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Tables

(Table 3.1) Deformation sequences in the Lake District as interpreted by various authors; the last column shows the system adopted in the present volume.

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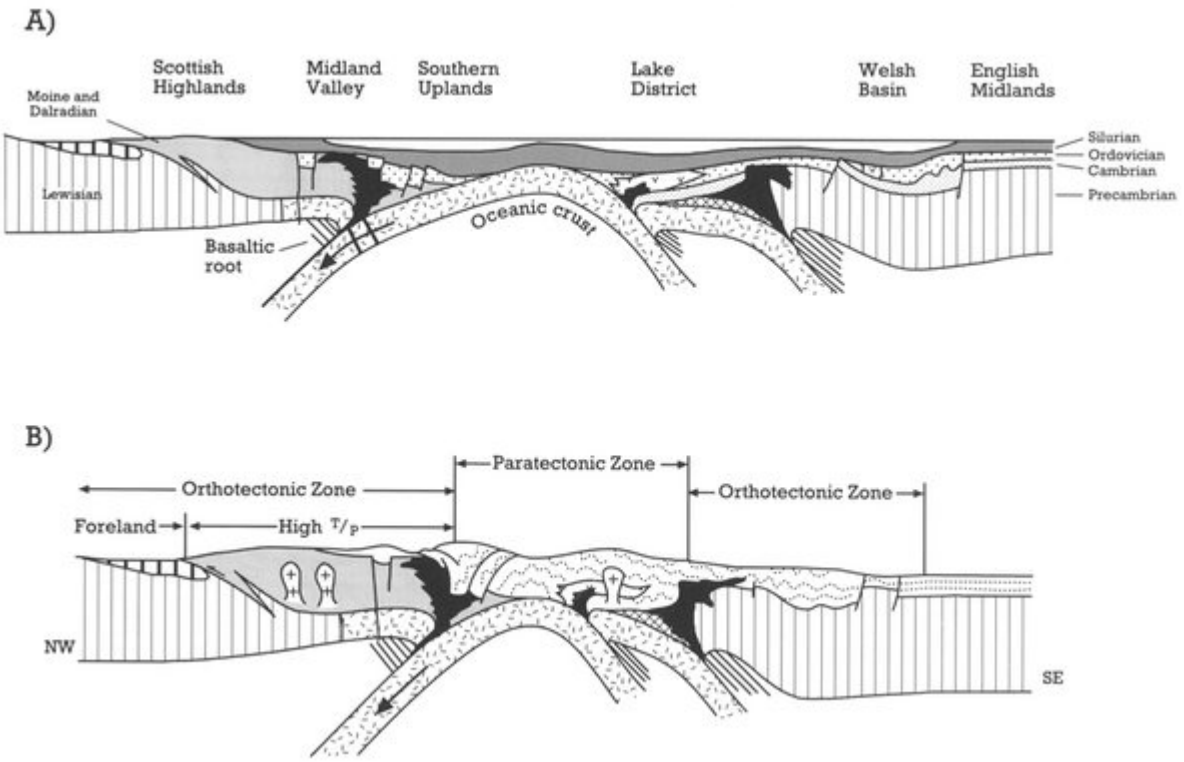

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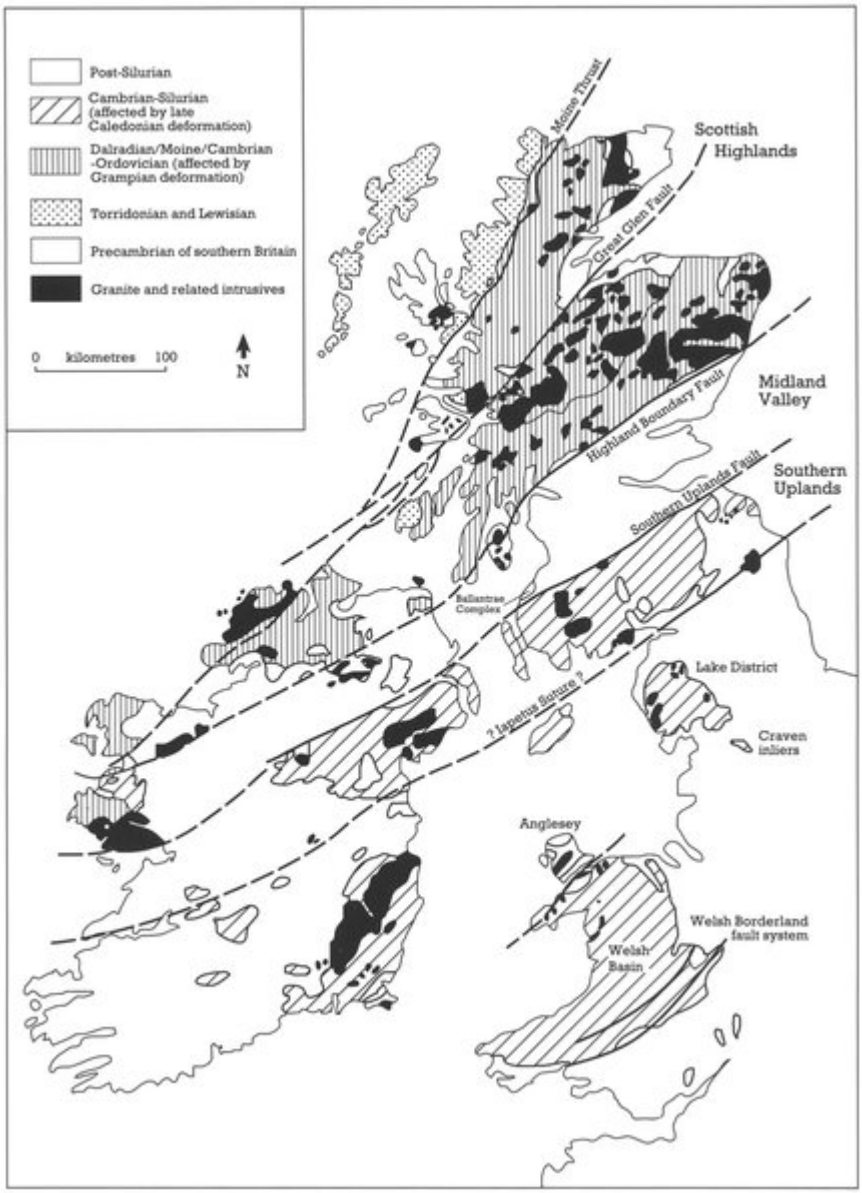

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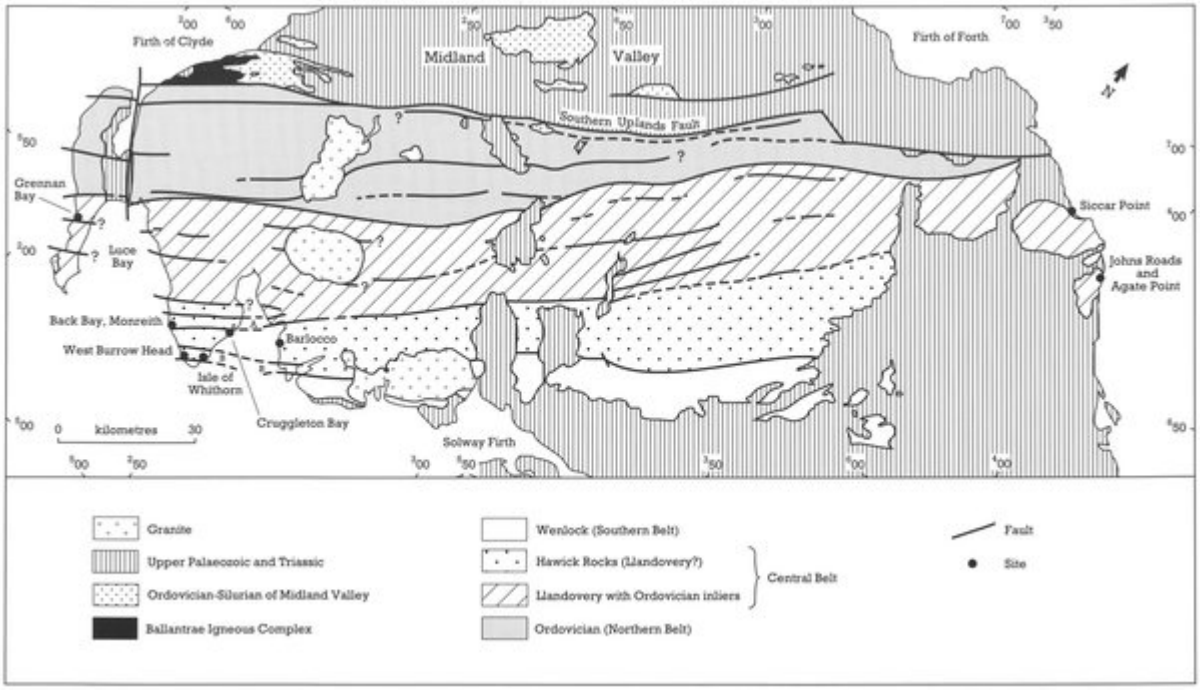

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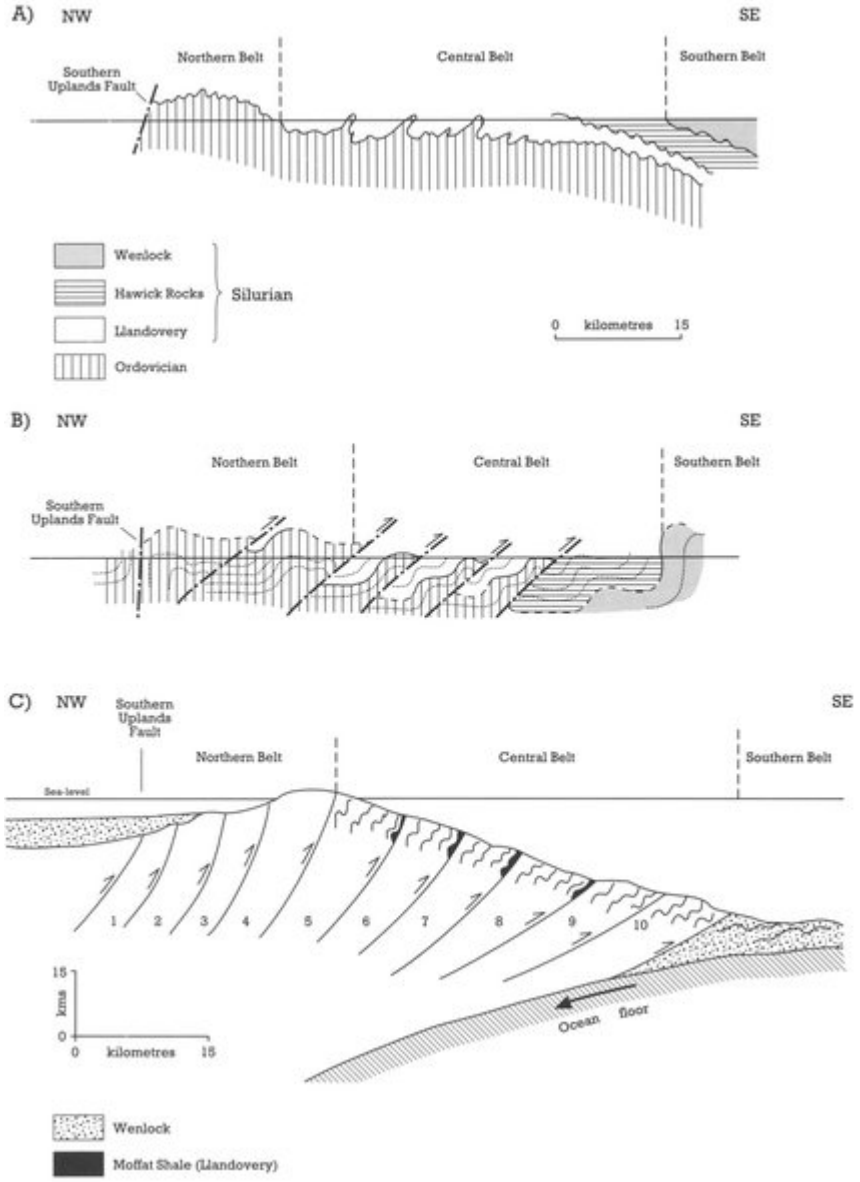

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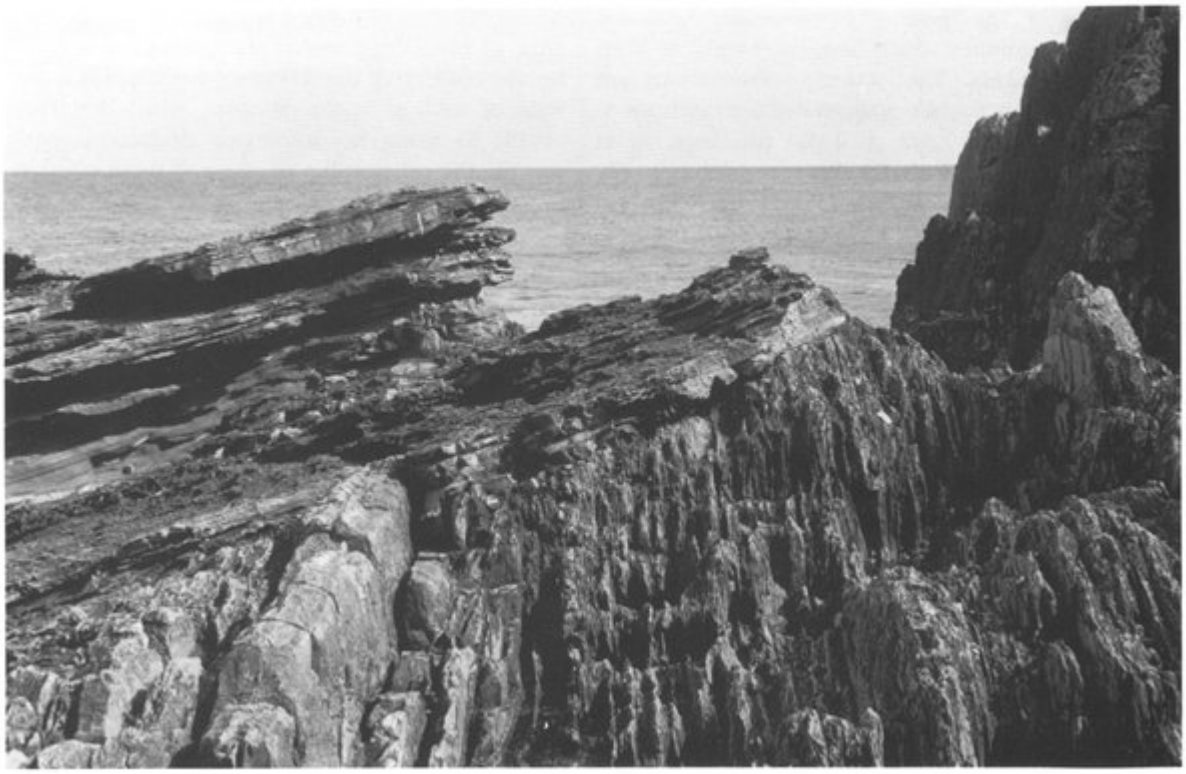

