

# 地层古生物论文集

第二十三辑

中国地质科学院地层古生物论文集编委会

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责任编辑 舒志清

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# 陕南川北奥陶系再研究

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(中国地质科学院地质研究所)

## 一、前言

陕南川北的奥陶系分布于扬子地台北缘边界断裂带(即阳平关—勉县、饶峰、青峰断裂线)的南沿,其西以龙门山深断裂带为界,向东延至城口附近,构造上属扬子准地台中的龙门—大巴台缘褶皱带(任纪舜等1980)的一部分,地层区划上归于米仓山—龙门山分区(赖才根等1982)。该区的奥陶系在赵亚曾、黄汲清、杨敬之、谷德振、侯德封、王现珩等人的各类报告中,均已涉及,至今已有50余年的研究历史了。卢衍豪(1943, 1959, 1975)在该区确立的奥陶系层序,虽经多人、多次研究,对某些地点或某类问题提出过不少修改意见,但有关深入的生物地层研究资料和详细的实测剖面资料的报导,所见不多;有些问题,如该区有无五峰期沉积、奥陶系与志留系间是否连续、庙坡期属何种沉积相、以及对西梁寺组的含义等问题的争论仍然存在,尚待解决。为此,我们在大致沿汉南杂岩北缘的几个地点,于1985年和1986年,两度实测和观察了四川广元谭家沟、陕西宁强赵家坝、宁强大竹坝、南郑元坝、南郑下梁山、南郑中梁寺和西乡、三郎铺等地的奥陶系剖面,采集了大量化石和部分岩石样品。经室内研究并结合前人资料分析,我们发现:米仓山—龙门山分区的奥陶系呈环带状分布于汉南杂岩周边,奥陶系下部和寒武系上部均有不同程度的缺失,奥陶系底部均发育有一层砾岩或砂岩,成为奥陶系总的发育特点;以镇巴—司上断裂为东界的米仓山地层小区内,据其地层发育差异还可划分为广元—宁强地区(位西北侧)和南江—西乡地区。前一地区在奥陶系与志留系交界处有不同程度的缺失;后一地区在奥陶系与志留系间是连续的,志留系底部的笔石带齐全,五峰期可划分出三个笔石带,南郑页岩应归入奥陶系。文内公布的四川广元谭家沟和陕西宁强赵家坝奥陶系剖面资料,就其所含各门类化石之齐全、丰富、层位之多、岩石及生物地层单元划分之细,是前所未有的,为今后各方面的研究工作提供了素材。广元谭家沟的谭家沟组的时代更改为牯牛潭期,宝塔组属牯牛潭晚期至庙坡期,宝塔期以后均已缺失的结论;宁强赵家坝宝塔组的大部分应属庙坡期的结论;西梁寺组顶界不超过 *Glyptograptus austrodentatus* 带的结论,与该区沉积和地质历史的阐述是吻合的。笔者对生物群特征与沉积环境的叙述属粗浅看法,发表于此,供讨论。

本文作者自始至终参加了野外和室内分析、鉴定各门类化石工作。在完成本项目研究过程中,姬再良参加了1985年野外工作,金若谷代为鉴定岩石薄片,野外交通和实验室使用上得到西安地质矿产研究所、陕西地矿局区调队和西安地院的帮助和支持,谨致谢意。

# 陕南川北奥陶系区划露头分布及剖面位置图

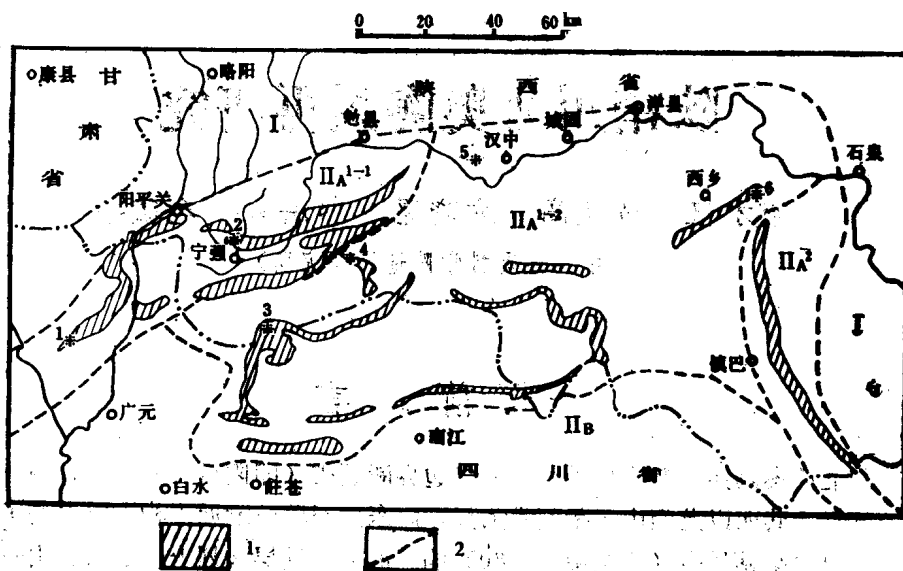


图 1

I—昆仑秦岭地层区；II—扬子地层区；II<sub>A</sub>—米仓山—龙门山地层分区；II<sub>A</sub><sup>1-1</sup>—广元—宁强地区；II<sub>A</sub><sup>1-2</sup>—南江—西乡地区；II<sub>A</sub><sup>1-3</sup>—堵河地层小区；II<sub>B</sub>—四川盆地地层分区  
 • 实测剖面位置及编号：• 1—四川广元谭家沟；• 2—陕西宁强赵家坝；• 3—陕西宁强大竹坝；• 4—南郑元坝大佛崖；• 5—南郑下梁山及中梁寺；• 6—西乡三郎铺杨家沟  
 1—奥陶系露头；2—地层区划界线

