

# **Geochemical variations of the Cenozoic basalts in NE China through time: Constraints on transition time and mechanism from active continental margin setting to trench-arc-basin system in NE Asia**

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In the Cenozoic, the transition from active continental margin setting to trench-arc-basin system happened with the opening of Japan Sea in NE Asia. However, the opening time and mechanism of the Japan Sea and/or the transition from active continental margin setting to trench-arc-basin system are debated. The geochemical variations of the Cenozoic basalts in NE China through time provide direct evidence on deep mantle processes and shed new light on the transitional time from active continental margin setting to trench-arc-basin system.

The Cenozoic basalts in NE China mainly formed at ~52 Ma, ~33 Ma, ~21 Ma, ~11 Ma, and ~2 Ma. The ~52 Ma basalts were derived from partial melting of lithospheric mantle modified by slab-derived fluids and recycled sediments, whereas the ~33 Ma and ~21 Ma basalts were derived from partial melting of asthenospheric mantle. The ~11 Ma basalts were derived from partial melting of residual lithospheric mantle that was the source of the older Cenozoic basalts. However, a larger contribution from asthenospheric mantle is required in the source of the ~2 Ma basalts.

The geochemical variations of these Cenozoic basalts in eastern part of NE China through time indicate that the change of magma sources from 52 Ma to 33–21 Ma marks the rollback of the subducting slab and initiation of the upwelling of asthenospheric mantle, which is the beginning of the transition from active continental margin setting to trench-arc-basin system. And, the variation of basaltic magma source nature from 21 Ma to 11–2 Ma marks the retreat of the trench and the final stages of formation of the Japan Sea. These findings and published data reveal sustained large-scale upwelling of asthenospheric mantle from intracontinental to marginal regions in NE Asia during the late Eocene to Miocene. Asthenospheric flow, triggered by rollback of the subducting Pacific slab and retreat of the trench, was the key mechanism that led to the transition from active continental margin setting to trench-arc-basin system in NE Asia.

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