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陈国达 著

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Diwa Theory—Outline on Activated Tectonics and Metallogenic Theoretic System

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内 容 简 介

本书是一部由著者于1956年创立，被列为“世界科学史大事之一”，现已成为国际性大地构造学派的地洼学说的专著。全书内容涉及：最初在地洼区——一种新发现的大陆地壳构造单元——基础上建立的初始理论；继后充实、扩展这一理论有关的一系列理论新概念及实体研究；并发展成为历史-因果论综合大地构造学的理论范畴体系，由地洼构造和全球性综合大地构造超单元——壳体构造等核心概念，由五个部分和四个衍生新学科，组成的活化(地洼)构造理论体系，本书对此进行了较为系统、全面、概要的专门论述。并对一些专门性问题，以及中国大地构造、亚洲大陆海壳体大地构造基本特征，诸多方面予以了阐述。书中并附有《著者论著目录》。

本书是运用历史-动力综合分析法，研究大陆地质的最新总结性论著，可供作为跨世纪全球大陆地质前沿研究的参考，适宜从事地球科学基础研究及应用研究相关学科科研、生产部门的科技人员使用。

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DIWA THEORY

——Outline on Activated Tectonics and Metallogenic Theoretic System

CHEN GUO-DA

Central South University of Technology Press

陈国达在27届(1984，莫斯科)国际地质大会主席台上

序　言

——总结过去　开创未来

一个科学理论要能不断发展，有赖于继承积累，创造增新。地洼学说自诞生以来，经受了40年国内外学者的实践检验和时间考验，以及广大同仁的艰苦努力，已发展成为包括五个组成部分和四个衍生学科的初具规模的理论体系。但仍属幼稚，尚未能足够适应发展国民经济、加速社会发展和建设的需要；特别是面对当今知识爆炸时代的各种新技术、新理论的挑战，尤其显得渺小。稍有自满，就会与世界科技发展前沿之间出现大的差距。因此，总结以往走过的历程，探索未来发展的方向，加紧努力，不断向前，是十分必要的。

1956年，著者在《中国地台"活化区"的实例并着重讨论华夏古陆问题》一文中，初步开出了大地构造及成矿学上的一条新思路。这一尝试性的探索之能够取得一个开端，主要受惠于无数前人的劳动成果，以及科学研究工作中"理论与实践结合，继承与创新结合"的要诀。自19世纪中期以来，地质学中占统治地位的大地构造理论是由美、奥等国学者创立并相继发展的地槽—地台学说。它的主要论点是：地壳发展历程有两个阶段，即地槽阶段和地台阶段，依次出现的构造单元称为地槽区和地台区，前者活动性强，后者弱。这一学说的功绩在于提出并阐明了以槽台为代表的一种活动区和一种稳定区，以及这两个构造单元的出现顺序和转化关系，这样由活动构造单元(地槽区)转化为稳定构造单元(地台区)，简称为稳化，从而正确反映了地壳演化史中为人们最早认识的一段历程和部分规律。但实践表明，它也存在不足之处，遂致运用于象中国东部及世界上其他地区那样的地壳演化过程更较复杂的地区时，难于符合实际。因为这些地区于经历了地槽——→地台阶段后，又出现了新的转变，有强烈的构造、岩浆及变质作用，其特征与地台区相反，又与地槽区有别，显然是转入一个新的活动区阶段的标志。因为这个新型活动区是由于"地台活化"而成的、取名活化区。又因其最易认识的构造—地貌特征是由造山运动形成的一种特有山间盆地，叫做地洼，故于1959年又称它为"地洼区"；列为槽台以外的已知的第三种构造单元。这是原始的地洼学说的基本内容。

持续发展与累进是科学研究不断前进的关键。地洼区的发现和阐明，使人们有可能开拓了思路。进一步研究表明：地壳发展是多阶段、多单元的。地台区固然不是演化的最后形式，地洼区之后逐也可以还有其他新构造单元产出。另一方面，地槽区也不是演化的起点，其前已经出现过多个更老的构造单元。而且，这个演化过程是通过各种不同的活动区与稳定区互相交替更迭，由简单结构到复杂结构，按照"否定之否定"法则，螺旋式升进的。这叫"动定转化递进律"。

科研目的不只在于认识自然，还在于利用自然、改造自然，为人类谋幸福。地壳中的矿产分布是不均匀的。研究得知：首先，矿产的形成及其时空分布是受地壳演化规律制约的。不同大地构造单元有不同的成矿专属性。后成构造单元可继承先成构造单元的矿产，据以形成"多代同堂"的矿床叠加现象。出现顺序越后的构造单元继承的矿产越多，形成了成矿递进性。地洼区是出现较后的现知构造单元，因此累积矿产最多，丰富多彩。其次，后成构造单元的

成矿作用还可把先成矿产或矿源层(岩)叠加、改造，形成了常可为更富、更大的“多因复成矿床”。这个“递进(活化)构造成矿理论”或地洼成矿理论被运用于国内外找矿，已收到显著效果。