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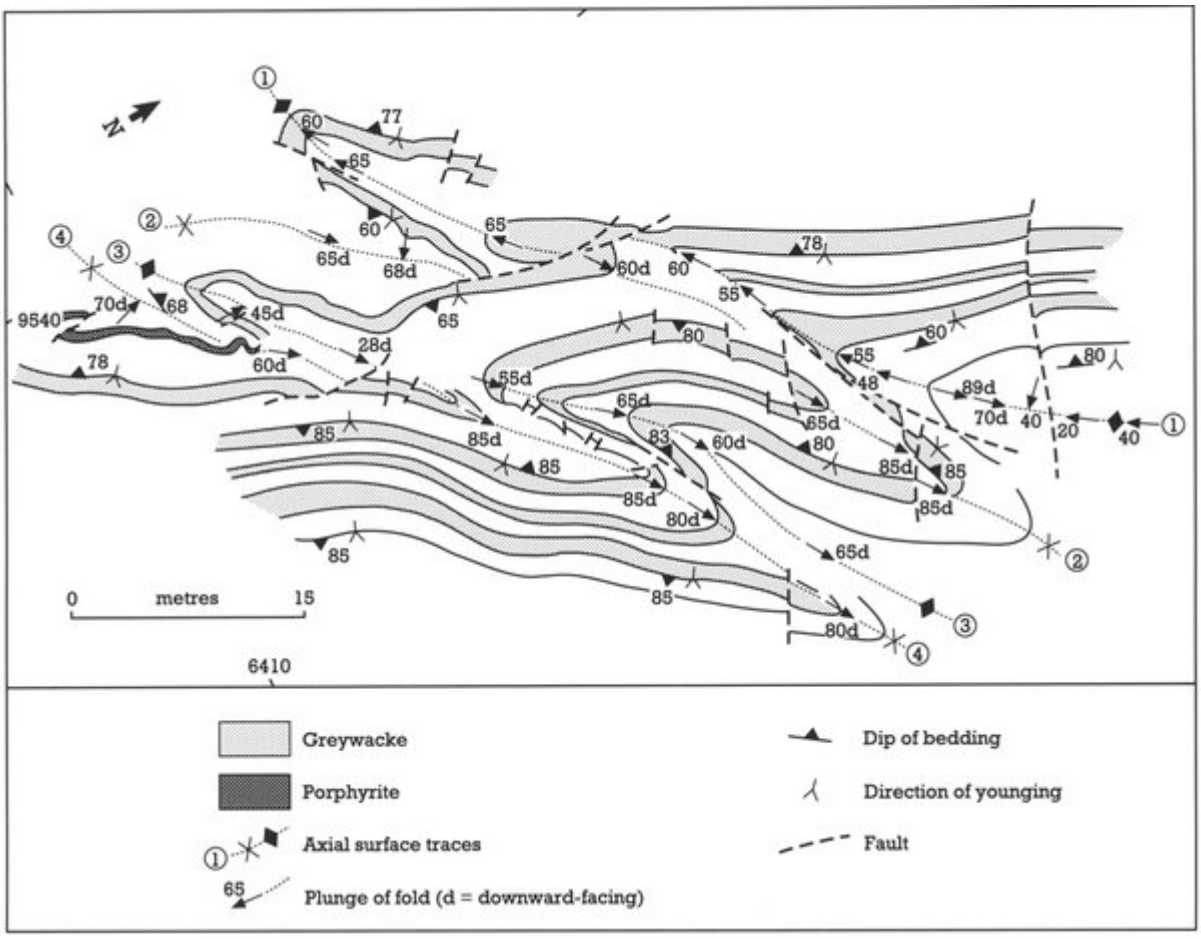

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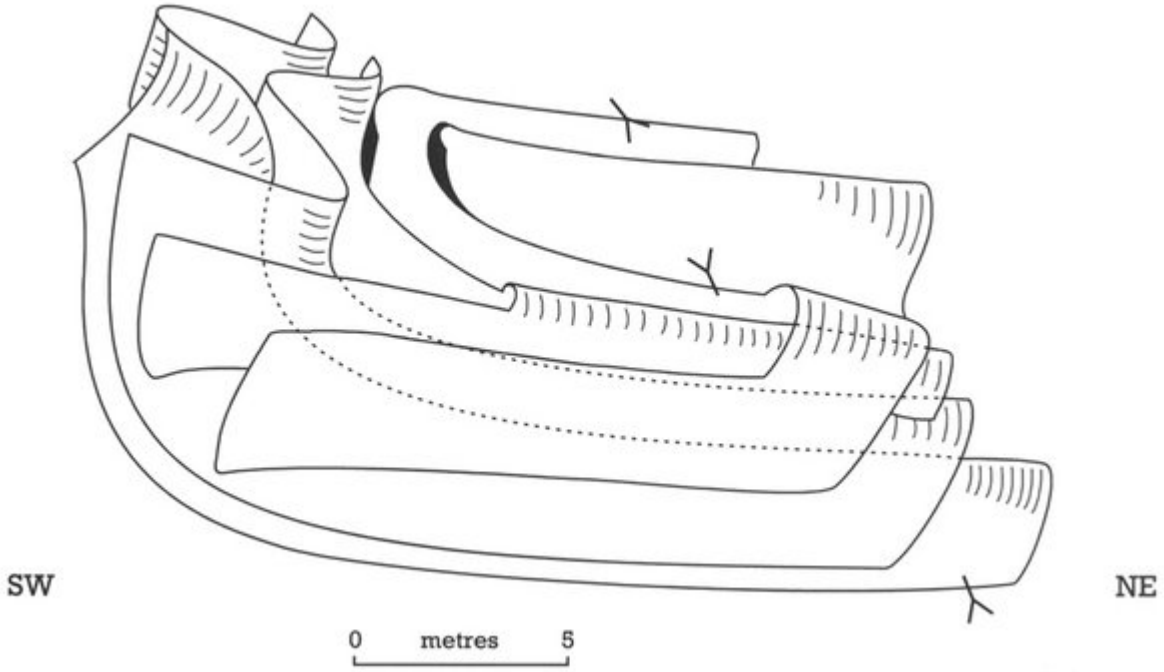

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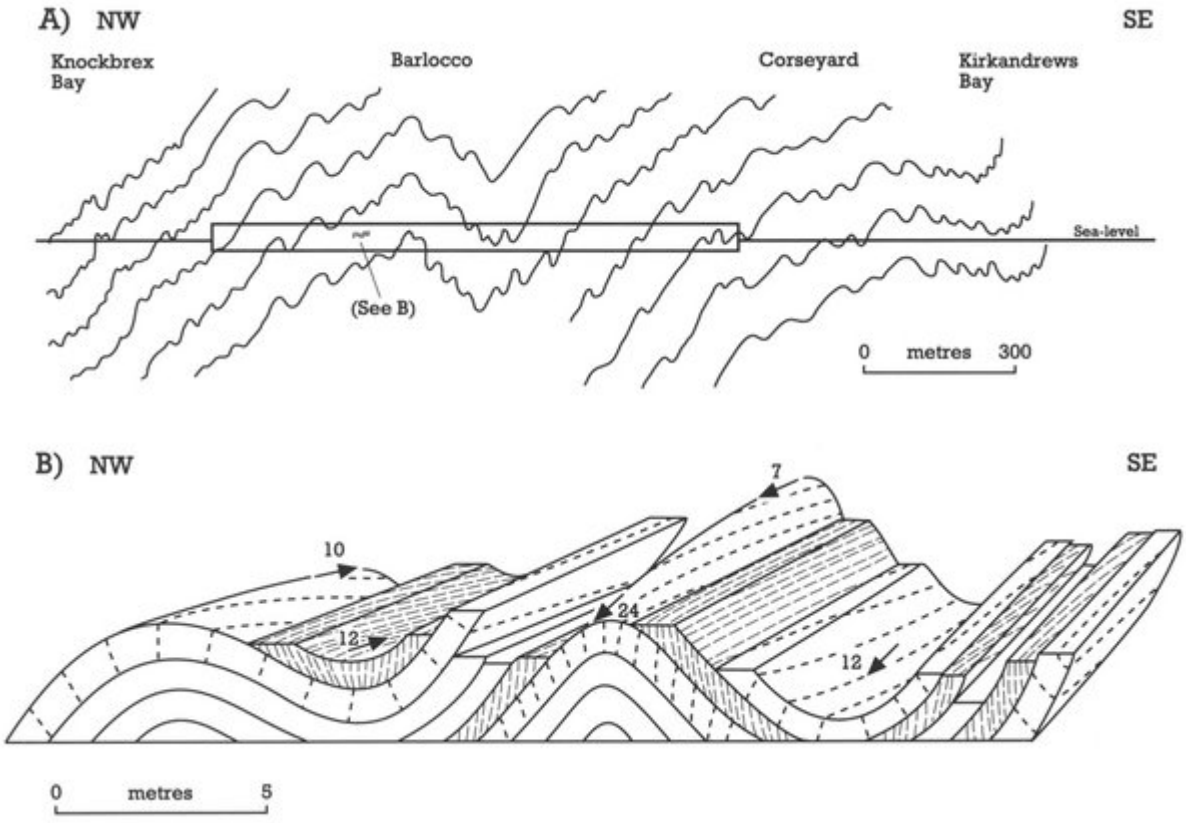

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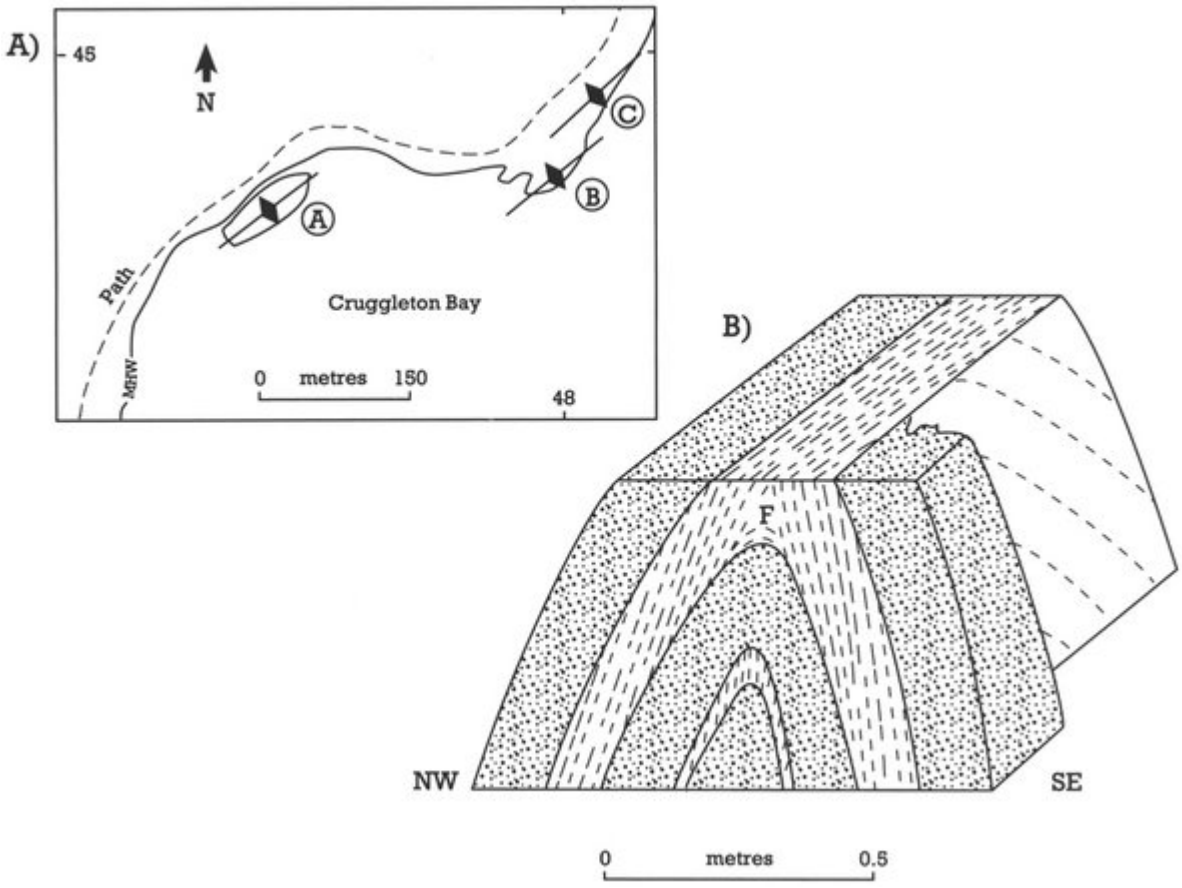

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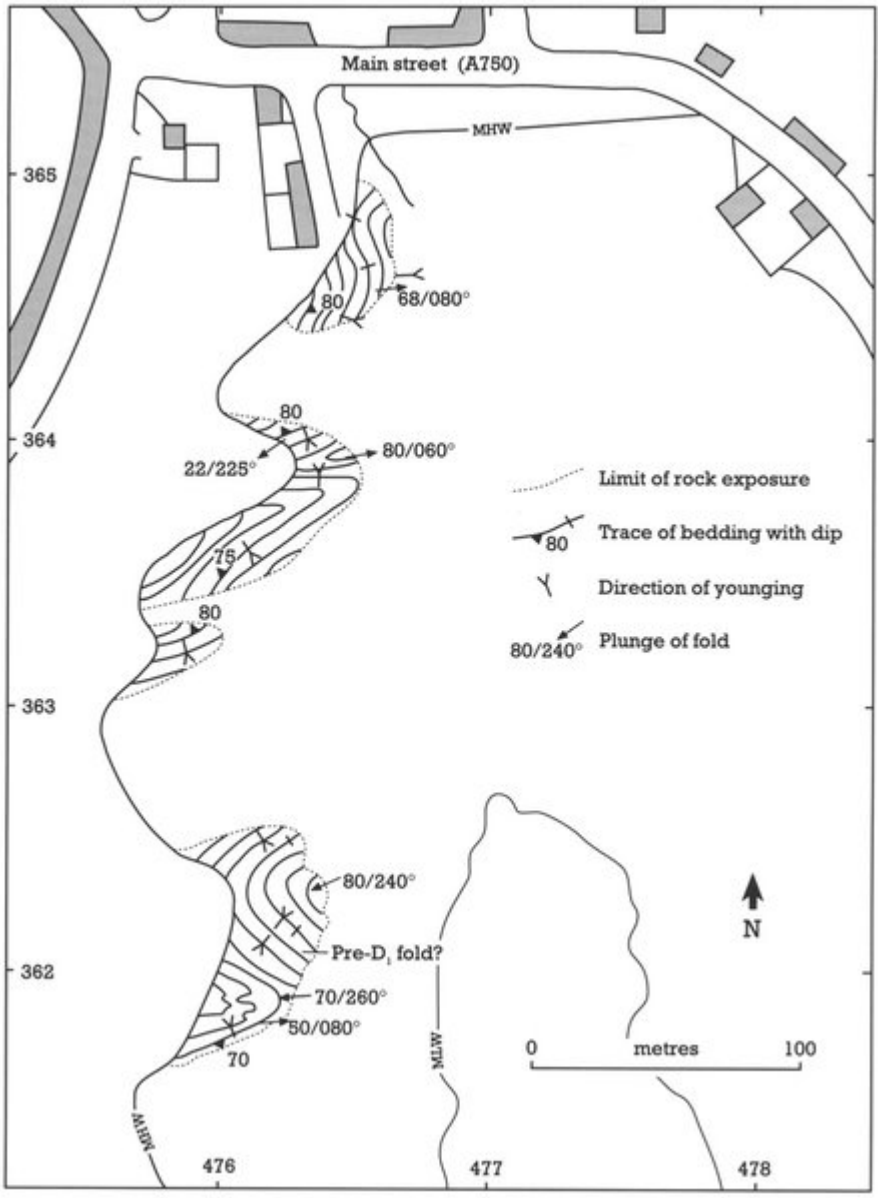

