Chapter 6 The Quaternary of Mid Wales

Introduction

In this account, Mid Wales is broadly defined as lying between a line running approximately west to east through the Barmouth Estuary and a line from the Cardigan Bay coast at Newquay to the northern escarpment of Mynydd Eppynt. The area includes the uplands of Cadair Idris, the Cambrian Mountains (Mynydd Elenydd) and the Welsh Borderlands. It excludes the coastlands of west Mid Wales which are dealt with separately — see Chapter 4. Although Late Pleistocene landforms and deposits are widespread in Mid Wales, these have received relatively scant attention. Two main themes, however, are of major significance to an understanding of the Welsh Quaternary as a whole. First, there has been considerable disagreement about whether landform and sedimentary evidence in the region indicates extensive glaciation of the uplands during the Late Devensian or is indicative of generally ice-free conditions and protracted periglacial activity throughout the Devensian Stage. Second, the region has become an important focus of attention in studies of Late Devensian late-glacial and Holocene environmental change and pollen biostratigraphy.

Extensive Late Devensian glaciation or a periglacial landscape?

Although aspects of the regional glacial history were discussed by Keeping (1882), Reade (1892, 1896), Dwerryhouse and Miller (1930), Jones and Pugh (1935), Miller (1946), Coster and Gerard (1947) and Howe and Yates (1953), these isolated studies have not led to any great elaboration of the Late Pleistocene history of Mid Wales, particularly the uplands. Miller (1946) concluded that Cadair Idris had formed a local centre for ice dispersal, with its own system of small glaciers feeding into and exploiting pre-existing valleys such as the fault-guided Tal-y-llyn Valley. The dominant regional direction of ice movement appears to have been NNE to SSW in this area. Although Cadair Idris nourished its own ice (Reade 1896; Miller 1946) and contributed westerly flows to the coast, this ice was subordinate to an ice cap, a larger dispersal centre, farther north. Working in the Harlech Dome, Foster (1968) demonstrated that this Merioneth ice cap deposited till as high as 427m on Aran Fawddwy, and that the ice escaped westwards through cols to provide felsite erratics for the tills of the Dyfi Estuary (Jones and Pugh 1935).

It was not until the work of Watson (1960, 1962, 1965a, 1965b, 1966, 1967, 1968, 1969, 1970, 1976, 1977a) and Potts (1968, 1971), however, that the landforms and deposits of these Mid Wales uplands were described in any detail. Watson provided substantive accounts of the glacial landforms around Cadair Idris (Watson 1960), the glacial morphology of the Tal-y-llyn Valley (Watson 1962), stratified screes in the area (Watson 1965a), nivation cirques in the Ystwyth Valley (Watson 1966), and slope deposits in the Nant Iago Valley near Aberstwyth (Watson 1969). He has used this evidence together with that derived from studies of local coastal sections (for example, Watson and Watson 1967; Watson 1982) to argue for a dominantly periglacial evolution of the west and Mid Wales landscapes during the Devensian Stage (Watson 1967, 1968, 1970, 1976, 1977a). Fundamental to Watson's views was the demonstration, by use of clast fabric analyses, that most Pleistocene deposits in the region were slope deposits and that any glacial deposits were not in their original position, having undergone extensive reworking and mixing with the slope deposits (Watson and Watson 1967; Watson 1969, 1982). In combination with studies of the distribution of fossil pingos (Watson 1971, 1972; Watson and Watson 1972, 1974), the Watsons argued for restricted Late Devensian glaciation in Wales, agreeing with the views of Mitchell (1960, 1962, 1972), Synge (1963, 1964) and Wirtz (1953). Mitchell and Synge envisaged that Irish Sea ice only reached as far south as the North Wales coast in the Late Devensian, being marked on Ll■n by the Bryncir-Clynnog moraine — see Chapter 7. Watson in fact argued that this ice had reached slightly farther south, to Sarn y Bwch. Wirtz (1953) envisaged that a lobe of Late Weichselian (Late Devensian) Irish Sea ice also impinged on south Ceredigion and Preseli but that Mid Wales remained largely ice-free. These argued that Welsh ice was only locally present in the uplands, but did not specify where in the region. Therefore, repeated cold pulses during the Devensian Stage, when the region was believed to have been largely ice-free, were considered to account for the thick accumulations of slope deposits and reworked glacial sediments — the latter presumably from a pre-Devensian glacial phase.

