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GENETIC AFFILIATIONS OF WADI EL- SHERM EL- QIBLI ALKALI FELDSPAR GRANITE INTRUSION AND THE CO-MAGMATIC HYDROTHERMAL ACTIVITY, EASTERN DESERT, EGYPT

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ABSTRACT

Wadi El- Sherm El- Qibli granite outcrops forming the northern - northeastern rims of Wadi El Sherm El Qibli comprise two types; pale whitish pink altered muscovite albite granite (M A granite with alteration zones) and the red alkali feldspar granite (A F granite). The A F granites are intruding with sharp intrusive contact the M A granite, island arc meta-volcano-sedimentary and meta-andesite rocks. The A F granites are coarse- grained, composed of quartz, orthoclase, microcline, and plagioclase arranged in decreasing order with the accessories; zircon, muscovite, sericite and opaques, showing hypidiomorphic, occasionally porphyritic, more common perthitic and pioklitic textures of anorogenic within-plate tectonic setting. The EDAX and ore microscope investigations recorded magnetite, ilmenite, hematite, pyrite, arsenopyrite, galena, rutile, zircon and monazite. Besides these investigations show that hematite- rutile, sericite-muscovite, are alteration products of ilmenite and plagioclase respectively. As well, the substitution of zircon by REEs, U, Hf, and the stannite - celestite are products of alteration processes due to action of oxidizing hydrothermal fluids co-magmatic to the intrusion of the A F granites. The recorded Cr, Ni, Sn, Nb, Ba, Sr, Cu, Zn, Pb geochemical association beside the recorded Au in Khor Abu-Meriewa is an evidence of existence of cordilleran-extensional gold deposit at deeper levels and Nb-U-Th-REEs-Hf mineralization occurs within the alteration zones of M A granite.

Keywords: *alkali feldspar granites, mineralogical survey, mineralization, Wadi El Sherm El Qibli*

INTRODUCTION

The study concerns Wadi El- Sherm El- Qibli alkali feldspar granite exposures facing Gabal El Delihimmi proper at the north – northeastern side of the area (Fig. 1). It is located between Latitudes 25° 46' and 25° 48' N, and Longitudes 34° 18’ and 34° 21' E, central Eastern Desert, Egypt. The biotite granite of Gabal El Delihimmi proper is bordered from the west by the upper reaches of W. El- Sherm El- Bahari, Khor Abu-Harida and Gabal Um-Ghannam granitoids. There, the Pan-African Neoproterozoic dismembered ophiolite, island arc metavolcanic rocks of the Arabian-Nubian Shield are exposed.

Hassaan, *et al*., (2009) mentioned that Khor Abu Meriewa is draining the northern slope of altered M A granite exposure inter-bedded with extended quartz veins bordering W. El-Sherm El-Qibli from the north. Besides, the basement rocks exposed in the upper reaches of W. El-Sherm El-Bahari and W. El-Sherm El-Qibli are dismembered ophiolitic sequence including serpentinite, talc-carbonate, listwaenite (the tectonic mélange of EGSMA Map, 1992), island- arc (meta-volcano-sediments, meta-andesite) intruded by late- to post- orogenic biotite granite of Gebel El- Delihmi; all are intruded by muscovite albite granite with alteration zones._The muscovite albite granite consists essentially of microcline-albite perthites ~60-65 %, quartz ~20-25 %, albite ~10-5 % and muscovite 10~ 5 % and accessory minerals are zircon, rutile, ilmenite and staining of iron oxides(Hassaan, *et al*, 2009). Zaki *et al*, (2011) differentiated the last type (M A granite) into low-pressure rare metal granite and alkali feldspar granite. The area is structurally dissected by a system of faults trending NW, NNW, and NE.

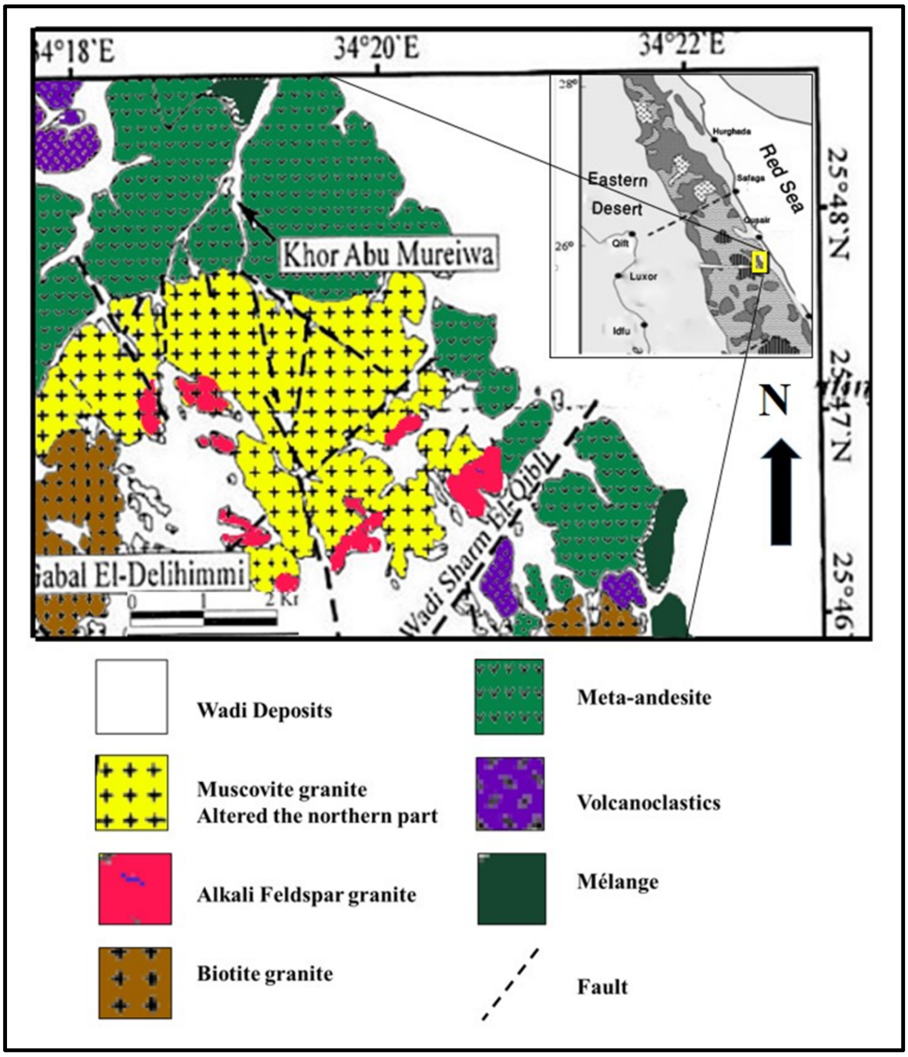


Fig. 1: Geologic map of the study area (After Mabrouk, 2011).

Hassaan *et al*., (op. cite) recorded in the altered muscovite albite granite high contents of Cr, Sr, Rb, Ba, Mo (8 - 1 ppm), Zn (1902 - 40 ppm), Pb (43- 9 ppm), Sb (1 ppm), Ga. Besides, Zaki et al, (op. cit.) added Ni, U, Nb, Th. They also recorded in the altered muscovite albite granite at Khor Abu Meriewa gold (0.45-0.06 ppm) which exhibits similar distribution with antimony, the element of lower temperature. Besides, both elements are also recorded in Homret Ghannam granites and Khor Abu-Harida meta-volcano-sedimentary rocks, the first is related to old gold mine existing there. In this respect, the sulphide-gold mineralization in the Eastern Desert is grouped based on the plate tectonic concept by Hassaan and El-Mezayen (1995) into ophiolitic, island arc, and cordilleran- extensional groups having various genetic affiliation. Each group is distinguished by its ore mineral assemblage and geochemical association (Hassaan, 2011).

