

## Timing of glacial changes in SST and $p\text{CO}_2$ from foraminiferal U/Ca, Mg/Ca and $\delta^{18}\text{O}$ in a Caribbean core

ANN D. RUSSELL<sup>1</sup>, MATTHEW L. SCHMIDT,<sup>1</sup>  
HOWARD J. SPERO<sup>1</sup> AND DAVID M. ANDERSON<sup>2</sup>

<sup>1</sup>Department of Geology, University of California, Davis, CA 95616, USA

<sup>2</sup>NOAA Paleoclimatology Branch, National Climatic Data Center, 325 Broadway, E/GC Boulder, CO 80302, USA

One of the most critical tools for understanding the forcing of climate change is establishing the relative timing of changes in climate-related parameters such as sea-surface temperature, ice volume, salinity, and atmospheric carbon dioxide. Recently, the use of multiple geochemical proxies in foraminifers has emerged as a powerful technique for identifying changes in sea-surface temperature, ice volume, and salinity. Since these measurements are all based on the same sample, this approach improves the accuracy of leads and lags in timing by avoiding errors inherent in matching different age models (for example, for ice versus marine sediment cores) as well as ambiguities inherent in combining data from different sources (ie alkenone-based SST and foraminiferal  $\delta^{18}\text{O}$ ).

Here we use combined measurements of U/Ca and Mg/Ca in *G. ruber* from a Caribbean core (ODP999A) to examine the relative timing of changes in SST and atmospheric  $p\text{CO}_2$  at the end of the last glacial maximum and early deglacial period. Culture experiments have demonstrated that the U/Ca ratio in two species of planktonic foraminifera is inversely related to  $[\text{CO}_3^{2-}]$  in seawater. This region of the ocean is in equilibrium with atmospheric  $p\text{CO}_2$  today, and the *G. ruber* U/Ca record in ODP999A shows a remarkable resemblance to ice core  $p\text{CO}_2$ , consistent with a carbonate-ion control. Thus, a comparison of Mg/Ca (a proxy for SST) and U/Ca provides a means to examine the role of atmospheric carbon dioxide in forcing climate change. Our initial results confirm the ice core finding that within uncertainty, the increase in  $p\text{CO}_2$  (and therefore carbonate ion) is simultaneous with the increase in temperature at the end of the last ice age.

## High-resolution deglacial record of climate change in central Florida from fresh water ostracodes

D. W. HASTINGS<sup>1</sup>, T. A. HOLLWEG<sup>1</sup>, B. P. FLOWER<sup>2</sup>,  
T. CRONIN<sup>3</sup>, N. T. EDGAR<sup>4</sup> AND T. M. QUINN<sup>2</sup>

<sup>1</sup>Marine Science, Eckerd College, St. Petersburg, FL 33711, USA (hastings@eckerd.edu)

<sup>2</sup>College of Marine Science, University of South Florida, St. Petersburg, FL 33701, USA (bflower@marine.usf.edu)

<sup>3</sup>U.S. Geological Survey, Reston, VA, USA (tcronin@usgs.gov)

<sup>4</sup>U.S. Geological Survey, St. Petersburg, FL 33701, USA

An 11.28 m sediment core was collected in Tampa Bay, FL, USA. During the last glacial period through the deglacial warming, the present day marginal marine system of Tampa Bay was a fresh water lake. Radiocarbon dates on well preserved shells, including nine during the deglaciation, provide a reliable chronology. Mg/Ca, Sr/Ca and  $^{18}\text{O}$  were measured on two species of freshwater ostracodes, *Limnocythere floridensis* and *Candona annae*. Variations in Sr/Ca reflect changes in water chemistry and Mg/Ca variations reflect changes in both water temperature and water chemistry. While absolute values were different for each species, the relative changes in Sr/Ca and Mg/Ca for both species were parallel.

Applying Sr distribution coefficients for *L. floridensis* (Chivas et al, 1986) and *C. annae* (Holmes and Chivas, 2002) results in virtually identical records of  $(\text{Sr}/\text{Ca})_{\text{water}} \cdot (\text{Sr}/\text{Ca})_{\text{water}}$  is relatively constant from 20 ka to 14.1 ka at 12.4 mmol/mol, increases by a factor of two from 14.1 to 12.5 ka to ~21 mmol/mol, then decreases by about 25% from 12.5 to 11.5 ka. High Sr/Ca values infer increased salinity due to higher evaporation during drier climates and vice-versa. Reliable Mg distribution coefficients as a function of temperature do not exist for these species so we can only infer relative temperature changes. The major trend is a doubling of Mg/Ca starting at 13.8 ka with a relative maximum at 12.5 ka, followed by a decrease of 30% to 11.5 ka. There is a 2.0% decrease in O-18 from 13.7 to 11.5 ka.

The overall scenario depicted by these proxies is a relatively cool and wet climate during the Bolling/Allerod from 14.3 to 13.8 ka, changing to a warmer and drier climate during the Younger Dryas, with the warmest period centered at 12.6 ka. This climate record from Central Florida is not synchronous with the northern high latitude ice core records and supports the observation that western tropical Atlantic SST was out-of phase with Greenland climate.