BIOSTRATIGRAPHY OF ALBIAN – SANTONIAN SUCCESSION ALONG SURDASH TO SHAQLAWA AREAS, NE IRAQ

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Received: 08/ 01/ 2014, Accepted: 06/ 11/ 2014
Key words: Biostratigraphy, Foraminifera, Albian, Santonian, Dokan, Gulneri, Kometan, Iraq

ABSTRACT

Three formations were studied along Surdash, Qallat, Khalakan, Hezob, Sektan, Degala and Shaqlawa areas in the Sulaimaniyah and Erbil governorates, NE Iraq. These are: Dokan, Gulneri and Kometan formations. The age of these formations are determined depending on the biozones of planktonic foraminifera, and the contact between each two formations was discriminated in the field and by microfossils content.

Eleven biozones were distinguished from Albian – Santonian age and at least two biozones up to seven biozones can be discriminated in each section along the study area.

Forty-nine species belong to twenty-four genera were used as species of biozones and coeval fossils support each zone.

الطباقية الحياتية لتتابع الالبيان – كامبانيان من منطقة سورداش الى منطقة شقلاوة، شمال شرق العراق

صلاح علي حسين و سعد سامي الشيخلي

المستخلص

تم في هذا البحث دراسة الانطقة الحياتية لثلاثة تكاوين في مناطق سورداش، قلات، خله كان، هيزوب، سيكتان، ديكله وشقلاوة، هذه التكاوين هي: تكوين دوكان وتكوين كلنيري وتكوين كوميتان. تم تحديد عمر هذه التكاوين من خلال انطقة المتحجرات الطافية وتم تحديد الحدود الطباقية بين كل تكوينين في الحقل ومن خلال المحتوى الحياتي.

تم تمييز أحد عشر نطاقا حياتيا ممتدة من عمر الألبيان الى عمر السانتونيان وقد توزعت بين نطاقين على الأقل وسبعة أنطقة حياتية كحد أقصى لكل مقطع طباقي من المقاطع قيد الدراسة. وقد استخدمت (49) نوعا من المتحجرات تعود الى (24) جنسا كأنطقة حياتية ومتحجرات متواجدة ضمن النطاق كمتحجرات داعمة للنطاق.

INTRODUCTION

The use of planktonic Foraminifera as guide fossils is generally accepted today. Their abundance in open marine environments, and the short stratigraphic range of many species, make this group of Foraminifera one of the most suitable and reliable tools for detailed biostratigraphic investigations. The Planktonic Foraminifera, of practical use in biostratigraphy, first occur during the Early Cretaceous. They continue on a world – wide scale, and in a rapid succession of species, to the Recent, (Postuma, 1971).

The lithology of Dokan Formation in the study area is crystalline grayish brown, thick bedded limestone. The lower contact with Qamchuqa Formation is unconformable, and the upper contact with Gulneri Formation is unconformable too.

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The lithology of the Gulneri Formation is hard black shale. The lower contact with Dokan Formation is unconformable and the upper contact with Kometan Formation is unconformable too.

The lithology of the Kometan Formation is grayish brown to yellowish brown, hard, stylolitic, well bedded limestone. The stylolites occur along bedding planes of Kometan Formation throughout. The chert nodules occur near the upper part of the formation. The lower contact with Gulneri Formation is unconformable and the upper contact with the Shiranish Formation is unconformable too.

The study area is located in the High Folded Zone of northeastern Iraq (Sulaimaniyah and Erbil) (Figure 1). It is bordered from the northeast by the Thrust Zone and from the southeast by the Low Folded Zone and bounded by the coordinates (44° 15' – 45° 06') E and (35° 50' – 36° 25') N. The seven selected sections are shown in Table (1).

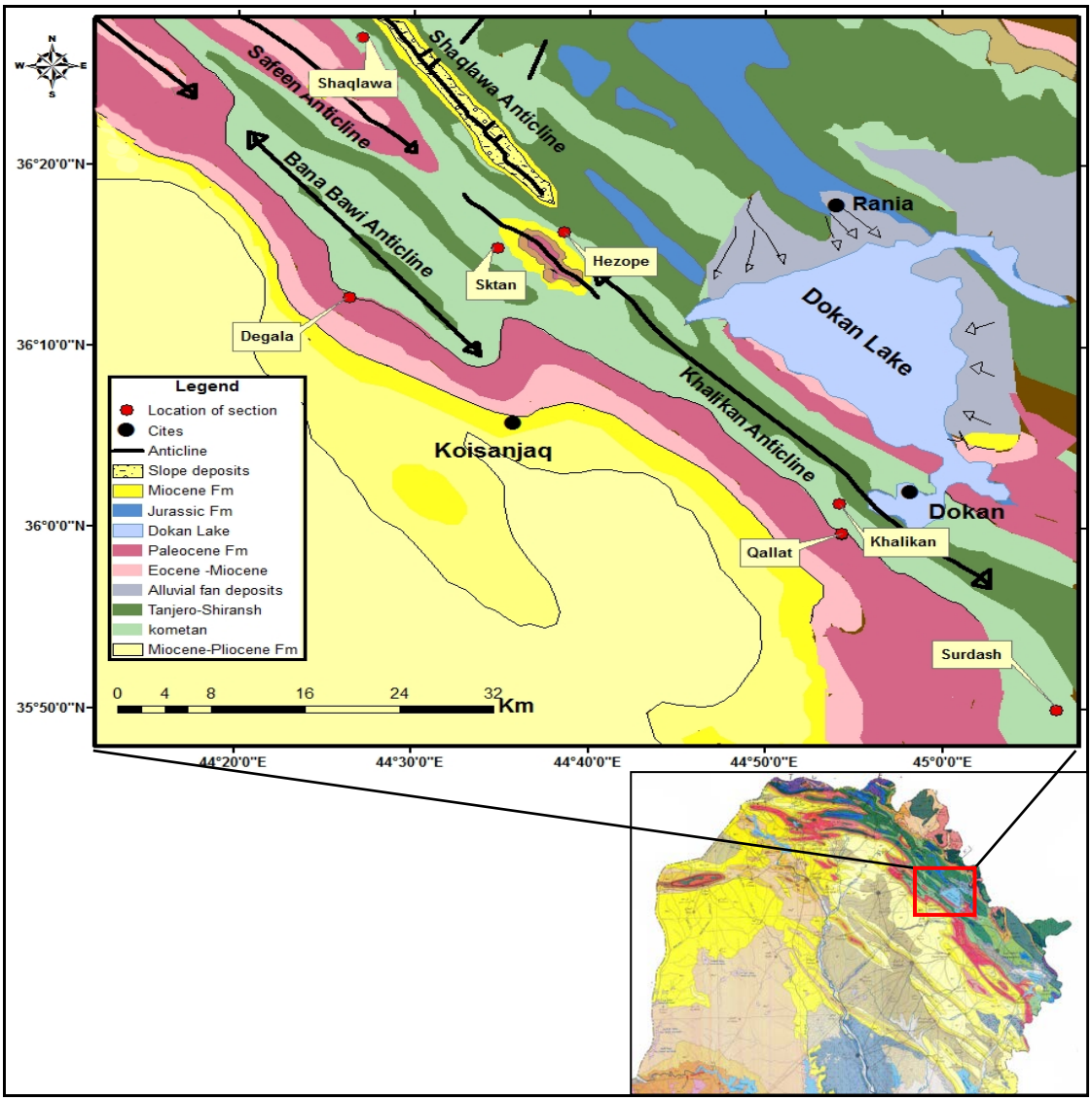

Fig.1: Location and geological map of the study area (after Sissakian, 2000)

