
Occurrence of Late Permian fossil plants in Hong Kong

Lee Cho Min

Lee Cho Min 1996. Occurrence of Late Permian fossil plants in Hong Kong. *Palaeobotanist* 45 : 289-294.

A number of fossil plants collected from the north-eastern shore of the Centre Island, Tolo Harbour, New Territories, Hong Kong have been described. The specimens are preserved in black carbonaceous shale, silty shale and siltstone, which Allen and Stephen (1971) considered to be of Tolo Harbour Formation possibly of the Permian age, although they had no palaeontological evidence for this supposition.

The specimens which form the first report are : *Pecopteris* (*Asterotheca*) cf. *norinii* Halle, *Pecopteris* sp. (cf. *P. lativenosa* Halle); *Compsopteris* cf. *contracta* Gu et Zhi ; *Cordaites* cf. *shenkii* Halle ; *Gigantopteris* (cf. *Gigantopteris* sp.). They belong to the early Upper Permian (P21) *Gigantopteris* flora commonly seen in the Longtan Formation (formerly known as Longtan Coal Series) in Guangdong Province, China. Since the stratum yielding the above fossil plants is significantly different from the Tolo Harbour Formation in lithology, fossil contents and age, it has been proposed as a new stratigraphic unit—the Centre Island Formation.

Key-words—*Gigantopteris*, Fossil plants, Centre Island Formation, Late Permian, Hong Kong.

Lee Cho Min, Department of Civil & Structural Engineering, Hong Kong Polytechnic University, Hong Kong.

सारांश

हाँग काँग में अनंतिम परमियन पौधों की उपस्थिति

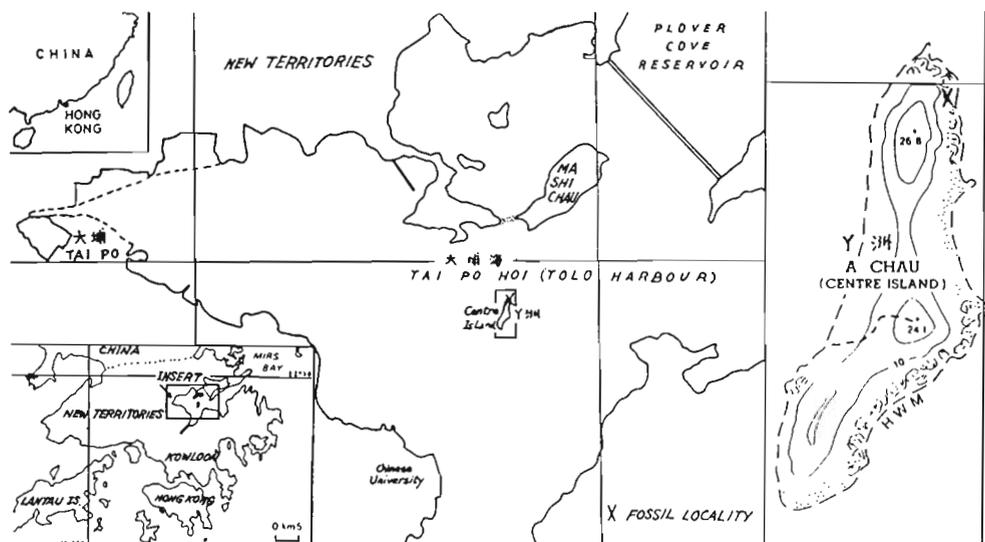
ली चो मिन

इस शोध-पत्र में हाँग काँग में केन्द्रीय द्वीप के उत्तर पूर्वी तट से एकत्रित अशिमत पौधों का वर्णन किया गया है। उपलब्ध प्रादर्श काली कार्बनमय शैलों, गाद युक्त शैलों एवं गादयुक्त पत्थरों में परिरक्षित हैं जिन्हें एलन एवं स्टीफेन (1971) ने परमियन आयु के प्रस्तावित किये हैं यद्यपि इसके पुष्टीकरण हेतु कोई पुरातात्विक प्रमाण उपलब्ध नहीं हैं।

