

Transportation and precipitation characteristics of toxic element in river and its bottom sediment in Asama-yama area

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Some toxic trace elements are often transported to agricultural land by some water system and move to bottom clayey soil by precipitation. Therefore, it is important issue on prevention of health hazards to clarify the mechanism for transportation, precipitation and concentration of toxic elements in a water system.

In this study, in order to clarify the mechanism for transportation, precipitation and concentration of toxic trace elements in a water system, river waters and bottom sediments were sampled at 18 points in a small river of Asama-yama volcanic mountain area. From the correlation between major elements and toxic trace elements, major attracter elements are found in a river. The following conclusions are obtained: 1) The toxic trace elements (Cu, Pb, Co, Sr) in bottom sediments are with compatible major attracter elements; K₂O for (Cu,Pb), (T-Fe₂O₃) for Co, Al₂O₃ for Sr, 2) The toxic trace elements (Cu, Pb) in river waters are with compatible major attracter elements; (Al, Ti) colloid for (Cu, Pb), 3) No attractor for Sr in river water, 4) Fe-colloid is a attractor of (Al, Ti) in river water.

From the described above, it is modeled that first, (Cu,Pb) are transported by Fe-colloid, that is attractor of (Al,Ti), second, Fe-Al-Ti-colloid precipitate with (Cu, Pb), third, (Cu, Pb) are attracted by K₂O, and move to bottom sediment, finally, Fe-Al-Ti-colloid released (Cu, Pb) moves from bottom sediment to river water. These processes are repeated, and (Cu, Pb) are move from water to bottom sediment. Co will move with Fe-colloid, because Fe-colloid is a compatible attractor of Co.

Keywords: toxic trace element, bottom sediment, river

Modeling transportation of noxious trace elements in rivers by means of colloidal iron interaction

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Toxic elements in water systems can expose crops to dangerous levels of contamination through irrigation and soil pollution. Therefore, it is of vital importance to ascertain the dynamic state of noxious trace element as they are carried by soil colloids via river systems. However, the behavior of toxic elements varies depending on their current state. Possible states consist of the colloidal state, in which the element is attracted to some colloids by sorption, or water-soluble state where the element exists as an ion or a complex ion.

The study focuses on two rivers with headwaters in volcanic rock areas near Mt. Asama and Mt. Yatsugatake in Saku, Nagano. The concentrations of both major elements and trace elements are measured before and after filtration. By comparing the concentrations before and after filtration, the current state (water-soluble or colloid) of the toxic elements (Arsenic, Cadmium, Cesium and Lead) in river may be determined. From correlations between the various elements, the parameter that explains the effect of the concentration and transportation of toxic trace elements can be elucidated.

As a result, 1) The current state of toxic trace elements in Mt. Asama area is: Arsenic (water-soluble state), Cadmium (colloidal state), Cesium (water-soluble state), and Lead (colloidal state). The state of toxic trace elements in Mt. Yatsugatake area is: Arsenic (water-soluble state), Cadmium (colloidal state), Cesium (colloidal state), and Lead (colloidal state). 2) When the current state of trace elements is colloidal state, the parameter which explains the effect of the concentration and transportation of toxic trace elements is sorption by Fe-Al-Ti colloid. When the current state of trace elements is water-soluble state, the parameter is pH. 3) The model of transportation of noxious trace elements by means of colloidal iron interaction is formed. The model has two types. Type 1: In Y-river in Mt. Yatsugatake area which does not contain much iron, toxic trace elements are attracted to Fe-colloid by sorption. Type 2: In A-river in Mt. Asama area which largely contains colloidal iron, toxic trace elements are also attracted to Fe-colloid by sorption. However, there are some colloidal irons without toxic trace elements.

Keywords: noxious trace elements, river, colloid, Yatuga-take, Asama-yama

The comparative study of watershed environment and material circulation -In case small basins of the Goto Islands-

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1. Introduction

In general, water composition of the land water is expected to have a relationship between the geological and the surrounding environment. In the case of the islands it is also conceivable to greatly affected by sea salt from its geographical reasons (Goto other 1989). Therefore, this study is to clarify the current status of each island of water environment in Goto Islands, and small watershed of each of its rivers and is obtained by comparing the discussed material circulation in.

