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SOME LOWER CARBONIFEROUS STRAIGHT NAUTILOIDS FROM HUNAN AND KANSU

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(**Summary**)

INTRODUCTION

The straight nautiloids are not abundant in the Lower Carboniferous strata of China. The works of studing and collecting have been greatly neglected. Recently, a few specimens were collected by Messrs. H. Liu and Y. T. Lin. Among them Mr. Liu described two species from Hunan. In this paper the following species (comprising a full redescription of Liu's species) are described:

Rayonnoceras hunanense (Liu)
Rayonnoceras sp.
Dolorthoceras guijangense Lai (sp. nov.)
Euloxoceras orientale Lai (sp. nov.)
Michelinoceras sp.

The localities of these specimens are listed as follows:

1. Kweiyang and Changning, Hunan province: The fossil Cephalopods, comprising two species, viz. *Rayonnoceras hunanense* (Liu) and *Dolorthoceras guijangense* Lai were collected from the limestone member of Lower Carboniferous. It was found in association with *Kueichouphyllum* sp. and *Syringopora geniculata* Phillips. Another specimen (*Michelinoceras*) was obtained from the limestone of Lower Carboniferous at a locality 5 miles northwest of Tienwei, Changning, Hunan.

2. Chungwei, Kansu province: Collected by Mr. Lin, comprising two species. Among them *Euloxoceras orientale* Lai was collected from the Chouniukow formation at Siao-wan, Sia-ho-yen, Chungwei, associated with *Dibunophyllum bristolense* Grawood et Goodyear, *Arachnolasma* sp., *Barrandeophyllum* sp. and *Productus* sp. Prof. C. C. Yü and his student Mr. Y. T. Lin have considered their age is the same as that of the Subzone D_2 of Upper Visean. Another species *Rayonnoceras* sp. was collected from the same horizon as that of Siao-wan, at Hweishihgou, southern Changlopu, Siahoyen, Chungwei.

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DESCRIPTION

Sactoceratidae Troedsson, 1926

Rayonnoceras Croneis, 1926

Discussion: *Rayonnoceras* is widely distributed in the Lower Carboniferous of Europe and America. It is recognized for the first time in China.

Turner (1951) described numerous British species of *Rayonnoceras* from the Upper Visean and Namurian, such as *R. perigiganteum, R. lowickense, R. windmerense* and *R. simmsii.* Only one species *R. shiphamense* was collected from Tournaisian. It is also worthy of note that *R. millicentense,* with narrow siphuncle, is not agree with the generic diagnosis emend by himself and therefore it can not be referred to *Rayonnoceras.*

Shimansky (1961) described a species, *Rayonnoceras fainae,* from the Lower Carboniferous (Namurian ?) of Moscow region, Russia.

In North America most species of *Rayonnoceras,* except one which was described as *Rayonnoceras huecoense* Miller, Dunbar et Condra 1933 from the Lower part of the Bend formation (early Pennsylvanian), was found in Fayetteville shale (*R. solidiforme, R. fayettevillensis*), Cany shale (*R. vaughanianum*) and Chester formation (*R. malotti*). Cordon (1957) pointed out that the age of these beds and formations is all equal to Upper Visean and Lower Namurian.

The Chinese species *Rayonnoceras* sp. collected from Kansu was found in association with *Dibunophyllum bristolense* Grawood et Goodyear, *Barrandeophyllum* sp. and *Arachnolasma* sp. Its age is therefore approximately the same as that of the Subzone D_2 of Upper Visean. The horizon of *Rayonnoceras hunanense* (Liu) is not very clear; according to its associate fossils it is also of Upper part of Lower Carboniferous.

These evidences suggest that the genus *Rayonnoceras* had mostly flourished in the Visean age.

Rayonnoceras hunanense (Liu)

(Pl. I, Fig. 6; Text-fig. 1)

Diagnosis: Conch is orthoceraconic with straight and transverse sutures. The siphuncle is excentric and about one-third the diameter of the shell. It is cyrtochoanitic in outline. The neck and brim are subequal and about twice the area of adnation. Approximately 5 camerae occur in the space of the diameter of shell. The curvature of the septum is equal to the depth of one and a half camerae. The annulosiphonate deposits are very developed. Hyposeptal and episeptal cameral deposits are very thick.

