Sedimentological and Depositional Environment of Upper Cretaceous Sediments “Ain Topi member” NW Libya Gharyan Area.

Ayub Sijok Abdelwahed Makhlof Abdelraoof Tabeb.

department of Earth science, Faculty of science, Azzytuna University.

ملخص:

يمثل عضو عين طبي المكون السفلي لتكوين سيدي الصيد ويحده من الاسفل تكوين ككلة بسطح عدم توافق ، ويعلوه عضو يفرن من أعلى بترسيب تدريجي.والتابع لرواسب حقبة الحياة المتوسطة من العصر الطباشيري (الكريتاسي) العلوي، والذي يقع غرب ليبيا ، وبالتحديد تم اختيار مقطع طبقـي بجبل نفوسة (بمنطقة أبوغيلان - مدينة غريان) 70كم شمال غرب طرابلس . حيث ركزت الدراسة على المشاهدة الحقلية والوصفية المعملية لرواسب صخور الكربونات والعينات التي تم جمعها زمن تم دراستها معمليا، والتي تتكون من الحجر الجيري والحجر الجيري الدولوميتي غالبا ، بالاضافة الى التعرف على البنيات الرسوبية الواضحة كالتطبق الجيد والترقق وكذلك التطبق المتفاطع. وتحديد البيئات الرسوبية من خلال وصف العينات.

Abstract

Ayn Tobi member represents the upper cretaceous (Cenomian) age. And it is a lower member of the SIDI AS SID Formation, which is followed up gradationally by the Yafrin member, and Nalut Dolomite. The Ayn Tobi member is unconformably underline by Kiklah Formation in the west and the Abu Shaybah Formation in the east. Which is located in western Libya. Jabal Nafusa (Abu

Ghaylan area - Gharyan city) 70 km northwest of Tripoli. Where the study focused on field observation and laboratory descriptive sediments of carbonate rocks and samples that were collected and studied in the same time, which consist of limestone and mostly dolomitic limestone, in addition to identifying clear sedimentary structures such as well bedding and lamination , as well as cross bedding . Also determine the sedimentary environments by describing samples.

Introduction:

The Sidi as Sid Formation was named and described by El Hinnawy and Cheshitev for a marine sequence in the Gharyan area overlying the Kiklah Formation in the west and the Abu Shaybah Formation in the east. The formation comprises two members, a lower carbonate unit named the Ayn Tobi Member, and an upper marlstone unit, the Yifran Member.

A type section for the Ayn Tobi Member was designated by El Hinnawy and Cheshitev on the Gharyan Dome, as a replacement for the previous composite type section selected by Christie. At this location the member comprises 100m of grey and yellow crystalline limestones and dolomites with thin marlstone interbeds. The base is marked by a thin sandstone horizon which contains quartz pebbles derived from the underlying Kiklah Formation. At the type locality the middle of the limestone is marked by a distinctive horizon full of rudistids and other pelecypods. The lower contact is unconformable, the upper contact with the Yifran Member is gradational. The member contains a rich fauna of pelecypods, echinoderms, Ostracods and algae which indicate a Cenomanian age. (Don Hallet, petroleum geology of Libya).2002.

This member is one of the most widely distributed rock units. Along Tarhuna-Gharyan Scarps it forms the topmost part of these scarps .It consists mainly of well bedded limestone, sometimes dolomitic, yellow to light grey in Colour, The basal part is characterized by the presence of abundant sand grains and quartz pebbles. The type section is well defined in Gharyan Dome where the member is well defined. The Ain Topi has nearly constant Thickness all over the area except the west to the west of Yafrin where it is somewhat thinner 60m, than in the east. Along Tarhuna the Ain Topi Limestone is thicker 110 m and more dolomitic especially in its lower part (Burollet, 1963-a).

For our study of Sedimentological description of the Sidi as Sid Formation ((Ayn Tobi Member)), we collected specimen of the (('Ayn Tobi Member) from locality near Gharyan west Libya, at 32 15 49.6 N, 13 01 07.7 E about 80 km west of Tripoli. (Figure No. 1)

The Upper cretaceous deposits of west Libya were divided into five rock units from base to top: SIDI AS SID, NALOT, QASR TAGHRINNAH, MIZDAH and ALGHARBIA Formation. (Don Hallett 2002). (Figure. 2-A).

In this study, an attempt to describe and interpret about 60 meters of a rocks section of the Sidi as Sid Formation (Ayn Topi Member).

