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Discovery of Lower Permian corals in Sumatra

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Abstract: Lower Permian corals *(Protomichelinia, Kepingophyllum, Chusenophyllum?* and *Polythecalis)* are for the first time recorded from Sumatra. These corals are associated with fusulinids indicative of the Middle-Late Asselian, *Pseudoschwagerina* Zone. Lower Permian sediments appear to be widely developed in the upper Mesumai River area and appear to represent a forested volcanic arc surrounded by a shallow muddy sea.

INTRODUCTION

Lower Permian corals have not been previously described from Sumatra, in fact, even the presence of the Lower Permian was poorly documented. A field trip was recently carried out at the foot of the Barisan Mountains in the western part of the Jambi Province, a province drained by the largest river system of Sumatra (Fig. 1). The Lower Permian has been encountered in many places along the Mesumai River, the Merangin River and the Sungai Saro, a tributary of the Tembesi River. Corals have been found at the Mesumai River.

GENERAL GEOLOGY

Localities

Permian limestone is exposed at four places in the lower reaches of the Mesumai River. These localities, from downstream to upstream, are Pulau Apat, Muara Liso, Batu Gajah and Batu Impi (Fig. 2). All the outcrops are small and protrude only 2 or 3 metres above the water level. They are Lower Permian in age as indicated by the microfossils, they contain *Darvasites* cf. *fornicatus, Boultonia willsi, Rugosofusulina parvula, Schubertella* ex gr. *kingi, Stafella moelleri, Pseudoschwagerina* sp. (Fontaine and Vachard, 1983). Sediments exposed in the upper reaches of the Mesumai River are Upper Jurassic in age.

At Pulau Apat about 1 km downstream from Muara Liso (= Mouth of Sungai Liso), limestone is discontinuously exposed over a 200 m stretch. It crops out more widely on the left bank than on the right bank and dips gently towards the north-northwest. Microfossils (algae, fusulines and other foraminifera) are abundant. Macrofossils are scarce and represented only by fragments. Corals are absent. The limestone of Pulau Apat is associated with black shale and volcanics. Moreover, a few fragments of the volcanic rock are included in the limestone.

At Muara Liso and at 1 km upstream (are not visited by the author), a limestone intercalated in a conglomerate contains fusulines and corals according to Tobler (1919) and dips 15–20° towards the east. Geologists of the Geological Research and Development Centre (Bandung) provided a sample of this limestone to the author. This sample contains only algae and foraminifera.

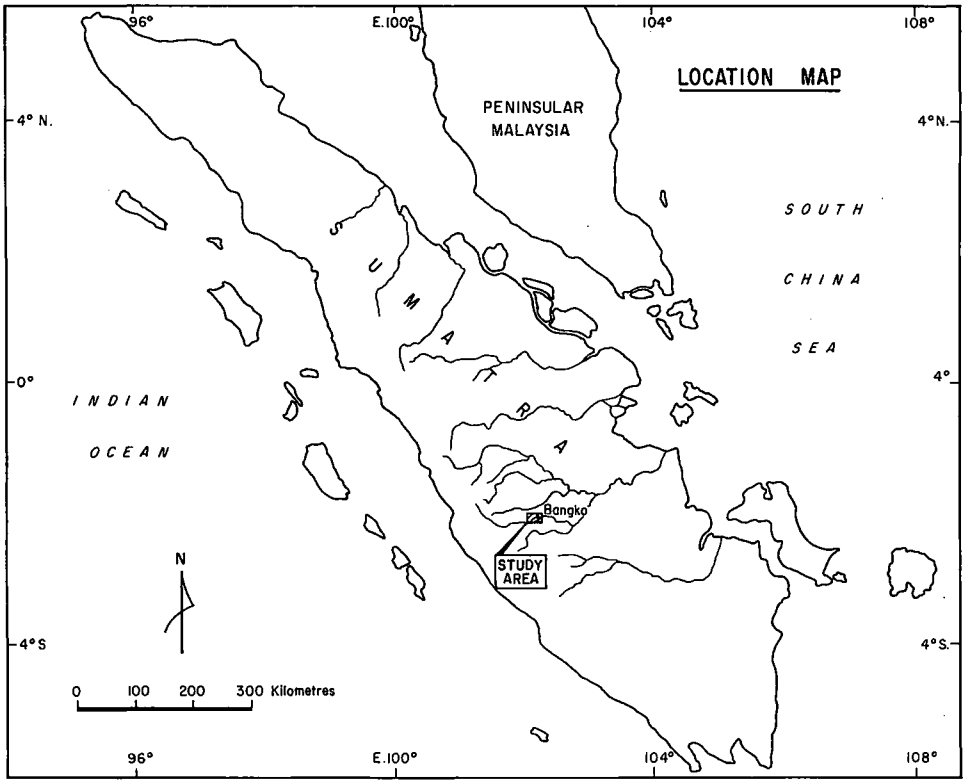

Fig. 1. Location map of study area.

