NANNOFOSSILS BIOZONES OF CONTACT BETWEEN KOMETAN AND SHIRANISH FORMATIONS, CHAQCHAQ VALLEY, SULAIMANYIA, NE IRAQ

Omar Ahmed Al-Badrani [1]
Kamal H. Karim[2] **and Khalid M Ismail** [3]

Key words: Shiranish Formation, Kometan Formation, gradational contact, transitional zone, nannofossils, Chaqchaq valley.

ABSTRACT

Nineteen species of calcareous nannofossils were identified from contact between Kometan and Shiranish Formations that exposed in the Chaqchaq valley northwest of the Sulaimanyia city, NE Iraq. The recorded calcareous nannofossils assemblages permit recognition of two biozones:

2- ***Ceratolithoides aculeus*** **Interval Biozone (CC 20)**
1-***Aspidolithus parcus – Calculites ovalis*** **Interval Biozone (CC 18- CC19)**

Based on nannofossils biozonation, the contact between Kometan and Shiranish Formations is considered to be conformable. In the studied area, the age of the Shiranish Formation is extending into Early Campanian.

الطباقية الحياتية لمتحجرات "النانو" في حد التماس مابين تكويني كوميتان وشرانش، وادي جقجق، السليمانية، شمال شرق العراق

عمر احمد البدراني ، كمال حاجي كريم و خالد محمود اسماعيل

شخص تسعة عشر نوع من متحجرات **"النانو"** الكلسية من حد التماس مابين تكويني كوميتان وشرانش المنكشفان في وادي جقجق شمال غرب مدينة السليمانية، شمال شرق العراق. خلال الانتشار الطباقي لحشود المتحجرات يمكن تمييز نطاقين حياتيين هما:

2- ***Ceratolithoides aculeus*** **Interval Biozone (CC 20)**
1-***Aspidolithus parcus – Calculites ovalis*** **Interval Biozone (CC 18- CC19)**

اعتمادا على المتحجرات المتناهية الصغر وجد ان حد التماس مابين تكويني كوميتان وشرانش متوافق. ويمتد عمر تكوين شرانش من الكامبانيان المبكر في المنطقة الدراسة.

[1] Assistant professor Dept. of Geology, College of Science, Mosul University, Mosul, Iraq.
[2] Professor Dept. of Geology, College of Science, Sulamani University, Sulaimanyiah, Iraq. E-mail: karimgeology@yahoo.com
[3] Assistant Professor Dept. of Geology, College of Science, Sulamani University, Sulaimaniyiah, Iraq. E-mail: khalshin@yahoo.com

INTRODUCTION

Kometan Formation is first described by Dunnington (1953, in Bellen *et al.*, 1959). It is exposed in High and Low Folded Zones in subsurface sections in the Mesopotamian Zone (Dunnington1958; Buday, 1980, Buday and Jassim, 1987). The type section is located at 400m to the west of Kometan village in the Naudasht valley in the foothills of Qandil Mountain about 20 km to the north of Ranyia town in the Imbricated Zone (Fig.1). According to aforementioned authors, the formation is composed of well bedded, light grey or white limestone. It contains locally chert nodules or ribbons with rare pyrite concretions.

The thickness of the formation, in the High Folded and Imbricated Zones, reaches (100–120) m. The lower and upper contacts of the formation are unconformable (Dunnington, 1953 in Bellen *et al.*, 1959, Buday, 1980 and Al-Khafaf, 2005). The first author added that faunal and intense glauconization indicate depositional hiatus and probable erosion. In this contact, in addition to glauconite and faunal break, he found polygenetic micropebbles.

Recent sedimentological studies such as Karim, *et al.* (2008) and Taha (2008) analyzed what called by Bellen *et al.*, 1959 “polygenetic micropebbles”. They proved that there are no such deposits in all six studied sections. In the contact, they found siliceous nodules and glauconite at one section. In the other section, they observed gradational contact as regular alternation of white limestone and bluish white marl.

Shiranish Formation is the most important rock unit throughout the Cretaceous of north Iraq. It’s type section is first described by Henson, 1940 (cited in Bellen *et al.*, 1959) and lies at Shiranish Islam Village near Zakho City. It reaches about 228 meters in thickness and consists mainly of marl and marly limestone representing off shore, open sea sediments of the Late Campanian-Maastrichtian age on the basis of the foraminiferal assemblages content.

LOCATION AND GEOMORPHOLOGY

The section is located 10km to northwest of Sulaimaniyah city and about 3 km south of Lower Hanaran Village in the middle part of the Chaqchaq valley. It is located in the intersection of latitude 35° 39' 46" N and longitude 45° 22' 35" E (Fig.1 and 2). The contact is exposed clearly along the right bank (when looks upstream) of the perennial Chaqchaq stream (Fig.3).

