Facies Analysis and Sequence Stratigraphy of the Barremian Succession in the Luhais and Rachi Oil Fields, Southern of Iraq

Kamal Salim Mohammed **Aiad Ali Al-Zaidy**

Department of Geology, College of Science, University of Baghdad, Baghdad,Iraq

Kamal.salim2013@yahoo.com

Submission date:- 25/10/2017	Acceptance date:-15/11/2017	Publication date:- 6/8/2018

Abstract

The Barremian succession in the present study is represented by the Zubair Formation which is the most significant sandstone reservoir in Iraq. The area of study is located in the Southern part of Iraq at the Luhais and Rachi oil fields, within the Mesopotamian basin.

The petrographic study showed that quartz mineral is the main component of the sandstone in Zubair Formation with minor percentage of feldspar and rare rock fragments to be classified as quartz arenite. There are five lithologic changes (lithofacies) that are characterized the studied succession: - course to medium sandstone well sorted, fine sandstone well sorted, course to medium sand poorly sorted, clay sandstone poorly sorted, and shale. These lithofacieses were deposited in the deltaic environments as three associated facies [delta plane, delta front and lacustrine (marsh)].

The main diagenetic processes affected Zubair Formation in different intensity are cementation, compaction, dissolution, and dolomitization these processes affected porosity in different ways and stages.

The different lithofacies contributed to division of the Zubair Formation into three distinct rock units, which were used in interpreting and distributing the suggested environments. The lower unit is composed of shale with lenses of fine sand with high organic matter, and it was deposited in the flood-delta plain environment. The presence of the delta plain associated facies overlaying the unconformity surface (SB1) referred to the transgressive system tract (TST). This stage has ended with a channel fills deposit to mark a high-stand system tract (HST).

The middle unit is composed of sandstone with the shale inter layers with high amount of heavy minerals, which was deposited in the distributary-mouth-bar within the delta front environment. There are two sequences as TST in this part, which ends with the maximum sea level rise (mfs) to mark the upper part of the Zubair Formation.

While the upper part is composed of shale with high amount of pyrite and organic matters. This represents the lacustrine (marsh) associated facies within the delta plain environment, which deposited during the high stand stage. The sea level rise marks the end of this stage with the deposition the upper part of Zubair Formation, and the beginning of deposition of the Shuaiba Formation as shallow carbonate marine.

Key wards: - Facies Analysis, Sequence Stratigraphy, Barremian Succession, Zubair Formation, and Luhais and Rachi oil fields.

Introduction

The Zubair Formation was introduced by Glynn Jones in 1948 from the Zubair oil field and amended by Nasr and Hudson in 1953 [1].

It is the most significant sandstone reservoir in Iraq, composed of fluvio- deltaic, deltaic and marine sandstones. It covers wide areas of the Arabian Plate including northern Saudi Arabia, Kuwait and most of southern and part of Central Iraq. The formation correlates with the Biyadah (Riyadh) Formation in Saudi Arabia [2].

The study area is located in the Southern part of Iraq at the Luhais and Rachi oil fields, within the Mesopotamian basin at the stable shelf. The studied oil fields are located in the southern desert, about 90 km south-west of the city of Basra, which lies about of 50 km southwest of the Northern Rumaila oil field (Fig.1).

Rachi oil field in southern Iraq is located within the administrative border of the province of Basra, just 80 km south-west of the city of Basra southern Iraq.

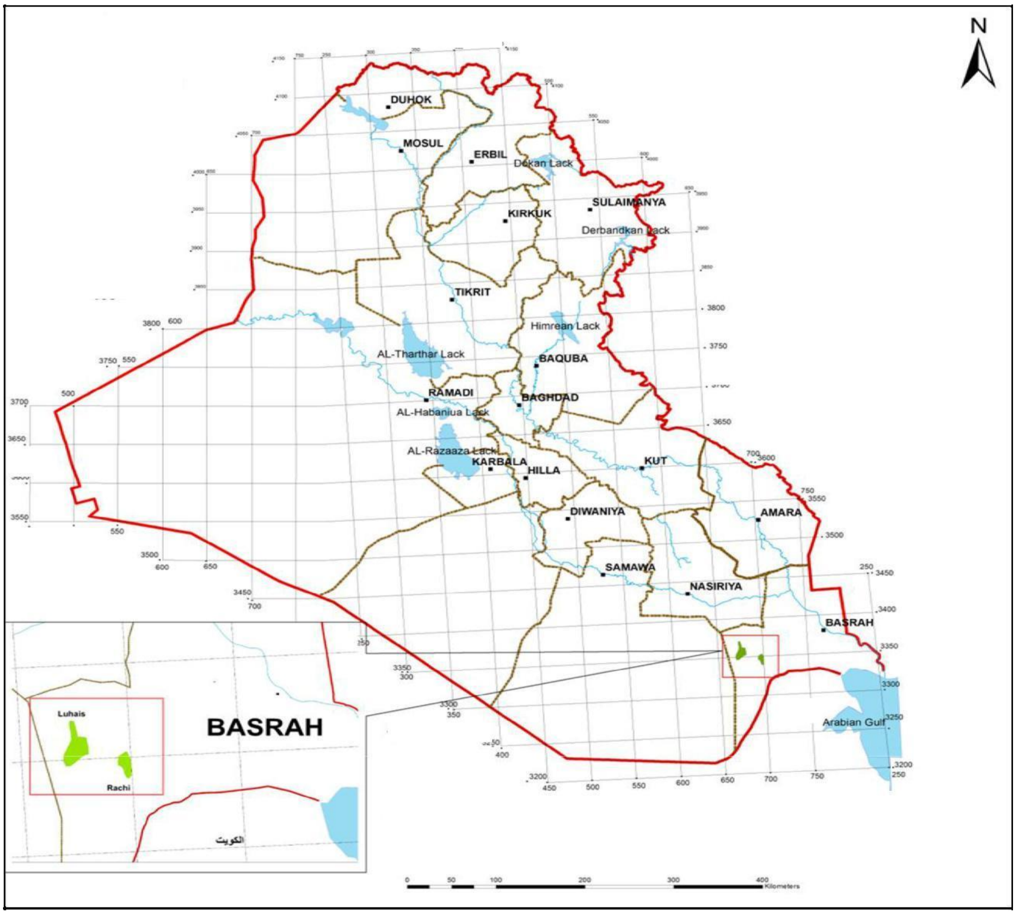


Figure (1) Map Show the Study Area. [3]

During the Hauterivian to Early Aptian age, the formation was deposition with 380-400

m of alternating shale, siltstone and sandstone [1]. The Zubair Formation is assumed to represent a prograding delta originating from the Arabian shield [4].

The upper contact of the formation with the Shuaiba Formation are mostly gradational and conformable (Fig.2). The lower boundary is, however unconformable with Ratawi Formation [5] and this unconformity described by [6].

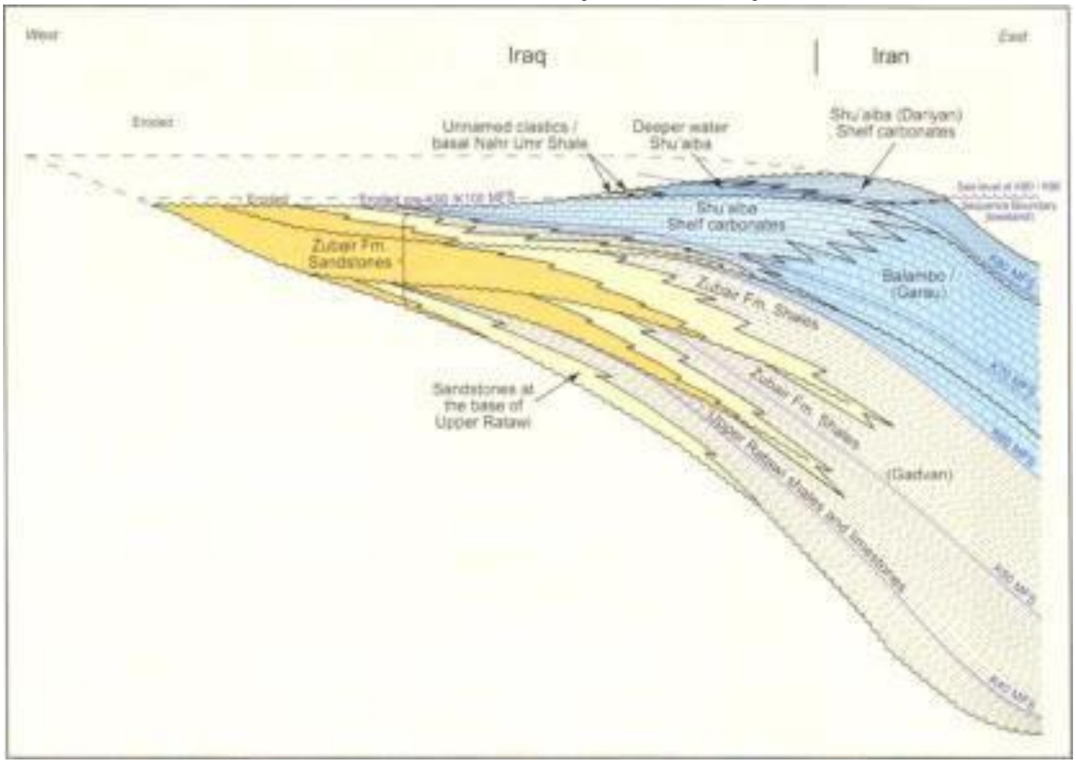


Figure (2) Schematic west-east profile across southern/ central Iraq illustrating stratigraphic position of Zubair Formation [2]

