

## Water chemistry of shallow groundwater and its evolution processes in southern parts of Okinawa island, Japan

Kaede Shimoji<sup>1</sup>, \*Masaya Yasuhara<sup>1</sup>, Seongwon Lee<sup>1</sup>, Takashi Nakamura<sup>2</sup>, Kazuyoshi Asai<sup>3</sup>

1. Rissho Univ., 2. Yamanishi Univ., 3. Geoscience Laboratory

The southern parts of Okinawa island consist of the less-permeable Shimajiri Group mainly composed of siltstone and the Ryukyu Group composed of the permeable Ryukyu limestone. It is widely recognized that chemical fertilizers continuously used exclusively or in excess in sugarcane fields have significantly increased the nitrate concentration in shallow groundwater in recent years. To elucidate the current state of shallow groundwater quality and its evolution process, we investigated 25 groundwater samples for water quality, stable isotopes of nitrogen and oxygen of nitrate ( $\delta^{15}\text{N}$  and  $\delta^{18}\text{O}$ ) and residence times based on  $\text{SF}_6$ .

Groundwater quality in the study area proved to be of  $\text{Ca-HCO}_3$  type, and considerable contamination by nitrate was observed in the whole survey area. A wide range of  $\delta^{15}\text{N}$  values from 4 to 20 ‰ implies nitrate contamination is caused by diverse sources such as chemical fertilizers, organic fertilizers, livestock manure, and domestic wastewater.  $\text{SF}_6$  concentration of groundwater indicates the residence time of groundwater of 7-19 years. The relationship between  $\delta^{15}\text{N}$  value and concentration of nitrate nitrogen shows two processes, that is denitrification and mixing, play important roles in the evolution of groundwater quality. Taking into account denitrification and mixing, we classified groundwater quality evolution processes in the southern parts of Okinawa island into 4 cases.

Keywords: Ryukyu limestone formation, shallow groundwater, nitrate nitrogen, nitrogen isotope, residence time, evolution of water chemistry