The supply process of dissolved inorganic carbon into groundwater - A case study in the Akiyoshi-dai Plateau -

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1 INTRODUCTION

The DIC composes of four carbonate species (CO_2, H_2CO_3, HCO_3^-, CO_3^{2-}). Bicarbonate generally is major among anions in groundwater. If the contribution ratio to DIC in groundwater can be estimated, that becomes available information indicating the groundwater flow, recharge source and the evolution of groundwater quality. There are some studies about the origin of DIC in groundwater. However there is little study clarified contribution ratio to DIC in groundwater. There is a clear difference between the stable carbon isotope ratio of limestone and the plant. This difference was used for the consideration of DIC origin for groundwater in this study. The purpose of this study is to clarify the supply process of the DIC from the limestone and soil organic matter into groundwater using the stable carbon isotope composition as a tracer.

2 METHOD

The study area is the Akiyoshi-dai Plateau and its adjacent district. In the Akiyoshi-dai, groundwater samples were collected from 5 points in August, 2005 and February, 2006. Groundwater collected at 34 points in its adjacent district in August, 2005. Water temperature, pH and electrical conductivity of groundwater were measured at each sampling site. Chemical compositions, stable carbon isotope ratios and DIC values in groundwater were analyzed in the laboratory. Limestone was sampled from 2 points at Akiyoshi-dai, soil was sampled at its adjacent district in December, 2005. Carbon isotope ratio of limestone and the soil organic matter was measured in the laboratory.

3 DISCUSSION

In the Akiyoshi-dai, it is considered that the origin of DIC in groundwater is the limestone and soil organic matter. The contribution ratio to DIC in groundwater was calculated using the pH and DIC value. As the result of calculation, the contribution ratio of limestone is calculated 43%, that of soil organic matter was 57% to No.19 groundwater that is most DIC value and SI in all observation groundwater. It was considered by using the carbon isotope ratio whether the calculated contribution ratio by using the pH is correct. From the consideration, it is considered that the contribution ratio calculated by pH and DIC value was fault. It is considered that the dissolution of silicate mineral related to the supply process of DIC into groundwater. The alteration of silicate minerals to clays consumes H^+ in soil water and groundwater. The soil in the Akiyoshi-dai includes the silicate mineral. So the contribution ratio to DIC in groundwater was calculated by using the carbon isotope ratio. The contribution ratio of DIC originating in the limestone to DIC in No.19 groundwater was calculated 0-42% and that originating in the soil organic matter was calculated 58-100%. For the all observation groundwater, the contribution ratio of soil organic matter to DIC in groundwater is higher than that of limestone. The dissolution of the silicate is a buffer substance for the dissolution of limestone into groundwater in Akiyoshi-dai.

From consideration, for the all observation groundwater in the Akiyoshi-dai in February, 2005, the contribution ratio of limestone to DIC in groundwater is higher than that of soil organic matter. The contribution ratio of limestone to DIC in groundwater in February, 2005 is higher than that in August, 2005. The DIC value of groundwater in the Akiyoshi-dai in February, 2006 is higher than that in August, 2005. The DIC value in groundwater originating in the soil organic matter in February, 2005 is almost same value to that in August, 2005. It was considered that the difference of residence time the factor.