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鄂尔多斯地区上地幔岩石圈三维速度结构面波反演研究

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3-D lithospheric structure of upper mantle beneath Ordos region from Rayleigh-wave tomography

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摘要 双平面波拟合法是一种新的面波成像方法,反演中考虑地震波场中的非平面波成分,提高反演的分辨率.本文利用双平面波拟合法,反演获得鄂尔多斯地区上地幔岩石圈的速度结构.所用资料为国家数字地震台网69个宽频带地震仪和北京大学34个流动数字地震台观测到的地震波面波资料.首先从面波记录中提取了研究区域20~125 s瑞利波相速度频散曲线,进而得到各个周期瑞利波相速度异常分布图.结果显示,短周期瑞利波相速度异常与地表的构造特征吻合较好,中长周期的瑞利波相速度可以反映出上地幔岩石圈的速度异常分布以及构造特征.由研究区20~125 s的瑞利波相速度分布图可以反演得到地表到地下200 km范围内的三维剪切波速度结构.结果显示,鄂尔多斯块体内部稳定均一,活化或改造的痕迹不明显;鄂尔多斯块体西南缘受到青藏高原的强烈作用,有大量地幔物质流动的痕迹存在;中央转换带下超过200 km深度存在地幔物质上涌,可能与太平洋板块的俯冲和青藏高原板块的挤压有关.

关键词 双平面波拟合法, 面波成像, 鄂尔多斯, 华北克拉通, 岩石圈

Abstract: We apply two-plane-wave tomography, which takes the influences of the non-plane wavefield into consideration, to study the structure of velocity of the upper mantle lithosphere of Ordos region. The source of data consists of two parts, one is from 69 broad-band seismographs of China Earthquake Networks Center, and the other is from 34 mobile digital broad-band seismographs of PKU. At short periods most high and low velocity anomalies correlate well with surface geological features. The difference of the structure of upper mantle lithosphere is revealed by long-period surface waves. We extracted the 3-D structure of shear velocity anomalies of 200 km depth from the Rayleigh wave phase velocities. The results reveal that the Ordos block has the high velocity beyond 200 km depth, and no evidence for reactivation. There is fierce interaction between Ordos block and Tibet block at the southwestern edge of Ordos block, which causes the upper mantle flow there. Upwelling beneath the Central zone may be caused by both the subduction of Pacific plate and India plate.

Keywords Two-plane-wave method, Surface wave tomography, Ordos, North China Craton, Lithosphere

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