The Chaqchaq valley is flat bottomed at its mouth, to the east of Sulaimanyia city while it become v-shaped at it's middle part and head. The valley is surrounded from southwest, north and northeast by Piramagroon, Daban and Azmir Mountains respectively (Fig.2). Structurally, it consists of wide syncline in which Tanjero, Shiranish and Kometan Formations are exposed near the it's axis and along the lower parts of the limbs. Along the upper parts of southwestern and northeastern limbs; Qamchuqa and Balambo Formations are exposed respectively.

MATERIAL AND METHODOLOGY

Forty one samples are taken from the Kometan and Shiranish Formations across the contact between them. Two samples are taken from proper Kometan Formation at the base of the sampled interval. Eight samples are taken from what it seems to be the transition Zone (alternation between white pelagic limestone and bluish marl) at the middle part of the sampled intervals. The other samples are taken from the proper Shiranish Formation (bluish white marl) at the top of the sampled intervals. These samples are inspected under normal and polarized microscope with more than 1000 magnifications. The samples are identified and the significant samples were photographed and then systematic paleontology and biozonation are achieved as mentioned hereinafter.

For preparing smear slides, a small part of the sample is put on a glass slide and mixed thoroughly with distilled water. The slide is dried on a hot plate and covered with glass cover slide by using Canada balsam and examined with normal microscope.

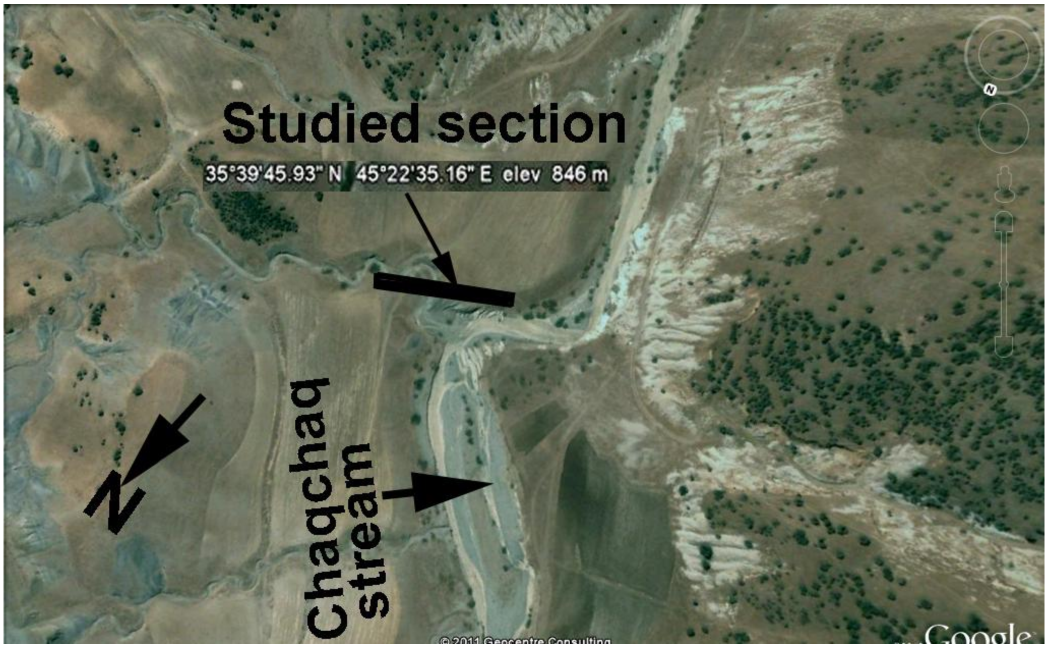

Fig.1: Google earth view of the area around the sampled section in the Chaqchaq valley.

