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Biometric Analysis of Miogypsinidae and their Taxonomic Significance from Azkand Formation (Oligocene-Miocene) in Kirkuk area, Iraq

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Abstract:
The investigation is based on a well exposed and subsurface stratigraphic succession of bioclastic limestone in Kirkuk area. These sequences were deposited in a shallow open marine environment during Chattian to Aquitanian. Test of larger foraminifera Miogypsinidae are abundant in the lower and upper parts of this sequence. The internal morphology of the Miogypsinidae test has been thoroughly investigated.
Biometric analysis on *Miogypsina* reveals that the oldest species of *Miogypsina* are present in the lower part of the Azkand Formation in the Khabaz well-3 and Qarah Chauq Dagh sequence represented by *Miogypsinoides complanata* and *Miogypsinoides formosensis.* The early Miocene association of the *Miogypsina s.s.* is often accompanied by associations of *Miogypsinoides*. Most of these are close to *Miogypsinoides bantamensis*. On the basis of the mean of embryon size ; two types of assemblage of *Miogypsinoides* could be distinguished in the Early Aquitanian sediments. Type I with the smaller embryon (D_1 = 110-125 μm) and Type II with the larger embryon (D_1 = 210-230 μm). The data set for the main lineage of *Miogypsina* exhibit a distinct overall change in morphology of the nepiont, which change is in agreement with the principle of nepionic acceleration as defined by[1].
Another abundancy of the *Miogypsina s.s.* has occurred in the upper part of Azkand Formation with mean values of (X) between (9-11) represented by *Miogypsina gunteri-tani*, which occurred simultaneously with *Miogypsinoides bantamensis* with their mean values of (X) between (10-13).

Introduction:
The genus *Miogypsina* name was officially introduced in 1893 by[2], is usually divided into a number of subgenera. As early as 1936a, [3]had a good idea of the evolutionary trends in the Miogypsinidae. But it was [4]introduced numerical methods in the classification of the Miogypsinidae. Later, in 1963, discussed in detail the evolution pattern in the Miogypsinidae[5]. The principle of nepionic acceleration was tested in the succession of Indian Miogypsinidae by [6],[7],[8]using numerical methods and these studies supported the idea of more than one pattern of evolution in this group.

The importance of the Miogypsinidae occure in Iraqian Stratigraphy because of their extensive occurrence in the oil wells ,and most studied of Miogypsinid associations were derived from the Khabaz well-3 and Qarah Chauq Dagh sections. Fig. (1).
The importance data of the Miogypsinidae are discussed from the Oligocene-Miocene carbonates rocks (Azkand Formation) which are subdivided into four units (I, II, III and IV). Fig.(2). This paper represents an overview of the Iraqian Miogypsinidae with particular emphasis on distribution and biostratigraphic zonation based on an numerical methods.

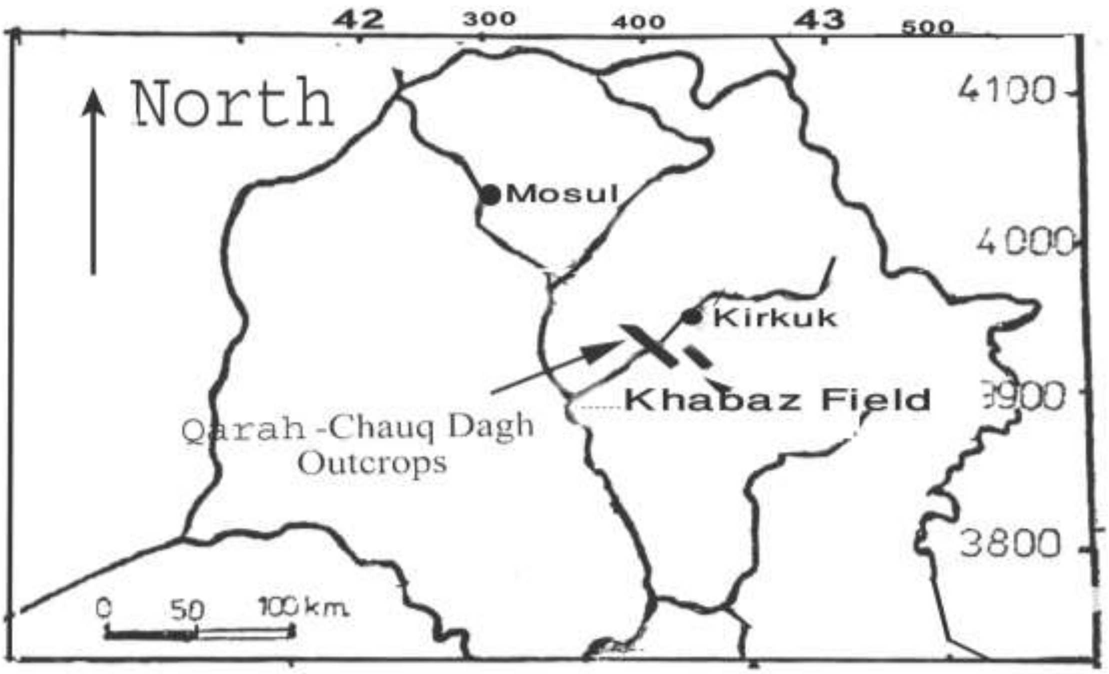

Fig.(1). Location map of the studied area

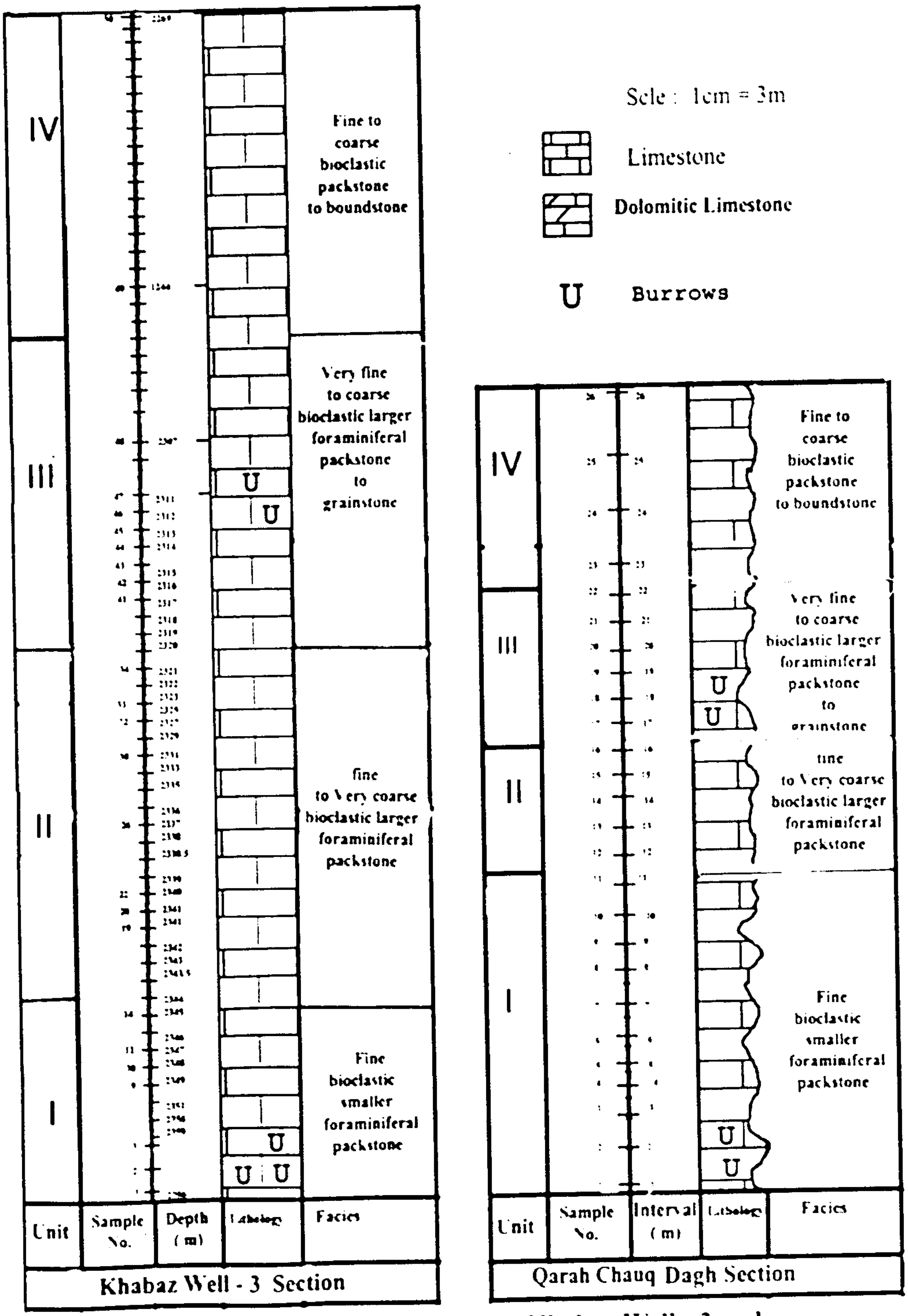

Fig (1) : Lithostratigraphic columns of the Khabaz Well - 3 and Qarah Chauq Dagh sections

