Geological effects on the chemical compositions of small island rivers

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The dissolved inorganic carbon transported by rivers is an important net flux that connects terrestrial and oceanic carbon reservoirs. The chemical composition of river water, however, has a great variation depending on drainage geology through the following processes: 1) the chemical weathering of soil and/or surface rocks and 2) contribution of base flow, which has contacted with subsurface rocks.

The primary aim of this study is to estimate how sensitively these processes affect the river water properties and the carbon transportation. In order to investigate the influence of watershed geology, a water sampling survey was conducted on Ishigaki and Iriomote Islands, southwest of Japan, whose basement rocks are carbonate and siliceous sandstone, respectively. The survey was conducted on March 2007.

Samples from Miyara River (length: 12 km) in Ishigaki showed generally high total alkalinities and DIC concentrations (300-2600 umol/kg) reflecting the effect of carbonate erosion and those concentrations drastically increased downriver. From the fluctuation pattern of d^{13}C values of DIC, we concluded the increases were the result of groundwater mixing, which was one of the characteristic features of the high-porosity carbonate basement. As a result of carbonate dissolution, the samples from Miyara River also showed relatively higher pH values (7.2 in average.) In contrast, samples from Urauchi River (length: 19km) in Iriomote showed lower DIC concentrations (80-150 umol/kg) and pH values (6.5 in average,) reflecting slow chemical erosion of silicate rocks and less groundwater contribution.

These variations of two river water compositions are distinct even though these rivers are extremely shorter than large continental rivers such as Amazon or Mekong. This result indicates the geological distribution of watershed affects the composition of river water on a small scale of space and time.