

Wetlands as the primary source of dissolved iron in land and the impact of land use change

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Iron is one of the most insoluble elements during the weathering process, but it is known that iron is solubilized under reductive conditions such as wetlands, where reduction of Fe leads to a production of soluble Fe²⁺ and more stable organic Fe complex form. The objectives of the present study are 1) to understand the quantitative importance of land surface in the Amur Basin as a dissolved iron source with a reference to hydro-topographical and ecological situations, and 2) to evaluate the impact of land use change, which has been largely expanded in Sanjiang plain, China, in these decades.

[1] Intensive field survey of stream water in a natural watershed as a model field site revealed a striking dependency of dissolved iron concentration on their elevations, suggesting that topographical gradient of land surface is a determinative factor to control dissolved iron concentration in discharge water.

[2] A monitoring of soil interstitial water in natural wetland, paddy field and upland field in Sanjiang plain demonstrated a significant difference in the biogeochemical behavior of iron among them. Upland fields, formed after reclamation by drainage, proved to have an oxidized condition with high Eh, where little iron solubilization takes place. Paddy fields had lower dissolved iron concentrations in both surface and soil interstitial waters throughout a year and a shorter period of reductive condition due to agricultural water managements. Controlled water drainage and negligible water penetration into soil probably result in reduced iron transport from paddy fields.

[3] Presence of peat layer observed in most terrains suggests a predominance of wetlands in Sanjiang plain in the pristine age. Current ground water tables were found to be greatly lowered in most regions in Sanjiang plain, due to the reclamation by water drainage. It is likely that such alterations in land condition from wetlands result in a decrease in river transport of dissolved iron as observed in a major branch river in recent decades.

Keywords: dissolved iron, wetlands, land use change, HNLC, limitation of Fe in the ocean, reductive condition