The Bed rock survey for mineral deposits undertaken by Hassaan *et al*., (2009) at Khor Abu Meriwa using verified Landsat ETM+ ratio images (5/7,5/1,4 in R,G,B) discriminated muscovite albite granite exposure interbedded with laterally extended quartz veins, its upper part is subjected to intensive alteration processes producing alteration zones. The recorded sulphide- gold mineralization by Hassaan *et al*., (op .cite) in the northern side of the altered muscovite albite granite exposure where Khor Abu Meriewa is draining northeastward recommended undertaking detailed studies on the southern side of this exposure. In this respect, Zaki *et al*, (2011) recorded alkali feldspar granite outcrops intruding the rare metal M A granite.

Genetic affiliations of Wadi El- Sherm El- Qibli alkali feldspar granite

The present study aims at undertaking geologic setting, petrographical, mineralogical and geochemical studies on the alkali feldspar granite and its co-magmatic hydrothermal activity in relation to the alteration and mineralization of the M A granite to reveal the genetic affiliations to achieve whether A F granite are bearing such similar sulphide-gold mineralization .

METHODOLOGIES

Field work, sampling, petrographic, mineralogical and geochemical studies were undertaken. A total of fifteen bed rock samples were collected from the A F granite (13) beside M A granite (2) bordering the northern tributary of W. El Sherm El Qibli. Petrographic thin-sections of five samples were microscopically studied. As well, a total of seven polished surfaces were also prepared for studying the opaque minerals using the ore microscope and SEM-EDAX microanalysis. Microphotographing of these polished surfaces was conducted using Philips XL30 scanning electron microscope with energy dispersive X-ray attachment working at 30 kV acceleration voltage. Ten representative samples of the A F granite beside M A granite were analyzed for geochemical characterization using XRF technique for major oxides in Metallurgical Development Research Center (MDRC) Laboratory and for trace elements in Central Laboratories of Nuclear Materials Authority (NMA) of Egypt using X-ray fluorescence (XRF) techniques using (Philips X-Unique) II spectrometer (PW-1510) with automatic sample charger.

GEOLOGIC SETTING

Gabal El Delihimmi plutons are trending NW parallel to the regional structures of the Red Sea (Fig.1). Mabrouk (2011) classified the granitoid rocks of Gabal El Delihimmi and of Wadi El- Sherm El-Qibli into; biotite, muscovite and potash feldspar granites which are intruding the ophiolitic and island arc country rocks with sharp contacts. These oval shaped granitoid outcrops are structurally dissected by a system of faults trending NW, NNW, and NE represented by western, northern, northeastern and southern tributaries of W. El Sherm El Qibli. W. El Sherm El Qibli A F granite outcrops occupying the north-northeastern side of the area are intruding the altered M A granite outcrops and the meta-andesite. The pluton exhibits low to moderate hilly terrain, intruded with sharp contact into the meta-andesite rocks at its NE and NW parts of the area (Fig.1).The studied site of the granite exposure bordering W. El Sherm El Qibli from the north comprise two types; the altered muscovite albite granite (with alteration zones) occupying the upper part of the exposure intruded with sharp intrusive contact by the alkali feldspar granite exposures of small size exposed as low altitude (about 36 m) hills (Fig. 2, 3).

The studied granites are fractured and jointed with parallel joints trending NNW that reflect the fault trend present in the area. Quartz veinlets crosscutting the alkali feldspar granite are common (Fig. 4)

Fig .2: Panorama showing W. El Sherm El Qibli granites, looking west.

Fig. 3: The red (A F Granite) and muscovite albite granites (M A Granite) sharp contact G.l El Delihimmi, looking west.

The alkali feldspar granite is distinguished by its red color compared to the pale whitish pink color of the muscovite albite granite and its alteration zones. The alkali feldspar granite is also recorded into the deep fractures cutting the metavolcano-sedimentary rocks forming the western side of Khor abu Meriewa, which points to this granite type is intruded into not only the altered muscovite albite granite but also the older rocks associated with the co-magmatic hydrothermal alterations.

Fig.4: Small Quartz veinlets cutting across Gabal El Delihimmi.

PETROGRAPHY

In the present work only the alkali feldspar granites and its co-magmatic hydrothermal effects (alterations and mineralizations) are studied since the mineralogical and textural features of the M A granite are studied in detail by Sakr (2006) and summarized in Hassaan *et., al* (2009) as follows : ~60-65 % microcline-albite perthites , ~20-25 %, ~10-5 % quartz albite and 10~ 5 % muscovite and the accessory minerals ; zircon, rutile, ilmenite and stainings of iron oxides. Texturally, microcline and microcline perthite show subordinate poiklitic texture, (presence of fine-grained quartz and biotite (occasionally chloritized and muscovitized) completely enclosed in their surface.

The alkali feldspar granites are petrographically composed of, quartz, orthoclase, microcline, and albite arranged in decreasing order, the modal analysis of which is shown in table 1 and fig. 5. The samples are plot in the alkali feldspar granite, except one sample is syeonogranite.The accessory minerals are, zircon, opaque minerals (magnetite and ilmenite) and alteration minerals (muscovite, sericite, hematite, rutile and iron oxide staining).

Texturally, this granite is coarse-grained, showing hypidiomorphic (subhedral granular) texture (Fig. 6.a) occasionally porphyritic, perthitic is more common in some samples (Fig. 6b) and poiklitic in others. This granite is also subjected to slight sericitization, muscovitization, albitization and oxidation alteration processes by the comagmatic residual hydrothermal fluids.

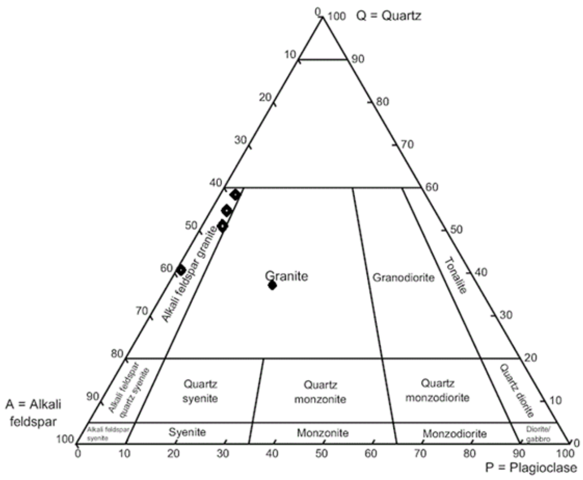


Fig. 5: The modal analysis of the studied granites on the ternary diagram of Streckeisen (1976).

