

辽宁古生物化石珍品



FOSSIL TREASURES FROM LIAONING

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主 编 吴启成

Chief Editor Wu Qicheng

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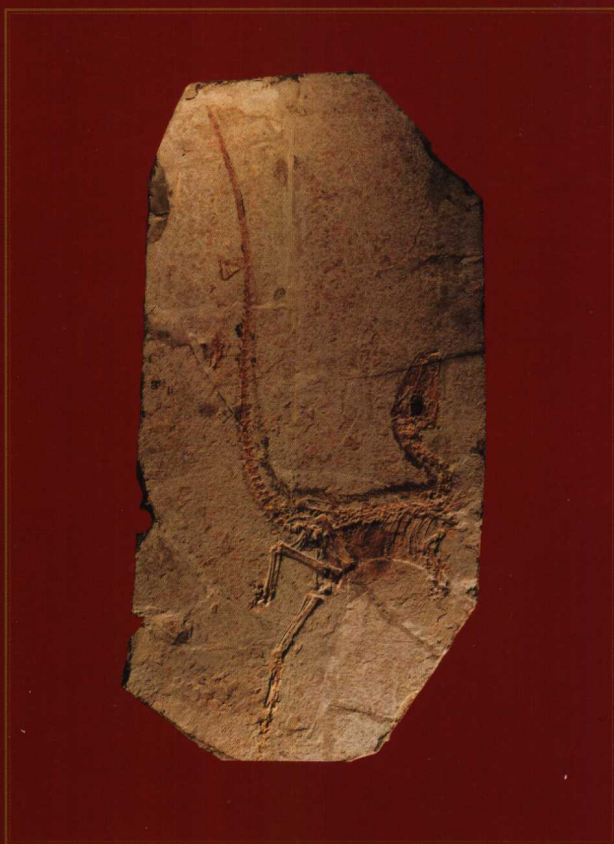
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内 容 提 要

辽宁省境内地层中蕴藏着丰富的古生物化石,尤以辽西热河生物群化石为著,其门类的齐全性、标本的珍奇性、保存的完好程度令很多国内外学者叹为观止,称辽宁为世界古生物化石的宝库。本书从这个化石宝库中精心选录了100种化石,其中古动物化石78种,古植物化石22种。书中刊有化石图片,并附以中英文简要说明。图片多为古生物学家研究与鉴定过的正型标本照片,比较逼真地反映了化石标本的原貌,有较高的收藏价值。文字说明中介绍了化石的学名、产地、产出地层及时代,并从化石外形特征、鉴定特征、生活习性等方面进行了简要描述。本书可供地史、古生物、地质等专业人员、大中专院校师生,以及化石爱好者研究参考与收藏。让更多的人了解辽宁地质历史,让更多的人认识辽宁地层的研究价值,共同揭示地球生命演化之谜。

ABSTRACT

Liaoning Province is famous for producing abundant fossils, especially those from the Jehol Biota, which includes many internationally known, rare, and excellently preserved taxa of extraordinary diversity. Liaoning has recently won the reputation of treasure house of fossils. In this book, 100 representative species of fossils are carefully selected from Liaoning, comprising 78 animals and 22 plants. The pictures are followed by both Chinese and English brief explanations. All pictures are collected from those already published by paleontologists. These pictures basically reflect the original features of the specimens; therefore, it is highly recommended for collection. In the brief explanations of the fossils, we have provided information about the scientific name, locality, horizon, age, morphology, diagnosis and even reconstruction of the habits of the fossil. This book should be interesting for such readers as geologists, paleontologists, college teachers, and all who are interested in fossils. We hope this book will stimulate the interest of more people in studying the geological history of Liaoning, appreciating the value of the deposits in Liaoning, and further exploring the mysterious evolution of earth life.

