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## PETROGRAPHICAL ,GEOCHEMICAL AND RADIOACTIVITY STUDIES ON GRANITE AND GRANODIORITE ASSOCIATIONS IN ASWAN CATARACTS, EGYPT

MOHAMED ABDEL MONSIF  
*Nuclear Materials Authority, Cairo, Egypt*

### ABSTRACT

Aswan granites are divided into two types: 1) granite extends from Aswan north to El Shellal south and 2) granodiorite-quartz monzodiorite form two separated elongated and parallel bodies extending in N-S direction. At the contact between the two types there are some enclaves and ferromagnesian minerals.

Aswan granite is composed mainly of alkali-feldspars, plagioclase, quartz, biotite, hornblende. Allanite, zircon, monazite, fluorite, apatite, titanite and opaques are the main accessory minerals. Secondary minerals are muscovite, chlorite and carbonates. Two generations of quartz which included in hornblende, microclinzation of plagioclase, presence of skeletal apatite, presence of secondary titanite in granite due to the presence of high titanium content which derived from granodiorite-quartz monzodiorite, the presence of zircon included in biotite and both of them mantled with hornblende and the presence of different types of textures, all the previous are some criterias for magma mixing.

There are some criteria in the geochemistry of the trace elements for magma mixing, presence of low content of Ba and Sr in granite as compared with granodiorite-quartz monzodiorite, low Zr content in granite but high in granodiorite-quartz monzodiorite, presence of high Zn and Pb in granite and the presence of small gap between the two rock samples which may be attributed to absence of complete spectrum of samples to causes such gabs.

This study revealed that the uranium content in granite is lower than that of granodiorite-quartz monzodiorite and the thorium content in granite is greater than that of granodiorite-quartz monzodiorite which give an indication for the mixing magma. On the other hand, the uranium content in both types are suitable for using this granite as ornamental stones.

### INTRODUCTION

Aswan granites crop out between long.  $32^{\circ} 50' - 32^{\circ} 55' N$  and lat.  $24^{\circ} 00' - 24^{\circ} 05' E$  (Fig.1).

Aswan granite is categorized with the Egyptian younger granites (YG) of (565-592Ma) Abdel Monem & Hurley (1980) and Hashad et al. (1972). This rock intrudes older rocks including schists and granite gneisses.

It forms the base of the modern Aswan town foundation and the surrounding urban including some islands in the River Nile and the Old Aswan Cataracts. At the south and west of Aswan city, the suite is covered by Nubian Sandstone. The oldest open quarry in the world is still preserved in this granite where uncompleted obelisk is excavated into the rock and left there because it met with fracture (Gindy&Tamish,1998).

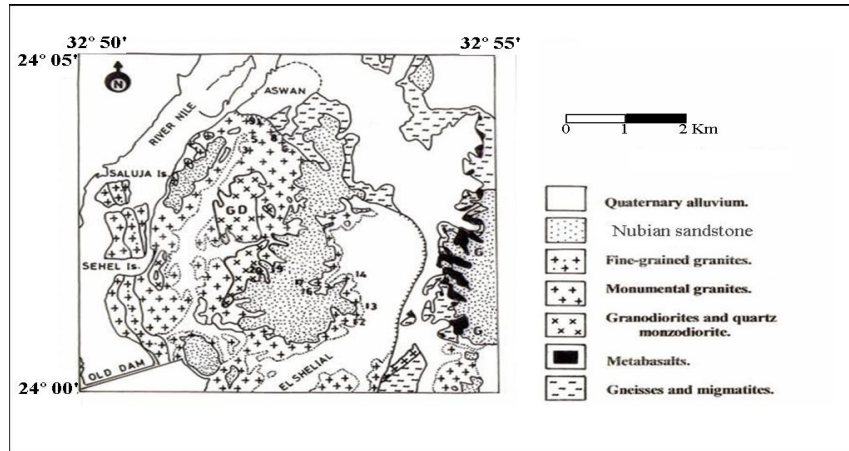


Fig.1:Geologic map of Aswan monumental granitoid suite (Modified after Gindy & Tamish, 1998)

Many authors studied this granite because of its unique textural, compositional and origin with respect to that settled for the younger granite (YG). For example, Barthoux (1922), Andrew (1934), Hume (1935) and Gindy (1974) considered a magmatic intrusive origin for this granite. On the other hand, El-Shazly (1954) observed an uncommon porphyroblastic rocks highly injected with pegmatite with no distinct foliation within the metamorphic rocks around the Aswan granite. This led him to postulate that the addition of alkalis and silica to the pre-existing metamorphic rocks could produce granodiorites and the coarse-grained granite of the Aswan granites.

Gindy (1954, 1956 and 1957), Higazy & Wasfy (1956) and Zaghoul & Khaffagy (1965) considered a metasomatic origin of these granites according to their studies on separated zircon crystals. Abu-El-Ela (1973) compared the morphology of zircon crystals separated from the metamorphic country rocks with those from the Aswan granitoids as described in Zaghoul & Khaffagy (1965) and he realized that the Roundness Index of the country rocks zircons (73%-98%) is much greater than that of coarse-grained granites

(42%-50%).

