

The Geochemistry of biogenic volatiles in Shuangliao volcanic rocks and related xenoliths: Implications for the sediments into mantle

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It is always known that the composition and geochemistry of mantle-derived fluids are very complex. For understanding the characteristics of mantle fluids, we have investigated the features of volatiles extracted from basaltic rocks and related xenoliths collected from Shuangliao volcanic field, Northeastern China. The Shuangliao volcanic rocks consist of basanite, alkali olivine basalt, transitional basalt and diabase. These rocks carry abundant mantle xenoliths of spinel lherzolites. Two types of fluid inclusions can be recognized in the olivine phenocrysts and constituent minerals of xenoliths. The volatiles in early stage inclusions trapped during the crystallization of minerals represent the initial volatiles of magmas. The volatiles in late stage inclusions trapped by minerals alteration and metasomatism processes represent the external volatiles. The volatiles in early and late stage inclusions are released at the high temperature interval (600~1200°C) and the low temperature interval (200~600°C), respectively. Initial volatiles of xenoliths are composed mainly of H₂O, CO and H₂ with minor CO₂ and CH₄. The δ¹³C values of CO₂ and hydrocarbons indicate a biogenic origin of initial volatiles which can be attributed to the involvement of sedimentary organic matters in mantle during the formation of lithosphere mantle. Metasomatic volatiles of xenolith are dominated by H₂O and CO₂ with minor CO, H₂ and CH₄. They are characterized by similar δ¹³C values of CO₂ and CH₄ with initial volatiles and also show biogenic signatures for CO₂ and hydrocarbons. The biogenic volatiles were most likely derived from the sedimentary organic matters in subducted Pacific slab.

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