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MINERALOGICAL AND MINERALLURGICAL CHARACTERISTICS OF SAMARSKITE–Y, COLUMBITE AND ZIRCON FROM STREAM SEDIMENTS OF THE RAS BAROUD AREA, CENTRAL EASTERN DESERT, EGYPT

A unique occurrence of a samarskite–Y variety was recorded in the stream sediments surrounding the Ras Baroud younger granite pluton, Cenral Eastern Desert of Egypt. This mineral variety was found associated with columbite, zircon, magnetite, garnet, goethite, ilmenite, hematite and mica. In the representative composite sample of these sediments, samarskite–Y was found to assay 1.5% by weight. Both microscopic examination and Scanning Electron Microscope (SEM) were used to identify and describe the studied mineral variety, while the electron microprobe analysis was applied to determine its empirical formula. Size analysis of the representative samarskite-Y stream sample revealed its wide distribution in almost all size fractions with an increased tendency to concentrate in the small sizes. The investigated mineral variety is moderately paramagnetic and its magnetic susceptibility is lower than that of the associated columbite. Accordingly, it would be possible to obtain a rich samarskite concentrate using both gravity and magnetic separation techniques.

1. INTRODUCTION

The studied occurrence is located in the Central Eastern Desert of Egypt directly to the north of Qena-Safaga asphaltic road and covers an area of about 70 km^2 (Fig. 1 a). The area of Ras Baroud is actually surrounded by both younger and older granitic masses. Its geology has been studied by several authors (Omar 1995; Zalata et al. 1996, etc.). Niobium and tantalum multiple-oxide minerals such as samarskite and

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columbite were recorded in numerous localities in the granites pegmatite and associated stream sediments of the Eastern Desert of Egypt. The Nb-Ta mineralization has been recorded in the pegmatite bodies of Gebel Ras Baroud granite as well as in the granite itself and in the surrounding stream sediments (Kaoud 1982; Mahdy et al. 1991; Sayyah et al. 1993). Raslan et al. (2009) identified samarskite-Y, columbite, zircon and thorite in the pegmatite bodies of the Ras Baroud granitic pluton.

In spite of the numerous occurrences of Nb-Ta multiple oxide minerals in the pegmatite bodies of the Eastern Desert, no one paid attention to the assay and minerallurgical (separation) characteristics of these minerals, a matter which will be greatly important in mineral beneficiation and processing. Accordingly, the present paper deals with the detailed mineralogical and minerallurgical characteristics of the recorded samarskite present in the stream sediment surrounding the Ras Baroud granite pluton.

2. SAMPLING AND TECHNIQUES

Eight friable stream sediment samples were collected from holes having about 70 cm diameter and about 1 meter depth (Fig. 1b). The oversize 1 mm was first removed by sieving. A large bulk composite sample representing different mineralized zones of the Ras Baroud stream sediments (weighing about 100 kg) were prepared for mineralogical investigation and concentration processes. A representative sample was prepared and properly sieved before subjecting to heavy media separation using bromoform having density equal to 2.85 gm/cm^3. From the obtained heavy fractions, pure mineral grains were hand picked and investigated under a binocular microscope. Some of the picked mineral grains were subjected to analysis with an Environmental Scanning Electron Microscope (ESEM). This instrument is supported by an energy dispersive spectrometer unit (EDS) (model Philips XL 30). The applied analytical conditions involved 30 kV as the accelerating voltage, 1-2 mm beam diameter during 60 to 120 second as the counting time and a minimum detectable weight concentration ranging from 0.1 to 1 wt.%.

The magnetic behavior of samarskite and associated heavy minerals was investigated using a Frantz Isodynamic Separator (L-I) and a High Intensity Induced Roll Magnetic Separator (Carpco Model MI27). All the analyses were carried out at the laboratories of the Egyptian Nuclear Materials Authority (NMA).

A thin-polished sections of samarskite crystals were prepared and analyzed using the Field Emission Scanning Electron Microscope (JEOL 6335F). This instrument is fitted with an Oxford Energy Dispersive X-ray Spectrometer (EDS) for elemental analysis of micro areas. The applied analytical conditions involved 0.5 to 30 accelerating voltage, 1.5 nm (at 15 kV)/5.0 nm (at 1.0 kV). Imaging modes are secondary electron imaging and backscatter electron imaging (BSE).