Table.1: The modal analysis of the studied granites

S. No	Quartz	K-Feldspar	Plagioclase	Muscovite	Biotite	Iron Oxides	Zircon	Opaque Minerals	Sericite
1 G	35.13	59.30	0.41	0.19	-	4.74	0.22	-	-
4 G	51.70	39.52	4.28	0.94	-	3.52	0.03	0.02	-
8 G	50.14	44.19	5.32	0.14	0.08	-	-	0.13	-
9 G	37.23	41.18	21.03	0.31	0.03	0.07	0.02	-	0.13
14 G	59.59	34.78	3.47	0.62	-	1.37	0.17	-	-

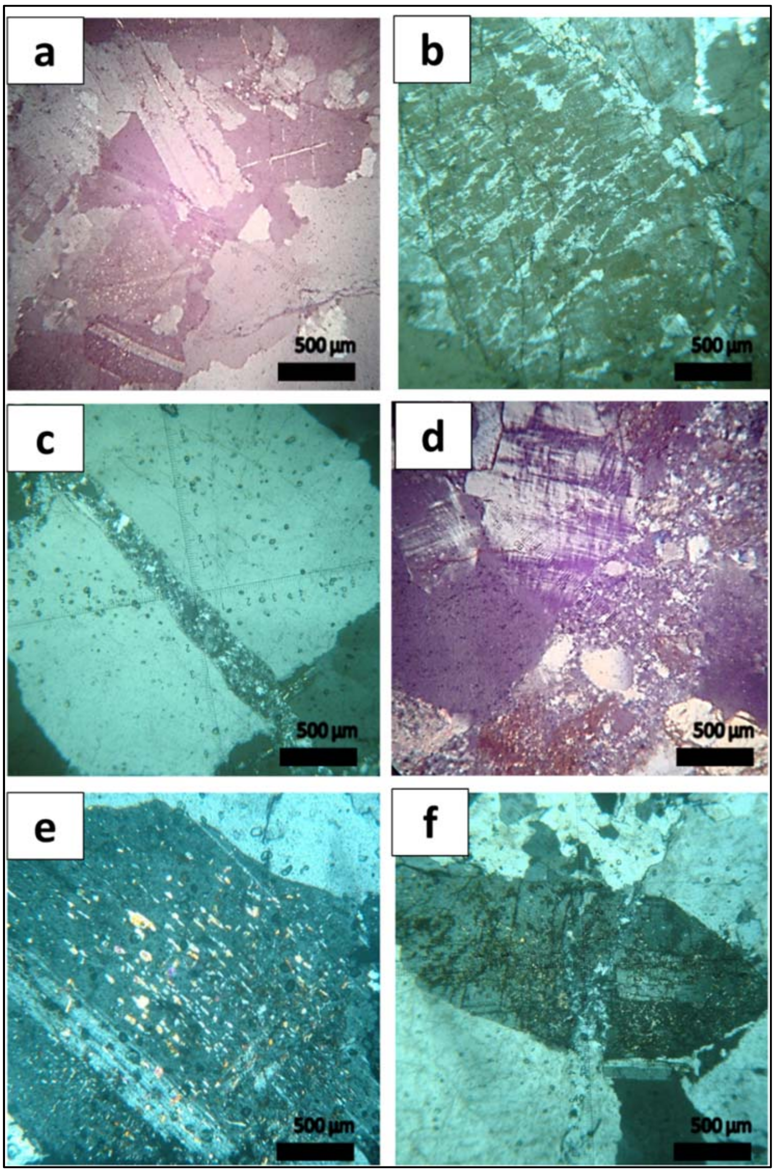


Fig. 6: Photomicrograph showing the textures and the mineral composition of the studied granite. a) hypidiomorphic texture of main minerals. b) perthitic texture, c) fracture in quartz crystal due to deformation, d) microcline with a well-developed cross hatching, e) sericite alteration in plagioclase, f)altered, deformed plagioclase crystal.

Quartz occurs as colorless medium- to coarse-grained. Subhedral to anhedral crystals occasionally present. Some quartz crystals are fractured reflecting action of deformation processes (Fig. 6c). The quartz exhibits more frequent undulose extinction. Also, secondary quartz veinlets are also present.

Table 2: Alteration effects of granite

Process	Primary minerals	Chemical changes	Addition minerals
Albitization	K-Feldspar Ca- Plagiclase	+ Na_2O -K_2O	Albite
Muscovitization	K-Feldspar Plagiclase biotite	-K_2O	Muscovite
sericitization	K-Feldspar Plagiclase	+K_2O CaO	Sericite

The Potash-Feldspars are microcline and orthoclase. Microcline is much more common exhibiting a well- developed cross-hatching (Figs. 6d). Texturally the mineral was originally crystallized at higher temperatures, with monoclinic symmetry and subsequently inverted to the triclinic polymorph (Phillips and Griffen1981). Subhedral to anhedral orthoclase crystals characterized by simple twinning are recorded.**Plagioclase** occurs as euhedral to subhedral prismatic twinned crystals, in many cases, are displaced, cracked and deformed implying higher deformational features. Sericite representing an alteration product is common (Fig.6e). Some plagioclase crystals do not show lamellar twining due to deformation (Fig. 6f). Plagioclase occurs within feldspar grains forming poiklitic texture.

The accessory minerals include muscovite, zircon, rutile, and the opaque minerals (almost hematite, magnetite, ilmenite). Muscovite is present in small amount characterized by high interference color (Fig. 7a). Sericite is recorded as alteration product of plagioclase. Zircon is characterized by high interference colors with a high relief (Fig. 7b). Stainings of iron oxide as well as subhedral crystals of opaque minerals are also observed (Fig. 7c, 7d).

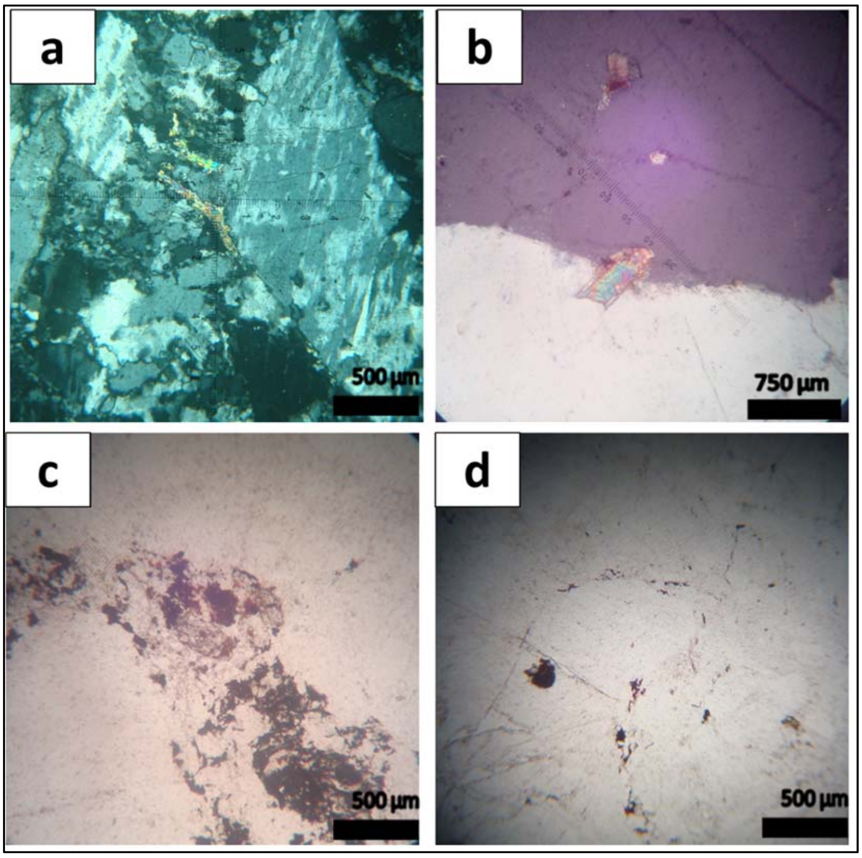


Fig.7: Photomicrograph showing the accessory minerals in granite. a) muscovite with high interference colors , b) zircon showing high interference color, c)stainings iron oxides, d) opaque minerals.

