



SUB-MILANKOVITCH CYCLES IN HOLOCENE STALAGMITES FROM SAUERLAND

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The study of deep sea sediments from the Northern Atlantic documents that Earth's climate may be very sensitive to extremely weak perturbations in the sun's energy output, not only on the decadal scale but also on centennial to millennial scales (Bond, 2001). Calcitic stalagmites are very good archives for ambient conditions and Th/U dating delivers a reliable chronology of the periods of stalagmite formation. Growth rates ranging from some microns to several hundred microns per year, allow extremely high resolution. Calcitic stalagmites from Attacave and from the B7-cave, which lie in partly dolomitized massive limestone of middle Devonian age in the southern Sauerland area, Germany, prove the existence of sub-Milankovitch cycles in precipitation during the last 6,000 years. Spectral analysis of $\delta^{18}\text{O}$ from 6,000 a BP up to the recently accumulated top of a newly analyzed stalagmite from Attacave yields statistically significant peaks at 1,450 a, 117 a, 94 a, 64 a and 57 a. Additionally we find a good correlation of the stalagmite's $\delta^{18}\text{O}$ and $\Delta^{14}\text{C}$ from European tree rings. The 1,450 a cycle in the stalagmite probably is analogous to the pervasive millennial scale climate cycle described by Bond et al. (2001), derived from the amount of Ice Rafted Debris in deep sediments from the North Atlantic. Our results suggest that the centennial to millennial shifts observed in the North Atlantic are accompanied by synchronous shifts of the climate in Northern and Central Europe which most probably can be attributed to solar irradiation variations.

Bond, G., B. Kromer, J. Beer, R. Muscheler, M. N. Evans, W. Showers, S. Hoffmann, R. Lotti-Bond, I. Hajdas, G. Bonani (2001). "Persistent Solar Influence on North Atlantic Climate During the Holocene." *Scienceexpress* 10.1126 (Science.1065680): 1-15.