

NEWSLETTER

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THE GEOLOGY OF CHINA

C.H. Tan, P & T Civil Engineers Ltd.

1. Introduction

This paper has been prepared to provide a brief review of the overall tectonics of China and the principal schools engaged in the study of tectonics.

In the last thirty years a lot of detailed study has been carried out and this has led to various schools of thought being developed. Five of these are summarised here.

2. Major Structural Divisions of China

The terrain of China can be divided into two major parts. One is the Chinese craton and the other is surrounding areas of geosynclines, as shown in Figure 1 (Ref. 3, 6 & 10).

- 2.1 In the central part, the Chinese craton can be further subdivided into the Northern China craton, sometimes called Sino-Korean craton, and the Southern China craton or Yantze craton.

Generally a craton comprises a shield in the centre surrounded by marginal platforms. The term "shield" as originally used, refers to the subdued topography and low domal form of continental nuclear areas. By contrast in China, we use this term only in a limited meaning, that is a block of Pre-Paleozoic rocks which, after the Sinian-Period, has been subjected to a long period of emergence (Ref. 10 & 12).

- 2.2 The surrounding geosynclines belong to three systems. In the southeast is the Pacific System, in the southwest the Tethys-Himalayan System and in the north the Alti-Orhosk System (Ref. 10).

3. Main Characteristics of The Geology of China

- 3.1 In many continent of the world, cratons comprise a central shield surrounded by platforms. In China, the situation is different. The central feature is a platform and this is surrounded by many smaller shields, mostly of elongated shape bounded by very deep faults. This phenomenon is interpreted by Chinese geologists as arising from very long term activity controlled by the faults.

- 3.2 The Chinese platform within the marginal shields is covered thickly with younger platform sediments. Bordering the marginal shields are trench-shaped depressions. The thickness of sediments in these depressions is tens of thousands of metres, and the rocks are slightly metamorphosed. In the central parts of the platforms, thicknesses are common to general platforms elsewhere, some 2,000 to 3,000 metres, and the rocks are not metamorphosed (Ref. 10, 11 and 12).

- 3.3 The stratified formations of the Chinese platforms always have a square shaped nose of folds which are either doubly plunging or linear parallel (Ref. 8, 10). The faults are always at high angles, either normal or thrust (Ref. 8, 10). In eastern China, the main structural trend is to the north-east, which Chinese geologists called "Cathaysian" direction. But in western China, the structural trend is mainly north-west, while in northern China, it is almost latitudinal (Ref. 1, 2 & 3). Most of the structural movements in the platform are of the Jurassic-Cretaceous age; Chinese geologists called this movement the "Yuenshan" movement. It caused folding and faulting of the crust of Eastern China and was accompanied by major extrusive and intrusive igneous activity. However, it did not cause regional metamorphism (Ref. 2, 3, 6 and 8).
- 3.4 The products of volcanic activity of "Yuenshan Movement" occurred in three belts:-

Da Hinggan Ling Belt
ChangBai-GiaoLiao Volcanic Belt
Southeastern Coast Volcanic Belt

These lie in echelon (Fig. 1). The rocks are intermediate and acid volcanics (Ref. 5, 8, 10 and 11).

The Yuenshan granitic intrusions mainly occur in Southeastern China, where the basement is made up of rocks of the Caledonian Geosyncline. Detailed studies of the last thirty years show that most of the granitic geological bodies are stocks; that is to say, each body is small and has steep contacts dipping outward. Granitic stocks are joined in straight lines as a rosary (Ref. 8, 11 and 13). With these granites are associated wolframite, scheelite, molybdenite, tin-ore, uranium minerals and many other minerals (Ref. 10, 11 and 12).

