Trace elements in sediments of lakes in the Warta river basin

IZABELA BOJAKOWSKA*, TOMASZ GLIWICZ AND JAROSŁAW KUCHARZYK

Polish Geological Institute-National Research Institute, Warsaw, Poland (izabela.bojakowska@pgi.gov.pl)

The Warta River catchment (length 808.2 km), occupies an area of 54 529 km^2. The northern part of the catchment area covered by the Vistulian glaciation deposits, characterized by high abundance of lakes, while the southern part of the basin is practically without lakes.

The lake sediment samples taken from 5cm surface layer from profundal zone of 207 lakes, were analyzed for the content of As, Ba, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sn, Sr, Ti, V, Zn, Al, Ca, Fe, K, Mg, Na, P and S using ICP-OES method after digestion in aqua regia. From solid samples the Hg content was measured by AAS method and C_{org}. was determined using coulometric method.

Geometric mean contents in the sediment were for: Ag - <0.5 mg/kg, Ba - 96 mg/kg, Cd - 0.5 mg/kg, Co - 2 mg/kg, Cr - 7 mg/kg, Hg - 0.10 mg/kg, Cu - 13mg/kg, Ni - 7 mg/kg, Sr - 148 mg/kg, V - 11 mg/kg and Zn - 72 mg/kg. Sediments of most of the studied lakes are characterized by low contents of trace elements, similar to the geochemical background values. Markedly increased levels of Cd, Cu, Hg, Pb, Sr and Zn were recorded in the sediments of several lakes located within the cities or their boundaries, e.g. Lakes Człuchów, Trzesiecko, Wierzysko and lakes which are used as places of recreation (e.g. Lake Jasień) and their maximum contents were for: Cd - 7.0 mg/kg, Cr - 135 mg/kg, Pb – 153 mg/kg, Zn – 1413 mg/kg, Hg - 1.163 mg/kg. High levels of Cu (579 mg/kg), Ba and Sr were detected in lake sediments, whose waters are included in the cooling system power plants Pątnów and Konin (among them Lake Goławskie and Licheńskie). Warta basin lake sediments compared to sediments of lakes, created on postglacial sediments associated with other glaciations show significantly higher contents Ba, Sr and Ca, and lower contents of Cr, Pb, Zn and Fe. Sediments from lakes of the Warta catchment are also characterized by lower contents of Ni and V as compared to the sediments of lakes of the Pomeranian phase of the Vistulian glaciation.

The presence of high amounts of Cd, Cu, Hg, Pb and Zn in sediments of some lakes in the basin of the Warta is linked to anthropogenic factors (the functioning of cities, recreation, industry). The differentiation has been observed in the contents of trace elements in sediments of lakes situated on postglacial deposits associated with various glaciations.

Submarine groundwater discharge, the subterranean estuary and climate change: *Quo vadis*?

H. BOKUNIEWICZ

School of Marine and Atmospheric Sciences, Stony Brook University, Stony Brook, New York 11794-5000 U.S.A.

The elusive role of submarine groundwater discharge (SGD), and groundwater in general, to global geochemical budgets has special importance in models of climate change. Conversely, geochemical fluxes *via* SGD can be expected to be altered significantly by a change in global climate. Our understanding is distilled from multifaceted case studies. Over the past several decades, the study of SGD has matured from being a fairly interesting novelty studied at a handful of sites before 1985; to a previously unrecognized nutrient source to coastal waters recognized in 45 studies at 39 sites worldwide by 2000 [1]; to a recognizably ubiquitous phenomenon of global importance investigated in over 300 studies and 160 sites, and counting, worldwide today. SGD is often, but not necessarily, confined to the shoreline and it is typically many times greater than the flow of terrestrial, fresh groundwater under the shoreline (i.e. the underflow). In special cases, other drivers might be considered, geothermal gradients, osmotic pressures and consolidation. Deciding its role in global geochemical budgets is, of course, compounded by variations in scale and geology. Nevertheless, issues, such as the flux of carbon, need to be addressed on the largest possible scale. Better distribution of sampling sites is warranted not only to better define current geochemical budgets, but also to anticipate future alterations. Research at sites in high latitudes, in arid environments and around oceanic islands are to be encouraged.

[1] Taniguchi, M., *et al*. (2002) *Hydrological Processes* **16**: 2115- 2129