CHAPTER - I

INTRODUCTION

Nuweibi area is located in the Central Eastern Desert, 30 km north of Marsa Alam and about 33 km west of the Red Sea coast. It lies between latitudes 25° 10\ 30\\ and 25° 15\ 15\\ N and longitudes 34° 29\ 00\\ and 34° 38\ 29\\ E, covering an area of about 135 km^2 (Fig.1-a&b). It is mainly covered by metasediments, serpentinites, metagabbros, grey granites, albite granites, post and pre-albite granite dykes. The albite granite massif was developed through high temperature multistages metasomatism and belonged to final stage of the Gattarian intrusive (El Tabaal, 1979). This granite appears to be formed along the fault plane of N-S direction which in turn divides the massif into two main blocks; eastern and western parts (Riad, 1979). It displays intermediate position between normal and subalkaline albite granite (Sabet, 1980). This granite is magmatic in origin and crystallized through four steps (Helba et al., 1997 and Abu El-Maaty and Ali Bik, 2000).

Nuweibi area is drained by two main wadis, the first one is Wadi El-Nabi located at the north while the second is Wadi El-Nuweibi at the south (Fig. 2). The two wadis run through the concerned area from west to east and drained their load from the surrounding country rocks. The downstream of the two wadis is intersecting and consequently poured their weathered product in the Wadi Dubur which runs to the east to the Red Sea coast.

Weathering processes plays a major role in accumulation of the stream sediments through three essential stages which are weathering, transportation and deposition stages. In weathering stage, the material disintegrates from the neighbored country rocks by the effect of various chemical and physical processes. These processes increase with increasing the rain water, which clean the surface of mother rocks and transport the eroded materials to the different tributaries. The heavy and coarse particles were deposited in the stream due to the different factors as the current velocity decreases, change of the valley cross-section, decrease of the slope gradient and the presence of any obstacle. The placers deposits of Nuweibi area have been formed under short torrential showers and mud flows. It is restricted to the central part of the wadi floor as well as the

lower parts of the loose sediments (Sabet et al., 1976). Hence, the similarity in the mineralogy for both the stream sediments as well as the country rocks was recorded and these good indications for the same heavy and economic minerals in stream sediments may be contributed from the neighbored country rocks. Consequently, the stream sediments of the Nuweibi area are considered the natural trap for the surrounding country rocks. Moreover, they act as reservoir for the accessory and some radioactive minerals such as ilmenite, magnetite, hematite, cassiterite, walframite, zircon, barite, pyrite, apatite, fluorite, monazite, chromite, epidote, allanite, garnet and rutile.

Recently, the studied area displays relatively economic importance due to the presence of some rare metal mineralization at Gabal Nuweibi granite which represented by fine disseminations of columbite-tantalite with subordinate cassiterite and other accessory minerals. Naim et al., (1996) stated that, the highest concentrations of the rare metals mineralization at Gabal Nuweibi occurs in the upper part of the mass and decrease gradually with depth. Furthermore, the tantalum ore reserve content in Nuweibi area is about 1286 2.7 Ton and the columbite ore reserve content is about 7557.6 Ton. Generally, columbite is the most widespread niobium mineral and makes for an important ore of the industrially useful metal. Niobium is used in alloys for improved strength.

