Diagenesis in the Rocks of the Linwe Formation between Yatsawk and Bawsaing Area, Shan State (South), Myanmar

Aye Aye Han[1]

Abstract

A research concerning with the diagenesis in the rocks of the Linwe Formation was carried out between Yatsawk and Bawsaing area, Shan State(south)in Myanmar.The rocks of the Linwe Formation are well exposed in the area striking NNE to SSW. Among the diagenetic process, lithification occupies in biointraclastic wackestone microfacies. The carbonate particles are well packed by microcrystalline calcite mud throughout the whole rock unit. Clayey coating of carbonate particles can be observed in biointraclastic wackestone and bioclastic lithoclastic packstone microfacies. Fabric of cementation is granular equant mosaic occured in bioclastic packstone, bioclastic wackestone and bioclastic lime mudstone microfacies respectively. Authigenesis took place in bioclastic lime mudstone microfacies. Nodular bedding can be seen in bioclastic packstone macrofacies. Microstylolites are late diagenetic features in bioclastic wackestone microfacies. Staining of thin section can reveal replacement of dolomite in microcrystalline calcite mud.

Keywords: Shan state, microfacies, diagenesis, linwe formation

Introduction

The research area lies between the limit of latitude 21° 03' N to 21° 07' N, longitude 96° 45° E to 96° 55' E. This area occupies northern part of Bawsaing range.(See Fig.1). Stratigraphically Bawsaing range is covered with the rocks of the Chaungmagyi Group (Precambrian), the Pindaya Group (Ordovician), the Mibayataung Group (Silurian), the Zebingyi Formation (Early Devonian) and the plateau Limestone Group (Permian to Early Triassic) (National Committee, I.G.C.P., 1980). This research comes out from the microfacies analysis of the rocks of the Linwe Formation in this investigated area. At least 6 microfacies can be distinguished from the rocks of Linwe Formation in this investigated area.

Terminology and classification for microfacies is according to Folk (1962), Dunham (1962) and Wilson (1975). Folk (1965) terminology for carbonate crystal shapes is also adopted for this research.

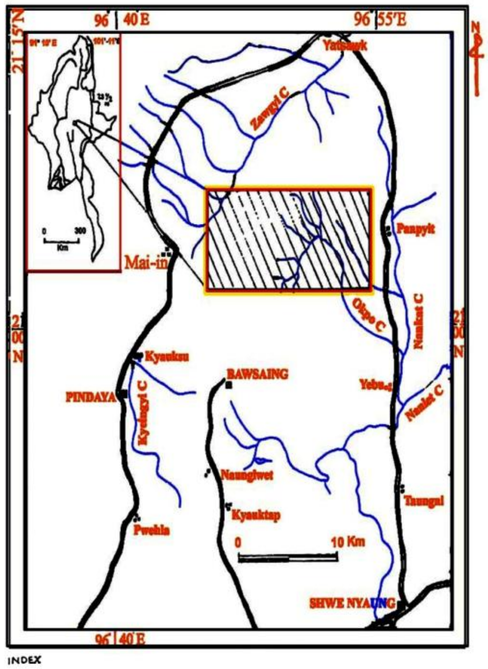

Figure 1. Location map of the study area

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[1] Pro Rector, Dr, Barmaw University

Methods of Study

- Tracing lithologic contact from one inch topographic map and aerial photographs
- Field investigation and collecting the samples
- Microscopic examination
- Staining Analysis

Diagenetic Process

Diagenesis encompasses any physical or chemical changes in sediments or sedimentary rocks that occur after deposition (excluding process involving high enough temperatures and pressures to be called metamorphism). Diagenesis, can begin at the sea floor (syngenetic or eogenetic alteration), continue through deep burial (mesogenetic alternation), and extend to subsequent uplift (telogenetic alteration). Diagenesis can obscure information about primary features, but diagenesis also can leave behind substantial information about the history of post-depositional settings, pore water compositions, and temperatures. (P.A. Scholle, and D.S.Ulmer-Scholle, 2003).

