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Dissolved gas concentrations of the geothermal fluids in Taiwan

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Taiwan, a geologically active island, is located on the boundary of the Philippine Sea Plate and the Eurasian Plate. High heat flow and geothermal gradient generated by the complex collision and orogeny, warm up the meteoric water and/or the ground water. The heated water becomes geothermal fluids. In previous studies, researchers tried to categorize hot springs based on the appearance, chemical compositions and lithological areas. Because of the chemical inertness, the concentrations and isotopic composition of dissolved noble gases are good indicators of the mantle degassing, geothermal conditions, and so on. In this study, 55 hot springs were collected from different tectonic units. It is the first time to systematically study the hot springs in Taiwan in terms of dissolved gases.

Hot spring water is sampled and stored in pre-evacuated glass bottles for analyzing gas compositions. The abundances of noble gases were determined by a quadrupole mass spectrometer based on the isotope dilution technique. Samples with glass vials are introduced to RAD 7 and GC for dissolved Rn and major dissolved gases analyses. Furthermore, helium isotopic ratios and helium-neon ratios are measured on a conventional noble gas mass spectrometer. For hydrochemistry analysis, water samples are analyzed by IC, ICP-MS and titration.

We can classify the hot springs samples into three major groups from main anion concentration data; and then, subdivide them into nine minor groups by cation concentration data. Moreover, according to major dissolved gases compositions, three major gas components: CH_4, N_2 and CO_2, are identified. Dissolved noble gases provided more detailed clues about hot springs sources in Taiwan, such as the degree of mixing between meteoric water and deep-source water, which will be further discussed in this study.