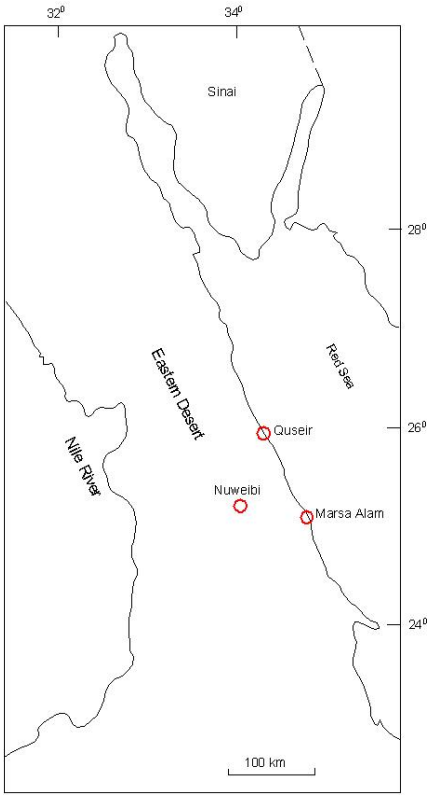

Fig. (1-a) Key map showing the studied area

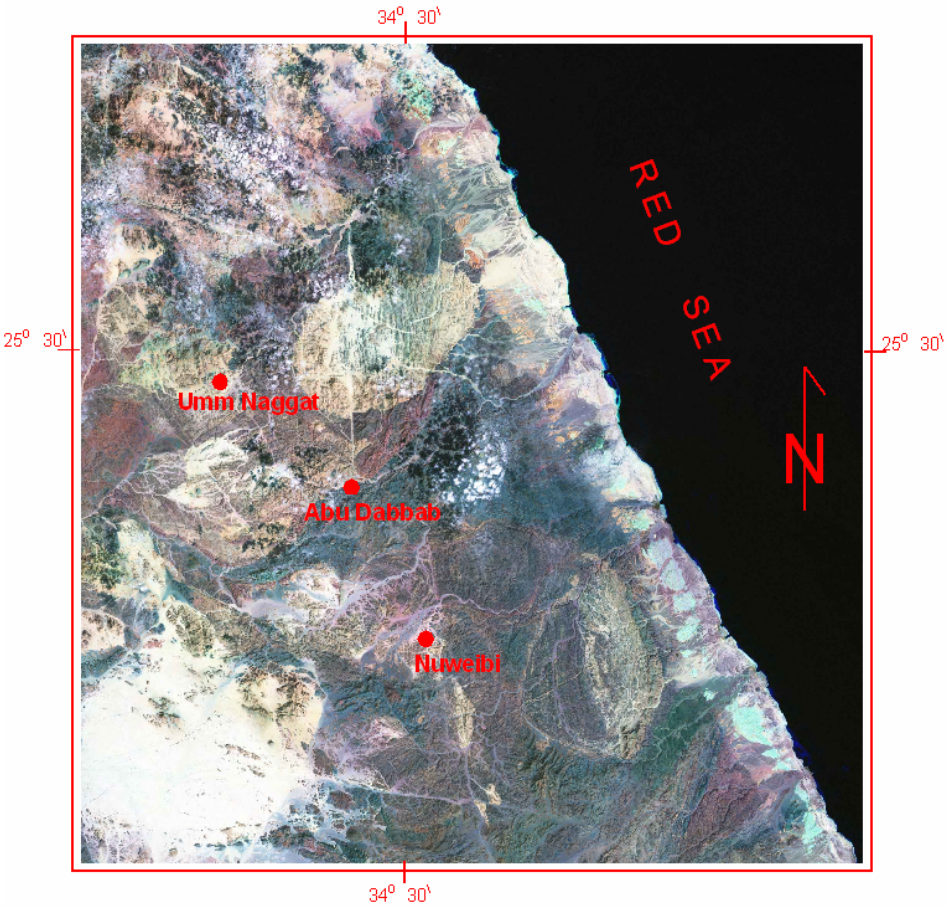

Fig. (1-b) Landsat image of the aimed area.

