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Zeolitization of nepheline in the contaminated rock from the Kushiro outcrop, Tojo-Cho, Hiroshima Prefecture, Japan

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The high-temperature skarn from the Uenotani outcrop of Kushiro, Tojo-Cho, Hiroshima Prefecture, Japan, was produced and then the cooling process accompanied the contaminated plutonic rock (Kusachi and Henmi, 1990). The contaminated rock is mainly composed of pyroxenes and feldspars. The mineral assemblage as alkali feldspar + cancrinite + nepheline was reported by Kusachi and Henmi (1990). Of these minerals, only nepheline was assayed. Research on the elucidation of the formation mechanism of the present high-temperature skarn requires more elaborate studies of the contaminated rock.

Therefore this study proves that the present contaminated rock includes the relict of nepheline that is partially replaced by thomsonite, natrolite and analcime. Pectolite partially occur in the form of a strip line sandwiched between natrolite and analcime. although Kusachi and Henmi (1990) identified one of the zeolites as cancrinite. Production of zeolites from the Uenotani outcrop has never been reported up to now. This finding constitutes substantial evidence for the experience of hydrothermal alteration in addition to high-temperature skarn acting. As well, zeolitization of nepheline and feldspar in the alkaline rock complex was reported from Mitchell and Platt (1979) and Ross et al. (1992). However, the process of zeolitization remains unexplained.

This study was aimed at investigating the characteristics of zeolitization of nepheline, identifying and describing the constituent mineral assemblage, and estimating the alteration process in the contaminated rock from the Uenotani outcrop of Kushiro, Hiroshima Prefecture, Japan.

The contaminated rocks from the Uenotai outcrop were examined using powder XRD for mineral identification, electron probe microanalyzer (EPMA) and LA-ICP-MS for chemical analysis, and micro-Raman spectroscopy and micro-FTIR for characterization of hydrous species.

From the above results, it is concluded that the present contaminated rock had experienced the following process of zeolitization:

1. Thomsonite could be produced from the reaction of nepheline with Ca-rich hydrothermal water (100-200 degree-C), which led to Na leached out by hydrothermal solution.
2. Na-rich hydrothermal solution reacted with thomsonite to cause the alteration into natrolite. In consequence Ca was eluted in the hydrothermal solution. The Ca- and Na-rich hydrothermal solution partially produces pectolite.
3. The analcime coexistent with the above minerals could be produced from alteration of the microcline reacting with Na-rich hydrothermal solution (100-200 degree-C)

Nepheline in the contaminated rock from the Uenotani outcrop occurred in accompany with the skarnization (Kusachi and Henmi, 1990). This study discovered that the nepheline in the contaminated rock is different from that crystallized from alkaline magma, in chemical composition containing both trace elements and the existence or non-existence of water.

Keywords: high-temperature skarn, Kushiro, nepheline, micro-raman, hydrothermal alternation, zeolite