Table 1: The coordinates of the studied sections

Section name	Longitude	Latitude	Altitude
Surdash	45° 06' 26"	35° 50' 01"	770 m
Qallat	44° 54' 26"	35° 58' 10"	634 m
Khalakan	44° 54' 18"	35° 59' 45"	921 m
Hezob	44° 41' 17"	36° 10' 08"	552 m
Sektan	44° 37' 42"	36° 13' 59"	702 m
Degala	44° 26' 23"	36° 12' 43"	856 m
Shaqlawa	44° 15' 58"	36° 25' 14"	891 m

The study area is located in northeastern part of the Arabian Plate on the Unstable Shelf directly to the southwest of the main Zagros Suture Zone (Buday and Jassim, 1987 and Jassim and Goff, 2006). All sections of this study are located in the High Folded Zone.

The area was affected by transversal blocks and it was intermittently uplifted in Cretaceous and Palaeogene time and strongly deformed in the Late Tertiary. The High Folded Zone covers most of the Iraqi Kurdistan region.

It comprises harmonic folds with Mesozoic limestone in their cores and Palaeogene and Neogene limestone and clastics on their flanks (Jassim and Goff, 2006). The strata suffered from intense deformations especially those located within the axis of synclines due to the imposed stress of Iranian Plate. The stresses generated many thrust and transverse faults in the area. Most of the gorges are developed along transversal, normal and strike slip faults, (Figure 2).

Fig.2: set of normal faults near Sektan

The present study aims to determine the biozones of the Dokan, Gulneri and Kometan formations. To achieve this aim, 277 samples have been collected from seven outcrops that belong to Dokan. Gulneri and Kometan formations in Sulaimaniyah and Erbil governorates; of which 550 slides were prepared in the workshop of department of Geology, University of Baghdad. The slides were examined under microscope to determine the age and the stratigraphic range of the fossils.

PREVIOUS WORK

- **Dokan Formation**
  - Lancaster (1957) (in Bellen *et al*., 1959) described the Dokan as separate formation, it was formally included in the Kometan Formation. The type locality is on the site of the Dokan Dam in the High Folded Zone. It comprises 4 m of light colored grey and white oligosteginal limestone, locally rubbly, with glauconitic coatings of the pebble-like masses.
  - Buday (1980) shows that the depositional environment of this formation was of open sea, evidenced by the abundant pelagic faunal elements, including Ammonites.
  - Alsharhan (2003) shows that Dokan Formation is developed in the High Folded Zone in northeastern Iraq, the formation ranges in thickness from 4 to 150 m. It consists of light-colored, grey with white locally rubbly, oligosteginal limestone, with glauconite coated on pebble-like masses. It is bounded by unconformities above and below.
  - Hashem (2010) studied the Dokan Formation in Zewa and Azmer, NE Iraq and she gave a Late Cenomanian age to the formation according the presence of *Rotalipora cushmani* (Morrow) *Rotalipora greenhornensis* (Morrow) range zone reflecting deep marine depositional environment due to the presence of oligostegina and *Rotalipora* species.

- **Gulneri Formation**
  - Lancaster (1957) (in Bellen *et al*., 1959) was the first to describe the formation from the site of Dokan Dam in the High Folded Zone, NNE of Sulaimaniyah, where it consists of about 2 m of black bituminous, finely laminated, calcareous shale with some glauconite and cellophane in the lower part.

The Gulneri Shale Formation is a thin, highly condensed unit which is locally at the top of the Cenomanian – Early Turonian sequence. Stratigraphic breaks occur at the base and top of the formation.

- Bellen *et al*. (1959) described the *Rotalipora* cf. *appenninica*, *Globotruncana helvetica,* minute globigerinids, fish detritus, small bicarinate *Globotruncana*, indicating early Turonian age. *Globotruncana* (*helvetoglobotruncana*) *helvetica* is restricted in range to the *Helvetica* Zone of the late Early-early Middle Turonian.
- Karim *et al*. (2009) studied the Gulneri Formation in the Dokan area NE Iraq. They found that the formation consists mainly of marl and marly limestone with no more than 20% laminated shale. Thin section study showed that the shale is highly deformed, which has foliation-like texture. Therefore, most probably the previously described shale is originally marl, changed to laminated shale-like rock, by pressure that released insoluble residue and bitumen materials from surrounding rocks. Also they found that the upper and lower contacts of the Gulneri Formation seem to be conformable; as conglomerates, erosional surfaces and paleosoils were not found. They suggested that the formation combining should be merged with the Kometan Formation because the formation occurs only in Dokan dam site and it does not exist in the surrounding areas.
- Hashem (2010) studied the Gulneri Formation in Zewa and Azmer, NE Iraq and she gave a Turonian age for the formation according to the presence of *Helvetoglobotruncana helvetica* range zone and a deep marine water under reduced and poisonous conditions and limited water circulation as the depositional environment of the formation.

- **Kometan Formation**
  - Dunnington (1953) (in Bellen *et al*., 1959) was the first to describe the formation from the Kometan village near Endezah in NE Iraq. The formation comprises 120 m of light grey, thin bedded, glolobigerinal-oligosteginal limestone, locally silicified (with chert concretions in some beds), with a glauconitic bed at the base (Bellen *et al*., 1959). The formation has a similar lithology throughout the Balambo – Tanjero Zone. However, to the W and SW it becomes increasingly argillaceous. The formation also contains varying proportions of globigerinal and oligosteginal limestone.
  - Bellen *et al*. (1959) indicated that the basal beds of the formation are of Turonian age (based on the presence of *Globotruncana renzi*, and that the overlying beds are of Santonian age.
  - Al-Tememmy (1986) studied the biostratigraphy of Kometan Formation and divided it into four biostratigraphic foraminiferal Zones, these are: *Globotruncana renzi – Glt. sigali* zone, *Glt. concavata* zone, *Glt. fornicate* zone and *Glt. fornicate – Glt. elevate – Glt. stuartiformis* assemblage zone.
  - Al-Sheikhly *et al.* (1989) found five new species belonging to the Kometan Formation; these are *Spiroplectammina sayyabi*, *S. rectangularis*, *Gaudryinella kometanensis*, *G. triqaudratus* and *Osangularia abnormis*.
  - Karim *et al*. (2008) re-studied the contact between Kometan and Shiranish formations in the field and laboratory and divided the contact into three types: obvious gradational, burrowed and glauconitic and sharp contacts.
  - Hashem (2010) studied the Kometan Formation in Zewa and Azmer, NE Iraq and she gave a Coniacian – Campanian age for the formation according to the presence of *Dicarinella primitiva* (DALBIEZ) *Dicarinella concavata* (BROTZEN) range zone and *Globotruncana elevata* (BROTZEN) range zone. The deep marine is the depositional environment of the formation.