The A F granite is affected by the alteration processes oxidation, muscovitization and sericitization. The reaction of ionized hydrothermal fluids with plagioclase forms sericitic muscovite and albite (Que and Allen, 1996) Muscovite could be resulted after plagioclase. Seritization is also recorded as alteration product of K-feldspar; microcline, (from Pirajno, 2009). Base exchanges resulted by action of the hydrothermal fluids converted microcline follwing to albite, where Na^+ replaces K^+. Large et al., (2001).

$$\underset{\text{Albite}}{3NaAl_3Si_3O_8} + K^+ + 2H^+ = \underset{\text{Sericite}}{KAl_3Si_3(OH)_2} + \underset{\text{Quartz}}{6SiO_2} + 3Na^+$$

ORE MINERALOGY

Ore Microscopic Investigation

The most ore minerals in A F granite are pyrite and magnetite with minor amounts of arsenopyrite. Magnetite occurs as a subhedral octahedron crystal, while pyrite is subhedral hexahedron crystals occasionally characterized by yellowish color. Subhedral prismatic arsenopyrite crystals are overlapping pyrite (Figs. 8 & 9).

Ilmenite: $FeTiO_3$

It occurs as small amounts characterized by subhedral to euhedral crystals filling vugs. The main elements are Fe (43.53%) and Ti (11.85%), small amounts of Mn, K, Na and Ca (Fig. 10).

Hematite and Rutile

Hematite occurs as large crystals (Fe 87.61%, Fig.11a) and Ti (2.21 %). associated mainly with rutile (Ti 84.61%, Fe 6.42 %, Fig.11b). Other euhedral hematite crystals (Fe 66.39%, Fig. 11c) and little amount of Ti (2.21%) occur beside rutile (Ti 70.24 %, Fe 2.25%, Fig. 11d). Rutile associated with hematite is characterized by euhedral hexagonal crystals of dark color.

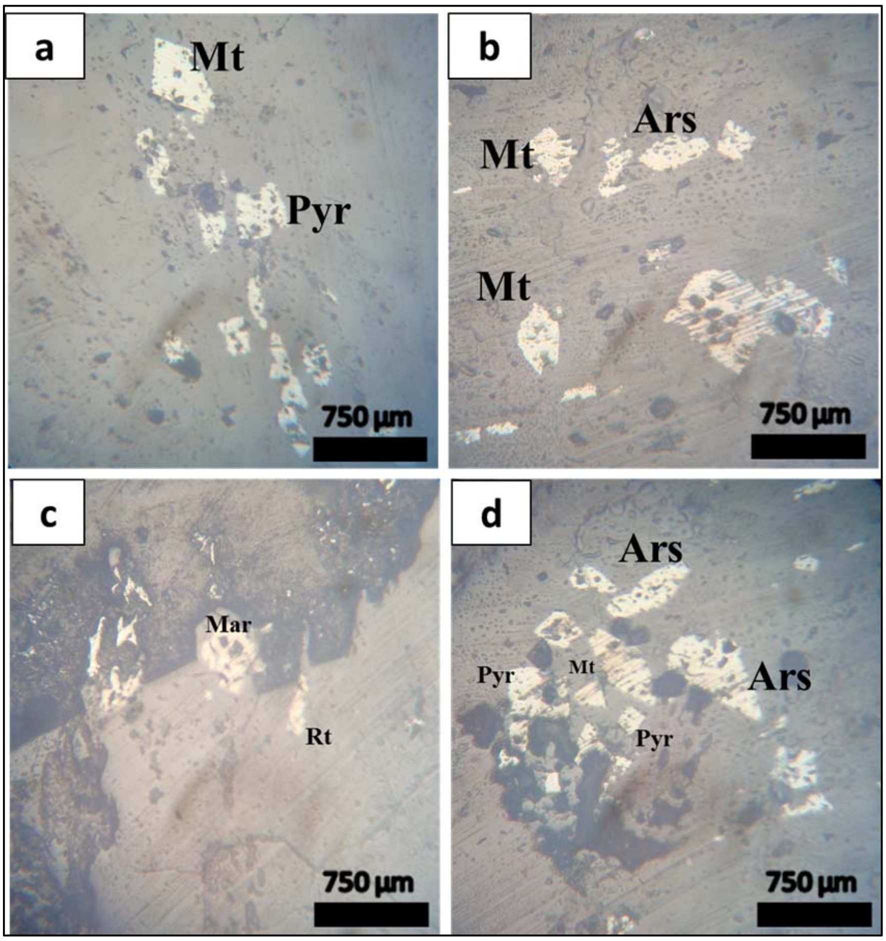


Fig. 8: Photograph the recorded ore minerals recorded in the A F granite: a) magnetite (Mt)trails and pyrite (Pyr), b) magnetite (Mt) with arsenopyrite (Ars) , c) martite (Mar) after magnetite with rutile (Rt) (recorded by EDAX), d) magnetite, pyrite , and arsenopyrite minerals.

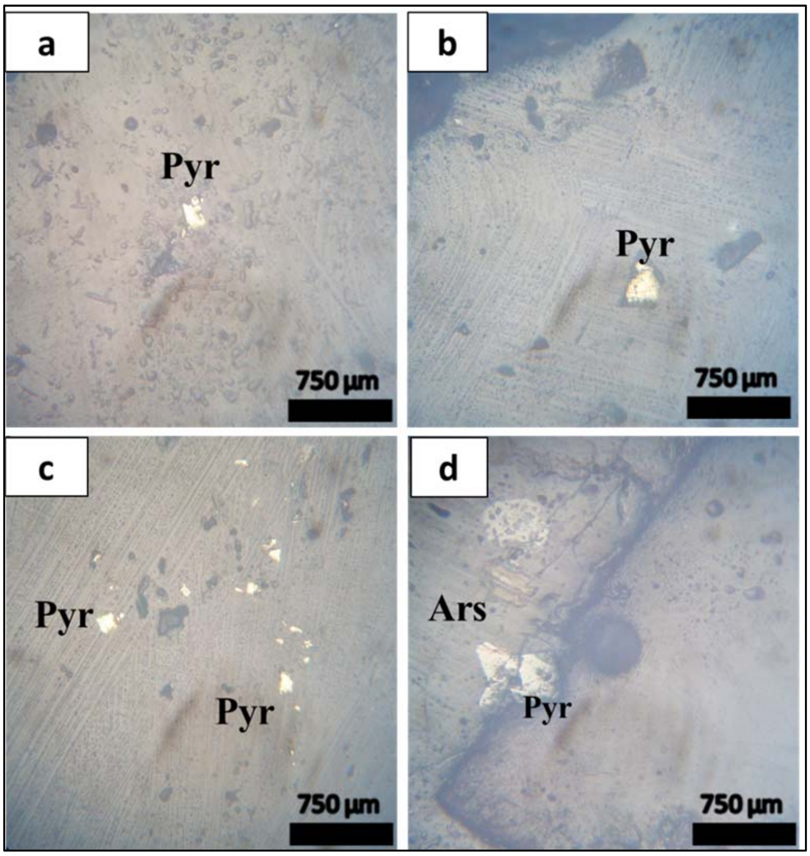
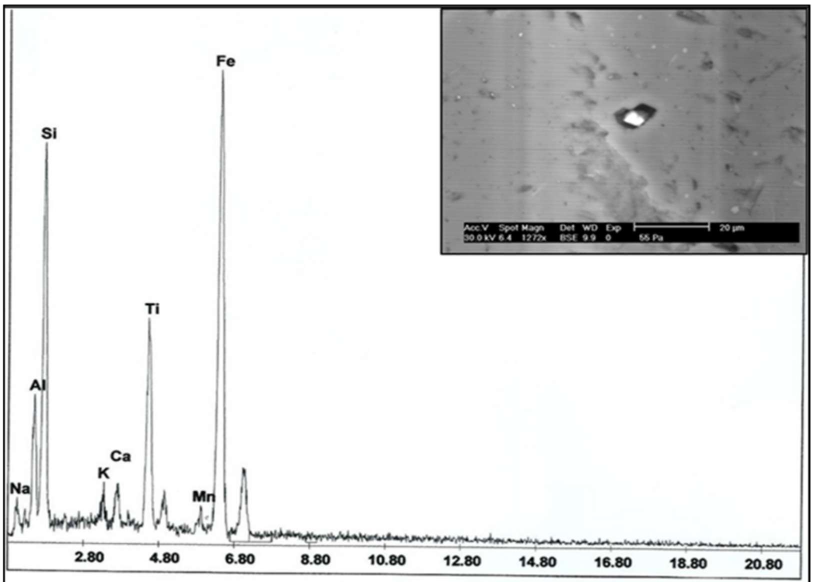


Fig. 9: Photograph showing the pyrite (Pyr) and arsenopyrite (Ars) in the A F granite: a,b,c) pyrite, d) arsenopyrite with pyrite.