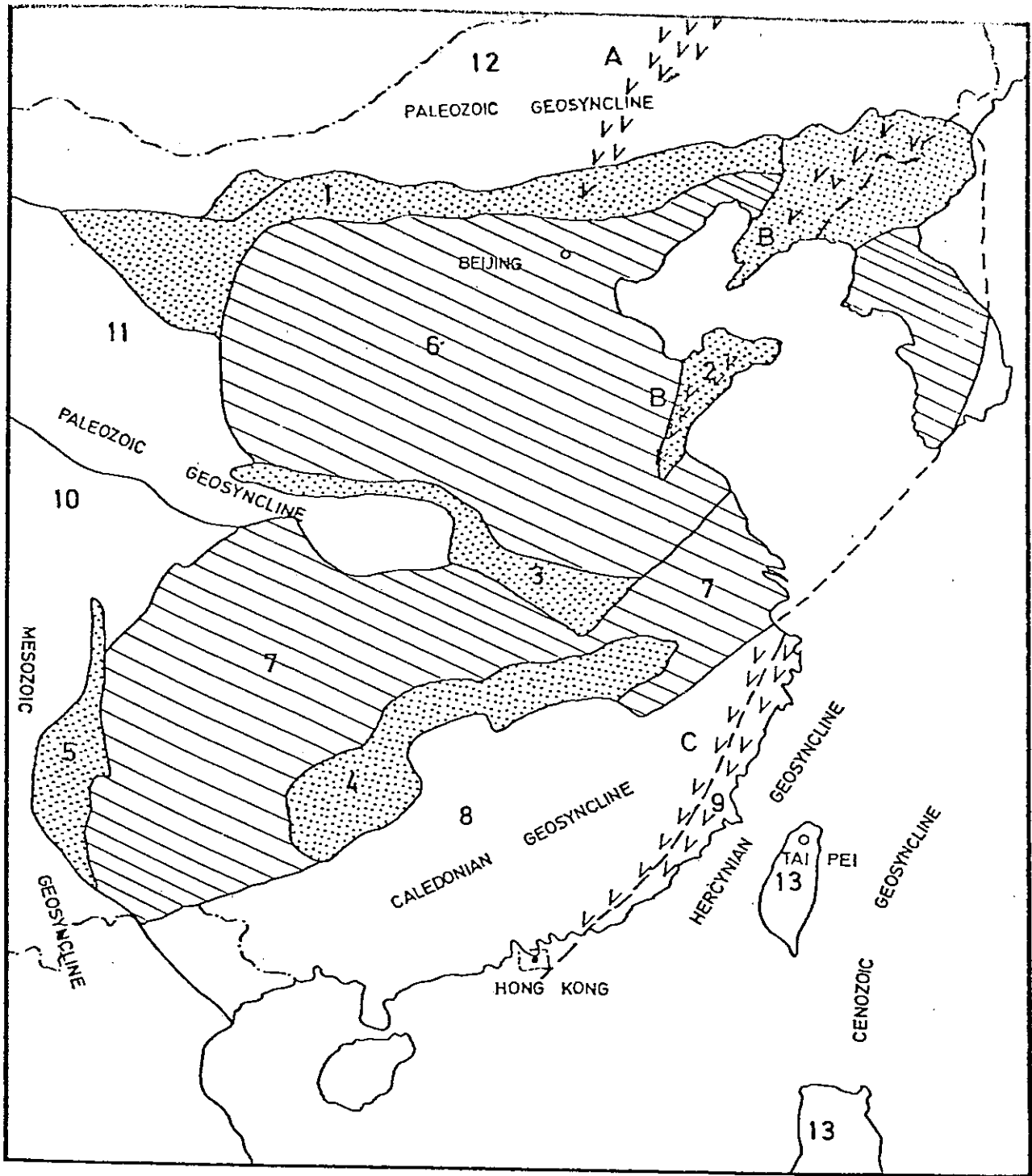
4. Review of The Principal Tectonic Schools in China





At present there are several different schools of thought on the tectonics of China. However the main principals outlined below are common to all schools. For a little understanding of the more detailed work, a brief description is given below of the philosophy of five principal tectonic schools.

- 4.1 Dr. J.S. Lee, in 1926, published an article entitled "The Fundamental Cause of Evolution of the Earth's surface features" (Ref. 1). in which he suggested that the variation in rotation rate of the earth might cause changes in global tectonics. On this basis, he published the book entitled "The Basis and Methods of Geomechanics" in 1945 (Ref. 4), thus formally establishing his own discipline "Geomechanics". In 1962, he collected many new examples and published the book entitled "Outline of Geomechanics" (Ref. 5). In this book, he divided the tectonic systems of China as follows:-

1. Latitudinal System
2. Meridional System and
3. Shearing System

The latter, he further subdivided into Neocathaysian, Cathaysian, Cathaysoid, or ϵ -type, η -type and vortical systems.



KEY :  Shield  Platform  Geosyncline  Volcanics

MAIN TECTONIC DIVISIONS OF CHINA

Chinese Craton:

- | | | |
|---------------------|---------------------|--------------------------|
| (1) Yinshan Shield | (4) Jiangnan Shield | (6) North China Platform |
| (2) Jiaoliao Shield | (5) Kangtian Shield | (7) South China Platform |
| (3) Weiyand Shield | | |

Geosynclines:

- | | |
|---|--|
| (8) South Eastern Caledonian Geosyncline | (11) North Western Paleozoic Geosyncline |
| (9) South Eastern Coast Hercynian Geosyncline | (12) Northern Paleozoic Geosyncline |
| (10) South Western Mesozoic Geosyncline | (13) Island Arcs Cenozoic Geosyncline |

Volcanic Belts:

- (A) Da Hingan Ling Belt
- (B) Chang Bai - Giaoliao Belt
- (C) South Eastern Coast Belt

