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《东特提斯地质构造形成演化》:书评

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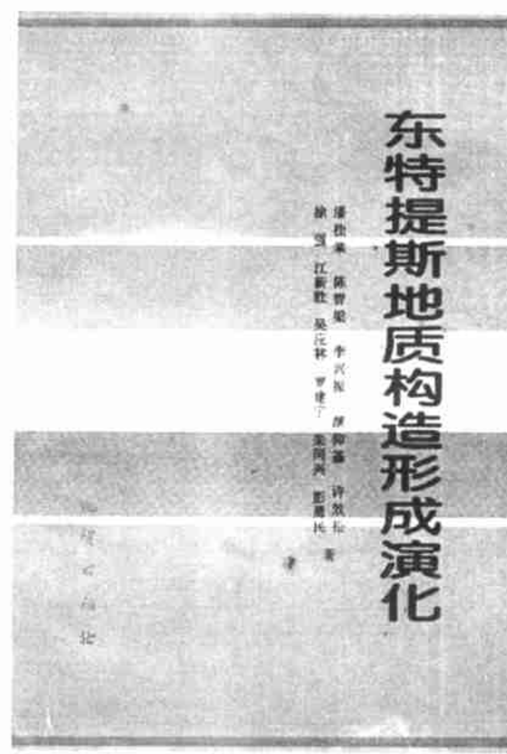
《东特提斯地质构造形成演化》(潘桂棠等,1997)一书的作者高瞻远瞩,对东特提斯的地质构造演化提出了独特的见解,作者的解释是对这个问题很多传统观点的挑战。他们不仅假定东特提斯开始于前寒武纪晚期,比太平洋体系更老,而且拼合形成陆壳的构造单元主要是由弧、海山、混杂岩带、陆块和弧后盆地、弧的基底和大洋盆地的洋壳组成的增生复合体。构造活动使这些岩石单元加积增生,形成了三个大陆群,即劳亚、冈瓦纳和泛华夏大陆群。这些大陆边缘时而受到伸展构造的裂解,时而被其它期次的大洋新生物质加积增生。直到新生代,大陆群才最终缝合,物质增生才告完成。



作者在充分研究大洋、大陆、大洋岛弧和边缘海环境的基础上提出现实主义的模式,这些模式包括建立在弧-弧、弧-陆、陆-陆碰撞及与之相关的前陆和后陆盆地基础上的框架。从构造、岩相、地层、古生物和地球化学资料推断,大多数变形地带内的蛇绿岩不是来自大洋区域,而是来自于几百公里至上千公里宽的边缘海。因此,他们以现代太平洋西南区域作为东特提斯区域内诸多构造单元的模式。

作者对东特提斯演化现今地质研究中提出过的三个基本模式,即(1)剪刀张模式,(2)传送带模式,(3)洋盆的手风琴开合模式进行了评论。他们发现这些模式都有不足之处,应该有更好的解释。因而他们推陈出新,提出多岛弧构造模式解释东特提斯的演化和亚洲大陆壳的形成环境。

近年来,许多蛇绿岩带和广阔的混杂岩带的识别,为多岛弧模式提供了佐证。从昆仑往北到祁连山一带的早古生代构造单元即为一例。作者根据现有的地质资料,认为这个地块为弧、边缘海和复杂碰撞带的复合体,其是在劳亚大陆边缘形成时打开和闭合的。其岩带包括弧、具边缘海特征的蛇绿岩、陆块、增生混杂岩、洋底高原、洋岛和礁复合体,证明这些边缘海环境不断打开和闭合的复杂过程与太平洋西南极其类似。

另一个实例是晚古生代到早中生代的金沙江缝合带。他们认为在构造弧和大洋环境组成的岩石下面,存在与寒武纪增生构造类似的较老的前泥盆纪岩石的基底。

作者的一些解释无疑是对现有东特提斯构造演化模式的挑战。他们认为班公-怒江缝合带是冈瓦纳的北缘,其在前寒武纪晚期曾为大洋环境。他们进一步提出,三个大陆群的陆源物质主要为大西洋西南型增

生组合，而非来自从冈瓦纳裂离并向北漂移的陆块。班公缝合带以南的陆块如拉萨地块是由于冈瓦纳之下的斜向俯冲而从冈瓦纳裂离出来的，而雅鲁藏布缝合带则是小洋盆而不是普遍认为的大洋闭合的结果。他们提出的软流圈流动的地球动力学模式为复杂旋转的传送带模式，这也为进一步研究提出了新思路。