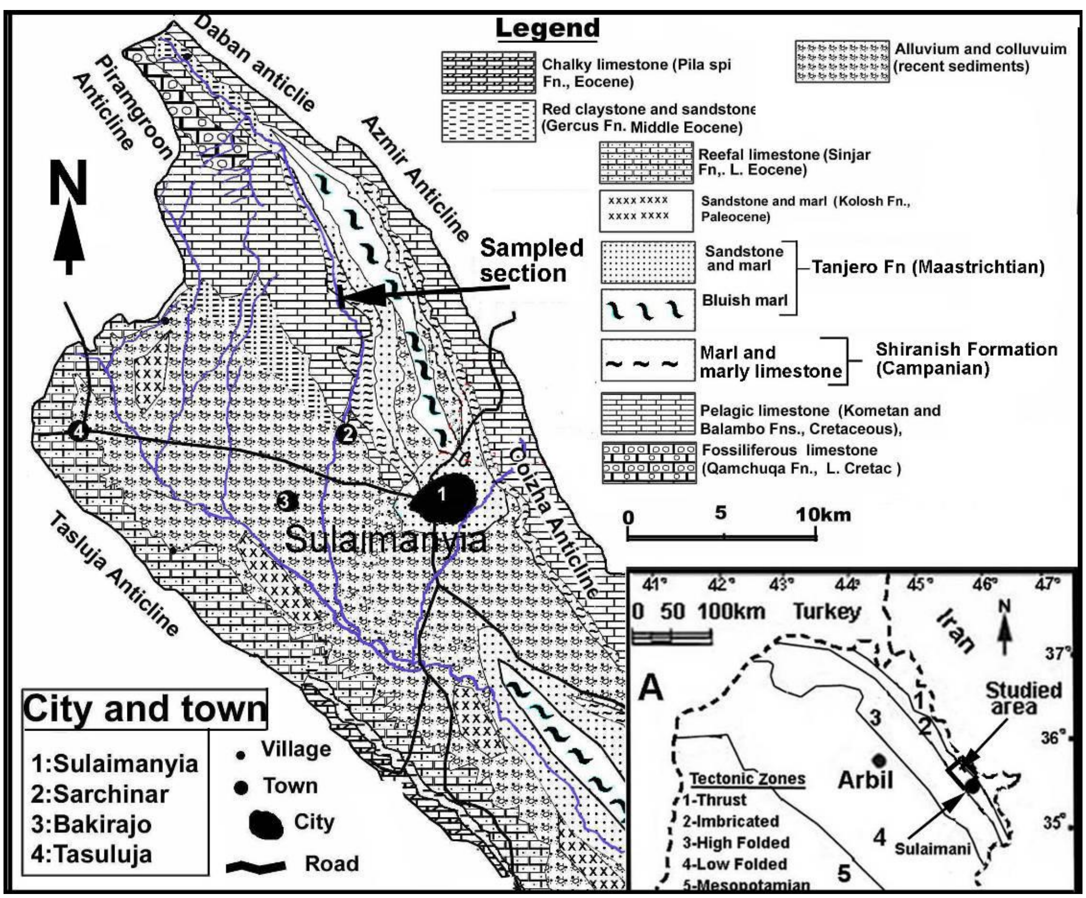

Fig.2: Geological map of the area around Sulaimaniyia city includes Chachaq stream (modified from Sissakian, 2000 and Ali, 2009)

Fig. 3: Gradational contact between Kometan and Shiranish formations in the Chaqchaq stream. The contact is represented by alternation of grey marl and fine crystalline limestone. The marl increases towards Shiranish Formation.

SYSTEMATIC PALEONTOLOGY

The following species are identified and classified below:

Kingdom Protista
Division Chrysophyta
Class Coccolithophyceae
Family Arkhangelskiellaceae Bukry, 1969
Genus *Aspidolithus* Noël, 1969
***Aspidolithus parcus* (Stradner, 1963) Noël, 1969 (**Figs. 4.1,2)
***Aspidolithus* sp.** (Fig. 4.3)

Family Calyptrosphaeraceae Boudreaux and Hay, 1969
Genus *Lucianorhabdus* Deflandre, 1959
***Lucianorhabdus cayeuxii* Deflandre, 1959 (**Fig. 4.16)

Family Chiastozygaceae Rood, Hay and Barnard, 1973
Genus *Calculites* Prins and Sissingh, 1977
***Calculites obscurus* (Deflandre, 1959)** Prins and Sissingh, 1977 (Fig. 4.5)
***Calculites ovalis* (Stradner, 1963)** Prins and Sissingh, 1977(Fig. 4.6)
Family Chiastozygaceae Rood, Hay and Barnard, 1973
Genus *Chiastozygus* Gartner, 1968
***Chiastozygus platyrhethum* Hill, 1976** (Fig. 4.10)
***Chiastozygus* sp.** (Fig. 4.11)
Family Eiffellithaceae Reinhardt, 1965
Genus *Eiffellithus* Reinhardit, 1965
***Eiffellithus eximius* (Stover, 1966)** Perch-Nielsen, 1968 **(**Figs. 4.12,13)
***Eiffellithus turriseffelii* (Deflandre, 1954) Reinhardit, 1965 (**Fig. 4.14)

Family Ellipsagelosphaeraceae Noël, 1965
Genus *Watznaueria* Reinhardt, 1964
***Watznaueria barnesae* (Black, 1959)** Perch-Nielsen, 1968 **(**Fig. 4.21)
***Watznaueria biporta* Bukry, 1969 (**Fig. 4.22)

Family Nannoconceae Deflandre, 1959
Genus *Nannoconus* Kamptner
***Nannoconus malticadus* Deflandre and Deflandre, 1959 (**Fig. 4.19)

Family Podrorhabdaceae Noel, 1965
Genus *Bipodorhabdus* Noël, 1970
***Bipodorhabdus tesselatus* Noël, 1970 (**Fig. 4.4)

