

***Lepidocyclina (Nephrolepidina) kirkukensis* n. sp., a new Larger Foraminifera from the Late Oligocene of Kirkuk Area, Northern Iraq**

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ABSTRACT

Lepidocyclina(Nephrolepidina) kirkukensis a new Foraminifera is recorded from the Late Oligocene Baba Formation (Kirkuk and Bai-Hassan Oil Fields, North Iraq). The new species is described and figured based on variations in (A_i , C and α) parameters in agreement with the principles of nepionic acceleration as defined by Tan Sin Hock. The paleoenvironment of the *Lepidocyclina (Nephrolepidina) kirkukensis* is concluded as shallow marine according to the lithological features and faunal association.

نوع جديد من الفورامنيفرا الكبيرة من الأوليوسين المتأخر
منطقة كركوك ، شمال العراق

قحطان احمد محمد
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المخلص

تم وصف النوع *Lepidocyclina(Nephrolepidina) kirkukensis* n. sp., كنوع جديد من الفورامنيفرا في بئرين من حقل كركوك و باى حسن النفطيين، شمال العراق، بالاعتماد على المتغيرات (A_i , C and α).

حددت بيئة ترسيب تكوين بابا الحاوى على النوع الجديد بكونها بيئة بحرية ضحلة اعتمادا على الطبيعة الصخرية وحشود المتحجرات المسجلة في التكوين.

INTRODUCTION

During biometric analysis of *Lepidocyclina (Nephrolepidina)* Douville- by authors in accordance with the evolutionary “Principle of nepionic acceleration” (Tan Sin HocK, 1932), (Drooger,1984), were performed according to parameters (Ai, C, D1, D2 ,R and α counts). The representative of *Lepidocyclina (Nephrolepidina)* shows regular increase in the average degree of embracement of the protoconch by the deuterococonch (Ai) and in the average number of accessory auxiliary chambers on the deuterococonch (C). The morphometric data of *Lepidocyclina (Nephrolepidina)* associations are derived from the (Kirkuk well – 19, (Units I,II and III) and Bai-Hassan well – 4 (Units II and III) sections, northeastern Iraq (Fig.1).The Oligocene carbonate (Baba Formation), characterized by the occurrence of the first primitive type of *Lepidocyclina (Nephrolepidina) praemarginata* depended on the mean values of the (Ai,- C, D2-C, and C- α) relation from the middle part of the Baba Formation, (Fig. 2).

In Kirkuk well-19 (Unit II) samples (18, 19 and 20) (Fig. 3), the variation in the A-C combination is rather wide along this road causes to determine ex. interc. species that situated in their character between *Lepidocyclina (Nephrolepidina) praemarginata* and *Lepidocyclina (Nephrolepidina) morgani* as seen in the (Fig.4).

The species designation of the intermediate assemblages is the aim of this study by using counts and measurements on the early chambers of *Lepidocyclina (Nephrolepidina)*. According to the procedures described by De Mulder, 1975; Drooger and Rohling, 1988, Drooger, 1993, Saraswati and Kummar, 2000.

PREVIOUS WORKS ON LEPIDOCYCLINA

The genus of *Lepidocyclina* was first described by Gümble, 1868. Tan Sin Hok (1936) was the first to emphasize the importance of peri-embryonic chambers of the evolution. Van der Vlerk (1957, 1959, 1963, 1973, 1974) developed biometrical approach still further by introducing and or defining a number of parameters.De Molder (1975) subdivided the European *Nephrolepidina* into three successive species with species boundaries based on means values of C and A. Geerates (1983), studied the biometrical analysis of the early middle Oligocene *Nephrolepidina praemarginata* and *Heterostegina* sp.

from Spain, suggested two distinct lineage based on the large mean protoconch diameters.

