



中国地质调查成果
CGS 2016-020

地质出版社 编写
中国地质图书馆

热河生物群

J E H O L B I O T A

主 编 王 章 俊
Chief Editor Wang Zhangjun



地 质 出 版 社



中国地质调查“地质调查成果大众
化服务产品开发”项目资助

地质出版社 编写
中国地质图书馆

热河生物群

J E H O L B I O T A

主 编 王 章 俊
Chief Editor Wang Zhangjun

地质出版社
· 北 京 ·



图书在版编目 (CIP) 数据

热河生物群: 中英文对照画册 / 王章俊主编. -- 北京:
地质出版社, 2016.3

ISBN 978-7-116-09562-5

I. ①热… II. ①王… III. ①早白垩世-古生物-生物群-东亚-图集 IV. ①Q911.731-64

中国版本图书馆 CIP 数据核字 (2015) 第 300054 号

REHE SHENGWUQUN

责任编辑: 林建 朱晨光

责任校对: 田建茹

出版发行: 地质出版社

社址邮编: 北京海淀区学院路31号, 100083

电话: (010) 66554528 (发行部); (010) 66554577 (编辑室)

网址: <http://www.gph.com.cn>

传真: (010) 66554577

印刷: 北京顺诚彩色印刷有限公司

开本: 889mm × 1194mm $\frac{1}{16}$

印张: 17.5

字数: 100千字

版次: 2016年3月北京第1版

印次: 2016年3月北京第1次印刷

定价: 228.00元

书号: ISBN 978-7-116-09562-5

(如对本书有意见或建议, 敬请致电本社; 如本书有印装问题, 本社负责调换)

《热河生物群》

编委会

主 编：王章俊

副主编：姬书安 林 建

编 委：（以姓氏笔画排序）

任 东 朱晨光 祁向雷 何 蔓

郁秀荣 罗军燕 金 星 苗永胜

张立军 张 靓 郑少林

JEHOL BIOTA

Editorial Board

Chief Editor: Wang Zhangjun

Associate editors: Ji Shu-an Lin Jian

Editors: Ren Dong Zhu Chenguang Qi Xianglei He Man

Yu Xiurong Luo Junyan Jin Xing Miao Yongsheng

Zhang Lijun Zhang Liang Zheng Shaolin





前言

1.2亿年前的一扇窗

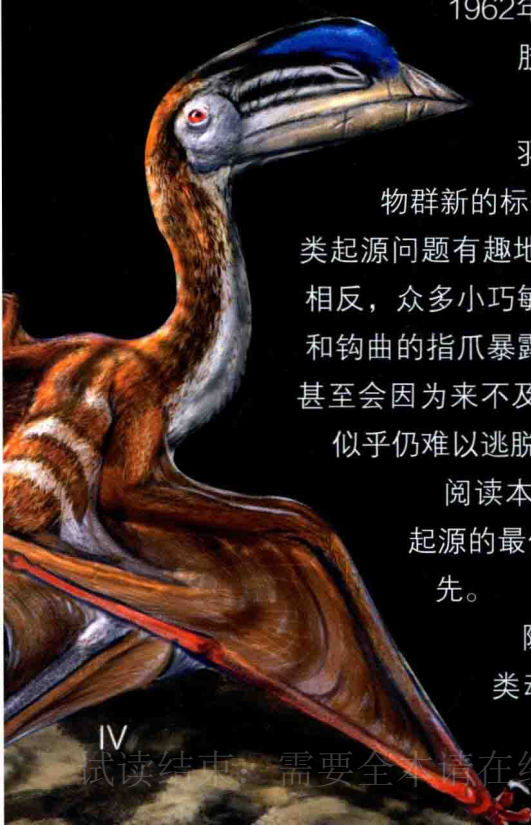
本画册所讲述的热河生物群（Jehol Biota）是生活在东亚地区1.35亿~1.12亿年前早白垩世的一个古老生物群，其分布范围包括了现今中国的东北部、蒙古、俄罗斯外贝加尔以及朝鲜半岛等国家和地区。如果对照地图，我们就会发现这个范围与地球的表面积相比其实非常小。那1.35亿~1.12亿年前的时限又是怎样一个概念呢？假如我们把地球46亿年的时间压缩成一天24小时的话，那么热河生物群出现的时间就是23点17分，在7分钟13秒后又悄悄离场。

