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On the Palynomorph Assemblage from the Panti Sandstone, Kota Tinggi, Johor

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Abstract

A fairly well-preserved palynomorph assemblage is described from a rock sequence of the Panti Sandstone which is exposed at a quarry to the north of Kota Tinggi, Johor. The rock sequence overlies an older granite body, and it consists of predominantly mudstone, siltstone and thinly-bedded sandstone layers followed by coarser-grained sandstone and conglomerate layers towards the top of the succession. The most common palynomorph genera present in the assemblage are *Classopollis*, *Cicatricosisporites*, *Aequitriradites*, *Ischyosporites* and *Ephedripites* together with genera that are of relatively rarer occurrence, which include *Dictyophyllidites*, *Polycingulatisporites*, *Baculatisporites*, *Concavissimisporites*, *Leptolepidites* and *Neoraistrickia*. Based on the palynomorph assemblage it appears that the rock sequence is Lower Cretaceous (Berriasian-Valanginian) in age and the climate during the deposition of the sediments was warm and dry.

Himpunan Palinomorf dari Batu Pasir Panti Kota Tinggi, Johor

Abstrak

Himpunan palinomorf yang tersingkap dengan agak baik dalam jujukan batuan Batu Pasir Panti terdedah di kawasan kuari di bahagian utara Kota Tinggi. Jujukan batuan ini menindih jasad granit tua dan terdiri daripada batu lumpur pradominan, batu lodak dan lapisan nipis batu pasir diikuti oleh batu pasir butir kasar dan lapisan konglomerat menghala kebahagian atas. Genera palinomorf yang lazim diwakili oleh himpunan *Classopollis*, *Cicatricosisporites*, *Aequitriradites*, *Ischyosporites* dan *Ephedripites* dan genera yang jarang dijumpai seperti *Dictyophyllidites*, *Polycingulatisporites*, *Baculatisporites*, *Concavissimisporites*, *Leptolepidites* dan *Neoraistrickia*. Berdasarkan himpunan palinomorf yang ditemui, usia jujukan batuan kawasan kajian ialah Kapur Awal (Berriasian-Valanginian) dan iklim semasa pengendapan sedimen adalah panas dan kering.

INTRODUCTION

The Gunung Panti area, situated to the north of Kota Tinggi, Johor, was mapped by Drummond (*in* Burton, 1973). The lithology of the rocks from this area shows a close resemblance to Jurassic-Cretaceous rocks in the central and southeastern parts of Pahang as well as in several parts of Johor. Some of these rocks, which are typically flat-bedded overlying older rocks of either granite or other Upper Paleozoic rocks, were mapped as Tebak Formation (Rajah, 1969). Kee (1966) mapped the Gunung Panti area and described the rocks as grey sandy mudstone and rich in plant fossils. Kon'no (1966) identified several plant fossils namely *Gleichenites (Gleichenoides) pantiensis*, *Frenelopsis malaiana* and *Frenelopsis malaiana* subsp. *parvifolia* of Late Jurassic-Early Cretaceous in age. To date, a detailed study on the presence of palynomorphs was not reported from the Panti Sandstone. However, Kee (1966) reported the presence of *Classopollis* sp. (cf. *C. classoides*) and *Aequitriradites* sp. (cf. *A.* cf. *verrucosus*). The former species is generally recorded as having long stratigraphic range as compared to the later which is confined in the Early Cretaceous strata. Some sedimentological aspects of the Panti Sandstone were described by Wan Mohd Muhiyuddin Wan Ibrahim, 1997.

The present study mainly deals with the palynological aspect of the Panti Sandstone. The palynomorphs were extracted from samples of a well-exposed rock sequence at a quarry located to the east of Gunung Panti (Figure 1A). The acquired palynological data are utilised in interpreting some geological aspects such as the age of the rock sequence and the climate during which the sediments were deposited. It is believed, and in several cases it has been proven that palynological data from the Jurassic-Cretaceous sedimentary rocks in Peninsular Malaysia are required as an alternative to provide supporting evidence in interpreting the geological aspects due to the scarcity of macrofossils, which are seldom found in well-preserved conditions.

