

The crust nature and mantle source characteristics of the Celebes Sea

SHUAI WANG^{1,2}, GUO-LIANG ZHANG^{1*}, ZHI-HUA ZHAO^{1,2}, JI ZHANG^{1,2}

¹ Key Laboratory of Marine Geology and Environment, Institute of Oceanology, Chinese Academy of Sciences, Qingdao 266071, China (*correspondence: zhangguoliang@qdio.ac.cn)

² University of Chinese Academy of Sciences, Beijing 100049, China

The Celebes sea is a Cenozoic marginal sea, located at the junction of the Indian Ocean plate, the Pacific plate and the Eurasian plate. Because the Celebes Sea crust are covered by thick sediments, its crust nature and mantle source characteristics are debated and speculative. The Ocean Drilling Program (ODP) LEG 124 drilled Site U0767 and Site U0770 in this basin to study the nature of the crust and opening mechanism of the Celebes sea. And LEG 124 has recovered seafloor basalts at Site U0767 and Site U0770. We have analyzed major and trace elements and Sr–Nd–Pb–Hf isotopes of the basalt samples of ODP Site U0770. The Samples are tholeiite based on the plot of total alkaline versus SiO₂. The trace element pattern shows that the samples are Mid-ocean ridge basalt (MORB). On the basis of down-hole trace element variations, the samples can be classified into two groups. Group1 basalts show trace element patterns less depleted than the Group 2 basalts. Group1 is N-MORB type and group2 is E-MORB type. The basalts of Site U0770 are above Northern Hemisphere Reference Line (NHRL) on the plots of 208Pb/204Pb versus 206Pb/204Pb and 207Pb/204Pb versus 206Pb/204Pb, which are similar to the Indian Ocean MORBs. The correlation of εNd with Sm/Yb is primarily controlled by heterogeneous mantle source, which reflect the effect of an enriched end-member in mantle source. The enriched end-member have higher Sm/Yb ($Sm_N/Yb_N > 1$), Hf/Hf* ($Hf/Hf^* > 1$) and lower εHf indicates the recycle oceanic crust exist in mantle. The correlations of εNd with Eu/Eu* and the enriched end-member depleted Eu may be that recycle oceanic crust subjected to fractional crystallization of plagioclase. The heterogeneous mantle source of Celebes Sea is mixing of the depleted mantle and the recycled oceanic crust which subjected to fractional crystallization of plagioclase.

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