इस समुच्चय से *पीकोप्टेरिस* (*एस्टेरोथीका*) सजातीय *नोरिनाई* हाले, *पीकोप्टेरिस* जाति (सजातीय *पी. लेक्टवीनोसा* हाले), *कोम्पसोप्टेरिस* सजातीय *कोन्ट्रेक्टा* गु व झि, *कोर्डैटिस* सजातीय *शेन्काई* हाले, जाइगेन्टोप्टेरिड (सजातीय *जाइगेन्टोप्टेरिस* जाति) का पहली बार वर्णन किया गया है। ये उपरि परमियन जाइगेन्टोप्टेरिस वनस्पतिजात से सजातीयता व्यक्त करते हैं। चूँकि शैलविज्ञान की दृष्टि से ये स्तर तोलो हारबर शैल-समूह से भिन्न हैं अतः इन स्तरों हेतु केन्द्रीय तोलो द्वीप शैल-समूह नामक एक नई स्तरिकीय इकाई प्रस्तावित की गई है।

IN the Centre Island of the Tai Po Hoi (Harbour) about 6 km east of Tai Po market in the northeast part of Hong Kong (Text-figure 1), slightly metamorphosed black carbonaceous shale intercalated with siltstone and sandstone is exposed. Allen and Stephens (1971) believed that lithologically this stratum is similar to the sandstone and shale of the Tolo Harbour Formation occurring in Ma Shi Chau

Island about 1 km northeast of Centre Island. The Tolo Harbour Formation, in which brachiopods, crinoidal stems, corals, plants and bryozoid had been discovered, was once believed to be marine beds of Carboniferous-Permian or possibly Permian age. Detail study in recent years has revealed, however, that the fossils recovered from it belong to the Early Permian age (Lee *et al.*, 1991).



Text-figure 1—Location map of the fossil plant-bearing beds.

In February 1981, when carrying out a brief geological survey in Centre Island, the author collected from the greyish black carbonaceous shale in the northeast tip of the Island a number of fossil plants which were later found to be the elements of *Gigantopteris* flora including *Pecopteris* (*Asterotheca*) cf. *norinii* Halle, *Pecopteris* sp. (cf. *P. lativenosa* Halle), *Compsopteris* cf. *contracta* Gu et Zhi, *Cordaites* and *Gigantopteris* sp. They are common in the Late Permian strata, specifically in the Longtan Coal Series in Guangdong and elsewhere in south China. Therefore the occurrence of these fossil plants for the first time in Hong Kong has proved the existence of Late Permian stratum in Centre Island. It is distinguishable from the younger than Early Permian Tolo Harbour Formation in Ma Shi Chau Island. Since the fossil contents of the stratum in Centre Island are entirely similar to those of the Late Permian Longtan Formation in southeastern China and hitherto unknown in Hong Kong, a new stratigraphic unit—the Centre Island Formation, has been proposed.

The specimens are housed at the Department of Civil and Structural Engineering, Hong Kong Polytechnic University, Hong Kong.

STRATIGRAPHY

With a spindle outline the NNE-elongated Centre Island is situated in the Tai Po Hoi Sea (Tolo Harbour) to the northeast of Hong Kong. It is about 400 m long and about 100-150 m wide, with the hills on it rising up to about 26.8 m above sea level. The stratum exposed throughout the Island consists largely of greyish black to black shale, carbonaceous shale and pelitic shale intercalated with silty shale and grey, medium fine quartz sandstone and feldspathic quartz sandstone, with an exposed thickness of about 30 m. The shales are thin-bedded while the sandstones largely thick-bedded in structure, dipping generally toward SN at angles varying from about 40° to 70° . In the southwest part of the Island, granite porphyry veins are recognisable, penetrating the black shale, causing the stratum in the Island to be metamorphosed slightly. This weak metamorphism is demonstrated mainly by cordierite crystallites occurring as spots in the shales. The fossil plants occur in a fossiliferous bed of black pelitic shale 30 cm in thickness among the black carbonaceous shale in the sea cliff on the northeast corner of Centre Island. Geology outside the Island is more or less complex :

PLATE 1

- 1-3. *Pecopteris* (*Asterotheca*) cf. *norinii* Halle
4. *Pecopteris* sp. (cf. *P. lativenosa* Halle)
- 5-11. *Compsopteris* cf. *contracta* Gu et Zhi

- 12-14. *Cordaites* cf. *schenkii* Halle
15. *Gigantopterides* (cf. *Gigantopteris* sp.)

