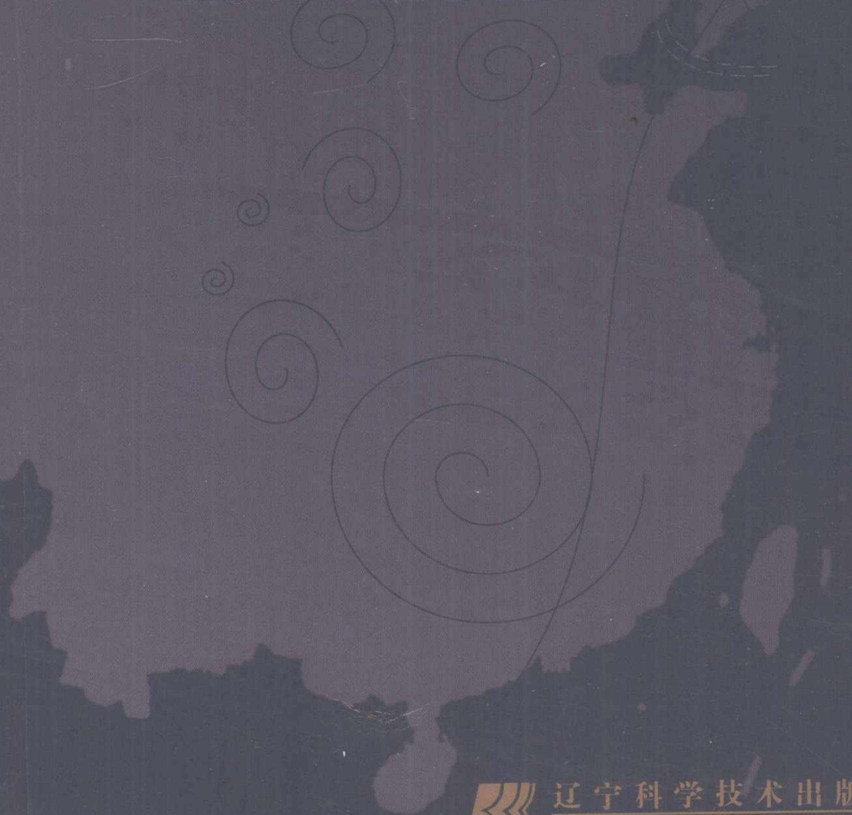
中国东部
陆板块与大型旋转构造体系

杨美霞 编著

EASTERN CHINA PLATE WITH LARGE-SCALE LAND ROTATING TECTONIC SYSTEM



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提 要

本书的目的是试图依据板块构造学理论，列述并解释中国陆板块内部极其独特、极其复杂的现代地质面貌特征。发生在新生代喜山期的印度板块与欧亚板块碰撞，在中国东部陆板块内产生强大的水平撞击力并转化为使基底岩块体及盖层岩系产生巨大旋转构造运动，尤其华北、华南两个超大型煤盆地及基底古陆块遭受到极大破坏，从而形成由旋转构造体组成的大型旋转构造体系。

一、旋转构造运动和大型旋转构造体系的成因机制

根据中国东部陆板块内华南、华北两个超大型煤盆地及基底古陆块遭受构造运动破坏后，对残存煤田构造形态及基底古陆块岩体构造特征的分析结果，认为它们均受旋转构造运动和大型旋转构造体系控制，这是新生代老第三纪渐新世中期印度板块与欧亚板块相碰撞在中国东部陆板块内产生的结果。时间的确定主要是根据中国东部陆板块内各时期聚煤盆地，特别是对华北东部老第三纪聚煤盆地在受构造运动破坏后的残留煤田及其基底岩块体构造特征的分析，分析发现这些聚煤盆地的岩相和沉积特征差异极大。其原因是受“东南大型北东左向旋转构造体”的外旋回层古陆岩块体由南向北发生迁移的构造运动，并破坏华北大型煤盆地，使东半个煤盆地向北迁移，在华北大型煤盆地东缘形成纵贯南北的北北东左向平移深大断裂带（一般称之为郯庐平移深大断裂带）。受其影响，使华北东部老第三纪原来浅湖型、湖滨洼地型和山间盆地型的聚煤盆地，改造成为沿深大断裂带展布的狭长条状断陷型聚煤盆地，使原聚煤环境遭受极大的破坏与改变。同时大量的粗粒碎屑迅速沉积并形成巨厚的碎屑岩系覆盖在下部含煤岩系之上，从而结束了老第三纪聚煤期。因此，郯庐平移深大断裂的生成时期即是老第三纪聚煤的结束时期，也就是老第三纪的渐新世中期。

