How does river damming affect elemental fluxes to the oceans?

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Riverine transport of dissolved- and particulate material from the continents to the oceans is a major process in the global cycling of elements, such as essential nutrients. Damming of rivers changes the seasonality of the discharge and also the physical, chemical and biological properties of the water.

During 2003 – 2007 the largest dam of its type in Europe was built in Jökulsá á Dal glacial river catchment in Eastern Iceland. The purpose was to make a reservoir for a 690 MW hydropower plant. Monitoring of the riverine fluxes of dissolved- and particulate elements started five years before the construction began and continued for five years after the construction was finished. This allowed the comparison of the elemental fluxes before and after the damming.

Even though the seasonality of the fluxes has changed, the annual average flux of most of the dissolved elements is comparable to the one prior to damming. That is excluding the annual fluxes of dissolved Fe and Ti which are now 2 – 4 fold the before dam fluxes.

Jökulsá á Dal is a glacial river loaded with sediments, of which, most is now accumulating in the reservoir. Indeed, the particulate flux is now only 15% of the flux prior to damming. These fine grained sediments, which are mostly basaltic glass, have high specific surface area, are highly reactive and dissolve fast in seawater. They carry large amounts of adsorbed elements on the surface which can become bioavailable when entering the ocean. Studies have shown that only if a small percentage of the particulate material dissolves after its arrival in the ocean it would dominate the flux of dissolved elements [1] and be the most important flux of nutrients to the costal water. The accumulation of the suspended material in the reservoir is therefore likely to diminish the riverine flux of essential nutrients to the coastal waters in Eastern Iceland.

[1] Oelkers E.H., Jones M.T., Pearce C.R., Jeandel C., Eiriksdottir E.S, Gislason S.R.. Riverine particulate material dissolution in seawater and its implication for the global cycles of the elements. *Comptes Rendus Geoscience*, **344**, 646-651.