利用地震波速研究青藏高原东北缘地壳组成及其动力学

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摘要 依据穿过巴颜喀拉地块的北部、秦岭地块、祁连地块、海原弧形构造区和鄂尔多斯地块的玛沁-兰州-靖边人工地震剖面的P波、S波的速度结构和泊松比结构，对青藏高原东北缘的地壳组成进行研究，并探讨其动力学过程. 首先，系统地归纳总结出一套将地震测深得到的原位P波速度校正到实验室温压条件下波速的具体可行的方法，利用大地热流值求取地壳不同深度的温度是该方法的关键. 然后，将上述剖面的原位P波速度校正到600 MPa和室温条件下，结合泊松比与相同温压条件下的实验室岩石波速测量结果进行对比，确定研究区的岩性组成. 结果表明，青藏高原东北缘地壳平均P波校正波速为6.43 km/s，地壳整体像上地壳一样呈酸性. 巴颜喀拉地块和秦岭地块南部的下地壳底部缺失校正速度V_p>6.9 km/s的基性岩，下地壳中酸性互层，下地壳整体呈酸性. 其他地块下地壳底部有2～10 km厚的校正速度V_p>6.9 km/s的基性岩，下地壳整体呈中性. 最后，根据青藏高原东北缘地壳结构和组成的研究成果，支持地壳增厚主要发生在下地壳的观点；提出巴颜喀拉地块和秦岭地块南部曾发生过下地壳拆沉作用，并导致高原的加速隆升.

关键词   青藏高原,速度校正,温压计算,地壳组成,下地壳拆沉

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Study on crustal composition and geodynamics using seismic velocities in the northeastern margin of the Tibetan Plateau

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Abstract Based on P-wave, S-wave velocity structures and Poisson's ratio of Maqin Lanzhou-Jingbian seismic refraction/wide angle reflection profile, which crosses the northern Bayan Har block, the Qinling block, the Qilian block, the Haiyuan arcuate tectonic region, and the Ordos block, the crustal composition of the northeastern margin of the Tibetan plateau is studied and the geodynamic issues are discussed. At first, a set of feasible methods are systemically summed up, with which in situ P-wave velocities observed by deep seismic sounding can be corrected to the velocity under the special condition of temperature and pressure in the laboratory. It is the key to the methods to get temperatures in the crust using heat flow. Secondly, in situ P-wave velocities of the profile are corrected to the velocities under a standard pressure of 600 MPa and room temperature，the corrected velocities, combined with Poisson's ratio, are compared with laboratory measurements of ultrasonic velocities, and the crustal petrologic composition is determined in the study area. The results show that the average corrected velocity in the northeastern margin of Tibetan plateau is 6.43 km/s, and the bulk crustal composition is felsic like the composition of the upper crust. In the Bayan Har block and the southern part of Qinling block, there is a lack of V_p>6.9 km/s mafic rock layer in the lowest crust, with felsic layer and intermediate layer alternating in the lower crust, and the bulk composition in the lower crust is felsic. In other blocks, there is a 2～10 km thick mafic layer of V_p>6.9 km/s in the lowest crust and the bulk composition is intermediate in the lower crust. At last, on the basis of the crustal structure and composition in the northeastern margin of the Tibetan plateau, the opinion that crustal thickening occurred mainly in the lower crust is supported, and it is proposed that delamination possibly occurred in the lower crust of the Bayan Har block and southern Qinling block in the recent geologic time, which accelerated the uplift of the Tibetan plateau.

Key words   Tibetan plateau   Velocity correction   Computation of temperature and pressure Crustal composition   Delamination of lower crust

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