Batu Gajah is a small ourcrop in the left bank of the Mesumai River 900 m downstream from the mouth of the Sungai Simpai. The limestone is bedded, gently dipping towards the north (= downstream) and contains abundant fusulines. Some colonies of *Protomichelinia* (collected samples: IN462, IN468) are present, reaching 40 cm in diameter.

Batu Impi is 200 m upstream of Batu Gajah on the right bank of the Mesumai River. Here the limestone dips 20° towards the south indicating that Batu Impi and Batu Gajah form an anticline. The limestone is bedded and contains rather abundant corals: *Protomichelinia* (IN471, IN472, IN473), *Kepingophyllum* and waagenophyllids (IN355, IN474, IN479, IN480).

In the area covered by this paper, limestone, shale, tuffaceous sandstone (locally with plant remains), conglomerate, rhyolite and andesite are discontinuously exposed along the Mesumai River and its tributaries. Dips are gentle, but varied in direction giving slightly undulating strata.

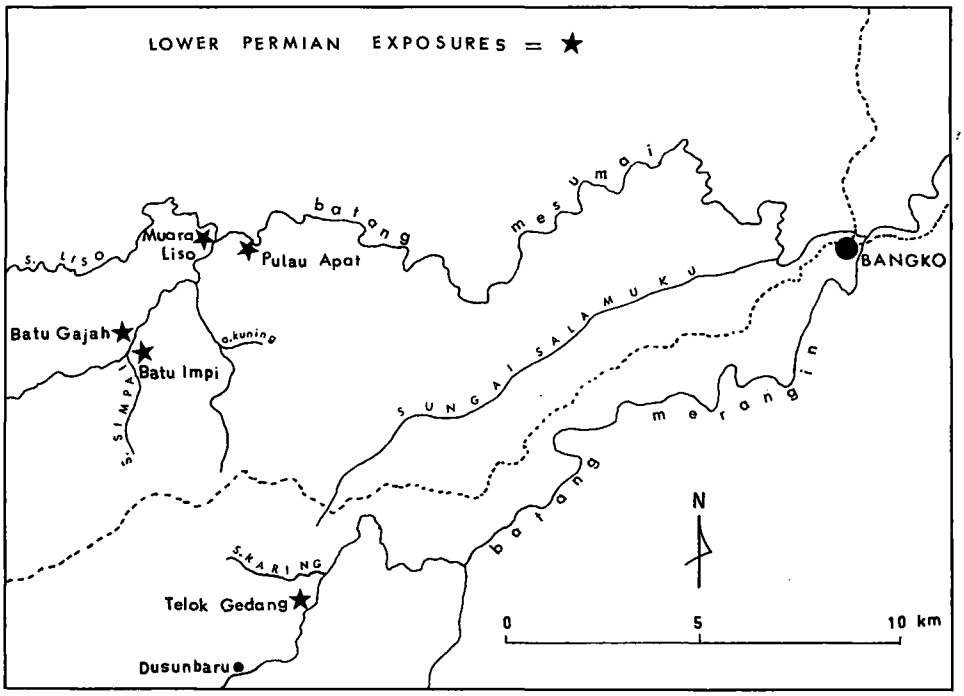

Fig. 2. Lower Permian exposures in the lower reaches of the Mesumai River.

Depositional environment

At Sungai Bukit Tinggi (Telok Gedang) and Sungai Karing, tributaries of the Merangin River, paralic sediments are exposed at less than 10 km from the coral localities of the Mesumai River. They are composed of Lower Permian limestone with fusulines and brachiopods, black shale rich in fossil plants, a few thin seams of coal and sandstone containing *Stigmaria* in place. Thus, corals of the Mesumai River thrived near the seashore.

The environment was shallow marine, muddy and with low energy being sheltered from wave action. The limestone is mainly a wackstone. Corals could not build reefs and were scattered on the sea floor. Whereas the *Protomichelinia* colonies reached a large size, the *Kepingophyllum* and waagenophyllid coralla remained small, floating on mud and expanding in width.