Taher (1976) analyzed the biotite separated from the Aswan Granites and supported the magmatic origin claimed previously by Gindy (1974). He concluded that the Aswan Granites form a post-orogenic composite stock. It constitutes of granodiorites, coarse-grained granites, fine-grained granites and leucogranites having intrusive nature and co-magmatic origin.

Gindy and Tamish (1998) concluded that due to the collisional suture that extend at N-S and meridian to the present Nile at Aswan and continued southwards into the Sudan and Ethiopia, the collisional thickening, partial melting occurred in the lower crust and upper mantle and both melts mixed together and eventually produced earlier granodioritic magma and a later monzogranitic magma that had arisen to form the post-collisional post-kinematic granitoids of the area.

El Tokhi and Saleh (2001) stated that the evolution of pan african Aswan-type rapakivi granite, southeastern of Aswan city. Texturally, tree types of rapakivi granites were identified, South Eastern wiborgite, pyterlite and porphyritic. Petochemical parameters

and variation diagrams suggest that these rapakivi granites were formed by partial melting of silica crustal rocks mixed with mafic material.

Ammar (2003) stated that the monumental granitic rocks at Aswan cataract comprise a suite of rocks having metaluminous , calc alkaline affinities, represented by granite and granodiorite-quartz monzodiorite. At the contact between these types abundance of rounded to elongated microgranitoid enclave and their textural assemblage (e.g. interstitial, resorbed rims, chemical zoning and rapakivi) are interpreted as mixing having occurred between two penecontemporaneously emplaced magmas.

This paper deals with the geology, petrography and uranium, some trace elements geochemical features at Aswan granites. Also, the aim of this study declares the evidences of magma mixing and the uranium content which may be affect on the water or the granite which used as ornamental stones. Eighteen samples (eleven from granite and seven from granodiorite-quartz monzodiorite) were collected each sample more than 10 kg for petrographic and geochemical studies.

### GEOLOGIC SETTING

Generally, the Aswan granites are intruded into country rocks composed of biotite granitic gneisses and schists of Proterozoic age (Abdel Monem & Hurley, 1980). The contacts are usually sharp intrusive one. These rocks are covered by Nubian Sandstone (N.S.S).

### Biotite Gneisses and Migmatites

The biotite gneisses and migmatites are the oldest rocks in the area. They are fine- to coarse-grained rocks, varying in color from brownish grey to dark grey. Sometimes, the rock shows light color due to the increase of feldspar minerals and decrease in biotite percent. They are mostly described at the eastern contacts of the Aswan granites.

### Aswan Monumental Granites

The Aswan granites are coarse-to very coarse-grained rock unit. It composed of two rock varieties granite and granodiorite-quartz monzodiorite rocks (Ammar, 2003). The granite is extending from Aswan north to El Shellal south and underlying the N.S forming many conspicuous hills. The granodiorite-quartz monzodiorite rocks form two separated elongated and parallel bodies extending in N-S direction. The eastern body is larger than the western one. The contacts between these rock types are mostly crenulated and dipping about 40° in the NNE direction (Fig.2). At the contact enclaves (Fig.3) and ferromagnesian minerals (Fig.4) increase in the granite towards the peripheries with granodiorite-quartz monzodiorite bodies. Quartz and feldspar phenocrystals increase in the granodiorite-quartz monzodiorite rocks towards the margins with granites. Four main rock varieties are defined as a member of the studied suite (Ammar, 2003) :

- 1-Aswan granite containing abundant large , rounded and elongated enclaves.
- 2-Granitic rock enrichment by mafic minerals and containing abundant enclaves of small scale.
- 3-Granodioritic rocks containing alkali feldspar and quartz phenocrystals.
- 4-Quartz monzodioritic rocks.



Fig.2: NNE dipping direction of the studied granites

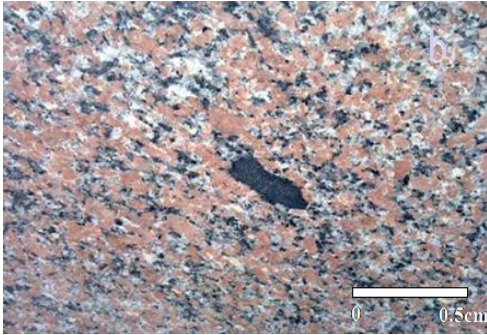


Fig.3: Elongated enclave in the studied granites.

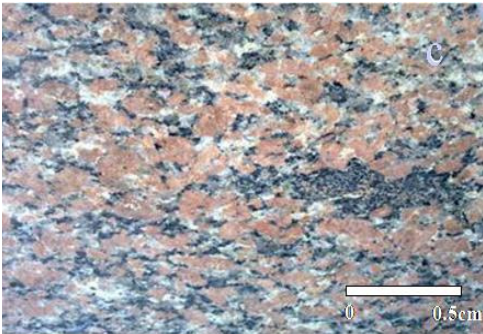


Fig.4: Ferromagnesian minerals distributed in the studied granites

The contacts between these rock members indicate the contemporaneous emplacement of both granitic and granodioritic-quartz monzodioritic magmas.