Both near surface and surface diagenesis can be described from the microfacies analysis of the rocks of the Linwe Formation in the research area.

Diagenesis typically involves a variety of physical and chemical processes which are prevailed in the rocks of Linwe Formation under studied area are micritization, cementation, compaction, neomorphism authigenesis and dolomitization.

Eogenetic diagenesis

Micritization

Micritization is the process whereby the margins of carbonate grains are replaced by micrite at or just below the sediment water interface. (A.E Adams and W.S MacKenzie, 1998).

Micritization can be observed in bioclastic packstone microfacies in this study. Micritization is due to the boring of organism in marine phreatic diagenetic environment. Figure (2) display poorly sorted rounded bioclastic grains subjected to micritisation.

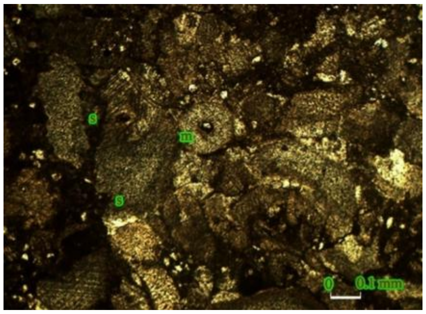

Figure 2. Bioclastic grain, later micritization occur. Bioclastic packstone microfacies.
PPL. (S.No. A.44)

Limemud

Carbonate mud is the equivalent of clay in terrigenous rocks and can form pure deposits (processes in marine pheratic environment). Variously termed micrites, carbonate mudstones, lime mudstones, etc. (P.A Schoole, and D. S. Ulmer-Scholle, 2003). Carbonate muds can be part of the spectrum of disintegration products of carbonate organism, some can be formed by direct inorganic precipitation, and some may be precipitated interstitially at or near the seafloor, or during later diagenesis. (P.A Schoole, and D.S. Ulmer-School, 2003).

Infine-grained carbonate sediments of Linwe Formation there is little or no carbonate alteration but only slight compaction and fabric rearrangement as the soupy and settles on the sea bottom. This diagenetic change is in shallow marine water. Microcrystalline limemud are covered up to 90% by volume in limemudstone microfacies and bioclastic limemudstone (Fig.3). This process is eogenetic process. Micritic Mg calcite is the products by the active zone diagenetic environment.

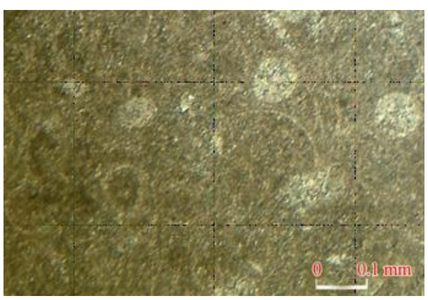

Figure 3. Well preserved ostracod shells (o) are well packed by microcrystalline carbonate mud (m) in bioclastic lime mudstone microfacies (MF-2) PPL. (S.No.A 12)

Burial Diagenesis

Burial diagenesis represents alteration that occurs below the zone of near-surface water circulation (i.e., below the meteoric phreatic mixing zone or below the zone of active sea water circulation). Most rocks, especially limestones, show a consistent loss of porosity with progressive burial related mechanical compaction features (P.A Schoole, and D. S.Ulmer-Schoole, 2003).

Stylolites

Chemical dissolution takes many forms in carbonate rocks, and stylolites are probably the most readily identifiable of them. This styolite in dolomitized bioclastic wackestone microfacies is marked by concentration of insoluble materials along its irregular surface. The surface represent a pressure-induced zone of dissolution with differential grain interpenetration depending on the relative solubilities of grains present on each side of the surface. Stylolite formation is associated with thin water films that allow solute to move away from sites of dissolution (Bathurst, 1971). Figure (4) displays microstylolite along which clay materials are observed in bioclastic wackestone microfacies.

