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西南地区下寒武统划分与对比
——兼论早寒武世系列生物群的时代*

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提要　根据世界主要地区近年来下寒武统生物地层和三叶虫序列研究的最新成果,将我国西南地区下寒武统与世界重要地区(摩洛哥、西伯利亚和劳伦古陆)下寒武统进行了对比,列出了对比方案,为确定早寒武世系列生物群的时代提供了正确的依据,对早期后生动物起源、演化的研究具有重要的意义。

关键词　下寒武统　对比　系列生物群

1　前言

西南地区是我国乃至世界下寒武统发育、出露最好的地区之一,也是我国目前下寒武统建阶的层型剖面所在地。下寒武统的研究始于丁文江、王曰伦(1937)。30—40 年代,孙云铸、卢衍豪、许杰等曾研究过滇西、滇东、黔北和三峡附近的寒武纪地层。

近年来,西南地区下寒武统划分和对比的研究,更是成果累累(卢衍豪,1962;张文堂等,1979,1980,1987,1998;项礼文等,1981;周志毅等,1980a,1980b,1982;罗惠麟等,1981,1993,1994)。随着目前国际上对地球早期生命演化研究的不断深入,在早寒武世除云南澄江生物群外(张文堂,1987;陈均远等,1996)一系列或多或少带软躯体的生物群被不断发现,如贵州台江生物群(赵元龙等,1998),牛蹄塘组生物群(Steiner *et al*.1993;赵元龙等,1999),波兰生物群(Lendzion, 1975, 1977;Dzik and Lendzion, 1988),格陵兰北部 Sirius Passet 动物群(Conway Morris *et al*., 1987;Conway Morris and Peel, 1990, 1995;Budd, 1999);加拿大 Mount Cap 动物群(Butterfield, 1994);南澳大利亚 Emu Bay Shale 生物群(Glaessner, 1979)。

对于早寒武世出现的一系列生物群,一些专家都声称自己发现了世界上最古老的节肢动物、腹足类、海绵等(张文堂,1987;Dzik and Lendzion, 1988; Steiner *et al*., 1993)。在上面所述的系列生物群,究竟哪一个属最古老的生物群?它们在早寒武世出现的顺序如何?这对于研究后生生物的起源和演化至关重要。为了正确认识早寒武世系列生物群的时代,必须对早寒武世地层的划分和对比有一个正确的认识。从近几年所发表的一系列文章来看,划分和对比的主要依据是下寒武统的三叶虫序列。但是,不同专家之间划分对比的方

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案还有着较大的差异。首先是不同地区不同剖面上出现的最低层位的三叶虫那一个属最古老的三叶虫? 在具有世界性权威新版的节肢动物门三叶虫纲的专著中,有人认为摩洛哥的 *Eofallotaspis* 是迄今发现的最古老的三叶虫,其次为西伯利亚地台上的 *Profallotaspis* 和劳伦古陆的"*Fallotaspis*",而中国的 *Parabadiella* 则被认为是出现较晚的三叶虫(Shergold, 1997, p.310—311)。与此同时,俄罗斯的学者认为西伯利亚地台上的 *Profallotaspis* 比摩洛哥的 *Eofallotaspis* 更古老外,还认为中国西南地区最低层位的三叶虫 *Parabadiella*, *Mianxiandiscus* 出现更晚,甚至可与西伯利亚下寒武统中部 Botomian 阶底部相当(Zhuravlev, 1995, p. 150)。另一些人则持相反的观点,认为我国的 *Parabadiella*, *Mianxiandiscus* 等三叶虫为世界上最古老的三叶虫(张文堂,1987,1998)。其次是对下寒武统顶界及其对比认识也很不一致。有人认为代表我国的龙王庙阶,甚至沧浪铺阶上部的地层应划归中寒武统,并将龙王庙阶的 *Redlichia nobilis* 带与 *Triplagnostus gibbus* 带相对比(Rushton and Powell, 1998, p.132)。本文根据近 20 年来世界主要地区下寒武统生物地层和三叶虫研究的最新成果,以我国三叶虫序列为基础,与世界主要地区(Morocco, Siberia, Laurentia)的早寒武世三叶虫序列进行比较,以建立较为正确的对比方案,为早寒武世系列生物群的出现顺序提供正确依据,这对早期后生生物的起源、演化的研究具有重要的意义。

2　西南地区下寒武统三叶虫的地层分布(表Ⅰ)

目前,三叶虫序列及三叶虫属的地层分布仍然是国际间下寒武统对比的基础。西南地区下寒武统三叶虫系列及三叶虫属的地层分布,在 80 年代初曾进行过一些系统的研究(张文堂等,1979,1980;周志毅、袁金良,1980,1981),也是本文深入研究的基础。这里需要补充说明以下几点:

(1) 有关早寒武世盘虫类三叶虫属,有人主张取消 *Mianxiandiscus*, *Liangshandiscus*, *Emeidiscus*,将其归于 *Tsunyidiscus* 属内,取消 *Shizhudiscus* 和 *Guizhoudiscus* 将其归于 *Hupeidiscus* 属内(张文堂, 1987, p. 8—9),更有甚者将上述 7 属合并为 1 属,一并归于 *Tsunyidsicus* 属内(Jell, 1997, p.387),笔者认为如此归并不妥。在考虑三叶虫属一级分类时,除头部特征外,尾部特征也相当重要。*Mianxiandiscus* 与 *Tsunyidiscus* 两属尾肋部肋沟的有无是区别两个属的重要特征。*Mianxiandiscus* 在本文中的含义还包括 *Liangshandiscus* 和 *Emeidiscus*。*Tsunyidiscus* 则包括了 *Shizhudiscus*。而 *Hupeidiscus* 则包括了 *Guizhoudiscus*。根据 Jell (1997, p. 400) 的意见: *Szechuanaspis* Chien and Yao, *S.* (*Zhenbadiscus*) Zhang 为 *Hebediscina* Rasetti, 1972 的同义名,笔者表示赞同。

(2) 早寒武世莱得利基虫类三叶虫属,经张文堂等(1997)修订后, *Metaredlichioides* Chien and Yao, 1974 归于 *Ushbaspis* Pokrovskaya, 1965; *Yankongia* Zhou, 1974 和 *Zhenbaspis* (*Zhenxiongaspis*) Lin and Yin, 1978 归于 *Zhenbaspis* 属内; *Malungia* Lu, 1961 降为 *Dolerolenus* Leanza, 1949 的一个亚属; *Drepanuroides* (*Paradrepanuroides*) Zhao, Huang and Mao, 1984 归于 *Qingkouia* Zhang, Lin and Zhou, 1980; *Anadoxides* Matthew, 1899 归于 *Metadoxides* Bornemann, 1891; *Parabadiella* (*Danagouia*) Chen, 1985 归于 *Parabadiella* 属内。此外尚有一些未被确认的属也未被列在表内,它们是: *Eomalungia* Li,

