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MINERALOGY AND TRACE ELEMENTS GEOCHEMISTRY OF PEGMATITE BODY AT THE NORTHERN PERIPHERY OF GABAL RAS BAROUD, CENTRAL EASTERN DESERT, EGYPT

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ABSTRACT

Ras Baroud area has several rock units arranged from the oldest to the youngest as: older granites, younger granites, pegmatites, dykes and quartz veins. Younger granite of Ras Baroud is exposed as small semirounded isolated mass, which is medium to coarse grained and pink to reddish pink in color. This granite is dissected with several types of dykes ranging from basic to acidic ones. Pegmatite body is encountered at the peripheral parts of this granite. It is compositionally zoned, being composed of massive milky quartz in the core and pink color blocky K-feldspars with subordinate nest like aggregates of yellowish white mica the outer rim.

Ras Baroud granite is composed mainly of K-feldspars, plagioclase quartz and micas (biotite and muscovite) associated with zircon, titanite, and opaque as accessory minerals. On the other hand, the secondary minerals are represented by sericite and chlorite.

The pegmatite bodies at the northern periphery of Gabal Ras Baroud consist essentially of orthoclase, quartz, plagioclase and mica (muscovite and biotite). The accessory minerals include zircon, allanite, fluorite and opaques.

Compared to the parent granitic pluton, the pegmatite body has higher concentrations of Zr, Rb, Y, Ba, Pb, Nb and lower Cu, Sr concentrations. It is important to notice that the variation in the concentration of trace elements in the studied pegmatite samples may be due to the difference in the mineralogical composition of these samples.

Uranium content in pegmatite body ranges from 10 ppm to 235 ppm with an average 84 but the thorium content range from 1 ppm to 309 ppm with an average 95.

Pegmatite body of Ras Baroud has several important rare-metal bearing minerals include; samarskite-Y, columbite, cassiterite, zircon, fluorite and rutile in addition to some opaque minerals as magnetite and ilmenite.

INTRODUCTION

Ras Baroud area is located in the Central Eastern Desert of Egypt, directly to the north of Qena Safaga asphaltic road at 35Km from Safaga city. The geology of the area has been studied by several authors (e.g. Abu El Ela, 1979, Kaoud, 1982, Mahdy et al., 1991, Sayyah et al., 1993, Omar 1995, Zalata et al., 1996 and Surour et al., 2004). Nb-Ta mineralization in the Eastern Desert of Egypt has a direct relationship with the granites (Sabet and Tsogoev, 1973). Such a type of granite is commonly termed “apogranite” and it is belived to be a special type of metasomatic granitoids (Beus, 1982). The first contribution to the occurrence of Nb-Ta mineralization in the pegmatites of Ras Baroud was mentioned by Sayyah et al. (1993) and Omar (1995).

Sayyah et al. (1993) studied various clusters of distinguishable megascopic crystals of columbite-tantalite and alvarolite (manganotantalite $MnTa_2O_6$) minerals scattered within the pegmatitic bodies of Ras Baroud granite.

Surour et al. (2004) studied the structural state and the geochemistry of columbite from the rare-metal pegmatites of Ras Baroud granite. They show a compositional range from mangano to ferrocolumbite at the cores to rims. Also, they added the cryptically zoned columbite crystals with Fe-rich rims suggest remarkable reducing conditions during the columbite crystallization which is also responsible for the formation of minute pyrite crystals found in the peripheral zone.

Raslan et al. (2010) identified samarskite-Y, columbite and zircon from pegmatite bodies and the stream sediments surrounding Ras Baroud granitic pluton. They studied the rare metals within pegmatites at G. Ras Baroud and clarify the importance of these pegmatites as hosts of accessory minerals of rare metals, REEs and radioactive elements.

Pegmatites are classified based on their shape, texture, emplcement, and relatioship to metamorphism and granitic pluton (Buddington 1959, Ginsburg et al. 1979, Cerny 1992, Zagorsky 1999& 2003). Salterly (1957) divided the pegmatites into simple and complex. Cerny (1992) categorized the pegmatites into four main classes depending on their depth of emplacement and metamorphic grade and minor element content. They are abyssal, muscovite, rare element and miarolitic pegmatites. The term “rare elements” or “rare metals” is generally used to encompass a variety of elements such as tantalum, niobium, beryllium, lithium, zirconium, and rare–earth elements (REEs) concentrated in acidic magmatic rocks, pegmatites and carbonatite complexes. Rare-metal pegmatites are those that genetically and spatially bear mineralization of one or more of the elements: Nb, Ta, Zr, Hf, Li, Be, W, Sn, U, Th and rare-earth elements (REEs). The rare element pegmatites are subdivided based on composition into LCT and NYF types; the LCT for Lithium, cerium and tantalum enrichment while NYF for niobium, yettrium and fluorine enrichment.

The present work deals with the geology, petrography, geochemistry and mineralogy of pegmatite body at the northern periphery of G.Ras Baroud to determine the type of this pergmatite and its uranium content and to identify the radioactive minerals which may be found.

METHODOLOGY

Fifteen representative samples (three from granite and twelve from the pegmatite body) were collected and studied petrographically using the polarized microscope in Nuclear Materials Authority (NMA).

