第六卷·区域地质

Volume Ⅵ Regional Geology

李四光全集

The Complete Works of Li Siguang

湖北人民出版社

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编者说明

本卷收入作者1924—1959年间写作的有关区域地质的论著30余篇，其中前半部的英文部分，分别集自《中国地质学会志》、英国《地质杂志》、印度《古植物学家》等刊物。后半部中文部分除少数篇目外，主要集自1974年科学出版社出版的《区域地质构造分析》一书。

在整理过程中，编者对原文一些篇目的标题、表格、注释、标点符号及参考文献进行了统一处理，有些图例重新作了清绘，部分图例的图幅有所缩小。此外，原文的勘误表和错别字都作了订正处理，书中均未一一出注说明。

目　录

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The Stratigraphy of the Anthracolithic Formation[①] in the Liuhokou Coalfield, N. China[②]

As a preliminary enquiry into the geology of any part of N. China, one would naturally first turn to von Richthofen's celebrated geological Atlas perhaps with more respect to the author, as a pioneer of extensive geological exploration in China than to the authority of the information contained in his maps. The area in question should be located in about latitude 36°13′N. longitude 114°20′E. on Richthofen's map ③ and is erroneously mapped by him as the "Kohlenkalk".

The Liuhokou(六河沟) coalfield is easily accessible by the

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① The term 'Anthracolithic' was first introduced by W. Waagen (Salt Range Fossils, Palaeont. Indica, Ser, XⅢ, I, Productus-Limestone Fossils. p. 998., IV Geological Results, p. 242,(1989－1891),and recently adopted E. Haug (Traité de Géologie, Ⅰ,p. 744) to denote the Carboniferous-Permian Formation as distinguished from toe Permo-Carboniferous. This term appears to be particularly suitable for Chinese geology.

② 原载北京大学《地质研究会年刊》,第 1 期,第 1－18 页,1922 年。——编者注

③ Richthofen, Atlas von China. Erste Abtheilung, Tafel 18.

Kinhan railway and its branch line from Fong-lo-tchen, the latter is now under construction.

It was M. V. K. Ting, Who, at the request of the Liuhokou Coal Mining Company, first geologically surveryed the ground in some details. Owing to the pressure of other work, he could only remain in the field for two days. Nevertheless, M. Ting summarized the more important structural as well as stratigraphical facts which he was able to gather during his reconnaissance in a comprehensive synopsis. This unpublished valuable note together with other useful information was communicated to me by the said author to whom I owe my thanks. When I undertook the present work in the field, I was accompanied by four students,—K. P. Chao, P. C. Miao, K. M. Wang, C. C. Young. They all rendered good service in collecting fossils and measuring sections.

From the record of M. Ting's observation, it can be readily seen that the structure of the Liuhokou coalfield, like many of the other coalfields of N. E. China, is strikingly simple. The piled-up strata of the coal-bearing series are successively exposed along the valleys near the village of Aikow (艾口); and some of them are highly fossiliferous. These circumstances suggest at once that here we have a splendid opportunity for examining the sequence of the Anthracolithic Formation as developed on the eastern side of the Taihang (太行) Range. I take this broader view because there is reason to suppose that in most, if not all, the coalfields flanking the eastern slope of this long range, the coal—bearing series stratigraphically dif-

fer to no great extent from one another. The limestone bands Which are characteristic of the Lower Series are found. for instance, in the Tzechou(磁州) coalfield, about 90 lis or 45 km. to the north of Liuhokou.

Before entering on the stratigraphical details, it may be well to note, in the briefest manner, (a) the structure of the Liuhokou coalfield in the narrow sense of the name, (b) the general structure of the entire expanse of this coalfield of which the so-called Liuhokou coalfield is only a small portion, (c) and lastly the general structure of all the coalfields lying on the eastern side of the Tai hang Range as inferred from observations in the Liuhokou coalfield, and scattered observations outside of it.

