

中國古生物誌新乙種第四號

田奇璫著

總號第一二三冊

湖南泥盆紀之腕足類

中華民國二十七年一月

經濟部地質調查所
國立北平研究院地質學研究所 印行

(學術研究與國立中央研究院國立北京大學
兩廣地質調查所湖南地質調查所合作)

中國古生物誌新乙種第四號

田奇瑞著

總號第一二三冊

湖南泥盆紀之腕足類

中華民國二十七年一月

經濟部地質調查所
國立北平研究院地質學研究所 印行

(學術研究與國立中央研究院國立北京大學
兩廣地質調查所湖南地質調查所合作)

CONTENTS

	PAGE
INTRODUCTION	1
STRATIGRAPHIC SUMMARY	1
Classification of Devonian Formations in Central Hunan	1
Faunal Assemblages	7
Synoptic Table of the Distribution of the Devonian Brachiopods in Central Hunan...	12
DESCRIPTION OF SPECIES	15
Class <i>Brachiopoda</i> Cuvier	15
Order <i>Protremata</i> Beecher	15
Superfamily <i>Strophomenacea</i> Schuchert	15
Family <i>Strophomenidæ</i> King	15
Genus <i>Stropheodonta</i> Hall	15
Subgenus <i>Leptostrophia</i> Hall and Clarke	15
1. <i>Stropheodonta (Leptostrophia) mccarthyi</i> Grabau	15
Family <i>Productidæ</i> Gray	15
Genus <i>Productella</i> Hall	15
2. <i>Productella subaculeata</i> (Murch.) mut. <i>alpha</i> Grabau	15
3. <i>Productella shetienchiaensis</i> Tien (sp. nov.)	16
4. <i>Productella lachrymosa</i> (Conrad) var. <i>asiatica</i> Tien (var. nov.)	17
5. <i>Productella hemispherica</i> Tien (sp. nov.)	19
Family <i>Orthidæ</i> Woodward	21
Genus <i>Schizophoria</i> King	21
6. <i>Schizophoria kütsingensis</i> (Grabau)	21
7. <i>Schizophoria kütsingensis</i> mut. <i>beta</i> (Grabau)	24
8. <i>Schizophoria excellens</i> Grabau	25
9. <i>Schizophoria excellens</i> var. <i>kansuensis</i> (Grabau)	26
Order <i>Telotre mata</i> Beecher	29
Superfamily <i>Rhynchonellacea</i> Schuchert	29
Family <i>Camarotoechidæ</i> Grabau	29

Genus <i>Camarotæchia</i> Hall and Clarke	29
10. <i>Camarotæchia hunanensis</i> Tien (sp. nov.).....	29
11. <i>Camarotæchia depressa</i> Tien (sp. nov.)	30
12. <i>Camarotæchia elliptica</i> var. <i>hsinghuaensis</i> Tien (sp. nov.).....	32
13. <i>Camarotæchia livoniciformis</i> Tien (sp. nov.)	33
14. <i>Camarotæchia sublivoniciformis</i> Tien (sp. nov.)	35
15. <i>Camarotæchia shetienchiaensis</i> Tien (sp. nov.)	36
Variety α (var. nov.)	37
Variety β (var. nov.)	39
Variety γ (var. nov.)	39
16. <i>Camarotæchia hsikuangshanensis</i> Tien (sp. nov.).....	40
Variety <i>bifurcata</i> Tien (var. nov.)	42
Genus <i>Yunnanellina</i> Grabau	43
17. <i>Yunnanellina hanburyi</i> (Davidson)	43
18. <i>Mutation lata</i> Grabau	44
19. <i>Mutation sublata</i> Tien (mut. nov.)	45
20. <i>Yunnanellina uniplicata</i> Grabau	46
21. <i>Yunnanellina</i> cf. <i>triplicata</i> Grabau	46
22. <i>Yunnanellina triplicata</i> var. <i>latiformis</i> Tien (var. nov.)	47
23. <i>Yunnanellina obesa</i> Tien (sp. nov.)	48
Genus <i>Yunnanella</i> Grabau	48
24. <i>Yunnanella synplicata</i> Grabau	49
Variety <i>subtriplicata</i> Tien (var. nov.)	50
25. <i>Yunnanella supersynplicata</i> Tien (sp. nov.)	51
26. <i>Yunnanella abrupta</i> Grabau	53
Variety <i>rostrata</i> Tien (var. nov.)	54
Variety <i>media</i> Tien (var. nov.)	55
Variety <i>globosa</i> Tien (var. nov.)	56
Variety <i>schnurioides</i> Tien (var. nov.)	57
Variety <i>subcuboides</i> Tien (var. nov.)	59
27. <i>Yunnanella simplex</i> Tien (sp. nov.)	60
28. <i>Yunnanella triloba</i> Tien (sp. nov.).....	61
29. <i>Yunnanella uncinuloides</i> Tien (sp. nov.)	62
30. <i>Yunnanella uncinuloides</i> var. <i>subpentaplicata</i> Tien (var. nov.).....	64
31. <i>Yunnanella wangi</i> Tien (sp. nov.)	65

