Petrology and Origin of Nodular Structure in Nyaungbaw Formation, Naungcho area, Naungcho Township

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Abstract

The research work deal with Classification of the Paleozoic sequence in Naungcho area, situated about 30 miles north-east of Pyin-Oo-Lwin, in Naungcho Township. The Silurian strata of the study area can be classified into three lithostratigraphic unit of formation rank, viz,Nyaungbaw Formation (Silurian), in the view of Petrology. There are three microfacies want to desgnitated, 1. Silty Biomicrite/ Bioclastic Wackestone, 2. Ferruginous Biomicrite/ Bioclastic Mudstone- Wackestone and 3. Biomicrite/ Bioclastic Wackestone or Packstone. Nodular structures formed generally by compaction of various size and amounts of calcium sulfate nodules in sediment of varing permeability. Such structures are seen today forming on modern subkhas but also result from compaction following burial (in Wilson, 1975). The nodules are wrapped around by the argillaceous materials. The microstylolitic seams formed by the process of pressure solution are parallel to the bedding plane in thin-section. The widespread occurrence of nodular structure also found in both northern (Nyaungbaw Formation) and southern Shan State (Linwe Formation). The origin of nodular bedding is formed not only the primary but also the secondary compactional fabric. The phacoidal structure (nodular bedding) of limestone was possibly formed by sub-sea solution process. According to litholoty, faunal content, and sedimentary structure, the depositional environments of all lthese units can be concluded as follow; low enery water below normal wave-base and fairly deep marine enviornment.

Keywords: Siluria, Nodularl structure, compaction, pressure solution, sub-sea solution, Nyaungbaw Formation, Linwe Formation,

Introduction

The Naungcho area, a part of the Eastern Highland, is situated about 57.6 km, north-east of Pyin-Oo-Lwin township. The present area is located at latitude 22º 21' N and 96º 43' E to 96º 52' E in one inch topographic maps 93 B/11, B/12, B/15 and B/16. It covers approximately 261.3 km^2 of rugged and mountainous terrain.

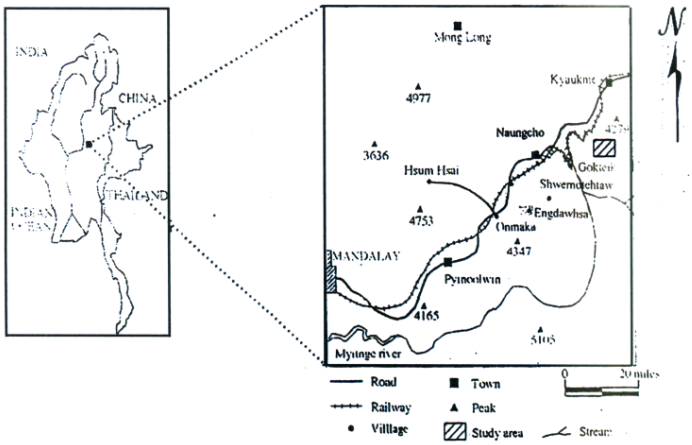

Figure (1). Location map of the present study area

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In the present area, the strata of Nyaungbaw Formation is composed essentially of purplish to greenish grey, medium- to thick – bedded argillaceous limestone with phacoidal to subphacoidal structure and thin calcareous shale interbeds are also present.

According to the lithologic characters, the Nyaungbaw Formation can be subdivided into two sub-units of member rank. Viz, the lower member and the upper member.

The lower member is composed of purple to reddish brown, chocolate brown, grey green, medium – to thick – bedded (about 30cm-50cm), argillaceous limestones about buff shale. The upper member of the unit is mainly composed of grey to dark grey, greenish to publish phacoidal micritic limestone interbedded with thinly bedded, purple, calcareous shales and thinly bedded, yellowish to buff siltstone.

Figure (2). Medium-to thick- bedded argillaceous limestone and buff-coloured silty shale of Nyaungbaw Formation (Loc-N 22 19' 57.7"/ E 96 50' 3.1")

