

MESOZOIC FORMATIONS IN SOUTH EASTERN HONAN AND THEIR BEARING ON THE DATE OF THE TSIN LING FOLDING

(With 2 figures)

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In this paper I shall attempt to describe briefly the Mesozoic strata occurring along the northern slope of the Ta Pieh Shan (大別山) range, i. e., the eastern extension of the Tsin Ling Range, for the purpose of discussing the date of the Tsin Ling folding. In regard to this point, geologists gave divergent interpretations based on different observations and conceptions. After taking the reconnaissance survey along the northern slope of the Ta Pieh Shan range in southeastern Honan in the Spring of 1925, I got some facts that may contribute to more accurate dating of the Tsin Ling folding.

In starting from Hsin Yang (信陽) at first only the Wutai system and the Archæan strata were met with en route. After reaching the territories of the Kuang Shan (光山), Shang Ch'êng (商城) and Ku Shih (固始) districts I found many outcrops of tuff and lava which resemble those contained in the formation which I called tuff-conglomerate[§] occurring in other parts of northern China, especially in Shantung and the strata which contain anthracite seams and plant fossils. The former is here also called the tuff-conglomerate formation and the latter, the coal series. The coal series occurs in the northern part of Shang Ch'êng and the southern part of Ku Shih and rests unconformably upon the Wutai system. It consists chiefly of dark shale, slate, white quartzite, quartzitic conglomerate, greenish-yellow shale and crystalline schist with lenticular and thin anthracite seams in the middle part. In the dark shale or slate near the coal seams are contained the plant fossils which are preliminarily determined by Mr. T. H. Chow as *Pityophyllum cf. longifolium* etc., belonging to the Liassic, so that the

§ See my paper on the Mesozoic and Early Tertiary in Shantung. Bull. Geol. Surv. China. No. 5, Part 2, p. 114, also see my explanation to the Peking-Tsinan geological sheet.

coal series may be referred to Lower Jurassic. The strata are mostly steeply inclined and sometimes become vertical. According to this disturbed structure and the metamorphic character of the rocks, it is undoubted that the coal series was affected by the orogenic movement. The tuff-conglomerate formation occurs along the northern foot of the Ta Pieh Shan range in discontinuous areas and forms many low hills standing in front of the main range. In the northern part of Shang Chang districts this formation lies unconformably upon the Wutai system (fig. 1), whereas in the Kuan Shan and Hsin Yang districts it lies also unconformably upon the Lower Jurassic coal series (fig. 2). This formation is composed largely of red-brown tuff,

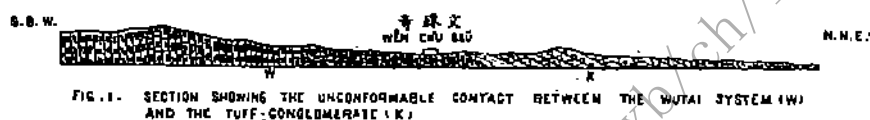


FIG. 1. SECTION SHOWING THE UNCONFORMABLE CONTACT BETWEEN THE WUTAI SYSTEM (W) AND THE TUFF-CONGLOMERATE (K).



FIG. 2. SECTION SHOWING THE JURASSIC COAL SERIES (J) AND ITS UNCONFORMABLE CONTACT WITH THE WUTAI SYSTEM (W) BELOW AND THE TUFF-CONGLOMERATE (K) ABOVE.

lava and tuff-conglomerate, and red clay and sands in the lower part. No fossils were found in this formation, so that the age can not be here accurately determined. But according to the petrographic characters as well as the stratigraphic position, it may correlate to the tuff-conglomerate formation occurring in Chihli and Shantung. In the lower part of the tuff-conglomerate in Shantung I have found in 1923 reptiles, pelecypods and other fossils⁵ which have been determined as belonging to the Cretaceous. The Cretaceous strata here generally dip to the north with gentle inclination, and no metamorphic effect is indicated. So this formation seems to not have been affected by folding and metamorphism.

After having thus outlined the characters of these formations I shall now turn to discuss the date of the Tsin Ling folding. The Tsin Ling Shan proper is situated in the southern part of Shensi and extends westward to

⁵ A. W. Grabau, Cretaceous fossils from Shantung Bull. Geol. Surv. China No. 5, Part 2, pp. 143-162.

Kansu and Szechuan on the one hand and eastward to Honan, Hupeh and Anhui on the other hand. Cross sections in the Tsin Ling Shan proper were observed by v. Richthofen, B. Willis and Blackwelder. The former found an important unconformity between the metamorphosed strata and the Jurassic sandstone and the latter between the Kueichow series and Shihchuan sandstone. On the basis of these observations these geologists all assigned the period of the folding and metamorphism to between the Permo-Triassic and Middle or Upper Jurassic. The western extension of the Tsin Ling Range was visited by Richthofen, Loczy and Obrutchew, the date of the folding was referred to the Permian by Richthofen owing to the existence of the unconformity between the strongly folded Palaeozoic strata and the less folded Permo-Triassic limestone; it was supposed to be post-Triassic by Loczy. It is however to be noticed that no fossil evidence has been obtained by any of these explorers. The Jurassic age was assigned by them to the formation above the unconformity merely by assumption.

The eastern extension of Tsin Ling Range was studied in Honan by Richthofen and Loczy, who referred the date of the folding again to post-Palaeozoic. In northern Anhui Messrs. C. C. Liu[§] and C. Li found that the pre-Cambrian formation is unconformably overlain by the porphyritic sandstone (equivalent to tuff-conglomerate formation), which fact seems to show that date of the folding is pre-Cretaceous. The latter conclusion is quite in accord with the author's observation in southeastern Honan.

In conclusion, the age of the Tsin-ling folding was always assumed without definite stratigraphic and palaeontologic basis. As I have observed in southeastern Honan, the coal series containing Liassic plant fossils was strongly affected, together with the underlying Wutai system, by the folding, and the tuff-conglomerate formation unconformably lying above and free from metamorphism is very probably the same as the similar formation which contains Cretaceous fauna in Shantung, hence it may be deduced that the folding and metamorphism of the Tsin Ling range took place during the middle and late Jurassic time or possibly continuing into the Lower Cretaceous.

[§] C. C. Liu and J. C. Chao, Report on the geology and mineral resources of northern Anhui Bull. Geol. Surv. China, No. 1, p. 8-9.