32. <i>Yunnanella hunanensis</i> Tien (sp. nov.)	67
33. <i>Yunnanella hsikuangshanensis</i> Tien (sp. nov.)	68
Variety a Tien (var. nov.)	69
Variety b Tien (var. nov.)	70
Variety c Tien (var. nov.)	70
Variety d Tien (var. nov.)	70
34. <i>Yunnanella</i> sp. (sp. nov.)	72
Classification of <i>Yunnanellas</i>	74
Genus <i>Pugnax</i> Hall and Clarke	75
35. <i>Pugnax acuminata</i> (Mart.) var. <i>rectangularis</i> Tien (var. nov.)	75
Family <i>Athyridæ</i> Phillips	77
Subfamily <i>Athyridinæ</i> Waagen	77
Genus <i>Athyris</i> McCoy	77
36. <i>Athyris huddlestoni</i> Reed var. <i>sinensis</i> Tien (var. nov.)	77
37. <i>Athyris gurdoni</i> Reed	79
Variety <i>transversalis</i> Tien (var. nov.)	81
38. <i>Athyris supervittata</i> Tien (sp. nov.)	83
39. <i>Athyris chitralensis</i> Reed var. <i>hunanensis</i> Tien (var. nov.)	84
40. <i>Athyris chitzechiaoensis</i> Tien (sp. nov.)	86
Variety <i>compressa</i> Tien (var. nov.)	88
41. <i>Athyris subplana</i> Tien (sp. nov.)	88
Family <i>Meristellidæ</i> Hall and Clarke	90
Subfamily <i>Meristellinæ</i> Waagen	90
Genus <i>Meristella</i> Hall	90
42. <i>Meristella tiaomachienensis</i> Tien (sp. nov.)	90
43. <i>Meristella hunanensis</i> Tien (sp. nov.)	92
44. <i>Meristella kütsingensis</i> Grabau	92
45. <i>Meristella kütsingensis</i> var. <i>chitzechiaoensis</i> Tien (var. nov.)	93
46. <i>Meristella flayelliformis</i> Tien (sp. nov.)	94
Superfamily <i>Spiriferacea</i> Waagen	95
Family <i>Atrypidæ</i> Gill	95
Genus <i>Atrypa</i> Dalman	95
47. <i>Atrypa douvillii</i> Mansuy	95
48. <i>Atrypa douvillii</i> var. <i>lungkouchungensis</i> Tien (var. nov.)	97
49. <i>Atrypa douvillii</i> var. <i>changuliensis</i> Grabau	98

50.	<i>Atrypa aspera</i> var. <i>subkwangsiensis</i> Tien (var. nov)	100
51.	<i>Atrypa desquamata</i> mut. <i>hunanensis</i> Grabau	101
52.	<i>Atrypa desquamata</i> mut. <i>magna</i> Grabau	103
53.	<i>Atrypa desquamata</i> mut. <i>alpha</i> Grabau	104
54.	<i>Atrypa shetienchiaensis</i> Tien (sp. nov.)	105
Subfamily <i>Martininae</i> Waagen		105
Genus <i>Emanuella</i> Grabau		105
55.	<i>Emanuella plicata</i> Grabau	105
56.	<i>Emanuella plicata</i> var. <i>pentagona</i> Grabau	107
Genus <i>Ambocælia</i> Hall		108
57.	<i>Ambocælia sinensis</i> Tien (sp. nov.)	108
Family <i>Spiriferidae</i> King		110
Genus <i>Spirifer</i> Sowerby		110
Subgenus <i>Sinospirifer</i> Grabau (emend.)		110
58.	<i>Spirifer</i> (<i>Sinospirifer</i>) <i>sinensis</i> Grabau	114
59.	<i>Spirifer</i> (<i>Sinospirifer</i>) <i>subextensus</i> (Martelli)	116
Subgenus <i>Tenticospirifer</i> Tien (subgen. nov.)		117
60.	<i>Spirifer</i> (<i>Tenticospirifer</i>) <i>tenticulum</i> de Verneuil	117
61.	<i>Spirifer</i> (<i>Tenticospirifer</i>) <i>vilis</i> Grabau	123
	Variety <i>kwangsiensis</i> Tien (var. nov.)	124
62.	<i>Spirifer</i> (<i>Tenticospirifer</i>) <i>supervilis</i> Tien (sp. nov.)	127
63.	<i>Spirifer</i> (<i>Tenticospirifer</i>) <i>murchisonanus</i> de Koninck	129
64.	<i>Spirifer</i> (<i>Tenticospirifer</i>) <i>hsikwangshanensis</i> Tien (sp. nov.)	131
Subgenus <i>Hunanospirifer</i> Tien (subgen. nov.)		137
65.	<i>Spirifer</i> (<i>Hunanospirifer</i>) <i>ninghsiangensis</i> Tien (sp. nov.)	137
66.	<i>Spirifer</i> (<i>Hunanospirifer</i>) <i>wangi</i> Tien (sp. nov.)	139
Superfamily <i>Terebratulacea</i> Waagen		143
Family <i>Centronellidae</i> Hall and Clarke		143
Genus <i>Centronella</i> Billings		143
67.	<i>Centronella</i> (?) <i>sinensis</i> Tien (sp. nov.)	143
Family <i>Stringocephalidae</i> de Koninck		144
Genus <i>Stringocephalus</i> Defrance		144
68.	<i>Stringocephalus burtini</i> Defrance	144
	Mutation <i>alpha</i> Grabau	145
	Mutation <i>beta</i> Tien (mut. nov.)	146

