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Geology, Petrology and Radioactive Potentiality of Um Bogma Formation in the Area West of Wadi El-Nasab, Southwestern Sinai, Egypt

By

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NOTE

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Beside the research work materialized in this thesis, the candidate has successfully passed the final examinations of post-graduate courses covering the following topics:

1. Field Geology.
2. Geostatistics.
3. Sedimentary Petrology.
4. Sedimentation.
5. Advanced Mineralogy.
6. Geochemistry.
7. Igneous Petrology.
8. Metamorphic Petrology.
9. Advanced Crystallography.
10. Ore Petrology.
11. Lab Techniques.
12. English Language.

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Dedication

To
My Parents
My Husband Kareem
&
My Lovely Daughter Farida

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First of all, praise is due to almighty ALLAH for his compassion and mercifulness that allowed me to finish this work.

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'' If it were not for you, I would not have been here''

ABSTRACT

The exposed rocks in Talet Seleim area west of Wadi El-Nasab are represented by the Precambrian Basment Complex overlain by a succession of the Lower Carboniferouos Um Bogma Formation and the unconformably overlying Abu Thora Formation. Extensive field and laboratory studies on the Um Bogma Formation indicated that it consists of a lower siltstone-dolostone member, a middle siltstone-mudstone-dolostone member and an upper dolostone member. These rock units have mainly unconformable relationships and show marked lateral variations in thickness and minor changes in lithology. The rocks display several primary sedimentary structures the most common of which are bedding, lamination and biogenic features. Also, the succession is variably affected by faulting, jointing and small-scale folding and contains gypsum veins and clastic dykes.

The argillaceous rocks in Um Bogma Formation are slightly to highly calcareous and ferruginous. They are texturally classified as siltstone, sandy siltstone, mudstone and sandy mudstone. Their clay fractions consist of kaolinite and minor proportions of illite and montmorillonite-illite. The nonclay mineral assemblage is made up of non-radioactive, radioactive and REEs- and heavy metals-bearing minerals. It contains thorite, uranothorite, fergusonite, allanite, cerite, ferricorondite, chalcophanite, cassiterite, brass (Cu, Ni, Zn) and REEs concentrates. These minerals exist in a variety of forms, habits and modes of occurrence indicative of primary and secondary as well as allogenic and authigenic origin. On the other hand, the carbonate rocks in the lower two members of Um Bogma Formation and those constituting its upper member are classified as dolosparite (dolomitized crystalline carbonate) and dolomitized intra-biosparite (dolomitized wackestone). These carbonates

consist of dolomite and lesser proportions of calcite. Dolomite crystals are micro-to macrocrystalline and of two types: idiotopic and xenotopic. The noncarbonate fractions consist of a large number of minerals including thorite, uranophane, zircon, Ni concentrates, gold and silver.

The argillaceous rocks, especially those of the middle member, are markedly enriched in Al_2O_3, Fe_2O_3 and MnO in addition to a large number of the trace and rare earth elements (mainly LREEs) and heavy metals. The majority of these elements are concentrated in the heavy mineral fractions. Their moderate to strong positive correlations indicate genetic relationships. It is most likely that they were concentrated during weathering and diagenesis. The rocks showed moderate negative Ce and Eu anomalies when normalized to chondorites. This indicates the prevalence of reducing conditions during their deposition and / or diagenesis. Applying several discrimination diagrams revealed that the detrital components of the rocks were derived from continental source rocks having intermediate chemical composition or from mixed felsic and basic rocks. Evidently, these rocks were subjected to moderate to strong weathering under tropical conditions.

The argillaceous rocks in Um Bogma Formation, especially those of its middle member, have much higher radioactivity than that of carbonates. Also, the rocks in the eastern part of Talet Seleim area are more radioactive than those in its western part. Evidently, the majority of Um Bogma rocks were subjected to continuous and contrasting uranium mobilization processes that resulted in its addition in rocks of the middle member and a state of equilibrium for each of the lower and upper members. Assessing the time of the last uranium migration in the rocks revealed that it ranged between 20.32 and 322.5 Ka for rocks of the middle member and is 97.59 Ka for those of the upper member.

Abstract

Diagenetic compaction, cementation, alteration, replacement and dissolution greatly modified the original textural and, especially, compositional characteristics of Um Bogma rocks. The first two processes were more profound in the argillaceous rocks whereas the other three affected mainly the carbonates. Dolomitization of the original limestones occurred during both the mesogenetic phase (by the action connate waters) and epigenetic phase (in the zone of mixing of marine waters and underground freshwaters).

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