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Sedimentology and hydrocarbon generation potential of middle tithonian-berriassian chia gara formation,well k-109, Kirkuk oil field, NE Iraq

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Abstract

The Chia Gara Formation (M.Tithonian-Berriasian) from the well K-109 has been studied in detail sedimentologically and from hydrocarbon potentiality point of view. The studied rock samples obtained from the North Oil Company, Kirkuk. The formation consists of alternation of dark fissile calcareous shale and organic-rich limestone layers (argillaceous limestone). The limestone beds are thin and lacking any bioturbation. The lower contact is conformable with the Barsarin Formation and the upper boundary is gradational with the Karimia Formation. The radiolarian mudstone-wackestone is the major microfacies in the succession. Nearly all radiolarians are filled by calcite as a major diagenetic process.The TOC% has a range between 0.62% and 7.26%, with high values in the lower part of the Formation. The type of organic matter is mostly brown amorphous as seen in palynological slides and the TAI is about 3+.The Rock-Eval Pyrolysis results indicate low value of HI and the type of kerogen is type II-S & III. Several diagrams used for determining the type of kerogen,maturity and oil or gas potentiality.The kerogen is mature and in oil zone.The sulfur content as determined from CNS analyzer is high in the lower part of the sequence. All sedimentology and organic geochemistry data reveal that the formation deposited in deep shelf basin (Late Jurassic passive continental margin of the Arabian Plate) with quiet and warm water. The euxinic environment can be concluded from the absence of microboring and high rate organic matter preservation as well as the abundance of pyrite. The Chia Gara sediments could be considered as an important source rock for petroleum in accumulated oil in Kirkuk structure.

Introduction

The Chia Gara Formation (M.Tithonian-Berriasian) was first defined by Wetzel (Bellen et al., 1959)at the Chia Gara anticline, south of Amadia town in the High- Folded zone of north Iraq.The thickness of the formation , at its type locality , is 232m and composed of unbroken succession of thin bedded limestone and shale,rich in ammonite fauna ,and grading upwards to yellowish marly limestone and shale with a zone

of bullion beds, 21m thick at base(Bellen et al., 1959).The detailed study carried out by Spath(1950)was done on the ammonites in this formation. One of the pioneer studies on this formation was carried out by Mc Carthy et al.,(1955 in Bellen, 1959).They studied the formation in Zakho area, at this section the sequence generally consists of alternation of bituminous limestone and dark bituminous shale . Dunnington (1958) described the Tithonian-Berriasian sediments as basinal euxinic radiolarian shale-limestone.Buday(1980),and Jassim and Goff(2006)were considered sediments of the Chia Gara Formation to represent the deep marine facies.Al-Qayim and Saadalla(1992)studied the formation from Bekhma Gorge and Rawandoz area.They concluded that the formation reflects the deep marine characters.The organic matters in the formation from different parts of Iraq,surface and subsurface sections, studied by Al Habba(1985) , Al Jubory(1989),Al Habba and Abdullah (1989), Othman (1990), Odisho and Othman(1992) and Al-Beyati(1998), they all agreed that the formation might represents good source rocks. The upper boundary of Chia Gara Formation remains difficult to recognize especially in the northeastern region from the type locality. Jassim and Goff (2006) suggested that the Karimia Formation, which is passes into Chia Gara Formation towards the NE, can be included in the Chia Gara Formation. The present study focuses on the sedimentology and organic geochemical evaluation of the Chia Gara Formation for hydrocarbon generation potentiality in well K-109, Kirkuk Oil Field, NE Iraq (Fig.1).

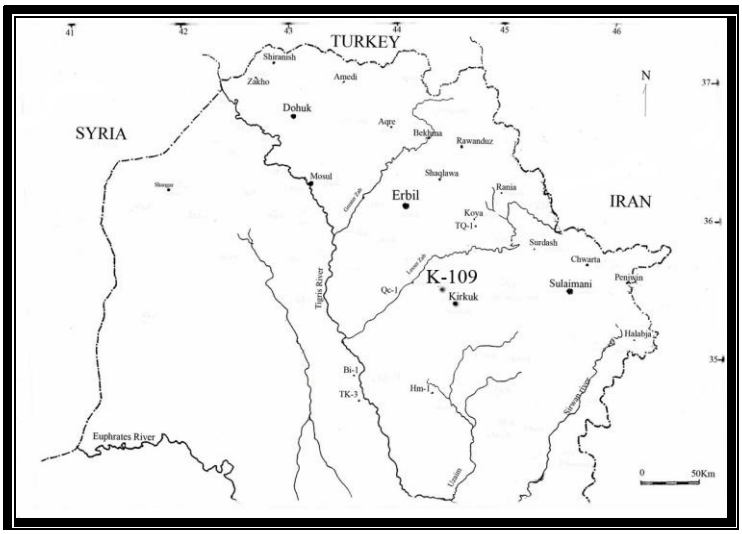


Fig.1. Location map of well K-109.

Materials and Methods

Cutting samples of the Chia Gara Formation from borehole K-109 were taken from the North Oil Company (NOC), Kirkuk, NE Iraq. Sedimentologically the thin sections were studied for determining the petrographical constituents as well as the diagenetic processes.Staining with Alizarin red solution used for discriminating calcite from dolomite. Palynological thin sections also prepared after treatment with HCl and HF acids based on standard method.In addition to the stratigraphy and sedimentology analyses, organic geochemical evaluation carried out using standard methods for the samples.LECO instrument used for determining the Total Organic Carbon content (TOC %) in the samples.Rock- Eval pyrolysis was used for calculating the hydrocarbon parameters.The Carbon Nitrogen Sulfur (CNS)Analyzer used for determining the percentages of C, N and S elements within the samples. The results of these analyses were plotted on diagnostic plots. The classification of the source potential of the studied samples is taken from Peters et al.,(2005).The Pyrolyzable Carbon Index was also calculated (PCI=0.83*(S1+S2)) (Shaaban et al., 2006).This parameter, in addition to S1 and S2 peaks, used to identify the kerogen type and its hydrocarbon potential. Preparation of samples and analyses were carried out in the Department of Geobiology,Geosciences Center, University of Gottingen and the Department of Organic Geochemistry, Institute of Geology & Mineralogy, Cologne, Germany.