Family Polycyclolithaceae Forchheimer, 1972
Genus *Micula* Vekshina, 1959
***Micula decussata* Vekshina, 1959 (**Fig. 4.17)
***Micula swastica* (**Fig. 4.18), Stradner and Steinmetz, 1984
Genus *Lithastrinus* Stradner, 1962
***Lithastrinus grillii* Stradner, 1962 (**Fig. 4.15
)
Family Zygodiscaceae Hay and Mohler, 1967
Genus *Reinhardites* Perch-Nielsen, 1968
***Reinhardites anthrophorus* (Deflandre, 1959) Perch-Nielsen, 1968 (**Fig. 4.20)
Incertae sedis
Genus *Ceratolithoides* Bramlette and Marini, 1964
***Ceratolithoides verbeekii* Perch-Nielsen, 1979 (**Figs. 4.8 ,9)
***Ceratolithoides aculeus* (Stradner, 1961)** Prins and Sissingh, 1977 (Fig. 4.7)

NANNOBIOSTRATIGRAPHY

The boistratigraphic subdivision of the section is achieved which resulted in two main interval zone as shown in the below and in the Fig.5.

1-*Aspidolithus parcus – Calculites ovalis* Interval Biozone (CC 18- CC19)
Definition: First occurrence of *Aspidolithus parcus* to first occurrence of *Ceratolithoides aculeus.*

Thickness: 24.5 meter of limestone, marly limestone and marl.

Boundaries and Discussion: Perch-Nielsen (1977) used the same definition for her Early Campanian *Eiffellithus eximius* Zone. Verbeek (1977), Roth(1978) and Doeven(1983) defined a *Broinsonia parca* Zone from the first occurrence of *Broinsonia parca* to first occurrence *Ceratolithoides aculeus*, the event used by Sissingh (1977) to define the top of his zone CC19 (Perch-Nielsen, 1985), therefore the age of this biozone is Early – middle Campanian (Gradstein *et al*., 2004).

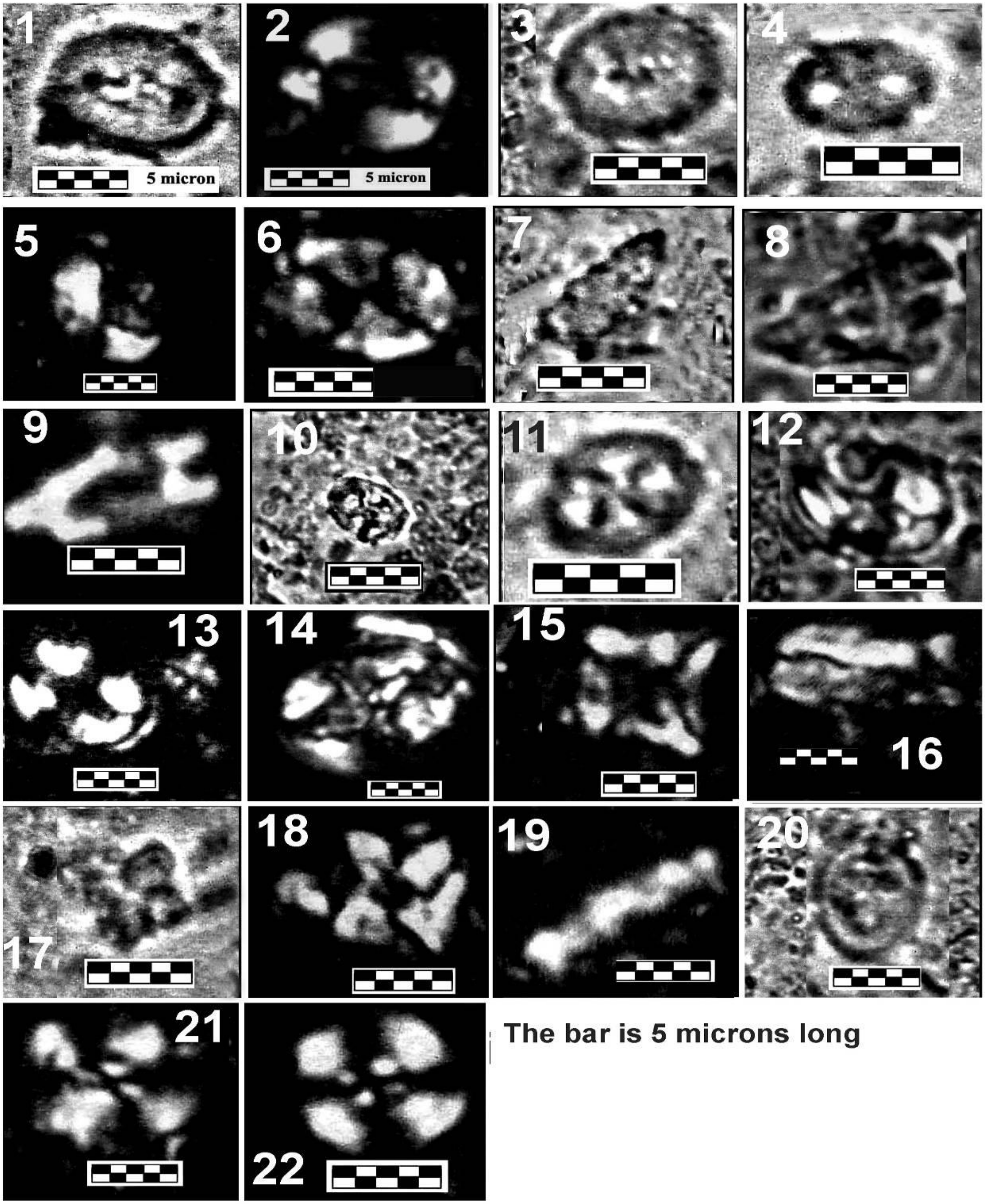

Fig.4: Nannofossils found in the sampled section across the boundary between Kometan and Shiranish formations).
(The names of the species are listed in page 25)