Facies analysis and depositional environment interpretation and the stratigraphic development of the studied succession are the major

Methodology:

The present study was completed by two major stages:

1. Field observation and sampling stage:

This stage is represented by going to the Luhais and Rachi oil fields where the studied section to collectand sample the core and cutting samples (table 1). In dditional to describe the selected cores and capture photos (Fig.3) are deserved along with the and viewing the information and available final reports.

Figure (3) shows the collected cores from studied oil fields

Table (1) shows the interval sampling, number of sample.

Well No.	Formation	Top	Bottom	Number of samples	Type of samples
Lu-2	Zubair	2760	3195	32	Cores
Lu-3	Zubair	2777	3210	44	Cutting
Lu-5	Zubair	2770	3200	25	Cores
Lu-8	Zubair	2780	3220	25	Cores
Lu-12	Zubair	2785	3218	67	Cutting
Rc-1	Zubair	2938	3400	no	Cutting
Rc-2	Zubair	2947	3998	no	Cutting

Lithofacies Analysis

The geological and reservoir properties of sedimentary rocks depend upon an interplay of tectonics, sea level, and sediment supply, physical and biological processes of sediment transport and deposition, and climate. At the basin scale, these processes interact to produce the geometric arrangement of different depositional environments or systems tracts through time, known as the stratigraphic architecture of the basin [7].

One of the first steps in the facies analysis of a clastic reservoir is the description and interpretation of available conventional core [8]. An important result of core description is the subdivision of cores into lithofacies, defined as subdivisions of a sedimentary sequence based on lithology, grain size, physical and biogenic sedimentary structures, and stratification that bear a direct relationship to the depositional processes that produced them. Lithofacies and lithofacies associations (groups of related lithofacies) are the basic units for the interpretation of depositional environments.

According to the available parameters, there are 8 lithofacies in the Zubair succession.

I. Course-moderates Sandstone Well Sorted Lithofacies

This facies consist of coarse sized quartz arenite sandstone, well sorted and well bedded about 10-20cm thick bed (Plt. 1A).

II. Fine Sandstone well sorted lithofacies

This facies consist of fine grained quartz arenite sandstone, well sorted and laminated bed sedimentary setructure (Plt. 1B).

III. Course-moderate Sand poorly sorted lithofacies

Poorly sorted quartz arenite characterizes this lithofacies with graded bedded and wavy lamination (Plt. 1C)

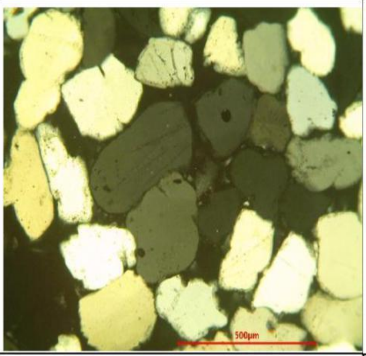
IV. Clay Sandstone poorly sorted

The sandstone in this lithofacies is classified as wacke quartz arenite because it contains amounts of clay at rates exceeding 25% (Plt. 1D). This lithofacieschractrized by presenting of flaser lamination.

V. Shale lithofacies

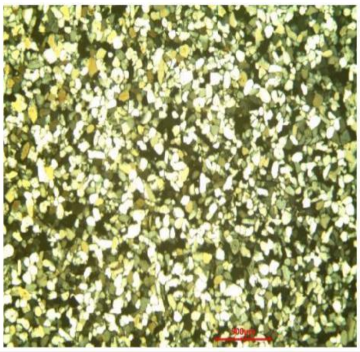
Consisted mainly of mud (more than 50%) and less amounts of sand (quartz grains) with lenticular (Plt. 1E).

Plat (1)



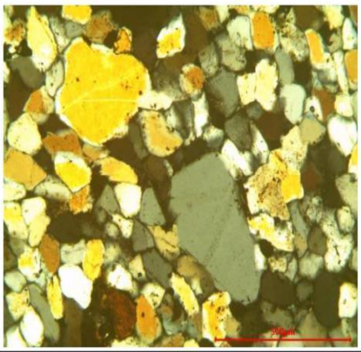
A

Course-moderate sandstone well sorted Lu-2 (2845.25-2845.52)



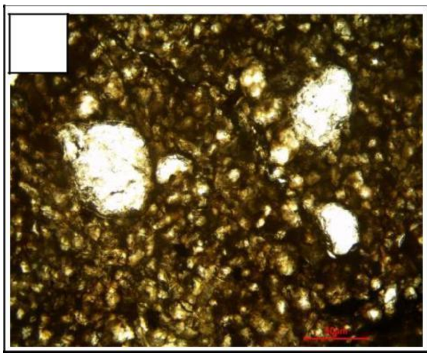
B

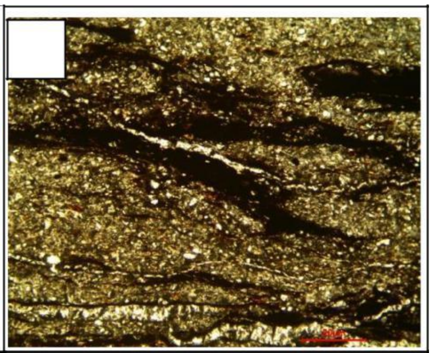
Fine Sandstone well sorting Lu-2 (2850.25-2851.25)



C

Course-moderate Sand poorly sorted Lu-2 (2794.55-2795.55)





Clayey Sandstone poorly sorted
Lu-2(2789.69)

Shale lithofacies
Lu-5(K2805b)

Diagenetic Processes

Diagenesis alters the original pore type and geometry of a sandstone and therefore controls its ultimate porosity and permeability. Early diagenetic patterns correlate with environment of deposition and sediment composition. Later diagenetic patterns cross facies boundaries and depend on regional fluid migration patterns [9]. Effectively predicting sandstone quality depends on predicting diagenetic history as a product of depositional environments, sediment composition, and fluid migration patterns.

Diagenesis may also play an extremely important role in postdepositional modification of porosity, causing either adecrease in porosity as a result of compaction and cementation or increase in porosity owing to solution processes. Thus, the economic importance of a particular sandstone body as a reservoir rock for petroleum [10].

Diagenesis refers primarily to the reactions which take place within sediment between one mineral and another, or between one or several minerals and the interstitial or supernatant fluids [11].

There are four types of diagenesisthat were distinguished in the studied succession, as follows:

1. Compaction

2. Dissolution

3. Cementation

4. Dolomitization

The effects of diagenesis on sandstone reservoirs include the destruction of porosity by compaction and cementation, and enhancement of porosity by solution for that it is control regional variations of reservoir quality the main processes to include:-

Compaction

This is the process of volume reduction and consequential pore- water expulsion within sediments [12].

The degree of compaction dependent on sorting, clay content, percentage of ductile fragments and burial depth or tectonic stresses [13].

1. Compaction of Sandstone

There are two types of sandstone compaction, physical and chemical (pressure solution) [10].

- ***Physical compaction***

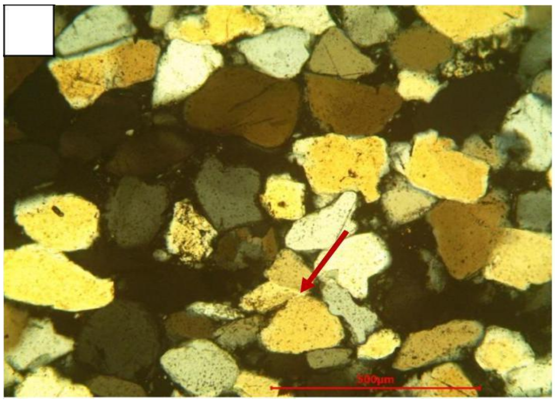
The physical compaction can be noted from its effects: -

a. Ternary concourse to grain of quartz that is contact relation between grains in ideality state on impact of mechanical precision (Plt 2A).

