Sr-Nd-Pb isotopic systematics and the sediment source–to-sink pattern of the Changjiang (Yangtze) River

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The suspended particulate and fine-grained floodplain sediments were collected from the main stream and tributaries of the Changjiang River for Sr-Nd-Pb isotopic measurements. The $\varepsilon_{Nd}(0)$ values gradually decrease downstream from −10.8 on average in the upper reaches to −12.3 in the lower reaches, whereas the $^{87}Sr/^{86}Sr$ ratios increase correspondingly, averaging 0.721899 and 0.725826 respectively in the upper and middle-lower reaches [1]. The Pb isotopic ratios show larger variations in the main tributaries, especially in the upper reaches, than those in the main stream.

The compositional variations primarily reflect the complex controls of provenance rocks, chemical weathering, and sediment characters between different catchments. The abnormal Sr-Nd isotopic compositions of the Yalongjiang, Fujiang, Tuojiang and Yuanjiang Rivers indicate the sediment provenance contributions from the Emeishan Basalt in the upper reaches and the old metamorphic and siliceous rocks in the middle-lower reaches. The Sr-Nd isotopic ratios of the Changjiang sediments can better reflect the average composition of weathered continental crust compared to other major rivers in the world because of the unique source rock types in the Changjiang drainage basin [2-5]. The recognition of the Sr-Nd-Pb isotopic systematics of the Changjiang sediments will contribute to our understanding of the Changjiang evolution history and continental weathering processes during the Cenozoic, and also to reconstruct the paleoenvironmental changes in East China and the marginal seas.

This research was supported by the National Natural Science Foundation of China (Grant No. 40676031) and by Program for New Century Excellent Talents in University (NCET-06-0385).

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Abnormally enriched arc lavas at arc-continent collision zone: An example from Lutao volcanics, offshore SE Taiwan

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The Taiwan-Luzon arc, which was generated in response to the subduction of the South China Sea, collided with the eastern margin of the Eurasian plate at the arc's southern and northern ends. As a consequence, volcanism ceased or was reduced to low levels in the proximity of the collision zones. Sr-Nd-Pb isotopic analysis indicates that the magma characteristics of the northern Taiwan-Luzon arc are strongly controlled by the heterogeneity of the mantle source ($^{87}Sr/^{86}Sr$=0.70321~0.70569; εNd=+9.4~-5.8; $^{206}Pb/^{204}Pb$= 18.13~18.54) which produces extreme geochemical variations ($[La]_N$=0.19~534; $[La/Yb]_N$=0.53~75.8). The most enriched lavas occurred at Lutao volcanic islet, offhsore of Se Taiwan, ca. 0.54~0.95 Ma. In general, the geochemical characteristics of the lavas changed dramatically 5~4 Ma ago. Temporal geochemical variations of the representative lavas from Taiwan-Luzon arc show that enrichment occurred in this area after 5 Ma. All of the younger lavas exhibit enriched geochemical signatures, i.e., high K_{Si}, LILE, $[La/Yb]_N$, and higher $^{87}Sr/^{86}Sr$ and low εNd values. Various enrichment components have been proposed to account for the geochemical features of the Luzon arc lavas. Obviously, none of a simple two end-member, i.e., depleted mantle source and enriched component, mixing model can easily explain the systematic enriched characteristics of the arc magmas. Multiple source components and enrichment processes are necessary for the Taiwan-Luzon arc system. We consider that the continent-derived sediments shall play an important role in the magmagenesis during and after the arc-continent collision at both ends of the arc. Except for some of the unusual 'low-Nd' array, i.e., the lavas have Nd isotopic ratios below the so-called 'mantle array' in the Sr-Nd isotopic plot, all of the northern Taiwan-Luzon arc magma compositions can be explained by the subducted sediment and depleted mantle mixing model. Meanwhile, the 'low-Nd' array lavas, which mainly occurred around Lutao after 2 m.y. ago, may be the result of recently additional mixing of the enriched components which were lower crust melts for Lutao magmas.