



Chronology and correlation of Last Termination events using tephra isochrons

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A number of Icelandic ash isochrons of Last Termination and early Holocene age occur throughout the North Atlantic region, both in visible (macrotephra) and distal fine ash ('micro-'/'crypto-tephra'; <100 μm) form,. Some can be traced between terrestrial, marine and ice-core sequences and hence offer considerable potential for testing precise correlations between diverse sedimentary records (Davies et al. 2002). Two well-established ashes, the Saksunarvatn Ash and Vedde Ash, are of particular importance in this respect due to their widespread geographical distribution and stratigraphic positions. They have been detected in the Greenland ice-cores, giving ages of 10,347 (mce 89) GICC05 yr b2k and 12,171 (mce 114) GICC05 yr b2k respectively (mce is the 'maximum counting error' of the GICC05 timescale; see Lowe et al., 2008). Additional ash isochrons have been detected in recent years which enhance the tephrostratigraphical framework and potential for the North Atlantic region (Turney et al., 1997; Björck & Wastegård, 1999; Wastegård, 2002; Davies et al, 2003; Pyne-O'Donnell, 2007). However, it is also becoming more apparent that this framework is not yet as fully established or clearly defined as previously thought, but includes a number of chemically equivalent or equivocal ashes, several of which are closely spaced in time (Davies et al., 2004; Pyne-O'Donnell et al, in press). Here we report on attempts to trace these ash isochrons into North Atlantic shelf and deep marine sequences, outline some of the problems involved, and assess

the potential for overcoming them. Resolving the difficulties will lead to clarification of the roles played by ice-rafting and air-fall transport in the dissemination of the various tephras, to a fuller understanding of the distorting effects of bioturbation on ash layers in marine sequences, and ultimately to more precise correlations between marine, terrestrial and ice-core records.

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Björck, J., Wastegård, S. (1999). Climate oscillations and tephrochronology in eastern middle Sweden during the last glacial-interglacial transition. *Journal of Quaternary Science* 14, 399-410.

Davies, S. M., Branch, N. P., Lowe, J. J., Turney, C. S. M. (2002). Towards a European tephrochronological framework for Termination 1 and the Early Holocene. *Philosophical Transactions of the Royal Society of London A* 360, 767-802.

Davies, S. M., Wastegård, S., Wolfarth, B. (2003). Extending the limits of the Borrobol Tephra to Scandinavia and detection of new early Holocene tephras. *Quaternary Research* 59, 345-352.

Davies, S. M., Wohlfarth, B., Wastegård, S., Andersson, M., Blockley, S. P. E., Possnert, G. (2004). Were there two Borrobol Tephras during the early Lateglacial period: implications for tephrochronology? *Quaternary Science Reviews* 23, 581-589.

Lowe, J. J., Rasmussen, S. O., Björck, S., Hoek, W. Z., Steffensen, J. P., Walker, M. J. C., Yu, Z., INTIMATE group. (2008). Precise dating and correlation of events in the North Atlantic region during the Last Termination: a revised protocol recommended by the INTIMATE group. *Quaternary Science Reviews* 27, <http://dx.doi.org/10.1016/j.quascirev.2007.09.016>

Pyne-O'Donnell, S. D. F., (2007). Three new distal tephras in sediments spanning the Last Glacial-Interglacial Transition in Scotland. *Journal of Quaternary Science* 22, 559-570.

Pyne-O'Donnell, S. D. F., Blockley, S. P. E., Turney, C. S. M., Lowe, J. J. (in press). Distal volcanic ash layers in the Lateglacial Interstadial (GI-1): problems of stratigraphic discrimination. *Quaternary Science Reviews* 27, <http://dx.doi.org/10.1016/j.quascirev.2007.02.019>

Turney, C. S. M., Harkness, D. D., Lowe, J. J. (1997). The use of microtephra horizons to correlate Late-glacial lake sediment successions in Scotland. *Journal of Quaternary Science* 12, 525-531.

Wastegård, S. (2002). Early to middle Holocene silicic tephra horizons from the Katla volcanic system, Iceland: new results from the Faroe Islands. *Journal of Quaternary Science* 8, 723-730.