Figures and tables

Figures

(Figure 1) Aspects of the Quaternary geology and geomorphology of Wales and the Welsh borderland (after Bowen 1977a, 1982b)

(Figure 2) Some proposed ice limits on Gower (from Bowen 1970a; Bowen 1981a, 1981b; Campbell 1984; Bowen *et al.* 1985)

(Figure 3) Quaternary sequence at Hunts Bay (after Bowen and Henry 1984)

(Figure 4) Pleistocene sequence at Bacon Hole Cave (from Currant *et al.* 1984)

(Figure 5) Pleistocene sequence at Minchin Hole (from Sutcliffe and Currant 1984)

(Figure 6) Quaternary sequence at Eastern Slade and Western Slade (after Bowen and Henry 1984)

(Figure 7) Quaternary sequence at Horton (after Bowen and Henry 1984)

(Figure 8) Quaternary sequence at Rhosili Bay (after Campbell 1984)

(Figure 9) Quaternary sequence at Broughton Bay (after Campbell *et al.* 1982)

(Figure 10) Quaternary deposits at Ynyslas and Borth Bog (after Godwin 1943)

(Figure 11) Quaternary sequence at Clarach (from Heyworth et *al.* 1985)

(Figure 12) Pleistocene sequence at Morfa-bychan (after Watson and Watson 1967)

(Figure 13) Drift provinces of South Wales (from Bowen 1970a)

(Figure 14) Some suggested Late Devensian ice limits in South Wales (from Bowen and Henry 1984; Campbell 1984)

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

(Figure 16) The Maesyprior meltwater channel system (after Bowen 1970a)

(Figure 17) The Cledlyn Valley pingos (after Watson 1971; Watson and Watson 1972)

(Figure 18) Mynydd Du: principal landforms (after Ellis-Gruffydd 1972; Statham 1976)

(Figure 19) Traeth Mawr: a summary of pollen, lithological and radiocarbon evidence (from Walker 1984)

(Figure 20) Craig Cerrig-gleisiad: a summary of pollen, lithological and radiocarbon evidence (from Walker 1984)

(Figure 21) Quaternary sequence at Cwm Nash (after Evans *et al.* 1978)

(Figure 22) Cadair Idris: principal landforms (after Watson 1977a)

(Figure 23) Cwm Ystwyth: principal landforms (after Watson 1966; Watson and Watson 1977)

(Figure 24) Llyn Gwernan: a summary of pollen, lithological and radiocarbon evidence (from Lowe *et al.* 1988)

(Figure 25) Elan Valley Bog: Devensian late-glacial and Holocene sequence (from Moore and Chater 1969a)

(Figure 26) Tregaron Bog: a summary of pollen, lithological and radiocarbon evidence (from Hibbert and Switsur 1976)

(Figure 27) Late Devensian and Late Devensian readvance ice limits (from Bowen 1974, 1977b)

(Figure 28) Quaternary sequence at Dinas Dinlle (from Whittow and Ball 1970)

(Figure 29) Pleistocene sequence at Gwydir Bay (from Saunders 1968d)

(Figure 30) Pleistocene sequence at Porth Oer (from Saunders 1968d)

(Figure 31) Quaternary sequence at Porth Neigwl (from Saunders 1968d)

(Figure 32) Quaternary sequence at Porth Ceiriad (from Whittow and Ball 1970)

(Figure 33) Quaternary sequence at Glanllynnau (after Whittow and Ball 1970; Boulton 1977a)

(Figure 34) Quatemary sequence at Morannedd (from Whittow and Ball 1970)

(Figure 35) Quaternary sequence at Pontnewydd (after Green *et al.* 1981)

(Figure 36) Snowdon (Yr Wyddfa): principal landforms

(Figure 37) Y Glyderau: principal landforms (after Campbell 1985b)

(Figure 38) Y Carneddau: principal landforms

(Figure 39) Devensian late-glacial and Holocene sequence at Cors Geuallt (after Crabtree 1972)

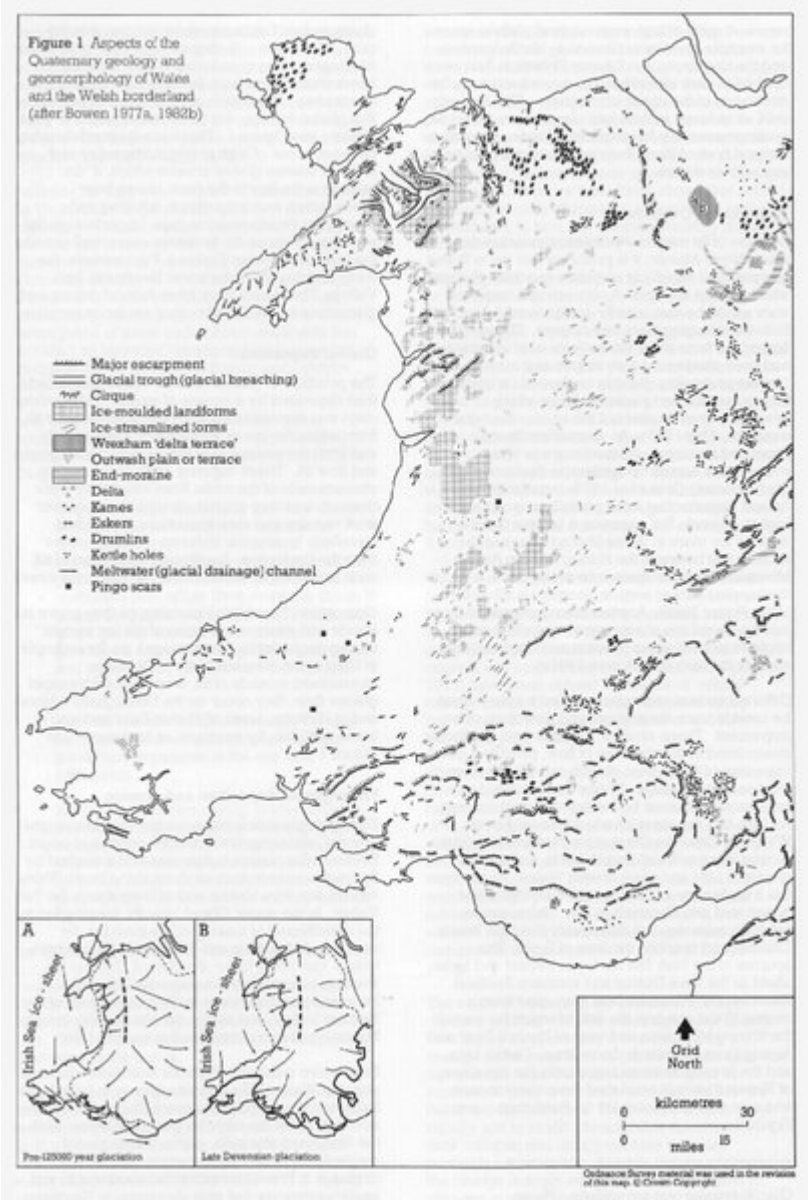
Tables

(Table 1) Geochronology (age) of Oxygen Isotope Stage boundaries is from Martinson et al. (1987) [back to stage 7], and Imbrie et al. (1984). Specific events are radiocarbon dated at 10, 11, 12, 13, 14 and 17,000 years BP (details in text). The Pennard and Minchin Hole D/L Stages are from Bowen et al. (1985). For chronostratigraphic correlations see Bowen and Sykes (1988), Behre (1989) and Bowen et al. (1989). Sites outside Wales are correlated with Oxygen Isotope Stages as follows — Upton Warren, St Germain II and Odderade (Sub-stage 5a), Chelford, BrOrup and St Germain I (Sub-stage 5c) and Stanton Harcourt and Aveley (Stage 7).

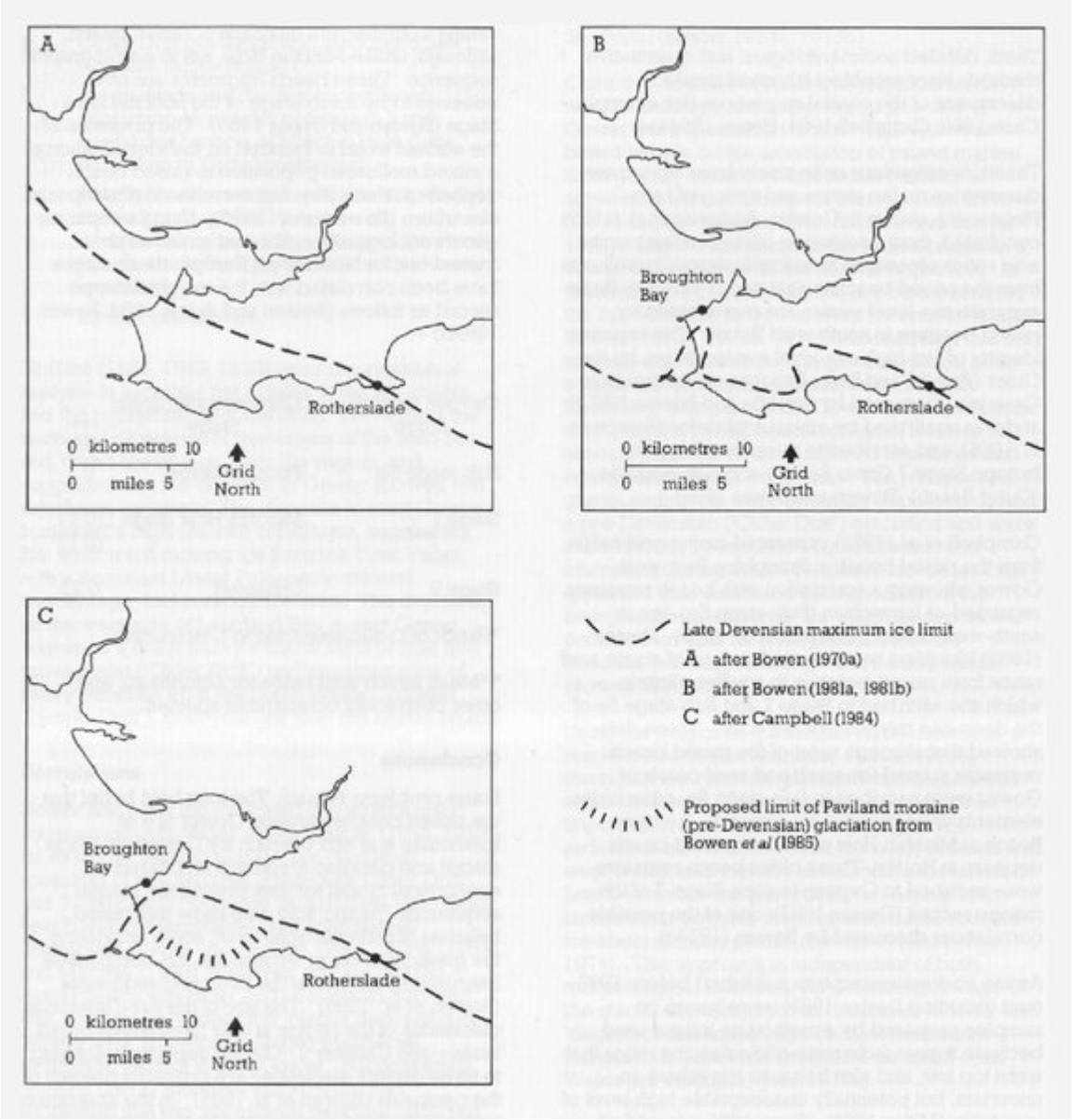
(Table 2) Gower chronology (T N George 1932)

(Table 3) Uranium-series age determinations on stalagmite samples from Bacon Hole.

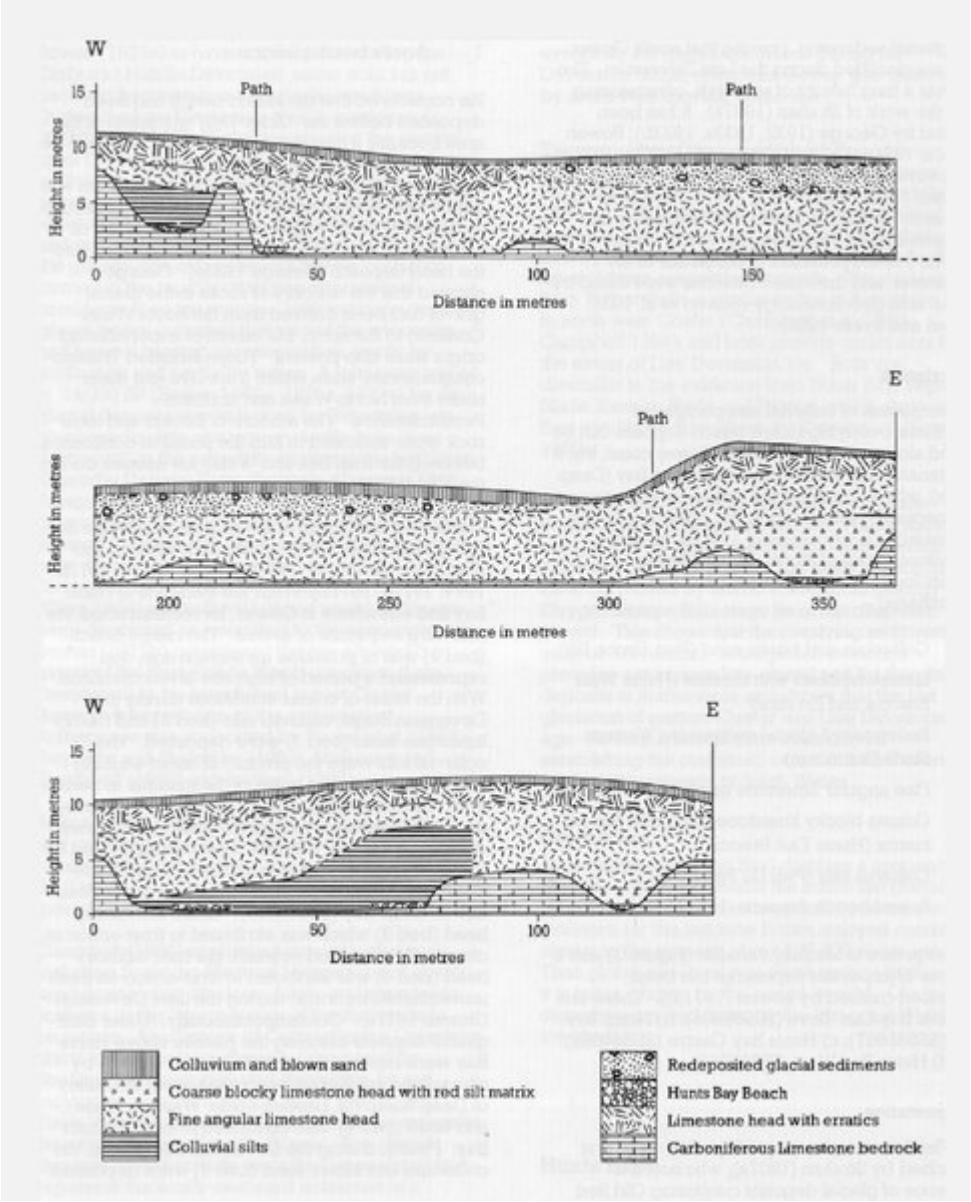
References



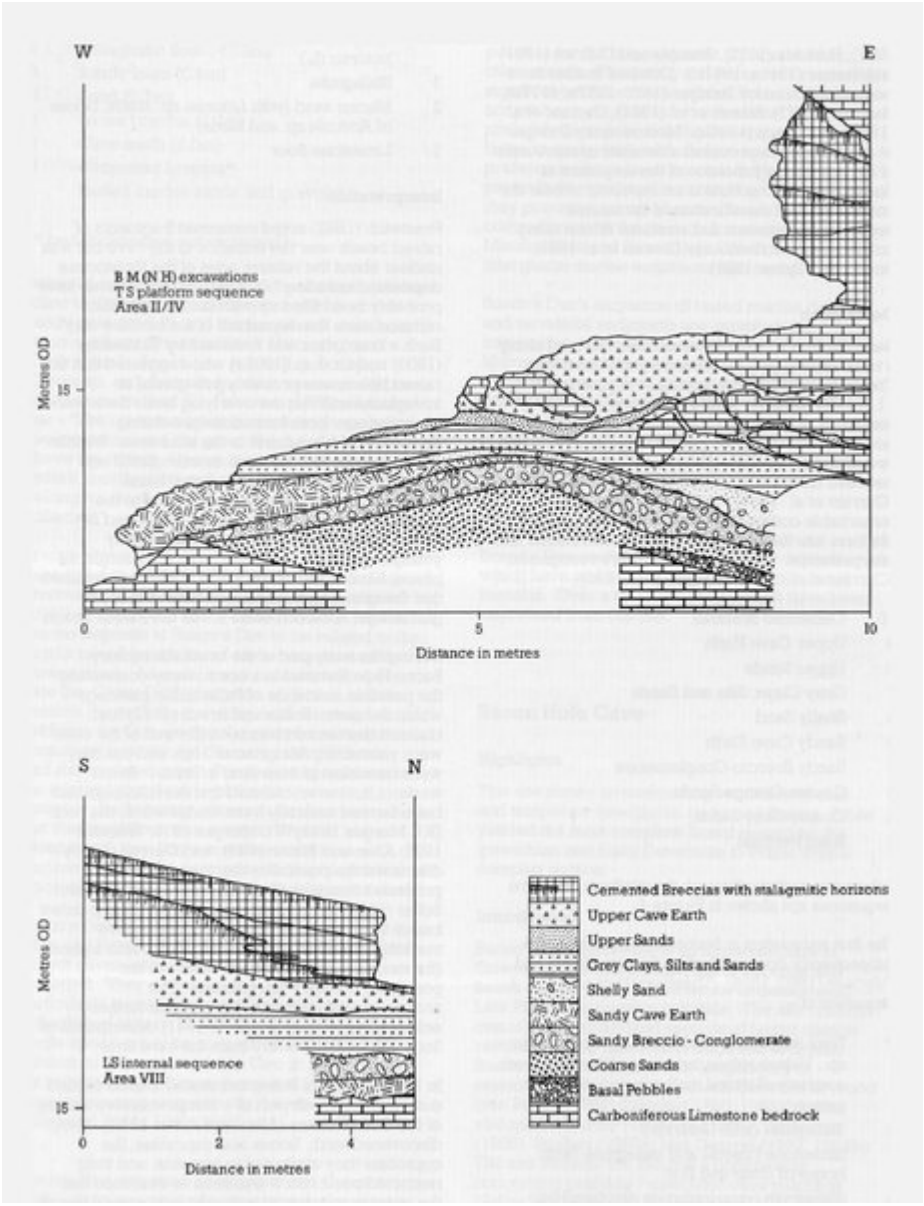
(Figure 1) Aspects of the Quaternary geology and geomorphology of Wales and the Welsh borderland (after Bowen 1977a, 1982b)