Previous Research on Miogypsinidae:

Some of the early works from 1900 to 1940 were reviewed by many authers but [4] combined the theory of Tan Sin Hock with simple numerical methods to evolve a new classification for *Miogypsina*.

For different reason, some paleontologists followed typological species concept in defining species of the Miogypsinidae[9],[10],[11],[12],[13]. A typical embracing problem of such typological species classification is the failure of agreement among specialists. The detailed research on the phylogeny of *Miogypsina* made this genus a very useful tool for chronostratigraphical correlations, especially on regional scale[14].

The biometric analysis of Miogypsinidae with their evolution aspects investigated by[15] in India and near Mineo (Sicily)by [16].

The occurrences of Miogypsinidae from Iraq, mentioned from Miocene strata based on statistical study of (20) specimens from Bashiqa area, Mosul[17],[18].

Methods Of Investigation:

A number of counts and measurements for Miogypsinidae species have introduced by [6],[19]. Only the few characteristic parameters that define species are considered in this paper. Fig. (3)

These are :-

(**X**)**:** The total number of nepionic chambers in the initial spiral excluding the two embryonic chambers and including the closing chamber, if present.

(γ): This angular parameter is quantitative measure of the orientation of the nepiont in the foraminiferal test. A detailed description of the way of measuring γ was given by [19].

Two line segments determine this variable. The first one starts at the center of the protoconch and passes through the center of the deuteroconch and continues through the apex of the test, coinciding with the apical –frontal line. The zero of the γ-scale has been arbitrarily fixed at the configuration where both line segments coincide in individuals with one whorl or less.

γ is positive if the first principal auxiliary chamber points to the frontal margin of the test. Otherwise γ is negative. In the later case it is measured by rotating the embryonic line segment in the direction of coiling towards the apical frontal line segments.

(α): The arc length of the circumference of the protoconch underlying the shorter spiral.

(β): The arc length of the circumference of the protoconch underlying both protoconchal spirals .

(V): This parameter depends on two angular variables,**γ**, and **β**, in the following way: $V= 100\ \alpha /0.5\beta= 200\alpha/\beta$.

The dimensionless ratio, which scale ranges from 0 to 100 indicates the degree of symmetry of the protoconchal spirals.

(D_1): The maximum diameter of the protoconch is measured perpendicular to the embryonic line (see γ) and includes half of the thickness of the walls

(D_2)**:** These parameters represent the largest diameter of the deuteroconch, determined parallel to the measurement line of D_1.

(P): Percentage of specimens with two principle auxiliary chambers.

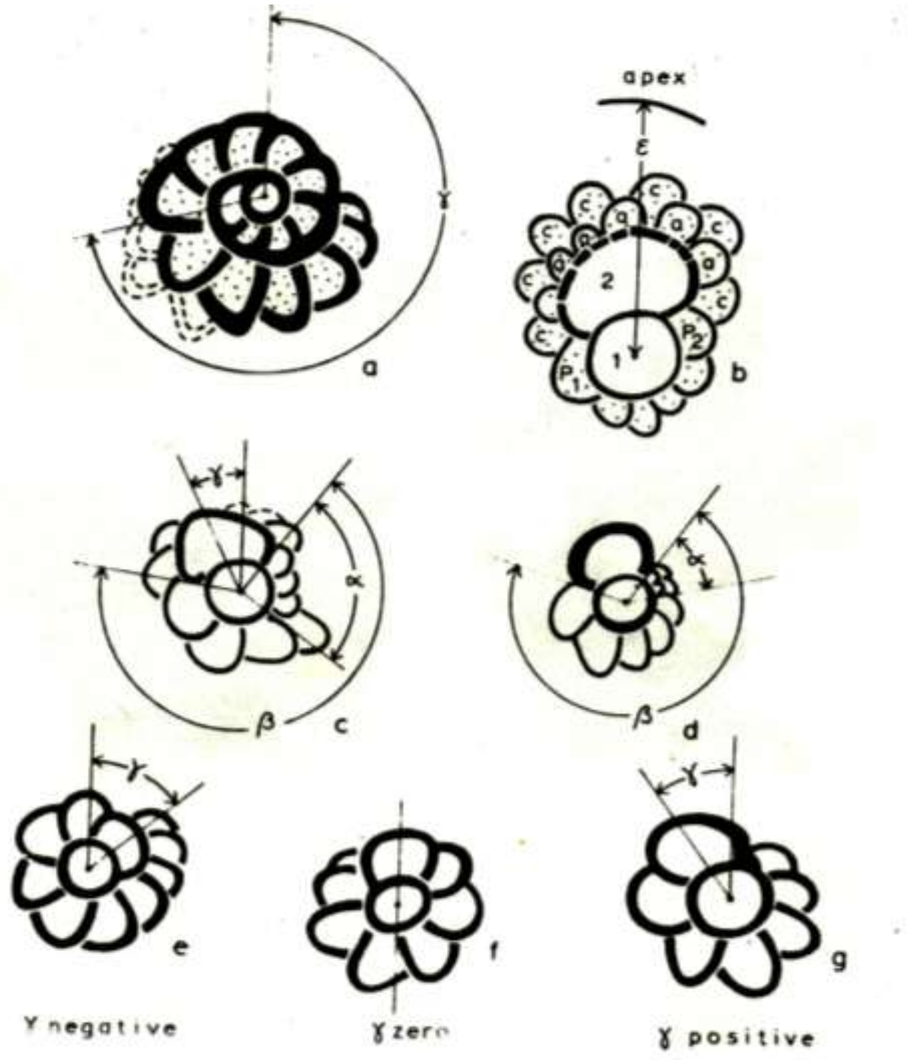

Fig.(3): Schematic drawing the median sections of the embryonic-nepionic stage Miogypsinidae illustrating the derivation of (α, β andγ). 1=protoconch, 2=deuteroconch. 1 and 2 constitute the embryonic stage; chambers around the embryonic stage(doted in figs. a, b) constitute the nepionic stage. P_1=first principal auxiliary chamber, P_2=second principal auxiliary chamber; a=accessory auxiliary chamber, c=closing chamber. (after Raju, 1974 & Drooger,1993)

Heterogenity Of The Assemblages:

The lower most associations of *Miogypsina s.s* in Unit (III), samples (42) of Khabaz well-3 section, and sample (18)of Qarah Chauq Dagh section, marked by the joint presence of types with lateral chambers and types without such chambers. The two groups correspond with the subgenera *Miogypsina s.s.* and *Miogypsinoides* respectively. The larger part of the Khabaz well-3 section in Units (I, II, II and IV), and the Qarah Chauq Dagh section consist entirely of individuals with massive sides, they all belong to the subgenus *Miogypsinoides*.