尽管范围狭小、时间短暂，这一生物地理区系却留下了丰富多彩的古生物遗迹，使我们得以通过这个时空窗口了解到许多生物演化的奥秘。它同加拿大伯吉斯页岩及德国索伦霍芬灰岩一道，成为世界上最重要的古生物化石产地。

白垩纪生物的蕃息之地

1923年，葛利普（Grabau）在辽宁西部的凌源地区注意到叶肢介、狼鳍鱼以及一些双壳类生物的特殊组合特征，并在5年后命名了“热河动物群”。

1962年，中国学者顾知微将以狼鳍鱼—三尾类蜉蝣—东方叶肢介为代表的化石群通称为“热河生物群”。



时至今日，国内外古生物爱好者熟知的中华龙鸟、羽王龙、小盗龙、孔子鸟、热河鸟等，已经成为热河生物群新的标签，因为它们的发现将最迷人的恐龙和最让人困惑的鸟类起源问题有趣地联系起来。在这里，很少有大家印象中的恐龙形象，相反，众多小巧敏捷、身披羽毛的恐龙在当时的丛林中穿梭，满口利齿和钩曲的指爪暴露了它们作为掠食者的天性。飞行能力还欠发达的鸟儿甚至会因为来不及快速起飞而成为它们的餐点，而且它们在树上生活时似乎仍难以逃脱被恐龙撕咬的命运。

阅读本画册之后，读者就会发现热河生物群是一个重现鸟类起源的最佳场所，就会知道长着羽毛的恐龙其实是这些鸟类的祖先。

除此之外，生活在淡水中的还有众多的腹足类和双壳类动物，比起鱼和龟鳖，离龙无疑是当时水中的顶级捕

食者；生活在阴湿湖岸的蜥蜴也时常可以见到从水中探出脑袋的蟾和蝶螈；陆地上除了最为活跃的恐龙外，还有一些原始的哺乳动物，而后者绝不甘心于生活在前者的淫威之下；各种各样的翼龙盘旋在湖泊上方，以优美的滑翔姿势与鸟类共享一片蓝天。研究表明，这里可能是白垩纪翼龙的中心栖息地。在陆地、天空和湖泊中还生活着不可计数的昆虫，最早的被子植物也静静地生长在光照充足的浅水水域中。

我们不禁要问，热河生物群产地是如何在1.35亿~1.12亿年前为如此丰富的生物提供了绝佳的栖息地？它又是如何成为这些生物的葬身之所呢？

热河生物群的前世

三叠纪至早中侏罗世时期，辽西及华北地区处于西伯利亚板块和华北板块的汇聚地带。碰撞与挤压控制着当时的地理地貌格局，软化的岩石圈将大量的热释放出来，形成大规模的火山活动。到了中晚侏罗世—白垩纪，西伯利亚板块和华北板块最终拼贴完成，但板块运动并没有停止，因此在大陆内部形成了规模宏大的造山带。与此同时，西太平洋板块开始向欧亚板块俯冲，软化的岩石再度冲破地表，形成一次次强烈的火山爆发。早白垩世的热河生物群就是在这样的背景下产生的。

板块运动在造成火山喷发的同时，也在辽西地区形成了几个大的盆地。它们当时是一些淡水占据的湖泊，周围环绕着茂密的森林，构成了当时的主要景观。除此之外，高山、丘陵、沼泽等地貌分别孕育了不同的动植物群落。

然而，当时火山喷发频繁，这些湖泊也成为众多生物的葬身之所——

炽热的火山碎屑流从火山口喷涌出来，来不及逃跑的以恐龙为主的陆地生物被裹挟进来，它们中的少数则被赶进湖泊，无奈之下落入湖底；

随之而来的大量火山灰也铺天盖地落入湖泊，它们搅浑了湖水，致使一些水生生物死亡；

火山爆发在邻近地区产生高温，翼龙和鸟类纷纷向湖泊上方的低



温地区逃散，而它们最终也逃不过硫化氢等有毒气体的荼毒，死亡后直接掉进湖泊。

总之，这些沉入湖底的不幸儿，被湖泊中沉降的泥沙和落入湖泊的火山灰埋藏起来，从而形成了我们现今见到的热河生物群化石。有人将热河生物群称为“中生代的庞贝城”，这再形象不过了。

