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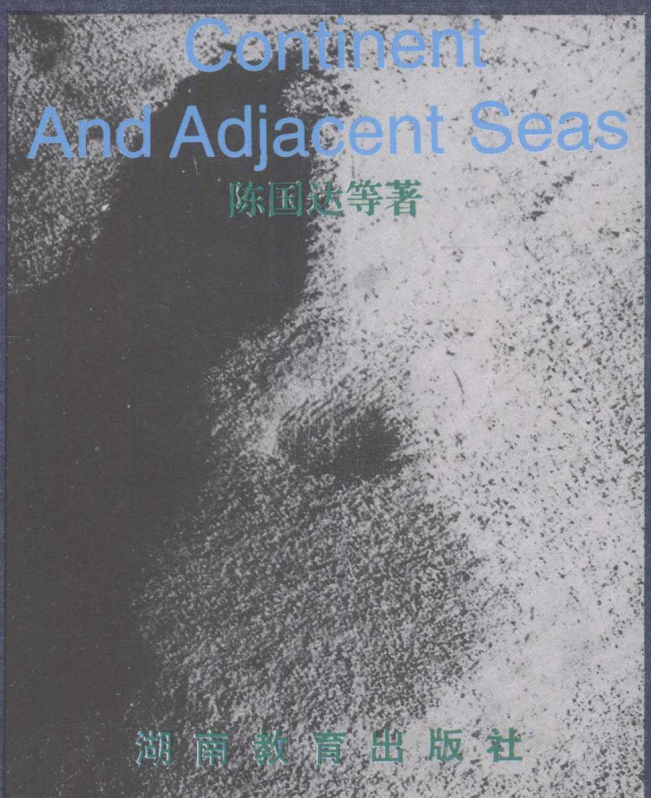
亚洲陆海壳体大地构造

Crustobody Geotectonics of Asian Continent And Adjacent Seas

陈国达等著



湖南教育出版社

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前　言
INTRODUCTION

中国科学院院士　陈国达

亚洲地区是全球范围内大陆壳区面积最大的一个。同时，它的突出之点还在于无论在岩石圈特征上还是在大陆成长、增生扩大及其中各个壳体演化-运动史中的一般历程或突出事件上，都有不少独具的特色，非其他大陆壳区所可比拟。例如，首先，在岩石圈结构特征上，它具有外地壳及岩石圈的最大厚度；它具有地面的最高高度；它是由为数最多且类别众多的壳体所组成，因而具有复杂程度最高的平向结构。诸壳体中，大部分成熟度均已很高，这些壳体的组合方式是多样的：有增生接合式，有裂生组合式，还有聚汇接合式。其次，亚洲大陆壳区在其增生、成长、扩大及壳体演化-运动进程中的重大事件，甚为突出。发生过的重大事件有：(1) 古生代晚期接纳了从冈瓦纳古大陆裂解出来的印度、阿拉伯和巽他几个外来壳体，使面积突然大大扩展；(2) 中新生代时广泛出现了标志着克拉通活化（活动区化）的地洼体制构造单元，那是一种陆内造山带，使大陆岩石圈刚性块体大部分发生了向塑性的转化；(3) 中新世开始发生了世界上独一无二的宏伟的青藏高原的隆升和最高山脉——喜马拉雅山脉的崛起，二者共同构成了世界屋脊；(4) 新生代时在亚洲大陆东部发生了大规模的陆缘扩张运动，陆壳块体裂解蠕散并部分地沉陷，形成了一条壮观的、展布范围包括陆海地区以习惯所称的沟-弧-盆为特征的、狭长的东亚陆缘扩张带，它代表一条巨型的离散式大陆边缘。

特别值得重视的是上述亚洲大陆成长、增生、扩大历程中的某些特征，既有典型性，又有广泛的对比性。同时，诸重大事件中，有些对于阐明全球构造及检验某些现有地学理论具有关键性

作用。因此，对亚洲陆海岩石圈的演化-运动开展专题研究，无论是在学术上对于认识地球、协调人类与自然关系的问题，还是在生产上对于寻找和开发资源、能源、消减灾害等问题，都有重大的理论意义和实用意义。

