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Sedimentological Study of Tanjero Formation– Dokan Section North of Iraq

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Abstract
Tanjero Formation (Campanian- Maastrichitian) has been studied at Dokan section, north of Iraq. Eighteen carbonate samples, include limestone, marly limestone and marl were collected and thinned section to analyze them under polarized microscope. Involved carbonate rock bed units were subdivided, according to petrography, organic contents and diagensis into:

1- Recrystallized Limestone beds,
2- Sugary texture beds,
3- Foraminiferal limestone beds,
4- Planktonic and Benthonic fossiliferous Limestone beds.

Sedimentological study shows that the rock bed units of the lower part were deposited at deep marine environment overlined by supratidal environment; the middle part at open marine shelf; and the upper part at deep shelf marine environment.
Keywords: Iraq, Dokan, sedimentology, petrography, fossils, marine environment.

1- Introduction

Tanjero Formation (Campanian- Maastrachtian) cropped out at high folded and imbricate Zone, North east of Iraq (Buday, 1980) (Fig. 1). It is consists of thick sequence of sandstone and clystone, thick beds of conglomerate and biogenic fossiliferous limestone (Fig. 1). Studied section from Kani Bardina area at the foot of the south western flank of Azmur Mountain which located north east of Sulaimaniyah City (Dunnington, 1952 in Bellen et al., 1959). The lower part is consists predominately of *Globigerinal* open sea, marl and rare beds of marly limestone. The upper part is consists of silty marls, siltstone, sandstone, conglomerates and sandy or silty limestone (Al- Rawi 1981). *Planktonic forminifera* refers to deep marine depositional environment (Al- Kassab, 1975) while the middle part was deposited at deep basin environment (Kamal, 2006). Tanjero Formation is overlined by unconformable contact of basal conglomerate of Kolosh Formation and underlined by conformable contact of Balambo Formation near Azmor Anticline, as well as of Shiranish Formation in other exposures. The aim of this study is to determine the environment of deposition, according to petrographic components, fossils contents and diagenetic processes of the carbonate rock bed units of Tanjero Formation, at Dokan Section, North Iraq.

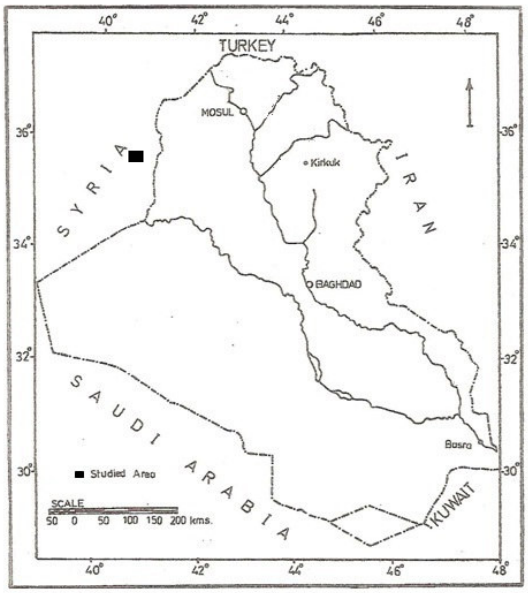
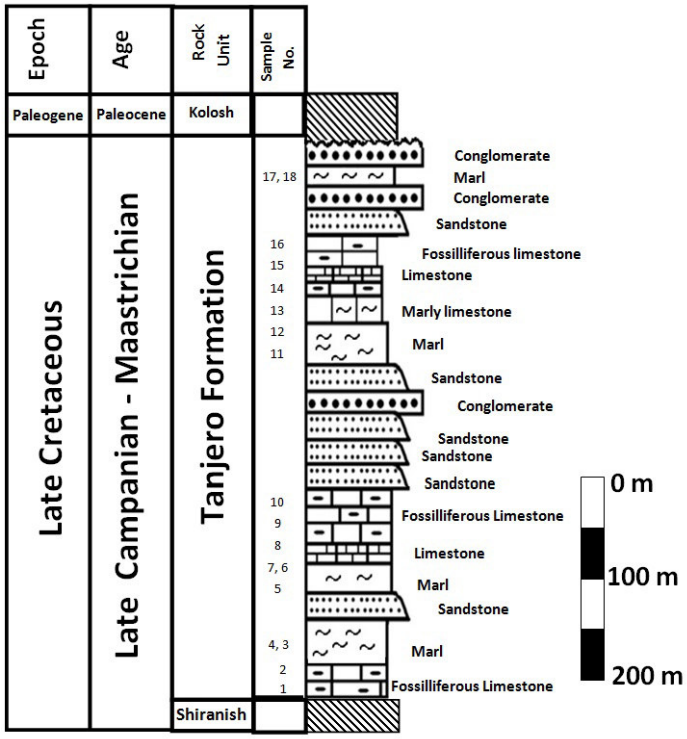


Fig. 1: Location map of studied area.