Pressure solution after deep burial and stylolites due to solution occurred in deep subsurface connate water environment.

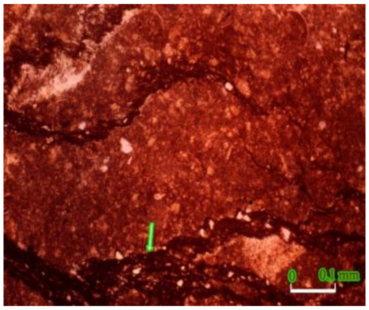

Figure 4. Network type microstylolite (arrow) due to pressure solution in late diagenetic process, bioclastic wackestone. PPL. (S. No. B. 11)

Cementation

Cementation is the process of precipitation of space filling crystals (A.E Adams & W.S. MacKenzie, 1998).

Drusy fabric

Drusy fabric are due to diagenesis in shallow marine water environment (Bathurst, 1971). Drusy mosaics can also be formed in meteoric environment. There is drusy type of cements in lime mudstone and bioclastic wackestone(seefig. 5) whichis a typical meteoric phreatic cement. First generation is fine, granular, clear and second generation is equant blocky crystal cement. Drusy type cementation reflects the meteoric phreatic diagenetic process after deposition.

Authigenesis

The minerals of a sediment, in part detrital and in part chemical in origin, are not necessary in chemical equilibrium with one another or with the interstitial fluid at the time of deposition.The authigenesis process are largely processes attempt to establish an equilibrium assemblage or facies by elimination of the unstable species, growth of stable species, and the production of new and stable species by appropriate chemical reaction. The processes involved the insoluble reduction, especially of the iron (PettiJohn 1956).

Apparently after burial, the iron sulfide material is segregated and crystallized as scattered pyrite cubes, in part replacing the matrix material (figure 6) as crystal aggregates of pyrite .Scattered pyrite bits are 0.025mm to 0.075 mm in size containing less than 1% by volume. They are idiotopic fabric with square outline in bioclastic lime mudstone (see Fig.6)

The close correlation between the suffice contact and the contact of carbonaceous or organic matter in many sediments strongly suggests a diagenetic or sedimentary origin for the sulfite proper.

Nodular structure

Nodular structure is observed in bioclastic wackestone and bioclastic packestone in Linwe Formation (see Fig.7)

In general nodular limestones are considered to be of a secondary or post, depositional origin. (PettiJohn1956).

The origin of the nodular limestone has been much debated. Among them, acceptable views are described in this paper.

Nodular limestones formed by air unmixing process from a one homogeneous lime clay mixture (Hallan, 1964, 1967)

Hollmann (1962), explains that the nodules are solution relicts of once continuous beds partially destroyed on the sea floor by a process termed subsolution. Nodules were further modified by solution after burial as abundant stylolitic contract between nodules attest.

Wonless 1973 attributed this facing in the Grand Canyon Cambria to post depositional over barber solution along stylotitic surface and foliage.

The nodules ascribed to differential compaction of the clay and lime mudstone, such compaction being controlled by clay mud lenses. exotically and randomly distributed through carbonate muds.

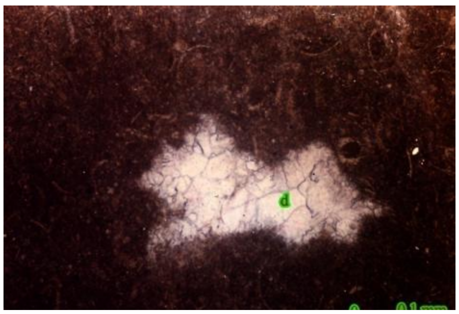

Figure 5. Drusy cement in lime mudstone microfacies. PPL.

