CMR41-153

The Use of Isotope and Geochemical Techniques for Geothermal Reservoir Studies, in Tawau, Sabah, Malaysia

FREDOLIN JAVINO

Minerals & Geoscience Department Malaysia, Sabah, Locked Bag 2042,
88999 Kota Kinabalu Sabah, Malaysia
Email: fjavino@gmail.com, fjavino@jmg.gov.my

The main objectives of the studies were to determine the baseline isotopic and chemical characteristics of the geothermal outflowing fluids and the surface and shallow/deep groundwater systems which are useful to determine the recharge zones and origin of the water. The isotopic and geochemical data obtained may assist in assessment of geothermal resource potential and development. The extended sampling programme includes sampling for Tawau precipitations, catchments/surface waters, hot and cold springs for isotope and hydrogeochemical analyses. Isotope samples collected includes 18-O, deuterium and tritium. The data for 14-C/13-C (TDIC), 34-S/18-O (ppt.) were taken from the similar program, prior to this extended sampling. The hydrogeochemical samplings were mainly for the hot spring waters to determine the water type and the level of solutes in the geothermal waters. The isotope and geochemistry data may be used to estimate the subsurface or the reservoir temperatures. The sampling programme for Tawau precipitations includes at least one hydrological cycle in various catchments areas, to form the regression line for Tawau area. This regression line are created for the first time in this area. From the studies done, geochemically the water type in the Tawau geothermal prospect are steam-heated waters of typical upflow zone i.e high in SO_4 and low in Cl contents in the Upper Tawau River(T2) and Balung areas. In the Lower Tawau River area (T1), the water type is chloride-bicarbonate i.e high in Cl and HCO_3 contents and in the Apas Kiri area, the water type is chloride which is typical of the outflow zone of a geothermal system. The plot for Na-K-Mg for Apas Kiri geothermal waters shows that the waters are partially equilibrated, and plot for Cl-SO_4-HCO_3 shows that the waters are near matured chloride waters. Isotopically, the water in the Apas Kiri is enriched. The δ18-O is about -5%o VSMOW and the δ2-H is about -45%o VSMOW. The geothermal waters, which is δ18-O shifted for about -2%o VSMOW from the surface waters, indicate that the old geothermal waters are in non-mixtures with the young groundwaters. This indicate that, the reservoir is capped by a confining sequence, in this system case called 'clay cap'. The clay capping is one of the indications of a promising and stable geothermal reservoirs. For the Apas Kiri geothermal prospect system, the sub-surface temperature estimated by using several Na/K geothermometers are in the range of 185.7 – 220.3°C (Fournier 1979), (158.3 – 198.9°C, Arnorsson, 1983), 203.0-235.4 °C (Giggenbach 1988), 149.1-191.8°C (Truesdell 1976). By using several quartz geothermometers, the range of 188.9-202.1°C (F&P, 1982), 169.1-187.8°C (Arnorsson, 1985), 178.58-201.08°C (Fournier 1977, no steam loss). By using chalcedony geothermometers, the range of sub-surface temperature is 151.6-175.2°C (Arnorsson, 1983), 157.3-183.4°C (Fournier 1977). By using isotope techniques, alfa (SO_4-H_2O), the temperature estimate range from 152.17-195.14°C.

Warta Geologi (Newsletter of the Geological Society of Malaysia), Vol. 43, No. 3, July-September 2017