辽宁古生物化石珍品

闻世震题



辽宁——世界古生物化石的宝库

位于中华人民共和国东北地区的辽宁省，地层发育比较齐全，各断代地层中赋存着丰富的古生物化石，尤其中生代陆相地层是中国以及世界上典型发育地区之一，以赋存热河生物群而闻名于世。近些年来，在辽宁省西部地区晚中生代热河群中，挖掘出的带羽毛恐龙化石、古鸟类化石及早期被子植物化石，为研究鸟类和被子植物的起源与早期演化，提供了重要的科学依据，引起了全世界古生物学家的普遍关注。很多来访者都为其化石门类之齐全，保存之完美，研究价值之重大而赞叹不已，称辽宁为世界级古生物化石宝库。

在漫长的地质时期，辽宁大地与亚洲东部区一样，经历了多次陆壳抬升与沉降、海进与海退、岩浆的侵入与喷发。这些地质经历与事件，都被我们现在所看到的岩层与岩性、岩石结构与构造，以及赋存其中的古生物化石记录下来。应该说，地层中广泛分布的古生物化石是最精美的文字、最生动的语言，它记录和凝固了生命进化过程和各个地史时期的渐变和突变的各种地质事件，为我们今天科学研究提供了珍贵的物证。

中生代后期，当世界广大区域还是海水茫茫的时候，辽宁所在的亚洲东部区，已抬升为陆，并被广阔的淡水水域覆盖。在这块陆地上，分布着大量的呈北东向延伸的互相隔离的湖泊。气候由干旱—半干旱转向湿润，生物繁茂。苏铁类、银杏类和松柏类等高大的裸子植物耸天蔽日，蕨类等植物漫山遍野。这时高等的显花植物——被子植物开始出现，并迅速蔓延。在广阔的陆地上，遍布了真正的鲜花和硕果。所有这一切，为鱼类、两栖动物、爬行动物、鸟类、哺乳动物的生息繁衍创造了适宜的生存空间，形成了一个种类与数量可观的生物群体。这些生物在纵向发展、种系代谢的同时，也在横向发展并进行生态交替。它们在互相依存的生物链中，为适应环境和盘踞领地互相争斗着，谱写了多少部令人难以破译的生灵演义巨卷！

在这个地史时期，地壳运动加剧。著名的燕山运动是自显生宙以来较为强烈的一次地壳运动，导致区域构造运动频繁并伴有岩浆活动。长时间间歇式的火山喷发，大量的火山灰遮天蔽日，各种有毒气体弥漫空间，造成局部气候与环境恶化。营不同生活方式的生物相继大批死亡，并有很多生物被迅速掩埋，形成了今天我们所见到的、保存非常精美的化石。致使生物群的原始生态信息被完整地保存下来。就目前挖掘统计，仅辽西热河生物群古生物化石就有20余门类，主要包括苏铁类、银杏类、松柏类和蕨类植物，以及双壳类、腹足类、昆虫类、两栖类、爬行类、鱼类、鸟类和原始哺乳动物等。无论是从数量还是从化石种类上，都已远远超过以始祖鸟而著名的德国巴伐利亚索仑霍芬 (Solnhofen)。

在这个化石宝库中，动物化石丰富，仅鸟类就有17属21个种，数量超过1000件。各种古脊椎动物近于原位埋藏，保存完好，形态逼真。除骨骼等硬体部分完整保存外，相当多的化石还较完整地保存了包括羽毛在内的皮肤印痕、胃脏残余物和其他软体组织，为生物的进化及环境研究提供了宝贵的资料。尤其是近年来6属7种与鸟类关系密切的带羽毛恐龙的发现，使很多的专家学者卷入“龙”、“鸟”之争，开始了鸟类起源问题新一轮讨论。

在这个化石宝库中,与早期鸟类及带羽毛恐龙同层产出的古植物化石门类繁多。目前,已报道的就有56个属88个种,新属新种还在不断地发现。辽宁古果等化石的发现,不仅对被子植物起源这个重大的理论问题研究有着重要的价值,更重要的是填补了我国晚侏罗世植物群研究的空白。