## 二、地层剖面描述

### 陕西宁强赵家坝剖面 (图2)

剖面位于宁强县城北5km的赵家坝双河口以东约800m的山脊和沟内，距卢衍豪 (1959, 1975) 的剖面约500m。层序如下：

上覆地层 下志留统崔家沟组：灰绿色、质纯、性脆泥岩，含笔石：*Streptograptus* sp., 微古植物 (A-41), *Verykachium rhomboides* Downie, *V. sadcatum* Stockmans

——平行不整合——

上奥陶统

宝塔组 (13.85m)

19. 青灰色薄层含生物碎屑微晶灰岩，由密集的泥质条带和网纹分隔呈小瘤状体，含三叶虫 (86NS-19-T); *Cekovia dettoides* Lu, *Cyclopyge recurva* Lu, *Pandoria orbiculata* Ji, 距顶1.5m处含牙形石 (85NS-14-C<sub>3</sub>); *Hamarodus europaeus* (Serpagli), *Dapsilodus similis* (Rhodes), *Pseudooneotodus mltiratus* (Moskalenko)

1.86m

18. 暗紫红色薄层至中层含生物碎屑微晶灰岩，含三叶虫 (86NS-18-T), *Cyclopyge* sp., *Trinucleoid* sp.

1.4m

17. 暗紫红色钙质、粉砂质泥岩，含三叶虫最丰富的介形虫化石。三叶虫 (86NS-

- 17-T) 有: *Pliomerina* sp., *Trinodus* sp., *Trinucleid*, *Hammatocnemis* sp., *Cyclopyge* sp., *Hanshengaspis elongatus* Chen 0.88m
16. 紫红色薄层网纹灰岩, 含青灰色灰岩眼球体 1.12m
15. 暗紫红色厚层生物碎屑微晶灰岩及含生物碎屑微晶灰岩。夹泥质条带(厚2—3cm), 各条带相隔10—15cm, 层面上具龟裂纹构造。距底2.19m处采得头足类(86NS-15-T); *Lituites ningjiangense* Lai, 及三叶虫; *Nileus armadilloformis* Lu, *Trinucleid*, *Geragnostus* sp., *Hadromeros* sp., *Cyclopyge recurva* Lu, (86NS-15-T); *Cyclopyge* sp., *Pseudopetigurus granulatus* Chen, *Cekovia elevata* Lu, 距底1.5m含牙形石(85NS-14-C<sub>1</sub>); *Baltoniodus prevariabilis* (Fähræus), *Complexodus pugionifer* (Drygant), *Protopanderodus rectus* (Lindström), *Drepanodus sculponea* (Lindström); 距底3m含牙形石(85NS-14-C<sub>2</sub>); *Baltoniodus prevariabilis* (Fähræus), *Complexodus pugionifer* (Drygant), *Rhodesognathus elegans* (Rhodes), *Drepanodus arcuatus* Pander, *Walliserodus ethingtoni* (Fähræus) 4.66m
- 在宁强滴水铺赵家坝村(原卢衍豪, 1959年所测剖面)的宝塔组中下部(相当本剖面15层)获得牙形石(85NS-M-T); *Pygodus anserinus* Lamont & Lindström, *Baltoniodus variabilis* Bergström, *Dapsilodus procus* (Ethington), *Complexodus pugionifer* (Drygant), *Eoplacognathus jianyeensis* An & Ding, *E. miaopoensis* An & et al., *Baltoniodus prevariabilis* (Fähræus), *Panderodus gracilis* (Branson & Mehl), *Amorphognathus hielensis* Dzik, *Rhodesognathus elegans* (Rhodes), *Paroistodus parallelus* (Pander), *Protopanderodus rectus* (Lindström), *Spinodus ramosus* (Hadding), *Paroistodus originalis* (Sergeeva), *Protopanderodus parvibasis* Löfgren 等; 在宝塔组顶部(相当本剖面16层)采得头足类 *Lituites* sp.
14. 青灰色含泥质条带微晶砂、砾屑灰岩及生物碎屑微晶灰岩。底部含三叶虫(86NS-14-T); *Cyclopyge* sp. 和牙形石(85NS-13-C<sub>1</sub>); *Eoplacognathus elegatus* (Bergström), *Polyplacognathus sweeti* Bergström, *Keislognathus* sp., *Dapsilodus similis* (Rhodes), 距底3.06m处采得三叶虫(86NS-14-T<sub>1</sub>); *Pseudopetigurus granulatus* Chen, *Cyclopyge* sp.; (86NS-14-T<sub>2</sub>); *Cyclopyge chinensis* Chen, *C. recurva* Lu, *C. subcylindrica* Chen, *Sphaerexochus* sp., *Pancleria orbiculata* Ji, *Hadromeros* sp., *Iliaenus mienhsiensis* Lu, *Nileus armadilloformis* Lu; 头足类(86NS-14-2); *Michelinoceras elongatum* (Yü), *Bactraceras angustisiphonatum* (Rüdiger) 和牙形石(85NS-13-C<sub>2</sub>); *Drepanodus sculponea* (Lindström), *Oistodus longiramus* Lindström 3.33m
13. 上部紫红色粉砂质页岩, 下部姜黄色粉砂质页岩 0.6m
- 下奥陶统
- 牯牛潭组
12. 青灰色(风化后呈黄灰色)中层状含灰岩团块粉砂质泥灰岩及泥灰岩。灰岩团块呈灰色、与基质边界不清, 基质具波状层理、团块局部重结晶, 并含大量生物碎片。岩石层面呈豹皮状, 断面呈条带状, 距底9.44m处夹一层6cm厚的暗紫红色泥灰岩。距底3.18m处夹一薄层生物碎屑微晶灰岩, 在本层中部1/3厚度范围内采得头足类(86NS-12-Ce); *Richardsonoceras* spp., *Aucistroceras* sp. 13.6m

