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Provenance of Late Triassic Liuyehe and Lingguanmiao basins in North Qinling and their relationships with the Ordos Basin, China: detrital zircon evidence

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A number of Late Triassic to Early Jurassic rift basins were developed along major faults in the North Qinling Orogen after the Early Triassic orogeny. This study chooses the representative Liuyehe and Lingguanmiao basins and uses detrital zircon U-Pb age data to trace the provenance of the sediments and determine the paleogeography at the time. Along the giant Shangda fault zone, the Lingguanmiao Basin is located about 120 km to the east of the Liuyehe Basin.

Age data of quartz sandstone from Liuyehe basin gave rise 7 age groups: 266-475Ma, 1500-1680Ma, 1750-2190Ma, 2190-2310Ma, 2400-2650Ma, 2700-2800Ma, 2700-2800Ma, 2850-2960Ma and 1750-2190Ma. Among the groups, the Paleoproterozoic one (1750 -2190Ma) accounts for 64% of the total measured points. All the age values span from 266 ± 7 to 2954 ± 25 Ma. Compared with the age structure of the periphery terranes, we suggest that the major provenance of sedimentary fill in the Liuyehe Basin was located in the southern part of the North Qinling orogen including the Erlangping, Qinling, Danfeng and Liuling groups as well as the magmatic material developed in the Caledonian trench-arc-basin system along the Shangdan suture zone during the Late Triassic. The small amount of detrital zircons with Late Paleoproterozoic and Neoproterozoic ages may come from the Kuanping Group located to the north of the basin. The age population implies that the formation of the provenance is related to the Caledonian trench-arc-basin system and the Paleoproterozoic magmatism.

Age data from the fine-grained sandstone of the Lingguanmiao Basin form five age groups: 425-605Ma, 661-1173Ma, 1494-1788Ma, 2113-2261Ma and 2825-3297Ma. The major age groups are 425-605Ma (59% of the total analytical points) and 661-1173Ma (32% of the total). The age structure reflects the tectono-magmatic events occurring in source region during the Caledonian and Grenvillian orogenic periods, respectively. Compared with age data of the surrounding terranes and coupled with other geological evidence, it shows that the provenance of the Lingguanmiao Basin fill might have been the Neoproterozoic Kuanping Group and the Caledonian granites which intruded into Erlangping and Qinling groups. A less important sediment source might have been located in the Paleozoic Erlangping and Proterozoic Qinling complex.

Through the zircon age comparison of the Late Triassic Liuyehe, the underlying Carboniferous Liuyehe, the Late Triassic Lingguanmiao basins and the Yanchang Formation in southwest Ordos Basin, the following conclusions can be drawn: 1) the Neoproterozoic age is lacking in the Late Triassic Liuyehe Basin, which means that the former uplifting part in east-west trending in the northern North Qinling located between the Liuyehe and Ordos basins during the Carboniferous was removed in Late Triassic and became the secondary provenance of Liuyehe Basin, while the southern part of North Qinling became the major provenance for the basin. 2) The Late Triassic Lingguanmiao Basin characterized by the Neoproterozoic age peak shows that the uplifting northern part of North Qinling still existed as a major provenance for the basin. 3) Combined with palaeontological evidence, the similar age distribution pattern of the Triassic fill in the Liuyehe Basin and the Yanchang Formation in southwest

Ordos basin strongly suggests that the Liuyehe Basin was likely connected with the southern Ordos basin and represented the southern margin of the Ordos Basin during the Late Triassic.