(Fig. 2): Petrographic description of the studied sections of Tanjero Formation at Dokan North Iraq (after Kamal, 2006).

2- Materials and methods:

Eighteen carbonate samples has been collected from studied Dokan Section which include limestone, marly limestone and marl has been thinned section and examined by polarized microscope to identify petrographic components, fossils contents and diagenetic processes.

3- Results and Discussion:

According to petrography, fossil contents and diagenetic processes, carbonate rock bed units of Tanjero Formation are subdivided into four beds after analyzing 18 thin section by polarized microscope:

3-1-Recrystallized limestone beds:

it is present at the lower bed and consists of micrite (Plate 1-1). The texture of recrystallized Limestone is not clear (Reid, 2000). The main fossils of this bed are *planktonic foraminifera* such as: *Globegerina sp.* (Plate 1-2), *Globotruncana sp.*. The presence of non transported *planktonic foraminifera* refers to quite deep marine environment in which there is no sediment transportation (Schlager, 2002), and Ostracoda also presence. Dolomite and Pyrite minerals are scattering within matrix and filled fossils chambers. Dolomite refers to the dolomitization which deposited either authigenic or from underground water (Schieber, 2002). Pyrite mineral refers to alkaline reducing deep marine environment. Diagenetic processes show that the calcite- cement is deposited in the fossil chambers.

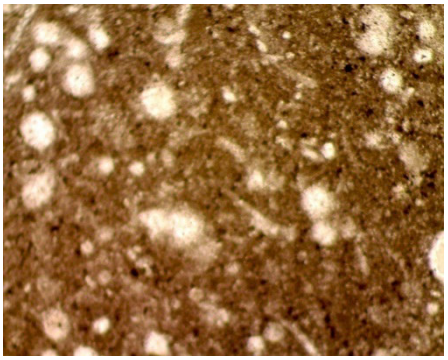
3-2-Sugary texture bed:

it is present at the middle part of the formation. It is consists of fine crystals of dolomite (Plate 1-3) without fossils. Sugary texture forms by replacement diagenetic processes of carbonate rocks of high porosity during late dolomitization which reflects supratidal environment.

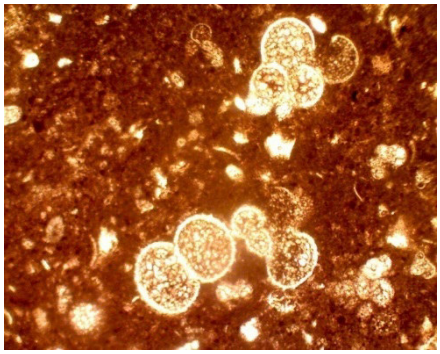
3-3-Foraminiferal Limestone bed :

it is found at the middle and upper part of section, and has high amount of *foraminifera* such as: *globigerina sp.*, *globotruncana* sp. and shell fragments within micrite matrix (Plate 1-4), which refers to relatively quite water of low energy environment and partially washing of muddy lime (Debenay, 1999). The main diagenetic processes are the calcite- cement and pyrite that are filling fossil chambers (Plate 2-1). Mentioned above beds are refers to open marine shelf environment.