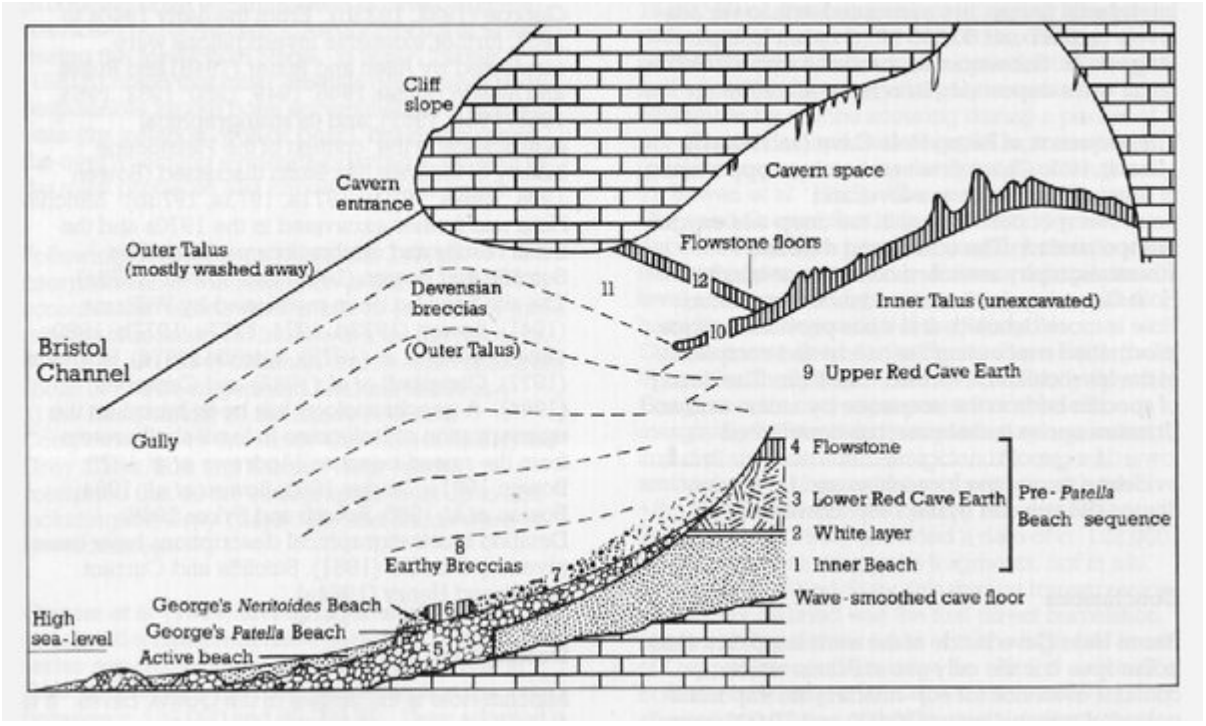
(Figure 2) Some proposed ice limits on Gower (from Bowen 1970a; Bowen 1981a, 1981b; Campbell 1984; Bowen et al. 1985)



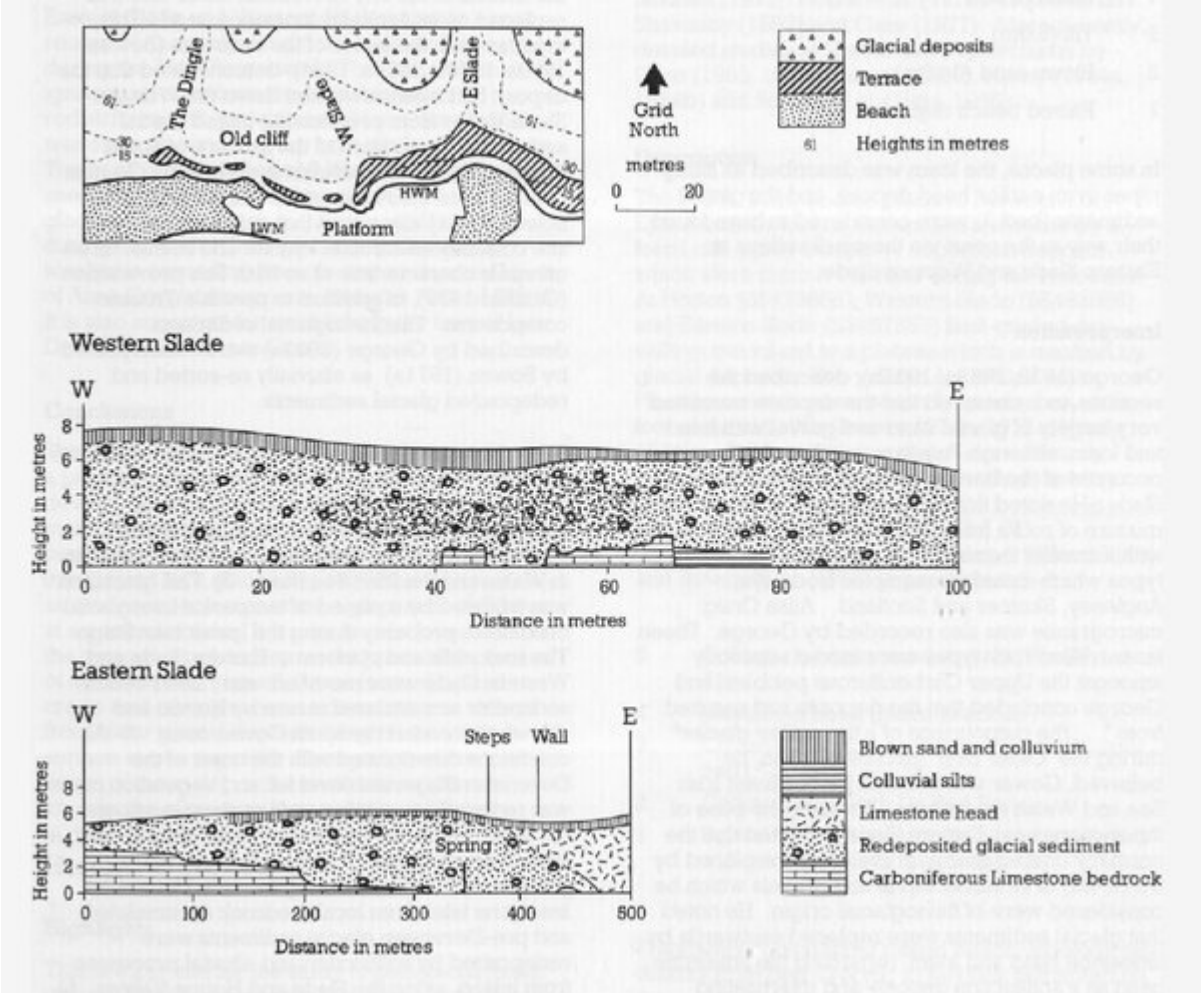
(Figure 3) Quaternary sequence at Hunts Bay (after Bowen and Henry 1984)



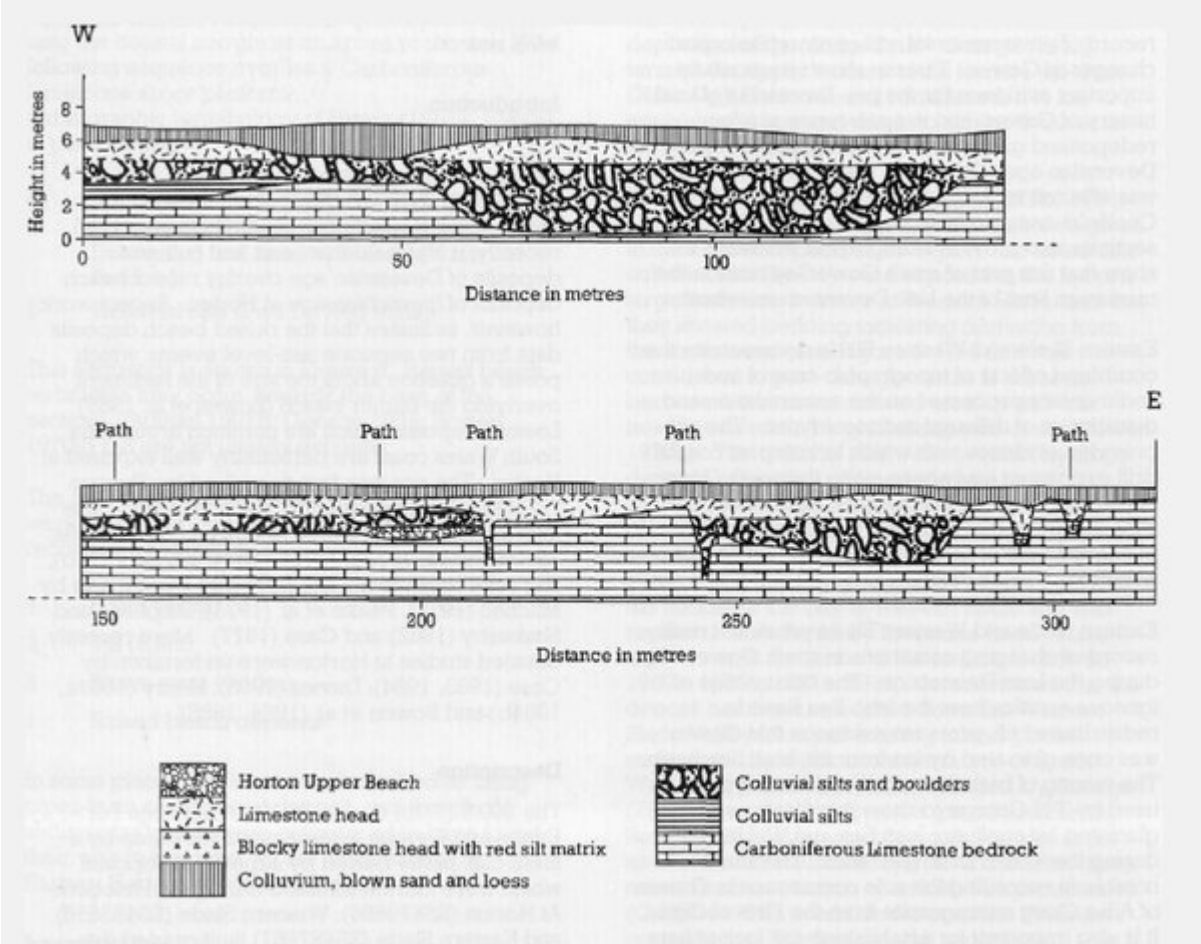
(Figure 4) Pleistocene sequence at Bacon Hole Cave (from Currant et al. 1984)



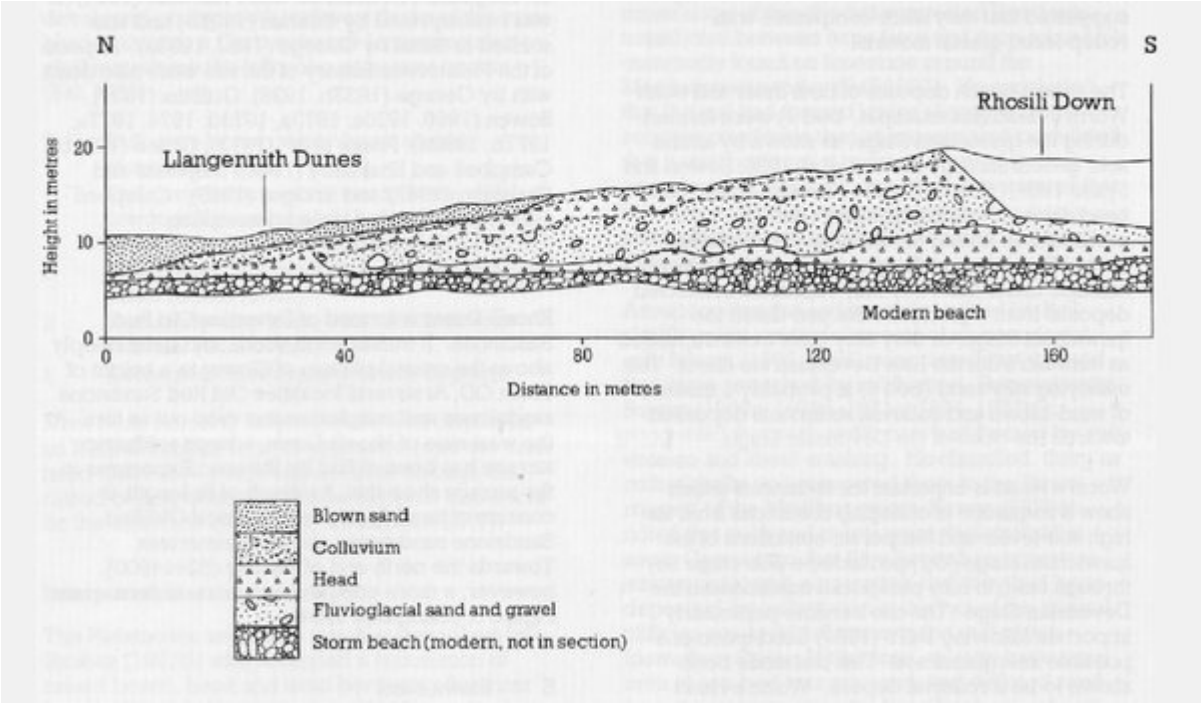
(Figure 5) Pleistocene sequence at Minchin Hole (from Sutcliffe and Currant 1984)



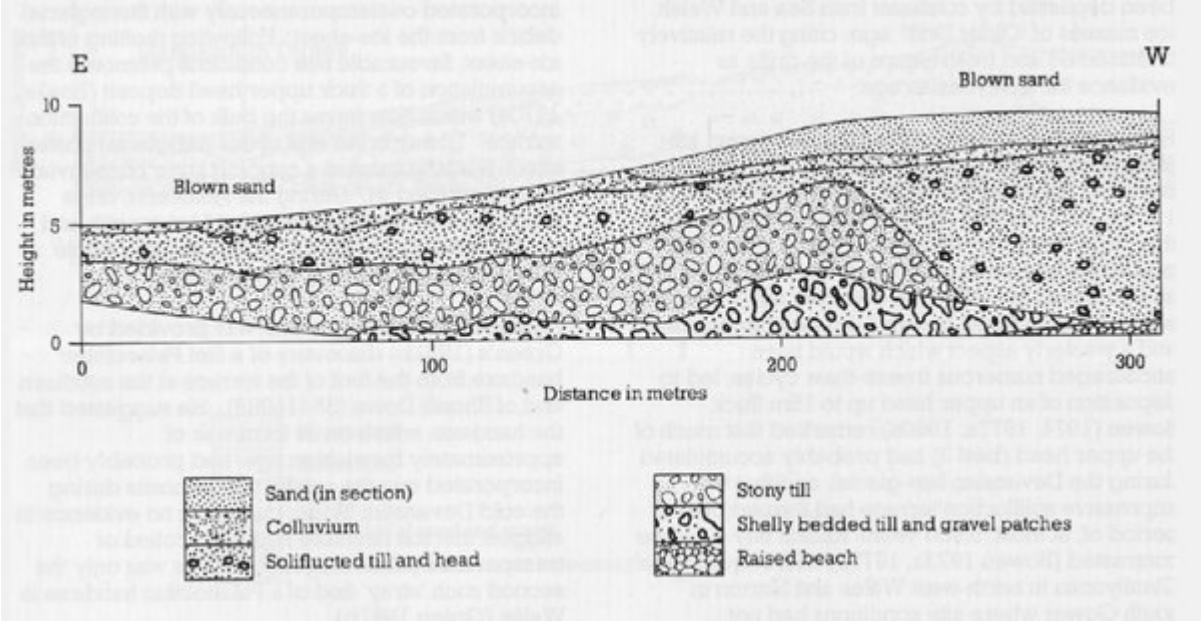
(Figure 6) Quaternary sequence at Eastern Slade and Western Slade (after Bowen and Henry 1984)