二、中国东部陆板块内，华南与华北地区大型旋转构造体系的划分

喜山期印度板块与欧亚板块相碰撞，在中国陆板块内的西南部形成著名东西向展布的巨大青藏高原隆起褶裂构造带。在中国陆板块内的东部由于华南、华北两个超大型煤盆地及基底古陆块相碰撞在其中间形成秦岭碰撞挤压褶裂构造带，以此构造带为界划分为华南、华北两个不同特色的大型旋转构

造体系。

华南地区：东南大型北东左向旋转构造体、四川次级右向旋转构造体、滇中东滑移分地质体、康滇迁移分地质体及灌县（都江堰）低序次右向旋涡构造体。

华北地区：分为东部、西部和中部。

东部：东南迁移地质体，下辽河平原东、西部斜坡带地质体，渤海海域东、西部地质体，鲁东、鲁西地质体，北部邻区伴生的东北部隆起地质体和北东向楔形地质体。

西部：脱离岩壳大型北西西右向旋卷构造体、祁连山分地质体、阿拉善分地质体和柴达木分地质体。

中部：大型北东左向旋转构造体、次级右向旋转构造体、次级左向旋转构造体及低序次东南右向旋移构造体。

三、大型旋转构造体系的主要特征

在我国关于普通旋卷构造这一类型的构造体系早已被地质学者们认识。本书所叙述、划分的大型旋转构造体系，系指受喜山期印度板块与欧亚板块相碰撞的影响，在中国东部陆板块内产生强大的水平撞击力并转化为形成巨大旋转构造运动应力场，从而形成规模巨大、涉及范围广、切割古陆块深、破坏力极强的大型旋转构造体系。

1. 以受外部强大水平构造运动应力作用为主，所以大型旋转构造体的外旋回层、外旋裂带最为发育，而核心（砥柱）部位不明显，体积小甚至很难确认。

2. 旋转构造运动以水平构造运动为主，因此基底古陆块所受到的冲击与破坏最为强烈。旋转构造运动应力强度多集中在基底古陆岩块上，使其自身产生强烈破坏与抬升，并同时控制上覆盖层岩系，在巨大的旋转构造运动应力场作用下，形成大型旋转构造体。所以说大型旋转构造体的产生是基底古陆块受构造运动剧烈破坏、变迁的结果。埋藏在深部的岩煤系常被基底古陆块携移到浅部出露，并产生滑移甚至被消减掉。例如：华北中部区大型北东左向旋转构造体。

3. 华北地区西北部因受中国陆板块内的西南部青藏高原大幅度隆起的巨大褶裂构造带影响，旋转构造运动应力强度高度集中在抬升的基底古陆块陆缘碰撞处，故而产生巨大垂直向上脱离岩壳的旋转构造运动应力场，使上覆盖层岩系全部卷入其中形成大型旋卷构造体，在重力作用下脱散地表形成很发育的分地质体。例如，华北西部区脱离岩壳大型北西西右向旋卷构造体与分地质体。

4. 旋转构造运动应力场，发生在不同岩系地层或相同岩性地层内，所产

生的旋转构造体类型也各不相同。在巨厚古老变质岩体上，形成面积较大的菊花形旋转构造体。例如长白山白头山天池广大地区，所出露的老第三纪和第四纪玄武岩受菊花形旋转构造体控制，呈现大面积圆形分布。