We might wonder whether the presence of both subgeneric groups can also be recognized in their biometric charaters. The ranges of parameter values found for the *Miogypsina s.s.* and *Miogypsinoides* individuals show a wide overlap in all parameters of the Khabaz well-3 and Qarah Chauq Dagh sections, (Figs. 4 and 5). Apparently both taxa are not mutually exclusive on the basis of individual, morphometric characteristics. Theoretically the presence of more than one biometric group might be recognized from the bimodal shape of the frequency distribution, from the large coefficient of variability for one or more parameters or from the patchiness of clusters in the scatter diagrams. However the low relative frequencies of *Miogypsinoides* in most samples seriously hamper the chance to recognize such mixture phenomena. The sample (42) from the Khabaz well-3 section and (18) from the Qarah Chauq Dagh section, they are only, one in which both subgenera are frequent.

In this association *Miogypsina s.s.* and *Miogypsinoides* show distinctly different modal classes in the frequency distributions of the embryonic size parameters.(Figs.4, and 5). The heterogenity is also visible from the nepionic parameters.*Miogypsinoides* being more primitive in both X and γ.

Coefficient of variability for *Miogypsina s.s. and Miogypsinoides* in sample (42) in the Khabaz well-3 section, and sample (18) from the Qarah Chauq Dagh section, which are shown in (tables 1 and 2), in a way which support the inhomogenity of the assemblage. V_{D1} for *Miogypsina s.s.* is high (V_{D1} = 36.7 and 35.58 in samples 42 and 18 respectively), But (V_{D1}) for *Miogypsinoides* in the same samples remain unacceptably high.

This anomalous value of the coefficient of variability which are seen in (tables 1 and 2) is understandable from the investigation of the scatter diagrams for the samples (Fig. 6), in which (D_1) is plotted against (X, D_2 and γ) respectively. In the D_1-γ scatter diagram in both samples, it is obvious that the individuals of *Miogypsinoides* fall apart in two clusters. But this division is not reflected in the other two diagrams. It refers to that we are investigating with two different associations for *Miogypsinoides* in samples (42 and 18).

Two groups of *Miogypsinoides* are distinguished depend on the protoconchal diameter Group I consists of individuals with small protoconches and group II comprises individuals with large protoconches.

In the scatter diagram of (D_1 andγ), it can be noted that group II is completely separated from *Miogypsina s.s*. cluster, whereas group I shows an overlap with the later (Fig. 6). In contrast, the D_1- X and D_1-D_2 scatter diagrams show the overlap of *Miogypsina. s*.s. with both groups of *Miogypsinoides*.

The association of individuals with the smaller embryons will be referred to as *Miogypsinoides* I; the other will be named *Miogypsinoides* II. The critical value of (D_1) to discriminate between both groups appeared to be (200) μm.

Table (1): Coefficient of variability for *Miogypsina* in sample (42) of Khabaz well-3 section

	V_{D1}	V_{D2}	V_X
Miogypsina s.s	36.7	31.42	13.9
Miogypsinoides I	28.7	28.06	10.55
Miogypsinoides II	10.04	08.09	11.66

Table (2): Coefficient of variability for *Miogypsina* in sample (18) of Qarah Chauq Dagh section

	V_{D1}	V_{D2}	Vx
Miogypsina s.s	35.58	29.9	11.07
Miogypsinoides I	29.79	29.5	11.19
Miogypsinoides II	9.89	9.75	11.63

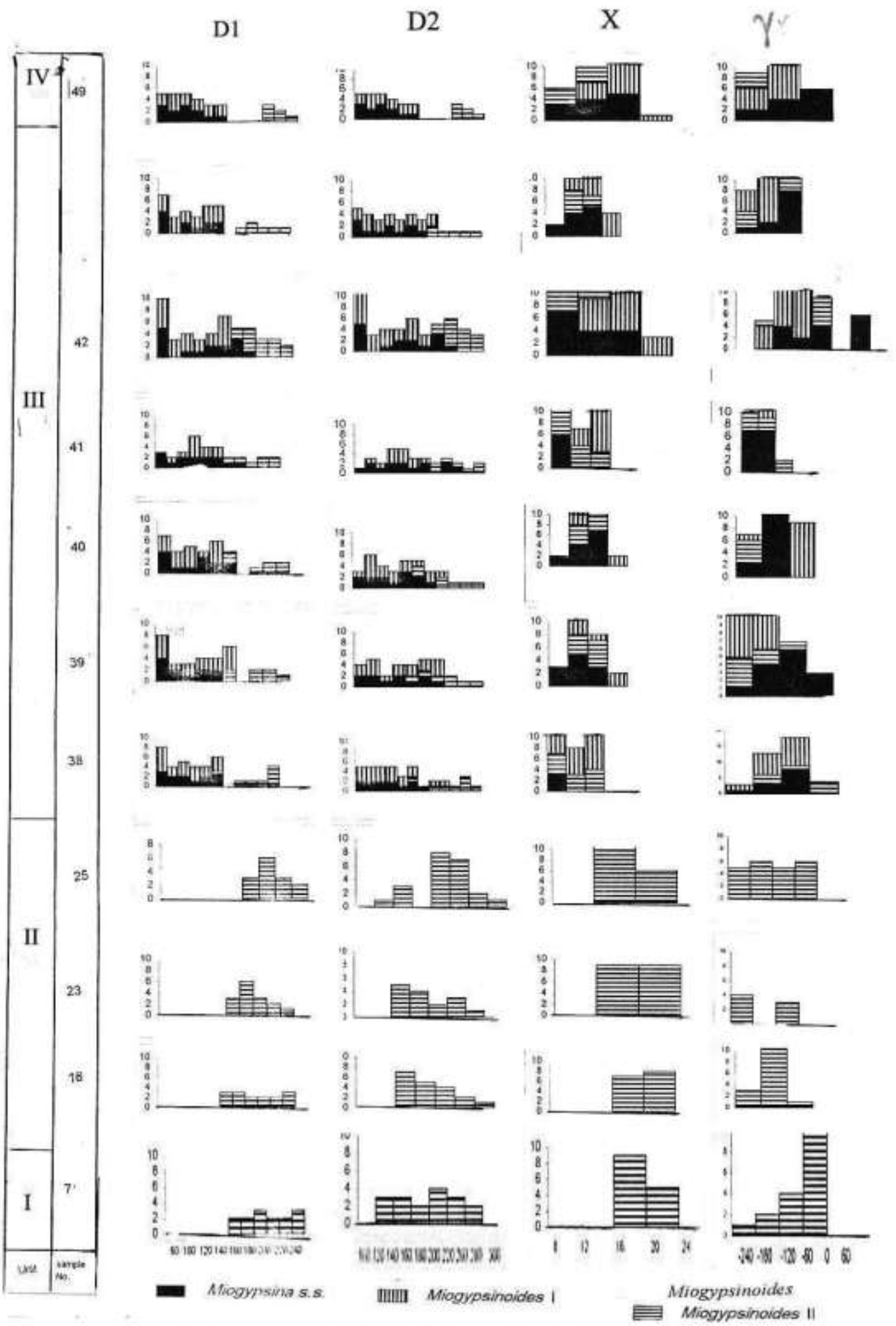

Fig.(4):- Histograms of D1,D2,X and γ of ***Miogypsina s.s.*** and ***Miogypsinoides*** I and II in the Khabaz well-3 section, Miocene carbonates,Azkand Formation.

