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Chronostratigraphic Subdivision of the Cambrian of China

S. PENG

Nanjing Institute of Geology and Palaeontology, the Chinese Academy of Sciences
39 East Beijing Road, Nanjing, People's Republic of China 210008. E-mail: speng@pub.jlonline.com

ABSTRACT

The chronostratigraphic framework for the Cambrian of South China is reviewed. Currently four series and nine stages are recognized. The Cambrian of South China is subdivided into one pre-trilobite-bearing series, the Diandongian Series, and three trilobite-dominated series, the Qiandongian, Wulingian, and Hunanian. The nine stages are, in ascending order, the Jinningian, Meishucunian, Nangaoan, Duyunian, Taijiangian, Wangcunian, Youshuian, Waergangian, and Hunanian. All of these units have been named recently and are boundary-stratotype-based, with the lower boundaries being defined by the first appearances of characteristic species, most of which hold potential for long-range correlation.

KEYWORDS | Cambrian System. Chronostratigraphy. Lower boundary. Type section. South China.

INTRODUCTION

The first attempt to produce a nomenclature for the Cambrian stages of China was that of Lu Yanhao, who read a paper entitled "Cambrian stratigraphy of China (first draft)", at the first national congress of the All-China Committee on Stratigraphy in 1959. The names of three series and eight stages appeared for the first time on a chart showing Cambrian correlations for China, North America and Europe. Those series and stages (in ascending order) are Chiungchussuan, Tsanglangpuan and Lungwangmiaoan of the Lower Cambrian Series; Hsuchuangian and Changhian of the Middle Cambrian Series; and Kushanian, Changshanian, and Fengshanian of the Upper Cambrian Series. The stages were all adopted directly from the names of lithostratigraphic units; separate definitions for these "stages" were not given. Afterward, when the manuscript of the talk was published, Lu (1962: p. 104) had no longer used the stage nomenclature but the formation names on the same correlation chart. His abandoning of the stage nomenclature and his replacement of those stage names with the lithostratigraphic units indicates that the concept of his stages is lithostratigraphic rather than chronostratigraphic. Since then, and for a long period afterward, almost no new Cambrian chronostratigraphic nomenclature had been discussed and used in the Chinese literature, except for the paper of Qian (1977), who proposed a new "stage", the Meishucunian. The Meishucunian Stage, like the stages proposed by Lu (1959), shares the concept and name of a lithostratigraphic unit, the Meishucun Formation. The formation was previously considered to be of latest Precambrian in age. Based on the presence of small shelly fossils in the Meishucun Formation, Qian (1977) assigned the Meishucunian as the lowest stage of the Cambrian of China.

In 1979, China held its second national congress on stratigraphy, and the need of a chronostratigraphic subdivision for the Chinese Cambrian System was once again recognized by Chinese stratigraphers. As a result, a framework including 10 Cambrian stages was worked out. Lu's (1959) nomenclature, together with the Meishucunian Stage (Qian, 1977) was accepted. Additionally, one new stage, the Maochuangian (Middle Cambrian Series), was added. The Middle-Upper Cambrian stages were based on