MATERIALS AND METHODS

The rock sequence was measured and systematic sampling was carried out in ascending order throughout the succession (Figure 1B). A total of thirty-two samples, mainly mudstone, siltstone and fine-grained sandstone, were collected for palynological study. The samples were then

processed according to the standard palynological preparation techniques by using hydrofluoric acid and nitric acid (or Schulze solution) to dissolve silicate materials and as an oxidising agent, respectively. As a precaution to prevent the palynomorphs from being destroyed, the samples were oxidised with nitric acid prior to applying the stronger oxidising agent of Schulze solution. Oxidation time varied from one sample to another due to the difference in organic content, which ranged from light brown to black in colour. The later organic materials required a longer oxidation time or a stronger oxidising agent to obtain the optimum colour to be studied under transmitted light microscope. The organic residues were mounted in a permanent medium of Canada balsam. The palynomorphs were then identified and compared with palynomorphs recorded from other areas. Some selected palynomorphs are illustrated in Figure 2.

RESULTS AND DISCUSSION

A total of eighteen samples yielded palynomorphs at different stages of preservation. Out of this, only seven samples (902, 910. 915, 916, 916, 921 and 927) yielded identifiable palynomorphs, which can be assigned to eleven genera. The rest of the samples contain either badly-preserved palynomorphs or unidentifiable plant fragments.