Twelve samples of pegmatite were crushed and analyzed for trace elements in the laboratories of NMA. Trace elements were determined using X-ray fluorescence technique (XRF). Quantitative determination of radioactive elements U and Th of the studied pegmatite samples were obtained using the multichannel γ-ray spectrometer, (NaI”T1”-detector). A proper weight (300-350g) of crushed samples was placed in a standard size plastic container, sealed and left for at least 30 days to accumulate free radon and to attain radioactive equilibrium.

The studied samples were comminuted by a laboratory jaw crusher and a roll mill as fine as -1mm, separated by bromoform solution (sp. gr. 2.81g/cm^3) and methylene iodide solution (sp.gr. 3.32g/cm^3). The heavy fractions were subjected to magnetic separation using a permanent magnet to remove magnetite, and the Frantz Isodynamic Magnetic Separator (model LP1). The obtained fractions resulted from the magnetic separation were studied carefully using the binocular stereomicroscope and the X-ray diffraction technique (XRD). A Phillips X-ray diffractometer (model PW1010) with a scintillation counter (model PW25623/00) and Ni filter was used.

GEOLOGIC SETTING

Ras Baroud area is characterized by different morphological features with low to moderate topography, except Gabal Ras Baroud which is relatively high, with prominent peaks up to 1446m above sea level. According to the field observations, the rocks cropping out at Ras Baroud area are classified (from the oldest to the youngest) into older granites, younger granites, pegmatites, dikes and quartz veins (Fig.1).

G. Ras Baroud granite is exposed as small semirounded isolated pluton with an area of 40 Km^2 (Fig.1&2). It is nearly trending in the N-S direction. The granite of Gabal Ras Baroud is medium to coarse grained and pink to reddish pink in color. The pluton is strongly jointed and faulted and is dissected by numerous basic and acidic (felsite and granitic) dikes of different directions (Fig.3). It intruded all the surrounding country rocks and sends several offshoots into them. Also, it contains xenoliths of different shapes and sizes from the surrounding older rocks. These xenoliths show different stages of digestion depending on their size and composition. The intensity and size of these xenoliths increase gradually toward the contact with the country rocks. The contact between this granite and its surrounding rocks is rather sharp and well defined. The younger granite is strongly weathered, showing exfoliation, bouldery and cavernous weathering.

Several pegmatite bodies are encountered at the peripheral parts of the post-orogenic granite of Gabal Ras Baroud (Fig.4). They

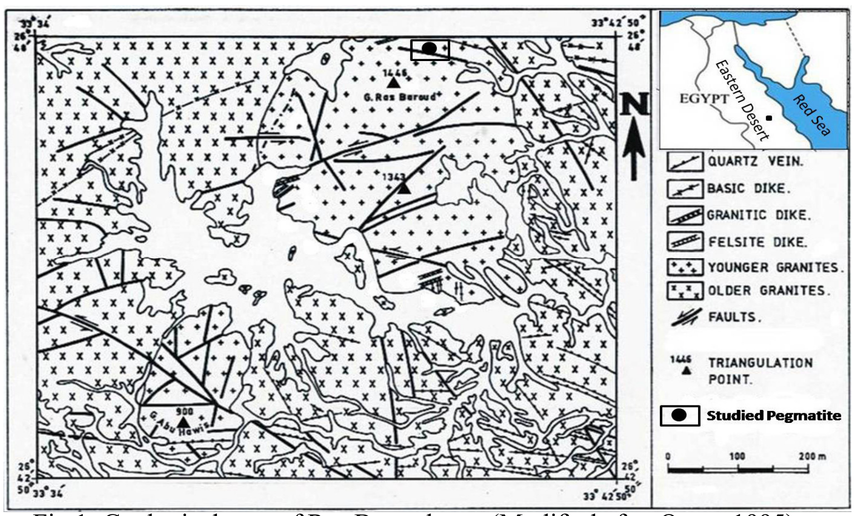

Fig.1: Geological map of Ras Baroud area (Modified after Omar, 1995)

Fig.2: Panoramic view of Gabal Ras Baroud younger granites

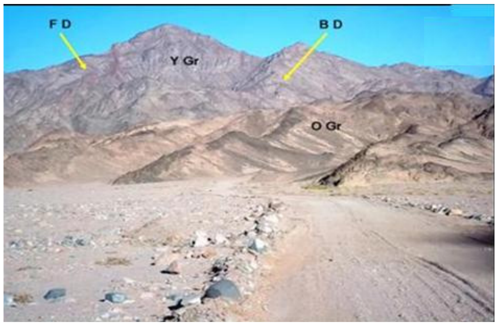

Fig.3: Sharp contact between the younger granites (YGr) and older granites (OGr). Notice basic (BD) and felsic (FD) dikes intruding the younger granites

Fig.5: Excavated pegmatite body showing the milky quartz core and the pink K-feldspar outer zone

