



شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم



HANAA ALY



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جامعة عين شمس التوثيق الإلكتروني والميكروفيلم

قسم

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Facies, Geochemistry and Rare Elements Potentiality of Um Bogma Formation in the Area East of Wadi Baba, Southwestern Sinai, Egypt.

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في الآفاق وفي أنفسهم حتى يتبين لهم أنه الحق

أَوَلَمْ يَكْفِ بِرَبِّكَ أَنَّهُ عَلَىٰ كُلِّ شَيْءٍ شَهِيدٌ

- فصلت ٥٣ -

Dedicated to

The soul of my lovely brother,

Ayman

&

My supportive Family

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Abstract

Key words: Egypt, Sinai, Lower Carboniferous, Um Bogma Formation, facies, genesis and diagenesis, radioactivity, trace and rare earth elements, base metals.

The mineralized Lower Carboniferous Um Bogma Formation was studied in eight localities distributed in a vast area east of Wadi Baba. These localities are (from west to east): Talet Seliem, Abu Zarab, Abu Thor, Farsh Al-Azraq, Allouga, Lehyan, Wadi Sewig and Ramlet Hemiyyer. Extensive field studies comprised the preparation of geologic maps, the collection of a large number of spot and channel samples and carrying out radiometric measurements.

The Um Bogma Formation in the study area consists of three members showing marked lateral variations in thickness and lithology. Their facies characteristics were determined based on their lithologic and petrographic attributes as well as the primary sedimentary structures. Throughout the study area, the lower member consists of four facies types; namely: mudstone- gibbsite- dolostone- dolomitic limestone, bedded laminated siltstone, dolostone- dolomitic limestone and sandstone. The middle member is made up of five facies; namely: siltstone- claystone- dolostone, laminated siltstone- mudstone, laminated siltstone, siltstone- gibbsite- dolostone and siltstone- sandstone- dolostone. The upper member consists of three facies types; namely: dolostone, siltstone and sandstone- conglomerate.

The detailed petrographic, mineralogic and geochemical characteristics of the studied Um Bogma rocks were determined using several lab techniques. The argillaceous rocks are texturally classified as claystone, mudstone, sandy mudstone, siltstone, sandy siltstone and muddy sandy siltstone. The arenaceous rocks are represented by sandstone, muddy sandstone and gravelly muddy sandstone whereas the rudaceous rocks are muddy conglomerate and muddy sandy conglomerate. On the other hand, the Um Bogma carbonate rocks are petrographically classified as sparite, dolosparite, intra-sparite, dolo- intrasparite, dolomitized macrosparite, dolo-biosparite, dolomitized intra- oo-sparite and dolomitized oo- bio-microsparite.

The light and heavy fractions of the studied Um Bogma rocks consist of large assemblages of essential and accessory minerals that are non-

radioactive, radioactive and U-, Th-, REEs- and base metals- bearing. Based on their forms, habits and modes of occurrences, these minerals could be genetically classified as primary allogenic, primary authigenic, secondary allogenic and secondary authigenic.

The results of extensive geochemical studies confirmed the varying enrichment of the studied rocks in many trace and rare earth elements as well as base metals. The rocks in Allouga locality and, to a lesser extent, those in Talet Seliem and Abu Zarab have the highest potential as possible resources of these elements. Sequential extraction of Mn, Cu, Fe, Pb, U, Th, Y, La and Dy from five fractions revealed that these elements are exchangeable, bound to carbonates, iron and manganese oxides and organic matter and/or residual.

The distributions of trace elements and REEs among the different rock types show variation based on their affinities to specific lithologies. The REEs generally show enriched patterns and negative Eu anomalies. U enrichment in the rocks is correlated with the occurrence of several types of uranyl silicate minerals such as uranophane, sklodowskite, cuprosklodowskite, carnotite, uranothorite, kasolite and torbernite. The co-existence of these minerals reflects variations in the activities of Ca, Mg, Cu and Pb. The hydrothermal activities related to the Red Sea extension were responsible for the oxidation of sulfides, alteration of primary minerals and genesis of Mn oxides, surficial uranyl and REEs mineralizations. Based on the obtained data, certain localities are recommended for future prospecting plans.