Mafic enclaves in Aswan granite are generally regular in the form of elliptical shape, fine-grained and distributed in all the granite body. They range in diameter from few centimeter up to one meter and feldspar crystals in the enclaves are oriented in alignment parallel to the feldspar crystal of the host granitic rocks indicating that the earliest phase remained in a magmatic state until other phase had been emplaced (Ammar,2003). These enclaves are widespread in most collisional granitoid (Reid et al., 1983; Vernon, 1984; Frost & Mahood, 1987; Vernon et al.,

1988; Poli et al., 1989).

The measured linear orientation of feldspar and ferromagnesian minerals at the central part of the Aswan granite body plunges between 15° to 64° in the NW and SW directions (Ammar,2003). Some later phases of aplitic and Tertiary mafic dikes were recorded cutting this granites.

### PETROGRAPHY

Aswan granites are composed mainly of alkali-feldspars, plagioclase, quartz, biotite, hornblende. Allanite, zircon, monazite, fluorite, apatite, titanite and opaques are the main accessory minerals, while the secondary minerals are muscovite, chlorite and carbonates.

**Alkali-feldspars:** They are coarse to very coarse grains represented by perthite which include patchy perthite (Fig.5) and string perthite. Microcline is associated with perthite (Fig.6), microcline perthite (Fig.7).

**Plagioclase:** It is coarse to very coarse grains which digested by perthite (Fig.8). Plagioclase is also found mantled by perthite (Figs. 9 &10) referring to the mixing magma. On the other hand, plagioclase may be transformed to microcline (Fig.11).

**Quartz:** It is coarse grains found in two generations, primary and secondary quartz in-

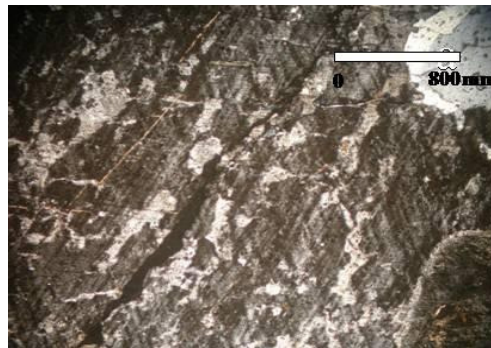


Fig.5: Photomicrograph showing patchy perthite in Aswan granite, XPL

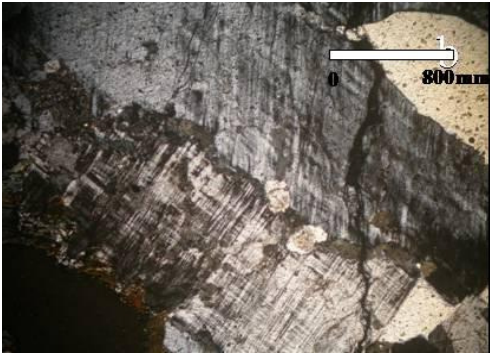


Fig.6: Photomicrograph showing microcline associated with perthite in Aswan granite, XPL

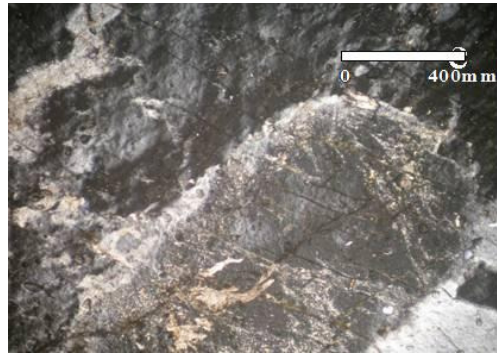


Fig.9 : Photomicrograph showing plagioclase mantled by perthite in Aswan granite, XPL

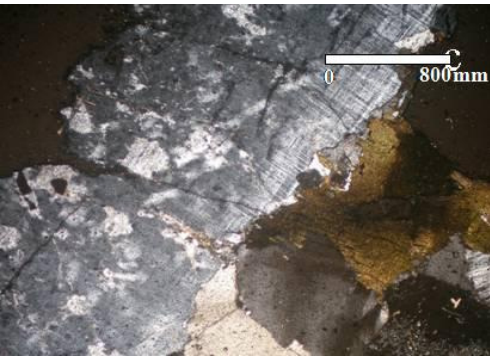


Fig.7: Photomicrograph showing microcline perthite in Aswan granite, XPL



Fig.10: Photomicrograph showing plagioclase mantled by perthite in Aswan granite, XPL

