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陈国达全集

The Complete Works of Chen Guoda

第八卷 活化（地洼）构造及成矿理论外文论著
(1956—2005)

Volume VIII Works on Activated (Diwa) Tectonics
and Metallogeny Written in Foreign Language



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Responsible Editors: Liu Shinian

Responsible Proofreader: Zhou Yufan

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Foreword

Chen Guoda(1912 – 2004) is a senior academician of the Chinese Academy of Sciences, first-degree professor, educationalist, social activist, world-famous geotectonist, metallogenist, originator of the theory of activated tectonics and metallogeny or diwa theory and founder of its international school. He occupied the following positions: Vice-Chairman of the Commission on Tectonics of Ore Deposits (CTOD), International Association of the Genesis of Ore Deposits (IAGOD), International Union of Geological Sciences (IUGS), Chairman of the Working Group 4 Tectono-Magmatic Activation (Diwa), First Director of the Department of Geology, Central-South Institute of Mining and Metallurgy (now Central South University), Vice-President of the Central-South Institute of Mining and Metallurgy, First Chairman of the Geological Society of Hunan Province, First Director of Changsha Institute of Geotectonics, Academia Sinica, Member of the Committee of Planning and Guiding of Geological Work of China, Vice-Chairman of the Geological Society of China, Deputy to the Fourth, Fifth, Seventh and Eighth National People's Congress, National Advanced Worker, Scientific-Technological Advanced Worker of All-China Colleges and Universities, Special-Class Model Worker and First Scientific-Technological Star of Hunan Province.

He engaged in research and teaching in the fields of regional geology, structural geology, metallogeny, geomorphology, seismology and pale botany for more than 70 years. According to incomplete statistics, he published more than 420 books and papers in and outside China, with more than 50 books and papers unpublished. These books and papers deal with broad contents and varied forms, contributing to both regional geotectonics and metallogeny and basic geology and new disciplines. His greatest attainment lies in founding a new geotectonic theory, diwa theory (activated tectonics and metallogeny), which made an outstanding contribution to the development of Earth sciences and the exploitation of natural resources and exerted a far-reaching international influence. The founding of diwa theory threw off the yoke of geosyncline-platform theory governing Earth science for nearly a hundred years, and listed as one of the greatest events in the history of science in the 20th century. After unceasing development, improvement and test by practice, diwa theory was accepted by the geological community and highly appraised, thus becoming an international school originating in China with Chen Guoda named as "the guide of first generation."

He won honour for the Chinese nation and was still more an outstanding representative of scientific-technological flowers of China.

I

Chen Guoda was born on January 22, 1912 in a poor sales clerk family in Wufuli, Xinhui County, Guangdong Province, China.

In this young ages, Chen Guoda was wise, keen on learning and fond of using his head. He often followed his father going up hill and down dale and little by little became very interested in mountains and seas. Nurtured by nature, Chen Guoda from childhood cultivated the character of probing the mysteries of mountains and rivers and the habits of realistic approach, careful investigation, diligent thinking and intensive study.

In 1925, Chen Guoda was admitted to the Xinhui First Middle School. In 1928, with his excellent results he was admitted to a preparatory course at the college of Science of Zhongshan University. After two years he was promoted to an undergraduate course and chose geology. In the university his professors were geologist Zhang Xidi, paleontologist Yue Senxun, geotectonist Li Chengshan, Swiss geotectonist A. Heim and Austrian paleontologist K. Krejci-Graf. He studied very hard, paid equal attention to theory and practice, not rested on extracurricular practice arranged by the university and often used festivals and holidays to investigate the countryside around Guangzhou City.

Chen Guoda was brim with talent. In four years at the university, he published three papers. The first paper “Geology of Xinhui County”, written after investigating his home village during the summer holiday, won a bonus from the National Peiping Academy for research on geology and mineral resources. Other paper *Problem Concerning the Guangzhou Delta*, based on factual materials, boldly suggested that it is not a real delta, but a geomorphological landscape consisting of a bedrock peneplain covered by alluvium of the Pearl River flood plain and remaining bedrock hills. This paper was published in the journal “Science” (1934) edited by the China Scientific Society, and won a bonus and a gold medal from it. The third paper (graduation thesis) *Red Beds in Guangdong Province* was written during his field investigation in the Danxia Mountain, Renhua County, Guangdong Province, in which he expounded the depositional environment of the Meso-Cenozoic red beds and proposed a term “Danxia Mountain Landform”. This paper and other one entitled *On the Subdivisions of the Red Beds of Southeastern China* published in English in 1938 formed the most primitive basis for him to found later diwa theory and to name “diwa region” and “diwa sedimentary layer”. With new ideas and originality the paper again won a bonus from the National Peiping Academy for research on geology and mineral resources.