The results of the laboratory radiometric examinations revealed that the studied Um Bogma rocks are variably enriched in U, Th and K. The activity concentrations of ^{238}U , ^{232}Th and ^{40}K vary among the rocks in the various localities as a result of differences in their mineral and chemical compositions. The rocks in the western and central sectors of the study area are more radioactive than those in the east. In almost all localities, the mean activity concentrations are in the order of $^{232}\text{Th} < ^{238}\text{U} < ^{40}\text{K}$. The total dose rate is extremely higher than the world average value. The D- factor reveals that most of the studied samples have values of the chemically analyzed U greater than those obtained radiometrically reflecting a disequilibrium state characterized by U addition.

Assessing the sedimentary history of the studied Um Bogma rocks revealed that their detrital components were inherited from felsic to mafic igneous rocks and, to a lesser extent, metamorphic and older sedimentary

rocks in Post Archean source areas. These parent rocks were affected by moderate to strong chemical weathering under predominant tropical climatic conditions. The weathering products were transported (mainly mechanically) to the depositional environments by rivers and streams of low to moderate energy. Sediments of the lower and middle members were deposited in shoreline environments (lakes, lagoons, tidal flats and tidal deltas) and, in the eastern localities, fluvial environments (river channels and alluvial fans). The transition from the middle to the upper members witnessed a minor southeastward sea transgression that resulted in the prevalence of tidal flat and tidal delta environments at the expense of lakes and lagoons with the persistence of fluvial deposition in the eastern sector of the study area. Generally, deposition of the Um Bogma sediments occurred under warm humid climatic conditions and witnessed fluctuations in the water salinity.

Diagenesis greatly modified the original textural and compositional characteristics of the studied Um Bogma rocks. It commenced during the mesogenic (burial) stage but was more profound during epigenesis. The diagenetic processes are represented by compaction, cementation, replacement, alteration (mainly dolomitization) and dissolution. The effect of each of these processes varied among the different localities, stratigraphic levels and rock types.

Contents

	<i>PAGE NO.</i>
LIST OF FIGURES	
LIST OF TABLES	
CHAPTER ONE	
INTRODUCTION	
1.1. SINAI	1
1.2. SOUTHWESTERN SINAI	2
1.2.1. GEOLOGIC SETTING	2
1.2.2. THE UM BOGMA FORMATION	5
1.2.3. THE MINERALIZATIONS	8
1.3. THE STUDY AREA	13
1.4. AIM OF THE WORK	16
CHAPTER TWO	
MATERIALS AND METHODS OF STUDY	
2.1. MATERIALS	18
2.2. METHODS OF STUDY	22
CHAPTER THREE	
GEOLOGY AND LTHOSTRATIGRAPHY	
3.1. TALET SELEIM LOCALITY	26
3.2. ABU THOR LOCALITY	28
3.3. ABU ZARAB LOCALITY	29
3.4. ALLOUGA LOCALITY	36
3.5. LEHYAN LOCALITY	40
3.6. FARSH AL- AZRAQ LOCALITY	45
3.7. WADI SEWIG LOCALITY	47
3.8. RAMLET HIMEYIR LOCALITY	52
CHAPTER FOUR	
PETROGRAPHY	
4. 1. TALET SELEIM LOCALITY	55
4. 1.1. THE LOWER MEMBER	55
4. 1.2. THE MIDDLE MEMBER	58
4. 1.3. THE UPPER MEMBER	61
4.2. ABU THOR LOCALITY	62
4.2.1. THE MIDDLE MEMBER	62
4.2.2. THE UPPER MEMBER	66
4.3. ABU ZARAB LOCALITY	67
4.3.1. THE LOWER MEMBER	67
4.3.2. THE MIDDLE MEMBER	70
4.3.3. THE UPPER MEMBER	74
4.4. ALLOUGA LOCALITY	77
4.4.1. THE LOWER MEMBER	77
4.4.2. THE MIDDLE MEMBER	81
4.4.3. THE UPPER MEMBER	84
4.5. LEHYAN LOCALITY	85
4.5.1. THE LOWER MEMBER	85
4.5.2. THE MIDDLE MEMBER	87

