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长英质高级片麻岩中夕线石的形成与变形-变质-深熔作用的关系 —— 以南极拉斯曼丘陵区为例

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摘要:

南极拉斯曼丘陵高级长英质片麻岩的夕线片麻岩中可有两类结构和变质矿物组合均有所不同的两种域,一种含夕线石部分对应于片理组合,另一种对应无夕线石的非片理化组合。岩石的变形尤其是破裂性裂隙的率先出现对于富夕线石部分的形成是必要的。在非破裂性片麻理岩石域中,中-低压/高温条件下黑云斜长片麻岩进变质发展的结果往往是形成Grt+Qtz±Opx组合。这两种不同的变质域的组合与应变分解造成的强应变带和弱应变域相一致。而且,夕线石的形成不是简单的变质早期矿物固相反应的结果,而是反应链上的一部分。其出现是由开放体系中组分的差异迁移造成的,这种差异迁移实际上是碱土金属迁出(淋滤)的过程,与变形相伴的流体活动使得SiO₂发生强烈淋滤,残留组分中SiO₂活度大为降低,并使长英质组分和镁铁质组分分凝,主要组分大都可以单独富集(集中)、形成复杂的矿物演化和分布。这种演化还可从MgO等碱(土)金属组分的外迁程度差异来理解。随着碱(土)金属丢失程度的减小,依次出现夕线石、石榴子石、斜方辉石和堇青石,或者说,不同的变质或分异阶段形成不同的矿物(组合):变形-变质起始阶段,碱(土)金属组分迁移初期残留形成夕线石,之后为镁(铁)质组分迁移,初期残留不透明钛铁氧化物,晚期残留组分形成堇青石。石榴子石-长英质组合为体系基本封闭情况下的结晶。此外,夕线石的形成往往标志着深熔作用的开始,一旦深熔作用发展完善,夕线石呈准稳定状态或趋于消失。拉斯曼丘陵与夕线石有关的长英质岩石经历了复杂的变形、变质和流体活动变化。

英文摘要:

In the high-grade quartzofeldspathic gneisses in the Larsemann Hills, East Antarctica, two domains of distinct mineral assemblages and textures have been discerned. One is the sillimanite-bearing assemblage aligned along the foliation, while the other is the sillimanite scarce or absent assemblage domain. Deformation, especially the occurrence of the fracture is essential to the formation of sillimanite. In the weakly foliated gneiss domains, the biotite-plagioclase tend to be prograded to form the assemblage of Grt+Qtz±Opx under medium-low pressure granulite facies conditions. The two domains may correspond to the high and low strain zones, respectively, of strain decomposition. In addition, sillimanite is actually stage outcome of the reaction chain in prograding metamorphism, not simply resulted from the early solid reactions. The occurrence of sillimanite is derived from the differential migration of components in the open system. The migration is substantially the leaching of the alkaline and alkaline-earth metals. The fluids accompanying deformation made the severe leaching of SiO₂ and dramatically decrease the mobility of SiO₂ in the residues. Meanwhile the leaching is responsible for the segregation of the felsic and mafic components and the separate aggregation of some minerals of major components, forming the complex patterns in distribution and evolution of the metamorphic minerals. The evolution also can be illuminated by the differential migration of the oxides of alkaline-earth metals, like MgO. That is to say, as the degree of leaching of the component decreases, sillimanite, garnet, orthopyroxene and cordierite may occur sequentially. In other words, the major mineral or mineral assemblages may vary with the developing metamorphism or differentiation stages. In the beginning of deformation-metamorphism, the initial residues of alkaline metals leaching were responsible for the formation of sillimanite, then migration of the mafic components successively resulted in the residues of opaque iron-titanium oxides and cordierite. Garnet and related quartzofeldspathic assemblages generally crystallize in the closed system. Furthermore, the occurrence of sillimanite usually indicates the beginning of anatexis. Once anatexis is well developed, sillimanite is metastable and tends to be decomposed. The sillimanite-bearing quartzofeldspathic gneisses in the Larsemann Hills have undergone complicated evolution in deformation, metamorphism and fluid activity.

关键词: [夕线石](#) [变形](#) [深熔作用](#) [组分迁移](#) [南极拉斯曼丘陵](#)

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