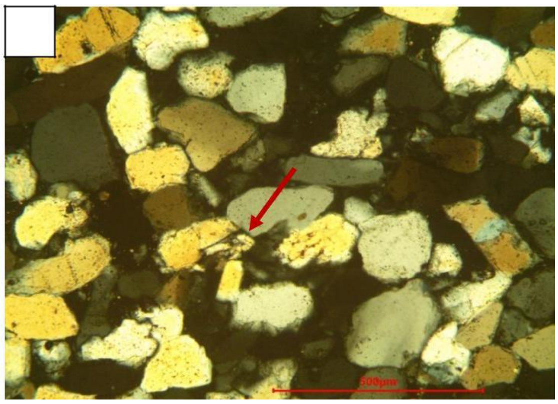
b. Quotient deformation to wake grains (Plt. 2B).

c. The fissures are happening to grains (Plt. 2C).

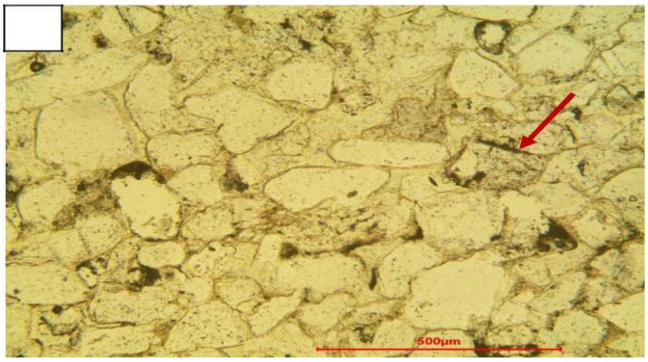
Plat (2)



A



B



C

A. Ternary concourse to grain of quartz contact relation between grains. Lu-2 (2828.35-2829.35).

B. Quotient deformation to wake grains. Lu-2 (2828.35-2829.35)

C. The fissures are happening to grains. Lu-2 (2845.25-2845.52)

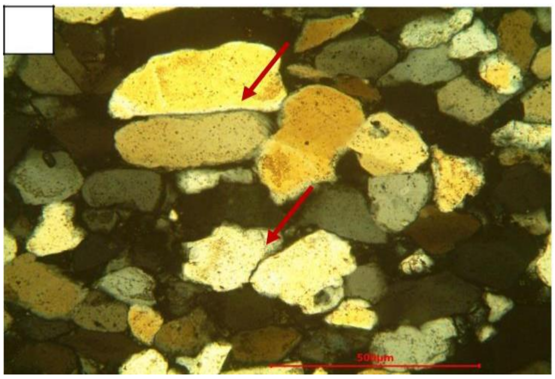
• ***Chemical Compaction***

It can continue during burial. The solubility of silicate minerals tends to increase with increasing pressure and temperature [12].

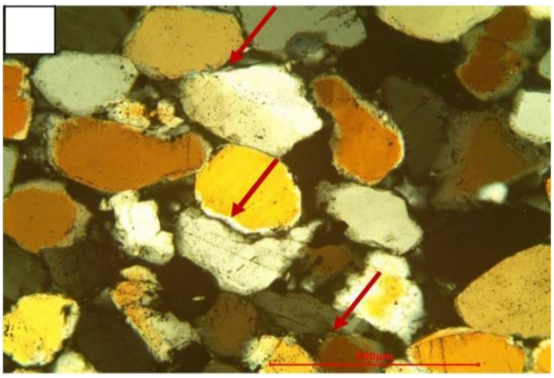
After the initial physical rearrangement of grains, chemical compaction can continue during burial in further porosity loss. The solubility of silicate minerals tends to increase with increasing pressure and temperature [12].

Pressure dissolution is compaction response of sandstone during burial to increase the surface area of grain – grain contacts. Thus point – contacts evolve through straight – elongate to concave – convex and even sutured contacts (Burley, 2003 (Plt. 3 A & B).

Plat (3)



A



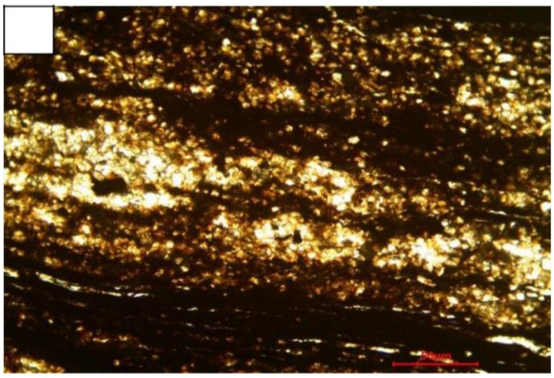
B

A & B Chemical compaction, point – contacts evolve through straight – elongate to concave – convex and even sutured contacts. Lu-2 (2845.25-2845.52).

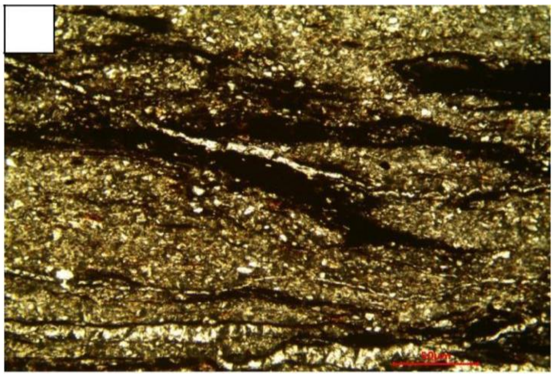
2-Compaction of Muds

Modern muds contain > 60% water, which can be squeezed out by exerting little pressure. Muds can be compacted because grains are ductile (flexible) and can pack easily [13]. This type of compaction is common in the all shale units in the studied succession (Plt. 4 A&B)

Plat (4)



A



B

A & B shale compaction in Zubair Formation. Lu-2(2836.2).

Cementation Refers to growth or precipitation of minerals in pore spaces [12] so it hasa special important in the reservoir studied.

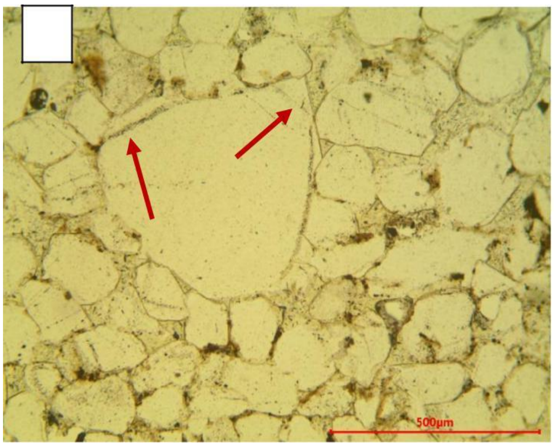
In the studied area, there are four types of cement: Silica cement, Carbonate cement, Iron oxide cement, Clay cement. (Plate 4)

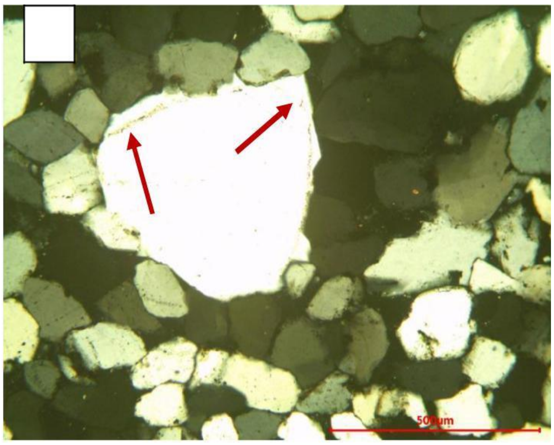
Silica cement

Quartz overgrowths

Quartz overgrowths develop by the precipitation of silica directly from aqueous solution as well-ordered, low (alpha) quartz. The most common form of quartz cement is an overgrowth, a syntaxial rim with the same crystallographic orientation and optical continuity as that of the detrital grain. Overgrowths are one variety of [13]. sedimentary (low-temperature) quartz and are megaquartz in [14] size classification of sedimentary quartz. This type of cement is abundant in the sandstones of Zubair Formation in the studied sections (Plt. 5A & B).