BIOSTRATIGRAPHIC ZONES

Eleven biozones can be distinguished in the studied sections; these are from the oldest to the youngest:

1. *Ticinella primula* Zone (Fig.3)

Category	Total Range Zone
Age	Middle Albian
Authors	Longoria and Gamper (1974)
Definition	Interval from first appearance datum (FAD) of *Ticinella primula* to Last appearance datum (LAD) of *Ticinella primula*
Remarks	This zone is recognized in Dokan Formation, Surdash section, Sulaimaniyah governorate, NE Iraq

2. *Rotalipora ticinensis* Zone (Fig.8)

Category	Total Range Zone
Age	Upper Albian
Authors	Dalbiez (1955)
Definition	Interval from (FAD) of *Rotalipora ticinensis* to (LAD) of *Rotalipora ticinensis*
Remarks	This zone is recognized in Dokan Formation, Degala section, Erbil governorate, NE Iraq

3. *Rotalipora appenninica* Zone (Figs.5, 7 and 8)

Category	Total Range Zone
Age	Upper Albian
Authors	Bronnimann (1952)
Definition	Interval from (FAD) of *Rotalipora appenninica* to (LAD) of *Rotalipora appenninica*
Remarks	This zone is recognized in Dokan Formation, Khalakan and Sektan sections, Sulaimaniyah governorate, and Degala section, Erbil governorate, NE Iraq

4. *Guembelitria cenomana* Zone (Figs.4, 5 and 8)

Category	Total Range Zone
Age	Cenomanian
Authors	None
Definition	Interval from (FAD) of *Guembelitria cenomana* to (LAD) of *Guembelitria cenomana*
Remarks	This zone is recognized in Gulneri Formation, Qallat and Khalakan section, Sulaimaniyah governorate and Degala section, Erbil governorate, NE Iraq

5. *Whiteinella archaeocretacea* Zone (Figs.3, 5 and 8)

Category	Partial Range Zone
Age	Lower Turonian
Authors	Bolli (1966)
Definition	Interval from (FAD) of *Whiteinella archaeocretacea* to (FAD) of *Helvetoglobotruncana Helvetica*
Remarks	This zone is recognized in Kometan Formation, Surdash and Khalakan sections, Sulaimaniyah governorate, and Degala section, Erbil governorate, NE Iraq

6. *Helvetoglobotruncana helvetica* Zone (Figs.3, 5 and 6)

Category	Partial Range Zone
Age	Middle Turonian
Authors	Sigal (1955)
Definition	Interval from (FAD) of *Helvetoglobotruncana helvetica* to (FAD) of *Marginotruncana sigali*
Remarks	This zone is recognized in Kometan Formation, Surdash, Khalakan and Hezob sections, Sulaimaniyah governorate, NE Iraq

7. *Marginotruncana sigali* Zone (Figs.3 and 8)

Category	Total Range Zone
Age	Upper Turonian
Authors	Barr (1972)
Definition	Interval from (FAD) of *Marginotruncana sigali* to (LAD) of *Marginotruncana sigali*
Remarks	This zone is recognized in Kometan Formation, Surdash section, Sulaimaniyah governorate and Degala section, Erbil governorate, NE Iraq

8. *Dicarinella primitiva* Zone (Figs.6 and 8)

Category	Partial Range Zone
Age	Lower Coniacian
Authors	Caron (1978)
Definition	Interval from (FAD) of *Dicarinella primitiva* to (FAD) of *Dicarinella concavata*
Remarks	This zone is recognized in Kometan Formation, Hezob section, Sulaimaniyah governorate and Degala section, Erbil governorate, NE Iraq

9. *Dicarinella concavata* Zone (Figs.3, 4, 5, 6 and 8)

Category	Total Range Zone
Age	Late Coniacian to Early Santonian
Authors	Sigal (1955)
Definition	Interval from (FAD) of *Dicarinella concavata* to (LAD) of *Dicarinella concavata*
Remarks	This zone is recognized in Kometan Formation, Surdash, Qallat, Khalakan and Hezob sections, Sulaimaniyah governorate, and Degala section, Erbil governorate, NE Iraq

10. *Dicarinella asymetrica* Zone (Figs.3 and 6)

Category	Total Range Zone
Age	Middle to Upper Santonian
Authors	Postuma (1971)
Definition	Interval from (FAD) of *Dicarinella asymetrica* to (LAD) of *Dicarinella asymetrica*
Remarks	This zone is recognized in Kometan Formation, Surdash and Hezob sections, Sulaimaniyah governorate, NE Iraq

11. *Globotruncana sigali – Globotruncana renzi* Zone (Fig.9)

Category	Total Range Zone
Age	Upper Turonian to Lower Coniacian
Authors	Bolli (1957)
Definition	Interval from (FAD) of *Globotruncana sigali* to (LAD) of *Globotruncana renzi*
Remarks	This zone is recognized in Kometan Formation, Shaqlawa section, Erbil governorate, NE Iraq