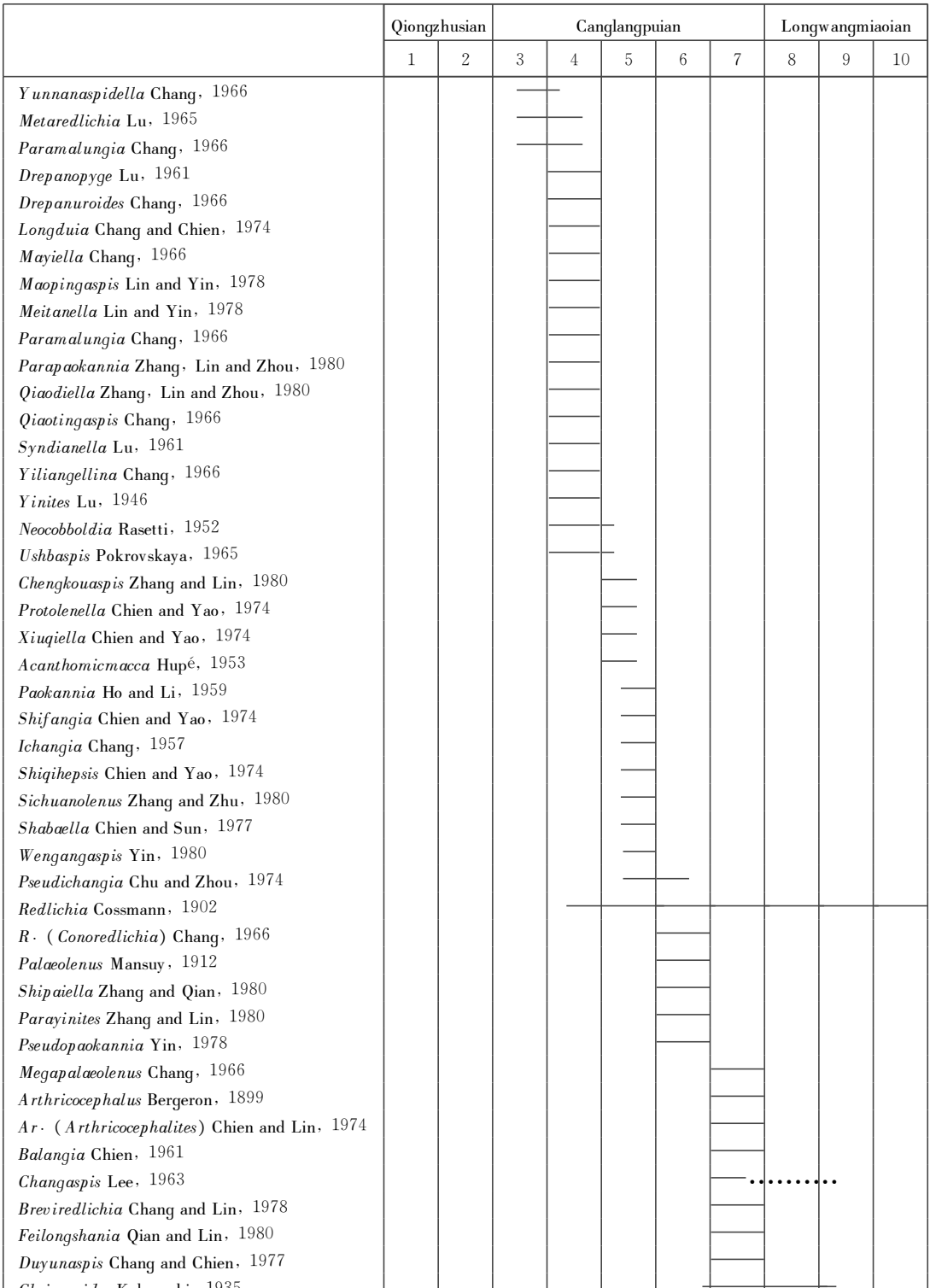
1978, *Fandianaspis* Li, 1978, *Guangyuania* Li, 1978, *Longmengshania* Li, 1978, *Micangshania Zhou in Li et al.*, 1975, *Shangsiaspis* Li, 1978, *Parawutingaspis* Li, 1978, *Runnania* Li, 1978, *Xingzishania* Zhou in Li *et al.*, 1975, *Yiliangella* (*Pseudoyiliangella*) Yin, 1978。

表 I 西南地区下寒武统三叶虫属(亚属)的地层分布

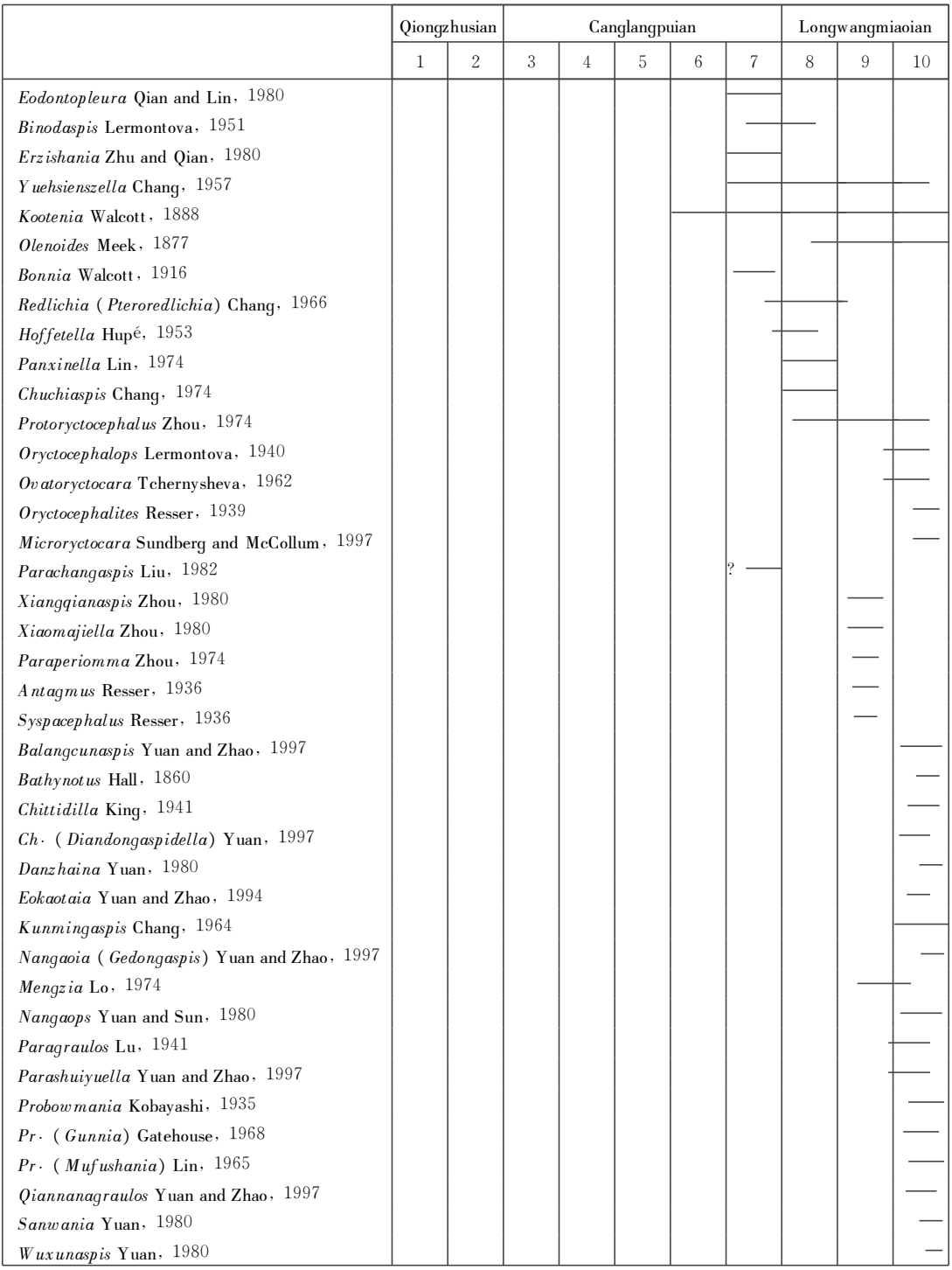
Ranges of trilobite genera (subgenera) of Lower Cambrian in Southwest China