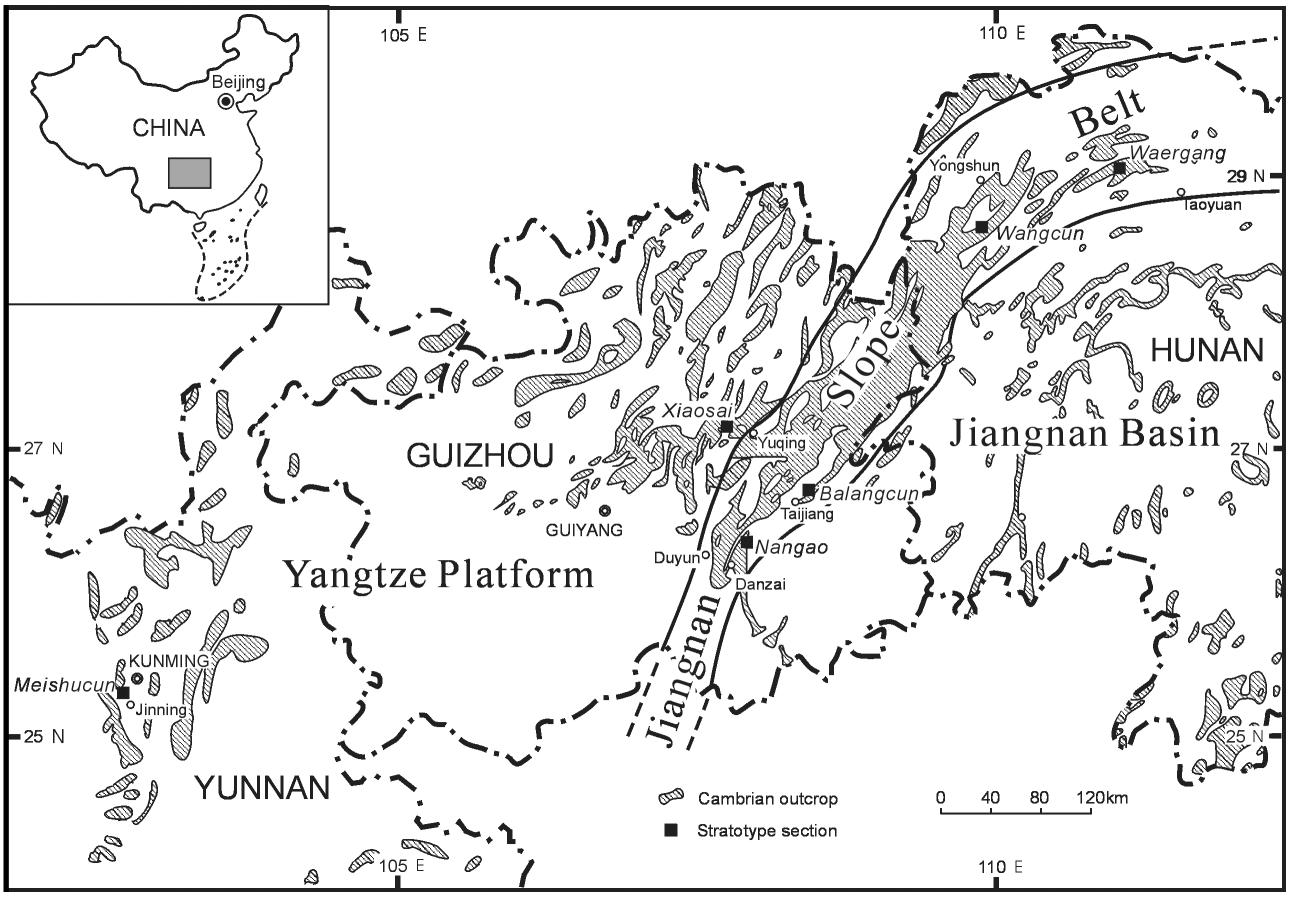

FIGURE 1 **Geological sketch map of northeastern Yunnan, Guizhou, and western Hunan Provinces, showing Cambrian outcrops, bio-palaeogeographical regions, and localities of the stratotype sections for the series and stages of South China.**

formations in Shandong and Hebei Provinces of North China, while the Lower Cambrian stages were based on formations in eastern Yunnan Province of South China. The age of Maochuangian Stage, just as the age of the Maochuang Formation, has been debatable (Chang, 1980, 1986, 1988; Lu and Zhu, 1981). The framework was later published by Xiang (1981), and, since then, has been accepted as the standard subdivision of the Cambrian of China. However, all those stages, as defined by Xiang (1981), are actually of lithostratigraphically based rather than chronostratigraphically based because the type sections of formations are used directly as stage "stratotype sections", and the stages are defined basically by lithologic changes or by paleontological contents rather than by boundary-stratotypes. As discussed by Peng et al. (1998, 1999, 2000a), these traditional Cambrian stages should not be taken as the standard of Cambrian chronostratigraphy in China because they do not fulfill the requirements of modern chronostratigraphy (Cowie, 1986, 1990; Cowie et al., 1986; Salvador, 1994; Remane et al., 1996). The problems they have include: a) these stages are actually lithographic rather than chronostratigraphic units; b) these stages are defined by unit-stratotypes rather than boundary-stratotypes, and, therefore, could have overlaps or gaps between them; c) the stage boundaries have never been precisely defined; d) their trilobite faunas, which are dominated by endemic polymeroids, have little interregional or international correlation potential.