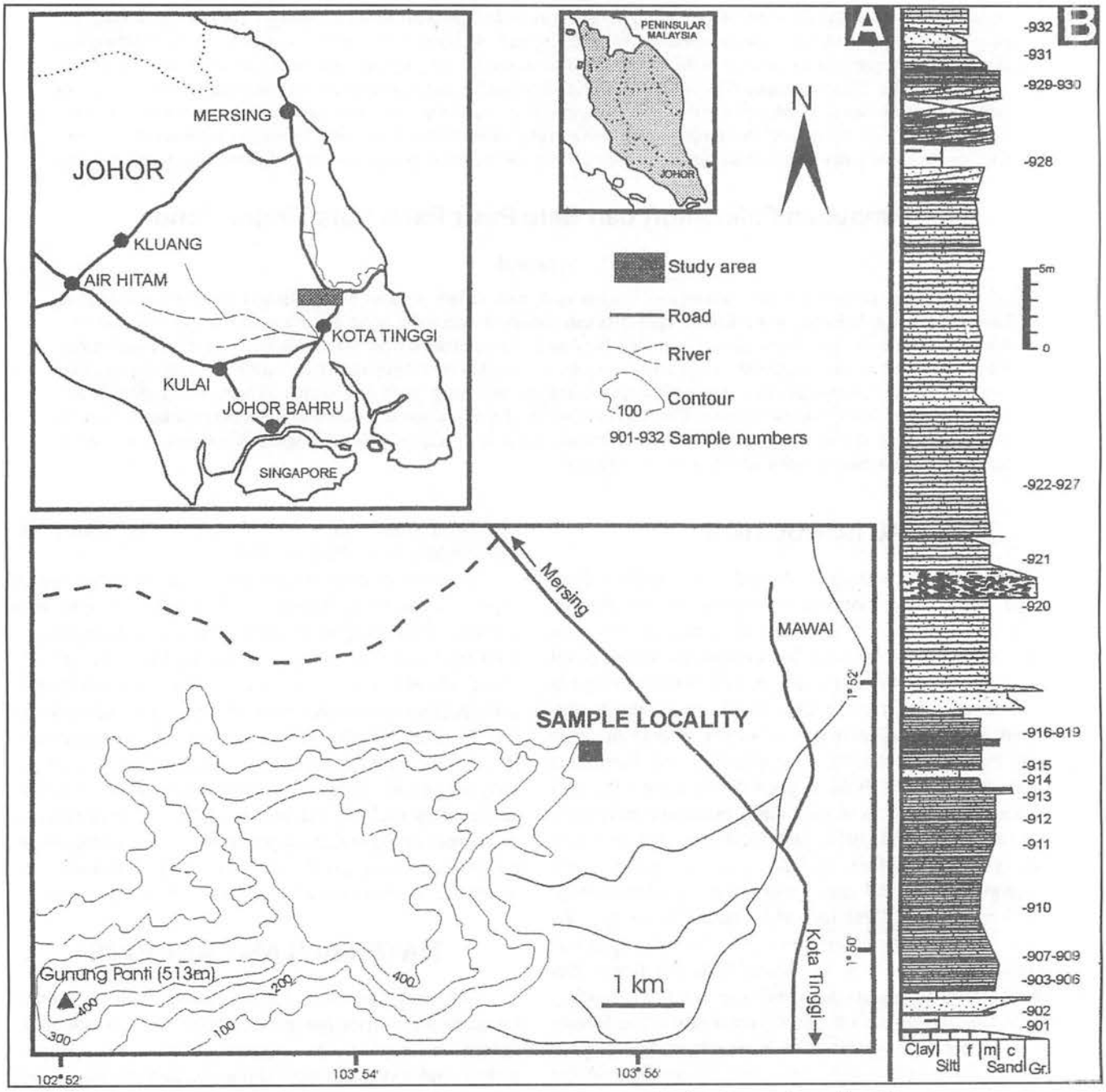

Figure 1: Map of the study area (A) and the measured section showing the sample position (B).

