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## Lligwy Bay RIGS Site

NRW RIGS no. 380 [SH 49904 87123]

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### RIGS Statement of Interest:

Lligwy Bay RIGS Site comprises exposures in the lower Dinantian succession including the Lligwy Bay Sandstone and the Lligwy Bay Disturbance. Complex relationships between siliciclastic and carbonate units reflect deposition within deeply incised channels and the subsequent collapse of the karstified channel margin. This unique site is critical in providing evidence of the scale of, and the processes associated with, penecontemporaneous fluvial incision and karstification of the Anglesey Dinantian sequence. This sequence as a whole records the progressive growth of a carbonate platform during a pulsed Dinantian transgression. The Lligwy Bay RIGS significantly modifies the GCR description and interpretation proffered by Adams and Cossey (2004). Exposures at the western end of the site at Carreg Ddafad [SH 4974 8710] reveal a poorly sorted boulder conglomerate resting on an irregular limestone surface (Greenly, 1919; Cope 1975). The conglomerate contains abundant angular blocks of dolomitised limestone as well rounded clasts of local Precambrian and Lower Palaeozoic lithologies. Greenly (1919) recognized rock types similar to ones only visible today in the vicinity of Parys Mountain near Amlwch. To the south, the conglomerate passes up into pebbly sandstones and limestone conglomerates, the latter, well seen to the south of a narrow gully, principally composed of rounded and tightly packed limestone clasts. At the base of cliffs which form the south-eastern side of Lligwy Bay, dips in the conglomerate and sandstone unit steepen sharply below the Lligwy Bay Disturbance (Greenly, 1919; Bates and Davies, 1981; Davies 1983). The latter comprises a bedded limestone sequence with intercalated mudstone and sandstone units but which is tipped on its side and dips steeply to the east. At its north-eastern end, the bedding within disturbed sequence becomes distorted and it gives way to a chaotic assemblage of limestone blocks set in a red silty mudstone with yellow sandstone beds. Davies (in Bates and Davies, 1981) was first to recognize that the bedded sequence within the Lligwy Bay Disturbance can be matched to an intact sequence at a higher level in the local stratigraphy, exposed in cliffs to the south; the upper most beds within the disturbed zone equating with beds 50 m higher in the in situ stratigraphy. He concluded that the Lligwy Bay Disturbance recorded the foundering of this higher stratigraphy and, self evidently, that this event post-dated the deposition of these rocks. Brachiopod and corals confirm that the succession at Lligwy Bay, including the strata involved in the Lligwy Bay Disturbance can be assigned to the D1 Biozone, equivalent to the Asbian Stage of the Dinantian (Greenly, 1919; George et al., 1978). However, Davies (1983), based on thickness comparisons alone, suggested that the shelly limestones below the Lligwy Bay Conglomerate could be of early Asbian age and contrast with the late Asbian age of the succeeding units. Cope (1975) interpreted the limestone surface at Carreg Ddafad as a wave cut platform and the upstanding masses of the limestone as the bases of fossil sea stacks. By inference the overlying conglomerate was interpreted as a boulder beach deposit. However, the ill-sorted nature of the deposit indicated a fluvial origin to Davies (1983) (see also Bates and Davies, 1981) who interpreted the underlying limestone surface as the irregular floor of incised river channel; one of many now recognized within the Anglesey Dinantian succession (Walkden and Davies, 1983; Davies, 1994). For these reasons, Davies (1983) included the conglomerate and sandstone sequence overlying the limestone in his Lligwy Bay Sandstone, and viewed it this as quite separate from Greenly's (1919) basal Lligwy Sandstone. The relationship between the Lligwy Bay Sandstone and the Lligwy Bay Disturbance are poorly observed and remain enigmatic. The foundered strata of the disturbance may record the collapse of a karstic cavern either during the Dinantian, or much later, perhaps during Triassic or Tertiary periods of dissolution. However, palaeokarstic surfaces are a feature of the local Dinantian succession and record frequent periods of sustained subaerial exposure during which the carbonate platform was subjected to karstification, soil development and fluvial incision (Davies, 1991). The highest beds within the foundered sequence equate with one such level (see RIGS JRD 6) and one, moreover, which displays evidence of such incision. It is feasible, therefore, to interpret the Lligwy Bay Sandstone and the Lligwy Bay Disturbance as features linked to, and contemporaneous with, this higher palaeokarstic event; to view the former as fluvial deposits preserved at the base of a 50 m deep channel cut down from this higher surface; and the 'disturbance' as recording the local collapse of the margin of this same channel. This

interpretation carries with it another radical possibility, i.e. that much of the nearby crop of Greenly's (1919) Lligwy Sandstone, far from being a basal division of the local Dinantian sequence, may also form part of this younger channel fill.

**Geological setting/context:** The Dinantian succession of North Wales records the evolution and growth of a carbonate platform founded on the older Palaeozoic and Precambrian rocks of the region in response to pulsed, but sustained marine transgression (George, 1958, 1974; Somerville & Strank, 1989; Davies et al., 2004). The Dinantian sequence on Anglesey was deposited during the latter phases of this event, during the Asbian and Brigantian stages. Frequent falls in sea level (forced regressions) characterize this period of time and, as a consequence, the limestone successions on Anglesey, and elsewhere, are constructed from a series of shoaling-upwards sedimentary cycles. The tops of each cycle display features indicative of subaerial exposure, karstification and soil formation (Davies, 1991). However, the Anglesey succession accumulated at the landward margin of the platform and is unique in preserving features and deposits restricted to such a setting. Here, during periods of regression, fresh water streams flowed on to the emergent platform surface and incised deep channels (or palaeovalleys). Distinctive siliciclastic facies accumulated within these features and their margins display the effects of contemporaneous dissolution. The Lligwy Bay RIGS appears to provide unique evidence of the depths to which such channels were incised (over 50 m) and hence of the scale of contemporary sea level movements. It is unique in preserving features which testify to instability and collapse of the channel margins. The RIGS can be interpreted as casting doubt on the stratigraphical position of the Lligwy Sandstone of Greenly (1919), suggesting that it too may form part of the younger, channel-filling, siliciclastic sequence.

**Network context of the site:** The site forms one of series of 9 selected to illustrate the Anglesey Dinantian succession and the processes – erosional, depositional and diagenetic – which were active during and subsequent to its accumulation; these in turn form part of a broader network of Upper Palaeozoic RIGS in North Wales.

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**Site geometry:** Site boundary