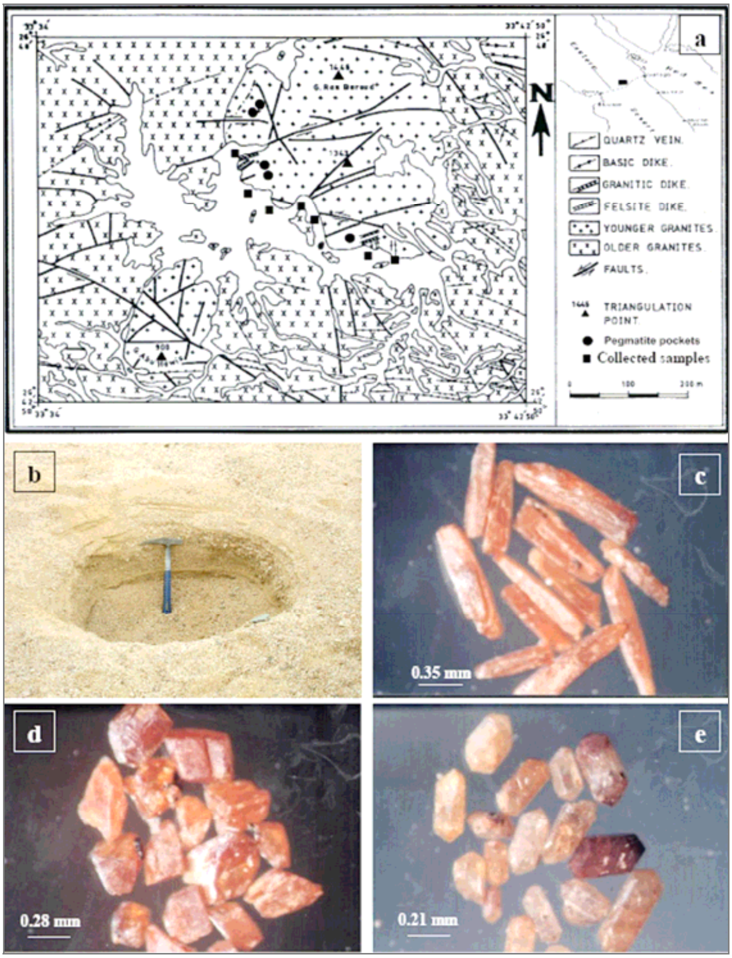

Fig. 1. a) Geologic map of Gabal Ras Baroud, Eastern Desert, Egypt (after Omar, 1995),
b) Hole which friable stream sediment samples were collected,
c) Reddish brown samarskite crystals of rod-like shape, binocular microscope,
d) Massive granular samarskite crystals, binocular microscope,
e) Prismatic "magnetic" zircon crystals. binocular microscope

Additionally, thin-polished sections of samarskite grains were also analyzed using a JEOL SUPERPROBE 733 with an accelerating voltage of 15 kV and a beam size of approximately 1 micron. The crystals used for the elemental analysis involved thallium acid phthalate, pentaerythritol lithium fluoride and the samples were carbon coated (less than 20 nm in thickness). The analyzed elements were loaded into the quantitative program (PRZ) and oxygen was calculated by difference (weight percentage is calculated by subtracting the measured weight). The used standards included niobium (Nb), tantalum (Ta), biotite (Ti-Fe-Si), uranium metal (U), monazite (Th), fluorite (Ca), and cubic zirconia (Zr-Y).

3. MINERALOGICAL AND GEOCHEMICAL INVESTIGATION

Heavy minerals present in the studied stream sediments have been identified using binocular, polarizing, and scanning electron microscope as well as electron microprobe analyses. The heavy mineral content of different size fraction have been mineralogically analyzed by the counting technique and distribution of each accessory heavy mineral among the various size fraction was estimated (Table 1). The studies revealed the presence of samarskite-Y, columbite, zircon, magnetite, garnet, goethite, ilmenite, hematite and mica (phlogopite). In the representative composite sample of these sediments, samarskite-Y was found to assay 1.5%. A detailed mineralogical and geochemical characteristic of samarskite–Y, columbite and zircon is given below.

Table 1. Heavy mineral contents among the various size fractions of Ras Baroud stream sediments

Mineral% / Size, (mm)	Samaraskite	Columbite	Zircon	Mica	Garnet	Ilmenite	Hematite	Goethite	Magnetite
–1.000 + 0.800	10.20	1.30	–	38.90	–	–	17.20	1.90	30.50
–0.800 +0.630	15.80	1.70	–	25.30	–	–	18.90	2.50	35.80
–0.630 +0.400	18.40	1.90	3.60	17.00	0.40	–	19.30	3.10	36.20
–0.400 +0.200	22.80	2.70	10.30	13.40	2.30	5.50	16.50	9.60	17.20
–0.200 +0.063	26.60	1.80	20.10	8.50	5.50	10.40	7.50	10.80	9.80

3.1. SAMARSKITE–Y

Samarskite is a group of the Nb-Ta mineral varieties having the general formula $A_mB_nO_{2(m+n)}$ where A represents Fe^{2+}, Ca, REE, Y, U and Th while B represents Nb, Ta and Ti. Hanson et al. (1999), proposed a nomenclature for the samarskite group of minerals based on their classification into three species. Thus, if the REE+Y are the dominant, the name samarskite-(REE+Y) should be used with the dominant of these cations as a suffix. If U+Th are the dominant, the mineral is properly named ishikawaite whereas if Ca is the dominant cation, the mineral should be named calciosamarskite. Recently, samarskite-(Yb) has been identified as a new species of the samarskite group (Simmons et al. 2006). Nickel and Mandarino (1987) described samarskite-Y as a mineral with Y+REE dominant at A-site. Warner and Ewing (1993) have proposed that samarskite should be formulated as an ABO_4 oxide. It is worth to mention that ishikawaite with an average assay of about 50% Nb_2O_5 and 26% UO_2 has been identified for the first time in Egypt in the mineralized Abu Rushied gneissose metamorphosed granite (Raslan 2008).