Plat (5)





A **B**

A. Quartz overgrowths. Lu-2 (2794.55-2795.55).

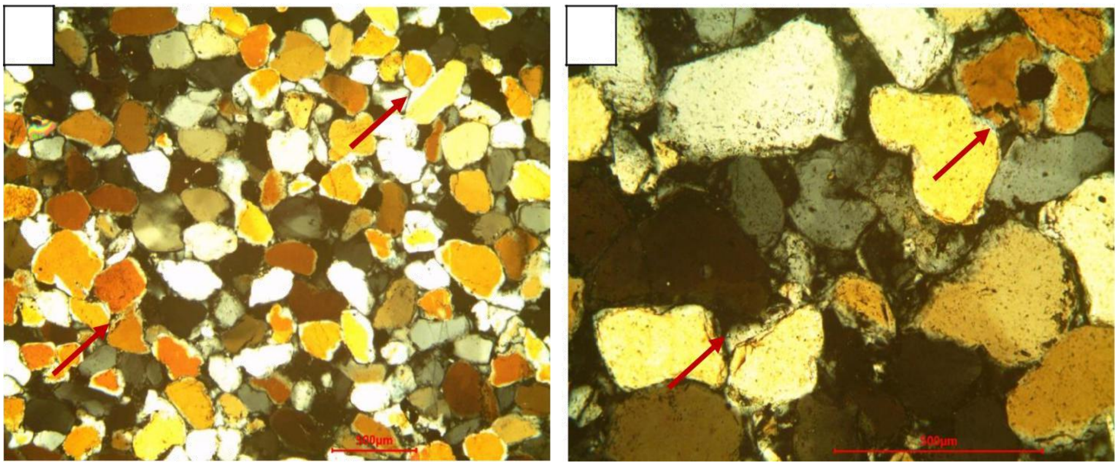
B. Quartz overgrowths under the polarized. Lu-2 (2794.55-2795.55).

Mico-crystals Quartz Cement

Other polymorphs of silica that occur as cements in sandstones are fibrous microcrystalline quartz. Almost all occurrences of these polymorphs are in silcretes, indurated products of surface silica diagenesis (Plt. 6A & B).

Plat (6)

Plat (6)



A B

A & B Micro crystalline Quartz cement. Lu-2 (2845.25-2845.52).

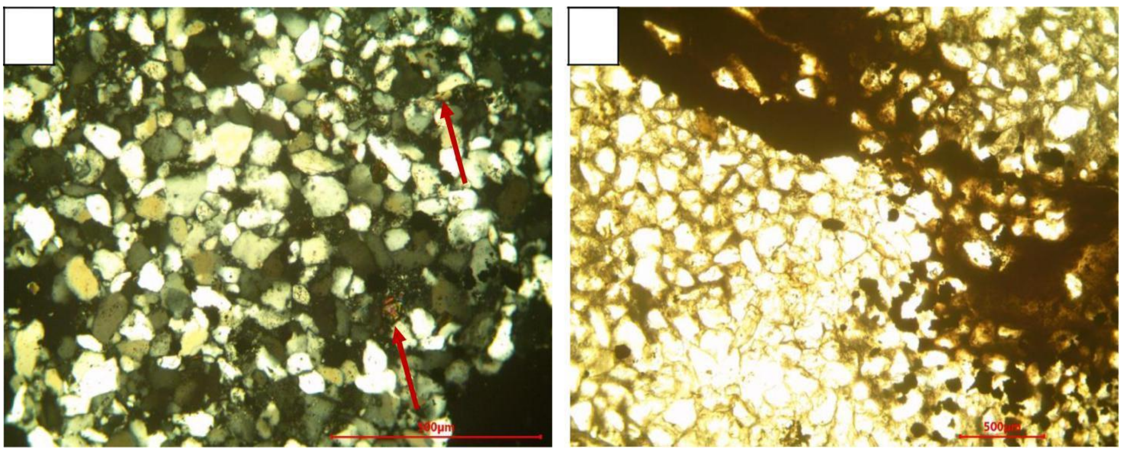
Clay cement

The average of this cement is less than 1% (Plt. 7A). The source of this cement is partly from dissolution to rock fragment and feldspar. This cement has an important effect on permeability [12].

Carbonate cement

The carbonate cement is also uncommon in sandstone of Zubair Formation. Some sandstone has carbonate cement with silica and iron cement. The average of it is 1% in the studied wells. Sometimes it appears as patches between quartz grains. The source of carbonate cement from Ratawai and Shuaiba Limestone Formations (Plt. 7B).

Plat (7)



A B

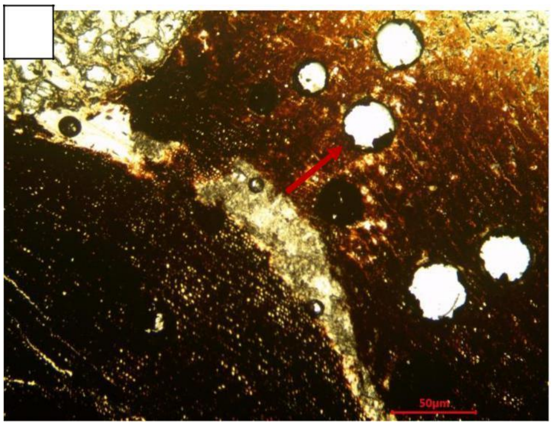
A. Clay cement

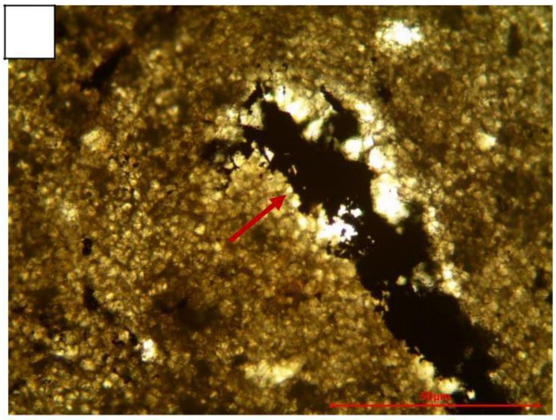
B. Carbonate cement

Dissolution

Rock fragments and low stability silicate minerals dissolved because of increasing burial temperatures. There are two types of dissolution; the first is the pressure solution (see compaction) and the second is the dissolution which leads to increase in secondary porosity [10] (Plt. 8A & B).

Plat (8)





A B

A & B Dissolution in shale unit of Zubair Formation

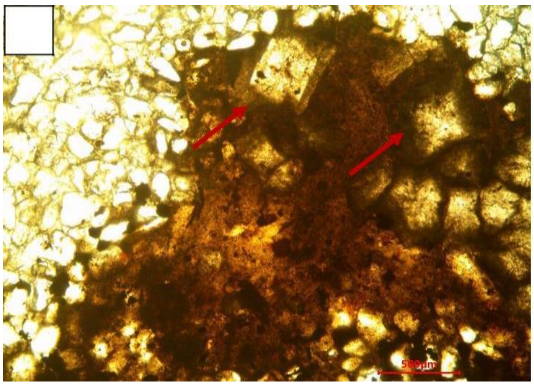
Dolomitiztion

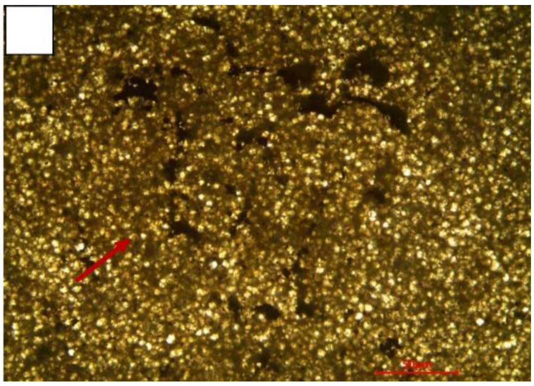
Is a process whereby limestone or its precursor sediment is completely or partly converted to dolomite by the replacement of the original $CaCo3$, by magnesium carbonate, through the action of Mg bearing Water, [15].

The size of crystals is about 0.18-0.6 mm (medium, coarse and very coarser) as well as most crystals have rhombohedral shape where selective dolomitization attacks the limestone forming dolomitic limestone, where the original depositional texture may be preserved [15].

At the studied succession, the dolomite is occurred in some parts of shale unit as a secondary pervasive zoned dolomite (cloudy rim) (Plt. 9A) and scattered fine crystal dolomite (Plt. 9B).

Plat (9)





A B

A. Secondary pervasive zoned dolomite (cloudy rim).
B. Scattered fine crystal dolomite.

Diagenesis History

The concept of diagenetic systems is a broad framework that relates diagenetic processes to the evolution of sedimentary basins. Three conceptual systems are commonly recognized: early diagenesis (eogenesis), burial diagenesis (mesogenesis) and uplift-related diagenesis (telogenesis). This terminology was adopted from a scheme developed initially by [16] to describe limestone diagenetic processes, but is now more generally applied: correctly so, the same fundamental processes and controls operate in clasticdiagenesis and in carbonate diagenesis. Alternative schemes (e.g. the Russian system including such terms as catagenesis and epigenesis have been used but are less commonly applied now [17]. This is because systems and classifications defined by the maximum temperature of burial run into the difficulty of the effect of varying time spent at a given temperature—a direct consequence of the kinetic control on the rate of diagenetic reactions.