After graduation in 1934, Chen Guoda was selected and recommended for admission to the Geological Institute of the National Peiping Academy as a postgraduate, where he took Weng Wenhao, famous geologist and discoverer and name-maker of Mesozoic orogenic movement in China, Yanshan Movement, as his teacher, and also studied under Professor Si Xingjian, famous paleobotanist, and Professor A. W. Grabau, American geotectonist. During this period he investigated Hebei, Shandong, Shanxi and Inner Mongolia, collected numerous first-hand factual materials, and published four papers, such as *A Note on the Subaquatic Deformation in the Taiku Deposits* and *A Discussion on the Maanshan Alkaline Syenite, Jungcheng County, Shandong Province*. As a result of thorough research, he found out that the “North China Platform” designated according to the traditional geosyncline-platform theory was not in accordance with the Mesozoic orogenic structures observed by him in North China. This doubt marked the birth of a new geotectonic idea in his brain. In 1935, Chen

Guoda finished graduate study, returned to Guangzhou, occupied a position as a technician in the Guangdong and Guangxi Geological Survey and concurrently taught at the Department of Geology, Zhongshan University.

On April 1, 1936, the Lingshan area, Guangdong Province, was struck by a violent earthquake. Facing the risk of aftershocks, Chen Guoda rushed to the stricken area to make investigation and wrote a far-reaching monograph *Report on the Lingshan Earthquake, Guangdong Province*, querying the validity of the traditional theory that China is low in crustal mobility with few earthquakes. This monograph is taken by seismologists as an initiative example for earthquake researches.

In 1937, Japan committed aggression against China and Guangzhou fell into enemy hands. Chen Guoda took up a job as a technician in the Jiangxi Geological Survey. During the War of Resistance Against Japan, he passed through many provinces in South China to investigate geology, entered the haunts of tigers and wolves, lived in dilapidated temples, ate solid food, had meals in the wind and slept in the dew. This made him to suffer from rheumatism and pulmonary tuberculosis. But he not only defeated the demon of diseases, but also carried out wide investigation of the Yanshan Movement, geology and mineral resources of Jiangxi Province and even southeastern China. During this period Chen Guoda touched a wide range of disciplines and published a lot of papers. The term "Danxia Landform" proposed in the paper *Geology of the Gongshui Valley, Jiangxi Province and Geology and Mineral Resources between Chongren and Yihuang* is now widely used to describe the Danxia-type red beds landforms famous for marvelous peaks, with Chen Guoda praised as one of the founders of red bed geomorphology. He also discovered a plant fossil *Neuropteris gigantea* along the Gongshui River broke through the view on Jiangxi Province having only Permian coal series, and proved conclusively that there exists Carboniferous coal series in Jiangxi Province, thus widening the trend for seeking coal in this province.

In August 1945, Chen Guoda returned to Zhongshan University, occupying a position as head of the Department of Geology and appointed professor. In 1947, he traveled to coastal Guangdong Province to study the coast geomorphology of China. In the papers *Elevated Wave-cut Benches near Guangzhou and the Origin of the Compound Shoreline of Guangdong Province* and *The Coastline Problem of China*, he corrected with convincing arguments the prevailing simple conclusion made by German geologist Richtofen on China's coastline elevated in the south but sunk in the north, and proposed a new judgment on the coastline originating as a compound from block-faulting differentiated elevation and subsidence. It is of more far-reaching significance that he gained facts about active recent (neotectonic) crustal movement in eastern China. Scientific practice of Chen Guoda during this period and scientific accumulation lasting for nearly 20 years proved that from the Mesozoic "Yanshan Movement" to the Cenozoic and until to modern neotectonic movement, a wide area manifested itself in a high crustal mobility. Liberation in academic thought removed major obstacles to initiating theoretical geotectonic exploration and study by "inheritance and innovation", forming a basis for him later to establish the "theory of platform activation". This is the period of pregnancy.

In 1948, Chen Guoda investigated oil shale in Maoming, Guangdong Province, wrote the pa-

pers Notes on Oil Shale in Guangdong and *Short Notes on Oil Shale of China*, in which he fixed great reserves of oil shale and provided the earliest reliable basis for developing oil shale after the liberation. In 1949, Chen Guoda read out a paper entitled *Exploitation of Oil Shale in Southern Guangdong* at a symposium held by the Association of 12 Scientific Organizations in Guangzhou. This paper not only aroused interest of many geologists, but also drew high attention of government officials to mineral development.

