

A THALLOID PLANT FROM THE PERMIAN OF SHANSI, CHINA

BRITTA LUNDBLAD

Palaeobotaniska Avdelningen, Naturhistoriska Riksmuseet, Stockholm

ABSTRACT

Thallites hallei sp. nov. from the Permian of Taiyuanfu, China is described. The species is represented by a unique specimen carrying some specialized ramifications interpreted as reproductive organs. *T. hallei* is believed to be an extinct taxon of the *Bryophyta* (*Hepaticae*) or a member of an entirely unknown group of plants, but algal affinities are also possible.

INTRODUCTION

The specimen to be described here was presented in 1936 as a gift by the Late Professor H. C. SZE, Peiping to the Section for Palaeobotany of the Swedish Museum of Natural History, Stockholm. It belongs to a collection brought together near Taiyuanfu by Sze with the support of Professor E. NYSTROM, one of the Swedish scientists active in China at that time. The Taiyuanfu district is known as the source of the rich collections described by the Late Professor T. G. HALLE in his monograph "Palaeozoic plants from Central Shansi" (1927). The labelling and information in a letter from SZE to HALLE (dated September 24th, 1935), kept in the Section for Palaeobotany, indicate that the material was obtained from Bed 18 of the Shihhotse valley East of Taiyuanfu, i.e. from the Lower Shihhotse Series, which according to NORIN (1922) is placed in the Permian (cf. also LEE, 1963, p. 179).

THE MATERIAL

The unique specimen to be described here is contained in a fine-grained light brownish (beige) sandstone. The plant-remains are to the greater part preserved as impressions, with some carbonaceous substance remaining in places. The material was principally studied under xylol.

No determinable remains of land plants are exposed on the same surface of rock as the thalloid plant. Fragmentary fern-like foliage was observed, however, with the veins of the pinnae and pinnulae partly preserved; the rest of the leaf had disappeared, probably as the result of natural maceration. It seems likely that the thalloid remains represent a plant growing on the shore, near water, or even submerged.

The structures shown in Pl. I, Figs. 2-4 were treated with strong Nitric acid and Potassium Chlorate followed by Ammonia, but no spores were obtained. An attempt was made to extract spores from a piece of the rock with the thalloid remains, employing the method of KNOX (1942), followed by oxidative treatment, but the result was negative.

DESCRIPTION

Thallites hallei sp. nov.

Pls. 1-2; Text-fig. 1.

Derivation of name—The species is named in honour of the Late Professor THORE G. HALLE (†1964), well-known as a specialist of the Palaeozoic floras of China.