	Qiongzhusian		Canglangpuian					Longwangmiaoian		
	1	2	3	4	5	6	7	8	9	10
Parabadiella Chang, 1966										
Wutingaspis Kobayashi, 1944										
Mianxiandiscus Zhang and Zhu, 1980										
Tsunyidiscus Chang, 1966										
Chaoaspis Chang, 1966										
Eoredlichia Chang, 1952										
E. (*Pachyredlichia*) Chang, 1966										
Ningqiangaspis Zhang and Lin, 1980										
Malongocephalus Zhang and Lin, 1980										
Yunnanocephalus Kobayasshi, 1936										
Changyangia Chang, 1965										
Chengjiangaspis Zhang and Lin, 1980										
Fuminaspis Zhang and Lin, 1980										
Guangyuanaspis Chang and Qian, 1974										
Hongshiyanaspis Zhang and Lin, 1980										
Jingyangia Chang and Zhang, 1974										
Kuanyangia Hupé, 1953										
K. (*Sapushania*) Chang, 1966										
Dolerolenus (*Malungia*) Lu, 1961										
Shaanxia Zhang and Lin, 1980										
Hsüaspis Chang, 1957										
Hupeidiscus Chang, 1974										
Metadoxides Bornemann, 1891										
Qingkouia Zhang, Lin and Zhou, 1980										
Sinodiscus Chang, 1974										
Wangzishia Sun, 1977										
Zhenbaspis Chang and Chu, 1974										
Hebediscina Resetti, 1972										
Dicerodiscus Chang, 1964										
Kweichowia Lu, 1942										
Mianxianella Zhang and Lin, 1980										
Pseudoredlichia Chang and Lin, 1978										
Proichangia Zhang and Zhu, 1980										
Shatania Chang and Lin, 1974										
Yiliangella Chang, 1966										
Yunnanaspis Chang, 1966										
Hunanocephalus Lee, 1963										
Zhangshania Li and Zhang, 1990										

续表 1



续表 2



1. *Parabadiella* Zone 2. *Eoredlichia* Zone 3. *Yunnanaspis-Yilaingella* Zone 4. *Drepanuroides* Zone 5. *Paokannia-Ushbaspis* Zone 6. *Palaeolenus* Zone 7. *Megapalaeolenus* Zone 8. *Hoffetella-Redlichia murakamii* Zone 9. *Redlichia guizhouensis* Zone 10. *Bathynotus-Nangaops* Zone

(3) 根据下、中寒武统界线的新定义,以 *Oryctocephalus indicus* (Reed)一种的首次出现作为中寒武世的开始(袁金良等,1997),本文所引用的龙王庙阶的定义比传统的龙王庙阶定义有所扩大,即龙王庙期沉积的地层包括了原龙王庙组和陡坡寺组下部的一段地层或黔东南的鸟训组和凯里组下部的一段地层。

(4) 在褶颊虫类三叶虫属中,根据头盖的一般形态特征,特别是宽而平坦的外边缘,*Yiliangaspis* Luo, 1994 应为 *Probowmania* (*Gunnia*) Gatehouse, 1968 同义名。根据头盖的形态特征,特别是内外边缘形态,头鞍形态以及眼叶的大小及位置 *Xilingxia* Lu, 1980 应为 *Binodaspis* Lermontova, 1951 的同义名。就头盖的一般形态特征,内外边缘宽度比例及眼叶大小、位置、壳面装饰等征来看,摩洛哥 Tissafinian 阶 *Cephalopyge notabilis* 带所产 *Oreisator* Geyer and Malinky, 1997 应为我国沧浪铺阶 *Megapalaeolenus* 带所产的 *Erzishania* Zhu and Qian, 1980 的同义名。在 Chengkouiidae 科三叶虫之中,据研究(Geyer and Malinky, 1997) *Chengkouia* Chien and Yao, 1974 为 *Acanthomicmacca* Hupé, 1953 的同义名;而 *Zhuxiella* Zhang and Zhu, 1980, *Estaingia* Pocock, 1964 为 *Hsüaspis* Chang, 1957 的同义名(Palmer and Rowell, 1995),笔者表示赞同。

3　西南地区与其他地区下寒武统的对比及有关生物群的时代(表Ⅱ)

在早寒武世,特别是早寒武世早中期,三叶虫乃处于演化发展的初级阶段,世界寒武纪三叶虫动物群面貌存在着巨大的差异,因此要对不同地区寒武纪地层和三叶虫带作精确对比,还有一定的困难。本文以我国下寒武统三叶虫序列为基础,就目前国际上流行的对比方案,进一步阐明我们的观点。

摩洛哥的下寒武统三叶虫序列依据,Hupé(1953),Sdzuy(1978)和 Geyer and Landing (1995)的资料。可用于直接对比的三叶虫属有 *Lemdadella* Sdzuy, 1978 和 *Pararedlichia* Hupé, 1953,这 2 个属在摩洛哥产于 *Fallotaspis tazemmourtensis* 带。据最新研究表明 *Pararedlichia* 一属为 *Eoredlichia* 一属的同义名(张文堂等,1997, p. 438);另据 Palmer 等(1995, p. 3)在横越南极山区发现 *Lemdadella* 一属与 *Yunnanocephalus* 共生,而 *Yunnanocephalus* 在我国西南地区产于 *Eoredlichia* 带的中上部。因此,摩洛哥的 *Fallotaspis tazemmourtensis* 带大致可与我国的 *Eoredlichia* 带的中上部对比。而其下部的 *Eofallotaspis* 带大致可与 *Eoredlichia* 带的下部至 *Parabadiella* 带上部对比。因此把摩洛哥或西伯利亚下寒武统最低层位的三叶虫看作世界上最古老的三叶虫是毫无根据的。

摩洛哥 Banian 阶主要产 Gigantopygidae 科、Saukiandidae 科和 Ellipsocephalidae 科的三叶虫,如 *Gigantopygus* Hupé, 1953, *Longianda* Hupé, 1953, *Antatlasia* Hupé, 1953, *Sectigena* Geyer, 1990 等,而我国西南地区 Gigantopygidae 科的三叶虫和与 Ellipsocephalidae 科三叶虫相似的 Protolenidae Richter and Richter, 1948 科三叶虫,如 *Yiliangella* Chang, 1966, *Yiliangellina* Chang, 1966, *Zhangshania* Li and Zhang, 1990, *Hsüaspis* Chang, 1957, *Wangzishia* Sun, 1977, *Changyangia* Chang, 1965, *Proichangia* Zhang and Zhu, 1980 等主要产于 *Yunnanaspis-Yiliangella* 带,因此 Banian 阶可与我国沧浪铺阶下部相当。