The widespread development of periglacial landforms and deposits in Mid Wales is not disputed, although the interpretations of the Watsons and others have been considerably modified by subsequent workers (for example, Potts 1968, 1971; Bowen 1974; Macklin and Lewin 1986). Four principal lines of evidence mitigate against the proposition that much of Mid Wales remained ice-free in the Late Devensian.

1. Considerable lithostratigraphic data from coastal sections around Wales (for example, Bowen 1970a, 1973a, 1973b, 1974, 1977a, 1977b; John 1970a) indicate extensive Late Devensian glaciation by Irish Sea and Welsh ice to the limits proposed across South Wales by Bowen (1970a, 1981a, 1981b). This alone implies the presence of an extensive Late Devensian ice cover in the Mid Wales uplands (Bowen 1974).
2. The prominent *samau* present along the Cardigan Bay coast (Sarn Badrig, Sarn Cynfelyn, Sarn y Bwch) are thought to prove an extensive westward flow of Late Devensian Welsh ice from the uplands (Foster 1970b; Bowen 1974), which in places may have prevented contemporaneous Irish Sea ice from impinging onto the Welsh mainland over much of the present day Cardigan Bay coastline. Although Foster (1970b) proposed that the *sarnau* represented medial moraines between the Welsh and Irish Sea ice-sheets, Bowen (1974) argued that Sarn Badrig (near Mochras) was co-extensive with the upper till on eastern Llyn (Llanystumdwy Till), deposited when Irish Sea ice is thought to have been absent from western Llyn. Unfortunately the precise dating of the *sarnau* to either the main Late Devensian ice-sheet or to its possible subsequent readvance — see Chapter 7, and their correlation with stratigraphic sequences elsewhere, remains insecure.
3. The landform evidence from the Welsh Borderlands also shows an extensive development and a major easterly component of flow from Late Devensian ice in Mid Wales (Dwerryhouse and Miller 1930; Pocock 1940; Cross 1966, 1968; Luckman 1966, 1970). Ice nourished from central Wales is generally thought to have escaped eastwards into Herefordshire and Shropshire where it was unimpeded by other ice masses (Luckman 1970). The Clun, Teme, Lugg, Hindwell and Arrow Valleys are all believed to have contained glaciers fed by ice from the west (Luckman 1970). Similarly, farther south, the Wye glacier spread over the Hereford basin in a large piedmont lobe (Luckman 1970). The maximum extent of this Mid Wales ice is usually taken as the limit of continuous drift of an undissected nature (Bowen 1974), and it is marked in many areas by prominent morainic accumulations. Although absolute dates are unavailable, this morainic belt is thought to represent the maximum limit of the Late Devensian ice-sheet (Bowen 1974), and in this region the limit corresponds closely to the 'Newer Drift' limit drawn by Charlesworth (1929). Highly dissected drift and remanie deposits outside this limit are believed to date from a pre-Devensian glacial episode (Luckman 1970).
4. Landforms and sediments within this proposed Late Devensian maximum limit in Mid Wales are commensurate with a thoroughly glaciated landscape (Wood 1959; Potts 1971; Bowen 1974), but with a significant subsequent periglacial modification. Such evidence includes valley moraines, kettle holes and kame terraces in Radnorshire and Herefordshire (Luckman, 1966), and extensive lacustrine deposits around Wigmore and Presteigne where Cross (1968) estimated the thickness of Late Devensian ice to have been in the region of 240m, extensive outwash deposits in the Builth-Llanwrtyd lowland (Potts 1968; Lewis 1970b), and an extensive system of moraines and outwash terraces in the Wye Valley (Pocock 1940). Moreover, in the uplands proper Potts (1968) has mapped extensive areas of till and outwash in the major valleys, which he considered to be Late Devensian in age. Potts (1968, 1971) argued that extensive reworking of these glacial sediments by solifluction occurred during the Late Devensian late-glacial; and, where slope conditions and lithology were suitable, head, stratified screes, blockfields and tors formed.

