THE EARLY PERMIAN BRACHIOPODA FROM ZWEKABIN RANGE, HPA-AN TOWNSHIP

Ohnmar Soe Yin[1], Aung May Than[2] & Khin Thuzar Min[3]

Abstract

This paper concerns with the Taungnyo Formation and the Moulmein Limestone from the Zwekabin Range with regard to their biostratigraphy and age according to the Early Permian Brachiopod fauna. Fourteen species belonging to thirteen genera are reported as collected from three localities of the Zwekabin Range. Two new species ? *Verneuilia* n.sp. and *Vediproductus* n.sp. are described. The most common species are *Spinomartinia prolifica*, *Retimarginifera alata, Retimarginifer* sp. and *Cancrinella* sp. together with *Productus* cf. *carbonaricus*de Koninck, *Kasetia kaseti* Waterhouse, *Phricodothyris* sp., *Chonetinella* sp., *Kutorginella* sp., *Neospirifer* sp., *Neochonetes* sp. and *Spiriferellina* sp. The three brachiopod biozones namely as *Arctitreta-Bandoproductus* Zone, *Spinomartinia prolifica* Zone and *Horridonia timanica* Zone which are regarded as Early Permian (Sakmarian to Kungurian) in age. The brachiopod fauna from the Taungnyo Formation and the Moulmein Limestone is considered to be equivalent of the early Permian brachiopod from the upper Kaeng Krachan Group and Rat Buri Limestone of Thailand.

Keywords : Early Permian, Brachiopods, Biozones, Zwekabin Range

Introduction

The Upper Paleozoic (Carboniferous-Permian) rock units in Hpa-an area, Kayin State can be subdivided into the Taungnyo Formation and the extensive Moulmein Limestone. The Moulmein Limestone consists predominantly of well-bedded, dark grey limestone and silicified argillaceous limestone. It is underlain by the clastic sediments of the Taungnyo Formation which is composed of gray and yellowish shale, mudstone, yellowish or buff-coloured, fine-grained sandstone and siltstone with interbeds of calcareous mudstone and marl. Bryozoans and mainly brachiopods were found in buff-coloured siltstone and calcareous mudstone of the Taungnyo Formation. Systematic field sample and data collections were made at three localities

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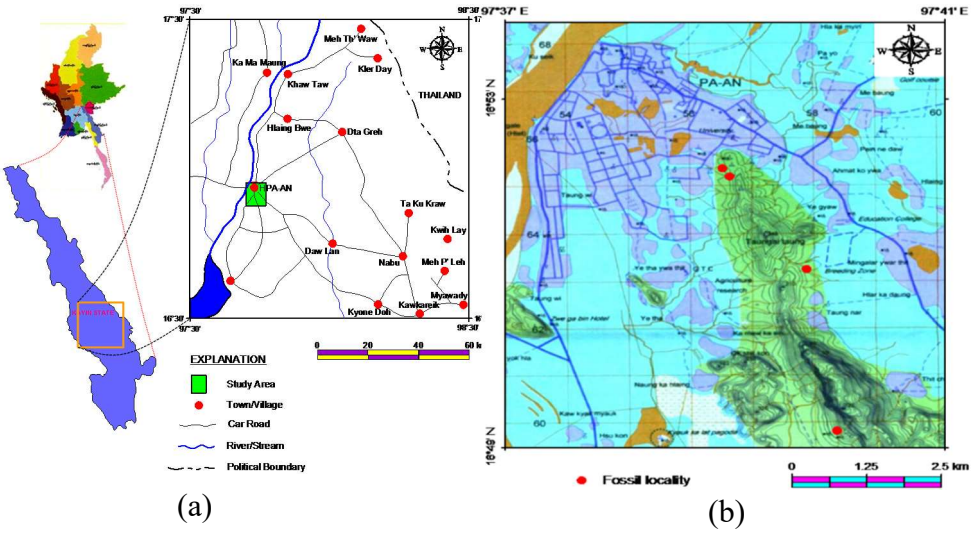
situated on the eastern foot hill (near Hla Ka Daung), northwestern part (Kya-in Taung) and western foothill of the Zwekabin Range. (Figure 1a,b)



