



MORPHOLOGY OF EARLY LIFE—500 MILLION Y

AGO

——五亿年前地球生命的摇篮

FOSSILS—THE KEY TO THE PAST

贵州省黔东南苗族侗族自治州科学技术局

Edited by
The Bureau of Science and
Technology, Autonomous Prefecture
of Miao and Tong Nationalities,
Southeastern Guizhou Province,
China.

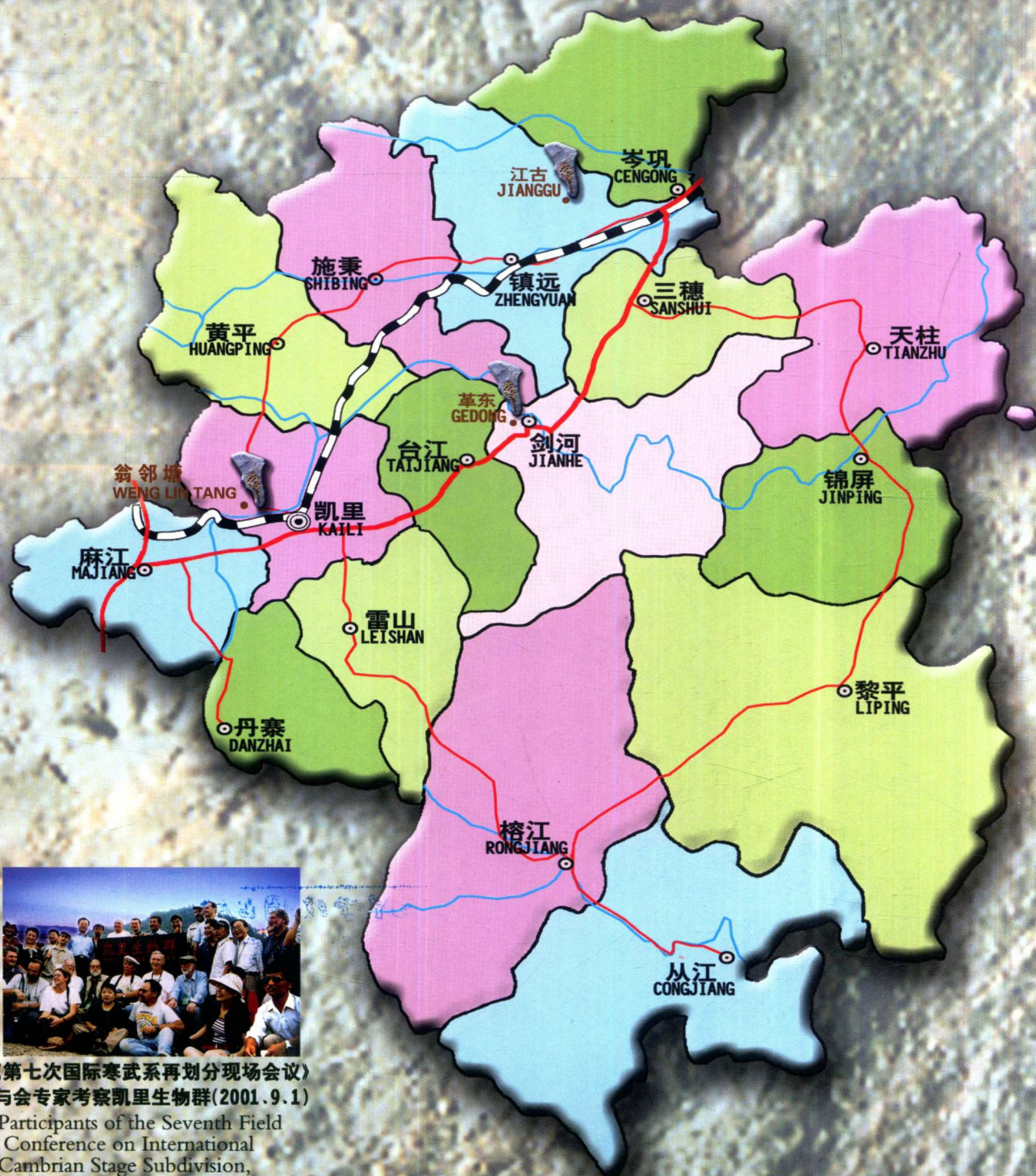
贵州东部凯里一带早寒武世和中寒武世地层极为发育，生物化石极为丰富，成为全国之冠，在全球范围内亦属稀有。

中国科学院资深院士 卢衍豪

Lower and Middle Cambrian strata are fossiliferous and well developed in the Kaili area of eastern Guizhou, China. These strata contain important fossils that are well known in China and worldwide.

