Cwm yr Eglwys (Dinas) and Esgyrn Bottom

Highlights

This site shows fine examples of channels in one of the best and largest systems of meltwater channels in Wales. These features were formed by meltwater flowing under pressure beneath Late Pleistocene ice.

Introduction

Cwm yr Eglwys (Dinas) [SN 010 399] and Esgyrn Bottom [SM 975 346] are glacial meltwater channels in the well documented Gwaun-Jordanston system. This system is one of the largest and most spectacular in the British Isles, the interpretation of which has been important for determining the extent of Late Devensian ice in the area. The origin of the channels was first discussed by Charlesworth (1929). Since that time, numerous authors have investigated and described the features (for example, Jones 1946; Jones 1965; Bowen and Gregory 1965; Gregory and Bowen 1966; Bowen 1967, 1969a, 1971b, 1974, 1977a, 1981a, 1982, 1984; John 1965a; 1970a, 1971a, 1972, 1976; George 1970). The channels at Dinas and Esgyrn Bottom contain Devensian late-glacial and Holocene pollen sequences (Seymour 1973; Slater and Seymour 1977; Seymour 1985).

The Gwaun-Jordanston (Fishguard) meltwater channel system

The area to the north-west of Mynydd Preseli and immediately south of Fishguard contains a well developed network of glacial meltwater channels that has long been referred to as the Gwaun-Jordanston system. Detailed descriptions of the morphology and distribution of these features have been given, for example, by Bowen and Gregory (1965) and John (1970a) — see (Figure 15). The largest channel is that of the modified Gwaun Valley, some 14 km long and passing between the Carn Ingli and Mynydd Preseli. Near its western end and its exit into Fishguard Bay, the Gwaun Valley is joined from the north-east by the Cwmonnen Valley and, at this point, three major exits from the channel swing towards the south and west. This is the most complex part of the system comprising the spectacular channels of the Crinney Brook, Esgyrn Bottom, Nant-y-Bugail and numerous smaller and subsidiary channels. In addition to these interconnected channels, other examples have been described, particularly towards the west near Abermawr and Jordanston, and to the northeast where the Cwm yr Eglwys Channel all but separates Dinas Head from the mainland. The present day streams are small in relation to the channels they occupy; the Nant-y-Bugail, for example, is some 85m deep but contains a tiny stream (John 1970a). Some channels are cut through pre-existing watersheds, and they are steep-sided features with flat floors, the latter caused by substantial Devensian late-glacial and Holocene sedimentation and peat growth.

The Gwaun-Jordanston system was originally described by Charlesworth (1929). In defining his 'South Wales end-moraine' in Pembrokeshire, he interpreted the steep-sided channels as ice-marginal features produced by ice-dammed lake water overflow during the northward retreat of the Irish Sea ice-sheet — see (Figure 15). These proglacial lakes were dammed by the Irish Sea ice margin in local valleys. Ice-marginal and direct overflow channels were formed as one lake spilled over into another. This glacial lake hypothesis was subsequently accepted, albeit with minor modifications, by Griffiths (1940), M Jones (1946), O T Jones (1965) and Pringle and George (1948).

From a detailed survey of the channels, Bowen and Gregory (1965) reinterpreted their mode of formation. First, they showed that evidence for former extensive proglacial lakes such as shoreline features, delta or lake deposits was generally lacking in the area. Only in the Teifi Valley at, for example, Llechryd did laminated lake clays exist (Jones 1965; Bowen 1967, 1984; Bowen and Lear 1982), and these are widespread between Cardigan and Pentre Cwrt (Bowen and Lear 1982; Lear 1986). Second, the Fishguard channels show a range of characteristics incompatible with an ice-marginal hypothesis. Bowen and Gregory (1965) noted that many of these channels showed 'humped' long-profiles, and, on some valley sides, channels with V-shaped profiles were sharply incised along the lines of the steepest slopes. Bowen and Gregory suggested that such an assemblage of features was most readily interpreted as the result of subglacial stream erosion. Humps on some long-profiles, for example, could not have formed at an ice margin because subaerial meltwater could not have flowed upslope: these features were more easily explained by subglacial meltwater flowing under considerable hydrostatic pressure. The steeply incised, superimposed valley side channels showed a close correspondence to features described as subglacial chutes by Mannerfelt (1945).