The Zubair formation in the study area is affected by many diagenetic processes throw deposition represented by (Fig .4).

After cleaning, the sand deposition of sand is affected by the compaction in low amount follows by chemical dissolution, which leads to make the secondary quartz precipitated in the original grains. This decreases the primary porosity, increase the compaction process, and destroys the quartz and rock fragment grains to be associated with chemical solution that leads to precipitate extra grains of quartz as a small grain decreasing the porosity. After this process, the change in chemical and physical properties of depositional basin leads to precipitate the calcite cements, and finally as a result of organism activity calcite dissolved and produced the secondary porosity.

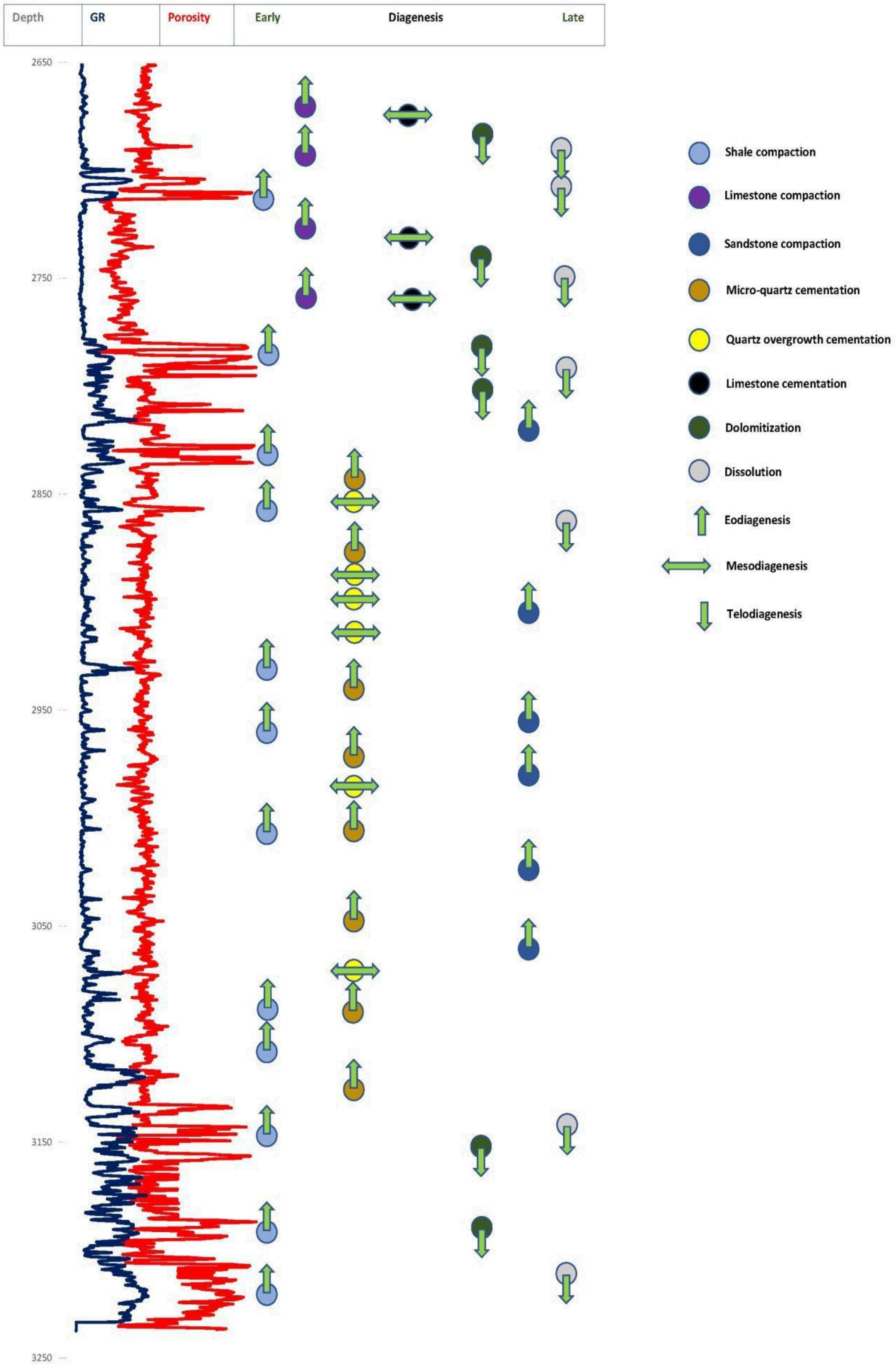


Figure (4) Diagenetic history of Zubair Formation in the Study Area

Associated Facies and Depositional Environments

There are three main association of deltaic facies in the studied succession: -

1. Delta plain (Upper delta plain- flood plain deposits)

2. Delta Front (Subaqueous delta plain)

3. Back shore (Upper delta plain- Lacustrine delta-fill)

These different facies contributed to division of the Zubair Formation into three distinct rock units, which are used in interpreting the suggested environments above: -

Lower Part:-

The main composed of this unit is shale with the lenses of fine sand with high organic matter. The lower contact of this unit is unconformable with the Ratawi Formation according to [1]. This unit is characterized by high gamma ray values with abundant of coarse up-ward (Funnel shape), with exception of the part near the lower contact which shows fine up-ward (Bell shape) (Fig. 5). The main lithofacies in this unit is shale lithofacies (V) additied to Clayey Sandstone poorly sorted (IV). This represents the delta plain succession deposited in the flood-delta plain environment.

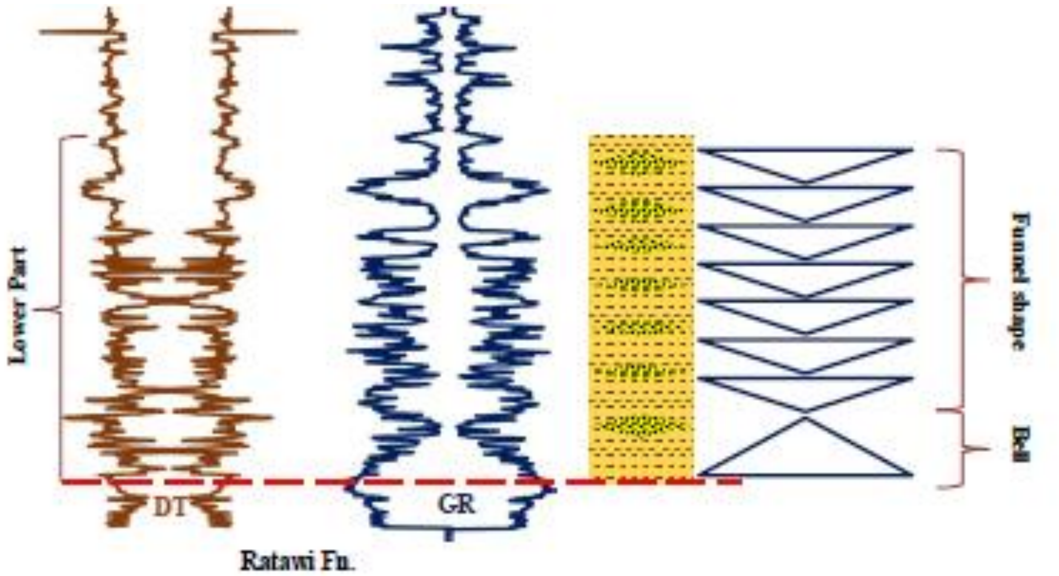


Figure (5) the direct correlation between facies and a variety of sonic and GR log shapes for the lower part of The Zubair Formation (Lu-3)

Middle Part:-

The main composed of this unit is sandstone with the shale inter layers with high amount of heavy minerals. This unit is characterized by low gamma ray values with two cycles of fine

Up-ward (Bell shape) in the lower zone of this part, and coarse up-ward (Funnel shape) in the upper zone divided the serrated shape into two cycles of pure sandstone (Fig. 6).

