Thesis Abstract

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In the British and Irish Isles there has been considerable research effort expended in improving understanding of the expansion and retreat of the last ice-sheet (Marine Isotope Stage 2) but the chronological control for the Last Glacial Maximum (LGM) extent and subsequent retreat phases of the British and Irish Ice-sheet (BIIS) is poor. Based on results from extensive sedimentological and stratigraphic studies of fossil ice-marginal sandar at *Orrisdale* (Isle of Man), *Co. Wexford* (south-eastern Ireland) and *Porth Dinllaen* (north-western Wales), a suite of glaciofluvial lithofacies were identified and sampled for OSL analysis, with the ultimate aim of dating the retreat of the Irish Sea Ice-Stream (ISIS) during the last deglaciation of the Irish Sea basin. Complete bar-form fining-up sequences were targeted as they are typically indicative of waning or shallow water flow, allowing sufficient opportunity for bleaching of quartz grains within these glaciofluvial deposits.

Different grain size fractions of quartz were extracted and the SAR protocol applied using small aliquots (~30 grains) to identify which depositional environments and grain size fractions were best suited for optical dating. Equivalent dose (D_e) distributions for all samples showed wide and positively skewed characteristics with overdispersion values >40%, indicative of heterogeneous bleaching. The 'age' model decision-protocol of Bailey and Arnold (2006) was used to choose the most applicable 'age' model (i.e. Minimum Age Model; MAM, Central Age Model; CAM or Lowest 5% Model; L5%) by analysing the D_e distribution via weighted skewness, kurtosis and overdispersion. This enabled a statistically informed choice to be made as to which 'age' model was appropriate for burial dose estimation.

No observable difference was evident between the ages calculated for different grain size fractions of the same sample; agreement within 2σ errors was observed. Glaciofluvial sandur systems appear to act as an efficient 'mixer' of sediment grains, allowing some to be well-bleached and others to be poorly-bleached, with no bias towards preferential bleaching of a particular grain size fraction. However differences between ice-proximal and ice-distal depositional sub-environments were more evident. The ice-distal Orrisdale and Porth Dinllaen samples showed better bleaching characteristics (as observed from skewness and overdispersion parameters) than the ice-proximal Wexford samples. Age overestimation was observed for the Wexford samples, even using the MAM. The only obvious lithofacies difference observed was that of the trough cross-bedded sample (laterally extensive deep sandur palaeo-channel) taken from Orrisdale which showed very poor bleaching characteristics in comparison to the other samples taken from this field site, once again, resulting in significant age overestimation.

Ages of ~ 23 ka were calculated for Wexford samples, indicative of almost immediate retreat of the ice-stream margin from its LGM extent off the north coast of the Scilly Isles and the Celtic Sea to the present-day coastline of Co. Wexford. The OSL age from Porth Dinllaen is ~21 ka, indicative of continued northwards retreat, albeit in a slower and more oscillatory manner, due to the stabilisation of the ice-stream as it was constrained by the narrow corridor of land between Wales and Ireland. Ages in the range of 17-14 ka were calculated for the Orrisdale samples, coincident with the Heinrich Event 1/Killard Point stadial readvance in north-eastern Ireland. In combination with previously published ages, a detailed Bayesian model-derived retreat sequence for the ISIS was established which allowed estimated retreat rates to be calculated for different ice-marginal phases.