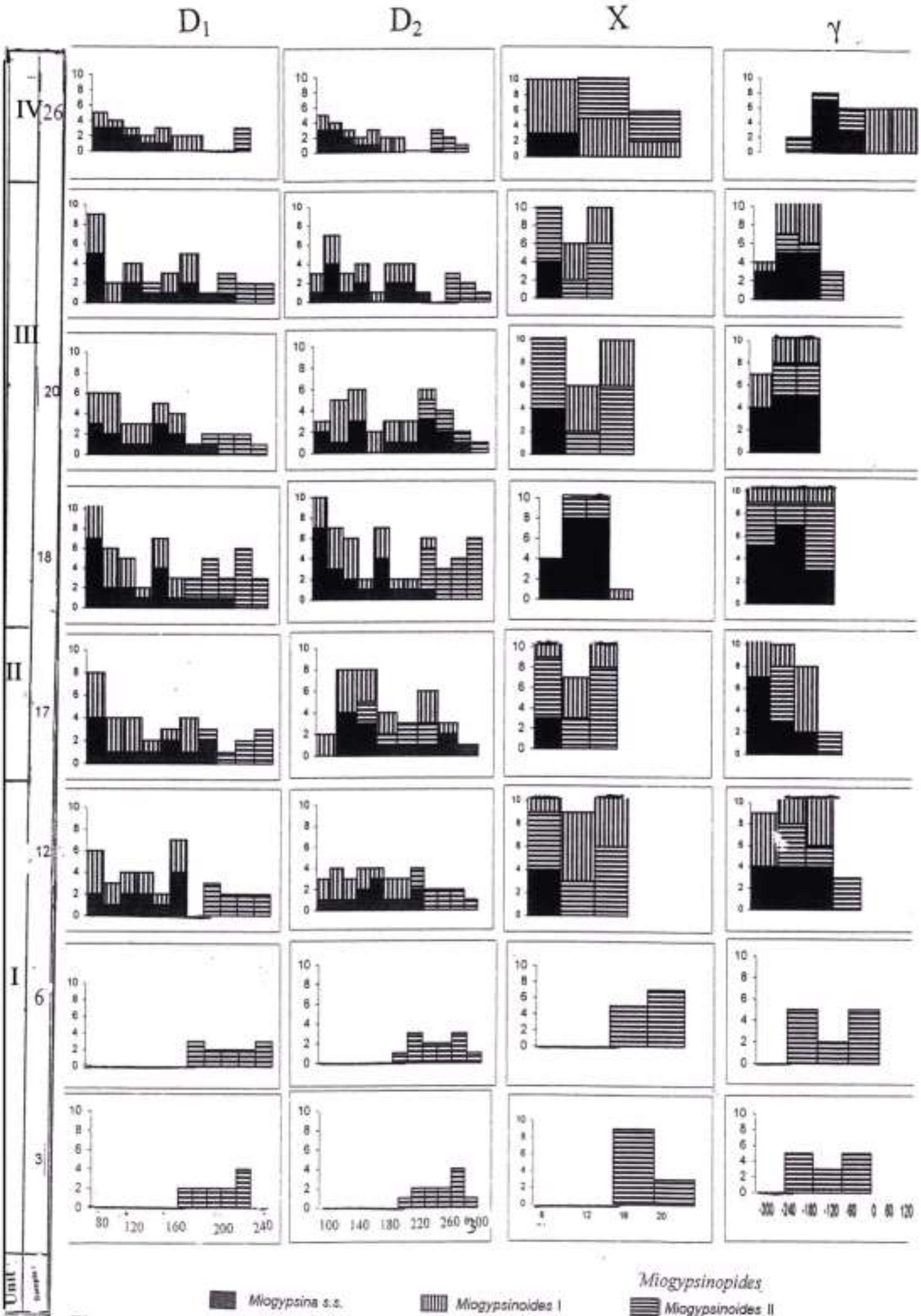

Fig.(5): Histograms of D_1, D_2 , X and γ of *Miogypsina s.s.* and *Miogypsinoides* I and II in the Qarah Chauq Dagh section. Oligocene carbonates **Azkand** Formation

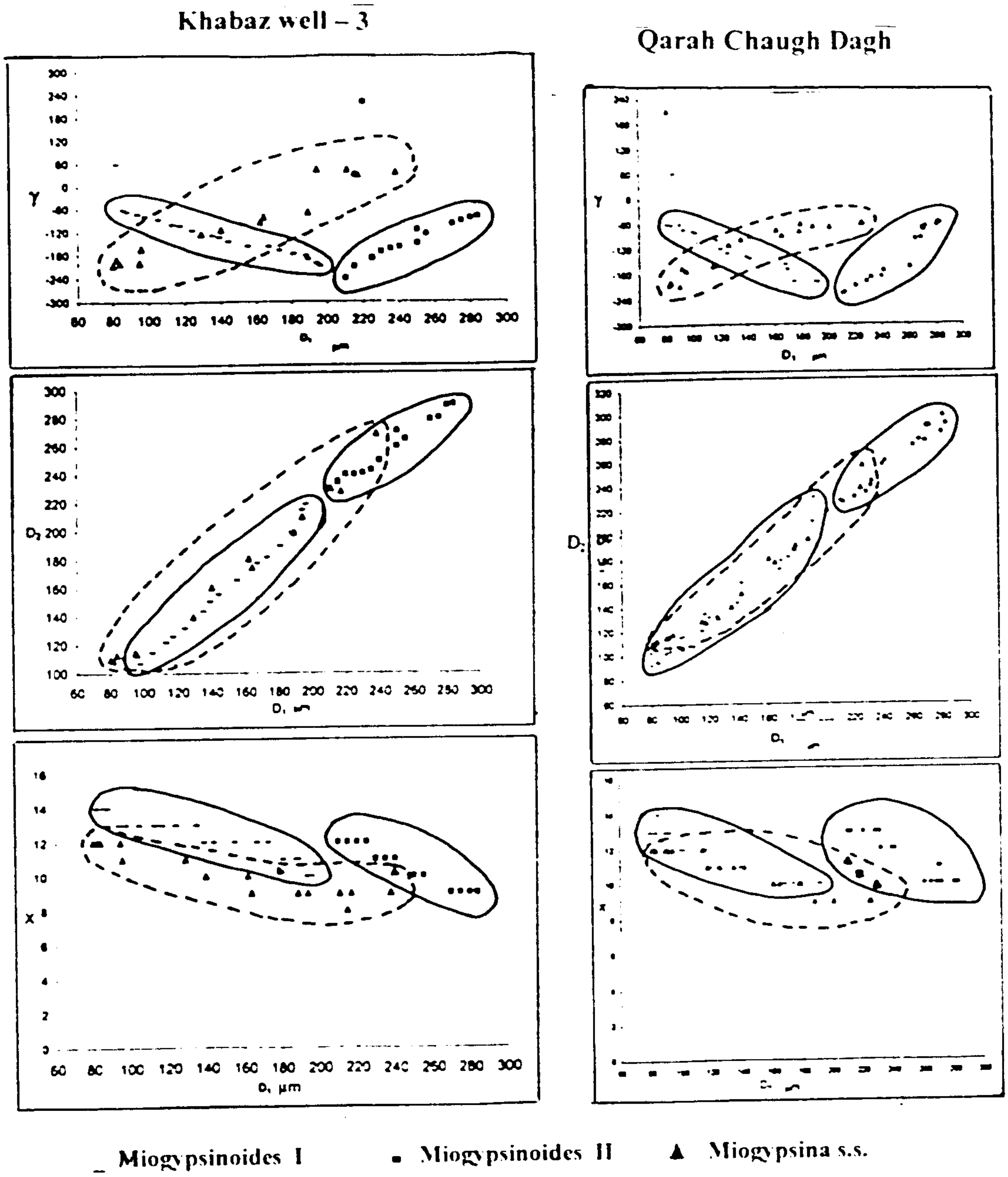

Fig. (6): D1- X, D1 –D2 and D1- γ scatter diagrams of Miogypsinoides and Miogypsina s.s in samples(42) of the Khabaz well – 3 section and sample(18) of the Qarah Chaugh Dagh section.

Preliminary Notes On Analysis Of Individual Lineages Of Miogypsinoides:

Pairs of samples means were selected for the Chi square and the t test, to provide as with a good, overall picture of the small scale changes, present in the series of *Miogypsina*. The differences between samples at large stratigraphical distances were not given special attention, because the direction of the change is probably the same as the direction of the overall trend. If significant shifts were suspected to be present in more variable, all parameters of the sample couplet under consideration were tested. On the other hand no tests were applied to sample pairs, which do not show marked, visual differences in any variable.

The basal assemblages of *Miogypsinoides* which are not yet associated with *Miogypsina s.s.,* was observed from the samples (7.16,23 and 25) in Khabaz well-3 section and(3 and 6) in Qarah Chauq Dagh section, show a distinct, positive shift in the nepionic and in the embryonic parameters. The results of the t-test and the Chi square test of the observed differences between the samples of *Miogypsinoides* from two section (Khabaz well-3 and Qarah Chauq Dagh) are seen in (Table-3).

