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Climate in northern Spain through the Younger Dryas and Holocene preserved in a precisely dated speleothem from La Garma cave, Cantabria

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Stalagmite GAR-01 preserves a continuous, high-resolution record of climate in northern Spain over the past 14,000 years. High resolution (i.e. biennially- to decadally-resolved) laser isotope data reveal both high and low frequency climatic variability through the Holocene including a prominent carbon isotope anomaly centred on 4,000 yrs BP. Most striking is the GAR-01 pre-Holocene record that includes a pronounced excursion to cold and dry conditions at the time of the Younger Dryas Event. According to the well-defined carbon isotope excursion and six U-Series dates across the anomaly, stalagmite GAR-01 records the Younger Dryas in northern Spain between 12,907 $\pm$ 77 to 11,653 $\pm$ 116 yrs BP, in excellent agreement with the latest NGRIP Younger Dryas chronology (i.e. 12,846 $\pm$ 138 to 11,653 $\pm$ 99 yrs BP; Rasmussen et al., 2006).

The GAR-01 Younger Dryas oxygen (a 1.8 per mil negative excursion) and carbon (a 3.4 per mil positive excursion) isotope anomalies are muted relative to higher latitude proxy records but the uninterrupted growth during the Younger Dryas at an average rate of 37 microns/year combined with in situ laser isotope and trace element techniques permits a detailed reconstruction of the last stages of deglaciation. The GAR-01 biennial-scale isotope and subannual-scale trace element record of the Younger Dryas Event provides 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 14,000 year carbon isotope record and the coeval Cariaco Basin Ti and Fe (%) records suggests that northern Iberia may be an important location for understanding North Atlantic tropical-extratropical teleconnections.