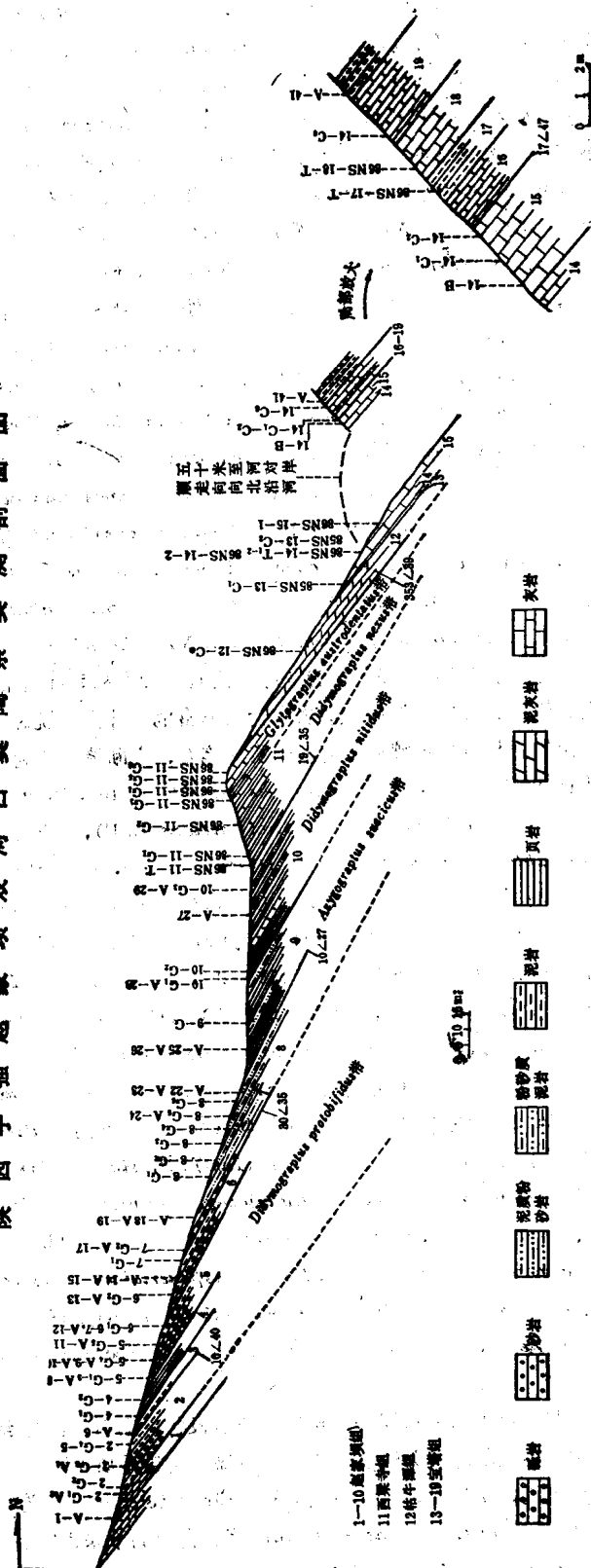
## 西梁寺组

11. 深灰色粉砂质页岩夹灰色粉砂质泥岩及致密灰岩透镜体或灰岩条带。灰岩条带单层厚10—20cm, 每一条带相隔20—50cm。在中上部灰岩条带相对集中, 呈瘤状, 与页岩呈互层状。自上而下采得8层笔石, 距底21.36m (86NS-11-G<sub>8</sub>), 含 *Aulograptus leesakuangi* (Hsü), *Phyllograptus* cf. *anna* Hall, *Cryptograptus uniformis* Chen, *Cryptograptus uniformis* (subsp. nov.), *Glyptograptus austrodentatus* Harris et Keble, *G. austrodentatus major* Mu, *G. cf. robustus* Mu, *G. cf. tongziensis* Mu, *G. spp.*, *Amplexograptus* spp.; 三叶虫: (A-32); *Ninghianolithus welleri* (Endo), *Megalaspides* sp., 距底20.15m (86NS-11-G<sub>5</sub>); *Didymograptus* cf. *hirundo* Salter, *Janograptus* sp., *Didymograptus* sp., *Aulograptus leesakuangi* (Hsü), *Cryptograptus uniformis* Chen, *G. cf. uniformis* Chen, *Climacograptus* sp., 三叶虫 (86NS-11-T<sub>2</sub>); *Ninghianites ninghanensis* Lu, *Iliaenus* sp., *Asaphus expansus* (Wahlenberg), 距底18.78m (86NS-11-G<sub>4</sub>); *Didymograptus* sp., *Cryptograptus* sp., 距底16.02m (86NS-11-G<sub>3</sub>); *Didymograptus* sp., *Cryptograptus* sp., *Glyptograptus austrodentatus* Harris et Keble, *Pseudoclimacograptus* sp., 距底10.53m (86NS-11-G<sub>2</sub>); *Didymograptus* cf. *hirundo* Salter, 三叶虫 (86NS-11-T); *Iliaenus sinensis* Yabe, *Isoteloides liangshanensis* Lu, *Hanchungolithus multiserialatus* (Endo), *Hanchungolithus* sp., *Ninghianites ninghanensis* Lu, *Ninghianolithus* sp., 距底2.8m (86NS-11-G<sub>1</sub>); *Didymograptus* cf. *hirundo* Salter, *D. nexus* Wang, *D. paterulus* Hall, *D. spp.*。近底部采得三叶虫 (86NS-11-T); *Nesaeurus shensiensis* (Lu), *Ninghianites ninghanensis* Lu, *Trinucleid*; 在本层近顶部还采得头足类: *Protocycloceras deprati* Reed, *Michelinoceras paraelongatum subcentrale* Lai, 海林擒, 三叶虫; *Nileus armodilloformis* Lu, *Nileus liangshanensis* Lu, *Asaphus expansus* (Wahlenberg)。微古植物 (A-36) 为: *Cymatogalea modesta* Gorka, *Cymatogalea timofeevi* (Martin), *Lophosphaeridium orbiculatum* Xing, *Baltisphaeridium simplex* (Douriff), *Microhystridium bacilliferum* Deflandre。底部的微体古植物 (A-36) 为: *Baltisphaeridium hirsutoides* (Eisenack), *B. klavense* (Vavrdova), *B. crinitum* Martin, *Goniosphaeridium dentatum* (Timofeev), *Dasydiacrodium* sp., *Acanthodiacrodium* sp., *Clavachitina decipiens*, *Microhystridium skinstonensis* Downie, *M. imitatum* Deflandre; 在小沟对岸, 采得三层化石。距底1.5m处含笔石 (85NS-11-G<sub>2</sub>); *Tetragraptus quadribrachiatatus* (Hall), *T. cf. rigidus* Geh, *T. spp.*, *Didymograptus hirundo* Salter, *D. cf. hirundo* Salter, *D. cf. extensus linearis* Monson, *D. mundus* T. S. Hall, *D. spp.*; 三叶虫 (85NS-11-T); *Isoteloides liangshanensis* Lu, *Taihungshanina* sp., *Ninghianites ninghanensis* Lu, *Trinucleid*; 近底部采得笔石 (85NS-11-G<sub>1</sub>); *Didymograptus hirundo* Salter, *D. cf. hirundo* Salter, *D. cf. extensus* Monson, *D. cf. ensiensis*, *D. nexus* Wang, *D. spp.* 11.97m