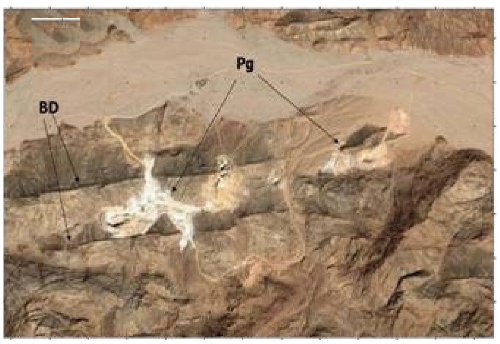

Fig.4: Satellite image showing pegmatite bodies (Pg) along the northern periphery of Gabal Ras baroud. Notice basic dikes (BD) cutting the younger granites

are subrounded to elliptical in shape and show sharp contacts with the host granite. They are compositionally zoned, being composed of massive milky quartz in the core and pinkish color blocky feldspars with subordinate nest like aggregates of yellowish white mica the outer zone (Fig. 5).

Two lithtypes of pegmatites are distinguished at Ras Baroud area; the graphic and perthitic pegmatites, based on the size and texture as well as the type and composition of the feldspar. Most pegmatite displays a mild NYF-like (Nb–Y–F enriched) signature, as shown by the relative abundance of magnetite and lanthanium-bearing minerals. Various radioactive anomalies and clusters of fan-shaped columbite-tantalite minerals were detected in the feldspar zones of these pegmatite body as shown on Figure 6.

Muscovitization, illitization, fluoritization (Fig.6) and hematitization (Fig.7) are the common alteration features accompanying the rare metal mineralization.

PETROGRAPHICAL STUDIES

Ras Baroud Granite

It is medium-to coarse-grained. It composed mainly of K-feldspars, plagioclase, quartz and micas (biotite and muscovite). Zircon, titanite and opaques are accessory minerals. The secondary minerals are represented by sericite and chlorite.

K-feldspars are represented by microcline perthite (Fig. 8), and microcline. They are euhedral to subhedral coarse crystals with characteristic cross-hatched twinning (Fig. 9).

Plagioclase is medium to coarse in size, occurring as euhedral crystals of blade-like forms and showing lamellar twinning (Fig.10). Some plagioclase is deformed and accompanied with partial sericitization (Fig.11).

Quartz is medium to coarse grained. The

Fig.6: Illitization and fluoritization in the studied pegmatite

Fig.7: Hematitization in the studied pegmatite

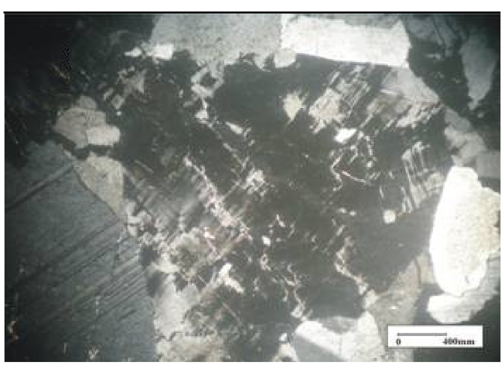

Fig.8: Subhedral crystal of microcline perthite associating plagioclase and quartz, XPL

Fig.9: Subhedral crystal of microcline associated with plagioclase and perthite, XPL

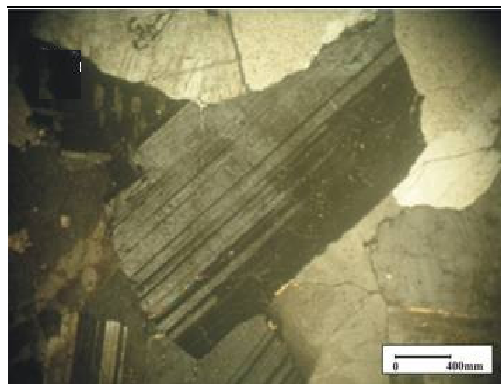

Fig.10: Blade-like plagioclase crystals with albitic twinning, XPL

Fig.11: Deformed plagioclase with sericitization, XPL

quartz crystals are anhedral to subhedral and show wavy extension. It also found as equant crystals with undulose extention (Fig.12)**.**

Biotite is present as long prismatic brown crystals. In most sections biotite is fresh and occasionally included in quartz (Fig.13). Some biotite crystals are partially altered to muscovite.

Muscovite is found in two generations; the first is primary muscovite which characterized by medium flakes with second order interference color. The second generation of muscovite occurs as fan-shaped fine flakes filling the fractures of other minerals.

Zircon is present as euhedral prismatic crystals with second order interference color and enclosed in biotite (Fig.14). Some zircon crystals in biotite are surrounded by black hallows probably due to radioactive elements (Fig. 15).

Titanite is a secondary mineral and associated with chlorite (Fig. 16)

The Pegmatites

In the northern part of Gabal Ras Baroud, they consist essentially of orthoclase, quartz, plagioclase and mica (muscovite and biotite). The accessory minerals include zircon, allanite, fluorite and opaques.

