Characteristics of ground water under the central Osaka

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On the west side of Osaka plain, several clay layers accompanying repeated sea level change accumulate in layers, and the gravel layer between the clay layers forms a submerged aquifer where abundant underground water resides. On the other hand, due to the severe ground subsidence caused by the massive pumping up of factory water in the 1960s, pumping is currently strictly regulated. However, in recent years, especially in Osaka city, consideration is being made on effective utilization of groundwater, such as the promotion of underground water use project as regenerative thermal energy.
Therefore, we conducted survey of water level, water temperature, and water quality using existing observation holes near Nakanoshima from around Osaka Station for the purpose of acquiring background data on the properties of groundwater at the present time. The aquifer covered in this study is a sand gravel layer (1st aqueduct layer: Dg1) distributed beneath the clay layer (Ma13) of the Holocene, and the gravel layer (the second caught aquifer: Dg 2) distributed under the clay layer (Ma12). Regarding the water quality, we analyzed the composition of the principal components etc. for groundwater sampled 4 times in total in June, September, November 2016 and January 2017. As a result, it was revealed that both Dg 1 and Dg 2 were reductive and showed a Na - Cl type water quality composition, especially Dg 1 had a higher salt concentration. In addition, mineral composition analysis (XRD) of the fine grains obtained when filtering with a membrane filter of 0.45 μm was carried out, and it was found that amorphous iron oxide was included together with detrital grains. The abundance and the mineral composition of such fine particles present in the groundwater are important information in searching for effective use of groundwater in the future.

Keywords: ground water, borehole, database, water quality

A study on the water environment in Shingashi river basin

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1.First

Some rivers flowing through urban areas in Japan still have problems with water quality, and it is important to grasp the water environment of the river in the current urban area in order to promote the conservation of the water environment. Hosei University has continued to conduct research on the Shingashi river basin that flows through suburbs of Tokyo since the 1930s, and in recent years it has been conducting water quality surveys in cooperation with civil society groups. Here we will clarify the water environment of the current Shingashi river basin, based on the results of the water quality survey conducted four times from 2013 to 2016.

2.Region overview

The Shingashi river basin is located in 10 cities and 1 town in Saitama Prefecture, 6 cities and 1 town in 3 wards in Tokyo. The Shingashi river of mainstream is a first class river belonging to the Arakawa water system. The flow path extension is 34.6km, and the tide zone is about 16km from the confluence point with the Sumida river. In addition, the catchment area is 411km2.

3.Survey method

In the Survey on familiar water environments conducted in June every year, citizen groups provided water collected, and in the laboratory we measured pH, RpH, EC and analyzed TOC, Analysis of major dissolved components is carried out.

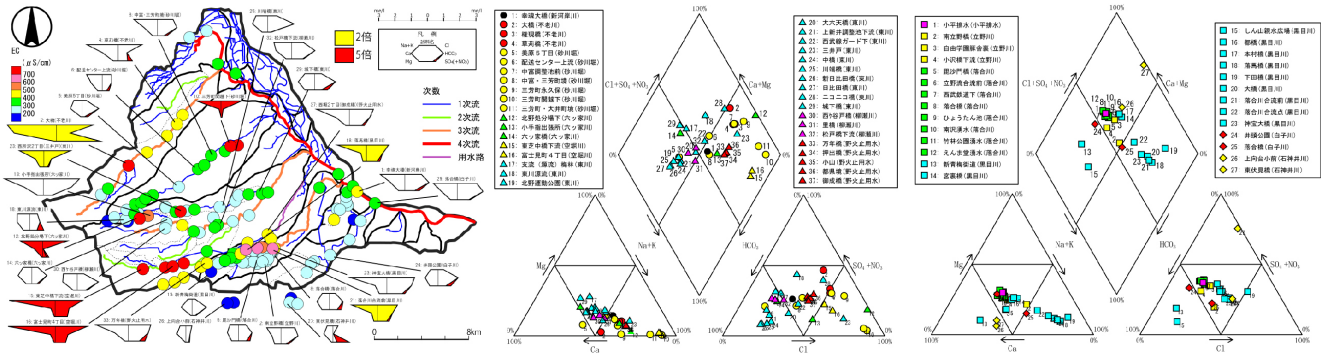
4.Results

As a result of the survey, various water quality is distributed in the Shingashi river basin, but in the upstream area of each river, the Calcium bicarbonate type water quality composition is shown, the downstream side tends to show the composition of sodium chloride type at the downstream side, this suggested the effect of domestic wastewater. It also detects nitrate ions, it is also anticipated that agricultural fertilization will affect rivers.

5.Conclusion

Because there was bias at the analyzed points, we could not grasp the water environment throughout the basin. In future, we aim to deepen collaboration with civil society groups and to grasp the water environment of the entire Shingashi river basin.