2. Regional Overview

Goto Islands is located in the westernmost of Kyushu. They are over about 80km from the southwest side to the northeast side, consisting of 52 inhabited islands and 11 uninhabited islands. Population is about 70,000 and the total area is 420.87km². In addition, they have a wide variety of coastal landscapes such as sea cliff and drowned valley. For geology, it is constituted by sandstone and mudstone deposited on the Neogene Miocene called Goto layer group and solute tuff.

3. Investigative method

The local hydrological observation of rivers, mountain streams, groundwater and reservoirs in the Goto Islands went twice at 82 points from 3 to 5 in May and 179 points from 27 to 31 in August, 2014. Observation items is AT, WT, EC, pH and R-pH. Also, the those samples were analyzed to the measurement of total organic carbon and the main dissolved component.

4. Results and Discussion

The value of the EC were many places showing almost 200 μ S/cm. In contrast, EC showed more than 300 μ S / cm in agricultural reservoirs and fields near the river Uku Island and Ojika Island and the river near the ranch of Fukue Island. With regard to total organic carbon, those points are showed a relatively high value of 4-6 mg / L. The overall values are lower in August than May. This reason is considered to be because the influence of dilution by precipitation in summer. Also, the major components dissolved rivers are totally the type of Na-Cl except for some, it is understood that it is under the influence of sea salt. The groundwater such as well shows the type of Ca-HCO₃, it is considered to be a circulating water.

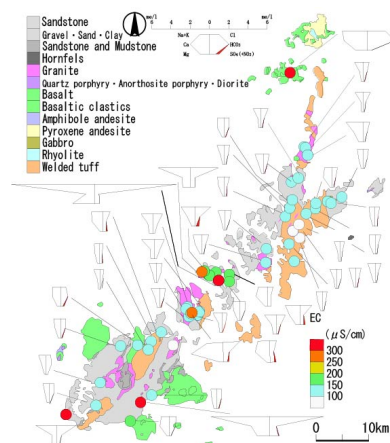
5. Conclusion

Some degrees could be related to the geological feature of the island and the basin, the difference in the environment of the land condition and the water quality clearly by the former study. I'd like to conduct a field survey more in detail by the special by which a typical basin was selected and deepen consideration about a relation between the basin environment and material recycling from now on.

Reference

Goto, H. and Noma, Y.(1989):Stream water geochemistry and estimation of the effect of sea salt in Tokunosima. *Bull. Geol. Surv. Japan*, vol.40(11), p.625-633

Keywords: Goto Islands, Material circulation, Water quality, Main dissolved component



Estimation of the climate change effect on the long-term variation in river temperature in a snow-covered watershed

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According to the effect of climate change such as global warming, it is possibly predicted that seasonal precipitation, snowfall, and river ecosystem changes in a watershed scale. Therefore, the estimation of climate change effect on river environment especially in a snow-covered watershed is important. In the present study, two different trends were found in the river temperature in western Japan; monthly decreasing trends and annual increasing trends. These trends could be explained by the hydrological process such as increase of snowfall and rainfall in the headwater area during winter seasons and increasing of the groundwater discharge to the river in summer seasons, respectively. An estimation of the temperature of river water by an extrapolation model in 2011-2050 indicates that annual temperature will increase.

Evaluations of spatial distributions in groundwater recharge in an urban and suburban, Yamato river watershed

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In coastal megacities, severe groundwater depression and land subsidence occurred. For sustainable groundwater use and risk management of flood, it is necessary to estimate not only groundwater recharge in upstream area of a megacity but flood discharge in subsidence area. In addition, spatial distributions of them would be especially expected in various annual precipitations. However, such estimations and predictions in future have not been fully done in previous studies. Therefore, we aimed to evaluate spatial distribution in groundwater recharge and flood discharge in an urban and suburban watershed of 1000km² scale including Osaka metropolitan city. We applied SWAT model to predictions of floods and groundwater recharge from 1990 to 2013 in Yamato river watershed. It was calibrated by the daily river runoff data from 2003 to 2004 in Japanese Ministry of Land, Infrastructure and Transport and it was validated the data from 2008 to 2009. The daily variation in river runoff in 2012 indicated the typical increase at the rainfall event with the amount above 100mm, especially it was one of the largest flood on the end of June in 2012. According to these results, the increase of the flood risk on the Osaka megacity was suggested. Based on the river runoff simulation, the spatial distributions in groundwater recharge were also evaluated. The urban area indicated the low recharge rate but forest area had the high rate. For the sustainable groundwater use and decline of flood risk, it was suggested that we should keep the present percentage of forest cover.

