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中地壳的水和水岩相互作用实验及其地球物理涵义

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Experimental study on water and water rock interactions in the mid-crust conditions and i

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摘要 本文重点报道了高温高压下流体与流体-岩石相互作用实验结果,提供了中地壳条件下流体性质和水岩反应速率数据.这助于理解中地壳的一些地球物理现象.作者进行了25℃~435℃和22~39 MPa条件下水-岩相互作用反应动力学实验.同时,临界区至超临界区的性质.一般地说,中地壳大致位于10(15)至25 km的深度范围.各地的地壳厚度不同,但是中地壳高导-低范围十分相似.中地壳的顶界温度处于300℃,底界大致为450℃范围,压力高达200 MPa以上.流体-岩石相互作用实验表明:和岩石的硅最大溶解速率出现在300℃~400℃.此时,硅酸盐矿物格架解体.通常,地壳里普遍存在水、流体.地壳构造活动导隙、减压、流体流动.这时,有可能导致中地壳处于300℃~450℃流体的压力减低,由超临界区进入临界态、亚临界态.这会引动的水与岩石相互作用.溶解反应导致岩层的硅淋失,硅的强烈淋失又会导致硅酸盐矿物格架解体,岩石崩塌.同时,进一步促进动.实验表明300℃~400℃下的强烈水岩相互作用促进了岩石破坏,并有可能影响岩层的地球物理性质,如高导层出现.另外,研究表明处于300℃~400℃流体具有高电导率性质.这些水岩相互作用会使中地壳出现高导-低速层.

关键词: 中地壳 水-岩相互作用 临界态 溶解速率 高导层和低速层 地震流体

Abstract: For purpose of understanding geophysical nature of the crust, e.g. high conductance-low ve zone and earthquake sources in mid-crust, a lot of experimental studies on dry rock system were perforn is well known that fluids exist in the crust, so far a few experiments on rocks combined with water (wate system) have been done. This paper reports experiments on water rock interactions at elevated tempera pressures, and provides the data about fluid nature and dissolution rates of rocks in the mid-crust.The m is present in the depth of 10(15) to 25 km below surface. Even though the thickness of the crust is varic everywhere, but the depths of the high conductance-low velocity zones at different locations are nearly same. The temperature of top of the zone is about 300℃, the bottom temperature is about 450℃. We h carrying out the kinetic experiments on water-rock interactions in the upper mid-crust conditions and stu nature of water and aqueous solutions in the critical and supercritical regions. Dissolution experiments of (albite, actinolite, pyroxene, etc) and rocks (basalts, syenite and granodiorite) in aqueous solutions were performed at temperatures from 20 to 435℃ and at pressures of 23 to 35 MPa. Experiments found that t maximum release rates of silica in mineral or in rocks always occur at 300 to 400℃.As water exists in the crust and tectonic activities may cause faults, structure cracks, pressure decrease, and fluid flowing in t crust, then aqueous solution in the mid-crust would be present in the sub-critical and super-critical stat Strong dissolving mineral and rocks, leaching silica, and breaking silicate network continuously happen, tl leading to rock layer collapse. Those events will enhance fluid flowing. If fluids come to a sub-critical sta vapor immiscibility field, the boiling will occur, and also a possible fluid eruption. This could induce earthq earthquake fluids.Aqueous solutions at temperature from 300 to 450℃ and fluids from the sub-critical to regions accompanied by strong water-rock interactions will show the high conductive-low velocity featur mid-crust.

Keywords: Mid-crust Water-rock interaction Critical state Dissolution rate High conductive and l velocity zone Earthquake fluids

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