

## GEOMORPHOLOGY

**Khaldoun A. Ma'ala\***

Received: 10/ 4/ 2008, Accepted: 29/ 1/ 2009

### ABSTRACT

This study deals with defining the landforms, morphogenetic processes and climatic fluctuations during the continental phases through the Tertiary and Quaternary periods, based on the available data obtained from the geological studies in the Iraqi Southern Desert.

The study reveals that the present surface of the Southern Desert is attributed to rejuvenated plateau, which originated from influence of the destruction and construction processes, during two continental phases. The first phase, which commenced after the Oligocene Uplift, formed the older plateau. It is characterized by prevailing of denudation processes in a semiarid climate; as well, beginning of subterranean hallows and caves. The second phase, which started after the last Alpine movements, included the Pliocene and Quaternary Periods, formed the younger plateau. It is characterized by climatic fluctuations between wet – arid and semiarid, which induced denudations in places and depositions in others.

Twenty four landform assemblages, related to seven morphogenetic groups of variable origins, are distributed on three physiographic units, named: Al-Hijara, Al-Dibdibba and the Periphery. Each unit has specific landform assemblages, which reflect effect of the structure, lithology and climate. Moreover, the exterior part of the younger plateau suffered from depressing due to influence of erosional process along the Euphrates Fault Zone, which modified later on to foot basin, due to supply of a clastic sediments from the elevated parts of the plateau, during the Pleistocene and early Holocene. In addition to polygenetic accumulations referred to evaporation, Aeolian, estuary and floods of Euphrates River. This phase was witnessed the development of two types of lakes: collapse lakes (in the elevated part) and seepage lakes (in the depressed part). The former is filled by clastic sediments of Zahra Formation, whereas the latter is filled by salt accumulations, excluding Sawa Lake.

The underground drainage system was active and originated network of passages and chambers since Oligocene to Recent time. While the surface drainage system was active and originated sub parallel rivers, which were running towards NE since Late Pleistocene to early Holocene and became dry later on, due to climatic changes.

The study revealed that the formed landforms, by the present semiarid climate contributed in the protection of the area by desert pavement, excluding the karstified areas (Limestone pavement) that served as passageways for rainwater. Consequently, new geomorphological map for the Iraqi Southern Desert is constructed based on the achieved data.

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\* Expert (Retired), State Co. of Geological Survey and Mining, P.O. Box 986, Baghdad, Iraq

## **TECTONIC AND STRUCTURAL EVOLUTION**

**Khaldoun A. Ma'ala\***

Received: 13/ 3/ 2008, Accepted: 29/ 1/ 2009

### **ABSTRACT**

The available geological information including stratigraphic sequence, unconformities pattern, drill-hole data, structural elements have been integrated to infer the tectonic and structural evolution of the Iraqi Southern Desert.

The Southern Desert is a part of the northern Arabian Platform, where relatively thin Phanerozoic sediments cover the Precambrian NW – SE and NE – SW fractured continental basement complex. The platform itself is divided into two parts, a stable one to the west (Southern Desert) and unstable one to the east. The boundary between the two parts of the platform is taken along Euphrates Fault Zone (extension of Abu Jir Fault Zone).

The Paleozoic sequence is reduced in the Southern Desert. Its composition and development is still unknown. The Mesozoic cover characterized by significant carbonate deposition with interspersed clastic episodes and is marked by few gaps in Campanian – Maastrichtian. However, the Cenozoic sequence displays gradual retreat of the sea and final transition to the continental conditions.

The main structural element is Safawi Arch, which initiated in Late Triassic – Early Jurassic. The sedimentation pattern through the most of the Mesozoic era was a reflection to a fluctuating sea level and periodical movements of Safawi Arch. In the Tertiary, the main tectonic activities were periodical uplift and downwarp along the southeastern slope of Safawi Arch during Late Oligocene and Miocene periods which reactivated of Al-Batin fracture system, as well are contributed to formation of the Dibdibba basin and terminated by a limited right lateral strike – slip movement on Euphrates Fault Zone in Pliocene – Pleistocene period. Finally, conclusive evidences on the nature of Al-Batin fracture system were introduced.