在国家自然科学基金会的资助和中国科学院及所有参加单位的各级领导的关怀和支持下，作者等从1987年开始了编制《亚洲陆海壳体大地构造图》(1∶8 000 000)的工作，1988年又开始了本书的撰述工作。由于本书是亚洲图的配套学术专著，所以二者在指导思想、思维方式、学术思路、研究方法、资料、内容、观点等方面，都是紧密相关的。

作者等认为，在科学研究中，宜遵循这样的一条原则：对于前人的科学理论，无论是中国的还是外国的，新兴的还是原有的，都应该虚心学习，避免派性成见和喜恶取舍。但学习时，也不论中外古今，都应一分为二，客观地经过亲自实践，并结合前人积累的实际资料，对它们加以检验，分清其精华糟粕，批判地继承。经过了扬弃，在学百家之长的基础上，自主创新。关于亚洲大地构造问题，前人研究程度已经很高，出色的成就已有很多；运用过的理论和指导思想，各有特色和优点。根据上述的科学研究原则，我们对于前人研究成果中的优点和经得起检验的部分，都尽量吸收；同时，也对其中的不足之处尽自己的能力提出补充，或易向思考；现有资料未足认识的问题，则留待今后进一步研究。本次研究成果的主要特色有以下两点：

(1) 为了把岩石圈的演化与运动融为一体，统一研究，采用了历史-因果论(历史-动力)综合大地构造学中的壳体构造概念作为亚洲陆海的主体构造单元。既采用历史分析法重塑本区岩石圈块体的演化过程和规律，又运用动力分析法阐述这些块体的运动历史和特点，包括平向运动和垂向运动，以及整体运动和体内运动；既强调发展观点也强调联系观点，时间与三维空间兼顾（四维思维），不加偏颇。

(2) 对于组成区内陆海岩石圈块体——壳体的性质、演化阶段、运动方式及方向，以及大陆成长过程中的诸大事件等存在着争论的重大问题，都作了较多的探索。例如西北太平洋地区以及亚洲东部的“沟-弧-盆”地带的地壳性质及演化阶段问题，大陆壳区克拉通的活化以及大陆岩石圈块体的现阶段物理性质问题，陆内造山带的动力学及其属性问题，青藏高原隆起原因及其与印度壳体同亚洲大陆聚汇接合事件的时间和力学关系问题，海沟的地

壳性质、构造特征及所谓洋壳俯冲带问题，东亚陆缘扩张带的成因问题等等，都根据作者等各自观察所积累的和收集了解到的实际资料，按照自己的思路和研究方法，提出了自己的见解。

科学的进步，有赖于不断地加深对自然规律的认识。认识是没有止境的，这是科学发展的动力和源泉。本书的一些看法，乃是在亚洲陆海大地构造问题研究中的一个较新阶段的产物，或可作为另辟蹊径的引玉之砖。作者期望，如能因此引起读者的兴趣，沿着新的思路继续深入研究，或许有可能使某些问题获得新的解决途径，得到更进一步的阐明。这就有赖于今后的研究者。

本专著（以及配套的《亚洲陆海壳体大地构造图》）在著述和编制过程中，除有国家自然科学基金会的资助和有关各级领导的关怀以及课题组全体参加者的艰苦努力之外，还得到国内外地球科学界人士的大力帮助。他们或提供宝贵的资料，或给予启发性意见，或从其他方面给予支持。这些帮助都使我们的工作获益不少，我们至为感激。其中有必要特别提到的是王仁、李星学、张炳熹、郭令智、孙枢、欧阳自远诸院士，向辑熙、焦淑沛、秦葆瑚、马福臣诸高级工程师，黎彤、何绍勋、周裕藩、杨心宜、吴延之、李兆麟、黄玉昆、彭省临、戴塔根、刘代志诸教授，刘元龙、刘忠书、陈胜早、肖庆辉、刘嘉麒、林舸诸研究员，姚岁寒编审、李祺芳副编审，陈子龙、潘传楚、王璐、易建斌、陈欣、张琴华、彭文澜、贺伯初、王岳军、彭勃、彭建堂、张崭春、李自安、单业华诸副教授，澳大利亚的 Dong R. Choi 教授，美国的 Sankar Chatterjee，Arthur A. Meyerhoff，V. Anfiloff 诸教授，俄罗斯的 B. I. Vesil'yev，I. K. Tuezov 诸教授，日本的藤田至则（Yuknori Fujita）、矢野孝雄（Takao Yano）诸教授等。本书（及图）的完成，同以上各位学者以及未一一提到的其他学者的助力是分不开的。谨此一并致谢！

