Lipid composition and stable isotope determination of particulate and sedimentary organic matter in Lake Bled (NW Slovenia)

[a]Petrišič M G, [a]Ogrinc N

The aim of our work was to identify the carbon source and transformation pathways of particulate and sedimentary organic matter in Lake Bled, using a combination of chemical and stable isotope analyses of lipid biomarkers. The composition and depth distribution of lipids is determined by the relative importance of the different sources (terrestrial, anthropogenic) and by a series of compound-specific (chemical structure, reactivity) characteristics. In October 2006, samples of particulate organic matter (POM) and sediments were collected. POM samples were taken at two depths, 12 and 26 m, while sediment trap material was collected at three depths in the water column: in the upper layer, thermocline and lower, anoxic layer. In these samples aliphatic hydrocarbons (HC), aliphatic alcohols (OH), sterols (ST) and fatty acids (FA) were determined after extraction and derivatization by GC-FID analysis and identify by GC-MS, while stable isotope analysis were obtained using GC-C-IRMS. It was found that autochthonous material prevailed in POM, trap material and sediments. The predominance of autochthonous POM was further supported by biomarker analysis, since fatty acid (FA) distribution, n-alkanes, and n-alkanols were predominantly of algal, zooplankton and bacterial origin. The predominance of $C_{18:0}$ *n*-FA, short chain, even carbon n-alkenols, the high proportion of cholesterol, higher cholesterol/phytosterol ratio and δ^{15}NPN values indicate an increased input from zooplankton feeding on phytoplankton produced during bloom conditions in the thermocline. Methanotrophic bacteria represented a main source of POM indicated by low δ^{13}CPOC and δ^{15}NPN values (from -36 to -33‰ and from 0.8 to 1.8‰). The presence of methanotropic bacteria was also observed at the sediments surface by the hopanoid distribution in the neutral lipid fraction, where hop-17(21)-ene with the average δ^{13}C value of -76.2 ± 5.1‰ was the most abundant. The distribution of lipids in sediment was markedly different from those in the water column indicating extensive bacterial degradation and recycling of labile lipids. The contribution of "fresh" autochthonous lipids to sedimentary organic matter changed from 48% at the surface to 20% at a depth of 20 cm, indicating that more refractory lipids of terrestrial origin prevailed in deeper sediment. The contribution of lipids of bacterial origin was more pronounced at the surface, comprising 13%, while their contribution in deeper layers ranged between 4 and 11%. Isotopic composition of lipid biomarkers in Lake Bled in the majority ranging from –40.4‰ and -29.9‰, depending on the origin of organic matter in sediments. The obtained results contribute to a better understanding of the composition, origin and distribution of organic matter in the lake and are useful in determining pollution impact.

[a] *Department of Environmental Sciences, Institute of "Jozef Stefan", Jamova 39, 1000 Ljubljana, Slovenia (marinka.petrisic@ijs.si)*