The presence of lava and pyroclastic deposits indicate that the Mesumai River area was in the vicinity of volcanoes that were quite active.

In conclusion, the region of the Mesumai–Merangin Rivers may correspond to a volcanic island arc, covered by forests (fossil woods are common) and circled by a shallow sea. Coral reefs could not develop in the Mesumai River area, but maybe present elsewhere in better environments. Such outcrops are yet to be located.

Systematic Paleontology

Tabulata are prominent; however, they are represented only by the Genus *Protomichelinia*. Tetracorallia consist of massive Waagenophyllidae belonging to *Kepingophyllum, Polythecalis* and maybe *Chusenophyllum*.

TABULATA

Protomichelinia (Yabe and Hayasaka, 1915)
Protomichelinia laosensis Mansuy
Pl. 1, figs. 3–4; pl. 2, figs. 1–3

The corallum is massive and up to 40 cm in diameter. Corallites are polygonal in transverse section, rather regular in size with mature ones averaging 4 to 5 mm in diameter. The walls are composed of a dark line flanked by two lamellar layers. Septal spines are absent and mural pores few, about 0.2 mm in diameter. Tabulae are generally complete, horizontal or slightly inclined, straight or gently arched, 8 to 11 in number per cm for samples IN462, IN468, IN471 and IN473, but more closely spaced in the sample IN472 (14 to 19 per cm).

The above samples are very close to *Protomichelinia laosensis* Mansuy (= *P. siyangensis* Reed). This species had been previously found at the base of the Ruteh Limestone in North Iran, under a horizon with *Ipciphyllum* and from beds considered Artinskian in age by Flugel (1964). It is also known in Southwest Iran (Douglas, 1936), in the Chihsia Limestone (= Artinskian) in China (Yoh & Huang, 1932; Huang, 1932), and in Central Afghanistan where it was collected again from an Artinskian limestone (Vachard, 1980).

The samples of Sumatra are a little older, Middle–Late Asselian in age according to the associated microfauna. This fact is not surprising because *Protomichelinia laosensis* seems to range from the Lower Carboniferous to the Lower Permian. This species occurs in the Lower Carboniferous of Yunnan and Laos.

TETRACORALLIA

Kepingophyllidae
Kepingophyllum Wu and Zhou
Kepingophyllum sp.
Pl. 1, figs. 1–2

The corallum is massive. Corallites are almost regularly polygonal and 7 to 10 mm across. The walls are partially vanishing, displaying a characteristic structure composed of vermiform prickles. Major septa, 11 to 13 in number, reach nearly to the columella. Minor septa are thinner and shorter than the major ones. Lonsdaleoid dissepiments are well-developed. The columella, about 1 mm in diameter is composed of closely set tabellae, bisected by a median plate. The tabularium is 0.9 mm wide, consisting of clinotabulae and transverse tabulae.

Kepingophyllum is a genus restricted to the Lower Permian in China (Maping Limestone).

