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BOOK OB ABSTRACTS

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Are isotopes of Mg, Sr and Uin fluvial sediments identifiers of authigenic carbonate?

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It is now well established that authigenic carbonate is a potent, but highly dispersed CO2 sink, which has not been adequately quantified yet. This is particularly important in terrestrial aquatic sedimentary settings, where sedimentary carbonates are subject to multiple carbon sources with overlapping C and O isotope signatures and a multitude of early diagenetic processes that often operate simultaneously, but fractionate C and O isotopes in opposite directions. In river sediments, the presence of detrital carbonate may further complicate the estimation of their efficiency of CO2 storage. Obviously, traditional carbonate isotopes cannot provide enough information to establish the content of authigenic carbonate in carbonate sediments, therefore new identifiers must be invoked. Considering the mechanisms of formation of authigenic carbonate in river sediments, the alien cations incorporated into the CaCO3 seem to be an obvious choice. Uranium concentration in cross-plot with δ13C values of carbonate was suggested as the identifier of marine authigenic carbonate[1], but it failed in riverine carbonates. Therefore, the isotope compositions of ubiquitous trace metals in CaCO3 – Mg, Se and U – were tested as potential identifier of authigenic carbonate.

The test environment was a tufa-precipitating karst river in Croatia (Krka River). Recent actively growing tufa from seven locations with different carbonate precipitation rates was analyzed for elemental composition and isotope compositions of C and O in carbonate, as well as non-traditional isotopes (δ26Mg, 87/86Sr, δ88Sr, δ235U and 234U/238U activity ratios). River water, as well as local potential sources of detrital carbonate (soil, bedrock) were analyzed, too. The questions to be answered were (1) how the traditional and non-traditional isotopes in tufa behave downstream the river during precipitation of tufa, (2) what information can be obtained from isotope compositions of Mg, Sr and U on conditions of precipitation of carbonate, local hydrology or both and (3) whether it is possible to identify and quantify the amount of authigenic carbonate in tufa. The results showed that the isotope fingerprints of tufa reflect the complexity of the local hydrology and that in such complex settings as fluvial sediments, non-traditional isotopes are a better identifier of authigenic carbonate than traditional (C and O) isotopes. The quantification of authigenic carbonate, however, requires an extensive characterization of local sources of detrital carbonate.

[1] Zhao, M.-Y., Zheng, Y.-F. & Zhao, Y.-Y., Nature Communications 7, 2016, 10885.

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