

The Holocene and MIS 1: not quite the same

It is commonly assumed that the Holocene and Marine Isotope Stage 1 (MIS 1) are the same, because both are effectively the present interglacial. However, as the diagram below shows, that's not quite true, for reasons resulting from the records by which they are defined, but with a useful result.

Marine isotope stages are defined relative to the marine isotopic record (hence their name), and most commonly relative to the oxygen isotopic variation in

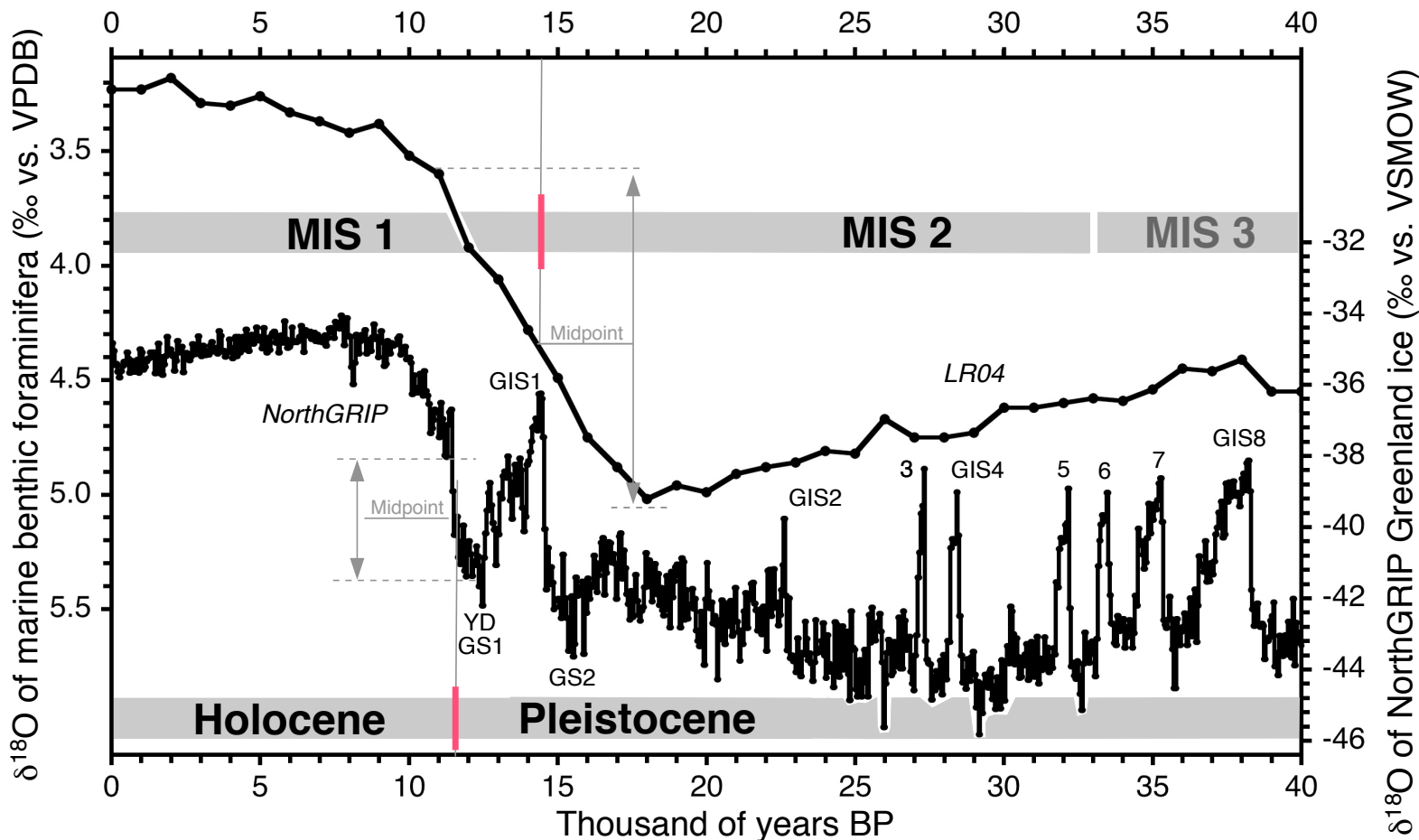
marine benthic foraminifera from deep-sea cores (e.g., the LR04 record of Lisiecki and Raymo (2005). Resolution in the marine benthic record is sufficiently low that, from MIS 2 to MIS 1, one sees only a gradual transition, the midpoint of which must be the boundary between the two stages, which falls at about 14.5 ka (e.g., Railsback et al. 2015).

Walker et al. (2009) defined the beginning of the Holocene as the end of Younger Dryas as recorded

in the NorthGRIP Greenland ice core. That boundary falls at 11.7 ka, and thus 2.8 kyr after the MIS2 - MIS1 break – hence “not quite the same”.

Walker et al. (2009) sought to define the beginning of the Holocene, not the end of the Pleistocene. From at least a European perspective, the Holocene (the present period of warm climate) began at the end of the Younger Dryas. However, the Younger Dryas, also called Greenland Stadial 1 (GS1), was not a typical Greenland stadial like its higher-numbered predecessors: it was a melt-out event, not a post-interstadial return to full glacial

conditions like those of the previous 50 thousand years. Thus one could argue that the end of the Pleistocene (in the sense of “the end of glacial conditions”) would be placed better at the beginning of Greenland Interstadial 1 (GIS 1), at about 14.5 ka. That definition is not going to happen – but it makes the MIS 2 - MIS 1 break at 14.5 ka an alternative boundary more relevant to the end of the Pleistocene.



Lisiecki, L.E., and Raymo, M.E., 2005. *Paleoceanography* 20, doi:10.1029/2004PA001071.
 Railsback, L.B., et al., 2015. *Quaternary Science Reviews* 111, 94-106.
 Walker, M., et al., 2009. *Journal of Quaternary Science* 24, 3-17.