

Lithostratigraphy and Sr isotopic ages of the Bau Limestone Formation in northwestern Borneo, Malaysia.

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<Introduction>

The Mid-Mesozoic era (from the Late Jurassic to the Early Cretaceous) was one of the periods in terms of the largest deposition of marine carbonate. The breakup of the supercontinent Pangea generated new seaways, and expanded humid climates. Additionally, it intensified terrestrial weathering and continental flux of inorganic nutrients and carbonate alkalinity to seawater. In the eutrophied ocean, reef-builders were flourished under the circumstance of a relatively high CO₂ concentration and the warm ocean environment.

Sedimentology and stratigraphy of the Mid-Mesozoic carbonate were well studied in Europe, the former territory of the Tethys Ocean. On the other hand, because information on the Mid-Mesozoic carbonate of Asia and Pacific realm were limited, more information and more studies of them have been expected. Here, we present the lithostratigraphy and Sr isotopic age of the Bau Limestone Formation (the Upper Jurassic to the Lower Cretaceous) in northwestern Borneo of Malaysia, for the first time.

<Lithostratigraphy and depositional environments>

We surveyed at two quarries (Marup and SSF) of the Gunung Panga rock body, located at 30km southwest of Kuching City. The lithofacies are mainly massive limestone yielding mega fossils. At Marup Quarry, we described the lithology of 40m thick horizontal range. The lithology is subdivided into Bioclastic wacke-packstone including many cidaris spines and Bafflestone containing corals. Many rudists are yielded at the lower horizon of the surveyed section. At SSF Quarry, we described the lithology of 190m thick horizontal range. The lithology is subdivided to 5 facies: Oncoidal Packstone, Peloidal Packstone, Bioclastic Packstone, Bindstone, and Frame-Bafflestone. Mega fossils are yielded at the all facies, and the intergranular spaces are occupied by sparitic cements. Many rudists are yielded at the lower horizon of the surveyed section, too.

We surveyed at Bunkit Akut Quarry near Kuching=Serian Road, witch is located at 40km south-southeast of Kuching City. The limestone is clearly stratified and slumping fold is developed at the upper horizon of the surveyed section. Lithofacies are fine-grained limestone and subdivided into 3 facies: Calcarenite, Lime mudstone, and Bioclastic wackestone. Addition, mud beddings are intercalated within limestone at the middle to upper horizon of surveyed section.

Because of sparitic cements and hermatypic biota, the depositional environment of the Gunung Panga limestone body is considered to be photic zone influenced by wave. On the other hand, because of absence of hermatypic biota and developing of slumping fold, the depositional environment of Bunkit Akut limestone body is considered to be deeper than storm wave base, and environment where siliciclasts were intermittently supplied. Based on our description, it is concluded that the depositional environment of the Bau Limestone Formation is subdivided into two environments: shallow marine and hemipelagic at least.

<Apply of Sr isotopic stratigraphy for age-determination>

Outer layers of rudist shells collected from Marup and SSF Quarries were powdered, and Sr was

separated from them by a use of chromatography using Sr ion exchange resin and nitric acid. The $^{87}\text{Sr}/^{86}\text{Sr}$ isotopic ratios were measured by a thermal ionizing mass spectrometer (TIMS; Thermo Finnigan TORITON). The Sr ratios were projected on the standard age-profile of Look-up Table in order to evaluate the depositional age.

In the results, it is obvious that $^{87}\text{Sr}/^{86}\text{Sr}$ ratio of Marup and SSF are correlated to late Oxfordian to early Kimmeridgian of the Late Jurassic. In the previous studies, the age of Bau Limestone Formation was indefinitely considered to be later than the Late Jurassic by bad-preserved ammonoid fossils. But in this study, we are able to determine the depositional age of the specific horizon of the Bau Limestone Formation for the first time.

Keywords: Bau Limestone Formation, the Late Jurassic to the Early Cretaceous, Rudist, Sr isotopic stratigraphy