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山东昌乐新生代碱性玄武岩中的巨晶单斜辉石成因研究

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摘要:

山东昌乐新生代碱性玄武岩中除斑晶单斜辉石和基质单斜辉石外, 还发育大量巨晶单斜辉石和同源斜方辉石捕虏晶。巨晶单斜辉石与玄武岩间发育复杂和简单两种类型的反应边。复杂反应边往往发育在颗粒较大的巨晶单斜辉石外围。复杂反应边可分为4个带: 内部带、过渡带、外部带和边缘带, 其中, 内部带、过渡带和外部带均由具不同结构特征的单斜辉石+熔体+金属氧化物构成, 边缘带为不含熔体和金属氧化物的干净的单斜辉石; 内部带的单斜辉石具梳状构造, 过渡带的单斜辉石具细密筛孔构造, 外部带为具似砂钟构造的筛孔状单斜辉石。反应边中单斜辉石、熔体及金属氧化物的成分显示, 只有内部带受到单斜辉石巨晶的影响, 其余带均受玄武岩浆的制约。简单反应边往往发育在颗粒较小的巨晶单斜辉石外围。简单反应边仅发育不含熔体和金属氧化物的干净的单斜辉石。巨晶单斜辉石的反应边是巨晶与玄武岩浆间温度差造成的。在与玄武岩浆反应的过程中, 大颗粒的单斜辉石巨晶需要较长的时间与玄武岩浆达到温度平衡, 从而有足够的时间发育包含4个带的复杂反应边; 反之, 由于缺乏足够的反应时间, 小颗粒单斜辉石巨晶的外围只发育不含熔体和金属氧化物的简单反应边。同源斜方辉石捕虏晶的成分与地幔二辉橄榄岩包体中的斜方辉石类似, 其边部发育类似于Bowen反应(1956)形成的单斜辉石环边。在单斜辉石 $Al^{IV}-Al^{VI}$ 图解上, 巨晶单斜辉石、二辉橄榄岩包体中的单斜辉石以及部分单斜辉石斑晶的核部, 均位于较高压力的“麻粒岩和玄武岩中包体”区域, 反应边中单斜辉石、基质单斜辉石以及绝大部分斑晶单斜辉石位于“火成岩”区域, 说明部分斑晶单斜辉石核部来源于地幔二辉橄榄岩, 属于捕虏晶。结合单斜辉石结晶压力的估算, 笔者认为巨晶单斜辉石的成因模式为: 来自软流圈的碱质基性熔体上侵到地幔岩石圈下部, 结晶形成单斜辉石巨晶, 后来该熔体携带巨晶单斜辉石与来自上地幔岩石圈、夹带大量二辉橄榄岩包体以及斜方辉石(和单斜辉石)捕虏晶的玄武岩浆混合, 巨晶单斜辉石随混合后的碱性玄武岩浆上升、喷出地表。

英文摘要:

There are four types of pyroxenes in the Cenozoic alkali basalt at Changle, Shandong Province: phenocryst clinopyroxenes, matrix clinopyroxenes, clinopyroxene megacrysts and homologous orthopyroxene xenocrysts. The coronas, between the clinopyroxene megacrysts and alkali basalt, could be divided into complex coronas and simple coronas. The complex coronas appeared in the outside of larger clinopyroxene megacrysts and could be divided into four zones based on their characteristics of textures and components. The zones of interior, transitional and exterior are composed of clinopyroxenes with different textures and a few melts and metal oxides. The edge zone is composed of clean clinopyroxene without melt and metal oxide. The clinopyroxenes at the coronas display comb texture in the interior zone, sieve texture in the transitional zone and both similar sector-zoned and sieve texture in the exterior. The compositions of the clinopyroxenes, melts and metal oxides at the coronas are controlled by the clinopyroxene megacrysts only in the interior zone, and by basaltic magma in other zones. The simple coronas appear in the outside of smaller clinopyroxene megacrysts and are composed of whole clinopyroxene without melt and metal oxide. The coronas of clinopyroxene megacrysts are resulted from the temperature difference between clinopyroxene megacrysts and basaltic magma. If the grain of clinopyroxene megacryst is larger, the time taken to adjust the difference of temperature is longer, then the complex coronas with four zones will form; if the grain is smaller, the simple coronas with edge zone will form as a result. The compositions of homologous orthopyroxene xenocrysts are within the range of compositions of the orthopyroxenes in the lherzolite xenoliths. The clinopyroxene rim or reaction rim surrounding the orthopyroxene xenocrysts are the results of the compositional difference between orthopyroxene and basaltic magma, similar to the reaction rim texture described by Bowen (1956). All clinopyroxene megacrysts, clinopyroxenes in the lherzolite xenoliths and part of the core of clinopyroxene phenocrysts are located in the "granulites and the inclusions in basalts" field of Aoki and Shiba (1973) in the  $Al^{IV}-Al^{VI}$  diagram, suggesting a relatively high-pressure crystallization. It suggests that part of the core of clinopyroxene phenocrysts come from mantle lherzolite, and they belong to xenocrysts. Clinopyroxenes in the coronas, matrix clinopyroxenes and a majority of clinopyroxene phenocrysts are plotted in the "igneous rocks" field. Based on the estimated crystallization pressure for clinopyroxene megacrysts and clinopyroxenes in the lherzolite xenoliths, we suggest a formation mechanism for the clinopyroxene megacrysts as following: first, the asthenosphere-derived alkali basaltic melts invaded into the lithospheric mantle near the lithosphere asthenosphere boundary and produced clinopyroxene megacrysts, then the melts with a great lot of clinopyroxene megacrysts mixed with the existing magmatic system from mantle lithosphere entraining an abundance of the xenocrysts of clinopyroxenes and orthopyroxenes and lherzolite xenoliths. The mixed alkali basaltic magmas with clinopyroxene megacrysts, xenocrysts

ysts and xenoliths ascended from the crustal magma chambers, and erupted at the surface.

关键词: [碱性玄武岩](#) [单斜辉石巨晶](#) [辉石捕虏晶](#) [形成模式](#) [山东昌乐](#)

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