Adam (1987) subdivided *Lepidocyclina* into three subgenera *Lepidocyclina* (*Lepidocyclina*), *Lepidocyclina* (*Eulepidina*) and *Lepidocyclina* (*Nephrolepidina*) on the nature and arrangement of their periembryonic chambers, in particular, the presence or absence of adauxiliary chambers. According to Matsumaru, 1992, some taxa of the subgenus *Nephrolepidina* in *Lepidocyclina* are described and illustrated from the Upper Miocene in Japan. Drooger, 1993, subdivided the morphometric and evolution of radial Foraminifera, including *Lepidocyclina* (*Euolepidina*) by using two parameters A_i and C . The biometric parameters of *Lepidocyclina* (*Nephrolepidina*) from the Oligocene early Miocene of India, the interrelations of morphometric parameters of *Nephrolepidina* are estimated statistically and the evolutionary trend is argued by Saraswati, (1995). Morphometric of some *Lepidocyclina* Foraminifera discussed by Saraswati and Kumar, 2000, proved in accordance to the morphometric analysis of some Indo-pacific species that the two subgenera are distinctly different. Muthukrishnan and Saraswati, 2001, debated the morphometric of these subgenera to examine if the two subgenera are taxonomically valid and to view of the fact that the adauxiliary chambers are not visible very often. Saraswati, 2003 emphasized the morphometric of foraminifera shows that the most foraminifera morphometers are limited to size, due to partly to easy measurement and its significance in documenting evolutionary trends especially in *Lepidocyclina* Ghafor (2004), studied the biometric analysis of *Lepidocyclina* (*Nephrolepidina*) in Kirkuk area, north Iraq, from Chattian-Aquitania age.

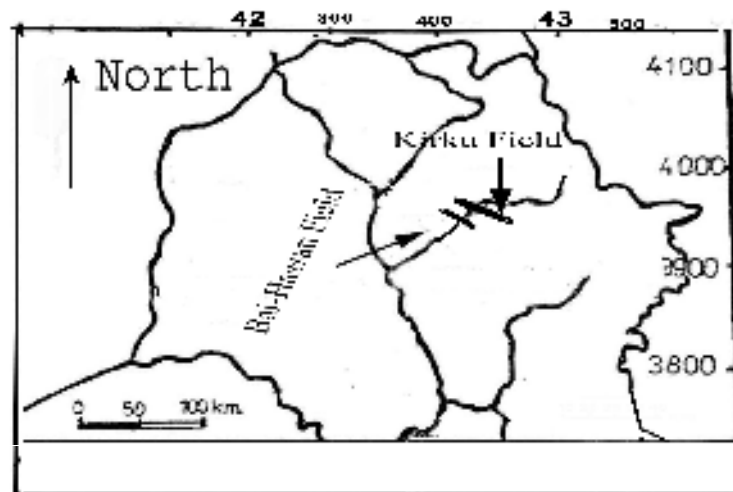


Fig. 1 : Location Map of the Studied Area.

LITHOLOGY AND LARGER FORAMINIFERAL ASSOCIATIONS

The ex.interc. species of *Lepidocyclina* (*Nephrolepidina*) new species recorded from Oligocene carbonate Formation within two microfacies units (II and III) (Fig. 2).

Unit II : Fine to very coarse bioclastic Larger Foraminiferal Packstone

This part of the succession consists of bedded, fine to very coarse packstone, the thickness of the unit II is about (9)meters in Bai-Hassan well-4 and (8) meters in Kirkuk well-19 sections. (Fig. 2). Although distinct variations in the average grain size occur throughout, unit II as whole shows a fining upwards trend, the coarse fraction of the packstone is dominated by larger Foraminifera, echinoid and algal bioclastics especially the later, which is in most cases are of the melobesioid type, generally have a subrounded shape. The total number of the larger foraminifera in the analyzed thin sections varies between 10 and 17 specimens, *Lepidocyclina* (*Eulepidina*), *Lepidocyclina* (*Nephrolepidina*) attains its highest relative frequencies in the lower part of this unit, another groups of importance is *Heterostigina* and *Operculina* with a percentage ranging from 5 to 40, the group of Pararotalia which constitutes about 35% in the lower part. The types of bioclast with high B h(P+B) ratio indicate that the sediment were deposited on a relatively shallow marine environment.

