Barremian and Aptian Mollusca of Gabal Mistan and Gabal Um Mitmani, Al-Maghara Area, Northern Sinai, Egypt

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Abstract: A very rich assemblage of 40 Molluscan species was identified from the Lower Cretaceous succession of Gabal Mistan and Um Mitmani lying at the extremity of the northern flank of Gabal Al-Maghara, northern Sinai. These are used to date the investigated material as Barremian and Aptian. Comparison of the Sinai material with coeval deposits in the northern Caucasus and Western Europe signifies a possible direct marine connection between these areas.

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Keywords: Barremian, Aptian, Albian**,** Mollusca, North Sinai.

1. Introduction

Aim and Material: The stratigraphic boundaries of the Lower Cretaceous chronostratigraphic units are a matter of great deal. Ammonites are used successfully for this achievement. The author focuses attention to delineate the stages of Barremian, Aptian and Albian (Hegab *et al*.; Hamama, 1992, 1993 and 2000). Rich Molluscan specimens were collected by the author during field excursions from the area east of Gabal Lagama at Gabal Mistan and Gabal Um Mitmani. The identified molluscan fauna, especially ammonites were used to subdivide the Barremian and Aptian into substages and to determine some biozones of the Lower Cretaceous succession at the area of study.

Recent detailed important works on the Lower Cretaceous of north Sinai were made by Aboul – Ela *et al.* (1991), Aly, M. and Abdel-Gawad (2001 &2006), Hewaidy *et al.* (1998), Aly, M.(2006), Abu Zied R. H. (2006 & 2008), Mekawy, M. S. and Abu-Zeid, R. H (2008) at Gabal Manzour, Gabal Lagama and Gabal Abu Ruqum. The identity of the identified ammonite species with those of Northern Caucasus and Western Europe is taken as an indication to the presence of a marine seaway which connected North Sinai with Tethyan Province.

Stratigraphy: The measured Lower Cretaceous section of Gabal Mistan and Gabal Um Mitmani (Fig. 1) is represented by the Risan Aneiza Formation. The lower part of this formation consists mainly of sandstones, marls and intercalation of thin limestone beds, whereas the Upper part is composed mainly of marls and limestone with few sandstone intercalation. The Lower part of the succession was named Um Mitmam Member and the Upper part is Manzour Member (Hegab *et al.* (1989), Hamama (1992 & 2009), Hamama and Gabir (2001). The studied Mollusca were collected from Um Mitmam Member.

2. Systematic Paleontology

More than forty five species of ammonites, gastropods, Pelecyopods were identified. All the collected specimens were collected by the author and they were deposited at the Geological Museum of the Geology Department, Mansura University. The systematic of ammonites are adopted after Moore (1996), and for the Gastropods and Pelecyopods we use the systematic of Pcelincev and Korobkov (1960).

AMMONOIDEA
1-Order AMMONOIDEA Zittel, 1848
Suborder ANCYLCERATINA Wiedmann, 1966
Superfamily DOUVILLEICERATACEAE Parona & Bonarelli, 1897
Family DOUVILLEICERATIDAE Parona & Bonarelli, 1897
Subfamily CHELONICERATINAE Spath, 1923
CHeloniceras Hyatt, 1903
C. (*Epicheloniceras*) Casey, 1954a

***C.* (*Epicheloniceras*) *subnodosocostatum* Sinzow, 1954a**
(pl.2, fig. 1a-c)

1907 Kilian: *Douvilleiceras martini* Orbigny, pl. 2, fig. 5.
1915 Nikchitch: *Douvilleiceras seminodosum,* pl.1, fig. 9.
1960 Drushchitz, &. Kudriavteseva (Eds): *Epicheloniceras subnodosocostatum* Sinzow**,** p. 341, pl.XXI, Fig.3; pl. XXII, Fig 4&5.-b.
1989 Follmi: *Cheloniceras subnodosocostatum* (Sinzow), p. 134, Pl .6, Figs.17 – 20.

Remarks: The identified specimen is very similar to many *C.* (*Epicheloniceras*) species described by some authors. It differs by faint ribbing and distinct nodes from *Cheloniceras* (*Epicheloniceras*) *martini caucasica* described by Drushchitz &.Kudriavteseva (p.339, pl.

XVII, Fig.4a, pl. XX, fig3). The species is strongly similar to *Epicheloniceras tschernyschewi* described by the same authors (p.339, pl.XIX, Fig.2a-b), but it differs by distinct ventrolateral nodes. Moreover the described specimen may represent an embryonic stage of *C.* (*Epicheloniceras*) *tschernyschewi* described by Moore, (P. 269, Fig. 208, 5. C).

Age: Middle Aptian, *subnodosocostatum* Zone, Gabal Mistan.

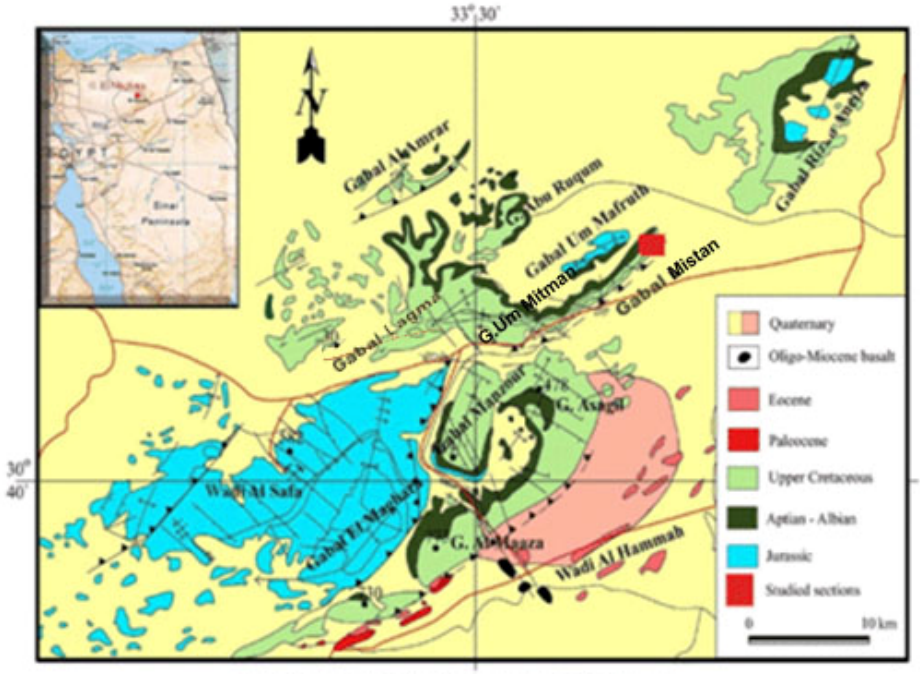

Fig.(1): Geological map of Maghara area, showing the study area
(After Geological Atlas of Sinai, 2004)

Text- Fig.1: Geological map of Al- Maghara area with Lower Cretaceous rocks surrounded the Al-Maghara Massif (after Geological Atlas of Sinai, 2004)

Superfamily DESHAYESITACEAE Stoyanow, 1949
Family DESHAYESITIDAE Stoyanow, 1949
Subfamily DESHAYESITINAE Stoyanow, 1949
Deshayesites Kazansky, 1914

***Deshayesites deshayesi* (Leymerie MS.) Orbigny**
(pl. 1, figs.1-2)

1842 Orbigny: *Ammonites deshayesi,* p. 288, pl. 85, fig. 1-4.
1936 Rengarten: *Deshayesites dechyi* Papp, pl. II, fig. 2
1960 Drushchitz, &. Kudriavteseva (Eds): *Deshayesites deshayesi* Leym, p.309, Pl .I, fig. 2 & 5.
1960 Casey: *Deshayesites d*eshayesi (ORBIGNY), p. 300, Text-Fig 106, *e, f. g.*
1996 Moore, R. ed.: *Deshayesites* deshayesi (Orbigny) p. 271, fig.211, 1a-c

Remarks*:* The described specimen is very similar to *D. Deshayesi* (Orbigny) var. *stringosus* Casey (p. 300, Text-Fig 106, h), but the latter has dens ribbing.