1, 2) Aspidolithus *parcus* (Stradner, 1963) Noël, 1969, sample no.2, normal and polarized transmitted light.
3) *Aspidolithus* sp. sample no.18, normal transmitted light.
4) *Bipodorhabdus tesselatus* Noël, 1970, sample no.2, normal transmitted light.
5) *Calculites obscurus*(Deflandre, 1959) Prins and Sissingh, 1977, sample no.6, polarized transmitted light.
6) *Calculites ovalis* (Stradner, 1963) Prins and Sissingh, 1977, sample no.2, polarized transmitted light.
7) *Ceratolithoides aculeus* (Stradner, 1961) Prins and Sissingh, 1977 sample no.18, normal transmitted light.
8, 9) *Ceratolithoides verbeekii* Perch-Nielsen, 1979, sample no.6, normal and polarized transmitted light.
10) *Chiastozygus platyrhethum* Hill, 1976 sample no.23, normal transmitted light.
11) *Chiastozygus* sp. sample no.18, normal transmitted light.
12, 13) *Eiffellithus eximius* (Stover, 1966) Perch-Nielsen, 1968, sample no.11, normal and polarized transmitted light.
14) *Eiffellithus turriseffelii* (Deflandre, 1954) Reinhardit, 1965, sample no.18, polarized transmitted light.
15) *Lithastrinus grillii* Stradner, 1962, sample no.11, polarized transmitted light.
16) *Lucianorhabdus cayeuxii* Deflandre, 1959, sample no.8, polarized transmitted light.
17) *Micula decussata* Vekshina, 1959, sample no.10, normal transmitted light.
18) *Micula swastica* Stradner and Steinmetz, 1984, sample no.6, polarized transmitted light.
19) *Nannoconus malticadus* Deflandre and Deflandre, 1959, sample no.9, polarized transmitted light.
20) *Reinhardites anthrophorus* (Deflandre, 1959) Perch-Nielsen, 1968, sample no.10, normal transmitted light.
21) *Watznaueria barnesae* (Black, 1959) Perch-Nielsen, 1968, sample no.9, polarized transmitted light.
22)*Watznaueria biporta* Bukry, 1969. Sample no.2, polarized transmitted light.