参加本课题研究工作的单位包括中国科学院长沙大地构造研究所、中国科学院南海海洋研究所、中山大学地质系、地矿部第一海洋地质大队、广东科学院广州地理研究所；另有编图课题组成员 38 人，专著课题组成员 17 人。本专著分上编、下编两部分。上编由陈国达主笔；下编分别由有关同志撰写初稿，杨洪之研究员曾对其进行了初步归纳和修改。当本书付梓之际，谨对这些单位及学者的贡献致以衷心的感谢！

INTRODUCTION

Chen Guoda
Academician
Chinese Academy of Sciences

Asia, the largest area of the continental crust in the world, has markedly special features of not only its lithospherical characteristics, but also the gradual changes and unexpected events in the process of its continental accretion and enlargement, and the evolution-movements history of its crustobodies, compared with the crust in other continents. For example, it develops the thickest outer crust and lithosphere, has the highest altitude of the land surface, and is composed of the most multiple-types of crustobodies, hence has the most complicated horizontal construction. Most of its crustobodies are highly mature. There are many combination ways of these crustobodies, i. e. accretion-connection type, division-connection type and converging-connection type. Secondly, the intermingling of gradual changes and unexpected events during the accretion, growth and evolution-movements history of Asian continental crust mentioned above are very noticeable. There are four important events, (1) marked and rapid enlargement of its area by admitting the allochthonous crustobodies (the India crustobody, Arab crustobody and Samatra crustobody) split from Gondwana in late Paleozoic, (2) wide development of the geodepression (diwa) regime tectonic element representing the reactivation of the craton during Mesozoic and Cenozoic, an intracontinental orogeny, resulting in transformation from rigid to plastic in most of the areas of its continental crust, (3) the uplift of the unparalleled Qinghai-Xizang (Tibet) Plateau and the highest Himalaya Mountain Ranges in the world from Miocene, making up the roof of the world and (4) the large-scale marginal expansion, stretching, diffusion and part subsidence

in the eastern Asian continent, resulting in the formation of the eastern Asian continent marginal expansion zone marked by the usually called trench-arc-basin system, representing a huge divergence continental margin.

Some features of growth, accretion and enlargement of the Asian continent are not only typical, but also widely comparable, and some of the important events are vital to studying the global tectonics and judging some modern theories of earth sciences, which should be paid much attention to. Therefore, the research project about the evolution-movements of the Asian lithosphere is theoretically and practically significant not only to the study of the earth and adjustment of the relationship between man and nature, but also to exploration of resources and eliminating natural calamities.

The compilation of *The Crustobody Tectonic Map of Asia and Adjacent Seas* at scale 1 : 8 000 000, began in 1987 and the book began to be written in 1988, with funding from the National Natural Sciences Foundation of China and the Chinese Academy of Sciences. This book is a corresponding work to the map, so the guiding ideology, thinking styles, study methods, materials, contents, views, etc. of them are closely related.

In scientific research, it should be abided by that the former theories, no matter Chinese or foreign and old or new, should be open-mindedly studied without factionalism prejudice, and should be judged, under that everything divides into two, through objective practicing combined with analysing the former materials, so as to discard their dross and select their essence. Therefore the new is brought forth after selecting the essence from hundreds of schools of thought. As to Asian geotectonics, a lot of remarkable achievements have been made by using variable theories and thinking styles with different characteristics and merits. Based on the scientific research principle mentioned above, the project has been carried out not only by selecting the former essence, but also correcting the dross through making use of the materials now available, and some problems need to be further investigated because of the lack of materials at present. The main achievements by the project are as follows:

(1)For the sake of combining the evolution with the movements

of the lithosphere in the project, the concept of the crustobody in the historistic-causationist (or historic-dynamic) synthetic geotectonics is used as the main tectonic element of the Asian continent and adjacent seas. The crustobody evolution process and regularities have been revealed by using the historic method, and the crustobody movements (including movements of both vertical & horizontal directions, and movements in the way of both whole body and intrabody) history and characteristics have been studied by using the dynamic method. Emphasis is placed in the light of the development view combined with the relation view and in the light of conception of time combined with conception of three dimensional space.