Age: Early Aptian, ***deshayesi*** Zone, Gabal Mistan.

***Deshayesites lavaschensis* Kazansky, 1914**
(pl. 1, fig.3)

1914 Kasansky: *Hoplites (Deshayesites) lavaschensis*, p. 105, pl. VI, fig. 87.
1960 Drushchitz, & M. P. Kudriavteseva: *Deshayesites lavaschensis* Kazansky, p. 311, p. lI, fig. 4a – b.
1964 Casey: *Deshayesites forbesi*, p.314, pl. XLVII, fig. 6a, Text-Fig 109, b & c.

Remarks: According Casey (1964, part v, p.314), the *D. forbesi* differs from *D. deshayesi* by an oblique umbilical wall and a more feebly ribbed nucleus, and from the earliest times it has been misidentified as *D. deshayesi.* The described specimen is similar to *Deshayesites multicostatus* Swinnerton described and figured by Casey (1964, p.304, pl. XLIII, fig. 5), however the latter has normal s-shaped ribs. The species is similar to *Deshayesites weissiformis* Bogdanova.

Age: Early Aptian, Gabal Mistan.

Superfamily ANCYLOCERATACEAE Meek, 1876
Family HAMITIDAE Gill, 1871
Hamites Parkinson, 1811

***Hamites intermedius* Sowerby 1814**
(pl. 2, fig. 10)

1889 Follmi: *Hamites intermedius* Sowerby, p. 124, pl.4, figs. 17-23.

Remarks: The ribs of the described species are thin relative to the Lower Aptian *Leptoceras biplex* Koenen (Drushchitz and Kudriavteseva, 1960, p.295, pl. XXXIX, fig., and 3). The described species is very similar to *Tonohamites aequicingulatus* (von Koenen) figured by

Casey (1960, part I, pl. IX, figs 2-4), but our specimen is slender with relatively thin and straight ribs.
Age: Early Aptian, Gabal Um Mitmani.

Family HAMULINIDAE Gill, 1871
Anahamulina Hyatt, 1900
Anahamulina lorioli Uhlig, 1883
(pl. 1, fig. 4)
1960: Drushchitz & M. P. Kudriavteseva.: *Anahamulina lorioli* Uhlig, p.265, pl. X, fig.
Remarks: From *Anahamulina subcylindrica* Orbigny, the described species differs by the presence of a pair of ventrolateral tubercles (Moore, 1996, p. 231, fig.181, 1a-c; Drushchitz & Kudriavteseva, 1960, p.364, pl. X, fig.2a-b).
Age: Barremian, Gabal Um Mitmani.

Suborder AMMONITINA Hyatt, 1953
Family DESMOCERATIDAE Zittel, 1895
Subfamily BARREMITNAE Breskovski, 1977
Barremites Kilian, 1913
***Barremites subdifficilis* (Karakasch, 1907)**
(PL. 1, figs. 5 – 7)
1907 Karakasch: *Desmoceras subdifficile,* p. 58, pl.6, fig.1a-b.
1960 Drushchitz & Kudriavteseva: *Barremites subdifficilis* Karakasch, 299, pl. XLII, fig. 2.
1974 Akobiana: *Barremites subdifficilis* Karakasch, p.269, pl. 92, fig. 8.
1996 Moore: *Barremites difficilis* (Orbigny), p.69, Fig.50, 1a-b.
Remarks: *Barremites difficilis* (Orbigny) and *Barremites subdifficilis* Karakasch is thought to be a dimorphic pair deferring in the height of the whorl section, one with very high whorl section and the other with relatively low section.
Age: Barremian, Gabal Mistan.

***Barremites charrierianus* Orbigny, 1840**
(Pl. 1, fig. 8)
1883 Uhlig: *Haploceras psilotatus*, p.226, pl. 16, figs. 2-3.
1960 Drushchitz & Kudriavteseva: *Barremites charrierianus* Orbigny, p. 300, PL XLII, fig. 4-5.
1974 Akobiana: *Barremites charrierianus* (Orbigny), p.270, pl. 92, fig. 5.
AGE: Barremian, Gabal, Um Mitmani.

***Barremites psilotatus* (Uhlig, 1883)**
(pl. 1, fig. 11)
1838 Uhlig: *Haploceras psilotatus*, p.226, pl. 16, figs. 2 and 3.
1960 Drushchitz & Kudriavteseva: *Barremites psilotatus* Uhlig, p. 73, 299, PL XLII, fig. 3a, b.
1972: Vasicek, Z: *Barremites psilotatus* Uhlig, p. pl. XII, fig.2, 3.
Remarks: The wide sinuous constrictions, the large size of the adult specimen, the presence of feeble lirae and the relatively low oval whorl section characterize the described specimen from the *Barremites difficilis* Orbigny described by Moore (1996, Fig 50, 1a-b) and Drushchitz & Kudriavteseva(1960, pl. XLII, fig. 1a-b).
Age: Barremian, Gabal Um Mitmani and Gabal Mistan

Subfamily PUZOSIINAE Spath, 1922
***Puzusia (Puzusia) matheroni* Orbigny**
(Pl. 1, fig. 12)
1916 Douville: *Puzusia matheroni* Orbigny, p.103, pl.XIII, figs. 1 – 7.
1960 Drushchitz & Kudriavteseva: *Spitidiscus seunesi* Kil., p. 306, pl. XLVII, fig.4.
1996 Moore: *Spitidiscus Rotula* (Sowerby), p.69, fig. 49, 1a-c.
Remarks: The described specimen is identical to that figured by Douville'. From *S. seunesi* it is relatively compressed. The three species of *Spitidiscus* Killian figured by Drushchitz & Kudriavteseva (1960, p. 305-306, pl. XLVII) seam to me as polymorphic forms of Lower Barremian ammonites. It is similar to *Puzosia quenstedti media* Seitz from the Albian of Poland by less inflated sides (1990, Marcinwski, pl. 6, fig.1).
Age: Upper Barremian-Early Aptian, Gabal Um Mitmani and Gabal Mistan.