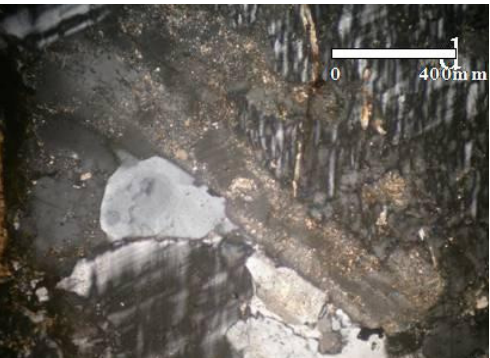


Fig.8 : Photomicrograph showing plagioclase digested by perthite in Aswan granite, XPL

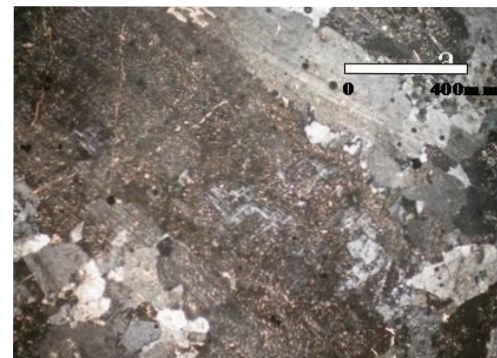


Fig. 11: Photomicrograph showing microclinization of plagioclase in Aswan granite, XPL

cluding in hornblende crystal (Fig.12). The two generations of quartz in hornblende refer to the presence of two magma mixing.

**Biotite:** It is medium to coarse grains carrying apatite crystal (Fig.13) and may be altered to chlorite.

**Hornblende:** It is medium to coarse grains found hosting two generations of quartz. On the other hand, zircon included in biotite (present the original phase of granite) and both of them are mantled with hornblende (Fig.14). These arrangement is the reverse with Bowen reaction series which give

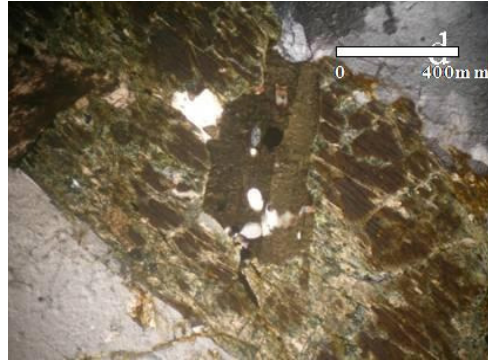


Fig.14: Photomicrograph showing zircon included in biotite and all mantled by hornblende in Aswan granite, XPL

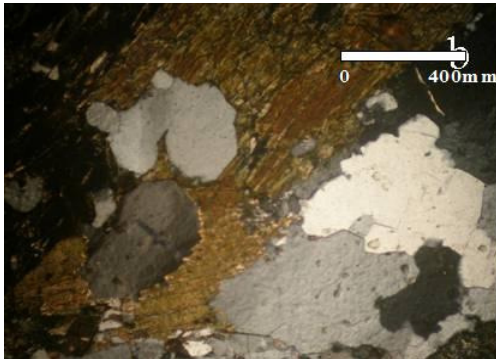


Fig. 12: Photomicrograph showing primary and secondary quartz included in hornblende in Aswan granite, XPL

a good evidence for magma mixing.

**Apatite:** It is found as skeletal crystal of apatite (Fig.15).

**Titanite:** It is found as secondary sphene due to the presence of high titanium content and associated with chlorite (Fig.16).

In Aswan granite there are several types of textures represented by rapakivi (Fig.17), non rapakivi, perthitic and granitic textures, also myrmekitic texture is found (Fig.18).

Rapakivi texture is used to describe pla-

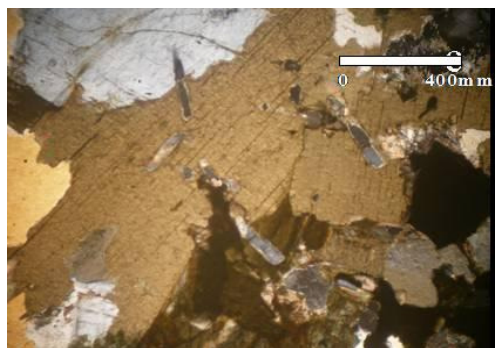


Fig.13: Photomicrograph showing apatite included in biotite in Aswan granite, XPL



Fig.15: Photomicrograph showing skeletal crystal of apatite in Aswan granite., XPL

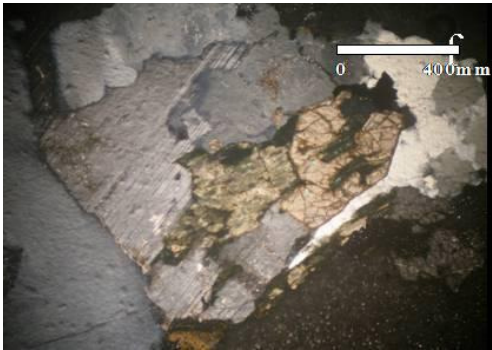


Fig.16: Photomicrograph showing titanite crystal associated with chlorite in Aswan granite, XPL