Discussion: Liu placed this species in *Actinoceras,* but the outline of the siphuncle i.e., narrower necks and the area of adnation, horizontally radical canals, suggests a relationship with Sactoceratidae.

The siphuncle of the present form may be compared with that of *Sactoceras,* but the latter differs in its brim shorter than neck and having a smaller siphuncle.

The outline of the specimen is similar to *Paraloxoceras* Flower. The lack of dorsoventral differentiation of the annulosiphonate deposits, horizontally radical canals are opposed to *Paraloxoceras,* which was referred to Pseudorthoceratidae by Flower, although this genus shows a remarkable relationship with Actinoceroidea.

The genus *Rayonnoceras* was proposed by Croneis (1926). In 1933, Schindewolf established the genus *Carbactinoceras,* which was regarded as a subgenus of *Rayonnoceras* by Flower. The present writer agrees with Flower in treating the *Carbactinoceras* as a subgenus of *Rayonnoceras.* Flower states the following characters to distinguish these two genera:

Rayonnoceras	*Carbactinoceras*
1. Siphuncle broad, ventral	1. Siphuncle narrower, subcentral
2. Necks relatively long, not less than brims	2. Necks shorter than brim
3. Cameral deposits episeptal and hyposeptal	3. Cameral deposits episeptal only

The present species represents a state of the intergradation between the two extreme types. The narrower and central siphuncle suggests a similarity with *Carbactinoceras,* but the length of necks, cameral deposits and other characters suggest a relationship with *Rayonnoceras.*

The Chinese species attains a smaller size than *Rayonnoceras solidiforme,* from which it can be differentiated by the smaller and more central siphuncle. It is also similar to *Rayonnoceras malotti,* but distinguished by having a greater ratio of expansion (1:7.5), shallower curvature of the septum and longer brim which is about twice the neck.

Horizon and locality: From the limestone of Lower Carboniferous at Kweiyang, Hunan. Cat. No. Ce 1001.

Rayonnoceras sp.

(Pl. I, Fig. 4)

Diagnosis: Conch is orthoceraconic. The siphuncle is large and about one-half the diameter of the shell, and is located half way between the center of the conch and the ventral wall. The width of segments is considerably greater than height. A wide area of adnation is retained on the venter. The concavity of the septa is equal to the length of one camera. Four camerae occur in the space of one diameter of the conch.

Discussion: The present form may be compared with *Rayonnoceras foerstei* Gordon, but differs from the latter in having narrower neck and wider nummuloidal segments. It is also similar to *R. solidiforme,* but distinguished from one another by the following characters:

1. The diameter of the conch is about twice that of the siphuncle in *Rayonnoceras* sp., but three fold in *Rayonnoceras solidiforme.*

2. The segments retain the 2:1 ratio of maximum and minimal diameter in *R. solidiforme,* 5.6:1.7 in *Rayonnoceras* sp.

3. The length of the camerae of Chinese specimen is larger, and the depth of septal concavity is smaller than that of American specimen.

Horizon and locality: From the Chouniukow formation at Hweishihgou, southern Changlopu, Siahoyen, Chungwei, Kansun. Cat. No. Ce1006.

Dolorthoceras guijangense Lai (sp. nov.)

(Pl. I, Fig. 1)

Material: Only one incomplete specimen.

Diagnosis: The conch is cylindrical, gradually expanded. Rate of increase about 1 in 9. The siphuncle is about one-sixth the diameter of the conch, situated at the subventral in neanic stage, but eccentric in ephebic stage. The neck is slightly greater than the brim, and about twice the area of adnation. The siphuncular segment is more typically fusiform. The interior of the siphuncle bears continuous lamellar deposits. There are five camerae in a length equal to the diameter of the shell.

Discussion: The genotype of *Dolorthoceras, D. circulare* Miller, resembles the new species, but differs in its more eccentric siphuncle and abruptly contracted at the passage of the siphuncle through the septa. The present form may be compared with the Belgigue species, *Dolorthoceras goldfussianum,* which was described by Koninck from Visean limestone, but our specimen has narrower camerae and more expanded segments at posterior end.

Horizon and locality: Same as *Rayonnoceras hunanense* (Liu). Cat. No. Ce1002.

Euloxoceras orientale Lai (sp. nov.)