重返热河生物群

为了全面呈现出热河生物群的全貌，又不失之冗杂，我们选择的古生物物种往往具有较强的代表性。另外对于翼龙类、恐龙、鸟类及哺乳类这四类尤为重要的生物，我们进行了详尽的分类描述，使读者在阅读本画册的时候，对这些古生物的观察就能有更广阔的视角。

在编写形式上，我们设置了两大板块：第一板块是基本描述，对各门类生物进行简洁的概述，使读者对这一门类生物有个整体认识；第二板块是化石档案，主要展示各古生物化石照片和复原图。在第二板块中，我们穿插了一些分类描述、知识链接以及探索发现。知识链接给读者拓展一些古生物的有趣知识，探索发现则主要介绍一些有趣的研究成果。本画册的编写力求简单明了、科学有趣，行文谨慎地在专业与通俗之间展开。对于化石，我们多描述看得见的形态结构，将生物结构与功能之间的紧密联系呈现给读者。

我们更希望偶尔读到它的、对古生物不甚了解的读者也能喜欢这本画册并成为古生物爱好者的。

特别鸣谢

在本画册的编写过程中我们得到了中国地质科学院地质研究所、中国科学院南京地质古生物研究所、辽宁省化石资源保护管理局的大力支持与帮助，在此表示最真诚的谢意。画册中的一些图片采用自赵闯、邢立达以及Mick Ellison等人，还有的来自网站如wikimedia commons, www.rah-bop.com等。然而画册中还有部分图片因查无出处，我们无从标注，在此向这些图片的原作者表示感谢，并欢迎这些图片的作者与我们联系。

限于我们的知识和能力，画册难免会有不当甚至错误之处，恳请读者批评指正，我们将不胜感激。

编者

2015年11月15日





Preface

A glance at the Jehol Biota 120 million years ago

This album is about an ancient Jehol Biota living in East Asia 135-112 million years ago in the Early Cretaceous. The distribution ranges include the northeast of China, Mongolia, Transbaikalia of Russia and Korean peninsula, etc. It is noticed that the range of this area is so small compared to the earth's surface. And if we compress the 4.6 billion years of earth life into 24 hours a day, the Jehol Biota appeared at the point of 23:17, and it disappeared 7 minutes and 13 seconds later.

Although the range is narrow and the time is short, there also left a lot of fossils. And we can understand many mysteries of biological evolution through this glance. It is one of the most important fossil localities in the world, together with the Burgess shales of Canada and Solenhofen limestones of Germany.

A paradise for the Early Cretaceous organisms

In 1923, Grabau mentioned the special assemblage of fossils *Estheria-Lycoptera*, as well as some bivalves in western Liaoning Province, and he named Jehol Fauna five years later. In 1962, the Chinese scholar Zhiwei Gu named the fossil groups as Jehol Biota with the representatives of *Lycoptera-Ephemeropsis trisetalis-Eosestheria*.

Today, the well-known fossil animals such as *Sinosauropteryx*, *Yutyrannus*, *Microraptor*, *Confuciusornis* and *Jeholornis*, have become the new labels of Jehol Biota. These findings connect fascinating dinosaurs with puzzling avian origin. There were many small and agile dinosaurs covered with feathers shuttling in the jungle, while their toothed mouths and hooked claws exposed them as predators. The birds with weak flying ability became the meals of dinosaurs because the birds could not take off quickly. Besides, they lived on trees and hardly to escape from the fate of eating by dinosaurs.

After reading this album, the readers will find Jehol Biota is an amazing place, where you can reproduce the origin of birds and realize that the dinosaurs are the ancestors of birds.

There were many animals lived in the fresh water, such as numerous gastropods, bivalves, fishes and turtles, while the choristoderes were the top predators. There were lizards lived along the shores, while toads and salamanders appeared from the water.

On land, except the most active dinosaurs, there were some primitive mammals and they never gave up to dinosaurs. A variety of pterosaurs hovering above the lake, shared the same sky in graceful glide postures with birds. Researches show that there could be the habitat for Cretaceous pterosaurs. There were also a large amount insects living everywhere, while the earliest angiosperms were growing in the shallow waters full of sunshine.