Lu Yanhao

The senior academician of Chinese Academy Science



《第七次国际寒武系再划分现场会议》
与会专家考察凯里生物群(2001.9.1)

Participants of the Seventh Field Conference on International Cambrian Stage Subdivision, investigating the Kaili Biota at Balang, Taijian, Guizhou.

看寒武遗迹

寻生命摇篮



朋友，你曾想过，今天古朴浓郁的“歌舞之州、森林之州、神奇之州、百节之乡——黔东南”，在5.2亿年前的远古时代，曾是一个生机盎然的海底世界。想知道吗？让我们共同来翻开这神秘的页码，页页都是一个活生生的历史画卷，都是一片片大自然的缩影，都在告诉我们一个个古老传奇的故事。那时，似乎所有现代动物门类和已经灭绝动物的祖先代表来地球报到，到这里聚会，这里一派繁荣，异彩纷呈，可谓地球生命的摇篮。困惑吗？栩栩如生的化石会告诉你也告诉我它的来龙去脉。

我们将二十多年来中外科学工作者发掘研究成果编辑成册，谨以此献给为贵州省黔东南州地质事业做出贡献的广大中外科学工作者。

祝第四届国际寒武纪地质大会圆满成功！

Today, southeastern Guizhou is well known for its unique people, culture, festivals, forest and natural resources. 500 million years ago; however, this region was a seafloor and contained vivid benthic marine life. The strata in this region contain records of earth history of the past. Well-preserved fossils are telling us some splendid stories of the ancient life before our time. This cradle of life consists of fossils that either represent extinct phyla, or are ancestral to modern animals.

Many famous Chinese and foreign scientists have conducted research projects in this region over the past twenty years. Therefore, we acknowledge their valuable scientific contribution and dedicate this book to the numerous people involved in studying the geology of southeastern Guizhou.

We extend our best wishes for a successful meeting, the fourth International Cambrian Conference.

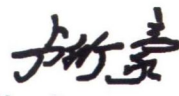
贵州省黔东南苗族侗族自治州人民政府

副州长 李再勇

二〇〇五年七月二十八日

Vice-governor Li Zaiyong
Autonomous Prefecture People's
Government of Miao and
Tong Nationalities, Southeastern
Guizhou Province, China.

凯里动物群是我国古生物学科有史以来少数几个重大发现之一，这不但是中国科学史上一大光荣，也是亚洲科学史上一大光荣。

中国科学院资深院士 
一九九四年五月三日

台江早中寒
武世化石群
全球第三位
中国科学院资深院士
中国地质大学(北京)教授 杨遵仪
一九九四年三月

中国科学院资深院士
中国地质大学(北京)教授 杨遵仪

台江动物群是国内，很可能也是全球发现的早期生物遗迹的最为丰富的地点和动物群。这对于研究生物起源与演化至关重要。这是台江县人民的幸福，也是贵州和全国人民的幸福。
中国科学院资深院士 国际第四纪研究联合会主席 刘东生
一九九九年三月二十九日



中国科学院资深院士 杨遵仪(91岁)(左四)为台江古生物博物馆剪彩1998、4、30
Professor Yang Zunyi (Senior academician of Chinese Academy Science), left4, at the ribbon-cutting ceremony for the Taijiang Museum of Palaeontology 30—4—1998.

