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Stable isotope distribution in precipitation in Romania and its relevance for palaeoclimatic studies

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A surge of recent studies in Romania have targeted various aspects of palaeoclimate (based on stable isotopes in ice, speleothems, tree rings), mineral water origin, wine and other juices provenance. However, while much needed, these studies lack a stable isotope in precipitation background, with only two LMWL's being published so far. In this paper we discuss the links between the stable isotopic composition of precipitation (δ18O and δ2H), climate (air temperature, precipitation amount and large scale circulation) and their relevance for the palaeocllimatic interpretation of stable isotope values in cave ice, cryogenic calcite and tree rings from different sites in Romania.
Most of the precipitation in Romania is delivered by the Westerlies, bringing moisture from the North Atlantic; however, their influence is greatly reduced in the eastern half of the country where local evaporative sources play an important role in the precipitation balance. The SW is dominated by water masses from the Mediterranean Sea, while the SE corner clearly draws most of the moisture from the Black Sea and strongly depleted North Atlantic vapor masses. In 2012, Romania experienced the worst draught in 60 years, possibly due to a northward shift of the jest stream associated to blocking conditions in summer, which led to a more northern penetration of the Mediterranean-derived air masses, as well increased precipitation of re-evaporated waters.
We have further analyzed cave drip water (δ18O and δ2H), cryogenic cave calcite (δ18O and δ13C) and tree rings (δ18O and δ13C) from selected sites across NW Romania, where the water isotopes in precipitation showed the best (and easiest to understand, given the climatic conditions in 2012) correlation with climatic parameters. Our results that 1) δ18O and δ2H in cave ice are a good proxy for late summer through early winter air temperature; 2) δ13C in cryogenic cave calcite are possible indicators of soil humidity and 3) δ18O in pine tree rings is a good proxy for air temperature during the growing season.

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