Unit III : Fine bioclastic smaller foraminiferal packstone

This unit with a thickness of about (II) meters in Bai-Hassan Well-4 and (9)meters in Kirkuk Well-19 sections, consist of vaguely bedded, fine and medium-fine packstone, in which larger bioclastics are very rare, small scale burrows are present, the lower part of the unit is marked by the increase of the grain size, above this the trend is reversal. Coarse to medium packstones, large bioclasts were met within the basal of unit which makes this sediments grading into a floatstone, the relative frequencies of *Lepidocyclina* and of the encrusting foraminifera are much higher in the lower part of the unit II.

Lepidocyclina is a very characteristic element of the unit by its large relative frequencies between 25 and 75 percent and its diameter about 5 mm and the Nummulitids remain present in the lower part of unit III. The appearance of larger bioclasts of shallow marine origin points shallowing during the deposition of the upper part of the unit for the occurrence of coral patches.

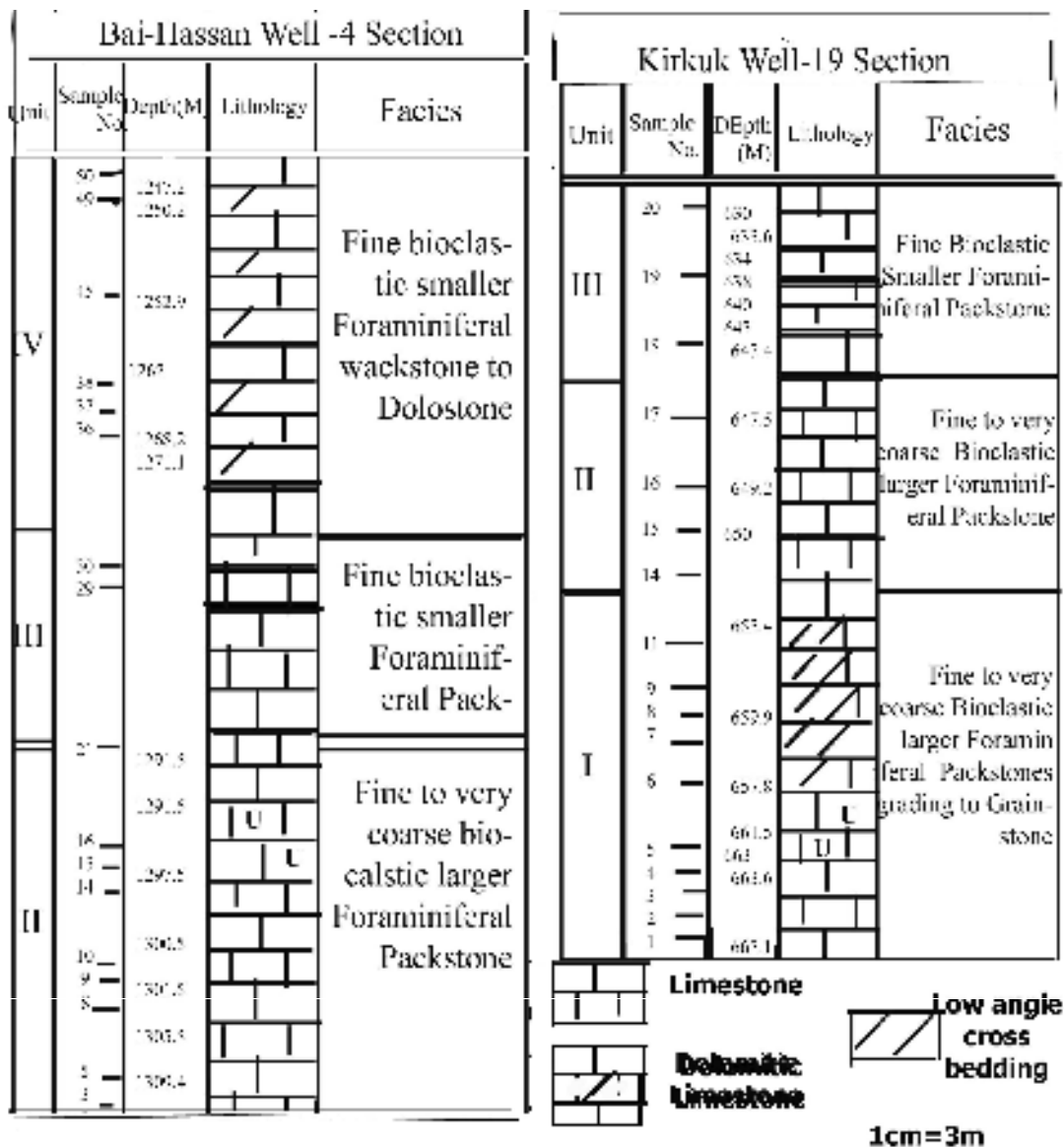


Fig. 2: Lithostratigraphic Column of Bai-Hassan Well-4 and Kirkuk Well-19 Sections

Systematic description
 Order Foraminiferida Eichwald, 1830
 Suborder Rotaliina Delage and Hérouard, 1896
 Superfamily Asterigerinacea Loeblich and Tappan, 1961
 Family Lepidocyclusinae Scheffen, 1932
 Subfamily Lepidocyclusinae, Scheffen, 1932
 Genus *Lepidocyclus* Gümbel, 1870

Subgenus *Lepidocyclina* (*Nephrlepidina*) Douville, 1911

Genus *Nephrlepidina* H. Douvillé, 1911

Lepidocyclina (*Nephrlepidina*) *kirkukensis* n. sp.

Pl 1, (Figs. 1- 6),

Derivation of name: According to the type locality Kirkuk area.

Holotype: Equatorial section Figured on Pl.1, (Fig. 1).

Paratypes: Equatorial sections Figure on Pl, (Figs. 2 - 6)

Type locality : Subsurface section of Kirkuk Well no. -19 (North Iraq)