Element	Wt %	At %	K-Ratio	Z	A	F
NaK	4.60	7.69	0.0075	1.0335	0.1567	1.0029
AlK	9.04	12.86	0.0276	1.0303	0.2936	1.0082
SiK	26.15	35.76	0.0962	1.0612	0.3459	1.0022
K K	1.31	1.29	0.0098	1.0189	0.7145	1.0271
CaK	1.97	1.89	0.0167	1.0422	0.7805	1.0383
TiK	11.85	9.50	0.1044	0.9533	0.8774	1.0531
MnK	1.54	1.08	0.0133	0.9384	0.9198	1.0000
FeK	43.53	29.93	0.3932	0.9579	0.9429	1.0000
Total	100.00	100.00				

Fig.10: EDAX, BSE images and the chemical composition of ilmenite.

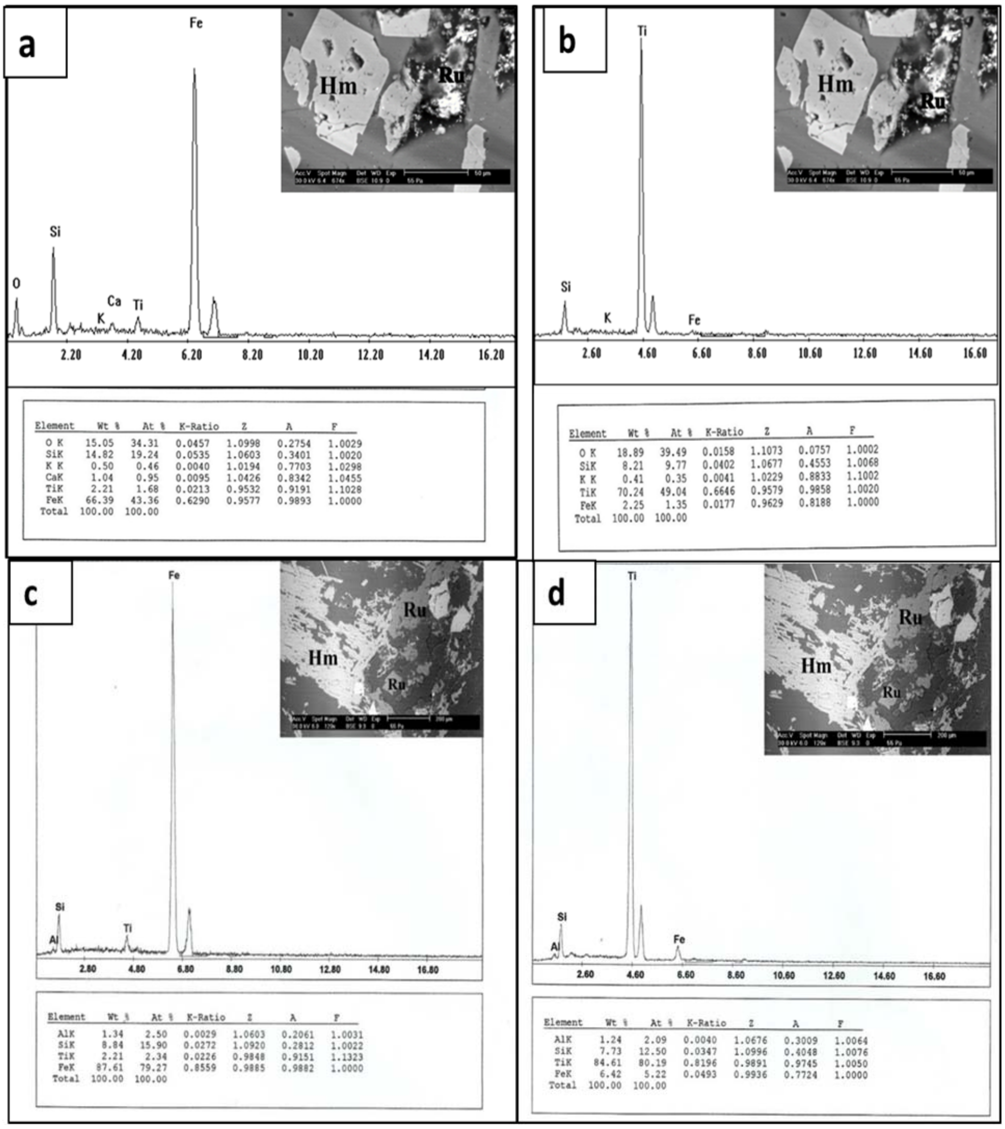


Fig.11: EDAX, BSE images and the chemical composition of hematite and rutile.

Pyrite and Galena

Euhedral octahedron pyrite crystal is composed mainly of S 47 % and Fe 46 % (Fig.12a).Other minute pyrite grains composed mainly of Fe and S are recorded (Fig.12b).Small amounts of galena (Pb 41 %, Fig. 12c) is very common associating pyrite with presence of K(16.39%) and in small amount Na(2.05%, Fig.12c).

Zircon

In the studied alkali-feldspar granites, zircon occurs as euhedral prismatic strongly metamict crystals consisting essentially of Zr (61%), Si (26%) ,(Fe 6.44 %)and Hf (3.44%). Both Al and Ca are also present in minor amount (Fig. 14a). In this figure three zircon crystals are observed partially overlapping each other reflecting sequential crystallization, the edges of two of which are substituted with rare earth elements, the concentration of which increases with crystallization related to increase of the REEs concentration in the hydrothermal fluids with separation of the silicate minerals. The most substituting elements are Nd-La-Ce- Pr and Sm (1.97%, Fig.14b). Other zircon crystals are substituted with K, Y, Er , Yb, Na, Ca, Fe and Hf. occur in minor amounts (Fig. 14c). Since zircon is one of the important radioactive bearing accessory minerals in the alkali feldspar granite, the early formation of zircon would lead to the enrichment of REEs as well as U, and Hf in the residual hydrothermal fluids forming zonation in zircon crystals due to fluctuation of their concentration during the course of crystallization (Pagel, 1982).

Monazite (Ce, La, Nd, Th) PO_4

Monazite is recorded as small anhedral crystals filling the fissures with high concentration of Th (18.99 %, Fig.15a). The ESEM analysis of monazite revealed presence of considerable amount of Si, La, Ce, Nd, Sm, Pr, Gd, Al, Ca, U,Ti and Cr.

Celestite: $SrSO_4$

Celestite occurs as small crystals filling the vugs. It is composed mainly of Sr (60 %) and S (22.6 %) with presence of K and Ca (Fig. 15b).

Stannite: Cu_2FeSnS_4

It is composed of Cu (47.71 %), (Fe 21.95 %) and (Sn 8.56 %) as the main elements, with presence of S, Cr and Ca (Fig. 15c). The minor amount of S reflects its oxidation, liberation and combination with Sr forming celestite.