In recent years, remarkable progress on Cambrian stratigraphy has been made for South China. It reveals that the strata there, especially those in the Jiangnan Slope Belt as defined by Peng (1990, 1992) (Fig. 1), are quite suitable for chronostratigraphic subdivision. As a key fossil group for Cambrian chronostratigraphy, the trilobites of the Jiangnan Slope Belt are highly diverse, with species having international correlation potential. Gradual transitions in the phylogenetic series of widespread species is often observed in the Cambrian succession, thus providing good first appearance data (FAD) of species that can be used to define precisely the lower boundaries of series or stages. Thanks to the revision made by Luo et al. (1994) on the Lower Cambrian stages of eastern Yunnan, the preliminary biostratigraphic studies made by Zhou et al. (1979, 1980), and Zhou and Yuan

(1980) on the Lower Cambrian of eastern Guizhou, and the detailed biostratigraphic studies made by Peng (1987, 1992), and Peng and Robison (2000) on the Middle through Upper Cambrian of western Hunan, a chronostratigraphic subdivision with 4 series and 9 stages could be developed (Peng et al., 1998, 1999, 2000a, b; Peng, 2000). Considering that North China and South China were separate continental fragments on the margin of Cambrian Gondwana (Burrett et al., 1990), it seems necessary to have two sets of Cambrian chronostratigraphy for the Chinese Cambrian. The new framework had been accepted by the All-China Stratigraphic Committee at its third national congress in 2000, and is currently considered as the local standard of South China. After being redefined precisely, the traditional stages may serve as the local standard for North China.

CAMBRIAN CHRONOSTRATIGRAPHIC SUBDIVISION IN SOUTH CHINA

As one of the major systems of the Phanerozoic, the Cambrian is presently not subdivided into formal series and stages. After its lower and upper boundaries had been formally defined, searching for subdivisions within the system has become a major goal of the International Subcommission on Cambrian Stratigraphy (ISCS). As first steps toward defining lower boundaries of Cambrian series and stages, 16 biohorizons that were considered to have potential for interregional or intercontinental correlation have been chosen for further evaluation (Shergold and Geyer, 1998). Establishment of global standard chronostratigraphic units of the Cambrian will rely largely on precisely defined local or regional chronostratigraphy. One of the purposes of subdividing Cambrian rocks chronostratigraphically in South China is to provide local units and their boundaries in the sense of modern stratigraphy for consideration by the ISCS. Table 1 shows the newly proposed chronostratigraphic framework of South China.

The Global Standard Stratotype-section and Points (GSSPs) for the lower boundaries of the Cambrian and Ordovician have been formally defined, and both are in Newfoundland. The lower boundary of the Cambrian, adopted in 1992, is placed at the first appearance datum of *Tricophycus pedum*. The lower boundary of the Ordovician, adopted in 1999, is the FAD of *Iapetognathus fluctivagus*. These two levels have not yet been precisely defined yet presently in China. *T. pedum* occurs in the basal part of the Jinningian in eastern Yunnan (Li and Yang, 1988). According to Zhu (1997), *T. pedum* occurs first within the small shelly fossil Zone 1 of the Xiaowaitoushan Member of the Yuhucun Formation (the *Anabarites – Protoherzina* Zone) in the Meishucun section, near Kunming. However, it is uncertain whether this occurrence is the lowest one or just within the stratigraphic range of the species. Zhu (1997) interpreted the base of Zone 1 as the lower boundary of the Cambrian System.

I. fluctivagus has been recently found in the basal part of the Panjiazui Formation at Waergang, northwestern Hunan (Dong Xiping, pers. comm.), which is very close to where Peng (1984) inferred the position of Cambrian-Ordovician boundary in the section. Further study will refine the level of the first appearance of the species and thus refine the boundary level.

In following the practice of Palmer (1998, 1999) and Landing (1998), the Chinese Cambrian rocks are here subdivided into four series, one pre-trilobite series and three trilobite-dominated series being roughly equivalent to the traditional Lower, Middle and Upper Series. Together, these series embrace nine stages. These units are all defined by boundary-stratotypes. The lower boundaries of series and stages are defined by the FADs of species, most of which belong to the biohorizons considered by the ISCI to have wide correlation potential. Those species are placed in shadowed blocks between stage names on Table 1. The upper boundary of each series or stage is defined by the lower boundary of its overlying series or stage.