Srtratigraphy and Sedimentology

The Chia Gara Formation in well K-109 is underlain by the Barsarin Formation(NOC, 1953).The Barsarin Formation is composed of stromatolitic limestone and evaporate layers (Bellen et al., 1959).The first appearance of brown to dark shale or argillaceous limestone,after stromatolitic limestone beds,is considered as the Chia Gara Formation (Fig.2) .Although the contact is sharp and abrupt, the surface is believed to be conformable(Buday,1980).The same relationship observed in outcrops at the Rania area, Kurdistan region (Mohyaldin, 2007). The radiolarian mold appearance in thin sections also indicates the beginning of the Chia Gara Formation. The overlain formation is Karimia, which is composed of monotonous dark colored calcareous mudstone (Bellen et al., 1959). Jassim and Goff (2006) suggested that the Karimia Formation should include to the Chia Gara Formation.

However there are no proved criteria for this suggestion and the two formations lithologically are different.The Chia Gara Formation in well K-109 has a thickness of 309.5m (depth interval 2782.5 to 3092m) (NOC,1953).

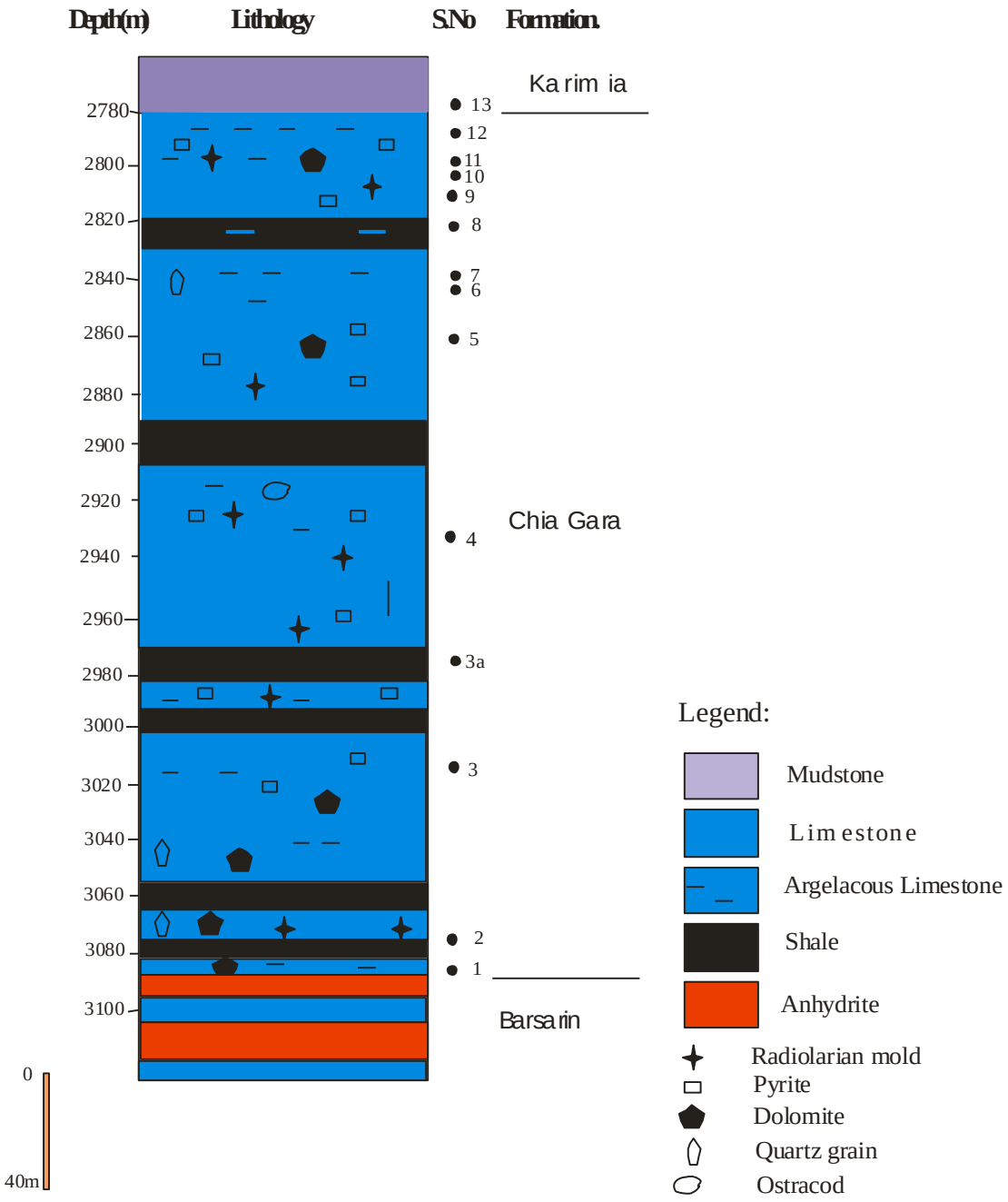


Fig. 2 . Stratigraphic column of the Chia Gara Formation in K-109Well, NE Iraq, (Modified from NOC, 1953) and the location of studied samples.