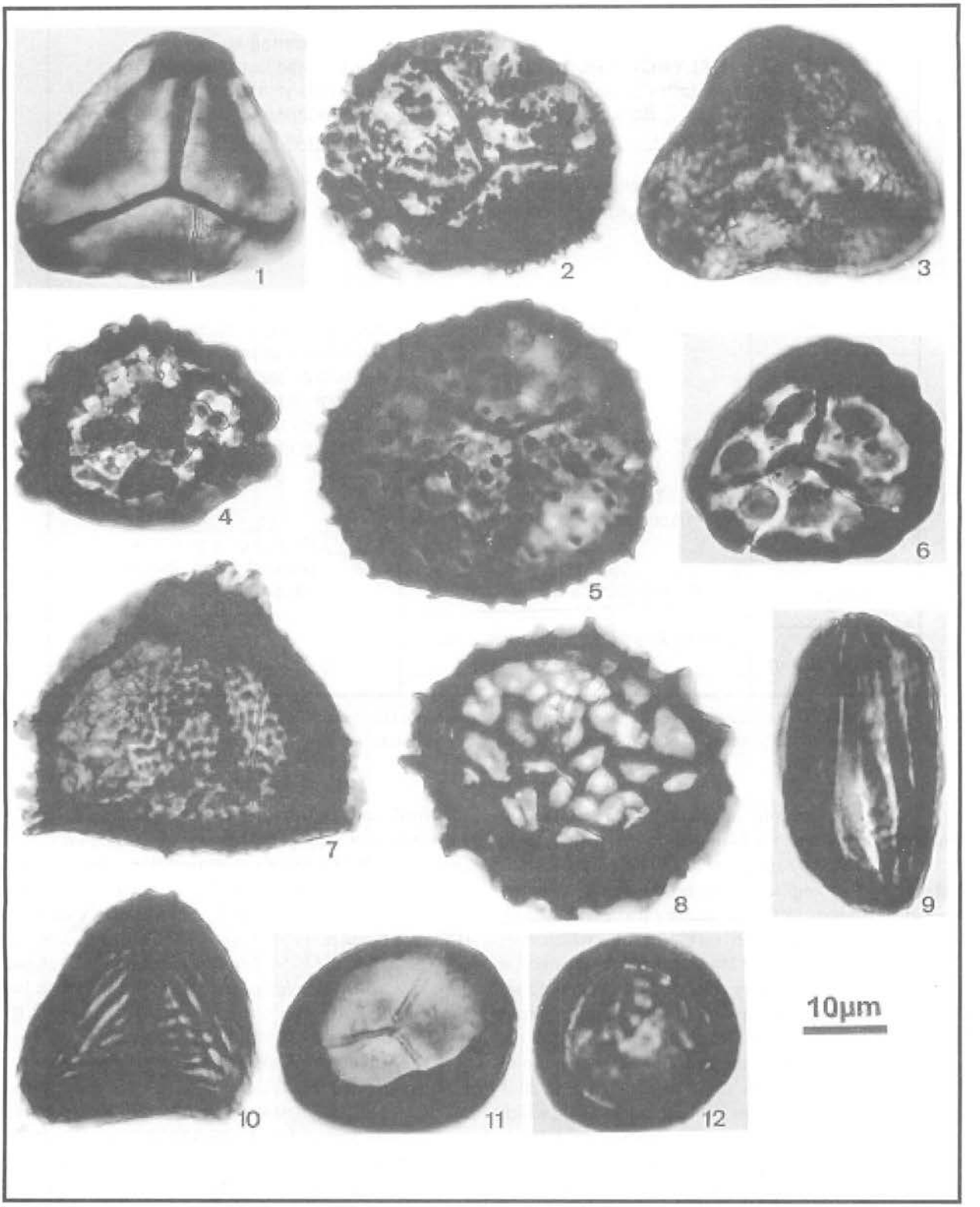

Figure 2: Selected palynomorphs from the Panti Sandstone. 1: *Dictyophyllidites equiexinus* (Couper) Dettmann 1963, 2: *Baculatisporites comaumensis* (Cookson) Potonié 1956, 3: *Concavissimisporites variverrucatus* (Couper) Brenner 1963, 4: *Ischyosporites scaberis* Cookson and Dettmann 1958, 5: *Neoraistrickia levidensis* (Balme) Backhouse 1988, 6: *Leptolepidites verrucatus* Couper 1953, 7: *Aequitriradites inornamentus* Backhouse 1988, 8: *Ischyosporites variegatus* (Couper) Schulze 1967, 9: *Ephedripites multicostatus* Brenner 1963, 10: *Cicatricosisporites australiensis* (Cookson) Potonié 1956, 11: *Polycingulatisporites reduncus* (Bolkhovitina) Playford and Dettmann 1965, and 12: *Classopollis classoides* (Pflug) Pocock and Jansonius 1961.