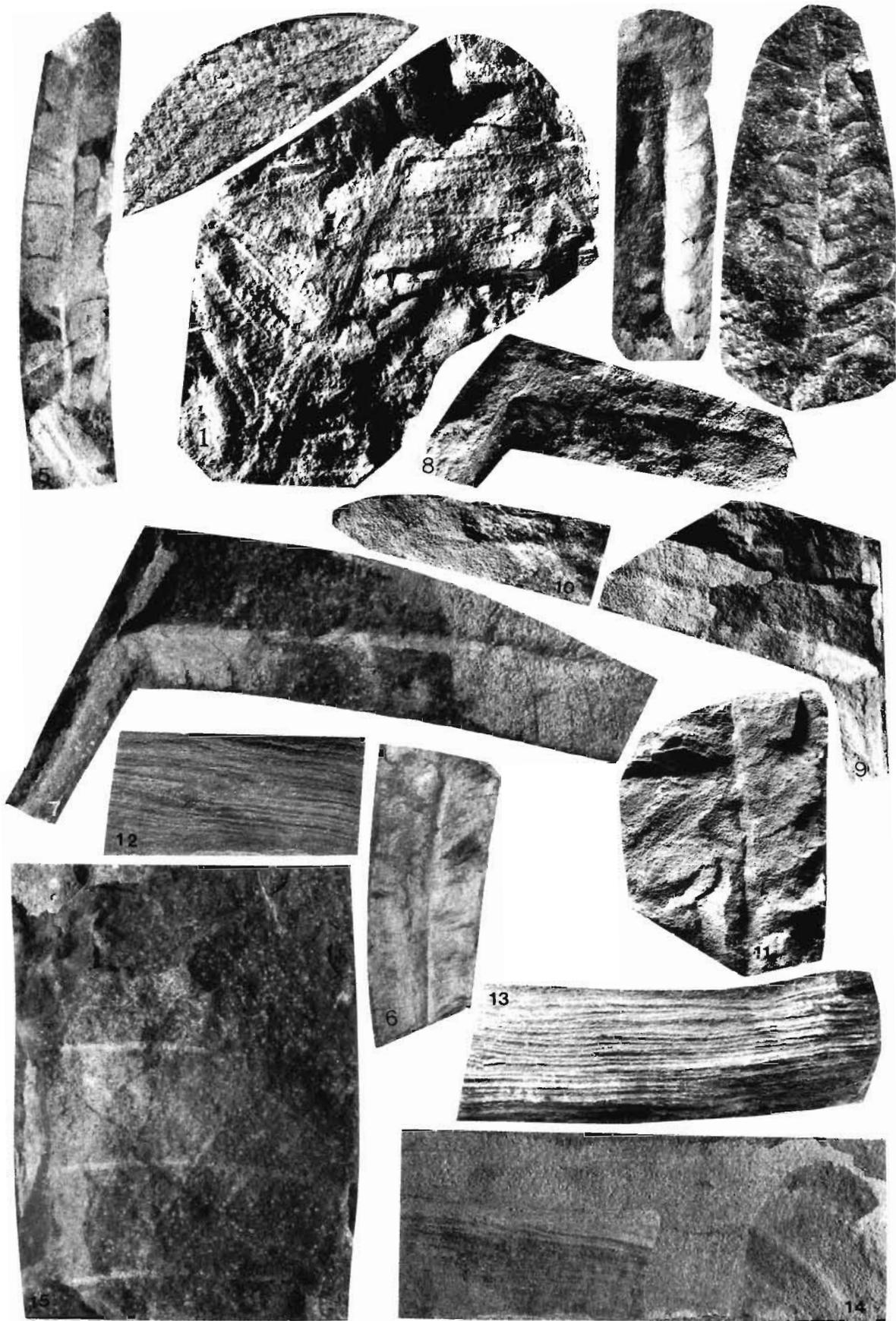


PLATE 1

there are the Devonian System exposed in Plover Cove Reservoir to the east, limestone in the sea area between Ma Shi Chau and Plover Cove Reservoir, limestone of possibly Devonian-Early Carboniferous age and granite, Late Jurassic volcanic rocks, and metamorphosed sandstone and shale of possibly Permian age between Tai Po market and Chinese University.

SYSTEMATIC DESCRIPTION

Pecopteris cf. (*Asterotheca*) *norinii* Halle

Pl. 1, figs 1, 2, 3

There are altogether three well-preserved specimens showing penultimate pinnae about 10 cm broad. The ultimate pinna is linear, reaching a length as much as 3 cm and a breadth of about 8 mm. Pinnules are tiny, closely set, regularly and nearly perpendicularly attached to the rachis on both sides, oblong or rectangular in shape, 3.5-4 mm long and 1.5-1.6 mm broad with a length/breadth ratio of about 2.1-2.5, showing obtusely rounded apex and distinct margin. The midrib is distinct and thick, depressed but not decurrent. Lateral veins are fairly strong. Fertile pinnae consist of pinnules bearing *Asterotheca*-type synangia on both sides of the midrib.

Pecopteris sp. (cf. *P. lativenosa* Halle)

Pl. 1, fig. 4

There are three specimens which show penultimate pinnae about 10 cm in length. The ultimate pinna is linear and decreases in width gradually towards the tip of the pinna, where it forms an obtusely rounded apex. The pinnules are closely set and form an angle of roughly 70° from