More recently, Macklin and Lewin (1986) confirmed that a number of valleys in the region contain locally thick successions of glacial and alluvial sediments, and referred to local (Welsh) till mantling slopes and interfluves, for example, in the Rheidol Valley. In reply, S Watson (1987) maintained that nowhere was this till *in situ,* having been widely reworked and incorporated into slope deposits. In response, Macklin and Lewin (1987) concluded that till in the Rheidol Valley exhibited fabric properties entirely consistent with deposition by a westerly moving glacier.

It is within the context of this background that the selected GCR sites should be viewed. Those at Cadair Idris and Cwm Ystwyth provide some of the best evidence currently documented from Mid Wales for Late Pleistocene glacial and periglacial conditions. Cadair Idris and Tal-y-llyn demonstrate an excellent range of large-scale glacial erosional features, including the outstanding cirque of Cwm Cau (Watson 1960, 1977a) and the over-deepened valley of Tal-y-llyn (Watson 1962, 1977a).

The interest of these sites is enhanced by landforms and deposits thought to have formed largely as the result of periglacial activity. These include the massive landslide impounding Tal-y-llyn, a number of alluvial fans and blockstreams, scree slopes and protalus ramparts. The cirque moraines and protalus features of this massif provide the best evidence for cirque glacier and snowpatch development in Mid Wales during the Devensian late-glacial. As such, the site provides complementary landform evidence to selected sites in northern Snowdonia and the Brecon Beacons. Cadair Idris also provides important exposures through stratified screes (Grezes Litees). These deposits are a widespread feature in the Mid Wales uplands and they reflect the susceptibility of local geological strata, particularly mudstones and shales, to frost-assisted weathering processes under periglacial conditions (Watson 1965a, 1977a). It is likely that they formed in the Devensian late-glacial (Potts 1968).

Devensian late-glacial and Holocene environmental change

Although details of pre-Late Devensian late-glacial history are less well known in inland Mid Wales than in the coastal regions, the area is the most intensively studied in Wales for Devensian late-glacial and Holocene environmental history. Since Godwin and Mitchell's (1938) study at Tregaron, numerous profiles have been described and detailsof Devensian late-glacial and Holocene vegetational history established (for example, Moore 1966, 1968, 1970, 1972a, 1972b, 1973; Moore and Chater 1969a, 1969b; Smith and Taylor 1969; Hibbert and Switsur 1976; Lowe 1981; Lowe *et al.* 1988). Several studies have traced the course of vegetation development into historical and recent times (Turner 1964, 1965, 1977; Moore 1968, 1973; Moore and Chater 1969b), and Smith and Taylor (1969) have applied pollen biostratigraphic methods to soil profiles, enabling patterns of pedogenesis to be related to the established Holocene pollen zones, as well as documenting the influences of Bronze Age Man and his successors. Sites in the region have also featured in a number of nationwide studies which discuss aspects of regional floral diversity and diachroneity during major Devensian late-glacial and Holocene events (for example, Smith and Pilcher 1973; Taylor 1973; Deacon 1974; Birks *et al.* 1975). Sequences at Llyn Gwernan and the Elan Valley Bog provide the most extensive and complete Devensian late-glacial to Holocene sequences so far known in the region. Cors y Llyn (Llyn Mire), Tregaron Bog and the Elan Valley Bog represent the most detailed records of vegetation history during the Holocene for Mid Wales. Comprehensive radiocarbon calibration is available for the sequences at both Llyn Gwernan and Tregaron.

References