The main objective of this study is a descriptive study (Sedimentology) to investigate and analyze the Upper Cretaceous deposits of the Mesozoic Era, based on the lithological characteristics of this rock section.

During field study, the section was divided into 6 units based on different lithology based on field observations ((Show columnar section Figure No. 2-B)).

The formation of Sidi as Sid, which is divided into two members, from the bottom (Ayn Topi member, then above a Yifren member), and as Ayn Topi member, which characterized by An unconformity surface between Kiklah formation overlying Ayn Topi member, there also at the base of the member and the end of the formation a clear normal fault, as shown in Photo No1.

After that, manual samples were taken and studied descriptively as a first step (Sedimentology) by identifying:

1. Colour : by using The Geological Society of America Rock Color Chart
2. Type of Rock: by using Dunham classification 1963.(Richard Selley, (1988)
3. Porosity and structure
4. Depositional environment.

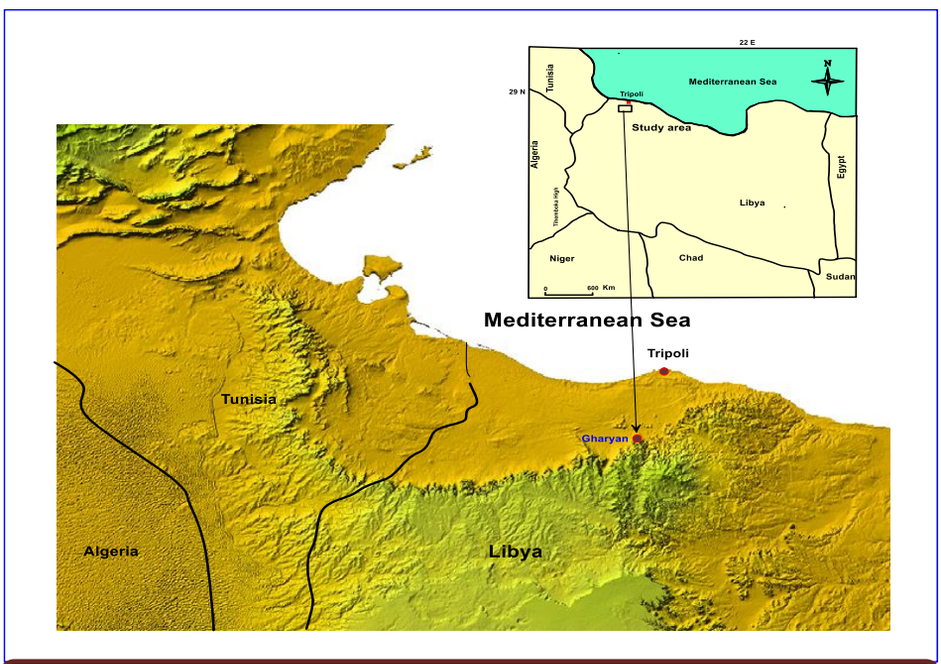


Figure No 1. Location map, Gharyan (study Area)