The succession is composed of alternating argillaceous limestone and shale (Fig.2).The sequence is rich with radiolarian molds,very rich with pyrite (framboidal and large crystals) and rhombohedral dolomites(most of them in the early stage of formation) (Fig.3a,b&c).Nearly all radiolarians skeletons are filled by sparry calcite, the same phenomena discussed by Mohyaldin (2007).Although few collophane and anhydrite inclusions were recorded by North Oil Company, no one of them observed in this study.The limestone beds characterized by the Radiolarian mudstone –wackestone microfacies (Fig. 3a).The major property is the abundance of pyrite crystals in minute and large grains(10 to 300µ) (Fig.3b).Rhombohedral dolomites observed in many horizons and they are mostly in the early stage of formation (Fig.3c),they are fine crystalline hexagonal or pentagonal and surrounded by a very thin reddish outline.They are homogeneous in size about (10-20 µ).This type of dolomite interpreted as syndepositional dolomite (Nicolaides,1995).The organic matters are distributed within the matrix along the sequence and especially at the lower part of the section. In contrast with the exposed sections (Mohyaldin,2007)the Phacoid Horizon is not determined in this section.The main diagenetic process is the replacement or filling of calcite in the radiolarian skeletons.From the sedimentological point of view the sequence represents sediments deposited during transgression period (i.e.raising the sea level)in a deep shelf environment of the Late Jurassic Passive Continental Margin of the Arabian Plate.The basin probably restricted as deduced from the euxinic and anoxic water,which precipitated the argillaceous limestone and shale rich with pyrite.

Geochemical evaluation

In order to understand the sedimentary organic matter type, distribution, origin and degree of maturity along the section, fourteen samples were subjected to geochemical analysis (Fig.2).The hydrocarbon parameters (i.e.S1, S2, S3& T_{max}) determined by Rock-Eval Pyrolysis.Then the other parameters (such as HI,OI,PI,PPand PCI) were calculated.The organic geochemical evaluation of the Chia Gara samples could be discussed as below:

Amount of organic matter :

The amount of organic matter in rocks is usually measured as Total Organic Carbon (TOC %) content,expressed as a percentage of the dry rock(Tissot& Wellte, 1984, Hunt, 1996).

From the TOC% results it is clear that the formation is rich with organic matters (Table 1 and Fig.4a).Organic carbon content of the Chia Gara Formation in the studied well exhibit variable richness ranging from 0.62 to 7.26 wt% in the formation. According to Peters et al.,(2005) they ranged from fair to very good potentiality.The total Sulfur (S %) content is high (Table 1 and Fig.4b) which is coincides with the petrographical study, high distribution of pyrite.This may be indicating to euxinic environment (Einsele, 2000).

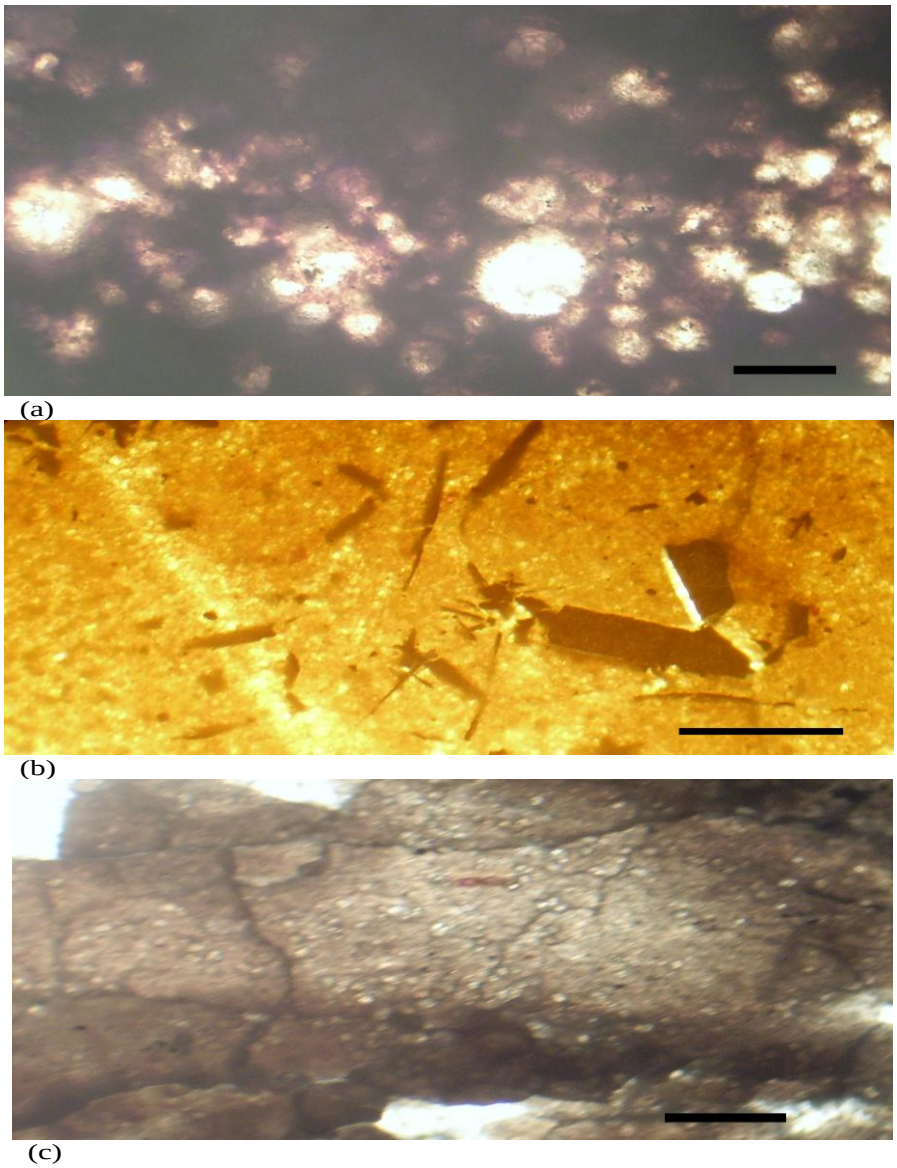
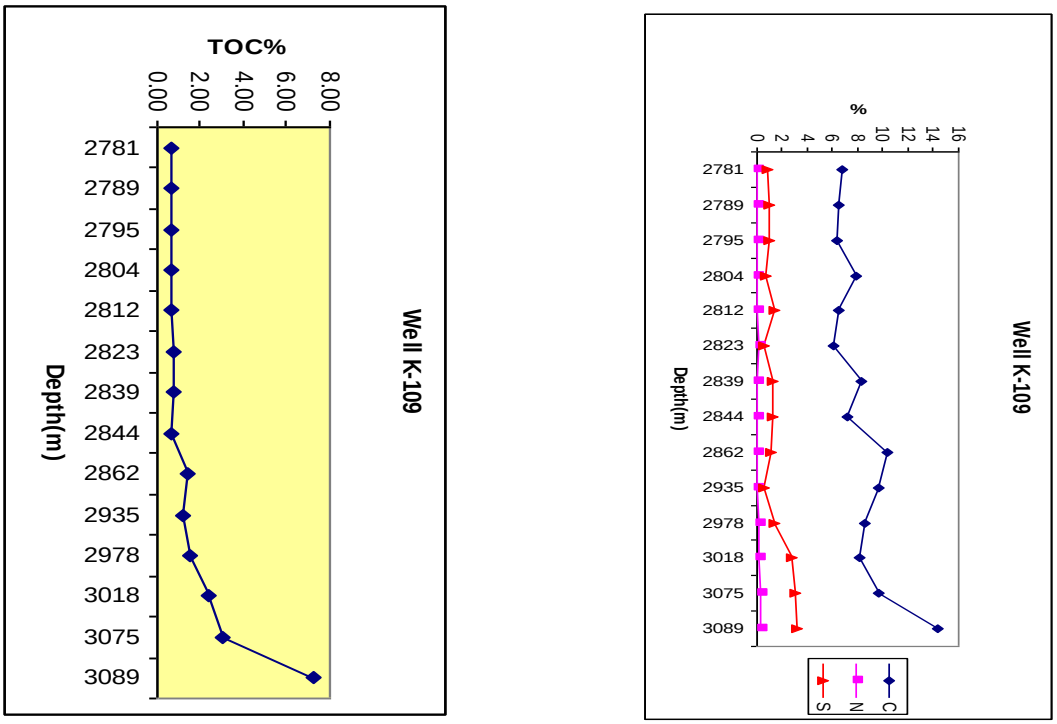


