

## Geochemical characteristics of hot spring water from Shiba-toge spa, Tokamachi, Niigata, central Japan

# Masaaki Takahashi[1]; Noritoshi Morikawa[2]; Hiroshi Takahashi[3]; Michiko Ohwada[4]; Kohei Kazahaya[5]

[1] GSJ, AIST; [2] Res. Center for Deep Geol. Environ., GSJ, AIST; [3] Geological survey of Japan, AIST; [4] Inst. Geol. and Geoinfo., GSJ, AIST; [5] Geol. Surv. Japan, AIST

Geochemical analysis was carried out for the hot spring water sample obtained from Shiba-toge spa, Tokamachi, Niigata, central Japan. This hot spring water showed relatively large  $d^{18}O$  (-0.2permil), compared with  $Cl^{-}$  (4800ppm). Similar geochemical characteristics are observed in Matsunoyama (Tokamachi, Niigata), Yukidaruma (Joetsu, Niigata), Wakkanai, Enbetsu, Toyotomi and Nakagawa (northern Hokkaido) hot spring waters, and also in oil field brines from Niigata and Akita areas.

$Cl^{-}$  and  $d^{18}O$  values of these waters are distributed between type A brine, which  $Cl^{-}$  is similar to seawater and  $d^{18}O$  is in -4 to -6 permil, and type B brine, which  $Cl^{-}$  is relatively low and  $d^{18}O$  is in +4 to +10 permil. The former is consistent with lowest  $d^{18}O$  oil field brine, and the latter with water released from clay and/or zeolite minerals shown by Yasuda (1996). It is also deduced that these waters are formed under less or small contribution of meteoric water.

Near Shiba-toge, Matsunoyama and Yukidaruma hot springs, there are Matsudai mud volcanoes, and there is Utakoshibetsu mud volcano nearby Enbetsu hot spring, too. Shiba-toge spa and Matsudai (Gamo and Muro) mud volcanoes lie along the Gamo syncline, and geochemical feature of water samples obtained from Matsudai (Muro) mud volcano ( $Cl^{-}$ =4000ppm,  $d^{18}O$ =-2.5permil) is so similar to that of Shiba-toge spa.