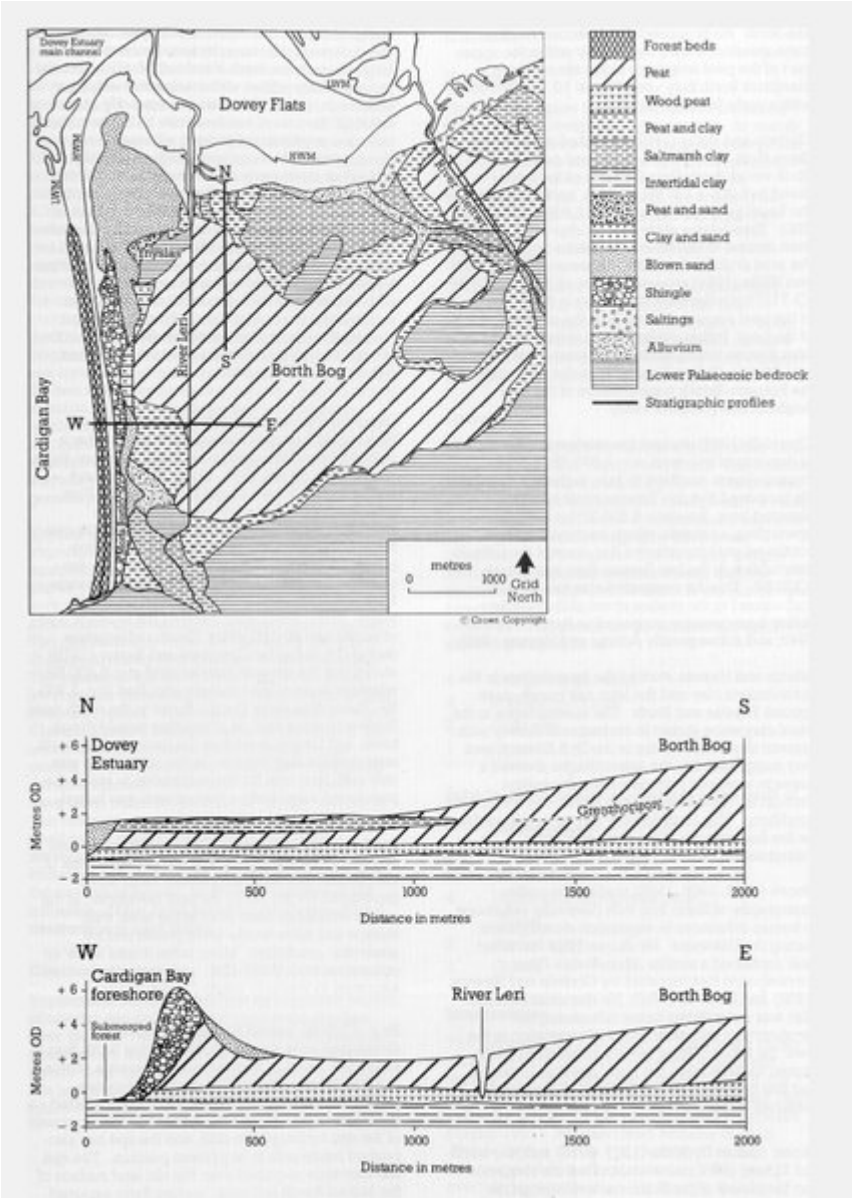
(Figure 7) Quaternary sequence at Horton (after Bowen and Henry 1984)



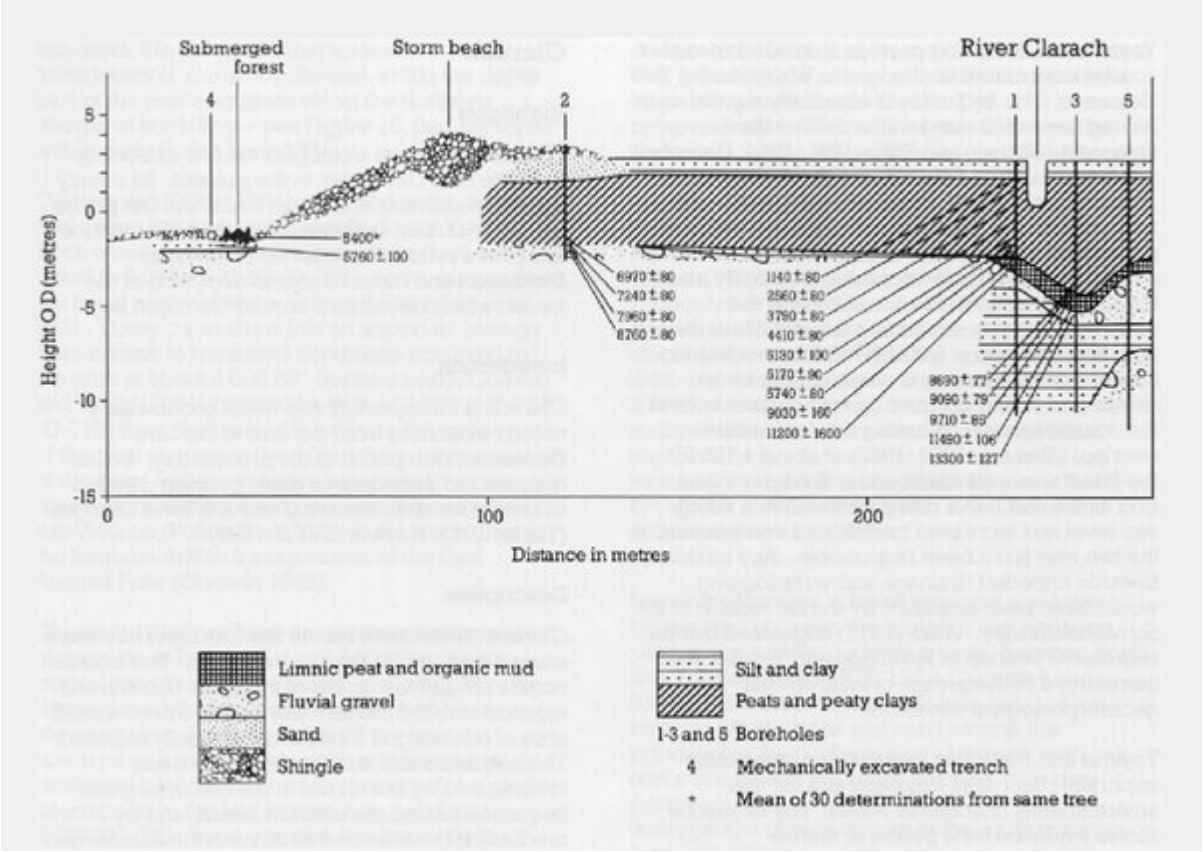
(Figure 8) Quaternary sequence at Rhosili Bay (after Campbell 1984)



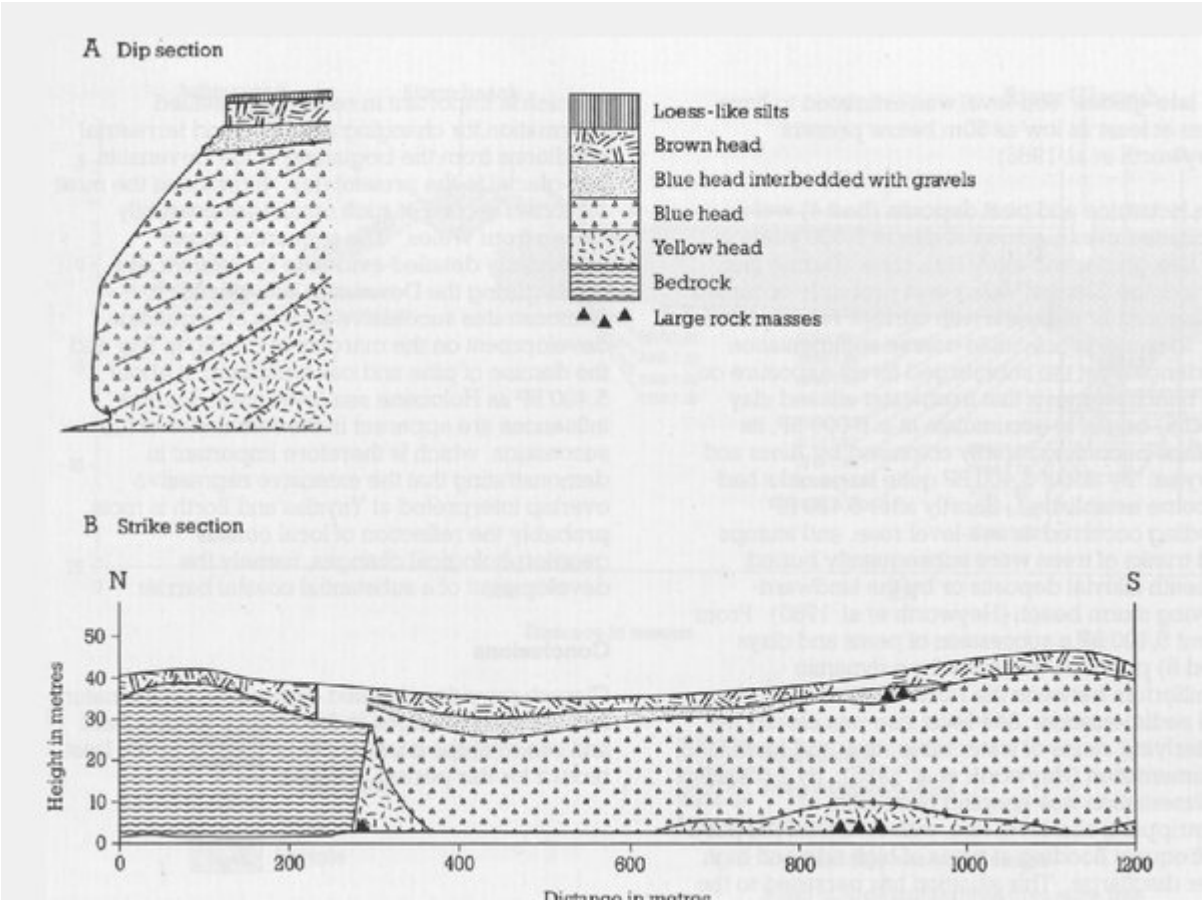
(Figure 9) Quaternary sequence at Broughton Bay (after Campbell et al. 1982)



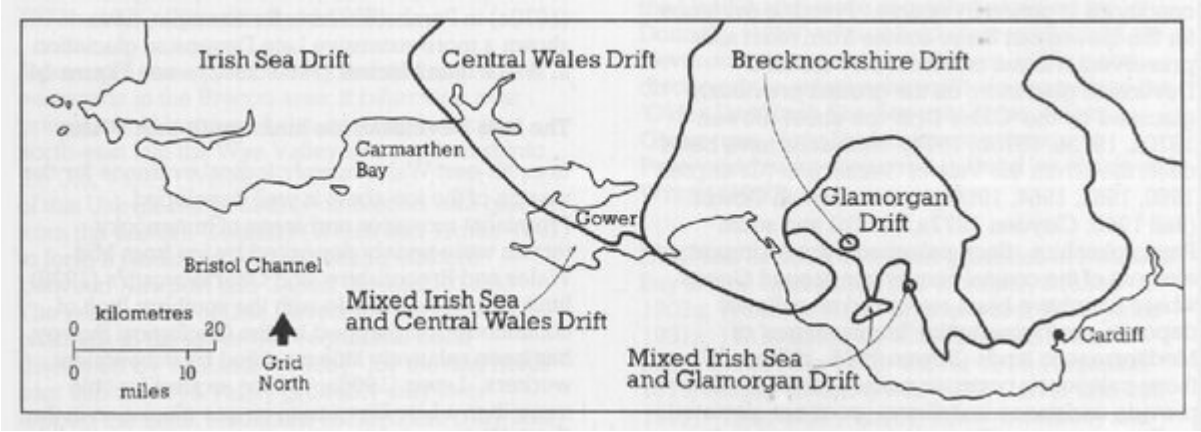
(Figure 10) Quaternary deposits at Ynyslas and Borth Bog (after Godwin 1943)



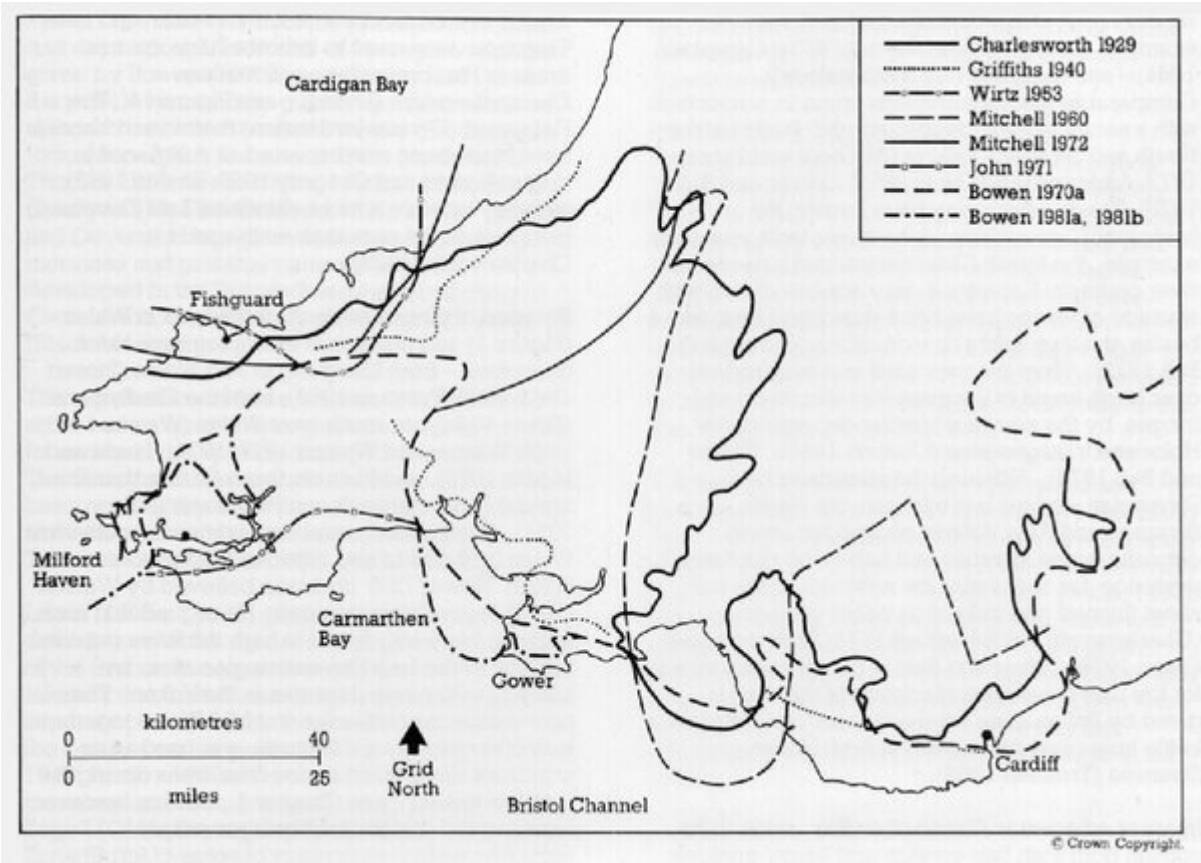
(Figure 11) Quaternary sequence at Clarach (from Heyworth et al. 1985)



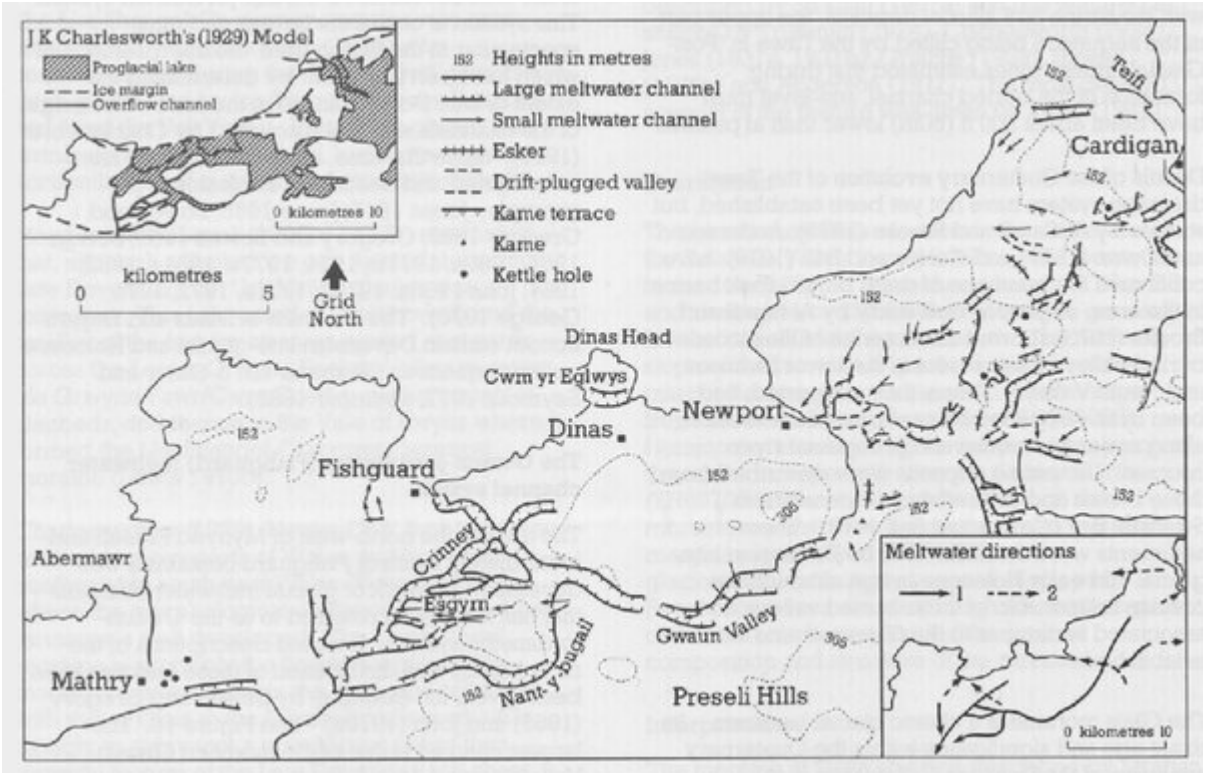
(Figure 12) Pleistocene sequence at Morfa-bychan (after Watson and Watson 1967)



