

**NEW SEDIMENTOLOGIC AND STRATIGRAPHIC  
CHARACTERISTICS OF THE UPPER BOUNDARY OF  
QAMCHUQA FORMATION (EARLY CRETACEOUS)  
IN NE ERBIL, KURDISTAN REGION, NE IRAQ**

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Received: 24/ 5/ 2007, Accepted: 14/ 5/ 2008

**ABSTRACT**

The contact between Qamchuqa (Early Cretaceous) and Bekhme (Late Cretaceous) formations is studied in the field and laboratory. On lithological basis, the contact is described and analyzed in four different sections. In all four sections, the result of the study showed that the boundary seems to be gradational; two of four sections (Zante gorge and Perse Mountain) are barren of conglomerate, breccias or erosional surfaces, so the contact seems to be conformable in the field. The other two sections (outlet and inlet of Bekhme gorge) contain beds of apparent conglomerate (or conglomerate-like masses), which in the present study are inferred to be not depositional, but diagenetic in origin. They are secondary ball and pillow structures, which formed during burial by lithostatic stress. In the inlet of Bekhme gorge section, there is a mass of breccia (about 1.5 m thick), which is located 10 m above the beds, which include ball and pillow structures. This breccia is not depositional as it consists of extremely angular clasts of limestone. These clasts are believed to be tectonic in origin and derived from younger beds, above the contact, which are not more than 20 m higher from their location. The clasts are transferred to this location, possibly by a reverse fault across Greatyer Zab river.

In contrast to previous studies, the contact suffered from deepening relative to the overlying and underlying Bekhme and Qamchuqa formations, respectively. This is manifested by green marl, marly limestone, limestone bearing planktonic forams and breccias. The soft succession at the boundary (about 30 m thick) is most possibly deposited during the previously suggested gap or unconformity.

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## **LITHOSTRATIGRAPHIC STUDY OF THE CONTACT BETWEEN KOMETAN AND SHIRANISH FORMATIONS (CRETACEOUS), IN SULAIMANIYAH GOVERNORATE, KURDISTAN REGION, NE IRAQ**

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Received: 24/ 5/ 2007, Accepted: 14/ 5/ 2008

### **ABSTRACT**

The contact between Kometan and Shiranish formations (Cretaceous) is re-studied in the field and laboratory. The study elucidates the nature of the contact and discusses the previous ideas of unconformable contact. On lithological basis, the contact is described and analyzed in eight different sections and grouped into three types: Obvious gradational, Burrowed-glaucitic and sharp contacts. Following recent studies, the basin in which the sediments of these types are deposited is considered as foreland basin and the location of each section is indicated within it. The sections are interpreted to be deposited in the beginning of clastic influx into the basin at threshold time and space between pure carbonate sedimentation and mixed sedimentation of clastic and carbonate, during and after drowning of the previous platform.

The first type of the contact (Obvious gradational) is interpreted to be deposited in front of major submarine fans, which are supplied by regular but intermittent clay influx of highly diluted turbidity currents. The second type (Burrowed-glaucitic) is attributed to the areas between the fans, which are supplied by clear water and rich in nutrient, Fe, Mg and O<sub>2</sub>. This supply is most probably due to currents that are driven from the turbidity currents, when the basin was passing from deep water to shallower one. The pebbles and granules exist only in one section, out of eight and they are intraformational clasts (not terrigenous) and formed by submarine erosion. The third type (Sharp) represents sudden and unusual event of clay influx of the turbidity currents into the location of the sections, so that the marl is deposited instead of pure limestone of Kometan Formation. This rapid deposition may be due to a sudden switching of submarine channel, or an event such as large storm or tsunami. All evidences suggest that the contact is most probably conformable and shows no any signs of sub aerial erosion or long non-deposition, but does not exclude short submarine erosions and slow rate of sedimentation across the contact.

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## **MATHEMATICAL MODEL FOR GROUNDWATER FLOW WEST AL-RAZZAZAH LAKE, IRAQI WESTERN DESERT**

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

### **ABSTRACT**

The groundwater in the studied area is found in two main aquifers, within Umm Er Radhuma – Dammam and Tayarat formations, which consist of intensively faulted, fractured and karstified limestone and dolomite. The source of aquifers recharge is subsurface flow from the regional aquifer that extends in the Saudi Arabian territory, in addition to small amount of precipitation that percolates and affects the upper aquifer precisely. Thus, groundwater flows from southwest towards northeast direction that coincides with the topographic slope. The aquifers are non homogeneous, where the hydraulic conductivity varies both vertically and laterally due to the effect of karst features and directions of fracturing. The whole aquifer system can be considered very interesting for its high discharge and recharge rates with negligible drawdown.

Mathematical model was designed to show the behavior of flow in the upper aquifer (Umm Er Radhuma – Dammam) and to study the possibility of increasing the discharge rate to 3750 l/ sec from the basin to utilize it in agricultural projects. Accordingly, the mean yearly drawdown through the period 2003 – 2018 is expected to be ranging from 4 m in the west to 50 m in the east, which in turn will effect the springs outflow that contribute in recharging of Al-Razzazah Lake.

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## **APPLICATION OF TERRAIN CORRECTION FOR MICROGRAVITY DATA**

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Received: 28/ 8/ 2007, Accepted: 3/ 7/ 2008

### **ABSTRACT**

Microgravity measurements were carried out on a hill, which has relative elevation of about 30 m above the surroundings. The elevated area is located near the center of Sulaimaniyah city in the northeast of Iraq. The measurements were carried out for detecting any subsurface cavity and to delineate weakness zones, in comparison with the surroundings for engineering purposes.