5. 大型旋转构造体的旋裂带对岩块体的破坏最为强烈。尤其是外旋裂带在外旋回层岩块体旋移构造运动作用下，产生切割深、旋移距离大、破坏性最强烈的外旋裂带。例如著名的郯庐平移深大断裂带即是东南大型北东左向旋转构造体外旋回层岩块体北迁旋移构造运动的产物。

6. 大型旋转构造体所派生的次级旋转构造系列控制分地质体的生成与构造形态特征。

7. 大型水平旋转构造运动是在应力偶不均衡状态下相互作用，产生巨大旋转构造运动应力场并形成旋转构造体。但在水平旋转构造运动应力偶均衡的核心部位即开始转化为垂向旋转构造运动，使核心部位的岩体产生似螺旋式的下降运动，形成地质降落体。控制地质降落体的构造为旋涡构造即是低序次旋涡构造体的形成。低序次旋涡构造体特征明显，一是垂向旋转构造运动发育，破坏、切割深部岩体与煤层。二是受现代新构造运动影响复活性强。所谓低序次旋涡构造体的复活，首先是水平旋转构造运动的复活而导至旋涡构造体垂向构造运动的加强，影响周围岩块体重新遭受极大破坏。突出表现在地表浅层岩系中破坏性最强烈的帚状外旋裂带，由于旋运强度极大与周围岩块体上的深大断裂带产生交切，形成新的极复杂的交织断裂构造带。例如灌县（都江堰）低序次右向旋涡构造体的帚状外旋裂带与龙门山深大断裂带及四川次级右向旋转构造体所派生的分内旋裂带相互交切，形成规模巨大的交织断裂构造带。推测 2008 年 5 月 12 日四川省汶川大地震与上述交织断裂构造带有直接关系。

四、大型旋转构造体控震特征

依据历史地震资料记载[30]，结合中国东部陆板块内区华南、华北两个大型旋转构造体构造特征，从地质构造角度出发作了概略分析，分析认为：

1. 大型旋转构造体是以陆板块内水平旋转碰撞构造运动为特征，垂直差异构造运动不发育，因此受大型旋转构造体控制的中国陆板块内东部区地震带与西部区属于喜马拉雅地震带有显著差异。东部区相对不易发生地震。

2. 大型旋转构造体的旋裂带对岩块体破坏性最强烈，尤其是在外旋回层岩块体旋移构造运动作用下产生切割深、水平旋移距离最大的外旋裂带，在遇到巨大的阻应力阻截或与深大断裂带剧烈相互交切时，即会形成极其复杂的交织断裂构造带。其能量应力强度的转换高度集聚，创造了易发生大地震的条件。依据历史地震资料记载，例如发生 8 级以上大地震的有山丹县马场、临沂、渤海海域、渭南、临汾、崇明等。

外旋回层岩块体在外旋裂带控制下，在旋移构造运动过程中能量应力都得已释放，所以外旋回层岩块体本身是不易发生地震的，尤其是外来岩组成的地质体。例如东北地区的东南迁移地质体，山东地区的鲁东、鲁西地质体等。

由于外旋回层岩块体抬隆旋移构造运动应力的增强，与平原断陷区形成巨大的差异断裂构造带，使平原区断陷盆地深处能量、应力易于集聚，在现代强大新构造运动作用下，在平原断陷区易发生地震。例如华北地区中东部平原区等。

3. 各大型旋转构造体类型存在差别，其控震特征也不相同。旋转构造体所派生的分地质体都具有独立的构造特点，因而反映出不同的分地质体控震特征是不同的。例如银川、海原、六盘山、天水、松潘及汶川大地震带，从分布地理区域上呈现南北向分布，但各地震带特点均受各自大型旋转构造体、次级旋转构造体及低序次旋涡构造体控制，彼此没有任何构造上的关联。因此说在划分地震带与预测地震带的发生，决不可忽视大型旋转构造体系控震特征的重要作用。作者对地震学知之甚少 ，只是依据历史地震资料从地质构造角度作了简略粗浅分析，只作参考，有误之处敬望指正。

Introductory Remarks

The author tries to cite and interpret very unusual,very complex modern geological features inside the continental China plate through plate tectonic theory. The Indian plate actively collided with the Eurasian plate during Himalayan period of Cenozoic era have produced strong horizontal impacting force and transformed into huge rotational tectonic movement of basement block and capping rock series, immensely destructed two ultra–large typed North China and South China coal basins and basement old landmass,thus two ultra–large rotational tectonic systems were formed mainly comprised of large rotational tectosomes.