该书提出了许多颇具挑战性的概念，其解释新颖，别具一格。更为重要的是，他们提出的模式可为野外地质工作实践所验证，这将在未来若干年内对地质工作者产生深远的影响。

附：原文

COMMENTS ON PAN ET AL., 1997 GEOLOGICAL-TECTONIC EVOLUTION IN THE EASTERN TETHYS

This book takes a much longer view of the evolution of the Eastern Tethys than is usual. The reason is because the authors present an interpretation for the Eastern Tethys that challenges most of the commonly held ideas on this subject. Not only do they hypothesize that the Eastern Tethys had its inception in Late Precambrian time, and is thus older than the Pacific Ocean realm, but that the amalgamation of tectonic units that form the continental crust are largely accretionary complexes composed of arcs, sea mounts, mélange belts, continental fragments and fragments of oceanic crust of back arc basins, arc basement and more rarely large ocean basins. Tectonic activity accreted these rock units to three large continental domains, Laurasin, Gondwana and Pan-Cathaysia. These margins were subject at times to disruption by extensional tectonics and at other times to the accretion of new material, largely born in the oceans. Final suturing of these continental domains and the complex accreted materials was not completed until Cenozoic time.

The authors present actualistic models of well-studied broad oceanic, continental and oceanic arc and marginal sea environments. These models include the framework built on arc/arc, arc/continental, and continent/continent collisions and their associated foreland and reto-foreland hasins. From tectonic, petrographic, stratigraphic, paleotological and gechemical data they conclude that the ophiolitic fragments within most of the deformed belts are not from large ocean domains, but marginal seas, with widths of a few hundred kilometers up to a couple of thousand kilometers. Thus they use the modern SW pacific region as the model for most of the tectonic elements found within the Eastern Tethyan region.

They review the three basic models that have been proposed during the modern era of geological investigation for the evolution of the Eastern Tethys: (1) the scissor model, (2) the conveyor belt model, and (3) the concertina model of opening and closing of oceanic basins. They find them all lacking, for various reasons, as good explanations for the evolution of the Eastern Tethys. Instead, they argue for a progression of ideas toward the development of an archipeligo model as the main tectonic model for the evolution of the Eastern Tethys and the environment for the formation of the Asian continental crust.

The support for the archipeligo model comes from the recent recognition of numerous ophiolite belts and extensive zones of mélange formerly mapped as stratigraphic units. One example comes from the Early Paleozoic tectonic units present from the Kunlun northward into the Qilian Shan. They use geological data to interpret this terrane as a complex of arcs, marginal seas, and complex collisional belts that were opened and closed against the Laurasian continental margin. These belts of rocks include arcs, ophiolites of marginal sea character, continental fragments, accretionary mélanges, oceanic plateaus, oceanic islands and reef complexes as evidence for the complex superposition of opening and closing of marginal sea environments similar to those of the SW Pacific realm.

Another example comes from the Jinsha suture zone of Late Paleozoic to Early Mesozoic age. Below the rocks that comprise well-known tectonic arc and oceanic environments, they argue there is a basement of pre-Devonian rocks of an older history of accretionary tectonics of similar type that may extend back to Precambrian time.

Several of their interpretations will certainly challenge the modern tectonic paradigms for Eastern Tethyan evolution. The Bangong-Nujiang suture is regarded as the northern edge of Gondwana. This was an ocean that had its inception in Late Precambrian time. They further suggest that most of the continental material added to the three large continental domains represents SW Pacific-type accretionary complexes, not the large continental fragments derived by northward movement of rifted pieces from Gondwana. Contientnal fragments south of the Bangong suture, such as the Lhasa terrane, were rifted from Gondwana by dipping subduction below Gondwana, and the Yarlung-Zangbo suture represents the closure of a small ocean basin, not a large ocean as commonly assumed. Their geodynamic model for asthenospheric flow as a conveyor with complex eddys also presents new ideas for future research.

There are a great many challenging concepts presented in this work. The interpretations presented here are in large part new and brought into a single volume. What is important is that the models they present are testable by detailed geological work that will confront geologists for many years in the future.

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