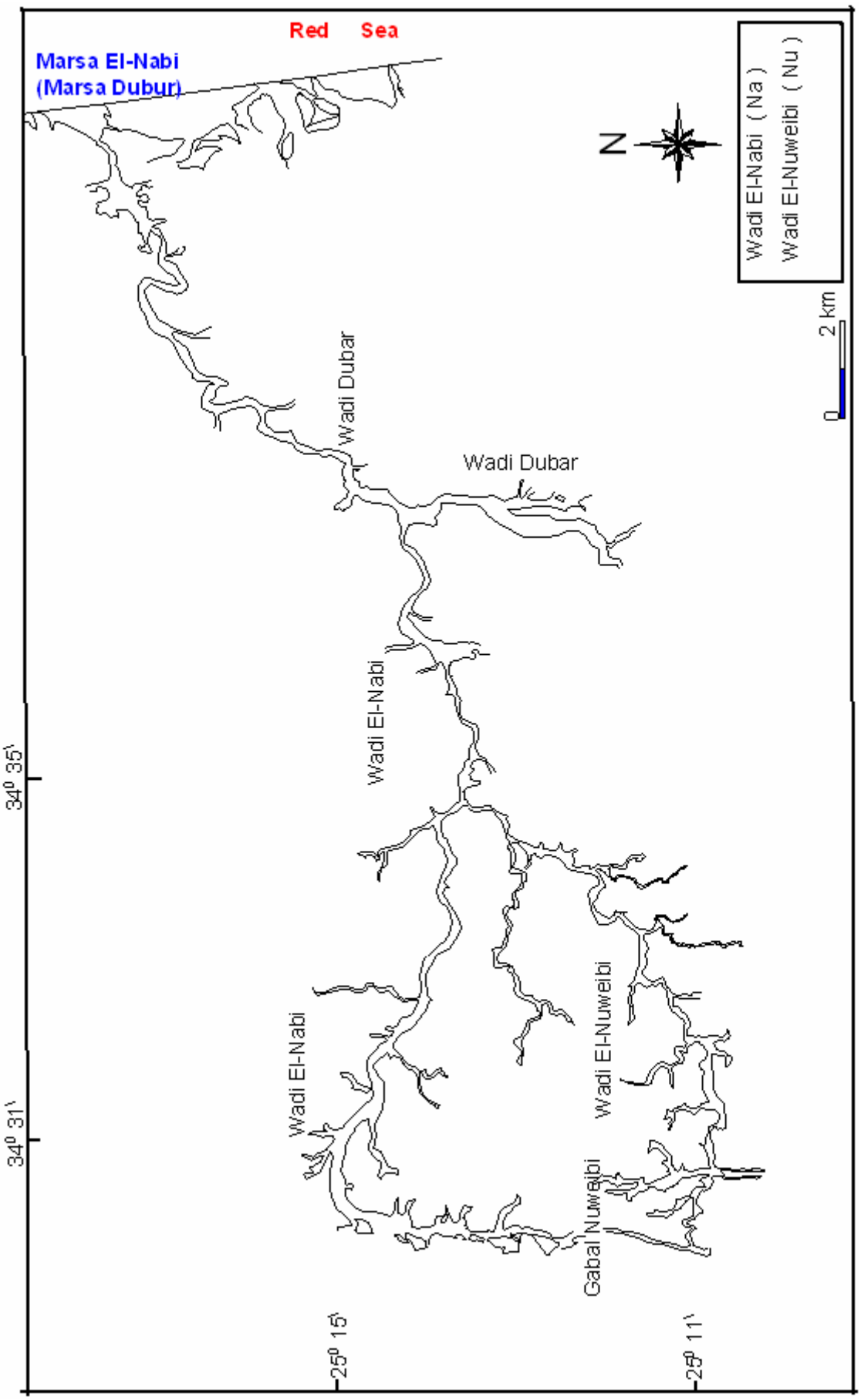

Fig. (2) Drinage map showing the main wadis of the studied area.

1.1 Previous work

The following is a review of the previous investigations on the studied area.

Amin et al., (1952) studied the granitic rocks exposed in the Nuweibi area, and pointed out that these rocks consist of microcline, microcline perthite, orthoclase, albite, quartz and muscovite.

Sabet and Tsogoev (1973) studied the problems of geological and economic evaluation of tantalum deposits in apogranites during stages of prospecting and exploration. They mentioned that, the rare metal albite granites comprise three main groups namely albite granite of the normal, subalkaline and alkaline order. Each group characterized by specific association of rare metal mineralization due to the metasomatic alteration.