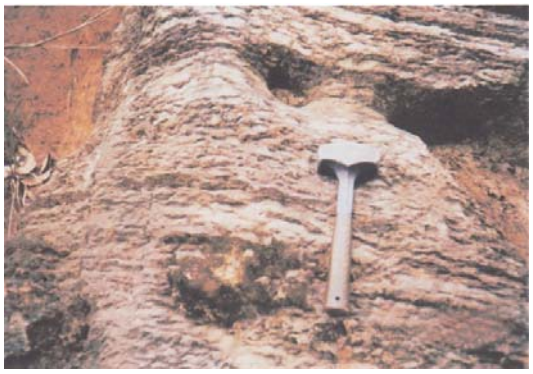
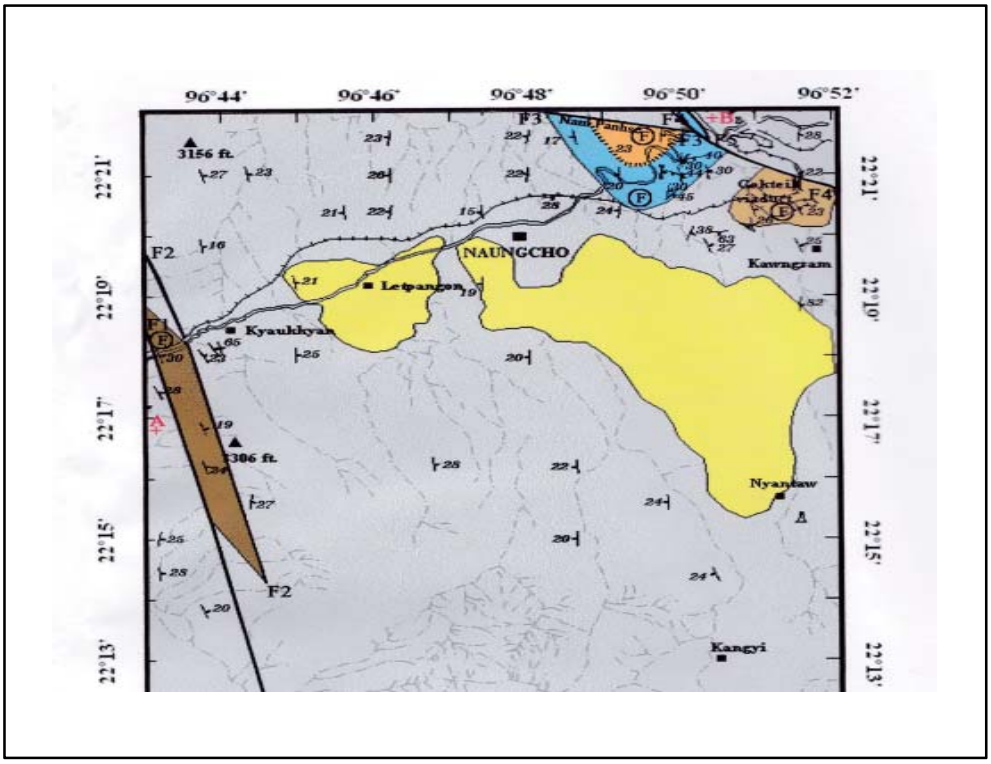
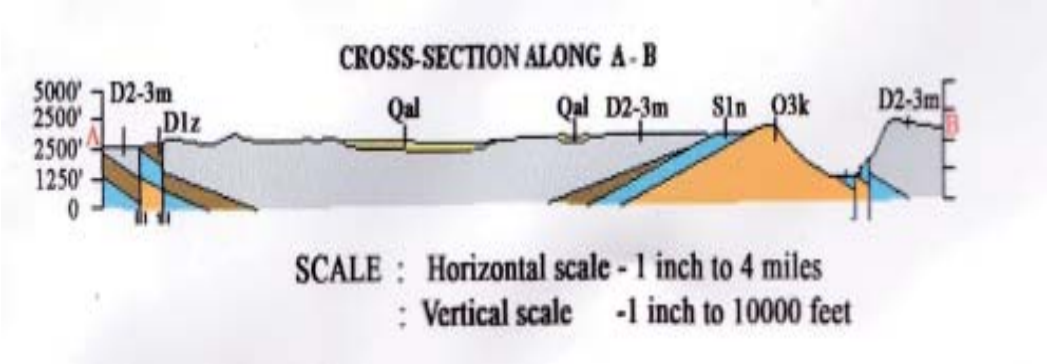


Figure (3). Greenish to purplish phacoidal micritic limestone of Nyaungbaw Formation (Loc-N 22 20' 36.5"/ E 96 49' 55.7")

Geological Map of the Study Area





EXPLANATION

SEDIMENTARY ROCKS

QUATERNARY — Alluvium

Unconformity

EARLY PERMIAN — **THITSIPIN FORMATION**
Thick-bedded to massive, light grey to grey, fine-to medium-grained limestone, interbedded with thinly bedded calcareous shales or mudstone.

Unconformity

MIDDLE DEVONIAN TO LATE DEVONIAN — **MAYMYO DOLOMITE FORMATION**
Thin-bedded to massive, light grey to grey,brecciated dolomitic limestone and shale.

EARLY DEVONIAN — **ZEBINGYI FORMATION**
Medium to thick-bedded, dense black limestone and thin-to medium-bedded carbonaceous shale with yellow to buff silty clay and marl.

