Reconstruction of paleoclimatic signals from groundwater in large aquifers-a case study in Leizhou peninsula, Southern China

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The past is the key to the future, Knowledge of the paleoclimate is essential to understand the present climate and project potential future climate scenarios. Groundwater in aquifers, though as a low time-resolution archive, can provide valuable information regarding past climate change. In this study, 13 deep monitoring wells were chosen for water sampling during our first fieldwork in Leizhou peninsula, a (sub)tropical area in southern China. Multiple tracers (^{3}H, ^{4}He, ^{14}C, ^{81}Kr, ^{85}Kr) were applied for accurate groundwater dating and the concentration of noble gases dissolved in groundwater was measured for paleotemperature reconstruction. Stable isotopes (^{2}H, ^{13}C, ^{18}O), major ions and other geochemical properties were also analyzed for these samples. According to the preliminary results, most groundwater samples' age is located in the dating range of ^{14}C and shows a relatively continuous record through the past 30,000 years. A possible recharge gap during LGM (Last Glacial Maximum) is identified and may indicate a quite cold and dry environment during this period in Leizhou peninsula. Paleotemperature revealed by the physically-based NGT (Noble Gas Thermometer) method shows that at least an environment temperature difference of 3.4 ℃ exists between the cold period and the present. A detailed comparison between NGTs, excess air (represented by ΔNe) and ^{18}O indicates that the major controlling factor of stable isotopes (^{2}H and ^{18}O) in local groundwater might be the amount of precipitation rather than temperature, therefore the signals of ^{18}O in groundwater can be interpreted as the change of moisture. Together with the NGTs, it is possible to reconstruct the paleoclimate information (including the climate state of warm/cold and wet/dry) through the groundwater archive in this study area. In addition, the groundwater dating results and recharge history revealed by this study can assist in local groundwater resource management and exploitation.

Keywords: Paleoclimate reconstruction, Groundwater , Multiple tracers, Noble gases, Stable isotopes

