Land use control of groundwater chemistry in the Pyosun Watershed, Jeju Island, Korea

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As groundwater from basaltic aquifers is a unique source of water supply in the volcanic Jeju Island, Korea, a better understanding of the current status of groundwater is important for a sustainable future water supply. For this study of the Pyosun Watershed located at the southeastern part of the island, we collected 90 groundwater samples from 45 existing wells and 41 soil water samples using porous cups installed at various depths at two sites. Hydrochemically, well groundwater was dominantly of the Na(-Mg-Ca)-HCO_3(-Cl) type, while soil water varied between Na(-Mg-Ca)-Cl-HCO_3(-SO_4) type at an upgradient forested area to a Na(-Mg-Ca)-Cl type at a downgradient agricultural (orchard) area. Most ions in groundwater, especially NO_3, Cl, SO_4, Na, Ca and Mg, increased in concentrations in aquifers at low altitudes (about <150 m a.s.l.) where land use is dominated by orchards and rural developments. Nitrate concentrations of groundwater ranged from 0.4 to 23.3 mg/L (median 4.7 mg/L). The results of a Principal Component Analysis (PCA) of hydrochemical data indicates that two major processes (i.e., anthropogenic contamination and water-rock interaction) control the groundwater chemistry. Water-rock interactions were dominated by silicate weathering (as indicated by the increases of HCO_3 and silica) with minor ion exchange and sorption. Combined with hydrochemical data, nitrogen and oxygen isotopes of groundwater nitrate (n=43) showed the systematic change of major nitrate sources, from nitrification in soil organic matter at upgradient forested and grassland areas to chemical fertilizers at the orchard areas to minor contributions of manure and sewage-derived nitrate at low altitudes. Thus, careful control of fertilizer use is highly recommended for a sustainable management of future groundwater quality in the Pyosun Watershed.

Hydrochemical characteristics of Bigadiç (Balikesir) geothermal area, Turkey

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The study area is located in 57 km southwesthern of Balıkesir, West Anatolia, Turkey. The stratigraphy of the area is characterized by the presence of ophiolites of Mesozoic basement, covered by Tertiary aged Dedetepe Formation (riodacite, dacite, tuff, agglomerate) and Quaternary covers. Major visible tectonic lines that control fluid flow in region is represented by faults approximately trending in N-NE direction; it determined the main morphological structure of the region.

The chemical composition of water discharges clearly shows that the Bigadiç geothermal system produces similar types of fluids having travelled distinctly different pats. A plume of high HCO_3 and SO_4 waters feeds discharge area, bordered by two strike slip faults. EC values of hot and mineral water in region are range between 2100 and 3040 μS/cm, temperature is between 24 and 98 ºC, total mineralization ranges from 2646 to 3537 mg/l, and pH values range from 6.4 to 8.3 and show generally the acidic character. Four wells in region were opened (HK-1; T=47 ºC and Q=0.5 l/s: HK-2; T=98 ºC and Q=60 ºC: HK-3; T=98 ºC and Q=40 l/s; HK-4; T=94 ºC and Q=10 l/s) to use in balneological purposes, space and greenhouse heating.

The hot and mineral waters have “Rav waters” properties according to Giggenbach diagramme. The reservuar rock temperature is calculated due to geothermometers as 100 to 110 ºC. The hot and mineral water is classified as B-F-Na-HCO_3-SO_4 according to AIH. High content of boron in fluids produced from the geothermal system throughout the volcanic environment, thought to be associated with extentional tectonics and volcanic hosted rocks leachings from the Bigadiç area appear to repr. All of these extentional type discharges from the Bigadiç area appear to represent geothermal fluids most directly derived from an environment dominated by riolitic/andesitic magmatism.