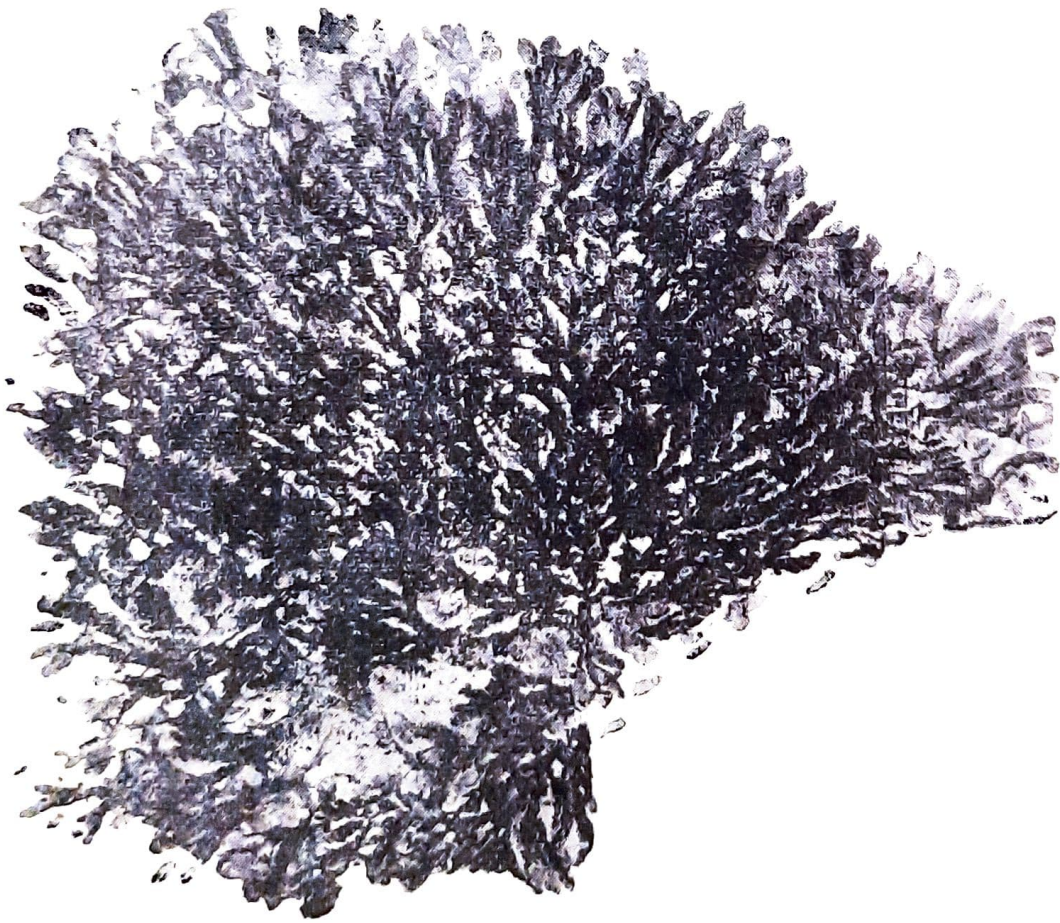
Holotype—The specimen illustrated in Pls. 1-2 and text-fig. 1 of this paper.

Type locality—Bed 18 of HALLE 1927 (p. 16): “Ch'en-chia'-yü, 2 li up the Shih-ho-tse valley, on the south side.”

Type stratum—Bed 18, as above “140 m. above the Pei-tsa-kou sandstone”; Permian.

Material—One specimen obtained from Professor H. C. SZE, Peiping.

Repository—Section for Palaeobotany, Swedish Museum of Natural History, Stockholm.



Text-fig. 1. *Thallites hallei* n. sp. Holotype. Taiyunfu, Province of Shansi, China. Permian. x 1.

Diagnosis—Thalloid plant of \pm concentric growth, about 10 cm in diameter, composed of dichotomizing lobes about 1-1.5 mm in diameter. The ends of the lobes are indistinct, and may appear fimbriate from the presence of distal elongated processes. Some of the ramifications carry distally structures which may be interpreted as reproductive organs, fertile or vegetative. One type is reminiscent of a receptacle carrying a few fusiform or sac-like organs 2-3 mm in length, another shows closely aggregated structures, which are more or less triangular in side view and 1-2 mm long, terminating in a pointed end or tube. The third type shows distally \pm fimbriate, possibly bell-shaped structures 3-5 mm in length.

Comparison—A direct comparison with previously described thalloid fossils did not lead to any positive results. The systematic position of the Chinese fossil is well expressed in the definition of the genus *Thallites* (WALTON, 1925, p. 564):

“Fossils in which the plant body is of a thalloid form, as may be found in the Algae, Bryophyta, or sometimes in higher groups; but possessing no characters by which they may be assigned to any of these groups to the exclusion of all the others”.

DISCUSSION

The Chinese fossil described above may represent one of the following groups in the Vegetable Kingdom:

- (1) *Algae*
- (2) *Bryophyta (Hepaticae)*
- (3) higher plants adapted to life in water or wet surroundings
- (4) an unknown group of thalloid plants.