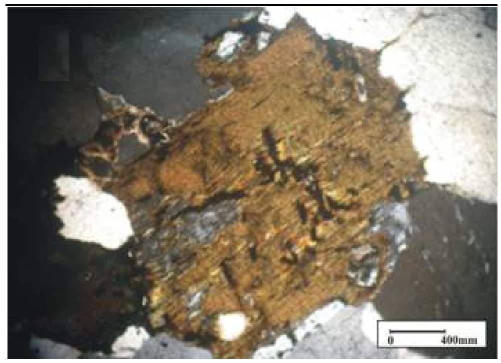

Fig.13: Primary biotite surrounded by quartz and partially altered to chlorite, XPL

Fig.14: A flake of chlorotized biotite including zircon, quartz and plagioclase, XPL

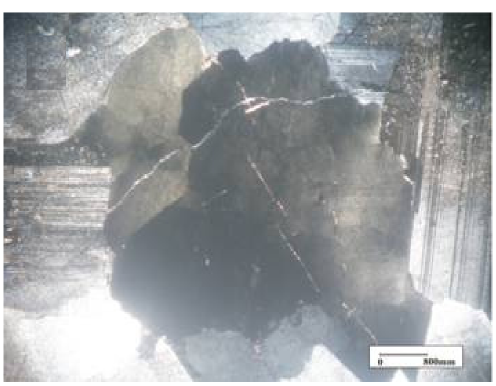

Fig.12: Anhedral crystal of quartz with undulose extention associating plagioclase, XPL

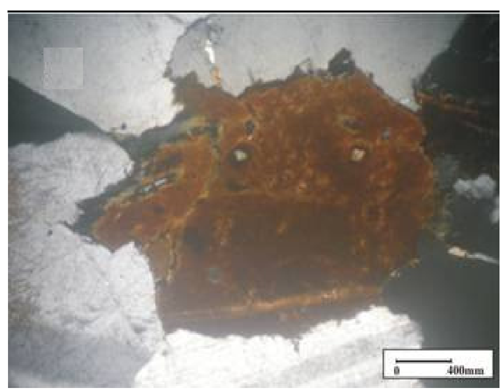

Fig.15: Minute crystals of zircon surrounded by pleochroic hallows in biotite crystal,XPL

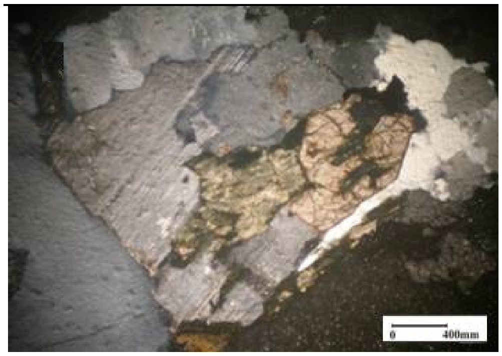

Fig.16: Titanite crystal associated with chlorite, XPL

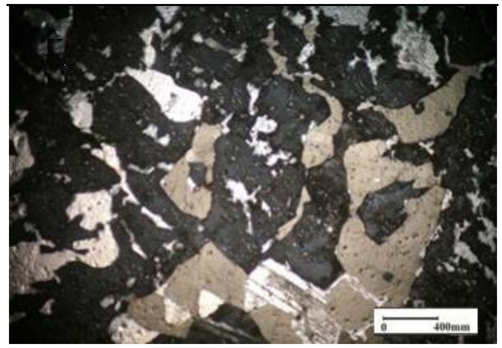

Fig.17: Graphic texture in pegmatite body at the northern periphery of Gabal Ras Baroud,

Orthoclase is coarse to very coarse grained and represented by megacrysts of perthite and microcline.

Quartz occurs as anhedral, fine to coarse crystals in which the graphic texture is appeared intergrown with perthite (Fig. 17).

Plagioclase forms euhedral to subhedral tabular crystals (Fig. 18) ranging in their composition from albite to oligoclase (An8-25).

Zircon is present as medium to coarse euhedral prismatic crystals (Fig.19).

Allanite is represented by medium to coarse subhedral crystals (Fig.20).

GEOCHEMISTRY OF TRACE ELEMENTS

Trace elements data and the measured (eU) and (eTh) of the pegmatites are presented in Table 1; Compared to the parent granitic plotun, the pegmatite body has higher concentrations of Zr, Rb, Y, Ba, Pb, Nb and lower Cu, Sr concentrations. It is important to notice that the variation in the concentration of these trace elements in the studied samples may be due to the difference in the mineralogical composition of these samples.

The correlation matrix for the trace elements in the pegmatites is listed in Table 2. The most noticeable positive correlations are Zr vs

Fig.18: Plagioclase crystal in pegmatite at the northern periphery of Gabal Ras Baroud, XPL

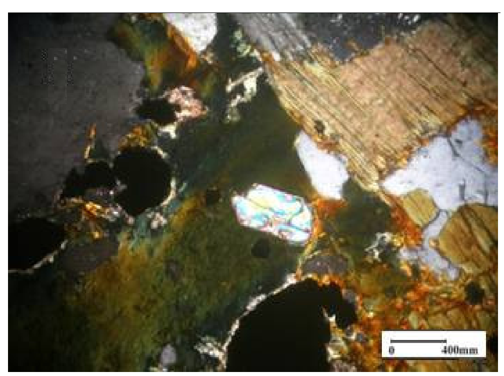

Fig.19: Prismatic crystal of zircon in pegmatite of Gabal Ras Baroud, XPL

Fig.20: Allanite crystal in pegmatite at the northern periphery of Gabal Ras Baroud, XPL