## 赵家坝组

10. 暗灰色、灰黑色页岩, 风化后呈纸片状。下部夹一层土黄色细砂岩和数层薄层粉砂岩。顶部为黑色页岩夹深灰色、黄绿色薄层粉砂质泥岩, 含三叶虫和丰富的笔石。顶部笔石 (85NS-10-G<sub>2</sub>) 为: *Didymograptus hirundo* Salter, *D. cf. hirundo* Salter, *D. ensiensis* Ni, *D. mundus* T. S. Hall, *D. cf. ensiensis*。

山西制碱工業公司 河双坝廠趙強中 西陝



2

Ni, *D. cf. uniformis* Elles et Wood, *D. nitidus* (Hall), *D. scalenus* Lin, *D. spp.*; 微体古植物(A-29)有: *Lophosphaeridium granulosum* (Staplin), *L. pilosum* Downie, *Microhystridium ciliiforme* Fu, *M. imitatum* Deflandre, *Baltisphaeridium simplex* (Deunff), *B. acer* (Timofeev), *Cymatogalea cuvillieri* (Deunff); 本层上部含微体古植物(A-27), *Lophosphaeridium pilosum* Downie, *L. citrinum* Downie, *Baltisphaeridium simplex* (Deunff), *Microhystridium spachorosuesi* Stockmans et Williere; 距底部1.65m处含笔石(85NS-10-G<sub>12</sub>); *Didymograptus hirundo* Salter, *D. cf. hirundo* Salter, *D. extensus linearis* Monson, *D. cf. nitidus* (Hall); 距底0.41m处含(85NS-10-G<sub>1</sub>); *Didymograptus hirundo* Salter, *D. cf. hirundo* Salter, *D. extensus linearis* Monson, *D. nitidus* (Hall), *D. cf. patulus* (Hall), *D. spp.*, *Azygograptus suecicus* Moberg; 微体古植物(A-28), *Lophosphaeridium orbiculatum* Xing, *L. citrinum* Downie, *L. granulosum* (Staplin), *Helosphaeridium sp.*, *Baltisphaeridium simplex* (Deunff), *B. clavicornium* Wetzel, *Goniosphaeridium dentatum* (Timofeev), *Cymatogalea margaritata* Deunff, *C. cuvillieri* (Deunff), *C. multisepta* (Deunff), *Microhystridium shinetonensis* Downie; 该层内采得三叶虫(85NS-10-T) (85NS-10-TD, 85NS-10-T<sub>2</sub>); *Ptychopyge sp.*, *Taihungshania intermedia* Lu, *Megalaspides sp.*, *Nesouretus sp.*, *Ninghianolithus sp.*

18.58m

9. 暗灰绿色与黄绿色页岩互层, 中夹薄层黄灰绿色泥质粉砂岩和粉砂质条带; 页岩质纯、致密、性脆。在所夹泥质粉砂岩中含较丰富的三叶虫、腕足类和双壳类。在泥质粉砂岩与页岩过渡层中含较丰富的笔石, 以断笔石类为主, 少量对笔石, 计有(85NS-9-G); *Didymograptus hirundo* Salter, *D. cf. hirundo* Salter, *D. cf. extensus linearis* Monson, *D. cf. nitidus* Hall, *D. cf. patulus* (Hall), *Azygograptus fluitans* Ge, *A. cf. fluitans* Ge, *A. undulatus* Chen et Xia, *A. cf. undulatus* Chen et Xia, *A. lapworthi* Nicholson, *A. cf. lapworthi* Nicholson, *A. cf. suecicus* Moberg; 三叶虫为(85NS-9-T<sub>1</sub>), *Nesouretus sp.*, (86NS-原9-T<sub>1</sub>); *Megalaspides sp.*, (85NS-9-T<sub>2</sub>, 86NS-9-T<sub>2</sub>); *Ptychopyge sp.*, *Taihungshania shui* Lu; (86NS-原9-T<sub>1</sub>); *Nileus sp.*, *Ichangolitus sp.*, *Ninghianolithus sp.*, *Psilcephalina sp.*; (86NS-原9-T<sub>2</sub>); *Isoteloides liangshanensis* Lu; (86NS-原9-T<sub>2</sub>补含); *Nesouretus shensiensis* Lu, *Taihungshania intermedia* Lu; 在本层下部含微体古植物(A-25, A-26); *Baltisphaeridium impalpabile* (Timofeev), *B. mutiens* (Rud), *B. simplex* (Deunff), *Lophosphaeridium citrinum* Downie, *L. granulosum* (Staplin), *L. orbiculatum* Xing, *L. pilosum* Downie, *Goniosphaeridium dentatum* (Timofeev), *Coryphidium milada* Cramer et Diez, *Buedingisphaeridium tremadocum* Rasul, *Helosphaeridium sp.*, *Multiplicisphaeridium multipugiumculatum* Cramer & Diez, *Coryphidium sp.*, *Microhystridium acuminosum* Cramer & Diez