Thus, Bowen and Gregory and subsequently Gregory and Bowen (1966), and Bowen (1967, 1971b, 1974, 1977a, 1981a, 1982, 1984) have argued that the Gwaun-Jordanston system of channels had formed largely by processes of subglacial stream erosion, and that some channels may have developed following superimposition of englacial streams, and others as subglacial chutes. Bowen and Gregory also reconstructed a sequence of channel formation corresponding to various stages in the process of ice-sheet thinning — see (Figure 15).

They considered that the fresh appearance of the channels probably indicated that they could be referred to glaciation in the Late Devensian, and observed that the re-evaluation of the channels as subglacial in origin necessitated a greater cover of ice than had been envisaged by Charlesworth (1929). This is consistent with the stratigraphic evidence from a wider area for Late Devensian glaciation (for example, Bowen 1973b, 1974).

The Gwaun-Jordanston channel system was also described and discussed by John (1970a, 1971a, 1972, 1976). He considered that the features had probably been cut by meltwater during a pre-Devensian (possibly Saalian) glaciation. Three main lines of evidence were put forward to support this contention -1) the large size of many of the channels; 2) many of the channels in Preseli are 'plugged' by thick sequences of periglacial and glacial sediments. These show that the channels existed prior to the depositional phase of the Late Devensian. Bowen (1966), however, argued that some of the tills were soliflucted, thus allowing for the possibility that both the channels and drift dated from the same (Late Devensian) glaciation. 3) The orientation of the channels was seen by John to have a bearing on their age, following the ideas of Mannerfelt (1945) who suggested that the orientation of subglacial meltwater channels, although influenced by bedrock relief, was controlled primarily by the direction of the ice surface gradient. Consequently, John observed that if the Gwaun-Jordanston channels dated from the Late Devensian, they would be expected to be aligned approximately north-west to south-east. In fact, the channels are generally oriented north-east to south-west; from which John concluded that it was more satisfactory to relate the channels to a pre-Devensian glaciation when there may have been a suitable ice gradient sloping from north-east to south-west on the flanks of Mynydd Preseli.

Such a conclusion is not, however, in keeping with prevailing opinion, which suggests that during the pre-Devensian glaciation of south-west Wales, Preseli was extensively invaded by north-west to south-east moving Irish Sea ice (for example, Griffiths 1940; Bowen 1973a, 1973b, 1974, 1977b). John (1970a) suggested that the 'fresh' appearance of the channels was satisfactorily explained if they had again been utilised by meltwater during the Late Devensian glaciation.

Esgyrn Bottom

Esgyrn Bottom [SM 975 346] is a steep-sided, generally north-east to south-west oriented valley, lying approximately 80m above sea-level in the central 'interconnected' part of the Gwaun-Jordanston system — see (Figure 15). Near Llanwern Farm [SM 977 349] a smaller channel enters the Esgyrn Bottom Channel. This runs west for a distance of about 0.5 km before joining the larger Crinney Brook Channel. The steep sides of Esgyrn Bottom are densely wooded, providing a contrast with the bog vegetation on the floor of the channel. The channel reaches a maximum width of some 180m, and the main raised peat area is some 800m in length.

The peat deposits have been described in detail by Seymour (1973) and Slater and Seymour (1977) who recorded the following generalised sequence:

8 *Eriophorum, Sphagnum, Eriophorum* and *Molinia,* and *Eriophorum* and *Sphagnum* peats