DEVONIAN BRACHIOPODA OF HUNAN

By

C. C. TIEN

INTRODUCTION

In the course of the past six years, many stratigraphical researches in central Hunan have been conducted in the Palæozoic strata, especially in the Devonian and Carboniferous formations. The geological data have been previously reported on both by myself and by my colleagues of the Geological Survey of Hunan in the bulletins and memoirs of that Survey. Many of the important palæontological collections however have not been worked out except a part of the Devonian brachiopods obtained before 1931 in the region between Shihyenpu and Tiaomachien in the Changsha district was described by Prof. A. W. Grabau in his big monograph "Devonian Brachiopoda of China." Since 1931, much new material has been systematically collected from Devonian formations and a critical study of this material seems desirable, because in the past most of the Devonian fossils described from China were obtained either from Chinese drug-stores with unknown origin or from scattered regions with no definite stratigraphical succession. The present monograph is devoted to the Devonian brachiopods, while the other classes such as corals, cephalopods, gastropods, etc. are left for future study.

Here I desire to express my deep indebtedness to my teacher Prof. A. W. Grabau for his valuable suggestions and criticisms. I have to thank Dr. W. H. Wong, Director of the National Geological Survey of China, and Mr. C. P. Liu, Director of the Geological Survey of Hunan Province, for giving me every facility in carrying out this work in Peiping. I also owe my thanks to Messrs. Y. L. Wang, H. C. Wang, Y. S. Chi and C. Y. Liu for allowing me to study their valuable collections.

STRATIGRAPHIC SUMMARY

CLASSIFICATION OF DEVONIAN FORMATIONS IN CENTRAL HUNAN

In a previous article,¹ dealing with the geology of central Hunan, a provisional classification of the Devonian formations has been made as follows:

¹ Tien, C. C., H. C. Wang and Y. T. Hsu, 1933. Geology of Changsha, Hsiangtan, Hengshan, Hengyang, Hsianghsiang and Shaoyang districts, central Hunan. Geol. Surv. Hunan, Geol. 2, Bull. 15, pp. 8-19.

Super-Formation:

Lower Carboniferous: Menkunao Series

Devonian:

Upper Devonian:

Yohlu quartzite

Hsikuangshan limestone

Middle Devonian:

Shetienchiao Series

Shihyenpu Series (=	{	Lungkouchung beds
Chitzechiao Series)		Chitzechiao limestone
		Shehushan sandstone

Tiaomachien Series

Unconformity

Sub-Formation:

Silurian: Tanchiapa Series

As the result of my palaeontological as well as stratigraphical researches in the last three or four years, I become aware that there are many points to be modified in the above mentioned classification. First of all, on the basis of the palaeontological evidence, the Shetienchiao series and the Lungkouchung beds should be grouped together with the upper division rather than with the middle one. Secondly, in many places the lower part of the so-called Yohlu quartzite is nothing but an equivalent of the Hsikuangshan limestone, whereas the uppermost part, with *Calamites*, should be regarded as the base of the Feng-ninian or Lower Carboniferous, there being a more or less marked hiatus somewhere within the formation. Thirdly, the upper part of the Tiaomachien (Chaomachien) series should be separated out as a new member of the Chitzechiao (now used instead of the old term "Shihyenpu") series or group, because it also carries *Stringocephalus*. The Tiaomachien series is restricted to the part below the bed 149 m. in the Tiaomachien section (Fig. 1) or 172 m. in the Ichiawan section. According to the lithological character and fossil contents, the restricted Tiaomachien series is still divisible into two parts. The lower begins with a basal conglomerate lying unconformably upon either the Tienmashan series or the Tanchiapa series, both of them being most probably of Silurian age, and having been folded during the Kwangsian or Caledonian orogenic period. The basal conglomerate is followed upward by sandstones, then by a purplish shale or yellow sandy shale carrying pelecypods and gastropods, which is in turn succeeded by a conglomeratic sandstone followed by a purplish shale and a whitish gray sandstone furnishing *Protolepidodendron* and remains of Ostracoderms mostly belonging to the family Tremataspidae. The upper part is characterized by a *Stropheodonta* (*Leptostrophia*) fauna and is chiefly composed of yellow weathered argillites in the type section, while in the Ichiawan section it becomes intercalated with limestone bands or concretions.

Formerly in the type section (Fig. 2), the Hsikuangshan series was believed to consist of two members; the lower being a shale, not yet named, the upper a limestone, named Hsikuangshan limestone which is capped by a sandstone, now known to be the base of the Fengnianian. Recently Mr. Y. L. Wang has redivided this limestone into 3 members. In descending order they are as follows:

3. Makunao limestone200 m.
2. Nitangli iron ore bed1-2 m.
1. Tutzutang limestone10-20 m.

The shale below the Tutzutang limestone about 30-50 m. thick has been renamed by Wang Changlungchieh shale.

From a palæontological point of view, the upper two members, the Nitangli iron ore bed and the Makunao limestone, should be regarded as a unit because they are characterized by one and the same *Yunnanella* fauna which makes its first appearance in the iron ore bed and ranges up to the top of the limestone. The Tutzutang limestone carries a particular fauna of its own, the leading types of which are *Yunnanellina hanburyi* and *Athyris gurdoni*. Furthermore, in central Hunan the *Yunnanella* beds are more widespread than the *Yunnanellina* beds. The latter and the Changlungchieh shale as observed in the vicinity of Shuehfengshan are entirely absent in Ninghsiang, the iron ore bed there lying directly upon a conglomerate which is underlain by sandstones with intercalations of shales carrying fragments of *Spirifer* (most probably belonging to the group of *Sinospirifer*). In Changsha and Hsiangtan districts the Hsikuangshan series is either entirely absent or entirely replaced by the Yohlu sandstone of continental origin. It then becomes evident that a disconformity exists above the Hsikuangshan series or below the Shuehfengshan sandstone.

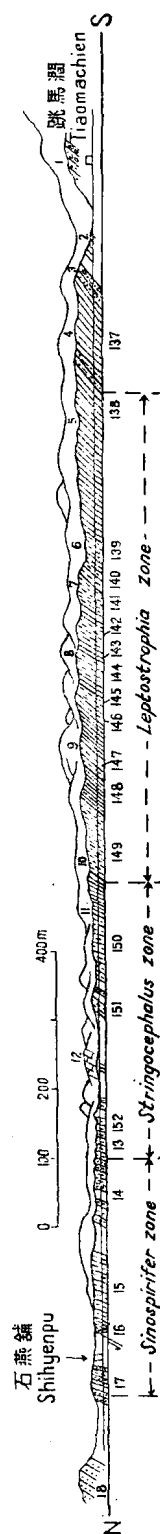


Fig. 1. Section made between Shihyenpu and Tiaomachien in the southern part of Changsha, showing the succession of the Devonian strata. 1-13. Middle Devonian. 1-5. Lower part of Tiaomachien series. 1. conglomerate and sandstone, 2. purple shale, 3. conglomeratic sandstone, 4. purple shale and whitish gray sandy shale carrying *Prolepidodendron* and *Ostracoderms*. 5-10 (149). Upper part of Tiaomachien series. 5. weathering yellowish or greenish yellow argillite carrying gastropods and pelecypods, 6. weathering yellow to brownish yellow and bluish gray to greenish gray argillites with *Spirifer* (*Undospirifer*) *padaukpingensis* var. *pigmaeus* (139), 7. bluish or greenish gray calcareous shale furnishing *Atrypa desquamata* var. *hunanensis*, *Schizophoria kutsingensis*, etc. (140), 8. weathering yellowish to greenish yellow argillite with *Leptostrophia mearnsi*, *Productella* (143), *Productella* sp. c (144), 9. green to yellow shale with *Leptostrophia mearnsi*, *Productella* sp. d (147) and *Chonetes* sp. d., 10. bluish gray to yellow argillite with small *Leptostrophia* (149). 11-13. Chitzechiao series. 11. Blue and yellow shale with *Tentaculites* and pelecypods (150-151), 12. bluish gray thick-bedded limestone (Chitzechiao limestone) very rich in compound and simple corals, 13. shales intercalated with limestone bands carrying *Atrypa* and corals. 14-18. Upper Devonian. 14-17. Shehtienchiao series. 14. intercalations of thin sandstones and shales, 15. thin green shale occasionally intercalated with thin sandstone in the upper part, 16. purplish sandy shale with *Sinospirifer stenosus*, 17. thin shales and sandstones with intercalations of limestone bands carrying *Sinospirifer* and bryozoa. 18. Yohlu quartzite.