Type Horizon : Shelly foraminiferal limestone of Baba Formation (Late Oligocene) in association with *Pararotalia viennoti* Grieg; *Operculina complanata* Schlumberger, *Heterostigina assilinoidea* Blankenhorn, encrusting algae.

Material: About eighty equatorial thin sections.

External morphology: Test free, discoidal to inflated lenticular with distinct equatorial layer of chambers and zones of lateral chambers at each side. The diameter of the test (Megalospheric Form) is between (0.4 - 2) mm, and the thickness at periphery is (0.2)mm and at central part is (0.3)mm. The isolated individual of the microspheric form could not gathered easily because of the samples are too strongly indurated, dolomitized and state of preservation. Ornamentation consist essentially of postules which vary in size and distribution.

Internal Structures: Protoconch and deuteroconch unequal (P<D) in size. Deuteroconch kidney shape, clearly embracing the protoconch. The diameter of protoconch (D_1) is varied between (230 - 318) μm and diameter of deuteroconch (D_2) is ranged between (287 - 361) μm .

The degree of embracement of the protoconch by the deuteroconch (A_i) is varied between (39-41). Two primary auxiliary chambers observed, one on either side of the embryonic apparatus and one adauxiliary chambers on the deuteroconch and similar chambers or more (accessory auxiliaries) develop occasionally on the deuteroconch. Adauxiliary and accessory auxiliary chambers are usually larger than adjacent interauxiliary chambers. Each adauxiliary and or accessory are jointed directly by closing chambers. The number of accessory auxiliary chambers on the deuteroconch (C) is ranging between (2-4). The degree of curvature ($R=100h/W$), (Fig. 1) is varied between (23-30.6). The amount of (α) is ranged between (200-207). Equatorial chambers are simple arcuate chambers in lateral

contact adopt a compressed, ogival form, Lateral chambers well-developed, usually numerous (Plate 1).

