بسم الله الرحمن الرحيم

شبكة المعلومـــــات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

﴿ قـــسـم ﴾

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد اعدت دون آية تغيرات

يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of
15 – 25c and relative humidity 20-40 %

بعض الوثائق الأصلية تالفة

بالرسالة صفحات

لم ترد بالأصـــل

GEOCHEMICAL AND HYDROGEOCHEMICAL INVESTIGATIONS OF EL-BAHARIYA DEPRESSION, WESTERN DESERT, EGYPT. APPLICATIONS TO GENESIS OF ORE DEPOSITS

Thesis Submitted

FOR THE DEGREE DOCTOR OF PHILOSOPHY

IN GEOLOGY

By

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(B.Sc AND M.Sc.)

To

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FACULTY OF SCIENCE
AIN SHAMS UNIVERSITY
CAIRO, EGYPT

1999

ACKNOWLEDGEMENT

Greatly thanks and gratitudes are expressed to Prof. ***Dr. ABDALLA A. ABDEL-MONEM,*** chairman of Research sector, Nuclear Materias Authority (NMA); and ***Prof. Dr. EZZAT A. KORANY*** Professor of hydrogeology Geology Department, Faculty of Science, Ain Shams University for Supervising the whole work, reading the maunscript, constructive criticism and continous encouragement.

The author is indepted to the Head of Geology Department, Ain Shams University for the facilities offered.

I am grateful to ***Dr. SALEH E. AMMAR AND MR. EHAB KORANY*** for help in petrographic investigation and also to ***Dr. FATHI AMMAR*** for XRD analysis of glauconite in the Nuclear Materials authority (NMA).

Deep gratitudes are expressed to late ***Prof. SAID ATTWA*** and the staff of Desert Research Center for the help in groundwater chemical analysis.

The author wishes to acknowledge and thanks ***Dr. Engineer. M.M. ABOU EL-SAADAT*** chairman of Mines and Quarries Sectors, Egyptian Iron and Steel Company; Engineer ***ABD EL-RAZEK. A. EL GANDOOR,*** Chairman of El Bahariya Iron Mine Sector and Geologist ***ABD EL-HAMEID B. MAZEID,*** General Research and exploration Manager for continous encouragement.

Many thanks are due to the Geologists of Geology, Exploration and drilling Section and The Chemists of the chemistry Lab. of El Bahariya Iron Mines Sector for the logistic facilities to carry out field works and analyses of iron ore samples.

Last but not least my sincerest appreciation and gratitude are due to my wife and family for their support and encouragement during the preparation of this thesis.

ABSTRACT

El-Bahariya Depression is located in the Western Desert of Egypt between latitude 27° 48˙ and 29° 30˙ N and longitude 28° 30˙ and 29° 10˙ E, about 350 km south west of Cairo. The exposed rock units in the studied area from base to top are as follows 1- The sandstones and shales (Bahariya Formation, Lower Cenomanian) were deposited in a complex environment comprising an oscillation between delta platform and prodelta with fluvio-marine conditions 2- The limestones and dolomitic limestone (Naqb Formation, Lower Middle Eocene), were deposited in an open marine environment. 3- The glauconitic sandstone. Radwan Formation, Oligocene), were deposited in marine environment by precipitation from sea water under reducing conditions 4- Basaltic sheet (Miocene), comprises non-porphyritic doleritic olivine basalt erupted on a continental crust. 5- Surficial deposits (Quaternary), comprise sands wadi fills, mud fans and evaporites.

The water bearing rocks in El-Bahariya Depression are formed of a series of Nubia Sandstones intercalated with shales (Bahariya Formation). The succession is vertically divided into two aquifers an upper aquifer and lower aquifer. The regional flow patterns of groundwater in the aquifer system are directed lateraly from SW to NE in the Western Desert of Egypt and vertically upward. The hydrochemical characteristics of groundwater in El-Bahariya Depression are defined as follows: (1) The salinity increases to the northeast and decrease downward from the upper aquifer to the lower aquifer, also the temperature varies between 35°C to 49°C and increases downward (2). The groundwater have shallow to deep meteoric genesis and belong to the sulphate and chloride group. 3) The iron and manganese oxides in the ironstone bands are subjected to chemical dissolution by groundwater (4) The hypothetical salts comprise, Na_2SO_4, NaCl, $Mg(HCO_3)_2$ KCl and $Ca(HCO_3)_2$