(a) (b)

Figure 1(a.b) Location and Fossil Locality Maps of the Study Area

Previous Brachiopod Studies

Zaw Win and Kyaw Htin Khaing (2006) recorded five species of brachiopods from the upper part of the Taungnyo Group on the northwestern flank of the Zwekabin Range, Kayin State, including the following species:

1. *Spinomartina prolifica*
2. *Retimarginifera* sp.
3. *Phricodethyris* sp.
4. *Torinifer* sp.
5. *Chonetinella* sp.

The above mentioned fauna of the Taungnyo Group can be correlated with the *Spinomartina prolifica* fauna of the Early Permian Ko Yao Noi Formatiom of southern Thailand.

Stratigraphy of the Hpa-an Area, Kayin State

The stratigraphic classification of the Hpa-an Township (cited from Dr. Maung Thein, 2014)

Stratigraphic Units	Geological Age
Moulmein Limestone Group	Permian
Taungnyo Formation	Carboniferous-Early Permian

Taungnyo Formation

It is typically exposed along the Taungnyo Range south of Mawlamyine. The Carboniferous rocks of the Hpa-an District of the Kayin State are refered to Taungnyo Group by Brunnschweiler (1970) after Leicester (1930), gray and yellowish shale, mudstone, yellowish or buff-coloured, fine-grained sandstone and siltstone with interbeds of calcareous mudstone and marl. The calcareous sandstones at the top of the sequence contains gastropods, brachiopods (*Dictyoclostus, Mesolobus, Spirifer* spp.), bryozans, corals and ostracods and indicates Late Carboniferous age (Brunnschweiler, 1970).*Spinomartinia prolifica* assemblage occur in the siltstone and Taungnyo Group exposed along the northwestern flank of the Zwekabin Range. These fauna assemblage indicates that the Taungnyo Group is up to Early Permian (Late Sakmarian) (Zaw Win and Kyaw Htin Khine, 2006).In the present study, the brachiopod assemblage such as *Vediproductus* n.sp, *Productus* cf. *carbonaricus*de Koninck, *Cancrinella* sp., *Spinomartinia prolific* Waterhouse, *Kasetia kaseti* Waterhouse, *Retimarginifera alata* Waterhouse, *Phricodothyris* sp., *Torinifer* sp., *Retimarginifer* spp., *Chonetinella* sp., *Kutorginella* sp., ? *Verneuilia* n.sp., *Neospirifer* sp.and *Spiriferellina* sp. occurs in the northwestern part (Taungai Taung) and eastern foot hill (near Hlar Ka Daung) of the Zwekabin Range. The brachiopod assemblage bearing Taungnyo Formation can be correlated with Upper Kaeng Krachan Group in southern Thailand.

Moulmein Limestone

T.Oldham (1856) first gave the name to the limestone of Kayin State and Tanintharyi Region overlying the Mergui Group, forming isolated rock pillars. Brunnschweiller (1972) believed that the Moulmein Limestone overlies the Carboniferous Taungnyo Group. It is exposed as isolated rugged hills or ranges in the Hpa-an area. It is mainly composed of well-bedded dark grey limestone and silicified argillaceous limestone. Chert significantly common in the form of bands, layers, nodules and patches. *Neospirifer* sp. and *Spiriferellina* sp. occur in the northwestern part (Taungai Taung) of the Zwekabin Range. The Moulmein Limestone bearing a few brachiopods can also be correlated with the Ratburi Limestone of southern Thailand.

