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龙门山韧性剪切带主要矿物结构水含量与变形的关系

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摘要:

矿物中的各种水对变形有显著影响。本文研究了龙门山中央断裂带映秀-北川断裂南段韧性剪切带花岗质岩中石英和长石的变形和水含量的关系。通过显微镜下统计石英、长石的粒度和轴比,得出剪切带中花岗质岩石的变形程度分为:弱变形带和过渡带的花岗片麻岩以及强变形带的初糜棱岩。其中弱变形和过渡变形样品中有细粒化强变形条带。根据石英动态重结晶粒度与流动应力关系,计算了剪切带的流动应力约15~200MPa。利用稳态流变方程,估算出韧性剪切带的变形温度范围400~550℃。花岗质岩石和细粒化剪切带的全岩化学成分分析显示,强变形导致SiO<sub>2</sub>、K<sub>2</sub>O减小,Fe<sub>2</sub>O<sub>3</sub>、CaO、MgO、LOI增大。Fe、Mg含量增大,K含量降低。显然说明长石含量降低,铁镁质矿物含量增多,初步认为是长石经水解反应发生云母化导致的。利用傅里叶变换红外吸收光谱仪(FTIR)对剪切带花岗质岩石中的主要矿物石英和长石进行了结构水含量的分析,结果表明长石的水含量高于石英的水含量,弱变形的粗粒长石和石英的水含量低于强烈变形的细粒长石和石英的含水量,即随着变形程度的增强,矿物中的含水量呈增加趋势。因此,在剪切带中,强烈剪切变形导致长石和石英晶体位错密度变大,形成点缺陷和缺陷,这些缺陷中被OH充填,形成结构水。这种结构水促进了剪切带中岩石的变形。

英文摘要:

All kinds of water in minerals have a significant effect on its deformation. We studied the relationship between water content and deformation of the quartz and feldspar in granitic rocks, which are on the southern section of ductile shear zones in Yingxiu-Beichuan Fault that is one of Longmenshan fault zone. By microscopic statistics, we gained grain size and axial ratio of quartz and feldspar. Based on this, we divided the deformation of granitic rocks in shear zone into three parts. That is granite gneiss of weak deformation zone and the transition zone, and protomylonite of strong deformation zone. Weak deformation and transition zone samples have fine-grained strong deformation bands. According to the equation about grain size of quartz dynamic recrystallization and flow stress, it is estimated that the flow stress of the shear zone is about 15~200MPa. Then use of steady-state power law, we estimated that deformation temperature of the ductile shear zone is range of 400~550℃. Whole rock chemical compositions of granitic rocks and fine-grained shear bands show that SiO<sub>2</sub>, K<sub>2</sub>O contents reduce, Fe<sub>2</sub>O<sub>3</sub>, CaO, MgO and LOI contents increase as deformation. Fe and Mg contents increase, K content decrease. It clearly shows that feldspar content decrease and mafic mineral content increase. Initially speculation is feldspar turns into mica by the hydrolysis reaction. Using Fourier transform infrared spectroscopy (FTIR), we measured constitutional water contents of quartz and feldspar in granitic rocks (granitic gneiss and protomylonite), which collected from a ductile shear zone. The results show that water contents of feldspar is higher than quartz, water contents of coarse-grained feldspar and quartz is lower than fine-grained feldspar and quartz. As the deformation degree increases, water contents of minerals are increased. Therefore, in the shear zone, strong shear deformation develops that crystals dislocation density of feldspar and quartz become larger, forming point defects as well as line defects, which are occupied by OH and then form constitutional water. This constitution of water accelerates rock deformation of the shear zone.

关键词: [结构水](#) [韧性剪切带](#) [傅里叶变换红外吸收光谱\(FTIR\)](#) [变形](#) [粒度与轴比](#) [龙门山断裂带](#)

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