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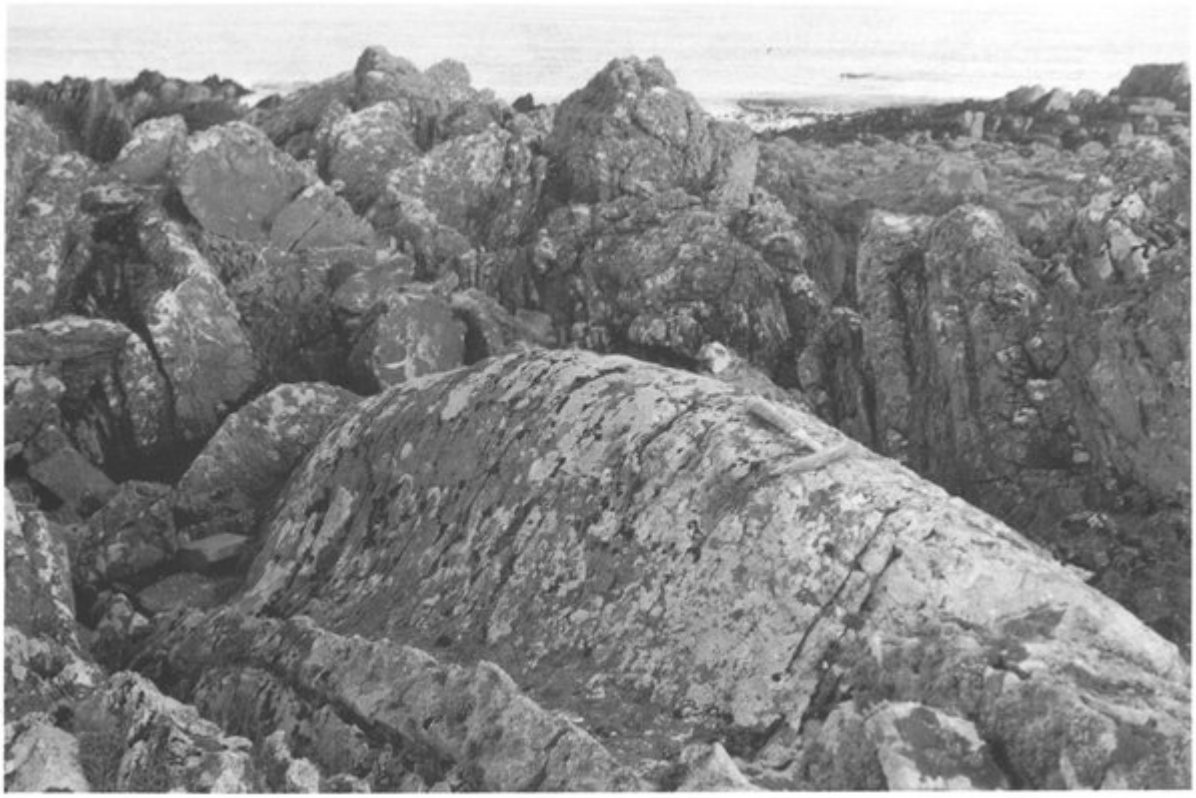

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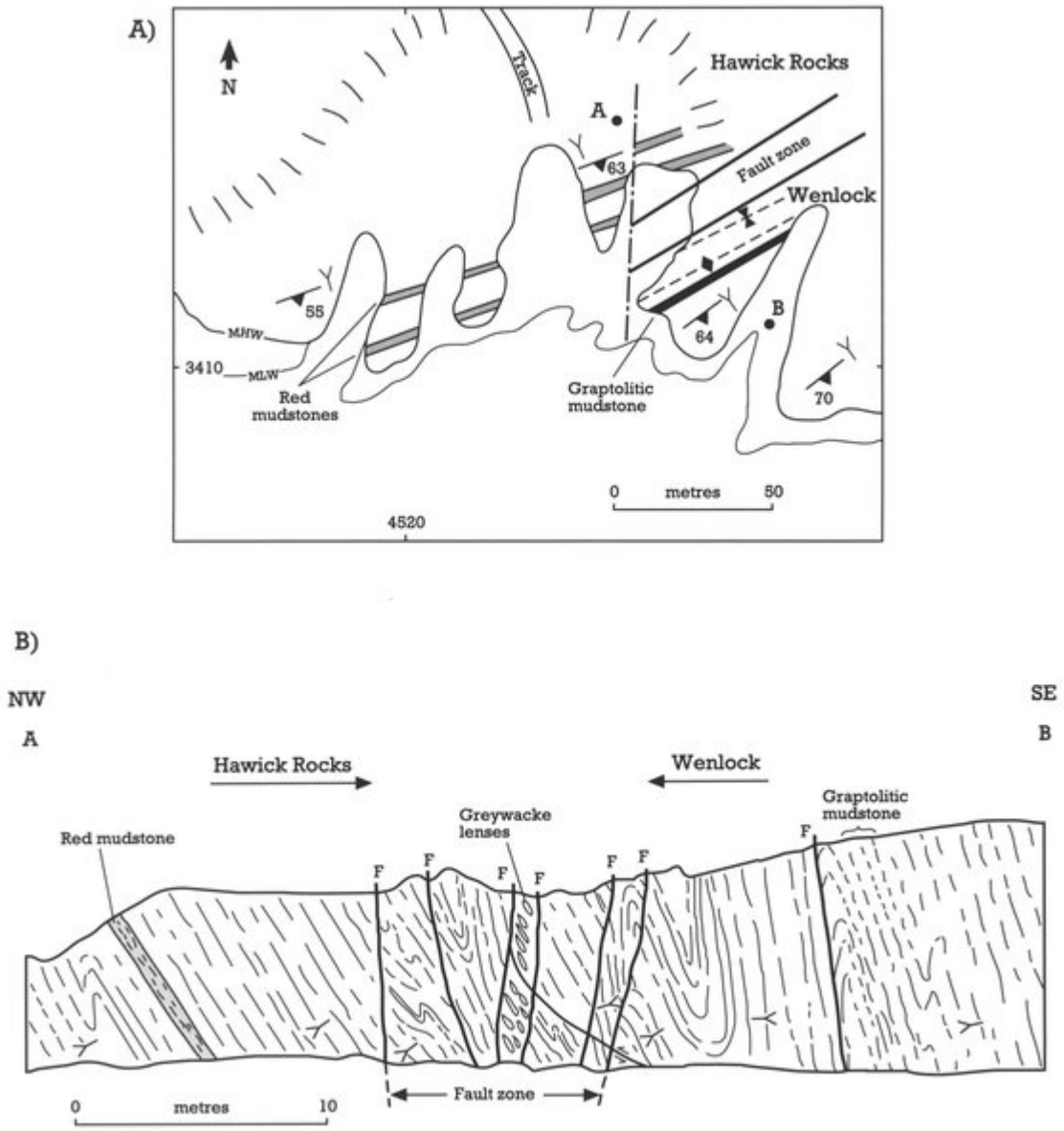

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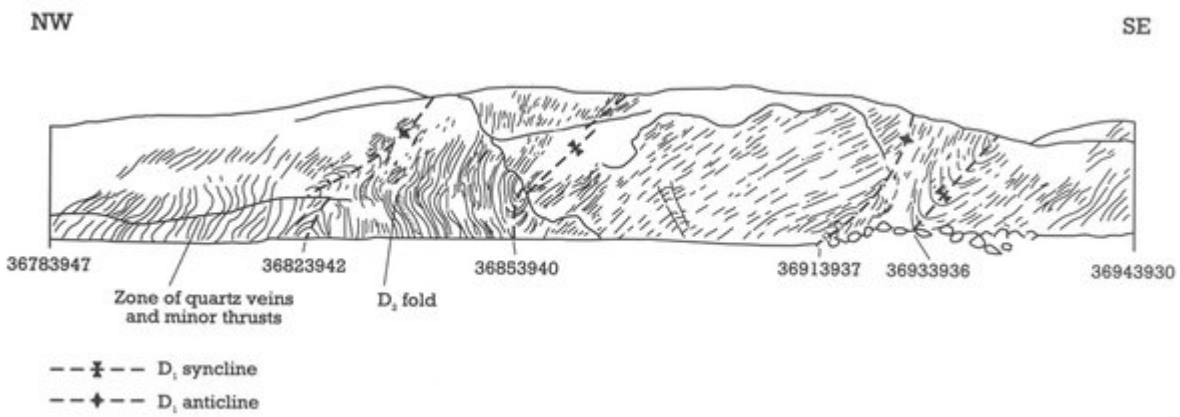

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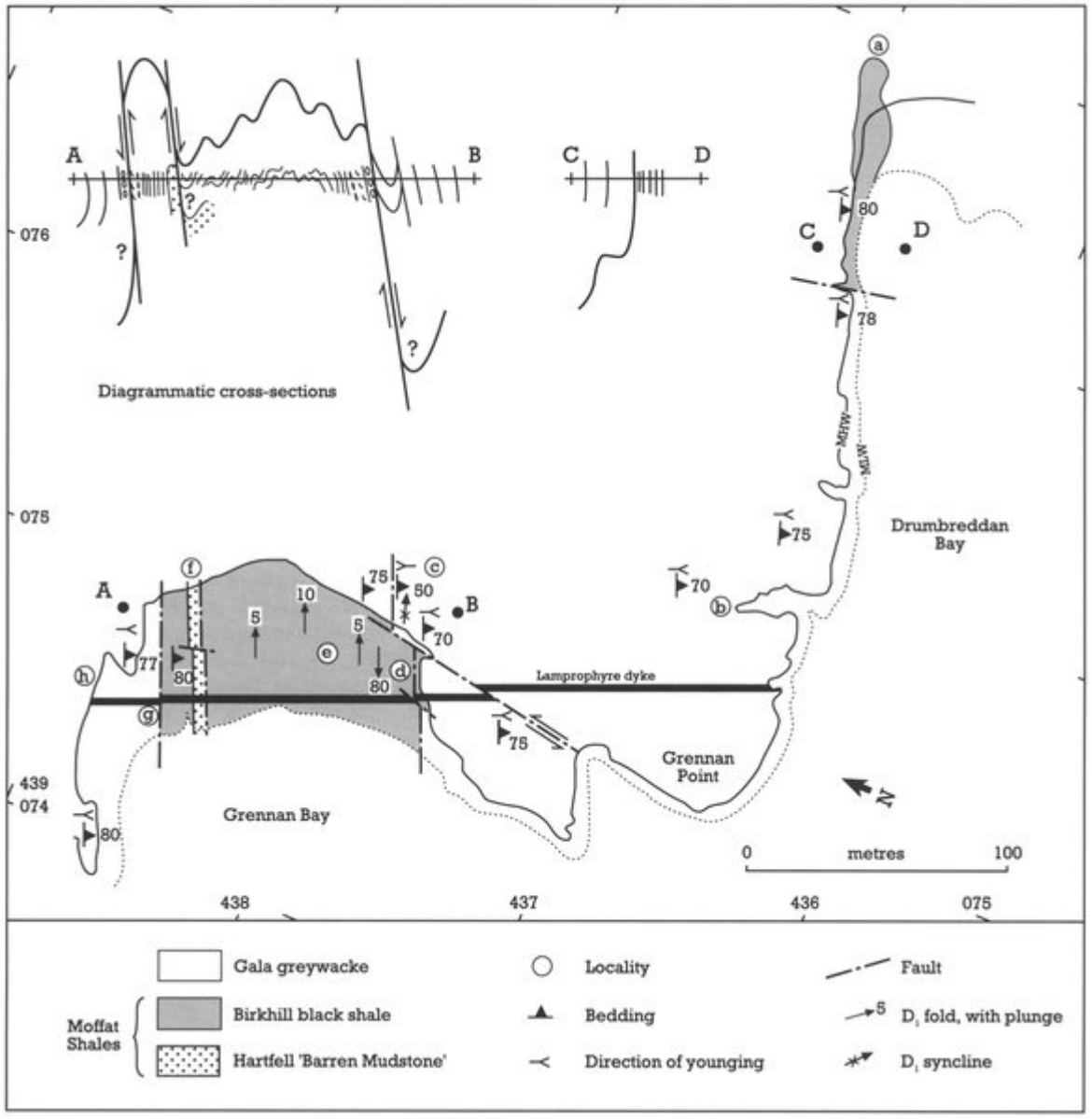

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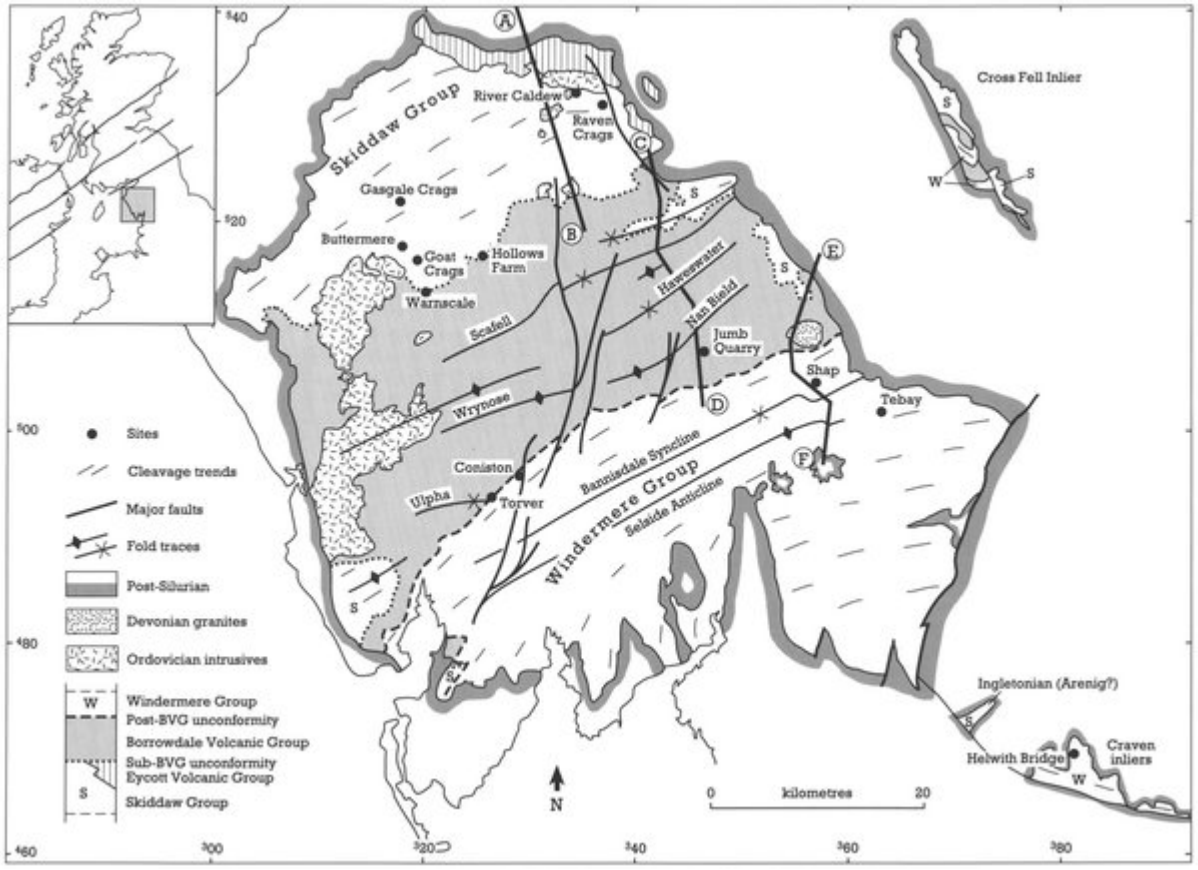