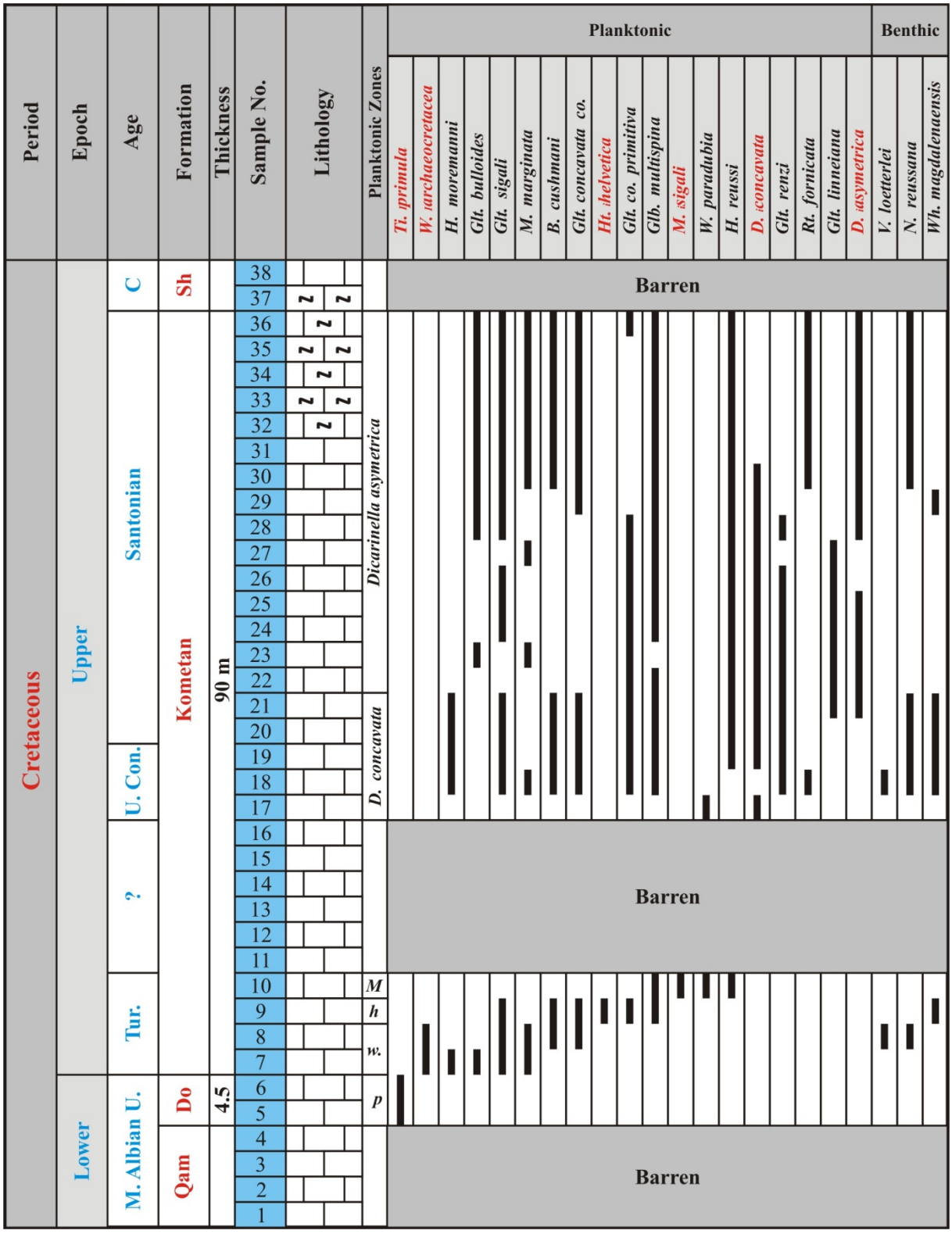

Fig.3: Biostratigraphic range chart of foraminifera in Surdash section
(Not to scale)

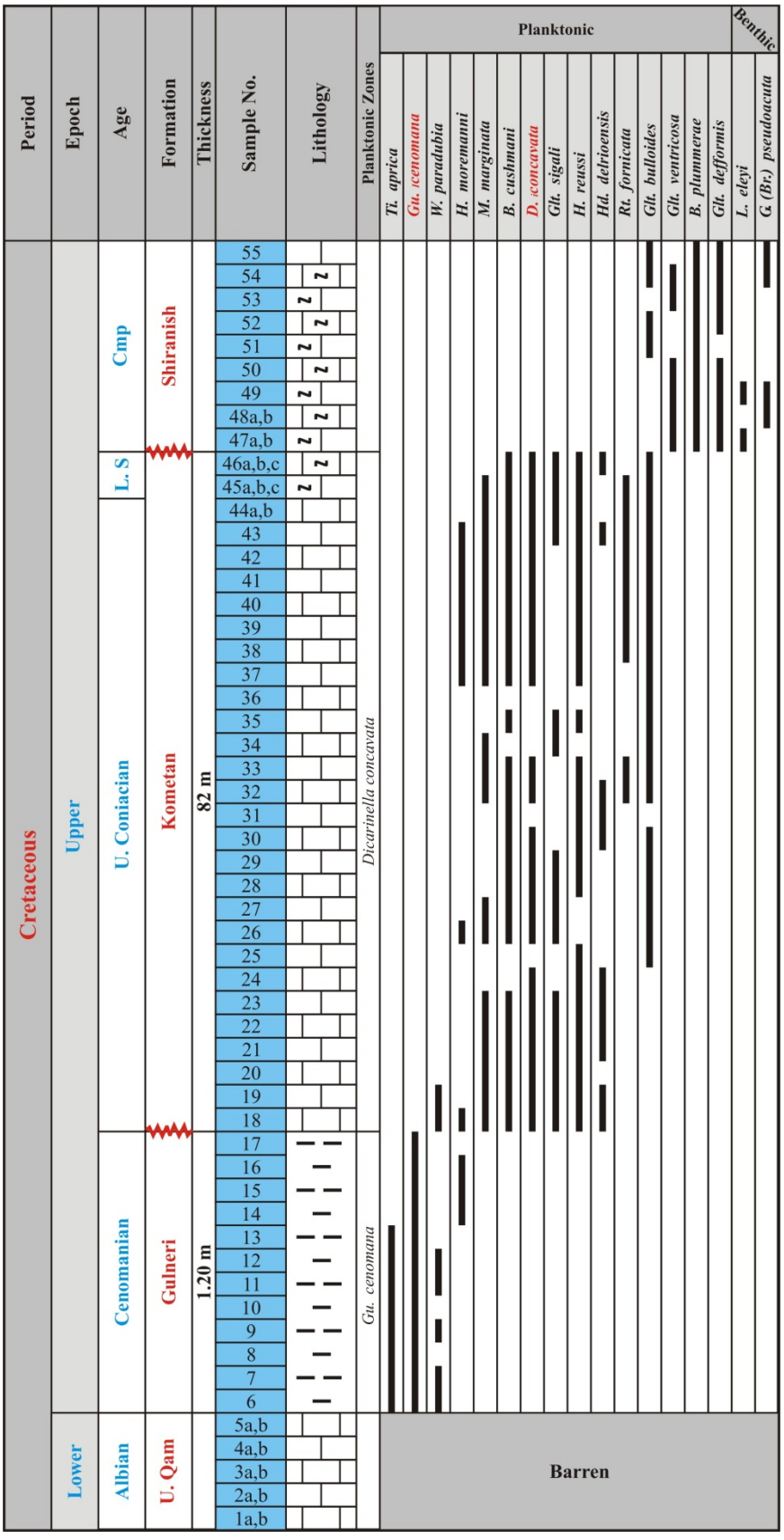

Fig.4: Biostratigraphic range chart of foraminifera in Qallat section (Not to scale)