These changes are not unequivocally continued in the younger series of *Miogypsinoides* (Fig. 7). Concerning in the statistic (X^-), type I and II in samples (18) and (42) upwards seem to represent a more advanced stage of *Miogypsinoides* with respect to the associations in basal samples (3 and 6) and (7, 16, 23 and 25) in both sections. The mean embryon diameters of the two types of *Miogypsinoides* in the younger samples show opposed changes with relative to the assemblages in sample (6) and (25), *Miogypsinoides* I is marked by a drop in (D_1) and (D_2) whereas these means increase significantly towards *Miogypsinoides* II (Fig. 7 table 3).

In the sequence of *Miogypsinoides* assemblages co-occurring with *Miogypsina s.s.*, no distinct further changes are apparent, both in type I and type II, the difference between the value of the mean of the parameters are too small relative to their values of standard errors(fig. 7). Care must be taken in evaluating the above statements on the two *Miogypsinoides* types, because they may be biased by too low frequencies.

Table (3): Results of the t-test and the Chi square test of the observed differences between the samples of *Miogypsinoides*, levels of significance, p=0.01(++/--), p=0.05(+/-) degree of freedom in t-test, $df=N_1+N_2 -2$, N_1+N_2= sum of observations in both sample.

Sample couple	Chi square Test			t-test			
Khabaz well-3 section							
	X^-	γ^-	df	D_1^-	df	D_2	df
38-42 (Type II)	0.454	0.78	20-	2.412	20-	2.57	20-
38-42 (Type I)	0.371	0.78	34-	2.001	34-	1.79	34-
7-25	0.349	1.43	31	3.314	31-	3.204	31-
Qarah Chauq Dagh section							
12-18 (type II)	0.513	1.303	24	2.755	24-	-3.300	24
12-18 (type I)	0.418	0.849	30	0.078	30	-2.77	30
3-6	0.449	1.211	22	2.110	22-	2.301	22-

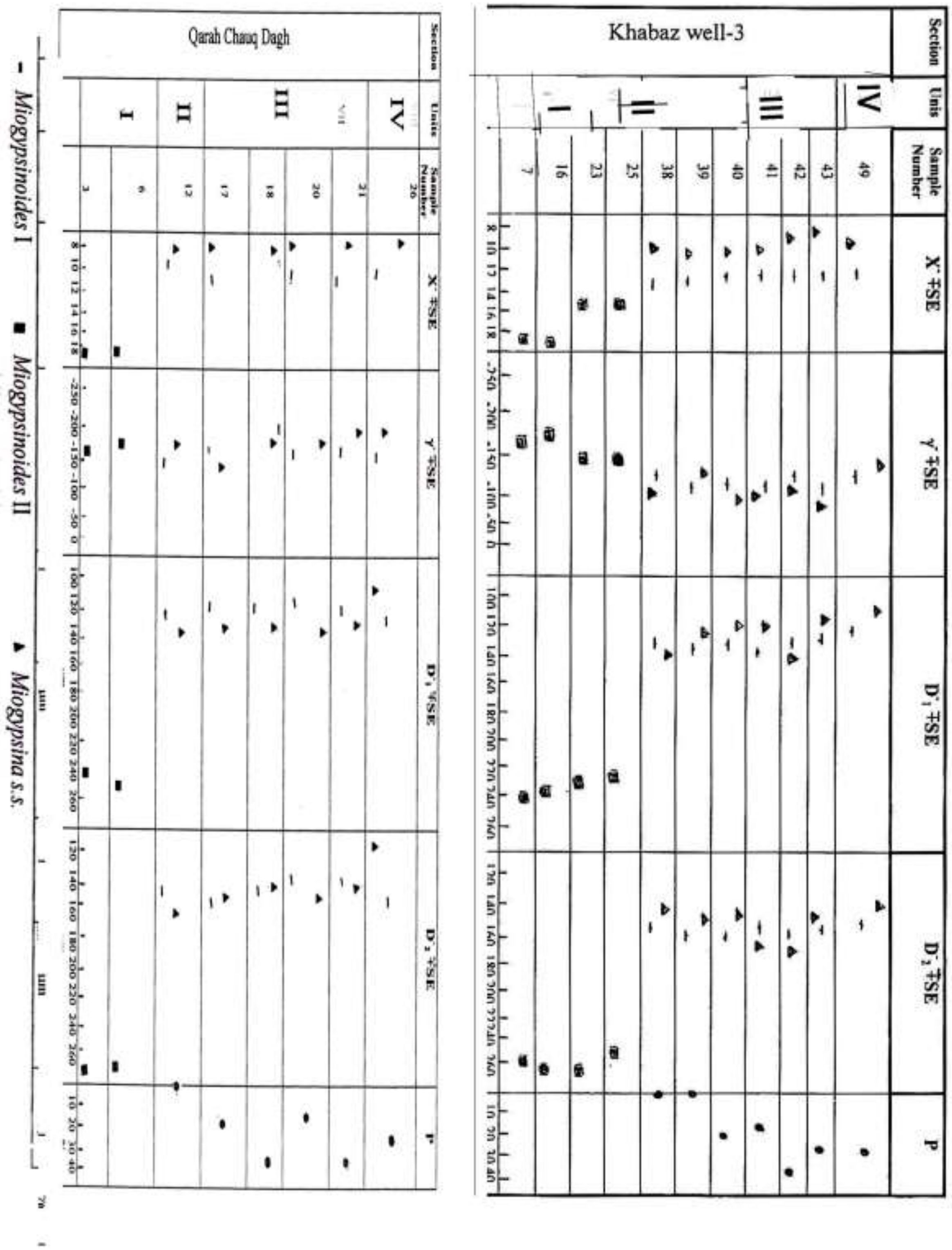

Fig. 7): X, Y, D1, D2 and P of *Miogypsina* in the samr's of Units (I ,II,III and IV) of Khabaz well-3 and Qarah Chauah Dagh sections

Biometric Taxonomical Classification in Miogypsinoides:

For the classification scheme we follow the compilation of[20]. The identified biometric species are listed in table (4), together with the necessary data for the determinations. The oldest association of *Miogypsinoides* was identified as *M. complanata*,(Plate 1, Figs. 1-2,), which is succeeded by *Miogypsinoides formosensis*, (Plate 1, Figs. 3-4) in the lower most samples in sections, the determination of the assemblages, co-occurring with *Miogypsina*, center around *is Miogypsinoides bantamensis.* (Plate 1, Figs. 5-6).

Type II assemblages are classified as *M. ex. interc. bantamensis-dehaartii* and types I assemblages are named as *M.ex. interc. formosensis-bantamensis.*

Table (4): Species list of *Miogypsinoides* and pertinent, biometric data; N=Number of observations on X in a sample or a sample suite; if N<11, then the name is presented in parentheses.

section	sample	X^-	SE	N	*Miogypsinoides* Ex. interc.
Khabaz well-3	49	12.3	0.35	13	*bantamensis*
	43	12.3	0.30	15	*bantamensis*
	42(Type2)	10.5	0.23	14	*bantamensis-dehaartii*
	42(Type1)	12.3	0.23	18	*formosensis- bantamensis*
	41	12.3	0.36	12	*bantamensis*
	40	12.6	0.27	15	*bantamensis*
	39	12.4	0.26	15	*bantamensis*
	38	12.3	0.27	18	*bantamensis*
	25	15.1	0.25	17	*formosensis*
	23	15.3	0.27	15	*Formosensis*
	16	19.3	02.7	15	*complanata*
	7	18	0.32	14	*complanata*
Qarah Chauq Dagh	21	11.6	0.31	14	*bantamensis*
	20	11.7	0.29	14	*bantamensis*
	18(Type2)	10.4	0.31	18	*bantamensis-dehaartii*
	18(Type1)	11.4	0.27	17	*formosensis- bantamensis*
	17	11.9	0.30	15	*bantamensis*
	12	12.6	0.33	15	*formosensis*
	6	19.8	0.34	12	*complanata*
	3	19.1	0.31	12	*complanata*