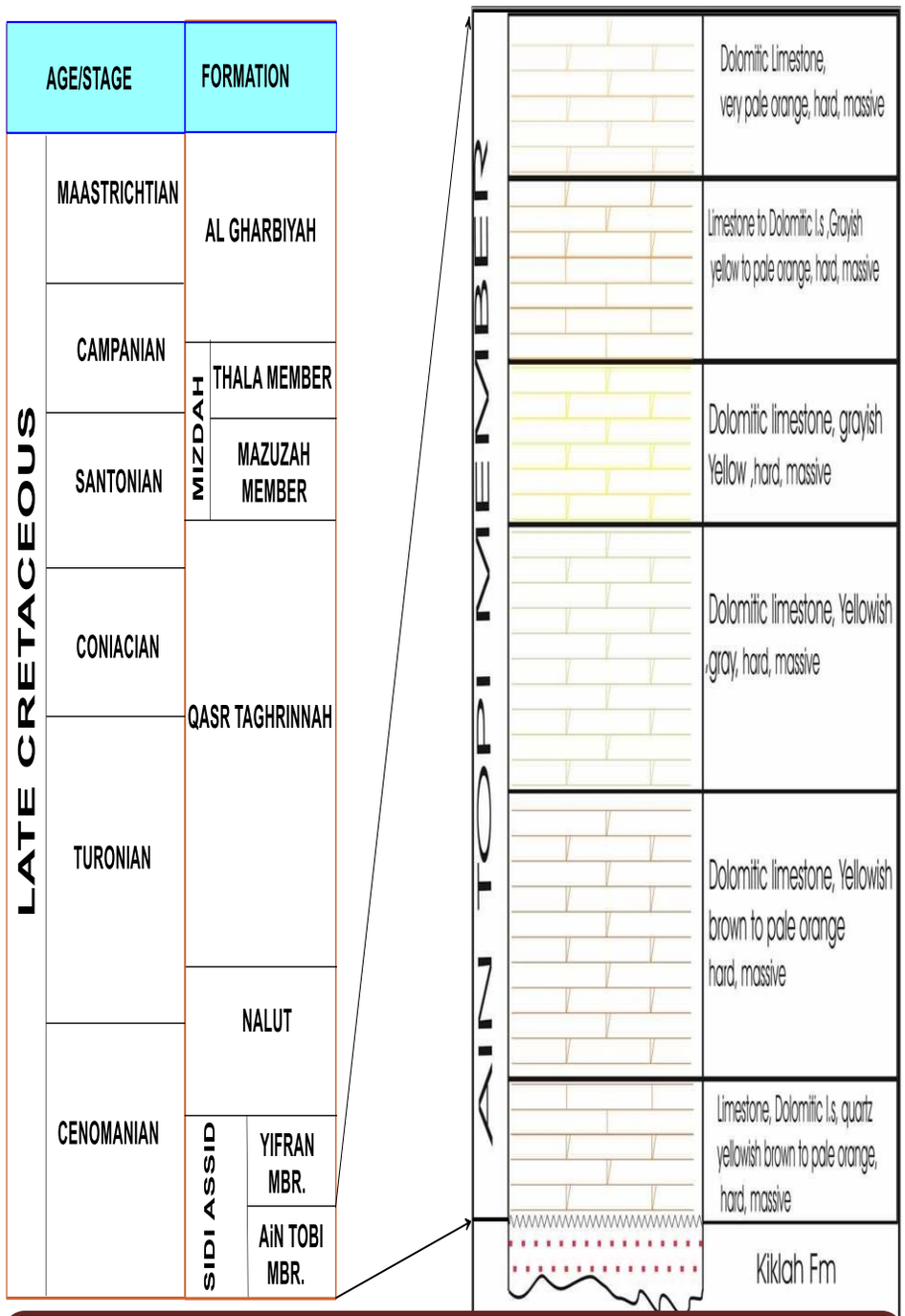


Figure 2. (A) Lithostratigraphic Nomenclature for the upper Cretaceous Rock of west Libya (Hallett, 2002). (B) Lithostratigraphic