EARLY SILURIAN — **NYAUNGBAW FORMATION**
Greyish, greensih to purple phacoidal limestone with minor shale, locally thin bands of yellow shale and marl in the upper part, medium-to thick-bedded, purple, reddish-brown grey-green argillaceous limestone interbedded with buff to white calcerous shale in the lower part.

LATE ORDOVICIAN — **KYAINGTAUNG FORMATION**
Thin-to medium-bedded, micaceous, variegated silt stone and marl with occasional bands of grey silty limestone lenses.

GEOLOGIC SYMBOLS

- 30 — Dip & strike of bedding
- F — Fossil locality
- Fault
- sharp contact
- Gradational contact

GEOGRAPHIC SYMBOLS

- Car-road
- Rail-way
- Town
- Village
- Spot heigh
- Stream

GEOLOGY BY: YAN NAING HTUN

Microfacies Analysis of the Rocks of Nyaungbow Formation

Microfacies 1. Silty Biomicrite/ Bioclastic Wackestone

Microscopically, it consists of micrite 70%, bioclasts 15%, sparry clacite 5% and detrital quartz gains 10%. The matrix is microcrystalline calcite. Angular to sub-rounded quartz – silt grains (0.01 mm to 0.1 mm) are within the micrite. They are moderately sorted. Rounding and sphericity of the grains are rather good and are monocrystalline quartz. Bioclasts are vary in size and are embedded in the micrite groundmass. Their internal structures are not well preserved. They include brachiopods, trilobites, sponges, echinoderm plates and thin shell bivalves fragments, see figure 4.

Microfacies 2. Ferruginous Biomicrite/ Bioclastic Musdstone –Wackestone

Microscopically, it contains 30% allochems; mainly bioclasts 20%, quartz grains 5%, pellet content ranges from 2% to 3% and pyrite 1% to 2%. Mircirte content 70%. They are highly oxidized and giving rise to reddish brown or cherry red color. The angular to subrounded quartz are oriented along the argillaceous lamination. The dark layers are composed almost entire of argillaceous materials whereas the clear layers are composed of quartz silt grains, see figure 5.

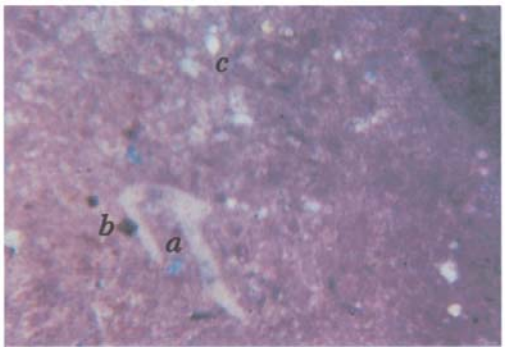


Figure (4).Photomicorphraph showing silty biomicrite of hook-shaped trilobite skeleton (a) anhedral authigenic mineral of pyrite crystal (b) and quartz silt grains (c) in the micrite of the Nyaungbaw Formation (under XN x 40)

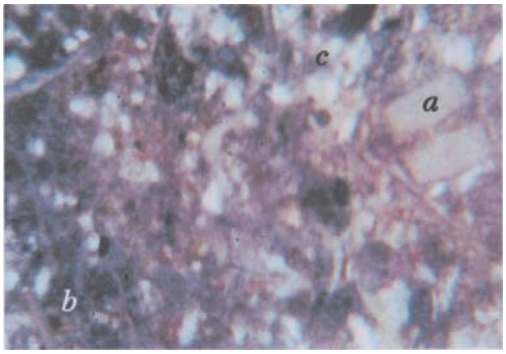


Figure (5).Photomicorphraph of Ferruginous biomicrite showing echinoderm plate (a), crinoid stem (b) and scattered quartz grains (c) of the Nyaungbaw Formation (under XN x 40)

Microfacies 3. Biomicrite / Bioclastic Wackestone or Packstone

Microscropically, it is mainly composed of micrite 50%, bioclasts 45% and chert clast 1% - 5%. Bioclasts are microbial needle, algae, bryozoans and crinoid. They are vary in size and are embedded in brown micritic groundmass. Longitudianl clasts are aggregated within the micirte. The accicular bioclasts can be needle-fibre calcite.

