

THE SINIAN GLACIATION IN THE LOWER YANGTZE VALLEY*

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In 1919, while on a visit to Wuning, Kiangsi, I happened to cross a rock exposure along the northern slope of Shuangchiaoshan (雙橋山) 1 mile and half SSE. of Honlu (橫路). My attention was immediately attracted by the presence of a peculiar bed, which consists of a fine, gray clay mixed up with sands of various sizes and sub-angular pebbles and which has a thickness of about 5 m.²

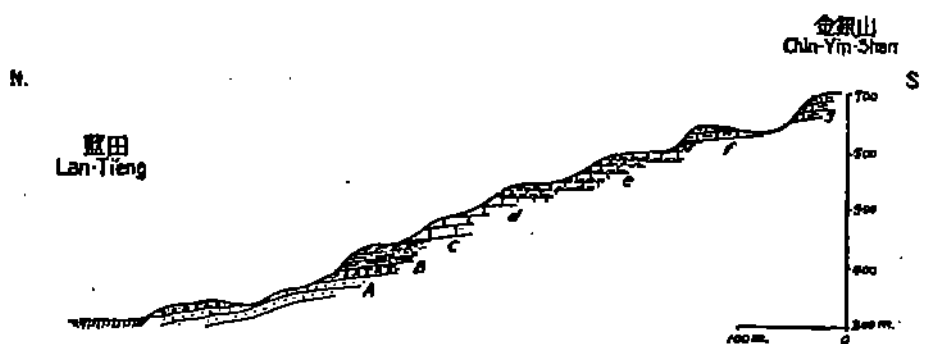
One year later Mr. C. Li and I noticed again a bed of a similar description in Lantien (藍田), Siuning Hsien (休寧縣), Anhui.

Last winter, Mr. S. C. Hsü and I paid another visit to Lantien and made a close investigation of the bed exposed on the northern slope of the Chin-yinshan (金銀山), Lantien. It consists chiefly clay usually mixed up with sands and pebbles or boulders and possesses precisely the same characteristics as those which we saw in Honlu, Kiangsi. The clay is extremely fine, pure and greenish gray when fresh, but turns yellowish gray after exposure. The sands range from the size of rice up to that of a pea, while the pebbles or boulders are $\frac{1}{2}$ " up to 5" in diameter; they are more or less sub-angular. The large boulders seem to be very few in number, but it is believed that in a better outcrop more large boulders might be obtainable. Owing to deep weathering, striations on the boulder-surface are naturally not preserved. The sands and pebbles are usually derived from quartzite or sometimes from sandstones. The large boulders are composed of various silicified material but more usually of granites and mica schists both of which, however, are not to be found in the vicinity. This being so, it may be reasonably suggested that the source of the granite and mica schist boulders must be sought somewhere else, anyway, it must be very far away from Lantien.

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The clays, sands and boulders are usually mixed up in an irregular manner, but sometimes do show some sign of bedding, the pebbles or boulders lying flat. In Honlu, Kiangsi, the bed, however, does not show the slightest sign of bedding.

From the above data, we may conclude that the beds consisting of clay, sands and pebbles or boulders in Lantien, Anhui, and in Honlu, Kiangsi, are of glacial origin. The presence of the sign of bedding might perhaps be due to pressure from the overlying strata or due to subsequent orogenic movement in the case of Lantien. The "tillite", in the case of Honlu, lies below a series of shales and limestones of about 500-800 m. in thickness⁹; which again disconformably underlie Cambrian shales. Below the tillite occurs a hard, white quartzitic sandstone of 100 m. thickness. This is the Tungmen sandstone² which rests unconformably on the Honlu series. Both the Tungmen Sandstone and the series of shales and limestones mentioned above are supposed to be of Sinian age. The "tillite" of Lantien is in the same stratigraphical position as that of Honlu, it underlies a series of shales and limestones, with more