Jinningian Stage

The Jinningian Stage, as defined by Peng (2000), corresponds only to the lower part of the original Meishucunian of Qian, 1977 (also see Qian in Zhang et al., 1979). The lower boundary of the stage is shared by the those of the Diandongian Series (Neoproterozoic), and the Cambrian System. The type section is the Meishucun section at Meishucun, Jinning County, eastern Yunnan Province. (Fig. 1). The type section and the point for the boundary have been discussed above.

Meishucunian Stage

The type section of the lower boundary of this stage (named by Qian, 1977 and revised by Luo et al., 1994) is also the Meishucun section in eastern Yunnan (Fig. 1), which has been studied in detail by Luo et al. (1980, 1984, 1987, 1990, 1991a, b, 1994). The Meishucunian, as revised by Luo et al. (1994), is restricted to the upper part of the original Meishucunian (Qian in Zhang et al., 1979; Xiang, 1981), i. e., the succession above the "China B" horizon, which marks the base of small shelly fossil Zone 2, the *Paraglaborilus-Siphogonuchites* Zone. This horizon is also the base of Bed 8 of Luo et al. (1984). The lower boundary is defined by the first appearance of the hyolithid *Paragloborilus subglobosus* (Fig. 2A).

Nangaoan Stage

As pointed out by Geyer and Shergold (2000), the first appearance of trilobites represents an important step in biotic development. For this reason, the FAD of trilobites is chosen

TABLE 1 **Chronostratigraphic subdivisions of the Cambrian System of South China. Suggested ages for the lower boundaries of series are based mainly to the work of Davidek et al. (1998) and Landing et al. (1998).**

Series	Stage		Age (Ma)
		FAD of *Iapetognathus fluctivagus*	491
HUNANIAN	TAOYUANIAN	*Leiostegium constrictum - Shenjiawania brevica* Zone *Mictosaukia striata - Fatocephalus* Zone *Achaeuloma taoyuanense - Leiagnostus* cf. *bexelli* Zone *Lotagnostus punctuosus - Hedinaspis regalis* Zone *Probinacunaspis nasalis - Peichiashania hunanensis* Zone *Eolotagnostus decorus - Kaolishaniella* Zone *Rhaptagnostus ciliensis - Onchonotellus* cf. *kuruktagensis* Zone *Agnostotes clavata - Irvingella angustilimbata* Zone	
		FAD of *Irvingella angustilimbata*	
	WAERGANGIAN	*Corynexochus plumula - Sinoproceratopyge* cf. *kiangshanensis* Zone *Agnostus inexpectans - Proceratopyge protracta* Zone *Glyptagnostus reticulatus* Zone	
		FAD of *Glyptagnostus reticulatus*	500
WULINGIAN	YOUSHUIAN	*Glyptagnostus stolidotus* Zone *Linguagnostus reconditus* Zone	
		FAD of *Linguagnostus reconditus*	
	WANGCUNIAN	*Proagnostus bulbus* Zone *Lejopyge laevigata* Zone *Goniagnostus nathorsti* Zone *Ptychagnostus punctuosus* Zone	
		FAD of *Ptychagnostus punctuosus*	
	TAIJIANGIAN	*Ptychagnostus atavus* Zone *Ptychagnostus gibbus* Zone *Oryctocephalus indicus* Zone	
		FAD of *Oryctocephalus indicus*	510
QIANDONGIAN	DUYUNIAN	*Bathynotus* Zone *Protoryctocephalus* Zone *Arthricocephalites- Changaspis* Zone *Arthricocephalus* Zone	
		FAD of *Arthricocephalus chauveaui*	
	NANGAOAN	*Sichuanolenus - Chengkouia* Zone *Hupeidiscus - Sinodiscus* Zone	
		FAD of trilobite	519
DIANDONGIAN	MEISHUCUNIAN	*Sinosachites - Lapworthella* Zone *Paragloborilus - Siphogonuchites* Zone	
		FAD of *Paragloborilus subglobosus*	
	JINNINGIAN	*Anabarites - Protohertzina* Zone	
		FAD of *Trichophycus pedum*	543

to define the lower boundary of the Nangaoan Stage of South China (named by Peng, 2000), even though obtaining a reliable lowest occurrence of trilobites in South China, and correlating such a level to other regions prove difficult. The lower boundary coincides with that of the Qiandongian Series.