Sabet et al., (1973) studied the tin, tungsten and the rare metal mineralization in the Central Eastern Desert of Egypt. They discovered unknown deposits of tantalum and other associated rare metals in the albite granites for the first time in Nuweibi, Igla, Abu-Dabbab and Humr Waggat. These albite granites seem to be related to the intrusive complexes of the last phase of the Gattarian granites.

Awad (1973) discussed the applications of the geophysical methods for mineral prospecting at Abu-Dabbab and Nuweibi areas, Central Eastern Desert of Egypt. He reported that, the albite granite rocks are characterized by relatively low magnetic field and high radioactive background with respect to the country rocks. However, a low magnetic field is also observed due to quartz-biotite schists. At Nuweibi both the eastern and southern areas with respect to the albite granite mass show high radiometric anomalies and lower magnetic field.

Geological Survey of Egypt (1974) examined the mineral deposits in Egypt. They concluded that, the albite granite massif have a complex geology and shows a clear metasomatic vertical zonation. Three major facial zones are distinguished in cross-section: the upper zone is mainly of albitic albite granite, the middle zone of muscovite-microcline-quartz-albite granite and a lower zone mainly of quartz albite granite.

Sabet (1974) investigated the placer deposits of Igla, Abu Dabbab and Nuweibi areas. He mentioned that, the placer is situated in the upper reaches of Wadi El-Nuweibi and is restricted to the central part of the wadi floor. The placer minerals comprise cassiterite, ilmenite, magnetite, walframite, rarely barite, apatite, topaz and rutile. Cassiterite is represented by typomorphic varieties and their distribution in wadi is uneven.

Sabet et al., (1976) summarized the results of geological structure and laws of localization of the tantalum mineralization at the Nuweibi deposits. They considered the Nuweibi deposit as big and the tantalum ores exhibits poor and medium quality. Genetically the ore minerals are featured by fine impregnations of tantalum- columbite with subordinate cassiterite, fluorite, muscovite and accessory minerals of the eastern part of the mass. The distribution of the tantalum mineralization in the Nuweibi deposit is even. They added that, the mineralization is subordinate to the metasomatic zonation developed in the mass being concentrated in its upper most part and gradually decrease with depth.

Sabet et al., (1976) study the placer tin deposits of Abu-Dabbab, Igla and Nuweibi areas. They concluded that, the placers have been formed under short torrential showers and mud flows. It is restricted to the central part of the wadi floor as well as the lower parts of the loose sediments. The thickness of the productive layer ranges within 0.25-2.55m (average 1m). The average cassiterite content is 2.5 kg/m3. Both the mineralized veins and the placer deposits are related to the albite granites.

Riad (1979) reported the geology and petrology on some apogranite occurrences in Nuweibi area. He concluded that, the structure of the albite granite massif appear to be formed along the fault plane of N-S direction which was rejuvenated to divides the massif into two blocks eastern and western parts. The mother rock of the albite granite was granitoid in composition; fine grained more or less rich in biotite and topaz.

El Tabaal (1979) made mineralogical studies on some rare-metal apograintes from Nuweibi and Abu-Dabbab areas. He recorded that, the investigated rocks were proved to have some rare metal and accessory minerals. Disseminated cassiterite is present in the

rock and may have inclusions of tantalite or columbite-tantalite. In some cases, they contain spherical aggregates of tabular walframite crystals and scheelite grains. It seems most probable that the studied rare-metal albite granite was developed through high temperature multi stage metasomatism of the Nuweibi and Abu-Dabbab granitic massifs belonged to be final stage of the gattarian intrusive.