12.36m

8. 下部为深灰色、暗绿色含粉砂质泥岩, 风化后呈薄板状, 层面上富含绢云母碎片, 化石稀少; 中上部过渡为浅黄绿色及暗黄绿色含粉砂质泥岩, 风化后呈页片状, 含头足类, 腕足类, 三叶虫及笔石。三叶虫(85NS-8-T)为: *Taihungshania multisepta*, *Megalaspides sp.*; 笔石自上而下采得6层; (85NS-8-G<sub>6</sub>); *Azygograptus cf. lapworthi* Nicholson, (85NS-8-G<sub>6</sub>); *Azygograptus*

*flexilis* Chen et Xia, (85NS-8-G<sub>4</sub>); *A. lapworthi* Nicholson, *A. cf. lapworthi* Nicholson, *A. cf. undulatus* Chen et Xia, (85NS-8-G<sub>5</sub>); *Didymograptus cf. hirundo* Salter, *Azygograptus flexilis* Chen et Xia, *A. lapworthi* Nicholson, *A. cf. lapworthi* Nicholson, *A. suecicus* Moberg, *A. cf. suecicus* Moberg, *A. cf. undulatus* Chen et Xia, *Azygograptus* spp., 三叶虫 (85NS-8-T); *Megalaspides* sp., (85NS-8-G<sub>2</sub>); *Azygograptus fluitans* Ge, *A. cf. flexilis* Chen et Xia, *A. suecicus* Moberg, *A. undulatus* Chen et Xia, *A. cf. undulatus* Chen et Xia, *Azygograptus* spp., (85NS-8-G<sub>1</sub>); *Azygograptus undulatus* Chen et Xia, *A. spp.*; 本层顶部含微古植物 (A-23), *Microhystridium acuminosum* Cramer et Diez, *Coryphidium milada* Cramer & Diez, *C. tadla* Cramer et Diez, *Veryhachium* sp., *Baltisphaeridium simplex* (Deunff), *B. duplicativum* (Timofeev), *Multiplicisphaeridium hydraferum* (Stockmans et al.), *Lophosphaeridium granulosum* (Staplin), *L. orbiculatum* Xing, *Goniosphaeridium naliukini* (Timofeev), *G. uncinatum* (Downie), *Cymatigalea cuvillieri* (Deunff), *Leiovalia oblonga* (Eisenack), *Acanthodiacrodium tasselli* Martin, *Striatotheca varirugulata* Cramer & Diez, 稍低为 (A-22), *Lophosphaeridium granulosum* (Staplin), *L. citrinum* Downie, *Coryphidium almohadilla* Cramer et Diez, *Multiplicisphaeridium furcatum* (Deunff), *Baltisphaeridium simplex* (Deunff), *B. duplicativum* (Timofeev), *Buedingiisphaeridium tremadocum* Rasul, *Synsphaeridium conglutinatum* (Timofeev); 其下相当笔石层 (8-G<sub>6</sub>) 的微古植物 (A-24) 为: *Baltisphaeridium simplex* (Deunff), *B. duplicatum* (Timofeev), *B. microspinosum* (Eisenack), *Cymatigalea cuvillieri* (Deunff), *C. timofeevi* (Martin), *Lophosphaeridium pilosum* Downie, *Microhystridium acuminosum* Cramer et Diez, *M. stellapilosum* Martin, *Protosphaeridium fusci-petiolatum* Cramer et Diez, *Coryphidium milada* Cramer et Diez, *Conochitina* sp., *Striatotheca varirugulata* Cramer et Diez, *Veryhachidium schmidtii* (Timofeev), *Veryhachium* sp.; 距 A-22 之下 3m 处产微古植物 (A-21): *Lophosphaeridium pilosum* Downie, *L. citrinum* Downie, *L. granulosum* (Staplin), *Microhystridium imitatum* Deflandre, *M. pellitum* Martin, *Synsphaeridium conglutinatum* (Timofeev), *Acanthodiacrodium tasselli* Martin, *Coryphidium australe* Cramer et Diez, *Cymatigalea timofeevi* (Martin), *Buedingiisphaeridium tremadocum* Rasul, *Goniosphaeridium naliukini* (Timofeev), *Multiplicisphaeridium* sp., *Baltisphaeridium microspinosum* (Eisenack); 本层中部产微古植物 (A-20): *Lophosphaeridium pilosum* Downie, *L. citrinum* Downie, *Cymatigalea* Rasul, *Microhystridium acuminosum* Cramer et Diez, *M. nannacanthum* Deflandre, *Coryphidium milada* Cramer et Diez, *Buedingiisphaeridium tremadocum* Rasul, *Baltisphaeridium simplex* (Deunff), *Multiplicisphaeridium consolator* Cramer et Diez, *Goniosphaeridium adlingans* (Timofeev), *Leioarachnium vittatum* Andreeva, *Lophodiacrodium primum* (Timofeev); 本层底部产微古植物 (A-19, A-18), *Lophosphaeridium pilosum* Downie, *L. citrinum* Downie, *Goniosphaeridium adlingans* (Timofeev), *G. striatum* Lu, *Leiovalia oblonga* Eisenack, *Baltisphaeridium massium* Martin, *B. simplex* (Deunff), *B. zaleskyi* (Timofeev), *Buedingiisphaeridium tremadocum*

*Rasul*, *B. fuscipetiolatum* (Cramer et Diez), *Coryphidium milada* Cramer et Diez, *Michrystidium nanacanthum* Deflandre

10.28 m

7. 黄绿色致密质纯性脆泥岩, 风化后呈页片状, 其中夹数层褐黄色薄层泥质粉砂岩。在泥岩过渡为粉砂岩的粉砂质泥岩和泥质粉砂岩中, 含少量三叶虫、头足类、腕足类及丰富的笔石。自上而下采二层笔石及微古植物, 笔石 (85NS-7-G<sub>1</sub>): *Azygograptus flexilis* Chen et Xia, *A. fluitans* Ge, *A. suecicus* Moberg, *A. undulatus* Chen et Xia, *Azygograptus* sp.; 三叶虫 (85NS-7-TY), *Psilocephalina* sp.; 微古植物 (A-17); *Lophosphaeridium pilosum* Downie, *L. citrinum* Downie, *Baltisphaeridium simplex* (Deunff), *Michrystidium imitatum* Deflandre; 笔石 (85NS-7-G<sub>1</sub>): *Azygograptus fluitans* Ge, *A. lapworthi* Nicholson, *A. suecicus* Moberg, *A. cf. suecicus* Moberg, *A. undulatus* Chen et Xia, *Azygograptus* spp.; 三叶虫 (85NS-7-T<sub>1</sub>); *Taihungshania intermedia* Lu, T. shui Lu