热河生物群,是20世纪20年代,由美国学者葛利普(A.W.Grabau)针对辽宁西部(当时属热河省)含狼鳍鱼化石岩系中的化石群落而提出来的,后被沿用。20世纪40~60年代,还称热河生物群是以东方叶肢介-三尾拟蜉蝣-狼鳍鱼为代表的化石群。近年来,由于带羽毛的兽脚类恐龙、古鸟类,以及原始哺乳动物的发现,极大地丰富了热河生物群的内容,为鸟类起源和早期演化、被子植物起源与演化等重大生物进化问题的研究,以及辽西地区古地理、古气候的研究,揭开了新的一页。

由于辽西属于互相隔离的断陷盆地,地层对比困难。多年来,义县组的时代归属问题,为地质界争论不已,一云属晚侏罗世,一云属早白垩世,亦云晚侏罗世-早白垩世过渡层。本书化石产出时代的标注,采用第三种说法。应该说,在诸多地层研究方法中,古生物法是比较有说服力的。不用多久,随辽西古生物化石研究的深入,义县组的地质年代问题必将水落石出。

在这个世界级化石宝库中,生物群呈水、陆、空爆发性辐射演化,不同类群和同一类群中原始和进步的种类共生。加强这一生物群系的深入研究,对解开生物进化的若干难题,如被子植物和鸟类的起源、兽类的起源、访花昆虫与显花植物的协同演化等,有着十分重要的意义。而对这一生物群的发生、发展,灭绝、复苏和辐射,与古地理、古气候,以及与火山频繁喷发制约关系的深入研究,必将为进一步揭示东亚中生代晚期以来的环境变化规律,提供宝贵的科学依据。为此,中国科学院将辽西“热河生物群综合研究”列为“九五”计划期间的重大科研课题(1997~2000年)。国家自然科学基金委员会也将“热河生物群的演化与环境演变研究”立为“九五”重点科研课题(1999~2002年)。

辽西,仅为辽宁古生物地层中的一朵奇葩,在辽宁东部的本溪、抚顺等地亦盛藏古生物化石。尤其是抚顺,赋存在琥珀中的各种精美的昆虫化石,晶莹剔透、栩栩如生,可堪称一绝。

本书收录了100块精美的化石标本,包括古植物和古脊椎与无脊椎动物,涵盖了辽宁中生代生物面貌,但重点是对辽宁西部热河生物群的展示。所谓珍品,是从化石的完整性、观赏性、珍奇性和科学研究价值等方面考虑的。随着时间的推移,挖掘与研究的深入,还会有更多的古生物化石珍品问世。

愿本书能够成为各界人士了解辽宁的一个窗口,为有志于古环境、古生态、古气候、古生物研究的专家学者提供一点信息。同时,也奉献给乐于此业的收藏者。



辽宁省国土资源厅 厅长
辽宁省古生物化石鉴定委员会 主任委员

WORLD-CLASS TREASURE HOUSE OF FOSSILS FROM LIAONING

Liaoning Province is located in the northeast part of the People's Republic of China. It has preserved comprehensive deposits of long geological history, with rich fossils. Western Liaoning area is one of the most typical areas in the world, with well-developed continental Mesozoic sediments. Most notable fossils from Liaoning are from the terrestrial Yixian Formation in western Liaoning Province, where feathered dinosaurs, primitive birds and early angiosperms have been discovered, providing important evidence for the study of the origin and early evolution of birds and flowered plants. These discoveries have attracted paleontologists from all over the world. Many of the visitors are astonished by the superb preservation and the scientific value of the comprehensive fossils from Liaoning, a world-class treasure house of fossils.

During the long geological history, Liaoning has experienced a number of ascending and descending of the crust, transgression and regressions of sea, and eruptions of volcanic rocks. These geological events have been recorded in the strata that comprise both fossils and tectonic structures. Admittedly, the fossils represent the most vivid and beautiful language that can tell us a lot about the biological evolution and geological changes, and become the most valued evidence for scientific research today.

