

硝酸態窒素同位体比による急流河川の栄養塩輸送状況の解明 ~ 富山県東部河川を例として

Clarification of Nutrient Transport in Rapid Flow River by Nitrogen Isotopes Ratio

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Aquatic plants need many types of nutrients for growth, including nitrogen, phosphorus, and silica. A significant proportion of silicate, nitrate and phosphate in the river systems are derived mainly from anthropogenic. The purpose of this work is the determination of nutrients sources in the rivers water.

Total of 18 sites were selected from three rivers. From November 2009 to October 2011, total of 200 samples were collected from three rivers. Water samples were collected in new polyethylene bottles, which were rinsed in water three times prior to sample collection sealed cork. The physical parameters of water samples were measured in the field for temperature, pH and electrical conductivity. Major ions (Na, K, Ca, Mg, Cl, SO₄, and NO₃) were analyzed by ion chromatography. Alkalinity was determined by titration with HCl (0.01N). Ionic balance was computed for each sample and all samples exhibited imbalances lower than 5%. Silica was determined by the molybdenum-yellow method. A mass spectrometer was used for O and H isotope analysis of water samples. Analytical accuracy of plus minus 0.1 permil for delta¹⁸O and 1.0 for delta D.

Rivers water was characterized by Ca-HCO₃, Na-SO₄ and Na-Cl type. Water isotopes compositions were compared with the local meteoric water lines. All samples were plotted between local meteoric water lines. d-excess values data indicates rivers were recharge by spring season precipitation, but Kado and Katagai rivers recharge rate was slower than Hayatsuku river. Due to slow recharge rate, sources of recharge water mixed with other season of precipitation. Recharge areas were calculated to trace the sources of water.

NO₃⁻ concentrations were not varied with seasons in Hayatsuki, but Kado and Katagai rivers showed variation in NO₃⁻ concentrations, especially in the downstream. To trace the sources of NO₃⁻, nitrogen isotope (¹⁵N) was measured. Nitrogen isotope (¹⁵N) did not show seasonal variation whereas Kado and Katagai rivers showed variation especially in the downstream in the same manner as NO₃⁻. ¹⁵N values suggested that source of NO₃⁻ from forest. The amount of NO₃⁻ fluxing through Hayatsuki, Katagai, and Kado into Toyama bay are 1.6 x 10³ t/yr, 1.7 x 10³ t/yr and 0.5 x 10³ t/yr, respectively. The total amount of NO₃⁻ from these rivers is approximately 25% of the entire rivers discharging into Toyama bay.

キーワード: 硝酸態窒素, 同位体, 急流河川, 栄養塩, 扇状地, 伏流水