Elements in Colloidal Concentrations

There is LREEs enrichment due to the hydrothermal action. Two forms of LREE are recorded. The first recorded elements with high concentration are Nb(20.91 %),Y(15.63 %),Th (4.81%),(Th- 3.7 %), U(12.38 %) and Ti(17.83 %). Other elements Like Fe and K are also present (Fig.16a). The second element of colloidal form is Th present with high concentration (28.51 %). Other elements are occurring in a small amounts (U, La, Ce, Nd, Sm, Pr, Gd, Al, Ca, and Cr, Fig.16b).The observed amount of chromium filling micro-fractures may be due to its leaching from mafic country rocks by the residual hydrothermal fluids (Fig.16c).

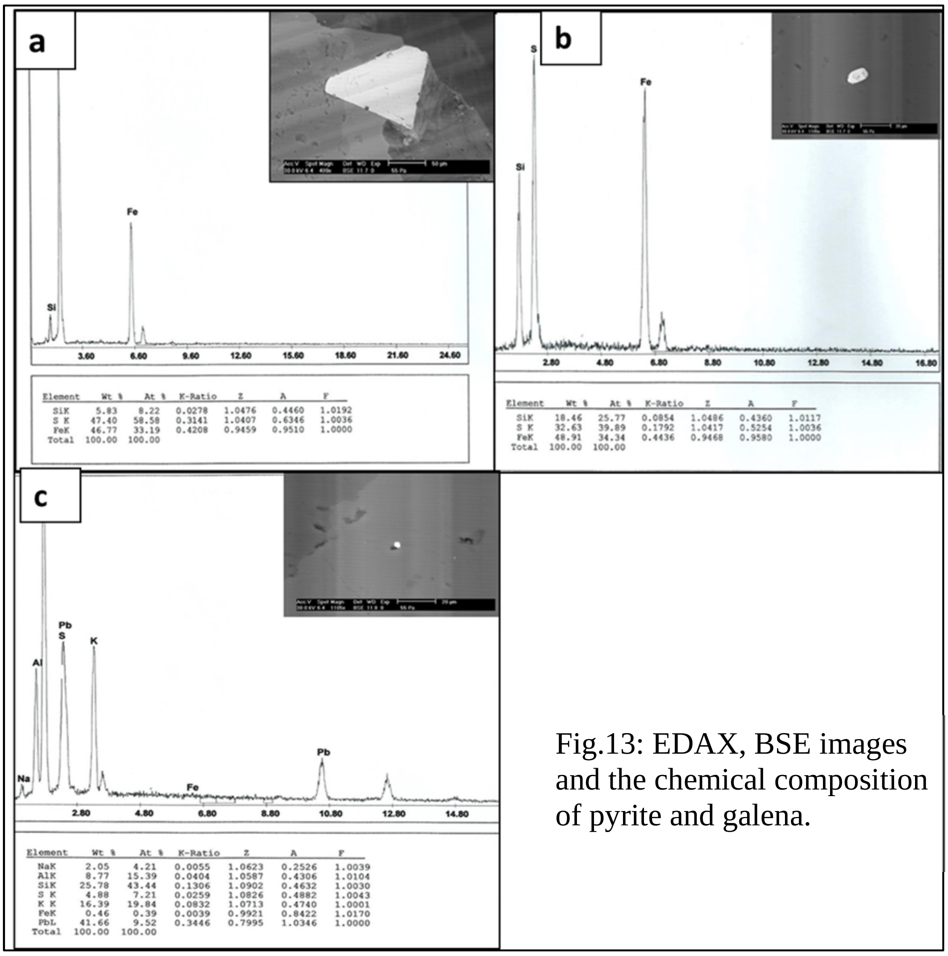
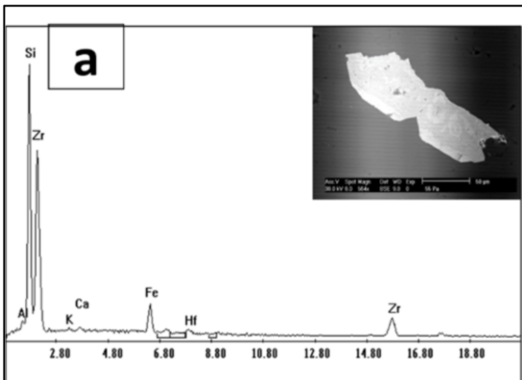
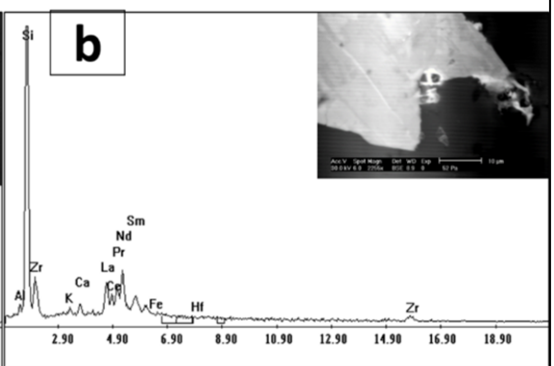


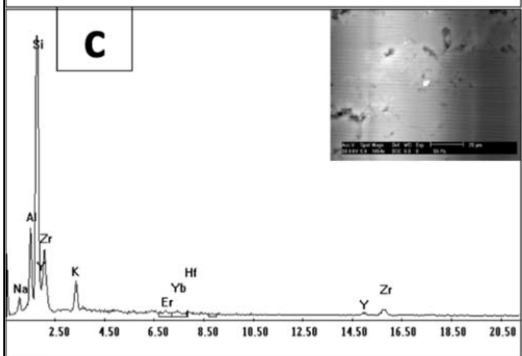
Fig.13: EDAX, BSE images and the chemical composition of pyrite and galena.



Element	Wt %	At %	K-Ratio	Z	A	F
AlK	1.11	2.26	0.0057	1.0817	0.4651	1.0218
SiK	26.42	51.54	0.1603	1.1140	0.5340	1.0198
K K	0.65	0.91	0.0031	1.0865	0.4397	1.0021
CaK	0.79	1.07	0.0046	1.1105	0.5252	1.0024
FeK	6.44	6.32	0.0577	1.0120	0.8818	1.0042
HfL	3.04	0.93	0.0266	0.8493	1.0278	1.0000
ZrK	61.55	36.97	0.5687	0.9248	0.9992	1.0000
Total	100.00	100.00				



Element	Wt %	At %	K-Ratio	Z	A	F
AlK	1.28	2.07	0.0043	1.0481	0.3176	1.0167
SiK	51.23	79.49	0.2127	1.0794	0.3832	1.0039
K K	0.83	0.93	0.0048	1.0498	0.5386	1.0131
CaK	1.04	1.13	0.0071	1.0730	0.6229	1.0189
LaL	9.39	2.95	0.0754	0.8454	0.9474	1.0023
CeL	5.84	1.82	0.0484	0.8540	0.9686	1.0009
PrL	3.73	1.15	0.0318	0.8648	0.9873	1.0009
NdL	10.41	3.14	0.0899	0.8598	1.0034	1.0011
SmL	1.97	0.57	0.0167	0.8525	0.9975	1.0008
FeK	0.52	0.41	0.0043	0.9791	0.8334	1.0010
HfL	0.95	0.23	0.0076	0.8214	0.9806	1.0000
ZrK	12.81	6.12	0.1138	0.8935	0.9943	1.0000
Total	100.00	100.00				



Element	Wt %	At %	K-Ratio	Z	A	F
NaK	3.26	5.34	0.0122	1.0310	0.3596	1.0085
AlK	7.56	10.55	0.0456	1.0277	0.5720	1.0261
SiK	48.63	65.19	0.2827	1.0585	0.5445	1.0087
K K	5.30	5.10	0.0272	1.0204	0.5022	1.0005
ErL	1.20	0.27	0.0103	0.8148	1.0497	1.0000
YbL	1.67	0.36	0.0143	0.8069	1.0572	1.0000
HfL	1.26	0.27	0.0107	0.8003	1.0617	1.0000
Y K	7.78	3.29	0.0676	0.8667	1.0021	1.0000
ZrK	23.33	9.63	0.2017	0.8619	1.0028	1.0000
Total	100.00	100.00				

Fig.14: EDAX, BSE images and the chemical composition of zircon.