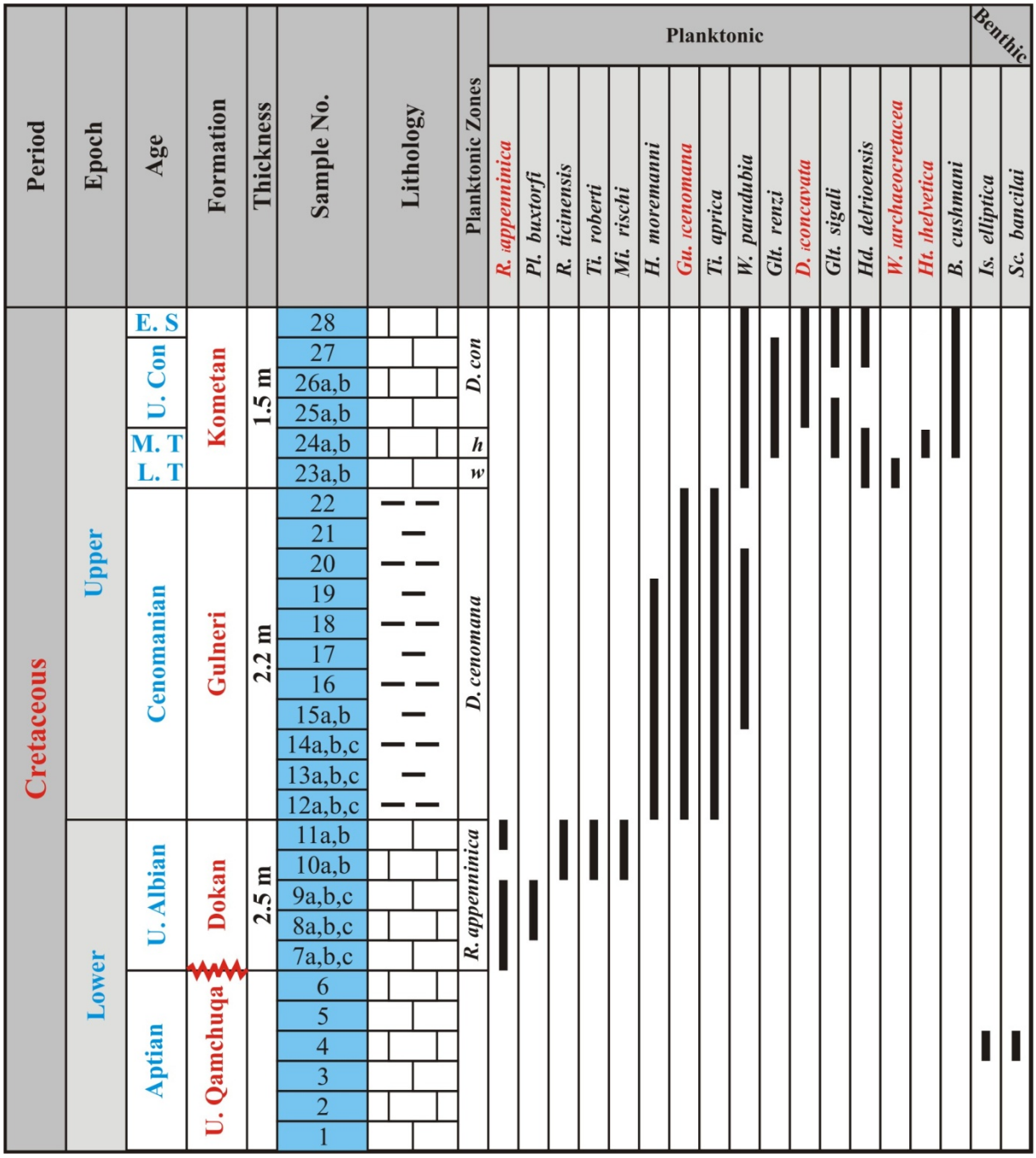

Fig.5: Biostratigraphic range chart of foraminifera in Khalakan section
(Not to scale)

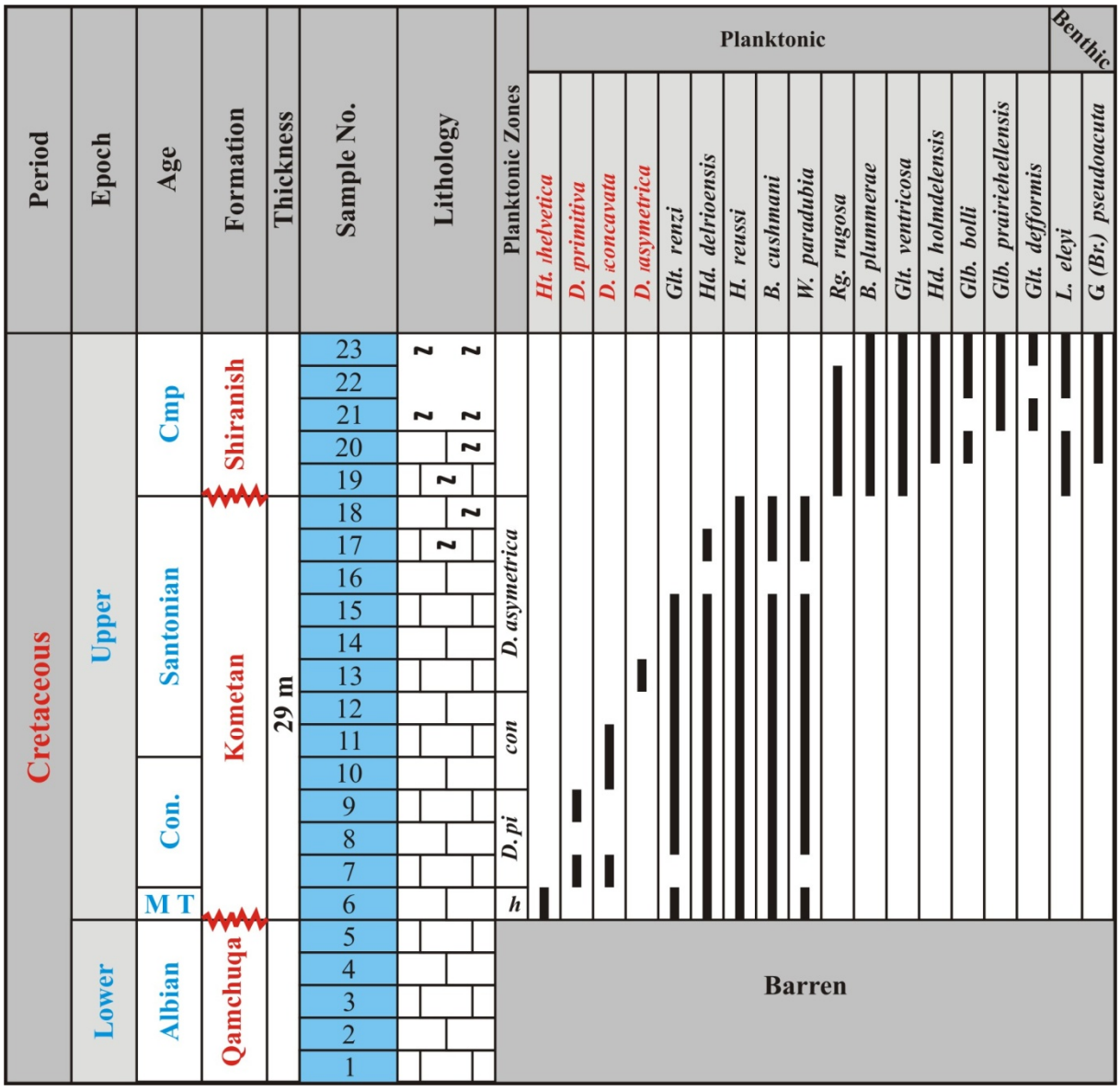

Fig.6: Biostratigraphic range chart of foraminifera in Hezob section
(Not to scale)