为了把地壳的演化与运动统一研究，1977 年开始提出“壳体”或“壳体构造”概念。这是在岩石圈形成和发展过程中可先后不一地出现于不同地域，在诞生、成长、运动、变化和发展等方面分异进行；既在演化又在运动的时空的全球性综合超级构造单元或综合构造区。不同壳体可由不同数目和(或)不同性质类别的大地构造体制的构造区组成。

关于壳体演化与运动的根本原因和力源机制，地洼学说认为是在于地幔中，由于物质、温度的不均一性引起的蠕变与流动，以及由此带来热能的变化。当地幔蠕动活跃期，壳体或其中有关地段积热增多，引起大地热流增高，构造、岩浆、变质作用强烈，有造山运动，形成了活动区；反之，当地幔蠕动转入和缓期，壳体或其中有关地段热能补给减少，大地热流降低，导致构造、岩浆、变质作用转弱，转化为稳定区。这叫“地幔蠕动热能聚散交替假说”。

通过构造运动与成矿关系的研究，已经阐明：地壳构造运动不只是机械过程，而且是化学过程。它可把成矿化学元素驱动、迁移、富集，形成矿床。为了把这两种过程统一研究，建立了一门新的交叉学科——构造地球化学。又由于构造运动不止有过去认识的控矿作用，并且有成矿作用，这又促使另一门衍生学科——成矿构造学的建立。在这两门学科的基础上，还形成了成为递进(活化)构造成矿论核心内容的“构造(区)演化成矿”概念。它们已在生产中起了一定的作用。

进一步通过不同构造区与深部地壳结构关系的研究，表明构造单元的地球物理场特点是与其演化与运动过程有密切联系的一种综合反映，使之构造地球物理学这门衍生学科正在逐步形成。另一方面前述壳体构造——一种综合大地构造单元概念的提出及阐明，促使了另一衍生学科：壳体大地构造学的诞生。

在大地构造学发展史上，存在着历史论与因果论的分歧。随着科学发展及生产需要，地洼学说当前的发展是把这两种大地构造学的研究目的、对象、任务及方法结合起来，融为一体，形成一门新的综合性学科——“历史-因果论综合大地构造学”。它的研究思路是：历史分析法与动力分析法结合；发展观点与联系观点结合；时间观念与三维空间观念结合；水平运动与垂直运动并重；壳体的整体运动与体内运动并重；构造层与构造系划分结合；洋壳与陆壳兼顾；远古与近代并重；全球与地区兼顾；岩石圈演化与运动并重。地洼学说曾沿这条思路取得了初步进展，还将继续为充实完善这门综合学科而深入开展研究。

总结过去，开创未来。本书的编著出版正是为此目的。未来的研究领域更加辽阔，任务更加艰巨。地洼学说（活化构造）的发展，已往的历程曾经凝聚了国内外无数学者的智慧；今后的前程更加有赖于广大学者的努力。

陈国达

1996. 11. 8

Preface

Inheritance, accumulation, creation and innovation are vital to the continuous development of scientific theories. Since its birth, the diwa (geodepression) theory has been tested by time in the geological practice home and abroad. Through forty years's arduous efforts, the author and his colleagues have developed the diwa theory into a preliminarily integrated theoretical system which is composed of five components and four derivative disciplines. But it still is in its youth stage, and can not completely satisfy the need of the development of national economy and the construction of society. Especially in today's knownledge-explosing era, the diwa theory is challeged by various new technologies and theories. Being self-satisfied, it will be left behind the global developing frontier of science and technology. So, summarizing the past experiences, exploring the future trend, working hard and pressing on are criticd important for us.

In 1956, the author wrote an article named "Example of 'activated region' in the Chinese platform with special reference to the 'Cathaysia' problem", and preliminarily expanded a new idea of tectonics and metallogeny. The success of this attempt is benefited from the achievements gained by predecessors and the guiding ideology that is the combination of theory and practice, and the combination of inheritance and creation. Since the middle 19th century, the dominant tectonic theory was the geosyncline-platform theory which was proposed and advanced by the American and Austrian scientists. Its main viewpoint is that the development of crust can be divided into two stages: geosyncline stage and platform stage. And these two tectonic elements are called geosynclinal region (mobile), and platform region (stable) respectively. The contribution of this tectonic theory is that it recognizes two tectonic elements (geosyncline and platform), their emerging subsequence and converting relationship which reflect correctly part passage and regularities of the crust development. But practices prove that this theory also has defects. When it is applied in areas with complex history of crust evolution such as East China, it can not tally with the actual geological situation. The reason is that after the geosyncline and platform stages, these areas (East China) have entered into a new stage characterized by intense tectonic, magmatic and metamorphic activities. Their characteristics are contrary to those of platform regions, and also differ from those of geosynclinal regions, which indicate they have entered into a new mobile stage. Since this new type mobile region is the product of "platform activation", we named it "activation region". In 1956, according to its distinct tectonic-geomorphologic mark——itermountain basin which is called diwa (geopression) in Chinese, the author renamed it "diwa (geodepression) region", and ranked it as the third tectonic element besides the geosyncline and plat-

form. This is the basic contents of the primitive diwa theory.