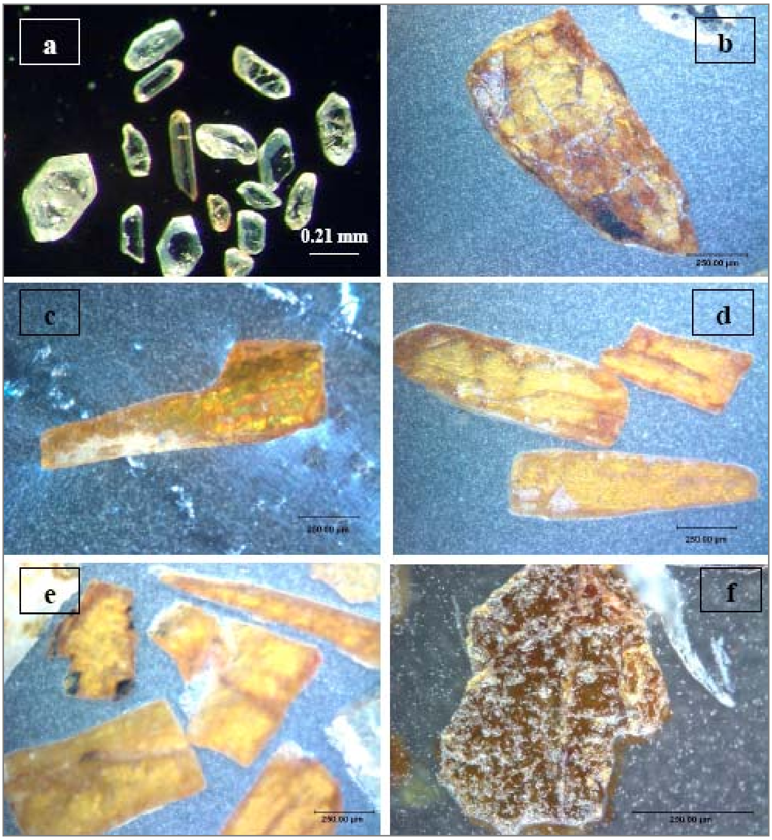

Fig. 2. a) Colorless prismatic zircon crystals, binocular microscope,
b) Bloody red samarskite crystal, Crossed Nicolas,
c-d) Samarskite crystal of rod-like shape, Polarized light,
e) Massive granular samarskite crystals of bright yellow color, Polarized light,
f) Massive granular samarskite of dark yellow color, Crossed Nicolas

Under the binocular microscope, the defined samarskite crystals are generally massive with a rod-like form and having a characteristic vitreous luster. These crystals are generally translucent, compact, and hard. They are mainly velvet-reddish brown to bloody red in color (Fig. 1c). Although most crystals often possess rod-like in shape, however, some crystals are present as massive granular and tabular crystals (Fig. 1d). Under the polarizing microscope, the samarskite grains are mainly velvet-yellow brown to bloody red in color (Figs. 2b-f).

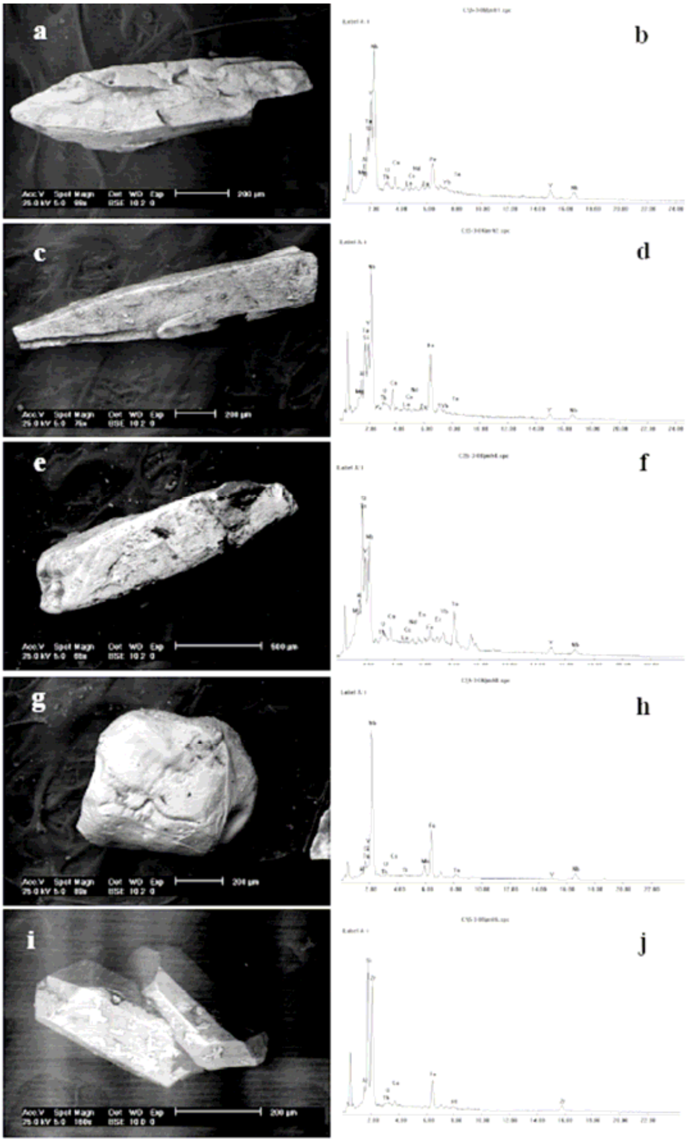

Fig. 3. a–f – backscattered electron image of samarskite and corresponding EDX analyses, g-h – BSE image of columbite grain and its spectrum, i-j – backscattered image of magnetic zircon crystals and their semiquantitative analysis

