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In-situ REE calibration as palaeohydrogeological proxies in stalagmites

P. Aliaga and J.P. Bernal

Centro de Geociencias, Universidad Nacional Autónoma de México, Campus Juriquilla, Querétaro, Mexico (pilyaliaga@geociencias.unam.mx)

We monitored several physicochemical parameters at "Gruta las Karmidas", Mexico, between January 2007 and May 2011 and carried out an *in situ* Experimental Speleogenesis (*is*ES) , where two glass plates (horizontal and leaned) were placed underneath two active drips and replaced every two or three months, in order to grow seasonal calcite upon the glasses surfaces. We sampled drip and residual (post depositional) water and monitored pH, temperature, alkalinity and drip rate. δ^{18}O, δ^{13}C and $\delta^{13}C_{DIC,}$ Mg, Sr, Ba, U, Ca and REE were analyzed in all water and calcite samples by ICP-MS. Additionally, we also monitored cave's atmosphere conditions throughout the cave, including the entrance in order to understand the response of the cave's environment's to external weather conditions and whether they have a role on the calcite precipitation process and its composition.

Results show that CO_2 levels inside the cave, water chemistry, dripping and precipitation rates and trace elements concentrations such as Mg, Sr, Ba and U vary seasonally in both water and calcite, and are strongly linked to local rainfall. However, although REE seasonal variations in residual water and calcite, they are not evident in drip water, suggesting that calcite's REE variations might be modulated by another, yet-to-be-discerned but apparently climatic-driven variable. Thus REE show seasonal variations in the calcite and, importantly their LREE/HREE ratio appears to be linked to +ENSO.