台江奇石
栩栩如生

中国科学院南京地质古生物所
李星学题 1999年2月13日

中国科学院资深院士 李星学



中国科学院资深院士刘东生题“台江古生物博物馆”馆名
Senior academician of Chinese Academy Science
Liu Dongsheng dedicated the title “Taijian Museum
of Palaeontology”

凱里化石
华夏增輝

中国科学院
南京地质古生物研究所
盛金章
一九九九年
二月一日

中国科学院院士 盛金章

台江化石宝库给人类
提供了研究生物进化的
金钥匙

叶大年
一九九九年元月廿二日

中国科学院院士 叶大年

凱里动物群是古生
物学的一件瑰宝
殷鸿福

1999年2月25日

中国科学院院士 殷鸿福

五亿年前的地球生命摇篮
百虫流芳的台江化石宝库

为台江古生物博物馆题

歐陽自遠
一九九九年

中国科学院院士 欧阳自远

This Museum is needed to preserve
a uniquely important part of the
natural history of Guizhou. A good
exhibition which will no doubt be
added to. Congratulations

John Shergold
Chair Cambrian Subcommittee
British
1 September 2001

译: 这个博物馆尚需悉心呵护。它是贵州自然历史的重要组成部分。好的展示无疑需要扩充。

恭喜!

国际寒武纪分会主席约翰·谢尔戈德教授(英国)
2001.9.1

Taijiang is cradle of
fossils

Linda McCollum
Eastern Washington
University USA

August 18, 1998

译: 台江是化石的摇篮
国际寒武纪分会委员
美国东华盛顿大学林达教授
1998.8.18

The Kaili fauna is an
important window showing
the composition of Cambrian
life. This museum is
important in preserving the
fossils for future generations

R. A. Robison

译: 凯里生物群是寒武纪生命架构的重要窗口。这个
博物馆为子孙后代保存了重要化石, 意义重大!

国际寒武纪分会名誉委员
罗宾森教授(美国)

2001.9.1

Kaili Fauna is
VERY IMPORTANT

The George Washington University

FREDERICK SUNDBERG

1998.8.18

译: 凯里动物群非常重要
美国乔治华盛顿大学
逊德布尔格博士
1998.8.18

Long live International
Research on the
TAIJIANG
BIOTA!

H. Van Iten
Hanover College,
USA
1999-7-7

译: 台江生物群国际研究合作万古长青!
美国汉诺威学院教授凡·伊顿

1999.7.7



国际寒武纪分会主席约翰·谢尔戈德教授(左)、
中国国家自然科学基金委员会地学部主任姚玉鹏
博士(右)为凯里生物群纪念碑剪彩 2001.9.1

Professor J. Shergold, (Chairman of International Cambrian
Subcommission), left, and Doctor Yao Yupeng (Dean of
Geological Department, National Science Fund Commission),
right, at the ribbon-cutting ceremony for the monument of
Kaili Biota. 1-9-2001