Biostratigraphy of the Zwekabin Brachiopod Fauna

Brachiopod bearing buff-coloured siltstone occurs in the upper part of the Taungnyo Formation which is well developed along the northwestern part (Taungai Taung) and eastern parts (near Hlar Ka Daung) of the Zwekabin Range. A few brachiopods occur in the cherty limestone of the Moulmein Limestone. The lithology of northwestern part of the Zwekabin Range exposure is generally made up of interbedded calcareous mudstone and siltstone. The beds dip at 20˚ to 25˚ to the west. Several fossiliferous horizons (H1-H5) were found in buff-coloured siltstone, calcareous mudstone and cherty limestone at the measured section (Figure 2). Brachiopods are rare and scattered in these calcareous beds. The measured section of the eastern part of the Zwekabin Range exposure is made up of laminated calcareous mudstone in the lower part. Above these calcareous mudstone horizons, a massive greenish to yellowish gray siltstone (H1-H3) yields an interval which is very rich in brachiopods (Figure 3). The exact geographic position of the fossil locality from UTM no. 1697- 09 at Grid no 566646, 677637.

The Zwekabin brachiopod fauna is comparable with three Early Permian brachiopod assemblage zones established by Shi et al. (1991) in the Sungai Itau Quarry in Malaysia and Waterhouse et al. (1981) in the Kao Noi and near Krabi in southern Thailand. The three brachiopod assemblage biozones of the Zwekabin Range are as follows:

3. *Horridonia timanica* Zone

2. *Spinomartinia prolifica* Zone

1. *Arctitreta-Bandoproductus* Zone

1. *Arctitreta-Bandoproductus* Zone : This zone which is best developed in the eastern parts (near Hlar Ka Daung) of the Zwekabin Range can be correlated with the *Arctitreta-Bandoproductus* Assemblage Zone in Sungai Itau Quarry in Malaysia. This zone includes *Torynifer* sp., *Kasetia kaseti* Waterhouse and *Phricodothyris* sp.

2. *Spinomartinia prolifica* Zone : The predominant brachiopod assemblage described in the present study is the *Spinomartinia prolifica* Assemblage Zone, occurring in the northwestern and eastern parts of the study area. This zone can be correlated with *Spinomartinia prolifica* Assemblage Zone in Krabi, southern Thailand and in Sungai Itau Quarry in Malaysia. It is characterized by the occurrence of the zonal species of *Spinomartinia prolifica* and also recognized by the common species of *Retimarginifera alata*, *Chonetinella* sp., *Kutorginella* sp., *Productus* cf. *carbonaricus*, *Vediproductus* n.sp.and ? *Verneuilina* n. sp.

3. *Horridonia timanica* Zone: The *Horridonia timanica* Zone is the uppermost zone, occurring in the northwestern part of the Zwekabin Range. It is characterized particularly by the abundance of *Cancrinella* sp., *Neospirifer* sp. and *Spiriferella* sp.

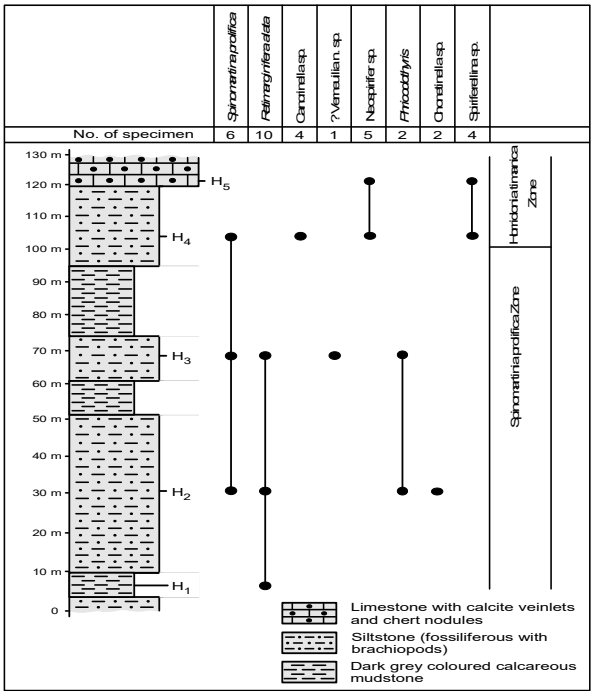


Figure 2. Columnar Section and stratigraphic range chart of the fauna of the upper part of the Taungnyo Formation and basal part of the Moulmein Limestone of the northwestern part (Taungai) of Zwekabin Range (Measured from 566646 to 568644)

