Distinctive Pb isotopic mantle evolution beneath the Paleo-Tethyan and Paleo-Asian Ocean

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Paleo-Tethyan Ocean (PTO)and Paleo-Asian Ocean (PAO) have existed on Earth throughout the Paleozoic. We analyze the geochemical and Pb, Nd and Sr isotopic compositions of representative mafic rocks from five Paleo-Asian Ocean ophiolites ranging in age from 354 to 624Ma to constrain the isotopic evolution of its mantle domain that, in turn, will help us better understand mantle geodynamics during Earth's history. Data suggest that the Sr isotopic composition of PAO ophiolites do not represent primary magmatic composition due to alteration. Combined with similar data for mafic rocks from Paleo-Tethyan Ocean ophiolites, the Nd and Pb isotopic composition indicates the sub-PAO and -PTO mantles have had similar long time-integrated history of Sm/Nd enrichment but marked differences in their Th/Pb and U/Pb fractionation. The former produced a Pacific MORB-type mantle with lower $^{207}Pb/^{204}Pb_{(t)}$ and $^{208}Pb/^{204}Pb_{(t)}$ for given $^{206}Pb/^{204}Pb$ ratios than the latter. The PAO and PTO evolutionary histories and associated tectonic characteristics suggest the Pb isotopic distinction between the two mantles may be due to the presence of two long-lived independent global-scale mantle convention cells, Pacific and Africa, that kept the sub-PAO and -PTO mantles isolated from each other. The Africa cell was overlain and, perhaps, at the same time controlled continental dispersals and collisions within the PTO realm whereas the Pacific cell was underlain and controlled the accretionary margins in the PAO realm. Consequently, the long time-integrated Pb isotopic evolution of the sub-PTO mantle most probably had been affected by continental materials more so than the sub-PAO mantle.

Acknowledgements

This study was jointly supported by NSFC funds (No. 41772059 and 41463002)