The Xiaosai section near Xiaosai, Yuqing, eastern Guizhou Province, is chosen as the type section of the lower boundary of the stage (Fig. 1). In the section, the eodiscoid trilobite *Tsunyidiscus* sp. first appears within Bed 5 (Zhang et al., 1979), but its precise position has not been reported, and the boundary therefore has not been well defined in the section. Also the possibility of even lower occurrences of trilobites in the section may exist. Bed 5 comprises a black shale succession that is 70.63 m thick. Further investigation of the lowest occurrence of trilobites in the section remains to be done.

The Nangaoan is the oldest trilobite-bearing stage in South China. Eodiscoids (*Tsunyidiscus, Neocobboldia, Sinodiscus, Hupeidiscus*), in association with protolenids (*Paraichangia*), characterize the lower part of the stage in the type section. As defined, the base of the stage seems to correspond to that of the traditional Chiungchussuan Stage.

Duyunian Stage

The FAD of *Arthricocephalus chauveaui* defines the lower boundary of Duyunian stage (named by Peng, 2000). In the type section, which is near Nangao, Danzhai, eastern Guizhou (Fig. 1), the species first occurs about 25 m above the base of Bed 10 (Zhang et al., 1979). Investigation suggests that this occurrence may be earlier than the first occurrence of the species in other sections of eastern Guizhou (Zhou Zhiyi, personal communication). *A. chauveaui* (Fig. 2B) is widely distributed in South China (Guizhou, Hunan, Jiangxi, Anhui, and Zhejiang). It is also known from Siberia and Greenland (Blaker and Pell, 1997: p. 112). Some associated trilobites in the Bed 10, for instance *Redlichia*, allow a more extensive correlation.