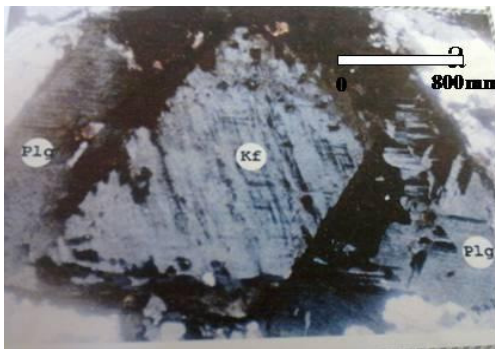


Fig.17: Photomicrograph showing rapakivi-like texture; K-feldspar is mantled by plagioclase in Aswan granite, XPL

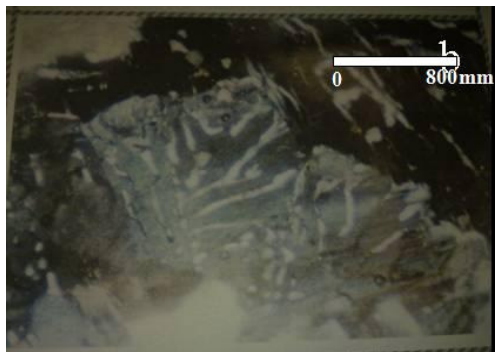


Fig.18: Photomicrograph showing myrmekitic texture in Aswan granite, XPL

gioclase-mantled alkali feldspar phenocrysts. Wahl,1925; Savolahti, 1962 and Vorm,1971 conclude that the rapakivi texture mechanisms include : a) degassing of fluid-saturated magma, b) decompression, c) magma mixing.

Myrmekitic texture is found in porphyritic granite and formed due to the action of metasomatic processes with the exsolution around the margins of feldspars phenocrysts (Ashworth, 1979).

Granodiorite and quartz monzodiorite rocks are composed mainly of plagioclase, microcline, quartz, biotite and hornblende. The main accessory minerals are titanite, zircon, apatite and opaques. Some samples show antiperthitic texture.

Generally, the petrographic studies show that there are several evidences for magma mixing in Aswan granite:-

- 1-Presence of different types of textures (Hibbard, 1991).
- 2-Two generations of quartz which included in hornblende.
- 3-Microclinization of plagioclase.
- 4-Presence of skeletal apatite .
- 5-Presence of secondary titanite in granite due to the presence of high titanium content which derived from granodiorite -quartz monzodiorite.
- 6-The presence of zircon included in biotite and both of them mantled with hornblende.

## GEOCHEMISTRY

Eighteen samples (eleven from granite and seven from granodiorite-quartz monzodiorite) were analyzed for trace elements, uranium and thorium in the laboratory of Henri Poincare University, Nancy, France (Table1). These elements were analyzed by Atomic Emission Spectrometer (AES) coupled with Inductively Plasma (IP) source.

The trace elements in granitic rocks are

Table 1: Trace elements, uranium and thorium geochemistry of Aswan granites, South Eastern Desert, Egypt

S.No.	Granite												Granodiorite- quartz monzodiorite							
	1	2	3	4	5	6	7	8	9	10	11	Ave.	12	13	14	15	16	17	18	Ave.
Ba	1124	904	1083	1064	1127	1099	998	982	981	1102	1188	1059	1035	1168	1417	1160	1110	1144	1150	1169
Rb	119	113	109	96.1	103	94.8	109	108	106	99.3	105	106	74.8	71.7	78.3	87.8	78.1	68.7	73.1	76.1
Sr	195	163	183	186	188	185	174	164	169	184	197	181	400	401	311	287	409	435	382	375
Y	43.6	34.7	37.2	39.3	36.6	35	40.3	30.6	38.9	36.6	29.6	36.6	54.3	57.6	50.8	47.9	52.6	56.7	56.3	53.7
Zr	430	359	377	416	356	363	395	282	363	401	312	368	458	538	546	503	474	542	539	514
Nb	25.4	19.8	23.2	22.4	18.5	19.3	22.3	16.6	21.3	19.9	16.9	20.5	42.1	42.3	35.6	34.5	42.9	45.7	39.4	40.4
Pb	19	19	19.5	18.5	19.4	17.4	17.9	20.1	18.7	17.4	18.9	18.7	14.7	15.3	16.5	17.4	15.7	14.9	15.1	15.7
Ga	22.4	22	21.6	21.3	20.9	21.3	21.2	20	21.8	21	21	21.3	24.6	25.5	24.5	23.3	25.5	24.7	24.5	24.7
Zn	74.8	57.5	67.5	68.6	55.3	62.3	68.4	50.9	65.3	62.5	54.8	62.5	158	148	107	111	152	161	155	142
Hf	10.6	9.15	9.7	10.9	9.74	9.24	9.95	7.42	9.67	10.1	8.03	9.5	10.9	12.8	13.4	12.6	11.7	12.2	12.7	12.3
Ta	1.72	1.42	1.68	1.7	1.21	1.14	1.62	1.14	1.53	1.19	1.05	1.4	2.82	2.94	2.18	2.51	2.98	3.08	2.68	2.74
Sn	3.28	4.87	91.9	2.33	1.8	2.48	4.6	9.17	17.4	2.6	1.75	12.9	2.78	3.1	2.63	2.82	2.75	2.98	2.75	2.83
Y+Nb	69	54.5	60.4	61.7	55.2	54.3	62.6	47.1	60.2	56.5	46.5	57.1	96.4	99.8	86.4	82.3	95.6	102	95.6	94.1
U	6.54	6.61	5.07	7.46	4.92	4.5	4.57	7.34	6.18	3.06	2.4	5.33	9.44	12.5	8.14	7.56	9.1	5.39	6.62	8.39
Th	18.8	15.7	14.5	15.5	13.9	19.8	16.2	24.4	15.7	7.02	16	16.14	10.8	9.93	10.4	12	10.3	11.1	10.2	10.68
Th/U	2.88	2.38	2.86	2.08	2.82	4.4	3.54	3.32	2.54	2.29	6.67	3.25	1.14	0.79	1.27	1.59	1.13	2.06	1.54	1.27