4.5.3. THE UPPER MEMBER	92
4.6. FARSH AL- AZRAQ LOCALITY	93
4.6.1. THE LOWER MEMBER	94
4.6.2. THE MIDDLE MEMBER	96
4.6.3. THE UPPER MEMBER	98
4.7. WADI SEWIG LOCALITY	100
4.7.1. THE MIDDLE MEMBER	100
4.7.2. THE UPPER MEMBER	102
4.8. RAMLET HIMEYIR LOCALITY	105
4.8.1. THE LOWER MEMBER	105
4.8.2. THE MIDDLE MEMBER	106
CHAPTER FIVE	
MINERALOGY	
5.1. MINERAL COMPOSITION	108
(I) TALET SELIEM LOCALITY	108
(II) ABU THOR LOCALITY	111
(III) ABU ZARAB LOCALITY	112
(IV) ALLOUGA LOCALITY	114
(V) LEHYAN LOCALITY	116
(VI) FARSH AL- AZRAQ LOCALITY	119
(VII) WADI SEWIG LOCALITY	119
(VIII) RAMLET HIMEYIR LOCALITY	119
5.2. MINERAL CHARACTERISTICS	124
5.2.1. THE ESSENTIAL MINERALS	124
5.2.2. THE ACCESSORY MINERALS	125
5.2.2.1. TALET SELIEM LOCALITY	125
(I) THE LOWER MEMBER	125
(A) RADIOACTIVE AND REES- BEARING MINERALS	125
(B) NONRADIOACTIVE MINERALS	125
(II) THE MIDDLE MEMBER	126
(A) RADIOACTIVE MINERALS	126
(B) U-, TH- AND REES- BEARING MINERALS	126
(C) NONRADIOACTIVE MINERALS	129
(III) THE UPPER MEMBER	131
(A) RADIOACTIVE MINERALS	131
(B) U-, TH- AND REES- BEARING MINERALS	131
(C) NON-RADIOACTIVE MINERALS	131
5.2.2.2. ABU THOR LOCALITY	132
(I) THE MIDDLE MEMBER	132
(A) RADIOACTIVE MINERALS	132
(B) U-, TH- AND REES- BEARING MINERALS	133
(C) NONRADIOACTIVE MINERALS	134
(II) THE UPPER MEMBER	136
(A) RADIOACTIVE- AND REES- BEARING MINERALS	136
(B) NONRADIOACTIVE MINERALS	137
5.2.2.3. ABU ZARAB LOCALITY	138
(I) THE LOWER MEMBER	138
(A) RADIOACTIVE- AND REES- BEARING MINERALS	138
(B) NON-RADIOACTIVE MINERALS	138

(II) THE MIDDLE MEMBER	140
(A) RADIOACTIVE MINERALS	140
(B) U-, TH- AND REES- BEARING MINERALS	141
(C) NONRADIOACTIVE MINERALS	142
(II) THE UPPER MEMBER	147
(A) RADIOACTIVE- AND REES- BEARING MINERALS	147
(B) NONRADIOACTIVE MINERALS	147
5.2.2.4. ALLOUGA LOCALITY	148
(I) THE LOWER MEMBER	148
(A) RADIOACTIVE MINERALS	148
(B) U-, TH- AND REES- BEARING MINERALS	151
(C) NONRADIOACTIVE MINERALS	153
(II) THE MIDDLE MEMBER	163
(A) RADIOACTIVE- AND REES- BEARING MINERALS	163
(B) NONRADIOACTIVE MINERALS	165
(III) THE UPPER MEMBER	166
(A) RADIOACTIVE- AND REES- BEARING MINERALS	166
(B) NONRADIOACTIVE MINERALS	166
5.2.2.5. LEHYAN LOCALITY	167
(I) THE LOWER MEMBER	167
(A) RADIOACTIVE- AND REES- BEARING MINERALS	167
(B) NONRADIOACTIVE MINERALS	169
(II) THE MIDDLE MEMBER	170
(A) RADIOACTIVE MINERALS	170
(B) U-, TH- AND REES- BEARING MINERALS	171
(C) NONRADIOACTIVE MINERALS	171
(III) THE UPPER MEMBER	174
(A) RADIOACTIVE MINERALS	174
(B) U-, TH- AND REES- BEARING MINERALS	175
(C) NONRADIOACTIVE MINERALS	175
5.2.2.6. FARSH AL AZRAQ LOCALITY	175
(I) THE LOWER MEMBER	175
(A) U-, TH- AND REES- BEARING MINERALS	175
(B) NONRADIOACTIVE MINERALS	175
(II) THE MIDDLE MEMBER	176
(A) RADIOACTIVE MINERALS	176
(B) U-, TH- AND REES- BEARING MINERALS	176
(C) NONRADIOACTIVE MINERALS	177
(III) THE UPPER MEMBER	181
(A) RADIOACTIVE MINERALS	181
(B) U-, TH- AND REES- BEARING MINERALS	181
(C) NONRADIOACTIVE MINERALS	182
5.2.2.7. WADI SEWIG LOCALITY	183
(I) THE MIDDLE MEMBER	183
(A) RADIOACTIVE MINERALS	183
(B) U-, TH- AND REES- BEARING MINERALS	184
(C) NONRADIOACTIVE MINERALS	185
(III) THE UPPER MEMBER	186
(A) U-, TH- AND REES- BEARING MINERALS	186