Fig.3. Photomicrographs of the petrographic constituents; a: Radiolarian wackestone rich with organic matter (depth2935m), PPL, (Bar=200μ)

Table1:Pyrolysis data, organic richness and elemental analyses for the studied samples from well K-109

Sample No.	depth (m)	S1 [mgHC/g rock]	S2 [mgHC/g rock]	S3 [mgCO2/g rock]	Tmax [°C]	TOC (%)	OI [mg CO2 / gTOC]	HI [mg HC / gTOC]	PI	PP	PCI	C (%)	N (%)	S (%)	Ro%	S1/TOC
K13*	2781.3	0.24	0.65	0.35	435	0.69	51	94	0.27	0.89	0.74	6.71	0.05	0.79	0.67	0.35
K12	2788.9	0.21	0.56	0.32	435	0.69	46	81	0.27	0.77	0.64	6.53	0.06	0.95	0.67	0.3
K11	2795	0.22	0.60	0.34	438	0.69	49	87	0.27	0.82	0.68	6.29	0.04	0.95	0.724	0.32
K10	2804.1	0.30	0.45	0.45	438	0.66	68	68	0.40	0.75	0.62	7.82	0.04	0.75	0.724	0.45
K9	2811.8	0.26	0.75	0.28	443	0.62	45	121	0.26	1.01	0.84	6.54	0.05	1.41	0.814	0.42
K8	2822.5	0.26	0.46	0.24	436	0.76	32	61	0.36	0.72	0.6	6.04	0.07	0.54	0.688	0.34
K7	2839.2	0.24	0.48	0.38	438	0.73	52	66	0.33	0.72	0.6	8.33	0.05	1.22	0.724	0.33
K6	2843.8	0.28	0.56	0.56	433	0.70	80	80	0.33	0.84	0.7	7.2	0.05	1.29	0.634	0.4
K5	2862.1	1.06	2.08	1.00	438	1.42	70	146	0.34	3.14	2.61	10.28	0.04	1.13	0.724	0.75
K4	2935.2	0.82	1.82	0.80	446	1.23	65	148	0.31	2.64	2.19	9.62	0.03	0.6	0.868	0.58
K3a	2977.9	0.84	1.98	0.75	454	1.54	49	129	0.30	2.82	2.34	8.5	0.09	1.39	1.012	0.55
K3	3017.5	0.26	0.36	0.36	438	2.34	15	15	0.42	0.62	0.51	8.17	0.17	2.69	0.724	0.11
K2	3075.4	1.21	2.78	0.92	457	2.99	31	93	0.30	3.99	3.31	9.61	0.28	2.98	1.066	0.4
K1	3089.1	2.56	6.84	2.00	450	7.26	28	94	0.27	9.4	7.8	14.3	0.26	3.18	0.94	0.35

OI: Oxygen Index ; HI: Hydrogen Index; PP: Petroleum Potential mgHC/g rock; PI: Petroleum Index; PCI:Pyrolyzable Carbon Index; Ro%: Vitinite reflectance, calculated theoretically. .* This sample is belonging to Karimia Formation.



(a) **(b)**

Fig.(4) a: Distribution of TOC% with the depth.
b: The elemental analyses C,N and S % for the studied samples.