classified into metallogenic elements, that tend to be associated with the processes of mineralization as Sn, W, Mo, Cu, Li, Be, Pb, Zn, Au, U, Ag, F and Cl and petrogenic elements associated with the normal magmatic processes of granitic melts as Rb, Ba, Sr, Y, Zr, Nb, Ta, Pb, Sc, Ga, REE, and Th. Some of the petrogenic elements as Ba, Nb, Ta, Th and REE may become highly enriched during mineralization processes and form mineral deposits.

It is noticed the following from Table (1):

Generally, granite has high contents of Ba and Sr as compared with the granodiorite-quartz monzodiorite, although the low contents of Ba and Sr in this granite may be due to the mixing of magma. On the other hand, Ba content is more higher than Sr content in this granite mostly due to the substitution of Ca with Ba.

Generally, Zircon content in granite has

high values rather than that of the granodiorite-quartz monzodiorite, but in the studied granite Zr content is lower than the granodiorite-quartz monzodiorite which reflect the mixing of magma.

Zinc content is low in granite and high in granodiorite-quartz monzodiorite, although, the Zn contents in studied granite and granodiorite-quartz monzodiorite are high being due to the mixing of two magmas.

Lead content in granodiorite-quartz monzodiorite is higher than granite, but in the studied granite Pb content is relatively higher than the granodiorite-quartz monzodiorite which also due to the evidence of magma mixing.

Uranium content in granite range from (2.4ppm to 7.46ppm) with average 5.33 being lower than the content in granodiorite-quartz monzodiorite (5.39ppm to 12.5ppm) with average 8.39. Thorium content in granite range



from 7.02ppm to 24.4ppm with average 16.14 which is greater than the content in granodiorite-quartz monzodiorite (9.93ppm to 12ppm) with average 10.68. These values are opposite to the normal,so they also may give an evidence for magma mixing.

From Table (2), the average of trace elements in the studied granite is not matching the average of the younger granites of El Gaby (1975) and low- Ca granites of Turekian and Wedepohl (1961). This may indicate that the studied granites had a different history than the standard or usual granite.

Figures (19-26) show some relationships between trace elements which show the increasing or decreasing and presence of straight-line or not between them.

From Ba-Sr diagram, there is a direct relationship between Ba and Sr and straight-line in the granite. On the other hand, most samples of the granite have Ba and Sr content relatively equal to that of the granodiorite-quartz monzodiorite which give an indication for magma mixing (Fig.19).

From Rb-Sr diagram, there is a reverse relation between Rb and Sr in both granite and granodiorite-quartz monzodiorite, but Rb content in granite is greater than that

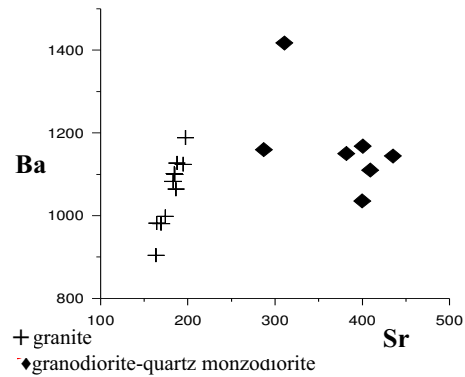


Fig.19: Ba versus Sr relationship in Aswan granite and granodiorite-quartz monzodiorite

of granodiorite-quartz monzodiorite as well as Sr content is greater in granodiorite-quartz monzodiorite than granite (Fig. 20).

Nb-Y diagram shows a direct relationship with straight-line between Nb and Y in both types of rocks , but the contents of Nb and Y in granite is lower than the contents of granodiorite-quartz monzodiorite (Fig. 21).

Rb-(Y+Nb) diagram declare a reverse relation between Rb and (Y+Nb) in both types. On the other hand, Rb content in granite is greater than granodiorite-quartz monzodiorite but the (Y+Nb) content in granite is lower than the other (Fig. 22).

