Radiolaria from the Lubok Antu Complex, Sarawak

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The Lubok Antu Mélange was introduced by Tan (1979) for a rock unit composed of blocks and fragments of mudstone, sandstone, cherts, hornfels, limestone, basalt, gabbro, and serpentinite of varying size, embedded in a sheared mudstone matrix. This unit was associated with subduction zone. The age of the unit ranges from Late Cretaceous to Middle Tertiary based on planktonic foraminifera (Tan, 1979). The presence of planktonic foraminifera in the matrix indicates that the mélange was originally a sedimentary mélange which had undergone deformations. The term Lubok Antu Mélange cannot be considered as a lithostratigraphic unit and therefore it should be changed to the Lubok Antu Complex.

The occurrence of chert blocks in the Lupar valley has been reported by Hinde (1900), Haile (1957) and Tan (1979). The largest chert block is that forming Bukit Buluk which is approximately 5.5 km in length. The radiolaria from the chert blocks were first studied by Hinde (1900). He concluded that the age of the chert was probably Jurassic, but possibly Early Cretaceous. Davies (in Haile, 1957) suggested the age of the chert between Middle Jurassic and pre-Cenomanian based on some radiolaria, identified from thin sections of twelve chert specimens. With the advent of the hydrofluoric acid technique (Pessagno and Newport, 1972) it is now possible to extract radiolarian specimens from the chert. Pessagno has identified some radiolarian assemblages indicative of Hauterivian to Aptian, Early Cretaceous (in Tan, 1979). Tumanda *et al.* (1993) have reported some late Jurassic and Early Cretaceous radiolaria from the Lubok Antu Mélange and the Serabang Formation. Recently, Basir Jasin and Haile (1993) have recorded some Albian-Cenomanian radiolaria from the chert of Bukit Buluk. The age of the chert in Lubok Antu Complex ranges from Late Jurassic to Cenomanian, Cretaceous

Recently, 14 samples of chert (Samples LA 1-LA 14) were collected from chert blocks exposed along the Lubok Antu and Batang Ai roads. The chert samples were crushed and soaked in hydrofluoric acid for two days. The samples were washed and filtered through filter paper. The samples were dried and picked by using a paint brush. The well preserved specimens were photographed by using a Scanning Electron Microscope.

The cherts are widespread within the Lubok Antu Complex. Some of the large chert blocks form prominent hills i.e. Bukit Melarang, Bukit Buluk, Bukit Tongkat, Bukit Terbalau, and Bukit Rakut. Most of the blocks embedded in the mudstone matrix. The cherts are bedded with thickness ranging from 1 cm to 10 cm. The cherts are interbedded with mudstones. The cherts are folded and some parts are fractured and sheared. The origin of the chert and its relationship with the Pakong Mafic Complex is not fully understood. These cherts were probably associated with the Pakong Mafic Complex which formed an ophiolite sequence.

Radiolarian assemblage and age

Three assemblage were recognised:-

1) **Assemblage 1**:- This assemblage is found in sample LA 14. The assemblage is composed of:

Sphaerostylus lanceola (Parona)
Homeoparonaella gigantea Baumgartner
Angulobracchia sp.
Titrab exotica (Pessagno).
Neotripocyclia sp.
Hsuum cf. cuestaensis Pessagno
Ristola boesii (Parona)
Mirifusus baileyi Pessagno
Spongocapsula sp.
Acanthocircus carinatus Foreman
Paronaella cf. bronnimanni Pessagno
Paronaella sp.
Protonuma sp.
Archaeodictyomitra excellens (Tan Sin Hok)
Ristola altissima (Rust)
Mirifusus mediodilatatus (Rust)
Parvicingula excelsa Pessagno and Blome

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The presence of *Ristola altissima* (Rust), *Parvicingula excelsa*, *Homeoparonaella gigantea*, *Neotripocyclia* sp. and *Titrab exotica* (Pessagno) indicates the Tithonian age, Late Jurassic. The assemblage represents the *Ristola altissima* Zone (Zone 4 of Pessagno *et al.*, 1993). This is the oldest radiolarian assemblage found in the area.

2) **Assemblage 2**:– This assemblage is found in samples LA 2 and LA 5. The assemblage is characterised by the occurrence of

Sphaerostylus lanceola (Parona)
Holocryptocanium barbui Dumitrica
"Cenosphaera" boria Pessagno
Cyrtocapsa grutterinki Tan Sin Hok
Stichocapsa altiforamina Tumanda
Dibolachras apletopora Foreman
Archaeodictyomitra lacrimula (Foreman)
Pseudodictyomitra sp.
Thanarla pulchra (Squinabol)
Parvicingula usotanensis Tumanda
Xitus spicularius (Aliev)
Staurosphaera septemporata (Parona)
Alievium cf. helenae Schaaf
Eucyrtis tenius (Rust)
Sethocapsa leiostraca Foreman
Podobursa triacantha (Fischli)
Archaeodictyomitra apiara (Rust)
Pseudodictyomitra carpatica (Lozyniak).
Pseudodictyomitra puga (Schaaf)
Thanarla conica (Aliev)
Ristola boesii (Parona)

This assemblage is indicative of Valanginian- Barremian age.

3) **Assemblage 3**:– The assemblage consists of

Holocryptocanium tuberculatum Dumitrica
Orbiculiforma sp.
Cryptamphorella conara (Foreman)
Stichomitra communis Squinabol
Obesacapsula somphedia (Foreman)
Thanarla elegantissima (Cita)
Ultranapora sp.
Novixitus mclaughlini Pessagno
Novixitus weyli Schmidt-Effing
Holocryptocanium barbui Dumitrica
Cryptamporella sphaerica (White)
Squinabollum fossilis (Squinabol)
Stichomitra sp.
Thanarla praeveneta Pessagno
Archaeodictyomitra vulgaris Pessagno
Pseudodictyomitra pseudomicrocephala (Squinabol)
Xitus spicularius (Aliev)
Rhopalosyringium majuroensis Schaaf

This assemblage indicates Albian-Cenomanian age. The assemblage is found in samples LA 1, LA 3, LA 4, LA 6, LA 7, LA 8, LA 9, LA 10, LA 11 , LA 12 and LA 13.

The age of the chert blocks in the Lubok Antu Complex ranges from Tithonian, Late Jurassic to Cenomanian, late Early Cretaceous.