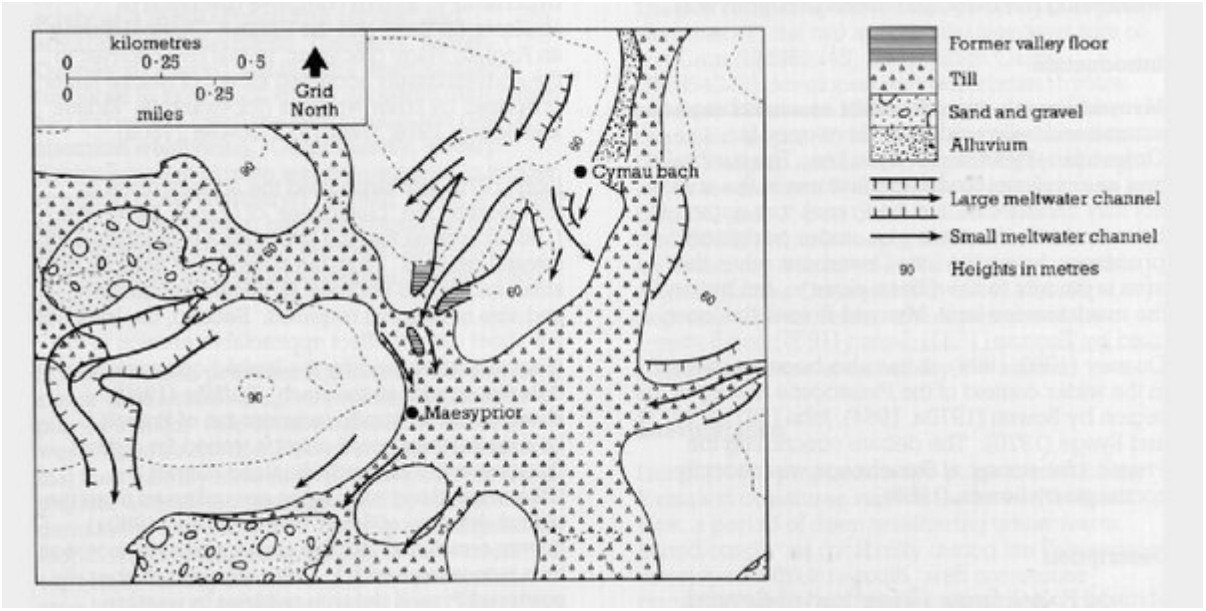
(Figure 13) Drift provinces of South Wales (from Bowen 1970a)



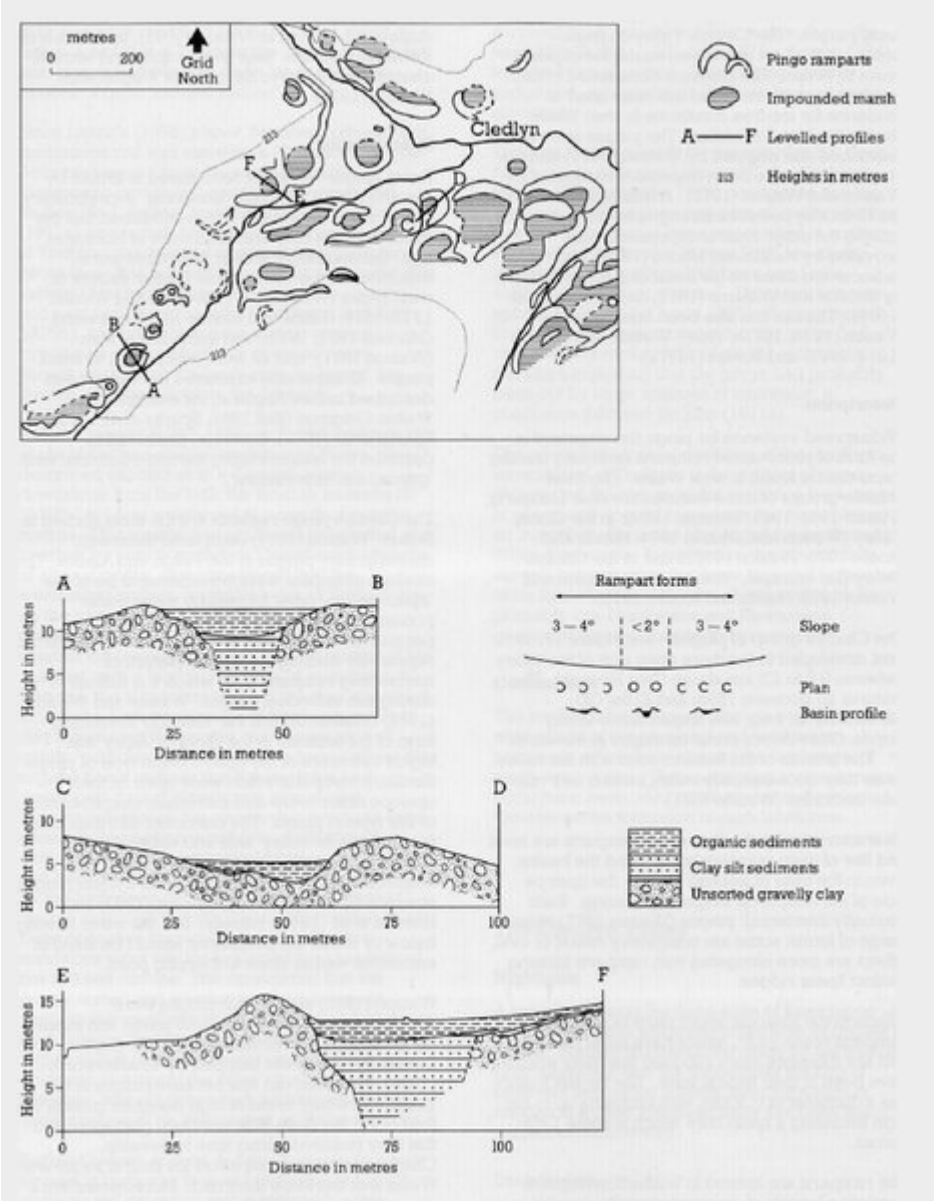
(Figure 14) Some suggested Late Devensian ice limits in South Wales (from Bowen and Henry 1984; Campbell 1984)



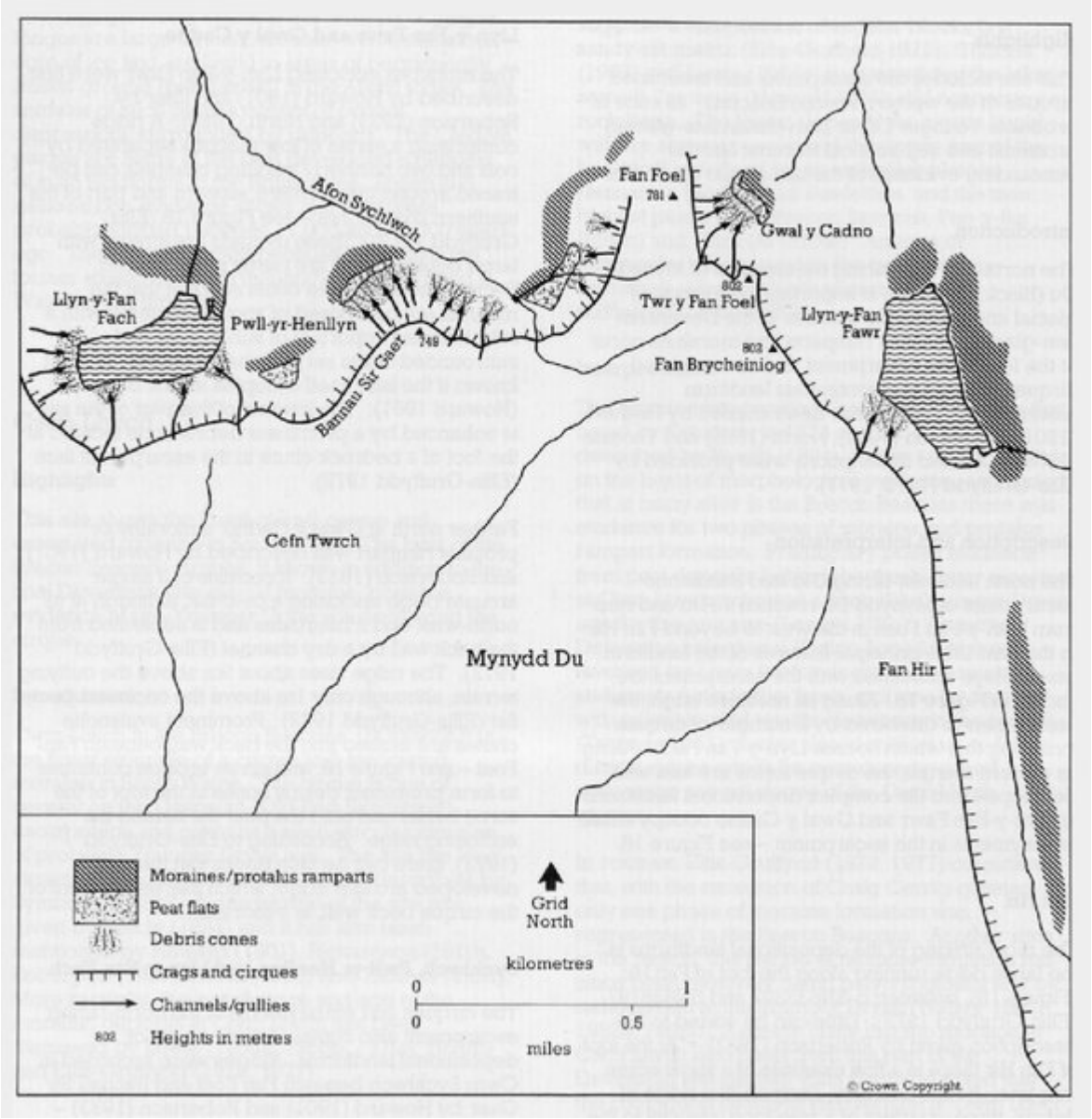
(Figure 15) The Gwaun–Jordanston meltwater channel system (from Bowen and Henry 1984)



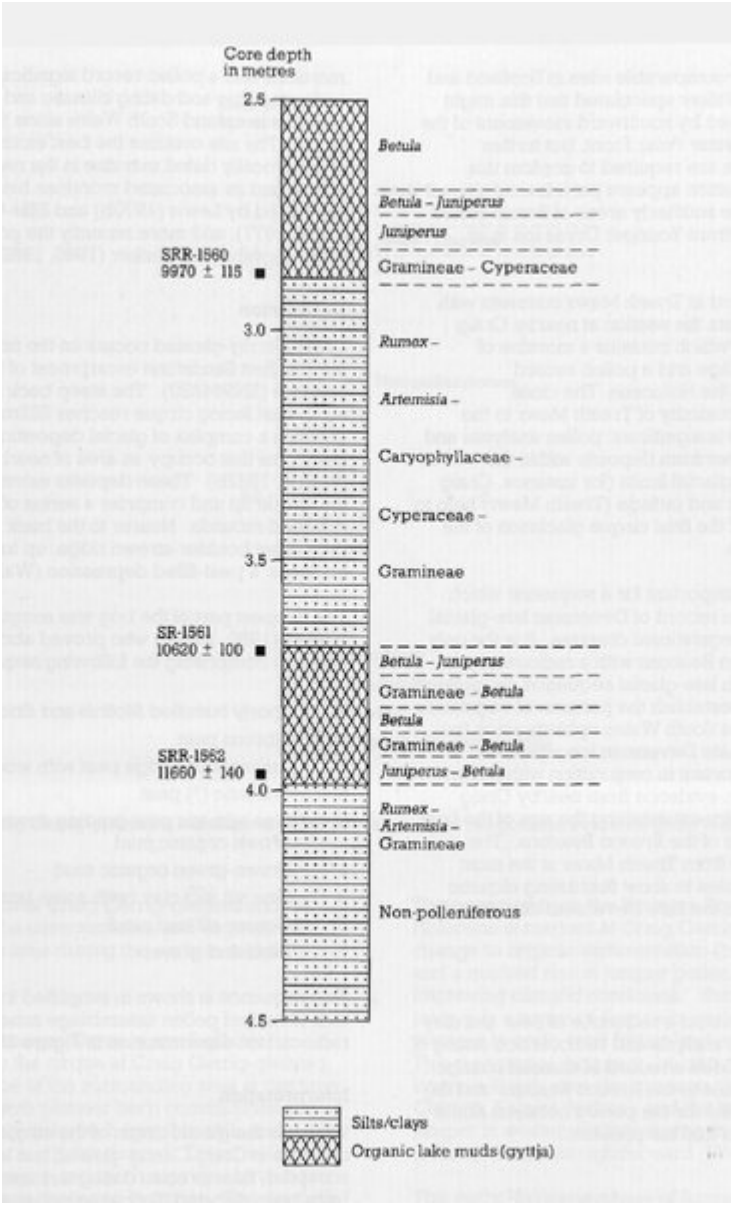
(Figure 16) The Maesyprior meltwater channel system (after Bowen 1970a)



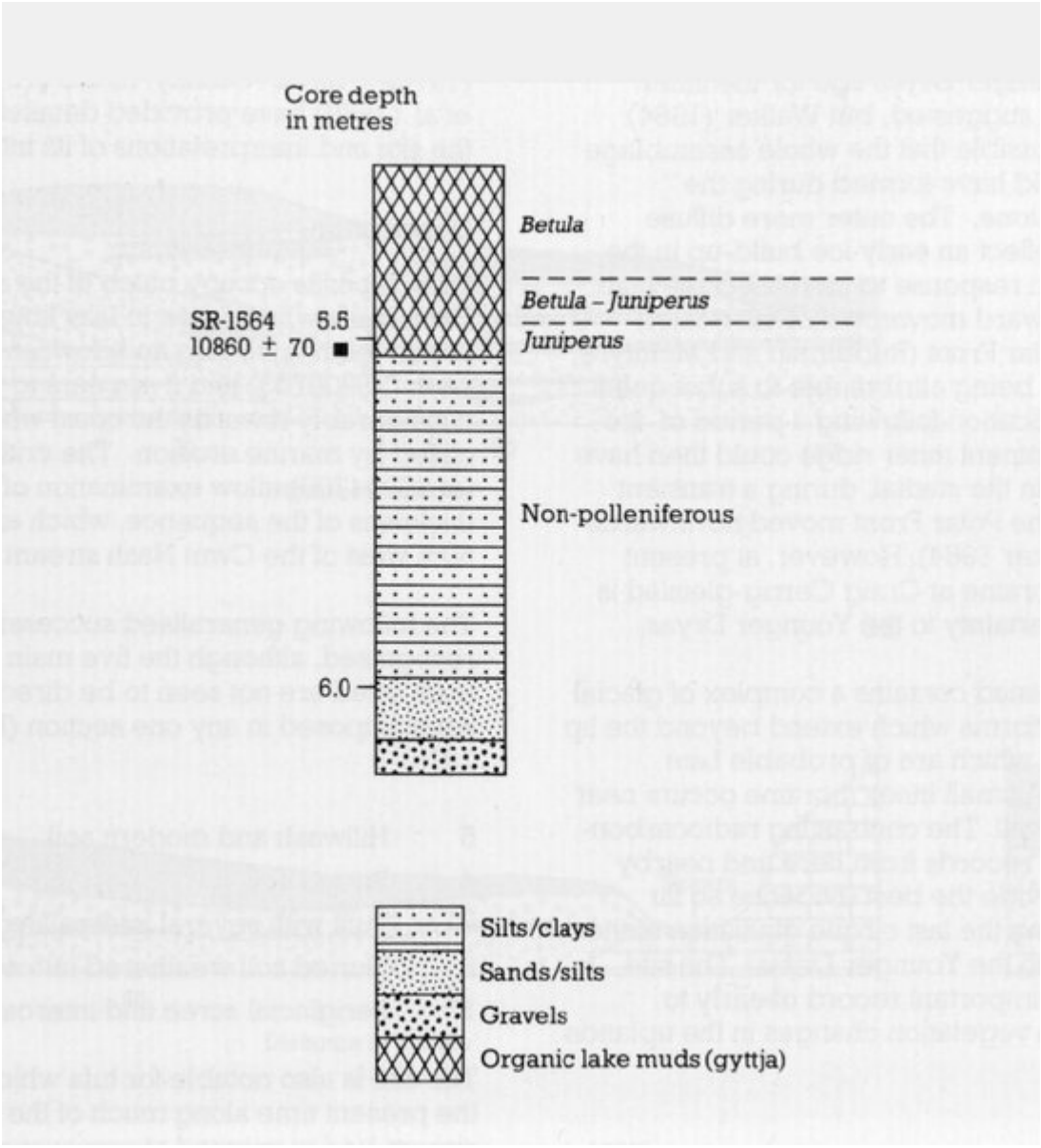
(Figure 17) The Cledlyn Valley pingos (after Watson 1971; Watson and Watson 1972)