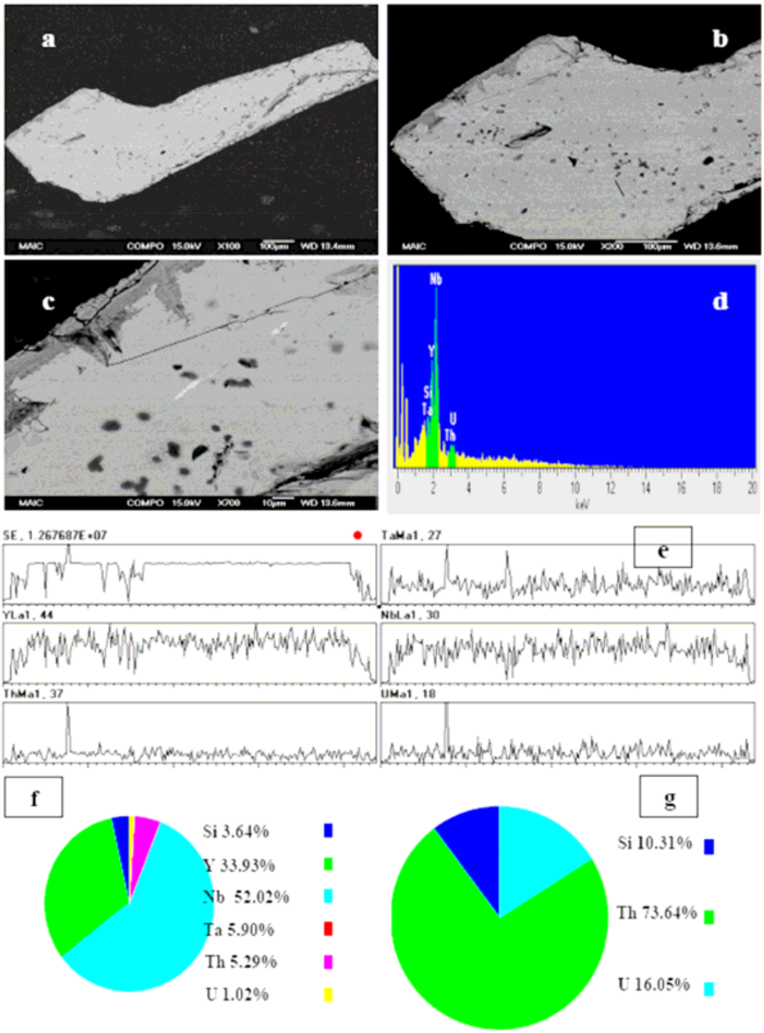

Fig. 4. a–d – backscattered electron images of samarskite crystal showing the bright thorite inclusions and EDX analysis, e – scan line elemental analyses of samarskite, f, g – Elemental composition of samarskite and thorite

The ESEM data of the studied samarskite grains (Figs. 3a-f) reflect their morphological features and chemical composition. Three semiquantitative analyses show that the mineral is enriched in Nb (av. 44.75 %) and Y (av. 22.95%), Ce (av. 0.94%), Nd (av. 1.50%), Sm (av. 1.420%), and Yb (av. 3.50%). On the other hand, both uranium and thorium are commonly present and their average assay attains 1.75% and 3.02% respectively. Additionally, several samarskite crystals have also been subjected to semiquantitative analyses using the Field Emission Scanning Electron Microscope

(JEOL 6335F) and the obtained SEM data show that both Nb and Y are the essential components. These analyses indicate the presence of thorite inclusions in some of the investigated samarskite crystals (Figs. 4a-g).

The electron microprobe analyses of the investigated samarskite–Y (Table 2) gave the chemical composition which corresponds to empirical formula $[(Y_{0.52}, REE_{0.29}, Th_{0.06}, Si_{0.01}, Ca_{0.02}, U_{0.03}, Fe_{0.00}, Zr_{0.00})_{\sum 0.97} (Nb_{0.93}, Ta_{0.00}, Ti_{0.02})_{\sum 0.96} O_4]$. The microprobe analyses were plotted on a ternary diagram of Hanson et al. (1999) which shows the A-site occupancy of the samarskite group of minerals (Fig. 5). It was found that all the corresponding data points plot in the samarskite-Y field.

Table 2. Selected EPMA analyses of the investigated samarskite-Y in Ras Baroud stream sediments, Central Eastern Desert, Egypt

No. Oxides	1R	2C	3R	4C	5R	6C	7R	Ave. 1–7
TiO_2	0.71	0.53	0.70	0.78	0.80	0.71	0.38	0.66
Nb_2O_5	44.77	47.86	49.26	46.06	46.05	43.38	46.02	46.20
SiO_2	0.47	0.06	0.17	0.13	0.09	0.17	0.08	0.17
Ta_2O_5	0.00	0.40	0.00	0.00	0.04	0.00	0.00	0.06
MnO	0.09	0.01	0.06	0.01	0.01	0.00	0.09	0.04
UO_2	3.80	2.20	3.70	2.18	3.90	3.75	4.01	3.36
ZrO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CaO	0.78	0.28	0.75	0.54	0.67	0.70	0.28	0.57
ThO_2	8.06	4.40	**5.61**	6.16	**5.54**	4.21	4.75	5.53
FeO•	0.11	0.06	0.00	0.06	0.26	0.06	0.08	0.09
Y_2O_3	22.30	25.76	25.30	23.57	23.39	24.49	25.78	24.37
∑REE	18.89	18.40	14.49	21.54	19.20	22.48	19.60	19.23
Total	99.98	**99.86**	100.04	101.03	99.95	99.95	101.07	100.27
Number of cations based on 4 oxygen								
Ti	0.025	0.018	0.023	0.019	0.027	0.025	0.013	0.021
Nb	0.930	0.969	0.987	0.866	0.947	0.904	0.947	0.935
Si	0.022	0.003	0.008	0.004	0.004	0.008	0.004	0.007
Ta	0.000	0.005	0.000	0.000	0.001	0.000	0.000	0.001
Mn	0.004	0.000	0.002	0.000	0.000	0.000	0.003	0.001
U	0.039	0.022	0.037	0.016	0.039	0.038	0.041	0.033
Zr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ca	0.038	0.013	0.036	0.009	0.033	0.035	0.014	0.025
Th	0.084	0.045	0.057	0.066	0.057	0.044	0.049	0.057
Fe	0.004	0.002	0.000	0.001	0.010	0.002	0.003	0.003
Y	0.544	0.614	0.597	0.313	0.566	0.601	0.624	0.523
∑REE	0.317	0.302	0.234	0.187	0.321	0.380	0.309	0.292
Sum A	1.048	1.001	0.969	0.596	1.030	1.108	1.044	0.971
Sum B	0.955	0.992	1.010	0.885	0.975	0.929	0.960	0.958

