

The 4th PAGES past interglacials workshop

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Examination of the paleoclimate record reveals a large diversity among interglacials in terms of their intensity, duration and internal variability, but a general theory accounting for these differing characteristics remains elusive (Tzedakis et al. 2009). This has provided the impetus to attempt a comprehensive comparison of interglacials of the last 800 ka BP within the context of a PAGES Working Group on Past Interglacials (PIGS).

An initial PIGS workshop held at Bernin, France in October 2008, laid out the themes to be addressed at each of three subsequent workshops. A second workshop, held at the University of the Aegean on the Island of Lesbos, Greece in August 2009, examined intra-interglacial variability and the deglacial onset of interglacials. The third workshop, held at Lamont-Doherty Earth Observatory of Columbia University, USA in October 2010

focused on the duration of interglacials and the ensuing glacial inception. The fourth workshop, held in Cambridge, UK in July 2012, focused on how well we can explain the diversity of interglacials from the forcing and feedbacks. The meeting brought together 35 scientists from 10 countries (including nine postdoctoral investigators and two PhD students), representing the marine, ice core, terrestrial and modeling communities.

The first theme of the workshop was on interglacial intensities, and more specifically, whether the distinction between "cooler" and "warmer" interglacials before and after the so-called Mid-Brunhes Event (MBE) ~430 ka BP, respectively, identified in Antarctic temperatures, CO₂ concentrations and benthic δ¹⁸O records (Jouzel et al. 2007; Lüthi et al. 2007; Tzedakis et al. 2009; Fig. 1C-D) was evident in other records. A review of the evidence



showed that a pre- and post-MBE distinction was also observed in deep-water temperature reconstructions (Elderfield et al. 2012), but not in some regional marine and terrestrial records, including speleothems, faunal and floral temperature reconstructions and lake sediment records (Fig. 1A-B). This raises questions about the global significance of the MBE and the extent to which Antarctic temperatures are representative of global temperatures during the pre-MBE interglacials.

The second theme of the workshop revolved around the duration of interglacials. More specifically, it examined the sequence of climatic events at glacial terminations and inceptions and considered whether any emerging patterns could be identified. This was followed by a discussion of whether differences in the duration of interglacials can provide insights into climate forcings and feedbacks that are relevant to the onset and end of interglacials. It was proposed that the broad duration of interglacials may be determined by the phasing of precession and obliquity and the history of insolation, rather than the instantaneous forcing strength at inception (Tzedakis et al. 2012).

The third theme considered whether models are capable of "explaining" the diversity of interglacials, and what they imply in terms of rules and processes. Finally, interglacials were placed within the wider context of glacial-interglacial cycles and the extent to which these are deterministic was debated.

The meeting ended with a session summarizing the discussions and planning a community paper that will develop the major themes considered over the course of the project. To this end, a writing-workshop, involving a focus group is taking place in March 2013.

Selected references

Full reference list online under:

http://www.pages-igbp.org/products/newsletters/ref2013_1.pdf

Elderfield H et al. (2012) *Science* 337: 704-709

Jouzel J et al. (2007) *Science* 317: 793-796

Lüthi D et al. (2008) *Nature* 453: 379-382

Tzedakis PC et al. (2009) *Nature Geoscience* 2: 751-755

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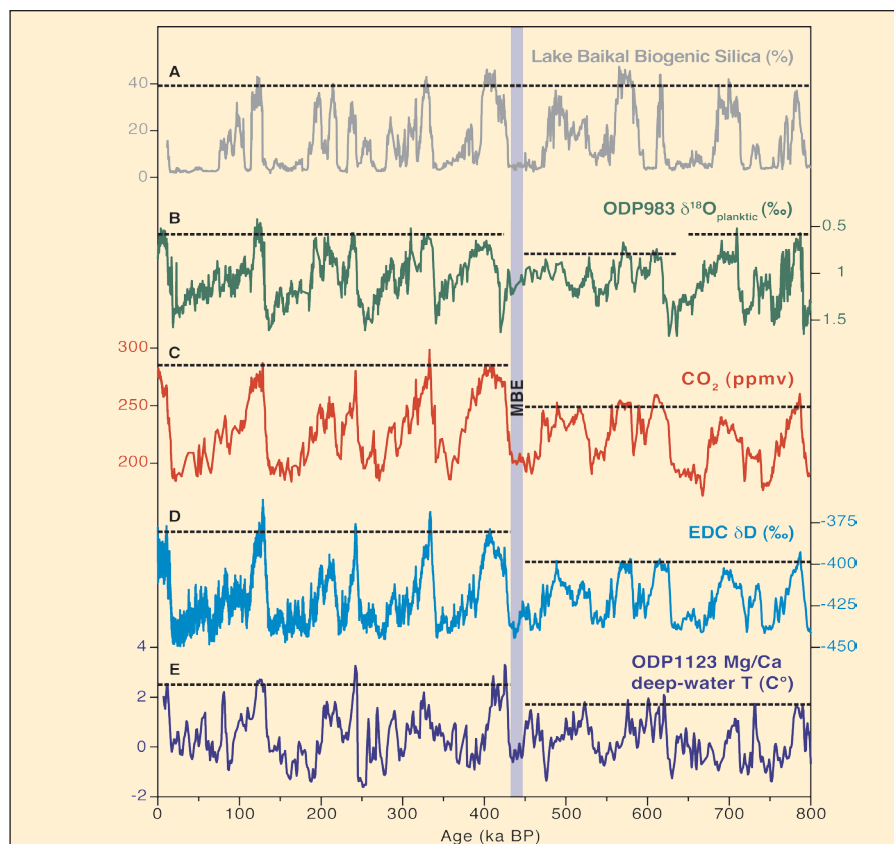


Figure 1: Differences in interglacial intensities in relation to the Mid-Brunhes Event (MBE; ~430 ka BP). **(A)** Percent biogenic silica in composite sequence BDP-96 from Lake Baikal, SE Siberia (Prokopenko et al. 2006); **(B)** Planktonic δ¹⁸O record from ODP Site 983, North Atlantic (Channell et al. 1998; Channell and Kleiven 2000); **(C)** Atmospheric CO₂ concentration in Antarctic ice cores (Lüthi et al. 2008); **(D)** δD composition of ice in the EDC ice core (Jouzel et al. 2007); **(E)** Mg/Ca deep-water temperatures from ODP site 1123 on the Chatham Rise, SW Pacific (Elderfield et al. 2012).