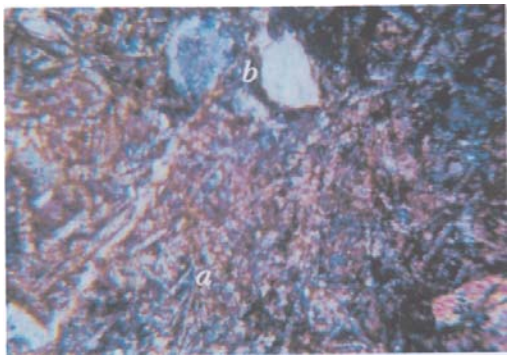


Figure (6). Photomicorphraph showing alveolar septal fabric of the needle fibre calcite (a) and angular to sub-rounded shape, segmented microfossils filled with finely carbonate of algae (b) in the biomicrite of the Nyaungbaw Formation (under XN ×40)

The Origin of Phacoidal Structure in Nyaungbaw

The characteristic feature of Nyaungbaw Formation is noted for its nodular (Phacoidal) bedding. The formation of Phacoidal structure in lime stone and bathymetry of its formation have been explained in various ways. Also unlike most other carbonate fancies, the origin of nodular aspect is not at all clear. It is not known whether the nodular character is an original primary features, whether it as partly or wholly diagenetic.

Hollmann's hypothesis (1962, 1964) explained that the nodular are solution relicts of once continuous bed partially destroyed on the sea floor by a process sub solution.

Also Wilson (1975) suggested that nodular beddings are formed by segregation of lime early in diagenetic history by solution, compaction and pressure solution under some overburden under water of variable depth < 1000m.

Scoffin (1984) also mentioned the difficult mechanical and chemical compaction was caused by lithicfication the inhomogenitics in packing. Insoluble residues of pressure solution are concentrated between the nodular layers.

Phacoidal structures are formed by an easily diagenetic segregation of carbonate with sort of unmixing process and later pressure dissolution process. They are common throughout the geological record and occurring particularly in deep-water, outer ramp, dawned-platform and basinal sequences.

In this study area, the nodular bedding is evident the nodular are wrapped around by argillaceous layer and significant clay horizon. Along the bedding planes and surface, pressure solution seams are characteristics. The solution planes are nearly parallel to the bedding planes and hences, it is a compactional features and due to the different mechanical and chemical compaction. (Scoffin 1984 and Pettijohn 1975, Wilson, Tucker and Wright, 1998). Many authors would like to agree the suggestion of Wilson (1975) and Scoffin (1984).

Figure (7). Purple, phacoidal-argillaceous limestone interbedded with thin calcareous shale layers of Nyaungbaw Formation (grid: 446 591).

Figure (8). Phacoidal structure in the purple argillaceous limestone of Nyaungbaw Formation (grid: 952598).

Therefore, it is believed that nodular limestone bedding is most probably diagenetic history by differential compaction of clay lense randomly and later accumulated by subsolution process.

Discussion

The nodular bedding of Nyaungbaws was initiated by a mechanism suggested by Wilson (1975) and later accentuated by subsea solution process. The features which support the above contention are as follows:

1. The structure is developed in sections in which significant clayey horizon are present.
2. The nodular bedding is very evident in highly argillaceous limestones.
3. The nodules are wrapped around by argillaceous materials.
4. The sizes of nodules are directly proportional to the thickness of the bed in which it is developed.
5. The zones between nodules are always marked by a swarm of stylolites features produced by dissolution.
6. The facies character of Nyaungs is quite uniform over a wide area, indicating a very extensive environment with uniform physio-chemical condition.

- The texture of limestones and prolific occurrence of Camerocrinus asiaticus (pelagic form are consistent with the above notion (Ko Ko Gyi,1991).
- The nodular bedding is distinctly observed in the purple, argillaceous limestone.
- This is because of being the pressure solution process; the argillaceous materials are more accumulated in a place in more argillaceous limestone during deposition.
- In addition to the less content of argillaceous materials, only the sub-nodular bedding occurs in the grey green carbonate-dominated limestone.
- Therefore, the argillaceous materials are wrapped around the nodules.
- The microstyliolitic seams formed by the process of pressure solution are parallel to the bedding plane.
- Hence, the origin of nodular bedding is formed **not only the primary but also the secondary compactional fabric.**
- The phacoidal structure (nodular bedding) of limestone was possibly formed by **sub-sea solution process.**

Conclusion

This formation is composed essential of purplish to greenish grey, medium- to thick-bedded argillaceous limestone with phacoidal to subphacoidal structure and thin calcareous shale interbeds are also presnet.There are many controversies over the origin of nodular aspect in limestone facies. The nodular bedding is distinctly observed in the purple argillaceous limestone. In addition to the less content of argillaceous materials, only the sub-nodular bedding occurs in grey green carbonate-dominated limestone. Therefore, the nodules are wrapped around by the argillaceous materials. The microstylolitic seams formed by the process of pressure solution are parallel to the bedding plane in thin-section. The widespread occurrence of nodular structure also found in both northern (Nyaungbaw Formation) and southern Shan State (Linwe Formation). The origin of nodular bedding is formed not only the primary but also the secondary compactional fabric. The (nodular bedding) of limestone was possibly formed by **sub-sea solution process.**

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