the rachis on both sides. The apex of each pinnule curves slightly forward and sickle shaped. At the base of the pinnule, the upper margin forms a ear-shaped curve, and the lower margin forms a smooth curve extending downwards and approaching the rachis.

• *Compsopteris* cf. *contracta* Gu et Zhi

Pl. 1, figs 5-11

In the specimens, the pinnule is attached to the rachis by contracted base, forming a 60° angle with

it, alternate, about 60 mm long and 10 mm broad, obtusely rounded, at apex; the lower base is obtusely rounded, ear-shaped in outline. Midrib is distinct, reaching the apex. Lateral veins are thin and dense, arching outward while bifurcating. Margins are entire.

Cordaites cf. *schenkii* Halle

Pl. 1, figs 12, 13, 14

Only a fragment of leaf is preserved. The leaf fragment is about 10 cm long and 3 cm broad, relatively smooth at the surface, with about 12-14 parallel veins per centimeter. In part of the specimen, the veins are distinct and bulging slightly above the leaf surface. One to five longitudinal striations are recognisable, sparsely spaced, often thinner, or as thin as the leaf vein.

Gigantopterides (cf. *Gigantopteris* sp.)

Pl. 1, fig. 15

Only one fragment of leaf is preserved. It is a large-scaled part of a leaf with thick and distinct midrib (primary vein). The outline of the leaf is unknown. The secondary veins are given off from the midrib at about 90° and at an interval of about 1 cm. The veinlets (tertiary and quaternary veins) are anastomose.