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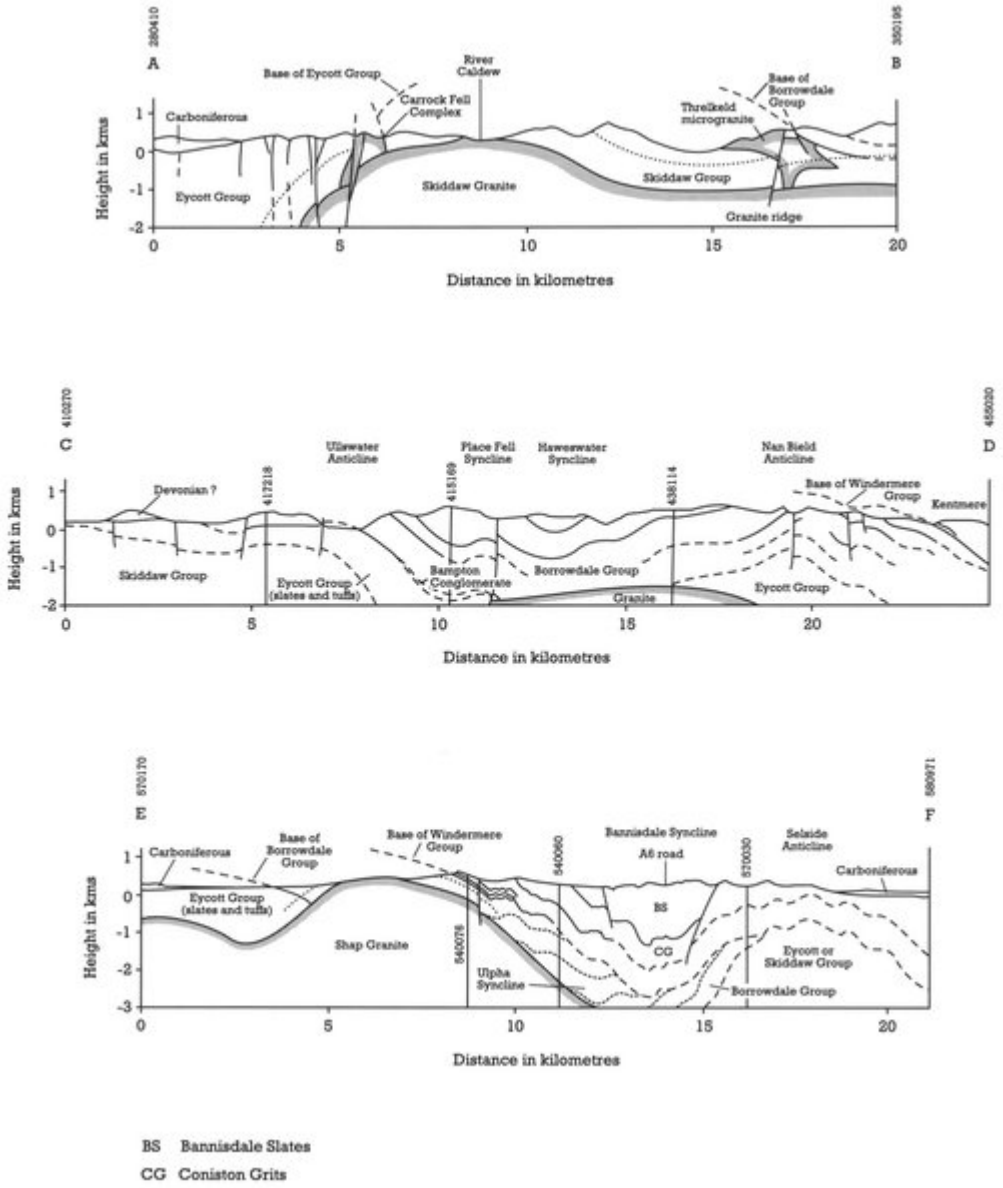

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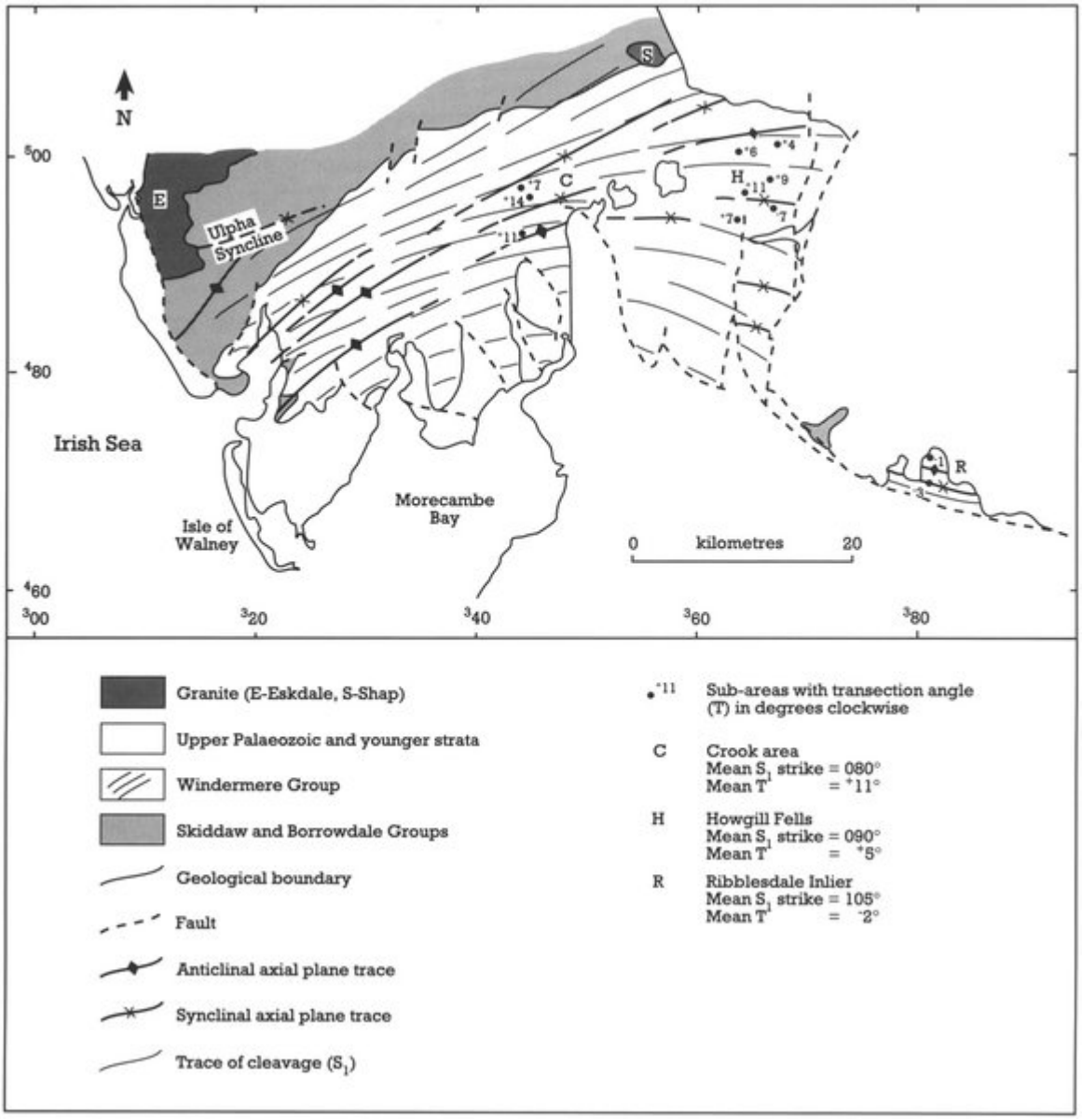

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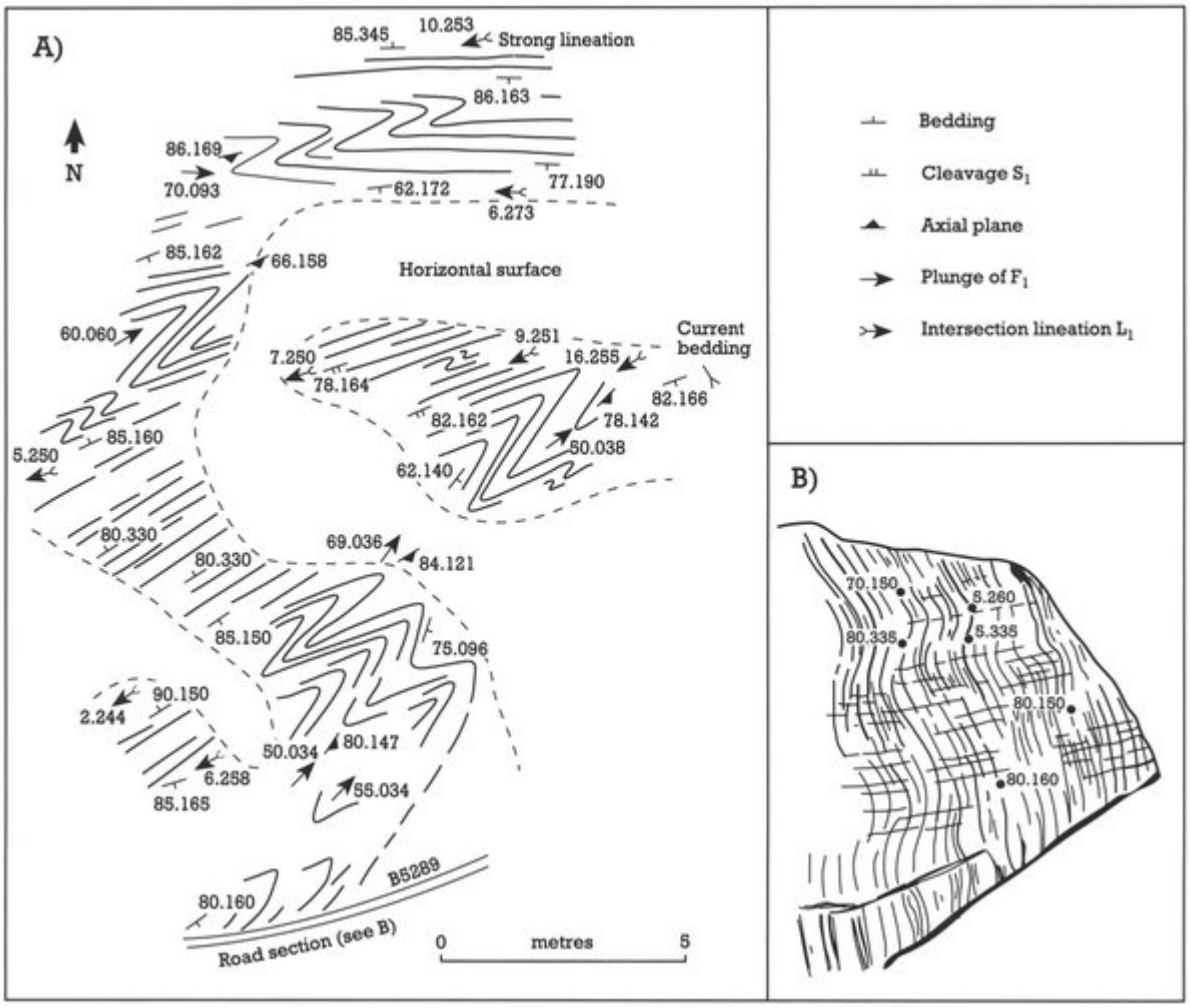