台江两个化石群
名震全球天下闻

贵州工业大学 赵元龙
一九九八.八.十八

贵州工业大学教授 赵元龙

库
寒武纪生物的重要宝库
凯里动物群是研究
项礼文
二〇〇一年九月一日

国际寒武纪分会委员
中国地质科学院研究员
项礼文

台江化石群
名扬海内外

中国科学院
南京地质古生物研究所 袁金良题

1998.8.18

中国科学院南京地质古生物研究所研究员 袁金良

弘扬科学精神
普及科学知识
南京古生物研究所
朱茂炎

中国科学院南京地质古生物
研究所研究员 朱茂炎

苗乡古化石
项礼文
八十三岁老红军战士 陈碧

八十三岁老红军战士 陈碧

生命之源

中国百名记者西部行采访团
陈永成 郭永成 郭永成 郭永成
郭永成 郭永成 郭永成 郭永成
郭永成 郭永成 郭永成 郭永成

中国百名记者西部行采访团

MORPHOLOGY OF EARLY LIFE—500 MILLION YEARS AGO

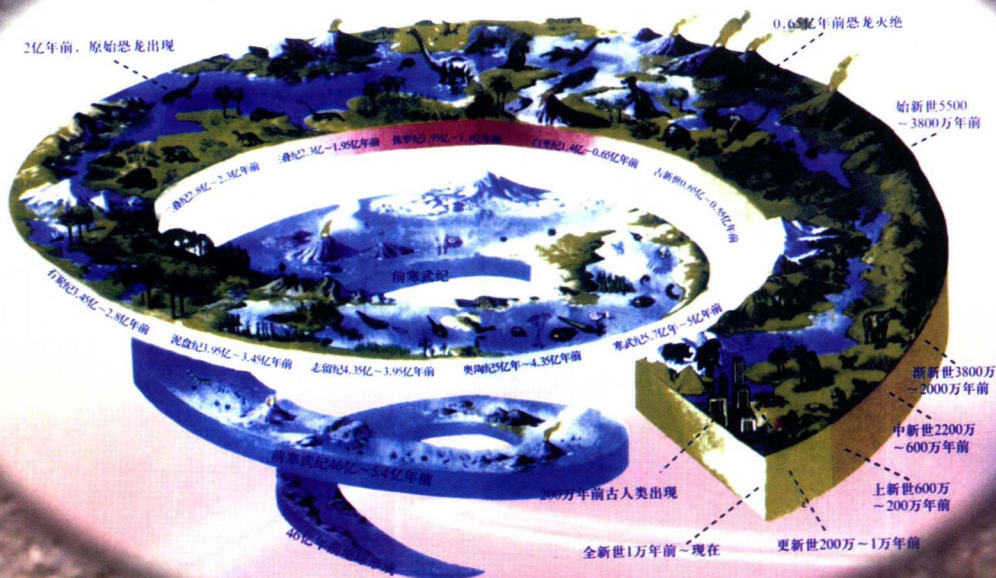
地球上发现最早生物是单细胞原核生物，距今大约35亿年前。20亿年前单细胞真核生物出现。10亿年前，单细胞向多细胞发展。5.4亿年前，寒武纪时期，具有分泌硬壳和骨骼能力的后生生物悄然兴起，即寒武纪生命大辐射或大爆发。

为什么众多门类的早期后生生物在短时间内会同时出现在地球上？产生背景是什么？前奏怎么样？爆发程度多大？生物间相互作用如何？怎样演化？……。揭开这些科学奥秘，需要解读化石的生命科学信息，探索地球生命的产生、演化规律，从而弄明白我们是谁？从哪里来？到哪里去？

一层层的岩石，一个个化石告诉我们，贵州省黔东南寒武纪生物群是地球寒武纪生命大爆发的极其重要遗迹。寒武纪早中期，黔东南以凯里、镇远为线，北西是扬子台地浅海，南东丹寨至台江为浅海陆棚斜坡，再往南东是江南深海。早寒武世中期，在凯里、镇远的台地浅海上沉积泥质碎屑（杷榔组），繁衍一群海洋生物——杷榔生物群。时间慢迁，海水东退。早寒武世晚期和中寒武世早期，陆棚斜坡区域成为泥质碎屑沉积（凯里组）。在台江县（今剑河县）革东的海底相继生息台江生物群、凯里生物群。生物生老病死、灾难死亡，被迅速埋藏，终成化石。

在这里，几乎所有现代动物门类的祖先代表及已经灭绝的动物门类被发现，这无疑是对达尔文进化论的修正和补充提供了强有力的科学依据；为破译地球早期后生生物的产生、演化奥秘提供了重要的生命科学信息。更为珍贵的是发现许多带软躯体动物化石，能够提供生物解剖、组织分化及分异等生物学的重要科学数据。

地球上生命的系统演化螺形图



The earliest evidence for life on the earth are unicellular organisms beginning about 3,500 million years ago, and the earliest eukayotes occur about 2,000 million years ago. Approximately 1,000 million years ago, unicellular animals gave rise to multicellular animals. At the beginning of the Cambrian, about 540 million years ago, primitive metazoans began to flourish and develop complex morphology, including the innovation of biomineralized skeleton. Abundant fossils from strata provide significant information to understand the first Cambrian radiation.

There are several key questions that need to be answered in order to understand biologic evolution. These questions include the following. Why did diverse metazoans representing many phyla occur in a relatively short period of time? What are the precursor conditions to the Cambrian radiation? What is the environmental background, and the main cause of the Cambrian radiation? What is the nature of the morphologic complexity during the Cambrian radiation?

Fossils provide the best evidence to understand the origin of life and its subsequent evolution. Thus, fossils are the key to answer the questions proposed above. Occurrences of Kaili, Taijiang and Balang biotas in southeastern Guizhou indicate that southeastern Guizhou contains strata yielding well-preserved fossils, especially from the Cambrian period, and these fossils can be important in understanding the origin of life. During the Lower to Middle Cambrian, this region is transitional between the shallow water Yangtze platform and deep marine Jiangnan basin. Complex environmental settings in this region led to diversification of endemic species during the Early to Middle Cambrian bio-radiation events. Good examples include the Early Cambrian Balang and Taijiang biotas, and the Middle Cambrian Kaili Biota.