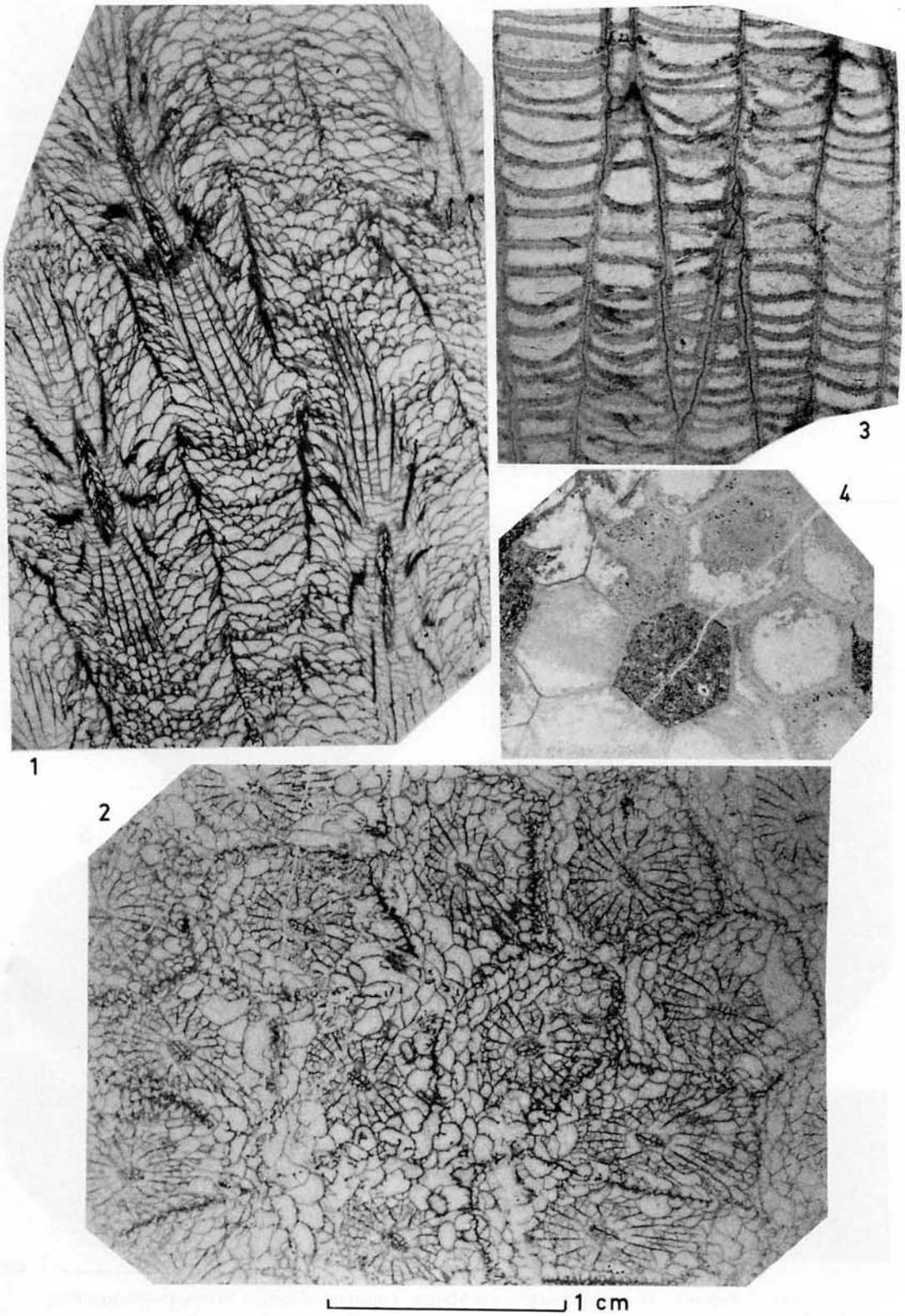

Plate 1. Figures 1 & 2—*Kepingophyllum* sp. Transverse (fig. 2) and longitudinal (fig. 1) sections. Sample IN355 from Batu Impi.Figures 3 & 4—*Protomichelinia laosensis* Mansuy. Transverse (fig. 4) and longitudinal (fig. 3) sections. Sample IN473 from Batu Impi.