We just wonder what is the reason for the prosperity for so many species originate 135 million ~ 112 million years ago? And how does it become the burial place for these creatures?

The forming background of the Jehol Biota

The Triassic-Early, Middle Jurassic period, western Liaoning Province and North China were in the converges between Siberia plate and North China plate. The collision and extrusion influenced the geographical features of that time. The softening lithosphere released a lot of heat from the formation of large-scale volcanic activities. In the Middle to Late Jurassic and Cretaceous, Siberian plate and North China plate finally stuck, while the interior of the continents formed a large-scale orogenic belt. At the same time, the Western Pacific plate subducted to the Eurasian plate, the softening rocks break out again, forming strong volcanic eruptions. The Jehol Biota was born under the background of these conditions in the Early Cretaceous.

Plate movements resulted in volcanic eruptions and formed several large basins in the western Liaoning Province at the same time. They were fresh-water lakes surrounded by thick forests, which constitute the main landscape of that time. In addition, the mountains, hills, and other landforms had been the habitats of many different animals and plants.

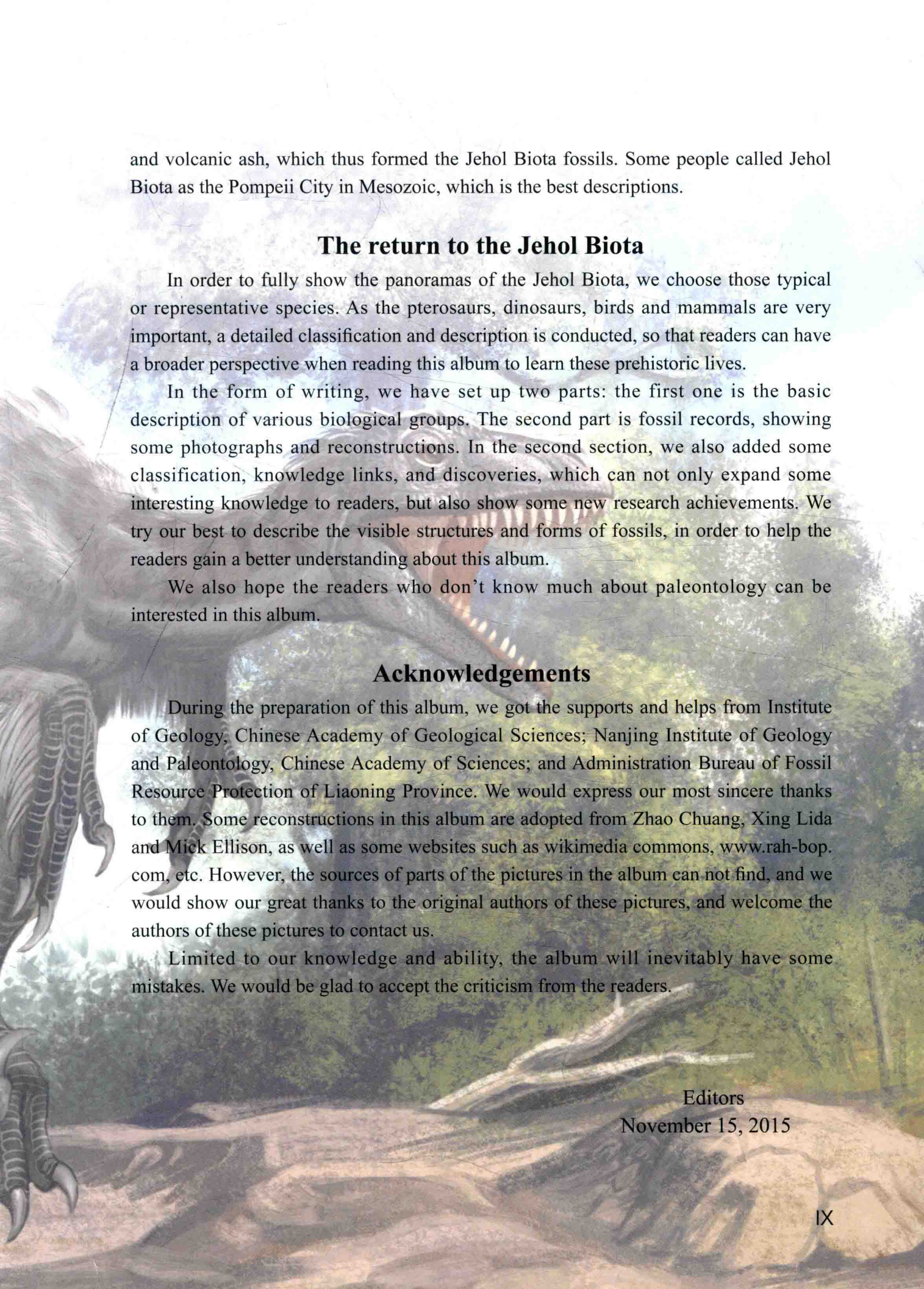
However, when the volcanoes erupted frequently, these lakes became the burial places for these creatures.