表II 中国和其他地区下寒武统对比

Correlation chart of Lower Cambrian between China and other regions

	Southwest China		Morocco（Geyer and Landing, 1995）		Siberia（Jegorova *et. al.*,1983）		Laurentia（Palmer and Repina, 1993）		Biota or fauna
Lower Cambrian	Longwangmiaoian	*Bathynotus-Nangaops* Zone			Toyonian	*Anabaraspis splendens*	Waucoban	*Bonnia-Olenellus*	◇
		Redlichia guizhouensis Zone				*Lermontovia grandis*			
		Redlichia murakamii-Hoffetella Zone	Tissafinian	*Ornamentaspis frequens*（C_3）		*Bergeroniellus ketemensis*			
	Canglangpuian	*Megapalaeolenus* Zone		*Cephalopyge notabilis*（C_2）	Botonian	*Bergeroniellus ornata* *Bergeroniellus asiaticus* *Bergeroniellus gurarii*			◆
		Palaeolenus Zone							
		Paokannia-Ushbaspis Zone		*Hupeloenus*（C_1）					
		Drepanuroides Zone	Banian	*Sectigena*（B_3） *Antatlasia gutta-pluviae*（B_2） *Antatlasia hollardi*（B_1）		*Bergeroniellus micmacciformis-Erbiella*			
		Yunnanaspis-Yiliangella Zone	Issendalenian	*Daguinaspis*（A_4） *Choubertella*（A_3） *Fallotaspis tazemmourtensis*（A_2） *Eofallotaspis*（A_1）	Atdabanian	*Judomia-Uktaspis*（*Prouktaspis*） *Pagetiellus anabarus* *Fallotaspis* *Profallotaspis jakutensis*		*"Nevadella"*	○ □
	Qiongzhusian	*Eoredlichia* Zone						*"Fallotaspis"*	●
		Parabadiella Zone							■
	Meishucunian				Tommotian				▲

◇ Taijiang Biota; ◆ Mount Cap Fauna; ○ Emu Bay shale Fauna; □ Sirius Passet Fauna; ● Polish Fauna; ■ Chengjiang Biota; ▲ Niutitang Biota

摩洛哥 Tissafinian 阶的底部 *Hupeolenus* 带内产有 *Protolenus* (*Protolenus*) Matthew, 1892, *Protolenus* (*Hupeolenus*) Geyer, 1990 等三叶虫,我国 *Paokannia-Ushbaspis* 带内所产的 *Protolenella* Chien and Yao, 1974, *Sichuanolenus* Zhang and Zhu, 1980 与上述两属十分相似,因此 Tissafinian 阶的底界大致应与我国沧浪铺阶 *Paokannia-Ushbaspis* 带的底界相当。Tissafinian 阶中部 *Cephalopyge notabilis* 带产有 *Oreisator* Geyer and Malinky, 1997,而此属为 *Megapalaeolenus* 带中的 *Erzishania* Zhu and Qian, 1980 的同义名,因此 Tissafinian 阶中部可与沧浪铺阶上部对比。

在约旦 Burj Formation 中产有 *Kingaspis campbelli* (King, 1923),与其共生的三叶虫尚有"*Palaeolenus antiquus*" (Lermontova in Tchernysheva, 1956),此三叶虫在摩洛哥产于 Tissafinian 阶顶部的 *Ornamentaspis frequens* 带(Rushton and Powell, 1998, p. 141)。而"*Palaeolenus autiquus*"一种更像我国 *Megapalaeolenus*,因此 Tissafinian 阶的上部大致应与我国沧浪铺阶上部至龙王庙阶下部相当。摩洛哥的 Toushamian 阶分 3 个化石带,从上而下分别为 *Pardailhania* 带, *Badulesia* 带和 *Kymataspis arenosa* 带,其中下部的 *Kymataspis arenosa* 内已产有典型的早期中寒武世三叶虫,如 *Conocoryphe* (*Parabailiella*), *Parasoleno-pleura* 等,因此它与早寒武世的 Tissafinian 阶之间可能缺失早寒武世最晚期沉积。

西伯利亚早寒武世三叶虫序列的资料来自有关西伯利亚下寒武统阶的划分及化石图册(Jegorova *et al*., 1983, p. 3—4)。可直接用于对比的三叶虫首先有 *Fallotaspis*,根据与摩洛哥地区早寒武世三叶虫对比, *Fallotaspis* 可与我国西南地区 *Eoredlichia* 带的中上部对比。其次为 *Metadoxides* Bornemann, 1891,此属即为过去在郭家坝组上部所产的 *Anadoxides* Matthew, 1899。据最新研究表明 *Anadoxides* 为 *Metadoxides* 同义名(张文堂等, 1997, p. 459),且与 *Fuminaspis* 十分相似,产于 *Eoredlichia* 带上部。在西伯利亚此属产于 Atdabanian 阶顶部 *Judomia-Uktaspis* (*Prouktaspis*)带,因此,Atdabanian 阶的顶界可与我国筇竹寺阶顶界或沧浪铺阶下部大致相当。而 Atdabanian 阶的底界则可能略高于筇竹寺阶的底界。Botomian 阶底部的 *Bergeroniellus micmacciformis-Erbiella* 带内产有 *Neocobboldia* Rasetti, 1952,而 *Neocobboldia* 在我国产于 *Drepanuroides* 带至 *Paokannia-Ushbaspis* 带,因此,Botomian 阶底界应略高于沧浪铺阶底界。Botomian 阶上部 *Bergeroniellus asiaticus* 带产 *Binodaspis prima* Lermontova, 1951 和 *B. secunda* Suvorova, 1960, *B. paula* Suvorova, 1960, *B. spinosa* Lermontova, 1951 等,此三叶虫与我国 *Megapalaeolenus* 带的产 *Xilingxia ichangensis* (Chang, 1957), *X. brevica* Chang and Yao, 1980, *X. chengkouenis* Zhu, 1980, *X. tenuis* Zhang and Yao, 1980 形态十分相似,笔者认为 *Xilingxia* 应为 *Binodaspis* 一属的同义名。因此 Botomian 阶的顶界大致应与我国沧浪铺阶的顶界相当。Toyonian 阶顶部产 *Namanoia namanensis* Lemontova, 1951 以及 *Bathynotus namanensis* Lermontova, 1951 (Repina *et al*., 1983, p. 57),而 *Bathynotus* 这个属产于我国修订后的龙王庙阶顶部。因此,Toyonian 阶顶部大致与我国龙王庙阶顶部相当。这里需要指出的是, *Schistocephalus* Lermontova in Tchernysheva, 1956 与 *Palaeolenus* Mansuy, 1912 两属虽然在头盖形态特征上很相似,但 *Schistocephalus* 具有深而横穿头鞍的头鞍沟,较窄的固定颊,两者不能混为一谈。Rushton 和 Powell(1998, p. 132, 143)将约旦的 Burj 组内的三叶虫定为 *Palaeolenus antiquus* (Lermontova in Tchernysheva, 1956),是鉴定上的错误,因为约旦的标本头鞍上不具

横越头鞍沟和较宽的固定颊，因而造成对比上极大错误，将我国龙王庙阶的 *Redlichia nobilis* 带与 *Triplagnostus gibbus* 带对比。