Valdedorsella Breistroffer, 1947b
***Valdedorsella akuschense* (Anthula)**
(Pl. 1, figs. 15 & 16)
1960 Drushchitz & Kudriavteseva: *Valdedorsella akuschense* Anthula, p. 301, fig.3.
1996 Moore: *Valdedorsella akuschansis* (Anthula), p. 71, fig. 61, 2a – b.
Age: Late Aptian, Gabal Um Mitmani and Gabal Mistan.

Subfamily BEUDANTICERATINAE Breistroffer, 1953
Zuercherella Casey, 1954a
***Zuercherella* aff. *Zuercheri* (Jacob)**
(pl.1, fig. 13)
1996 Moore: *Zuercherella zuercheri* (Jacob), p.80, fig. 61, 2a – b.
Age: Late Aptian, Gabal Um Mitmani and Gabal Mistan.

Uhligella Jacob 1907
***Uhligella clansayensis* (Jacob)**
(Pl. 1, fig. 14)
1996 Moore: *Uhligella clansayensis* (Jacob), p.80, fig. 61, 3b-c.
Remarks: Although the described specimen is similar to *Uhligella walleranti* Jacob (Marcinwski, 1990, pl. 6, fig.5a-b), the latter species is highly inflated.
Age: Late Aptian, Gabal Um Mitmani and Gabal Mistan.
Suborder PHYLLOCERATINA Arkell, 1950
Family PHYLLOCERATIDAE Zittel, 1884
Subfamily PHYLLOCERATINAE Zittel, 1884

Macrophylloceras Spath
***Macrophylloceras ptychostoma* Benecke**
(pl.1, figs. 9&10)

1960 Drushchitz & Kudriavteseva: *Macrophylloceras ptychostoma* Benecke, p. 252, pl. II, fig. 6.
Age: Barremian, Gabal Mistan.

Phylloceras (*Hypophylloceras*) Salfeld, 1924
***Phylloceras* (*Hypophylloceras*) *velledae* (Michelin, 1842)**
(pl. 2, fig. 6)

1834 Michelin: *Ammonites velledae*, p.280, pl.35
1960 Drushchitz & Kudriavteseva: *Euphylloceras velledae* MICHELIN, p. 252, PL II, fig. 5a-b.
1990 Marcinowski & Wiedman: *Phylloceras* (*Hypophylloceras*) *velledae velledae* (Michelin), pl. 1, fig.1.
Remarks: It seems to me that the *Phylloceras semistriatum* ORBIGNY described by Douvillé from the Barremian of Sinai (1916, Pl. XII, fig 1.) is identical to *Euphylloceras Ponticuli* Rousseau described by Drushchitzs & Kudriavteseva (p. 251, PL I, fig. 9a-b.) from the Lower Barremian of Crimea. Also the described species is similar to *Euphylloceras velledae* Michelin, and it also collected from higher stratigraphic position comparable with that of *Euphylloceras velledae*.
Age: Middle Aptian, Gabal Mistan and Gabal Um Mitmani.
Age: Middle Aptian, Gabal Mistan

***Phylloceras* (*Hypophylloceras*) *moreti* (Mahmoud)**
pl.2, fig 4

1956 *Salfeldiella (Goretphylloceras)* Moreti Mahmoud; p. 67, fig. 44, pl. 5: 2-4
1964 *Phylloceras* (*Hypophylloceras*) *moreti* (Mahmoud): Weidmann, p. 200, fig. 46, pl. 19:2.
1990 Marcinowski and Wiedman:*Ph.(Hypophylloceras) moreti* (Mahmoud); p. 21, pl. 1, fig. 6.
Remarks: The species is known from the Lower and Middle Albian of the Sinai Peninsula (see discussion), and was recently described from the Aptian-Albian boundary of Solovakian Carpathians (Marcinowski and Wiedman), 1990. Therefore it used herein to determine This Contact in the studied section
Age: Late Aptian, Gabal Mistan and Gabal Um Mitmani.

Order LYTOCERATIDAE Hyatt, 1889
Suborder LYTOCERATINA Hyatt, 1889
Superfamily LYTOCERATACEAE Neumayr, 1875
Family LYTOCERATIDAE Neumayr, 1875
Subfamily LYTOCERATINAE Neumayr, 1875
Protetragonites Hyatt, 1900
***Protetragonites crebrisulcatus* (Uhlig, 1883)**
(pl. 1, figs. 19 – 21)

1960 Drushchitz & Kudriavteseva, *Protetragonites crebrisulcatus* Uhlig, p. 260, PL VIII, fig. 1a, b.
Remarks: It is probable that the *Protetragonites crebrisulcatus* Uhlig and *Protetragonites karakaschi* Druczczic are one and the same species (Drushchits & Kudriavteseva, 1960, pl.VIII, fig 1a-b and pl.VIII, fig. 2a-b). Both species were collected from the Upper and the Lower Barremian of Crimea respectively.
Age: Late Barremian, Gabal Mistan.

Superfamily TETRAGONITACEAE Hyatt, 1900
Family TETRAGONITIDAE Hyatt, 1900
Subfamily TETRAGONITINAE Hyatt, 1900
Tet1ragonites Kossmat, 1895
***Tetragonites (Tetragonites)* aff. *heterosulcatus* Anthula 1899**
(Pl. 2, fig. 3, 5 and 7)

1960 Drushchitz & Kudriavteseva: *Tetragonites heterosulcatus* Anthula, p. 260, pl. VIII, fig. 3a, b.
Remarks: The described specimens are differentiated from *Tetragonaites*(*Tetragonites*) *nautilodes* (Pictet) figured by Marcinowski & Wiedman (1990, pl. 1, figs. 12-13) by less inflated shell and much constrictions. The present species has affinity to the same species described by Drushchitz & Kudriavteseva , but it characterized by rectangular whorl section, little inflation and narrower venter.
Age: Middle - Late Aptian, Gabal Mistan and Gabal Um Mitmani.

Tetragonites Kossmat, 1895
***Tetragonaites(Tetragonites) nautilodes* (Pictet, 1847)**
(Pl.2, figs.8 &9)

1847 Pictet: *Ammonites Timotheanus* var. *nautiloides*, p. 296, pl. 3, fig. 2.
1967 Murphy: *T. (Tetragonites) nautilodes* (Pictet), p.27, pl. 2, figs. 5-10.
1989 Follmi: *Tetragonites nautilodes* (Pictet), p. 119, pl. 3, figs. 13, - 15.
1990 Marcinowski & Wiedman: *T. (Tetragonites) nautilodes* (Pictet), pl. 1, and figs.12 - 13).
Age: Late Aptian – Early Albian, Gabal Um Mitmani.

***Tetragonites* (*Tetragonites*) sp.**
(Pl.2, fig. 2)

Description: Small size, inflated shell with rounded sides and broad venter, whorl section rectangular.
AGE: Middle - Late Aptian, Gabal Mistan ..

Class GASTROPODA Cuvier, 1797
Order PROSOBRANCHIA Milne Edwards, 1848
Superfamily TROCHACEA Rafinesque, 1815
Family TROCIDAE Rafinesque, 1815
Subfamily TROCHINAE Stoliczka, 1868
Discotectus Faver, 1913
***Discotectus* (*Discotectus*) sp.**
(Pl. 3, figs. 6 &12)

Description: Very small size; low cone with relatively broad base; apex obtuse; surface ornamented with axial raised, intercostae flush and /or relatively depressed of width two times as costae.
Age: **AGE**: Middle - Late Aptian, Gabal Mistan.