OCCURRENCE

In present study *Lepidocyclina(Nephrolepidina)kirkukensis* n. sp., described from the Oligocene Baba Formation in Kirkuk Well-19 and Bai-Hassan Well-4 sections (North Iraq), (Fig.4). it is associated with *Rotalia veionnoti* Grieg. *Operculina complanata* Schulumberger. *Heterostegina assimilinoides* Blankenhorn. This species is also recorded by De Mulder, 1975 from Jonian Island (Greece) as *Lepidocyclina (Nephrolepidina) ex. interc. praemarginata-morgani*.

BIOMETRIC COMPARISSON USING A_i, C, D₁, D₂, AND α PARAMETERS

It is noticed, the *Nephrolepidina* assemblages were described from samples (14,16) in Kirkuk Well-19 and samples (18,19,20) in Bai-Hassan Well-4 differ completely in their parameters values from underlying samples, their parameters counts refer to *Lepidocyclina (Nephrolepidina) praemarginata* and overlying samples which their parameters measurement indicate to *Lepidocyclina(Nephrolepidina) morgani* as seen in (Tables 1 , 2). *Lepidocyclina (Nephrolepidina) kirkukensis* n. sp., differ from *Lepidocyclina (Nephrolepidina) praemarginata* and *Lepidocyclina (Nephrolepidina) morgani* in accordance to mean values of the (C), (A) and (α) parameters as stated in table (3).