The composition and age of the Zwekabin Brachiopod Fauna

Brachiopods are scattered throughout the upper part of the Taungnyo Formation, concentrated particularly in the buff-colored siltstone and other calcareous beds. The Zwekabin brachiopod fauna is generally made of those of thick shells and a few with spinose shells. Almost all brachiopods are preserved as complete external and internal moulds. The distribution of particular brachiopod species tends to be restricted within the fossiliferous intervals except for the dominant species of *Spinomartinia prolifica* Waterhouse and *Retimarginifera alata* Waterhouse which are more widely distributed.

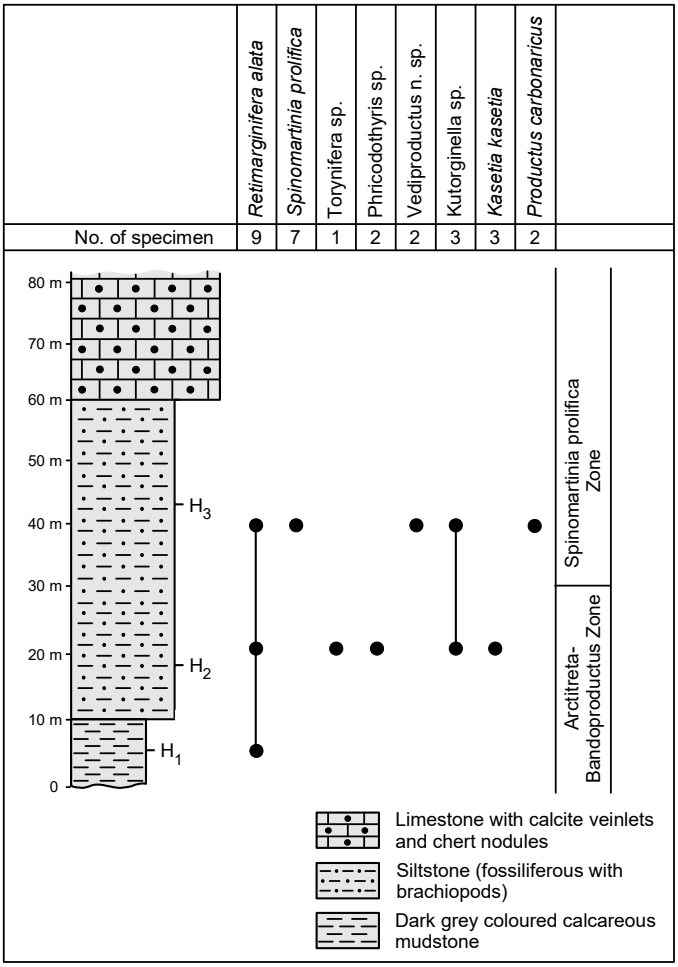


Figure 3. Columnar Section and stratigraphic range chart of the fauna of the upper part of the Taungnyo Formation and basal part of the Moulmein Limestone of the eastern foothill (near Hla ka Daung) of Zwekabin Range(Measured from 677637 to 676635)

Thirteen brachiopod genera were identified from the Zwekabin Range dominated by *Spinomartinia* and *Retimarginifera*. Among fourteen species identified are *Vediproductus* n.sp, *Productus* cf. *carbonaricus*de Koninck, *Cancrinella* sp., *Spinomartinia prolifica* Waterhouse, *Kastia kaseti* Waterhouse, *Retimarginifera alata* Waterhouse, *Phricodothyris* sp., *Torinifer* sp., *Retimarginifer* spp., *Chonetinella* sp., *Kutorginella* sp., ? *Verneuilia* n.sp.,

Neospirifer sp. *Spiriferellina* sp. These brachiopods are accompanied by some fenestellid bryozoa, corals, crinoids stems and echinoid plates.