Y, Sr, Nb, eU and eTh. Other positive correlations exist between Cr, Ni, Cu and Ga. In order to determine the inter-element relationships and common origin of the elements, the statistical technique of R-mode factor analysis was applied for the present data (Table.3). Three factors accounted for 94.16% of the total variability of the original data were obtained. The first factor (FI) explaining 48.87% of the total variance, is a factor with high positive loading (>0.8) for Zr, Y, Sr, Nb, U and Th. Most of these elements belong to the HFSE (high field strength elements) reflecting lithogenic

Table 1: Geochemistry of trace elements (ppm), eU and eTh (ppm) in the studied pegmatites at the northern periphery of Gabal Ras Baroud

	eTh	eU	Nb	V	Ga	Sr	Pb	Ba	Y	Rb	Zr	Zn	Cu	Ni	Cr
S1	105	70	72	7	10	14	19	307	194	215	395	212	18	25	77
S2	16	18	122	8	12	25	27	364	318	324	674	255	15	22	80
S3	256	231	3	22	14	uld	35	1139	13	494	15	386	39	19	47
S4	207	148	3	24	13	uld	36	1175	12	489	11	385	37	23	43
S5	14	14	244	11	51	56	146	335	627	211	1351	520	35	59	79
S6	309	203	233	11	50	53	149	339	603	212	1291	538	35	60	86
S7	9	25	15	15	45	2	128	462	40	78	83	632	60	110	171
S8	197	235	10	15	54	uld	122	479	32	73	66	621	76	108	161
S9	1	16	uld	41	5	uld	12	2116	8	1365	uld	534	6	11	34
S10	8	23	uld	40	6	uld	13	2128	7	1295	uld	545	6	11	34
S11	11	19	42	9	31	9	60	405	112	568	231	378	31	44	58
S12	1	10	3	uld	uld	uld	4	11	7	3	20	3	2	32	122
Max	309	235	244	41	54	56	149	2128	627	1365	1351	632	76	110	171
Min	1	10	uld	uld	uld	uld	4	11	7	3	uld	3	2	11	34
Average	95	84	62	17	24	13	63	770	164	444	345	418	30	43.7	81.9
*Av. Gr	-	-	33	-	-	77	12	337	30	84	154	-	42	-	-

*Av. Gr =average content of some trace elements of younger granites of G. Ras Baroud (Omar, 1995);**uld = under limit of detection

Table 2: Correlation coefficient of the trace elements, eU and eTh indicated by color codes in the studied pegmatites at the northern periphery of Gabal Ras Baroud

	Cr	Ni	Cu	Zn	Zr	Rb	Y	Ba	Pb	Sr	Ga	V	Nb	eU
Ni	0.865													
Cu	0.604	0.844												
Zn	0.108	0.507	0.580											
Zr	-0.028	0.151	0.030	0.110										
Rb	-0.727	-0.604	-0.497	0.279	-0.330									
Y	-0.038	0.143	0.026	0.111	1.000	-0.323								
Ba	-0.611	-0.486	-0.301	0.399	-0.445	0.932	-0.438							
Pb	0.505	0.817	0.732	0.625	0.610	-0.488	0.605	-0.419						
Sr	-0.055	0.134	0.008	0.122	0.998	-0.297	0.998	-0.412	0.606					
Ga	0.534	0.856	0.797	0.631	0.533	-0.488	0.527	-0.436	0.980	0.524				
V	-0.520	-0.351	-0.177	0.530	-0.405	0.892	-0.399	0.987	-0.283	-0.373	-0.302			
Nb	-0.035	0.145	0.025	0.109	1.000	-0.325	1.000	-0.441	0.606	0.998	0.528	-0.401		
eU	-0.034	-0.035	-0.129	-0.189	0.795	-0.347	0.801	-0.504	0.259	0.770	0.220	-0.514	0.797	
eTh	-0.090	-0.109	-0.178	-0.270	0.753	-0.322	0.758	-0.508	0.158	0.724	0.139	-0.534	0.755	0.951

Table 3: R-mode factor analysis of trace elements of the pegmatites at the northern periphery of Gabal Ras Baroud

	Factor I	factor II	factor II
Cr	-0.21913	0.615157	0.651334
Ni	-0.04544	0.911129	0.369815
Cu	-0.12540	0.890922	0.199899
Zn	0.060618	0.782075	-0.59523
Zr	0.970494	0.173779	0.111714
Rb	-0.16556	-0.33833	-0.89854
Y	0.973659	0.167442	0.105115
Ba	-0.31839	-0.17902	-0.92219
Pb	0.447239	0.877388	0.120979
Sr	0.968950	0.169474	0.074947
Ga	0.373227	0.902077	0.150954
V	-0.30296	-0.02793	-0.93864
Nb	0.972064	0.168801	0.107318
eU	0.853422	-0.14586	0.308518
eTh	0.823657	-0.23579	0.329948

origin of the studied pegmatite. The second one (FII) represents 27.13% of the total variability of the data and includes Cr, Ni, Cu, Zn, Pb and Ga. The third factor (FIII) accounts for 18.16% of the variance, is a dipolar factor and shows high positive loading (> 0.65) of Cr and high negative loadings of Zn, Rb, Ba and V. This factor may be due to the alteration processes affecting the pegmatites.