Kamel et al., (1980), study the mineralogy of alluvial and placer deposits of the Central Eastern Desert, Egypt. They concluded that, the magnetite, ilmenite and hematite are the essential opaque minerals. Minor amounts of rutile and sulphides are not uncommon. In addition to, two types of mineralization characterized the study area of the Central Eastern Desert were recorded:

1. Tin- tungsten mineralization mainly related to the formation of greisen quartz veins in Nuweibi, Abu-Dabbab. This mineralization is represented by an economic mineral assemblage consisting of cassiterite, fluorite, walframite, scheelite, topaz and beryl.
2. Gold-sulphide mineralization related to the formation of mesothermal quartz veins like in Atud. Besides, some niobium-tantalum and other rare earth placer minerals are also recorded in different localities.

Kamel and El-Tabbal. (1980) examined the petrology and mineralogy of Nuweibi and Abu-Dabbab rare metal apogranites. They indicated that, Nuweibi deposits are represented by a mass of albite granite with Ta-Nb and Sn mineralization. The mass consists of three distinct vertical zones:

a. The upper zone characterizing the front of Na metasomatism.
b. The middle zone characterizing the front of Li, K, Na metasomatism.
c. The lower zone characterizing by the superposition of high temperature silicification.

Sabet (1980) discussed the Tin-rare metal deposits at Abu-Dabbab and Nuweibi. He concludes that, the Nuweibi albite granite displays intermediate position between normal and subalkaline albite granite. It distinguished from both by a lower total content of alkalis, alumina and magnesia. The subalkaline varieties display K/Na ratio while the

normal types display total alkali/ silica. Its placer deposits is situated in the upper reaches of Wadi El- Nuweibi and restricted to the central part of the wadi floor.

Naim et al., (1996) study the main occurrence of tantalum-niobium and Tin mineralization in albite granite in Abu-Dabbab, Nuweibi, Um Naggat and Abu-Rushied, and mentioned that most of them are located at the intersection of regional faults and /or shear zones. The highest concentrations of the rare metal mineralization at Gabal Nuweibi occur in the upper part of the mass and decrease gradually with depth. The highest and most even concentrations of Ta_2O_5 are characteristic for the albite rich albite granite (upper zone) of the eastern part of the mass in Nuweibi area.

Helba et al., (1997) showed that the geochemical and petrographic studies of Ta mineralization in the Nuweibi albite granite complex. They indicate that the granites are late or post-orogenic with respect to the Panafrican orogeny. The albite granite of the Nuweibi indicates that the two parts are genetically related and essentially igneous origin.

Arslan et al., (1997) investigated the bedrock geochemical prospecting and ore potentiality of the rare metal-bearing granite at Nuweibi area. He concluded that, the main ore minerals recorded in the Nuweibi granite are columbite-tantalite, microlite and rare cassiterite. It noting that the eastern part is relatively depleted in F and Li which may reflect the degree of fluid phase migration. Hence it is expected that the eastern part represents the apical zone of the Nuweibi granite and the western part represents a deeper zone of the granitic intrusion. Limited metasomatic alterations do occur and are represented by muscovitization, microclinization and feldspatization which are noticed more effective on the eastern part.

Mohamed (1998) study the mineralogy and radioactivity of the alluvial deposits of Wadi Abu-Dabbab area. He concludes that, the southern branches of Wadi Abu Dabbab sediments are rich in the total heavy minerals content than the northern ones. The identified heavy economic minerals assemblage in the concerned sediments includes magnetite, ilmenite, hematite, goethite, chromites, leucoxene, pyrite, zircon, rutile, monazite, epidote, garnet and cassiterite. In addition to, the radioactivity of the concerned

sediments is very low and attributed mainly to the presence of the two radioactive minerals which are zircon and monazite.

Abu El-Maaty and Khalil (1999-a) study the mineral chemistry as a guide to magmatic evaluation of some basement rocks from Nuweibi area. He mentioned that, the Nuweibi area hosts Nb and Ta bearing albite granites. It is surrounded by schists, metapredotites, serpentinites, metagabbros, old granites and post granite dykes of different composition. The electron microprobe data show that all the rock forming minerals of the granitoids have a magmatic origin and none suffer any post magmatic alteration.