Type of kerogen :

The hydrogen indices,ranging between 15 and 148 mgHC/g TOC (Table 1).Hydrogen indices (HI- T_{max}) plot reveals Type II and III kerogens assemblages for the samples (Fig.5).A plot of HI versus OI agrees with the previous results (Fig.6).Type II kerogen is likely generates oil but Type III kerogen may be a source of gas if buried deeply enough (Kilops and Kilops,1993; Hunt,1996).Even for significant gas generation a minimum HI value 20 mgHC/gTOC is required for designation as an effective source rock (Kilops and Kilops, 1993; Keym et al.,2006).The petroleum potential (PP) represents the amount of petroleum (oil and gas) which can be generated by any rock during its thermogenic maturation (Akande et al.,2005).Fig.(7) shows the relationship between PP and TOC%,which indicates the fair to very good hydrocarbon potentiality of the samples.Evaluation of the Pyrolyzable Carbon Index indicates that all samples contain gas-prone kerogen, which is mainly Type III (Fig.8).

Thermal maturity :

The stage of maturity can be estimated using the temperature of maximum pyrolysis yield (T_{max}).In general,T_{max} values less than 435ºC indicate immature organic

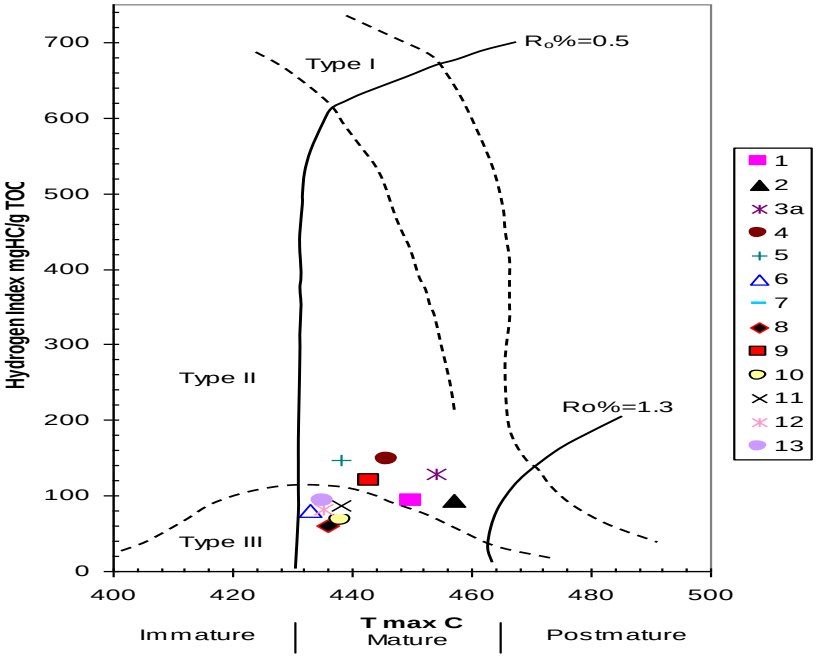


Fig.5. Classification of kerogens of the Chia Gara Formation on the HI-T_{max} diagram.

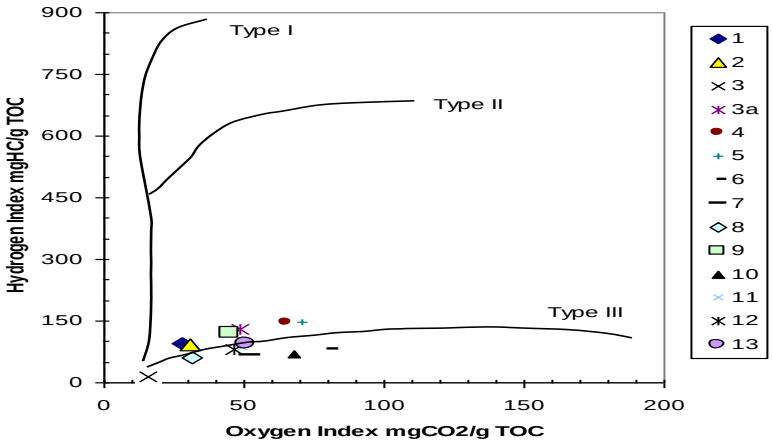


Fig.6. Hydrogen and Oxygen indices values for the studied samples

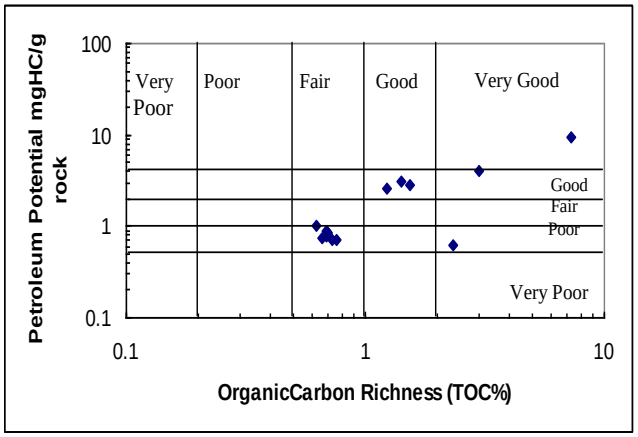


Fig.7. Petroleum potential versus total organic carbon diagram for the Chia Gara Formation samples in well K-109.

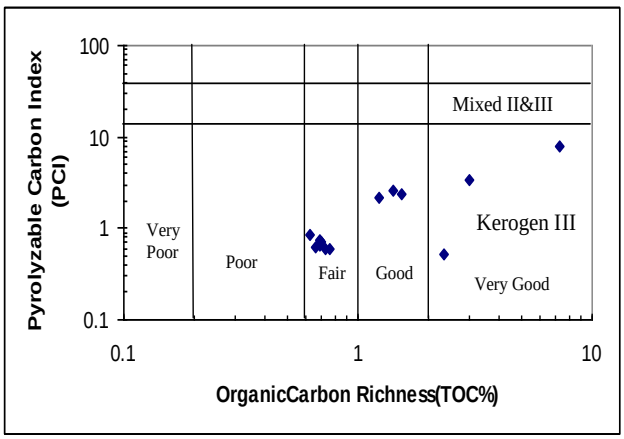


Fig.8. The organic carbon richness and the pyrolyzable carbon index of the studied samples, well K-109.

matter,whereas values of about 460ºC indicate the end of the oil window and the beginning of the wet gas zone (Shaaban et al., 2006). All the studied samples contain mature organic matter (Fig.5),with T_{max} values ranging from 435 to 457ºC (Table 1).These values are consistent with vitrinite reflectance data ranging between 0.67 % and 1.012 % [R_O % calculated theoretically according to the equation R_O %= (0.018* T_{max}) - 7.16 (Peters et al.,2005).At that level of maturity,hydrocarbon generated can migrate since the organic matter has reached the onset of generation with active expulsion corresponding to primary migration. Vandenbroucke et al.,(1993) place the initiation of these processes at T_{max} 445 ºC and R_O 0.70% for both Type II and III kerogens. The palynological thin sections support this conclusion and nearly all amorphous organic matters are brown with TAI about 3+ (based on the classification of Pearson,1990),however the structured palynomorphs are very rare.

