

Genetic reaction between alkaline water and reacted andesitic volcanics of the Wadagawa Formation in the Hakkoda Tunnel excavating area, Aomori Prefecture, Japan

Shigeto Kobayashi*¹, Toshio Mizuta*¹, Daizo Ishiyama*¹, Hinako Sato*¹,
Yasuhiko Tokutomi*², Yoshihiro Kikuchi*³ and Koichiro Sera *⁴

*1 Faculty of Engineering and Resource Science, Akita University
1-1 Gakuen-Machi, Tegata, Akita 010-8502, Japan

*2 Shichinohe Railway Construction office, Japan Railway Construction,
Transport and Technology Agency
32-2 Jishodakawakubo, Shichinohe, Aomori 039-2511, Japan

*3 Nikko Exploration & Development Co., Ltd.
2-7-10 Toranomom, Minsto Ward, Tokyo 105-0001, Japan

*4 Cyclotron Research Center, Iwate Medical University
348-58 Tomegamori Takizawa, Iwate 020-0173, Japan

Abstract

Acid water is formed in the area mineralized around some deposits in the Hakkoda Tunnel excavating area, while generation alkaline water is detected in an area consisting of diagenetic weakly altered andesitic volcanics in the Hakkoda Tunnel No. 3 construction area. Geology of the No. 3 construction area consists of the Wadagawa Formation of Middle Miocene age. The Wadagawa Formation is mainly composed of weakly altered andesitic lavas and their pyroclastic rocks with some lapilli tuffs. The mineral assemblage of weakly altered andesitic lavas is plagioclase, augite, quartz with small amounts of Na-bearing Mg-smectite, cristobalite calcite, magnetite and ilmenite. The weakly altered andesitic pyroclastic rocks consists of plagioclase, augite, quartz, Na-bearing Mg-smectite, Ca-zeolite (laumontite and epistilbite) and small amounts of cristobalite, calcite and pyrite.

A reaction between andesitic volcanics and distilled water was carried out to clarify the generation mechanism of alkaline water. The pH values of water reacted for 1 month with andesitic lavas and andesitic pyroclastic rocks are 7.0 to 8.0 and 8.0 to 9.0, respectively. The pH values of these solutions gradually change from alkaline to neutral according progress of reaction. The solution reacted with andesitic pyroclastic rocks has higher Na⁺, Ca²⁺ and SO₄²⁻ concentrations, while the solution reacted andesitic lavas has high Ca²⁺ concentration. Based on mineral assemblage of andesitic volcanics and ratios of [Mg²⁺]/[H⁺]² and [Ca²⁺]/[H⁺]² in these solutions, chemical composition of these solutions are controlled by the presence of Mg-smectite and Ca-rich zeolite.

In the solution reacted with andesitic pyroclastics calcium, sodium and sulfuric acid is likely to be generation from the surface reaction with from Ca-rich zeolite, Na-bearing Mg-smectite and pyrite, respectively.