• Total Fe was determined as FeO.
1R and 2C refer to rim and core.

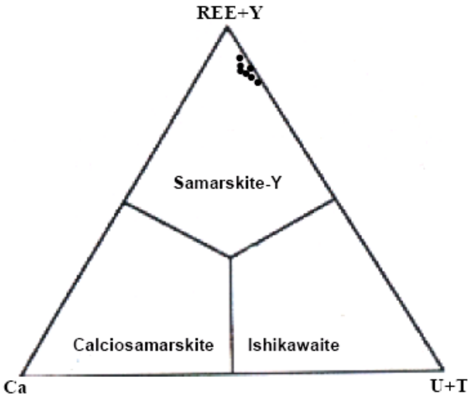

Fig. 5. Ternary diagram showing A-site occupancy of samarskite–group minerals after Hanson et al. (1999). Ras Baroud samarskite–Y is represented by the closed circles

From the obtained data, it is quite clear that the studied Nb-Ta mineral variety of Ras Baroud stream sediments reflects the chemical composition of an Y- and REE- rich samarskite species. Finally, it can be concluded that the investigated samarskite species separated from the Ras Baroud stream sediments is characterized by a dominance of Y+REE in the A-site while Nb in the B-site is higher than both Ta + Ti. Therefore, the defined samarskite species in the present work belongs actually to the compositional limits of the samarskite-Y mineral species as specified in the literature.

3.2. COLUMBITE

Rounded to subrounded massive black columbite grains were prepared and subjected to ESEM analyses (Figs. 3g and h). Semiquantitative analyses show that the chemical composition with high Nb/(Nb+Ta) of the columbite classifies it as ferrocolumbite in term of quadrilateral end members; $FeNb_2O_6$, $MnNb_2O_6$ and $MnTa_2O_6$. Most of columbite grains are characteristically containing surface cavities rich in iron (Raslan, 2005). These analyses gave Nb (63.74%), Fe (13.16%), Ta (4.40%), Mn (3.69%), Y (4.19%), U (1.26%) and Th (2.81%).

3.3. ZIRCON

Two types of zircon crystals have been recognized. The first one is generally colorless and transparent. The second is magnetic zircon which is commonly pale to deep brown in color and translucent to opaque (Figs. 1e and 2i). The most common habit is bipyrmidal form and some are characterized by extremely short prism. ESEM data reflect the morphological features and chemical composition of zircon. These analyses gave Zr (67.86%), Si (24.34%), Hf (5.14%), U (0.39%) and Th (0.41%).

4. MINERALLURGICAL INVESTIGATION PREPARATION OF SAMPLES FOR SEPARATION

Preparation of a suitable feed for separation is very useful for attaining the maximum efficiency of the used equipment. The size of the separated particles is the most important factor affecting separation (Taggart 1944; Jones 1959; Pryor 1974; Gaudin 1980). Accordingly, sieving was carried out on a prepared representative composite sample collected from the Ras Barous stream sediments in order to reduce the size of the head sample to pass 1.0 mm screen. The over- sized (+1 mm) fraction was rejected and the under- sized (-1 mm) fraction was deslimed using a desliming cone. It is advisable to wash the sample before treatment in order to remove dust adhering to the grains. The deslimed size fraction (-1 mm) was dried and screened using a set of screens represented by (0.800, 0.630, 0.400, 0.200, 0.045 mm) screens. The latter was chosen to save the majority of samarskite crystals in the treated size fraction. The size fractions were collected, weighed and representative portions from each fraction was subjected to heavy liquid separation using bromoform in order to determine the heavy minerals content, distribution and grade of samarskite in each size fraction. Granulometric analyses, heavy mineral content and samarskite assay among the different size fractions were presented in table 3 and presented as a histogram in figure 6. It is quite clear that the percentages of grain size, heavy minerals and samarskite increase with decreasing of the grain size.

