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喜马拉雅西构造结及邻区岩石圈演化三维有限元数值模拟

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Numerical simulation on lithospheric evolution of the Himalayan Western Syntaxis with 3-D finite element method

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摘要 用数值模拟的方法探讨了自10 Ma以来喜马拉雅弧形造山带的西构造结及邻区岩石圈的形变和位移变化特征，并采用不同的流变参数和流变结构模拟了前2 Ma内的形变和应力场的演化过程，通过对不同黏性系数、本构关系和初始地壳厚度的改变在演化过程中所起的作用研究表明：（1）采用黏弹性模型时，西构造结区黏性参数的选取对西构造结及邻区隆升高度和隆升范围有重要影响，计算结果给出西构造结区地壳黏性系数应小于10^{23}Pa·s；（2）相对刚性的塔里木盆地采用弹性结构时，对整个西构造结区域的应力和应变场均能引致明显变化；（3）力学性质稳定块体的存在并没有使应力场的传播出现明显的解耦现象.

关键词 西构造结区, 岩石圈演化, 有限元数值模拟, 黏性系数, 本构关系

Abstract：In this paper, the stress and strain fields of lithosphere in Himalayan Western Syntaxis orogenic belt and its adjacent areas since 10Ma are investigated through using the 3-D finite-element simulation, and deformation and evolution process in former 2Ma are simulated with different rheological parameters and rheological structure. Studies on functions in simulation process of different viscosity parameters, constitutive relation and changes of initial curst thickness show below results: (1) When various viscoelastic models are adopted, the selection of the coefficient of viscosity in the Western Syntaxis area has important influence on the its uplifts and evolutions. The computational results show that the viscosity in the Western Syntaxis area should be smaller than 10 ^{23}Pa·s; (2) When the elastic model is adopted in relatively rigid Tarim basin, obvious changes are induced to the stress and strain fields of the whole Western Syntaxis area; (3) The existence of mechanical property stable block doesn't make the propagation of the stress field show obvious decoupling phenomenon.

Keywords Himalayan Western Syntaxis, Lothospheric evolution, Finite element method, Coefficient of viscosity, Constitutive equations

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