7 Well humified sedge peat

6 Well humified wood peat with *Betula, Calluna* and *Eriophorum* remains

5 Wood peat with *Betula* remains

4 Humified peat with some *Phragmites* remains

3 Grey clay with peat

2 Blue lake clay with shale fragments

1 Blue lake clay

Slater and Seymour (1977) zoned the pollen assemblages collected from the sequence into the standard Godwin Pollen Zones IV-VIII, and local pollen assemblage zones were also recognised; no radiocarbon calibration was, however, provided. They proposed the following sequence of vegetational and environmental changes based on the pollen and plant macrofossil evidence. Organic deposits first began to accumulate in an early Holocene lake at Esgyrn Bottom towards the close of the pre-Boreal (Pollen Zone IV of Godwin). They considered that a fairly typical hydroseral succession took place at the site; that is a succession from non-productive open-water through a submerged macrophyte stage, a floating-leaved macrophyte stage, a reed swamp, a sedge and grass dominated fen and finally to bog with ericaceous species and *Sphagnum.*

The pollen record preserved at Esgyrn Bottom shows many of the classic features of the Holocene vegetation succession recorded at other sites in Wales. The well documented 'elm decline' is clear in the record as are the effects of forest clearance and the agricultural activities of early Man. Although the preserved record of vegetational changes is unexceptional in itself, the extreme westerly position of the site makes the record important in terms of interpreting regional variations in vegetation development throughout Wales.

Cwm yr Eglwys (Dinas)

The Cwm yr Eglwys Channel [SN 010 399] is some 1,300m long and opens onto the sea at both ends. The floor of the channel lies at *c.* 5m OD, and virtually isolates the Dinas headland from northern Preseli.

Both ends of the channel are 'plugged' by blown sand, while the area between is waterlogged, and it contains an infill of up to 11m of Devensian late-glacial and Holocene deposits. Seymour (1985) constructed a series of twenty local pollen assemblage zones from the profile and provided nine radiocarbon dates. The sequence was assigned to part of the Allerød (the Devensian late-glacial interstadial), the Younger Dryas and most of the Holocene.

A radiocarbon age of 11,700 ± 250 BP (GU - 1267) from the basal organic sediments provides a date for increased slope stability and improving conditions in the channel during the Allerød (Devensian late-glacial interstadial), as well as providing a date for the local expansion of *Corylus* and other shrub taxa (Seymour 1985). A sample from the top of the organic sediments, underlying a thin inorganic horizon, gave a radiocarbon age of 11,100 ± 140 BP (GU-1275), and provided a date for the marked climatic deterioration at the onset of the Younger Dryas. This return to colder conditions is evident in the lithological and pollen records.

The palynological data from Dinas and other sites in the Preseli region were used by Seymour (1985) to demonstrate that the presently distinctive climatic character of Preseli was probably established in Devensian late-glacial times. *Corylus,* for example, was locally present during the Aliened, and probably expanded from refugia lying to the south and west. In contrast, birch was relatively uncommon during the Devensian late-glacial and early Holocene, suggesting that its eastwards migration across the Cambrian uplands was inhibited. Seymour (1985) suggested that the pollen data also confirmed the early establishment of mixed oak forest along the coastal plain.

Glacial meltwater channels form an important element of the landscape of South and west Wales. The Gwaun-Jordanston system of channels is one of the finest of its type in the British Isles. Cwm yr Eglwys and Esgyrn Bottom are outstanding examples of channels in this extensive system. Although the channels were originally interpreted as overflow features from glacially impounded lakes (Charlesworth 1929), many are now believed to have been formed by subglacial meltwaters (Bowen and Gregory 1965). The interpretation of the Gwaun-Jordanston channels as subglacial in origin and of Late Devensian age (for example, Bowen and Gregory 1965; Bowen 1984) has important repercussions for the extent of the Late Devensian ice cover in south-west Wales and the manner of deglaciation: ice must have reached considerably farther south than envisaged by Charlesworth (1929), and ice wastage probably occurred by ice-thinning rather than by marginal retreat.