(1)In the so-called Liuhokou coalfield, namely that portion of the whole coal basin which lies within the area shown on the accompanying map and to the immediate east of it, the most important tectonic feature is the eastern fault(Fig. 1.) This fault throws the thick coal down on its western side to an amount of 40—50m. and runs from N. N. E. to S. S. W. As it proceeds south—southwestward, its course tends to bend towards the east as is revealed in the underground workings. More or less parallel to the eastern fault, there is another line of fracture (Fig. 2) which begins from the mouth of a small valley north of the working shaft, with a small amount of downthrow on its eastern side. Southwestward ,this fault disappears for a time,reappearing further southwest with ever-increasing throw. As the result of trough faulting, the strata

between these faults are folded to some extent with their synclinal axis running parallel to the faults This syncline is again cross-folded. The axis of the cross-fold runs N. W. and passes the south of the shaft. Thus the strata between the faults are folded into two basins of "pockets". The N. E. one opens out towards the Kwantai(观台)village;and the S. W. one opens out towards the upper part of the Liuhokou valley. Before it actually reaches the Liuhokou valley,it coalesce with another syncline whose axis passes the southern end of the Aikow village,and extends towards E. S. E.

As pointed out by M. Ting,"the structure east of the fault (Fig. 1)is uncertain as outcrops are very scarce. Judging from what can be seen in Mayukou the strike is still N. E. -S. W. ①, dip 15°—30°,the beds being gently-folded into an anticline and syncline. As far as can be judged from outcrop,there is no fault".

(2)The whole basin of the Liuhokou coalfield is much more extensive and its boundary is well-defined both on the western and the northern sides. On the western side, the coal-bearing series laps over the Sinian Limestone without any sign of discordance of strata, though it is well-known that a mighty unconformity exists between the two. They strike generally N. by E. The Chang-ho(漳河) flows along the strike for some distance. At a place about 5 lis or 2. 5 Km. N. N. W. of the

① According to my field notes the axis of the Mayukou anticline runs N. by E. -S. by W.

village of Aikow, the river abruptly alters its course from S.-N. to W. E. On the northern side of the Chang-ho, a gentle rise of the ground towards the north gradually acquires the dignity of a hill range with its orographic as well as tectonic axis running W.-E. Here again the coal-bearing series laps the southern flank of the limestone hill ,and dips generally south ward.

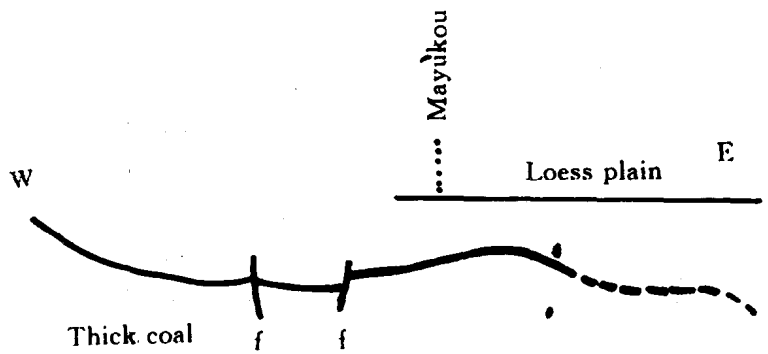

Fig. 1 Diagramatic Sectione Across the Liuhokou Coalfield.

Thus it is evident that the whole Liuhokou coal basin is bounded on its western side by a fold trending N. by E. ; and on the northernside by a fold running W.-E. The former manifestly plays the principal part in this system of folding; for it is the N.-S. fold that determines the trend of the great Tai-

hang Range. As one set of mighty folds is often supplemented by a secondary set running at right angle to each other, the case of Liuhokou is, then ,but an illustration of the general tectonic principle.

During my stay in the Liuhokou coalfield, I had no occasion to examine the nature of its southern boundary. If we may make use of Nystrōm's geological map of northern Honan which is yet unpublished, on this side we see that the coalfield is likewise limited by the Sinian Limestone. Nor should we wonder at this state of things if the principle of supplementary folding is here justly applied.