RARE METAL BEARING MINERALS

The studied pegmatite was characterized by the mineral assemblage including:Samarskite-Y, columbite, cassiterite, zircon and fluorite in addition to some opaque minerals as magnetite and ilmenite.

Samarskite-Y

The general formula of members of samarskite group is ABO_4, where A stands for Y, REEs, Ca, U, Fe, and B for Nb, Ta and Ti (Ercit, 2005). Samarskite group is confined to zoned pegmatites. The members of samarskite group include samarskite-Y, calciosamarskite and ishikawaite. Williams et al. (2006) identified a new species of samarskite group referred to samarskite-Yb. In the studied pegmatites, samarskite-Y occurs as fine to medium subhedral to anhedral grains mostly in fragmental shape. Samarskite mineral grains mostly exhibit reddish brown to dark brown color with resinous luster and are transparent in thin edges (Fig.21). They are tranlucent to opaque grains and fractures conchoidally. Since the early studies of samarskite, it had been investigated as metamict mineral. Metamictization is a phenomenon inherent in all described samples of samarskite. The mechanisms of metamictization have been described elsewhere (Ewing, 1994; Weber et al. 1998; Ewing et al. 2004). So, to restore the crystal structure of samarskite mineral grains, the picked grains of the mineral were heated at 1060C for about six hours. The X-ray diffraction data are listed in Table 4. Some of samarskite mineral grains were subjected to semiquantitative chemical analysis using the scanning electron microscope (Fig.22), which illustrates that the mineral is composed mainly of Nb and Y oxides with the presence of traces of U, REEs, Ta, Ti, Mg and Ca.

Columbite (NbO_2)

Cassiterite and columbite-tantalite mineralization can be found in the more evolved pegmatites according the paragenetic-geochemical classification scheme of Cerny (1991). Columbite is the chief ore of niobium and found in granites, pegmatites and placer deposits. Ferrocolumbite is composed of natural oxides of Nb, Ta, Fe and Mn. In the studied pegmatite, Columbite occurs as anhedral to subhedral tabular, medium to fine opaque grains. Columbite grains are mostly black to brownish black in color and have submetallic luster (Fig.23). The SEM data of the studied columbite grains is showen on Fig.24.

Cassiterite (SnO_2)

Cassiterite occurs in granites, pegmatites, hydrothermal viens and greisen, metamorphic

Fig.21: Photomicrograph of some reddish brown to dark brown grains of samarskite-Y mineral in Ras Baroud pegmatite bodie

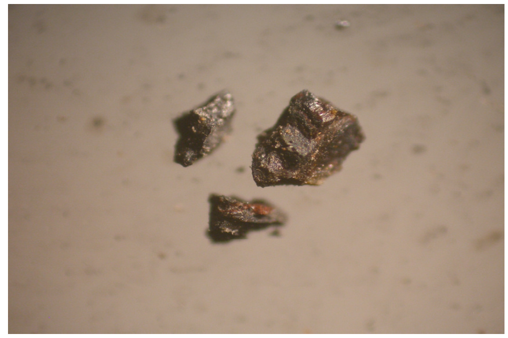

Fig.23: Photomicrograph of black to brownish black grains of columbite mineral in Ras Baroud pegmatite body

Table 4: X-ray diffraction data of the heated samarskite-Y from the studied pegmatite

Measured values		Samarskite ASTM card (2-690)	
dA°	I/I	dAº	I/I
6.84	8		
2.98	100	2.97	100
2.92	27		
2.58	23	2.58	60
2.55	41	2.52	20
1.82	41	1.82	80
1.70	11	1.71	40
1.65	9	1.64	40
1.56	34	1.56	80

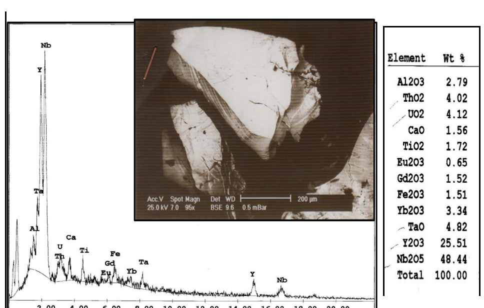

Fig.22: EDX mineral analysis and SEM image of samarskite-Y

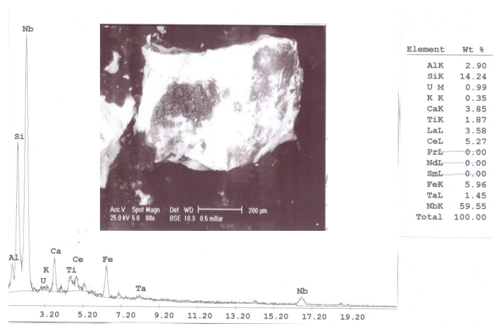

Fig.24: EDX mineral analysis and SEM image of columbite

rocks and large alluvial deposits. The mineral grains of cassiterite in the studied pegmatites exhibit dark brown to black colors with adamantine luster. The cassiterite grains occur mostly as opaque subhedral to euhedral crystals with pyramidal terminations (Fig.25). The scanning electron microscope analysis of cassiterite revealed that the presence of trace amounts of iron and niobium with tin oxide (Fig.26).