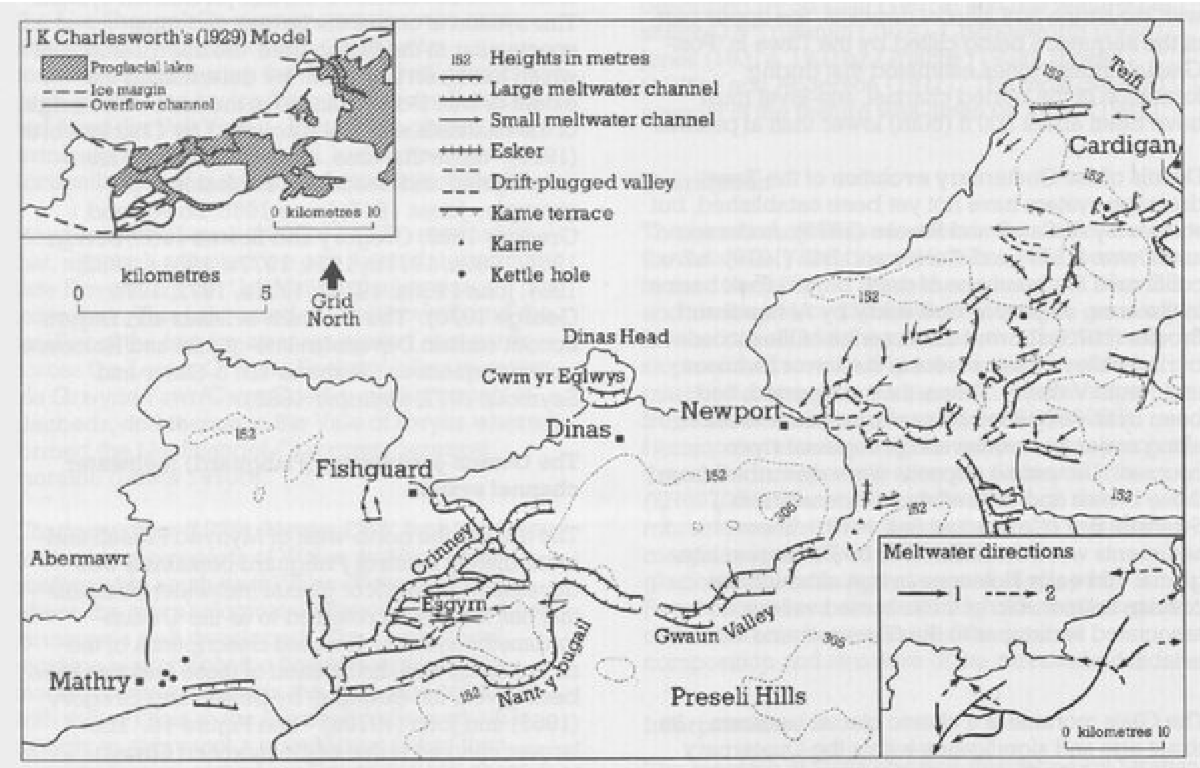
The channels are particularly noted for their large size and extent. This has led to some workers suggesting that they were occupied by meltwaters during more than one phase of ice wastage. As such, they contrast with the much more compact meltwater channel system near Carmarthen (at Maesyprior) of suggested Late Devensian age (Bowen 1967).

Cwm yr Eglwys and Esgyrn Bottom are both excellent and representative examples of glacial meltwater channels in the Gwaun-Jordanston system. This system is one of the largest and best documented in Britain, and is believed to have been formed largely by subglacial meltwaters. The scale and orientation of the channels are important factors in reconstructing and interpreting the sequence of Late Pleistocene events in south-west Wales; particularly for determining the extent of Late Devensian ice and the manner of ice wastage in the area. In addition, the channels at Cwm yr Eglwys and Esgyrn Bottom contain thick peat sequences with important Devensian late-glacial and Holocene pollen records.

Conclusions

The Cwm yr Eglwys and Esgyrn Bottom glacial drainage channels are thought to have been fashioned underneath an ice-sheet. They were probably formed at an early stage during the wastage of the last ice-sheet which occupied St George's Channel and Cardigan Bay. Because the disappearance of that ice-sheet may have been catastrophic, it means that these channels may well have been fashioned over a timescale that is brief even by human standards. The channels also contain thick deposits of peat that have yielded pollen grains which have been used for reconstructing climatic change since the ice age up to the present day.

References



(Figure 15) The Gwaun–Jordanston meltwater channel system (from Bowen and Henry 1984)