In 1951, he was appointed by the Central People's Government as a member of the Committee of Planning and Guiding of Geological Work of China.

In 1952, China made adjustment in the distribution of universities and colleges. With the incorporation of the Department of Geology of Zhongshan University into Central-South Institute of Mining and Metallurgy, Chen Guoda was transferred to Central-South Institute of Mining and Metallurgy and appointed Head of the Department of Geology, Chief of the Department of Scientific Research, Vice-President and Academic Advisor. From then on he concentrated his major effort on the "super-structure" of Earth science—solving the problem on crustal evolution and motion in geotectonics. He systematically rearranged factual materials and achievements accumulated in many years from his field investigation, and published in *Acta Geologica Sinica* a paper *Examples of Activated Region in the "Chinese Platform" with Special Reference to the "Cathaysia" Problem*, challenging the geosyncline-platform theory proposed by American and Austrian scholars and prevailing in the world for more than one hundred years. As a result of sublation and critical inheritance, he proposed the theory of platform activation. This is the initial founding of diwa theory, marking the birth of diwa theory in China. This year he joined the Communist Party, elected First Chairman of the Geological Society of Hunan Province and Vice-Chairman of the Hunan Province Association of Science and Technology. In January 1956, he attended as an observer the Second Session of the National Political Consultative Conference, kindly received at Zhongnanhai by Chairman Mao and Premier Zhou Enlai.

1956 ~ 1960 is an important period of development of diwa theory, when he together with Academician Yu. A. Kosygin investigated the tectonic structures of "activated platforms" in Hunan, Jiangxi, Guangdong, Fujian and Zhejiang Provinces, and thereafter published more than twenty papers on diwa theory, such as *Metallogenic Analysis of Activated Regions in China*, *How to Identify Activated Platforms*, *The Third Basic Tectonic Element of the Earth's Crust—the Diwa (Geodepression) Region*, *The Third Structural Layer of the Diwa Region—the Diwa Sedimentary Layer*, *A New Criterion for the Classification of Tectonic Regions—Construction and Theory of Progression with Transformation between Mobile and Stable Regions—A New Recognition of the General Regularity in Crustal development*, and also published a book *Theory of Platform Activation and Its Significance in Searching for Ores*. Up to this point the embryo of the earliest theoretical construction of diwa theory was formed. In 1965, Chen Guoda by use of a pluralistic concept published a paper *Diwa (Geodepression) Region—A New-Type Postplatform Mobile Region*, in which he gave a systematic description of the basis of the theory established by him—diwa region. This achievement won a prize on natural sciences from the Chinese Academy of Sciences.

In 1961, the State Council approved to set up a special institute, Central-South Institute of Geotectonics and Geochemistry, Academia Sinica, with Chen Guoda appointed Director.

In 1966, Xingtai, Hebei Province, was struck by a violent earthquake, Arranged by the State Council, Chen Guoda led his assistants to the stricken area to investigate the earthquake. He also undertook to do earthquake intensity regionalization in the Anyang area and to identify earthquake intensity along the Chengdu-Kunming railway.

During the Great Cultural Revolution, Central-South Institute of Geotectonics and Geochemistry was cancelled. All kinds of obstructions did not stop his academic thinking. He still worked untiringly and finished the manuscript of the book *Methods of Metallogenic Researches*. In 1975, the cancelled institute was resumed to be named Hunan Institute of Geotectonics with Chen Guoda appointed again Director. In 1977, he set up a journal "Geotectonica et Metallogenia" and himself held office as Editor-in-Chief.

Along with the end of the Great Cultural Revolution and the convening of the National Scientific Conference in 1978, Chen Guoda greeted the spring of life in the course of his scientific research, and diwa theory founded by him entered a stage of overall expansion. In 1978, his book *Methods of Metallogenic Researches* was published, and his *Tectonic Map of China* (1:4 000 000) and *Geotectonic Outlines of China* won two prizes from the National Scientific Conference. In the same year, Hunan Institute of Geotectonics turned over to the Chinese Academy of Sciences, renamed Changsha Institute of Geotectonics, Academia Sinica, and Chen Guoda held office first as Director and then Honorary Director. After that, his paper *The Third Tectonic Element of Continental Crust—Diwa Region* won a second prize for national natural sciences, and other books and papers related to diwa theory won separately prizes at provincial and ministerial levels.