(2) The nature, evolution stage, movements way and direction of the crustobodies comprising the lithosphere of the Asian continent and adjacent seas as well as the important events with argument in the growth of the continent have been sought in depth. For example, many problems, including the crustal nature and evolution stage of the trench-arc-basin zone in the northwestern Pacific and eastern Asia, the activation of the continent crustal craton and present physical nature of the continental lithosphere block, the dynamics and property of the intracontinental orogenic belts, the cause for the uplift of the Qinghai-Xizang (Tibet) Plateau and its temporal and dynamic relation with the converging-connection event of the India crustobody and Asian continent, the nature and tectonic characteristics of trenches and the problem on the so-called ocean crustal subduction zone, the mechanism of the eastern Asian continent marginal expansion zone, etc., have been probed into, according to our investigation, available materials, thinking style and research method.

The advancements of the science depend upon our constantly deepening understanding. The endless understanding is the motive power and source for developing the science. Even some views in the book are new achievements of the present stage in the study of Asian geotectonics, the work offers a few commonplace remarks by the way of introduction so that others may come up with invaluable opinions. The further searching for some problems in the book relies on the later researchers with new thinking styles and ways.

During preparation of the book and its corresponding map *The*

Crustobody Tectonic Map of Asia and Adjacent Seas, much attention has been paid to by the leaders of the National Natural Sciences Foundation of China (NNSFC) and a lot of contributions come from the industrious working of the members of the project group. Besides, great help comes from countless geoscientists of different countries who contributed their enlightening opinions, or provided invaluable materials, or helped in other ways. I especially thank the following academicians: Wang Ren, Li Xingxue, Zhang Bingxi, Guo Lingzhi, Sun Shu and Ouyang Ziyuan, the following senior engineers: Xiang Jixi, Jiao Shupei, Qin Baohu and Ma Fuchen, the following professors: Li Tong, He Shaoxin, Zhou Yufan, Yang Xinyi, Wu Yangzhi, Li Zhaolin, Huang Yukun, Peng Shenglin, Dai Tagen, Liu Daizhi, Liu Yuanlong, Liu Zhongshu, Chen Shengzao, Xiao Qinghui, Liu Jiaqi, Lin Ge, and editor Yao Suihan, vice editor Li Qifang, and the following associate professors: Chen Zhilong, Pan Chuanchu, Wang Lu, Yi Jianbin, Wang Lin, Zhang Shugen, Xiao Wuquan, Sun Shaohua, Guo Feng, Lai Jianqing, Guo Dignliang, Chen Xin, Zhang Qiaohua, Peng Wenlang, He Bochu, Wang Yuejun, Peng Bo, Peng Jiantang, Zhan Jiachun, Li Zhian, Shan YeHua, Professor Dong R. Choi from Australia, Professor Sankar Chatterjee, Professor Arthur A. Meyerhoff and Professor V. Anfiloff from USA, Professor B. I. Vesil'yev and Professor I. K. Tuezov from Russia, Professor Yukinori Fujita and Professor Takao Yano from Japan, for their great help.

The warmest thanks are also given to the following institutions: Changsha Institute of Geotectonics, Academia Sinica; South China Sea Institute of Marine Geology, Academia Sinica; Department of Geology, Zhongshan University; The First Research Group of Marine Geology, the Ministry of Geology & Mineral Resources; Guangzhou Institute of Geography, Guangdong Academy of Sciences; and the group (including 38 people) for completing the map and the group (17 people) for preparing the book.

This book is composed of two parts: Part One and Part Two. Part One is written by Academician Chen Guoda, whereas Part Two is written by various authors, and finally modified and compiled by Research Fellow Yang Hongzhi.