0.66 m

6. 深灰色致密质纯性脆泥岩, 风化后呈页片状, 夹灰绿色粉砂质泥岩和薄层粉砂岩。含少量头足类、腕足类、三叶虫及分散式保存的笔石碎片。顶部含微古植物 (A-15); *Lophosphaeridium pilosum* Downie, *L. citrinum* Downie, *Cymatigalea cuvillieri* (Deunff), *Coryphidium baraka* Cramer et Diez, *Baltisphaeridium simplex* (Deunff), *Goniosphaeridium dentatum* (Timofeev), *Michrystidium imitatum* Deflandre, *Verhachium saccatum* Stockmans et Wille, *Protosphaeridium fuscipetiolatum* Cramer et Diez, *Leiofusa* sp., (A-14); *Lophosphaeridium pilosum* Downie, *L. citrinum* Downie, *Lophosphaeridium pilosum* Downie, *L. citrinum* Downie, *Buedingiisphaeridium fuscipetiolatum* (Cramer et Diez), *Cymatigalea cuvillieri* (Deunff), *C. margaritata* Deunff, *Michrystidium accuminatum* Cramer et Diez, *Goniosphaeridium septangulum* (Timofeev), *Coryphidium almohadilla* Cramer et Diez, *Baltisphaeridium microspinatum* (Eisenack), *B. simplex* (Deunff), *Striatotheca varirugulata* Cramer et al., *Pirea ornatissima* Cramer et Diez; 中上部含笔石 (85NS-6-G<sub>1</sub>): *Azygograptus suecicus* Moberg, *A. sp.*, 微古植物 (A-13); *Lophosphaeridium pilosum* Downie, *L. citrinum* Downie, *Dactylofusa* aff. *cucurbita* Jardine et al., *Buedingiisphaeridium fuscipetiolatum* (Cramer & Diez), *Diatyotidium stenodictyum* Eisenack, *Scaphospinosa ischorica* Ti, *Cymatigalea cuvillieri* (Deunff); 近底部含笔石 (85NS-6-G<sub>1</sub>); *Didymograptus deflexus* E. et W., *D. aequabilis* Chen et Xia, *D. inflexus* Chen et Xia, *D. hurchi* Törnquist, *D. parvus* Chen et Xia, *D. saukros* Ni, *D. scalenus* Lin, *D. scanicus* Tjervik, *D. subconvexus* Chen et Xia; 三叶虫 (85NS-6-T<sub>1</sub>) *Taihungshania* sp.; *T. brevica* Lu; 微古植物 (A-12); *Lophosphaeridium pilosum* Downie, *L. citrinum* Downie, *Zonosphaeridium hiliiferum* Xing, *Pirea ornata* (Burmman)

5.44 m

5. 灰绿色泥岩, 风化后为深灰、黄绿色纸片状页岩, 夹粉砂质页岩, 顶部一层黄绿色页岩含笔石 (85NS-5-G<sub>1</sub>); *Didymograptus hurchi* Törnquist *D. scanicus* Tjervik; 及微古植物 (A-11); *Lophosphaeridium pilosum* Downie, *L. citrinum* Downie, *Baltisphaeridium simplex* (Deunff), *Cymatigalea cuvillieri* (Deunff); 中部所夹褐黄色粉砂质页岩含笔石 (85NS-5-G<sub>1</sub>); *Didymograptus*