In 1979, Chen Guoda was elected Vice-Chairman of the Geological Society of China. In 1980, he was elected Academician of the Chinese Academy of Sciences. In the same year he was invited to give lectures in Frankfurt University, Germany. This was a beginning for him to propagate diwa theory abroad. Then he attended on behalf of China the 26th International Geological Congress held in Paris, read out a paper *Diwa (Geodepression) Theory and Its Practical Significance*, elected Vice-Chairman of the Commission on Tectonics of Ore Deposits, International Association on the Genesis of Ore Deposits, International Union of Geological Sciences, and appointed advisory member of the Editorial Board of the Journal "Global Tectonics and Metallogeny". After the congress, he investigated the tectonic structures of the Baltic activated (diwa) region, the Kiruna iron ore deposit in Sweden and Cu-Zn sulfide deposits in Finland. In 1981–1989, he was one after another invited to deliver lectures in four institutes and nine universities in USA, such as New York University, Columbia University, Colorado University, American University and Texas University. He also investigated the western America activated (diwa) region, Rio Grande Rift Valley, Colorado Plateau and Tularosa diwa basin.

In 1982, as a first Chinese scientist invited after suspension of scientific relation between China and USSR, Chen Guoda was invited to visit USSR and give lectures in Moscow University, All-U-

nion Geological Institute and Institute of Precambrian Geology and Geochronology AS, USSR and Leningrad Institute of Mining. He was invited to attend the 6th Quadrennial IAGOD Symposium held in Tbilisi, took the chair and gave a specially invited lecture *Polygenetic Compound Ore Deposits and Their Origin in the Context of Regularities in Crustal Evolution*. This new concept of polygenetic compound ore deposits proposed by him was developed later into an important constituent part of the theory of progressive metallogenesis. After the symposium he investigated the geology of Central and West Asia. This visit of Chen Guoda was considered a milestone in China-USSR “scientific diplomacy.” In the same year he was approved by the State Council one of the first tutors of candidates for Ph. D. and then a tutor of postdoctoral researchers and visiting scholars.

In 1983, Chen Guoda presided over the First All-China Symposium on Tectonogeochemistry (in Changsha) and gave a lecture *Some Problems Concerning Tectonogeochemistry*. Proposed by Chen Guoda in 1961 and tested by long-term practice, this cross discipline became a newly added part of the theoretical construction of diwa theory. In June 1983, he traveled to Wuling Range, Zhangjiajie to investigate quartz sandstone peak-forest landscape, engaged as a scientific advisor for the Wulingyun National Scenery Area. In September he was invited by Japanese geologists to visit Japan and gave lectures in several universities and institutes. In Japan he investigated the Medium Tectonic Line, collapse structures and so on.

In July 1982, he was invited to visit Yugoslavia and give lectures. He traveled to Serbia, Bosnia-Herzegovina and Macedonia to see the activated (diwa) structures of these areas. In September 1984, specially invited by the Organizing Committee of the 27th International Geological Congress, he attended the congress, at which he gave a specially invited lecture entitled *Geotectonic Nature of the Fen-Wei Graben—a Rift-Type Diwa (Geodepression) System*. At the opening and closing ceremonies, he was arranged to be seated in the front row on the rostrum. He was the first Chinese scientist who was accorded such a courteous reception since the founding of the International Geological Congress.

In 1986, he was invited to give lectures in Hong Kong and accorded a warm welcome. In September 1986 he presided over the First All-China Symposium on Diwa Tectonics and Metallogeny. Deng Liqun, Secretary of the Secretariat of the Central Committee of the Communist Party of China, and other leaders attended the symposium to extend greetings. The symposium ended in the founding of the Chinese Research Society of Diwa Theory (preparatory), with Chen Guoda elected President. In 1987, he attended separately the Beijing Meeting of the International Lithosphere and the China-USSR Symposium on Marine Geology. A series of his academic exchanges and lectures further extended diwa theory (theory of activated tectonics and metallogeny) to the world.

In 1988, he presided over the First International Symposium on Diwa Tectonics and Metallogeny. At the Symposium delegates from various countries proposed to set up an international research center for diwa tectonics and metallogeny, with the center established in Changsha, China and Chen Guoda appointed Chairman. In 1989, he led the Chinese delegation of scientists to visit Mongolia, where they made academic exchanges and investigated the activated (diwa) structures and famous

copper mines of Mongolia. Afterwards, Russian and Mongolian Sub-centers were established in 1992 and 1992, respectively. In 1989, the English edition of the journal "Geotectonica et Metallogenia" was issued, with Chen Guoda appointed Editor-in-Chief.