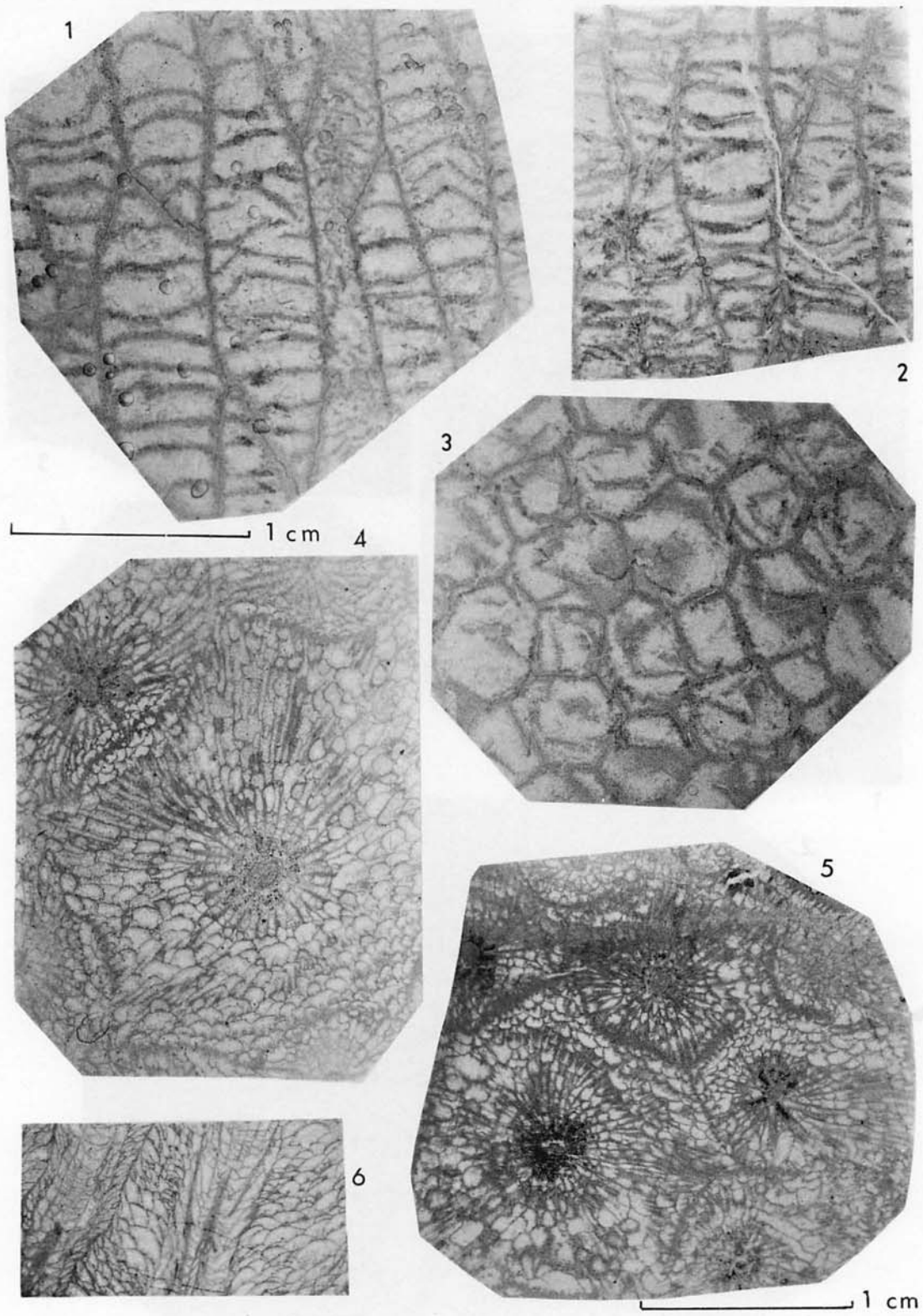

Plate 2. Figure 1—*Protomichelinia laosensis* Mansuy. Longitudinal section. Sample IN468 from Batu Gajah.
Figures 2 & 3—*Protomichelinia laosensis* Mansuy. Transverse (fig. 3) and longitudinal (fig. 2) sections. Sample IN462 from Batu Gajah.
Figures 4 & 5—*Polythecalis* sp. Transverse sections. Sample IN480 from Batu Impi.
Figure 6—*Chusenophyllum?* Longitudinal section. Sample IN474 from Batu Impi.

Waagenophyllidae
Polythecalis sp.
Pl. 2, figs. 4–5

The corallum is small and known only by transverse sections. Corallites, more or less polygonal and irregular in size, are 10 to 15 mm in diameter with partially vanishing walls. Major septa are 12 to 17 in number; some of them extending to the wall. Minor septa are slightly shorter than the major ones. Lonsdaleoid dissepiments are irregularly developed. The columella is elliptical in transverse section, 0.8 to 1.5 mm across and vesicular or compact.

This sample (IN480) was collected at Batu Impi.

Chusenophyllum?
Pl. 2, fig. 6; pl. 3, figs. 1–2

The corallum is massive; in transverse section it appears as a vesicular mass dotted with circular septate zones corresponding to the centres of the corallites. Walls are almost absent. The distance between the centres of two adjacent corallites ranges from 5 to 10 mm. Lonsdaleoid dissepiments are prominent. Major septa, 9 to 12 in number, extend inward to a short distance from the columella; minor septa are shorter and locally poorly developed. Septate zones are rather variable in size but are commonly from 3.5 to 4.5 mm in diameter. The columella is elliptical in transverse section, 0.8 to 1 mm across the major axis and 0.5 to 0.8 mm across the minor axis. In longitudinal section, tabellae forming the columella are closely set and commonly thickened, so that vesicular structure of the columella is locally obliterated. The tabularium is about 1.2 mm wide and composed of clinotabulae and large transverse tabulae.

Two samples of this species (IN474, IN479) were collected at Batu Impi.

Because the walls are almost absent it is difficult to know whether these samples belong to *Chusenophyllum* (without walls) or to a species of *Kepingophyllum* which has lost a great part of its walls.

CONCLUSION

At the Mesumai River, corals are not abundant because the depositional environment was not very favourable to them; however, they are interesting. They belong to the Middle–Late Asselian and Lower Permian corals are not well-known in Southeast Asia.