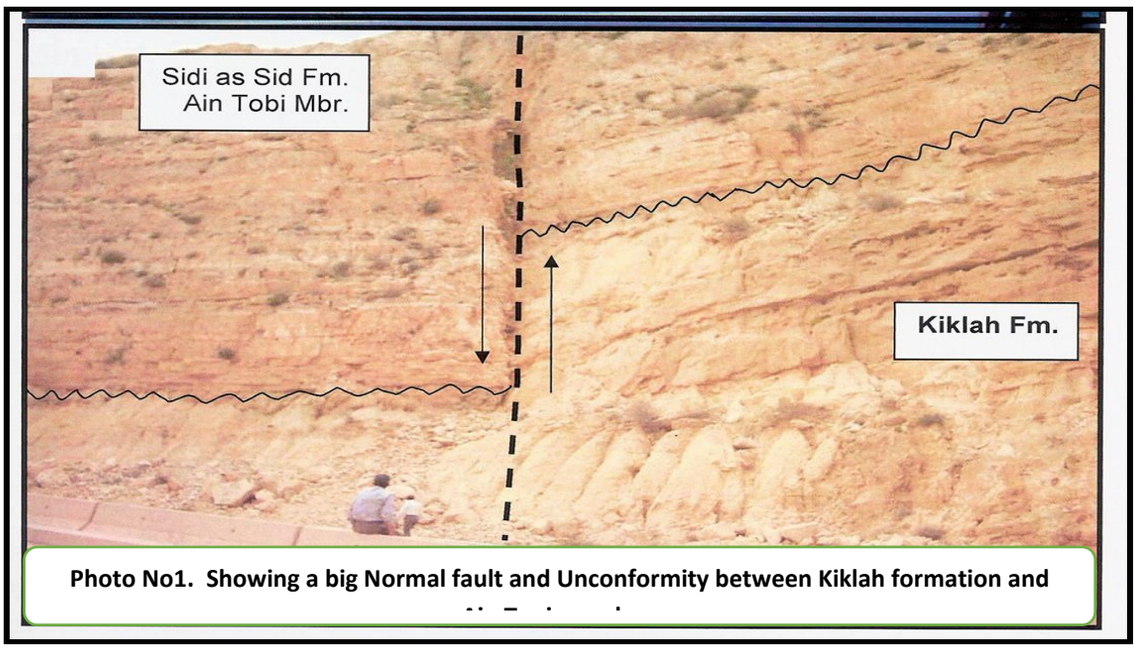


Photo No1. Showing a big Normal fault and Unconformity between Kiklah formation and

(The first unit)

The first unit appears in Photo No. (2). the length of this unit is (7 meters), Limestone to dolomitic limestone, very well bedded, and scatterings of quartz appear at the bottom of the unit. Two samples were taken from this unit and described as follows:

Sample No1.

- Rock type :Dolomitic limestone
- Colour : yellowish brown
- Classification of rock : Mud stone
- Porosity

➢ Close: Because dolomite was observed as cement material in the porosity.

- Sedimentary Structure

➢ Massive

Sample No2.

- Rock type : limestone
- Colour : Very pale orange

- Classification of rock: Wackstone
- Porosity : Open

➢ Close: Because dolomite was observed as cement material in the porosity.

- Sedimentary Structure

➢ Massive

Photo No.2: showing unit 1

(The second unit)

It appears in Photo No. (3) Unit 2. The length of this unit is 14 meters grey and yellow crystalline limestones and dolomites with thin marlstone interbeds .Three samples were taken from this unit and described as follows:

Sample No. 1

- Rock type : Dolomitic limestone
- Colour : Very pale orange
- Classification of rock:Mudstone
- Porosity

➢ Open

- Sedimentary Structure

Massive

Sample No. 2

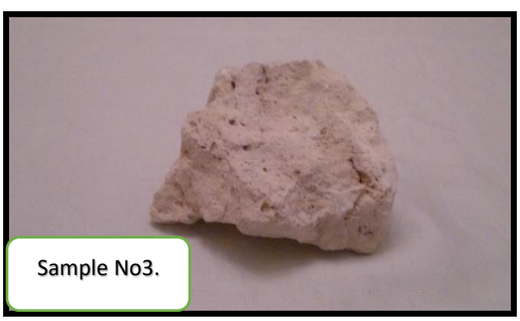
- Rock type : Limestone
- Colour : Yellowish gray
- Classification of rock :Mudstone
- Porosity

➢ Open

- Sedimentary Structure

Massive

Sample No. 3



- Rock type : Dolomitic limestone
- Colour : White
- Classification of rock : Wackstone
- Porosity

➢ Open

- Sedimentary Structure

Massive

Photo No.3: showing unit 2

The Third Unit

The length of this unit is (13 meters), it is characterized by very well beds, Sometimes Laminated beds, Photo No. (4 a and b), three samples were taken from this unit.

Sample No.1

- Rock type: Dolomitic Limestone
- Colour : Yellowish gray
- Classification of rock:Grainstone

- Porosity

➢ Close

- Sedimentary Structure

➢ Laminated

Sample No. 2

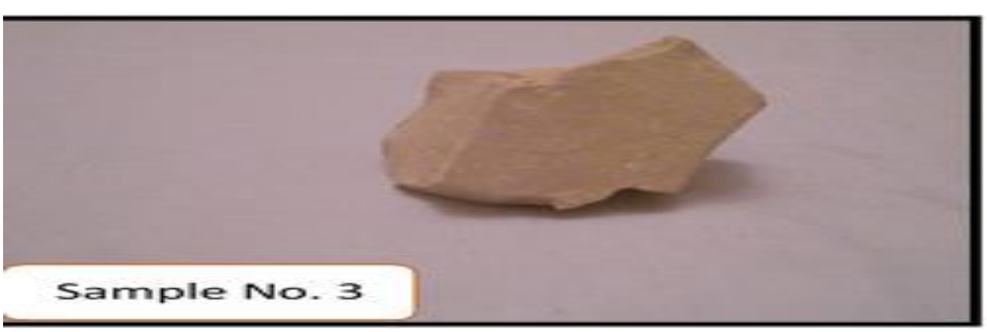
- Rock type: Dolomitic limestone
- Colour : White
- Classification of rock:Mudstone
- Porosity

