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بسم الله الرحمن الرحيم

مركز الشبكات وتكنولوجيا المعلومات

قسم التوثيق الإلكتروني



Safaa Mahmoud



جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

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Geology Department

The Role of Rock Alteration in the Distribution of Uranium and Associated Elements in the Um Bogma Formation at Wadi Nasib Area, Southwestern Sinai, Egypt.

by

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



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To...

I dedicate this work to my lovely family to whom I owe all my life ...

Father, Prof. Dr. Tarik Amer...

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Sister, Mrs. Angie

and

my lovely son : ALI Gad



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Abstract

The Lower Carboniferous Um Bogma Formation in Allouga, Abu Thor and Talet Seleim localities in Wadi Nasib area consists of three members made up of variably abundant siliceous, argillaceous and calcareous rocks together with ironstones. The formation hosts mineralizations of radioactive, rare and trace elements in addition to base metals.

The petrographic examination of the Um Bogma rock samples revealed that the siliceous rocks are represented by sandy siltstones and sandstones. The argillaceous rocks are made up of claystones, mudstones and gibbsite, whereas the calcareous rocks consist of limestones and dolostones.

The Um Bogma altered rocks are composed of large assemblages of essential and accessory minerals of mixed primary and secondary origin. Their heavy fractions are rich in radioactive, trace- and base metals - bearing minerals. These minerals are represented by uranophane, thorite, uranothorite, xenotime, autunite, zircon, monazite, pyrite, chalcocopyrite, chalcantite, ilmenite, apatite, columbite, celestobarite, chromite, hemimorphite, jarosite, plumbojarosite, cotunnite and native nickel.

The mineral and chemical compositions of the studied Um Bogma rocks indicate derivation from rhyolites and, to a lesser extent, dacite source rocks. The depositional environments of the Um Bogma limestones in Talet Seleim locality was the most reducing as compared to those of Allouga and Abu Thor localities. Generally, these environments were

characterized by physico-chemical conditions suitable for the fixation of several elements especially uranium and copper.

Alteration processes largely modified the original mineralogical and chemical composition of the studied Um Bogma rocks. Ascending hydrothermal solutions caused a significant alteration of the sedimentary country rocks especially those constituting the unconformity zone between the basement rocks and the overlying sedimentary succession. Also, this zone and the younger rocks were subjected to several alteration processes as a result of varying degrees of chemical weathering under warm and humid climatic conditions. Applying several bivariate and multivariate diagrams for the major elements revealed that these processes resulted in the formation of different types of laterites, Al-rich minerals, Fe and Mn oxides and bauxitic –ferritic kaolinite. They involved also sericitization and chloritization of the rocks in addition to the dolomitization of the original limestones.

The concentrations of the radioactive, rare and trace elements as well as base metals in the Um Bogma altered rocks were compared to those of UCC in order to determine their relative degrees of enrichment or depletion. The results obtained revealed that these processes varied among the different rock types and localities. Uranium was mobilized during epigenesis and subsequently enriched in some altered rocks especially those of Abu Thor and Allouga localities. Also, alteration resulted in the enrichment of: (i) Cu in all the calcareous rocks; (ii) Ba and Sr in those of Abu Thor locality; (iii) Pb and Y in those of Abu Thor and Allouga; and (iv) Ni and Zn in the argillaceous rocks of Allouga and Talet Seleim localities. Generally, the altered calcareous rocks of Abu Thor locality are the most diagenetically enriched in most of the trace elements and base metals.

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