Abu El-Maaty and Khalil (1999-b) studying the petrography and geochemistry of some plutonic rocks of Nuweibi and Mueilha. They conclude that, the plutonic rocks comprise nearly the same Neoproterozoic rock assemblages and characterized by the existence of albitized granites.

Abu El-Maaty and Ali Bik (2000) study the petrology of alkali feldspar granites of Nuweibi and Gabal El-Mueilha. They estimated that, the albite granites of Nuweibi area are peraluminous and post orogenic/anorogenic A-type granites emplaced at high crustal levels. They added that, the albite granite of Nuweibi area is magmatic origin and crystallized from magma through four steps.

Ghoneim (2003) study the mineralization of niobium and tantalum in the Central Eastern Desert, Egypt. He stated that, there are many ores founded in the Eastern Desert such as niobium, tantalum, cassiterite and feldspars. Tantalum characterized by high melting point reach to about 1600^0c. These ores related to albite granite, which found in many locations such as Nuweibi, Abu-Dabbab, Igla and Abu-Rushied at which the regional faults are intersected in these locations.

Abd El-Wahed (2004) study the structural and metamorphic evolution of Wadi Dubur metasediments, Central Eastern Desert, Egypt. He concluded that, Wadi Dubur metasediments occur in three localities named East Dubur, West Dubur and Nuweibi.

They are composed mainly of chlorite-biotite schist and metagreywacke. They are intruded and faulted against metagabbro-diorite complex, older granites and younger granites. Structural analysis of major, minor and micro structures and P-T estimates indicate that, these metasediments have been tectonically evolved through four phases of deformation (D_1-D_4). These four phases of deformation can be kinematically grouped into two events D_1-D_2 and D_3-D_4. these two main events were accompanied by three metamorphic events (M_1-M_3).

The metasediments close to the granites are thermally metamorphosed under condition similar to that of the kyanite-sturolite zone, whereas those far from the granites are metamorphosed within the range of the garnet zone.

Abdalla et al. (2008) study the chemistry of cassiterite in rare metal granitoids and the associated rocks in the Eastern Desert, Egypt. They stated that, the cassiterite of the metasomatized alkali feldspar granites is characterized by enhanced to moderate Nb, Ta, (with high Nb/Ta ratios), Ti, FeO and lower Ga_2O_3 (‹0.01 wt%). Also, characterized by the development of deep brown pleochroic color zones which oscillated or progressively alternate with lighter color zones. On the other hand, the cassiterite in the lithium albite granite is enriched in Ta, Nb (with low Nb/Ta ratio), Ti, FeO, Ga_2O_3 0.01-0.04%.

1.1 Aims and scope of the present study:

The present study is intended to investigate the geology, petrography, grain size distribution, mineralogy, chemistry and radioactivity of the wadi deposits in Nuweibi area and their relationship with the neighboring country rocks. The results will be used to shed light on the mineralogical composition of the alluvial sediments as well as the granitic rocks in the studied area with special attention to the characteristics of the heavy economic minerals. To achieve these objectives the following investigations were conducted on the studied area:

1. Review of previous studies.
2. Preparing regional geological map using landsat image.
3. Sample collection from alluvial deposits as well as the country rocks.
4. Petrological studies of some rock varieties encountered in the area.
5. Grain size distribution for the sediment samples.
6. Mineralogical studies were carried out using different techniques.
7. Geochemical investigation including major and trace elements for both alluvial sediments as well as the hard rocks in order to establish their relations with the mineral composition, in addition to, mineral chemistry for some recorded economic minerals.
8. Radioactive investigations are also carried out on alluvial sediments as well as hard rocks using Gamma-ray spectrometric multichannel analyzer technique to measure the four radionuclides; eU, eTh, eRa and K. Beside detail Gamma-ray spectrometry using (GS 256) apparatus in the field.
9. Identifying the radiation anomaly detected by airborne gamma-ray spectrometry.
10. Studying the distribution of radioactivity background of the different rock types.
11. Determination the role of structure in the localization of mineralization in the studied area.