Superfamily NERINEACEA
Family NERINEIDAE Zittel, 1873
Subfamily NERINEINAE Pcelincev
Nerinea Defrance, 1825
***Nerinea monocarinata* Pcelincev**
(pl. 3, fig. 18)

1960 Pcelincev and Korobkov (Eds): *Nerinea monocarinata* Pcelincev, p. 120, pl. XII, fig. 9.

1974 Collignon: *Nerinea* (*Ptygmatis) hottingera* Collignon, p.17, pl. 4, fig.7.

Remarks: The described species is very similar to *Nerinea archimedi* Orbigny identified by Pcelincev and Korobkov (P.123, fig 206) from the Lower Cretaceous , western Europe, but the latter has a wavy outline. Also *Nerinea* (*Ptygmatis) hottingera* Collignon described from Maroc meridional (Collignon, 1972. P.17, pl.4, fig. 7**)** has some affinity to the present identified species.

AGE: Late Barremian, Gabal Mistan.

Superfamily PSEUDOMELANIACEA Pcelincev, 1960.

Family TRAJANELLIDAE Pcelincev, 1953

Pseudomesalia Douville, 1916

***Pseudomesalia deserti Douville*, 1916**

(pl. 3, fig. 4)

1916: Douvillé: *Pseudomesalia deserti Douville*, pl. XVIII, figs. 18-25.

1949 Collignon: *Tympanotonus hourcqi* Collignon, P. 110, pl. XVII (V).

1991 Aboul Ela et al: *Pseudomesalia deserti Douvillé*, p. 208, pl. 2, figs. 10-11.

Remarks: Many species of *Pseudomesalia* recorded from the Cenomanian and Turonian of Armenia such as *P. brevis* Douvillé, *P. imbricate* Pcelincev, *P. angustata* Pcelincev differ from the present described *P. deserti* Douvillé by the presence of sharp strong spiral costae and depressed sutures (Okobiana, 1974, pl.119).

Age: Late Aptian, Gabal Mistan and Gabal Um Mitmani.

***Pseudomesalia* sp.**

(pl. 3, figs. 2 & 3)

1916 Douville': *Pseudomesalia bilineata* Douville', 1916, pl. XVII, fig.27)

Description: Very small, shell conical with acute apical angle, 6 to 7 rounded whorls with depressed sutures.

Remarks: The unknown *Pseudomesalia* sp. Is similar to *Nerinea mistanensis* Awad, 1952 descibed from the Middle Albian by Mekawy and Abu-Zied (2008, p. 316, pl. 4, fig. 20). But the latter species has slightly broader body whorl. If they may be encountered in the same horizon, they may probably represent a dimorphic pair.

Age: Late Aptian, Gabal Mistan.

Suborder MESOGASTROPODA

Family POTAMIDIDAE

Pyrazus Montofort, 1810

***Pyrazus* (*Echinobethra) magharensis* var. *rekebensis* Abbass.**

(pl. 3, fig. 8)

1991 Aboul Ela et al: *Pyrazus* (*Echinobethra*) maghareensis var. rekebensis Abbass, p. 208, pl. 2, fig. 21.

AGE: Late Aptian, Gabal, Mistan.

***Pyrazus* (*Echinobethra*) *sexangulatus* Ze'k**

(pl. 4, figs. 17-20)

2008 Mekawy and Abu- Zied: ***Pyrazus* (*Echinobethra*) *sexangulatus* Ze'k**, p. 208, pl. 4, fig. 13.

Remarks: This species is more or less typical to *Pyrazus valeriae* Vern. et Lor, however the axial nodes of the latter species is coarse forming alternating axial rows.

AGE: Late Aptian, Gabal, Mistan.

***Pyrazus valeriae* aff. *valeriae* (Vern.& Lor., 1868)**

(Pl. 3, fig. 9)

1916 Douvillé: *Pyrazus valeriae* Vern. et Lor., p. 136, pl. XVIII.

1972 Collignon: Confusiscala dupiniana (Orbigny), p.14, pl.2, figs.6 and 8.

Remarks: The described specimen has slightly fine axial ornamentation and smaller size relative to the original species.

AGE: Late Aptian, Gabal, Mistan.

Superfamily NATICACEA Forbes, 1883

Family AMPULLINIDAE (EUSPIRIDAE Cossman, 1907)

Tylostoma Sharpe, 1849

***Tylostoma (T.) canalliculata* Abdel Gawad**

(pl. 3, fig.1)

1991 Aboul Ela, et al: *Tylostoma (T.) canalliculata* Abdel Gawad, p. 210, pl. 3, figs.1 and 2,, Early Albian.

Remarks: This species shows a great affinity to species identified by Collignon as *Ampullospira (Euspirocrommium) exaltata* Goldf (Collignon, 1949, p. 104, Pl. XVI (IV), figs 9, 9a-b.

AGE: Late Aptian, Gabal, Um Mitmani

***Tylostoma (T.) maghareensis* Abbass**

(pl.3, figs. 13, 14, 16, 17; pl. 4, figs. 13 - 16)

1991 Aboul Ela, et al: *Tylostoma (T.) maghareensis* Abbass, p. 210, pl. 3, fig. 3.

Remarks: The described specimens are similar *to Natica laevigata* Deshayes from the Hauterivian of Crimea which described by Drushchitz & Kudriavteseva (1960, p. 159, Pl, VII, fig. 2)

AGE: Late Aptian, Gabal Um Mitmani.

***Tylostoma (T.) gloposum* Sharpe, 1849**

(pl. 3, fig. 21)

1991 Abdel – Gawad: *Tylostoma (T.) Gloposum* Sharpe, p. 211, pl.4, fig. 1.

Remarks: The described specimen is similar to? *Tylostoma* sp. Identified by Aboul-Ela *et al*. (1991, p. 211, pl. 4 figs. 2-3) of the Late Albian of Gabal Mannzur, but while the former is more globosely, the later species posses higher body whorl.

Age: Late Aptian - Early Albian, Gabal Mistan.

***Tylostoma (T.) zaghloulum* nov. sp.**

(pl.3, figs. 19 & 20)

Description: shell with short spire, consisting of four whorls; the body whorl incomplete, about one half of the spire; distribution of varices follows regular pattern when viewed in plan from above the apex as in Cassididae; aperture incomplete.

Derivation of name: The name of the species is derived in the memory of Professor Zaki Zaghloul.

Remarks: The nominated species has a short spire relative to Tylostoma sp. assigned to Late Albian by Aboul Ela *et al.* (1991, p.211, pl.3, fig. 5)

AGE: Late Aptian, Gabal Um Mitman.

Amauropsell Bayle, 1885

***Amauropsell holzapfeli* Cossmat.**

(pl.4, fig. 22)
1949 Collignon: *Amauropsell holzapfeli* Cossmat, p. 104, Pl. XVI (IV), figs. 8-8a.
Age: Late Aptian, Gabal Mistan.