Effect of groundwater movement on nitrite variation and redox condition in groundwater

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Introduction

Nitrite pollution in groundwater from agriculture area has become a serious problem and it has been caused widely concern. On the other hand, denitrification works as purification action to decrease nitrite in the groundwater, which generally occurred under reduction condition with low dissolved oxygen. However, the research related to mechanism of groundwater movement on redox condition of groundwater is still not enough. In our research, we would like to focus on the redox condition affected by the variation of groundwater movement from a granite unconfined aquifer. And consider its possible impact on denitrification in groundwater.

Location

The study area is located on southern part of Ikuchi Island in central Seto Inland Sea, Japan. The catchment is characterized by steep topography underlain by granite and the bedrock outcrops in up streams area. There shows a small slope near coastal area with the slope of about 1/50. An alluvial fan is formed in the downstream area. As the land use, the orchard of citrus fruits is distributed widely in a basin.

Methods

The observation boreholes are installed at the depths of 15m and 30m in downstream site, the water levels and ORP of each borehole were monitored by automatic data loggers. And water samples were collected at the interval of one month from 2014/9 to 2015/2. During sampling, The DO and ORP were monitored onsite for the calibration of data. After sampling, the water sample were brought back for analysis, NO₃-N concentration was analyzed by auto analyzer and Cl⁻ was analyzed by Ion chromatography.

Result and Discussion

he results shows the redox potential showed relatively low level to during the periods between 2014/9 and 2014/12. Which related to the lower groundwater level resulting from small precipitation at that periods. It decreased the groundwater velocity and increased the retention time of groundwater, therefore, the redox condition would like to shift to reduction condition rather than the oxidation condition. NO₃-N concentration of 15m borehole is about 9ppm and NO₃-N concentration of 30m borehole is about 6ppm.Both of sample show relatively high DO. Therefore, denitrification cannot works actively. The detailed information of nitrate concentration variation accompany with the redox condition change will be shown in this poster.

Factors controlling elevated fluoride concentrations in groundwaters at the western part of Kumamoto area, Japan

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Hydrogeochemistry of shallow and deep aquifer groundwaters collected from boreholes and wells (N=47) along the flow lines of western margins of Kumamoto basin, has been studied in order to evaluate the geochemical controls on fluoride concentrations. Kumamoto city, situated at the central part of Kyushu island in southern Japan, is considered as the largest urban groundwater city in Japan. 100% people of this city depends on groundwater for their drinking purpose. Groundwater aquifers are composed of Quaternary volcanic (pyroclastic) flow deposits. In both shallow and deep aquifers, groundwaters evolve along the down flow gradient from oxidizing conditions of recharge area to the reducing conditions of stagnant area of Kumamoto plain.

Groundwater pH is near-neutral to alkaline (7.05-9.45) while sodium and bi-carbonate is the predominant cation and anion respectively. Groundwaters are mainly Na-HCO₃ type along with few Na-Cl type samples. F⁻ concentration ranges between 0.1 to 1.57 mg/L with an average of 0.7 mg/L whereas 47% shallow groundwater and 21% deep groundwater exceeded the Japanese drinking water standard (0.8 mg/L). With respect to groundwater chemistry, high F⁻ concentrations were mainly observed in Na-HCO₃ type groundwater and low concentrations in Ca-HCO₃ type groundwater. F⁻ is positively correlated with HCO₃⁻ and Na⁺, indicating that groundwater with high HCO₃⁻ and Na⁺ contents help in dissolving of some fluoride-rich minerals. Groundwaters with higher F⁻ contents have relatively higher pH value, suggesting that alkaline environment favors the replacement of exchangeable F⁻ in fluoride-rich minerals by OH⁻ in groundwater. Different ionic relationships imply that the geochemical behavior of fluoride in groundwater is also influenced by the ion-exchange process which release Na⁺ to the groundwater and removes Ca²⁺ ions from groundwater. Thermodynamic relationship between the activities of Ca²⁺ and F⁻ indicate that groundwater is undersaturated with respect to fluorite (CaF₂). However upper limit of fluoride (F⁻) is controlled by the precipitation of Ca²⁺ ion. These observations reflect that fluoride concentration in Kumamoto groundwater is mainly controlled by the dissolution and precipitation processes of fluoride and Ca-rich minerals.

