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Stable isotopes in cave drip waters from the semi-arid southern Portugal: implication for paleoenvironment reconstructions

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Paleo-environmental studies rely on proxies for which present day conditions need to be documented. Here, we present results from a nearly two years sampling program of waters in precipitation, aquifers and cave drip waters in the semi arid region of Southern Portugal where a Mediterranean type climate prevails. Isotopic compositions of precipitations at Faro, from 1978 until 2001, are available through the Global Network of Isotopes in Precipitation (GNIP) database of the International Atomic Energy Agency. In addition, we measured oxygen and hydrogen isotopic compositions of water samples collected in 2011 and 2012 at one meteorological station located 20 km apart from the cave. In the cave itself, four different dripping locations were surveyed. Finally, five wells from the aquifer flowing underneath the cave were also sampled. Whereas local meteoric water line obtained from GNIP data shows an important contribution of local evaporating waters, precipitation data from this project rather points out to a drier moisture source, exhibiting a deuterium excess of close to 16.5 ‰Àquifer isotopic compositions show very small variations during the 2 yr sampling period, with mean values of -4.53±0.06 ‰ (VSMOW) and 23.39±0.81 ‰ (VSMOW) for δ^{18}O and δ^{2}H, respectively. On the other hand, drip waters isotopic compositions are dependent of the sampling site, although varying linearly (δ^{2}H∼13.3*δ^{18}O + 38.1, R^2=0.74, p<0.001, n=49) from -4.55 to -3.85 ‰ (VSMOW) for δ^{18}O and from -22.7 to -13.4 ‰ (VSMOW) for δ^{2}H. These variations bear on the reconstruction of paleo-environmental parameters from high-resolution analyses of late Quaternary speleothems at the study site where intense but not frequent rain events prevail, and may bias the interpretation of annual conditions reconstructions toward extreme event signatures.