
Trwyn y Parc RIGS

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RIGS Statement of Interest: Trwyn y Parc is of UK importance for its fossiliferous deposits of Miocene age — non-marine Miocene sediments containing datable floras are known from only three parts of Great Britain — the southern Pennines, Cornwall and Anglesey. The deposits at Trwyn y Parc have major implications for understanding how the British landscape evolved prior to the Pleistocene ice ages. In particular, they provide critical evidence to show that Anglesey's 'Menaian Surface', namely the broad shape and form of the island's landmass, and the adjacent Snowdonian mountain block were well-established landscape features by the end of the Miocene, that is by 5.3 million years before present.

The geomorphological features at Trwyn y Parc consist of a series of 15 'pipes', mostly circular or ovate in form, located in steeply dipping Precambrian limestone. The pipes are exposed both in plan on the foreshore and in profile in a series of natural cliff and quarried sections. They occupy an altitudinal range of 12m. Eight of the pipes contain a karstic infill. In several pipes, the zoned infill comprises multi-coloured clays and breccia truncated by Devensian Irish Sea till. Samples of black clay have yielded pollen and spores of 62 different taxa representing a fossil flora of Miocene age (Walsh et al., 1996).

Minerals present in the fill include goethite (a product of severe weathering of silicate-bearing rocks subjected to hot and wet climates) and gibbsite (often associated with intense tropical weathering). Mineralogical evidence from one pipe suggests that most of its fill must have been derived from weathering of a large mass of probably acid igneous extrusive rock, possibly a large clast in the Precambrian *mélange*, for which there is now no other evidence other than its weathering residues. The pipe deposits are thus interpreted as the remnants of an extensively weathered land surface or saprolite — a deposit of clay and disintegrated rock fragments, formed by the weathering and 'rotting' of rock in situ.

At Trwyn y Parc, the saprolitic deposits and palaeosols have been selectively preserved because karstic solution allowed them to extend and subside into a series of deep 'pockets' or 'pipes' into the underlying Precambrian limestones. The fossil flora suggests that the climate at the time of formation of the organic clays was temperate/warm temperate. Swamp forests appear to have been juxtaposed with the mixed vegetation of dry uplands. Anglesey's Miocene landscape was clearly dominated by a forest cover of trees and bushes. Because the pipes and their fill at Trwyn y Parc are likely to have been severely truncated by Pleistocene glaciations, it is estimated that northern Anglesey's Miocene land surface lay at c. 50m asl, somewhat higher than today's. It is tempting to conclude that the swamp-forest flora represents the former vegetation cover on this very flat geomorphological feature, whereas the mixed dry upland vegetation represents the cover on the already extant Snowdonian mountain block (Walsh et al. 1996). What is clear, however, is that the broad form of the Anglesey and Snowdonian landscape we see today was already well established by the end of the Miocene. This evidence has major implications for understanding the wider geomorphological evolution of the British Isles.

Geological setting/context: Long-term, pre-Pleistocene landscape development There is significant evidence that Permo-Triassic erosion effected the primary shaping of the present relief of the Palaeozoic rocks of western Britain. The broad outline and form of Anglesey's coastline and landscape thus appear to have been fashioned by that time. Although the landforms and deposits which adorn the present landscape are the result of processes (especially those of glacial and cold climates) operating in the Pleistocene, the landscapes of western Britain were in fact fashioned over the many millions of years between the Permo-Triassic and the Pleistocene, by a wide range of non-glacial processes operating under diverse, including tropical and sub-tropical, climatic regimes. Depositional evidence for the intervening Jurassic, Cretaceous and Tertiary is, of course, well represented elsewhere in south and eastern Britain, but deposits of these ages were either not deposited or have since been removed from substantial parts of Wales and south-west England. At the very best they have been selectively preserved on-land in narrow fault-controlled basins (e.g. the Eocene and Oligocene deposits found in the Bovey-Tracey and Petrockstow basins) and offshore (e.g. the Jurassic and tertiary deposits found in the Cardigan Bay, Central Irish Sea and St George's Channel basins). The weathering and shaping of the landmass we see today has therefore been a protracted process. Much of the evidence for the geomorphological processes that operated and shaped the landscape during these times was modified or removed by the Pleistocene

glaciations and periglacial processes, particularly in Wales, and the vast bulk of the evidence for these pre-Pleistocene events is erosional in nature and lends little precision to the interpretation of events.

The denudation chronology of the British landscape has been detailed in a wide range of publications (see Campbell et al., 1998 for a review). Traditionally, geomorphologists have viewed the early to mid-Tertiary as a time when the landmass of Wales and south-west England was subjected to alternating phases of marine inundation and planation and subaerial exposure and weathering: these conditions were used to account for a multiplicity of perceived erosion surfaces — 'staircases' of these surfaces were widely invoked throughout Wales (e.g. Brown, 1960) and south-west England (e.g. Balchin, 1937). Recent evidence, particularly from St Agnes Beacon in west Cornwall and Trwyn y Parc in Anglesey, shows Miocene and mid-Oligocene deposits overlying a prominent erosion surface at between c. 75–131m OD. This suggests that surfaces above this general level can be no younger than Miocene and lends much support to the view that large areas of the south-west Peninsula and Wales have existed, more or less, in their present forms since perhaps as early as the Eocene. Landscape evolution subsequent to this is likely to have been slow, the sole depositional evidence for a marine incursion onto these ancient landmasses being a minor transgression of late Pliocene age at St Erth, Cornwall.

In recent years, there has been an increasing tendency to invoke only one complex polygenetic erosion surface (e.g. Coque-Delhuille, 1982; Battiau-Queney, 1984), the constituent landforms having been shaped in tropical and sub-tropical environments (Upper Cretaceous and Palaeocene) and uplifted since the late Miocene (Green, 1985). In Wales, this inherited landform has been deeply dissected by Pleistocene glacial activity; in south-west England, periglacial processes appear to have been the chief Pleistocene land-shaping agents. In view of the above, sites where depositional evidence for pre-Pleistocene land-shaping events is preserved take on a disproportionate importance. In Wales and the Borderlands, evidence for long-term, pre-Pleistocene landscape evolution is represented by a network of RIGS where evidence of Tertiary weathering, the formation of weathered regoliths, saprolites and palaeosols is preserved and has a bearing on the development of specific landforms (e.g. tors) or major landscape features (e.g. erosion surfaces). At some of the sites, evidence for supergene weathering may be superimposed on bedrock previously altered by hydrothermal or pneumatolytic processes associated with intrusive igneous activity. These structurally compromised materials have been susceptible to subsequent exploitation by erosional processes and given rise to distinctive landscape features such as bays and inlets and specific landforms such as tors. The selective preservation of these weak rotten rock masses is something of a miracle, and they provide important clues for interpretations of landscape evolution.

Network context of the site Trwyn y Parc RIGS is one of four sites on Anglesey selected to demonstrate key evidence and concepts concerning the long-term geomorphological evolution of the island. It demonstrates a fossil flora of Miocene age with major implications for understanding the age of Anglesey's land surface (see also Rhes-y-cae RIGS, north-east Wales). Porth Wen RIGS, Porth Swtan RIGS and Porth Padrig RIGS are geomorphologically significant in providing important examples of highly altered bedrock possibly related to non-supergene processes (e.g. hydrothermal activity). Collectively, the sites have major importance for understanding the long-term geomorphological evolution of Anglesey's, and indeed Wales', landscape.

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strong>Site geometry: Site boundary