劳伦古陆下寒武统的三叶虫序列采用 Palmer 和 Repina(1993)的资料。“*Fallotaspis*”带与西伯利亚的 *Fallotaspis* 带大致相当。西伯利亚 *Pagetiellus anabarus* 带产有 *Nevadella subgrorenlandica* (Repina，1965)(Repina *et al*.，1983，p.110)，因此劳伦古陆的“*Nevadella*”带和 *Pagetiellus anabarus* 带大致相当。*Bonnia-Olenellus* 带中与我国沧浪铺阶上部和龙王庙阶共有的三叶虫属较多，如 *Bonnia*，*Kootenia*，*Syspacephalus*，*Bathynotus*，*Orycotocephalites* 等，此外，在格陵兰北部 *Bonnia-Olenellus* 带中部发现的 *Arthricocephalus Jishouensis*，*Ar. duyunensis*，*Changaspis* sp. nov.(Blaker，1986，p.68)都是我国西南地区 *Megapalaeolenus* 带的重要分子。因此，*Bonnia-Olenellus* 带大致与我国沧浪铺阶中上部至龙王庙阶对比。

在早寒武世生物地层进行对比的基础上，下面再扼要地讨论早寒武世一系列生物群的时代问题。

(1) 贵州遵义牛蹄塘组生物群是目前已知的寒武纪最古老的带软躯体的生物群。主要证据有，此生物群是产于牛蹄塘组黑色风化后黑灰褐色的粘土岩、钙质页岩的下部，离上部产三叶虫 *Tsunyidiscus* 灰褐色泥岩、粘土岩还有相当大的距离，而离底部的含磷的磷结核、磷块岩不足 4m。按照三叶虫化石的对比产 *Tsunyidiscus* 的层位相当于 *Eoredlichia* 带，因此，牛蹄塘组生物群应在 *Eoredlichia* 带之下；此外，从生物群本身的面貌来看也较原始，主要是一些藻类、海绵类和分异度低的较原始的个体很小的(一般在 5—10mm 长)的双瓣壳节肢动物(如 *Perspicaris*)和娜罗虫类(如 *Naraoia*)。

(2) 云南澄江生物群中的三叶虫有 *Eoredlichia* Chang，1950，*Yunnanocephalus* Kobayashi，1936，*Kuanyangia* Hupé，1953(张文堂，1987)，而澄江生物群中发现的 *Wutingaspis tingi* Kobayashi，1944(陈均远等，1996，147 页)可能鉴定有误，根据其尾部特征以及头盖的一般形态特征来看，则将其置于 *Guangyuanaspis* Chang and Qian，1974 属内更加合适。鉴于 *Kuanyangia* 一属仅产于 *Eoredlichia* 带的上部，因此可以确切地说澄江生物群主要产于 *Eoredlichia* 带的中上部。据最新的研究表明 *Yunnanocephalus* 在南极洲与 *Lemdadella* Sdzuy，1978 共生(Palmer and Rowell，1995，p.3)，而 *Lemdadella* 在摩洛哥和西班牙都是下寒武统底部主要的三叶虫化石，出现在 *Fallotaspis tazemmourtensis* 带，而 fallotaspidid 类三叶虫是西伯利亚 Atdabanian 阶下部特征分子，因此，将产澄江生物群的筇竹寺组与西伯利亚托莫特阶中上部对比是不恰当的(Hou and Bergström，1997，p.8)。

(3) 波兰生物群曾被认为东欧地台上最古老的生物群。关于此生物群的时代有过较详细的讨论(Dzik and Lendzion，1988，p.29—30)。据估计波兰生物群也大致相当于 Atdabanian 阶底部的 *Fallotaspis* 带。但是从目前已知的东欧地台上最古老的三叶虫 *Schmidtiellus mickwitzi*，*Holmia inusitata*，*Holmia kjerulfi* 都只相当于“*Nevadella*”带(Palmer and Repina，1997，p.406)，因此波兰生物群不会比澄江生物群更古老。

(4) 格陵兰 Sirius Passet 动物群产三叶虫 *Buenellus higginsi* (Blaker，1988；Blaker and Peel，1997)，而根据 Palmer 和 Repina(1995)意见，*Buenellus* 属产在 *Nevadella* 带的中部，(Palmer and Repina，1997，p.406)，因此，格陵兰 Sirius Passet 动物群与波兰生物群的时代

很接近,或许略晚一些。

(5) 南澳大利亚 Emu Bay 页岩动物群产三叶虫 *Estaingia bilobata* Pocock, 1964。此三叶虫与我国沧浪铺早期的 *Hsüaspis* Chang, 1957 及 *Zhuxiella* Zhang and Zhu, 1980 两属十分相似,因而将其合并为一个属(Palmer and Rowell, 1995, p. 16)。因此 Emu Bay 页岩动物群时代大致为沧浪铺早期。

(6) 加拿大 Mount Cap 动物群产三叶虫 *Wanneria*,此三叶虫在北美产于 *Bonnia-Olenellus* 带的中部(Butterfield, 1994, p. 477),而 *Bonnia-Olenellus* 带的中部大致可与我国沧浪铺晚期的 *Palaeolenus* 或 *Megapalaeolenus* 带对比。

(7) 贵州台江生物群是早寒武世最晚期的一个生物群,产于三叶虫 *Bathynotus-Nangaops* 带。

参 考 文 献

丁文江,王曰伦,1936－1937.　云南马龙、曲靖之寒武纪及志留纪地层.中国地质学会志,**16**:1－28.

P D 兰,M R 布莱克,张文堂,1988.　早寒武世节头虫(*Arthricocephalus*)属.古生物学报,**27**(5):553－560.

卢衍豪,1962.　中国的寒武系.全国地层会议学术报告汇编.北京:科学出版社.

卢衍豪,朱兆玲,钱义元,林焕令,周志毅,袁克兴,1974a.　生物-环境控制论及其在寒武纪生物地层学上和古动物地理上的应用.中国科学院南京地质古生物研究所集刊,5:26－116.

卢衍豪,张文堂,钱义元,朱兆玲,林焕令,周志毅,钱　逸,章森桂,伍鸿基,1974b.　寒武纪三叶虫.见:西南地区地层古生物手册.北京:科学出版社.80－107.

卢衍豪,朱兆玲,钱义元,林焕令,袁金良,1982.　中国寒武纪地层对比表及说明书.中国各纪地层对比表及说明书.北京:科学出版社.28－54.

陈润业,1985.　陕西南郑梁山早寒武世三叶虫.古生物学报,**24**(3):332－336.

罗惠麟,1981.　云南晋宁梅树村早寒武世筇竹寺组的三叶虫.古生物学报,**20**(4):331－338.

罗惠麟,蒋志文,唐良栋,1993.　论陡坡寺组.地层学杂志,**17**(4):266－271.

罗惠麟,蒋志文,唐良栋,1994.　中国下寒武统建阶层型剖面,昆明:云南科技出版社.1－181.

张文堂,1987.　澄江动物群及其中的三叶虫.古生物学报,**26**(3):223－235.

张文堂,卢衍豪,朱兆玲,钱义元,林焕令,周志毅,章森桂,袁金良,1980.　西南地区寒武纪三叶虫动物群.中国古生物志,新乙种第 16 号,497.

张文堂,袁克兴,周志毅,钱　逸,王宗哲,1979.　西南地区的寒武系.见:西南地区碳酸盐生物地层.北京:科学出版社.39－107.

周志毅,袁金良,1980a.　西南地区下寒武统三叶虫序列.古生物学报,**19**(4):331－339.

周志毅,袁金良,张正华,吴孝儒,尹恭正,1980b.　贵州寒武纪地层的分类和对比.地层学杂志,**4**(4):273－281.

周志毅,袁金良,1982.　试谈中国与世界主要类型寒武系的对比.中国科学院南京地质古生物研究所丛刊,5:298－306.