One hundred and five microgravity stations were measured in this survey. Conventional corrections, Bouguer slab and free air in addition to terrain correction were applied to get Bouguer gravity values. The website Google earth was utilized to obtain elevations and topography of the hill for calculating the terrain correction. 3D contour maps were drawn to represent three cases of Bouguer gravity values: the first was without terrain correction, the second includes terrain correction, extending to 50 m around each microgravity station and the third one was with terrain correction extending to 100 m around each microgravity station. The comparison between the three maps showed that it is not preferable to calculate the huge mass of the surroundings, like the elevated hill, when the area under study is small and the anomaly is small too, but it is preferred to calculate terrain correction, when delineation of weakness zones for engineering geological purposes is dealt with.

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## USING REMOTE SENSING AND GIS TECHNIQUES IN DETECTING THE ORIGIN OF UMM CHAIMIN DEPRESSION, WEST IRAQ

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Received: 13/ 3/ 2008, Accepted: 8/ 6/ 2008

### ABSRTACT

The Umm Chaimin Depression is the most outstanding and conspicuous geomorphic feature in the southwestern part of the Iraqi Western Desert. It is an almost circular depression with 2.9 Km diameter and 28 m depth. The exposed carbonate rocks on the surface and in depth belong to Ratga Formation (Eocene) that forms flat area and the beds dip off the depression. Therefore, the depression is invisible unless from a distance of few tens of meters, although a lot of rock fragments of different sizes occur near the rims.

Previously, different concepts are recorded about the origin of the depression. These are meteoritic impact, volcanic origin, gas explosion and karst origin. In this study, different geological, geophysical and remote sensing data with GIS techniques are used to indicate the origin of the depression. Eighteen different parameters are studied and used for comparing the present characteristics of the Umm Chaimin Depression with those of aforementioned four different origins. Majority of the parameters fit with those of karst origin.

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## **NITRATE POLLUTION IN GROUNDWATER OF SULAIMANIYAH CITY, KURDISTAN REGION, NE IRAQ**

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Received: 7/ 10/ 2007, Accepted: 14/ 5/ 2008

### **ABSTRACT**

This study deals with the nitrate pollution in groundwater of Sulaimaniyah city. Sixty eight water well samples and two water samples from "karez" were collected equally from the districts of the city. The samples collected from different aquifers (Quaternary sediments and Kometan and Tanjero formations) and from different depths. Majority of the water wells (63% of the groundwater in Sulaimaniyah city) is polluted with NO<sub>3</sub>. The main source of this pollution by NO<sub>3</sub> in the groundwater comes from sewages. Waters of polluted wells are not suitable for drinking purposes.

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**BIOSTRATIGRAPHY OF AQRA, TANJERO AND SHIRANISH  
FORMATIONS IN CHWARTA AREA,  
SULAIMANIYAH GOVERNORATE, NE IRAQ**

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**ABSTRACT**

This study deals with the lithostratigraphy and biostratigraphy of the rock units, which belong to the Late Cretaceous. The study of 53 collected hard samples and 38 soft samples from two outcrop sections, in the northeastern limb of Azmir Anticline, Chwarta area, Sulaimaniyah Governorate, NE Iraq, proved that they belong to Aqra, Tanjero, and Shiranish formations.

Eighty one species of benthonic and planktonic foraminifera related to 36 genera were identified. Among them species, genera and subgenera were described for the first time in Iraq within Aqra and Tanjero formations.

Depending on the assemblages of different groups of foraminifera, three biozones of large foraminifera were determined, for the first time in Iraq, namely:

1. *Lepidorbitoides ruttenei* Range Zone
2. *Omphalocyclus macroporus* – *Orbitoides medius* – *Siderolites calcitrapoides* Assemblage Zone
3. *Loftusia morgani* Range Zone

According to the identified biozones, the suggested age of Aqra and Tanjero formations is Late Maastrichtian.

## **TIGRIS RIVER POLLUTION: A COMPARATIVE STUDY BEFORE AND AFTER PRODUCTION STOPPAGE FROM AL-MISHRAQ SULFUR MINE, SOUTH OF MOSUL, CENTRAL NORTH IRAQ**

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### **ABSTRACT**

This study reveals a comparison of the environmental impact for the pollution of the Tigris river, from north of Al-Mishraq sulfur mine till the junction of Greater Zab River with Tigris River, before and after production stoppage by means of Frash method, through hydrochemical analysis of many samples collected in 2007 and their comparison with samples collected in previous studies, before the production stoppage period. It was found that there is no main change in the major ions concentration and pH; and they are within the acceptable limits, but the total dissolved solids in the collected samples during 2007 increased slightly as compared to the previously collected samples. Also a considerable increase was found in H<sub>2</sub>S, in a restricted area within Tigris River, which is not more than few hundred meters. It was found that the seepage from Al-Mishraq sulfur mine through the artificial springs that were developed during production is one of the reasons that have increased the pollution of Tigris River by H<sub>2</sub>S. From other reasons are: the presences of sulfatic springs that exist along the river from Mosul city down to the area of the junction of Greater Zab River with Tigris River, moreover, the presence of the naturally flowing wells that yield sulfatic water and drain into Tigris River. The pollution decreases considerably after the junction of Greater Zab River with Tigris River and disappears behind that.