



Dissolved Gas Composition of Groundwater in Taipei Basin and its implications

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This study is the first comprehensive analysis for dissolved gases of groundwater in Taipei Basin, northern Taiwan. In addition to conventional water chemistry, the dissolved-gas compositions of groundwater from 34 observation wells have been systematically analyzed. The relationship between dissolved gases and geological environment, and probable sources of the gases are discussed in this study. According to the water chemistry data of Piper plot, most of the groundwater samples in this study can be classified as $\text{Ca}(\text{HCO}_3)_2$ and NaHCO_3 types. Several samples exhibit NaCl type characteristic which reveals the mix with seawater. Isotopic compositions of hydrogen and oxygen for groundwater, surface water and meteoric water in Taipei Basin are aligned with Local Meteoric Water Line (LMWL), which indicates that they are influenced by meteoric water. Composition of groundwater in the southern part of the basin has similar characteristics with surface water. However, stratifications occurred in the observation wells from northern part of the basin. It reveals different recharge sources for groundwater samples in northern basin with the southern basin. Based on the major dissolved gases compositions, three major components are identified which are CH_4 , N_2 and CO_2 . The $\delta^{13}\text{C}$ of dissolved inorganic carbon (DIC) indicates microbial activities are dominant in the studied area. Dissolved radon concentrations are in the range of 200 - 20,667 Bq/m^3 in the studied area and the deeper well usually exhibits a higher radon value than the shallow one from the same site. Several sites with high radon values are correlated with the locations of fault zones, which may provide the conduit for deeper gas migrate to shallower aquifers. The groundwater samples from northern part of the basin exhibit unexpectedly high helium isotopic ratios ($R_A > 2$, where R_A is the $^3\text{He}/^4\text{He}$ ratio of air). Samples from five observation wells have R_A values more than 3 R_A and the highest one is 4.2 R_A , which probably the highest $^3\text{He}/^4\text{He}$ values ever reported in groundwater samples from basin area. The high R_A ratios represent signals from mantle and the source of excess ^3He may come from Tatun volcanic group (TVG) which located at the north side of Taipei Basin. Alternatively, the nearby active Shanchiao Fault may provide a pathway for mantle fluids invaded into the basin.