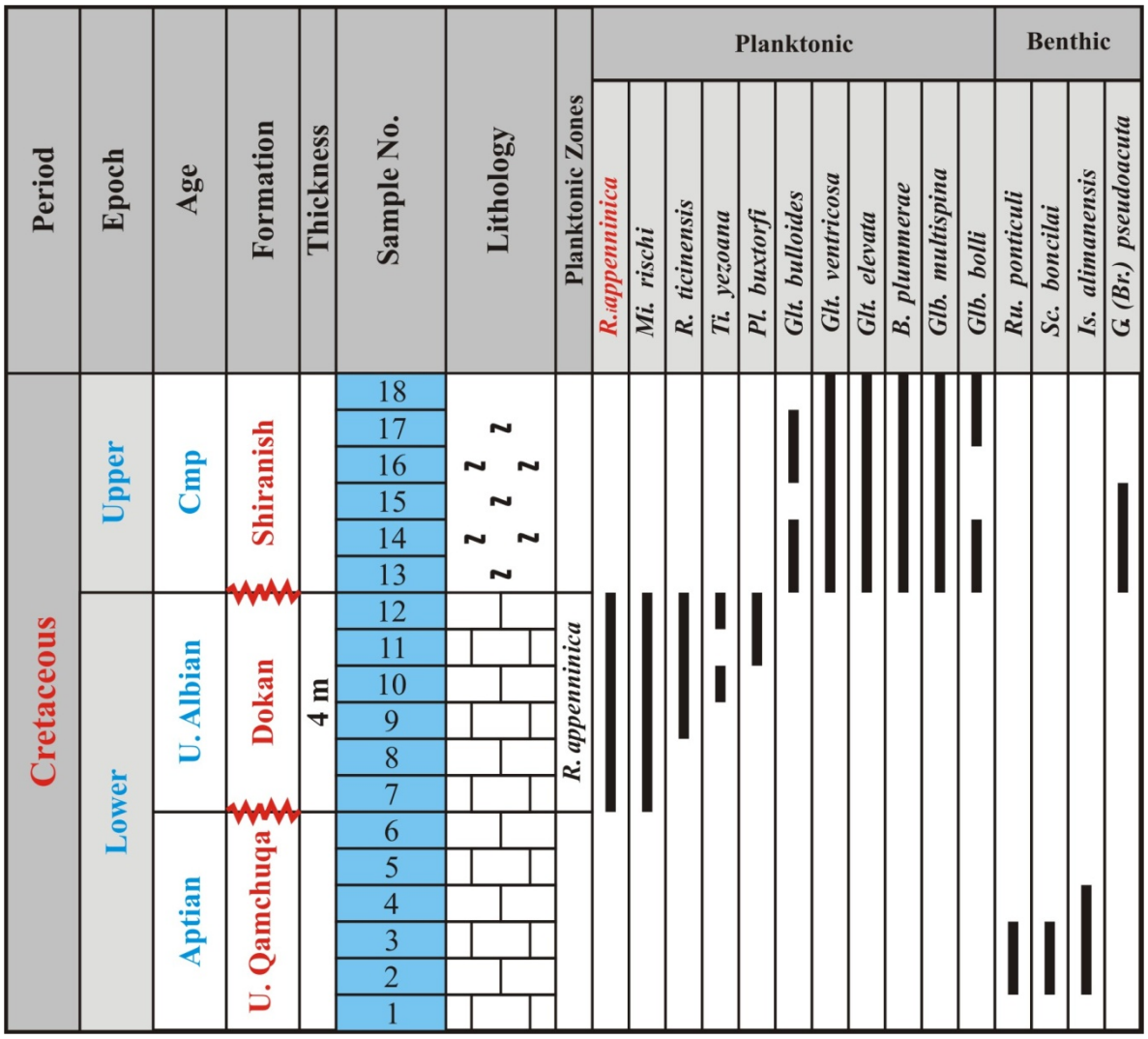

Fig.7: Biostratigraphic range chart of foraminifera in Sektan section
(Not to scale)

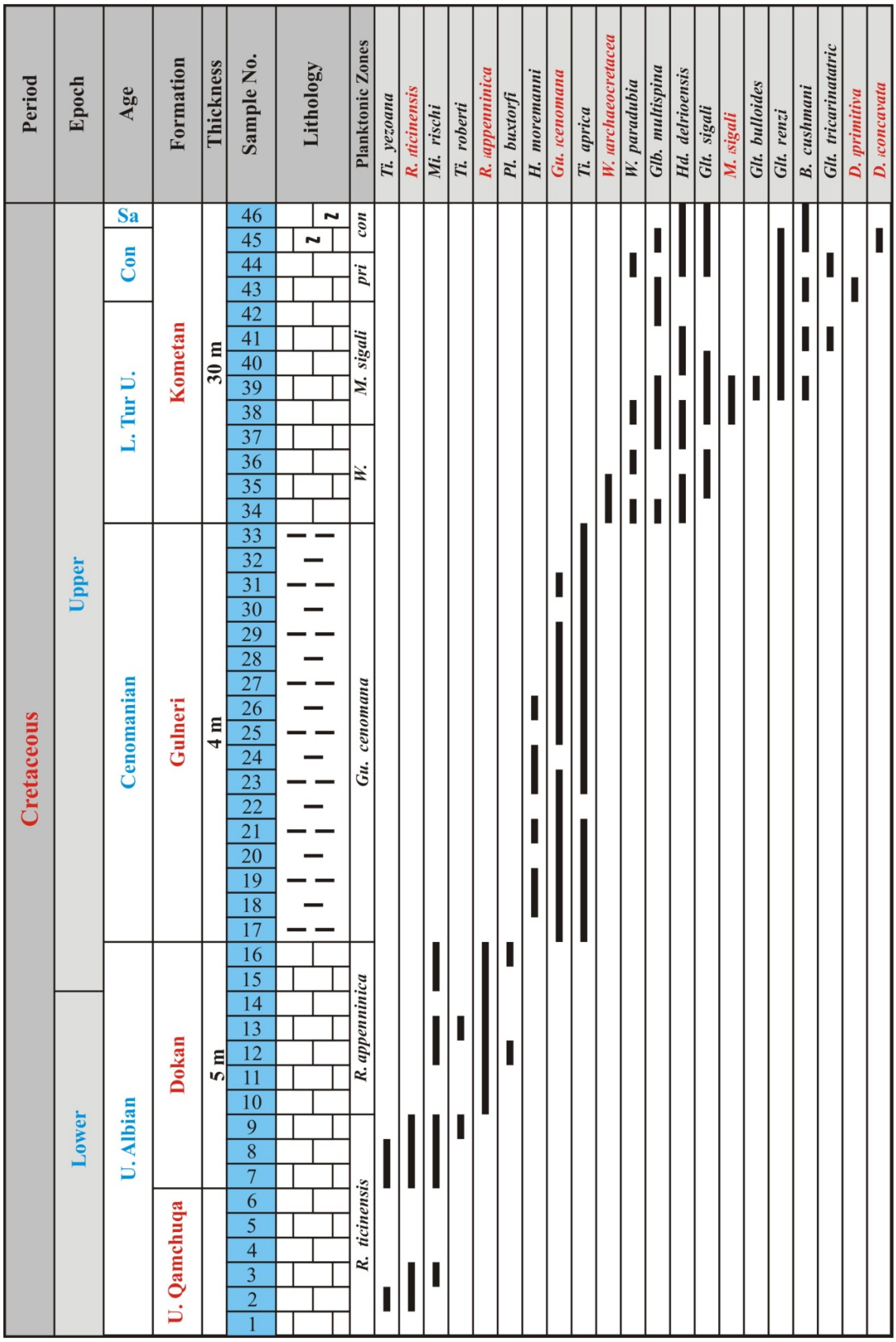

Fig.8: Biostratigraphic range chart of foraminifera in Degala section
(Not to scale)