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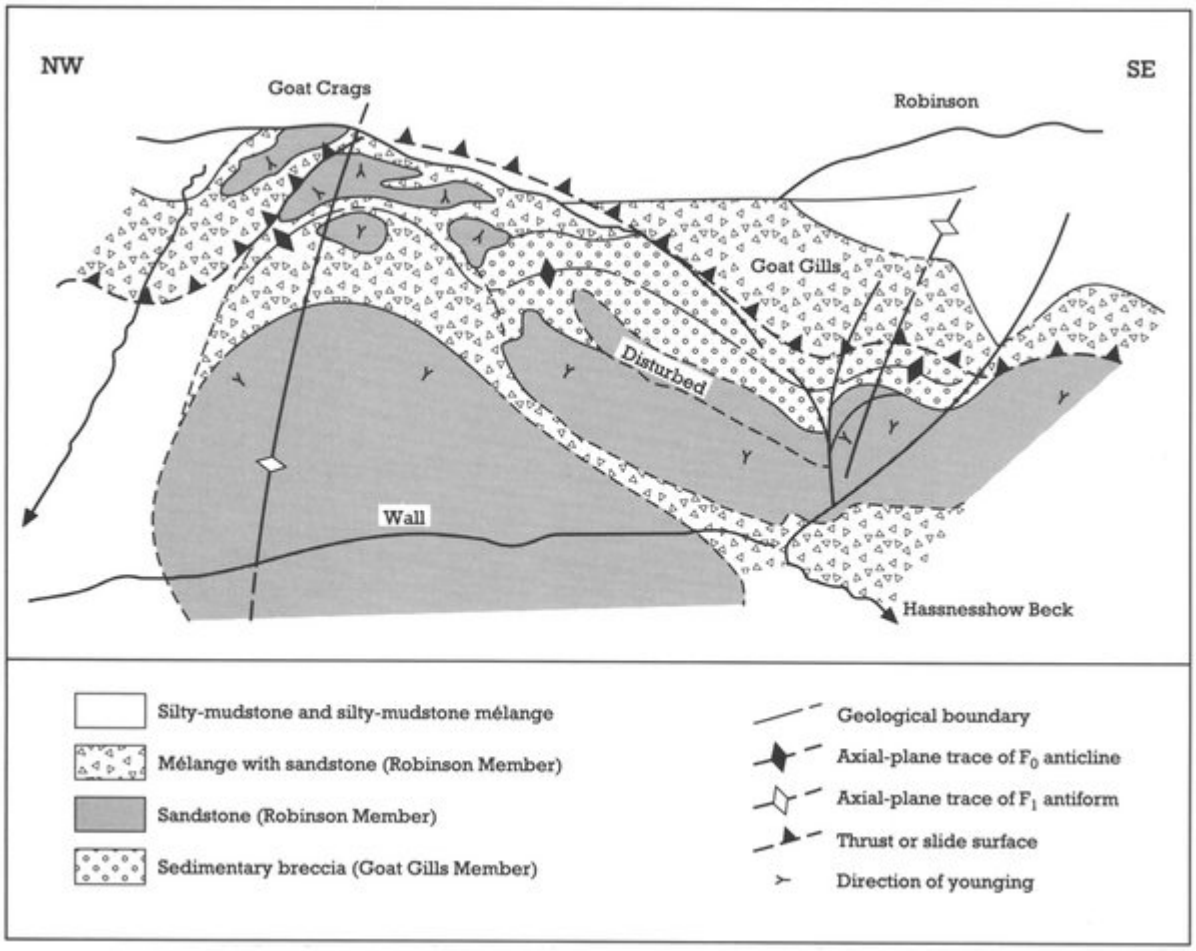
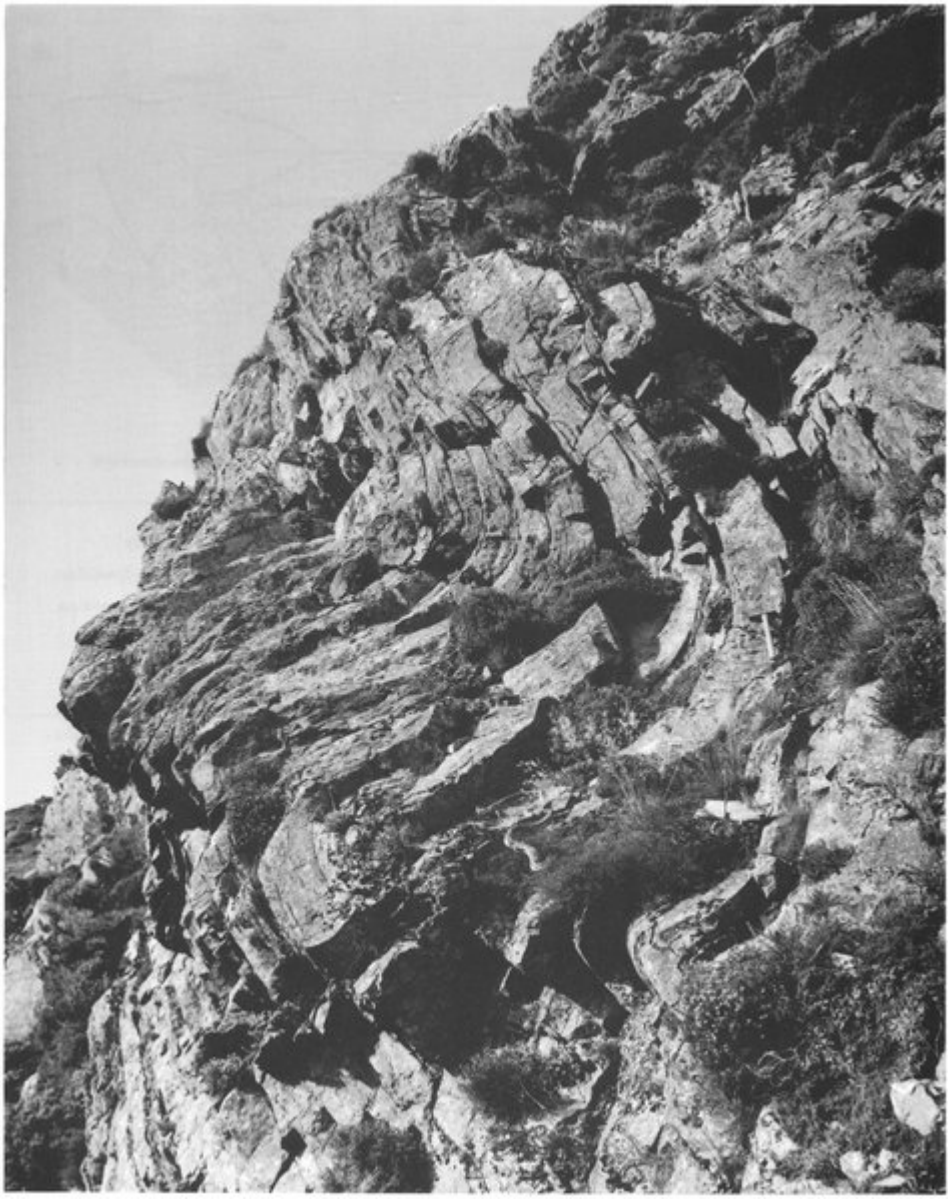
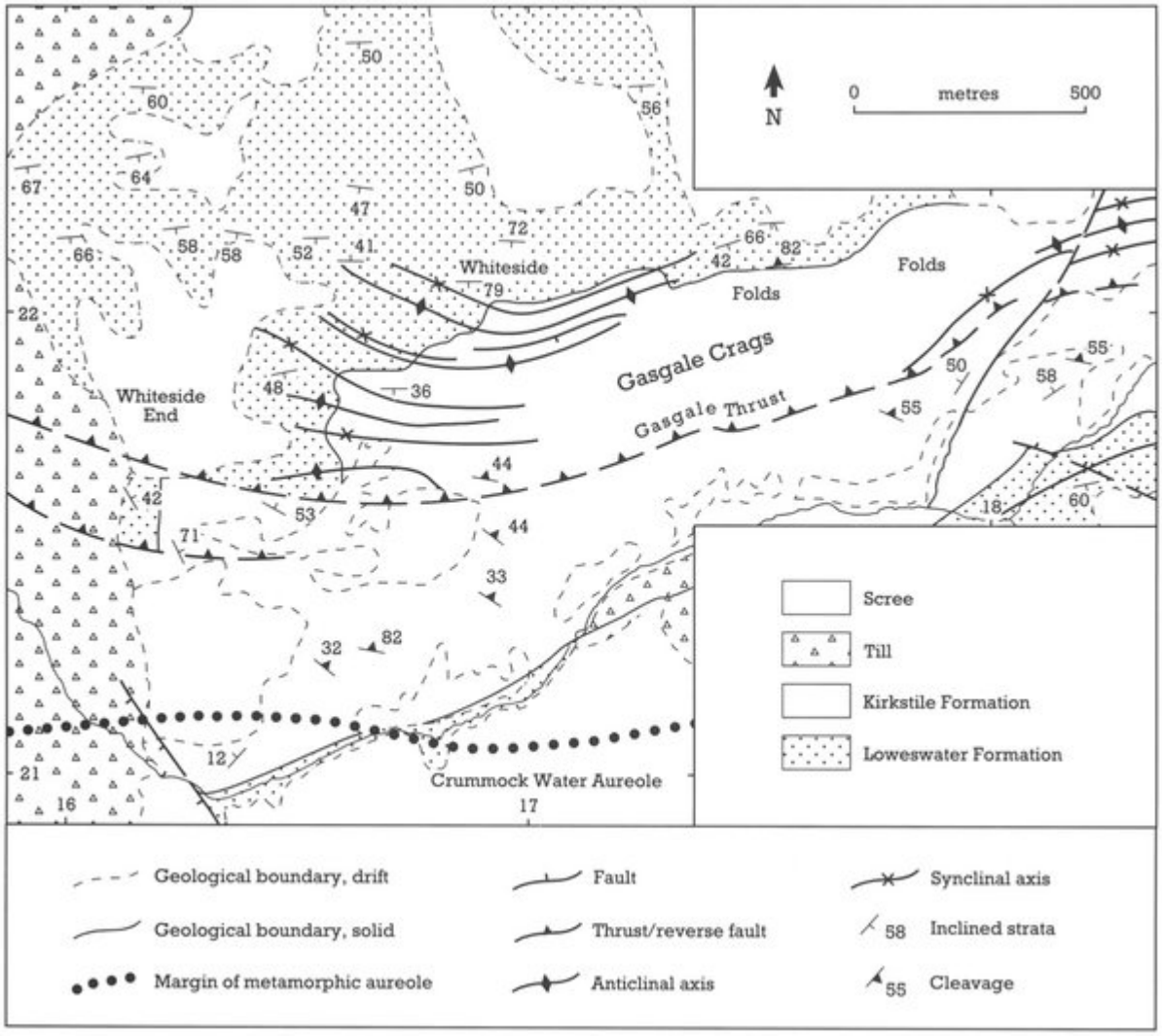


(Figure 3.5) Hassness and Goat Crags. Sketch view from the south-west, showing outcrop pattern and axial-plane traces. Length of foreground is approximately 500 m.

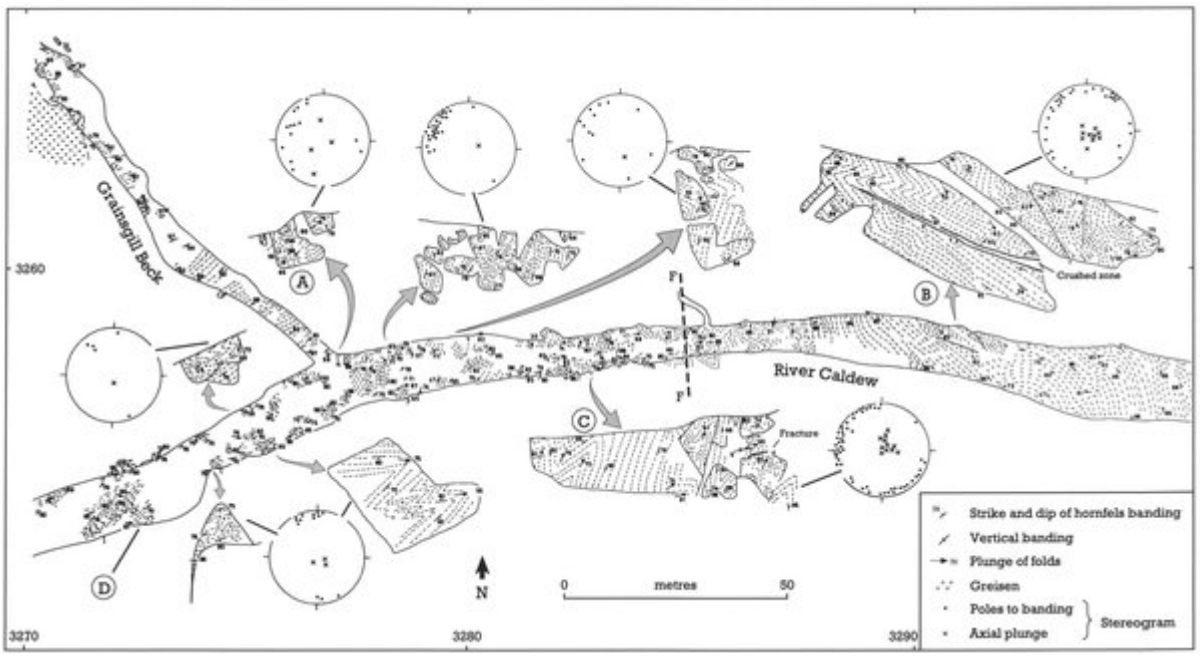


(Figure 3.6) Goat Crag, Buttermere. Slump-generated minor folds on the inverted limb of a major slump fold in the Skiddaw Group (hammer for scale, middle right). (Photo: reproduced by permission of the Director, British Geological Survey: NERC copyright reserved, D 3843.)

(Figure 3.7) Goat Crag, Buttermere. The sandstone lens is part of a slump-generated mélange which has been folded by minor D_1 folds with a poorly developed axial-planar cleavage. (Photo: reproduced by permission of the Director, British Geological Survey: NERC copyright reserved, D 3849.)

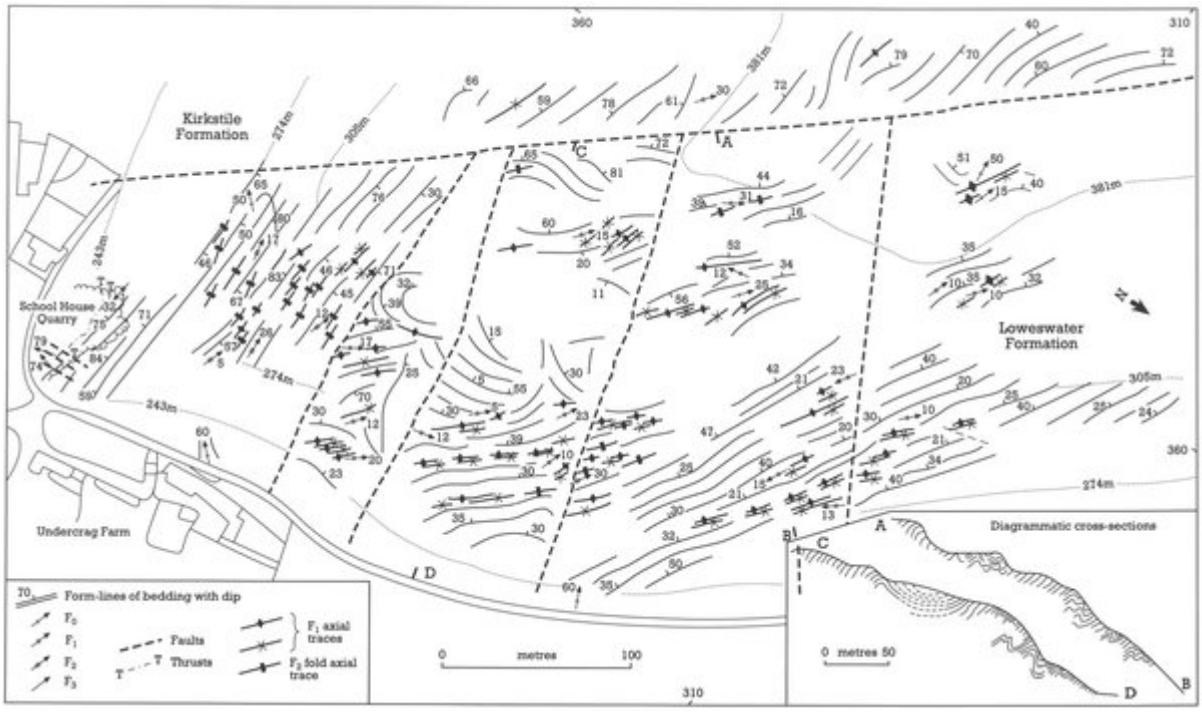


(Figure 3.8) Geological map of the Gasgale Crags and Whiteside area, based on Geological Survey map (NY 12 SE) surveyed by P. M. Allen, A. H. Cooper and B. C. Webb (see also Moseley, 1990, Figure 20).

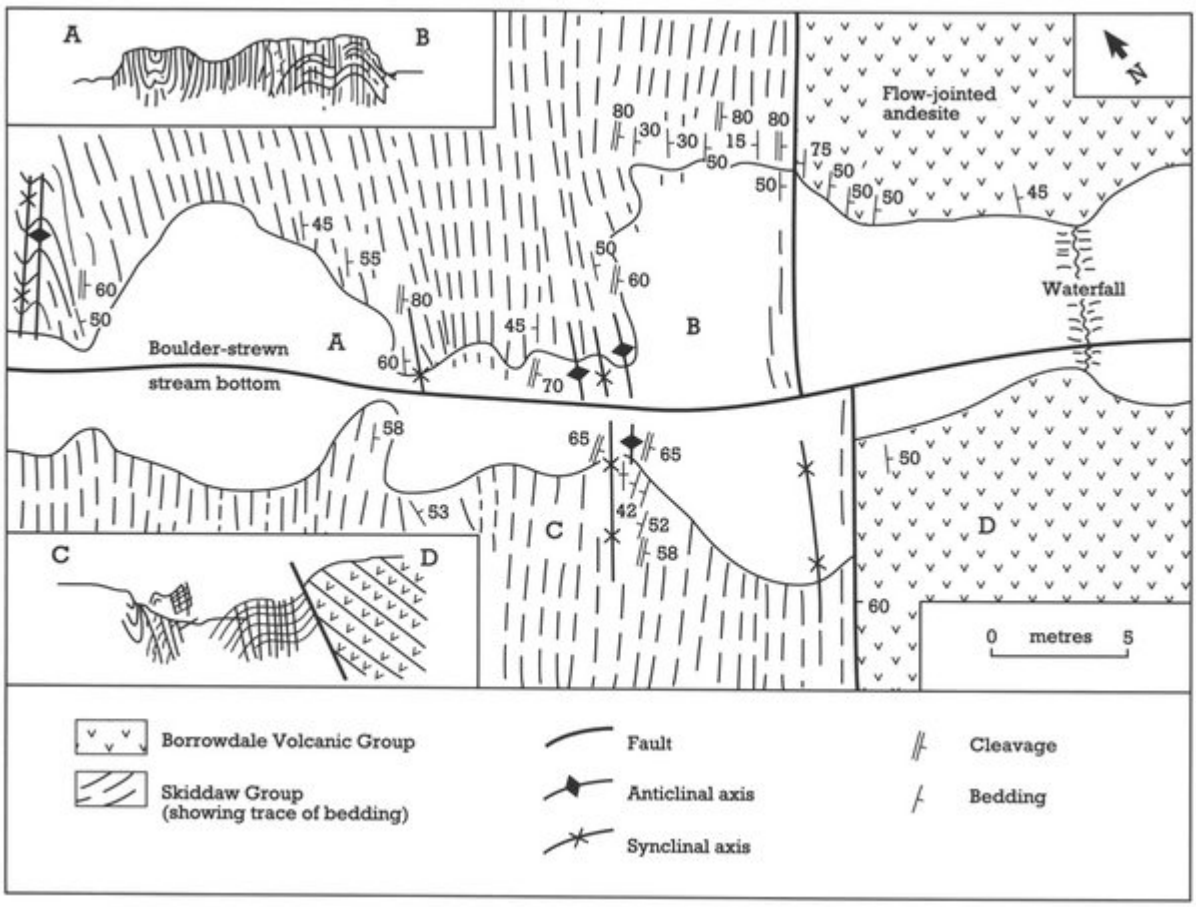


(Figure 3.9) Structural map of the River Caldew section, showing the main folds in the hornfelsed slates of the Skiddaw Group. Inset diagrams are enlargements (x4) of selected localities, each with an accompanying equal-area projection of the structural elements of that locality (after Roberts, 1971). Localities A–D referred to in text.