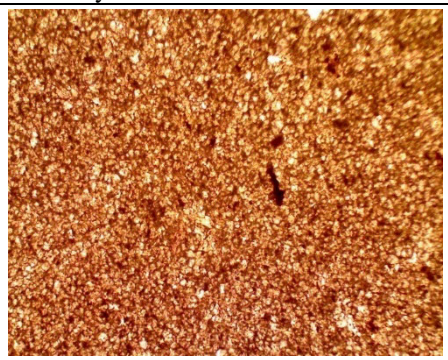
Plate- 1



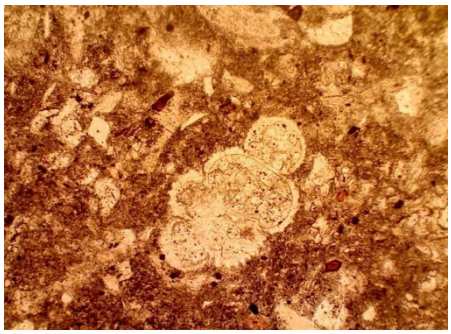
1-Recrystallized limestone 40x



2- Globigerina sp. filled with calcite 40x



3- **Sugary texture in Tanjero Formation 40x**

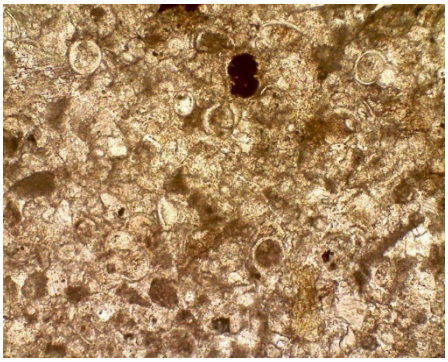


4- Globotruncana sp. with dolomite 100x

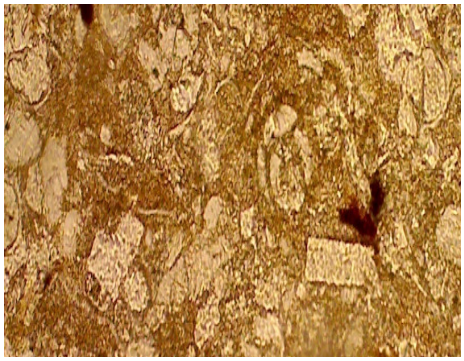
3-4-Planktonic and benthonic fossiliferous limestone bed:
It is found at the upper of the section. It is consists of micrite matrix and dolomite, with high amount of *planktonic* and *benthonic foraminifera* such as*: globigerina sp. globotruncana sp*. and *milliolid* (Plate 2-2), which shows transition zone from high energy to low energy environment (Fluegel, 2010). Low number of oval Ostracoda (Plate 2-3) also present at the middle part. Dolomitization considered the late diagenetic processes (Tucker, 1990) because it is formed in the facies rich in skeletals and valves of fossilis (Wanless, 1989). Pyrite is found in the fossils chambers. The main non skeletal grains are the pellets (Plate 2- 4) which refers to stable environment of deposition, and the interaclast which is not solid and derived from the basin and transports by water current inside the basin (Wignall and Twitcheltt, 1999). Above mentioned beds refer to deep shelf environment.

4- Conclusions:
Tanjero Formation has been subdivided into four beds according to petrography, organic contents and diagenetic processes. They are: recrystallized limestone beds, sugary texture beds, *foraminiferal* limestone beds, and *planktonic* and benthonic fossiliferous limestone beds. Sedimentological analysis showed that the lower part depoited under deep marine shelf environment, and the middle and upper part deposited under open marine shelf environment.

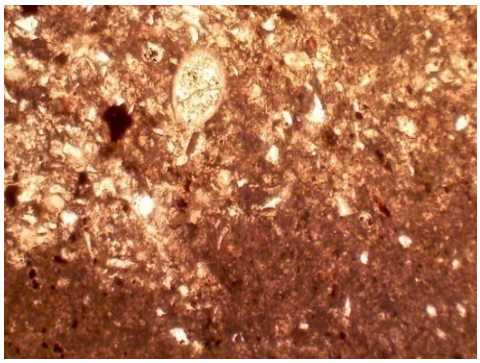
Plate-2



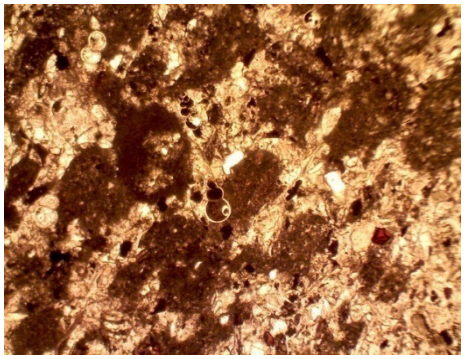
1- **Pyrite filled fossil chamber 100x**



2- **Globigerina sp. filled with calcite 40x**



3- **Ostracod in micrite- microsparite matrix 40x**



4- **pellet grains 40x**

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