Carboniferous (Mississippian) Dropstones and Diamictite from the Chepor Member, Basal Kubang Pasu Formation: Earliest Record of Glacial-Derived Deposits in Peninsular Malaysia

Meor H. Amir Hassan¹, Aye Ko Aung¹, R.T. Becker², Noor Atirah Abdul Rahman¹, Ng Tham Fatt¹, Azman A. Ghani¹, Mustaffa Kamal Shuib¹

¹Geology Department, University of Malaya, 50603 Kuala Lumpur (meorhakif@um.edu.my)
²Institut für Geologie und Paläontologie, Corrensstrasse 24, D-48149 Münster, Germany

INTRODUCTION

Ancient glacial marine deposits are known from the Singa Formation in Langkawi, which contains dropstones, diamictites and cold water brachiopods (Stauffer and Lee, 1986; Mohd Shafeea Leman, 1996). These have been associated with widespread Permian-Carboniferous glaciation on Gondwana (Veevers and Powell, 1987). Fossil brachiopods associated with these glacial marine deposits indicate an Early Permian (late Asselian-Early Sakmarian) age.

We here describe pebbly mudstone and diamicite intervals from the Carboniferous Chepor Member, Kubang Pasu Formation, and interpret them as representing the earliest record of glacial marine conditions on Peninsular Malaysia.

GEOLOGIC SETTING AND LOCATION

The basal unit of the Kubang Pasu Formation, known as the Chepor Member, is exposed at several small hills in Perlis state, Malaysia, including Guar Sanai, Hutan Aji and Bukit Tuntung, Pauh (Fig. 1). The unit comprises thick, grey to red fossiliferous mudstone with interbedded quartzitic and occasional feldspathic sandstone (Amir Hassan et al., 2014). The Chepor Member unconformably overlies Devonian black shales and limestone, and Tournaisian chert. A facies analysis of the Chepor Member succession in Guar Sanai and Hutan Aji was conducted. This was then combined with palaeontological data to construct a depositional model for the unit.

Figure 1: Location and geologic map of study areas in Perlis.
RESULTS AND DISCUSSION

The rocks of the Chepor Member are divided into four main facies: (1) Mudstone Facies characterised by thick fossiliferous mudstone interpreted as shelfal deposits; (2) Graded Sandstone Facies characterised by normal graded beds and incomplete Bouna sequences, interpreted as gravity-driven turbidites; (3) Clean Sandstone Facies characterised by fine grained sandstone displaying abundant wave and current generated sedimentary structures and interpreted as storm- and tide-generated bars, dunes, shoals or ridges; and: (4) Diamictite Facies characterised by poorly sorted sandstone with floating pebbles. Isolated pebbles are commonly found floating in the Mudstone Facies, where they disrupt and deform underlying laminae (Fig. 2A). The pebbles are interpreted as dropstones. Some intervals of the Mudstone Facies are also poorly sorted, with abundant, coarse grained sandstone grains distributed in the rock. These poorly sorted units are interpreted as rain-out diamictites. Both features probably represent debris fall out from melting icebergs. The Diamictite Facies is interpreted as gravity-driven debris flow deposits (Fig. 2B). The combination of shallow marine facies and glacially-derived dropstones and diamictites are consistent with the interpretation of a glacial marine shelf depositional setting.

The presence of the trilobite Weyeraspis sp. (previously Dietacoryphe sp.) and the ammonoids Goniatites sp. and Praedaraelites tuntungensis indicate a possible Mississippian (Viséan) age for the glacial marine deposits of the Chepor Member.

CONCLUSIONS

The combination of glacial-derived dropstone and diamictites, shallow marine, shelfal facies and a marine fossil assemblage indicates a glacial marine depositional setting, with the dropstones and diamictites originating as fall out debris from melting icebergs.

The fossils indicate that these glacial marine deposits are significantly younger than the glacial marine deposits of the Singa Formation which are Early Permian in age. Thus, the Chepor Member dropstones and diamictites are the earliest records of glacial marine conditions in Peninsular Malaysia.

REFERENCES


Figure 2: Glacial marine deposits of the Carboniferous Chepor Member, Kubang Pasu Formation. (A) Dropstone penetrating laminae of the Mudstone Facies. (B) Pebbles in the Diamictite Facies.