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\* Retired Expert, State Co. of Geological Survey and Mining, P.O. Box 986, Baghdad, Iraq

## STRATIGRAPHY

**Rafa'a Z. Jassim\* and Buthaina S. Al-Jiburi\*\***

Received: 22/ 4/ 2008, Accepted: 29/ 1/ 2009

### ABSTRACT

The stratigraphy of the Southern Desert is reviewed. Paleocene rocks represented by Umm Er Radhuma Formation are the oldest rock exposed in the area. The youngest rock represented by Pliocene – Pleistocene age, belong to Zahra Formation. For each exposed formation, the exposure areas, main lithology, thickness, fossils, age, depositional environment and the lower contact is described. Many Quaternary sediments are described in the area too, such as, terraces, gypcrete, alluvial fan, valley fill sediments and depression fill sediments. Al-Batin Alluvial fan, is the biggest fan in the Southern Desert of Pleistocene age, it extends from northeastern Saudi Arabian border northwards into Iraq and has been formed by four depositional stages. Jabal Sanam is the highest isolated hill presented in the area, probably formed by piercing of the Infracambrian salt forming the Sanam plug.

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\* Expert, State Co. of Geological Survey and Mining, P.O. Box, Alwiya, Baghdad, Iraq  
e-mail: rzjassim@yahoo.com

\*\* Senior Chief Geologist, State Co. of Geological Survey and Mining, P.O. Box, Alwiya,  
Baghdad, Iraq  
e-mail: buthaina57@yahoo.com

## HYDROGEOLOGY

Hatem K. Al-Jiburi\* and Naseer H. Al-Basrawi\*\*

Received: 28/ 2/ 2008, Accepted: 20/ 5/ 2008

### ABSTRACT

The Southern Desert represents a rolling and/ or undulating plain, which may be a flat or slightly rolling in some parts. The drainage system is internal, with most of the surface water percolating to underground through permeable strata, fractures, fissures and karst cavities. All valleys are intermittent draining either into marshes and sebkhas bordering the Euphrates River or are blind valleys.

The Southern Desert is built up of sedimentary rocks, mostly of carbonate sequences and friable clastics with very gentle dip northeastwards. The main recharge to the groundwater is from direct rain fall, as well as seepage losses from intermittent wadis.

There is a hydraulic connection between the main aquifers within the whole Southern Desert. Aquifers of Hartha, Tayarat, Umm Er Radhuma and Dammam formations represent a complex hydrogeological unit. Dammam aquifer is considered the most important one, on a regional scale due to its extent and content of large amount of water. Aquifers in Dibdibba formation and Quaternary sediments are also important in supplying water for irrigation purposes within the southeastern parts. While the aquifer within Ghar – Euphrates Formation is less important, due to high salinity of water and its local extent.

Generally, groundwater movement is from west and southwest to east and northeast, that is from the recharge areas towards the main discharge zone along Euphrates River, Hor Al-Hammar and Shatt Al-Arab. There are local deviations from the main direction of the movement due to geological, structural and topographical nature of the region. Groundwater level varies from tens of meters from ground surface, in recharge areas to near surface or artizian, in discharge areas. Water salinity increses in general, from recharge areas toward discharge areas. Fresh water of bicarbonate type may represent areas of direct recharge, while the discharge zone is characterized by water of higher salinity and of sulphitic or chloridic type.

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\*Expert, State Co. of Geological Survey and Mining, P.O. Box 986, Baghdad, Iraq

\*\*Assistant Chief Geologist, State Co. of Geological Survey and Mining, P.O. Box 986, Baghdad, Iraq

## MINERAL RESOURCES AND OCCURRENCES

Rafa'a Z. Jassim\*

Received: 13/ 7/ 2008, Accepted: 29/ 1/ 2009

### ABSTRACT

The economic potential and mineral occurrences of the Southern Desert is reviewed. The Iraqi Southern Desert is unlike to the Western Desert, which is rich in mineral resources and industrial rocks; it possesses no mineral resources, but few varieties of industrial rocks. Many occurrences of limestone, dolomitic limestone, dolomite, sandstone, clay and other materials like gypcrete, gravel and salt, as well as some showings of carnotite were recorded in the Southern Desert, during the Regional Geological Survey that carried out by GEOSURV. Those deposits and occurrences belong to Umm Er Radhuma, Dammam, Euphrates, Ghar, Nfayil, Zahra, Dibdibba formations and Quaternary sediments. The limestone deposits are suitable for chemical, White cement and Portland cement industries and marble alternatives. The dolomite is suitable for chemical, steel, metallurgy and glass industries; the dolomitic limestone is suitable for filler, road construction and as building materials. The clays are suitable for cement industry and the sandstone and gravel are suitable for building purposes. Sodium chloride salt, in Samawa Saltpan is thought to be most probably originated from leaching of deep seated salt horizons by groundwater and ascends upwards through faults to be redeposited in depression and extracted by dissolution and evaporation. Sulphur was found only in the sinkholes of Al-Kibritiya, located southwest of Al-Shbicha.

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\* Expert, State Co. of Geological Survey and Mining, P.O. Box 986, Alwiya, Baghdad, Iraq  
e-mail: rzjassim@yahoo.com