

Geochemical study of groundwater in Sabae, Fukui Japan for heat usage

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In Sabae City, Fukui Prefecture Japan, several spring waters such as Tougen Shouzu and Tona Shouzu has been used for bathing since ancient time. They are also used now for drinking of human health. In this area, groundwater is also used for industrial, fields of irrigation, snow melting on road and so on. In winter time, groundwater has been pumped out to surface and melt snow on road. This caused lowering of the groundwater level and land subsidence (Fukui Prefecture Report, 2014) As one of the solution to this problem, a geothermal heat pump (Geo-HP) can be applied to snow melting and also to house heating. The air temperature at Sabae exceeds 30°C in summer and less than 0°C in winter.

The purpose of this study is geochemically to examine the water quality and mode of shallow groundwaters in the Sabae City to apply them to build up the Geo-HP system. Twenty five groundwaters and 5 river waters were collected and analyzed for their chemical and isotopic compositions. The results show that the δD and $\delta^{18}O$ values of groundwaters are -51.8 to -31.2 ‰ and -9.6 to -7.4 ‰, respectively, and are plotted along meteoric precipitation lines ($\delta D = 8\delta^{18}O + 20$ in summer and $\delta D = 8\delta^{18}O + 30$ in winter). The chemical compositions of groundwaters in the eastern area are $Ca^{2+}-HCO_3^-$ type and those in the western area are $Na^+-HCO_3^-$ and $Ca^{2+}-HCO_3^-$ types. In this study, a possibility of precipitation of chemicals ($CaCO_3$ and $Fe(OH)_3$) as scales in the heat exchanger in the Geo-HP system is discussed by using a phreeqc calculation code. Several groundwaters in the study area are oversaturated with respect to $Fe(OH)_3$. This means that cleaning of the heat exchange should be considered when open-type Geo-HP is used for room air conditioning.