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穿越南沙礼乐滩的海底地震仪广角地震试验

阮爱国^{1,2}, 牛雄伟², 丘学林³, 李家彪^{1,2}, 吴振利¹, 赵明辉³, 卫小冬^{3*}

1. 国家海洋局第二海洋研究所, 杭州 310012;
2. 浙江大学地球科学系, 杭州 310027;
3. 中国科学院南海海洋研究所, 广州 510301

A wide angle Ocean Bottom Seismometer profile across Liyue Bank, the southern margin of South China Sea

RUAN Ai-Guo^{1,2}, NIU Xiong-Wei², QIU Xue-Lin³, LI Jia-Biao^{1,2}, WU Zhen-Li¹, ZHAO Ming-Hui³, WEI Xiao-Dong^{3*}

1. The Second Institute of Oceanography, State Oceanic Administration, Hangzhou 310012, China;
2. Department of Earth Sciences, ZheJiang University, Hangzhou 310027, China;
3. South China Sea Institute of Oceanology, Chinese Academy of Sciences, Guangzhou 510301, China

摘要

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摘要 本文对穿越礼乐滩东北部向西北方向延伸进入中央海盆长369 km的广角地震剖面OBS973-2进行了反演研究,以期了解南海南部陆缘的地壳结构,同时探讨南、北陆缘的共轭问题.结果表明OBS973-2剖面的速度模型中三个沉积层的速度分别为1.8~2.0 km/s、2.0~2.7 km/s和3.5~4.0 km/s;沿剖面沉积层总体上较薄或缺失.礼乐滩上地壳厚约9~10 km,速度为5.5~6.4 km/s,顶部存在小型火山;下地壳厚约11 km,速度为6.6~7.1 km/s.过渡区和海盆的上地壳厚约4~5 km,速度为5.9~6.1 km/s;下地壳厚约2~4 km,速度为6.6~6.9 km/s.从总体上看,海盆和过渡区的地壳厚度偏小,显示了拉伸减薄作用,速度分层显示陆壳比较典型,而洋壳和过渡壳的上地壳速度比标准洋壳偏高.莫霍面总体从陆坡向海盆方向较快速地抬升,在礼乐滩埋深约23 km,在海盆中的埋深8~12 km,海盆中的莫霍面顶部速度8.0 km/s,要明显小于礼乐滩下方的8.2 km/s.将OBS973-2剖面与北部陆缘的OBS2006-1剖面进行了对比,结果表明两者速度结构极为类似,讨论认为礼乐滩与中沙块体互为共轭.进而根据西北次海盆的宽度、礼乐滩与中沙块体的距离及前人提出的南海海盆的扩张时代,计算了扩张速率.

关键词: OBS广角地震剖面 地壳结构 南海礼乐滩 共轭边缘

Abstract: The wide angle seismic profile OBS973-2 that extends 369 km in NW-SE direction from the northeastern Liyue Bank to the central sub-basin is established by trial-and-error 2D ray-tracing method. This profile is compared with that in the northern continental margin for discussing the conjugation relationship between the northern margin and the southern margin. The velocity model consists of seven layers, i.e. water layer three sediment layers, upper crust, lower crust and upper mantle. The velocities of the three sediment layers are 1.8~2.0 km/s, 2.0~2.7 km/s and 3.5~4.0 km/s respectively. The sediment layers are thin in general and absent in some parts. There are some small volcanoes on the top of the crust in Liyue Bank and P wave velocities downward increase from 5.5~6.4 km/s in the upper crust (9~10 km thick) to 6.6~7.1 km/s in the lower crust (11 km thick). In the transition zone and sea basin P wave velocities downward increase from 5.9~6.1 km/s in the upper crust (4~5 km thick) to 6.6~6.9 km/s in the lower crust (2~4 km thick). The crust in the transition zone and sea basin shows some tectonic effect of stretching and thinning. The velocity structure of the model indicates that its continental crust is a standard one but its oceanic upper crust has relatively higher velocity than standard one. The seaward rising depth of Moho is 23 km in Liyue Bank and 8~12 km in the sea basin. The velocity beneath Moho is 8.0 km/s in sea basin, obviously smaller than 8.2 km/s in Liyue Bank. The comparison of profile OBS973-2 with a previous profile OBS2006-1 in the northern margin shows the remarkable similarity between them. This result and detailed discussion suggests a possibility of conjugation relationship between Liyue Bank and Zhongsha Massif, separated by the central seamount chain of the South China Sea. Furthermore, we calculate the seafloor spreading rate of the northwestern sub-basin and the southwestern sub-basin.

Keywords: Wide angle seismic profile of OBS Crustal structure Liyue Bank of SCS Conjugate margins

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About author: 阮爱国,男,1963年生,研究员,主要从事海洋地质构造调查与研究. E-mail: ruanag@163.com

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