A. Genetic Mechanism of Rotational Tectonic Movement and Large Rotational Tectonic System

Based on analytical results of remnant coalfield structural forms and basement old landmass structural features of the South China and North China two super coalfields in eastern continental China plate after tectonic movement destruction,have considered that they are all controlled by rotational tectonic movement,and large rotational tectonic sytsem and results of collision between Indian plate and Eurasian plate on the eastern part of continental China plate during middle Oligocene epoch,Paleogene period. The chronological timing is mainly based on the analytical results of different period especially eastern North China Paleogenic coal–accumulating basins' residual coalfields and their basement tectonic features after the plate destructed by tectonic movement happened in the eastern China plate. Analytical results have found that the lithofacies and sedimentary characteristics of coal–accumulating basins have greater differentiae. The causation is come from tectonic migration of old landmass outer rock slice between two vortical surfaces of the southeastern large–scale levorotatory tectosome from south to north and disrupted North China super coalfield made its eastern lhalf northward migrated and formed a NNE sinistral wrench zone (known as Tancheng–Lujiang translational major and profound fault zone). The impact of the zone made the original shallow lacustrine, lakeshore depression and intermountain basin type coal–accumulating basins changed into long and narrow strip faulted coal basins along the major and profound fault, and made the coal–accumulating environment suffering from great destruction and transformation. Large quantity coarse–grained detrital sediments deposited rapidly and formed very thick clastic rock system and overlying on the lower coal measures, and consequently wound up Paleogenic coal–accumulating age. Thus, the forming of Tancheng–Lujiang translational major and profound fault is exactly the wound up time of the coal–accumulating age in Paleogene period, i.e. middle Oligocene epoch.

B. The ivision of South China and North China Large Rotational Tectonic Systems in the Eastern Continental China Plate

The collision of the Indian and Eurasian plates during Himalayan stage formed a famous Qinghai–Tibet Plateau lifted fault–fold zone. In the eastern continental plate because of collision between the South China and North China two ultra–large coalfields and basement old landmasses has formed the Qinling compressive folded belt, as a boundary the belt separated South China and North China two different featured large rotational tectonic systems.

South China area: southeastern large–scale levorotary tectosome, Sichuan secondary dextrorotary tectosome, middle–east Yunnan gliding branching geologic body, Kangdian migrated branching geologic body and Guanxian (ujiangyan) subordinate dextrorotary whirl tectosome.

North China area can be divided into three parts of eastern, western and central:

Eastern part: southeastern geologic body, lower Liaohe Plain eastern and western geologic bodies, Bohai Sea eastern and western geologic bodies, Shandong eastern and western geologic bodies, north contiguous area associated northeastern uplift geologic body and northeastern wedge–shaped geologic body.

Central part: large–scale NE levorotary tectosome, subleel dextrorotary tectosome, sublevel levorotary tectosome and subordinate southeastern dextrorotary tectosome.

C. Main Features of Large-scale Rotational Tectonic Systems

1. Tectonic systems of common vortex structure and suchlike were cognizant of by Chinese geologists very early. Large-scale rotational tectonic systems the book has described and classified were related to impact by collision between Indian and Eurasian plates during Himalayan stage, huge horizontal impact force produced in eastern continental China plate and transformed into immense rotational tectonic stress field, consequently formed gigantic, deal with a vast area, deeply dissected into old landmass with very strong destructive power large-scale rotational tectonic systems. In other words, the systems are under mainly outside strong horizontal tectonic stress, thus outer rock slices, outer shatter belts of rotational tectosomes are developed very well, while cores (nuclear columns) are not clear because of small volume, even difficult to validate.