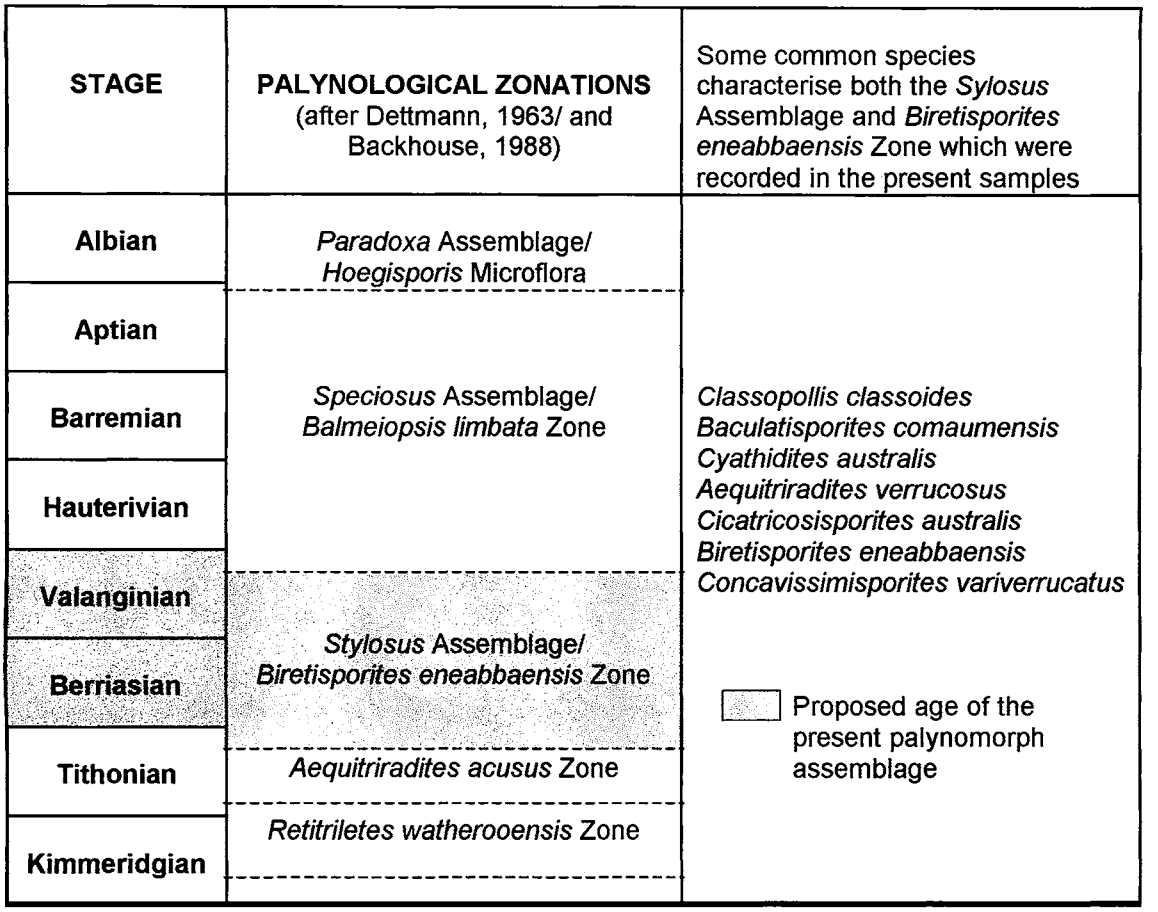

Figure 3: Upper Jurassic and Lower Cretaceous palynological zonatios (Dettmann 1963 and Backhouse, 1988) and the proposed age of the present palynomorp assemblage from Panti Sandstone.

Most of the palynomorphs are dark brown to black in colour and require longer oxidation time (15-30 minutes in Schulze solution). The opaqueness of the palynomorphs found in any palynological sample is often related to either metamorphic activity or the weathering process. Based on petrographical study conducted on the samples which were collected from the lowermost layer of the rock sequence, it was found that, there was no evidence that metamorphism had taken place. Therefore, the dark-coloured palynomorphs in the present samples is best explained as a result of the weathering process. Due to the badly-preserved nature of the palynomorphs found in most of the samples, it is interpreted that they underwent multiple degradation, which was initially due to some degree of degradation prior to burial, and followed by the present day weathering process. The weathering process must have been active during the deposition of the sediments as the climate at that time is interpreted to be warm as indicated by the dominance of *Classopollis* spp. (Pocock and Jansonius, 1961).

The diversity of palynomorphs varies from one sample to another, and sample 921 yielded the most abundant palynomorphs. The observed palynomorph genera are assigned to *Dictyophyllidites equiexinus* (Couper) Dettmann 1963, *Polycingulatisporites reduncus* (Bolkhovitina) Playford and Dettmann 1965, *Concavissimisporites variverrucatus* (Couper) Brenner 1963, *Baculatisporites comaumensis* (Cookson) Potonié 1956, *Aequitriradites inornamentus* Backhouse 1988, *Ischyosporites scaberis* Cookson and Dettmann 1958, *Ischyosporites variegatus* (Couper) Schulze 1967, *Cicatricosisporites australiensis* (Cookson) Potonié 1956, *Leptolepidites verrucatus* Couper 1953, *Neoraistrickia levidensis* (Balme) Backhouse 1988, *Classopollis classoides* (Pflug) Pocock and Jansonius 1961 and *Ephedripites multicostatus* Brenner 1963.

