Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.13610

# East Asia Big mantle Wedge evolution during late Cretaceous to early Cenozoic

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The subducting Pacific slab stagnated in the mantle transition zone in eastern China and the overlying mantle forms a big mantle wedge (BMW). An analogical BMW structure seem to have been there in the early Cretaceous. However, it is still doubtful whether similar structures existed in the late Cretaceous to early Cenozoic, and if so, their detailed evolution remains unclear. Given that the magmas derived from the BMW system have unique geochemical characteristics, we have investigated a synthesis of olivine compositional and whole-rock geochemical data of 106-60 Ma basalts from the Liaodong Peninsula and its adjacent areas (LPAA) to constrain the magma origin. Olivine and whole-rock major element (e.g., CaO, $FeO^T$, $Al_2O_3$, $TiO_2$) compositions demonstrate that these basalts were derived from hybrid mantle sources containing peridotite and olivine-poor pyroxenite. Two distinct recycled components in the source are also revealed based on $\delta^{18}O_{olivine}$ values and bulk-rock geochemical data. One is likely the altered lower gabbroic oceanic crust based on relatively low $\delta^{18}O_{olivine}$ (2.8~5.2‰), positive Eu and Sr anomalies, and high Ba/Th and Th/Nb ratios of the Liaoyuan alkali (99 Ma) basalts, Laohutai alkali (70 Ma) and tholeiite (60 Ma) basalts; the other may be altered upper oceanic crust and carbonated sediment on the ground of high $\delta^{18}O_{olivine}$ values (~6.2‰), low Th/Nb, and Δ8/4 for the Luanshishanzi (58 Ma) alkali basalts. We conclude the following three geochemical and source characteristics of 106-60 Ma LPAA basalts: (1) chemical compositions similar to that of oceanic island basalts (OIB) but generated in an intraplate setting; (2) extensive existence of recycled (altered oceanic crust, sediments, carbonates) components in the mantle source; (3) presence of deep and shallow mantle-derived magmas. The above three features of LPAA basalts are very similar to that of representative basaltic magmas derived from the Cenozoic BMW in eastern China. Therefore, we suggest that the 106-60 Ma LPAA basalts are the melting products of the BMW, which means that the BMW formed in the early Cretaceous has been preserved during 106-60 Ma and evolved until today. The relationship between the present and Mesozoic East Asian BMW may be one of succession and development.