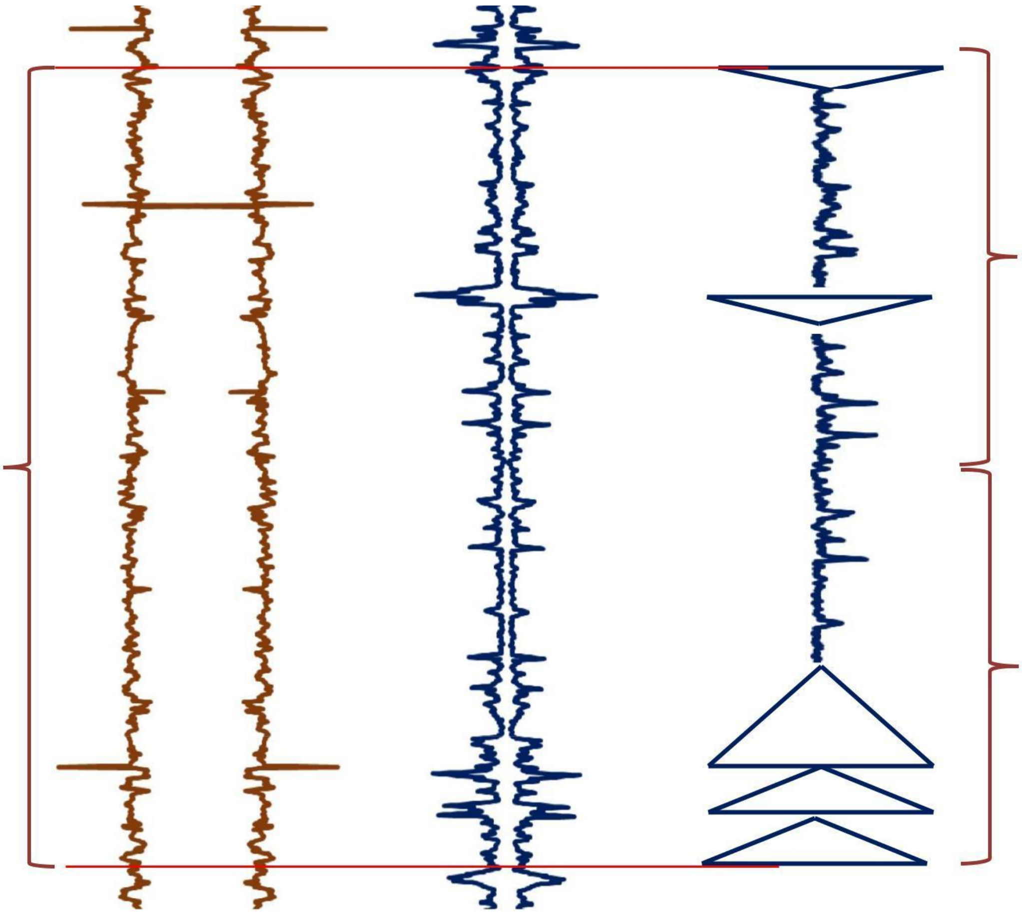


Figure (6) The direct correlation between facies and a variety of sonic and GR log shapes for the Middle part of The Zubair Formation (Lu-3)

The main lithofacies in this unit is Course-medium sandstone well sorted lithofacies (I) and fine Sandstone well sorted lithofacies (II), In addition to Clayey Sandstone poorly sorted (IV).

This represents the delta plain succession deposited in the distributary-mouth-bar within the delta front environment.

Upper Part:-

The main composed of this unit is shale with high amount of pyrite and organic matters.

This unit is interlaying with sandstone in the lower zone of the upper part.

The main lithofacies in this unit is shale lithofacies (V) and Clayey Sandstone poorly sorted (IV), while in the lower zone of this part, the Course-moderate Sand poorly sorted lithofacies (III).

This part is characterized by high gamma ray values with major trend of coarse up-ward succession (Funnel shape) (Fig. 7).

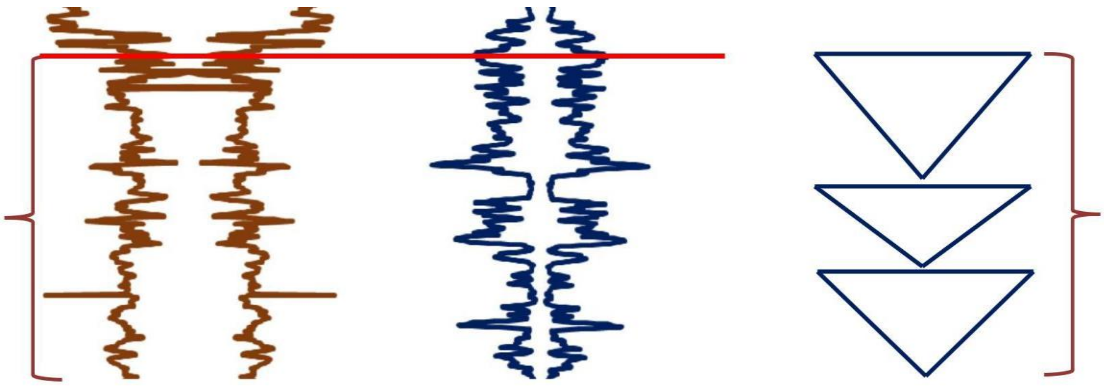


Figure (7) the direct correlation between facies and a variety of sonic and GR log shapes for the upper part of The Zubair Formation (Lu-3)

Sequence Stratigraphy

Sequence stratigraphy is the study of rock relationships within a chronostratigraphic framework of repetitive genetically related strata bounded by the surface of erosion or nondeposition, or their correlative conformities [18]. The stratigraphic signatures and strata patterns in the sedimentary rock record are the results of the interaction of tectonics, eustasy, and climate. [19].

Stratigraphic Development

During the deposition of the Zubair Formation, the siliciclastic shelf followed a cyclical pattern of evolution from the delta depositional mode to lacustrine mode. A sequence boundary type-I separates the Basinal shale of Ratawi Formation from the overlying deltaic influenced Lower Zubair Formation (Figs. 8, 9, 10).

The lower part of Zubair is characterized by wide spread mud -dominated delta plain associated facies. They seem to vertically separate relatively multi-storied mode and multi-

Lateral changes deltaic channel sand bodies resulting in compartmentalized reservoir architecture.

The presence of the delta plain associated facies overlaying the unconformity surface (SB1) refers to the transgressive system tract (TST). This stage has ended with appearance of the channel fills deposit to mark a high-stand system tract (HST). The fluctuation point between the TST and HST represents a maximum flooding surface (Figs. 8, 9, 10).

The middle part of Zubair Formation is characterized by moderate to well sorted quartz arenite sandstone with appeared bands of the shale overlaying the sand body. This succession was deposition in the delta front environment with steps of sea level rise during the transgressive stage. There are two sequences as TST in this part which end with the maximum sea level rise (mfs) to mark the upper part of the Zubair Formation. The next stage shows high concentrations of organic matters and pyrite mineral indicating that the sedimentary environment has been reduced to the marshes environment during the HST. This stage is not clear in the Rachi oil field, where rock characteristics indicate that they belong to the middle part as a TST.

The upper part of the Zubair Formation shows a more shallow environment with shale dominated rocks associated with high organic matters and pyrite. This highlights to the finning up-ward mode during highstand stage when the deposition environment being changed from delta front to marsh environment. The sea level rise marks the end of this stage when deposition the upper part of Zubair Formation, and the beginning of deposition the Shuaiba Formation as shallow carbonate marine.