Superfamily VOLUTACEA
Family VASIDAE
Tudicla Bolten, 1798
***Tudicla (Tudicla) spindllus* nov. sp.**
(pl. 3, fig.5)
Derivation of name: From the spindle - shaped y form of the shell.

Remarks: The species is identical to species identified by Aboul Ela, et al (1991, p. 211, pl.3, fig. 6).
AGE: Late Aptian, Gabal Mistan.

Superfamily SCALACEA
Family SCALIDAE
Confusiscala Boury, 1910
***Confusiscala dupiniana* Orbigny, 1842**
(pl. 3, fig. 7)
1960 Pcelincev and Korobkov (Eds): *Confusiscala dupiniana* Orbigny, p.173, fig 414, Albian France.
Remarks: The described species is very similar to *Scala* (*Criposcala*) primitive Collignon (Collignon, 1949, p.102, pl. XVI (IV), fig.4, but the costae of the second species is distant. Moreover, the costae of the present species are coarser than those of Confusiscala *dupiniana* Orbigny.
Age: Late Aptian, Gabal Mistan and Gabal Um Mitmani.

Superfamily PROCERITHIACEA
Family PROCERITHIIDAE Cossmann, 1905
Subfamily PARACERITHIINAE Cossmann, 1906
Cirsocerithium Cossmann, 1906
***Cirocerithium subspinosum* Deshayes**
(pl. 3, figs.10 &11)
1960 Drushchitz & Kudriavteseva: *Cirocerithium subspinosum*, p. 156, pl. VI, fig. 3a- b.
Age: Late Aptian, Gabal Mistan and Gabal Um Mitmani.

Order OPITHOBRANCHIA
Suborder TECTIBRANCHIA
Superfamily ACTEONACEAE
Family SCAPHANDRIDAE
Cylichna Loven, 1846
***Cylichna* sp.**
(pl. 3, fig. 15)
Description: obical cone, absent or very reduced spire, flat topped, smooth, aperture siphostomatus with canal.
Age: late Aptian, Gabal Um Mitmani.

Class BIVALVIA Linnaeus, 1758
Order HETERODONTA
Superfamily ASTARTACEA
Family Crassatellidae Ferussac, 1821
Crassatella Lamarck, 1799
***Crassatella (Rochella) seguenzai* (Thomas & Peron, *1890-1891*)**
(pl. 4, fig. 8)
1972 Collignon: *Crassatella (Rochella) seguenzai* (Thomas & Peron). 1916 Douville: *Trigonia analoga* Douvilllé, p.162, pl.XXI, fig.6.
AGE: Late Aptian, Gabal Mistan.

Superfamily CARDITACEA
Family CARDITIDAE Ferussac, 1821
Cardita Bruguiere, 1792
Cardita dupini Orbigny var. *deserti* Douvillé
(pl.4, fig.1)
1916 Douvillé: *Cardita dupini* Orbigny var.*deserti,* p.162, pl.XXI, fig.1, 2.
AGE: Late Aptian, Gabal Mistan.

Superfamily CYPRINACEA
Family CYPRINIDAE Adams, 1858
Cyprin Lamarck, 1812
***Cyprina (Anisocardia) hermitei* Choffat**
(pl. 4, figs. 2 & 5)
1916 Douvillé: *Cyprina (Anisocardia) hermitei* Choffat, p.156, pl.XIX, figs. 14-16.
AGE: Late Aptian, Gabal Mistan.

Superfamily VENERACEA Rafinesque, 1815
Family VENERIDAE Rafinesque, 1815
Subfamily VENERINAE Rafinesque, 1815
Meretrix Lamarck, 1799
***Meretrix* (*Flaventia*) *deserti* Douvillé, 1916**
(pl.4, fig.6)
1916 Douville: *Meretrix* (*Flaventia*) *deserti* Douvillé, p.151, pl.XIX, fig.10.
AGE: Late Aptian, Gabal Mistan and Gabal Um Mitmani.

Subfamily TAPETINAE Adams & Adams, 1857F
Flaventia Jukes - Browne
***Flaventia brongniartina* (Lymerie)**
(pl.4, figs. 3 & 4)
1991 Aboul Ela, et al: *Flventina brongniartina* (Lymerie), p. 213, pl. 5, figs 14-15.
AGE: Late Aptian, Gabal Um Mitmani.

Superfamily GLOSSACEA Gray, 1847
Family DICEROCARDIIDAE, Kutassy, 1934
Megalocardia Beringer, 1914
***Megalocardia* (?) *simplex* (Mahmoud)**
(pl.4, fig. 10)
1991 Aboul Ela, et al: *Megalocardia* (?) *simplex* (Mahmoud), p. 215, pl. 6, figs 1-2.
AGE: Late Aptian, Gabal Um Mitmani.

Order SCHIZODONTA
Superfamily TRIGONIACEA
Family TRIGONIIDAE Lamarck, 1819
Scabrotrigonia Deecke, 1925
***Scabrotrigonia scabra* (Lamarck)**
(pl. 4, figs.7, 9 & 11)
1958 Saveleev: *Scabrotrigonia scabra* (Lamarck), p.119, pl. LVIII, fig. 4a-b., Turonian, France.
1991 Aboul- Ela, *et al*.: *Pterotrigonia* (*Scabrotrigonia*) *scabra* (Lamarck) p. 213, pl.5, figs 6-7.
1916 Douville: *Trigonia orientais* Douvillé, p.162, pl.XXI, fig.1, 2.

AGE: Late Aptian, Gabal Mistan.

3- Discussion and Conclusion

1: Vertical faunal distribution as an approach for Barremian and Aptian biozonation.

The identified ammonites (19 species), gastropods (15 species) and pelecypods (7 species) were used to subdivide the Barremian from the Aptian. These species help to subdivide these two stages and to establish tentatively some biozones. The measured Lower Cretaceous of Gabal Mistan and Gabal Um Mitmani are divided into the following stages:

Barremian: The Barremian is represented by about 100 meters of marl and sandstone comprising the lower part of Risan Aneiza Formation. Many species of ammonites characterized the stage including: *Barremites charrierianus* Orbigny, *Barremites psilotatus* (Uhlig), *Macrophylloceras ptychostoma*, *Puzusia (P.) matheroni*, *Barremites subdifficilis*, *Anahamulina lorioli* Uhlig and *Protetragonites crebrisulcatus* (Uhlig). The first four species record the Lower Barremian.

Aptian: The Aptian rocks attain a thickness of about 200 meters of clastic rocks intercalated with thin beds of limestone. The Lower Aptian is defined by the presence of *Deshayesites deshayesi* (Leymerie) Orbigny and *Deshayesites lavaschensis* Kazansky. The zonal index species *C.* (*Epicheloniceras*) *subnodosocostatum* Sinzow in addition to *P.* (*Hypophylloceras*) *velledae* (Michelin,) *T. (Tetragonites) heterosulcatus* Anthula define the Middle Aptian. The Upper Aptian is defined by the presence of ammonite species *Uhligella clansayensis* (Jacob), *Valdedorsella akuschense* (Anthula) and *Zuercherella* aff. *Zuercheri* (Jacob). The Aptian is characterized by rich assemblage of gastropods and pelecypods in addition to abundant sceleractinids.