Table 3. Granulometric analyses, heavy mineral contents and assay of samarskite among the various size fractions of the studied sediments

Size (mm)	wt.%	H.M.%	Samarskite%
+1.00 gravels pebbles	32.20	–	–
–1.000 +0.800	6.10	9.60	10.20
–0.800 +0.630	7.25	11.20	15.80
–0.630 +0.400	**9.45**	11.90	18.40
–0.400 +0.200	13.95	13.90	22.80
–0.200 +0.045	27.10	16.20	25.60
–0.045	**1.90**	–	–
Slimes	**2.05**	–	–
Original	**100.00**	13.00	19.00

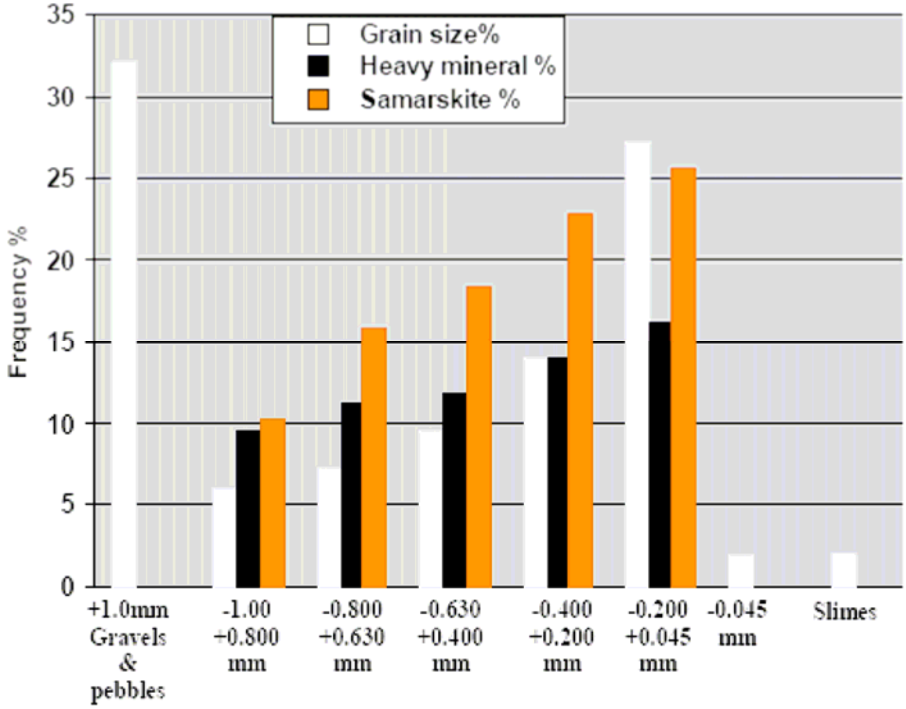

Fig. 6. Histogram to show distribution of grain size,
total heavies and samarskite content among various size fractions

5. MAGNETIC CHARACTERISTICS OF SAMARSKITE–Y

A considerable amount of the total bulk heavy mineral fraction was obtained by heavy liquid separation using bromoform. A proper magnetite-free feed was then prepared and subjected to magnetic separation using the Frantz Isodynamic separator (L-I) in order to determine the behavior of each heavy mineral including samarskite during magnetic separation. The setting of the separator during this study was (20°) forward slope and (5°) side slope.

The results shown in table 2 reveal that the investigated samarskite variety is moderately paramagnetic and concentrates as the magnetic fraction in the range of 0.7-1.0 amps of the Frantz Isodynamic separator. It was also found that its magnetic susceptibility is lower than that of the associated columbite. Columbite is concentrated as magnetic fraction in the 0.5 amps fraction. On the other hand, colorless zircon is concentrated as non-magnetic at 1.5 amps, while magnetic zircons are concentrated in the range between 0.5-0.7 amps. Cumulative percentage of the individual minerals separated as magnetic fractions at different current intensities is presented in table 4.

Table 4. Cumulative percentage of the individual minerals separated a magnetic fractions at different current intensities

Current (amp.) Mineral	0.2	0.5	0.7	1.0	1.2	1.5	Non-mag.1.5
Samarskite–Y	–	0.40	82.50	100	–	–	–
Columbite	10.80	**100**	–	–	–	–	–
Magnetic zircon	–	12.60	78.20	100	–	–	–
Colorless zircon	–	–	–	–	–	20.40	100
Mica	92.20	100	–	–	–	–	–
Goethite	95.70	100	–	–	–	–	–
Hematite	20.40	100	–	–	–	–	–
Garnet	12.60	**100**	–	–	–	–	–
Ilmenite	20.20	**100**	–	–	–	–	–

By applying the High Intensity Induced Roll Magnetic Separator (Carpco Model MI27) for the bulk heavy fraction, it is possible to obtain a rich concentrate of samarskite and zircon as a non-magnetic fraction in two stage operations. Separation was achieved at a medium air gap between the surface of the rotor and the magnetized pole of 1.5 mm and with a magnetic field current of 0.8 amp. The speed of the roll and the feed rate were adjusted at 50 rpm and 150g/min respectively. Mineralogical analyses of the magnetic separation products (magnetic and non-magnetic fractions) are presented in table 5. The obtained results indicated that the final non-magnetic concentrate of samarskite assays up to 73.80% and the rest are represented by both magnetic and non-magnetic zircon.

Table 5. Mineral analyses of the magnetic and non-magnetic products

Product	Mineral% wt.%	Samarskite–Y	Magnetic zircon	Colorless zircon	Mica	Ilmenite	Garnet	Others*
Non-magnetic fraction	30.55	73.80	9.20	12.50	3.0	–	1.5	–
Magnetic fraction	69.45	3.50	0.50	–	61.20	10.80	5.70	18.30

* Hematite and goethite.

6. PHYSICAL CONCENTRATION OF SAMARSKIT–Y

Magnetic separation characteristics of samarskite and zircon proved to have rather good potential in concentrating the majority of samarskite and zircon as a non-magnetic product. Therefore, the deslimed size fractions (-1.0 +0.800 mm, (-0.800 +0.63 mm), (-0.630 + 0.400 mm), (-0.400 + 0.200 mm) and (-0.200 + 0.045 mm) were separately fed to the laboratory Wilfely shaking table (No. 13) to obtain a primary concentration. The feed to gravity separation must be uniform in size (Taggart 1944).