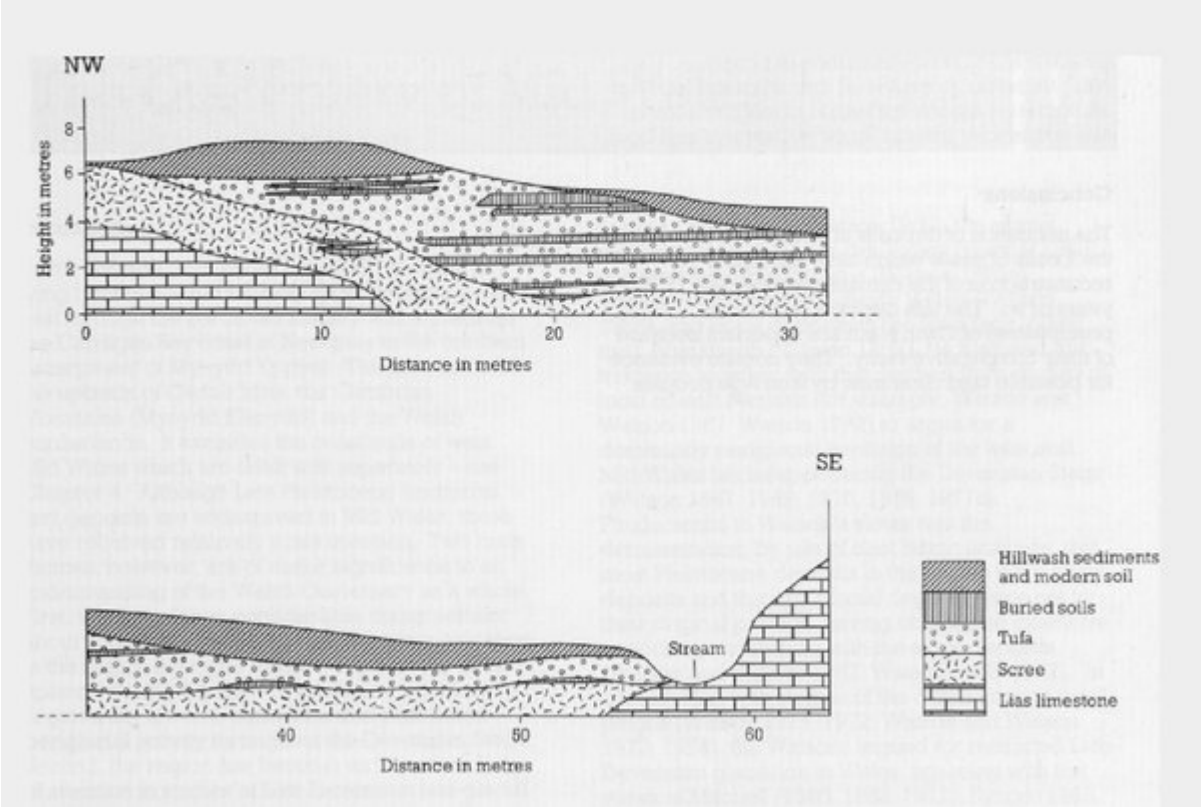
(Figure 18) Mynydd Du: principal landforms (after Ellis-Gruffydd 1972; Statham 1976)



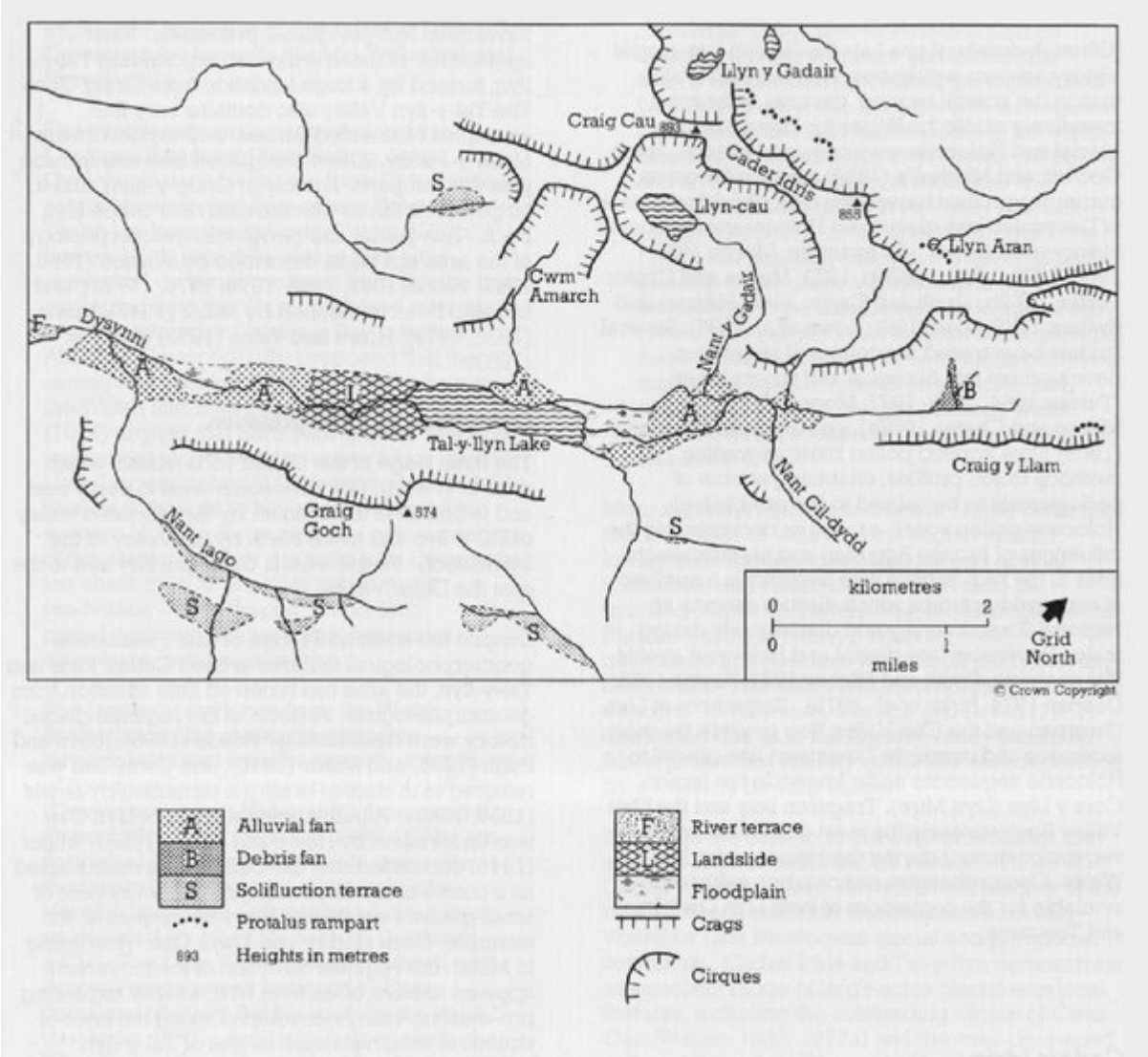
(Figure 19) Traeth Mawr: a summary of pollen, lithological and radiocarbon evidence (from Walker 1984)



(Figure 20) Craig Cerrig-gleisiad: a summary of pollen, lithological and radiocarbon evidence (from Walker 1984)



(Figure 21) Quaternary sequence at Cwm Nash (after Evans et al. 1978)



(Figure 22) Cadair Idris: principal landforms (after Watson 1977a)

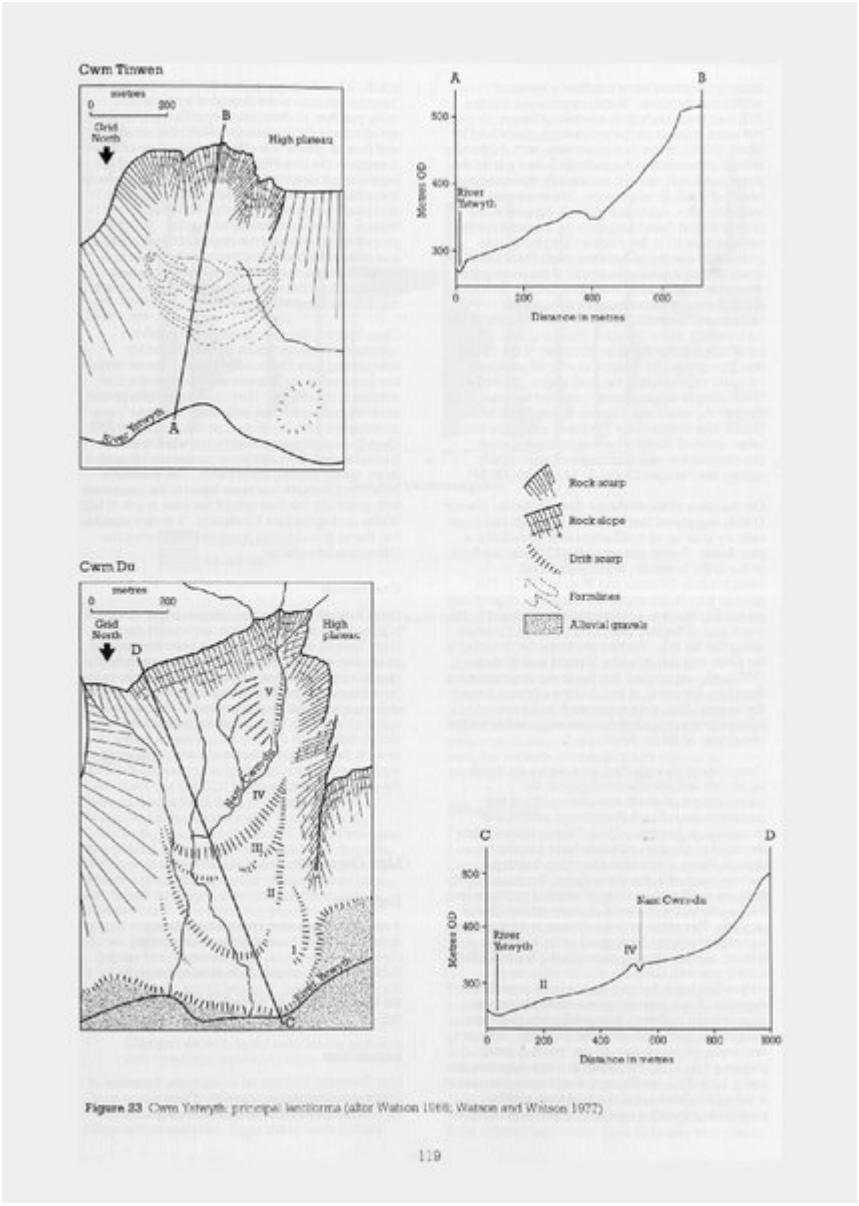
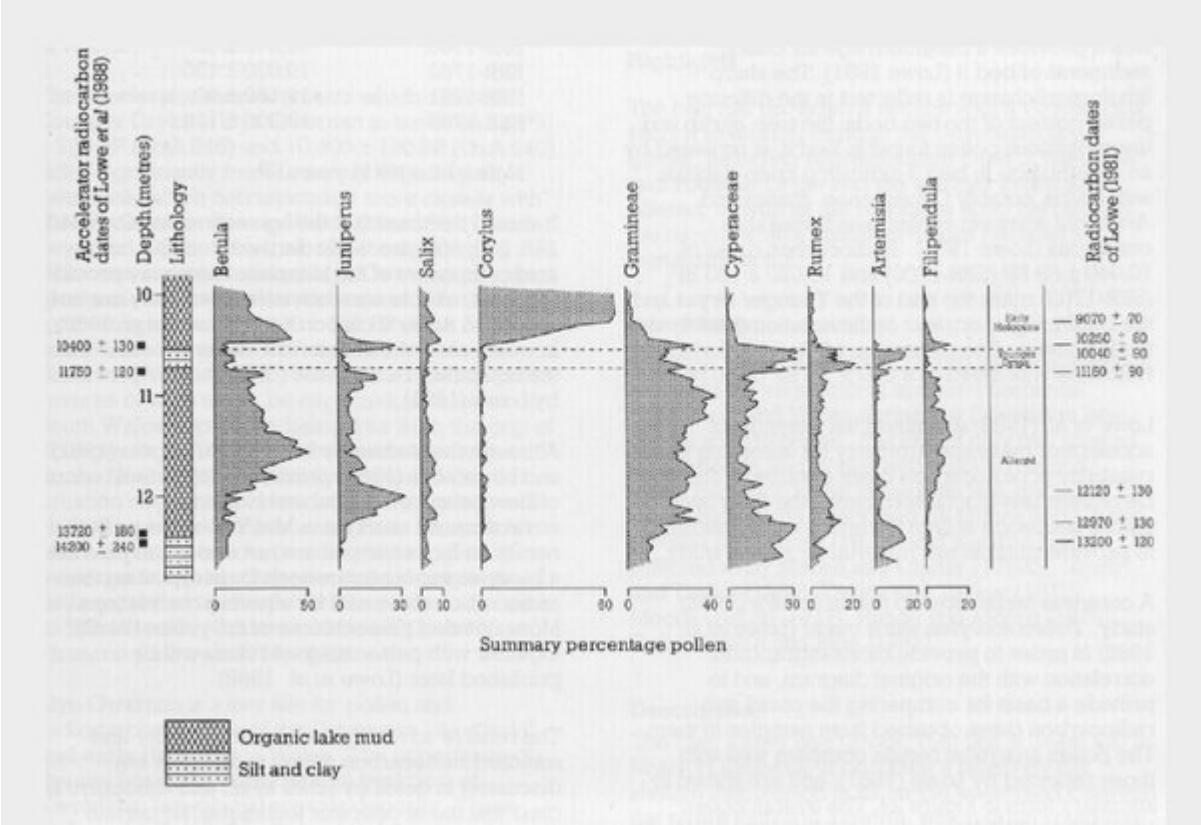
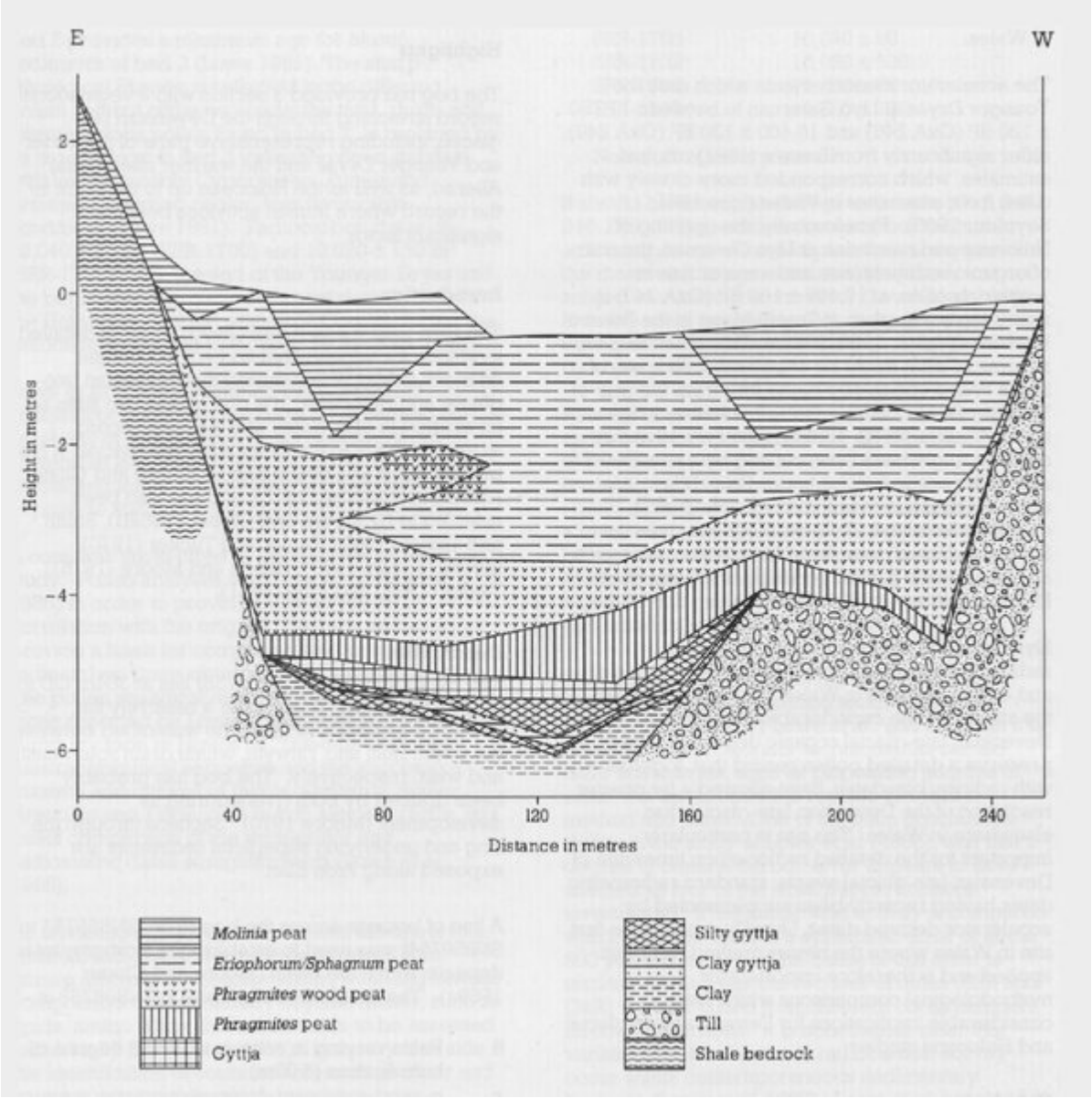