Continuous development and accumulation is key to the constant scientifical progress. The proposal and expound of the diwa theory expand geologists' train of thought. And further researches show the crust development is characterized by multi-stage and multi-elements. Platform region is not the end, nor is diwa region. After the diwa region, other new tectonic elements would appear. On the other hand, geosyncline is not the start of the crust evolution and there might exist several older tectonic elements. Moreover, this process of evolution is composed of mutual convertion between various mobile and stable regions which develop forward along a spiral from a simple to a complex construction and from a low to a high level, and advance uninterruptedly according to the "law of negation of negation". This is called "the progressive law with transformation between mobile and stable regions".

The purpose of scientific researches is not only to realize the nature world, but also to make full use of and rework the nature world for welfare of the people. Mineral resources in the crust are distributed irregularly. Researches show that the formation and temporal-spatial distribution of ore deposits are controlled by the evolution regularities of the crust. Different tectonic units yield different ore deposit associations, which leads to the "minerogenic specialization" of tectonic elements. The later tectonic element can inherit the residual mineral resources of its predecessors, and pile up forming the phenomena of "coexistence of ore deposits of many generations". Generally speaking, the more lately a tectonic elements emerges in a development sequence, the more inherited ore deposits can be found. Thus, the progression of ore fomation is brought into being. Diwa region is the latest tectonic unit among the presently known tectonic elements, and consequently mineral resources in it are more complex and varied than those in both geosynclinal and platform regions. Secondarily, mineralizaton in subsequent tectonic elements can superimpose and rework ore deposits or source beds (rocks) formed in preexisting tectonic elements, forming larger and richer "polygenetic compound ore deposits". This theory of progressive ore formation (diwa motallogeny) are applied in practice home and abroad and achieved a lot.

In order to integratively study the evolution and movement of the crust, the author proposed a concept of "crustobody" (or "crustobody tectonics") in 1977. Crustobodies are defined as tectonic time-space evolutional-motional large comprehensive units which appear in the process of formation of the earth's hard crust (lithosphere) probably early or late in different localities and have their own distinctive peculiarities in birth, growth, motion, change and development history. They consist of one or more geoteconic region (s) belonging to one or more tectonic regimes.

According to the diwa theory, basic cause and mechanism of crustobody evolution and movement is the mantle creep-flow resulted from mantle material heterogenity and temperature difference, During the period of active mantle creep-flow in a region, it promotes coacervation of geothermal energy, increase in terrestrial heat flow, rise of strong tectonic-magmatic-metamorphic processes, occurrence of orogeny, and intensification of crustal movements and thus forming a mobile region. On the contrary, when mantle creep-flow in the region becomes relatively quiet, the supply of geothermal energy decrease correspondingly, terrestrial

heat flow reduces, tectonic-magmatic-metamorphic processes weaken and even disappear; thus the region becomes a stable region. This is the "hypothesis of mantle creep-flow and geothermal energy coacervation-diffusion alteration".

Researches on the relationship between the tectonic movement and mineralization reveal that a tectonic movements are not only mechanical processes but also chemical processes which would drive, migrate and enrich ore-forming elements and lead to the formation and enrichment of ore deposits. In order to systematically study these two processes, the author established a frontier science ——tectonogeochemistry. Structure not only can passively control ore deposits, but also can actively take part in their formation. This viewpoint gives rise to a new derivative discipline—— "metallogenic tectonics". On the basis of the above-mentioned two disciplines, a new concept "teoctono-metallogeny" was formed. It is core of the progressive theory of ore formation. Comparative researches on the deep constructions of crust in different tectonic regions prove that geophysical fields of the tectonic units are reflection of evolution and movement of crust. This idea produces the third derivative discipline—— "Tectonogeophysics". On the other hand, the proposal and expound of the integrative tectonic concept "crustodody" leads up to birth of the fourth derivative discipline—— "Crustobody Tectonics".

In the history of tectonics, there were two different schools: one is historstic tectonics, theother causationist tectonics. With the development of sciences and the increasing requirement of society, the developing trend of the diwa theory is to put the aims, objects, tasks and methods of these two schools into unifying study. Such an integrative geotectonics called "historistic-causationist geotectonics"mainly comprise sthe following: development viewpoint combined with relation viewpoint; concept of time combined with concept of therr-dimensional space; laying equal stress on both horizontal and vertical movements; laying equal stress on both overall and internal movements of crustobodies; structural layer division combined with tectonic system division; consideration given to both oceanic and continental crusts; laying equal stress on both antiquity and present; consideration given to both the globe and regions; laying equal stress on both evolution and movement of the lithosphere. Diwa theory will continue its study along this trend.

Summarizing the past experiences and opening a new epoch are the purposes of publication of this book. While the future tasks will be more and more oeifficalf, I am sure our future research scope will become wider and wider. Previom development of the diwa theory concentrated the wisdom of numerous scholars home and abroad, and I sincerely hope geologists all over the world would uninterruptedly contribute more and more updete information to this scientific problem.

chen guo-Da

1996. 11. 8

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