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Watch your samples before getting them in the analyzer – stable isotopes in water between precipitation and post-analysis processing

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Precise and accurate determinations of the heavy to light ratios of oxygen and hydrogen isotopes in water are one of the main tools in stable isotope-base investigation of the past and present dynamics of the hydrological cycle (including palaeoclimate studies). However, while (usually and desirably) great care is taken when analyses are performed in the laboratory, a similar level of care during collection, storage, transport and general handling of the water samples before analyses is sometime overlooked. Thus, based on observations of what went wrong with several samples we have analyzed, we present here the results of several tests we have performed to ensure the best treatment of water samples between the moment of collection and that of analysis. We have set-up several experiments to mimic the conditions during sample collection, storage and transport, including leaking, poorly-closed and filled to various degrees vials; storage at different temperatures (between -20 and +30 degrees Celsius) and variable time spans (days to months), secondary evaporation etc. We have found that except for samples kept at low temperatures in fully-closed and sealed HDPE (or glass) vials, the initial stable isotope composition of the water in all other experiments was affected, to variable extent, by post-sampling processes. We will discuss these processes and present limits on storage type, time and conditions below which the samples become useless for scientific purposes.