The Cambrian metazoan fossils in this region represent all invertebrate phyla known to the rest of the world. One of the important aspects derived from studying these fossils is that many specimens bear both articulated skeleton and associated soft-parts. These valuable specimens help us better understand the palaeobiology, taphonomy and palaeoecology of this time period.

凯里生物群

1982年11月，贵州大学赵元龙、黄友庄、龚显英等在台江县革东镇八郎村后山上首次发现，并于1990年命名。发现了11个大门类，150余属，200余种古生物化石，其中，动物化石110余属，还发现大量软躯体动物化石。包括：多孔动物及开腔类，腔肠动物，蠕形动物，叶足动物，触手动物，腕足动物，软体动物，节肢动物三叶虫、三叶形虫、大型双瓣壳节肢动物、金臂虫、奇虾类及其它节肢动物，棘皮动物海百合亚门始海百合纲、海扁果亚门海箭纲、海胆亚门海座星纲、海参纲，宏观藻类，疑源类。与中国云南澄江生物群、加拿大布尔吉斯生物群构成世界三大布尔吉斯页岩型生物群。以含较多三叶虫、棘皮动物为特征，生物组合面貌既继承澄江生物群的一些重要分子，又先衍生布尔吉斯生物群的一些生物，在生物演化上具有桥梁作用，“是我国古生物学科有史以来少数几个重大发现之一”。



KAILI BIOTA

The earliest Middle Cambrian Kaili Biota discovered by Zhao Yuanlong, Huang Youzhou, Gong Xianyin from Guizhou University in 1982, was officially named in 1990. The Kaili Biota contains representatives of 11 phyla, namely : 1. algae, including red algae, brown algae, and coralline algae. 2. acritarchs; 3. poriferans, including sponges and cancelloriids; 4 coelenterates, including cetnophors and cnidarians, 5. "worms" ; 6. lobopods, 7. medusiform fossils; 8. brachiopods; 9. molluscs, including hyolithids, monoplacophorids and bivalves; 10. arthropods, including trilobites, large bivalve arthropods, and other problematic arthropods, 11. fossils of uncertain affinities, including Wiwaxia. They total more than 130 genera.

At present, the Kaili Biota consists of more than 110 genera of animal, and the Kaili Biota is ranked as the one of three most diversified biotas of the Burgess Shale-type Biota after Burgess Shale Biota and Chengjiang Biota. The most noteworthy fossils in the Kaili Biota are echinoderms, non-trilobite arthropods and soft-bodied fossils, such as well-persevered "worms" .

Current study on the Kaili Biota provides not only global paleontological information, but also useful evidence for the evolution of early metazoans, biodiversity of marine organisms and variety of marine environment after the Cambrian radiation, and palaeogeographic reconstruction of Cambrian plates. It plays an important role in the study of Burgess Shale-type deposits and the geological history of the earth.



部分主要研究工作者赵元龙（前右四）、袁金良（前右三）、朱茂炎（前右一）等
2001. 9. 1

The main researchers of Kaili Biota Zhao Yuanlong (Right 4),
Yuan Jinliang (Right 3), Zhu Maoyan (Right 1)

