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汶川 M_S 8.0级地震余震分布及周边区域P波三维速度结构研究

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Aftershock distribution of the M_S 8.0 Wenchuan earthquake and three dimensional P-wave velocity structure in and around source region

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摘要

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摘要 利用川滇地区长期积累的地震走时观测资料和汶川地震余震观测资料对汶川地震震源区及周边区域地壳和上地幔P波三维速度结构进行了研究.结果表明,浅部P波速度分布与地表地质之间具有很好的对应关系.龙门山断裂带在20 km以上深度表现为高速异常带,彭灌杂岩体和宝兴杂岩体为局部高速异常区.龙门山断裂带中上地壳的局部高速异常体对汶川地震的余震分布具有明显的控制作用.在余震带南端,余震全部发生在与宝兴杂岩体对应的高速异常体的东北侧;在余震带的中段,与彭灌杂岩体对应的高速异常体在一定程度上控制了余震的分布;在余震带的东北端,宁强—勉县一带的高速异常体可能阻止了余震进一步向东北扩展.龙门山断裂带中上地壳的P波高速异常表明介质具有相对较高的强度,在青藏高原物质向东挤出过程中起到了较强的阻挡作用,有利于深部能量积累.在30 km深度之下,扬子地块具有明显的高速特征,其前缘随深度增加向青藏高原方向扩展,在地下壳和上地幔顶部已达到龙门山断裂带以西.

关键词 汶川地震, 地震定位, 层析成像, 龙门山断裂带, 青藏高原

Abstract: 3-D P-wave velocity structure in crust and uppermost mantle in and around Wenchuan earthquake source region was studied using long-term accumulated seismic travel time data in Sichuan-Yunnan region and aftershock data of Wenchuan earthquake. The result shows that shallow P-wave velocity structure has good correlation with surface geology. Longmenshan fault zone is imaged as high P-wave velocity region in 0~20 km depth. Pengguan complex and Baoxing complex are imaged as two local high velocity anomaly bodies. The upper crustal high velocity anomaly bodies in Longmenshan fault zone control the distribution of aftershocks. At the southern part of the aftershock zone, aftershocks occurred only in the northeast of the high velocity body related to Baoxing complex. In the middle part, the distribution of aftershocks seems to be controlled by the high velocity anomaly body corresponding to Pengguan complex to some extent; In the northeast part, the high velocity body around Ningqiang-Mianxian may prevent the further extension of aftershocks to the northeast. The existence of upper crustal high P-wave velocity zone in Longmenshan implies that the upper crust has relatively high strength, which may play an important role in obstructing the extrusion of Tibetan Plateau material to east, and are prone to accumulate energy in deep depth. Yangzi Block is characterized by high velocity region below 30 km depth, and its front extends to Tibetan Plateau with depth increasing and reaches to the west of Longmenshan fault zone in the lower crust and upper mantle.

Keywords Wenchuan Earthquake, Earthquake location, Seismic tomography, Longmenshan fault zone, Tibetan Plateau

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