The palynomorph assemblage in the Panti Sandstone is characterised by the dominance of *Aequitriradites inornamentus*, *Ischyosporites scaberis*, *Ischyosporites variegatus*, *Classopollis classoides* and *Cicatricosisporites australiensis*. A rarer occurrence of several species were also identified, which include *Polycingulatisporites reduncus*, *Concavissimisporites variverrucatus*, *Baculatisporites comaumensis*, *Dictyophyllidites equiexinus*, *Leptolepidites verrucatus* and *Neoraistrickia levidensis*. The assemblage is closely comparable with other Lower Cretaceous palynomorph assemblages which were recorded from various parts of the world by previous workers such as Couper (1953 and 1958), Dettmann (1963), Singh (1964) and Backhouse (1978 and 1988). It shows a

close resemblance to the *Stylosus* Assemblage (Dettmann, 1963) and *Biretisporites eneabbaensis* Zone (Backhouse, 1978) (Figure 3). However, due to the low diversity of palynomorphs, some diagnostically occurring species in the previously proposed assemblages were not identified in the present samples, but they are closely comparable by the presence of other constituent species.

The most common forms present in the *Stylosus* Assemblage which include *Classopollis classoides*, *Baculatisporites comaumensis* and *Cyathidites australis* were also recorded in the present assemblage. As for *Leptolepidites verrucatus*, which was grouped as a less common constituent, it is similar to that recorded in the *Stylosus* Assemblage. Based on the occurrence of *Aequitriradites inornamentus*, the present assemblage is distinguished from the *Stylosus* Assemblage. The species is a common constituent in the former assemblage but it was not recorded in the later which is characterised by the presence of other species of the same genus (*A. verrucosus*). The present palynomorph assemblage also shows some similarities with *Biretisporites eneabbaensis* Zone. The first appearance of *Cicatricosisporites australiensis* which was used as the base of *Biretisporites eneabbaensis* Zone, was also recorded in the present samples. Furthermore, *Cicatricosisporites australiensis* occurs in Lower Cretaceous strata from other parts of the world as reported by Backhouse (1988). Apart from the presence of *Cicatricosisporites australiensis*, the present assemblage closely resembles the *Biretisporites eneabbaensis* Zone by the presence of *Concavissimisporites variverrucatus*. A similar Lower Cretaceous palynomorph assemblage was also recorded from a rock sequence in Paloh, which is located some 80km to the northwest of the present study area (Uyop Said and Kamal Roslan Mohamed, 1993), but it contains a relatively more dominant occurrence of *Cyathidites australis* compared to that recorded in the present assemblage.

The identified palynomorph assemblage from the Panti Sandstone is not comparable with other assemblages which are older or immediately succeeding the *Stylosus* Assemblage. A fairly common constituent of *Cicatricosisporites australiensis* in the present assemblage was not recorded in the older *Aequitriradites acusus* Zone (Backhouse, 1988) of Tithonian in age. It is also distinguished from the younger *Speciosus* Assemblage (Dettmann, 1963) and *Balmeiopsis limbata* Zone (Backhouse 1988). The *Speciosus* Assemblage is characterised by the presence of several common species such as *Cicatricosisporites ludbrooki* and *Cicatricosisporites hughesi* together with the diagnostically occurring species of *Dictyotosporites speciosus*. The two species of *Cicatricosporites* are confined to the *Speciosus* Assemblage which were not recorded during the present study. The *Balmeiopsis limbata* Zone was also interpreted to be post *Stylosus* Assemblage, and it is characterised by the first occurrence of *Balmeiopsis limbata* which was not found in the present assemblage.

CONCLUSIONS

From the available palynological evidence, it appears that the present palynomorph assemblage is Lower Cretaceous (Berriasian-Valanginian) in age (Figure 3). This assemblage is characterised by the dominance of *Cicatricosisporites australiensis* together with other significant constituent species. It shows a close resemblance to the *Stylosus* Assemblage and *Biretisporites eneabbaensis* Zone. Since the samples in the present study were collected from the lowermost part of the rock sequence, it is considered that the described palynomorph assemblage is the oldest in the Panti Sandstone. The climate during the deposition of the sediments is interpreted to be warm and dry as indicated by the dominance of *Classopollis classoides*.

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