Geophysical Research Abstracts
Vol. 15, EGU2013-1746, 2013
EGU General Assembly 2013

Role of hydrological events in sediment and sediment-associated heavy metals transport within a continental transboundary river system - Tuul River case study (Mongolia)

Jan Pietroń and Jerker Jarsjö
Stockholm University, Physical Geography & Quaternary Geology, Sweden (jerker.jarsjo@natgeo.su.se)

The concentration of heavy metals in rivers is often greater in the sediment load than in the water solution. Overall, heavy metal conveyance with sediment transport is a significant contributor to the global transport of heavy metals. Heavy metals once released to a river system may remain in the deposits of the river from short to very long times, for instance depending on to which extent erosion and deposition can influence the sediment mass stored in the river bed. In general, the mobility of contaminated sediments to downstream water recipients may to large extent be governed by natural sediment transport dynamics during hydrological events, such as flow peaks following heavy rainfalls.

The Tuul River (Northern Mongolia) belongs to a Tuul River-Orkhon River-Selenga River- transboundary river system that discharges into Lake Baikal. The river system is largely characterized by its natural hydrological regime with numerous rapid peak flow events of the spring-summer periods. However, recent studies indicate contamination of fine sediment with heavy metals coming from placer gold mining area (Zaamar Goldfield) located along the downstream Tuul River. In this work, the general idea is to create a one-dimensional sediment transport model of the downstream Tuul River, and use field-data supported modeling to investigate natural erosion-deposition rates and the role of peak flows in natural sediment transport at 14 km reach just downstream the gold mining area. The model results show that the sediment load of the finest investigated grain size has a great potential to be eroded from the bed of the studied reach, especially during the main peak flow events. However, the same events are associated with a significant deposition of the finest material. The model results also show different hysteresis behavior of the sediment load rating curves (clockwise and counter-clockwise) during the main peak flow events. These are interpreted as effects of changing in-channel sediment supplies due to sorting method applied in the model.

More generally, the modelling may increase our knowledge about the sediment transport patterns of the reach downstream the mining area. This part of the river may be considered as a temporal sink of heavy metals which may accumulate and store sediments. The deposition in such sinks can considerably support attenuation of contaminated sediment loads. On the other hand, sediments that are accumulated in sinks can increase the concentration of contaminated sediment loads during peak flow events. Information about the rates of eroded and accumulated contaminated material in such sinks is important for future water protection planning, especially under changing climate conditions. This work may also provide scientific input to discussions on both adverse environmental consequences of placer mining, and suitable designs of sediment control measures in the Zaamar Goldfield and other continental river systems.