地球物理学报 » 2012, Vol. 55 » Issue (11) :3601-3614 doi:10.6038/j.issn.0001-5733.2012.11.009
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引用本文(Citation):
危自根, 陈凌.东北地区至华北北缘地壳结构的区域差异: 地壳厚度与波速比的联合约束. 地球物理学报, 2012,55(11): 3601-3614,doi: 10.6038/j.issn.0001-5733.2012.11.009

WEI Zi-Gen, CHEN Ling.Regional differences in crustal structure beneath northeastern China and northern North China Craton: constraints from crustal thickness and V_p/V_s ratio.Chinese J.Geophys. (in Chinese),2012,55(11): 3601-3614,doi: 10.6038/j.issn.0001-5733.2012.11.009

东北地区至华北北缘地壳结构的区域差异: 地壳厚度与波速比的联合约束

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Regional differences in crustal structure beneath northeastern China and northern North China Craton: constraints from crustal thickness and V_p/V_s ratio

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摘要 本文通过对分布相对均匀的127个固定台站下方接收函数的*H*-*κ*叠加分析,并结合前人对97个线性密集流动台站的研究结果,获得了东北地区和华北克拉通北缘地壳厚度(*H*)与平均波速比(*κ*).结果表明研究区域地壳总体较薄,波速比变化复杂,地壳密度横向变化大,暗示着地壳在中—新生代经历了显著的不均匀破坏与改造.东北和华北北缘都存在明显的东西向差异.东北地区西侧兴蒙造山带地壳大致随着海拔增高逐渐增厚,*H*和*κ*分别主要在31~39 km和1.71~1.83之间变化,平均值分别为~35 km和~1.77;东侧吉黑褶皱带地壳厚度与海拔不成镜像关系,*H*和*κ*集中在28~37 km和1.72~1.89范围, 平均值分别为~33 km和~1.79.华北北缘西侧燕山带地壳由东往西逐渐增厚,*H*和*κ*主要在28~40 km和1.70~1.91范围内变化, 平均值分别为~34 km和~1.79.东侧辽东台隆地壳表现为中间厚四周薄,*H*和*κ*集中在29~35 km和1.71~1.83范围, 平均值分别为~32 km和~1.77.东北地区吉黑褶皱带相对薄的*H*和变化范围大的*κ*表明,该区域可能由于其自身的地壳结构复杂性和紧邻太平洋板块前缘从而在中新生代遭受到了与太平洋板块俯冲相关的更为强烈的地壳减薄与改造.华北北缘燕山带*H*和*κ*复杂的变化特征表明,该地区可能受到中亚造山带增生和太平洋板块俯冲的共同影响,从而发生了更为复杂的地壳改造变形.

关键词 东北地区, 华北北缘, 接收函数, 地壳厚度, 波速比

Abstract: Using teleseismic waveform records collected from 127 permanent seismic stations which are distributed relatively evenly, in combination with previous studies from 97 temporary seismic stations, we obtained the crustal thickness (*H*) and average crustal V_p/V_s ratio (*κ*) beneath the northeastern China and northern North China Craton (NCC) by *H*-*κ* stacking of receiver functions. The results show relatively thin *H* and complicated variations both in *κ* and crustal density, which suggest intense and uneven reactivation and modification of crust during the Mesozoic-Cenozoic times. Significant E—W difference in crust was imaged in the northeastern China and northern NCC. In northeastern China, *H* thickens nearly linearly as the elevation increases in the Xingmeng orogenic belt located in the west. *H* changes from 31 km to 39 km with an average of ~35 km, *κ* varies from 1.71 to 1.83 with an average of ~1.77. No clear correlation was observed between *H* and elevation in the Jihei fold belt located in the east. The values of *H* are in a range from 28 km to 37 km with an average of ~33 km. *κ* varies from 1.72 to 1.89 with an average of ~1.79. In the northern NCC, *H* thickens from east to west in the Yanshan belt located in the west, and changes from 28 km to 40 km with an average of ~34 km. *κ* is concentrated in a range from 1.70 to 1.91 with an average of ~1.79. *H* is larger in the middle in the Liaodong anteclise located in the east, and ranges from 29 km to 35 km with an average of ~32 km. *κ* changes from 1.71 to 1.83 with an average of ~1.77. Complicated variations and a large range in *κ* and relatively smaller *H* were observed in the Jihei fold belt (the northeastern China). This suggests that this region may have experienced more intense crustal modification and thinning related to the Pacific plate subduction because of the inherent complexity in crustal structure and being adjacent to the Pacific plate. In the northern NCC, complicated variations and large ranges both in *H* and *κ* in the Yanshan belt indicate that this region probably underwent a more complex crustal modification which may be associated with Central Asia Orogenic Belt accretion and Pacific plate subduction.

Keywords Northeastern China, Northern North China Craton, Receiver functions, Crustal thickness, V_p/V_s ratio

Received 2012-01-16;

Fund:国家自然科学基金(90814002,90914011,41225016)和国家专项项目"深部探测技术实验与集成"(SinoProbe-02) 资助.