2. Rotational tectonic movement is mainly horizontal movement, thus the impact and destruction to basement old land are the strongest. Rotational tectonic movement intensity of stress is mainly concentrated in basement old land, makes the landmass seriously destructed and uplifted itself and controlling overlying capping rock series under powerful tectonic movement stress field to form large-scale rotational tectosomes. So that formation of large-scale rotational tectosome is a result of basement old landmass tectonic movement violent destruction. Capping rocks and coal measures in depths are usually brought to shallow part and outcropped, glided even subducted, for instance, the large NE levorotary tectosome in the middle North China.

3. The northwestern part of North China because of impact from Qinghai-Tibet plateau big uplift tremendous fault-fold tectonic belt, rotational tectonic movement intensity of stress are highly concentrated on marginal collision zone of uplifting basement old landmass, therefore produce gigantic vertical upward rotational tectonic movement stress field to separate from rock crust make overlying capping rock series totally caught up in and form large-scale vortex tectosome, under gravity action drop to pieces on earth surface to form developed branching geologic bodies, such as the western North China large-scale NWW dextrorotary vortex tectosome and branching geologic bodies.

4. Rotational tectonic movement stress field arises in different of identical rock series strata, procuced rotational tectosome types are different. Upon the very thick old metamorphic rock mass can form rather large chrysanthemum rotational tectosome, such as in Tianchi area, Baitoushan, Changbai Mts. Has large area circular shaped Paleogene and Quaternary basalt outcropping controlled by chrysanthemum typed rotational tectosome.

5. Shatter belt of large rotational tectosome destructs rock mass violently. Especially outer shatter belt under outer rock slices block rotational gliding process will procuce deep dissected, rotational gliding distance longest, destructiveness strongest outer shatter belt. Such as famous Tancheng—Lujiang strike–slip deep major faulted zone is a result of southeast large size levorotary tectosome outer rock slice block northward migrated rotational gliding tectonic movement.

6. Secondary rotational tectonic series of rotational tectosome controls formation of branching geologic body and structuras form features.

7. Large rotational tectonic movement produces rotational tectonic movement stress field under unbalanced stress interaction to form rotational tectosome. But the nucleus part under the balanced horizontal rotational stress couple starts to transform into vertical rotational movement and makes rock mass in the central part helicoidally lowering down and forming downthrown geologic bodies controlled by whirl structure, thus the form of subordinate whirl tectosome with remarkable features. The first is strong vertical rotational tectonic movement, destructs and dissects rock mass and coal seams in depths. The second is strong reactivation because of impacts from modern tectonic movement. The reactivation of so–called subordinate whirl tectosome above all things is reactivation of horizontal rotational tectonic movement brings on deepening of whirl tectosome vertical tectonic movement and makes surrounding rock mass suffers from large destruction again. Eminently finds expression is strongly destructed brush shaped outer shatter belt in shallow and surface rock series. Due to intersect of strong movement of peripheral rock mass and deep major faulted zone forms new and very complex anastomosing faulted structures. Such as intersection between the

Guanxian (Dujiangyan)subordinate dextrorotary whirl tectosome brush shaped outer shatter belt and Longmenshan deep major fault and subordinate Sichuan dextrorotary rotational structure secondary branching inner shatter belt formed huge anastomosing faulted structure zone. It is supposed that the May 12,2008Wenchuan violent earthquake in Sichuan Province had direct relation with above mentioned anastomosing faulted structure.

D. Earthquake Control Characteristics of Large Rotational Tectosome

According to historical earthquake record [30],combined with structural features of South China and North China two large rotational tectosomes in eastern continental China plate analyzed from tectonic point of view,the analysis considered:

1. The movement of large rotational tectosome is characterized by horizontal rotation and collision,vertical differential tectonic movement is not developed,thus the eastern continental China plate earthquake zone controlled by large rotational tecosome is obviously different from the Himalayan earthquake zone in western part. Relatively, earthquake is not easy to happen in the eastern earthquake zone.

