Geophysical Research Abstracts,
Vol. 10, EGU2008-A-03462, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-03462
EGU General Assembly 2008

DOC speciation in boreal rivers and lakes and its link with microbial biomass, bacterioplankton production and degradation

L.S. Shirokova (1) and **O.S. Pokrovsky** (2)

(1) Institute of Ecological Problems of the North, Russian Academy of Science, Arkhangelsk, Russia (LShirocova@yandex.ru); (2) Géochimie et Biogéochimie Experimental, LMTG, CNRS, Universite de Toulouse, 14 Avenue Edouard Belin 31400, Toulouse, France (oleg@lmtg.obs-mip.fr)

Boreal zones of Russian Arctic are likely to play a crucial role in the regulation of major and trace elements input in the ocean at the high latitudes. In contrast to relatively good knowledge of Western European arctic environments, located in relatively warm climate on the Baltic sea coast, within the area subjected to some anthropogenic influence, our understanding of biogeochemistry of small watersheds located at the coast of the Arctic ocean and the White Sea remains extremely poor.

High concentration of Dissolved Organic Matter (DOM) and thus, organo-mineral colloidal status of most metals is the most important characteristic features of European Russian Arctic zone biogeochemistry. To get the first-order understanding of colloidal transport and speciation of organic carbon in this region, size fractionation of Dissolved Organic Carbon (DOC) in Severnaya Dvina and Pinega rivers in three different seasons: “unusual” winter flood in December 2006, winter base flow in February 2007, spring flood in May 2007 and summer base flow in August 2007 has been investigated using filtration and dialysis. To this end, samples were filtered in the field through a progressively decreasing pore size (5 μm, 2.5 μm, 0.22 μm, 100 kDa, 10 kDa and 1 kDa) using the frontal filtration and ultrafiltration technique and *in-situ* dialysis through 10 kDa and 1 kDa membranes with subsequent analysis by Shimadzu TOC 6000 Analyzer.

In (ultra)filtrates and dialysates, the major part of DOC is concentrated in the $<$ 1–10 kDa fraction implying the existence of small-size organic substances of fulvic rather than humic nature. Note that concentration of organic carbon in Sev. Dvina is twice lower during base flow compare to flood; however, this difference is only pronounced for large fractions (0.22 μm – 10 kDa). Organic carbon concentration in small colloidal (1 kDa – 10 kDa) and truly dissolved ($<$ 1 kDa) fractions is almost independent on season and hydrological situation. These observations indicate the presence of two pools of organic matter: allochtonous large-size colloids formed by lixiviation from upper soil horizons and autochthonous (aquatic) small molecular-size substances, probably linked to bacterial and phytoplankton exudates. While the proportion of the formers is highly seasonally dependent, the contribution of the latter's remain relatively constant over the year.

To gain further insights in the biogeochemical mechanisms that control dissolved organic carbon migration in surface boreal waters, we studied microbial population, primary production and biodegradation intensity in rivers and lakes of the White Sea basin (r. Pinega and its tributaries, surface streams of Karelian region in the Paanajarvi National Park and sub-arctic lakes in the south of Arkhangelsk region). Samples of natural waters, collected in sterile vials were immediately inoculated onto agar media to quantify the number of colony-forming units of the following microbiological taxons: autochthons eutrophic (standard agar media), facultative oligotrophes (Gorbenko media), oligotrophes (Difco media), facultative anaerobes (thioglycolate media) and yeasts. The time of bacterioplankton cell duplication and respiration intensity were measured using standard Winkler method upon incubation of samples under light and in the darkness, with subsequent [O_2] analysis with high precision oxygen meter. It was found that, in boreal rivers, the number of facultative anaerobes bacteria positively correlates with [DOC] and [Fe] originating from swamp zones. In contrast, the intensity of microbial degradation processes and the rate of heterotrophic plankton growth (reproduction) are higher in river waters with lower [DOC] and larger watershed size. In all studied boreal lakes, strong positive correlations between [DOC] and concentration of autochtonous eutrophic microorganisms and between [DOC] and concentration of facultative oligotrophes were observed (r^2 = 0.95 and 0.99, respectively). Size fractionation procedure demonstrated strong dominance of small size organic colloids ($<$ 1-10 kDa) over full depth profile of studied lakes. Therefore, DOC in boreal lakes, even if they are located in the swamp-dominated area, is essentially controlled by internal processes of phytoplankton production/microbial degradation occurring in the water column. Overall our results demonstrate strong reciprocal control of DOC on both microbial diversity and biomass but also on the rate of microbiological production/degradation processes.