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5.12汶川地震后龙门山断裂带东北段现今地应力测量结果分析

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Analysis of in situ stress measurements at the northeastern section of the Longmenshan fault zone after the 5.12 Wenchuan earthquake

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摘要

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摘要

5.12汶川大地震发生后,在龙门山断裂带东北段,开展了6个钻孔的原地应力测量工作.测量钻孔分别位于龙门山中央断裂带上下两盘的平武、北川、江油和广元等地.钻孔孔深在200~500 m之间,共取得了72个测试段的地应力测量数据,以及其中33个测段的印模定向试验数据,由此获得了每个测点处地应力的赋存状态,包括地应力量值随孔深的变化以及地应力作用方向.根据库仑准则,结合Byerlee定律对各测点实测数据进行分析,可以看出,龙门山断裂带上盘现今地应力的作用强度高于下盘.其上、下两盘现今地应力赋存状态特征及其差异性显示出该区域处于不平衡的应力环境,容易导致断裂失稳而产生新的活动;印模定向试验数据表明,龙门山断裂带东北段的北川、江油、平武的最大水平主应力优势方向为NEE向;广元附近为NWW或近东西方向.结合已有的研究成果,初步得到龙门山断裂带现今地应力作用方向的分段性特征,即大致以北川为界,龙门山断裂带东北段应力方向显示了与西南段不同的特征.其西南段现今地应力的优势作用方向为北西方向,而龙门山断裂带东北段,自江油、北川、平武一带至广元、青川附近,其现今地应力的最大水平主压应力的优势作用方向呈现了NEE→NWW的赋存状态和变化趋势.本文获得的研究结果对于认识5.12汶川特大地震的动力学机制具有一定的借鉴和启示作用.

关键词 5.12汶川大地震, 龙门山断裂带, 水压致裂, 地应力

Abstract:

In-situ stress measurements in 6 boreholes at the northeastern section of the Longmenshan fault zone were carried out after the 5.12 Wenchuan earthquake. The test boreholes, of which the depth is between 200~500 m, were at Pingwu, Beichuan, Jiangyou and Guangyuan areas, located at the hanging wall and foot wall of the Longmenshan central fault, respectively. Totally 72 depth interval test data for stress magnitudes and 33 depth interval data for directions of the maximum horizontal principal stress were obtained. According to the Coulomb faulting criterion, combined with the Byerlee law, analysis on the in-situ stress state for each test point was carried out, indicating that the stress value at the hanging wall is much higher than that of the foot wall, implying that the fault activity is apt to be triggered. The impression packer test results show that the dominant direction of the maximum horizontal principal stress at Beichuan, Jiangyou and Pingwu is NEE, and at Guangyuan is NWW or east-west direction. Compared with the previous study results of the Longmenshan area, the current stress field zoning characteristics regarding the stress direction were obtained, i.e., the dominant stress direction of the north east section of the Longmenshan fault zone is different from that of the south west part. The dominant direction of current stress of the south west part is NW. In the north east part, from Jiangyou, Beichuan and Pingwu to Guangyuan and Qingchuan, the direction of the current stress changes from NEE to NWW. The results of this paper may be helpful for the study of the dynamic mechanism of the 5.12 Wenchuan earthquake.

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