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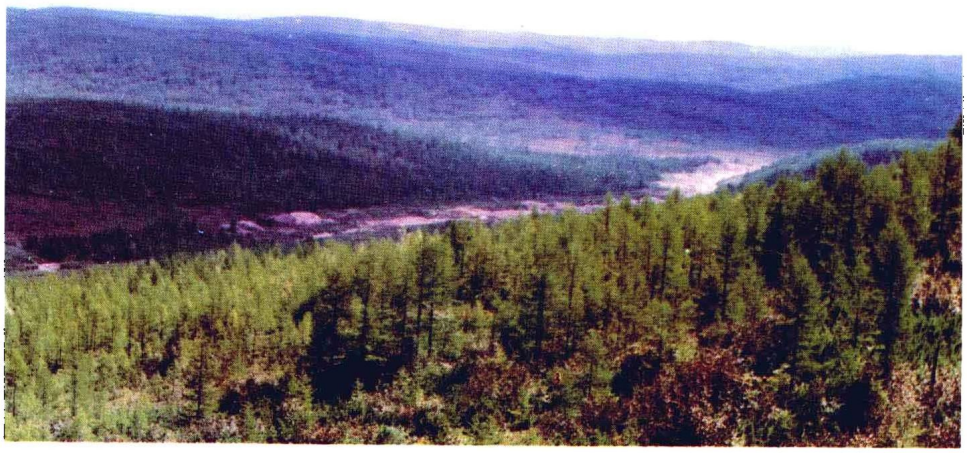

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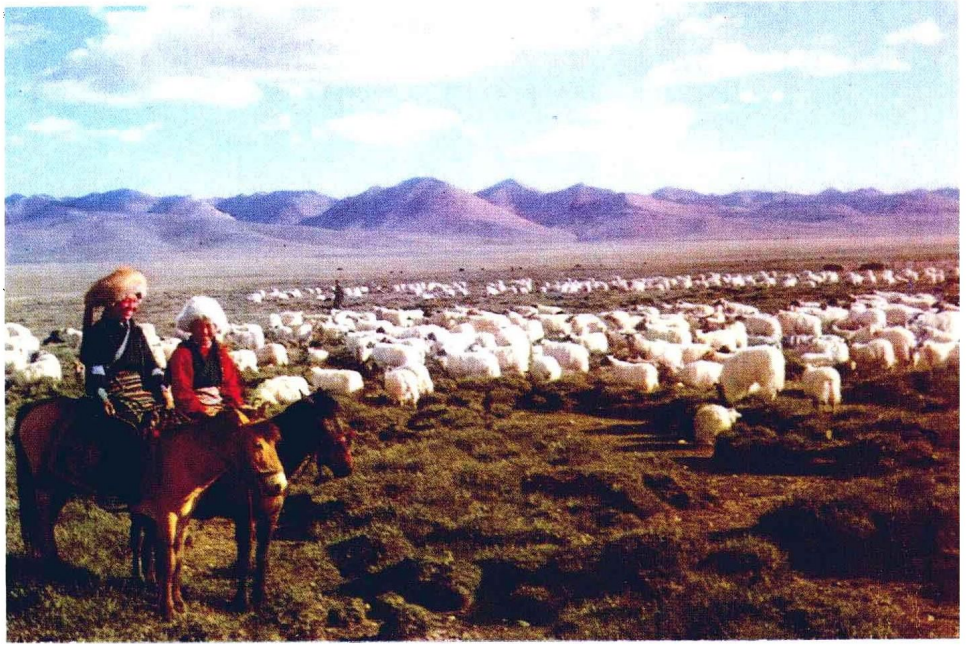

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(刘嘉麒赠)

图版Ⅳ　照片2　同照片1所示的阿什火山(现代火山，示该区为地洼激烈期)

(刘嘉麒赠)

内 容 简 介

本书是按历史-因果论综合大地构造学的壳体构造理论与方法，对亚洲陆海壳体大地构造的演化与运动并其机理，作出系统、专门论证的最新论著。书中对亚洲陆海现阶段大地构造单元的基本格局、壳体构造的时、空分布规律和演化与运动历史以及动力机因等理论问题，进行了全面的历史动力综合分析，并对相关内容作出了总结与探讨。

全书反映出在壳体构造理论与实践上的创新。作者对亚洲陆海地域，依据最新的地质、地球物理及深部地质等多学科成果资料，作出了壳体构造的区划：共计 14 个壳体构造区和 117 个基本大地构造区。全书内容充实、图文并茂、实证鲜明。

本书可供从事大地构造、地质、地震地质、工程及水文地质、环境地质及地质灾害防治，大陆与海洋资源勘查，国土规划与利用、整治等方面的科研、教学和生产人员参考使用。

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