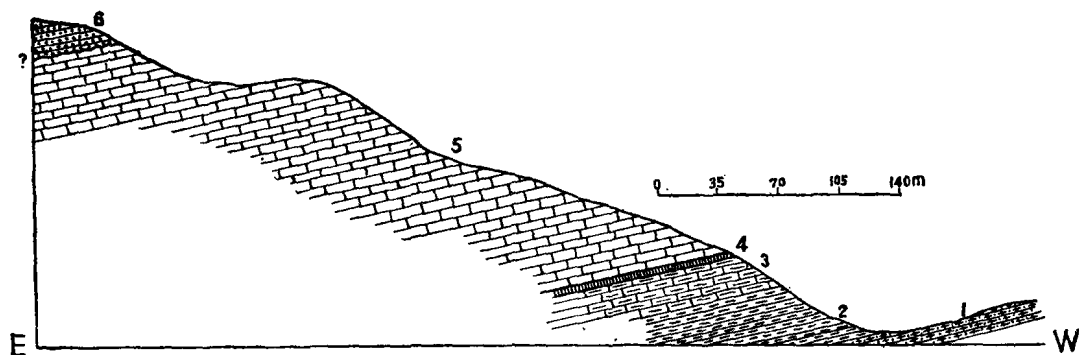


Fig. 2. Showing the succession of the Upper Devonian Hsikuangshan series at Hsikuangshan, Hsinghua, Hunan.

1-5. Upper Devonian. 1. Stibnite-bearing quartzose sandstone—Shehtienchiao series; 2-5. Hsikuangshan series. 2. Changlungchieh shale, 3. Tutzutang limestone with *Yunnanellina haburyi*, *Y. uniplicata*, *Athyris gurdoni*, etc., 4. Nitangli iron bed with *Yunnanella synplicata*, 5. Makunao limestone with *Yunnanella supersynplicata*, *Spirifer (Hunanospirifer) wangi*, *S. (Tenticospirifer) hsikuangshanensis*, *Camarotoechia hsikuangshanensis*, etc. 6. Hsuehfengshan sandstone of Lower Carboniferous age.

The Shetienchiao series as developed in Hsianghsiang and Shaoyang districts is mainly composed of limestones especially in its upper part, whereas in Changsha and Hsiangtan districts the limestone element becomes very rare, only forming few bands or thin layers intercalated in the sandstones and shales, while in Ninghsiang and Anhua districts the whole series is made up of sandstones with few intercalations of argillutytes, the calcareous member being entirely absent. The leading type of the fauna of this series is *Sinospirifer*.

Thus, on the basis of palæontological studies, the Devonian in central Hunan may be re-classified as follows:

Super-Formation:

Lower Carboniferous:

Hsuehfengshan sandstone with *Calamites flora*.

Hiatus and disconformity (more or less marked)

DEVONIAN:

UPPER DEVONIAN:

IV. HSIKUANGSHAN SERIES or group characterized by *Yunnanella* and *Yunnanellina* fauna (=Famenian), replaced by Yohlu sandstone in Changsha and Hsiangtan districts.

I. Makunao limestone with *Yunnanella* fauna.

Zone of *Spirifer (Tenticospirifer) hsikuangshanensis*.

Zone of *Camarotoechia hsikuangshanensis*.

Zone of *Spirifer (Hunanospirifer) wangi*.

Zone of *Yunnanella supersynplicata*.

Zone of *Yunnanella synplicata*—Nitangli iron ore bed.

Fig. 3. Correlation of Devonian Formations in Central Hunan.