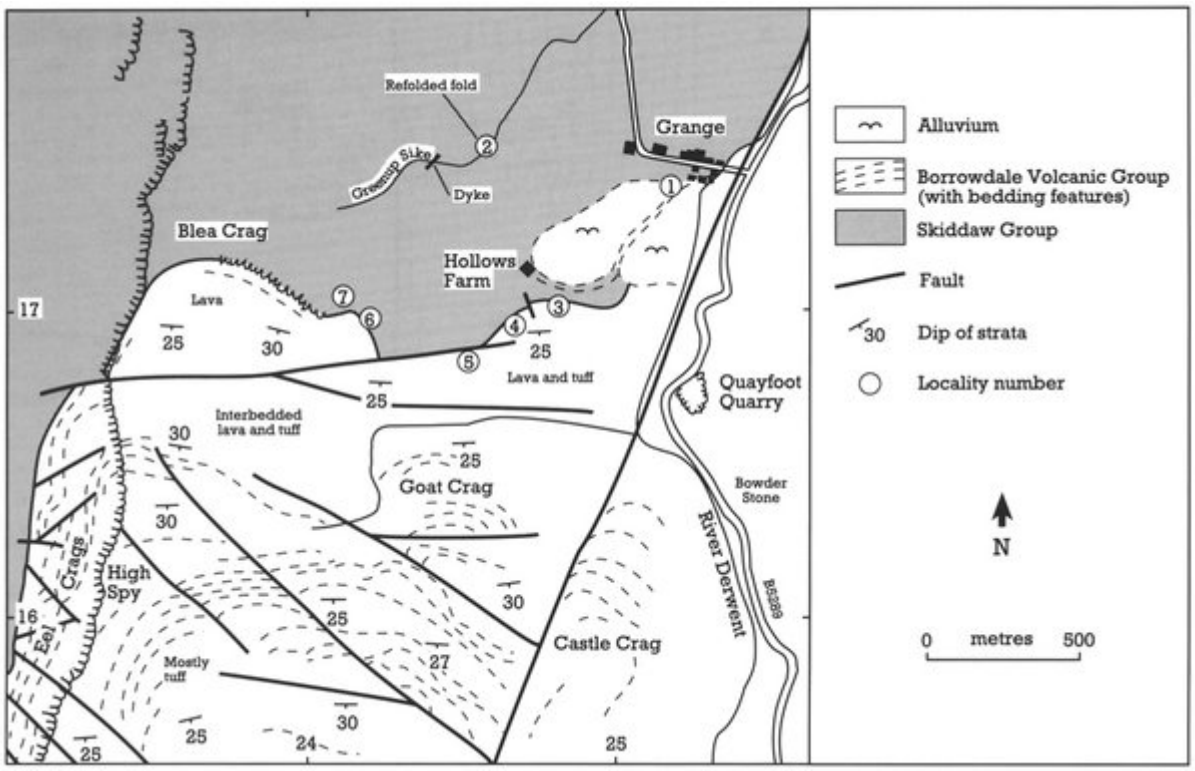
(Figure 3.10) River Caldew. Steep NE-plunging folds in hornfelsed slates of the Skiddaw Group produced largely by gravity-driven slumping. They show the truncations and variable, disharmonic style typical of this process. Bedding planes are chalked (compass top right for scale). (Photo: D. Roberts.)



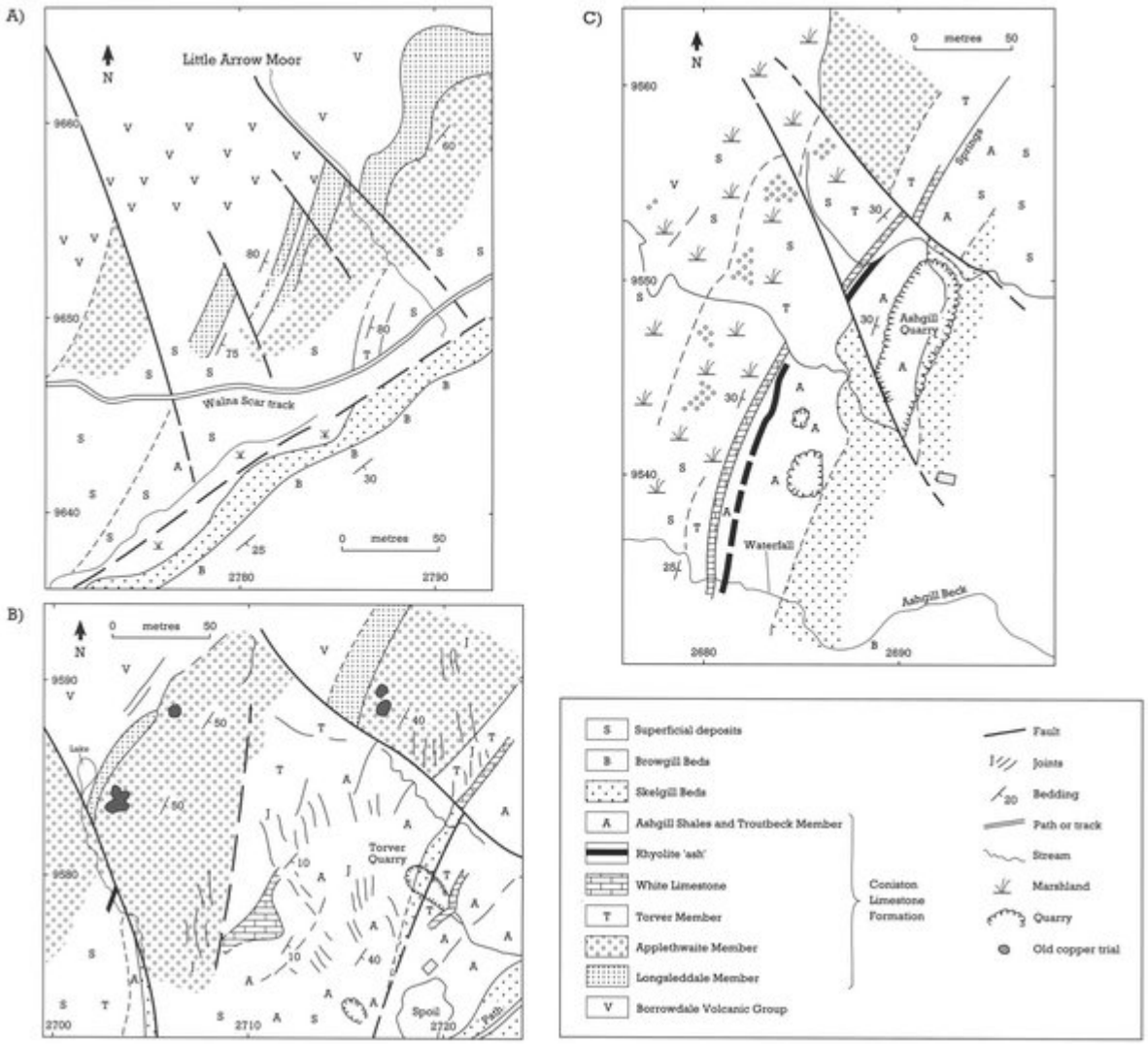
(Figure 3.11) Map of the structures in the Loweswater Formation on Raven Crags, Mungrisdale. A–B and C–D are the lines of the cross-sections illustrated in the inset (modified from Roberts, 1977b).



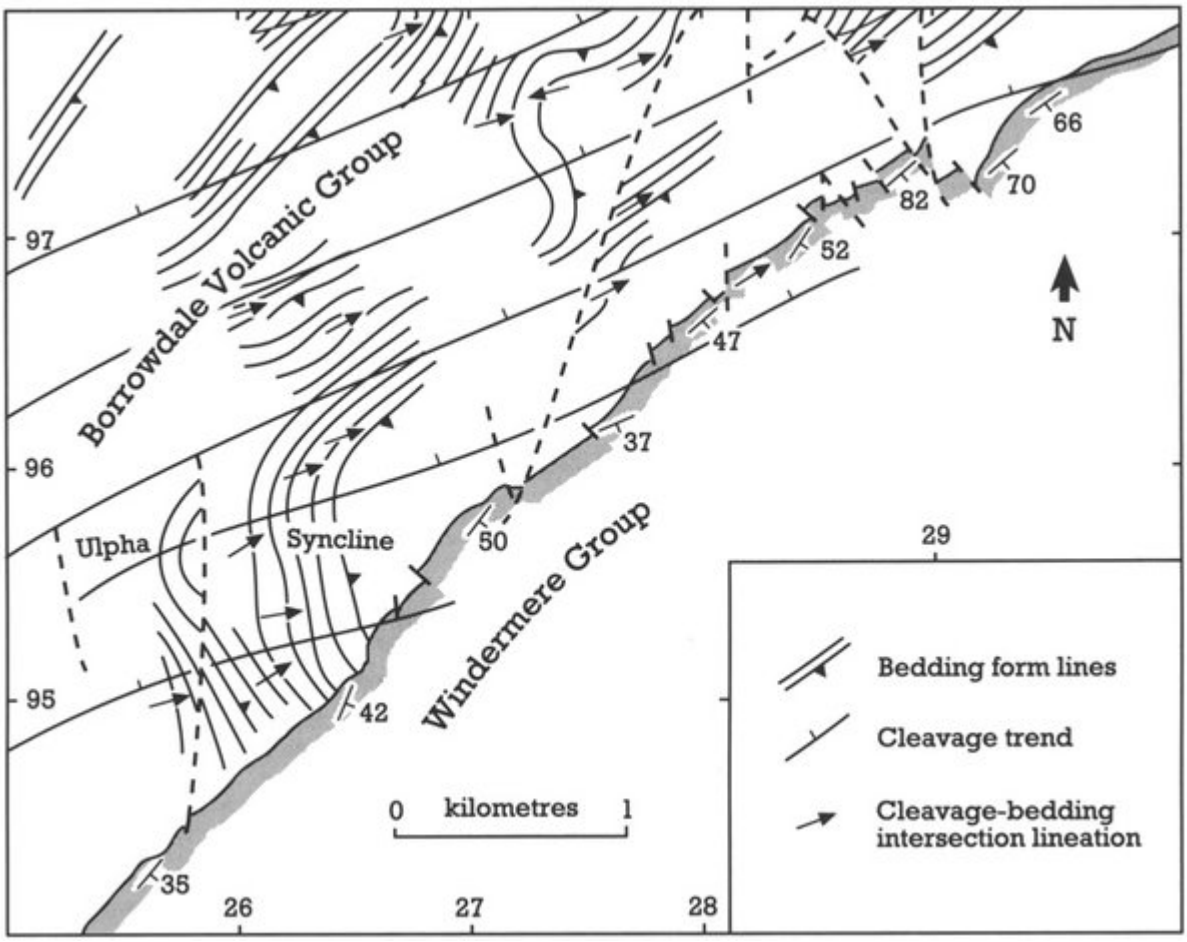
(Figure 3.12) Detailed map and sections of the Skiddaw Group–Borrowdale Volcanic Group junction exposed in Warnscale Bottom. Anticlines, synclines, dip of bedding and cleavage are shown (after Moseley, 1975).



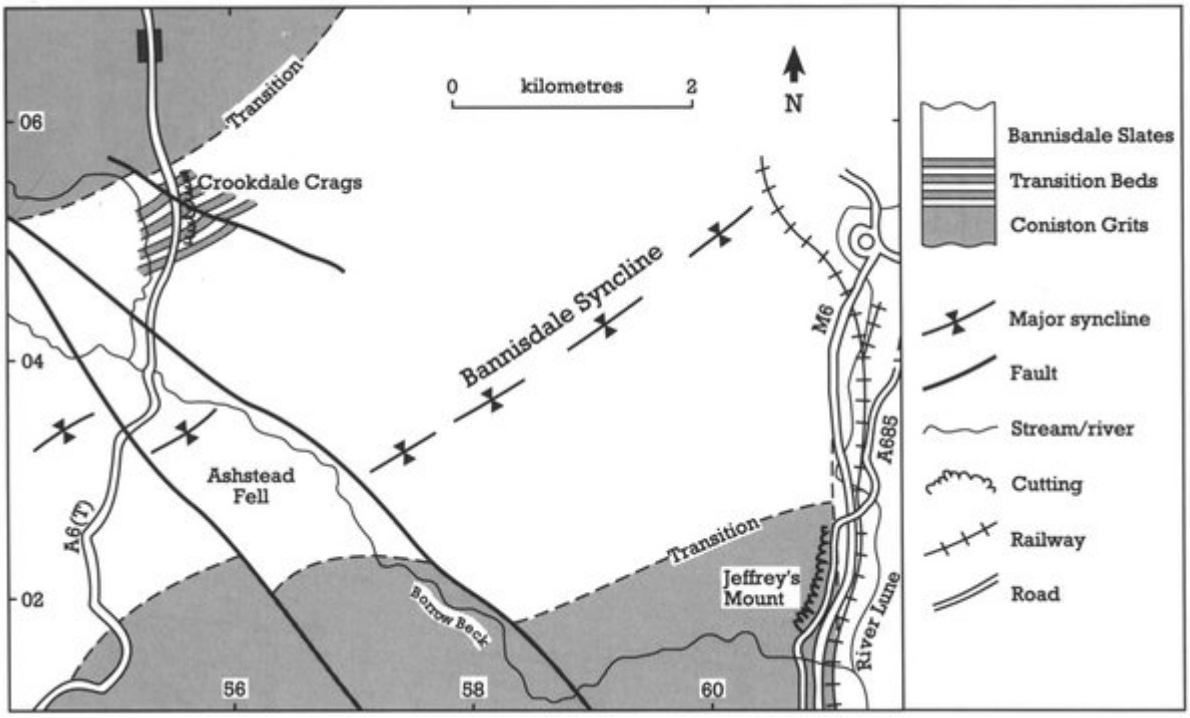
(Figure 3.13) Geological map of the junction between the Borrowdale Volcanic Group and the Skiddaw Group in the area around Grange-in-Borrowdale, Cumbria, showing localities mentioned in the text.