Geochemical characterization

The chemical analysis of the investigated granites were carried out in order to determine the magma type, tectonic setting and the geochemical behavior of trace elements, which provide additional contribution to the magmatic evolution of the studied A F granite. The results of chemical analysis are given in (Table 3).

The trace elements distribution exhibits the following characteristics: 1-The muscovite albite granite samples no. (Gkh , 10 G) and the AF granite samples no.(1G, 6G, 14G, 15G) show high Y and Nb, while sample no.3G shows only high Y(Table 2).

The major oxides concentration indicates high SiO_2 content averaging 76.42% and K/Na ratio more than one. The binary diagram of Zr VS 1000 Ga/Al of Whalen *et. al.*, (1987) (Fig.17c) indicates that the analyzed samples belong to A- anoroginic granite (crust or arc sources). The discrimination of the tectonic environment of A-type granites performed using Eby geochemical discriminated diagrams (1992) of Rb/Nb VS Y/Nb (Fig.20d) shows that the samples plot in the field of A2 anorogenic granites related to within plate granite(Fig.17d). On Pearce *et. al.*, diagrams (1984) between Y VS Nb and Rb VS Nb + Y, the samples plot in the within plate field except the muscovite albite granite sample no. 10G which plot in the syn-collision field. (Figs.17e, 17f).

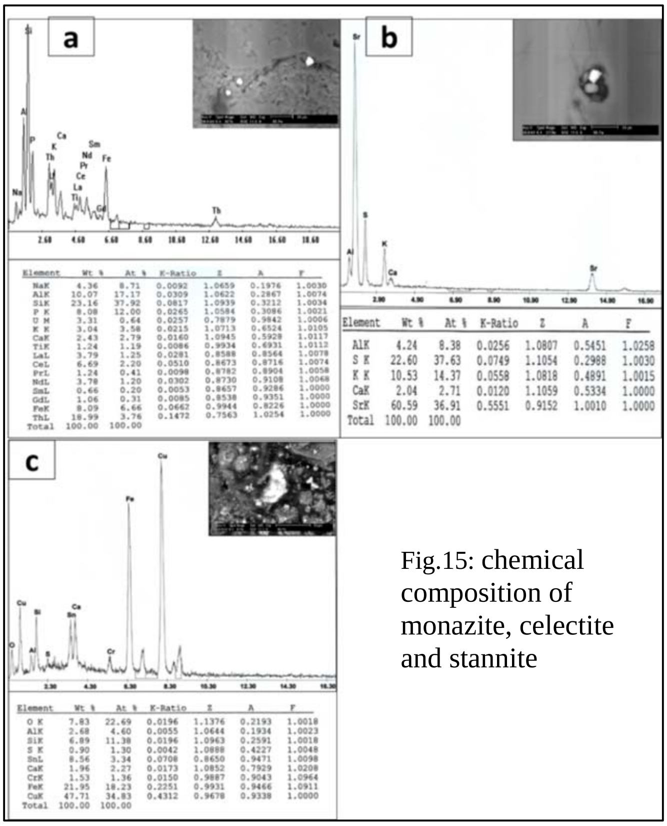


Fig.15: chemical composition of monazite, celectite and stannite

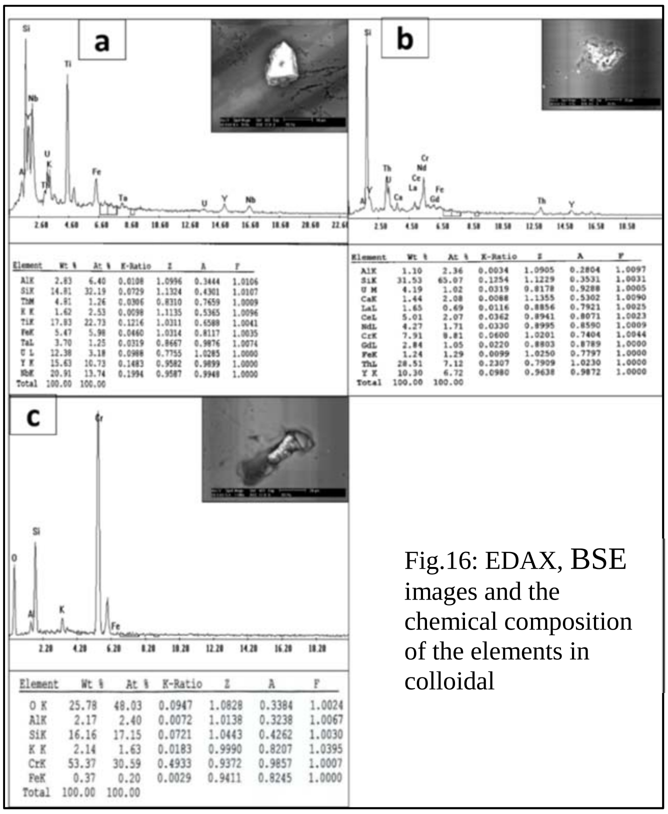


Fig.16: EDAX, BSE images and the chemical composition of the elements in colloidal

