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Eric Andrieux, Mark D. Bateman, Pascal Bertran

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The chronology of Late Pleistocene thermal contraction cracking derived from sand wedge OSL dating in central and southern France

Eric Andrieux[1], Mark D. Bateman[2], Pascal Bertran[1,3]

[1] PACEA, UMR 5199 Université de Bordeaux – CNRS, Bâtiment B18, Allée Geoffroy-Saint-Hilaire, CS 50023, 33615 Pessac cedex, France. *Email*: andrieux.e@gmail.com

[2] Department of Geography, University of Sheffield, Winter Street, Sheffield S10 2TN, UK. *Email*: m.d.bateman@sheffield.ac.uk

[3] INRAP, 140 avenue du Maréchal Leclerc, 33130 Bègles, France. *Email*: pascal.bertran@inrap.fr

Abstract

Much of France remained unglaciated during the Late Quaternary and was subjected to repeated phases of periglacial activity. Numerous periglacial features have been reported but disentangling the environmental and climatic conditions they formed under, the timing and extent of permafrost and the role of seasonal frost has remained elusive. The primary sandy infillings of relict sand-wedges and composite-wedge pseudomorphs record periglacial activity. As they contain well-bleached quartz-rich aeolian material they are suitable for optically stimulated luminescence dating (OSL). This study aims to reconstruct when wedge activity took place in two regions of France; Northern Aquitaine and in the Loire valley. Results from single-grain OSL measurements identify multiple phases of activity within sand wedges which suggest that wedge activity in France occurred at least 11 times over the last 100 ka. The most widespread events of thermal contraction cracking occurred between ca. 30 and 24 ka (Last Permafrost Maximum) which are concomitant with periods of high sand availability (MIS 2). Although most phases of sand-wedge growth correlate well with known Pleistocene cold periods, the identification of wedge activity during late MIS 5 and the Younger Dryas strongly suggests that these features do not only indicate permafrost but also deep seasonal ground freezing in the context of low winter insolation. These data also suggest that the overall young ages yielded by North-European sand-wedges likely result from poor record of periglacial periods concomitant with low sand availability and/or age averaging inherent with standard luminescence methods.