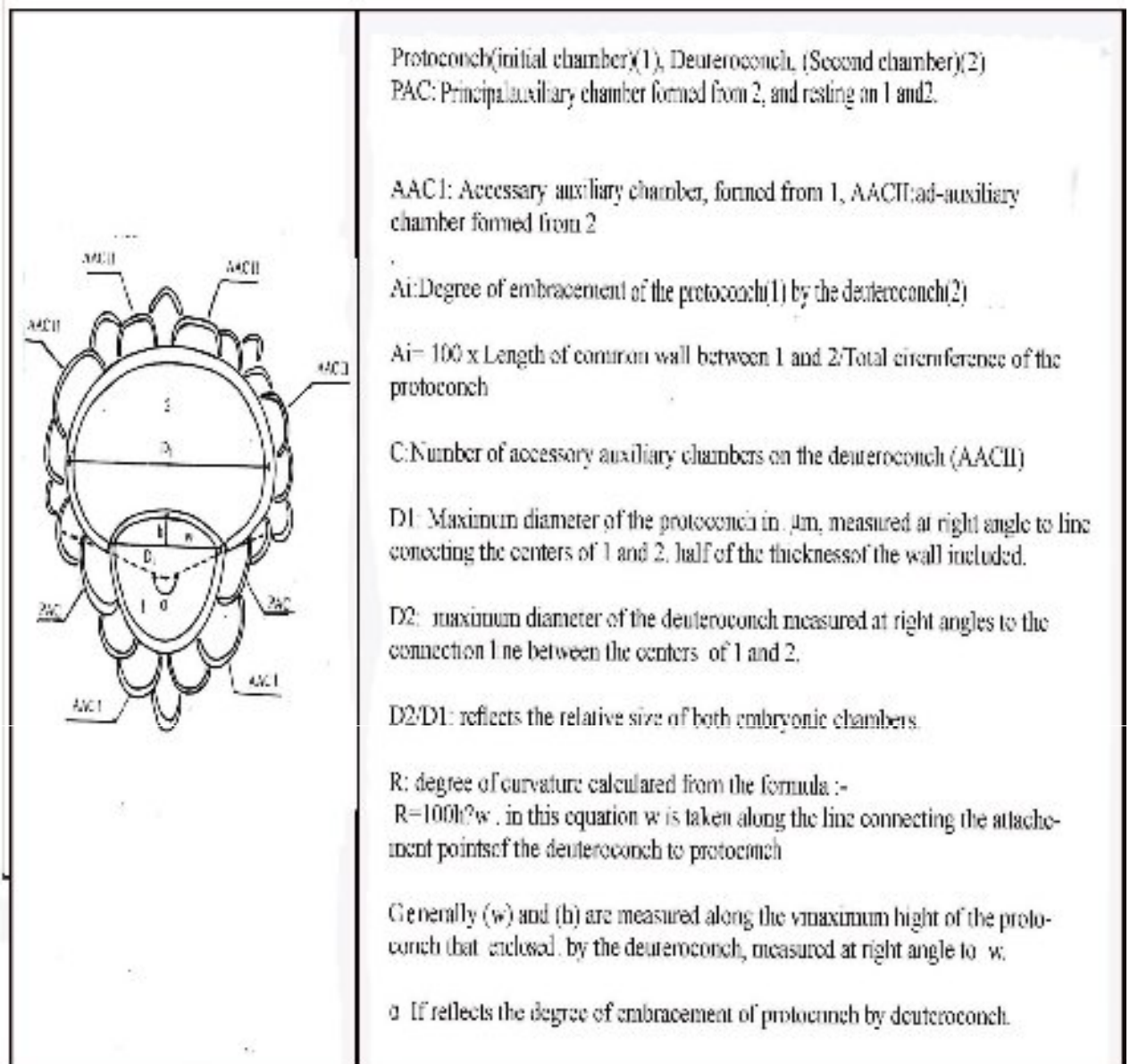


Fig. 3: Schematic drawing showing the methods of measuring and counting the Internal features in Nephrolepidina.

Table 1: Results of counting and measurements on *Nephrolepidina* assemblages in Kirkuk Well-19 section.

Series	Stage	Unit	Thickness (m)	Sample Number	A _i	C	D ₁	D ₂	R	α	Species	Present Nomenclature
Oligocene	Chattian	III	9	7	42.5	40	297.3	174.5	29.4	193.9	<i>L.morgani</i>	
				18	44.1	48	230.1	255.83	26.4	193.6	<i>L.morgani</i>	
		II	8	16	41.7	29	272	130.5	25.5	207.7	<i>L.ex.interc. praemarginat</i>	<i>Lepidocyclina (Nephrolepidina) kirkukensis</i>
				14	40.1	35	283.3	305.8	23.5	200.5	<i>L.ex.interc. praemarginat</i>	
		I	18	11	35.4	2	263.7	238.1	23.1	219.1	<i>L.praemarginata</i>	
				3	35.1	21	247.9	322.1	14.1	218.2	<i>L.praemarginata</i>	
				2	35.8	21	219	315.9	15.3	238.1	<i>L.praemarginata</i>	

Table 2: Results of counting and measurements on *Nephrolepidina* assemblages in Bai-Hassan Well-4, Section.

Series	Stage	Unit	Thickness (m)	Sample Number	A ₁	C	D ₁	D ₂	R	α	Species	Present Nomenclature
Oligocene	Chattian	IV	٣٥	٢٢	42.6	4.6	267.3	340	26.2	195.2	<i>L.morgani</i>	
				٢٢	43.1	4.5	207.1	267	30.4	194.6	<i>L.morgani</i>	
		III	١١	٢٠	42.1	3.2	300	278	31.3	196.2	<i>L.ex.interc.praemarginata-morgani</i>	<i>Lepidocyclina (Nephrolepidina) kirkukensis</i>
				19	41.7	3.3	218.1	289	24.5	202.4	<i>L.ex.interc.praemarginata-morgani</i>	
				1٨	40.1	3.5	283.3	205.8	22.1	201.5	<i>L.ex.interc.praemarginata-morgani</i>	
		II	9	1٦	35.3	2	233.7	258.1	21.5	217.2	<i>L.praemarginata</i>	
				١٥	35.4	2.1	237.4	282.6	15.2	219.4	<i>L.praemarginata</i>	
				٧	35.6	2.1	216	217.2	15.9	229.3	<i>L.praemarginata</i>	

Table 3: Mean Values of the (C) , (A) and (α) Parameters.