Albian: worthwhile to mention that many authors in the old literatures assigned the Clansayesian to the Albian, therefore what was considered as a basal Albian is actually Upper Aptian. All the gastropods and pelecypods are collected from low stratigraphic position below the Middle and Upper Albian. The Albian fauna is outside the scope of the present study. In the studied section, it is difficult to define the Aptian/ Albian boundary in the absence of the Lower ammonite *Leymeriella tardefurcata* and *Douvilleiceras mammillatum*. The contact is based on lithological variation between Um Mitmam Member and Manzour Member. Herein the facies changes from dominant siliciclastic to become calcareous facies.

2: Paleobiogeography

The Aptian-Albian interval (124.5-97.0 Ma) was a critical time both globally and for the Tethyan domain. In the Tethyan domain it was the time when a united Neo-Tethyan subduction zone became established between the future site of the Alps and Southeast Asia and greatly accelerated the rate of north-south convergence throughout the Tethyan region **(**Naci Görür, 1991**).** This is had been confirmed in the area of study by the identity of the identified ammonites between north Sinai, the Caucasus and the Atlantic region. The ammonite distribution shows that the faunal composition is ecologically controlled **(**Fabrizio Cecca**,** 1998). The diversity of molluscs in the studied section reflects an increase of the number of niches.

Sinai Peninsula lies within the South Tethyan region (North Africa, Middle East, Iran) **(**Damotte, R., 1990). Generally, the faunal assemblages recovered from the studied sections have Tethyan affinities. They indicate rather warm waters of normal to slightly hypersaline conditions that represent a shallow, near shore environment in which the water depth did not exceed 100 m (Abu-Elaa, *et al*., 1991).

In many regions it is impossible to distinguish pre-Barremian stages (Louise Beauvais, 1992). In Sinai as a whole and in Egypt in general, the pre-Barremian interval is assessted on microfossil specially palynomorphs in some rare exposures and in many boreholes (**(**Mahmud, M.S. and. Moawad**,** A**.**M., 2000). Rare and signals on macrofauna were mentioned in literatures. The missing of some Barremian and Aptian ammonite index species in the area of study, in addition to the small sizes of the molluscan shells including ammonites refer to crises. Crises in species richness and abundance during the Early and mid-Cretaceous were coeval with oceanic anoxia associated with platform drowning. These crises can be attributed to regional environmental, induced by either oceanic anoxia or tectonic movements (Steuber, T. and and LöserH., 2000).

A step-wise demise of the carbonate platform biota transpired in the latest Aptian to Middle Albian interval was recorded by many authors (Iba, Y. and Sano, S.**,** 2007**;** Coccioni*, et al.***,** 2006). In the Pacific Province nerineacean gastropods disappeared at the Late Aptian to Early Albian transition (Iba, Y. and Sano, S.**,** 2007), hoever in the area of study, they are well represented. The missing of Barremian zonal index ammonites of the Tethyan Province such as *Colchidites securiformis* Sim, *Imerites densecostatus* Renng., *Matheronites ridzewski* Kar., *Acrioceras furcatum* Orb., …etc. may refer to such step-wise demise. Also the same phenomenon is confirmed in the area of study by missing the Aptian indes zonal ammonites of *Turkmenicera turkmenicum* Tovb., *Deshayesites weissi* Neum.,*Procheloniceas albrechtiaustriae* Hoh., *Dufrenoya furcata* Sow, *Colombiceras crassicostatun* Orb., *Parahoplites melchioris* Anth., *Acanthohoplites nolani* Seun*., and Hypacanthoplites Jacobi* Coll; in addition to absence of the most basal Albian *Leymeriella tardefurcata* Leym., and *Douvilleiceras mammillatum*.

In Tunisia, the so called "Aptian Crisis" of the south Tethyan margin is suggested by Adel Rigane *et al.* (2004) due to deficiency in organic deposits except where the medusa coral are encountered. The presence of red beds of the studied section, in addition to hard grounds may refer to the change from generally humid to arid climates during the Barremian. In Western Europe it is

though to have been linked to the lowering of the sea level (Ruffell and Batten, 1990). Many hard grounds forming ledges are encountered in the area of Gabal Mistan and Gabal Um Mitmani.

On a global scale, major transgressions were stepwise enlarged in space and time from the Neocomian, via Aptian-Albian, to the Late Cretaceous, and the post-Cretaceous regression was very remarkable. Tectono-eustasy may have been the main cause of the phenomena of transgression-regression in the Cretaceous (T. Matsumoto, T., 1980). According to El-Azaby and El-Araby (2005) and Abd-Elshafy**,** E. & Abd El-Azeam, S. (2010), the Lower Cretaceous sequence is dominated by sandy braided-river deposits with minor overbank fines and basal debris flow conglomerate.

Three second order depositional sequences were recorded in the carbonate platform of the eastern Levant. These three second-order depositional sequences mid-Cretaceous succession are: (MCEL-1: Upper Barremian–Lower Aptian, MCEL-2: uppermost Lower Aptian–middle Upper Aptian and MCEL-3: middle Upper Aptian–Middle Albian. Moreover eight third-order depositional sequences were observed in the Upper Barremian–Albian interval. They comprise successions of the inner ramp facies from open marine to restricted lagoons or tidal flats **(**Bachmann, M. and Hirsch, F., 2006)**.** In the northern Sinai Upper Aptian to Middle Cenomanian succession represents an example of a carbonate platform, 18 sequences superimpose the second-order sea-level change: 3 sequences in the Upper Aptian and 11 sequences in the Albian (Bachmann, *et al*., 2003). Without hesitation, there was a direct link between Caucasus and North Sinai.