Plate -1 -

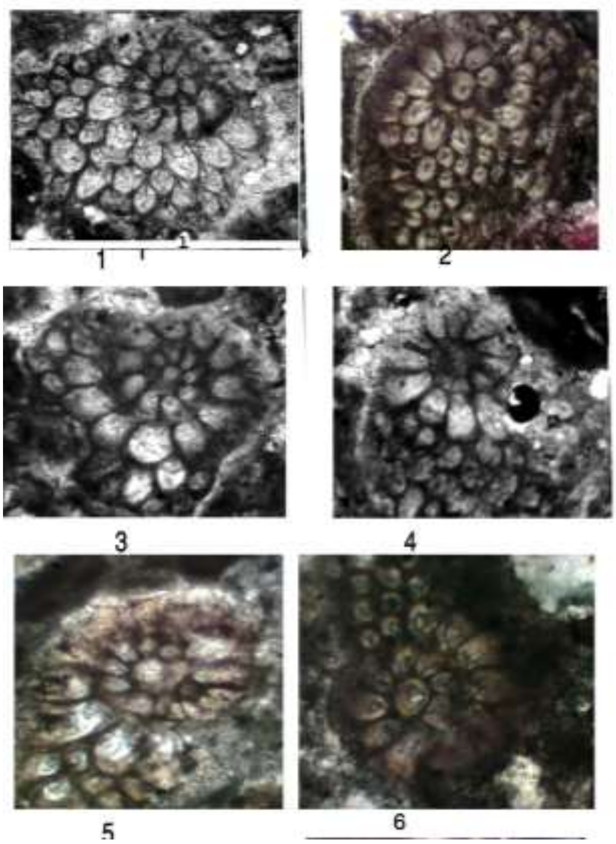

Figure (1): *Miogypsinoides complanata*, Unit (I), sample (7) Khabaz well-3 Section, Azkand Formation,Oriented section, (40X).
Figure(2): *Miogypsinoides complanata*, Unit (I), sample (7) Khabaz well-3 Section, Azkand Formation, Oriented section, (40X).
Figure (3): *Miogypsinoides formosensis*, Unit (II), sample (16) Khabaz well-3 Section, Azkand Formation, Oriented section, (40X).
Figure (4): *Miogypsinoides formosensis*, Unit (II), sample (16) Khabaz well-3 Section, Azkand Formation, Oriented section, (40X).
Figure (5): *Miogypsinoides bantamednsis*, Unit (I), sample (3) Qarah Chauq Dagh section, Azkand Formation, Oriented section, (45X).
Figure (6): *Miogypsinoides bantamednsis*, Unit (I), sample (3) Qarah Chauq Dagh section, Azkand Formation, (40X).

The Trend in *Miogypsina S.S* :

The overall changes in the parameters of *Miogypsina s.s.* in Units (II, III and IV), (Fig.7) of the both section were determined by testing the correlation between the parameter means and the ranking numbers of samples as in[21]. The result of the r-test are listed in table (5). The parameters show weakly significant and some of them significant, positive trends which means they are in line with the classical tendencies in the *Miogypsinoides* nepionic acceleration and embryonic size increase for example D_2 is highly significant correlated with the ranking number of a significant level of 0.01.

The overall changes in the values of P, the relative frequency of individuals with two principal auxiliary chambers was not tested statistically. From the graph of P in (Fig. 7) we infer that this variable tends to increase upward. The two lower assemblages of *Miogypsina s.s.* do not yet contain specimen with two P.A.C., whereas P attains values ranging from 20% to 35% in the upper part of the Unit (III).

Table(5): Trends in the various mean of *Miogypsina s .s.* in Units (II,III and IV)) tested with the r-test, df=N-2, N=number of samples; test carried out one sided; tested levels of significance: p=0.01(+ + /- -), p=(+ /-).

Stratigraphical interval	N	X^-	γ^-	D^-_1	D^-_2
Total Unit	12				
Khabaz well-3 Section	7	-0.91	-0.92	-0.93	++0.94
Qarah Chauq Dagh Section	5	-0.57	+0.65	-0.41	++0.42

In table (6) the result of the statistical tests were presented for the *Miogypsina s.s.* in the Units (II, III and IV) with the samples (38, 39, 40, 41, 42, 43, and 49) and (12, 17, 18,20, 21 and 26) of the Khabaz well-3 and Qarah Chauq Dagh section respectively. All parameters are subjected to positive shifts which are most frequently shown by (γ), namely in the upper part of Unit (III). Sometimes setbacks occur as well, only for the embryonic size parameters the changes opposite to the overall trend attain high significance level (P= 0.001). A significant change in a parameter is usually not accompanied by a significant shift in the other three variables of the same sample pair (table 6).

Qualitative Changes In The Frequency Distribution In Miogypsina S.S.:

All frequency distributions of (V) in Fig.(8) represent samples from the Units (III and IV) of the Khabaz well-3 and Qarah Chauq Dagh sections. In the lower part of the Unit (III) there are very few individuals with a second nepionic spirals, viz, one per sample at a maximum. Despite these low frequencies the variation in the observational values is relatively large in the lower interval. In the associations up to the samples (42) in Khabaz well-3 section and (18) from Qarah Chauq Dagh section, the classes is ranging from (40-60) are present. The next higher classes (80-100), appear in samples (43 and 20) from both sections while the range of (V) is large in Unit (IV) the relative frequencies of various morphotypes remain low.

Taxonomical Classification Of Miogypsina S.S.:

The biometric classification scheme of the *Miogypsinoides* as in [5] will be used to identify the assemblages of *Miogypsina*. A review of determinations is provided in table (7), which include also the relevant statistical data of the *Miogypsina* associations. The dominant species of *Miogypsina* in the lower part of the sections (Khabaz well-3 and Qarah Chauq Dagh) is *Miogypsina gunteri*,(Plate 1, Figs. 7-8) which is changed to another species, situated in their character between *Miogypsina gunteri* and *Miogypsina tani*, especially in the upper part of the sections which is in transitional state to *Miogypsina tani* may be called *Miogypsina gunteri-tani*.(Plate, 1, Figs. 9-10).

Table (6): Significance of the observed differences between the sample means of *Miogypsina s.s.* in Units(III and IV) tested by one sided t-test or Chi square test $=N_1+N_2-2;N_1+N_2$=Sum of observations in both samples; significance levels=0.01(+ +/ - -), p=0.05(+/-); no significant result(o).

Sample couple	**Chi square Test**			**t-test**			
Khabaz well-3 section	X^{-}	γ^{-}	df	D_1^{-}	df	D_2	df
43-49	0.423	0.12	21	-1.99	21	0.143	21
41-49	0.353	-0.139	24	0.78	24	-0.56	24
41-43	0.352	-4.6	23	3.43	23	-0.04	23
39-42	0.361	-1.57	24	1.27	24	-2.54	24
39-41	0.352	-1.69	15	-1.47	15	-0.84	15
38-40	0.371	0.73	23	0.800	23	2.14	23
38-39	0.442	0.43	21	1.32	21	2.34	21
Qarah Chauq Dagh section							
21-26	0.361	-0.73	21	-2.18	21	-1.192	21
20-26	0.349	-0.78	22	-0.44	22	-0.013	22
17-21	0.37	0.59	23	0.09	23	-0.07	23
17-20	0.35	0.97	25	3.35	25	-2.16	25
12-18	0.44	0.991	29	-1.01	29	-4.3	29
12-17	0.37	-1.74	22	4.09	22	2.877	22