- H. Tutzutang limestone with *Yunnanellina* fauna, either absent as in Ninghsiang and Anhua or replaced by Yohlu sandstone as in Changsha and Hsiangtan.
 Zone of *Yunnanellina hanburyi* mut. *latiformis* and *Athyris gurdoni*.
 Zone of *Yunnanellina hanburyi* and *Y. uniplicata*.
- G. Changlungchieh shale, the same variation as the Tutzutang limestone.

III. SHETIENCHIAO SERIES or group characterized by *Sinospirifer* fauna (=Frasnian).

- F. Shetienchiaio beds,—limestone with intercalations of shales in Shaoyang and Hsianghsiang; sandstones and shales with intercalations of limestone bands in Changsha and Hsiangtan; sandstones with intercalations of shales in Ninghsiang and Anhua.
 Zone of *Atrypa hunanensis*.
 Zone of *Camarotoechia shetienchiaensis*.
 Zone of *Hypothyridina cuboides*.
- E. Lungkouchung beds,—sandstones and shales with two or three intercalations of shaly limestones in Hsianghsiang and Shaoyang; sandstones and shales without calcareous elements in Changsha and Hsiangtan; entirely sandstones in Ninghsiang and Anhua.
 Zone of *Atrypa douvillii* var. *lungkouchungensis*.

MIDDLE DEVONIAN:

II. CHITZETCHIAO SERIES or group characterized by *Stringocephalus* fauna (=Givetian).

- D. Chitzechiao limestone:
 Zone of *Meristella flayelliformis*.
 Zone of *Meristella kütsingensis*.
- C. Ichiawan shale:
 Zone of *Tentaculites*.
 Zone of *Stringocephalus burtini* mut. *beta*.

I. Tiaomachien series:

- B. Upper part (=late Eifelian),—yellow weathered argillutypes or intercalated with limestone bands or inclusions characterized by *Stropheodonta* (*Leptostrophia*) fauna.
 Zone of *Chonetes* sp. d.
 Zone of *Chonetes plebeja*.

Zone of *Meristella tiaomachienensis*.

Zone of *Spirifer (Indospirifer) padaukpinensis* var. *pigmaeus*.

A. Lower part (=early Eifelian or Old Red Sandstone),—in Changsha and Hsiangtan districts consisting of the following beds:

5. Whitish gray sandstone and purplish shale with *Protolepidodendron* and Tremataspids.
4. Yellow and purple shales with bivalves.
3. Conglomeratic sandstone.
2. Purplish shale and yellowish sandy shale carrying pelecypods and gastropods.
1. Sandstone and conglomerate.

Unconformity (Kwangsian Movement).

Sub-Formation:

Silurian:

Tanchiapa series in Changsha and Hsiangtan or Tienmashan series in Hsianghsiang, Anhua, etc.

From the above tabulation, it will be clearly seen that the Chitzechiao series characterized by *Stringocephalus burtini* is undoubtedly equivalent to the Givetian, and the Shetienchiao series characterized by *Hypothyridina cuboides*, to the Frasnian of Europe or the Tully limestone of N. America. The Hsikuangshan series, according to its stratigraphical succession, might be regarded as corresponding to the Famennian of Europe or to the Chemung formation of N. America, although its faunal elements are almost entirely distinct from either of them especially in the later Hsikuangshanian. This either indicates that in the later Hsikuangshanian the development of the *Yunnanella* fauna was under the fostering conditions of isolation in the basin of China or shows that the deposit of the later Hsikuangshanian was absent in the Upper Devonian sections in other parts of the world.

As lying below the *Stringocephalus* beds—Chitzechiao series, and also carrying many either common or very closely allied Eifelian elements, it seems that the upper part of the Tiaomachien series in central Hunan is an equivalent of the later Eifelian or Couvinian, although in this part the leading type, *Calceola sandalina*, has so far not yet been found. The lower part of the series, from the recent discovery of the Tremataspids in a purplish shale by Mr. Y. S. Chi and Dr. C. C. Young, should be also taken as an equivalent of the early Eifelian, if not corresponding to the Old Red Sandstone of Lower Devonian age.

FAUNAL ASSEMBLAGES

In the following are given faunal assemblages described in the present monograph from different localities.

Assemblage from the Hsikuangshan series

East of Taotang, Hsikuangshan, Hsinghua. Coll. Y. L. Wang. Loc. & Hoz. Nos. H4-9.