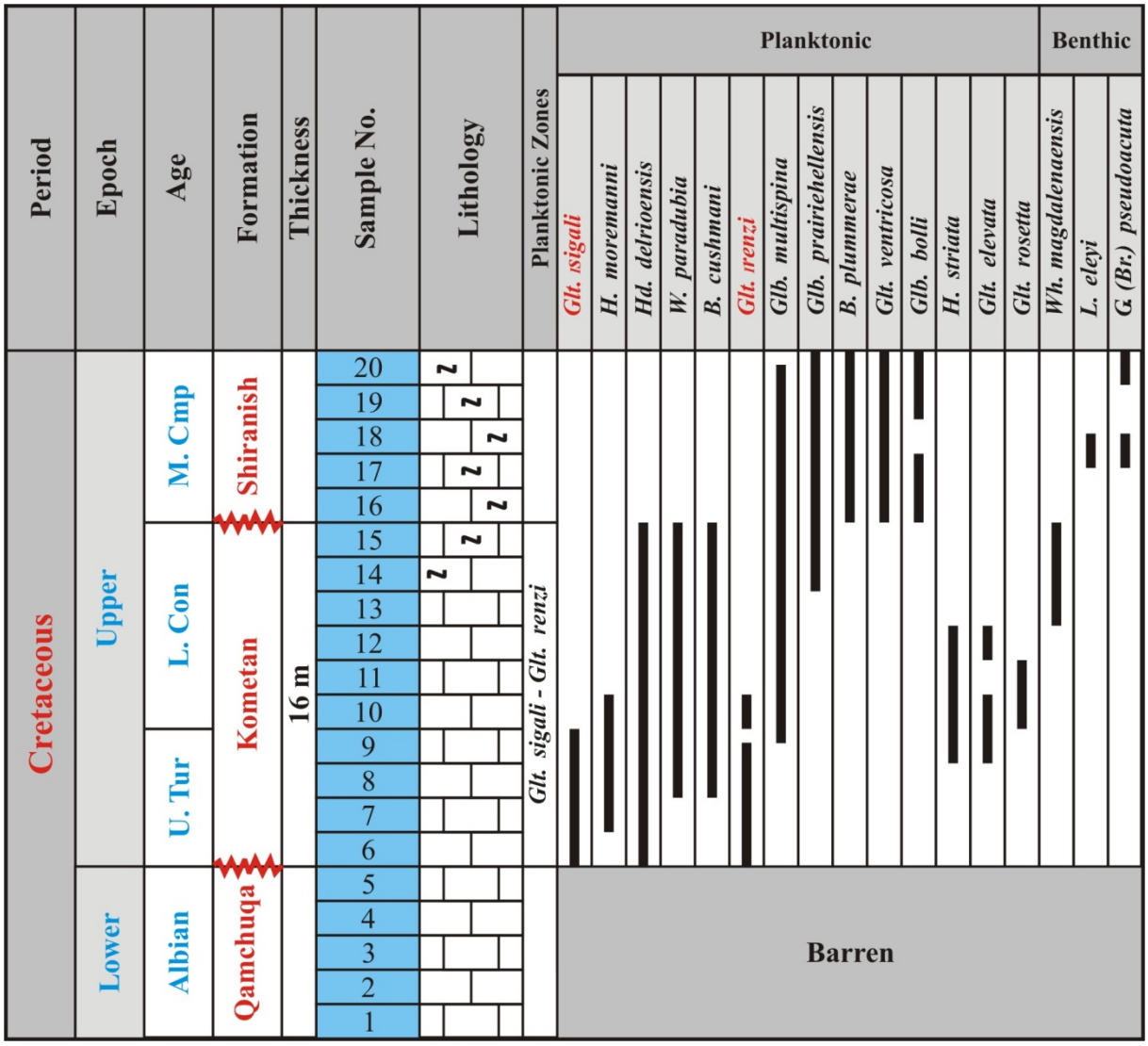

Fig.9: Biostratigraphic range chart of foraminifera in Shaqlawa section
(Not to scale)

Legend for figures (3, 4, 5, 6, 7, 8 and 9)

No.	Symbol	Explanation	No.	Symbol	Explanation
1.		stylolite	**2.**		limestone
3.		Marly limestone	**4.**	****	Glauconite
5.		Unconformity	**6.**		Chert nodules
7.		shale	**8.**		Marl
9.	""""""""	bioturbation	**10.**	Sh.	Shiranish formation
11.	Cmp	Campanian	**12.**	Do.	Dokan formation
13.	M.A.	Middle Albian	**14.**	Qam	Qamchuqa formation
15.	L.	Lower	**16.**	Alb	Albian
17.	Cen.	Cenomanian	**18.**	Gul.	Gulneri formation
19.	Tur.	Turonian	**20.**	Con.	Coniacian
21.	San.	Santonian	**22.**	*Ti.*	*Ticinella*
22.	*W.*	*Whiteinella archaeocretacea*	**23.**	*Glt.*	*Globotruncana*
24.	*M.*	*Marginotruncana*	**25.**	*B.*	*Bronnimannella*
27.	*H.*	*Heterohelix*	**28.**	*D.*	*Dicarinella*
29.	*Glb.*	*Globigerinelloides*	**30**	*Rt.*	*Rosita*
31.	*co.*	*concavata*	**32.**	*N.*	*Nonionella*
33.	*V.*	*Valvulinerea*	**34.**	*Wh.*	*Wheelerella*
35.	*Gu.*	*Guembelitria*	**36.**	*L.*	*Luxostomum*
37.	*Hd.*	*Hedbergella*	**38.**	*G.*	*Gavelinella*
39.	*Is.*	*Istriloculina*	**40.**	*Sc.*	*Scythiloculina*
41.	*R.*	*Rotalipora*	**42.**	*Mi.*	*Microhedbergella*
43.	*Pl.*	*Planomalina*	**44.**	*Ht.*	*Helvetoglobotruncana*
45.	*Rg.*	*Rugoglobigerina*	**46.**	*Ru.*	*Rumanoloculina*
47	*Br*	*Brotzenella*	**48**	*Gltn*	*Globotruncanita*
49	Ben	Benthic	**50**	C	Campanian
51	*p.*	*Ticinella primitiva*	**52**	*h*	*Ht. helvetica*
53	S	Santonian	**54**	T.	Turonian

DISCUSSION

***Ticinella primula* RZ** has been described as Interval Zone by (Van Hinte (1976), Sigal (1977) and Caron (1985) (in Bolli *et al*., 1985).

Neagu T. (2005) suggested that *Ticinella primula* first appeared in the Middle Albian and decreased in the upper part of Middle Albian.

***Rotalipora ticinensis* zone** has been described by Dalbiez (1955), Wonders (1980) and Caron (1985) (in Bolli *et al*., 1985) as interval zone from the Upper Albian. Bolli (1966) (in Bolli *et al*., 1985) described this zone from the Middle Albian.

***Rotalipora ticinensis* zone** is equivalent to the middle part of *Biticinella breggiensis* zone which was described by Postuma (1971) and Van Hinte (1976); (in Bolli *et al*., 1985) and equivalent to the upper part of *Biticinella breggiensis* zone which was described by Sigal (1977) (in Bolli *et al*., 1985).

Li *et al*. (2009) also described this zone from the Upper Albian.

***Rotalipora appenninica* zone** has been described by Bronnimann (1952) (in Bolli *et al*., 1985) as an interval zone. Bolli *et al*., (1966) and Van Hinte (1976) (in Bolli *et al*., 1985) and Wonders (1980) and Caron (1985) (in Bolli *et al*., 1985) also recognized this zone from the Upper Albian.

