline with or without few micas. All pegmatite veins are very small in dimension not marked on the map, and in general they strike E-W or nearly so. It is also noticed that some pegmatite veins are cut by quartz veins.

G. **Aplites**

Aplites or micor-graintes are encountered in the study area as vein or dykes cutting through all types of country rocks, and in some cases also the granitic rocks themselves whether massive or tectonized. The aplite dykes vary in thickness from

0.5 to 10 metres and may extend for few kilometres. In colour, different aplites vary with that of their feldspars from rosey to red and some of them have tiny dark spots, mostly of biotite. Aplite sheets, light red, fine grained, have been found intruding through diorite and epidiorite complex, striking NE-SW and dipping to SE. Also, they are noticed in the granite mass of Gebel El Missikat and Gebel El Gedami as thin veins not more than 5 metres in thickness, and in the granitoid metavolcanics south Gebel El Gedami, while at Wadi El Gedami, aplites occur like small stocks invading metavolcanic rocks. They are found associated with the granitic porphyry dykes, striking ENE-WSW, with steep inclination, along the periphery of Gebel El Gerra.

H. **Felsites**

They are not so common and they occur in the form of small bodies, mostly cutting all the mentioned formations covering the area and as the intrusion of Gebel Atalla, where it forms an elongate belt. In this occurrence the relation between felsites and Hammamat sediments is very obvious, and accordingly they are called "Post Hammamat Felsites" (Akaad et al, 1976). They are generally fine grained rocks of light colour, cream yellow, buff, light red, whitish blue or bluish grey. They are hard and resistant to weathering agents, thus they usually stand in relief in contrast to the surrounding rocks. By this and by their light tones on air-photographs, they are usually easily to be traced for long distance.

I. **Quartz Veins**

Quartz veins cut across the different rock formations in the study area, where they occur filling fractures, along fault planes and weak zones in the granitized metavolcanics, the geosynclinal sediments, the main geosynclinal volcanic rocks, granite plutons, but none of them cut the postorogenic volcanic rocks or the Nubian sandstones exposed in the area.

7. **Postorogenic and Foreland Volcanics**

According to El Shazly (1964), these volcanics are mainly forming dykes, sills and sheets or plugs of alkaline volcanics and basaltic bodies. The most important dykes of those in Wadi Atalla - El Missikat area are the basic dykes. They are abundant and distributed through the whole area invading all the rocks except that of the foreland sediments which are represented here by the Nubian sandstones. These dykes are mostly controlled by the structural feature, i.e. they often run parallel to and through the major faults or joints. Generally, they occur in three directional trends through the whole area. They are shown invading the synorogenic plutonites, late orogenic plutonites and metavolcanics, respectively according to their abundance.

Table 2

Chronological sequence of the rocks exposed in Wadi Atalla area, Eastern Desert of Egypt, (El Kassas, 1974)

Rock Units	Correlation with El-Shazly Classification (1964)	Structural Stages	Age	
Wadi deposits	Foreland sediments	Foreland proper	Quaternary	Phanerozoic (±600m.y. to Present)
Major unconformity				
Nubian sandstones	Third detrital sediments		Cretaceous	
Major unconformity				
Basic dykes	Postorogenic and Foreland volcanics	Postorogenic transitional stage	Paleozoic	
Quartz veins Felsites Aplites Pegmatites Granite porphyries Granites	Late orogenic plutonites and related rocks	Mountain building stage	Late Precambrian I Probably passing through early Paleozoic	Precambrian I or Upper Proterozoic (1000-1200±600m.y.)
Hammamat sediments	Postgeosynclinal sediments		Precambrian I	
Major unconformity		Late geosynclinal stage		
Porphyries Rhyolitic tuffs Rhyolitic flows	Emerging geosynclinal volcanics			
Grey granites Granodiorites Diorites	Synorogenic plutonites			
Acid volcanics Intermediate volcanics Basic volcanics Ultrabasic volcanics	Main geosynclinal volcanics	Early geosynclinal stage		
Schists Metamudstones Quartzites Gneisses	Geosynclinal sediments			

8. **Foreland Sediments**

They are represented here by the Nubian sandstones which rests unconformably over the basement rocks on a more or less peniplained surface. This sandstone, forming a rock unit which represents most probably shallow sea deposits in general, and its upper part in many places is made up of variegated shales. This sandstone, is presumably of lower Cretaceous age and its succession is represented by cross-bedded sandstones with some clayey and shaley bands in the upper parts, and it is widely-spread forming large plateau flanking the basement from west and southwest. The beds of the Nubian sandstones are mostly horizontal, however, they may be dipping slightly with an angle ranging from 2° tp 5° in various directions but mostly in the south-west. Generally they consist of conglomerates, sandstones and clayey siltstones, and commonly they show lateral variation in thickness and lithology.

REGIONAL STRUCTURES AND STAGES OF EVOLUTION

The studied area is covered by rocks of basement complex, which have been subjected since their formation to various stages of successive tectonic movements which took place during the Precambrian and the younger ages. The different rock units in the area yielded differently to these tectonic events due to their different lithological characteristics and accordingly produced the present complicated structures (Fig. 2).

The structure of the studied area shows many structural elements, such as folding, faulting and jointing. In the Hammamat sediments, NE of Gebel Semna an isoclinal fold trending N-S or nearly so is observed. The major faults traversing the various rock formation in the studied area are ENE-WSW, N-S, NNE-SSW and NNW-SSE respectively according to their predominance. Joints are of diverse origin, showed that they are widely distributed with variable intensities in each rock unit according to their physical and chemical properties. The chronological sequence of rock units exposed in Wadi Atalla - El Missikat area, with the corresponding structural stages, is summarized in Table (2).

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جيولوجية منطقة وادي عطا الله ـ المسيكات بالصحـــراء الشرقيـــة ـ مصـــــــر

إبراهيم على القصـــاص ـ فـــوزي سيحـــة بخيت

تقع منطقة وادي عطا الله ـ المسيكات في وسط الصحراء الشرقية بمصر ، وهي تغطي مساحة حوالي ٢٠٠٠ كيلومتـر مربـع بين خطي عرض ١٠ – ٢٦° ـ ٤٠ – ٢٦° شمالاً وخطي طول ١٥ – ٣٣° ـ ٤٠ – ٣٣° شرقاً وقد تم إعداد خريطة جيولوجية للمنطقة بمقياس رسم ١ : ٤٠,٠٠٠ كما درست المكاشف الصخرية التي تغطي المنطقة وكلها من صخور القاعدة المركبة التي تنتمي إلى عصر ما قبل الكامبري ـ الباليوزوي المبكر بالإضافة إلى بعض الصخور النارية الأحدث ، ويحفها من الجنوب الغربي طبقات من الحجر الرملي النوبي .

وقد أمكن تصنيف صخور المنطقة إلى المجموعات الرئيسية التالية وذلك في ضوء التصنيف الجيولوجي التركيبي لصخور القاعدة المصرية :

١ ـ رسوبيات التقعر الأقليمي. ٢ ـ بركانيات التقعر الأقليمي.

٣ ـ الاندفاعيات الملازمة لنشأة الجبال. ٤ ـ بركانيات الظهور من التقعر الأقليمي.

٥ ـ رسوبيات ما بعد التقعر الأقليمي. ٦ ـ الاندفاعيات الملازمة لنشأة الجبال.

٧ ـ البركانيات اللاحقة لنشوء الجبال وبركانيات أرض المقدمة.

٨ ـ رواسب أرض المقدمة الفتاتية .