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青藏高原中部地壳和上地幔各向异性分析

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Anisotropy of the crust and upper mantle beneath the central Tibetan plateau

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摘要 对布设于青藏高原中部INDEPTH-III宽频带数字地震台阵的41个台站记录的远震体波资料所提取出的P波接收函数和SKS波形资料做偏振分析,并采用以误差为权的叠加分析方法求得每一个台站的Pms和SKS快波偏振方向和快慢波的时间延迟,获得了从拉萨块体中部,经喀喇昆仑—嘉黎断裂系和班公湖—怒江缝合带,到羌塘块体中部的地壳和岩石圈地幔的地震波各向异性图像.从各向异性分析结果可以看到:Pms快慢波的时间延迟为0.3~0.5 s,在拉萨块体,快波方向主要为NE-SW向,在羌塘块体,快波方向为近E-W向.SKS快慢波的时间延迟为1~2 s,主要分布在拉萨块体的北端和羌塘块体,并且向靠近班公湖—怒江缝合带和昆仑—嘉黎断裂带的方向时差增大,快波方向基本与Pms快波方向一致.在喀喇昆仑—嘉黎断裂带以南的拉萨块体中部没有测量到明显的SKS分裂,这可能与该区存在双层快轴方向近垂直的各向异性层有关.结合研究区已有的研究成果可以推测:拉萨块体地壳各向异性层的快轴方向与印度—欧亚板块汇聚方向一致,可能与地壳较强刚性有关,其在板块汇聚过程中不易发生流展变形;而羌塘块体地壳和岩石圈中各向异性层的快轴方向与青藏高原物质逃逸方向一致,表明这一块体流变性均较强,在板块汇聚挤压力的作用下发生了侧向流变变形.

关键词: 青藏高原中部 地壳和上地幔各向异性 Pms SKS 流变性

Abstract: This paper analyzes S-wave splitting analysis in terms of P-wave receiver functions and the SKS shear waves from the INDEPTH-III profile which consists of 41 seismic stations deployed in central Tibet. Using the weight average technique with a weighting factor of the measuring error, the direction and extent of seismic polarization anisotropy in the crust and upper mantle beneath central Tibet, from the central Lhasa terrane, across the Karakoram-Jiali fault and Bangong-Nujiang suture to the central Qiangtang terrane, were imaged. Substantial splitting of Pms phase with delay time 0.3~0.5 s, and fast directions varying from NE-SW in the Lhasa terrane to EW in the Qiangtang terrane, was observed. The delay time of SKS for stations in the northernmost Lhasa terrane and Qiangtang terrane is 1~2 s which increases near the Bangong-Nujiang suture and Jiali fault, and the fast direction of SKS is similar to the Pms. No detectable SKS splitting was observed for stations located farther south in the central Lhasa terrane, which is related to a model with two-layer anisotropy of perpendicular fast direction. In combination with previous geological and geophysical studies, we infer that the Lhasa crust possesses high rigidity and has not experienced rheological deformation, so that the fast direction of the anisotropy layer in the crust is consistent with the direction of the India-Eurasia convergence. However, the Qiangtang terrane is possibly weaker and more likely has been rheologically deformed during the convergence process, so that the fast direction of the anisotropy layer in the crust and upper mantle is coincident with escaping direction of material of the Tibetan plateau.

Keywords: Central Tibetan plateau Anisotropy of the crust and upper mantle Pms SKS Rheology

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