DISCUSSION

There had been no fossil record from the Centre Island in the Tai Po Hoi (Tolo Harbour), Hong Kong. The stratum in this Island was often correlated with the Tolo Harbour Formation in Ma Shi Chau Island and considered to be of the same age (Allen & Stephens, 1981). These fossil plants are considered to be Late Permian in age. It should be pointed out that the fossil plant-bearing stratum in Centre Island is significantly different from the Early Permian marine facies Tolo Harbour Formation in Ma Shi Chau not only in their fossil contents but also in their lithological features. The stratum consists largely of greyish black pelitic shale, black carbonaceous shale, banded sandstone and shale, siltstone and quartz sandstone with part of the black carbonaceous pelitic siltstone showing banded and cross bedding, from

Table 1—Correlation of Late Permian between Hong Kong and Guangdong Province

		Northern Guangdong Province		Central-Southern Guangdong Province		Northeastern Guangdong Province		Hong Kong	
Upper Permian P ₂	Chang Xin Formation	P ₂ ⁴						Marine Facies	
	Wong Pan Li Formation	P ₂ ³						Marine-Continental Facies	
	Sui Chu Tang Formation	P ₂ ²						Marine-Continental Facies	
	Longtan Formation (Coal Series)	P ₂ ¹	<i>Pecopteris</i> sp. (<i>Asterotheca</i>) <i>Cordaites schenkii</i> <i>Compsopteris contracta</i> <i>Gigantonoclea acuminatiloba</i> <i>Sphenophyllum sino-coreanum</i> <i>Lebotannularia multifolia</i> <i>Taeniopteris</i> sp. <i>Gigantonoclea legrelii</i> <i>Cladophlebis rhomboidea-ovata</i> <i>Fasciapteris densata</i>	<i>Pecopteris</i> (<i>Asterotheca</i>) <i>crassinervis</i> <i>Cordaites schenkii</i> <i>Compsopteris contracta</i> <i>Sphenophyllum sino-coreanum</i> <i>Lebotannularia multifolia</i> <i>Fasciapteris densata</i> <i>Gigantonoclea legrelii</i> <i>Cladophlebis rhomboidea-ovata</i>	<i>Pecopteris</i> (<i>Asterotheca</i>) <i>hemitelioides</i> <i>Pecopteris marginata</i> <i>Compsopteris contracta</i> <i>Sphenophyllum sino-coreanum</i> <i>Gigantonoclea acuminatiloba</i> <i>Lebotannularia multifolia</i> <i>Gigantonoclea legrelii</i>	Coal Series	Centre Island Formation	<i>Pecopteris</i> (<i>Asterotheca</i>) <i>cf. norinii</i> <i>Pecopteris</i> sp. (<i>cf. P. lativenosa</i>) <i>Compsopteris cf. contracta</i> <i>Cordaites cf. schenkii</i> <i>Gigantopterides</i> (<i>cf. Gigantopteris</i> sp.)	
Lower Permian P ₁	Mao Kou or Gufeng Formation	P ₁ ²	<i>Paracelites</i> <i>Asioproductus gratosus</i> <i>Neoschwagerina</i>	<i>Paracelites</i> <i>Asioproductus</i> <i>Meixianites</i> <i>Altudoceras</i> <i>Neoplicatifera</i>	<i>Paracelites</i> <i>Meixianites yuangdongensis</i> <i>Neoschwagerina</i>	Marine Facies	Tolo Harbour Formation	<i>Tenuichontes tenuilirata</i> (Chao) <i>Neoplicatifera huangi</i> (Ustriski) <i>Paradoxispecten jiaheensis</i> Zhang <i>Enchondria jiaheensis</i> Fang <i>Enchondrioides thuzhouensis</i> Fang <i>Paracelites</i> sp.	
	Obita Formation	P ₁ ¹				Marine Facies Limestone			

which the fossil plants were collected. Whereas the Tolo Harbour Formation in Ma Shi Chau consists largely of greyish white, greyish purple, dark grey pelitic shale and pelitic siltstone often bearing pyrite crystals, and calcareous siltstone with occasionally sandstone. The fossils collected from this Formation include brachiopods, lamellibranchia, ammonitida, crinoidia, bryozoids and corals (Lam, 1972; Nau, 1980, 1981; Lee, 1987), all of which are of typical Early Permian marine facies (Table 1) (Lee *et al.*, 1990). Therefore, on the basis of palaeontological and stratigraphic correlation, the Centre Island stratum can not be equivalent to the Early Permian Tolo Harbour Formation; the former should be assigned to Late Permian or possibly early Late Permian. Hence, a new name—Centre Island Formation, has been proposed in this paper. Because these two formations are found isolated in two separate islands, the contact relation between them is still unknown.