- Productella subacleata* mut. *alpha* Grabau
Camarotoechia hsikuangshanensis Tien (sp. nov.)
C. hsikuangshanensis var. *bifurcata* Tien (var. nov.)
Yunnanellina triplicata var. *latiformis* Tien (var. nov.)
Yunnanella synplicata Grabau *synplicata*
Y. supersynplicata Tien (sp. nov.)
Y. abrupta Grabau
Y. abrupta var. *media* Tien (var. nov.)
Y. abrupta var. *globosa* Tien (var. nov.)
Y. simplex Tien (sp. nov.)
Y. hunanensis Tien (sp. nov.)
Y. hsikuangshanensis Tien (sp. nov.)
Athyris hudelestoni var. *sinensis* Tien (var. nov.)
Athyris gurdoni var. *transversalis* Tien (var. nov.)
Spirifer (*Tenticospirifer*) *tenticulum* de Vern. (subgen. nov.)
S. (Tenticosp.) vilis var. *kwangsiensis* Tien (subgen. & var. nov.)
S. (Tenticosp.) supervilis Tien (subgen. & sp. nov.)
S. (Tenticosp.) hsikuangshanensis Tien (subgen. & sp. nov.)
S. (Tenticosp.) murchisonanus de Vern.

Chilichiang, Hsikuangshan, Hsinghua. Coll. Y. L. Wang. Loc. No. H36.

- Productella hemispherica* Tien (sp. nov.)
Yunnanellina hanburyi David.
Y. obesa Tien (sp. nov.)
Athyris gurdoni Reed
A. gurdoni var. *transversalis* Tien (var. nov.)
A. huddlestoni Reed var. *sinensis* Tien (var. nov.)

Changlungchieh, Hsikuangshan, Hsinghua. Coll. Y. L. Wang. Loc. No. H31.

- Camarotoechia elliptica* var. *hsinghuaensis* Tien (var. nov.)
Yunnanellina hanburyi mut. *sublata* Tien (mut. nov.)
Y. cf. triplicata Grabau
Y. obesa Tien (sp. nov.)

$\frac{1}{2}$ li W. of Huangchialung, Hsikuangshan, Hsinghua. Coll. Y. L. Wang. Loc. No. H35.

- Yunnanella abrupta* Grabau
Yunnanella abrupta var. *globosa* Tien (var. nov.)

Y. abrupta var. *schnurioides* Tien (var. nov.)

Y. abrupta var. *subcuboides* Tien (var. nov.)

Y. triloba Tien (sp. nov.)

Yunnanella hunanensis Tien (sp. nov.)

Y. hsikuangshanensis Tien (sp. nov.)

15 li W. of Shetienchiao, Shaoyang. Coll. C. C. Tien & H. C. Wang.

Yunnanellina hanburyi (Davidson)

Y. hanburyi mut. *lata* Grabau

Y. uniplicata Grabau

Pawan, Hsianghsiang. Coll. C. C. Tien & Y. T. Hsu. Loc. No. 251.

Camarotoechia hunanensis Tien (sp. nov.)

C. depressa Tien (sp. nov.)

C. livoniciformis Tien (sp. nov.)

C. sublivoniciformis Tien (sp. nov.)

C. sublivoniciformis var. *subpentaplicata* (var. nov.)

Yunnanella synplicata var. *subtriplicata* Tien (sp. nov.)

Y. supersynplicata Tien (sp. nov.)

Y. abrupta Grabau

Yunnanellina uniplicata Grabau

Athyris chitralensis Reed var. *hunanensis* Tien (var. nov.)

Lochiapien, Hsianghsiang. Coll. C. C. Tien & Y. T. Hsu. Loc. No. 228.

Productella lachrymosa var. *asiatica* Tien (var. nov.)

Yunnanella abrupta var.

Shihpantang in the vicinity of Hsuehfengshan, Ninghsiang. Coll. Y. L. Wang & C. Y. Liu. Loc. No. N27.

Yunnanella abrupta var. *media* Tien (var. nov.)

Y. abrupta var. *globosa* Tien (var. nov.)

Y. abrupta var.

Y. sp.

Spirifer (Tenticospirifer) tentaculum de Vern. (subgen. nov.)

Spirifer (Tenticospirifer) supervilis Tien (subgen. & sp. nov.)

S. (Huanospirifer) ninghsiangensis Tien (subgen. & sp. nov.)

S. (Huanosp.) wangi Tien (subgen. & sp.)

Huangchinpang, Ninghsiang. Coll. Y. L. Wang & C. Y. Liu. Loc. No. N12.

Yunnanella uncinuloides Tien (sp. nov.)

Y. uncinuloides var. *subpentaplicata* Tien (var. nov.)

Y. wangi Tien (sp. nov.)

Assemblage from the Shetienchiao series

West of Chitzechiao, or Lungkouchung, Hsianghsiang. Coll. C. C. Tien, Y. S. Chi, and Y. T. Hsu.