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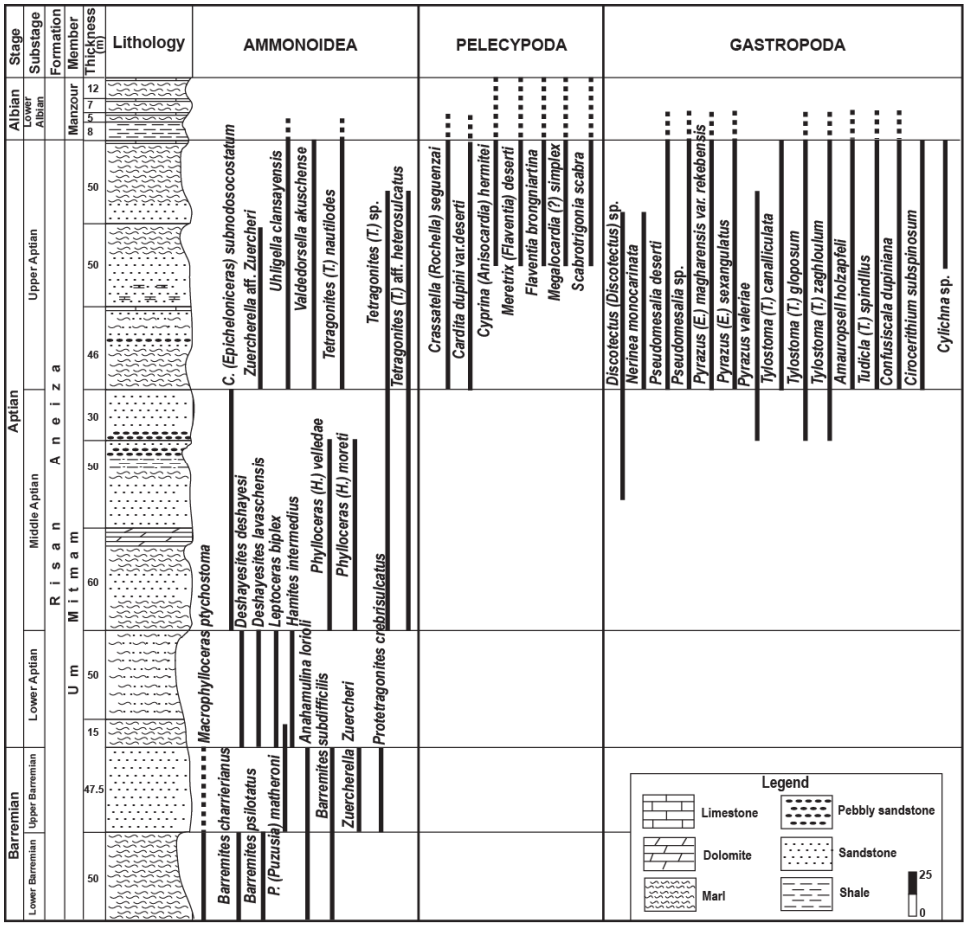
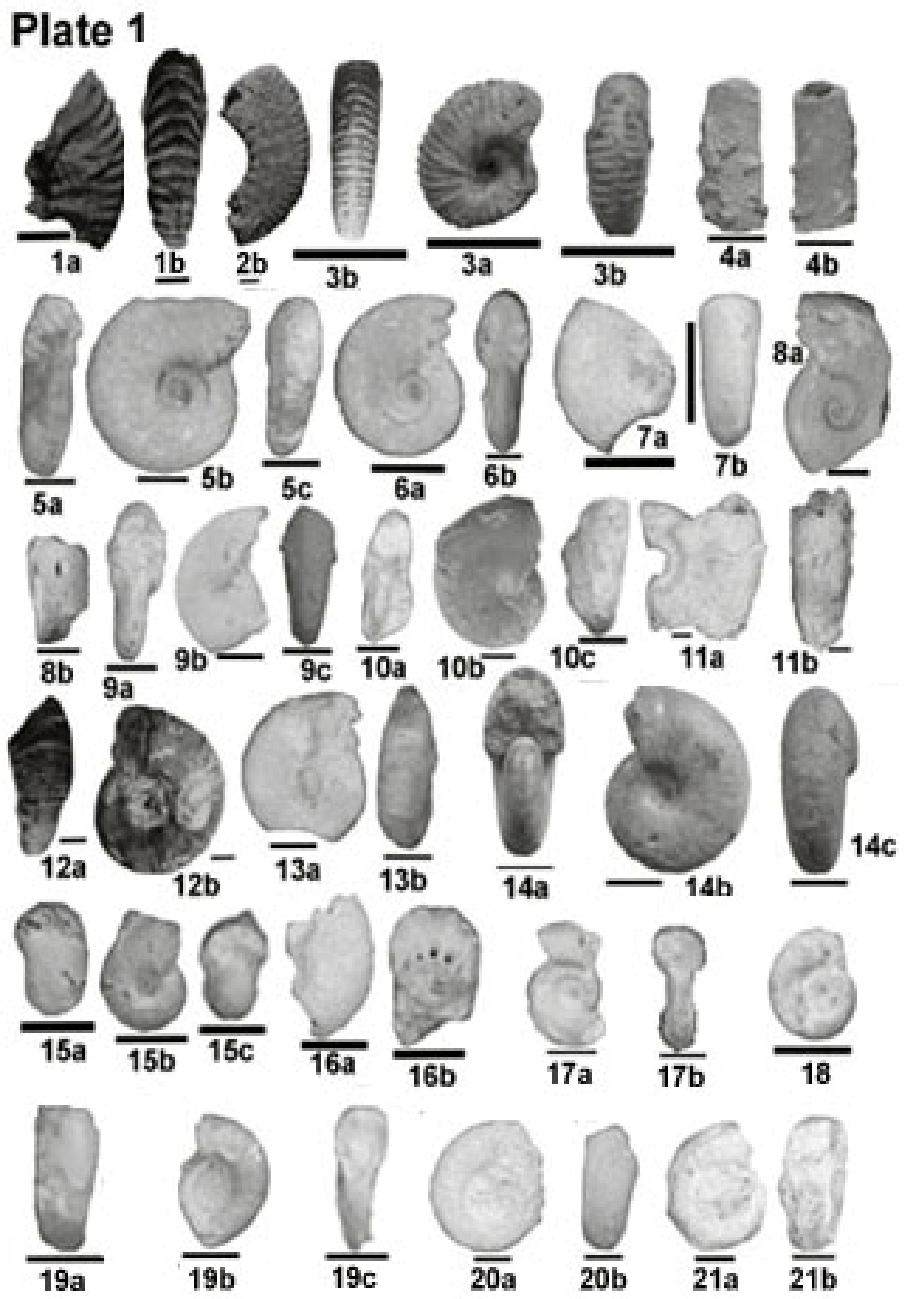
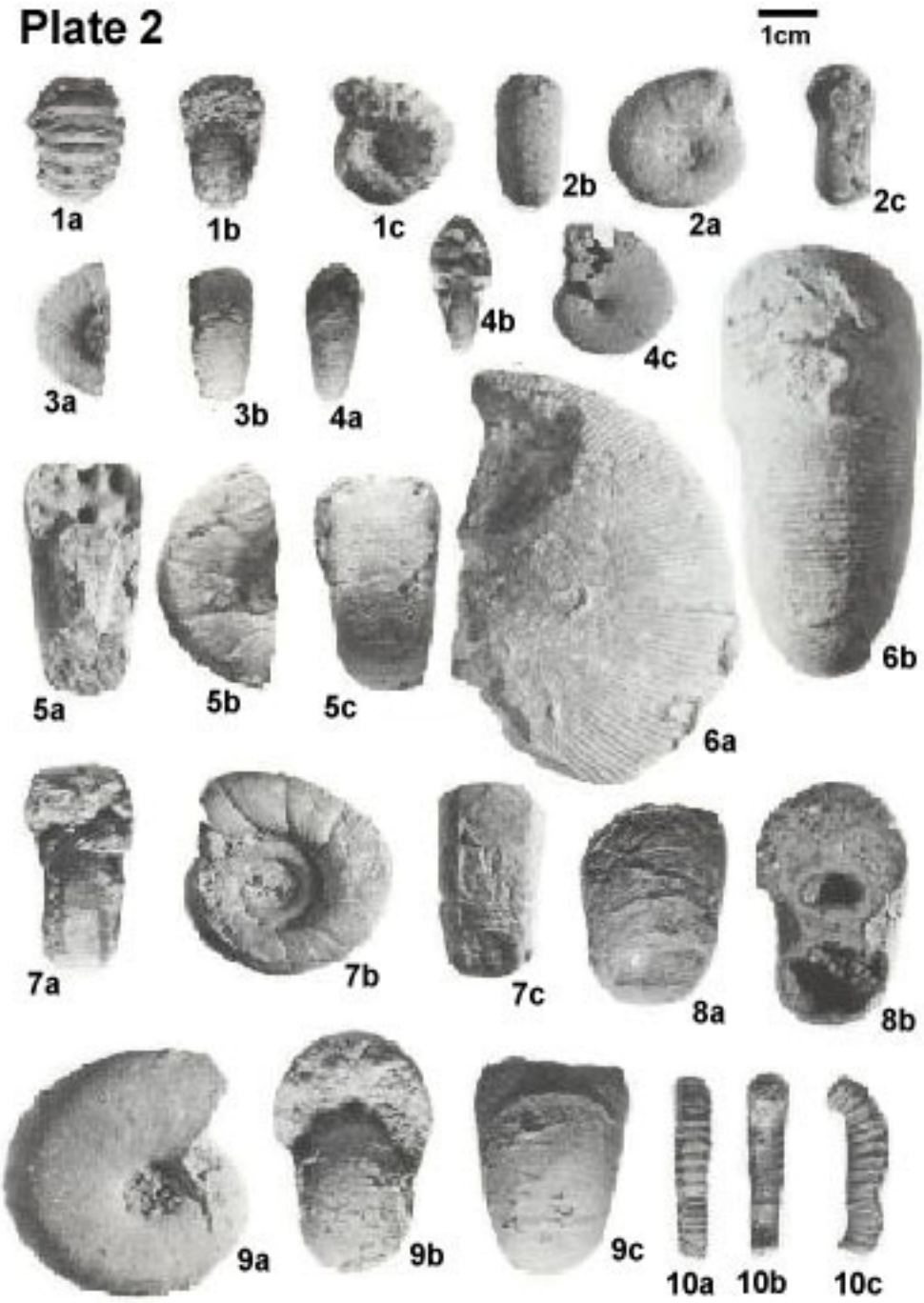