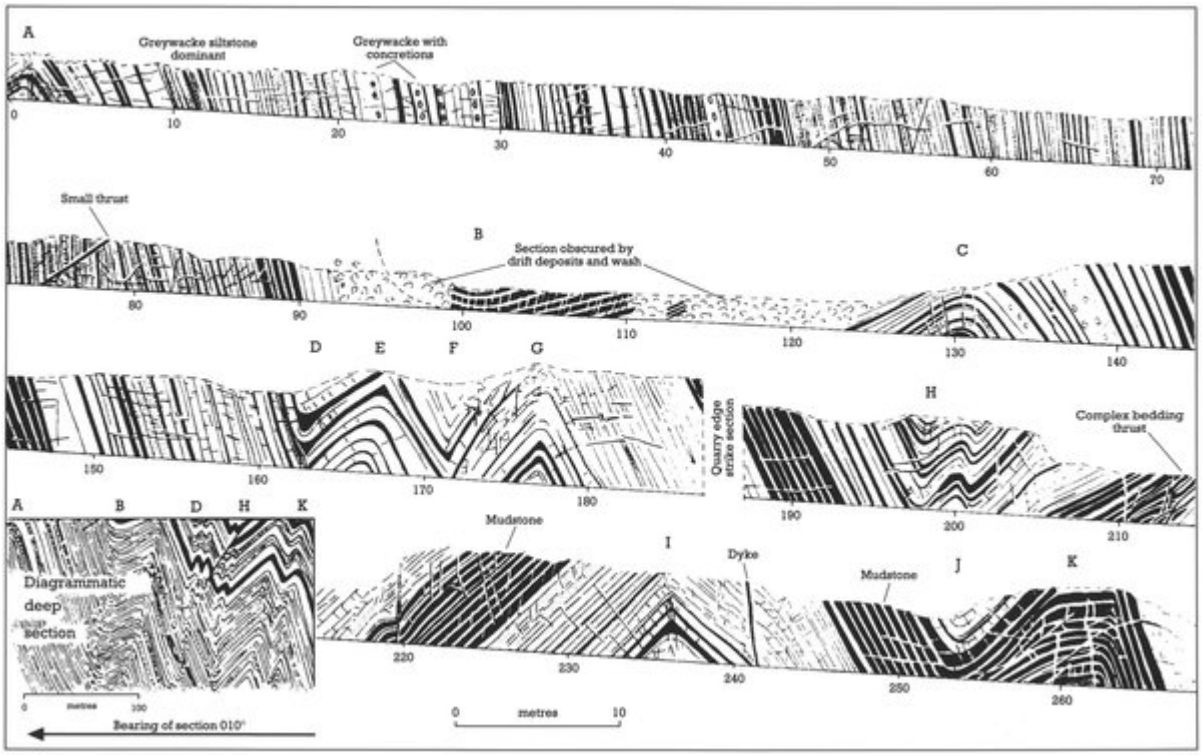
(Figure 3.14)A, B, and C (on pages 80 and 81) Geological maps illustrating the nature of the faulting in three areas within the Limestone Haws–High Pike Haw, Coniston site (after Moseley, 1990, Figure 52B, C and D). (A) South side of Little Arrow Moor. (B) Area around Torver Quarry. (C) Area around Ashgill Quarry.



(Figure 3.15) Structural map of the Ulpha Syncline at Torver High Common (after Soper and Numan, 1974; Soper and Moseley, 1978, figure 24).

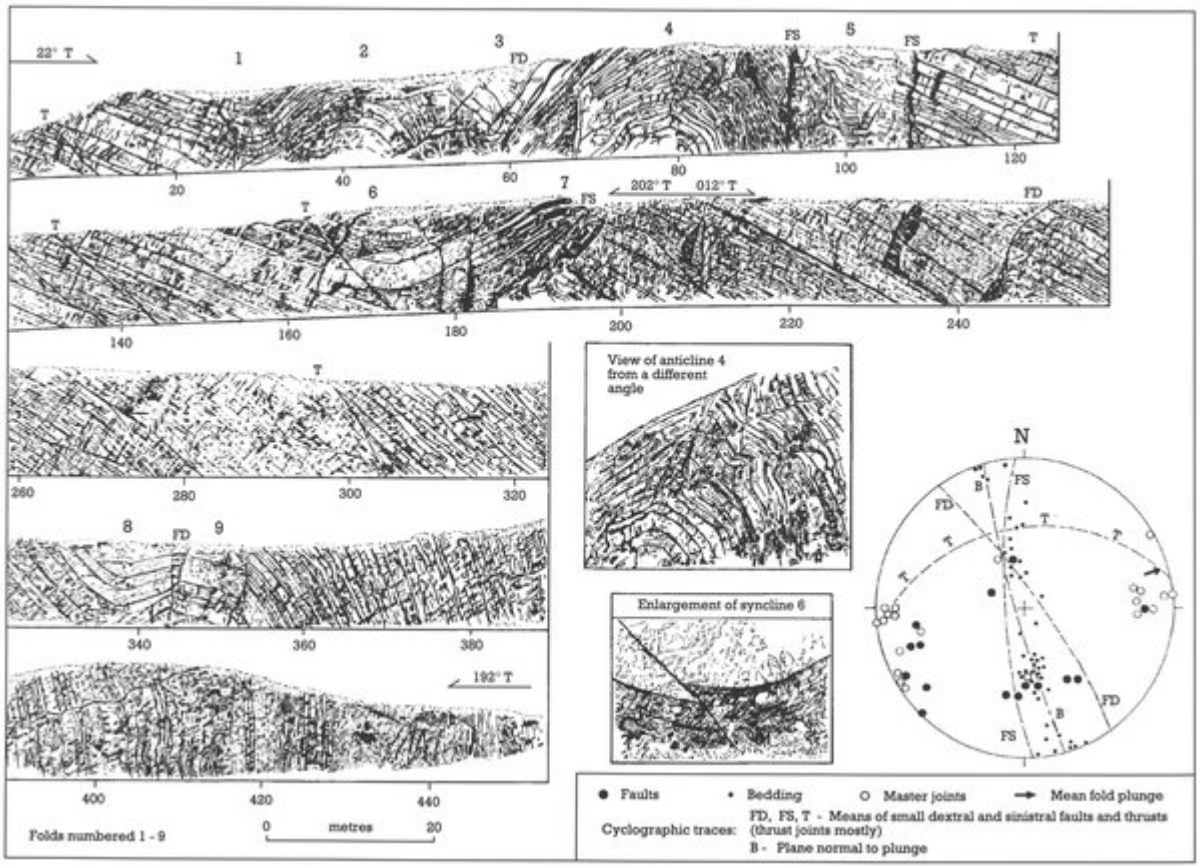


(Figure 3.16) Geological map of the Bannisdale Syncline, showing positions of Crookdale Crags (see Fig. 3.17) and Jeffrey's Mount (after Moseley, 1986).

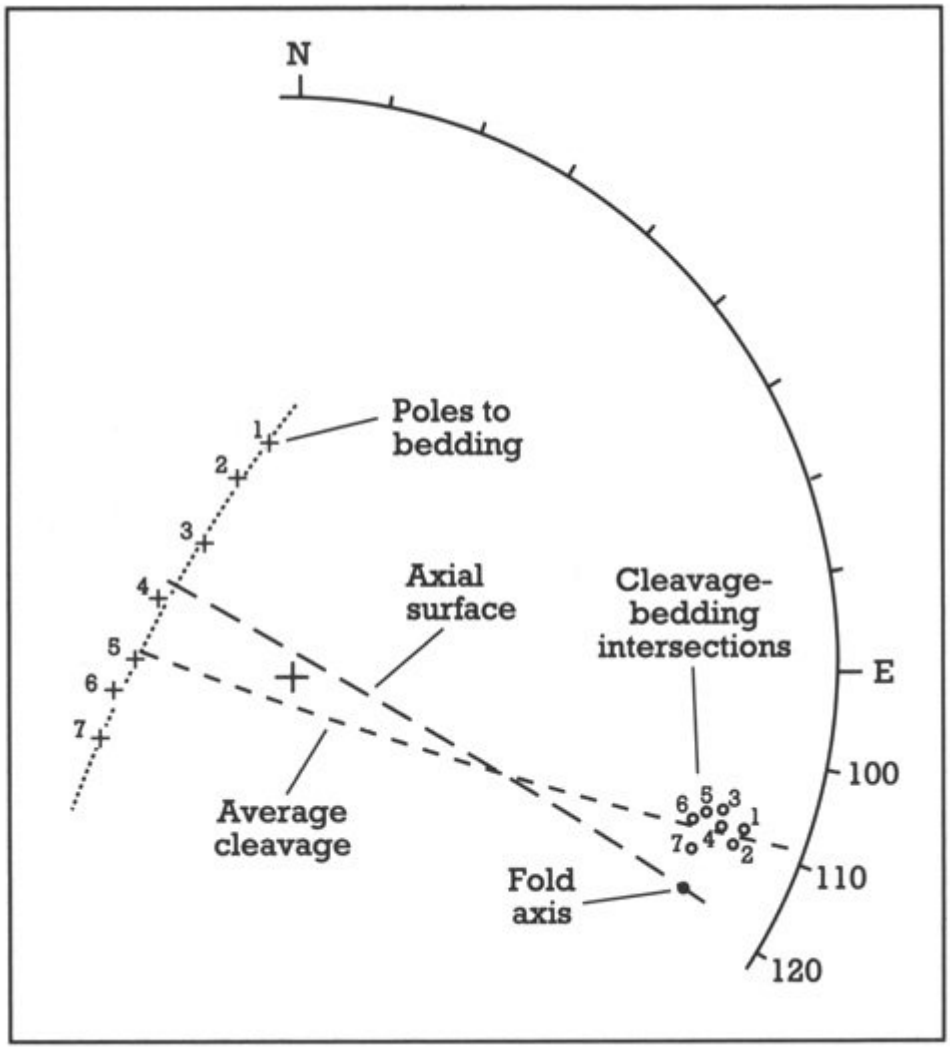


(Figure 3.17) Fold structure along A6 road-cuttings at Crookdale Crags, Shap (after Moseley, 1968).

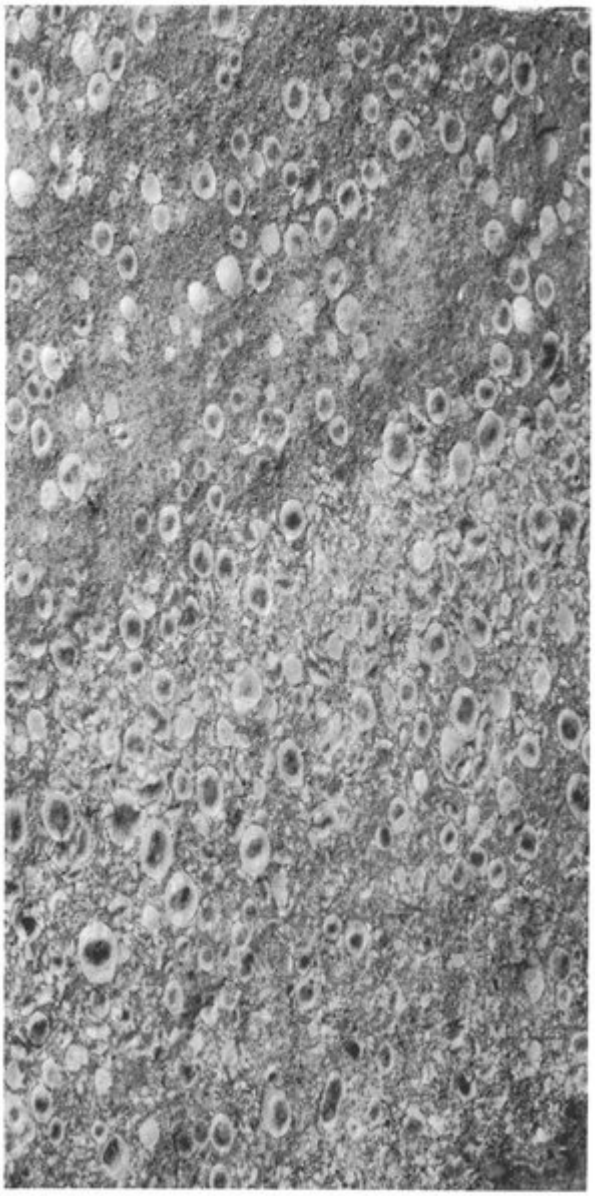
(Figure 3.18) Shap Fell. D_1 folds developed in Silurian greywackes; cleavage can be seen in the interbedded muddy siltstone. View to east. (Photo: J. Treagus.)



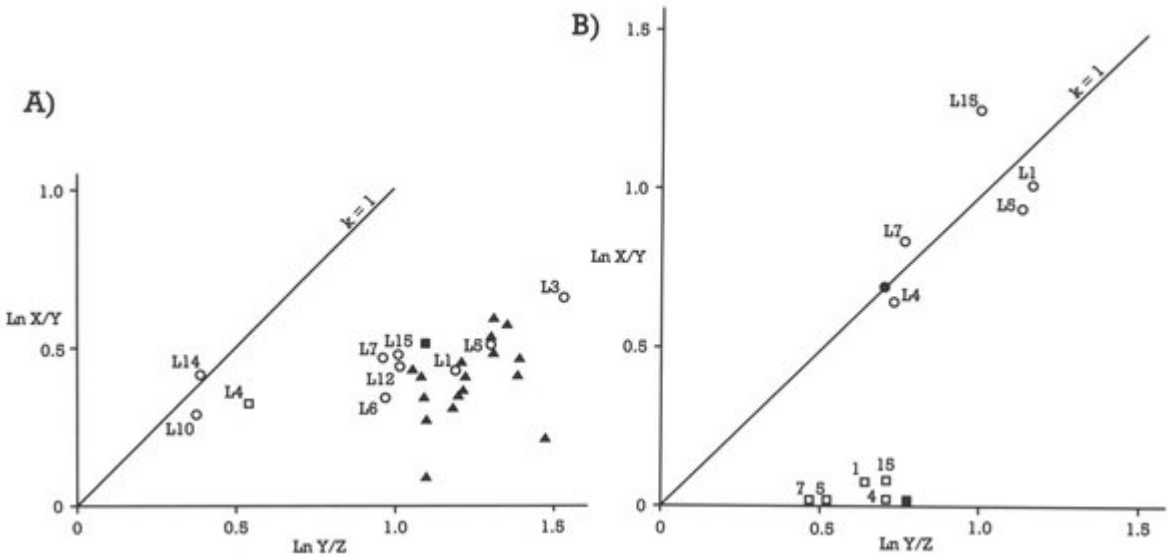
(Figure 3.19) Fold structure at Jeffrey's Mount, Tebay (after Moseley, 1972).