Petroleum source potential

The content of naturally generated hydrocarbons (S1) is low in the samples at the upper part of the section (0.2 mgHc/g rock) and downward the well increased (2.56mgHC/g rock)(Table 1).The Production Index (PI) is also good indicator for natural petroleum generation and /or accumulation,also known as the transformation ratio,which expresses the fraction of S1 over the total amount of free and pyrolysis-derived hydrocarbons(S1+S2)(Ejedawe,1986). This index increases with maturity as hydrocarbons are generated(Tissot and Welte,1984;Keym et al.,2006) .Any positive anomaly in PI values may indicate the presence of accumulated or migrated hydrocarbons(Shaaban et al.,2006). The Chia Gara samples from well K-109 have PI values between 0.27 and 0.42(Table 1 and Fig.9).The samples K3 and K10 have abnormally high PI values.This may be due to retention of migrating or in situ generated hydrocarbons(Shaaban et al.,2006).On the other hand,all samples,except K3,have S1/TOC values >0.2(Table 1),which according to Smith(1994 in Al Khafaje, 2006) interpreted as the process of hydrocarbon expulsion.A hydrocarbon yield (S2) versus TOC cross plots classified the samples of the Chia Gara Formation as effective primary source rocks as those having S2> 5mgHc/g rock,effective non-source rocks(ENS)grouping below S2 of less than 1mgHc/g rock and secondary source rocks when S2 is between 1 and 5mgHC/g rock(Fig.10).The plot of S2 vs.TOC and determining the regression equation is the best method

for determining the true average HI and measuring the adsorption of hydrocarbons by the rock matrix (Obaje et al.,2004; Akande, et al.,2005). The diagram (Fig.10) gave an average HI value of 91.26 mgHC/g TOC for the Chia Gara Formation samples.The relationship between petroleum Potential (S1+S2) and TOC% (Fig.7),shows that the samples from upper part of the section represent poor PP,while the samples of lower part show good to very good PP. Rocks with PP less than 2 mgHC/g rock suggest insignificant oil but some gas potential; whilst rocks with PP ranging between 2 and 6 mgHC/g rock are classified as moderately rich source rocks with fair oil potential (Tissot and Welte, 1984;Akande et al.,2005). A plot of S1 versus TOC can be used to discriminate between nonindigenous and indigenous hydrocarbons(Hunt, 1996; Rabbani and Kamali,2005).All studied rock samples have relatively high S1 and high TOC values(Fig.11) indicating the presence of indigenous (expelled) oil.

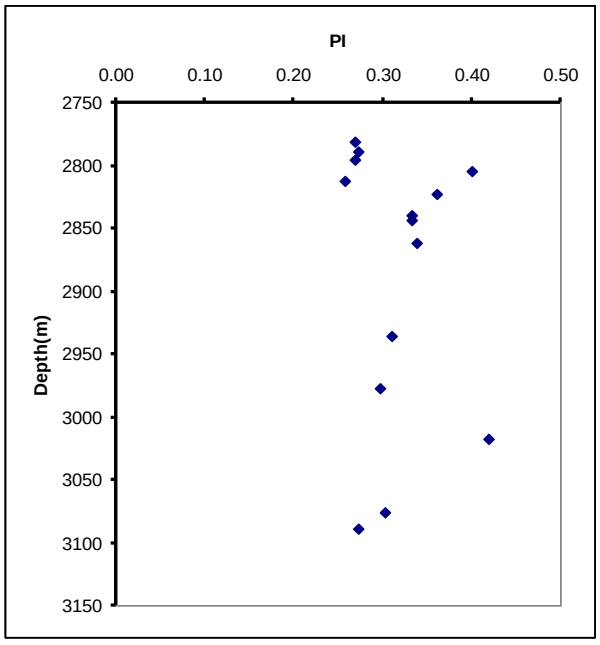


Fig.(9)Production index versus the depth for the studied samples, well K-109.

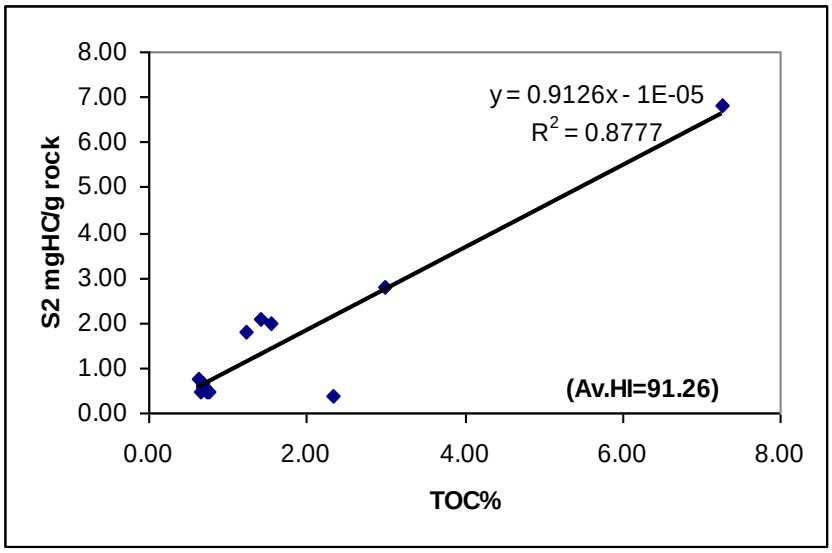


Fig.(10) Hydrocarbon yield (S2) versus TOC% for the studied samples.