Keywords: Shingashi river basin, Water Quality, Urbanization



Nitrate contamination in spring water and its relation to land use at upper and lower river terraces

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Groundwater contamination including nitrate has long been regarded as an important social problem. Numerous earlier studies have implicated land use at the ground surface as the cause of such contamination. To elucidate land use effects in this study, we investigated water quality composition including nitrate of spring waters in the northern part of Morioka city, Iwate Prefecture. Spring water A and B samples were taken on the terrace at a mountain side. Also, C was obtained from a paddy field site on the terrace. D and E were obtained under the terrace. Land uses on terraces included paddy fields, houses, ironworks, poultry farms, electrical parts factories, and cafeterias. Water quality compositions of A and B samples tended to be similar. Compared to B, spring water C showed higher NO_3^-. Whereas D had higher values of Cl^-, Na^+, K^+, and HCO_3^- than B. In the E sample, Na^+ and K^+, Cl^- concentrations were lower than in D; NO_3^- was conspicuously present. Annual changes in water temperature were observed in C, D, and E, suggesting that water was flow in the surface layer. The change in water temperature was more pronounced in D than in E; their groundwater flows are expected to be different. The cause of increased NO_3^- and SO_4^- in C was inferred as paddy field fertilization. Regarding D, tendencies showed increased K^+ and Cl^-, along with increased Na^+ and Ca^{2+} differing from C. Influences other than paddy fields irrigation and fertilization, such as households or industrial wastewater, were inferred. Moreover, D and E exhibited different water quality compositions, suggesting that groundwater was affected by narrow range of land use.

Keywords: groundwater, contamination, land use

Distribution and geochemistry of gas seepage on Boso peninsula, Chiba

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Within the area of Southern Kanto gas field in Chiba, with methane concentration of >99%, natural gas seepage is observed widely on land in the central part of Kujukuri plain to Otaki. Such gas has been used as a fuel by local residents, however, it may cause an accidental explosion and agricultural damage. In addition, if the gas is continuously released from the subsurface environment to atmosphere through the seepage, the impacts on the local carbon cycle should be taken into account. In this research, we aim to characterize the source, migration and seep processes of these gases by analyzing their chemical and isotopic compositions. Gas samples were collected from the boundaries between alluvial mudstone and sandstone or Kazusa Group, with a methane concentration generally of >75% and trace amounts of carbon dioxide and ethane with nitrogen from atmosphere. According to the methane/ethane ratio and stable carbon isotopic composition of methane, it is suggested that the majority of methane is of biogenic origin. Together with the stable carbon isotopic composition of carbon dioxide, it is considered that the methane is produced mainly by reduction of carbon dioxide and fermentation of acetate with some contribution of methane oxidation.

Keywords: gas seepage, methane, Boso peninsula

Hydromechanical Modeling of Urban Road Collapse and Land Subsidence Induced by Underground Facility Failure

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As population of cities grow, the demands of underground developments increase accordingly. However, without careful consideration of urban hydrogeology and soil characteristics, those subsurface constructions could alter urban hydrogeology and consequently induce land deformation on the surface, which are potentially hazardous to local communities.
In particular, land subsidence and sudden road collapse phenomenon are one of major geohazard frequently occurring in many metropolitan cities of which underground facilities become gradually old. In most cases, these surficial collapses are known to be induced by the failure of near surface artificial underground structures and pipelines (e.g. water supply/ sewer lines, subway tunnels); however, exact hydromechanics process of collapsing which incorporated by groundwater and subsurface characteristics is not yet fully understood.
The purpose of this study is (1) to explore the feasible mechanism of land subsidence and road collapse in the urban areas, (2) to develop a hydromechanical model that simulates the moment of failure and quantify the interaction between pore pressure and associated effective stress field. The stability of collapsing area is also inferred using Columb Shear Failure (CSF) potential. Lastly, (3) using 2D and 3D models, a variety of possible scenario are tested to obtain quantitative relations between failure potential and hydrogeologic factors such as precipitation, aquifer heterogeneity and leakage events.
A fully coupled groundwater flow –deformation equation is used for solving an urban collapse problem corresponding to transient pore pressure changes by natural and anthropogenic factors. Preliminary numerical results show that the subsidence pattern and failure potential are closely related to the local fluid pressure change affected by groundwater leakage through cavities created by underground facility damage, and hydromechanical properties of the aquifer play important roles in either mitigating or exacerbating the collapse process.

Keywords: urban road collapse, fully coupled hydromechanical modelling, underground facility failure

Case investigation of the efficiency degradation of open loop geothermal cooling and heating system(OLGCHS) in Korea

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This study was conducted to improve energy efficiency of open loop geothermal cooling and heating system (OLGCHS) showing low energy efficiency. When OLGCHS were installed, hydrogeological properties and groundwater yield were not considered. Therefore, various problems such as groundwater depletion, circulatory disturbance of groundwater, groundwater overflow, clogging by materials, and decrease of energy efficiency occur in many facilities which OLGCHS was installed and maintenance is very difficult. These circumstances have a negative influence on the spread of the OLGCHS in Korea. However, there is no proper investigation and cause analysis to solve the above problems. In this study, an advanced standing column well(SCW) was developed. In advanced SCW, wells used in OLGCHS are arranged in a row and these wells are connected using pipeline. Therefore, well depth was reduced and groundwater circulation was improved in the advanced SCW compared to a common SCW. In addition, installation cost can decrease and energy efficiency can increase. This research was supported by a grant(16CTAP-C116546-01) from Technology Advancement Research Program funded by Ministry of Land, Infrastructure and Transport of Korean government.

Keywords: open loop geothermal cooling and heating system(OLGCHS), efficiency degradation, hydrogeological properties