Species	A_i^-	C^-	α^-
Lepidocyclina(Nephrolepidina)morgani	$40 < A_i^- < 45$	$3 < C^- < 5.25$	$192.5 < \alpha^- < 199$
Lepidocyclina(Nephrolepidina)kirkukensis n.sp.	$30 < A_i^- < 41$	$2 < C^- < 4$	$199 < \alpha^- < 208$
Lepidocyclina(Nephrolepidina)praemarginata	$35 < A_i^- < 40$	$1 < C^- < 3$	$208 < \alpha^-$

The average means of (A-C) and (D₂-C) and (C- α) for *Nephrolepidina* assemblages from Kirkuk Well-19 and Bai-Hassan Well-4 sections showed three different assemblages. (Fig. 4)

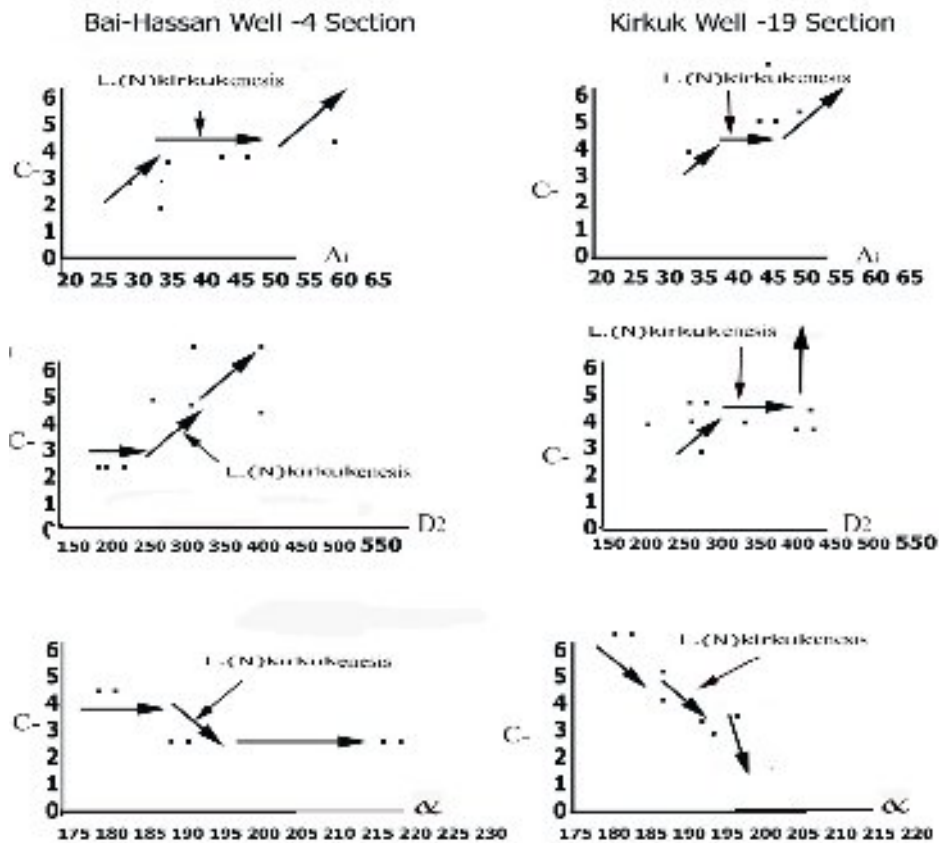


Fig. 4: Relation between C- A_i , C- D_2 and C- α mean values of *Nephrolepidina* assemblages4 in Bai-Hassan Well-4 and Kirkuk Well -19 Sections

CONCLUSIONS

1. *Lepidocyclina (Nephrolepidina) kirkukensis* n. sp., a new larger foraminifera recognized in Kirkuk Well-19 and Bai-Hassan Well-4 sections, North Iraq.
2. According to the lithological features and faunal association. the paleoenvironment of the *Lepidocyclina (Nephrolepidina) kirkukensis* is interpreted as shallow marine environment.

