Geochemical Studies of Late Cenozoic Basalts from the Abaga Region, Inner Mongolia

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Abstract

The Abaga basalt field (ABF) is located in southeastern Inner Mongolia and lies on the central region of the Xing'an-Mongolian Orogenic Belt. It is one of the largest and least known areas of late Cenozoic intraplate igneous activities in eastern China. Twenty-seven basaltic rocks from ABF have been analyzed for major and trace element contents and Sr-Nd-Pb isotopic compositions as well as K-Ar dating. These basalts consist predominantly of alkali basalt (basanite and alkali olivine basalt) with subordinate transitional olivine tholeiite and rare quartz tholeiite. Combing our five K-Ar dating data with previously published data show that the time of principal volcanic eruption were from Miocene to Pliocene (14.57 ~ 2.55 Ma) in the Abaga lava platform and from Pliocene to Quaternary (3.77 ~ 0.19 Ma) in the Hueiterngshilii lava platform.

The Abaga basalts exhibit chondrite-normalized REE patterns ($(La/Yb)_N$ = 6.93 ~ 22.34), incompatible elemental (Ce/Nb =1.03 ~ 1.93 ; Ba/Nb = 8.49 ~ 16.60; La/Nb =0.52 ~ 0.97) and isotopic ratios ($^{87}Sr/^{86}Sr$ = 0.703654 ~ 0.704286 ; $^{143}Nd/^{144}Nd$ = 0.512845 ~ 0.512891) affinities with OIB. In general, they have relatively homogenous Pb isotopic compositions ($^{206}Pb/^{204}Pb$ = 18.4091 ~ 18.5208; $^{207}Pb/^{204}Pb$ = 15.5140 ~ 15.5457; $^{208}Pb/^{204}Pb$ = 38.2585 ~ 38.4471), indicating that these lava suites have a similar source. But the alkali basalts are relatively enriched in incompatible element when compared to tholeiites. This compositional difference may be attributable to the different degree of partial melting in the mantle source. The Sr-Nd-Pb isotopic data indicate that the mantle sources of late Cenozoic Abaga basalts display a DMM-EM2 array similar to those of Southeast Asia. The $^{208}Pb/^{204}Pb$ vs. $^{206}Pb/^{204}Pb$ plot is also significantly displaced above the NHRL in a pattern similar to that of the Indian Ocean MORB that shows the Dupal signatures. Therefore, we suggested that the Abaga basaltic magmas were dominantly derived from an Indian Ocean MORB-like depleted asthenospheric source with less contributions of enriched mantle component (EM2) from the subcontinental

lithospheric mantle.

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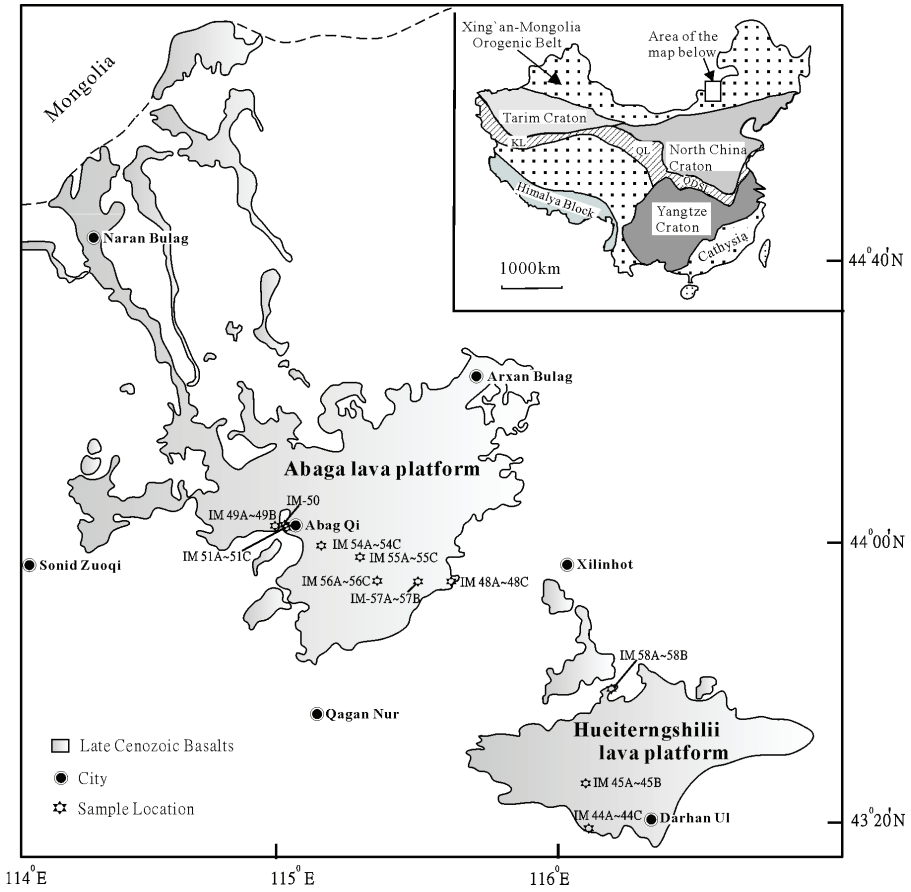

