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Investigating glacial and postglacial sediment deposition and relative sea level changes at Ruddons Point, Fife, Scotland

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Ruddons Point, situated on the Firth of Forth coastline, Scotland, is a laterally extensive terrace of glacial and marine sediment deposits which are raised above current sea level. The deposits are situated near to Kinraig Point, a key site that records a series of stepped erosional platforms carved into the local tuff and agglomerate bedrock, representing a series of post Last Glacial Maximum (LGM) paleoshorelines. The raised marine deposits of Ruddons Point are composed of sand, shell, gravel and cobble horizons, which have been deposited unconformably on glacial tills and clays. 1km inland, incised by a small stream (the Cocklemill Burn), numerous cut banks reveal further raised deposits. Previous attempts to date these sediments have produced conflicting depositional histories, with no clear correlation to the Kinraig Point paleoshorelines or those dated further west along the Forth Valley. To this end, a multidisciplinary study was conducted to provide a detailed geochronology and interpretation of this diverse field area, ranging from the dating of glacial clays, thought to be deposited during the early phases of sedimentation leading up to the LGM, through to establishing the timing of marine sediment deposition in the Mid to Late Holocene. Geophysical electrical surveys were employed to supplement the subsurface investigations of the shore and adjacent saltmarsh and to aid construction of a sedimentary deposition model. Optically stimulated luminescence dating and radiocarbon dating were carried out on selected samples through the raised deposits and subsurface cores to provide a chronometric framework. Results demonstrate that subsurface clay horizons date to ~29 ka, indicating deposition at the onset of the last glacial. Inland raised deposits along the Cocklemill Burn preserve periods of sedimentation ranging from ~8.5 ka to ~4.5ka, and suggest a punctuated rise in sea level during the Mid Holocene. The nearshore raised sands and gravels of Ruddons Point are dated to ~3.5ka, deposited during a period of relative sea level (RSL) fall in the Late Holocene. The study concludes that the combination of detailed fieldwork, geophysical survey and dating allow the scope for complex landscape changes to be identified and further the understanding of the interplay between glacial isostatic adjustment and RSL changes across the postglacial coastlines of Fife.