In the 1990's, research on the theory of activated (diwa) tectonics and metallogeny became part of the international cooperation organized and planned by IUGS. On August 14, 1990, the IA-GOD Council decided to set up WG4: Tectono-Magmatic Activation (Diwa) under the Commission on Tectonics of Ore Deposits, with Chen Guoda appointed Chairman. This is the first international academic organization named after the theory founded by a Chinese scholar. In the same year, at the 15th International Symposium on the History of Geological Sciences, he presented a paper *Historical Significance of the Yanshan Movement*. He emphasized from a global angle the objective geological record of Mesozoic orogenic movement, which played an important role and had a far-reaching significance for research on tectonics and metallogeny of continents.

In 1991, Chen Guoda and A. L. Yanshin together presided over the Second International Symposium on Diwa Tectonics and Metallogeny held in USSR. Then the IGCP-361 Project "Metallogeny of Mesozoic Activation Zones of East Asia" was approved by the IGCP Executive Committee. Chen Guoda held the post of first vice-chairman. He also together with Soviet and Japanese geologists accomplished the *Volcano-Tectonic Map of East Asia* (1:3 000 000). Thus diwa theory was further brought into international cooperation.

Chen Guoda initiated and emphasized the combination of geotectonic with metallogenic researches. From the 1980's onwards, he proposed from a metallogenic angle the theory of polygenetic compound ore deposits, further enriched the contents of diwa theory and metallogeny, and by using the theory instructed colleagues of Changsha Institutes of Geotectonics, Academia Sinica and Department of Geology, Central-South University, in taking on tens of national, ministerial and provincial projects. They obtained a lot of scientific research achievements and won successively prizes at national, ministerial and provincial levels.

From 1990 until to his death in April 2004, Chen Guoda made a systematical summary and an overall extension of diwa theory founded by him, dealing with discipline category, research scope and direction, research aim and methods. He wrote a book *Diwa Theory—Activated Tectonics and Metallogeny* published in Chinese and English in 1996 and 2000, respectively. This book is a comprehensive monograph clarifying the theoretical system of activated (diwa) tectonics and metallogeny for the geoscience community. In 1991, he proposed to set up historicist-causationist integrative geotectonics, putting the theoretical system of activated tectonics and metallogeny established by him into a higher level at a scale of global tectonics. In 1992, he published in Chinese and English a paper *Historicist-Causationist Geotectonics*, proposing to combine the evolution and motion of lithospheric blocks (crustobodies) of all continents and oceans for united study by using a historical-dynamic integrated analysis method, and thus founded historicist-causationist geotectonics. This is the continued innovation of diwa theory established by him. In 1994, he edited and published *Crustobody Geotectonic Map of Asian Continent and Adjacent Seas* (1:8 000 000), which won a second prize for

natural sciences from the Chinese Academy of Sciences. In 1996, he submitted a paper, *Crustobody Geotectonics—A New Concept in Integrative Geotectonics* to the 30th International Geological Congress. In 1998, a book *Crustobody Geotectonics of Asian Continent and Adjacent Seas* was published with him as Editor-in-Chief. Three events occurring in the process of evolution-motion of crustobodies in Asia proposed in the book as an original idea were praised by academic circles as three projects on the front of Earth science. This achievement won a candidate prize for National Book Prizes and a Second Scientific-Technological Advances (Scientific-Technological Books) Prize. At this stage of extension and reinnovation of diwa theory, he still published a few books and papers until his death in 2004, such as *Necessity for Studying the Tectonics and Metallogeny of Asian Continent and Adjacent Seas by Way of Thinking Independently and Innovating on One's Own* and *Historical-Dynamic Tectonic Differentiation of the Eastern and Western Parts of the Central Crustobody of Asian Continent and Its Significance*.

During a half century beginning in 1956, diwa theory (activated tectonics and metallogeny) founded by Chen Guoda went through several stages: from initial founding to enriching-development to extension and reinnovation, and underwent a long process of development. First the world connected to it and then it connected to the world. Chen Guoda devoted the energies of his last 20 years and more to pushing he original and innovative diwa theory to the world and to promoting international cooperation. He gave his all till his heart stops beating for development of Earth science, for vitalization of science and technology of China, and extension of its influence in the world.