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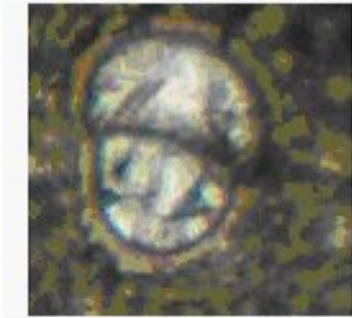
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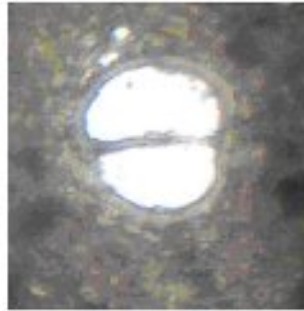
PLATE 1

- Fig. 1: *Lepidocyclina (Nephrolepidina) kirkukensis* n. sp., Unit (I), sample(1), Kirkuk well-19, Baba Formation, equatorial section, (40X).
- Fig. 2: *Lepidocyclina (Nephrolepidina) kirkukensis* n. sp., Unit (II), sample (16), Bai-Hassan well-4, Baba Formation equatorial section (40X).
- Fig. 3: *Lepidocyclina (Nephrolepidina) kirkukensis*, Unit (III), sample (18), Bai-Hassan well-4, Baba Formation, equatorial section (40X).
- Fig. 4: *Lepidocyclina (Nephrolepidina) kirkukensis* Unit(II), sample (19), Kirkuk well-19 section, Baba formation, equatorial section (40X).
- Fig. 5: *Lepidocyclina (Nephrolepidina) kirkukensis*, Unit (IV), sample(23) Bai-Hassan well-4 section, Baba Formation. axial section (30X).
- Fig. 6: *Lepidocyclina (Nephrolepidina) kirkukensis*, Unit (II), sample(22) Bai-Hassan well-4 section, Baba Formation. axial section (35X).

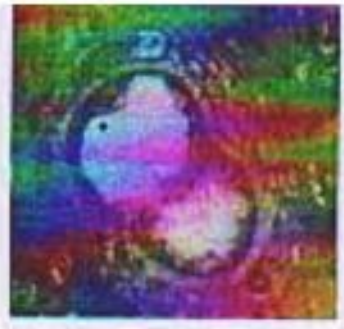
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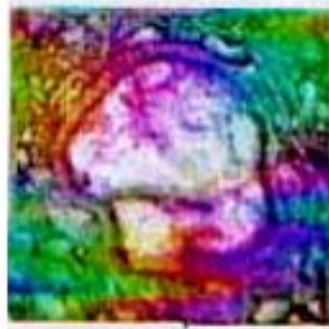
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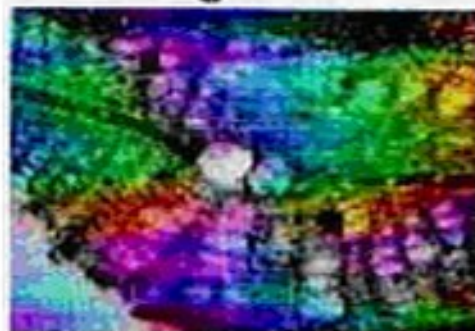
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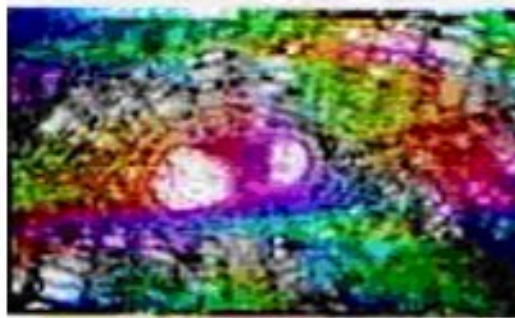
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