Geophysical Research Abstracts
Vol. 15, EGU2013-2270, 2013
EGU General Assembly 2013

Comparison between the calibrated radiocarbon (IntCal09) and Greenland Ice Core (GICC05) time scales for the Vedde and Saksunarvatn ashes and the Younger Dryas boundaries based on 118 14C dates

Jan Mangerud (1), Øystein Lohne (1), and Hilary Birks (2)

(1) University of Bergen, Dept. of Earth Science and Bjerknes Centre for Climate Research, Bergen, Norway (jan.mangerud@geo.uib.no), (2) Department of Biology and The Bjerknes Centre for Climate Research, University of Bergen

The Greenland Ice Core chronology was constructed by counting annual layers and represents a standard for past climate events. However, almost all records from the continents and oceans are dated with the 14C method. It is therefore crucial to know if the Greenland Ice Core (GICC05) and the calibrated 14C time scales are identical and if not, to quantify the offset between them.

We present Bayesian age-depth modelling of 118 AMS 14C dates of terrestrial plant macrofossils, calibrated using INTCAL09, from Kråkenes Lake, western Norway. It provides high precision age estimates for the Vedde and Saksunarvatn ashes and also for the Younger Dryas (YD) boundaries. The GICC05 gives slightly higher ages for all four equivalent levels in the NGRIP core than we obtained with INTCAL09 at Kråkenes. However, we emphasize that all differences were within 68.2% or 95.4% confidence intervals of measurement errors. At the 68.2% significance level the differences are (GICC05 - INTCAL09): Vedde: 55 $\pm$ 73 years, Saksunarvatn: 88 $\pm$ 58 years, the Allerød/YD boundary: 110 $\pm$ 86 years, and for the YD/Holocene boundary: 60 $\pm$ 76 years. Thus there is a consistent offset of about 80 years between the two time scales for the period around the Younger Dryas. The precision does not allow any determination of variation over time in the offset.

The YD boundaries in the NGRIP core (strictly speaking the boundaries for Greenland Stadial 1 = GS 1) are defined by the changes in Deuterium excess, which represent the first signs of climate changes, i.e. before the main climate changes reflected in the δ18O curves. For the comparison of time scales we therefore also selected the very first indication of climate change near the boundaries in Kråkenes Lake. These occurred about 40 years before the YD boundaries as defined by us when following the 'classical' criteria used in Scandinavia that are the marked litho-and bio-stratigraphic changes.

We conclude that the GICC05 time scale indicates 80 years older age than INTCAL09 for levels that we assume are in fact synchronous. There is in addition a real difference in age between the boundaries for the YD between Greenland and Scandinavia because GS 1, often used as a synonym for YD, in the ice cores is defined by the first signs of climate change, whereas the YD in the type area of southern Scandinavia is defined by the main steps in the changes. We estimate that the GS 1 equivalent boundaries at Kråkenes are about 40 years older than the 'classical' YD boundaries.