Figure 1. Map of the major outcrops of late Cenozoic basaltic rocks and sample sites in Abaga region, Inner Mongolia

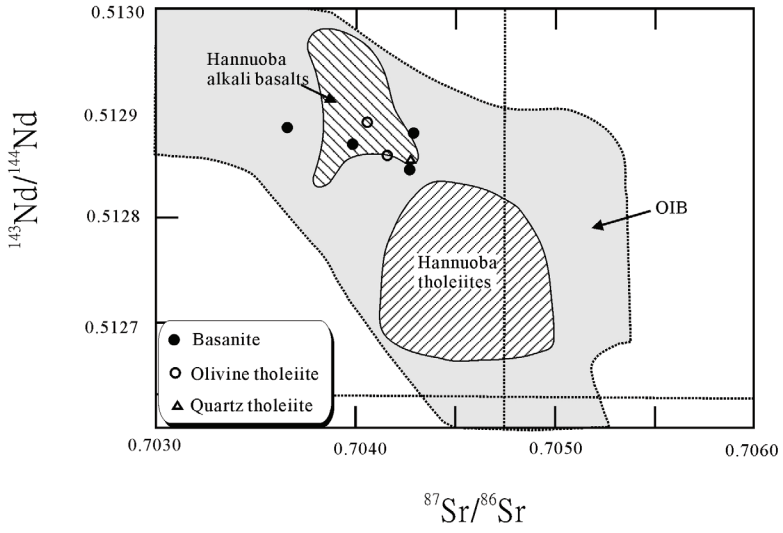

Figure 2. Plots of $^{143}Nd/^{144}Nd$ vs. $^{87}Sr/^{86}Sr$ diagram for the Abaga basalts. The fields for the tholeiite and alkali basalt of Hannuoba (Song et al., 1990) are shown for comparison. The OIB field is from Zindler and Hart (1986).

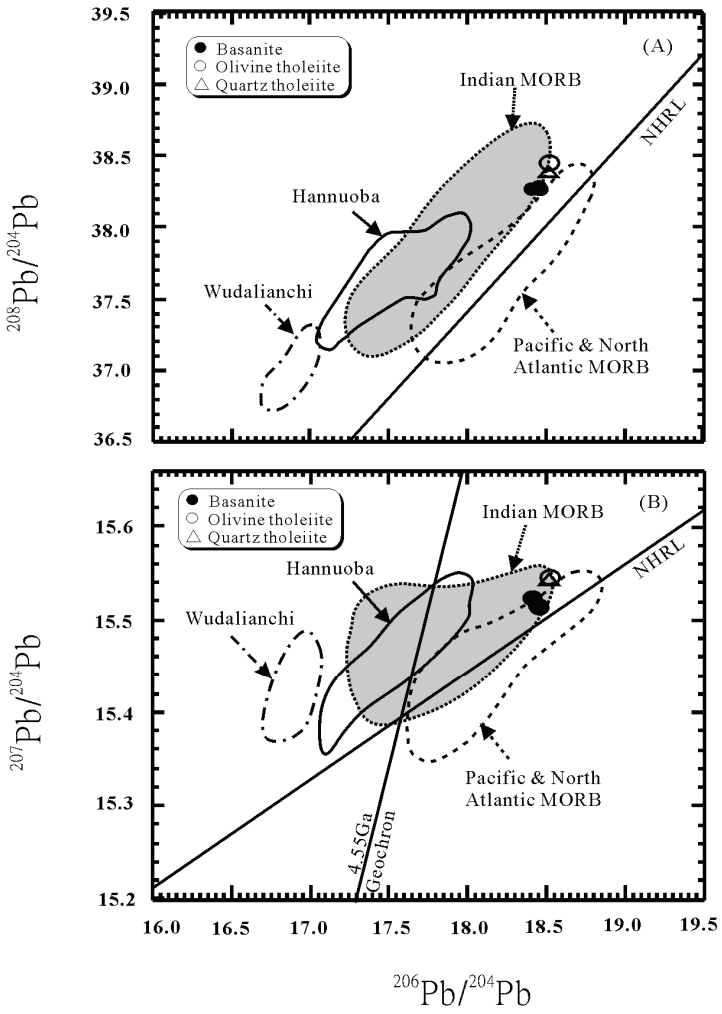

Figure 3. $^{208}Pb/^{204}Pb$ and $^{207}Pb/^{204}Pb$ vs. $^{206}Pb/^{204}Pb$ diagrams for the Abaga basalts. The fields for the late Cenozoic basalts of Hannuoba (Song et al., 1990; Zhi et al., 1990; Basu et al., 1991) and Wudalianchi (Zhang et al., 1998; Zou et al., 2003) are shown for comparison. The fields of Indian MORB and Pacific & North Atlantic MORB are from Barry and Kent (1998) and Zou et al. (2000).