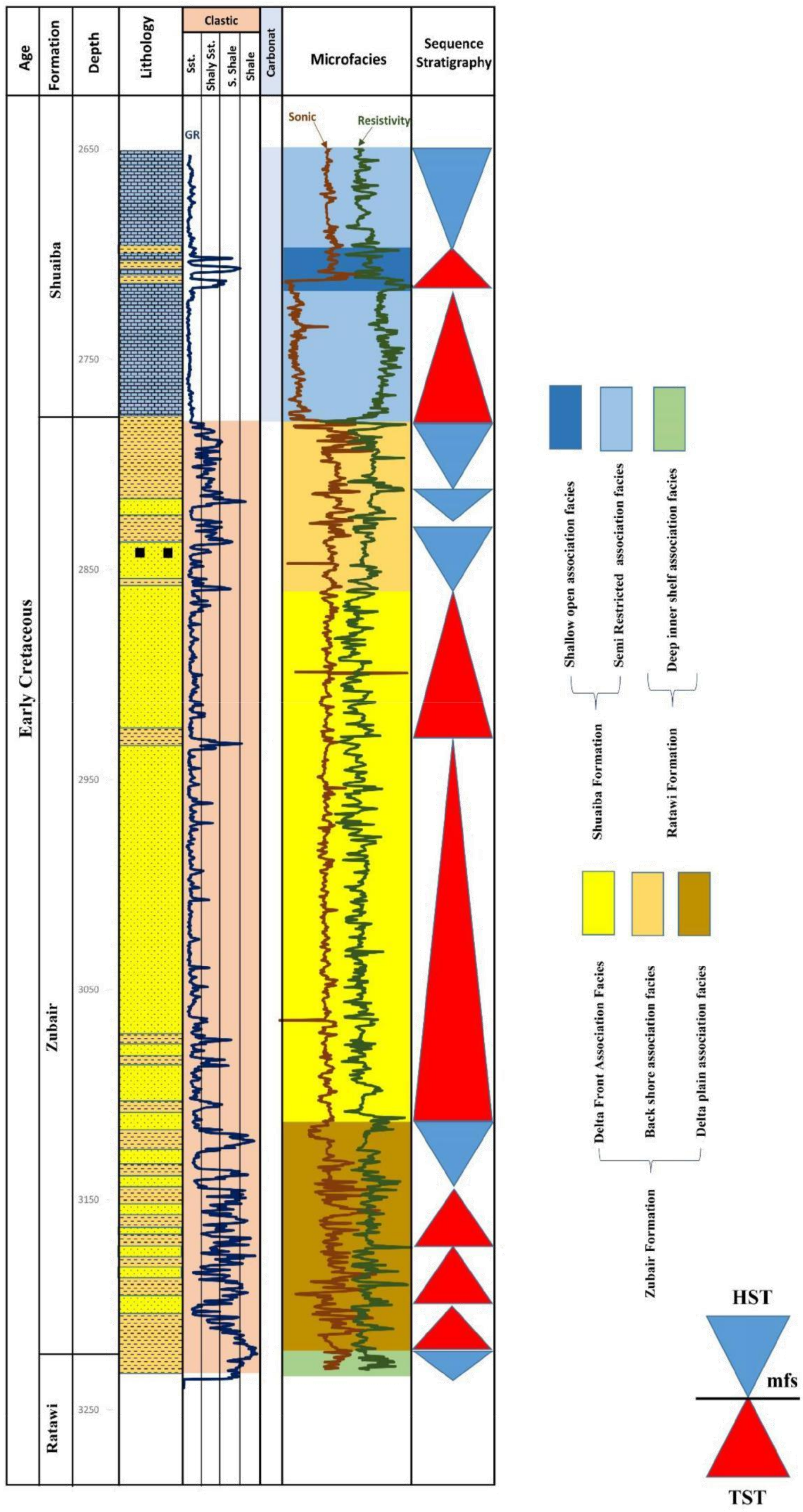


Figure (8) Stratigraphic columnar section for the Zubair Formation in the Lu-3.

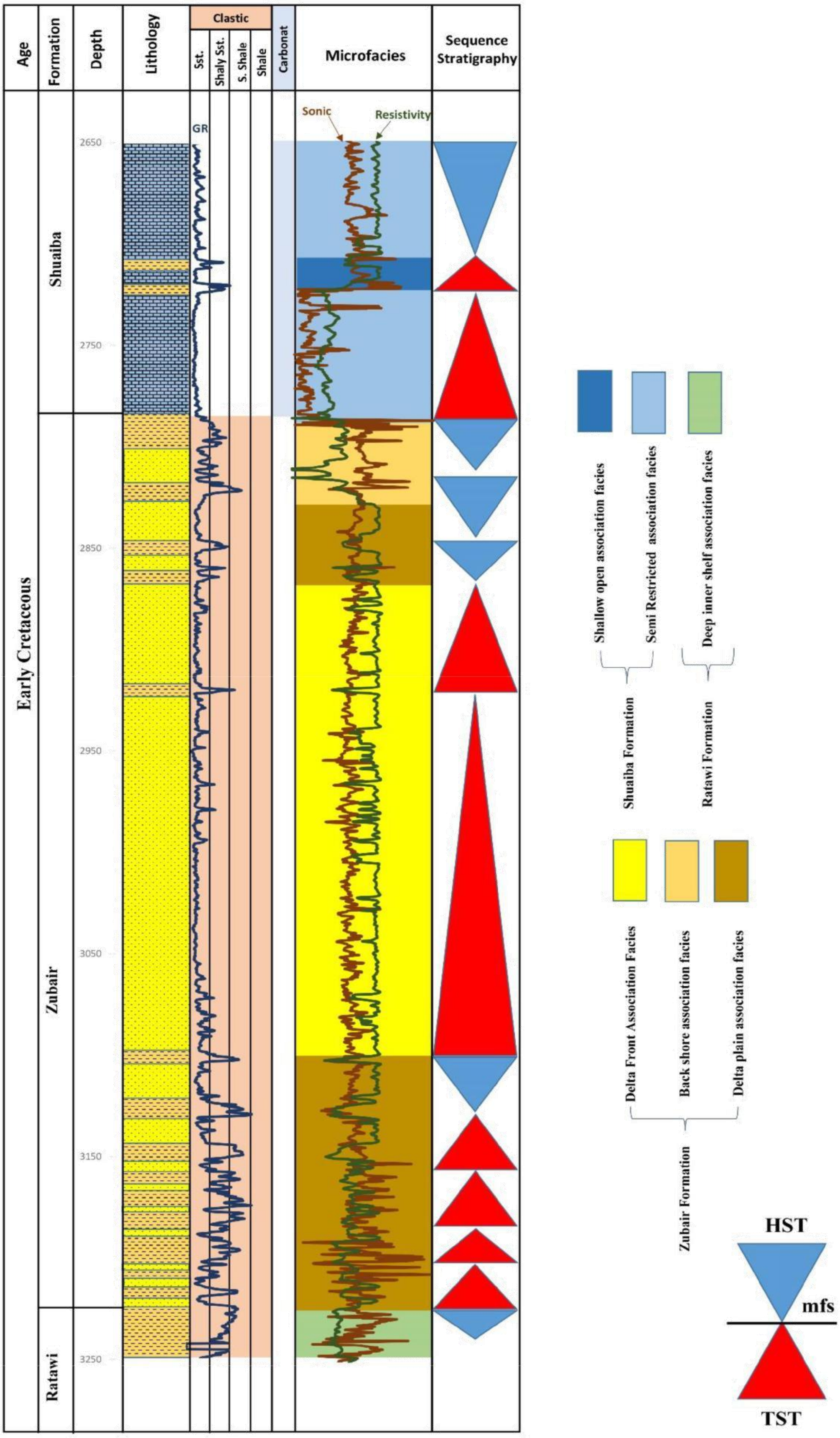


Figure (9) Stratigraphic columnar section for the Zubair Formation in the Lu-12.