Eastwards, the coal-bearing series dives underneath the Loess plain with gentle undulation and possibly normal faults trending N. N. E as is seen in the Mayukou anticline. Here arises a problem of immense economic importance—the possible, nay the probable existence of a vast concealed coalfield underneath the Loess plain on which runs the Kinhan Railway. The thick coal may have been brought to workable depths by the hypothetical anticlinal folds. I need not dwell on the significance of this promising harvest for the present. The exhaustion of the open stores of coals as a necessary consequence of the growing industrial activity in China would in time compel geologists and miners to explore that hidden field.

(3)Judging from the physiographical features of th Taihang Range and the scattered geological observations, it appears highly probable that the general structure of the Liuhokou Basin is repeated in all the coalfields on the eastern side of

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the range. Viewed as a whole they look like a series of Chinese dust-pickers arranged side by side. The following diagram will serve to show how these basins are separated from one another:

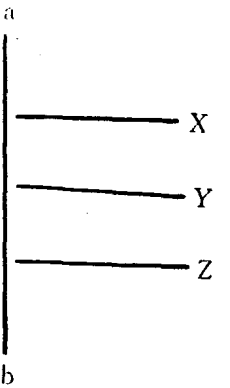

Fig. 2 a. b. The Tai-hang fold. x, y, z, The lateral or supplementary folds between which lie the coal basins.

Leaving the tectonic discussion, we now proceed to examine the sequences of the coal-bearing series exposed in various parts of the Liuhokou coalfield.

To the south of the Aikow village, all along the valley magnificent exposures are met with in the slopes of the hills. In the upper or the southern part of the valley, the lower part of the valley, the lower part of the coal-bearing series including the lowest stratum crops out, and its relation with the

Sinian Limestone can be investigated to the minutest detail. The upper part of the series however disappears from the scene, for it is unconformably overlain by the Liuhokou Conglomerate, a coarse conglomerate with well-rounded, large quartz and quartzitic pebbles cemented by a dark green material of arenaceo-calcareous nature. Northward, the higher beds gradually come in, while the lower beds become increasingly obscure being covered by debris and ploughed fields. Thus it is necessary to take several sections successively along the valley in order to obiain the whole sequence of strata exposed in that part of the field. The several sections are described below, each sequence being arranged in descending order:

p. Liuhokou Conglomerate.

g. Fairly even-grained yellow sandstone. rather coarse and soft.

f. Finely laminated bluish crumbly shale ····· 16.5 m.

α. A band of hard limestone crowded with comminuted crinoidal stems, containing here and there Productus and Spirifers, but not Fusulina. Very few of the organic froms seem to have reached the adult stage. (fossil No. 9) ····· 0.4 m.

e. Well-laminated shale ····· 0.6 m.

d. Massive dark blue limestone containing large and small black flints, a cherty band forms the base in which crinoids abound. A single specimen of Spirifera bisulcata? is found below the limestone escarpment in the form of a pebble presumably derived from this formation. (No. 9a). The limestone as

a whole is not as fossiliferous as might have been expected ..... 0. 7 m.

c. Blue soft shale containing a thin seam of siliceous limestone of in—constant character ..... 30 m.

b. A series of sandstones with interbedded shale.

3. Blue-grey sandstone ..... 1. 7 m.

2. Yellow, fissile calcareous shale with plant remains ..... 1. 8 m.

(No. 6).

1. Light blue-grey and purple calcareous sandstone weathering to a wine-red colour probably due to iron stain containing Lepidodendron, Calamites and other large fragments of fossil plants ..... 5 m.

(No. 7,8).

a. Blue-grey, even-grained sandstone with nodules, masses or lenses of haematite and ramifying haematitic veins, thickness variable average 2. 4 m.

s. Sinian limestone probably of Ordovician age.

