Estimation of the solute transport process of seawater to groundwater in the Yellow river delta

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The Yellow river delta has been developing by the large rate of sedimentation. The delta expanded 15 km toward the sea during only 20 years. Because the coastal groundwater is generally contacted with the seawater at the beach line, the boundary of seawater and groundwater would also have shifted quickly with the beach line. This is reflected by the displacement rate of seawater to groundwater in the developing delta area according to the groundwater flow rate. In case of the extremely low rate of groundwater flow, the boundary would be located at the inland of the beach line. In addition, the cation tends to be adsorbed in the clay and to be transported in the delayed rate as compared with the anion. Therefore, the adsorbed cation indicates the older information of the underground environment.

The objective of this research is to estimate the displacement process of seawater in the delta to groundwater, and to confirm the effect of the Yellow river condition on the groundwater environment and nutrient flux to the sea through the groundwater. We conducted the piezometric observations, resistivity measurements, chemical profile measurements of groundwater, and profile collections of soil in the delta area in 2003 and 2004. The piezometric observations were carried out at each riverside and seaside site, respectively. The results of the piezometric potential indicated groundwater flow from the river to groundwater and from groundwater to the sea, respectively. Miyaoka et al.(2004) indicated the some valley lines of the groundwater table. Other measurements and collections were conducted at a valley line and a ridge one of groundwater with assuming as the palaeovalley and palaeoridge, respectively. The resistivity profile at a palaeovalley was high at the surface layer and low at the deeper. In contrast, the palaeoridge had the inverse profile. This suggests the high displacement rate of seawater to the pure water with the groundwater flux or existence of compact sediment in the surface layer at the palaeovalley. The chemical profile in the wells supported the former suggestion. But we need to check also the geologic profiles in the area. The chemical properties of soil profiles were also analyzed after collecting at two palaeoridge and two palaeovalley lines. The results at a palaeoridge line indicated the continuous trend of displacement at the 7 plots on the line of 15 km from the riverside to seaside. Adsorbed cation extracted by NH4+ solution was composed of Na+ in the seaside area, while it was Ca2+ in the riverside area. This means the displacement from Na+ to Ca2+ in the inland area. Using the simple water balance model, the displacement rate was estimated to be 20 years at 15km of inland from the beach. It is similar to the sedimentation age. However, adsorbed Na content at the 15km from the beach was only one sixth of the value of seabed sediment. This high content coincides with the resistivity property in the surface layer. This means that the soil keeps high Na content as the adsorbed condition in the soil. We need to compare such results with those in the palaeovalley.