项礼文,李善姬,南润善,郭振明,杨家驎,周国强,安泰庠,袁克兴,钱　逸,1981.　中国的寒武系.中国地层,4:1－198.

赵元龙,黄友庄,龚显英,代星春,1990.贵州凯里地区早中寒武世凯里组的 *Bathynotus*.古生物学报,**29**(1):45－53.

赵元龙,袁金良,朱茂炎,黄友庄,郭庆军,杨瑞东,周　震,1998.　贵州台江早寒武世台江动物群的发现及意义.贵州工业大学学报,**28**(5):23－26.

赵元龙,Steiner M,杨瑞东,Erdtmann B -D,郭庆军,周　震,Wallis E, 1999.　贵州遵义下寒武统牛蹄塘组早期后生生物群的发现及重要意义.古生物学报,**38**(增刊):132－144.

袁金良,赵元龙,王宗哲,周　震,陈笑媛,1997.　贵州台江八朗下、中寒武统界线及三叶虫动物群.古生物学报,**36**(4):494－524.

Blaker M R, 1986.　Notes on the trilobite faunas of the Henson Gletscher Formation (Lower and Middle Cambrian) of central

North Greenland. Rapports Grønlands geologiske Undersogelse, **132**:65—73.

Blaker M R, 1988. A new genus of nevadiid trilobite from the Buen Formation (Early Cambrian) of Peary Land, central North Greenland. Rapport Grønlands geologiske Undersogelse, **137**:33—41.

Blaker M R, Peel J S, 1997. Lower Cambrian trilobites from North Greenland. Meddeleser om Grønland, Geoscience, **35**: 1—145.

Bengtson S, Conway Morris S, Cooper B J, Jell P A, Runnegar B N, 1990. Early Cambrian fossils from South Australia. Memoris of the Australasian Association of Palaeontologists, **9**:1—364.

Budd, G E, 1999. A Nektaspid arthropod from the Early Cambrian Sirius Passet fauna, with a description of retrodeformation based on functional morphology. Palaeontology, **42**(1):99—122.

Butterfield N J, 1994. Burgess Shale-type fossils from a Lower Cambrian shallow-shelf sequence in northwestern Canada. Nature, **369**:477—479.

Chang W T, 1987a. World's oldest Cambrian trilobites from eastern Yunnan. In Stratigraphy and Palaeontology of systemic boundaries in China. Precambrian-Cambrian boundary. Nanjing University Publishing House, Nanjing. 1—16.

Chang W T., 1987b. Correlation of the Cambrian of China. Palaeontologia Cathayana, 3:267—285.

Chang W T, Repina L N, Geyer G, 1997. Suborder Redlichiina Richter, 1932. In: Treatise on Invertebrate Paleontology part O. Arthropoda I Trilobita Revised volume 1;429—470. (Ed. R.L. Kaesler). The Geological Society of America, INC. And the University of Kansas, Boulder, Colorado and Lawrence, Kansas.

Chang W T, 1998. Cambrian correlation within the Perigondwana faunal realm. n extr. Homenaje al Prof. Gonzalo vidal: 23—34.

Chernysheva, N E, 1956. New genera of trilobites. In Poletaeva, O.K. and Chernysheva, N.E.: New families and genera of trilobites, materials of Palaeontology, All-Russian Sci. Res. Geol. Inst. (Moscow), new ser. 12:145—182, 324—335. (in Russian).

Conway Morris, S, Peel J S, 1990. Articulated halkieriids from the Lower Cambrian of North Greenland. Nature, **345** (6278):802—805.

Conway Morris S, Peel J S, Higgins A K, Soper N J, Davis N C, 1987. A Burgess Shale-like fauna from the Lower Cambrian of North Greenland. Nature, **326**:181—188.

Dzik J, Lendzion K, 1988. The oldest arthropods of the East European platform. Lethaia, **21**:29—38.

Geyer G, 1988. Agnostida aus dem hoheren Unterkambrium und dem Mittelkambrium von Marokko. Teil 2. Eodiscina. N. Jb. Geol. Palaeont. Abh, **177**(1):93—133.

Geyer G, 1990a. Die marokkanischen Ellipsocephalidae (Trilobita, Redlichiida). Beringeria, **3**:1—364.

Geyer G, 1990b. Revised Lower to lower Middle Cambrian biostratigraphy of Morocco. Newsl. Stratigr., **22**(2/3):53—70.

Geyer G, 1994. Cambrian corynexochid trilobites from Morocco. J. Paleont., **68**(6):1306—1320.

Geyer G, Landing E, 1995. The Cambrian of the Moroccan Atlas region. In: Morocco'95. The Lower-Middle Cambrian standard of western Gondwana. Introduction. Field Guide, Abstracts and Proceedings of the first conference of the Lower Cambrian stage subdivision working group and IGCP project 366: Ecological Aspects of the Cambrian radiation. (Ed. Geyer, G. And Landing, E.) Beringeria, special Issue, 2:7—46.

Geyer G, Palmer A R, 1995. Neltneriidae and Holmiidae (Trilobita) from Morocco and the problem of Early Cambrian intercontinental correlation. J. Paleont., **69**(3):459—474.

Geyer G, Malinky J M, 1997. Middle Cambrian fossils from Tizi N'Tichka, The High Atlas, Morocco. Part 1 Introduction and trilobites. J.Paleont., **71**(4):620—637.

Geyer G, 1998. Intercontinental, trilobite-based correlation of the Moroccan early Middle Cambrian. Can. J. Earth Sci., **35**:374—401.

Glaessner M F, 1979. Lower Cambrian crustacea and annelid worms from Kangaroo Island, South Australia. Alcheringa, **3**: 21—31.

Hou X G, Bergström J, 1997. Arthropods of the Lower Cambrian Chengjiang fauna, southwest China. Fossils and Strata, **45**:1—116.

Ineson J R, Peel J S, 1997. Cambrian shelf stratigraphy of North Greenland. Bull. Geol. Greenland Surv., **173**:1—120.

Jegorova L N, Repina L N, Suvorova N P, 1983. Lower Cambrian stage subdivision of the Siberia, Atlas of fossils. Transactions of the Institute of Geology and Geophysics, **558**:1—216. (in Russian).

Jell P A, 1997. Introduction to suborder Eodiscina. In: Treatise on Invertebrate Paleontology part O: Arthropoda I, Trilobita, Revised. Volume 1:384—404(Ed. R.L.Kaesler)., The Geological Society of America INC and the University of Kansas, Boulder, Colorado and Lawrence, Kansas.

Lendzion, K, 1975. Fauna of the *Mobergella* Zone in the Polish Lower Cambrian-Kwartalnik Geologiczny, **19**(2):237—242.

Lendzion K, 1977. First gastropod fauna from the Klimontovian Stage (Lower Cambrian) of the southeastern Poland. Kwartalnik geologiczny, **21**(2):239—243.

Luo H L, Jiang Z W, Tang L D, 1997. Stages, zones and correlations of the Lower Cambrian in China. In: Papers to 30th. IGC:13—16.

Palmer A R, Repina L N, 1993. Through a glass darkly: Taxonomy, phylogeny and biostratigraphy of the Olenellina. The University of Kansas, Paleontological contributions (new series), 3:1—35.

Palmer A R, Rowell A J, 1995. Early Cambrian trilobites from the Shackleton limestone of the central Transantarctic Mountains. J. Paleont., **69**(6):1—28.