Keywords: Groundwater, Volcanic aquifer, Fluoride, Geochemical process, Kumamoto

Monitoring Radioactive Cs Concentration in a Small Agricultural Pond

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Radioactive materials were released over wide areas around the Tokyo Power Fukushima Daiichi Nuclear Power Plant after the accident caused by the earthquake and tsunami on March 11, 2011. Radioactive cesium pollution in agricultural ponds that supply irrigation water in this region was a concern for the restart of farming. Therefore, it is important to determine the movement characteristics of radioactive cesium around agricultural reservoirs. In this ongoing study since June 2013, we measured the concentrations of radioactive cesium in inflow, outflow, and pooled water in a small agricultural reservoir located in the Abukuma Mountains. The area of the pond was 0.37 ha, and its pondage was 7500 m³. The concentration of total radioactive cesium in the water was relatively high, around 1-3 Bq/kg, during the summer, but decreased to 0.2-1.5 Bq/kg after October. However, the concentration of total radioactive cesium of the outflow temporarily increased to 2.9-4.0 Bq/kg, when the water level decreased by 1.2 m in the middle of September. The increase in radioactivity was believed to be due to disturbance of the bottom water and sediment caused by relatively fast water flow. The dissolved radioactive cesium concentration in the inflow was 0.02-0.07 Bq/kg, whereas that in the outflow was 0.02-0.11 Bq/kg; both were considerably lower than the total radioactive cesium concentration. The ratios of dissolved radioactive cesium to total radioactive cesium were 1-5% in the inflow and 1-3% in the outflow. Thus, our results showed a positive correlation between the total radioactive cesium concentration in stored water and that in precipitation that occurred over the previous 5 days.

Keywords: radioactive cesium, agricultural pond, irrigation water

Estimation for migration routes of coastal flatfish juveniles using a stable isotope analysis

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Coastal fish species migrate among many habitats depending on their ontogenetic changes with the resource requirement. The migration sometimes exceed several tens kilometers, and it is suggested that they play an important role which transport nutrients and materials among various habitats. Therefore, clarifying their migration route and resource use at stop-over sites is essential to understand a nutrient cycling in coastal ecosystems in large scale such as water sheds.

In North Pacific coastal areas, marbled flounder (*Pleuronectes yokohamae*) typically inhabit nearshore and estuarine areas at juvenile stages. In the life cycles, they gradually migrate to off-shore area in dependence on their growth after spending larva or juvenile period in nursery ground. Their migration is suggested to extend for several ten kilometers across ecosystem boundaries, although their migration route and resource use are still unclear. In this study, we tried to estimate the route of juvenile migration of marbled flounder in Tokyo Bay using stable isotope analysis.

We firstly revealed that geographic variation in $\delta^{13}\text{C}$ signature of organic materials of sediments in Tokyo Bay. Our analyses also clarified that $\delta^{13}\text{C}$ signature of juvenile marbled flounder well corresponded to that of the sediment in each area where they were caught by monthly census. Using these information and depth data of Tokyo bay, we analytically found two migration routes of the juvenile marbled flounder: Chiba coastal route and Tokyo-Yokohama route. Moreover, the result of our analyses indicated that the contribution of juveniles via Chiba route to the adult population of Tokyo Bay was higher than that via Tokyo-Yokohama route.

Keywords: coastal flatfish, juvenile, migration, stable isotope