➢ Open

- Sedimentary Structure

➢ Massive

Sample No. 3



- Rock type: Dolomitic Limestone
- Colour : Grayish yellow
- Classification of rock:Grainstone
- Porosity

➢ Open

- Sedimentary Structure

➢ Massive

Photo No.4 a: showing unit 3

Photo No.4 b : showing Lamination in unit 3

The Fourth unit

The length of this unit is 8 meters, it is characterized by Very thick beds, Unconformity appears at the end of this unit shown in Photo (5 a and b), Two samples were taken from this unit.

Sample No. 1

- Rock type: Dolomitic limestone
- Colour : Grayish yellow
- Classification of rock:Mudstone
- Porosity

➢ Open

- Sedimentary Structure

  ➢ Laminated

Sample No. 2

- Rock type: : Dolomitic limestone
- Colour : Grayish yellow
- Classification of rock:Wackstone
- Porosity

➢ Open

- Sedimentary Structure

Massive

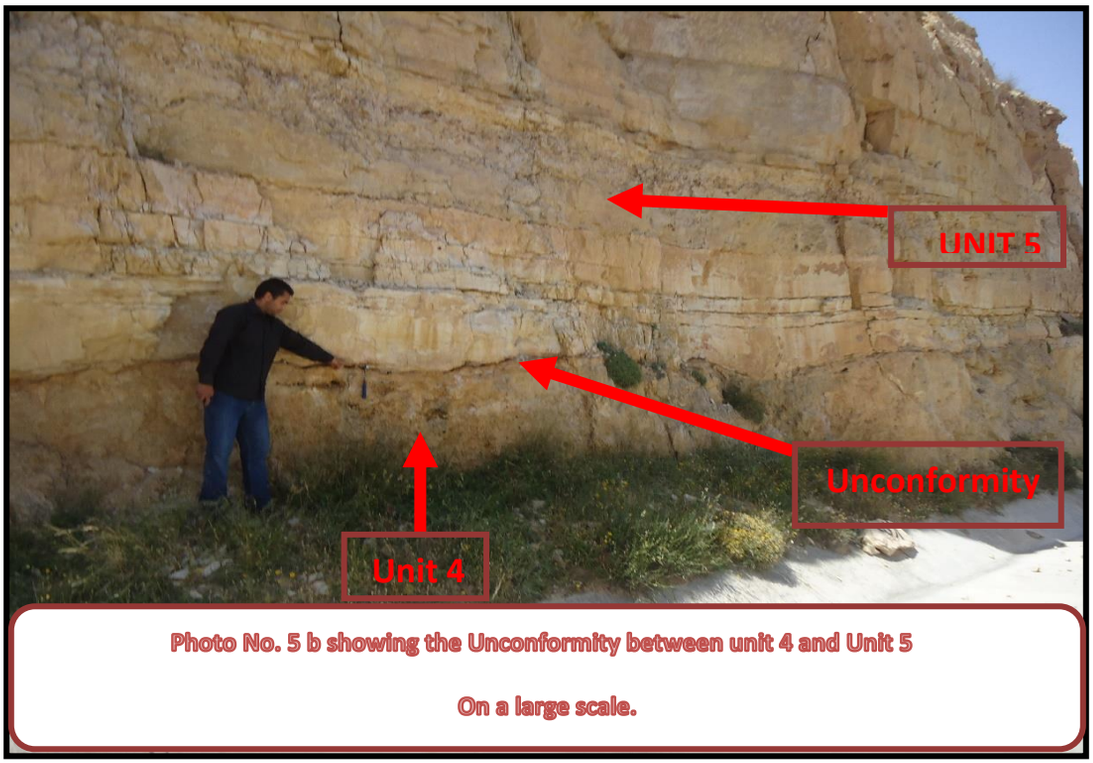


Photo No. 5 b showing the Unconformity between unit 4 and Unit 5

On a large scale.

Photo No. 5 a showing unit 4

The Fifth Unit

The length of this unit 9 meters, it is characterized by Very thick beds, (Photo No. 6). Three samples were taken from this unit.

