A high resolution, precisely dated speleothem record of the Younger Dryas and Holocene from La Garma Cave, northern Spain

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Stalagmite GAR-01 preserves a continuous, high-resolution record of climate in northern Spain over the past 14, 000 years. The GAR-01 Younger Dryas Event (YDE) isotope anomaly is precisely dated to between 12, 907 ± 77 and 11, 653 ± 116 yrs BP, in excellent agreement with the latest NGRIP YDE chronology (i.e. 12, 846 ± 138 to 11, 653 ± 99 yrs BP; [1]). The muted climatic impact of the YDE at this site relative to more northerly sites permitted continuous deposition of GAR-01 throughout the event at a rate of ~ 37 microns/year. *In situ* laser techniques yielded a biennial-scale isotope and subannual-scale trace element record of the YDE providing crucial information about the mechanisms that led to the onset, stabilisation, and termination of this important abrupt climate change event. Striking similarities between the GAR-01 carbon isotope record and the Cariaco Basin Ti (%) record [2] suggests that northern Iberia may be an important location for understanding North Atlantic tropical-extratropical teleconnections.

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The high U zircons, recorders of the post-crystallization thermotectonic events

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The great chemical and physical resistence allow the zircon to survive within the highest crustal thermotectonic conditions. Thus no significant Pb-diffusion is observable under ~900C [1]. However, at temperatures lower than 600-650°C, the lattice metamictization is frequently recorded, while above these temperatures the lattice is continously recovering [2]. The metamictization degree depends on the U content or α-dose [3], and only metamict zircons can be reset if reheated at temperatures over 600-650°C. Consequently, if the high U zircons remain sufficiently long time under 600-650°C and subsequently they are reheated above these temperatures then they can record the heating event. We observed such processes in the Romanian Carpathians basement, as for example in the South Carpathians Sebeş-Lotru terrane components. From its metamorphic basement several mataigneous Neoproterozoic and Ordovician protoliths [4] were dated. The Căpâlna augen gneiss zircons of 458.9±3.5 Ma have an average U content of 291.9 ppm (22 grains) and no grain is younger than 453.7±4.2 Ma. In the Tău metagranite zircons where the average U content of 35 dated grains is of 2776 ppm only a single protolith age of 473.1±28.1 Ma is preserved. Four grains reset at 420.8; 403.0; 400.9 and 400.7 Ma. From the other 30 dated grains, one yielded 298.2 Ma, and the rest of the ages range between 399.5 Ma and 318.1 Ma. Except the protolith age grain, all the other grains show a Variscan partial or total resetting during the eclogite grade metamorphism [5], either by diffusion or by recrystallization or by both.

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