A study on geochemical characteristics of deep groundwater in Japan using a Geographic Information System (GIS)

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To evaluate the long-term stability of the geological characteristics associate with groundwater, we have developed a database of deep groundwater chemistry using a geographic information system (GIS). Here, the *deep groundwater* means not only groundwater originated from meteoric waters but also magmatic waters, slab-derived deep fluids, and stagnant waters such as oil brines. In this presentation, we report relationships between deep groundwater chemistry and geological feature in non-volcanic areas, as an analytical result using the database. The groundwater data in the non-volcanic areas were obtained by removing the data within a 15 km radius of quaternary volcanoes from the database. In addition, the data were further divided according to four types of surface geologies (sedimentary rocks, accretionary prism, volcanic rocks, and plutonic rocks) based on a seamless digital geological map of Japan (1:1,000,000), and were compared for water temperature, pH, water type and oxygen and hydrogen stable isotopic ratios (d^{18}O-dD ratios).

As a result, the deep groundwater showed different characteristics between the surface geologies. For example, the largest data were found at the range from 10 to 20 degrees of water temperature in all surface geologies, whereas more than 40 degrees of groundwater in the volcanic rocks showed larger percentage compared with that of other surface geology. In addition, the most common water type in sedimentary rocks, volcanic rocks, and plutonic rocks was Na-Cl type (26.5, 17.5, and 17.3%, respectively). However, Na-HCO3 type was the most frequent water type in accretionary prisms (23.8%), and 12.0% of the Na-Cl type was found in them. The d^{18}O-dD ratios of groundwater in sedimentary rocks indicated the presence of stagnant waters which have heavy dD value (more than -30 per mil), magmatic waters and slab-derived deep fluids which show the d18O and dD values shifted from a meteoric water line. In contrast, the d^{18}O-dD ratios of groundwater in plutonic rocks did not clearly show the presence of such specific waters. These differences of geochemical characteristics may provide a clue to identify the origin of deep groundwater.