In the late Mesozoic when majority of the world was under the water, East Asia including Liaoning was covered by land and vast fresh water. Most of the lakes were isolated and distributed in northeastward direction. The climate varied from arid or semiarid to humid. Tall trees of cycads, ginkgoes, and conifers were common at that time. There were also abundant ferns on the ground. The early forms of flowered plants had also appeared and became progressively important in the paleoflora. Flowers and fruits decorated the ancient lands. All these created an ideal environment for the flourishing of fishes, amphibians, reptiles, birds and mammals, which formed a distinct fauna of considerable extent. While evolving in their own direction, these forms also expanded geographically. Ancient animals and plants competed for space and food; they also lived harmoniously in one ecosystem, in which the drama of life evolution was produced and remains to be seen by us today. During that geological time, the movement of the crust was frequent as a result of the famous Yanshan Movement, resulting in long lasting and intermittent volcanic eruptions. Poisonous gases filled the sky, causing the deteriorating microenvironment. Various lives were killed and quickly buried and became the beautifully preserved fossils that were exposed to our eyes today. Many of the original state of the biota have been completely preserved. Up to now, more than 20 major groups of fossils have been recovered including cycades, ginkgoes, conifers, ferns, bivalves, gastropods, insects, amphibians, reptiles, birds and primitive mammals. The Jehol Biota exceeds the famous *Archaeopteryx*-bearing Solnhofen assemblages in terms of both amount of specimens and diversity of taxa.

In this treasure house, animal fossils are also very rich. There are more than 17 genera and 21 species of birds, and the number of specimen totals more than 1000. Various vertebrate fossils were buried vividly in their original posture. In addition to the skeleton, feathers and other soft parts of the body such as skin impressions, stomach contents were often well preserved, providing important information for the study of the evolution and paleoenvironments. It is noteworthy that the discovery of 6 genera and 7 species of feathered dinosaurs has heated the discussion on the origin of birds.

In the treasure house of fossils in Liaoning, plant fossils associated with early birds and feathered dinosaurs are abundant. At least 56 genera and 88 species have been reported, and new species are being discovered and studied. The discovery of *Archaeofructus* has not only shed new light on the study of the origin of angiosperms but also filled the gap in the study of paleoflora in the Late Jurassic of China.

The study of the Jehol Biota dates back to the 20s of last century. American geologist Amadeus William Grabau first proposed the use of the Jehol Biota based on his studies on the *Lycoptera*-bearing sediments in western Liaoning. During the 40s-60s of last century, it was often called *middendorffii-Ephemeropsis-Lycoptera* Assemblage. Recently, with the discovery of feathered theropods, primitive birds and mammals, the contents of the Jehol Biota have been greatly enriched. And these fossils have contributed a lot to our understanding of many of the important evolutionary issues, such as the origin and early evolution of birds, angiosperms as well as the paleogeography and paleoenvironments.

Because the western Liaoning areas comprised mostly isolated faulting basins the correlation of sediments in different areas is often difficult. Recently, the age of the Yixian Formation has been a hotly debated issue. It has been referred to the Late Jurassic, Early Cretaceous or Late Jurassic-Early Cretaceous according to different authors. Obviously in this book we are not able to solve this controversy. Admittedly, in the study of the stratigraphy, the method of biostratigraphy is more convincing. We believe that with the further studies of the fossils in the Liaoning area, the debate on the age of the Yixian Formation will finally be settled.

In this world-class treasure house of fossils, ancient lives are explosively differentiated and radiated into the water, ground and the air. Various groups of lives or advanced types and more primitive forms of the same group coexisted. More in-depth studies of the Jehol Biota will help decipher many of the biological mysteries such as the origins of angiosperms, birds and mammals, and the co-evolution of flowered plants and pollinating insects. The study of the origin, development, extinction, recovery and radiation of the Jehol Biota as well as its relationship with the paleogeography, paleoclimate, and the frequent volcanic activities will provide important evidence for elucidating the environmental changes of East Asia since the late Mesozoic. For these purposes, the Chinese Academy of Sciences has included the project "The comprehensive studies of the Jehol Biota" (1997-2000) in the Major Research Projects during the "95" Period. The National Natural Science Foundation of China also awarded a "95" major project "The evolution of the Jehol Biota and the environmental changes" (1999-2002) for study of the Jehol Biota in Liaoning. Undoubtedly, Liaoning has become the focus of paleontological studies.

