Pathways of carbonate sediment accumulation in a large, shallow lake

ÁGNES ROSTÁSI[1], MELINDA FODOR[1], KORNÉL RÁCZ[1], BOGLÁRKA TOPA[2,3], TAMÁS WEISZBURG[2] AND MIHÁLY PÓSFAI[1*]

[1] Department of Earth and Environmental Sciences, University of Pannonia, Veszprém, Hungary (*correspondence: mihaly.posfai@gmail.com, rostasiagnes@gmail.com, amfor89@gmail.com, rkornel19@gmail.com)

[2] Department of Mineralogy, Eötvös Loránd University, Budapest, Hungary (topabogi@gmail.com, glauconite@gmail.com)

[3] Hungarian Natural History Museum, Budapest, Hungary

The unique features of 70-km long, 3.5-m deep Lake Balaton in Hungary provide an opportunity for the study of a freshwater „carbonate factory". Our goal was to estimate a mineral budget for the sediments of Lake Balaton, and to assess sedimentation rate by considering the different sources of sediment minerals: tributaries, rain, atmospheric dust and precipitation from lakewater.

The properties and concentrations of allochtonous minerals, in particular the compositions, particle sizes and habits of detrital calcite and dolomite were examined by depositing and filtering particulate material from water samples of selected major inflows derived from Triassic carbonate and mixed carbonate-siliciclastic (marly) beds. The contribution of atmospheric processes to the mineral budget was assessed by collecting rain and using available data on dry deposition. Both the mineralogical character and the amount of particles delivered by streams and through the atmosphere were similar, and formed a minor fraction of the annual sediment load. Since the inflowing water contains high concentrations of Ca^{2+}, Mg^{2+} and HCO_3^- (with a Mg/Ca mol ratio ranging from 1 to 4), Mg-bearing calcite (with 2 to 17 mol% $MgCO_3$) continually precipitates in the lake. According to XRD measurements, the Mg content of calcite increases from West to East, in parallel with changes in water chemistry. Dolomite is also present as a minor phase, and in the western part of the lake it typically produces a split 104 peak in X-ray diffractograms, suggesting two disctinct sources: while stoichiometric dolomite is allochtonous, a Ca-rich dolomite fraction forms in the lake. Mg-bearing calcite precipitating in the lake was found by far the largest contributor to sediment formation, with an estimated accumulation of about 2 mm consolidated sediment annually.

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