Hf-Zr diagram shows a direct relation between Hf and Zr in both granite and granodiorite-quartz monzodiorite with straight-line. On the other hand, Hf and Zr in granite is lower than the other. Zr in granite is lower than in granodiorite-quartz monzodiorite giving criteria for magma mixing (Fig. 23).

Th-U diagram shows a direct relation in granite with no relation in granodiorite-quartz monzodiorite. The values of uranium in granite is lower than that in granodiorite-quartz monzodiorite but the values of thorium in granite is higher than that in granodiorite-quartz monzodiorite (Fig. 24).

Table 2: The average composition of trace elements of Aswan granites compared with the average of El Gaby (1975) and Turekian and Wedepohl (1961) granites

	Study granite	El Gaby (1975)	Turekian and Wedepohl (1961)	
	granite	granodiorite-quartz monzodiorite		
Ba	1059	1169	403	840
Rb	106	76.1	177	170
Sr	181	375	39.6	100
Y	36.6	53.7	41.4	40
Zr	368	514	293	175
Nb	20.5	40.4	15.7	21
Pb	18.7	15.7	-	19
Ga	21.3	24.7	-	-
Zn	62.5	142	-	39

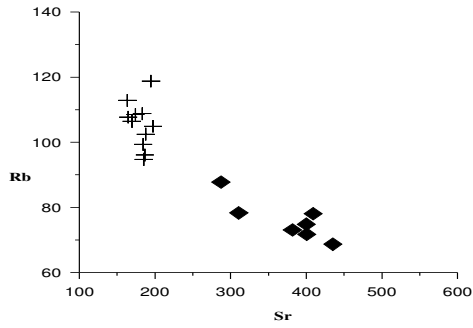


Fig.20: Rb versus Sr relationship in Aswan granite and granodiorite-quartz monzodiorite

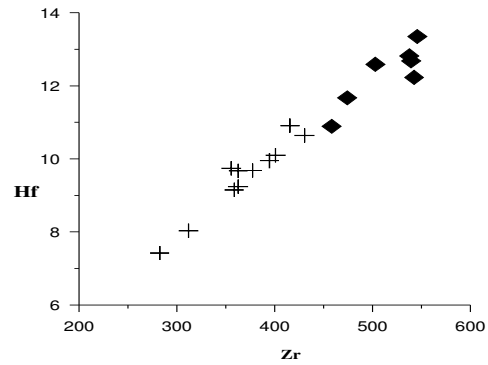


Fig.23: Hf versus Zr relationship in Aswan granite and granodiorite-quartz monzodiorite

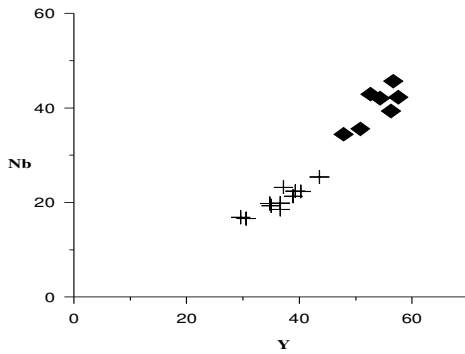


Fig.21: Nb versus Y relationship in Aswan granite and granodiorite-quartz monzodiorite

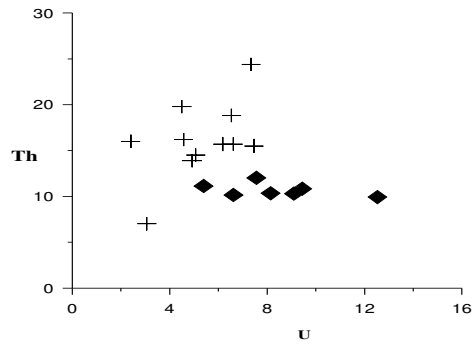


Fig.24: Th versus U relationship in Aswan granite and granodiorite-quartz monzodiorite

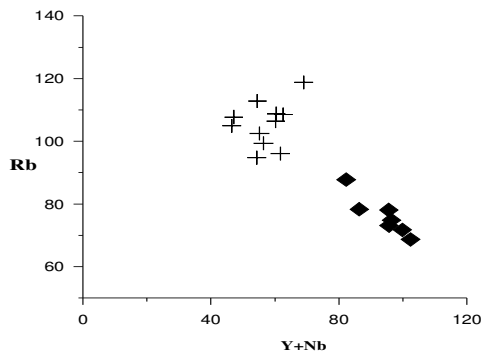


Fig.22: Nb versus Y+Nb relationship in Aswan granite and granodiorite-quartz monzodiorite

(Th/U)-Th diagram shows that the increasing in (Th) content the (Th/U) ratio is also increasing in both type. On the other hand, Th/U ratio in granite is greater than granodiorite-quartz monzodiorite ratio due to the enrichment of uranium in granodiorite-quartz monzodiorite than granite (Fig.25).

From (Th/U)-U diagram, it is declared that the two rock unites show a reverse relation between U and Th/U ratio but this relation is higher in granodiorite-quartz monzodiorite than granite due to the increasing of U in granodiorite-quartz monzodiorite (Fig.26).