II

Diwa Theory, when it was proposed, met with acceptance of foreign geologists. Many authors wrote papers or books, systematically quoting and introducing in detail this theory. In 1959, A. L. Yanshin first translated the Chinese term “diwa” into a Russian term “дива”. Afterwards, A. D. Shcheglov, V. I. Kazansky, F. F. M. Almeida, Yukinori Fujita and other scholars also successively quoted it. The term “diwa region” or “activated region” was included in the *Geological Dictionary of USSK* (1978), *dictionary of Earth Sciences of Japan* (1971) and *Lexicon and Dictionary of earth Sciences of China*, In fact, “diwa region” is not a phenomenon peculiar only to China, it exists everywhere in the world. For example, the book *Geology of Korea* (1968) stated that the geological development of Korea had entered a diwa stage since the Triassic, and the period of Mesozoic metallogenesis played an important role in the formation of ore in Korea. I. N. Tomson in his book *Metallogenic Analysis in Regions of Activization* pointed out: “The development of modern geology depends upon two new concepts, plate tectonics and the third type of the development of crustal structure determined by the process of tectono-magmatic activization. These two scientific directions have become a basis for reexamining metallogenic theories.” E. A. Alexandrov in reviewing A. D. Shcheglov's book *Metallogeny of regions of Autonomous Activization in Economic Geology* emphasized that “Credit is given to Chen Guoda of China . . .” A. D. Shcheglov in lectures delivered by him during his visit to Changsha Institute of Geotectonics and Nanjing University highly appraised the success a-

chieved by China in the fields of tectonics and metallogeny, pointed out that “the concept of tectono-magmatic activation of USSR is based on diwa theory”, “Chen Guoda is a guide of first generation to our theory” and “Professor Chen Guoda is a force supporting the concept of tectono-magmatic activation in the world.” He again and again stressed that “founded by Chen Guoda, diwa theory originated in China, but it is applicable not only to China, it has a global significance.”

In addition, diwa theory was also highly effective in directing mineral prospecting. Outside of China, the former USSR first applied the new concept of platform “activated region” to ore-seeking practice. Soviet geologists used the theory of diwa found rich deposits of tungsten and tin in the Transbaikalian area considered barren of ore. Tin deposits in the northern part of Brazil, fluorite, mercury and antimony deposits in Australia and many metallic ore deposits in Czech, France and Canada were all discovered by use of diwa theory. At the Scientific Conference on Mineral Resources and Geological Survey held in St. Petersburg, Russia, particular stress was laid on the metallogeny of activated (diwa) structures. Academician Petlovich pointed out that “Mesozoic tectonic activation is a global phenomenon, many important mineral deposits are related to it. Taking uranium deposits as an example, all supergiant uranium deposits on a world scale . . . occur in diwa structures, and thus metallogenic studies of diwa structures is of universal significance.”

In China there are still more examples of success in mineral prospecting by use of diwa theory. Based on the tectonic peculiarities of diwa regions, petroleum geologists found large oil fields in Xinjiang and northern China. The first discovery of primary gold deposits in Altai Mountain, Xinjiang, made the area promising in gold prospecting. Gold ore zones were also found in the Baoban area, Hainan Province. Large gibbsite deposits were first found in Guangxi. The Laochang lead-zinc-copper deposits and Gejiu tin deposits in Yunnan Province, the Xiangxi gold deposits, Xiangdong tungsten deposits and Huayuan lead-zinc deposits in Hunan Province, the Fankou lead-zinc deposits in Guangdong Province, the Daye iron deposits in Hubei Province, the Tongling copper deposits in Anhui Province, the Jinchuan nickel deposits in Gansu Province and other large metallic ore deposits were known by using diwa theory to contain new hidden mineral resources at depth and outside. Moreover, diwa theory also played an important role in earthquake prediction and site choice for the Wujiangxi and Zhexi hydroelectric stations. These facts fully reflect the distinguishing feature of diwa theory: theory combining with practice and innovation paralleling with extension.

As this new theory of crustal evolution played a pioneering role in geotectonics, it was cited as one of the great events in the history of science (Dictionary of History of Science and Technology, Japan, 1983). International academic exchanges, cooperation, lecturing and visits made by Chen Guoda from the end of the 1980's to the beginning of the 21st century not only extended diwa theory (activated tectonics and metallogeny) to the geoscience communities of various countries, enlarging the influence of this innovative theory in the world, but also demonstrated diligence and intelligence of the Chinese people and scientific researchers to the world, winning honour for the Chinese nation. Senior Academician Ye Lianjun in his paper *Cherishing Geotectonist Chen Guoda* wrote in praise of him: “Academician Chen Guoda is a geoscientist respected by the international geoscience commu-

nity”; “Academician Chen Guoda fought all his life for the advance and development of the geological cause of China”; “the theory of the third tectonic element, diwa theory, advanced by him was acknowledged by the international geotectonic community as a newest geotectonic theory, winning honour for the geological community of China.” In spite of poor health in his later years, he treated time as if it were gold, and uninterruptedly strode forward. The concept of crustobody geotectonics proposed by him in 1991, i. e. a new scientific idea combining evolution of the lithosphere with its motion for united study represents a new exploration target in the geoscience community.