多孔动物及开腔类

Porifera including ,Chancelloriids



开腔骨类
Chancelloriids



海绵复原图
Reconstruction of sponges from the Kaili Biota



锥状多棱角海绵 生长在软舌螺上
Angulostuspongia conia



锥状多棱角海绵
Angulostuspongia conia



卵形小斗蓬海绵 *Choaiaella ovata*

腔肠动物 Coelenterata



帐篷螺复原图
Reconstruction of *scenella*



八郎寒武杯管螺
Cambrovitus balangensis



帐篷螺 *Scenella* sp



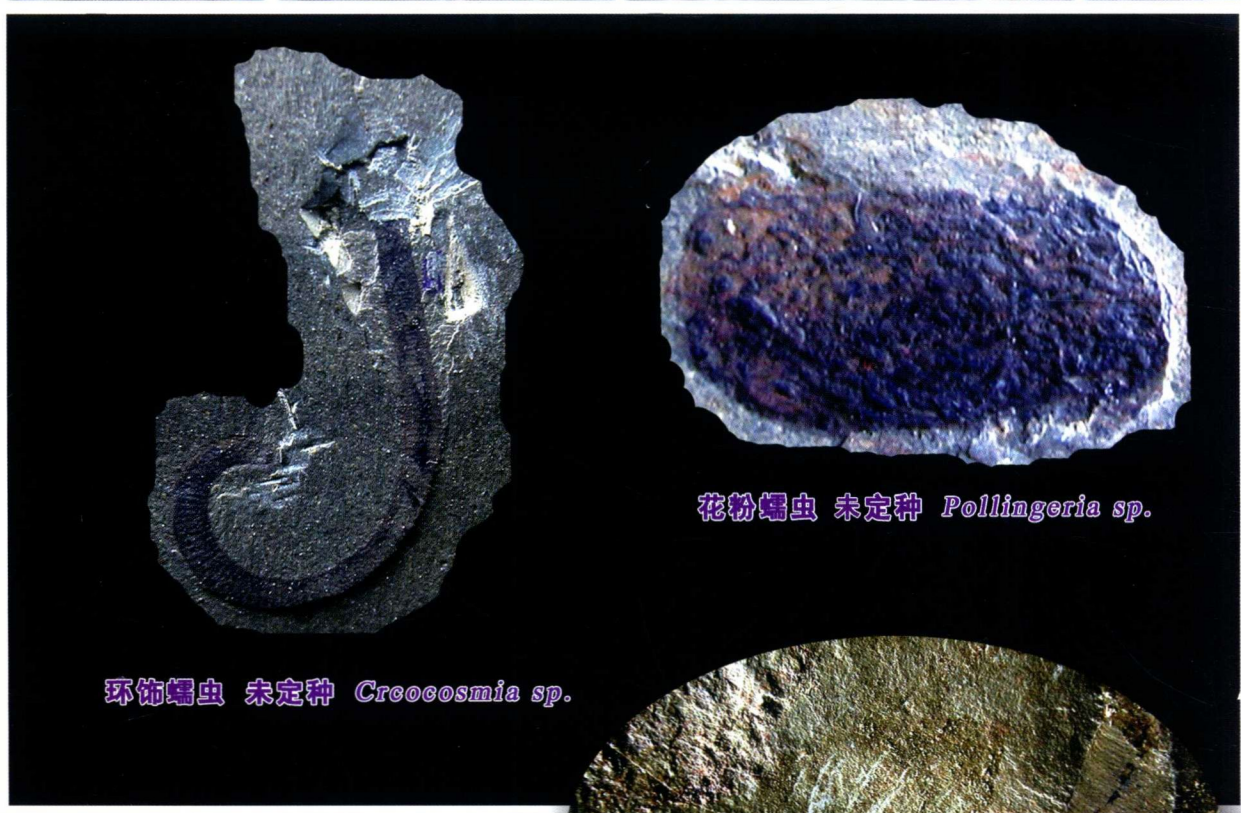
台江楔叶虫
Sphenothallus taijiangensis

MORPHOLOGY OF EARLY LIFE—500 MILLION YEARS AGO

蠕形动物 Worms

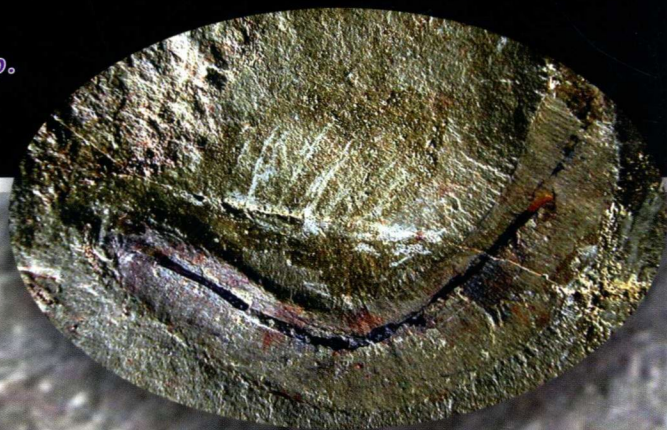


奥托亚虫 未定种 *Ottoia. sp.*



环饰蠕虫 未定种 *Creocosmia sp.*

花粉蠕虫 未定种 *Pollingeria sp.*



奥托亚虫 未定种 见明显的消化腔 *Ottoia.sp.*

叶足动物 *Lobopodia*

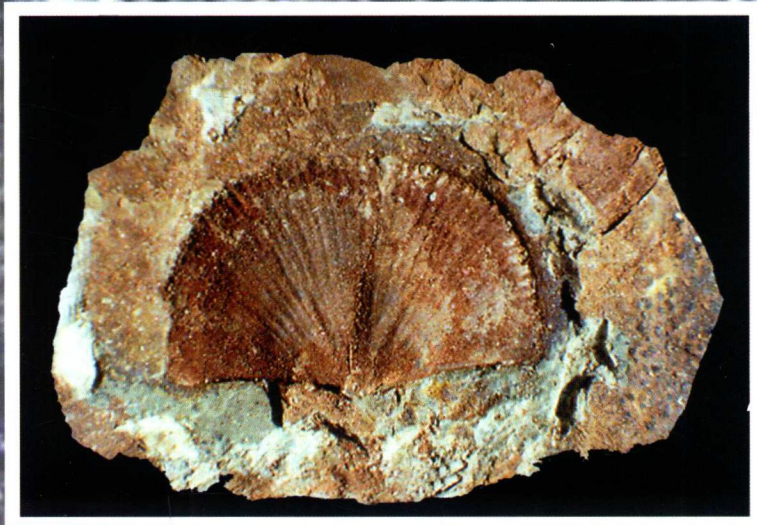


微网虫

Microdictyon sp