The fossil plants from the Centre Island Formation are similar to the Late Permian plants commonly seen in the Longtan Formation which is a very important coal bearing stratum known as the Longtan Coal Series in South China. It is very likely that the Centre

Island Formation in Hong Kong is equivalent to the Longtan Coal Series. However, it will be worth while to pay more attention to carry out the palaeobotanical studies and in prospecting the energy resources from this newly proposed formation.

ACKNOWLEDGEMENTS

The author thanks Mr Zhang Huanxin, engineer of the Institute of Geological Sciences of Guangdong Province who has greatly helped in the identification of fossil plants, Miss Wu Shunqing of Nanjing Institute of Geology and Palaeontology for critical comments, and Professor Xu Re (J. Hsu) of the Institute of Botany of Academia Sinica who reviewed the draft of this paper and offered fruitful comments. The author also wishes to thank Professor Yang Guanxiu of the China University of Geosciences (Beijing) for going through the final draft of this paper.

REFERENCES

Addison R 1986. *Report on the Geological Survey of Sha Tin*. Government Press, Hong Kong.
 Allen PM & Stephens EA 1971. *Report on the Geological Survey of Hong Kong*. Government Press, Hong Kong.

- Feng Shaonan, Chen Gongxing, Xi Yunhong & Zhang Caifan 1977. Plants. In: Hubei Inst. Geol. Sci. & others (Editors)—*Fossil Atlas of Central-South China II* : 622-674. Geol. Publ. House, Beijing (in Chinese).
- Hou HF, Zhan LP & Chen BW 1979. *The coal-bearing strata and fossils of Late Permian from Guangdong*. Geological Publishing House, Beijing, China (in Chinese).
- Lam KC 1972. Upper Palaeozoic fossils of the Tolo Harbour Formation, Ma Shi Chau, Hong Kong. *Hong Kong Geogr. Assoc. Bull.* **3** : 21-27.
- Lee CM 1985. Recent developments in Hong Kong stratigraphy. *Geol. Soc. Hong Kong Newsletter* 3(4): 7-9.
- Lee CM 1987. An outline of the geology of Hong Kong. *Guangdong Geol.* **2** (1) : 29-48.
- Lee CM *et al.* 1990. New collections from the Tolo Harbour Formation at Ma Shi Chau, New Territories. *Hong Kong. geol. Soc. Hong Kong Newsletter* **8**, Pt III.
- Li Xingxue, Li Peijuan, Zhou Zhiyan & Guo Shuangxing 1964. Plants. In: Wang Y (Editor)—*Index fossils of South China* : 114-117. Sci. Press, Beijing (in Chinese).
- Nanjing Institute of Geology and Palaeontology & Institute of Botany, Academia Sinica 1974. *Palaeozoic plants from fossil plants of China*, Vol. **I**, Scientific Press, Beijing, China (in Chinese).
- Nau PS 1980. Fossil plant from Ma Shi Chau Island, Hong Kong, a preliminary note. *Annal Geogr. Geol. Archaeol. Soc. Univ. Hong Kong* **8** : 27-32.
- Nau PS 1981. Geology of the Ma Shi Chau Island. *Annal Geogr. Geol. Archaeol. Soc. Univ. Hong Kong* **11** : 1-5.
- Ruxton BP 1960. The geology of Hong Kong. *Far. Econ. Rev.* **22** : 454-457
- Sze HC & Hsu J 1954. *Index fossils of China (plant)*. Geological Publishing House, Beijing, China (in Chinese).
- Zhou HQ 1963. Fossil plants. In: Chinese Academy of Geological Sciences (Editors)—*Fossil Atlas of the Nanjing mountains* : 158-176. China Industrial Press, Beijing, China (in Chinese).