- Productella shetienchiaoensis* Tien (sp. nov.)
- Contronella? sinensis* Tien (sp. nov.)
- Camarotoechia shetienchiaoensis* Tien (sp. nov.)
- C. shetienchiaoensis* var. α Tien (var. nov.)
- C. shetienchiaoensis* var. β Tien (var. nov.)
- C. shetienchiaoensis* var. γ Tien (var. nov.)
- Pugnax acuminata* var. *rectangularis* Tien (var. nov.)
- Athyris supervittata* Tien (sp. nov.)
- Atrypa douvillii* Man.
- Atrypa douvillii* var. *lungkouchungensis* Tien (var. nov.)
- Spirifer (Sinospirifer) sinensis* Grabau
- S. (Sinosp.) subextensus* (Mart.)

In the vicinity of Shetienchiao, Shaoyang. Coll. C. C. Tien.

- Productella shetienchiaoensis* Tien (sp. nov.)
- Camarotoechia shetienchiaoensis* Tien (sp. nov.)
- C. shetienchiaoensis* var. *a.* Tien (var. nov.)
- C. shetienchiaoensis* var. *b.* Tien (var. nov.)
- Pugnax acuminata* var. *rectangularis* Tien (var. nov.)
- Contronella? sinensis* Tien (sp. nov.)
- Athyris supervittata* Tien (sp. nov.)
- Atrypa shetienchiaoensis* Tien (sp. nov.)
- Spirifer (Sinospirifer) sinensis* Grabau
- Spirifer (Tenticospirifer) vilis* Grabau (subgen. nov.)

Meihuachuang, Shaoyang. Coll. C. C. Tien and H. C. Wang.

- Productella shetienchiaoensis* Tien (sp. nov.)
- Camarotoechia shetienchiaoensis* Tien (sp. nov.)
- Spirifer (Tenticospirifer) vilis* Grabau (subgen. nov.)

Assemblage from the Chitzechiao limestone

Chitzechiao, Hsianghsiang. Coll. C. C. Tien. Loc. No. W-12.

- Meristella kütsingensis* Grabau
- M. kütsingensis* var. *chitzechiaoensis* Tien (var. nov.)
- Atrypa desquamata* var.
- Stringocephalus burtini* Defrance

Wenchiachung of Ninghsiang. Coll. Y. L. Wang. Loc. No. N5.

Meristella flayelliformis Tien (sp. nov.)

Athyris chitzechiaoensis Tien (sp. nov.)

A. chitzechiaoensis var. *compressa* Tien (var. nov.)

A. subplana Tien (sp. nov.)

Ambocælia sinensis Tien (sp. nov.)

Hsiaotang of Ninghsiang. Coll. Y. L. Wang. Loc. No. N31.

Atrypa aspera var. *subkwangsiensis* Tien (var. nov.)

Nantienpiao of Hsianghsiang. Coll. H. C. Wang. Loc. No. 261.

Atrypa aspera var. *subkwangsiensis* Tien (var. nov.)

Assemblage from the Ichianwan shale

Ichianwan of Hsiangtan. Coll. C. C. Tien and H. C. Wang. Loc. No. 172C-P.

Stringocephalus burtini mut. *alpha* Grabau

Stringocephalus burtini mut. *beta* Tien (mut. nov.)

Atrypa desquamata var.

Assemblage from the upper part of the Tiaomachien series

Ichianwan of Hsiangtan. Coll. C. C. Tien and H. C. Wang. Loc. No. 172a-m.

Stropheodonta (Leptostrophia) mccarthyi Grabau

Schizophoria kütsingensis Grabau

S. kütsingensis mut. *beta* Grabau

S. excellens Grabau

S. excellens var. *kansuensis* Grabau

Emanuella plicata Grabau

E. plicata var. *pentagona* Grabau

Meristella tiaomachiensis Tien (sp. nov.)

M. hunanensis Tien (sp. nov.)

Atrypa desquamata var. *hunanensis* Tien (var. nov.)

A. desquamata mut. *magna* Grabau

Kaopayao of Ninghsiang. Coll. H. C. Wang and C. Y. Liu. Loc. No. 499.

Schizophoria kütsingensis Grabau

S. excellens Grabau

S. excellens var. *kansuensis* Grabau

Atrypa douvillii Man.

Atrypa douvillii var. *changuliensis* Grabau

Tapingli of Ninghsiang. Coll. Y. L. Wang and C. Y. Liu. Loc. No. N34.

Schizophoria excellens Grabau

S. excellens var. *kansuensis* Grabau

Atrypa desquamata mut. *magna* Grabau