Western Liaoning is, however, not the only area in Liaoning with rich fossils. In Benxi and Fushun in eastern Liaoning, beautiful fossils have also been discovered. For instance, in Fushun, many of the insects preserved in the ambers are transparent and vivid, forming a unique part of the treasure house of fossils in Liaoning Province.

One hundred beautiful fossils have been selected in this book, which include both fossil plants, invertebrate and vertebrate animals. They represent the biological history of various stages in Liaoning although the focus is on the Jehol Biota in western Liaoning areas. These fossils are called treasures or rare fossils because of their completeness, beauty, rareness and scientific values. We are certain that in the near future more and more precious fossils will be uncovered.

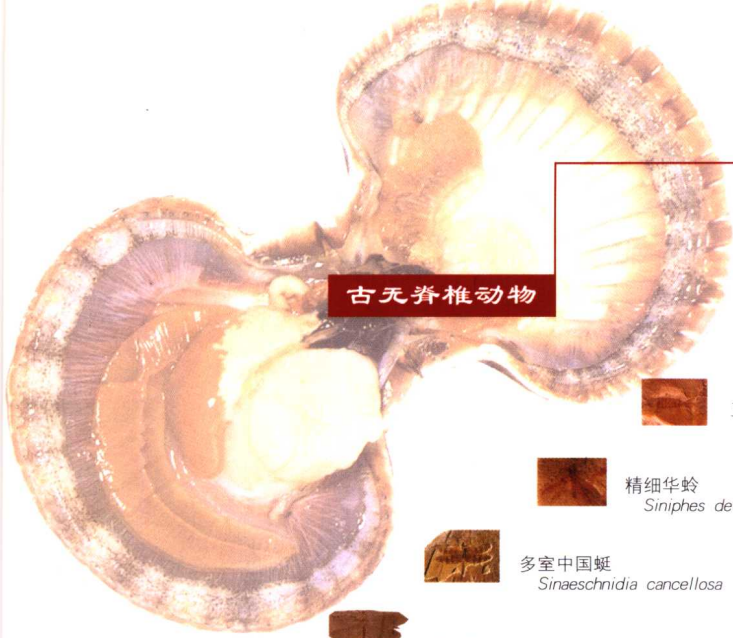
It is our hope that this book will open a small window for people of all walks of life to view and be acquainted with Liaoning, and provide information for experts and scholars in the study of paleoenvironment, paleoecology, paleoclimate, and paleontology. In the meanwhile, this book is also dedicated to devotional collectors of fossils.



Head of Land & Resources Department of Liaoning Province

Head of Fossil Appraisal Committee of Liaoning Province

古无脊椎动物



卵形东方叶肢介
Eosestheria ovata

10

凌源额尔古纳蚌
Arguniella lingyuanensis

11

四节辽宁洞虾
Liaoningogriphus quadripartitus

12

奇异环足虾
Cricoidoscelosus aethus

13

三尾拟蜉蝣
Ephemeropsis trisetalis

14

精细华蛉
Siniphes delicates

15

多室中国蜓
Sinaeschnidia cancellosa

16

沼泽野蜓
Rudiaeschna limnobia

17

义县光箭蜓
Liozomphus yixianensis

18

奇异神修
Hagiphama paradoxa

19

北票辽蝉
Liaocossus beipiaoensis

20

胡氏辽蝉
Liaocossus hui

21

疹状花格蝉
Anthoscytina aphthosa

22

穹脉西伯利亚蛇蛉
Sibooptera fornicata

23

舌状丽蛇蛉
Caloraphidia glossphylla

24

优美西伯利亚蚊蝎蛉
Sibiribittacus atalus

25

多脉聪蛉
Sophogramma plecophlebia

26

美丽花网翅虻
Flarinemestrius pulcherrimus

28

大型原棘虻
Protapiocera megista

29

丽卡拉套蠊
Karatavolvblattia formosa

30

长肢裂尾甲
Coptooclava longidopa

31

短脉优鸣螽
Habrohagla curtivenata

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长背鳍燕鲟
Yanosteus longidorsalis

