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华北克拉通北缘—西伯利亚板块南缘的地壳速度结构特征

李英康[1], 高锐[2], 姚聿涛[1], 米胜信[1], 李文辉[2], 熊小松[2], 高建伟[1]*

1. 国土资源实物地质资料中心, 河北 燕郊 065201;
2. 中国地质科学院地质研究所, 北京 100037

Crustal velocity structure from the northern margin of the North China Craton to the southern margin of the Siberian plate

LI Ying-Kang[1], GAO Rui[2], YAO Yu-Tao[1], MI Sheng-Xin[1], LI Wen-Hui[2], XIONG Xiao-Song[2], GAO Jian-Wei[1]*

1. Geological Information Centre, Ministry of Land and Resource, Yanjiao Hebei 065201, China;
2. Institute of Geology, Chinese Academy of Geological Sciences, Beijing 100037, China

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摘要 华北克拉通北缘—西伯利亚板块南缘（张家口—中蒙边界）的深地震测深剖面长600 km，跨越华北板块、内蒙造山带和西伯利亚板块.沿测线采用8个1.5t的爆炸震源激发地震波，使用300套数字地震仪接收，取得了高质量的地震资料.通过资料分析和处理，识别出沉积层及结晶基底的折射波（Pg）、上地壳底面的反射波（P2）、中地壳内的反射波（P3）、中地壳底面的反射波（P4）、下地壳内的反射波（P5，仅在镶黄旗—苏尼特右旗下方出现）和莫霍面的反射波（Pm）等6个震相.采用地震动力学射线方法（seis88）得到的地壳速度结构表明：（1）在华北板块与内蒙造山带之间，内蒙造山带与西伯利亚板块之间，上地壳中存在明显的高速度局部变化，在地表发育大量的古生代花岗岩体、超基性岩体.（2）在中下地壳华北板块南缘的地震波速度大，为6.3~6.7 km/s，西伯利亚板块北缘的速度小，为6.1~6.7 km/s，且界面比较平缓.原因是在内蒙造山带内地壳的缩短和隆升造山引起了中下地壳界面的剧烈起伏，不同海陆块的拼合和物质交换导致了不同区域速度的不均匀性.（3）莫霍面在赤峰断裂带（F_2）以南和索伦敖包—阿鲁科尔沁旗断裂带（F_4）以北较为平缓，平均深度为40~42 km.在F_2—F_4之间呈双莫霍面，莫霍面1明显上隆，深度为33.5 km，层速度为6.6~6.7 km/s.莫霍面2明显下凹，在西拉木伦河断裂带（F_3）下方，最深达到47 km，速度达到最大为6.8~6.9 km/s，这可能是由壳幔物质混合引起的.依据莫霍面的特点，本文认为双莫霍面以南为华北板块北缘，以北为西伯利亚板块南缘，拼合位置在赤峰断裂带（F_2）与索伦敖包—阿鲁科尔沁旗断裂带（F_4）之间的区域.

关键词 华北克拉通北缘, 西伯利亚板块南缘, 深地震测深, 地壳结构

Abstract: Deep Seismic Sounding profile from Zhangjiakou to China-Mongolia border is about 600 km long, it goes across North China Plate, Xingganling-Mongolian orogenic belt and the Siberian plate. The recording of seismic waves from 8 explosions was conducted of 300 recorders along seismic line. The P-wave field provided good quality data for most of the profile. The authors processed, analyzed, and modeled the data which was collected during the wide-angle reflection and refraction effort. There are six phases, arrivals of refracted and reflected waves from sediments and basement (Pg), the reflected wave form the bottom of upper crust (P2), in middle crust (P3), the bottom of middle crust (P4), in the lower crust (P5,only appears in the beneath Xianghuang-Sunite) and Moho (Pm). Crustal velocity structure was obtained by seismic dynamics ray method (seis88). The results show that,(1) In the upper crust where is in area between North China Plate and Mongolia orogenic belt and in area between Mongolia orogenic belt and the Siberian plate, there are obvious high-velocity partial variations, and a lot of Paleozoic granite and ultramafic rock are exposed in the ground surface. (2) The velocities which is 6.3~6.7 km/s in the lower crust of southern margin of the North China Plate is higher than the velocities which is 6.1~6.7 km/s in the lower crust of the northern margin of the Siberian Plate, and the interface of the southern margin of the North China Plate is more gently than the northern margin of the Siberian Plate. The reason is that, in Inner Mongolia orogenic belt, the violent undulation interface of middle and lower crust may be caused by the crustal shortening and orogenic uplift, the flatten and material exchange in different blocks of land and sea result in the different regions of the velocity heterogeneity. Moho is more gently in the south of F_2 fault and in the north of F_4 fault, which is 40~42 km. There are double Moho boundaries between F_2 and F_4 fault, the No.1 Moho uplifts obviously, the depth is 33.5 km and velocities is 6.6 to 6.7 km/s. The No.2 Moho lies low

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obviously, the deepest area reaches 47 km in the beneath of F_3 fault and the velocity is 6.8 to 6.9 km/s, which was caused by the crust-mantle mixed substance. Based on the characteristics of the Moho, the authors consider that the south area of double Moho boundaries is the northern margin of the North China Plate, and the north area of double Moho boundaries is the southern margin of the Siberian plate, the split position of the North China Plate and Siberian plate is between F_2 and F_4 fault.

Keywords Northern margin of North China Plate, Southern margin of Siberian plate, Deep seismic sounding, Crustal structure