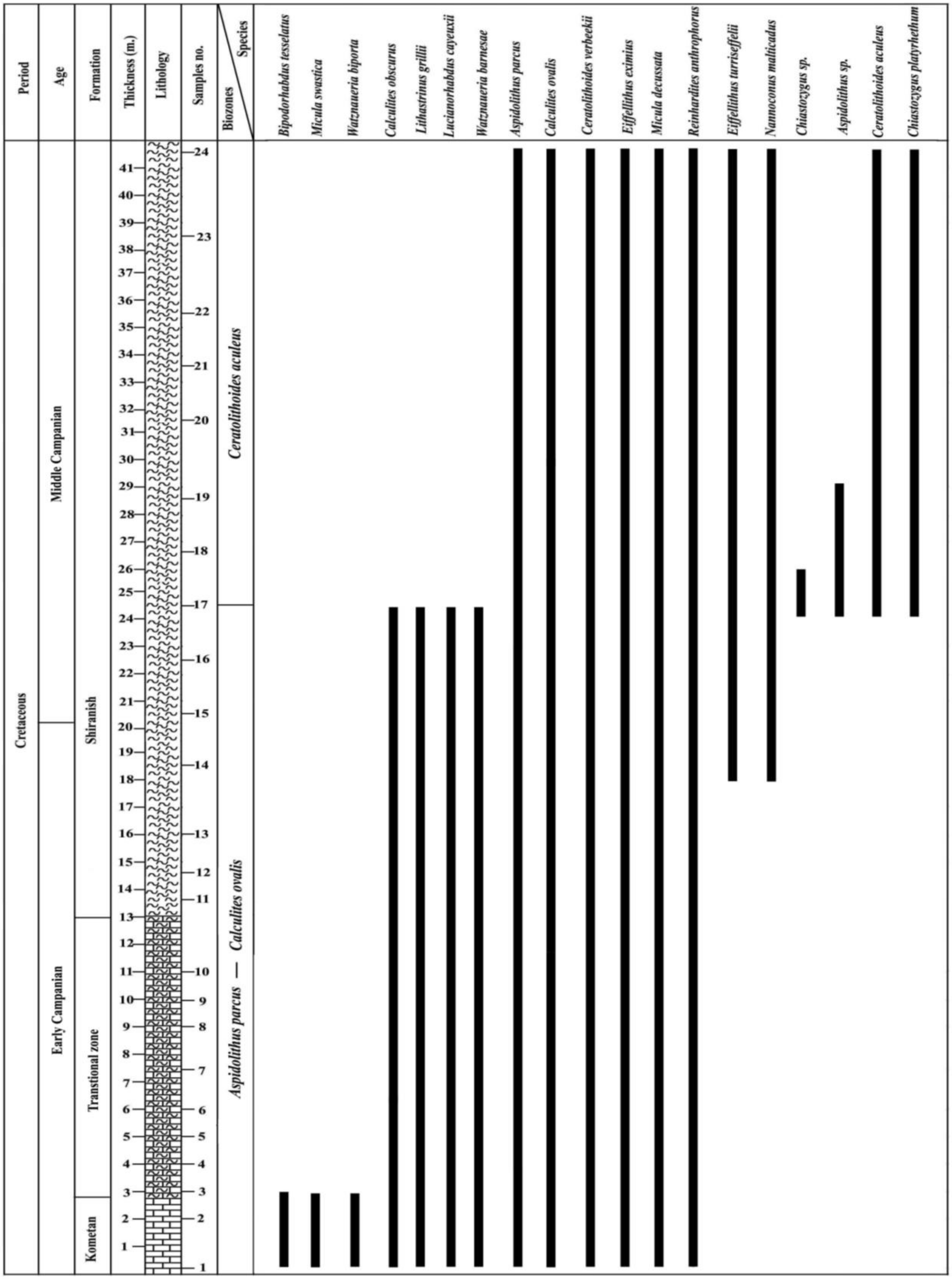

Fig.5: Range chart of the nannofossils that are found in the sampled section across the boundary between Kometan and Shiranish Formations

2- *Ceratolithoides aculeus* Interval Biozone (CC 20)
Definition: First occurrence of *Ceratolithoides aculeus* to first occurrence of *Quadrum sissinghi*.
Thickness: 16 meter marl.

Boundaries and Discussion: Roth (1978) define the Tetralithus aculeus zone from the first occurrence of Tetralithus aculeus to the first occurrence of Tetralithus trifidus including CC20 and CC21 (Perch-Nielsen, 1985), in the present study the Quadrum sissinghi not singed therefore unable to determined the upper boundary of the biozone, but the age of this biozone is Middle Campanian (Gradstein et al., 2004).

DISCUSSION

Two results are important in this study: The first is gradational contact which has representative sediments as indicated by the recorded nannofossils. The second is that the boundary between the two formations is located in the Early Campanian instead of Middle Campanian (as mentioned previously).

The biostratigraphically proved gradational boundary (conformable contact) is the first detail one. This proof has great paleogeographic and tectonic important which change the previous idea about uplift and subsidence in the Middle Campanian. Conversely, the study shows more calm tectonics and different paleogeographic setting of the northeastern Iraq during Campanian and Maastrichtian.

Recent sedimentological study discussed nine sections in Sulaimanyia and Erbil vicinity and in all these sections, it is inferred that there are submarine erosion or slow rate of the sedimentation (represented by glauconitic bed) in two nearby sections in Dokan area (see Karim, *et al.*, 2008 and Taha, 2008). The authors showed that the contact in other sections is gradational and without occurrence of conglomerate, erosional surface, paleosoil and glauconite beds. The only fulfillment lack of these papers was the paleontological proof which is provided by the present study.

The occurrence of the contact in the Early Campanian is more or less abnormal, as the previous studies indicated that the Middle Campanian is missing due to uplift of the area and then starting of erosion by which polygenetic micropebbles are deposited (Buday, 1980 and Bellen et al., 1959) and then Shiranish Formation is deposited in Late Campanian. According to Jassim and Goff (2006), Al–Jassim *et al.* (1989) and Al-Khafa (2005) Kometan Formation extends from Turonian to Middle Campanian. The same authors assigned that the age of the Shiranish Formation is Late Campanian-Maastrichtian. This age of Kometan and Shiranish Formations (in the studied area) is new. In the literature, there is one indirect pointing to the possibility of this age. This is proved in the sedimentological study of Taha (2008) who correlated the glauconite bed in Dokan area with same bed in the north of the Sulaimanyia city. He showed that the galuconite bed at Dokan Area is located nearly at contact between the two formations while it is located inside the Shiranish Formation (30 m above the contact) (Fig.6) in the north of Sulaimanyia city section. As the glauconite beds has wide distribution (Glaway,1988; Vail *et al.* 1977; Loutit *et al.* 1988; Haq,1991; Emery and Myers, 1996), therefore, the bed most possibly has the same age in both areas and thus both sedimentology and biozonation has more or less same result as concerned to the contact in Sulaimanyia area.