腕足动物 *Brachiopoda*



喀图金艾苏贝

Nisusia katujensis

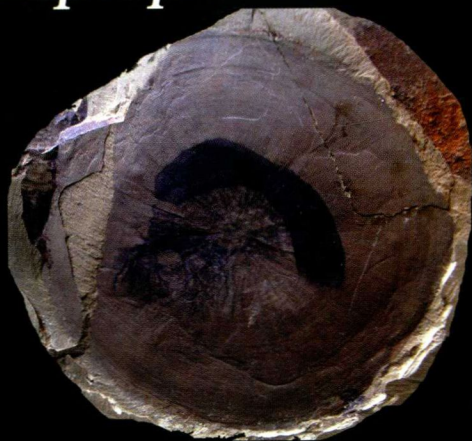
波希米亚正形贝

Glyptacrothele bohemia



MORPHOLOGY OF EARLY LIFE—500 MILLION YEARS AGO

触手动物 *Lophophorates*



贵州拟轮盘水母
Rotadiscus (Paraorotadiscus)
guizhouensis



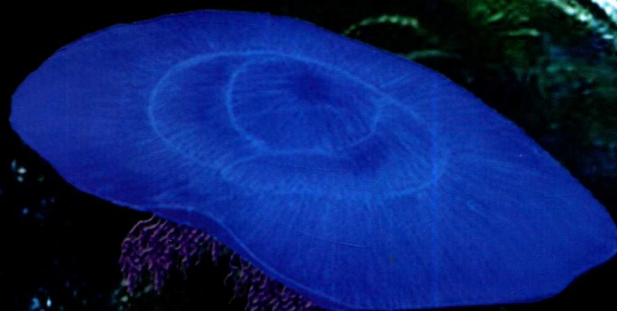
贵州拟轮盘水母群生状态
Rotadiscus (Paraorotadiscus)
guizhouensis



贵州拟轮盘水母
Rotadiscus (Paraorotadiscus)
guizhouensis



贵州拟轮盘水母
Rotadiscus (Paraorotadiscus) *guizhouensis*



贵州拟轮盘水母复原图
Reconstruction of *Parorotadiscus guizhouensis*



贵州拟轮盘水母（触手）
Rotadiscus (Paraorotadiscus) *guizhouensis*

软体动物 Mollusca



复原图 Reconstruction map

具肌痕脊状单臂螺 *Haplophrentis carinatus*



脊状单臂螺 未定种
Haplophrentis sp



丰满线带螺
Linevitus opimus



台江拉氏螺 *Latouchella taijiangensis*