A little way down the valley, two short sections were taken, and measurements were made. In these I found not only that the above figures were completely verified but estimated the thickness of the yellow sandstone (g) at 12. 8 m. A layer of coal now crops out immediately underheath the flint limestone. This is not observed in the above-described section.

Further north, a series of shales with bands of limestone are well exposed, resting conformably upon the yellow sandstone (g).

Section C D.

k. Shale with bands of yellowish sandstone.

r. Hard blue siliceous limestone full of crinoidal stems as in α; divides by two layers of shaly partings. Corals rarely occur. (No. 10) ····· 1 m.

i. Bluish white shale ····· 12 m.

β. Hard blue limestone as (α) and (γ)····· 1 m.

h. Shale as (i) ····· 3.1 m.

The limestone bands again appear in the section still further north.

p. Liuhokou Conglomerate.

n. Massive yellow sandstone.

m. A series of sandstone and shales. 0

3. Shale capped by a layer of coal ····· 4 m.

2. Soft sandstone ····· 35 m.

1. Shale ····· 15 m.

ε, Hard buff limestone Lithologically similar to (γ), (δ), etc; but apart from extremely few crinoidal fragments, it contains no other recognizable organic remains ····· 0.5 m.

l. Shale with bands of chert ····· 17.3 m

δ. Hard siliceous limestone crowded with comminuted crinoidal stems ····· 1.8 m.

k. A series of coal-bearing shales with intercalated sandstones ····· 44.5 m.

The succession of this series is as follows:

A thin layer of coal.

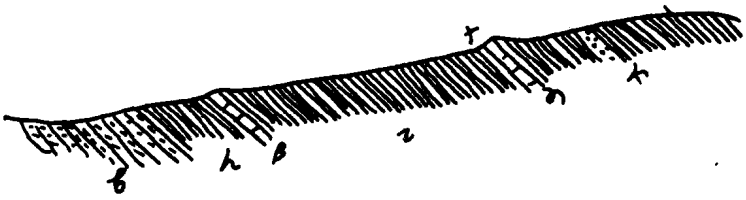

Fig. 4

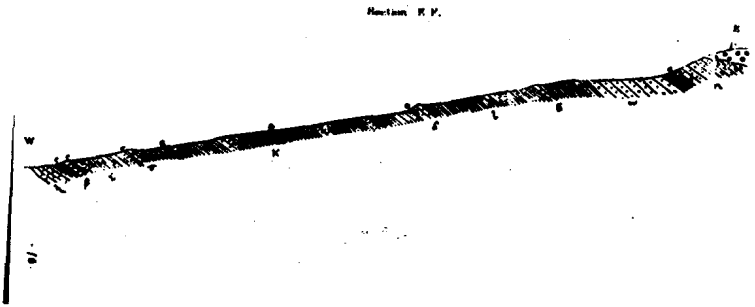

Fig. 5

Shale.

A band of calcareous sandstone.

Shale.

Yellow or blue sandstone.

Shale.

Coal seam 35 cm. thick.

Sandstone.

Shale.

Coal seam 60 cm. thick.

Shale.

γ. Hard siliceous limestone full of crinoidal stems appears to contain foraminiferal tests at places.

This limestone cam be subdivided into three parts:

Hard crinoidal limestone ····· 1 m.

Black cherty limestone ····· 0.15 m.

Well-laminated hard limestone ····· 0.4 m.

i. A band of sandstone with coal smuts followed downward by a bluish-white shale intercalated with layers of yellow sandtone, and then a ferruginous sandstone containing a thin layer of coal. Total thickness ····· 11.6 m.

β. Hard siliceous limestone as (α) ····· 0.8 m.

h. A layer of coal succeeded downwards by a whitish shale and yellow sandstone.

South-east of the Aikow village a mighty sequence of sandstones and shales is well-exposed all along the Liuhokou valley. Their road practically runs along the section marked GH on the map.

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