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环太平洋俯冲带内双地震带及其成因机制研究进展

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摘要 俯冲带作为地球最为庞大的循环系统的重要组成部分，已成为地球科学的研究热点之一.很多俯冲带，特别是环太平洋俯冲带内的中深源地震，在空间上呈明显的分层分布，并且各层地震具有不同的震源机制，即所谓的双地震带现象.本文简要介绍了环太平洋双地震带形态特征与震源机制的空间分布，并回顾了双地震带的几种成因模型.根据形态特征和震源机制的差异，中源深度的双地震带可以分为两类，其中，一类双地震带对应上、下二层分别为压缩和张性的地震分布；另一类双地震带的震源分布较浅，且其浅部地震以横向压缩为主.此外，日本本州东北俯冲带的地震分布可能是由三层地震带组成的，而且汤加、伊豆-小笠原地区还发现深源深度的双地震带.通过对双地震带的形态特征以及其热力学条件的研究，人们从抗弯作用、脱水脆化、相变断层等多方面，尝试建立解释双地震带成因的模型.目前，大多数研究利用数值计算结果，结合蛇纹石脱水脆化、相变断层模型，能够不同程度地分别解释中源和深源双地震带成因.不过，这些模型几乎相互独立，并不能同时解释中源和深源双地震带.有人试图尝试用统一模型解释中深源地震成因，例如，先前存在的断层模型，不过该模型还不很具有说服力.也可能是多种因素的联合作用，共同影响着俯冲板内的温度场、应力场分布.

关键词 俯冲带,双地震带,抗弯作用,脱水脆化,相变断层

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Progresses of the researches and the causing mechanisms on the double seimic zones within the subduction zones around the pacific ocean

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Abstract As our Planet’s largest recycling system, subduction zone has become one of the most significant leading research aspects of earth science. Intermediate-deep earthquakes in some subduction zones, especially most of circum-Pacific subdution zones, occur in two distinct layers, forming two seismic zones with different focal mechanisms, separated vertically by an aseismic zone about 40 km thick. The discovery and simultaneous studies of double seismic zones greatly contribute to the further studies on stress regimes of subduction zones. Briefly introduced spatial location, morphology and stresses distribution of Double seismic zones within some subductions around the Pacific ocean. In addition to the two types of shallow Double seismic zones with depth range from 60 to 200 km, there are deeper (>325 km) Double seismic zones beneath Tonga and Izu-Bonin arcs. According to the morphology and thermodynamic conditions of Double seismic zones, several models including unbending, dehydration embrittlement and transformational faulting, have been proposed as possible causes for intermediate-deep earthquakes and Double seismic zones. Comparing with numerical modeling results, many researches considered serpentine dehydration and transformational faulting as the dominant causes for intermediate and deep Double seismic zones, respectively. However, there is no a uniform model, which can be accepted as a mechanism for both intermediate and deep double seismic zones. Although it is very questionable and disputable, the hypothesis that intermediate-deep events occur on pre-existing or fossil faults may be a intriguing and paradoxical feature of intermediate-deep double seismic zones. Furthermore, the combination of several factors, such as unbending and dehydration, perhaps contributes more or less to the complexity of the thermal and stress regimes within the subduction zone.

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