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北京西山沿河城东岭台组火山岩成因及其地质意义

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摘要：

北京西山沿河城东岭台组火山岩由底部(第1岩性段)玄武粗安岩、下部(第2岩性段)酸性火山碎屑岩和上部(第3、4岩性段)粗面岩、流纹岩组成。根据地球化学特征，东岭台组下部第1岩性段玄武粗安岩属于碱性系列，具有Coombs成分变异趋势，上部的中、酸性岩属于高钾钙碱性；东岭台组火山岩整体具有从碱质富集的基性岩向硅饱和的中酸性岩变化的跨越式成分变异趋势。东岭台组中—基性岩是富集Ba、Sr、LREE和K的幔源原始玄武质岩浆在中等压力条件下分离结晶的产物，岩石在成岩过程中受到了下地壳物质的混染。东岭台组上部第3、4岩性段的粗面岩或英安岩依据地球化学特征分为3大类——富铝钾质粗面岩、富铝钠质粗面岩或英安岩与贫铝粗面岩或英安岩。富铝钾质粗面岩是玄武质岩浆与中地壳岩石发生熔融反应的产物；富铝钠质粗面岩或英安岩是内侵的基性岩含水熔融的产物；贫铝粗面岩或英安岩有可能由中—基性岩分异而来，成岩过程中受到围岩混染。东岭台组下部第2岩性段的酸性火山岩形成于下地壳低钾岩石在高氧逸度条件下的低程度部分熔融。东岭台组上部第3、4岩性段的酸性火山岩中的低硅端元是基性岩浆与中地壳岩石发生熔融反应的产物；高硅端元由低硅酸性火山岩分离结晶演化而来。燕山早白垩世早、中期大规模高钾钙碱性岩浆活动很可能是幔源岩浆与陆壳发生熔融反应的产物。东岭台组火山岩是早白垩世中期地壳被内侵玄武质岩浆加热，进而导致地温梯度增高的直观表征；地壳深部温度升高和部分熔融直接促使地壳发生侧向韧性流动，致使早白垩世时期的燕山地区由山地演变为高原。

关键词：火山岩 地球化学 岩石成因 东岭台组 燕山 北京西山

Origin of the Volcanic Rocks in the Donglingtai Formation from Yanhecheng Area, Western Hills of Beijing and Its Geological Implications

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Abstract:

The Donglingtai volcanic rocks exposed in Yanhecheng area, Western Hills of Beijing are composed of basaltic trachyandesite in the lowermost segment (1st member of Donglingtai Formation), rhyolitic pyroclastics in the lower portion (2nd member), and trachyte, rhyolite in the upper portion (3rd and 4th member). According to geochemistry of these rocks, the lowermost mafic rocks belong to alkaline series, and exhibit Coombs trend in total alkali vs. silica (TAS) diagram; however, the intermediate and acid rocks belong to high potassic calc alkaline series. As a whole, the Donglingtai volcanic rocks exhibit straddle trend in TAS diagram, which evolves from alkali rich mafic rocks to silica saturated intermediate and acid rocks. The mafic rocks are derived from fractional crystallization of primitive basaltic magma, which is enrichment of Ba, Sr, LREE, and K, under intermediate pressure; meanwhile, these mafic rocks had been assimilated by lower crust materials during petrogenetic process. The trachytes/dacites in upper Donglingtai Formation are divided into three categories: the aluminous rich potassic trachyte (KAT), and the aluminous rich sodic trachyte or dacite (NAT), and the aluminous poor trachyte or dacite (PAT). The petrogenetic analysis shows that, KATs are produced by melting interaction between basaltic magma and middle crust material; and the fluid bearing melting of solidified basaltic magma generates NATs; however, PATs are originated from mafic rocks through fractional crystallization accompanying wall rock assimilation, i.e. AFC process. The acid volcanic rocks in the 2nd member of Donglngtai Formation are generated by low degree melting of low potassic rock of lower crust under relative high oxygen fugacity condition. Whereas the low silica end members of acid rocks in upper Donglingtai Formation are the products of melting interaction between basaltic magma and middle crust material, and the high silica end members of acid rocks is derived from low silica end members by fractional crystallization. It is inferred that the large scale early—middle Early Cretaceous magmatism in Yanshan belt was originated from melting interaction between mantle derived magma and crustal rocks. Donglingtai volcanism is an exhibition of the crustal heating by intraplated basaltic magma in Yanshan region during middle Early Cretaceous epoch. The increased temperature and partial melting within the lower portion of crust triggered lateral flow of crust; eventually, the Early Cretaceous Yanshan changed from a high relief mountainous chain into a gently undulated plateau.

Keywords:volcanic rock geochemistry petrogenesis the Donglingtai Formation Yanshan Mountains Western Hill s of Beijing

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