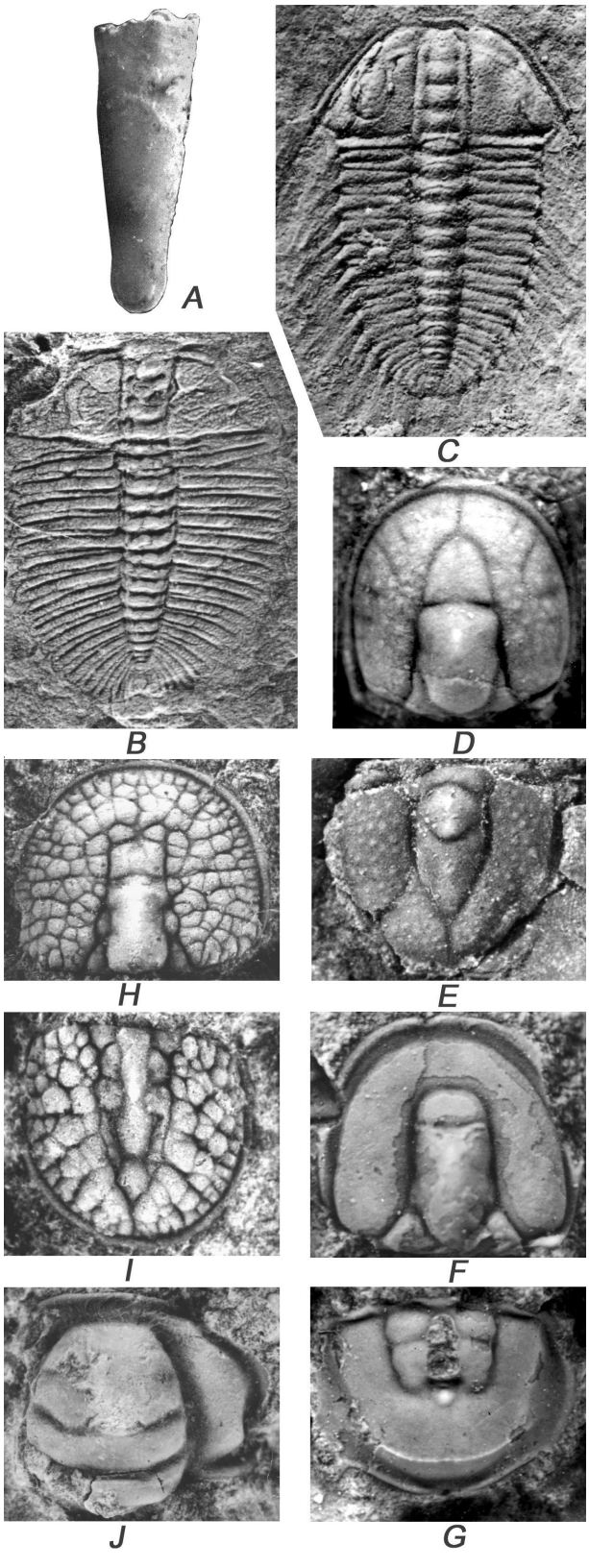

FIGURE 2 | **Species defining the bases of the series and stages of South China. A) *Paragloborilus subglobosus* (HE), lateral view, x 80, from the Daihai Member of Meishucun Formation, Meishucun, Jinning, eastern Yunnan. B) *Arthricocephalus chauveaui* BERGERON, exoskeleton, x 7, from the lower part of Balang Formation, Huanglian, Songtao, eastern Guizhou. C) *Oryctocephalus indicus* (REED), exoskeleton, x 5, from the lower part of Kaili Formation, Balancun, Taijiang, eastern Guizhou. D and E) *Ptychagnostus punctuosus* (ANGELIN), cephalon, x 16, pygidium, x 15, from 56.7 m above the base of Huaqiao Formation, Wangcun, Yongshun, northwestern Hunan. F and G) *Linguagnostus reconditus* POLETAEVA and ROMANENKO, cephalon, x 15, pygidium, x 10, from 210.5 m above the base of Huaqiao Formation, Wangcun, Yongshun, northwestern Hunan. H and I) *Glyptagnostus reticulatus* (ANGELIN), cephalon, x 6, pygidium, x 8, from the middle part of Huaqiao Formation, Waergang, Taoyuan, northwestern Hunan. J) *Irvengella angustilimbata* KOBAYASHI, cranidium, x 5, from the upper part of Huaqiao Formation, Waergang, Taoyuan, northwestern Hunan.**

TABLE 2 **Chronostratigraphic correlation between the South China and North China Cambrian Stratigraphic provinces.**

SOUTH CHINA		NORTH CHINA & E. YUNNAN	
HUNANIAN	TAOYUANIAN	U. CAMBRIAN	FENGSHANIAN
			CHANGSHANIAN
	WAERGANGIAN		KUSHANIAN
WULINGIAN	YOUSHUIAN		
	WANGCUNIAN	M. CAMBRIAN	CHANGHIAN
	TAIJIANGIAN		HSUCHUANGIAN
			MAOCHUANGIAN
QIANDONGIAN	DUYUNIAN	LOWER CAMBRIAN	LUNGWANGMIAOAN
			TSANGLANGPUAN
	NANGAOAN		CHIUNGCHUSSUAN
DIANDONGIAN	MEISHUCUNIAN		JINNINGIAN
	JINNINGIAN		

Taijiangian Stage

The lower boundary of this stage (named by Peng et al., 2000b), and that of the Wulingian Series as well, is defined by the FAD of *Oryctocephalus indicus* (Fig. 2C). The type section of the stage is near Balangcun, Taijianag, Guizhou Province (Fig. 1). In this section, the boundary lies between 48 and 52 m above the base of Bed 10, which is also the base of the Kaili Formation (Zhao et al., 1996; Yuan et al., 1997). The intercontinental correlation potential and suitability for a GSSP of series boundary (traditional Lower–Middle Cambrian boundary) of this level have been recently discussed by Yuan et al. (1997), Sundberg et al. (1999), and Geyer and Shergold (2000). The newsletter 2000-1 of ISCS reported that most of respondents to a questionnaire supported using this level for defining a GSSP of a series or stage.

Wangcunian Stage

The type section of the lower boundary of this stage (named by Peng et al., 1998) lies near Wangcun, Yongshun, northwestern Hunan Province (Fig. 1). The lower boundary is defined by the FAD of *Ptychagnostus punctuosus,* which firstly occurs at 56.7 m in the section (Peng and Robison, 2000). *P. punctuosus* (Figs. 2D and 2E) is a cosmopolitan agnostoid trilobite, although in China it is presently known only from Xinjiang (Xiang and Zhang, 1985), and Hunan (Peng and Robison, 2000). In western Hunan, Peng and Robison (2000) use its FAD to define the base of the zone bearing its name. In most regions, the species is used as a guide fossil that defines an interval-zone. Peng and Robison (2000), and Geyer and Shergold (2000) have discussed the potential of *P. punctuosus* for intercontinental correlation. In China, the associated agnostoids and polymeroids with *P. punctuosus* made it easy to correlate the boundary level widely.