Figure 23 Cwm Ystwyth: principal landforms (after Watson 1966; Watson and Watson 1977)

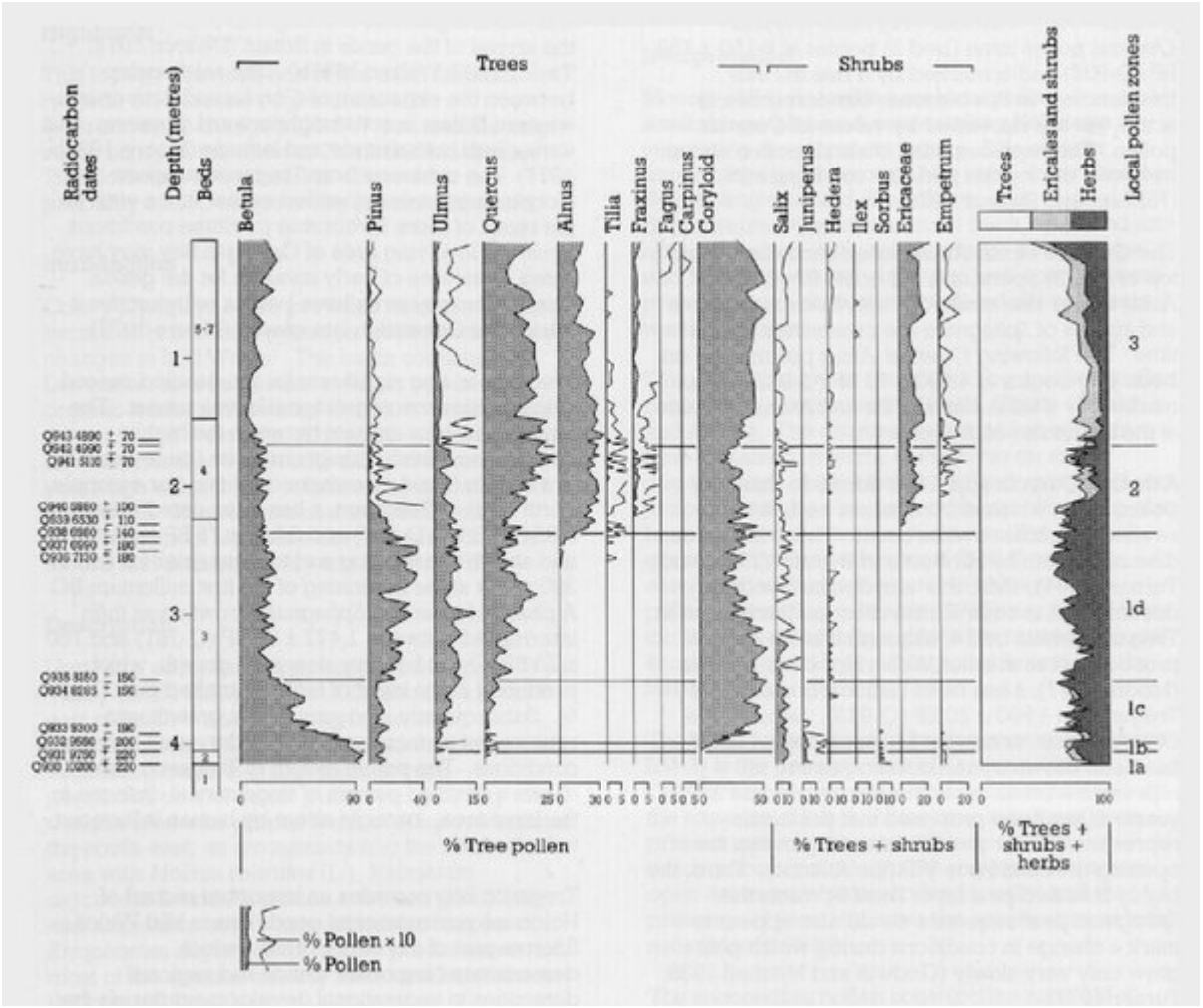
(Figure 23) Cwm Ystwyth: principal landforms (after Watson 1966; Watson and Watson 1977)



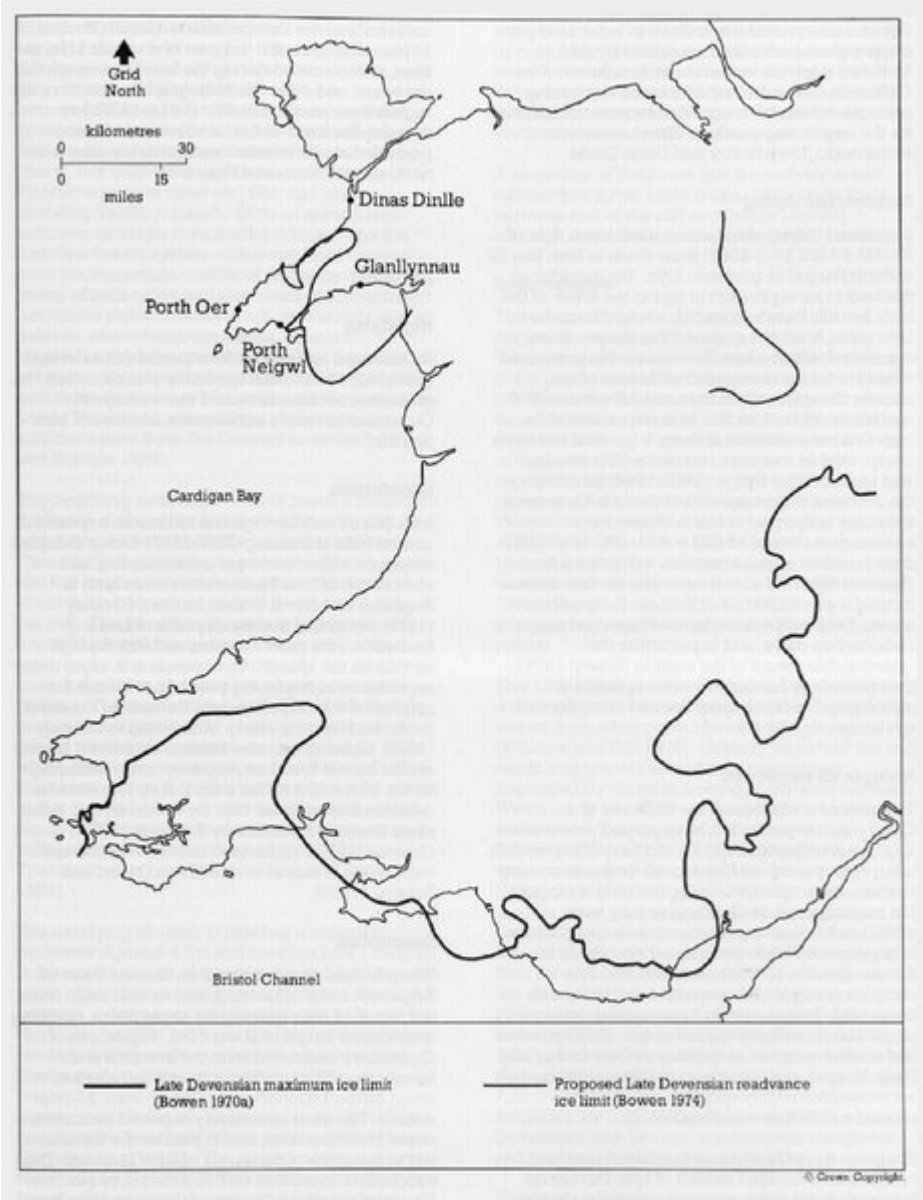
(Figure 24) Llyn Gwernan: a summary of pollen, lithological and radiocarbon evidence (from Lowe et al. 1988)



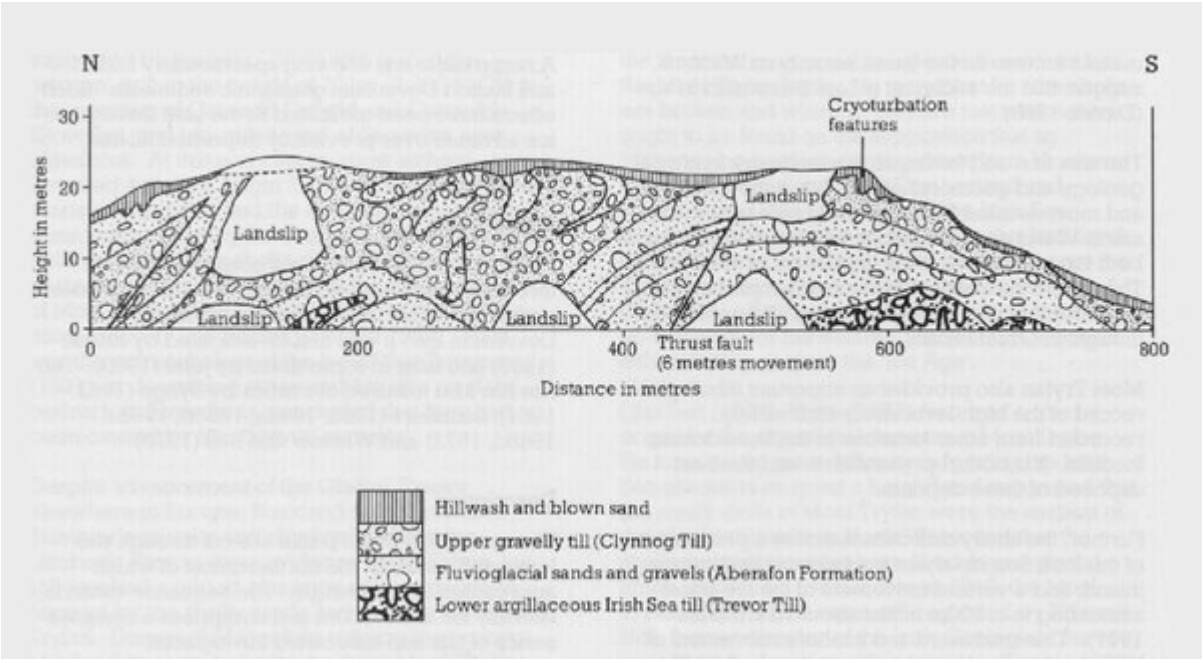
(Figure 25) Elan Valley Bog: Devensian late-glacial and Holocene sequence (from Moore and Chater 1969a)



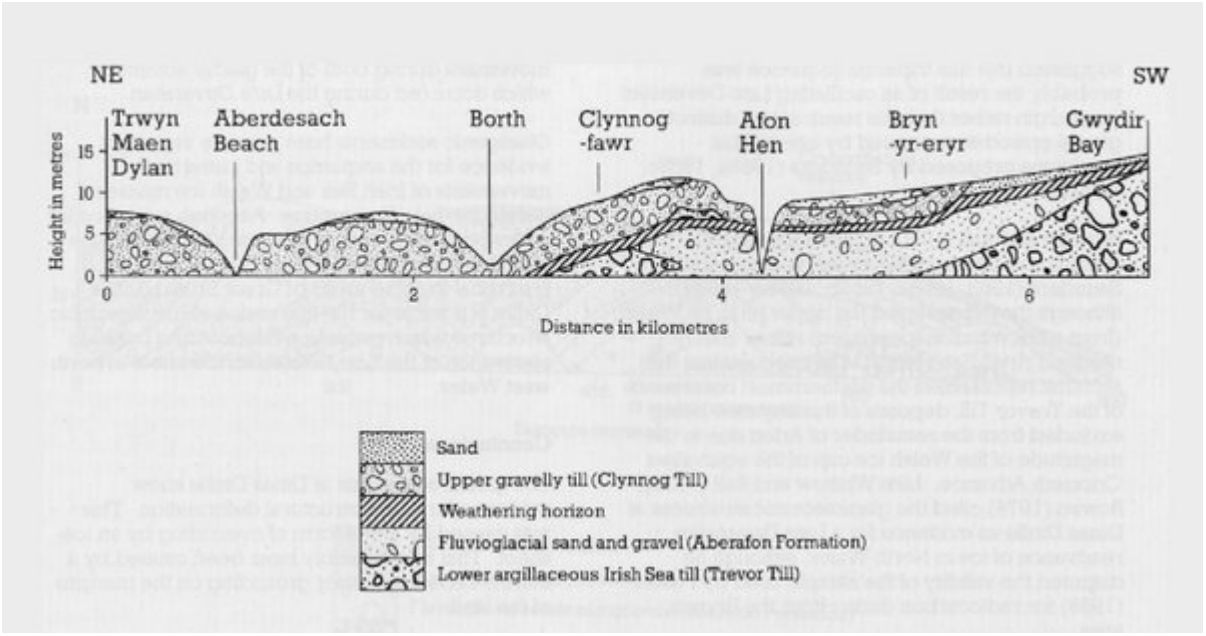
(Figure 26) Tregaron Bog: a summary of pollen, lithological and radiocarbon evidence (from Hibbert and Switsur 1976)



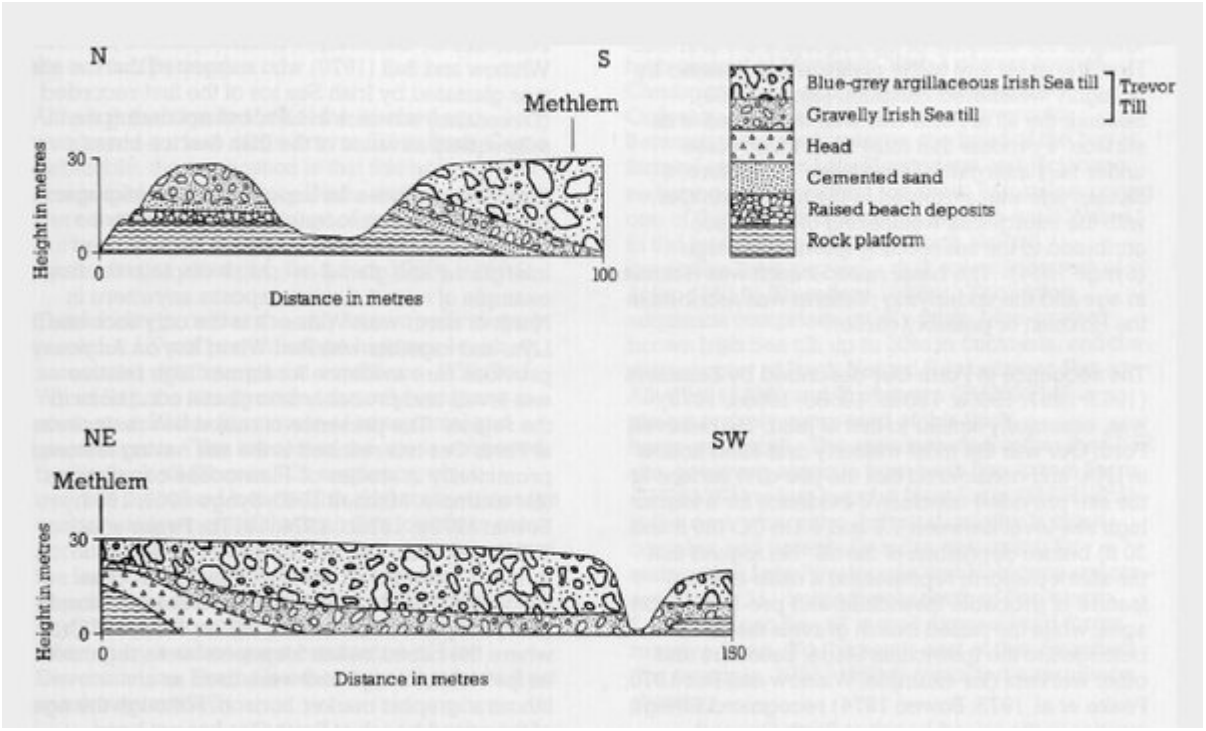
(Figure 27) Late Devensian and Late Devensian readvance ice limits (from Bowen 1974, 1977b)