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潘氏北票鲟
Peipiaosteus pani

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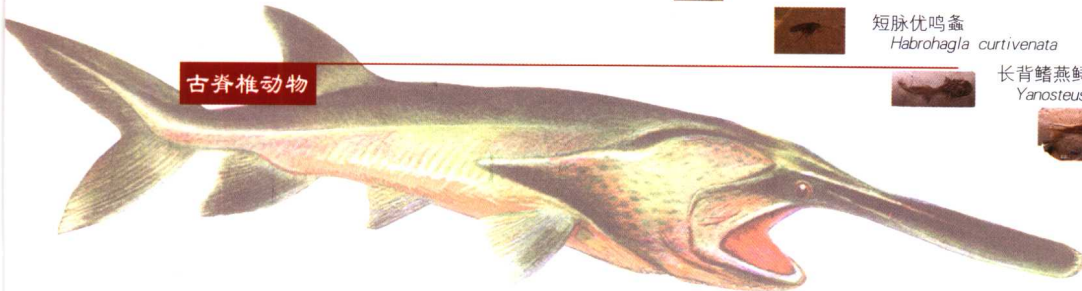
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Protopsephurus liui

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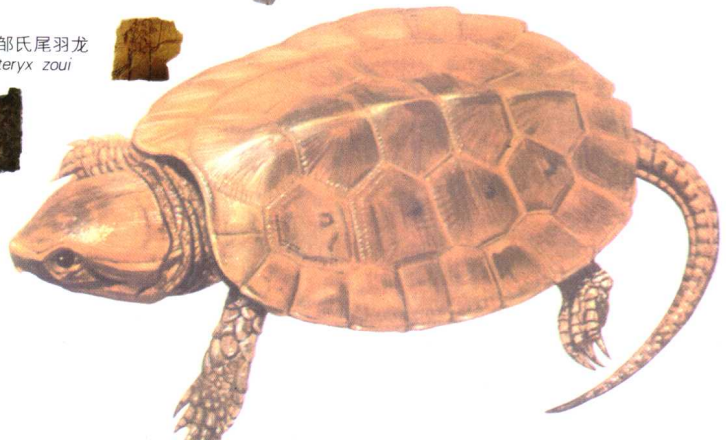
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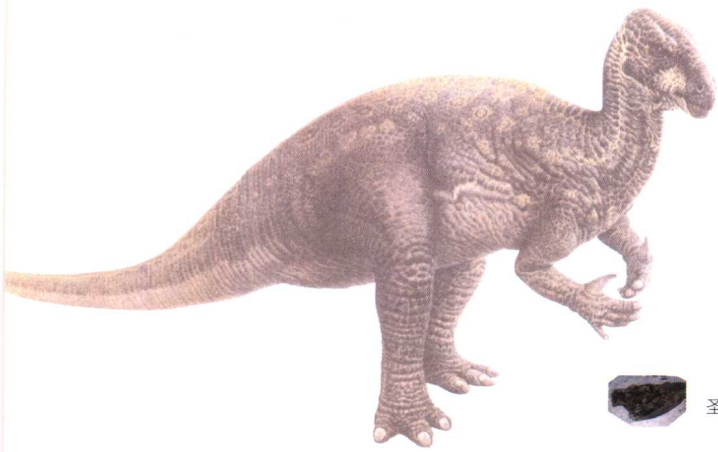




