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## Llanddona RIGS Site

NRW RIGS no. 138 [SH 57341 80967]

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### RIGS Statement of Interest:

Llanddona RIGS Site provides the most extensive and informative example of Holocene raised beach deposits, in a stratigraphic context, so far known from Wales. Significantly, the deposits contain datable materials (fossil mollusc shells and travertine) which have the potential to yield data for unravelling the complex and controversial nature and timing of Holocene sea-level events in the region. The raised beach deposits occur both in section and in a series of large ex situ conglomeratic/sandstone blocks which lie adjacent to the modern till cliff. In section, the locally cemented deposits appear as a wedge thickening seawards. They truncate Irish Sea till and are overlain by 1–2m of possible slope and wind-blown sediments. The deposits have been speculatively and probably erroneously correlated with the 25' raised beaches of North-West Scotland and ascribed to the early Holocene in contrast to the lower-elevation 2m/6' beaches found elsewhere in Anglesey, for example Llanddwyn Island, which appear to have formed during a later transgression. The conglomerate/sandstone blocks contain a rich molluscan fauna, of modern, temperate, shallow-water species, and locally thick travertine. It is possible that they are part of a formerly more extensive Holocene beach deposit that blanketed Late Devensian till in this location. Selective cementation may have been facilitated by lime-rich flushes emanating from the shelly till. Subsequent marine erosion appears to have removed uncemented raised beach materials, leaving the large cemented blocks stranded. The stratigraphic evidence from Llanddona therefore complements the lower-lying raised beach landforms of Llanddwyn Island RIGS and, with its fauna and interstitial cement, provides a range of geomorphological evidence of great importance to understanding Holocene sea-level events on the island. Importantly, the previous interpretation of similar deposits on the west side of Red Wharf Bay as Ipswichian interglacial raised beach deposits (i.e. penultimate interglacial; 125ka BP) must now be thrown into serious doubt.

**Geological setting/context:** About 2.4 million years ago there was a general cooling of the Earth's climate, heralding the onset of the Quaternary "Ice Age", a period of geological time extending to the present day. In reality, the period has seen a number of cold 'glacial' periods interspersed with warmer 'interglacial' periods such as the one in which we now live. Since about 450,000 years ago there have been at least four intensely cold periods during which large parts of upland Britain were covered by ice sheets for long periods. Although Anglesey was probably overrun by ice on these occasions, only evidence from the last major glacial phase – the Late Devensian – is known. Possible evidence from the warm interglacial period before the Late Devensian may locally have escaped the destructive erosional and depositional effects of the last ice sheet. Following gradual climatic warming, the Late Devensian ice sheet had probably disappeared from Anglesey by about 14,500 years ago. From this time, vegetation began to spread back over the land surface and soils started to form. The speed of plant colonisation and soil development was affected by fluctuations in climate. An intensely cold period about 11,000–10,000 years ago, known as the Younger Dryas, saw the reappearance of small cirque glaciers in the uplands of Snowdonia and elsewhere in Britain. Stratigraphic evidence for this cold period is known from several basinal peat sequences on the island and it is likely that there was discontinuous permafrost, local frost-cracking of the ground surface and the redistribution downslope of unconsolidated sediment such as boulder clay. The Younger Dryas was followed at about 10,000 years BP by what is known as the Holocene – the current interglacial. In Anglesey, as in the rest of Wales, the Holocene saw the development of temperate deciduous mixed oak forest and its progressive modification by humans. Early plant colonisers, such as crowberry, juniper, birch and willow were succeeded by ash and hazel and later by oak, elm and pine. Wetter periods, aided by the early tree-felling activities of humans, saw the extensive development of lowland bogs and extensive heaths. In inland areas of the island, soil development and plant colonisation reduced geomorphological activity. Locally, however, the solution of limestone continued and limestone pavements were exhumed. Significant changes, however, occurred around the coast. Throughout Devensian late-glacial time and into the Holocene, the Earth's crust recovered and rebounded from its depression beneath an extensive ice cover. Around the coastline of Wales, the Holocene rise in sea level culminated about 6,000 years ago. Rates of relative land/sea-level change due to the interplay between ice retreat (during deglaciation), rising global sea level and crustal

recovery or 'rebound', were subject to wide variation. Deglaciation of Welsh coastlands occurred earlier than in Scotland, for example, and crustal rebound occurred before rising global sea levels were able to modify the coastline. An exception is the slightly raised Holocene beaches of Anglesey which occur only a few metres higher than present sea level. The intermittent occurrence of 'submerged forest' beds seen in foreshore exposures around the coast of Anglesey (and widely elsewhere around the Welsh coast) attests to the inundation of a densely wooded coastal fringe by the rising Holocene sea.

Four sub-networks of RIGS have been selected to demonstrate the most important aspects of the Holocene evolution of Anglesey. These are: 1. Holocene peat beds and pollen biostratigraphy; 2. Holocene sea-level changes; 3. limestone pavements; and 4. Man and the Holocene.

**Network context of the site:** Llanddona belongs to Network 1 ('Holocene sea-level changes'). It is one of a series of sites that provides evidence for the Holocene sea-level history of the island. Whereas Gallow's Deep RIGS provides the most detailed Holocene sea-level record yet known from the region, Llanddwyn Island provides the best examples of the slightly raised Holocene beaches which occur on the island and a good example of the periodically exposed submerged forest bed. Malltraeth Marsh and Llanlleiana provide important complementary records of sea-level change and terrestrial sedimentation, while Cemlyn Bay provides a superlative example of a Late Devensian drumlin landscape drowned and modified by the Holocene sea. Llanddona provides a controversial and unique example of a proposed Holocene raised beach conglomerate that provides a rare insight into the evolution of Anglesey's coastline during the Holocene.

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