- g. Silicified Limestones or silicified bed, consisting of alternating white and black layers, each layer 1/10"-1/50".
- f. Dark to gray calc. shale. C-1 Thickness 120 m.
- e. Light gray, pure and thin bedded Limestone interbedded with calc. shale; each bed 1"-2".
- d. Carbonaceous, thin bedded Limestone interbedded with calcareous shale; each bed 1"-2".
- c. Brittle, thin gray shale.
- b. Yellowish to bluish gray clay or shale mixed up with round and sub-angular boulders 3"-5" in diameter, and sandy grains 5-10 m. thick (tillite)
- a. Fine purple sandstone (Siuning sandstone)

limestones in the upper and more shales in the lower part. The limestones are again succeeded by a silicified limestone.

The section of the Chinyinshan at Lantien, Siuning, is shown in Fig 1.

Although the purple sandstone (A in Fig. 1) is poorly exposed in Chinyinshan, a continuous exposure of 8 miles is met with in the SE. The strata show a gentle dip and form hills some 400 m. above the stream bed. This sandstone is also found in the N. about 5 li from Lantien and extends farther north for 2 miles, dipping 30° - 70° towards south. It consists either of purple fine sandstone or green sandstone or both. Occasionally it contains a soft yellowish brown argillaceous sandstone, with a basal conglomerate of about 40 m. thick. The total thickness of the sandstone, judging by the area occupied and by its dip angle, attains at least more than 500 m. We may propose the name "Siuning sandstone" for this very thick unit.

The Siuning sandstone rests unconformably on a series of phyllitic shale etc., for the former strikes N. 70° E. and dips 70° to S. whereas the latter strikes N. 70° - 85° at the place known as Ihushui (一壺水), 5 miles north of Lantien.

Lithologically and stratigraphically the Hsiuning sandstone can be correlated with the Nantou Grit¹ of Poof. J. S. Lee and with the Tungmen (洞門) sandstone² of the writer.

The series of shales and limestones above the tillite is already described in the section, but the silicified limestone (g) is also exposed at about 1 km. N. of Lantien forming a gorge where it has a thickness of more than 100 m. Above the silicified bed comes a series of carbonaceous shales intercalated again with silicified limestone, the top of which cannot be seen here, but the typical carbonaceous shale is unmistakably found at T'anchiachiao (潭家橋), Taiping Hsien (太平縣), (about 25 miles NE. of Lantien), where it gradually passes up into a very thick sequence of gray limestone intercalated with shaly limestone and white gray thin-bedded limestone towards the top. This sequence is again disconformably overlain by a uniformly gray, calcareous shale containing Upper Cambrian trilobites and graptolites (Tremadoc)³.

The series of shales and limestones above the "tillite" and below the Cambrian shale can be correlated with the T'ushant'o (陡山沱) Series and Tungying (燈影) Limestone of the Yangtze Gorge¹ and with the Wongying'u

(王音餘) series and the lower part of the Changyuan (章源) limestone of Wuning, Kiangsi.

If the above correlation holds good the tillites both in Lantien and in Honlu would fall exactly in the horizon of the Nantou Tillite.

With reference to Chekiang; farther E. in the Lower Yangtze Valley, the Hsiuning sandstone may be compared with the Taoshuiwu (倒水塢) sandstone⁴ and the series above the tillite with the lower part of the Yinchüp'u formation (印渚浦層)^{5,6}. Thus it might be worth while to look for similar tillites at the base of the Yinchüp'u formation⁷.

With the knowledge already obtained from the 3 localities, Ichang (宜昌); Wuning, and Siuning; we may reasonably conclude that the Sinian glaciation had an already known extension of 800 km. from W. to E. (See Plate I). Further research will undoubtedly throw more light on this very interesting subject.

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7. According to Mr. S. C. Hsü, the base of the Yin chü p'u formation consists of shales and pebbles (0.5 cm. in diameter).
8. Singwu C. Hsü: The Tremadocian in South Anhui (See p. 105-108 of this Bulletin).

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