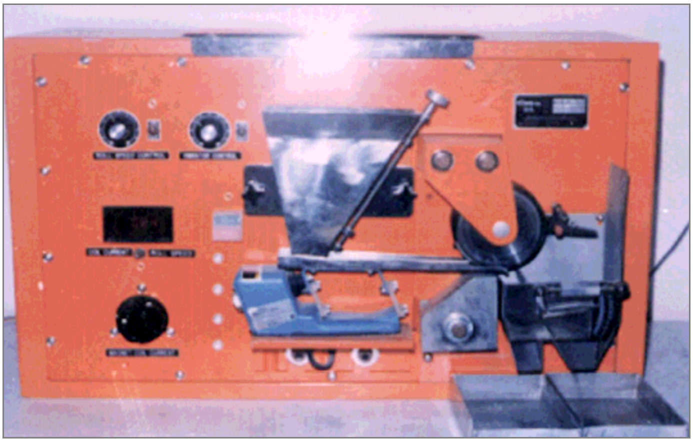

Fig. 7. The high intensity left-type magnetic separator, (Carpco), Model MLH (13) 111–5

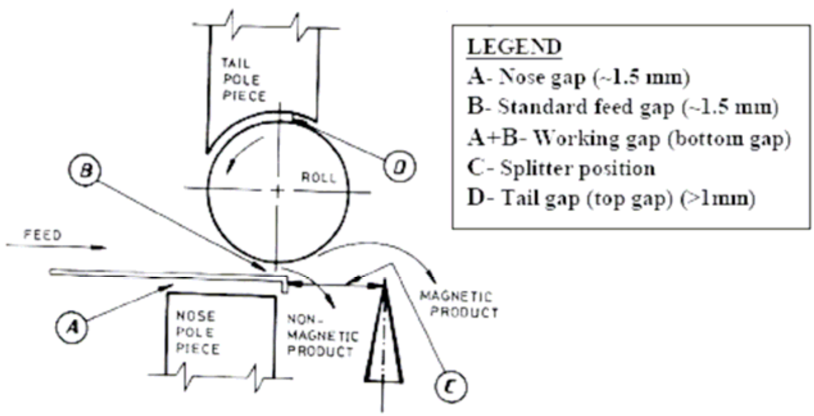

Fig. 8. Gap adjustment diagram for the high intensity lift-type magnetic separator