The various alternatives will be briefly discussed below:

- (1) Attempts at a comparison with different groups of Algae led to the conclusion that the habit of *T. hallei* may have some resemblance to certain *Rhodophyta*, such as *Chondrus crispus* (L.) STACKH., a highly variable species. A relationship with this group seems unlikely, however. The Red Algae are principally marine, and inhabit often considerable depths. Their reproduction is complicated but the supposed reproductive organ seen in Figs. 2 and 4, Pl. 1 do not correspond well with those of the *Rhodophyta*. If regarded separately, however, Fig. 3, Pl. 1 might possibly be compared with an algal shoot with procarps (cf. KYLIN, 1956, fig. 436 E).
- (2) A connection between *T. hallei* and the *Bryophyta (Hepaticae)* appears more probable than a relationship with the Algae even if there is no closer resemblance to any of the living genera.

Fig. 2, Pl. 1 might thus be compared with the archegoniophore of the *Marchantiales*, and the possibly bell-shaped structures seen in Fig. 4, Pl. 1 would then possibly represent antheridiophores with a distal involucre surrounding the antheridia, or *vice versa* Fig. 3, Pl. 1 must in this case be interpreted as lobes carrying distally groups of gemmae.—It is also possible to interpret Fig. 2, Pl. 1 or Fig. 4, Pl. 1 as gemma cups. The distal \pm triangular structures seen at the end of the lobes in Fig. 3, Pl. 1 might in this case represent involucre or simply scales surrounding the antheridia.—It is also possible that the structures seen in Fig. 2, Pl. 1 and in Fig. 4, Pl. 1 might represent different stages in the development of the same organ. According to such an interpretation the bell-shaped structures seen in Fig. 4, Pl. 1 might perhaps represent the involucre surrounding the sporophyte. In using the conceptions archegoniophore and antheridiophore in the comparison above the author does not pretend that the corresponding organs of the fossil plant may be as well-defined as those of the modern *Marchantiales*. The presence of a true stalk in the fossil material seems doubtful, and the structure in question may more closely correspond to elongated lobes of the thallus, or resemble the transitional forms described in *Asterella khasiana* by PANDE *et al.* (1953).

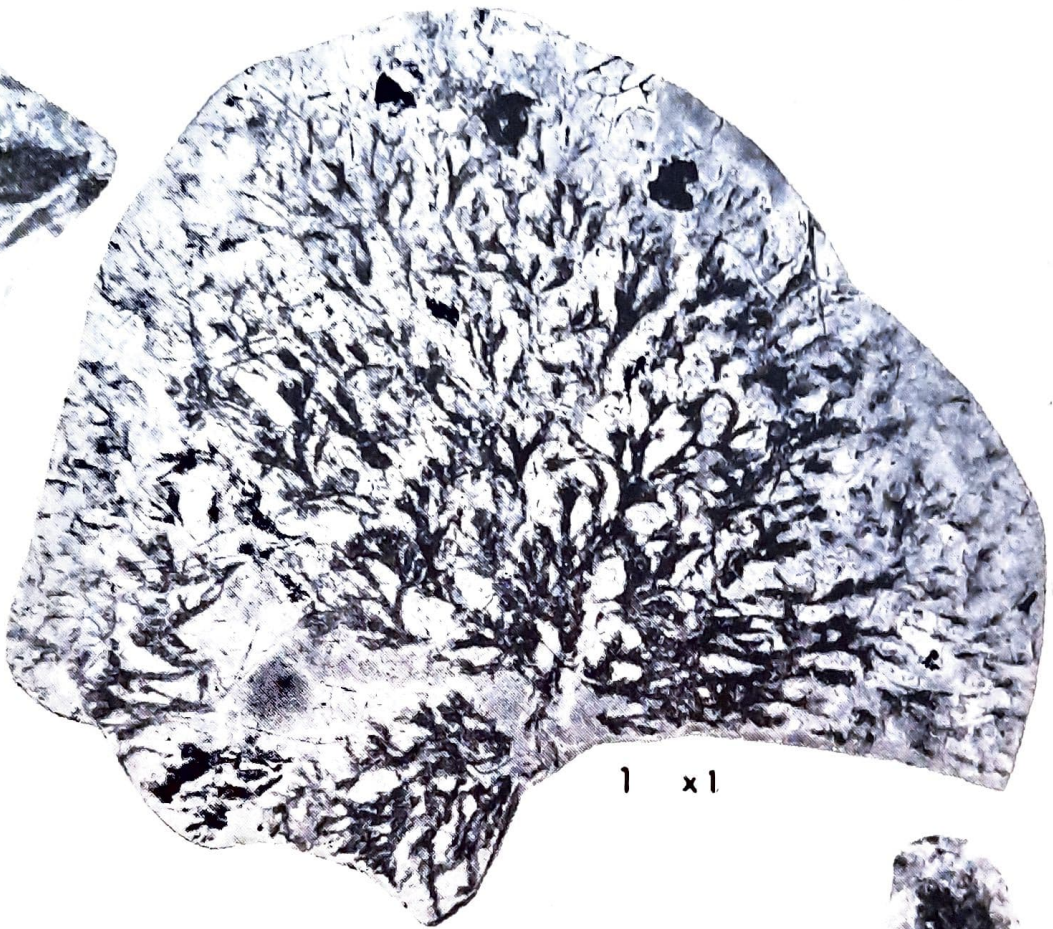
- (3) There is no reason to assume that *T. hallei* is a member of a higher group of plants adapted to life in water.
- (4) To regard *T. hallei* as a representative of an unknown extinct group of plants appears to be a sound interpretation.