(Pl. I, Fig. 5; Text-fig. 2)

Diagnosis: Conch orthoceraconic, with subcircular section and slightly excentric siphuncle, which expands abruptly on either end of the septal foramen, and is slightly concave in outline within the camerae. The brim is twice than the neck, the area of adnation is less than the brim. Approximately four camerae occur in the space of the dorso-ventral diameter of the shell. The curvature of the septum is equal to the depth of one camera. Hyposeptal and episeptal deposits are very developed. The sutures are slope slightly adaperturally on one side.

Discussion: The excentric position of the siphuncle, the outline of the siphuncular segments and the cameral deposits all are characteristics of the genus *Euloxoceras*.

The Pennsylvanian species *E. milleri* and *E. greeni* are comparable to the new species. But it differs from *E. milleri* in the inclined sutures, the more central siphuncle and the outline of the siphuncular segments. The same characters mentioned above and the very shallow camerae distinguish this species from *E. greeni*.

Gordon (1957) described *Euloxoceras* sp. from the Alapah limestone, at southern part of the Siksikpuk River Valley, Brooks Range, Alaska. The Alaska shell differs from the Chinese form in having slightly deeper camerae and more excentric siphuncle. *Euloxoceras* sp. has three camerae in a length equal to the diameter of the shell, whereas *Euloxoceras orientale* has four in such a length.

Horizon and locality: From Chouniukow formation at Siaowan, Siahoyen, Chungwei, Kansu province. Cat. No. Ce1005.

Michelinoceras sp.

(Pl. I, Figs. 2—3)

Discussion: The living chamber of the described fragments is not preserved, therefore, the author is in hesitation to refer these specimens to *Orthoceras* or to *Michelinoceras*. Basing on the smooth surface of the shell, the present specimens were refered to *Michelinoceras*.

Horizon and locality: Obtained from the limestone of Lower Carboniferous at 5 miles northwest of Tienwei, Changning, Hunan. Cat. No. Ce1003; Ce1004.

CONCLUSION

1. Comparatively little work has been done on the straight nautiloids from the Lower Carboniferous of China. These new data can be used in Europe, North America and China.

2. Basing upon the restudy of the holotype, the generic name of Liu's species, *Actinoceras hunanensis* and *Orthoceras* sp. should be changed to *Rayonnoceras hunanense* and *Michelinoceras* sp. respectively.

3. Formerly the genus *Euloxoceras* was reported only from Pennsylvanian. Gordon first recorded *Euloxoceras* sp. from the Alapah limestone of Alaska. *Euloxoceras orientale* Lai (sp. nov.) was collected from the subzone D_2 of Visean, at Chungwei, Kansu. These new data demonstrate that the age of that genus is Visean to Pennsylvanian.

4. The evidences, basing upon the species analysis of *Rayonnoceras*, might suggest that the genus had mostly flourished in the Visean time.

图 版 說 明

全部标本存放在地質博物館。

1. *Dolorthoceras guijangense* Lai (sp. nov.)
   縱断磨光面，×2，登記号：Ce 1002
2. *Michelinoceras* sp.
   縱断磨光面，×1，登記号：Ce 1003
3. *Michelinoceras* sp.
   縱断磨光面，×1，登記号：Ce 1004
4. *Rayonnoceras* sp.
   背腹縱断磨光面，×5，登記号：Ce 1006
5. *Euloxoceras orientale* Lai (sp. nov.)
   背腹縱断磨光面，×4，登記号：Ce 1005
6. *Rayonnoceras hunanense* (Liu)
   背腹縱断磨光面，×1，登記号：Ce 1001

Explanation of Plate

The specimens are all preserved in the Museum of the Ministry of Geology in Peking

Fig. 1. *Dolorthoceras guijangense* Lai (sp. nov.)
Longitudinal section. ×2. Cat. No. Ce 1002

Fig. 2. *Michelinoceras* sp.
Longitudinal section. ×1. Cat. No. Ce 1003

Fig. 3. *Michelinoceras* sp.
Longitudinal section. ×1. Cat. No. Ce 1004

Fig. 4. *Rayonnoceras* sp.
Longitudinal section in dorso-ventral mid-plane. ×5 Cat. No. Ce 1006.

Fig. 5. *Euloxoceras orientale* Lai (sp. nov.)
Longitudinal dorso-ventral section. ×4. Cat. No. Ce 1005

Fig. 6. *Rayonnoceras hunanense* (Liu)
Longitudinal dorso-ventral section. ×1. Cat. No. Ce 1001