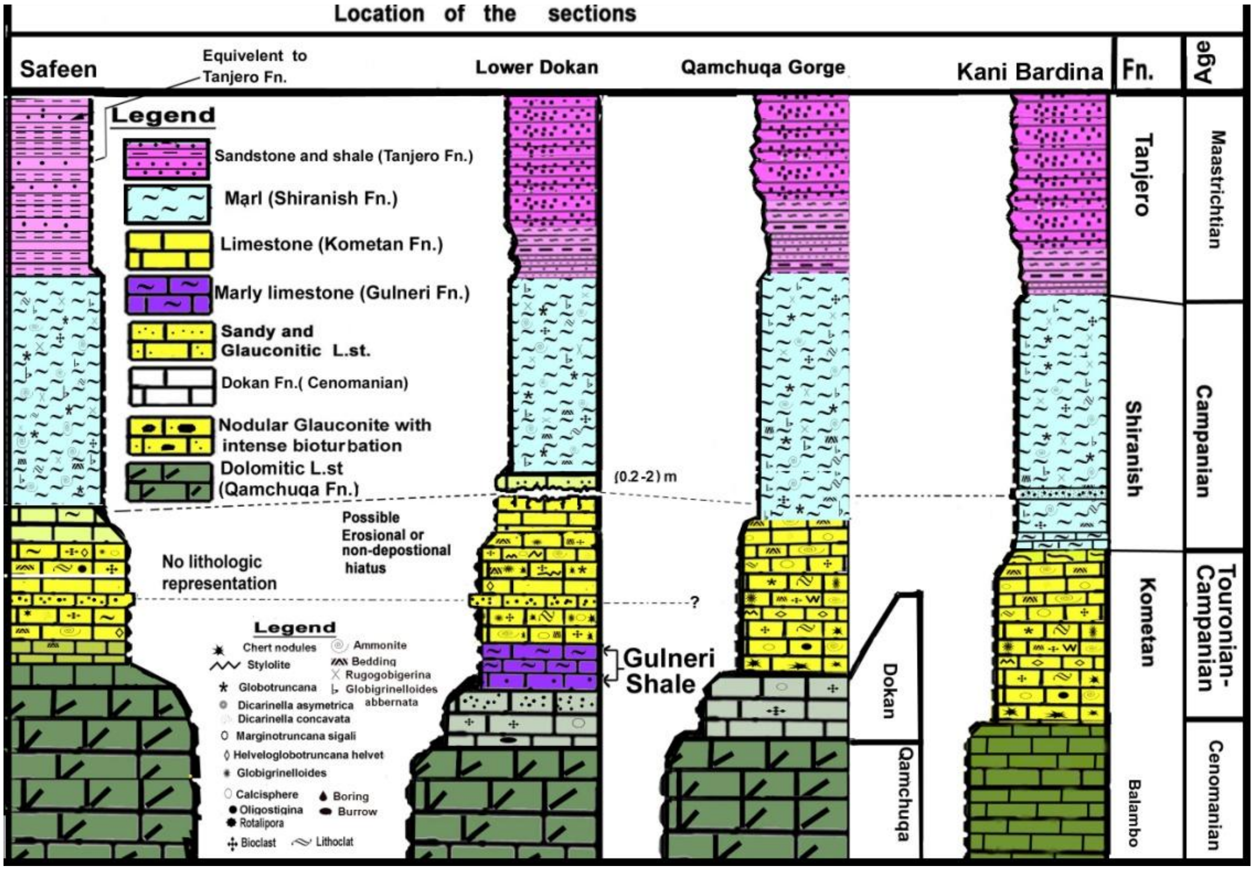

Fig.6: Sedimentological correlation between the glauconite beds near the boundary between Kometan and Shiranish formations in the lower Dokan and Kani Bardina sections (7 kms to northeast of Sulaimaniyah city). It shows that in the latter section, the bed located inside Shiranish Formation (Taha, 2008).

CONCLUSIONS

This study has the following conclusions:

- The recorded calcareous nannofossils assemblages permit the recognition of two biozones:
  1-*Aspidolithus parcus – Calculites ovalis* Interval Biozone (CC 18- CC19)
  2- *Ceratolithoides aculeus* Interval Biozone (CC 20)
- This study inferred that the contact between Kometan and Shiranish Formations is conformable with Early Campanian age.
- The contact age of the Shiranish Formation extends to Early Campanian.

REFERENCES

Al–Jassim, J. A., Al–Sheikhly, S.S.J. and Al–Tememmey, F.M. 1989. Biostratigraphy of the Kometan Formation (Late Torunian–Early Campanian) in northern Iraq.Jour. Geol. Soci. Iraq.V.22, N.1, p.53–60.

Al-Khafaf, A. O., 2005. Stratigraphy of Kometan Formation (Upper Cretaceous) in Dokan- Endezah Area, NE-Iraq. Unpublished MSc thesis, University of Mosul, Department of Geology, 79pp.

