Geophysical Research Abstracts
Vol. 18, EGU2016-13212, 2016
EGU General Assembly 2016

A sugar biomarker proxy for assessing terrestrial versus aquatic sedimentary input

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Lake sediments are valuable, often continuous and potentially high resolution archives for studying past climate changes. Thereby, one of the crucial questions is often whether the origin of the organic matter in lake sediments is allochthonous (terrestrial) or autochthonous (aquatic). Here we present patterns of neutral sugars of various plants and algae species to answer the question whether the deoxyhexoses (fucose, rhamnose) to pentoses (arabinose, xylose) ratio can serve as a proxy for aquatic versus terrestrial sedimentary lake input, respectively.
Our sugar pattern results show that the fucose + rhamnose content plotted against arabinose and xylose in a ternary diagram can be used to distinguish between algae and other (namely aquatic plants, emergent plant, and terrestrial plants) sugar sources. This finding is confirmed by a compilation with sugar data from the literature. Mosses plot within the range of algae. Although the (fucose + rhamnose)/(arabinose + xylose) ratio yields some overlapping between algae and soil/litter samples, we recommend this ratio, particularly when applied within a multiproxy approach, as promising proxy for distinguishing between aquatic vs. terrestrial organic matter in sedimentary archives. Regarding the sugar concentrations of the investigated samples, emergent plants show the highest values as well as the highest variability. Mosses, aquatic plants and algae yield lower sugar concentrations comparable to those of terrestrial plants.