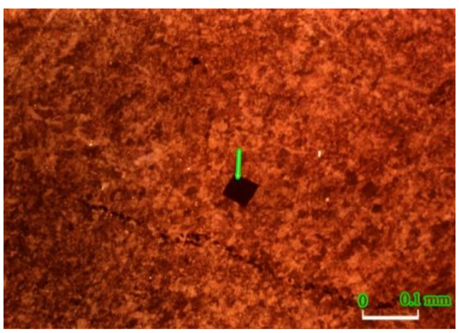

Figure 6. Pyrite (arrow) with rectangular outline scattered in bioclastic lime mudstone showing reducing environment. PPL. (S.No. B.7)

Figure 7. Laminated grey, thin to medium bedded argillaceous nodular limestone with bluish grey calcareous shale, 21° 05' 00" N, 96° 50' 40" E, 0.8 km SE of Kywe daung hill

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Nodular limestones formed by air unmixing process from a one homogeneous lime clay mixture (Hallan, 1964, 1967)

Dolomitization

Dolomitization is occured in (mottled dolomitized lime mudstone biointraclastic wackestone and bioclastic lithoclastic packstone microfacies. In the (figure 8) sparitized bioclasts are later subjected to dolomitized.Alizannie red staining analysis can be distinguished from calcite or aragonite to dolomite and then A.RS and K.F.S reveals dolomite to ferron dolomite. Dolomitization is shallow reflux (or) replacement by subsequence solution (Wilson, 1975).

Gastropod shell fregments is shown in figure(8). It is not unstrined after A.R.S. And the figure (8a) shows the shell lime in coloured stained by A.R.S and KFCN. It suggests that this shell fragment made up of ferron dolomite. This staining result proved that shell is primarily aragonitic, that later subjected to ferron dolomitized. And also figure (8b) reveal that bioclastic lithoclast are domomitized.

Clay coating

This rock consists of bioclasts about 1-2% by volume and slightly lithified intraclast 20%. Intraclasts are 1mm in maximum diameter. They are roughly equidimensional, not well sorted, but sub-rounded in appearance and clayey material coated (Fig.9)

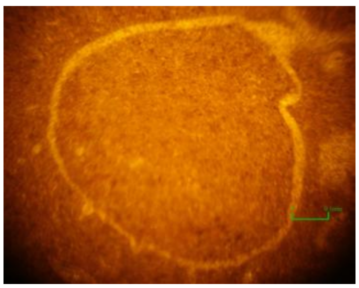

Figure 8 a. biointraclastic wackestone before staining.. PPL. (S.No. A12)

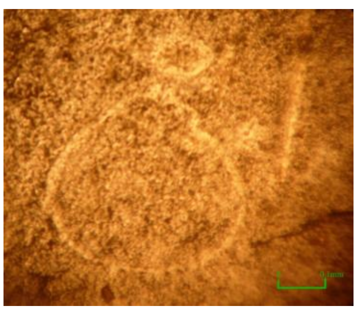

Figure 8 b. biointraclastic wackestone after staining.. PPL. (S.No. A12)

Summary and Conclusion

Micritization can be observed in bioclastic packstone microfacies in this study. Micritization is due to the boring of organism in marine phreatic diagenetic environment.fine-In grained carbonate sediments of Linwe Formation there is little or no carbonate alteration but only slight compaction and fabric rearrangement as the soupy and settles on the sea bottom. This diagenetic change is in shallow marine water. Microcrystalline limemud are covered up to 90% by volume in limemudstone microfacies and bioclastic limemudstone. Lime mudstone and bioclastic wackestone are typical meteoric phreatic cement.

Drusy type cementation reflects the meteoric phreatic diagenetic process after deposition. The iron sulfide material is segregated and crystallized as scattered pyrite cubes, in part replacing the matrix materialin bioclastic lime mudstone.

Nodular structure is observed in bioclastic wackestone and bioclastic packestone in Linwe Formation, is occured in (mottled dolomitized lime mudstone biointraclastic wackestone and bioclastic lithoclastic packstone microfacies.

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