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The potential of micro-tephra stratigraphy for dating and correlating sediment sequences in Europe: detection, preservation and geochemical analysis

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Tephrochronology has become a major tool for precise correlation between archaeological and environmental sequences at a regional scale. Tephra layers, because they result from abrupt air-fall events, can provide isochronous markers between different sedimentary archives. Some can also be dated precisely, where, for example, they relate to known historical eruptions (e.g. the AD 1104 eruption of the Icelandic volcano Hekla), or occur in well-dated ice-core or varved sequences (e.g. Gronvold *et al.* 1995; Litt *et al.* 2001), or their calibrated radiocarbon ages can be determined by the 'wiggle-matching' (*sensu* radiocarbon calibration) approach (e.g. Pilcher *et al.* 1995). Where tephras can be detected in different sedimentary settings, therefore, tephrostratigraphy can provide a basis for precise correlation between the records, and tephras of know age will provide a basis for dating the records (tephrochronology; see e.g. Lowe *et al*. 2001). The recent discovery of micro-tephras (tephra layers that are invisible to the naked eye; Turney *et al.* 1997) has enabled a number of tephras to be detected over much larger areas than was possible hitherto, and has led to the discovery of new tephras, not represented in the record of visible tephras. Here we report on the advantages that tephrochronology offers for investigation of the archaeological record, and summarise some of the key problems associated with the detection and analysis of micro-tephras. Micro-tephras can be difficult to isolate from host sediment; we report

on new developments in the laboratory preparation methods used for tephra extraction (Blockley *et al.* accepted). Questions can also be raised about the extent to which micro-tephras preserve diagnostic chemical 'signatures', and how reliably these can be measured. Since tephras are inherently unstable (Pollard et al., 2003), micro-tephras may be particularly prone to chemical alteration in the depositional environment and the laboratory. We report on experimentation we have conducted to examine these issues. The paper will include reference to new developments, such as the detection of micro-tephras in Bronze Age deposits in the London area, discovery of new tephras of Lateglacial and Holocene age in northern Britain, and detection of micro-tephras in deep marine sediment sequences

References:

Gronvold, K., Oskarsson, N., Johnsen, S. J., Clausen, H. B., Hammer, C. U., Bond G. and Bard, E. (1995) Ash layers from Iceland in the Greenland GRIP ice core correlated with oceanic and land sediments, Earth And Planetary Science Letters **135**: 149-155.

Litt, T., Brauer, A., Goslar, T., Merkt, J., Balaga, K., Muller, H., Ralska-Jasiewiczowa, M., Stebich, M. and Negendank, J. F. W. (2001) Correlation and synchronisation of Lateglacial continental sequences in northern central Europe based on annually laminated lacustrine sediments. Quaternary Science Reviews **20**: 1233-1249.

Pilcher, J. R., Hall, V. A, McCormac, F. G. (1995) Dates of Holocene Icelandic volcanic-eruptions from tephra layers in Irish peats. *Holocene* **5**: 103-110.

Pollard, A.M., Blockley, S.P.E., Ward K.R. (2003). Chemical alteration of tephra in the depositional environment: theoretical stability modelling Journal of Quaternary Science **18**, 385-394.

Turney, C. S. M., Harkness D. D. and 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