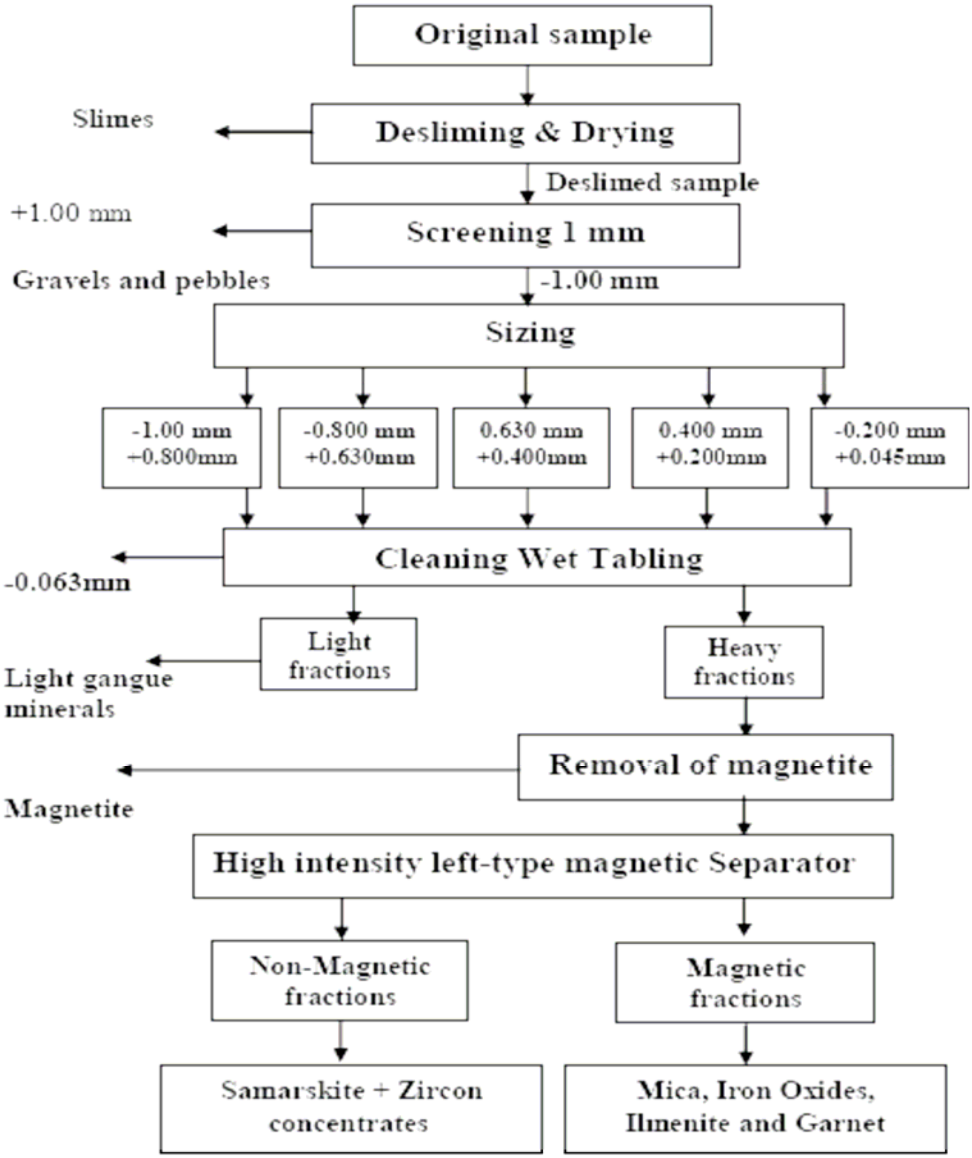

Fig. 9. A proposed flowsheet for beneficiation of samarskite, and zircon from Ras Baroud stream sediments

The purpose was to reduce the bulk light gangue minerals from the deslimed size fractions and attain clean concentrate for each size fraction. This operation was optimized by using less feed, less water, less tilt as much as possible, shorter length of stroke beside a low speed of the deck. The obtained cleaner concentrates were mainly composed of magnetite, samarskite, zircon, garnet, mica and iron oxides. It was found that the efficiency of tabling increase by decreasing the size range of the feed.

The tabling concentrate of each size fraction was then subjected to magnetite purification using a wet-magnetic technique. The used apparatus consists of a glass cylinder and mechanical stirrer. Around the cylinder is a permanent magnet. The sample was poured into the cylinder when filled with water and stirred. The magnetite grains were attracted towards the magnet poles through the turbid water helps in separating magnetite from other heavy minerals that discharged from the bottom of the glass cylinder.

The free magnetite tabling concentrate of each size fraction was then fed to the high Intensity Induced Roll Magnetic Separator (Carpco Model MI27) (fig. 7) in order to obtain pure concentrates of samarskite and zircon as a non-magnetic fraction. In the High Intensity Induced Roll Magnetic Separator, the magnetic materials are lifted magnetically up against gravity in comparison to other separators that have gravity operating in the same general direction as magnetic force. This separator utilizes a vibratory feeder to transport the feed horizontally through an adjustable magnetic field zone where the magnetic force acting on the particles is perpendicular upwards. The advantage of this principle is production of high purity magnetic products and also separation of more than one magnetic material. It was found that the efficiency of separation increased with decreasing of grain size. The effect of particle size and even shape on the behavior of samarskite crystals during the magnetic separation is quite pronounced. It is quite clear that the coarse massive granular samarskite crystals tend to be attracted to the magnetic fractions rather than those of small and rod -like shape. Their attractability is due to the effect of particle mass rather than their magnetic properties. The principles and gap adjustment of the used separator is shown in fig. 8. A schematic sequence of the processes followed in the upgrading operations is presented in the form of a proposed flowsheet in fig. 9.

7. CONCLUSIONS

Mineralogy of the Ras Baroud stream sediments revealed the presence of samarskite-Y associated with columbite, zircon, magnetite, garnet, goethite, ilmenite, hematite and mica. Electron microprobe analyses of the investigated samarskite–Y gave (av. in wt. %): Nb_2O_5 46.20, Ta_2O_5 0.06 TiO_2 0.66, UO_2 3.36, ThO_2 5.53, Y_2O_3 24.37, MnO 0.04, ZrO_2 0.00, CaO 0.57, FeO 0.09, SiO_2 0.17 and a total REE of 19.23 with an average sum of 100.27 Wt.%, which corresponds to empirical formula $(Y_{0.52}REE_{0.29}Th_{0.06}\ Si_{0.01}Ca_{0.02}U_{0.03}Fe_{0.00}Zr_{0.00})_{\sum 0.97}(Nb_{0.93}\ Ta_{0.00}\ Ti_{0.02})_{\sum 0.96}O_4$. Magnetic separation characteristics of samarskite-Y indicate a rather good potential to obtain a rich concentrate of such mineral using gravity and magnetic separation techniques respectively.

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MINERALOGICZNA I MINERALURGICZNA CHARAKTERYSTYKA SAMARSKITU–Y POCHODZĄCEGO Z OSADÓW RZECZNYCH OBSZARU RAS BAROUD PUSTYNI CENTRALNEJ W EGIPCIE

Odnotowano unikalne występowanie samarskitu-Y w osadach rzecznych otaczających obszar Ras Baroud na Pustyni Centralnej w Egipcie. Stwierdzono, że minerał ten jest związany z kolumbitem, cyrkonem, magnetytem, granatami, goethytem, ilmenitem, hematytem oraz miką. W reprezentatywnej próbce badanego osadu znaleziono samarskit-Y w ilości 1,5% wagowego. Badania przeprowadzone za pomocą mikroskopu optycznego jak skaningowego pozwoliły zidentyfikować i opisać badaną odmianę minerału, podczas gdy badania elektronowe w mikroobszarze pozwoliły na określenie jego formuły. Analiza składu ziarnowego reprezentatywnej próbki samarskitu-Y pochodzącego z osadu rzecznego wykazały szeroką dystrybucje rozmiaru ziarn z tendencją występowania większej ilości ziarn drobnych. Badany materiał był średnio magnetyczny. Stwierdzono, że jego podatność magnetyczna jest niższa niż współwystępującego kolumbitu. Możliwe jest otrzymanie bogatego koncentratu samarskitowego stosując separację grawitacyjną oraz magnetyczną.