(B) NONRADIOACTIVE MINERALS	187
5.2.2.8. RAMLET HIMEIYR LOCALITY	187
(I) THE LOWER MEMBER	187
(A) RADIOACTIVE MINERALS	187
(B) U-, TH- AND REES- BEARING MINERALS	188
(C) NONRADIOACTIVE MINERALS	188
(II) THE MIDDLE MEMBER	190
(A) RADIOACTIVE MINERALS	190
(B) U-, TH- AND REES- BEARING MINERALS	190
(C) NONRADIOACTIVE MINERALS	190
<i>CHAPTER SIX</i>	
GEOCHEMISTRY	
6.1. THE MAJOR OXIDES	193
6.1.1. CONCENTRATIONS AND NORMALIZATION OF MAJOR OXIDES	193
6.1.2. DISTRIBUTION TRENDS FOR THE MAJOR OXIDES	196
6.1.3. INTENSITY OF LATERITIZATION AND KAOLINITIC INDEX	206
6.2. THE TRACE ELEMENTS	207
6.2.1. CONCENTRATIONS AND NORMALIZATION OF TRACE ELEMENTS	207
6.2.2. DISTRIBUTION TRENDS FOR THE TRACE ELEMENTS	207
6.2.3. REDOX-SENSITIVE ELEMENTS	219
6.3. THE RARE EARTH ELEMENTS	226
6.3.1. CONCENTRATION AND NORMALIZATION OF RARE EARTH ELEMENTS	226
6.3.2. TRENDS OF RARE EARTH ELEMENTS	226
6.4. STATISTICAL TREATMENT AND DATA REDUCTION	235
6.4.1. THE CORRELATION MATRIX	235
6.4.2. THE R FACTOR	235
<i>CHAPTER SEVEN</i>	
GEOCHEMICAL POTENTIALITY	
FRACTIONATION OF RARE METALS IN THE STUDIED LOCALITIES	244
(I) DISSOLVED OR EXCHANGEABLE FRACTION	244
(II) CARBONATE-BOUND FRACTION (ACID SOLUBLE)	245
(III) FE-MN OXY-HYDROXIDES FRACTION (REDUCIBLE)	245
(IV) ORGANIC FRACTION (OXIDIZABLE FRACTION)	245
(V) RESIDUAL FRACTION	245
<i>CHAPTER EIGHT</i>	
RADIOACTIVITY	
²³⁸ U AND ²³² TH ACTIVITY RATIOS	259
DISTRIBUTION OF RADIUM	260
DISTRIBUTION OF POTASSIUM	260
RADIOACTIVE EQUILIBRIUM	261
CRITERIA FOR URANIUM MOBILIZATION	263
<i>CHAPTER NINE</i>	
GENESIS AND DIAGENESIS	
9.1.GENESIS	265
9.1.1. MINERAL GENESIS	265