Palmer A R, Repina L N, 1997. Introduction to suborder Olenellina. In: Treatise on Invertebrate Paleontology part O Arthropoda I Trilobita, Revised. volum 1:405—428.(Ed. R.L.Kaesler). The Geological Society of America INC and the University of Kansas, Boulder, Colorado and Lawrence; Kansas.

Pocock K J, 1964. *Estaingia*, a new trilobite genus from the Lower Cambrian of South Australia. Palaeontology, **7**:458—471.

Repina L N, 1986. Global correlation of the Lower Cambrian stage subdivisions by trilobites. Transactions of the Institute of Geology and Geophysics, **669**:4—25.(in Russian).

Rushton A, W A, Powell J H, 1998. A review of the stratigraphy and trilobite faunas from the Cambrian Burj Formation in Jordan, Bull nat. Hist. Mus. London (Geol.), **54**(2):131—146.

Sdzuy K, 1978. The Precambrian-Cambrian boundary beds in Morocco (preliminary report). Geol. Mag., **115**(2):83—94.

Shergold J H, 1997. Explanatory notes for the Cambrian correlation chart. In: Treatise on Invertebrate Paleontology part O. Arthropoda I. Trilobita, Revised. vol.1:303—311(Ed. R.L.Kaesler). The Geological Society of America, INC and the University of Kansas, Boulder, Colorado and Lawrence, Kansas.

Steiner M, Mehl D, Reitner J, Erdtmann B D, 1993. Oldest entirely preserved sponges and other fossils from the lowermost Cambrian and a new facies reconstruction of the Yangtze Platform (China). Berliner geowiss. Abh., **9**:293—329.

Zhou Z Y, Yuan J L, 1981. The biostratigraphic distribution of Lower Cambrian trilobites in Southwest China. In: Short papers for the second international symposium of the Cambrian system. 250—251.

Zhuravlev A Y, 1995. Preliminary suggestions on the global Early Cambrian zonation. Beringeria special Issue 2:147—160.

SUBDIVISION AND CORRELATION OF LOWER CAMBRIAN IN SOUTHWEST CHINA, WITH A DISCUSSION OF THE AGE OF EARLY CAMBRIAN SERIES BIOTA

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Summary

In last two decades A zonal scheme for the Lower Cambrian biostratigraphy and a brief discussion of correlation between Southwest China and other regions (Morocco, Siberia and Laurentia) have been made (Lu *et al*., 1982; Chang *et al*., 1979, 1980, 1987a, 1987b, 1998; Zhou *et al*., 1980a, 1980b, 1982; Luo *et al*., 1994). Until recently, most attention has been fucused on the series well-preserved soft-bodied Early Cambrian biota, such as Chengjiang biota, Taijiang biota, Niutitang Formation biota in Southwest China (Chang, 1987; Chen *et al*., 1994; Hou and Bergström, 1997; Steiner *et al*., 1993; Zhao *et al*., 1998, 1999); Polish biota (Lendzion, 1975, 1977; Dzik and Lendzion, 1988); Sirius Passet fauna (Conway Morris *et al*., 1987; Conway Morris and Peel, 1990, 1995; Budd, 1999); Mount Cap fauna (Butterfield, 1994) and Emu Bay shale biota (Glaessner, 1979). In order to clarify the age of above mentioned series biota it is necessary to restudy on the intercontinental correlation chart of Lower Cambrian. The correlation of Early Cambrian strata is essentially based on the common occurrences of certain trilobite species and genera, even common trilobite successions. At present a lot of intercontinental correlation charts of Lower Cambrian have been established (Zhou and Yuan, 1982; Chang, 1987, 1998; Geyer and Palmer, 1995; Zhuravlev, 1995; Shergold, 1997; Rushton and Powell, 1998). However, a persistent controversy exists in the intercontinental correlation of the Lower Cambrian between Southwest China and other regions, for example, which genus of trilobites is the oldest one all over the world? In Southwest China *Parabadiella* Chang, 1966 and *Mianxiandiscus* Zhang and Zhu, 1980 are worldwide considered as the oldest one by Chang (1987); Zhou and Yuan (1981) and other Chinese Palaeontologists. In contrast, *Eofallotaspis* Sdzuy, 1978 or *Profallotaspis* Repina, 1965 is regarded as the oldest one by Sdzuy (1978), Geyer and Landing (1995), Zhuravlev (1995) and Shergold (1997). In Southwest China the Lower Cambrian has been divided into four stages, including 10 trilobite Zones. They are listed in descending order as follows:

4. Longwangmiaoian Stage

(10) *Bathynotus-Nangaops* Zone

(9) *Redlichia guizhouensis* Zone

(8) *Hoffetella-Redlichia murakamii* Zone

3. Canglangpuian Stage

(7) *Megapalaeolenus* Zone

(6) *Palaeolenus* Zone

(5) *Paokannia-Ushbaspis* Zone

(4) *Drepanuroides* Zone

(3) *Yunnanaspis-Yiliangella* Zone

2. Qiongzhusian Stage

(2) *Eoredlichia* Zone

(1) *Parabadiella* Zone

1. Meishucunian Stage

Based on the data supplied by Chang *et al*. (1979, 1980), Zhou and Yuan (1980, 1981) and Luo *et al*. (1994) the ranges of trilobite genera (subgenera) of Lower Cambrian in Southwest China are given on the Table Ⅰ. However, the supplementary explainations are as follows: (1) Jell (1997) considered *Mianxiandiscus*, *Liangshandiscus*, *Emeidiscus*, *Shizhudiscus*, *Guizhoudiscus*, *Hupeidiscus* synonymous with *Tsunyidiscus*. However, in the present paper *Mianxiandiscus* (including junior synonym: *Liangshandiscus*, *Emeidiscus*), *Tsunyidiscus* (consisting of a junior synonym: *Shizhudiscus*), *Hupeidiscus* (containing *Guizhoudiscus*) are regarded as valid genera, because like glabellar shape and muscle insertion area patterns, pygidial structure remains comparatively stable over a wide range of genera, *Mianxiandiscus*, *Tsunyidiscus* and *Hupeidiscus* have different pygidial structure. *Szechuanaspis* Chien and Yao and *S*. (*Zhenbadiscus*) Zhang were considered a junior synonyms of *Hebediscina* Rasetti, 1972 (Jell, 1997); (2) According to new classification of Redlichina made by Chang and Repina (1997) *Metaredlichioides* Chien and Yao, 1974 is heve transferred to *Ushbaspis* Pokrovskaya, 1965; *Yankongia* Zhou, 1974 and *Zhenbaspis* (*Zhenxiongaspis*) Lin and Yin, 1978 are synonyms of *Zhenbaspis* Zhang and Zhu, 1974; *Malungia* Lu, 1961 is here regarded as a subgenus of *Dolerolenus* Leanza, 1949; *Drepanuroides* (*Paradrepanuroides*) Zhao, Huang and Mao, 1984 is synonymous with *Qingkouia* Zhang, Lin and Zhou, 1980; *Anadoxides* Matthew, 1899 belongs to *Metadoxides* Bornemann, 1891; *Pararedlichia* Hupé, 1953 is synonym of *Eoredlichia* Chang, 1952; *Parabadiella* (*Danagouia*) Chen, 1985 is transferred to *Parabadiella* Chang, 1966. In addition, the following unrecognizable redlichioid genera are omitted in Table Ⅰ: *Eomalungia*, *Fandianaspis*, *Guangyuania*, *Longmengshania*, *Micangshania*, *Parawutingaspis*, *Pseudowutingaspis*, *Runnania*, *Shangsiaspis*, *Xingzishania*, *Yiliangella* (*Pseudoyiliangella*). (3) The correlation of the Lower-Middle Cambrian boundary between Gondwana and Laurentia is provided by the stratigraphic occurrences of the