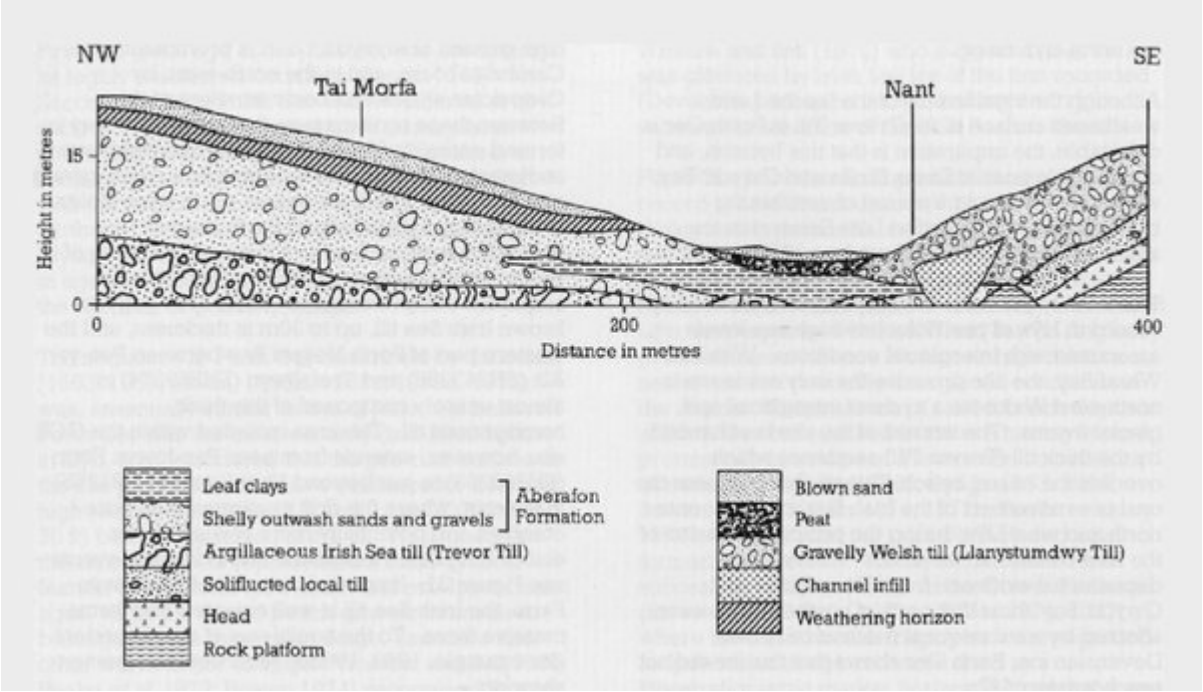
(Figure 28) Quaternary sequence at Dinas Dinlle (from Whittow and Ball 1970)



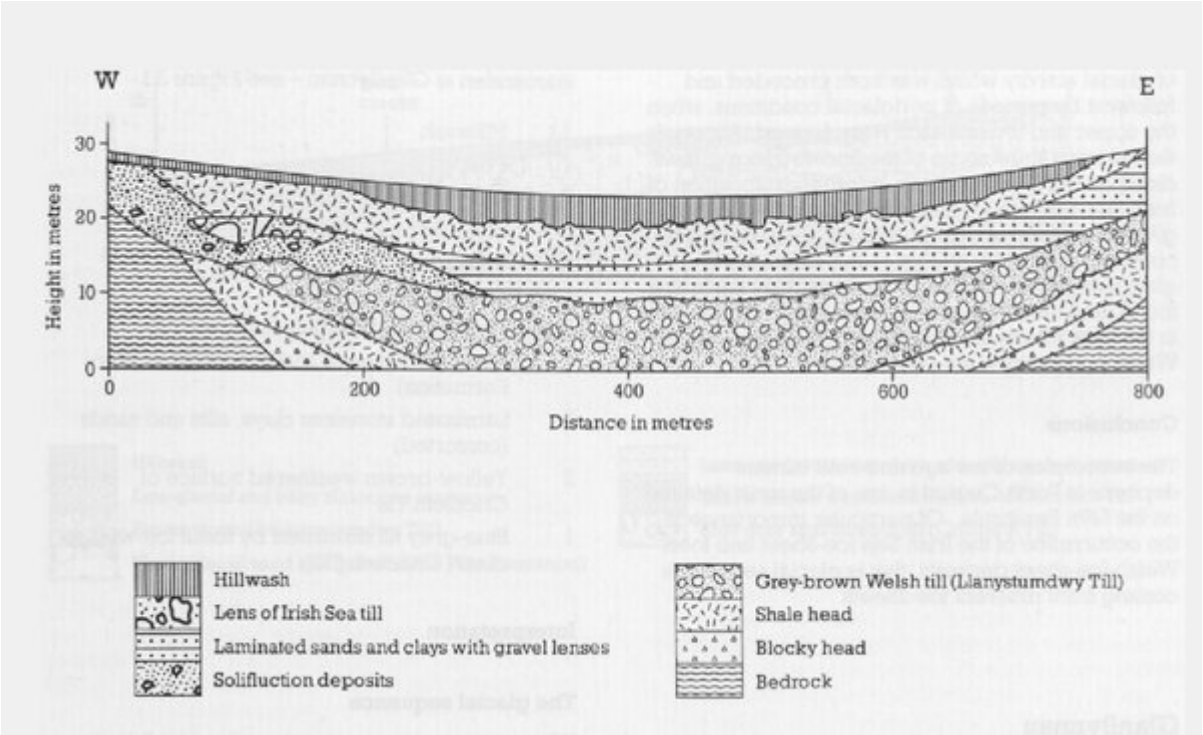
(Figure 29) Pleistocene sequence at Gwydir Bay (from Saunders 1968d)



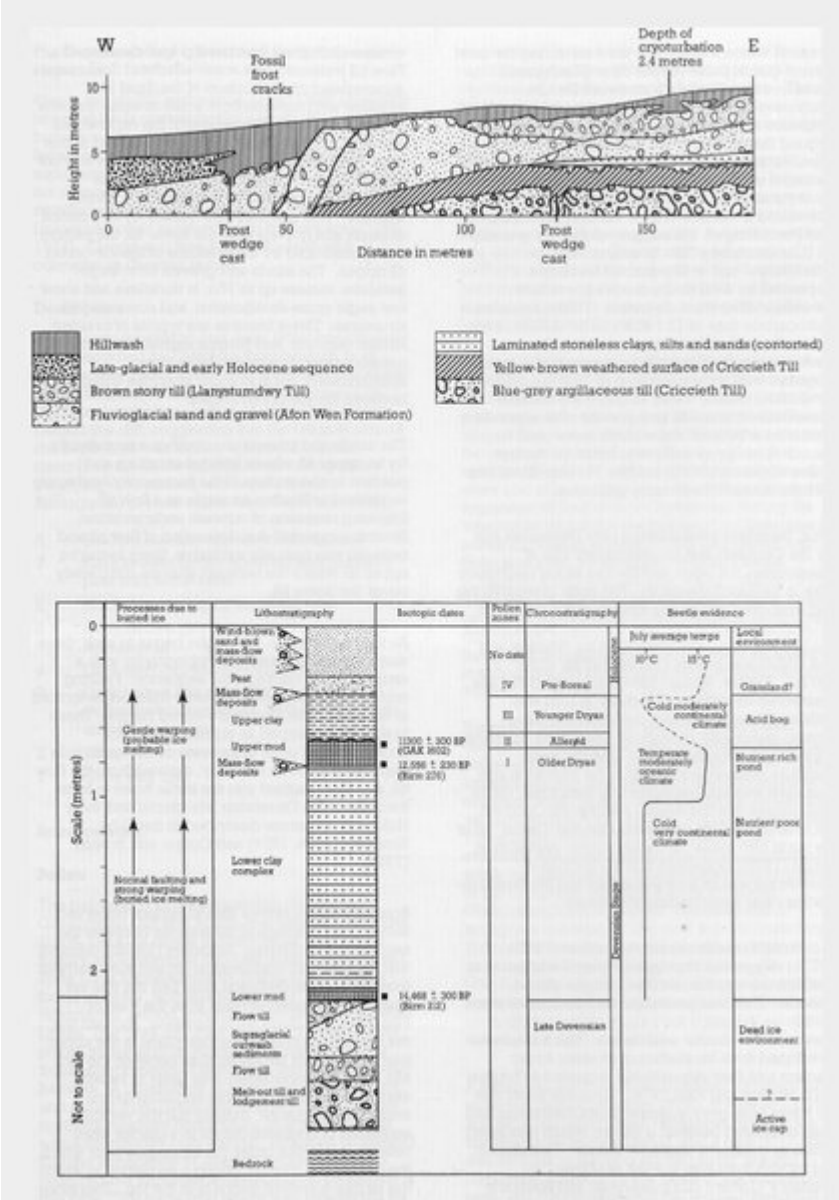
(Figure 30) Pleistocene sequence at Porth Oer (from Saunders 1968d)



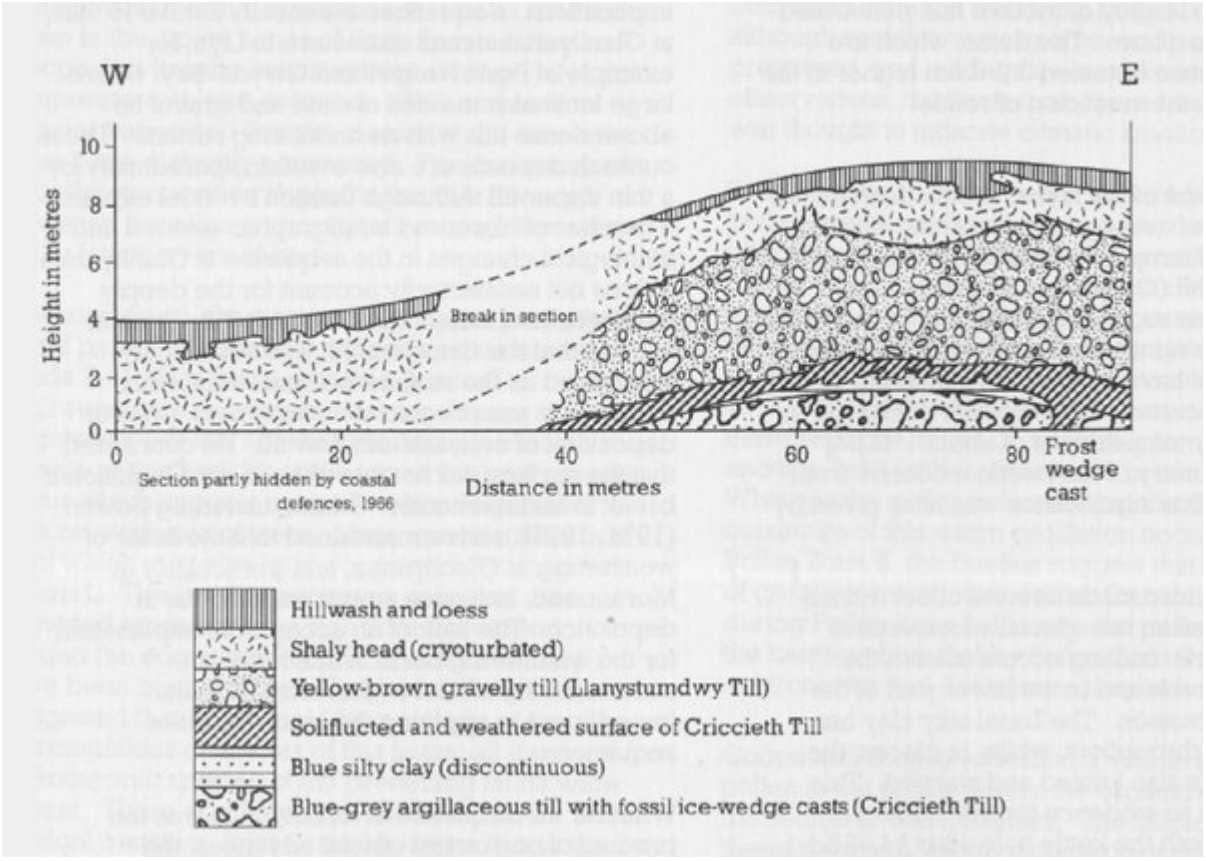
(Figure 31) Quaternary sequence at Porth Neigwl (from Saunders 1968d)



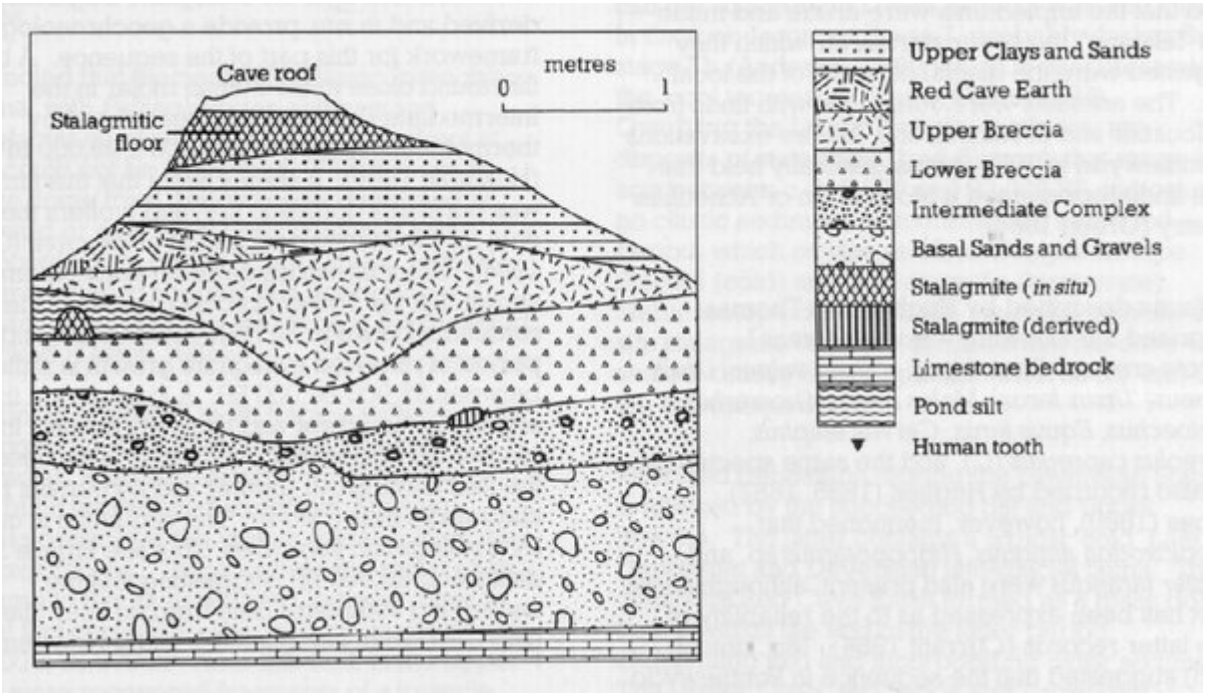
(Figure 32) Quaternary sequence at Porth Ceiriad (from Whittow and Ball 1970)



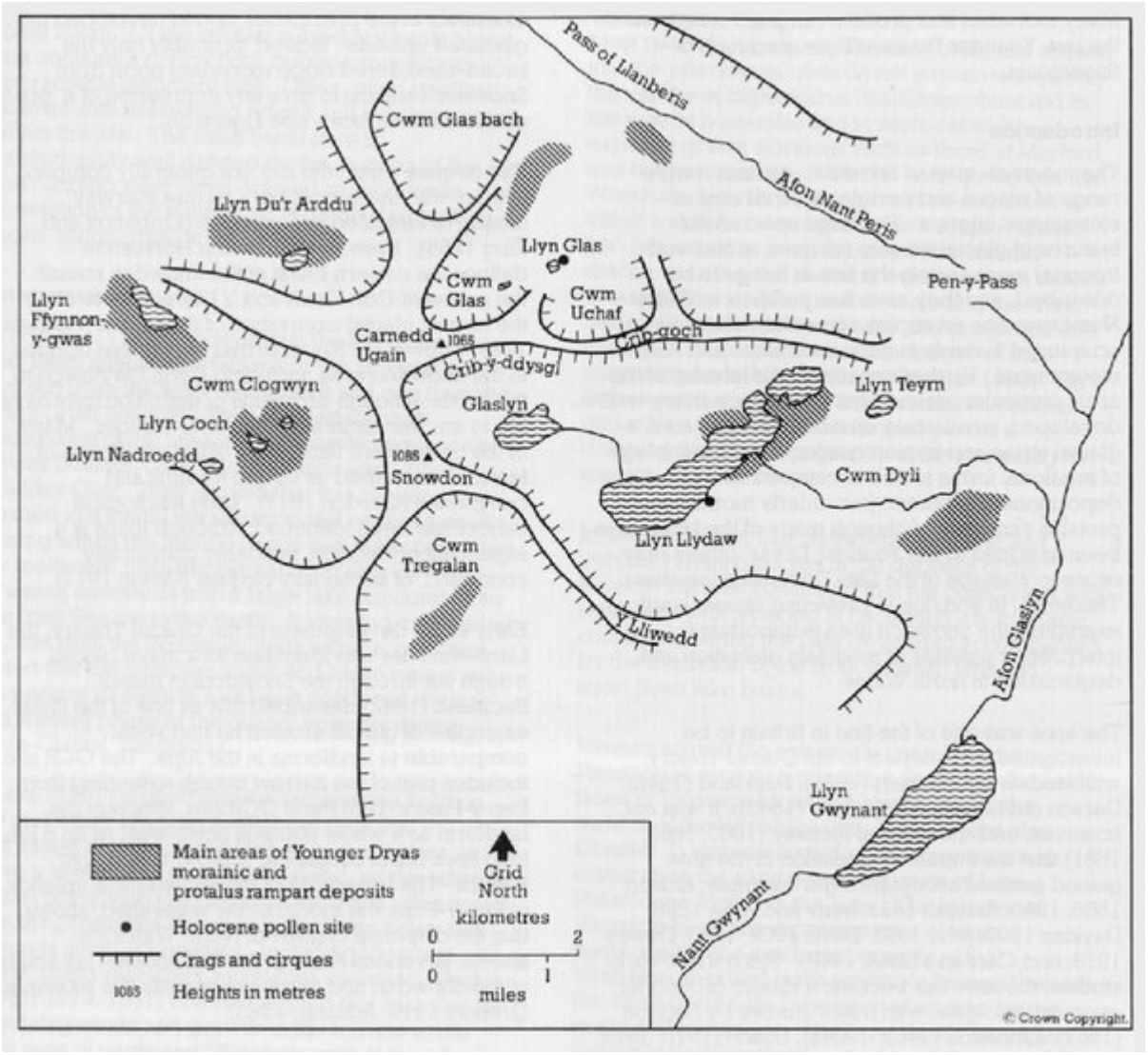
(Figure 33) Quaternary sequence at Glanllynnau (after Whittow and Ball 1970; Boulton 1977a)