- aeguabilis* Chen et Xia, *D. deflexus* Elles et Wood, *D. cf. deflexus* E. et W., *D. scanicus* Toerxvik, 及微古植物(A-9-10), (A-10), *Lophosphaeridium pilosum* Downie, *Micrhystridium acuminosum* Cramer et Diez, *Baltisphaeridium simplex* (Deunff), *Poleinosphaeridium macropylum* (Eisenack), *Cymatiogalea timofeevi* (Martin), *Verhachium* sp., (A-9), *Lophosphaeridium pilosum* Downie, *Leiosphaeridia wemlockia* Downie, *Leiosalia oblonga* (Eisenack), 下部含微体古植物 (A-8), *Lophosphaeridium pilosum* Downie, *L. citrinum* Downie, *Leiosalia oblonga* Eisenack, *Cymatiogalea suecica* (Eisenack), *Baltisphaeridium simplex* (Deunff), *Micrhystridium* sp., *Gontiosphaeridium septangulum* (Timofeeva), *Micrhystridium nannacanthum* Deflandre, 下部含笔石, 自上而下分为三层。(85NS-5-G<sub>3</sub>), *Didymograptus deflexus* E. et W., *D. cf. deflexus* E. et W., *D. scanicus* Tjervik, *D. saukros* Ni, *D. vacillans* Tullberg, *D. sp.*, (85NS-5-G<sub>2</sub>), *Didymograptus aequabilis* Chen et Xia, *D. filiformis* Tullberg, *D. kurchi* Tornquist, *D. saukros* Ni, (85NS-5-G<sub>1</sub>), *Didymograptus cf. sinensis* Lee et Chen *D. spp.* 8.03m
4. 褐黄色粉砂质页岩及灰绿色页岩, 间夹薄层泥质粉砂岩, 含三叶虫及笔石。上部含笔石 (85NS-4-G<sub>2</sub>), *Didymograptus cf. cognatus* Harris et Thomas, *D. diapason* Chen et Xia, *D. diapason* subsp. nov., 三叶虫, *Taihungshanina shui* Lu; 下部含笔石 (85NS-4-G<sub>1</sub>), *Didymograptus diapason* Chen et Xia, *D. cf. diapason* Chen et Xia, *D. minutus* Tornquist, *D. protobifidus* Elles, *D. sp.* *D. spp.* 4.13m
3. 褐黄色、灰绿色泥岩, 风化后呈纸片状, 偶夹铁质粉砂岩, 含三叶虫 (85NS-3-T), *Taihungshanina intermedia* Lu, 等 2.59m
2. 灰绿色、黄绿色泥岩, 风化后呈纸片状, 间夹褐黄色薄层粉砂质泥岩, 含三叶虫、腕足、头足及丰富的笔石。自上而下有下列化石: 顶部含笔石 (85NS-2-5), *Didymograptus minutus* Tornquist, *D. protobifidus* Elles, *D. spp.*, 三叶虫 (85NS-2-T<sub>2</sub>), *Taihungshanina* sp., *Megalaspides* sp., 微古植物(A-6), *Lophosphaeridium pilosum* Downie, *Leiosphaeridia minutissima* (Tim), *Cymatiogalea multarea* (Deunff), *Dictyonema stenodictyon* Eisenack, 距底8.63m处, 含笔石 (85NS-2-G<sub>1</sub>), *Didymograptus minutus* Tornquist, *D. cf. minutus* Tornquist, *D. protobifidus* Elles, *D. cf. protobifidus* Elles, *D. cf. subtilis* Chen, *D. sp.*, *D. spp.*; 距底4.74m处含笔石: (85NS-2-G<sub>2</sub>) *Dictyonema* sp., *Schisograptus*? sp., *Didymograptus parallelus* Chen et Xia, *D. cf. parallelus* Chen et Xia, *D. spp.*, 微古植物(A-4), *Leiosphaeridium orbiculata* (Staplin), *Leiosphaeridia hyperboeica* (Ti), *Cymatiosphaera multisepta* (Deunff), *Trachysphaeridium delilum* Xing, *Baltisphaeridium simplex* (Deunff), *Buedingisphaeridium fuscipetiolatum* (Cramer et Diez); 距底1.72m笔石 (85NS-2-G<sub>2</sub>) 有: *Didymograptus diapason* Chen et Xia, *D. protobifidus* Elles, *D. spp.*, *Dictyonema* sp.; 距底0.64m笔石 (85NS-2-G<sub>1</sub>) 有: *Didymograptus canadensis* Ruedemann, *D. obifidus* Chen et Xia, *D. cf. mammosus* Chen et Xia, *D. minutus* Tornquist, *D. nobilis* Chen et Xia, *D. parallelus* Chen et Xia, *D. spp.*, 三叶虫 (85NS-2-T<sub>1</sub>), *Megalaspides* sp., 微古植物(A-2), *Leiosphaeridia orbiculata* (Staplin), *L. eisenack* (Timofeev), *Lophosphaeridium pilosum*

Downie, *L. citrinum* Downie, *L. ruidum* Andreeva, *Nierhystridium pellitum* Martin, *Zonosphaeridium javasum* var. *miror* King (MS), *Z. limpatum* Ti, Z. aff. *annularium* King, *Gymatogalea cuillerti* (Deunff), *Goniosphaeridium septangulum* (Timofeev), *Buedingisphaeridium fuscipetiolatum* (Cramer et Diez); 距底0.42m笔石 (86NS-2-G<sub>1b</sub>) 有: *Didymograptus diapason* Chen et Xia, *D. cf. oobifidus* Chen et Xia, *D. protoartus* Decker, *D. protobifidus* Elles, *D. subtilis* Chen, *D. wudangensis* Chen, *D. sp.*, *Dictyonema sp.*; 底部含笔石 (86NS-2-G<sub>1a</sub>); *Didymograptus diapason* Chen et Xia, *D. oobifidus* Chen et Xia, *D. nobilis* Chen et Xia, *D. protobifidus* Elles, *D. subtilis* Chen, *D. sp.*, *D. spp.* *Dictyonema sp.* 8.68 m

1. 褐灰、灰黑色厚层砾岩。砾石成分主要为黑色燧石，分选和磨圆度较好。下部含微古植物 (A-1), *Lophosphaeridium filiosum* Downie 3.85 m

平行不整合

下伏地层 下寒武统阎王庙组褐黄色厚层含砾粗砂岩

#### 四川广元七里乡谭家沟剖面 (图3, 图4)

(西梁寺组以下剖面于谭家沟沟内测绘, 谭家沟组以上剖面测于谭家沟沟口河对岸公路旁)

上覆地层 下志留统崔家沟组黄绿色页岩

平行不整合

上奥陶统至下奥陶统

宝塔组

21. 青灰色中一厚层生物屑微晶灰岩, 具似龟裂网状构造, 在山梁上厚度增至6~7m。含三叶虫 (86GS-室-T) *Cyclopyge sp.*; 顶部含牙形石 (85-GT-C-1-C<sub>2</sub>): *Baltaniodus variabilis* (Bergström), *B. prevariabilis* (Fähræus), *Eoplacognathus cf. Hindei* (Hannar), *Amdorphagnathus hislensis* Dzick, *Sagittodontus robustus* Rhodes, *Eoplacognathus foliaceus* (Fähræus) *E. jianyeensis* An et Ding, *Protopanderodus varicosatus* (Sweet et Bergström), *P. rectus* (Lindström), *P. parvidens* Lötgen, *Drepanodus arcuatus* Pander; 距底2m含牙形石 (85GT-C-1-C<sub>2</sub>): *Drepanodistodus subrectus* (Branson et Mehl), *Dapsilodus similis* (Rhodes); 距底0.5m处含牙形石 (85GT-C-1-C<sub>1</sub>): *Eoplacognathus foliaceus* (Fähræus), *E. miaopoensis* An et al., *E. jianyeensis* An et Ding, *Baltaniodus prevariabilis* (Fähræus), *Pygodus serrus* (Hadding), *Compleodus pugionifer* (Drygant), *Protopanderodus rectus* (Lindström), *Panderodus gracilis* (Branson et Mehl), *Walliserodus shingtoni* (Fähræus) 2.3 m