Zircon ($ZrSiO_2$)

Zircon is considered as the most predominant accessory mineral in the pegmatite of G. Ras Baroud. It occurs in two states. The first one comprises transparent colorless to yellow

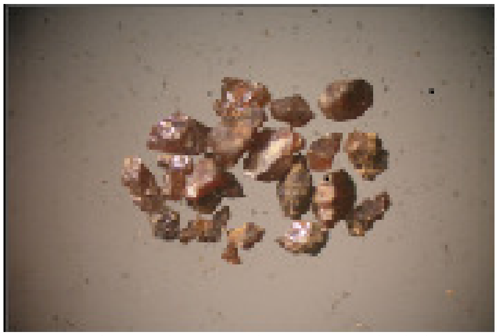

Fig.25: Photomicrograph of some dark brown to black grains of cassiterite mineral in Ras Baroud pegmatite body

Fig.27: Photomicrograph of some malacon type zircon grains with greyish to yellowish green color in Ras Baroud pegmatite body

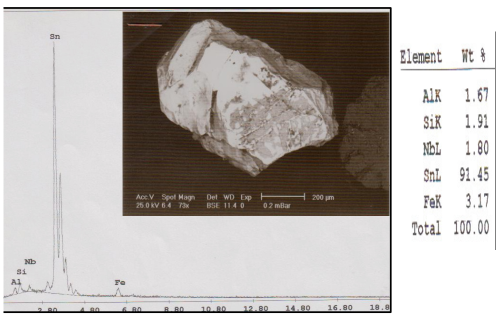

Fig.26: EDX mineral analysis and SEM image of cassiterite

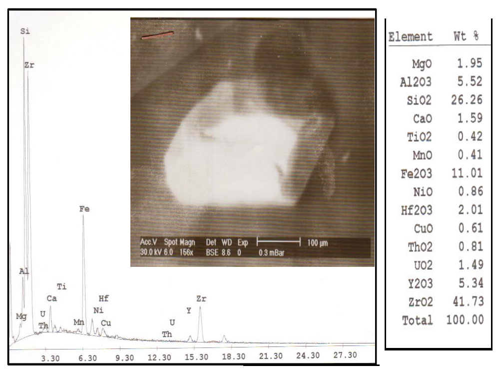

Fig.28: EDX mineral analysis and SEM image of zircon

mineral grains occasionally dark in color characterized by the presence of the prism in addition to bipyramidal terminations. The second stste, interpreted as malacon zircon, is greenish grey to dark brown translucent to opaque (Fig.27). It possesses a distinctive bipyramidal form due to the development of bipyramidal faces at expense of reduction or even disappearance of prismatic faces. This variety of neoformed zircon, in metasomatized apogranites, was designated as "mud zircon" by El Gemmizi (1984), based on comparison of the morphological characteristics with that of zircon described by Williams et al. (1956). The SEM data of the studied malacon zircon grains (Fig. 28) show that the presence of appreciable amount of Fe_2O_3 and Y_2O_3 and their assay attains 11.01% and 5.34%, respectively. The presence of Y_2O_3 may be attributed to the partial substitution of Zr by Y. ZrO_2/Hf_2O_3 is about 20.76 reflecting the origin of the studied mineral. Also, UO_2 and ThO_2 are present and their assay attains 1.49% and 0.81%, respectively.

Fluorite (CaF)

In the studied pegmatite, fluorite grains vary widely in their color from colorless to deep violet (Fig.29). The color variation may be attributed to the presence of radionuclides in the mineral constituents of the pegmatites.

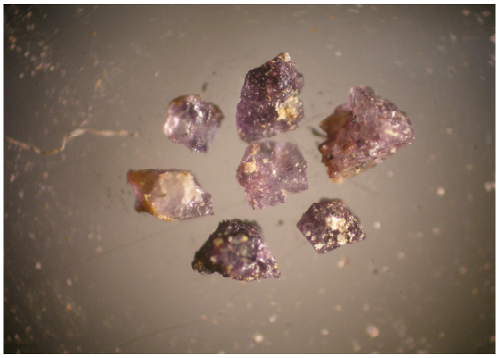

Fig.29: Photomicrograph of deep violet grains of fluorite

Rutile (TiO_2)

Rutile grains occur as fine to very fine subhedral tabular grains. They vary in color from yellowish brown, red, brown to black with adamantine luster. The black rutile grains can be referred to niobian rutile (Fig.30).