Chen Guoda made an outstanding contribution to science and thus earned favourable comment. He held more than 20 posts in the fields of science and technology, elected a deputy to the First, Second and Third Hunan Province People’s Congress and to the Fourth, Fifth, Sixth, Seventh and eighth National People’s Congress. In 1989, he was chosen as a special-class model worker of Hunan Province and a national advanced worker. From 1988 to 1989, he was chosen into American books “A Collection of International Distinguished Leaders” and “Dictionary of International Famous Persons” and a British book “Five Thousand World Famous Persons”. In 1990, he was conferred the title of an advanced worker of All-China institutions of higher learning and in 1966 chosen as a first scientific-technological star. In 2000, the Hunan Province Association of Science and Technology organized to sculpture two bronze statues, which stand at the campus of Central South University and in Changsha Institute of Geotectonics, respectively, to express reverence for this great academic master.

III

Chen Guoda was a Chinese scientist born and brought up in the locality. His brilliant achievements in scientific cause were closely related to his correct approach in academic pursuits and scientific methods. Four words “To persevere, to brave, to be strict and to be diligent” is an institute spirit formulated by him for Changsha Institute of Geotectonics as well as his academic motto and experience summary in his scientific exploration during more half a century.

Chen Guoda thought that a scientist must, first of all, have strong aspirations to scale new height in science, and keep in any situation a firm perseverance. Just such aspirations made him in the “ten chaotic years” withstand pressure from many sides, and did not break off working. Whatever happens, he always kept calm.

He constantly exhorted his students to dare to innovate and have a consciousness to outstrip predecessors. When working, one must be brave, but making investigation and doing experiment, he should be scrupulous about every detail. Discovery and invention need to be published promptly, and modesty is necessary when facing success.

He believed that a serious, strict and tight style of work and a steady, realistic and honest character are a key to success. He particularly placed stress on methods of thinking. A considerable amount of his papers was permeated with such a thought of materialist dialectics. When young, he was diligent in field investigation. Even in old ages, he still persevered at the forefront of scientific

research, with his footprints extending over whole China and famous mines of Asia, Europe and America.

He believed that scientific morality and work ethic are one of the most basic and indispensable qualities. A qualified scientist must have noble morals, good qualities and hardworking and thrifty habits. Depending on such habits, he was diligent in writing in his career as a geologist more than 70 years, having published over 420 books and papers. Even when he was over eighty years old, he learned to use computers to write, chosen as one of a hundred Chinese scientists with publications having the strongest international influence.

He was learned and versatile and had a good grounding in literature. After work on probing the mysteries of nature, he wrote nearly a hundred scientific poems, simple in style and far-reaching in meaning. A book *Selected Poems of Chen Guoda* was published in 1995, with second edition coming off the press in 1998.

Chen Guoda had a mind as open as a valley, cultivated people of ability and had students everywhere. Besides educating thousands of undergraduates, since the 1960's he had fostered more than one hundred masters, more than 50 doctors and several ten postdoctoral fellows, many of which already became scientific flowers at the front of geological research and production.

Chen Guoda was strict with himself and lenient towards others. He hated bitterly people being generous at the nation's expense and seeking private gain at public expense. He led a simple life. In his room there was not even a decent furniture besides the endless array of books. When giving lessons he begrudged throwing away the remaining chalk stubs, and when writing he even turned over used envelopes to use them again. Nevertheless, in order to promote the development of diwa theory and to encourage successors, he generously donated his money awards, contribution fees and other income to set up "Diwa Theory Reward Fund", encouraging those scientists who theoretically developed diwa theory or practically made a great contribution to it. Since founded in 1983, the fund has issued awards 11 times, and more than 80 geologists won such special honours. In addition, he also wrote prefaces to books of a few authors, encouraging young geologists to goall out to make themselves useful.

Chen Guoda used time as if it were gold. Even when he reached old ages and suffered from hypertension and coronary heart disease, he still worked without holidays. In spite of having difficulty getting about, he persisted in writing selflessly.

After 1996, he successively published a few books such as *Diwa Theory—Activated Tectonics and Metallogeny*, *Crustobody Geotectonics of Asian Continent and Adjacent Seas*, *Activated Tectono-Metallogeny* and *Crustobody Tectono-Metallogeny of Copper-Polymetallic Deposits in Yunnan Province* and nearly 10 papers. At a few hours before his death, he still wrote words of encouragement for the magazine *Education Heaven and Earth* and discussed academic problems with his assistants and students by telephone.

On April 8, 04:23, 2004, Chen Guoda died of myocardial infarction in Changsha at the age of 93.