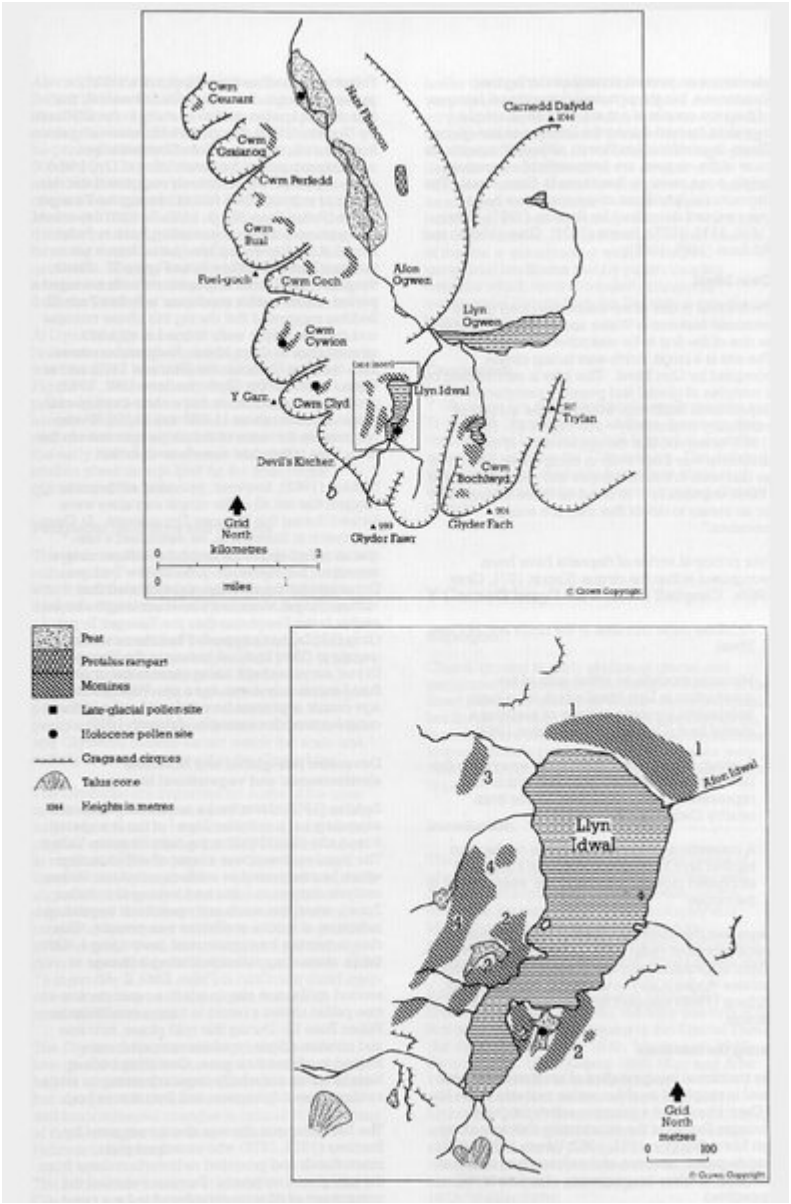
(Figure 34) Quatemary sequence at Morannedd (from Whittow and Ball 1970)



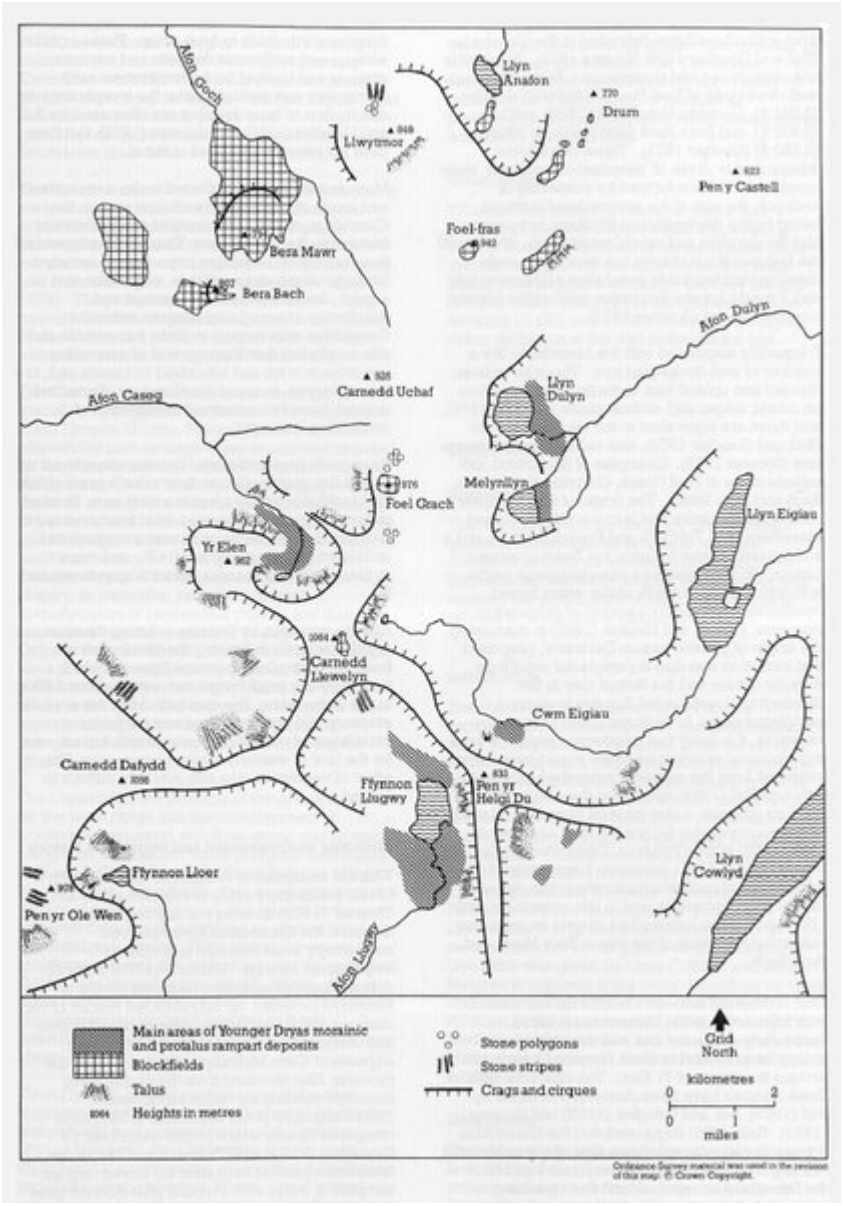
(Figure 35) Quaternary sequence at Pontnewydd (after Green et al. 1981)



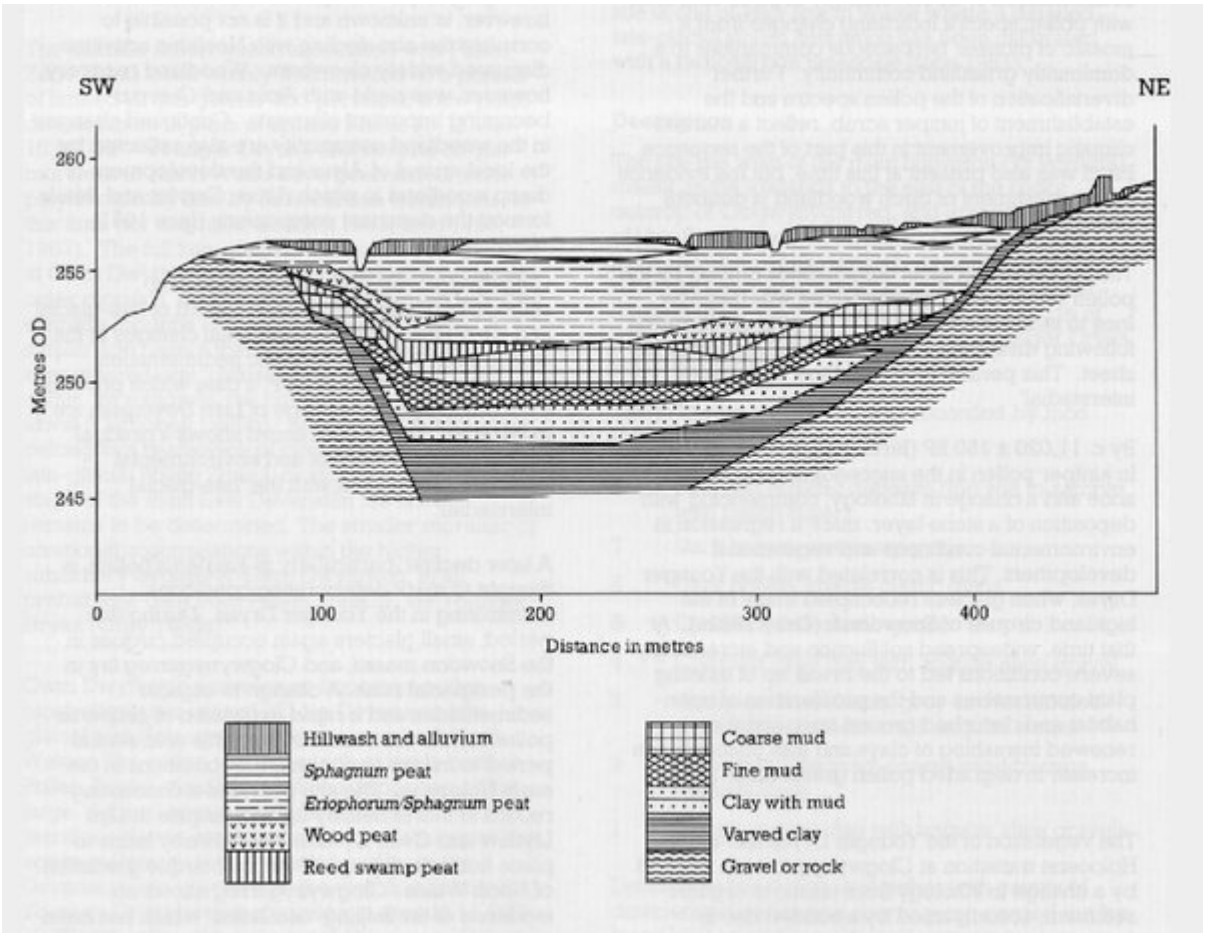
(Figure 36) Snowdon (Yr Wyddfa): principal landforms



(Figure 37) Y Glyderau: principal landforms (after Campbell 1985b)



(Figure 38) Y Carneddau: principal landforms



(Figure 39) Devensian late-glacial and Holocene sequence at Cors Geuallt (after Crabtree 1972)

A Pleistocene correlation chart for Wales

Irish Sea Province	Welsh Province	South Gower	Gower Caves	Chronostratigraphy		Oxygen Isotope Stage	Age (in thousands of years BP)
loess head solifluction deposits	North Wales, Mid Wales and Brecon Beacons cirque moraines and protalus ramparts	Horton loess	Cat Hole breccia	Younger Dryas	Late Devensian		10
Cwm yr Eglwys peat	Traeth Mawr peat			Allerød			11
	Glanllynnau basal clay		Bacon Hole stalagmite	Older Dryas		2	12 13
Abermawr Till, Trevor Till, Banc-y-Warren sands and gravels, Moel Tryfan shelly drift	Langland Bay and Broughton Bay Tills, Llanystumdwy Till	head	Minchin Hole Outer Talus Cone, Bacon Hole breccia				14 17
remanié molluscan fauna in overlying beds	Glanllynnau: weathered surface and frost cracking of Criccieth Till?		Long Hole breccia	Middle Devensian		3	24 59
	Criccieth Till, Langland Bay head	Western Slade redeposited glacial sediments	Bacon Hole breccia	Early Devensian		4	71
Red Wharf Bay, Porth Oer, Abermawr lower heads			Bacon Hole stalagmite			5a	80
		Colluvial beds	Bacon Hole temperate fauna			5b 5c	105
						5d	122
Red Wharf Bay, Porth Oer and Poppit raised beaches?	Langland and Broughton raised beaches	Hunts Bay Beach	Minchin Hole Outer Beach	Ipswichian (Penultimate D/L Stage)		5e	128
		Horton head?	Minchin Hole Lower Red Cave Earth			6	186
Pontnewydd Cave Intermediate Complex		Horton (Upper), Butterslade and Overton raised beaches	Minchin Hole Inner Beach	Minchin Hole D/L Stage		7	245
				Hoxnian Stage ?		8	303
		Hunts Bay Beach marine fauna				9 10	335
		Pavilland Till		Anglian		11 12	423 478
Kenn Freshwater Beds				Cromerian		13	524
						14 15	620
West Angle and Kenn Tills, South Wales Irish Sea drifts?		Irish Sea remanié drifts		Elster 1		16 17	659

(Table 1) Geochronology (age) of Oxygen Isotope Stage boundaries is from Martinson et al. (1987) [back to stage 7], and Imbrie et al. (1984). Specific events are radiocarbon dated at 10, 11, 12, 13, 14 and 17,000 years BP (details in text). The Pennard and Minchin Hole D/L Stages are from Bowen et al. (1985). For chronostratigraphic correlations see Bowen and Sykes (1988), Behre (1989) and Bowen et al. (1989). Sites outside Wales are correlated with Oxygen Isotope Stages as follows — Upton Warren, St Germain II and Odderade (Sub-stage 5a), Chelford, BrOrup and St Germain I (Sub-stage 5c) and Stanton Harcourt and Aveley (Stage 7).

Table 2 Gower chronology (T N George 1932)

9	Modern beach platform – coincident with Heatherslade Beach
8	Submerged forest (Late Neolithic)
7	Heatherslade Beach and platform (Early Neolithic)
6	Newer Drift glaciation – deposits present only along the eastern fringe of Gower, to the north of Mumbles Head (Magdalenian)
5	Cave deposits of Paviland and blown sand (Aurignacian – possibly latest Mousterian to Early Solutrean)
4	Older Drift glaciation and associated head deposits (Mousterian)
3	Blown sands and the *Neritoides* Beach, containing *Neritoides obtusata* (L.) and ossiferous breccia of Minchin Hole (Late Acheulian to Early Mousterian)
2	*Patella* Beach, containing *Patella vulgata* (L.) formed during a cold period – an interpretation based on erratics in the *Patella* Beach which George considered had been ice-rafted
1	Intense cliff erosion

(Table 2) Gower chronology (T N George 1932)

Sample No.	Age	Corrected Age	Stratigraphic significance
1978–801 :01	14,000 ± 2,000	13,000 ± 3,000	Broken block of surface stalagmite giving minimum age for Devensian fauna
:02	18,600 ± 1,999	12,800 ± 1,700	
1981–250	81,000 ± 18,000	–	Minimum age for the interglacial elements in Upper Cave Earth (bed 9)
1981–212 :01 (top)	129,000 ± 16,000	–	All are broken blocks of stalagmite floor incorporated into Shelly Sand (bed 6)
:02 (middle)	136,000 ± 23,000	125,000 ± 26,000	
:03 (bottom)	142,000 ± 27,000	129,000 ± 30,000	
1981–252 :02	116,000 ± 18,000	107,000 ± 21,000	This stalagmite probably formed on the underlying Sandy Cave earth (bed 5)
:01	122,000 ± 11,000	–	
Mean of last 5 determinations	127,000 +9,000 -8,000	122,000 ± 9,000	These dates relate to the main interglacial fauna and the last major Pleistocene marine transgression at the site

(Table 3) Uranium-series age determinations on stalagmite samples from Bacon Hole.