GEOLOGY AND REMOTE SENSING STUDIES ON SOME URANIUM-BEARING GRANITES, EASTERN DESERT, EGYPT

ABSTRACT

In the recent years, the Egyptian younger granites attracted a great of interest, due to their association with anomalous concentrations of rare and economically important elements.

The granitic rocks are considered as one of the most important source of uranium deposits. Comprehensive exploration programs conducted by Nuclear Materials Authority (NMA) to search for uranium mineralizations in Egypt. These programs led to the discovery of radioactive anomalies and uranium mineralizations in the Northern, Central and Southern Eastern Desert of Egypt, besides Sinai.

With respect to these discoveries, the present writer was motivated to integrate the geology with the remote sensing techniques to establish the common characteristic features leading to the recognition of more uranium mineralizations within the Pan-African younger granites of the Eastern Desert. The present work concerns with Gabal (G) Gattar, G. El Missikat and G. El Erediya uranium prospects for this study as they represent the most promising examples for the presence of economic uranium mineralizations.

Field characteristic features of these granites, such as circular shapes with pink to red color, devoid of tectonic foliation, posses sharp non-reactive contacts with the surrounding country rocks, postorogenic and epizonal emplacement with affinity to A-type granite, are more likely to retain uranium within their plutons.

The association of aplites, quartz and jasperoid veins and lamprophyric dykes throughout and near the mineralized sectors appear to play an important role in the distribution and localization of the mineralizations and their alteration processes. They act as heat source causing increase of the mobility of the uranium and its leachability.

These granties are characterized to be leucocratic, highly differentiated with the presence of zircon, monazite, fluorite, iron oxides, and apatite as accessories. Geochemically, they are characterized by high silica contents > 73%, metalumonous to slightly peralumonous, low Fe_2O_3, MgO and TiO_2, rich in alkali elements (Na_2O and K_2O), low Th/U ratio, and low $^{87}Sr/^{86}Sr$. They also rich in elements such as, Nb, Ga, Zr, Y, U, and Th.

In the granitic magma of metaulminous nature, the largest amount of uranium contents are bound to the structure of the accessory minerals, especially zircon, that contain abnormally high value of U, ranging from about

3000 to 11000 ppm. This uranium can be easily mobilized and leached only after metamictization, at least 100 Ma after the emplacement of the granite.

Image enhancement techniques are applied to the digital subset ETM^{+} data of the two studied areas. These techniques generated several products of image processing ranging from color composite images, ratio images, color ratio and multiplication composite images and principal components. These techniques have been successfully used in lithological discrimination of uranium-bearing granites, in addition to characterization and mapping the hydrothermal alteration zones that usually help in localization of uranium mineralizations.

The capabilities of remote sensing data to characterize the uranium bearing granites and to detect hydrothermally altered zones with extensive geologic and radiometric investigations let to the discovery of four locations of high radioactive anomalies with some uranium mineralizations, mainly connected to the studied younger granites.

Mineralogical studies were carried out, using ore and scanning microscope and XRD, for some selective mineralized samples. These investigations confirm the presence of uranophane mineral as uranyl silicates. This mineral is found in close association with hematite, quartz, calcite and chlorite. Relics of corroded pyrite grains are disseminated in the groundmass and filling some vuges and cavities. The uranium mineralization is found adsorbed and enclosed around pyrite. This may indicate that the presence of pyrite created a reduced environment favorable for the precipitation and fixation of uranium.