- 4.2 Dr. Huang Jiging, who is the President of the Geological Society of China at present, published a book in 1945 entitled "On Major Tectonic Forms in China" (Ref. 6), in which he tried to classify the tectonic units in China, according to the method of historical analysis, and, for the first time, put forward the view of polycyclic evolution of tectonic movements. He published a "Tectonic Map of China" (1:300,000), in 1960 and revised it in 1979. He pointed out that the Chinese craton can be subdivided into two parts: Sino-Korean Paraplatform and Yangtze Paraplatform. The term "Paraplatform" means unstable platform (Ref. 7).
- 4.3 Dr. Zhang Wenyong has established the hypothesis of "Block Tectonics" through application of both historical and geomechanical methods. In 1959, he published "The Tectonic Map of China and its neighbouring areas" and a book which is the explanation of the map, entitled "Outline of the Tectonic of China". He subdivided the crust of Eastern Asia into many "Fault Blocks". These are separated by crustal faults and basement faults. He pointed out that the main fault zones in China are conjugated in X-shaped shear nets (Ref. 10). He is about to publish a "Tectonic Map of Asia" based on his block Tectonics Study.
- 4.4 Professor Chen Guoda put up his "Diwa" (geodepression) hypothesis to explain the phenomenon of platform activation, such as strong block faulting and activities of extrusions and intrusions during the Mesozoic era in eastern China. He published a book entitled "Re-activities of Chinese Platform and its Mineral Resources Effects" in the early 1960s (Ref. 11). He pointed out that a post-platform mobile stage of "Diwa" is common in Asia, especially in Eastern China, during the Mesozoic and Cenozoic periods. Therefore, he suggested that the development of the crust tends to follow a spiral course upwards, mobility alternating with stability in the form of transformation, while the simple structure develops to the complex as does the lower to the higher in successive stages (Ref. 9).

Professor Yu Tack-Yen, Former President of Geological Institute of Changchun, also elucidated these "Re-activity of Platform" concept in his book entitled "The Geology of China" in August 1959 (Ref. 12).

- 4.5 Professor Ma Xingyuan of Peking Institute of Geology, during the last 20 years, stressed the important role played by gravity sliding in the course of tectonic movements. In 1982, he published his book entitled "Tectonic Deformation of the Song Shan Area. Honan Province, China". Professor Zhang Bosheng proposed his undulative-mosaic structure hypothesis in the early 1960s also (Ref. 9). Other writers, such as Professor Li Chunyu, Professor Guo Liangzhi, Professor Zhu Xiz and so on, have published many papers on the characteristics of the geology of China.

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中國地質簡介（摘要）

中國地體和地球表層的任何巨大地體一樣，可劃分出克拉通和地槽系兩大部份。中國克拉通又可分為華北（中朝）及華南（揚子）克拉通。中國地質界通稱中國克拉通為中國陸台或中國地台。

中國地槽系分屬三大系統：環太平洋系統、古地中海——喜馬拉雅系統、阿爾泰——鄂霍茨克系統。香港是位於東南加里東地槽系和東南沿海——海域海西地槽系交界處附近。後者的建立是近年中國地質研究的新發展。

中國地質上有許多重大的特點，如（一）克拉通的中央部份是低窪的地台，而邊緣部份却是翹起的條形地盾；（二）地盾和地台之間，往往出現長條狀的深拗陷帶，通稱台陷帶。其下部地層，常有輕微變質；（三）中國地台的蓋層褶皺，成長條梳狀，短軸箱狀或筴狀。而斷裂構造多為高角度的斷層。中國東部的構造線，多是北東向，稱為“華夏式”。發生在侏羅——白堊紀的地殼運動，中國通稱為“燕山運動”。它在中國東部十分顯著，不僅褶皺斷裂，而且有強烈的噴出與侵入活動，但卻沒有引起區域變質。（四）燕山運動的噴出活動，主要形成三條中、酸性火山岩帶：大興安嶺帶、長白—膠遼帶、東南沿海帶。香港是位於東南沿海火山岩帶的極南端。燕山期的侵入活動，以南嶺區為強烈。過去多認為是巨大的岩基體，近三十年來的詳細研究，已修改認為是岩株體的成羣出現或屬於多時代不同期的侵入雜岩體。

中國地質經過近六、七十年的研究，目前已形成許多重要的大地構造學派。它們從不同角度去解釋中國地質上的許多特點。如李四光教授為首的“地質力學”學派，主要解釋中國地體上構造形象的分佈特徵；黃汲清教授為首的“多旋迴”學派，依據歷史分析法，揭露中國地體受到長期多次的地殼運動強烈變形的特點；張文佑教授為首的“斷塊”學派，劃分中國地體為眾多的大小斷塊。認為中國主要的斷裂系統可以組成“X”型剪力網絡；陳國達教授為首的“地窪”學派，主要解釋了中國地體進入中、新生代以後，所具有的強烈活動現象；馬杏垣教授對於中國前寒武紀構造分區，作出許多重大嘗試。新近又出版了“嵩山構造變形”一書，指出“重力滑動”是大地構造運動的重要因素之一；喻德淵教授於1959年出版了“中國地質學”一書，很早就提出中國地台“活化”的概念，張伯聲教授於六十年代初提出“鑲嵌構造”的模式；還有李春昱教授、郭令智教授和朱夏教授等，都對中國地質構造的特徵，作出許多重要的解釋和貢獻。

通 訊

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