HYDROCHEMICAL CHARACTERISTICS AND EVOLUTION OF DEEP GROUNDWATERS IN GRANITIC HOST ROCKS OF THE KAMAISHI MINE, JAPAN

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The chemical evolution of groundwaters in granitic host rocks of the abandoned Kamaishi Fe-Cu mine in northeastern Honshu is interpreted on the basis of field data characterizing host-rock/fracture mineralogy and the chemical and isotopic composition of coexisting groundwaters. The groundwaters are meteoric in origin, and vary from Ca-HCO3 type solutions near the surface to Na-HCO3 solutions with increasing depth. Most groundwaters are relatively young (40 a). Samples from deeper levels of the mine are clearly older, however, and may have been recharged during the past several hundred years. In-situ measurements indicate that the deep groundwaters are reducing, and that redox potentials are undisturbed by excavation and mining.Geochemical models are used to simulate the evolution of groundwater chemistry at the Kamaishi site. Local equilibrium is assumed in the models as a first approximation and model parameters are constrained to the extent possible by field data. The reliability of the models is tested by comparing model predictions with the compositions (i.e., pH, Eh and concentrations of Na, K, Ca, Si, carbonate and sulfate) of groundwaters sampled at various depths in the mine. Results indicate that the simplified models of water-rock interaction can simulate with reasonable accuracy measured trends in groundwater compositions with increasing depth. This observation helps to establish confidence in the use of such models to predict general characteristics of deep groundwater chemistry supporting safety assessments of a high-level radioactive waste repository in Japan.