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- 49 长趾大凌河龙 *Dalinghesaurus longidigitus* 
- 50 凌源潜龙 *Hyphalosaurus lingyuanensis* 
- 51 楔齿满洲鳄 *Monjurosuchus splendens* 
- 52 杨氏东方翼龙 *Eosipterus yangi* 
- 53 秀丽郝氏翼龙 *Haopterus gracilis* 
- 54 梅勒营子鹦鹉嘴龙 *Psittacosaurus meileyingensis* 
- 56 杨氏朝阳龙 *Chaoyangsaurus yangi* 
- 57 上园热河龙 *Jeholosaurus shangyuanensis* 
- 58 杨氏锦州龙 *Jinzhouosaurus yangi* 
- 60 原始中华龙鸟 *Sinosauropteryx prima* 
- 62 邹氏尾羽龙 *Caudipteryx zoui* 
- 64 董氏尾羽龙 *Caudipteryx dongi* 
- 65 意外北票龙 *Beipiaosaurus inexpectus* 
- 66 粗壮原始祖鸟 *Protarchaeopteryx robusta* 
- 68 千禧中国鸟龙 *Sinornithosaurus millenii* 





恐龙蛋
Dinosaur egg

72



驰龙 (属种未定)
Dromaeosauridae Gen et sp indet.

71



赵氏小盗龙
Microaptor zhaoianus

70



张北足印
Changpeipus sp.

