32. Ordovician Stratigraphy in Eastern Hopei, China.¹⁾

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The Ordovician stratigraphy in the Liukiang coalfield²⁾ is by no means so simple as once stated by F. F. Mathieu in the Bulletin of the Geological Survey of China, No. 4, 1922, but more complicated.

Mathieu distinguished there three Ordovician formations, Peilintze (95 m thick, base unknown), Shihmenchai (155 m), and Liangchiashan (275 m) in ascending order; Grabau assigned all these three to the Lower Ordovician based on *Archaeoscyphia chihliensis* Grabau, *Ophileta squamosa* Grabau, *Fusispira* sp., *Proterocameroceras mathiewi* Grabau, *Chihlioceras nathani* Grabau, *C. chingwangtaoensis* Grabau and *Piloceras platyventrum* Grabau from the upper part of the Peilintze, and *Ophileta plana* Grabau, *Hormotoma styliforme* Grabau, *Cameroceas styliforme* Grabau and *Piloceras platyventrum* Grabau from the Liangchiashan, while the Shihmenchai has yielded no fossils.

On the contrary we obtained several Upper Cambrian fossils as *Eoorthis*, *Agnostus*, *Ptychaspis* and *Quadraticephalus* in a part of the Shihmenchai area colored by Mathieu and several Middle Cambrian fossils as *Anomocare*, *Blackwelderia* and *Changshania* in another; based on the lithological similarity these two horizons can easily be correlated with the Fengshan limestone and Changshan shale of the Upper Cambrian and to the Kushan shale of the Middle Cambrian respectively. The Shihmenchai formation is upward succeeded concordantly by the Lower Ordovician Liangchiashan formation; although the two formations have an appearance of passing insensibly from one to the other, yet in our opinion they are non-sequential. The Liangchiashan formation have two cephalopod zones, the lower or the zone of *Yehlioceras* with *Yehlioceras* gen. nov.,³⁾ and *Ectenoceras*, and the upper or the zone of *Manchuroceras* with *Manchuroceras*, *Chihlioceras* and *Kaipingoceras* gen. nov.⁴⁾ These are exactly equivalent to the Yehli limestone with the zone of *Yehlioceras* and the overlying coralline limestone with the zone of *Manchuroceras* respectively.

1) This is a part of results obtained in our visit to North China in 1936, under the financial support of the Ministerium of Foreign Affairs. Published by the permission of the Director of the Shanghai Science Institute, Shanghai.

2) Shihmenchai on the eastern border of the Liu Kiang coalfield is situated 19 km north of Chinwangtao, northeastern Hopei.

3) *Yehlioceras* gen. nov.: genotype *Suecoceras yehliense* Grabau:—Ordovician Fossils from North China, Pal. Sinica, Ser. B, Vol. 1, Fasc. 1, 1922, p. 40, pl. IV, figs. 7 a-b.

4) *Kaipingoceras* gen. nov.: genotype *K. elongatum* nov.=*Cameroceas attenuatum* (non Grabau) in R. Endô:—Additional Fossils from the Canadian and Ordovician Rocks of the Southern Part of Manchoukuo, Sci. Rep. Tôhoku Imp. Univ., Ser. 2, Vol. XVI, No. 4, 1935, p. 203, pl. X, fig. 12.

The Peilintze formation which Mathieu believed to lie beneath the Shihmenchai, is divisible into two parts. The upper part essentially of oolitic limestone has a Middle Cambrian fauna comprising *Anomocare* and *Solenopleura* and is fairly an equivalent of the *Changhsia* limestone. The lower part mainly of black massive limestone, with the zones of *Yehlioceras* and of *Manchuroceras* can certainly be correlated with the Liangchiashan formation which rests on the Shihmenchai as alluded to above. Downwards, the Peilintze conformably overlies an Upper Cambrian formation indistinguishable from the Shihmenchai lithologically as well as palaeontologically.

The repetition of Cambrian and Ordovician strata mentioned above can neither be explained by a simple anticline nor syncline; perhaps there is need to assume several faults, among others a thrust between the upper (Middle Cambrian oolitic limestone) and lower Ordovician black massive limestone) parts of the Peilintze, as shown in the following profile.

Profile through Pei-Lin-Tze in Eastern Hopei; 1, Changhsia Limestone; 2, Kushan Shale; 3, Changshang Shale; 4, Fengshan Limestone; 5, Yehli Formation; 6, Peichiatien Formation; 7, Carboniferous; 8, Intrusive dyke.

The Middle Ordovician Machiakou or *Actinoceras* limestone of Grabau is well developed in North China; we divided it into four parts, Leichuang, Wushan, Tangshan and Shohankuochuang formations in ascending order. The Leichuang formation is the zone of *Wutinoceras*, with *Wutinoceras*, *Maruyamaceras* and *Armenoceras*, and the Tangshan formation is the zone of *Pseudoeskimoceras*, with *Pseudoeskimoceras*, *Armenoceras*, *Pararmenoceras*, *Eospyroceras* and *Parormoceras*. The Machiakou limestone and the underlying coralline limestone are, in our opinion, conformable without break.

The Ordovician stratigraphy as observed in eastern Hopei in comparison with that in Manchuria is shown below.

Classification of the Ordovician Deposits in eastern Hopei and correlation of the
Lower Ordovician Deposits of eastern Hopei and Manchuria.

Age	Eastern Hopei, China				Manchuria	
	Shimizu & Obata (1936)			A. W. Grabau (1924)	T. Kobayashi (1933)	R. Endo (1935)
Formation	Zones	Chinese genera				
Middle Ordovician						
Shohankuo-chuang F. 70-100 m.	—					
Tangshan F. 40-80 m.	Pseudeskimo-ceras	Pseudeskimo-ceras Armenoceras Pararmenoceras Parormoceras Eospyroceras	Machiakou Limestone		Tofangian	Ssuyen F.
Wushan F. 70-100 m.	—					
Leichuang F. 100-120 m.	Wutinoceras	Wutinoceras Maruyamaceras Armenoceras				
					Wolungian	Wuting F. Kangyo F. Santao F.
Lower Ordovician						
Peichiatien Formation 150-200 m.	Manchuroceras	Manchuroceras Kaipingoceras Chihlioceras	Coralline Limestone			
Yehli F. 100-170 m.	Yehlioceras	Yehlioceras Ectenoceras	Yehli Limestone	Liangchiashan F.	Wanwanian	Pinchou F.