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A causal link between UHP metamorphism and Cenozoic seawater Sr isotopic evolution?: Clues from hydrothermal system in the NE Tibetan Plateau

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The evolution of seawater $^{87}Sr/^{86}Sr$ has attracted much attention as important evidence of continental weathering enhancement during Cenozoic. The hot springs and hydrothermal calcite in the Himalayas with highly radiogenic Sr due to high-pressure metamorphism contribute significant amounts of radiogenic Sr to Himalaya rivers, which affects the global seawater $^{87}Sr/^{86}Sr$ evolution during Cenozoic. However, whether such hydrothermal systems with highly radiogenic Sr occur in other continental collisional belts with intense metamorphism remains unknown. Here, we reported $^{87}Sr/^{86}Sr$ ratios of the hydrothermal system in the early Paleozoic North Qaidam ultrahigh-pressure metamorphic belts, NE Tibet. $^{87}Sr/^{86}Sr$ ratios of hot spring water and acetic acid-leachates of the surrounding rocks (schist and gneiss) found in the northern margin of the ultrahigh-pressure metamorphic belts range from 0.757~0.734. The $^{87}Sr/^{86}Sr$ ratios of acetic acid leachates of two marbles are ~ 0.713, and those ratios of acetic acid leachates of metamorphic rocks with trace vein carbonates found in the ultrahigh-pressure metamorphic belts vary from 0.713 to 0.737. All the above observations suggest that the hydrothermal systems around the Qilian-north Qaidam region are similar to the Himalayas. The compiled surface water $^{87}Sr/^{86}Sr$ ratio distributions around the Tibetan Plateau show that the north Qaidam-Qilian region displays the second-highest $^{87}Sr/^{86}Sr$ ratio, which is only lower than those in the Himalayas. These hydrothermal systems in the north Qaidam-Qilian region may deliver highly radiogenic Sr to rivers and lakes through hot springs, groundwater, and the weathering of hydrothermal calcite, resulting in the higher $^{87}Sr/^{86}Sr$ ratio around the Qilian Shan region than the surrounding areas. The limited exposure of the early Paleozoic ultrahigh-pressure metamorphic rock in the NE Tibetan Plateau has exerted a significant impact on regional water $^{87}Sr/^{86}Sr$ ratio at present, suggesting a pivotal role of ultrahigh-pressure metamorphic process in regulating past seawater $^{87}Sr/^{86}Sr$ evolution.