73



圣贤孔子鸟
Confuciusornis sanctus

74



川州孔子鸟
Confuciusornis chuanzhous

77



孙氏孔子鸟
Confuciusornis suniae

78



杜氏孔子鸟
Confuciusornis dui

80



横道子长城鸟
Changchengornis hengdaoziensis

82



义县锦州鸟
Jinzhournis yixianensis

83



张吉营锦州鸟
Jinzhournis zhangjiyingia

84



娇小辽西鸟
Liaoxiornis delicata

85



步氏始反鸟
Eoenantiornis buhleri

87



燕都华夏鸟
Cathayornis yandica

89



有尾华夏鸟
Cathayornis caudatus

90



异常华夏鸟
Cathayornis aberrans

92



朝阳长翼鸟
Longipteryx chaoyangensis

93



三塔中国鸟
Sinornis santensis

95



郑氏波罗赤鸟
Boluochia zhengi

96



六齿大嘴鸟
Largirostrornis sexdentornis

98



侯氏尖嘴鸟
Cuspirostrisornis houi

99



三燕龙城鸟
Longchengornis sanyanensis

100



长趾辽宁鸟
Liaoningornis longiditus

102



北山朝阳鸟
Chaoyangia beishanensis

103



马氏燕鸟
Yanornis martini

104





105 葛氏义县鸟
Yixianornis grabaui



106 五尖张和兽
Zhangheotherium quinquecuspidens



107 *Jeholodens jenkinsi*



109 卡勒莱新芦木
Neocalamites carrerei



110 长鞘似木贼
Epuisetites longevaginatus



111 蛇不歹豪土曼蕨
Hausmannia shebudaiensis



112 细齿似托第蕨
Todites denticulata



113 热河似阴地蕨
Botrychites reheensis



114 凌源似苏铁
Cycadites lingyuanensis



115 尖齿特尔马叶
Tyrmia acrodonta



116 不等裂热河似查米亚
Rehezamites anisolobus



117 美丽威廉姆逊
Williamsonia bella



118 中华薄果穗
Leptostrobus sinensis



119 坚直茨康叶
Cekanowskia rigida



121 薄氏辽宁枝
Liaoningocladus boii



122 密叶松型枝
Pityocladus densifolius



123 热河裂鳞果
Schizolepis jeholensis



124 披针型林德勒枝
Lindleycladus lanceolatus



125 长穗短叶杉
Brachyphyllum longispicum



126 较小似南洋杉
Araucarites minor



127 热河似罗汉松
Podocarpites reheensis



128 陈氏似麻黄
Ephedrites chenii



129 优美古尔万果
Gurvanella exquisita



130 辽宁古果
Archaeofructus liaoningensis



131 强刺北票果
Beipiaoa spinosa



132 辽宁的木化石
Fossil woods from Liaoning



CONTENTS



古植物

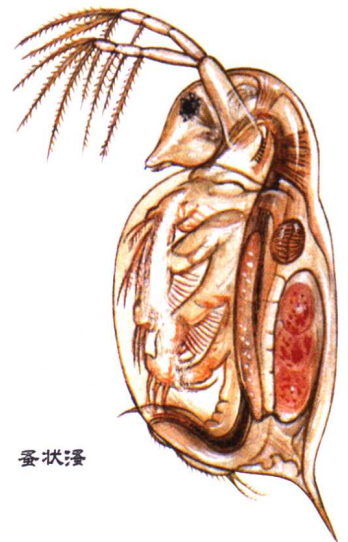
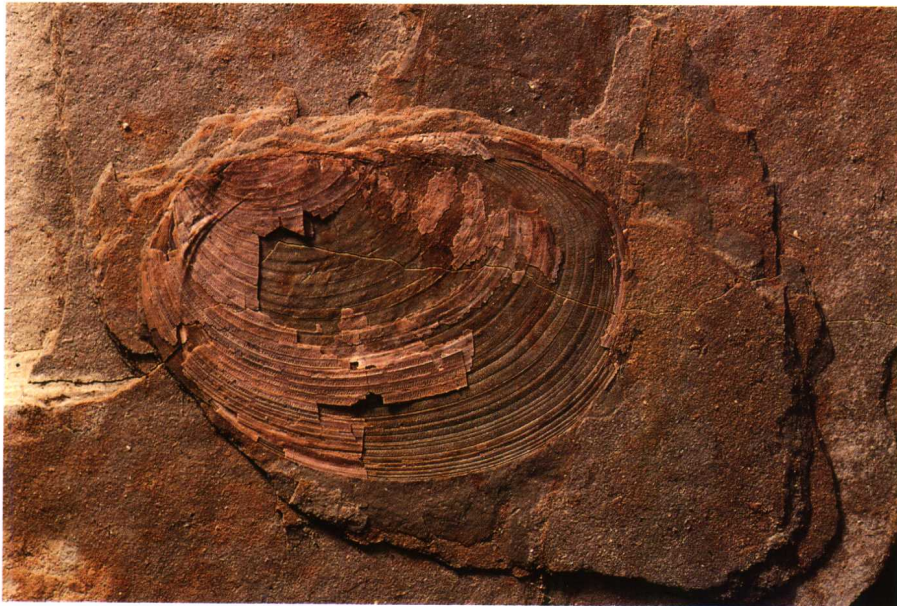
卵形东方叶肢介 *Eosestheria ovata* Chen, 1976

产地：中国辽宁省北票市上园镇四合屯
 时代及层位：晚侏罗—早白垩世义县组下部
 基本特征：为淡水小型节肢动物。壳瓣卵圆形—椭圆形，个体大，长17~21mm，高12~15mm。背缘直，壳顶位于基前端，前、后缘圆，腹缘向下拱曲，生长带比较宽，25~32条。壳瓣前腹部的生长带上具有比较大的网状装饰，形状不规则且上下拉长，向背部网孔变小，形状亦较规则；壳瓣后腹部生长带上具有较疏的细线装饰，间或夹有短线，有时并向上或向下分叉，常常歪曲，线脊之间的间距比较开阔。有着重要的地层对比意义。

Locality: Sihetun, Shangyuan, Beipiao City, Liaoning Province, China

Age and Horizon: Late Jurassic—Early Cretaceous, the lower part of Yixian Formation

Diagnosis: It is a miniature arthropoda living in fresh water, the valve is oblong, it is big, about 17 to 21mm long, 12 to 15mm high; with straight dorsal rim, umbo lies before the front end of radical, the edge of which is circle; venter rim arch downwardly; zone of growth is wide and the number of it is about 25 to 32, which dress the larger irregular retiform on preabdomen, but the little regular on dorsal; there are remote leptonema on zone of postabdomen, with some stubs in it; sometime it is furcated up or downwardly, and always distorted; the interval of each is wide. It is important for stratigraphic correlation.



蚤状溞