Sample No. 1

- Rock type: Limestone
- Colour : Grayish Yellow
- Classification of rock:Mudstone
- Porosity

➢ Open

- Sedimentary Structure
  - ➢ Massive

Sample No. 2

- Rock type: Dolomitic limestone
- Colour : White Bluish
- Classification of rock:Grainstone
- Porosity

➢ Close

- Sedimentary Structure

➢ Massive

Sample No. 3

- Rock type: Dolomitic Limestone
- Colour : Very pale orange
- Classification of rock:Mudstone
- Porosity

➢ Open

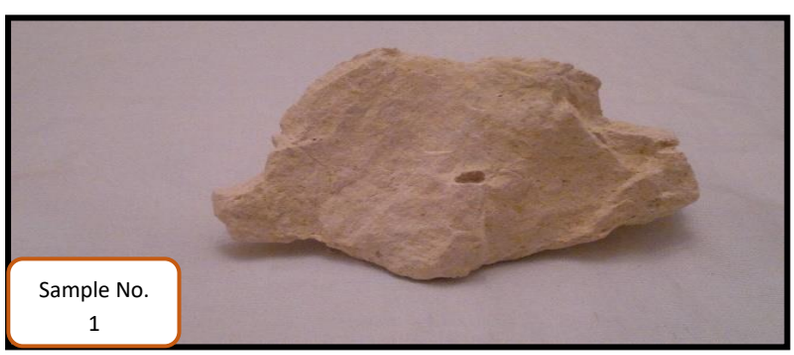
- Sedimentary Structure

Photo No. 6 Showing unit 5

The Sixth Unit

The length of this unit 8 meters, Dolomitic limestone massive beds, which characterized by the top of Ain Topi Member. (Photo No. 7). One sample was taken from this unit.

Sample No. 1



- Rock type: Dolomitic Limestone
- Colour : Very pale orange
- Classification of rock:Mudstone
- Porosity

➢ Open

- Sedimentary Structure

➢ Massive

Photo No. 7 Showing unit 6

Conclusion

The upper cretaceous deposits of west Libya were subdivided into five rock units from base to top: SIDI AS SID, NALOT, QASR TAGHRINNAH, MIZDAH and ALGHARBIA Formation. The formation of Sidi as Sid, which is divided into two members, from the bottom (Ayn Topi member, then above a Yifren member), and as Ayn Topi member, which characterized by An unconformity surface between Kiklah formation overlying Ayn Topi member, there also at the base of the member and the end of the formation a clear normal fault, and an upper marlstone unit, the Yifran Member. Referring to the previous description of the SIDI AS SID formation (Ain Topi Member) and based on different lithological elements, we divided the section into six units based on different lithology on field observations.

For our study of Sedimentological description of the Sidi as Sid Formation ((Ayn Tobi Member)), we collected specimen of the (('Ayn Tobi Member) from locality near Gharyan west Libya, at 32 15 49.6 N, 13 01 07.7 E about 80 km west of Tripoli.

Rock Samples were taken and studied descriptively as a (Sedimentology) by identifying: Colour, Type of Rock: Porosity and structure, Depositional environment: by using Dunham classification 1963.

Through the descriptive study of Ayn Tobi Member that has been chemically deposited as carbonate rocks, the Samples rocks shows and are characterized by high initial porosity as well as secondary porosity (Moldic to Vuggy porosity).

The sedimentary structures that characterize Ayn Tobi Member are 'Massive Bedding. Also the sedimentary energy of Ayn Topi member ranges from: Weak

sedimentation energy, which we conclude that the sedimentary environment that produced the mudstone and Wackstone rocks is a deep or restricted environment (quiet environment). High energy, from which we conclude that the sedimentary environment that produced Grainstone rocks is a shallow environment (active environment).

Acknowledgment

I would like to take this opportunity to thank the Libyan Petroleum Institute for providing the logistical assistance throughout the study, In particular, both respected Geologists (Mr. Mohammed Saaeed, Mr. Yousef Shagroni and Mr. Amazegh Madi) for their valuable efforts and commitment in providing their feedback and recommendation.

References

- BUROLLET, (1963-a).Geological map of Libya; 1:250,000. Sheet: Tarablus NI 33-13. Explanatory Booklet. Ind. Res. Cent., Tripoli, 32 p.
- Don Hallett, (2002). Petroleum geology of Libya. 175p.
- Richard Selley, (1988). Applied Sedimentology. 128p.