Hot pyroclastic flows spewed out from the volcanoes and the dinosaurs as well as other animals who were unable to escape were coerced to be buried, while some were driven into the lakes, falling into the bottom of the lakes.

The overwhelming volcanic ash fell into the lakes and the lakes became muddy and caused the death of some aquatic life.

Volcanic eruptions produced high temperature in the neighborhood, so the pterosaurs and birds fled to the areas above the lakes with low-temperature. However, they ultimately could do nothing but breathed hydrogen sulfide and other toxic gases. Finally they died and fell into the lakes.

In short, these deaths sank to the bottom of the lakes and buried by the sediments



and volcanic ash, which thus formed the Jehol Biota fossils. Some people called Jehol Biota as the Pompeii City in Mesozoic, which is the best descriptions.

The return to the Jehol Biota

In order to fully show the panoramas of the Jehol Biota, we choose those typical or representative species. As the pterosaurs, dinosaurs, birds and mammals are very important, a detailed classification and description is conducted, so that readers can have a broader perspective when reading this album to learn these prehistoric lives.

In the form of writing, we have set up two parts: the first one is the basic description of various biological groups. The second part is fossil records, showing some photographs and reconstructions. In the second section, we also added some classification, knowledge links, and discoveries, which can not only expand some interesting knowledge to readers, but also show some new research achievements. We try our best to describe the visible structures and forms of fossils, in order to help the readers gain a better understanding about this album.

We also hope the readers who don't know much about paleontology can be interested in this album.

Acknowledgements

During the preparation of this album, we got the supports and helps from Institute of Geology, Chinese Academy of Geological Sciences; Nanjing Institute of Geology and Paleontology, Chinese Academy of Sciences; and Administration Bureau of Fossil Resource Protection of Liaoning Province. We would express our most sincere thanks to them. Some reconstructions in this album are adopted from Zhao Chuang, Xing Lida and Mick Ellison, as well as some websites such as wikimedia commons, www.rah-bop.com, etc. However, the sources of parts of the pictures in the album can not find, and we would show our great thanks to the original authors of these pictures, and welcome the authors of these pictures to contact us.

Limited to our knowledge and ability, the album will inevitably have some mistakes. We would be glad to accept the criticism from the readers.

Editors
November 15, 2015



JEHOL BIOTA **热河** 生物群

无脊椎动物 Invertebrates

腹足类

Gastropods

双壳类

Bivalves

叶肢介

Estherians

介形类

Ostracods

小龙虾及洞虾

Crayfishes and Spellaeogriphacea

昆虫

Insects

目 录

前言

无脊椎动物 1

腹足类.....	2
双壳类.....	8
叶肢介.....	12
介形类.....	16
小龙虾及洞虾.....	18
昆虫.....	22

脊椎动物 43

无颌类及鱼类.....	44
两栖类.....	56
龟鳖类.....	62
离龙类.....	66
有鳞类.....	78
翼龙类.....	84
恐龙.....	118
鸟类.....	186
哺乳类.....	224

植物 251



Contents

Preface

Invertebrates 1

Gastropods	2
Bivalves.....	8
Estherians.....	12
Ostracods.....	16
Crayfishes and Spellaeogriphacea.....	18
Insects	22