***Rotalipora appenninica* zone** is equivalent to the upper part of *Biticinella breggiensis* zone equivalent to the lower part of *Planomalina buxtorfi* zone were recognized by Postuma (1971).

Guembelitria cenomana as a species was recognized as Cenomanian species by Caron (1985) (in Bolli *et al*., 1985) and Ehinola (2010).

***Guembelitria cenomana* zone** is equivalent to *Rotalipora brotzeni, R. reicheli, R. cushmani* Zones published by Bolli 1966; in Bolli *et al*., 1985, and equivalent to *R. evoluta, R. cushmani* zones published by Pessagno (1967) (in Bolli *et al*., 1985), and equivalent to *R. appenninica, R. greenhornensis, R. cushmani* zones by Postuma (1971) and wonders (1980) (in Bolli *et al*., 1985), and *Rotalipora brotzeni, R. cushmani* zone by Sigal (1977) (in Bolli *et al*., 1985), and *Rotalipora brotzeni, R. reicheli, R. cushmani* Zones published by Caron (1985) (in Bolli *et al*., 1985).

***Whiteinella archaeocretacea* zone** has been described as interval zone by (Wonders, 1980, and Caron, 1985) (in Bolli *et al*., 1985) both of them gave the Lower Turonian age to this zone.

***Whiteinella archaeocretacea* zone** was also recognized by Robaszynski (1998) (in Sari, 2006) U. Cenomanian – Early L. Turonian.

***Helvetoglobotruncana helvetica* zone** has been described by Bolli (1966) M. – U. Turonian, Postuma (1971) L. – U. Turonian, Van Hinte (1976), Sigal (1977), Wonders (1980) and Caron (1985) (in Bolli *et al*., 1985) M. Turonian, Robaszynski (1998) (in Sari, 2006) L. – M. Turonian.

***Marginotruncana sigali* zone** was recognized by Pessagno (1967) M. Turonian, Van Hinte (1976) and Sigal (1977) U. Turonian – L. Coniacian, Wonders (1980) and Caron (1985) U. Turonian (in Bolli *et al*., 1985).

***Dicarinella primitiva* zone** has been described by Caron (1978) (in Bolli *et al*., 1985) as interval zone. Wonders (1980) (in Bolli *et al*., 1985) recognized this zone from the Coniacian age.

***Dicarinella primitiva* zone** is equivalent to the lower part of *Globotruncana schneegansi* zone which was described by Bolli (1966) (in Bolli *et al*., 1985) and Postuma (1971), and equivalent to the upper part of *Globotruncana sigali* zone which was described by Van Hinte (1976) (in Bolli *et al*., 1985), and equivalent to the upper part of *Globotruncana schneegansi* zone which was described by Sigal (1977) (in Bolli *et al*., 1985).

***Dicarinella primitiva* zone** is equivalent to the upper part of *Globotruncana renzi-sigali* zone which was described by Youkhana (1976) and Al-Tememy (1989), and equivalent to the lower part of *Dicarinella concavata* zone which was described by Sari (2006).

***Dicarinella concavata* Zone** has been described by Bolli (1966), Pessagno (1967) and Van Hinte (1980) (in Bolli *et al*., 1985) L. – M. Santonian. Also recognized by Postuma (1971) and Wonders (1980) (in Bolli *et al*., 1985) L. Santonian, finally Caron (1985) (in Bolli *et al*., 1985) recognized this zone as U. Coniacian – L. Santonian.
Dicarinella concavata Zone was also recognized by Sari (2006) Coniacian – L. Santonian.

***Dicarinella asymetrica* Zone** has been described by Caron (1985) M. – U. Santonian (in Bolli *et al*., 1985).

***Dicarinella asymetrica* Zone** is equivalent to the upper part of *Marginotruncana concavata* zone and *Globotruncana fornicata* zone which discriminated by Bolli (1966) and Pessagno (1967) (in Bolli *et al*., 1985) and equivalent to the upper part of *Globotruncana concavata* zone and *Globotruncana carinata* zone which described by Postuma (1971).

***Dicarinella asymetrica* zone** is equivalent to the upper part of *Marginotruncana concavata* zone, *Globotruncana carinata* zone and *Globotruncana elevata* zone which described by Winders (1980) (in Bolli *et al*., 1985), and equivalent to *Globotruncana carinata* zone which described by Sigal (1977) (in Bolli *et al*., 1985).

***Dicarinella asymetrica* zone** is equivalent to the upper part of *Globotruncana concavata* zone which discriminated by Youkhana (1976), and equivalent to the upper part of *Globotruncana concavata* zone and *Globotruncana fornicata* zone described by Al-Tememmy (1989). Sari (2006) recognized this zone as Total Range Zone (M. – U. Santonian).

***Glt. sigali-Glt. renzi* zone** was first described by Youkhana (1976) and Al-Tememmy (1989) as a range zone from the Upper Turonian to Lower Coniacian.

***Glt. sigali-Glt. renzi* zone** is equivalent to *Whiteinella archaeocretacea* zone described by Pessagno (1967) and equivalent to *Glt. schneegansi* which was described by Premoli-Silva (1967) (in Bolli *et al*., 1985) and equivalent to the upper part of *Glt. helvetica* zone and the lower part of *Glt. schneegansi* zone which were described by Postuma (1971).

***Globotruncana ventricosa* zone** has been described by Dalbiez (1955); in Bolli *et al*., (1985). Wonders (1980) and Caron (1985) (in Bolli *et al*., 1985) recognized this zone as interval zone from the aged Upper part of Early Campanian to Late Campanian, and Sari (2006) recognized this zone from the Middle Campanian.

***Globotruncana ventricosa* zone** is equivalent to the upper part of *Globotruncana elevata* zone described by Postuma (1971) and Sigal *(*1977) (in Bolli *et al*., 1985) also equivalent to *Globotruncana stuartiformis* zone described by Van Hinte (1976) and equivalent to *Globotruncana calcarata* zone recognized by Premoli silva (1975) (in Bolli *et al*., 1985). Finally *Globotruncana ventricosa* zone is equivalent to the *Globotruncana fornicata* zone recognized by Youkhana (1976).

CONCLUSIONS

- Eleven biozones was distinguished from Albian – Campanian age and at least two biozones up to seven biozones can be discriminated in each section along the study area.
- The nature of contact between each two formation is variable according to the section.
- Maximum thickness of Kometan Formation is in Surdash and Qallat sections and it thins laterally toward Shaqlawa section and is absent in Sektan section.
- Maximum thickness of Dokan Formation is in Surdash section and thins laterally toward the NW until it disappears in Shaqlawa section.
- Maximum thickness of Gulneri Formation is in Degala section and thins laterally toward Khalakan reaching its minimum thickness in Qallat section and because absent toward the SE and NW.
- The age of Dokan Formation is Upper Albian.
- The age of Gulneri Formation is Cenomanian.
- The age of Kometan Formation is Turonian – Santonian.

ACKNOWLEDGMENT

The authors wish to thank the Department of Geology, University of Baghdad for providing the opportunity and facilities to complete this research. They are also indebted to the Departmental field staff (Summer 2012) for their full support during field work. Thanks are due to Dr. Mazin Y. Tamer Agha for his help and support. They would like also to thank Mr. Mahir Mandil for his full help during the field work.

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