The composition of the Zwekabin brachiopod fauna seem to be very close to that of the Ko Yao Noi and Krabi brachiopod fauna of southern Thailand described by Waterhouse (1981) and the fauna indicates a probable Sakmarian age. Shi and Archbold (1995) included the Kinta Valley fauna of Malaysia into the *Spinomartinia prolific* assemblage zone of Shan-Thai terrane or Sibumasu block. This assemblage has been established by Shi and Archbold for the Late Sakmarian fauna discovered by Waterhouse et al. (1981) from Ko Yoi and near Krabi in Southern Thailand and those of Kinta Valley.

The presence of *Phricodothyris* sp., *Torynifera* sp. and *Kasetia kasetia* Waterhouse in the Zwekabin fauna may represent earlier appearance of these species before the *Spinomartina prolific* assemblage zone can be assigned to the upper part of the *Arctitreta- Bandoproductus* zone of Early Sakmarian age. The closely associated fauna was also re-assigned to the same brachiopod zone, in the succeeding *Spinomartinia prolifica* assemblage zone of Late Sakmarian. The uppermost zone is the *Horridonia timanica* Assemblage zone characterized particularly by the abundance of including *Neospirifer* sp. and *Spirifella* sp which indicates Artinskian- Kungurian age. Thus, the age for these three Assemblage zones possibly ranges from Sakmarian to Kungurian age.

Summary and Conclusions

The Zwekabin brachiopod fauna consists of *Vediproductus* n.sp., *Productus* cf. *carbonaricus* de Koninck, *Cancrinella* sp., *Spinomartinia prolifica* Waterhouse, *Kasetia kaseti* Waterhouse, *Retimarginifera alata* Waterhouse, *Phricodothyris* sp., *Torinifer* sp., *Retimarginifer* sp., *Chonetinella* sp., *Kutorginella* sp., ? *Verneuilia* n.sp., *Neospirifer* sp. and *Spiriferellina* sp. Three Brachiopod Assemblage biozones namely as *Arctitreta-Bandoproductus* Zone, *Spinomartinia prolifica* Zone and *Horridonia timanica* Zone are recognized in the Zwekabin Range.

The *Spinomartinia prolifica* zone is closer in overall composition to fauna from the Moulmein Limestone. However, the Moulmein Limestone

includes *Neospirifer* sp. and *Spiriferellina* sp. not so far found in the *Spinomartinia prolifica* Zone. The common fauna such as *Spinomartinia* and *Retimarginifera* has its characteristic species of Taungnyo Formation and these fauna indicates Late Sakmarian age.

The uppermost part of the Taungnyo Formation and the basal part of the Moulmein Limestone consist of Cancrinella, *Neospirifer*, *Spiriferellina* and fenestellid bryozoa which indicates a Early Permian (Kungurian) in age.

The age of the Taungnyo Formation could be provided by the correlation of the overlying Moulmein Limestone, from which brachiopod fauna has been described. The bases for the Moulmein Limestone may be Kungurian in age, and the uppermost portion of the Taungnyo Formation is up to Sakmarian to Kungurian.