trilobite *Bathynotus*, *Microryctocara*, *Pagetia prolata* and *Oryctocephalus indicus* in both Southwest China and North America suggested by Sundberg *et al*. (1999). In the present paper Longwangmiaoian Stage implicates Longwangmiao Formation and lower part of Douposi Formation or Wuxun Formation as well as lower part of Kaili Formation including three trilobite Zones: *Bathynotus-Nangaops* Zone, *Redlichia guizhouensis* Zone and *Hoffetella-Redlichia murakamii* Zone. (4) In general configuration of cranidium ptychopariids trilobites *Xilingxia* Lu, 1980 is here considered synonymous with *Binodaspis* Lermontova, 1951; *Yiliangaspis* Luo, 1994 may be synonym of *Probowmania* (*Gunnia*) Gatehouse, 1968; *Oreisator* Geyer and Malinky, 1997 from *Cephalopyge notabilis* Zone of middle Tissafinian Stage in Morocco is here transferred to *Erzishania* Zhu and Qian, 1980, because of their general features of cranidium, the ratio of length between anterior border and preglabellar field, size and position of palpebral lobes and the same sculpture on the surface of the exoskeleton. Besides, *Chengkouia* Chien and Yao, 1974 was considered as synonymous with *Acanthomicmccca* Hupé, 1953 (Geyer and Malinky, 1997).

The data on trilobite succession of Lower Cambrian in Morocco are provided by Hupé (1953), Sdzuy (1978), Geyer and Landing (1995). *Lemdadella* Sdzuy, 1978 occuring in *Fallotaspis tazemmourtensis* Zone in Morocco cooccurs with *Yunnanocephalus* Kobayashi, 1936 from the Shackleton limestone of the central Transantarctic Mountains (Palmer and Rowell, 1995, p. 3), but *Yunnanocephalus* is known from the middle and upper parts of *Eoredlichia* Zone at the upper part of Qiongzhusian Stage in Southwest China. These occurrences permit correlation of *Fallotaspis tazemmourtensis* Zone with middle and upper part of *Eoredlichia* Zone. The trilobites from upper Issendalenian Stage to Banian Stage in Morocco belonging to Gigantopygidae, Saukiandidae, such as *Gigantopygous* Hupé, 1953, *Longianda* Hupé, 1953, *Antatlasia* Hupé, 1953, *Sectigena* Geyer, 1990, *Saukianda* Richter and Richter, 1940, *Despujolsia* Neltner and Poctey, 1949, *Perrector* Richter and Richter, 1940 indicate equivalence of interval from *Yunnanaspis-Yiliangella* Zone to *Drepanuroides* Zone of lower Canglangpuian Stage, because the similar trilobites belonging to Gigantopygidae and Protolenidae occur mainly in lower part of Canglangpuian Stage, for example, *Yiliangella* Chang, 1966, *Yiliangellina* Chang, 1966, *Zhangshania* Li and Zhang, 1990, *Hsüaspis* Chang, 1957, *Wangzishia* Sun, 1977, *Changyangia* Chang, 1965, and *Proichangia* Zhang and Zhu, 1980. The *Hupeolenus* Zone of Tissafinian Stage in Morroco contains *Protolenus* (*Protolenus*) Matthew, 1892, *Pro*. (*Hupeolenus*) Geyer, 1990. Similar trilobites *Protolenella* Chien and Yao, 1974 and *Sichuanolenus* Zhang and Zhu, 1980 are found in *Paokannia-Ushbaspis* Zone in Southwest China. Therefore, *Hupeolenus* Zone is approximately equivalent to *Paokannia-Ushbaspis* Zone. *Oreisator* Geyer and Malinky, 1997 from *Cephalopyge notabilis* Zone is here considered as a junior synonym of *Erzishania* Zhu and Qian, 1980, which comes from *Megapalaeolenus* Zone, so that *Cephalopyge notabilis* Zone can correlate with *Megapalaeolenus* Zone at the upper part of Canglangpuian Stage. *Kymataspis arenosa* Zone of lower

part of Toushamian Stage contains typical early Middle Cambrian trilobites, *Conocoryphe* (*Parabailiella*), *Parasolenopleura*. These occurrences cann't permit correlation with *Redlichia guizhouensis* Zone and *Bathynotus-Nangaops* Zone of upper part of Longwangmiaoian Stage. The data on trilobite succession of Lower Cambrian in Siberia Platform are provided by Jegorova *et al*., 1983. *Metadoxides* Bornemann, 1891 occurs both in upper part of *Eoredlichia* Zone as well as *Yunnanaspis-Yiliangella* Zone in Southwest China and in *Judomia-Uktaspis* (*Prouktaspis*) Zone at the top of Atdabanian Stage in Siberia. Based on these occurrences the upper limit of Atdabanian Stage can correlate with lower part of Canglangpuian Stage. *Neocobboldia* Rasetti, 1952 is known from *Bergeroniellus micmacciformis-Erbiella* Zone of lower part of Botomian Stage in Siberia; it ranges from *Drepanuroides* Zone to *Paokannia-Ushbaspis* Zone in Southwest China. Therefore, the lower limit of Botomian Stage may correlate with *Drepanuroides* Zone. *Bathynotus namanensis* Lermontova, 1951 known from the uppermost Toyonian Stage indicates equivalence of *Bathynotus-Nangaops* Zone at the top of Longwangmiaoian Stage in Southwest China. Correlation of Lower Cambrian strata in Southwest China with North America (Laurentia) has been presented earlier by Chang (1987), Zhou and Yuan (1982) and in supplemented in Table Ⅱ. The Niutitang Formation Biota containing small soft-bodied bivalved arthropods, sponges and other small shelly fossils is the oldest Biota of Lower Cambrian in Southwest China, because it occures earlier than the first appearance of trilobites. The Chengjiang Biota is known from middle and upper parts of *Eoredlichia* Zone at the middle and upper parts of Qiongzhusian Stage. Thus it is a little younger than Niutitang Formation Biota. The age of the Polish Fauna containing soft-bodied arthropods as the "*Fallotaspis*" Zone of the Atdabanian Stage discussed in detail by Dzik and Lendzion (1988) is about or a little younger than the age of Chengjiang Biota. The Sirius Passet Fauna associated with trilobite *Buenellus higginsi* is of *Nevadella* Biozone age of North American usage (Palmer and Repina, 1995). Therefore, the fauna may be younger than Polish Fauna. The Emu Bay Shale Fauna containing *Estaingia bilobata* Pocock, 1964, which is considered as a junior synonym of *Hsüaspis* Chang, 1957, suggests that the fauna is of *Yunnanaspis-Yiliangella* Zone at the lower part of Canglangpuian Stage. The Mount cap Fauna associated with *Wanneria* Walcott, 1910 is of mid *Bonnia-Olenellus* Biozone age of North American usage (Butterfield, 1994, p. 477). The Taijiang Biota falls within *Bathynotus-Nangaops* Zone. Thus it is the youngest Early Cambrian Biota.