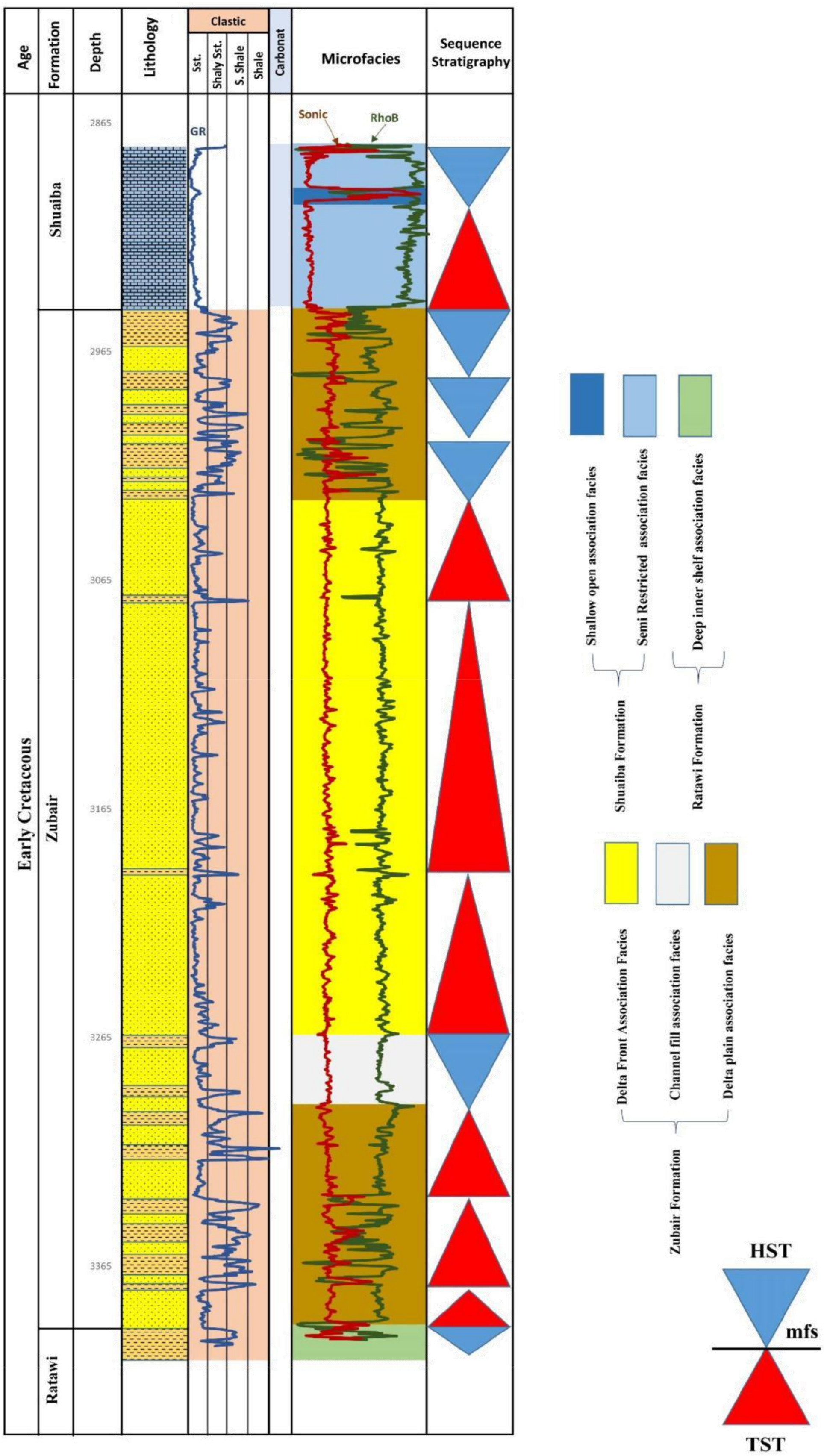


Figure (10) stratigraphic columnar section for the Zubair Formation in the Ra-2.

References

[1] Bellen, R.C., Dunnington, H.V., Wetzel, R. & Morton, D.M., Lexique stratigraphic international: Asia, Fascicule 10, Iraq, 333pp. (center national de la Recherchescientifique, Paris), 1959.

[2] Aqrawi, A.A.M., Goff, J.C., Horbury, A.D. and Sadooni, F.NThe petroleum Geology of Iraq, Scientific Press Ltd., 424pp, 2010.

[3] OEC, Geological Evaluation Study ofNahrUmr and Zubair Reservoirs of Rachi Oilfield, Oil Exploration Company, 2013. (Unpublished)

[4] Ziegler, M. Late Permian to Holocene paleofacies evolution of the Arabian Plate and its hydrocarbon occurrences, GeoArabia, 3, p. 445-504, 2001.

[5] Buday, T., the Regional geology of Iraq, VI: Stratigraphy and Paleogeography, state organization for minerals, Mosul, Dar Al-Kutab publication House, 445P, 1980.

[6] Douban, A.F. and Medhadi, P., Sequence Cretaceous Megasequences, Kuwait. AAPG Inernational, 1999.

[7] Miall, A. D., *Principles of Sedimentary Basin Analysis*: New York, Springer-Verlag, 490 p, 1984.

[8] Siemers, C. T., and R. W. Tillman, Recommendations for the proper handling of cores and sedimentological analysis of core sequences, in C. T. Siemers, R. W. Tillman, and C. R. Williamson, eds., Deep-Water Clastic Sediments—A Core Workshop: SEPM Core Workshop, n. 2, p. 20–44, 1981.

[9] Stonecipher S. A. and J. A. May, Facies controls on early diagenesis: Wilcox Group, Texas Gulf Coast, in I. D. Meshri and P. J. Ortoleva, eds., *Prediction of reservoir quality through chemical modeling*, AAPG Memoir 49, p. 25–44, 1990.

[10] Boggs S., Petrology of Sedimentary Rocks, Cambridge University Press, Cambridge University Press, New York, 600 p, 2009.

[11] Selley R. C., Applied Sedimentology, Academic press.P.523, 2000.

[12] Burley S. D. and Worden H., Sandstone Diagenesis, Recent and Ancient, Blackwell Publishing, P649, 2003.

[13] Blatt, H., Middleton, G., Murray, R., Origin of Sedimentary Rocks, Prentice-Hall, Englewood Cliffs, New Jersey, 634 pp, 1980.

[14] Folk, R., Petrology of Sedimentary rocks, Hemphill, Texas, P.182, 1968.

[15] Flugel E., Microfacies of Carbonate Rocks Analysis, Interpretation and Application, Springer.P976, 2004.

[16] Choquette, P. W. and Pray, L. C., *Geological nomenclature and classification of porosity in sedimentary carbonate*, APGB, Vol. 54, pp: 207- 250, 1970.

[17] Prozorovich, G.E. Determination of the time of oil and gas accumulation by epigenesist studies. Sedimentology, 15, 41–52, 1970.

[18] Vail P. R. and Wornardt W. W., *Well log-seismic stratigraphy; an integrated tool for the 90's: Gulf Coast Section*, SEPM Foundation Eleventh Annual Research Conference Program and Extended Abstracts, p. 379–388, 1990.

[19] Emery, D., Myers, K. J., Sequence stratigraphy, published by Blackwell Science Ltd, P.297, 1996.

.

.

التحليل سحني والتتابعية الطباقية لتتابع الباريمي في حقلي اللحيس وراشي النفطيين، جنوب العراق

كمال سالم محمد **أياد علي الزيدي**

قسم علم الارض، كلية العلوم، جامعة بغداد، بغداد، العراق

Kamal.salim2013@yahoo.com

الخلاصة

ان تتابع الباريميان في الدراسة الحالية يتمثل بتكوين الزبير والذي يعتبر من اهم مكامن النفط الرملية في العراق. تقع منطقة الدراسة في الجزء الجنوبي من العراق في حقلي لحيس وراجي النفطيين، ضمن حوض بلاد الرافدين التكتوني. اظهرت الدراسة البتروغرافية ان الكوارتز هو المكون الرئيسي للحجر الرملي في تكوين الزبير مع نسبة ضئيلة من الفلسبار ومكسرات الصخور لتصنف على أنها أرينيت الكوارتز. هناك خمسة تغيرات صخرية) سحنات صخرية (ميزت التتابع المدروس وهي سحنة الحجر الرملي الخشن–المتوسط جيد الفرز والحجر الرملي الناعم جيد الفرز والحجر الرملي الخشن–المتوسط رديء الفرز وسحنة الحجر الرملي الحامل للطين الرديء الفرز وسحنة الحجر الطفلي. وقد ترسبت هذه السحنات الصخرية في بيئة دلتاوية كثالث متتابعات سحنية) السهل الدلتاوي ومقدمة الدلتا والبيئة البحيرية–المستنقعات)

ان العمليات التحويرية الرئيسية التي اثرت على صخور تكوين الزبير بشكل متباين هي السمنتة والتراص واالذابة والدلمتة والتي اثرت بشكل واضح على المسامية بطرق ومراحل مختلفة.

وقد ساهمت مختلف أنواع االسحنات الصخرية في تقسيم تشكيل الزبير إلى ثالث وحدات صخرية متميزة، والتي أستخدمت في تفسير وتوزيع البيئات المقترحة وهي الوحدات السفلى والمتوسطة والعليا. تتكون الوحدة السفلى من الصخر الطفلي مع عدسات الرمل الناعم والمواد العضوية العالية التركيز، حيث ترسبت في بيئة سهل الدلتا الفيضي. ويشير اعتالء مترافقة بيئة السهل الدلتا لسطح عدم التوافق (SB1) إلى الترسيب خالل فترة التقدم البحري .(TST) وقد انتهت هذه المرحلة مع ظهور مترافقة قنوات المالىء النهري لتؤشر مرحلة ترسيب خالل توقف مستوى سطح البحر االعلى(HST) .

بينما تتكون الوحدة الوسطية من الحجر الرملي المتداخلة مع طبقات الطفل وتركز كمية عالية من المعادن الثقيلة، والتي ترسبت في شريط التوزيع في مقدمة الدلتا. في هذا الجزء هناك اثنان من التتابعات التي ترسبت خالل فترة التقدم البحري(TST) والتي تنتهي باقصى ارتفاع لمستوى سطح البحر (mfs) لتؤشر بداية الوحدة العليا لتكوين الزبير.

في حين يتكون الجزء العلوي من الصخر الطفلي مع كمية عالية من معدن البيريت والمواد العضوية. ويمثل هذا التتابع مترافقة البحيرية) األهوار–المستنقعات (لبيئة سهل الدلتا المترسب ضمن مرحلة توقف سطح البحر االعلى .(HST) ان ارتفاع مستوى سطح البحر بعد ترسيب الجزء االعلى أشر نهاية هذه المرحلة وبداية ترسب تكوين الشعيبة في بيئة بحرية جيرية ضحلة.

الكلمات المفتاحية: – التحليل لسحني، التتابع الطباقي، تتابع الباريميان، تكوين الزبير، حقول اللحيس والزبير.