Youshuian Stage

The type section of the lower boundary of this stage (named by Peng et al., 1998) is in the same section as the lower boundary of the Wangcunian. *Linguagnostus reconditus* (Figs. 2F and 2G) defines the lower boundary of the stage. Peng and Robison (2000) discussed the suitability of the species for defining the traditional Middle-Upper Cambrian boundary. *L. reconditus* is a distinctive agnostoid having a relatively wide geographical distribution. Other species of *Linguagnostus*, which are possible ancestors of *L. reconditus*, are also known from the type section. The FAD of *L. reconditus* is present at 210.5 m in the Wangcun section. Various agnostoid species characterize the *L. reconditus* Zone (Peng and Robison, 2000), the lowest biozone of the Youshuian Stage, and suggest it has worldwide correlation potential. As discussed by Peng and Robison (2000, p. 9), *L. reconditus* Zone is a close proxy for the *Agnostus pisiformis* Zone of Sweden, but it has a wider geographic distribution than *A. pisiformis*.

Waergangian Stage

The correlation potential of *Glyptagnostus reticulatus* (Figs. 2H and 2I) has been discussed by Peng and Robison (2000) and Geyer and Shergold (2000). The newsletter 2000-1 of ISCS reported that the base of *G. reticulatus* is thought to be the most favorable level for a GSSP defining the lower boundary of the uppermost Cambrian series. All respondents to a questionnaire supported this level (with one abstention). This level is considered here to define the base of the Hunanian Series and the Waergangian Stage (named by Peng et al., 1998).

In the type section of the lower boundary of the stage, which is at Waergang, Taoyuan, northwestern Hunan Province (Fig. 1), the lowest occurrence of the species lies 8.47 m above the base of the Bed 7 (Peng, 1990).

TABLE 3 | **International correlation of Cambrian chronostratigraphy with that of South China.**

SOUTH CHINA		AUSTRALIA		KAZAKHSTAN		LAURENTIA		SIBERIA		BALTICA	MOROCCO		E. AVALONIA	W. AVALONIA	
HUNANIAN	TAOYUANIAN	UPPER CAMBRIAN	DATSONIAN		"ORDOVICIAN"		"ORDOVICIAN"	UPPER CAMBRIAN	"ORDOVICIAN"	UPPER CAMBRIAN	UPPER CAMBRIAN		MERIONETH SERIES	UPPER CAMBRIAN	MERIONE-THIAN SERIES
			PAYNTONIAN	UPPER CAMBRIAN	BATYRBAIAN	MILLARDAN	SUNWAPTAN		MANSIAN						
			IVERIAN		AKSAYAN				KETYAN						
	WAERGANGIAN		IDAMEAN		SACKIAN		STEPTOEAN		YURAKIAN						
									ENSYAN						
									MADUAN						
									TAVGIAN						
WULINGIAN	YOUSHUIAN		MINDYALLAN		ARYUSOK-KIANIAN	LINCOLNIAN	MARJUMAN		NGANASANYAN						
	WANGCUNIAN	MIDDLE CAMBRIAN	BOORMERANGIAN	MIDDLE CAMBRIAN	ZHANARYKIAN			MIDDLE CAMBRIAN	MAYAN	MIDDLE CAMBRIAN	MIDDLE CAMBRIAN		ST.DAVID'S SERIES	MIDDLE CAMBRIAN	ACADIAN SERIES
			UNDILLAN												
	TAIJIANGIAN		LATE TEMPLE-TONIAN / FLORAN		TYESAIAN		DELAMARAN		AMGAN			TISSAFI-NIAN			
			ORDIAN / EARLY TEMPLETONIAN		"LENAN"										
QIANDONGIAN	DUYUNIAN	LOWER CAMBRIAN		LOWER CAMBRIAN		WAUCOBAN	DYERAN	LOWER CAMBRIAN	TOYONIAN	LOWER CAMBRIAN	LOWER CAMBRIAN	BANIAN	COMLEY SERIES	LOWER CAMBRIAN	BRANCHIAN SERIES
	NANGAOAN						MONTE ZUMAN		BOTOMIAN						
DIANDONGIAN	MEISHUCUNIAN								ATDABANIAN			ISSENDA-LENIAN			
						BEGADEAN			TOMMOTIAN						PLACENTIAN SERIES
	JINNINGIAN						Unnamed					No stages			
									NEMAKIT-DAL'DYNIAN						