Genetic affiliations of Wadi El- Sherm El- Qibli alkali feldspar granite

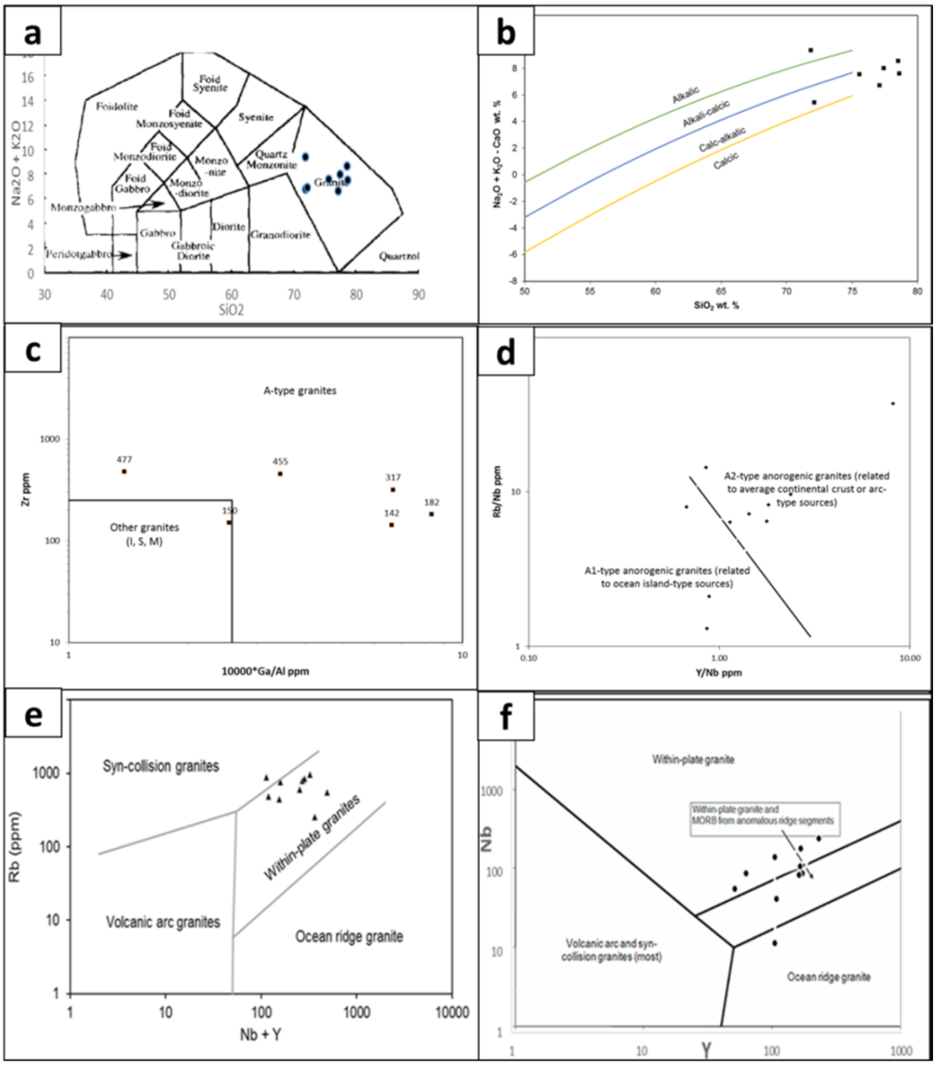


Fig. 17: Classification, magma type and tectonic setting for the studied granite.

Genetic affiliation and Discussion

The studied granites bordering W. El Sherm El Qibli from the north comprise two types; the altered muscovite albite granite (with alteration zones) occupies the upper part of the exposure is intruded with sharp intrusive contact by the alkali feldspar granite exposures of small size exposed as low hills (Fig. 2). The alkali feldspar granite is distinguished by its red color compared to the pale whitish pink color of the muscovite albite granite and its alteration zones. The alkali feldspar granite is also recorded into the deep fractures cutting the metavolcano-sedimentary rocks forming the western side of khor abu Meriwa (Hassaan personal observation)point to that this granite intruded not only the muscovite granite but also the older rock types supported by co-magmatic hydrothermal alterations of ilmenite to hematite and rutile. and plagioclase to sericite, followed by sulfide mineral constituents (pyrite , chalcopyrite, arsenopyrite, galena) then substitution zircon by REEs,Y, U, Hf. This discrimination is supported by the following observations:-

1- Hematite large crystals (Fe 87.61%, Ti 2.21%. Fig.11a) are associated mainly with rutile (Ti 84.61%, Fe 6.42 %, Fig.11b). Other euhedral hematite crystals (Fe 66.39%, Ti 2.21%, Fig.11c) occur beside rutile (Ti 70.24 %, Fe 2.25%, Fig.11d). In this respect, Sabet (1961) related the red coloration to hydrothermal effect during or post intrusion .Consequently, the red color of muscovite granite (Mabrouk, 2011) is related to the intrusion of the red alkali feldspar granite associated with hydrothermal fluids into the older rocks causing reducing of ilmenite to hematite and rutile.

2 - The three partially overlapping zircon crystals point to sequential crystallization, the overlapping edges of two of which are substituted with rare earth elements with variable concentration reflecting increase of degree of REEs substitution with the subsequent crystallization of zircon. The most substituted elements are Nd-La-Ce-Pr and Sm (Fig.14b). Other zircon crystals are substituted with K, Y, Er, Yb, Na and Hf with minor amounts of K, Ca, Fe (Fig.14c). This subsequent crystallization of zircon (following Pagel, 1982) led to the gradual increase of concentration and enrichment of REE, U, and Hf in the residual hydrothermal fluids during the course of crystallization.

CONCLUSIONS

1- The muscovite granite in the area is intruded with sharp intrusive contact by alkali feldspar granite associated with co-magmatic hydrothermal activity causing the formation of the altered muscovite albite granite and quartz veins bearing mineralization.

2- The quartz, orthoclase, microcline, and plagioclse arranged in decreasing order are the chief constituents of the alkali feldspar granite with muscovite, zircon, sericite, iron oxides, and opaque minerals as accessories. Texturally, these minerals are coarse-grained, showing hypidiomorphic texture occasionally porphyritic and either perthitic or poiklitic textures are occasionally more common. This alkali feldspar granite is subjected to sericitization, muscovitization, and albitization by the action of its residual hydrothermal fluids.

3- Magnetite, arsenopyrite, martite, ilmenite, hematite, rutile, pyrite, galena, monazite, celestite and stannite are recorded in the alkali feldspar granite outcrops exposed at the northeastern part of W.El - Sherm El- Qibli.

4- The crystallization of silicate minerals and deposition of ore mineral constituents led to increase of $REEs_s$ in the residual hydrothermal fluids substituting some silicate minerals particularly zircon. This is indicated by increase of degree of REEs substitution in the overlapping zircon crystal.

5- The recorded Sn, Nb, Ba, Sr, Cr, Cu, Zn, Pb as well as Nb-U-Th-REEs-Hf similar to the geochemical association of Homret Ghannam and Khor Abu-Meriwa in which gold is recorded, could be considered evidence of probable existence of gold mineralization at deeper levels of the studied alkali feldspar granite recommending further investigations.

6- As well, the recorded REEs and U in the alteration zones of the altered muscovite granite recommended for detailed exploration.

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علاقات في نشأة متداخلة جرانيت وادي الشرم القبلي الفلسباري القلي والنشاط الحرمائي الصهيري المصاحب ، الصحراء الشرقية ، مصر

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الخلاصة

تمثل مكاشف متداخلة جرانيت وادي الشرم القبلي الفلسباري القلي حواف الوادي الشمالية والشمالية الشرقية حيث تتداخل في جرانيت البيت مسكوفيت متغاير والانديزايت المتحول وصخور رسوبية بركانية متحولة بحدود تداخل فاصلة . وجرانيت الفلسبار القلي خشن الحبيبات يتكون من الكوارتز والاورثوكليز والميكروكلين والبلاجيوكليز كمعادن أساسية ، ومعادن اضافية : الزيركون و المسكوفيت والسيروسيت ومعادن معتمة . ويعتبر النسيج متساوي الحبيبات ذو الاوجه الناقصة هو الشائع، واحيانا تتواجد انسجة البورفيري والبرثيتي والبوكليتي، وذات وضع تكتوني لاتجبلي ضمن اللوح. وسجل استخدام (EDAX) ومجهر معادن الخام المعادن تجمع معادن من الماجنيتبت ، الالمنيت ، الهيماتيت ،بيريت ، الارزينو بيريت ، ، جالينا ، روتيل ، زيركون ، مونازيت ، وسجلت هذه الدراسات تغاير لالمنيت الى هيماتيت – روتيل و البلاجيوكليز الي سيروسيت – مسكوفيت ، واحلال الزيركون ب REEs , U , Hf وايضا الاستانيت – السيلستيت كنواتج تغاير اكسدة البلاجيوكليز والبيريت نتيجة نشاط بمحاليل حرمائية مؤكسدة صاحبت متداخلة جرانيت الفلسبار القلي. وسجلت الدرسة تواجد مصاحبة جيوكيميائية من: Cr, Ni, Sn, Nb, Ba, Sr, Cu, Zn, Pb بالاضافة الي الذهب السابق تسجيله بجرانيت البيت مسكوفيت متغاير بخور ابو ميروية ، مما يمكن اعتباره دليلا علي احتمالية تواجد راسب ذهب بمستويات أعمق بالجرانيت تحت الدراسة ، وتواجدت معادن Hf – U– Nb – REEs بنطاقات التغاير الجرانيت الالبيتي المسكوفيتي.