CONCLUSIONS

Thallites hallei sp. nov. from the Permian of China may be interpreted as an extinct taxon of the *Bryophyta (Hepaticae)* or as a representative of an extinct, unknown group of plants. Algal affinities appear less probable but may not be excluded.



2 x 5



1 x 1



3 x 5



4 x 5

ACKNOWLEDGEMENTS

The author wishes to thank MR. K. E. Samuelsson for the photographs reproduced in this paper. The drawing was made by Miss Sylvia Kasubski. Mrs. Nina Smith, Washington, D.C., kindly looked through the English of the manuscript.

REFERENCES

- HALLE, T. G. (1927). Palaeozoic plants from Central Shansi. *Palaeont. sin.* Ser. A, **2**(1).
- KNOX, A. S. (1942). The use of bromoform in the separation of non-calcareous microfossils. *Science*, **95**: 307-308.
- KYLIN, H. (1956). *Die Gattungen der Rhodophyceen*. Lund.
- LEE, H. H. (1963). Fossil plants of the Yuehmenkou series, North China. *Palaeont. sin.*, 148; n.s. **6A**.
- NORIN, E. (1922). The Late Palaeozoic and Early Mesozoic sediments of Central Shansi. *Bull. geol. Surv. China*, **4**.
- PANDE, S. K., SRIVASTAVA, K. P. & KHAN, S. A. (1953). On some anomalous female receptacles of *Asterella khasiana*. *Bryologist*. **56**(4): 229-241.
- SZE, H. C. (1935). Letter to T. G. HALLE dated September 24th, 1935. Section for Palaeobotany, Swedish Museum of Natural History, Stockholm.
- WALTON, J. (1925). Carboniferous Bryophyta. I. Hepaticae. *Ann. Bot.* **39**(155): 563-572.

EXPLANATION OF PLATES

The figured specimen is the property of the Section for Palaeobotany of the Swedish Museum of Natural History, Stockholm. The photographs are untouched.

PLATE 1

Thallites hallei sp. nov.—Taiyuanfu, Province of Shansi, China. Permian. All the figures were photographed under xylol. Fig. 1. Thallus, holotype, x 1. Figs. 2-4. Specialized ramifications of holotype, interpreted as reproductive organs, magnified, x 5.

PLATE 2

Thallites hallei sp. nov.—Taiyuanfu, Province of Shansi, China. Permian. Specimen photographed under xylol. Fig. 5. Part of the thallus of the holotype including the specialized lobes seen in Figs. 2-4, magnified, x 3.