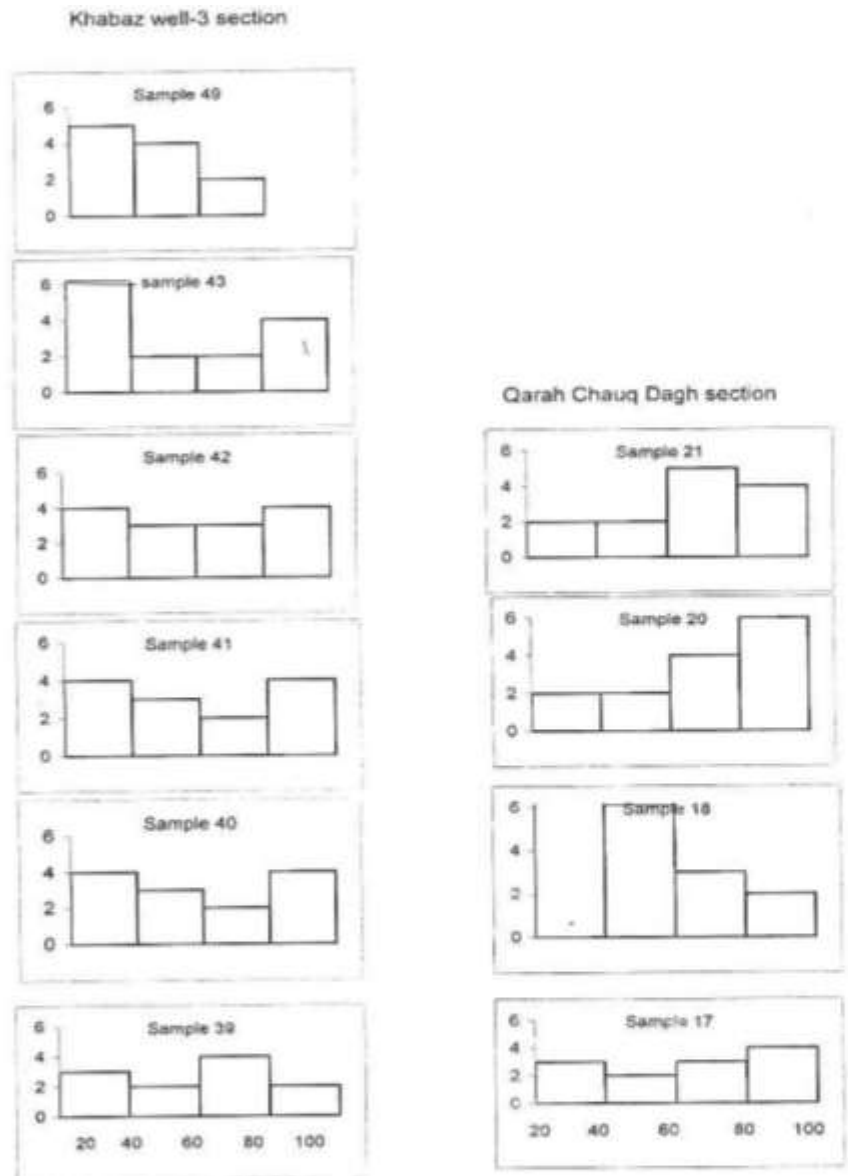

Fig.(8):- Histograms of V for some samples of *Miogypsina s.s.* in units (III,IV) of the Khabaz well-3 and Qarah Chuagh Dagh sections.

Table (7): List of identified, biometric species of *Miogypsina* s.s. and relevant, statistical data, N = number of observations on X in one sample; σ p standard deviation of p.

Section	Sample	X^{-}	SE	N	P%	бp	*Miogypsina/ M.ex. interc*
Khabaz well-3	49	9.51	0.46	12	25	1.6	gunteri-tani
	43	9.4	0.44	11	28	1.54	gunteri-tani
	42	10.1	0.36	15	35	1.41	gunteri
	41	10	0.35	14	21	1.41	gunteri
	40	10.8	0.41	13	23	1.36	gunteri
	39	10.5	0.37	11	0	1.1	gunteri
	38	11	0.48	12	0	1.54	gunteri
Qarah Chauq Dagh	26	9.1	0.35	12	1.32	1.32	gunteri-tani
	21	9.7	0.37	13	1.32	1.32	gunteri-tani
	20	10.3	0.36	14	1.27	1.27	gunteri
	18	10.4	0.38	13	1.15	1.15	gunteri
	17	10.3	0.3	12	1.31	1.31	gunteri
	12	10.3	0.40	12	1.37	1.37	gunteri

Plate 1

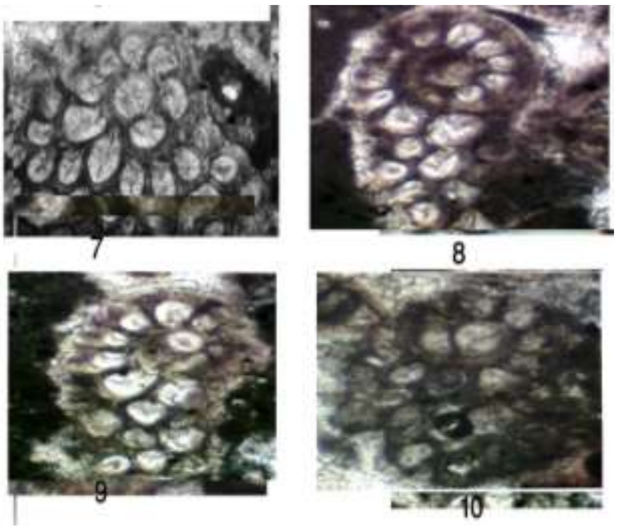

Figure (7): *Miogypsina gunteri*, Unit (I), sample (6) Qarah Chauq Dagh section, Azkand Formation, Oriented section, (45X)
Figure(8): *Miogypsina gunteri*, Unit (I), sample (6) Qarah Chauq Dagh section, Azkand Formation, Oriented section, (45X)
Figure(9): *Miogypsina ex. interc gunteri-. tani*, Unit (I), sample (6) Qarah Chauq Dagh section, Azkand Formation, Oriented section, (45X)
Figure(10): *Miogypsina ex. interc gunteri-. tani*, Unit (I), sample (6) Qarah Chauq Dagh section, Azkand Formation, Oriented section, (45X)

Correlation:

Both the (X-γ) and (D_1-D_2) combinations of the *Miogypsina s.s.* are distinctly correlated in about 30% and 100% of the total number of associations, negative and positive respectively. (Fig.9). Less evident are the links between the nepionic and embryonic variables. A significant negative result of the r-test (p=0.001) for (X and D_1 or X and D_2) occurs in about 40% of the samples and about 50% of the associations have a distinct positive correlation between (γ) and the diameters of the embryonic chambers.
The correlation data from the Khabaz and Qarah Chauq Dagh sections were also considered separately. (Table 8). The relative number of significant correlations (p= 0.05) tends to be smaller in both sections, except for D_1-D_2 in Khabazwell-3 section.
The sample means are without exception distinctly correlated at a significant level of 0.01. (Fig. 10).

P=0.0 P=0.01	**X**	**γ**	**D_1**	**D_2**
X		-30	-30	-75
γ	-30		+50	+65
D_1	-40	+50		+100
D_2	-40	+60	+100	

Fig(9): Percentage of significance correlations values (p= 0.05or p= 0.01) of *Miogypsina s.s* assemblages in Units (III and IV), +50 means positive correlation in 50% of the samples N= Number of samples.

Table (8): Number of samples with a significant correlation (P=0.05) for specific pairs of variables of *Miogypsina s.s.* in Units (II, III and IV) of the sections Khabaz well-3 and Qarah Chauq Dagh.

Section	N	D^-_1-D^-_2	X^--γ^-	X^--D^-_1	X^--D^-_2	γ^--D^-_1	γ-D_2
Khabaz well-3	7	++	-	0	-	++	++
Qarah Chauq Dagh	6	+	--	0	+	-	+

Fig. (10): Diagram showing the correlation between the various sample means of *Miogypsina s.s.* in Units (III and IV), 0f the Khabaz well-3 and Qarah Chauq Dagh sections.

γ^-	D^-_1	D^-_2	P=0.01 N=12
-	-	-	X^-
	+	+	γ^-
		+	D^-_1

Comparison Of The Various Biometric Species Units:

Reviewing the analyses of samples means, it becomes clear that the principle of nepionic acceleration is applicable to the total data set of units (II, III and IV).
The positive tendencies in (D^-_1) and (D^-_2) are not straight forward as in (X^-) and (γ^-). The embryonic diameters of *Miogypsina s.s.* in their lower most associations and of *Miogypsinoides* I, show significant shift with respect to *Miogypsinoides formosensis* by contrast, *Miogypsinoides* II, is marked by a positive change in these statistics. No distinct differences are apparent between (D_1^-) and (D_2^-) of *Miogypsinoide* I, and of *Miogypsina s.s.* from the lower part of both sections.
The possibility of different development rates of X^- and γ^- is the co-occurring *Miogypsina s.s* and *Miogypsinoides*, which is difficult to evaluate, because of too scanty information on the later subgenus. Both (X^-) and (γ^-) of *Miogypsina* show a progressive trend, while the few data of *Miogypsinoides* I, and II suggest stability

for both in the same interval, *Miogypsinoides* I, is always more primitive at a comparable stratigraphical levels, whereas *Miogypsinoides* II seems to shift from relatively somewhat more advanced than *Miogypsina s.,s.*. To gain more insight in the possible relationships between the three biometric entities, i.e. the primitive *Miogypsinoides* I, and II band the co-occurring *Miogypsina s.s.*, we made two scatter diagrams of (X-D_1) and (γ-D_1), (Fig.11). In which the variation of the three groups is illustrated by the individuals of selected samples.