下奥陶统

谭家沟组

20. 深灰色厚至中层中-粗粒致密细晶石英砂岩、钙质粗粉砂岩及钙质粉砂岩。距底2.3m处含少量笔石 (86GS-3-G) *Dendrograptus sp.*, *Dictyonema sp.*, 近顶部含微古植物 (86GS-A-2): *Baltisphaeridium brevifilicum* Kjellström, *B. hirsutoides* (Eisenack), *Comasphaeridium campae* (Stockmans et Willie-ra), *Gymatogalea cf. stelligena* Górka, *Nierhystridium henryi* Paris et Deunff, *Stelliferidium tortinula* Deunff et al. 27.86 m

# 四川广元谭家沟奥陶系实测剖面图

(化石号除注明86外均为85年采集, 省略了前面的85G T号码)

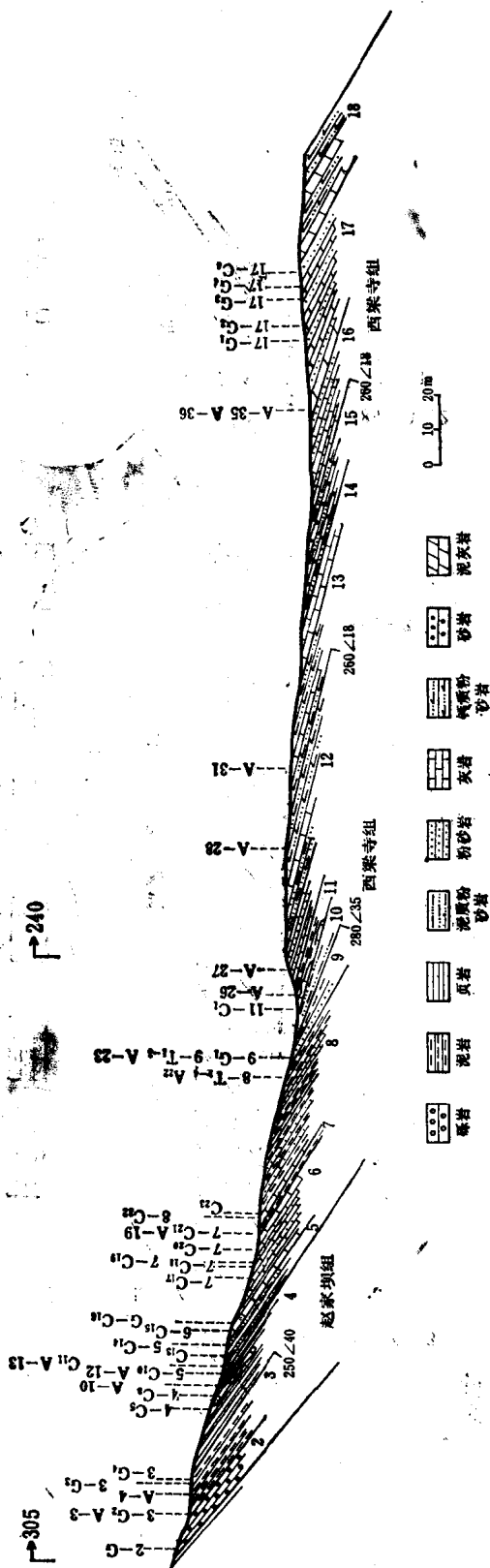


图 3

四川广元谭家沟沟口河对岸奥陶系实测剖面图

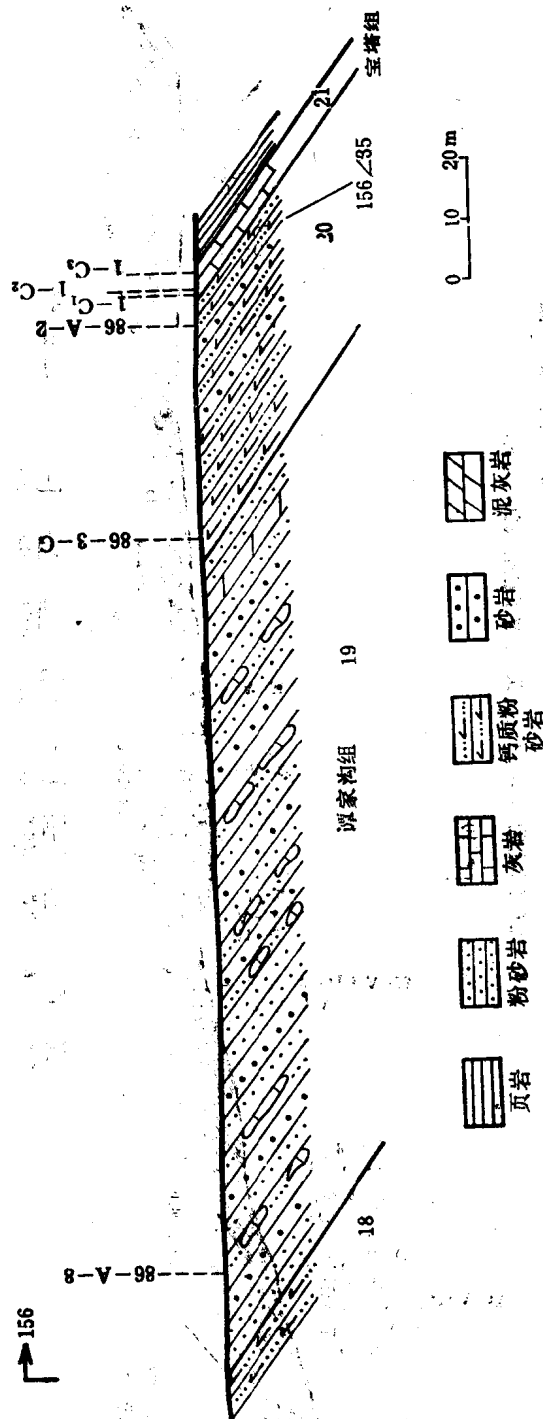


图 4