Vertebrates 43

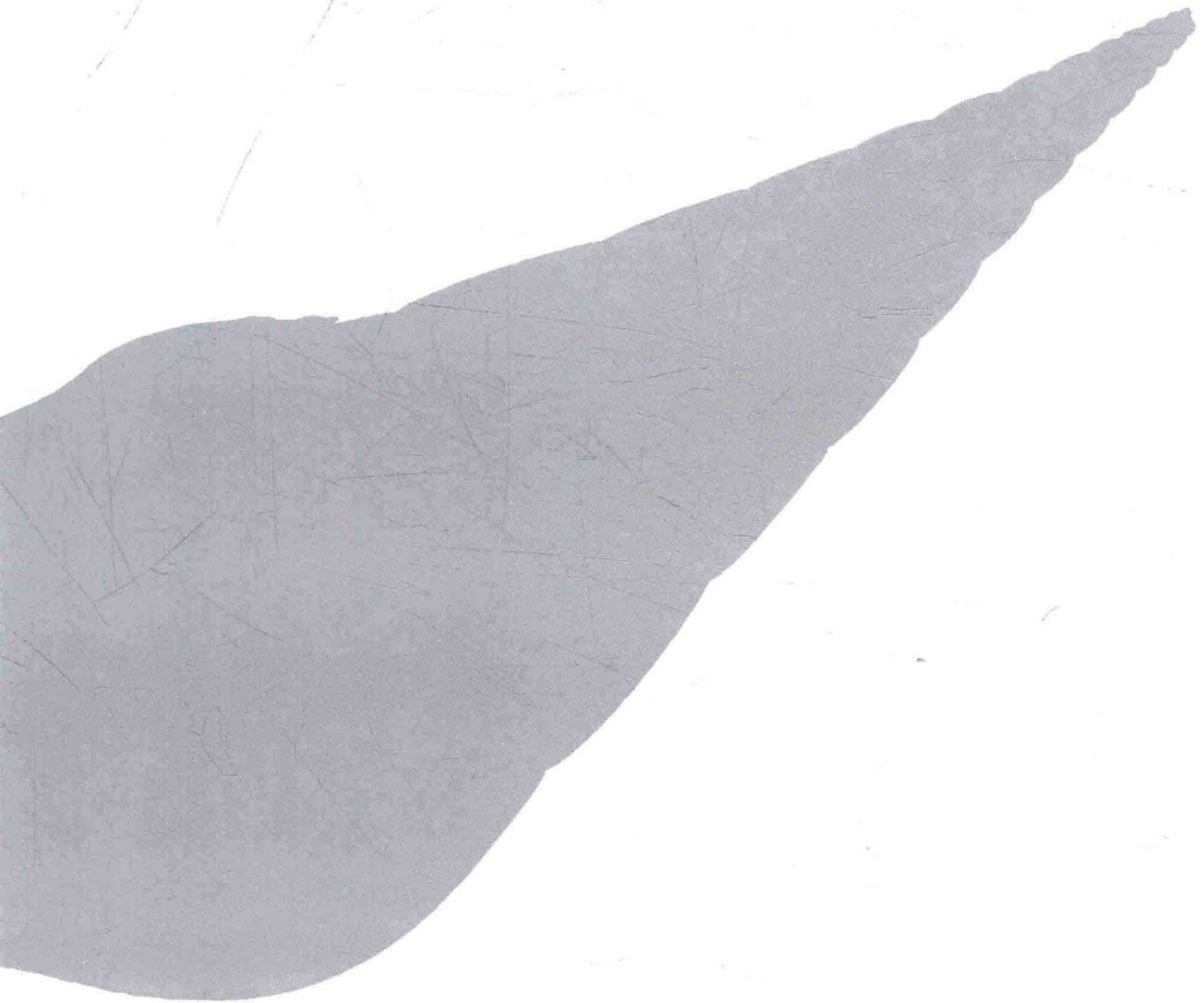
Agnathans and fishes.....	44
Amphibians.....	56
Turtles	62
Choristoderes	66
Squamates	78
Pterosaurs.....	84
Dinosaurs	118
Birds.....	186
Mammals.....	224