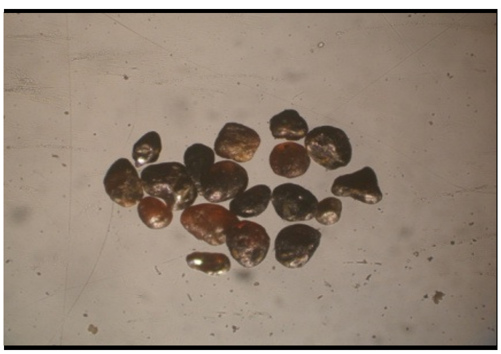

Fig.30: Photomicrograph of rutile grains with different colors

CONCLUSIONS

Ras Baroud area has several rock units arranged from the oldest to the youngest as: older granitoids, younger granites, pegmatites, dykes and veins. Ras Baroud granite is exposed as small semirounded isolated mass characterized by medium to coarse grain size and pink to reddish pink color. Several pegmatite bodies are encountered at the peripheral parts of this granite. They are compositionally zoned, being composed of massive milky quartz in the core and pink color blocky K-feldspars with subordinate nest- like aggregates of yellowish white mica in the outer zone.

Ras Baroud granite is composed mainly of K-feldspars, plagioclase, quartz and micas (biotite and muscovite) associated with zircon, titanite, and opaque as accessory minerals. The secondary minerals are represented by sericite and chlorite.

The pegmatite body at the northern periphery of G.Ras Baroud consists essentially of orthoclase, quartz, plagioclase and mica (muscovite and biotite). The accessory minerals include zircon, allanite, fluorite and opaques.

Pegmatites at the northern periphery of G.Ras Baroud are classified as rare metals pegmatite where Zr, Rb, Y, Ba, Pb and Nb have high concentration in these pegmatites than that of the parent granitic pluton, while the elements Cu and Sr exhibit low concentration. It is important to notice that the variation in the concentration of trace elements in the studied samples is due to the difference in the mineralogical composition of these samples.

Equivalent uranium content in pegmatite bodies ranges from 10 ppm to 235 ppm with average 8, but the thorium content ranges from 1 ppm to 309 ppm with average 95.

Pegmatite body of Ras Baroud has several minerals include; samarskite-Y, columbite, cassiterite, zircon, fluorite and rutile in addition to some opaque minerals as magnetite and ilmenite.

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معدنية وجيوكيميائية العناصر الشحيحة فى جسم بجماتيتى على الحواف الشمالية لجبل راس بارود – وسط الصحراء الشرقية-مصر.

محمد عبدالمنصف ، هشام عبد العزيز النحاس و سمير محمد عبدالله

يتكون جبل راس بارود من العديد من الوحدات الصخرية التى تترتب من الاقدم للاحدث كالاتى: الجرانيتات القديمة ، الجرانيتات الحديثة ،اجسام البجماتيت ثم العروق والقواطع. وتتميز الجرانيتات الحديثة بالشكل النصف دائرى ذو الحبيبات المتوسطة الى الخشنة واللون الوردى الى الاحمرالوردى. ولقد وجد ان البجماتيت من النوع النطاقى حيث يتكون من الكوارتز من الداخل ثم الفلسبار القلوى من الخارج مع وجود بعض شرائح المسكوفيت فيما بينهما.

ومن خلال الدراسات البتروجرافية وجد ان الجرانيت يتكون اساسا من الفلسبار القلوى، البلاجيوكليز،الكوارتز ثم الميكا (البيوتيت –المسكوفيت) مع بعض المعادن الاضافية مثل الزركون ،التيتانيت وبعض المعادن المعتمة وكذلك وجود بعض المعادن الثانوية مثل السريسيت والكلورايت.وعلى الجانب الاخر وجد ان جسم البجماتيت يتكون اساسا من الاورثوكليز،الكوارتز،البلاجيوكليز ثم المسكوفيت والبيوتيت مع وجود بعض المعادن الاضافية مثل الزركون،الالانيت ،الفلورايت مع بعض المعادن المعتمة . وقد وجد العديد من الانسجة البتروجرافية المميزة للبجماتيت منها النسيج الجرافيتى.

ومن خلال الدراسات الجيوكيميائية وجد ان جسم البجماتيت بجبل راس بارود من النوع (بيجماتيت العناصر النادرة) والتى تتميز بوجود تركيزات عالية من عناصر الزركون، الروبيديوم، الايتريوم،الباريوم،الرصاص وكذلك عنصر النيوبيوم بينما توجد تركيزات منخفضة من النحاس والاسترانيشيوم بالمقارنة مع الجرانيت المحيط بها.

ومن خلال الدراسات الراديومترية وجد ان محتوى اليورانيوم بجسم البجماتيت بجبل راس بارود تتراوح بين ١٠الى٢٣٥ جزء فى المليون بمتوسط ٨٤ بينما محتوى الثوريوم بها يتراوح بين ١ الى ٣٠٩ جزء فى المليون بمتوسط ٩٥.

ومن خلال الدراسات المعدنية وجد ان جسم البجماتيت بجبل راس بارود تحتوى على العديد من المعادن التى يتميز بها البجماتيت منها السمارسكيت وخاصة الايتريوم سمارسكيت ، الكلومبيت ، الكاسترايت ، الزركون ، الفلورايت، الروتيل بالاضافة الى بعض المعادن المعتمة مثل الماجنتيت والالمينيت.