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The dating game: palaeoflood reconstruction in an Irish catchment

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Incorporation of detailed palaeoflood records into flood frequency analysis enables the short-term hydrometric record to be contextualised within a longer timeframe, typically thousands of years (Baker et al., 2002). Despite growing concerns of flood risk in Ireland, there has been scant research into the geomorphology of Irish rivers particularly in lowland settings (Thorp, 1984; Turner et al., 2010), and the potential of sediment archives to augment the instrumental flood record. Previous geomorphological investigations in Irish catchments have almost exclusively focussed on high energy, upland settings (e.g. Croke, 1994; Thorp & Glanville, 2003). Adopting a retrodictive approach, this research investigates geological evidence of palaeoflood events, and aims to deduce the evolution of a lowland river floodplain system, potentially over millennial timescales.

Using the River Nore catchment as a case study, various process depositional environments have been targeted to investigate palaeoflood potential. There is a documented history of flooding in this catchment dating back to the eighteenth century (RPS Consulting Engineers, 2012). A suite of field and laboratory methods are being deployed to examine the floodplain architecture and chronological evolution of the floodplain-channel system. Surface investigations of the geomorphology take advantage of the latest technologies in topographic surveying, including the use of a drone and Structure from Motion (SfM) photogrammetry to generate high resolution digital elevation models (DEMs), complementing traditional geomorphological mapping (e.g. Hackney and Clayton, 2015). River channel change has been documented using historical Ordnance Survey map series and satellite imagery. The sub-surface structure of the River Nore floodplains are being analysed using Ground Penetrating Radar. The sedimentology of flood deposits is being characterised through examination of bank exposures and sediment cores. Laboratory analyses being employed include cutting-edge geochemical (Itrax μ-XRF) and geochronological approaches. Geochemical element ratios within sediment cores are useful proxies for grain size that have been shown to correlate with flood sediments (e.g. Jones et al., 2012).

Optically Stimulated Luminescence (OSL) is one of the geochronological approaches being adopted in this research. It is a chronostratigraphical tool used to date minerogenic sediments, in this case, flood deposits. There has been limited use of this approach in Irish dune systems (Wintle et al., 1998; Wilson et al., 2004) and coastal zones (Gallagher et al., 2015), but no success in fluvial sediments. However, the single-aliquot regenerative-dose (SAR) protocol of Murray and Wintle (2000; 2003), has been successfully applied to a variety of fluvial settings internationally (e.g. Preusser et al., 2008; Rhodes, 2011; Wallinga, 2002), and offers considerable potential as a dating tool in Irish catchments. Recent funding from the Geological Survey of Ireland presents an opportunity to test the approach in an Irish fluvial setting, offering potential to extend flood reconstruction over millennial timescales.

Preliminary findings from this palaeo-reconstruction in the River Nore catchment will be presented, with a focus on the technique of OSL. This paper will explore the pragmatic aspects of applying palaeoflood approaches in such fluvial settings over long timescales, and comment on the limitations of the approaches therein.