Plants 251



无脊椎动物

Invertebrates



腹足类 Gastropods



基本描述

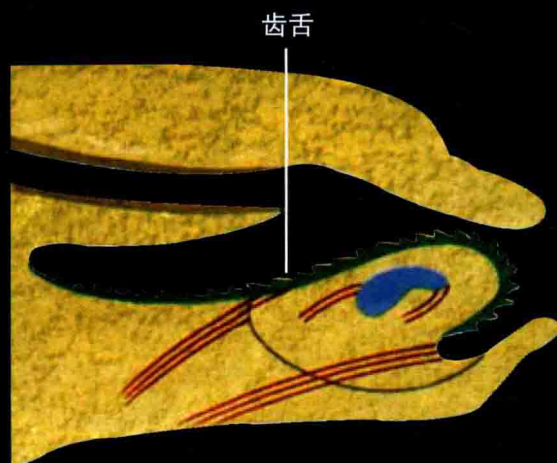
General description

腹足类是软体动物门的一个纲。我们常见的蜗牛和田螺，就是腹足类的典型代表。它们都有一个螺旋状的壳，有分化明显的头部、眼睛和触角，内脏团也随螺壳一起扭曲变形。因此，除了头和足，它们的身体是不对称的。

腹足类中的肺螺完全适应了陆地环境，这使得腹足类成为广泛分布于海洋、湖泊和陆地的一类生物。它们中大部分喜欢在水底栖息、爬行，仅有少数营浮游、附着、凿穴和寄生生活。它们主要依靠口部生有细齿的齿舌刮取食物，并通过软体部分的收缩和伸展来适应水体多变的环境。

古老地层中的腹足类化石，软体部分在它们死亡后不久就会腐烂分解，因此保存下来的都是它们的壳体或壳体的印模。

热河生物群中的腹足类种类不多，但个体数量极为丰富。它们大多数壳体微小，一般均在5mm以下。有研究表明，这些腹足类动物可能死于突发性事件（如水体缺氧、火山喷发等），并在原地快速埋藏，最终形成我们所见的化石。



腹足动物的齿舌

Gastropods are a class of Molluscs. Snails and viviparids are typical representatives of the them. They have a helical shell with differentiated head, eyes and tentacles, while their visceral mass is also in twisted deformation. So except the head and feet, their bodies are asymmetric.

Gastropods are widely distributed in the oceans, lakes and lands. They mainly scrape food by the radula in their mouth. They adjust to the changeable environments through the shrink and stretch of their soft parts.

Gastropod fossils can be found in old strata. After they died, the soft parts of their body would be decomposed soon. Thus the preservation always are their shells or mouldages of their shells.

Gastropod fossils are not rich in taxa in Jehol Biota, but the total amount of individuals is rich. Most of them own tiny size, generally less than 5mm. Studies have shown that these gastropods may have died of sudden events such as low-oxygen levels in the water and volcanic eruptions. Then they were buried soon, and ultimately became the fossils.



阿拉伯长鼻螺



化石档案 Fossil records

■ 格氏前贝加尔螺 (*Probaicalia gerassimovi*)

分类归属：前鳃亚纲 微黑螺科

时空坐标：早白垩世，辽宁北票等地

体型大小：壳高约3.3mm，壳宽1.3mm

形态特征：壳小而薄，呈高塔状；螺环可多至10个以上，紧密排列

生活环境与习性：栖居于淡水河流、湖泊的柔软水底，并在水底摄食生长



Classification: Order Prosobranchia Family Micromelaniidae

Age and Locality: Early Cretaceous, Beipiao City, Liaoning Province, etc

Size: Shell height 3.3mm, width 1.3mm

Morphology: The shell is small and thin, with a shape like high tower; the volution can be more than 10, which are closely arranged

Living habits: It lived and sought food on the bottom of lake or river



知识链接 KNOWLEDGE LINKING

怎么判断它们的壳是左旋还是右旋？

手持一枚腹足类动物，以壳顶向上，基部向下。当壳口面向观察者时，若壳口在壳轴的右侧，则称为右旋壳；壳口在壳轴的左侧，称左旋壳。大多数腹足类动物为右旋壳，少数种为左旋壳，也还有少数种同时具有两种个体。

How to determine if they have dextral or sinistral shell?

Hold one gastropod with its shell top up, base down. When the shell mouth faces the observer, if the shell axis on the right side of the mouth, it is called dextral shell and if the mouth is on the left side of the mouth, it is called sinistral shell. Most gastropods have dextral shell, while a few species have sinistral shell. There are still a few species having both shells at the same time.