Taoyuanian Stage

The Waergang section at Waergang in Taoyuan (Fig. 1) is also taken as the type section for the lower boundary of the Taoyuanian Stage (named by Peng et al, 1998). The lowest occurrence of *Irvingella angustilimbata* (Fig. 2J) in the section is 0.34 m above the base of the Bed 15 (Peng, 1990). *Agnostotes clavata* and *Irvingella angustilimbata* are used as guide fossils that define an assemblage-zone in the Cili-Taoyuan area, northwestern Hunan. They are observed making their first appearances together in the Shenjiawan section of the area, but so far *Agnostotes clavata* has not been found in the Waergang section (Peng, 1992). The *Irvingella-Agnostotes* assemblage has been observed in a significant number of regions in the world, and seems to have potential for an intercontinental correlation (Geyer and Shergold, 2000).

The Taoyuanian Stage seems to span a time interval that is much longer than that of the underlying Waergangian Stage. Perhaps the Taoyuanian can be subdivided into two separate stages by the first appearance of *Cordylodus proavus* or by a widespread agnostoid (e.g. *Lotagnostus asiaticus*). In the Cili-Taoyuan area, *Cordylodus proavus* was reported from the Shenjiawan section (Peng, 1984), with its observed lowest occurrence being at the base of the *Leiostegium constrictum* Zone of the Shenjiawan Formation (Peng, 1984). This occurrence seems lower than the first appearance of the species in Dayangcha, Jilin, North China (Chen, 1986). Research on the conodont systematics and biostratigraphy of the Waergang section is progressing (Dong, pers. comm.), and may contribute to a further subdivision of the stage. *Lotagnostus asiaticus* is known elsewhere in South China, and in Xinjiang as well (Troedsson, 1937; Zhang, 1981; Xiang and Zhang, 1985).

CONCLUDING REMARKS: CHRONOSTRATIGRAPHIC CORRELATION

Correlation between South and North China

Table 2 shows the inferred chronostratigraphic correlation between South China and North China (plus eastern Yunnan) stratigraphic provinces. Previously, the chronostratigraphy of the latter had been considered as the standard for the Cambrian System of China.

As shown in the table, only the base of the Waergangian coincides with the base of the Changshanian of North China. Such a correlation is based on the co-occurrence of *Chuangia* with *Glyptagnostus reticulatus* in sections of Hunan and Guizhou. *Chuangia* seems define the base of Changshania of North China.

In North China, the base of the Maochuangian is usually taken as the Lower-Middle Cambrian boundary. It is defined by either the extinction of *Redlichia* or by the first appearance of ptychopariid trilobites. Such a dual standard makes it difficult to determine the boundary or the base of the Maochuangian in some sections in South China, where *Redlichia* and ptychopariids are found in association. As shown by Yuan et al. (1997), in the Taijiang section *Oryctocephalus indicus*, which defines the base of the Wulingian Series and the Taijiangian Stage, occurs higher than the co-occurrence of *Redlichia* and ptychopariids. This suggests that the base of the Wulingian should be younger than the base of Middle Cambrian of North China no matter what kind of stand defining previously the Lower–Middle Cambrian boundary is adopted.

Luo et al. (1994) redefined the concept of the Chiungchussuan Stage as an interval of strata marked by the appearance of the trilobite *Parabadiella* through to the extinction of *Eoredlichia*. If the lowest occurrence of *Parabadiella* is close to FAD of trilobites, the base of Chiungchussuan may correspond to the base of the Qiandongian Series, but the direct evidence of this possibility remains unknown.

Intercontinental Correlation

The ISCS correlation table compiled by Geyer, Peng and Shergold (in Geyer and Shergold, 2000) includes only the stages embraced here by the Wulingian and Hunanian Series for the South China column. The correlation table is simplified as Table 3 to show the international correlation of all the stages and series of South China.

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