IV

Based on the wishes of Chen Guoda before his death and entrusted by his relatives after his death, two units in which Chen Guoda worked, Central South University and Changsha Institute of Geotectonics, Academia Sinica, took the lead to organize an editorial and publishing board composed of academicians, specialists and scholars for editing and publishing *The Complete Works of Cheng Guoda*. Entrusted by Chen Guoda's relatives, Central South University Press is in charge of concrete matters relating to publication. Chen Guoda's publications are plentiful. In order to correct and publish materials related to diwa theory, the Editorial and Publishing Board of "The Complete Works of Chen Guoda" has collected over three years more than 450 publications with Chen Guoda as sole or first author (including unpublished). According to the principle of volume division by contents in combination with time determined by some members of the Editorial and Publishing Board at a forum, the complete works were divided into nine volumes, with one volume containing about a million words.

Volume I : The pregnancy with Diwa Theory (Investigation of the Regional Geology and Mineral Resources of China) (in Chinese and English from 1932 to 1955)

Volume II : The Initial Founding of Diwa Theory (Activated Tectonics and Metallogeny) (from 1956 to 1960)

Volume III : The Enriching of Diwa Theory (Activated Tectonics and Metallogeny) (from 1960 to 1977)

Volume IV : The Extension of Diwa Theory (Activated Tectonics and Metallogeny) (from 1977 to 1992)

Volume V : The Reinnoation of Diwa Theory—Historistic-Causationist Crustobody Geotectonics (from 1992 to 2005)

Volume VI : Diwa Theory—Outline on Activated Tectonics and Metallogeny Theoretic System

Volume VII : Activated Tectono-Metallogeny

Volume VIII : Works on Activated (Diwa) Tectonics and Metallogeny Written in Foreign Language (1956 – 2005)

Volume IX : Scientific Thoughts and Methods, Popular Science Works and Poems.

Volume VI and VII systematically describe activated tectonics and metallogeny (I and II), being the summary of the world-famous diwa theory proposed by the author as a result of long-term theoretical study and scientific practice, and published in 1996 and 2004, respectively.

The Complete Works of Chen Guoda include papers, books and writing works reflecting his academic thought and fighting spirit, published before his death from the 1930's to the beginning of the 21st century. These works are all original. Textbooks (6), selected works (3), translations and works written by other authors in cooperation with Chen Guoda, apart from important contents included in the text proper, are generally put in the appendix to present them simply. In addition, the appendix also contains the following items related to Chen Guoda's activity: visits and giving lec-

tures in China and abroad, list of trained graduates (masters, doctors and postdoctoral fellows) and titles of their theses, representative projects and praises, winners of the “Diwa Theory Reward Fund” and titles of their papers, diwa theory exhibition hall, journal “Geotectonica et Metallogeny”, international symposia on diwa tectonics and metallogeny and Chen Guoda’s bibliography. Some important and unpublished lectures delivered in certain units are also included in the text. But other lectures, contents of which duplicate those of published papers to some extent, are included in excerpts.

Chen Guoda’s works span a long time and thus they vary in form and layout. Editors of *The Complete Works of Chen Guoda* use the international standardized style, which is expressed by 1, 1. 1, 1. 1. 1 . . . followed by 1), (1), ①, A and (a) . . . Figures and tables in papers are numbered in singular number arrays, e. g. Figure 1, Table 1, while those in books, in double number arrays, i. e. chapter number plus figure number, e. g. Figure 2-2, Table 2-2. Figures taken originally by photomechanical process, have to be duplicated by line scanning. Large maps (e. g. Tectonic Map of China at a scale of 1 : 4 000 000 and Crustobody Geotectonic Map of Asian Continent and Adjacent Seas at a scale of 1 : 8 000 000) are reduced in scale. Notes are divided into two Kinds. Author’s notes such as ①, ② and ③ are placed beneath pages, while editor’s notes are expressed by an asterisk (*) followed by footnotes (e. g. title of a book or journal, volume, number, page, time). Literature is still put after a paper or book, but adjusted to placing Chinese first and English next. Literature in the author’s publications largely adopts the Harvard System Record Method, and therefore literature in Volumes 1 to 7 and 9 (in Chinese) is standardized according to this method, but that in Volume 8 (in English) still adopts the order coding system.

In order to make readers to understand the writing background, main points and significance of some important publications concerning new concepts and viewpoints proposed in the process of development of diwa theory, we, entrusted by Chen Guoda before his death, specially invited related members of the Editorial and Publishing Board to write editor’s explanatory notes for every volume to indicate the number of publications in each volume, and the historical background, main points and influence of important publications. Titles of important publications in the contents of every volume are printed in boldface for attracting attention. Finally, entrusted by Chen Guoda before his death, we have also revised printing errors and unified special terms.

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