The fauna of the Mesumai River is very different from the fauna of Guguk Bulat which is Upper Murghabian (= upper part of Middle Permian) in age. Middle Permian) in age. *Ipciphyllum* is absent whereas this genus is common at Guguk Bulat. *Kepingophyllum* is present. *Protomichelinia* is very abundant, but maybe because of the depositional environment.

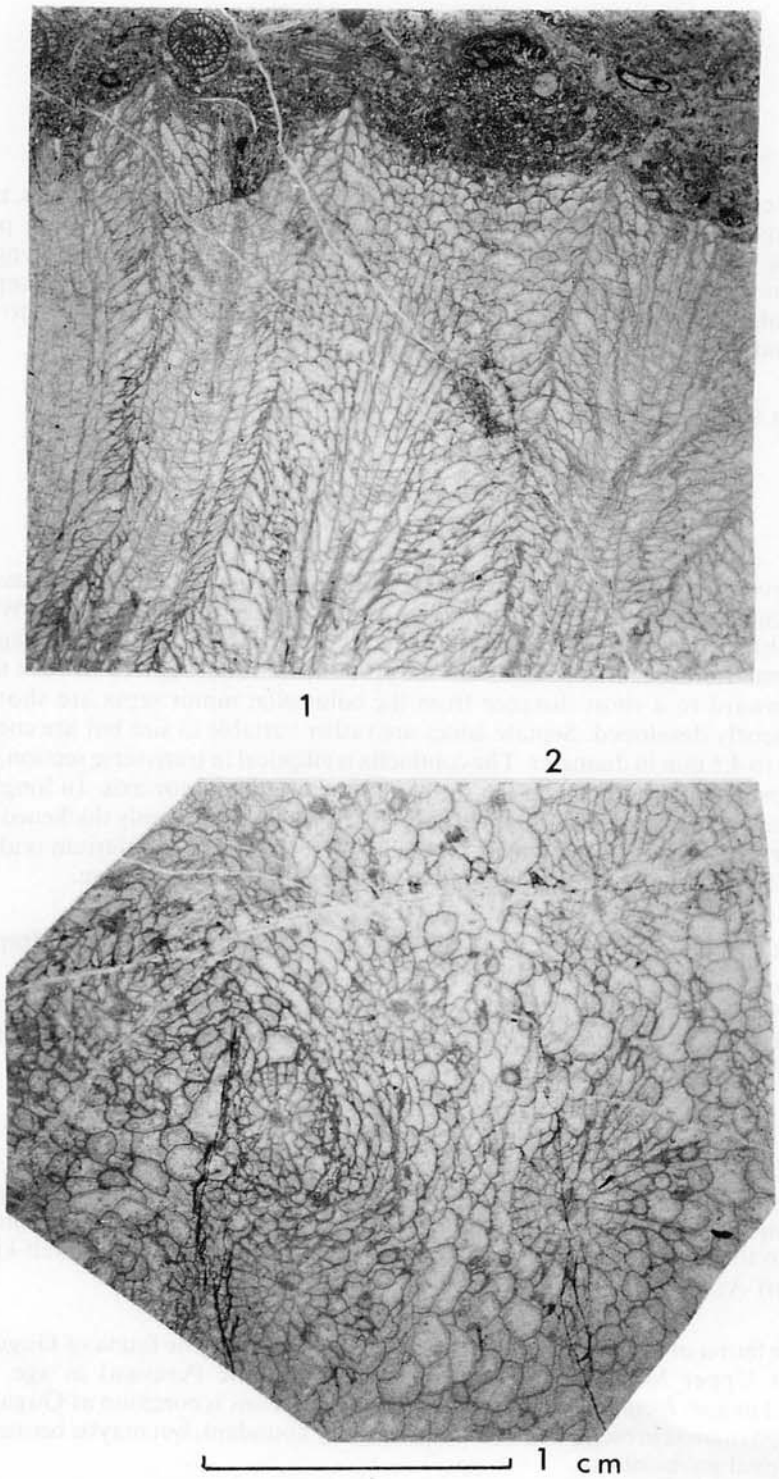

Plate 3. Figure 1—*Chusenophyllum?* Longitudinal section. Sample IN474 from Batu Impi.
Figure2—*Chusenophyllum?* Transverse section. Sample IN474 from Batu Impi.

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The coral samples described in this paper are provisionally kept in a collection stored at the author's address in France: 128, rue du Bac, 75341 Paris cedex 07, France.

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