The iron ore deposits at four localities in El-Bahariya Depression (El-Gedida, Ghorabi, Nasser and El Harra). El-Gedida and Ghorabi iron deposits occupy one stratigraphic horizon equivalent to the Naqb Formaiton (Eocene), while Nasser and El-Harra iron deposits occupy two stratigraphic horizons equivalent to the Naqb Formation (Eocene) and the Upper Cretaceous times. Reflected light microscopy revealed the presence of essenial minerals hematite, goethite and hydrogoethite, while the accessory minerals manganese oxides and sulphides. The gangue

minerals recorded include quartz, barite, glauconite, halite, calcite, alunite, gypsum, siderite and dolomite. The characteristic textures of iron ore are replacement, colloform zonned, open filling pisolitic, botryoidal and oolitic. The types of iron deposits, recognized in the field are namely, cavernous, brecciated, bedded, oolitic, pisolitic, blocky and manganiferous.

The chemical characteristics of Bahariya iron deposits, show that the high topographic areas e.g El-Gedida (High Central part), Central Ghorabi, Southwestern Nasser and South El Harra are characterized by high iron content, while the low lands exhibit slightly high to moderate iron contents. The slilica content is inversely related to the iron content and increases with increasing intercalations. The manganese oxide content is low to moderate in high topogrpahic areas in Bahariya iron deposits, while in low lands it increases due to the presence of Mn-rich layers. The Al_2O_3, MgO and K_2O contents in the four iron deposits depend on the presence of clay intercalations. The CaO content is slightly higher in El-Harra and Ghorabi deposits, than in El-Gedida and Nasser areas. The P_2O_5 and SO_3 contents is more or less the same and uniform in the four iron deposits. The chlorine content are higher in the upper parts of iron deposits. The barium oxide (BaO) content depends on the presence of barite. The TiO_2 and ZnO are the same in the four iron deposits.

The gangue minerals chemistry in the four iron deposits include: Pyrite Glauconite and Barite. 1) Pyrite zones occur at the periphery in El-Gedida Mine area., Nasser and in El-Harra areas. The formation of pyrite has been attributed to the presence of sulphate reducing bacteria in organic carbon rich clay layers (sapropel) which leads to precipitaiton of Fe-sulphides. 2) Glauconite may form during sedimentation or during diagenesis in marine environment by direct precipitation from sea water. 3) Barite is suggested to have been of sedimentary origin.

Three processes have controlled the formation of iron deposits in El Bahariya Depression as follows (1) Primary sedimentation processes in the original sedimentary basins or environments; (2) Diagenetic processes that took place during the compaction of the sediments and (3) Epigenetic processes that took place after lithification of the iron bearing sediments including weathering processes in the subsurface or on the surface.

The original Fe-minerals of the Fe-rich layers were diagenetically affected as follows (1) The Fe-mineral assemblages of the sapropel zone is oxidized and transformed into pisolitic limonitic ore.(2) The Fe Hydroxides are dehydrated to goethite and partly oxidized to hematitic materials. (3) Leaching of $CaCO_3$, silica and alumina, and redepositing them in the form of chert, alunite and gypsum. Also the weathering of chamosite and glauconite added the ferric iron to iron deposit (4) The volcanic activity during the Miocene might have activited and increased the rate of circulation of the thermal underground water system.

The thermal groundwater rise to the surface the following reactions may take place (a) mixing of sulphurated thermal water with waters enriched in Ba lead to precipitation of barite (b) oxidation of pyrite yields ferrous sulphate. Thermal water reacting with limestone and dolomite leads to formation of siderite and ankerite. (c) The thermal sulphurated water when reacted with the kaolinitic clay forms alunite (d) when the silica saturated waters ascends more and mix with surface meteoric water, silica is precipitated forming quartzitic sandstones and chert concretions. (e) Halite is precipitated from concentrated brine solution seeping to the surface and subjected to evaporation.

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