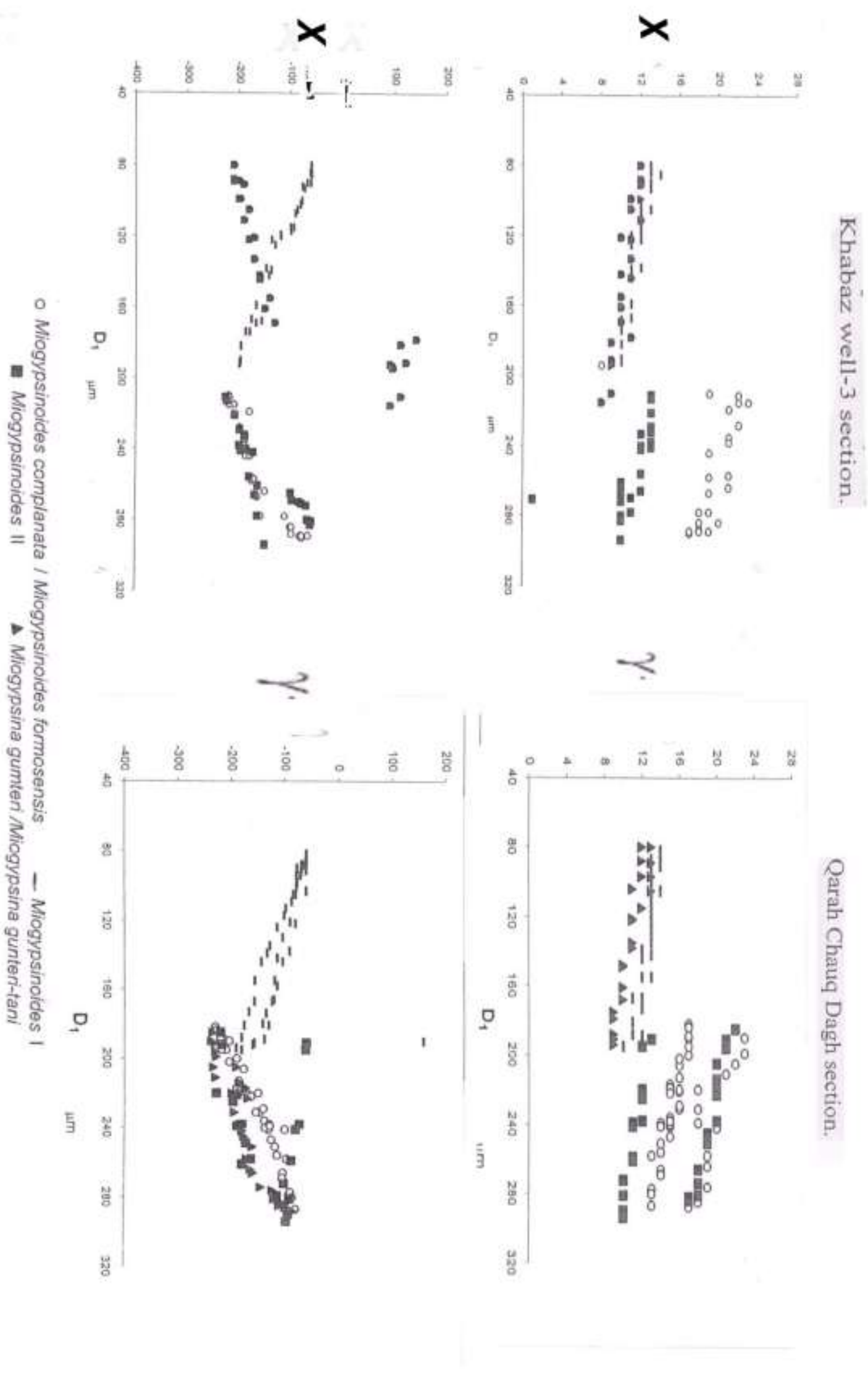

Fig.(11):X-D_1 and γ-D_1scatter diagrams for selected samples of *Miogypsinoides complanata-formosensis*, *Miogypsinoides* I and II and *Miogypsina gunteri*, of the Khabaz well-3 **and** Qarah Chauq Dagh sections

Conclusions:

The taxonomic classification of Miogypsinidae based on numerical methods to define species boundaries, is found to be useful for the set-up of the Iraqian Miocene basins. It is clear that the principle of nepionic acceleration as defined by Tan Sin Hock is applicable by analysis of carbonate sample means. On the basis of the mean of the embryon size two types of assemblages could be distinguished in the early Aquitanian sediments. Type I with the smaller embryon and type II with the larger embryon, Biometric analysis on *Miogypsina* reveals that the oldest species of *Miogypsinoides* represented by *M. complanata* and *M. formosensis* a accompanied by *Miogypsina gunteri* are present in the lower part of the Azkand Formation of Late Oligocene age (Chattian). The early Miocene association of *Miogypsina s.s.* represented by *Miogypsina gunteri-tani* are often accompanied by *Miogypsinoides*. Most of these are close to *Miogypsinoides bantamensis.*

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التحليل الاحصائي الحياتي لـ (Miogypsinidae) ودلائله التصنيفية من تكوين الازقند(المايوسين) في منطقة كركوك/ العراق

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الملخص:

جرى البحث على التتابعات الطبقية للصخور الكاربوناتية (تكوين الازقند) المنكشفة لمقطع قره جوق داغ السطحية وبئر خباز-٣ تحت السطحة والغنية بأصداف الفورامنيفيرا الكبيرة وخاصة العائدة للعائلة(*Miogypsinidae*) لفترة الاوليكوسين المتأخر-المايوسين المبكر. ان نتائج التحليل الاحصائي للجنس(*Miogypsina*) عكست بان الانواع القديمة(*Miogypsinoides complanata* , *Miogypsinoides formosensis*) لها متواجدة في الجزء السفلي من تكوين الازقند(الاوليكوسين المتاخر) في كلا المقطعين، وان تواجد النوع(*Miogypsina s.s.*) غالبا ما يصاحبه تواجد الانواع السائدة للجنس(*Miogypsinoides bantamensis*) ضمن ترسبات المايوسين المبكر. واعتمادا على معدل حجم الغرف الاولية امكن تمييز مجموعتان من تجمعات (*Miogypsinoides*) ضمن ترسبات الاكويتانيان حيث تمثلت المجموعة الاولى بالافراد ذات الغرف الاولية الصغيرة والتي تتراوح بين (١١٠-١٢٥ مايكرون) والمجموعة الثانية بالأفراد ذات الغرف الأولية الكبيرة (٢١٠-٢٣٠ مايكرون)، كما يظهر الخط التطوري الرئيسي للجنس(*Miogypsinoides*) تغيرات واسعة مميزة في شكل وحجم الغرف الاولية والتي تتفق مع مبدأ (Nepionic acceleration) والتي حددت من قبل(١). ان الانتشار الاخر للنوع(*Miogypsina s.s*) كان في الجزء العلوي من تكوين الازقند والتي تمثل بظهور النوع(*Miogypsina gunteri-tani*) ذات معدل قيم لـ(X) تتراوح بين(٩-١١) مصاحبة مع تواجد للنوع(*Miogypsinoides*) والممثل بالنوع(*Miogypsinoides bantamensis*) ذات قيمة(X) تتراوح بين(١٠-١٣).