Fig. 2: Text- Fig (2): Distribution chart of the Aptian and Albian Mollusca of Um Mitmani and Gabal Mistan.



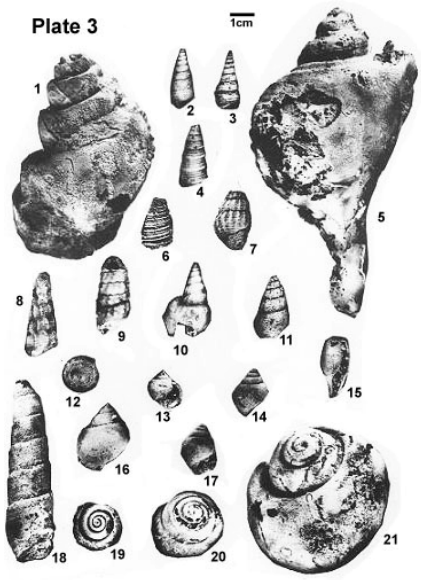
Explanation of Plate 1(bar=1cm)

Figs (1&2)*: Deshayesites deshayesi* (Leymerie MS.) Orbigny. Fig (3): *Deshayesites lavaschensis* Kazansky. Fig (4): *Anahamulina lorioli* Uhlig. Figs (5 – 7): *Barremites subdifficilis* (Karakasch, 1907). Fig (8): *Barremites charrierianus* Orbigny. Figs (9&10): *Macrophylloceras ptychostoma* Benecke, Fig (11): *Barremites psilotatus* (Uhlig). Fig (12): *Puzusia (Puzusia) matheroni* OrbignyFig (13): *Zuercherella* aff. *Zuercheri* (Jacob). Fig (14): *Uhligella clansayensis* (Jacob) Figs (15&16): *Valdedorsella akuschense* (Anthula). Figs (17 – 21): *Protetragonites crebrisulcatus* (Uhlig, 1883)



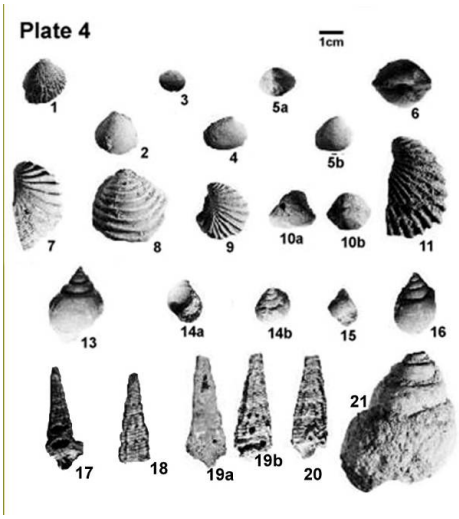
Explanation of Plate: 2

Figs (1)**:** *C.* (*Epicheloniceras*) *subnodosocostatum* Sinzow. Fig (2)**:** *T.* (*Tetragonites*) sp. Figs (3, 5&7): *Tetragonites* (*Tetragonites*) aff. *Heterosulcatus* Anthula. Fig (4)**:** *Phylloceras* (*Hypophylloceras*) *moreti* (Mahmoud). Fig (6)**:** *Phylloceras* (*Hypophylloceras*) *velledae* (Michelin). Figs (8 &9): *T. (Tetragonites) nautilodes* (Pictet). 10**.** *Hamites intermedius* Sowerby.



Explanation of Plate 3

Fig (1): *Tylostoma (T.) canalliculata* Abdel Gawad. Fig (2-3): *Pseudomesalia* sp. Fig (4): *Pseudomesalia deserti Douville´*. Fig (5): *Tudicla (Tudicla) spindllus* nov. sp. Fig (6&12)*: Discotectus* (*Discotectus*) sp. Fig (7): *Confusiscala dupiniana* Orbigny. Fig (8): *Pyrazus* (*Echinobethra) magharensis* var. *rekebensis* Abbass; Fig (9): *Pyrazus* aff. *valeriae* (Vern. & Lor). Figs (10- 11): *Cirocerithium subspinosum* Deshayes. Figs (13-14, 16-17): *Tylostoma (T.) maghareensis* Abbass. Fig (15): *Cylichna* sp. Fig (18): *Nerinea monocarinata* Pcelincev. Figs (19-20): *Tylostoma (T.) zaghloulum* nov. sp. Fig (21): *Tylostoma (T.) gloposum* Sharpe.



Explanation of Plate 4

Fig (1): *Cardita dupini* Orbigny var.*deserti* Douvillé. Fig (2 & 5): *Cyprina (Anisocardia) hermitei* Choffat. Figs (3 & 4): *Flaventia brongniartina* (Lymerie). Fig (6): *Meretrix* (*Flaventia*) *deserti* Douville. Figs (7, 9 &11): *Scabrotrigonia scabra (*Lamarck). Fig (8): *Crassatella (Rochella) seguenzai* (Thomas & Peron). Fig (10): *Megalocardia* (?) *simplex* (Mahmoud). Fig (13-16): *Tylostoma (T.) maghareensis* Abbass. Figs (17-20): *Pyrazus* (*Echinobethra*) *sexangulatus* Zek. Fig (21): *Amauropsell holzapfeli* Cossmat.