Ali, S. A.2008**.** Geology and hydrogeology of Sharazoor-Piramagroon basin in Sulaimani area, Northeastern Iraq. Unpublished PhD. Thesis, University of Bilgrad, Sirbia, 330pp.

Bellen, R. C. Van, Dunnington, H. V., Wetzel, R. and Morton, D., 1959. Lexique Stratigraphique, Interntional. Asie, Iraq, Fasc, 10a, Paris,10a, 333 pp.

Buday, T.,1980. Regional Geology of Iraq: Vol. 1, Stratigraphy: I.I.M Kassab and S. Z. Jassim (Eds) GEOSURV, Baghdad, 445pp.

Buday, T. and Jassim, S. Z., 1987. The Regional geology of Iraq: Tectonism Magmatism, and Metamorphism. I.I. Kassab and M.J. Abbas and Jassim, S.Z (Eds), GEOSURV, Baghdad, Iraq, 445 pp.

Emery, D. and Myers, K. 1996**.**Sequence Stratigraphy. Blackwell Scientific Limited. 297pp.

Doeven, P. H., 1983: Cretaceous nannofossils stratigraphy and paleoecology of Canadian Atlantic Margin. In Bolli, H. M., Saundes, J. B., & Perch-Nielsen, K. (eds.), 1985, Plankton stratigraphy. Cambridge University Press, Cambridge, p.329-426.

Dunnington, H. V. 1958. Generation, migration and dissipation of oil in Northern Iraq. In Arabian Gulf, Geology and productivity. AAPG Foreign Reprint Series No. 2.

Galloway, W.E., 1989, Genetic stratigraphic sequences in basin analysis; I, Architecture and genesis of flooding-surface bounded depositional units: AAPG Bulletin, v. 73/2, p. 125-142.

Gradstein, F.M., Ogg, J.G., Smith, L.J., et al. , 2004: A new geologic time scale, with special reference to Precambrian and Neogene. Episodes, Articles, 27(2), pp. 83-100.

Haq, B. U., 1991. Sequence stratigraphy, sea level change and significance for deep sea. Special Publs. Int. Ass. Sediment, 12(1). p.12-39.

Jassim, S.Z. and Goff, J.C.2006. Geology of Iraq. Published by Dolin, Prague and Moravian Museun, Berno. 341pp

Karim, K. H., Khalid, M. I., and Bakhtiar M. A., 2008. Lithostratigraphic Study of the contact between Kometan and Shiranish Formations (Cretaceous) from Sulaimaniyah Governorate, Kurdistan Region, NE Iraq. Iraqi Bulletin of Geology and Mining. Vol.4, No.2, P.16 -27

Loutit, T. S., Hardenbol, J., Vail, P. R., and Baum, G. R., 1988. Condensed section: The key to the age dating and correlation of continental margin sequences. In: sea level change: an integrated approach

Perch-Nielsen, K, 1979: Calcareous nannofossils from the Cretaceous between the North Sea and the Mediterranean. In Bolli, H. M., Saundes, J. B., & Perch-Nielsen, K. (eds.), 1985, Plankton stratigraphy. Cambridge University Press, Cambridge, p.329-426.

Perch-Nielsen, K. 1985: Mesozoic calcareous nannofossils. In Bolli, H. M., Saundes, J. B., & Perch-Nielsen, K. (eds.), Plankton stratigraphy. Cambridge University Press, Cambridge, p.427-554.

Taha, Z.A.2008. Sedimentology of Late Cretaceous Formation from Kurdistan Region, NE−Iraq, Unpublished, M.Sc thesis, University of Suilaimani.150 pp.

Roth, P. H., 1978:Cretaceous nannoplankton biostratigraphy and oceanography of the Northwestern Atlantic Ocean. In Bolli, H. M., Saundes, J. B., & Perch-Nielsen, K. (eds.), 1985, Plankton stratigraphy. Cambridge University Press,Cambridge, p.329-426.

Sissingh, W, 1977**:** Biostratigraphy of Cretaceous calcareous nannoplankton. In Bolli, H. M., Saundes, J. B., & Perch-Nielsen, K. (eds.), 1985, Plankton stratigraphy. Cambridge University Press,Cambridge, p.329-426.

Sissakian, V. K., 2000. Geological map of Iraq, sheets No.1, Scale 1:1000000, 3rd ed., GEOSURV, Baghdad, Iraq.

Vail, P.R., Mitchum, R.M., Todd, R. G., Widmier, J.M. and Hatleid, W.G., 1977. Seismic stratigraphy and global changes in sea level. In: seismic Stratigraphy–Application to Hyrocarbon Exploration (ed. by C. E. Payton). Memoir of the American Association of the Petroleum Geologists, Tulsa, 26, p.49-62.

Verbeek, J.w., 1977.Calcarous nonnoplankton biostratigraphy of Middle and upper Cretaceous deposits in Tunisia, southern Spain and France. Utrecht Micropal, Bull.Vol.16, p.1-157.