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Plate (1) Brachiopods from the Taungnyo Formation, Eastern foot hill (near Hlar ka Daung) of the Zwekabin Range (A,B *Vediproductus* n.sp, dorsal and ventral external moulds, C *Productus* cf. *carbonaricus*de Koninck, ventral external valve, D,E *Spinomartinia prolifica* Waterhouse, ventral internal mould and dorsal external valve, F,G *Retimarginifera alata* Waterhouse, exterior ventral valves, H *Kutorginella* sp., dorsal external valve, I,J,K *Kasetia kaseti* Waterhouse, ventral internalvalves and ventral external mould, L, M *Phricodothyris* spp., ventral internal moulds

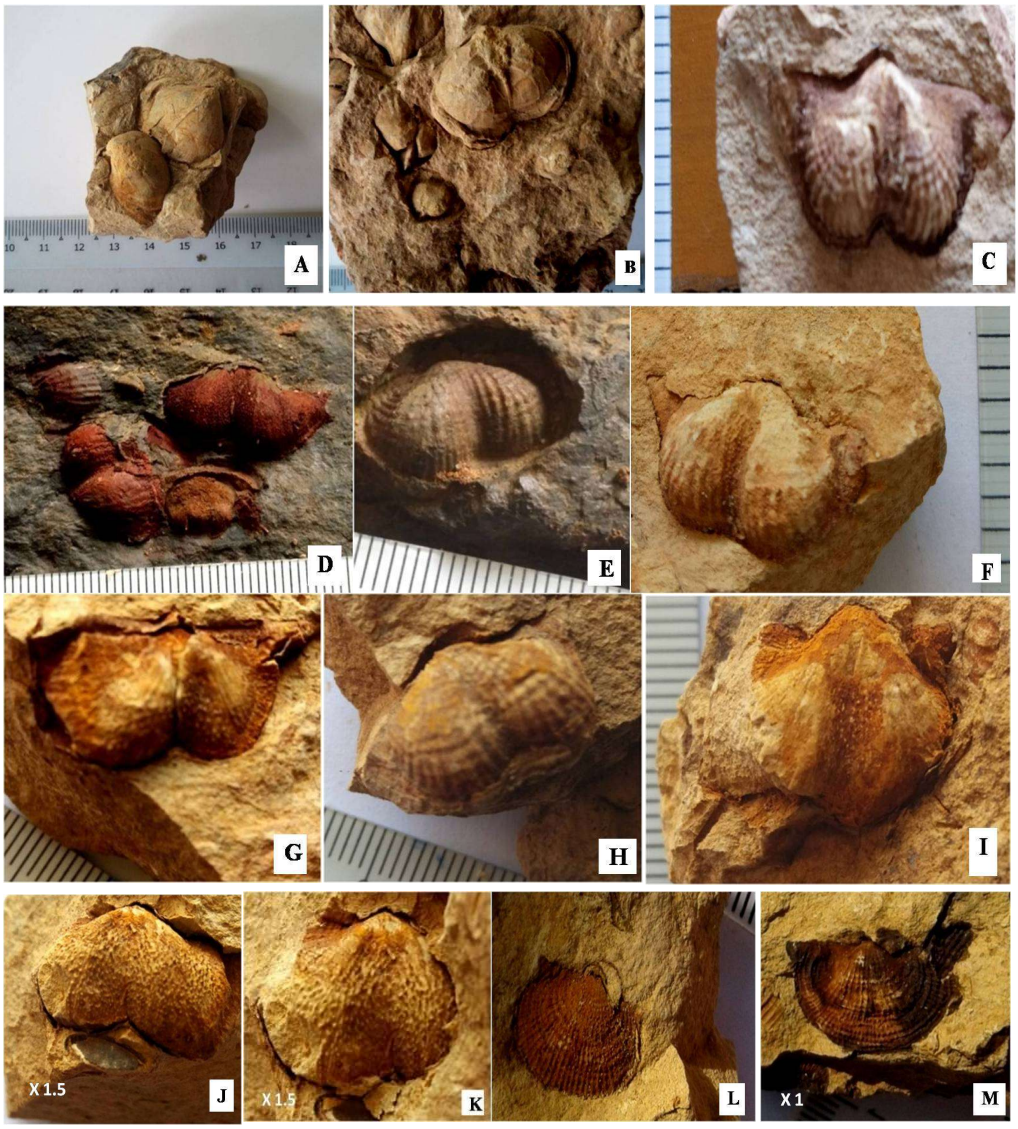

Plate (2) Brachiopods from the Taungnyo Formation, northwestern part (Kya-in Taung) of the Zwekabin Range (A,B *Spinomartinia prolifica* Waterhouse, ventral internal moulds, C-H *Retimarginifera alata* Waterhouse, exterior ventral valves, I-K *Retimarginifera* sp., L, M casts of exterior ventral valve and dorsal external valve)