2. In large rotational tectosome,destruction of shatter belt to rock mass is strongest,especially the rotational gliding of outer rock slices produced deeply dissected,rotational gliding distance longest outer shatter belt. When huge resistant stress intercepted or violently intersected with deep major faulted zone will produce very complicated anastomosing faulted structural zone. Its energy,stress transition and highly concentrated,created conditions of violent earthquake. Famous earthquakes with magnitude≥8 have Shandan horse ranch,Linyi,Bohai sea area,Weina,Linfen and Chongming etc.

Outer rock slices under the control of outer shatter belt,energy and stress all have released during rotational gliding process,thus outer rock slices per se not easy to happen earthquake,especially exotic geologic bodies,such as southeastern geologic body of Northeast China area,eastern Shandong and western Shandong geologic bodies of Shandong area.

Owing to increasing uplift rotational gliding structural movement stress of outer rock slices rock mass,a huge differential faulted zone produced between plain area faulted depression, makes energy and stress easy to concentrate in plain area depression basin depth. Under the recent period neotectonism action, easy to happen earthquake, such as in middle—east North China plain area.

3. Different rotational tectosomes have different earthquake controlling characters. Derived branching geologic bodies all have independent structural features, reflected their different earthquake characters. Such as the Yinchuan, Haiyuan, Liupanshan, Tianshui, Songpan to Wenchuan major earthquake belt is north to south distributed, but earthquake zone characteristics of each place are controlled by respective rotational tectosome, secondary rotational tectosome and subordinate whirl tectosome. Have no any structural relations between each other. Thus large rotational tectonic system cannot be ignored in earthquake zone division and earthquake prediction. The author is awake to indigent knowledge of seismology herself, can only give superficial analysis based on historical earthquake information.

前　言

作者一生从事地质工作，现已古夕之年，早已退休了，但对地质事业充满乐趣与热爱。对多年参与煤田地质勘探工作积累的大量地质实践勘查资料，结合收集同行地质专家们积累的有关中国大陆区域地质构造资料，运用板块构造学理论，进行综合分析研究，分析发现中国陆板块内尤其东部区均受由旋转构造体组成的大型旋转构造体系控制，并塑造了中国陆板块内极为独特、极其复杂的现代地质面貌特征。研究大陆区域构造特征，寻找适合中国陆板块内正确的大陆构造模式是非常重要的。本书以中国陆板块内东部区为主，以煤田地质实践勘查资料为论据，列述实例证明大型旋转构造体系对煤田（矿体）赋存构造形态特征的控制，提出大型旋转构造体系作为中国陆板块内尤其是东部区的主要大陆构造模式。这一提法是否合适，期望从事地质工作的专家们在实践工作中来验证与参考。

本书共分三部分，作者把中国陆板块内东部区分华北和华南两大部分叙述。由于作者的主要工作地区在北方，特别是在东北地区，因此这部分的实例研究内容非常丰富，从感性到理性进行了详尽的分析，因此篇幅较大，许多案例可在找矿尤其是找煤时作为参考。而华南这一部分，实际材料主要来自华南的地质工作者，作者运用了自己的大型旋转构造体系构造模式进行了分析，因此较为简约。

地震部分主要依据以往地震资料记载[30]，结合大型旋转构造体系构造模式作以简单分析，分析发现，如 2008 年 5 月 12 日震惊世界的四川省汶川大地震，是东南大型北东左向旋转构造体受现代新构造运动作用产生复活所致。因此研究地震形成及预测地震发生的可能，决不可忽视大型旋转构造体系控震特征的重要作用。作者只是从地质角度对地震资料作以简单分析仅作参考。

本书请中国煤田地质局毛邦倬教授审核，对全书不少地方作了订正和指导，并协助编写了本书英文提要。此致谢意。

作者　杨美霞

2008 年 10 月

目 录

第三章　大型旋转构造体系在中国陆板块内东部地区对地震带的控制作用