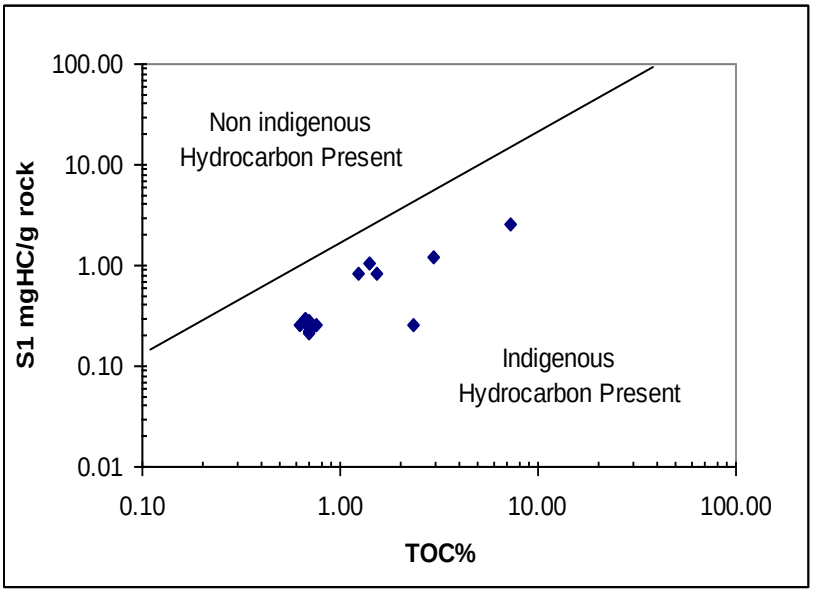


Fig.(11) Plot of S1 versus TOC,on which migrated or contaminating hydrocarbons can be distinguished from indigenous hydrocarbons (Hunt,1996),and the location of studied samples.

Conclusions

From this study the following points can be concluded:

1- The Chia Gara Formation composed of rocks deposited in deep shelf, quiet and euxinic environment on the Arabian Shelf of the Late Jurassic – Early Cretaceous Period.

2- The main diagenetic process is the filling of the siliceous skeletons of radiolarians by calcite , which indicate changing in water chemical conditions.
Also dolomitization is common in the section.

3- Type of kerogen is II-S and III, and all samples are in mature stage.

4- The lower part of the section characterized by good to very good petroleum potential, while the upper part is poor.

5- All the samples show the presence of indigenous oils.

6- The organic geochemical analyses evaluate the Chia Gara Formation as good source rocks for oils in the Kirkuk Oil Field,which mostly expelled hydrocarbons.

Acknowledgments

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References

- Akande,S.O., Oja,O.J., Erdtmann,B.D.and Hetenyi,M.,(2005): Paleoenvironments ,organic petrology and Rock-Eval studies on source rock facies of the Lower Maastrichtian Patti Formation,southern Bida Basin, Nigeria,Journal of African Earth Sciences,Vol.41, pp.394 - 406.
- Al Beyati,F.M.,(1998): Organic Geochemical and Environmental Evaluation study of Chia Gara Formation from selected boreholes in middle Iraq,Ph D thesis,University of Baghdad,Unpublished, ,172p.

- Al Habba,Y.Q.,(1985): Geochemical study of geological column for Well S-8,Central Laboratories,Oil Exploration Company,Internal Report, Baghdad,Iraq. (In Arabic).
- Al Habba,Y.Q. and Abdullah,M.B.,(1989): Geochemical Study for hydrocarbon source rocks in NE Iraq,Oil and Arab Cooperation,Vol.14 , pp. 11-51 (In Arabic).
- Al Jubury,N.M.,(1989): Palynology of Sarmord and Chia Gara Formations in Well S-8 and S-12,and their relations to source rocks, M Sc thesis,Unpublished, University of Salahaddin, 123p.(In Arabic).
- Al Khafaje,A.S.,(2006): Relation of Mishrif reservoir,crude oil with the source rock,Ratawi,South & North Rumaila Oil Field,Southern Iraq using biomarker and carbon isotopes,M Sc thesis,Unpublished, University of Baghdad, 146p(in Arabic).
- Al-Qayim,B. and Saadallah,A.,(1992): Petrology of Jurassic Chia Gara Formation,Northern Iraq,Journal of the Geological society of Iraq, II,(25).
- Bellen,R.C.Van,Dunnington,H.V.,Wetzel,R.And Morton,D.,(1959): Lexique Stratigraphique Intern..Asie.Iraq,Intern.Geol.Conger. Comm.Stratigr.3,Fasc.10a, 333p.
- Buday,T.,(1980): The regional geology of Iraq, Vol.I, Stratigraphy and Paleogeography, Publications of GEOSURV, Baghdad, 445p.
- Dunnington,H.V.,(1958): Generation,accumulation and dissipation of oil in northern Iraq.In weeks,L.G.,(ed) Habitat of oil, *AAPG*,Tulsa, Oklahoma,USA, pp.1194-1251.
- Einsele,G.,(2000): Sedimentary Basins,evolution,facies and sediment budget,2nd ed.,Springer,Berlin, 792p.
- Ejedawe,J.E.,(1986): The expulsion criterion in the evaluation of the petroleum source beds of the Teritary Niger Delta, Journal of Petroleum Geology, Vol.9, pp. 439-450.
- Hunt,J.M.,(1996): Petroleum geochemistry and geology,2nd ed.,W.H. Freeman and Company,New York., 501p.
- Jassim,S.Z.and Goff,C.(ed.),(2006): Geology of Iraq,Published by Dolin, Prague and Moravian Museum,Brno,341p.