Generally, there are some criterias in the

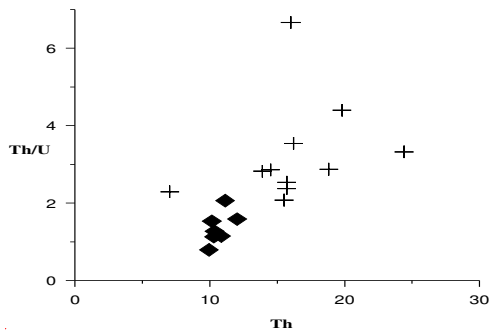


Fig.25: Th/U versus Th relationship in Aswan granite and granodiorite-quartz monzodiorite

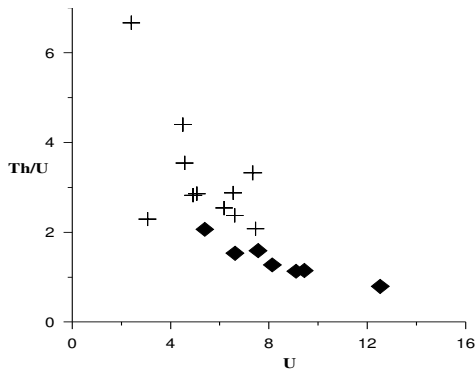


Fig.26: Th/U versus U relationship in Aswan granite and granodiorite-quartz monzodiorite

geochemistry of the trace elements for magma mixing, presence of high content of Ba and Sr in granite, low Zr content in granite but high in granodiorite-quartz monzodiorite, presence of high Zn and Pb in granites and the increasing of uranium in granodiorite-quartz monzodiorite than in granite is an evidenc for magma mixing.

### CONCLUSIONS

Aswan granites are divided into two types, granite and granodiorite-quartz monzodiorite. Some enclaves and ferromagnesian minerals are noticed at the contact between the two types.

Criteria for magma mixing are noticed in petrographical studies such as presence of different types of textures, two generations of quartz which included in hornblende, microclinization of plagioclase, presence of skeletal apatite, presence of secondary titanite in granite due to the presence of high titanium content which derived from granodiorite-quartz monzodiorite and the presence of zircon included in biotite and both of them mantled with hornblende.

There are some criterias in the geochemistry of the trace elements for magma mixing, presence of low contents of Ba and Sr in granite as compared with granodiorite-quartz monzodiorite, low Zr content in granite but high in granodiorite-quartz monzodiorite, presence of high Zn and Pb in granite. The study revealed that, the uranium content in granite is lower than that of granodiorite-quartz monzodiorite and the thorium content in granite is greater than that of granodiorite-quartz monzodiorite which give an indication for the mixing magma. On the other hand, the uranium content in both types are suitable for using this granite as ornamental stones.

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### دراسات بتروجرافية وجيوكيميائية وراڊيومترية على الجرانيت ومصاحبات الجرانودايورايت فى شلالات اسوان-مصر

محمد عبد المنصف زكى

تنقسم الصخور فى شلالات اسوان الى نوعين الاول وهو الصخور الجرانيتية والثانية صخور الجرانودايورايت والكوارتز مونزودايورايت ويتميز النوعان بوجود بعض المكتنفات والمعادن الحديدومغنيسية فيهما وهذه من دلائل اختلاط المigma.

ومن الدلائل البتروجرافية على اختلاط المigma وجود العديد من الانسجة البتروجرافية، وجود جيلين من الكوارتز داخل معدن الهورنبلند، وجود قطع صغيرة من الاباتيت، وجود معدن التيتانيت الثانوى نتيجة زيادة عنصر التيتانيوم فى الجرانيت، وجود معدن الزركون داخل معدن البيوتايت والموجود داخل معدن الهورنبلند.

ومن دراسة جيوكيميائية العناصر الشحيحة وجد العديد من الدلائل على اختلاط المigma منها وجود محتوى منخفض من الباريوم والاسترانشيوم فى الجرانيت بالمقارنة بالجرانودايورايت والكوارتز مونزودايورايت، انخفاض عنصر الزركونيوم فى الجرانيت وارتفاعه فى الجرانودايورايت والكوارتز مونزودايورايت، ارتفاع عنصر الزنك فى الجرانيت عن المعدل الطبيعى، ارتفاع عنصر الرصاص فى الجرانيت عن الجرانودايورايت والكوارتز مونزودايورايت.

ومن دراسة نتائج التحاليل الكيمائية لمحتوى اليورانيوم والثوريوم فى كلا النوعين وجد ان محتوى اليورانيوم فى الجرانيت اقل من الجرانودايورايت بينما محتوى الثوريوم فى الجرانيت اعلى من الجرانودايورايت مما يعطى دلالة على حدوث اختلاط للمigma فيما بينهما. على الجانب الاخر وجد ان محتوى اليورانيوم فى كلا النوعين مناسب لاستخدام هذا الجرانيت كاحجار للزينة.