Plate (3) Brachiopods from the Taungnyo Formation, northwestern part (Taungai Taung) of the Zwekabin Range A-D *Cancrinella* sp. ventral internal mould, dorsal external valve and dorsal internal moulds, E ? *Verneuilia* n.sp., ventral external mould, F, G, H *Neospirifer* sp., dorsal internal moulds and cast of dorsal interior, I *Spiriferellina* sp. ventral internal mould, J *Torinifer* sp. dorsal internal mould, K *Neospirifer* sp. dorsal internal mould L, M *Chonetinella* sp., dorsal external and internal moulds

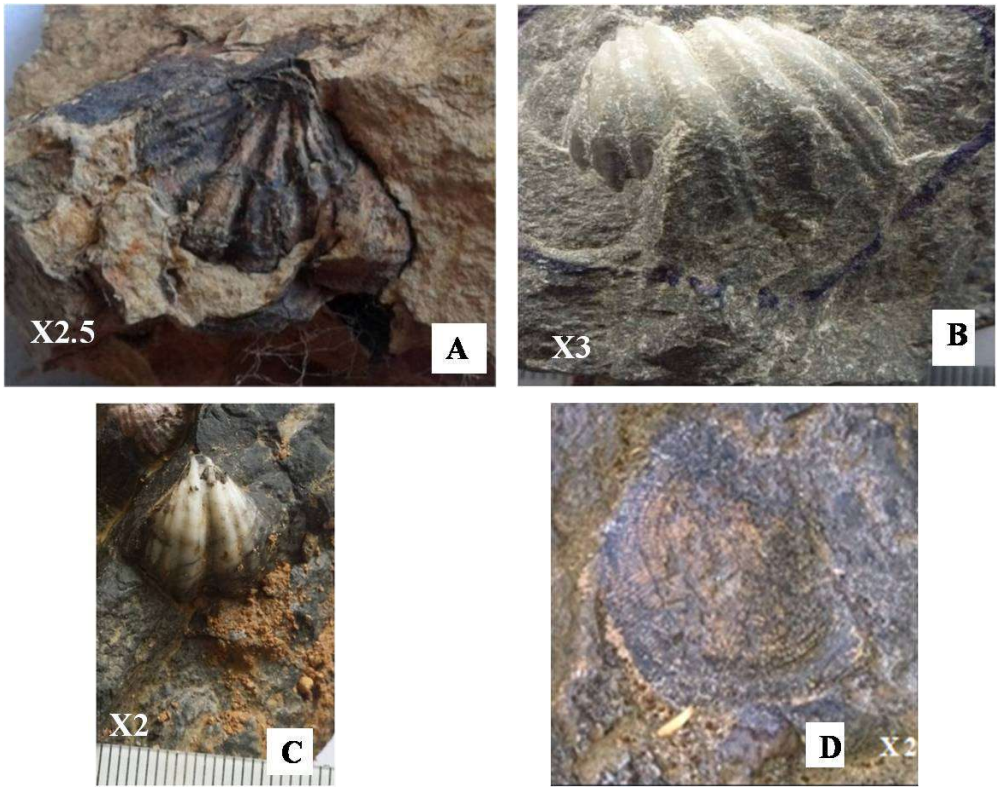

Plate (4) Brachiopods from the Moulmein Limestone, northwestern part (Kya-in Taung) of the Zwekabin Range A ? Neospirifer sp. ventral internal mould B,C *Spiriferellina* sp. dorsal external moulds and D, *Neochonetes* sp., dorsal external valve from western foothill of the Zwekabin Range