- Keym,M.,Dieckmann,V.,Horsfield,B.,Erdmann,M.,Galimberti,R.,Kua, L-C.,Leith,L.,and Podlaha,O.,(2006): Soursce rock heterogenity of the Upper Jurassic Draupne Formation,North Viking Graben,and its relevance to petroleum generation studies,Organic Geochemistry, Vol.37, pp. 220-243.
- Killops,S.D.and Killops,V.A.,(1993): An Introduction to Organic Geochemistry,Longmann Scientific and Technical, 265p.
- Mohyaldin,I.M.J.,(2007): Stratigraphy and sedimentology of organic rich limestones of the Chia Gara Formation, Rania area, Sulaimani, Kurdistan Region,NE Iraq,Journal of Zankoi Sulaimani (in Press).
- Nicolaides,S.,(1995): Origin and modification of Cambrian dolomites (Red Heart Dolomite and Arthur Creek Formation),Georgina Basin, central Australia,Sedimentology,Vol.42, pp. 249-266.
- North Oil Company(NOC).,(1953): Final report of Well K-109,Kirkuk, NE Iraq..
- Obaje,N.G.,Wehner,H.,Scheeder,G,Abubakar,M.B.,and Jauro,A.,(2004): Hydrocarbon prospectively of Nigeria's inland basins: organic geochemistry and organic petrology,AAPG Bulletin,Vol.88, pp.325-353.
- Odisho,K.Y.,and Othman,R.S.,(1992): Preliminary geochemical evaluation of hydrocarbon source rocks in northern part of Iraq,*Iraq Geological Journal*,Vol.25, pp. 136-153.
- Othman,R.S.,(1990**):** Generation,Migration and seepages of Hydrocarbons in Northern Iraq,M.Sc thesis,Unpublished,Salahadden University, 208p.(In Arabic)
- Pearson,D.L.,(1990): pollen/Spore color. Standard . Phillips Petroleum Company,Geology Branch.Second Printing of version 2,April.
- Peters,K.E.,Walters,C.C.and Moldowan,J.M.,(2005):The biomarker Guide,Volume 1,Cambridge University Press, 471p.
- Rabbani,A.R.,and Kamali,M.R.,(2005): Source Rock Evaluation and Petroleum Geochemistry,Offshore SW Iran,Journal of Petroleum Geology,Vol.28, pp. 413-428.

- Shaaban,F.,Lutz,R.,Littke,R.,Bueker,C.and Odisho,K.,(2006): Source-Rock evaluation basin modeling in NE Egypt(NE Nile delta and northern Sinai),Journal of Petroleum Geology,Vol.29,pp.103-124.
- Spath,L.F.,(1950): A new Tithonian Ammonoid fauna from Kurdistan, northern Iraq, Bulletin of the British Museum,(Natural History) Geology,Vol.1,pp. 95-137.
- Tissot,B.P.and Welte,D.H.,(1984): Petroleum Formation and Occurrence,2nd ed,Springer-Verlag,Berlin, 699p.
- Vandenbroucke, M. ,Bordenave,M.L.,and Durand,B.,(1993): Transformation of organic matter with increasing burial of sediments and the formation of petroleum in source rocks. In: Bordenave,M.L. (Ed.),Applied Petroleum Geochemistry,Editions Technip,Paris, pp. 101-122.

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رسوبية تكوين جياكارا (تيثونيان الأوسط–بيرياسيان) و كفائته البترولية في بئر-k 109 ، حقل نفط كركوك، شمال شرق العراق

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الخلاصة

تم دراسة تكوين جياكارا(تيثونيان الأوسط–بيرياسيان) في بئرk-109،حقل نفط كركوك،من الناحية الرسوبية والكفاءة البترولية.تم اخذ النماذج من شركة نفط الشمال، كركوك.يتكون التكوين من تتابع من الحجر الطيني الكلسى و الحجرالجيري الغنى بالمواد العضوية.طبقات الحجرالجيري رقيقة و تفتقد أي أثارلفعاليات الكائنات. الحد السفلي للتكوين متوافقة مع تكوين بارسرين والحد العلوي متدرجة مع تكوين كريميه.سحنة الحجرالكلسى الطيني– الواكى الراديولاري هي الأكثر شيوعا بين السحنات الرسوبية. كل القوالب للراديولاريا ملئت بالكالسايت السباري بعد ذوبان السليكا،حيث تعتبر إحدى العمليات التحويرية المهمة.النسبة المئوية للكربون العضوي الاجمالى(TOC)تتراوح بين 0.62% 7.26% ،مع تواجد النسب العالية في الجزءالسفلي للمقطع. أكثريةالموادالعضوية هي من نوع عديمة الشكل وقهوائية اللون كما ظهرت في الشرائح البالينولوجية وكذلك من خلال معامل التغيير الحراري حيث يقترب من 3+.نتائج التكسر الحراري تدل على معامل هيدروجين منخفض و نوع الكير وجين II-S وIII.تم استخدام عدد من العلاقات لتحديد نوعية الكير وجين و نضوج المادة العضوية و الكفاءة الإنتاجية للهيدروكاربونات.المواد العضوية ناضجة وهي في نطاق إنتاجيةالنفط . نسبة الكبريت عالية خصوصا في الجزء السفلى للمقطع.كل المعلومات الرسوبية والجيوكيمياء العضوية بينت بأن التكوين قد ترسب في بيئة رفيه عميقة (الحافة القارية للصفيحة العربية) مع وجود مياه هادئة ودافئة. البيئة الاختزالية يمكن استنتاجها من خلال غياب أثار الكائنات والحفظ الجيد للمادة العضوية بالاضافة إلى التواجد العالي للبايرايت.يمكن اعتبار تكوين ضياطارا صخور مصدرية مهمة لإنتاج النفط في حقل كركوك النفطي.