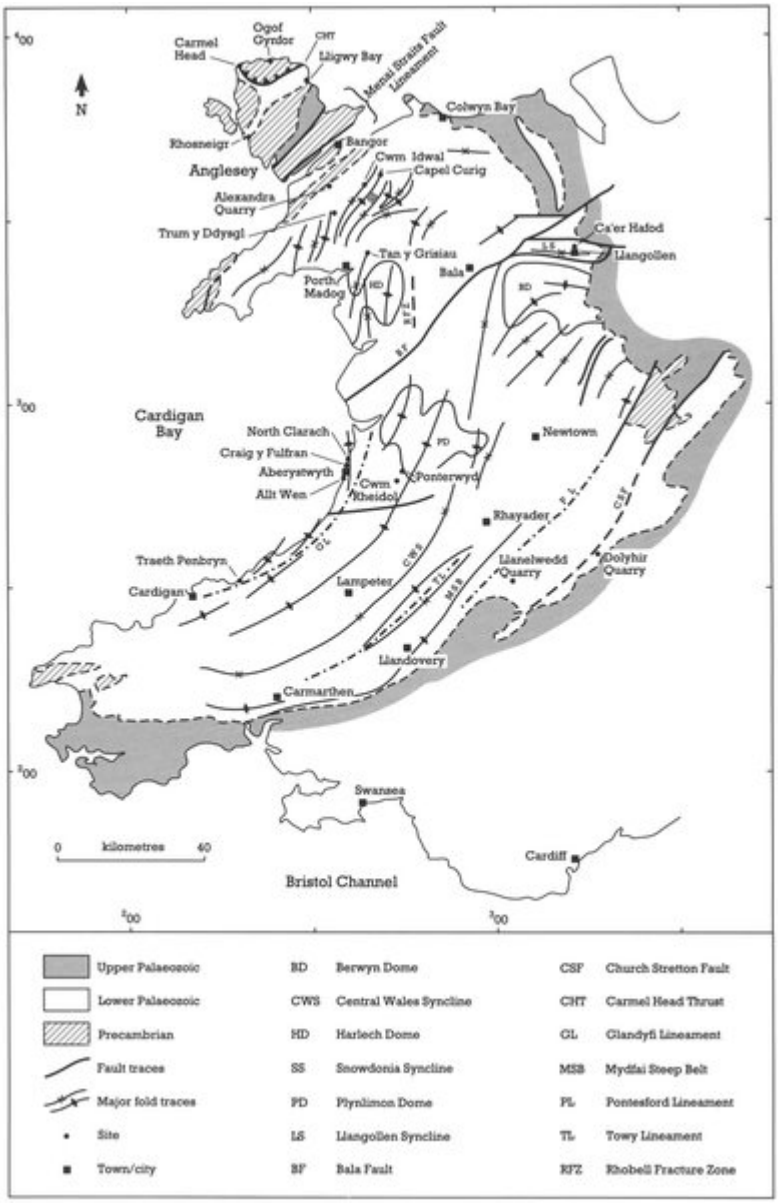
(Figure 3.20) Stereographic representation of data from Helwith Bridge. Poles to bedding (crosses) numbered across the anticline with corresponding numbers at bedding–cleavage intersections (open circles).



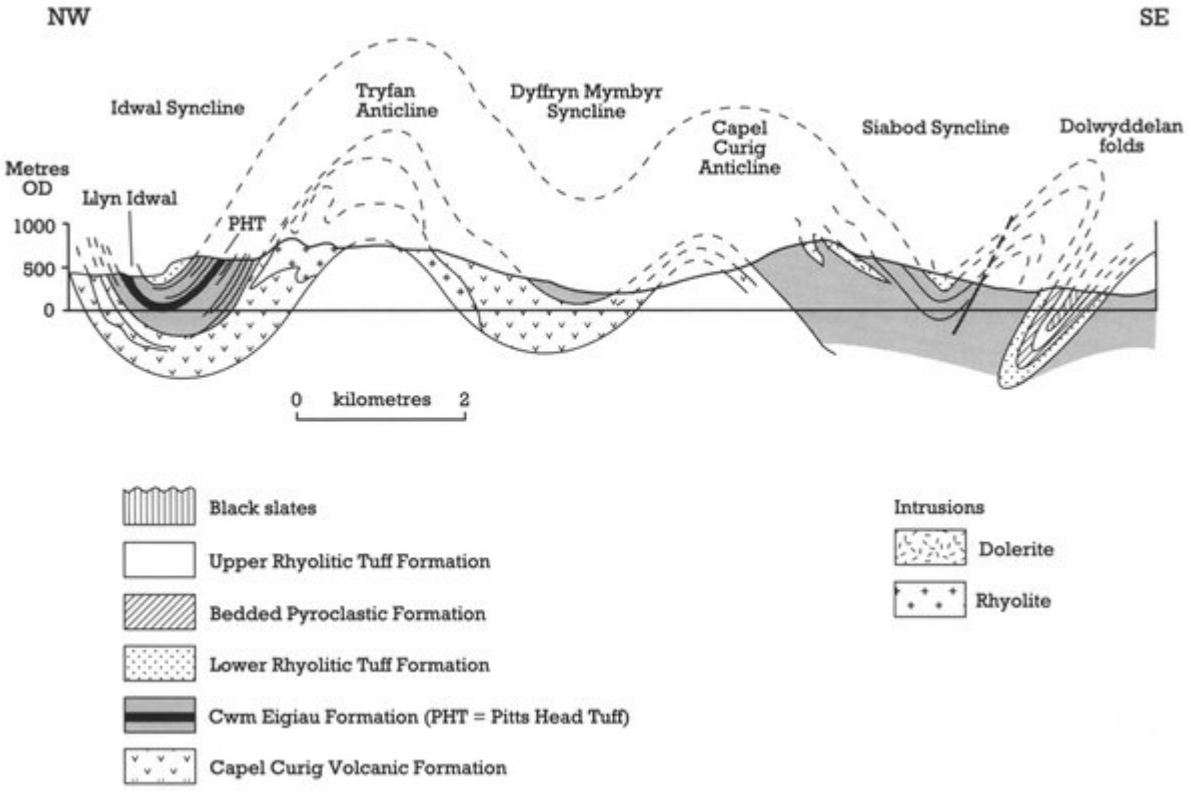
(Figure 3.21) Jumb Quarry. The deformed accretionary spheres of volcanic ash have been used to measure the Caledonian strain in these Ordovician rocks. The cleavage plane photographed is 30 cm high and shows the intersection of bedding plunging to the left. (Photo: Dept of Geology, Manchester University.)



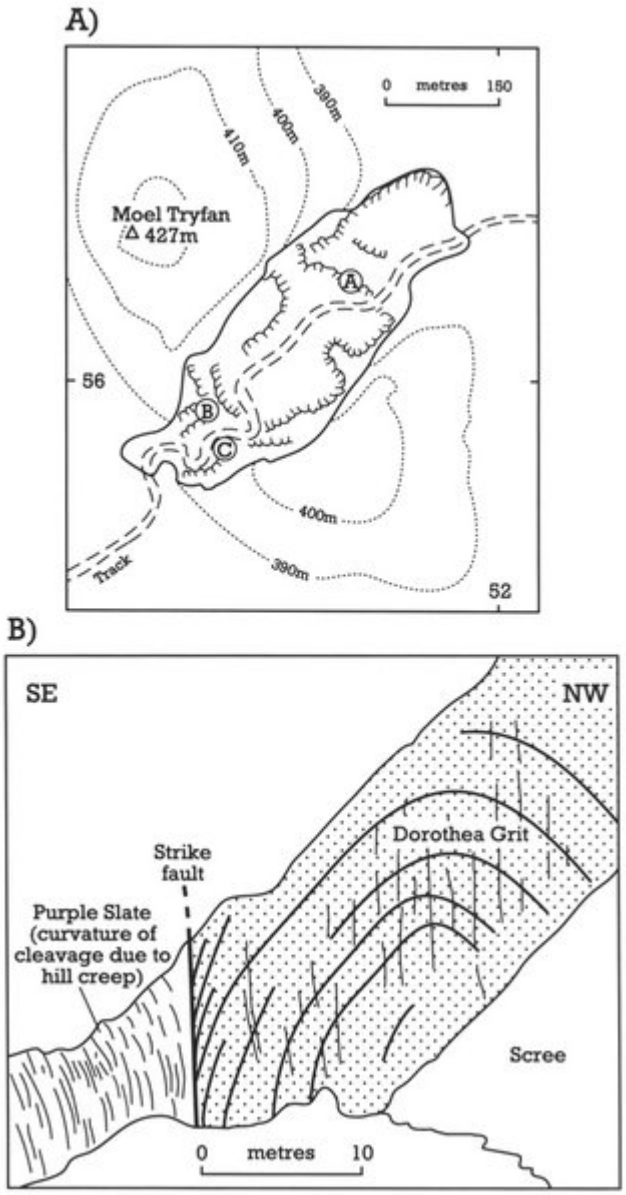
(Figure 3.22)A and B Flinn plots of average lapilli shapes (A) and actual strain ellipsoids (B) for accretionary lapilli horizons within the Borrowdale Volcanic Group. Ellipsoid long, intermediate, and short axes are denoted by X, Y, and Z respectively. (A) shows the range of overall lapilli shapes throughout the Borrowdale Group (data from Bell (1981 — open circles), Oertel (1971 — open squares), Green (1917 — solid squares) and Helm and Siddans (1972 —solid triangles)). (B) Bell (1981) resolved compaction strains (squares) and tectonic strains (circles). Compaction strains are uniaxial ((X = Y) > Z, k tends to zero) whereas tectonic strains are almost plane (k = 1) (data from Bell, 1981).



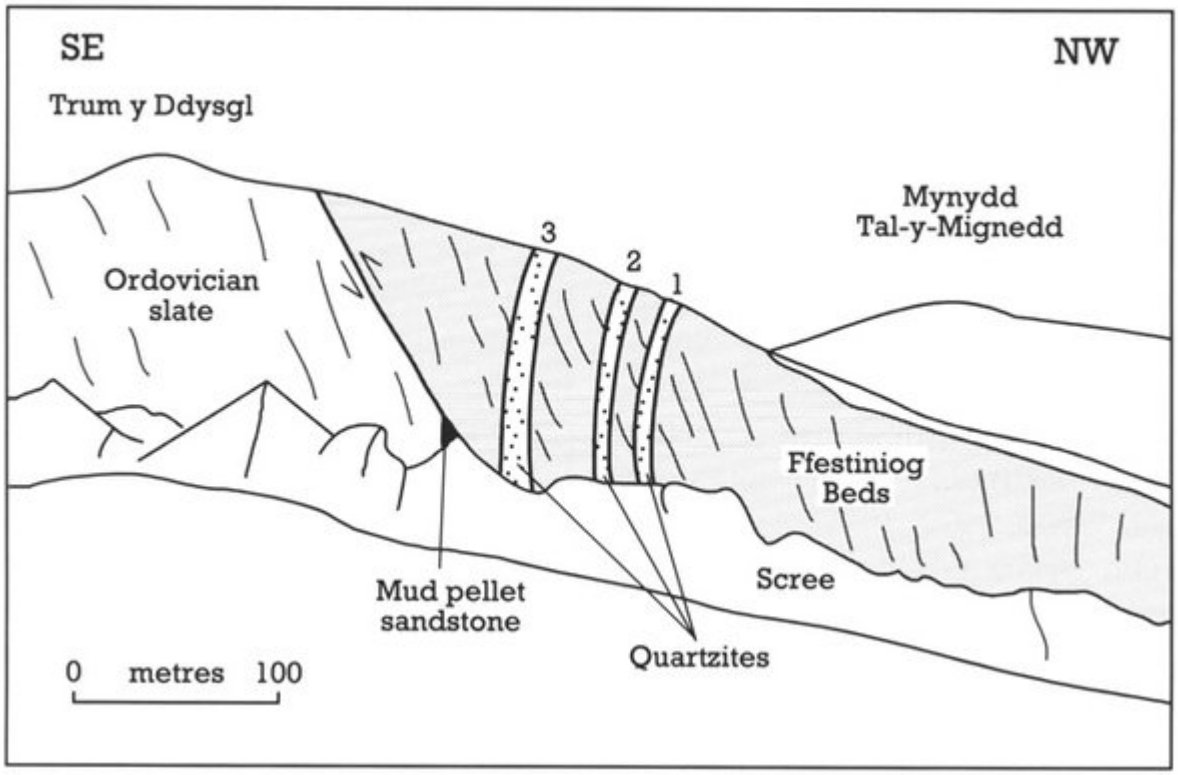
(Figure 4.1) Map showing the traces of the principal folds and faults of Caledonian age in Wales. The localities described in the text are also shown.



(Figure 4.2) Section through the major folds of Snowdonia (after Wilkinson, 1988).

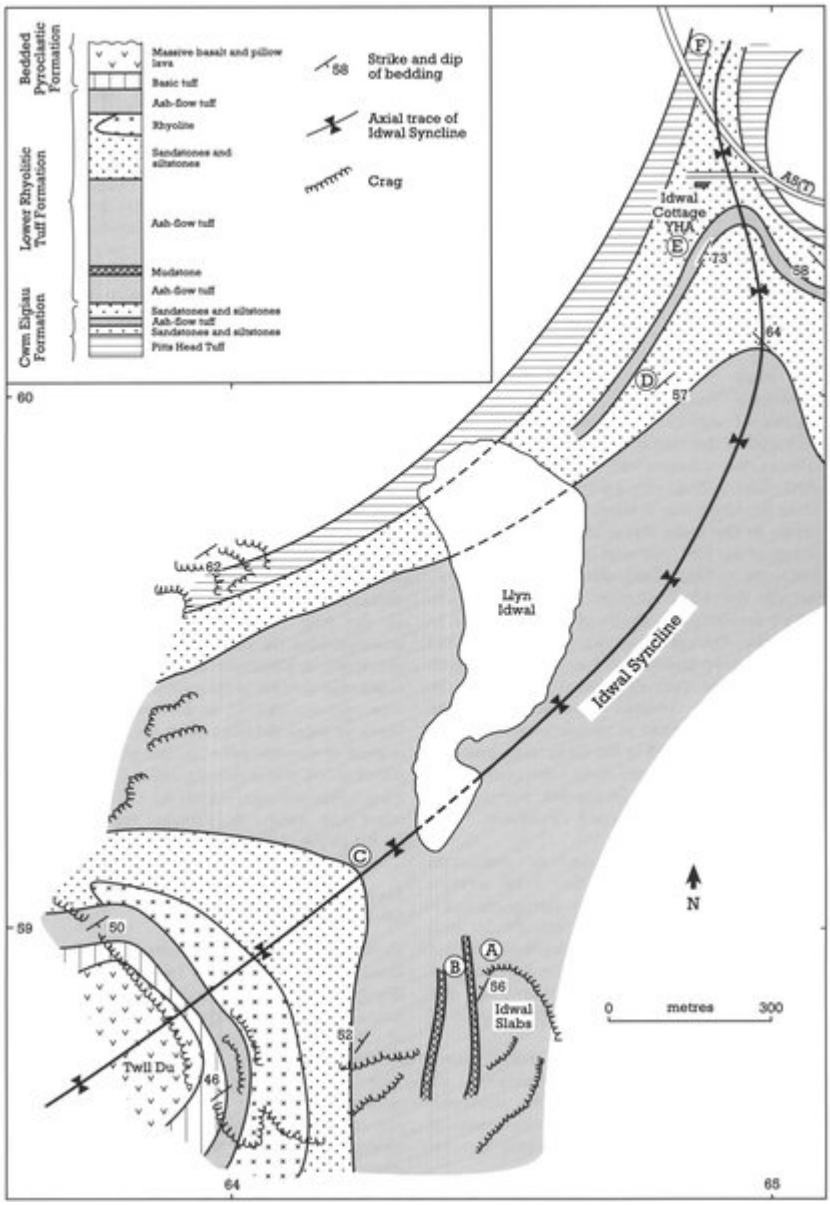


(Figure 4.3) Alexandra Quarry. (A) Site map, showing Localities A–C described in the text. (B) Sketch illustrating anticline in Dorothea Grit with a faulted south-east limb. See text for explanation. Locality B of Figure 4.3A.

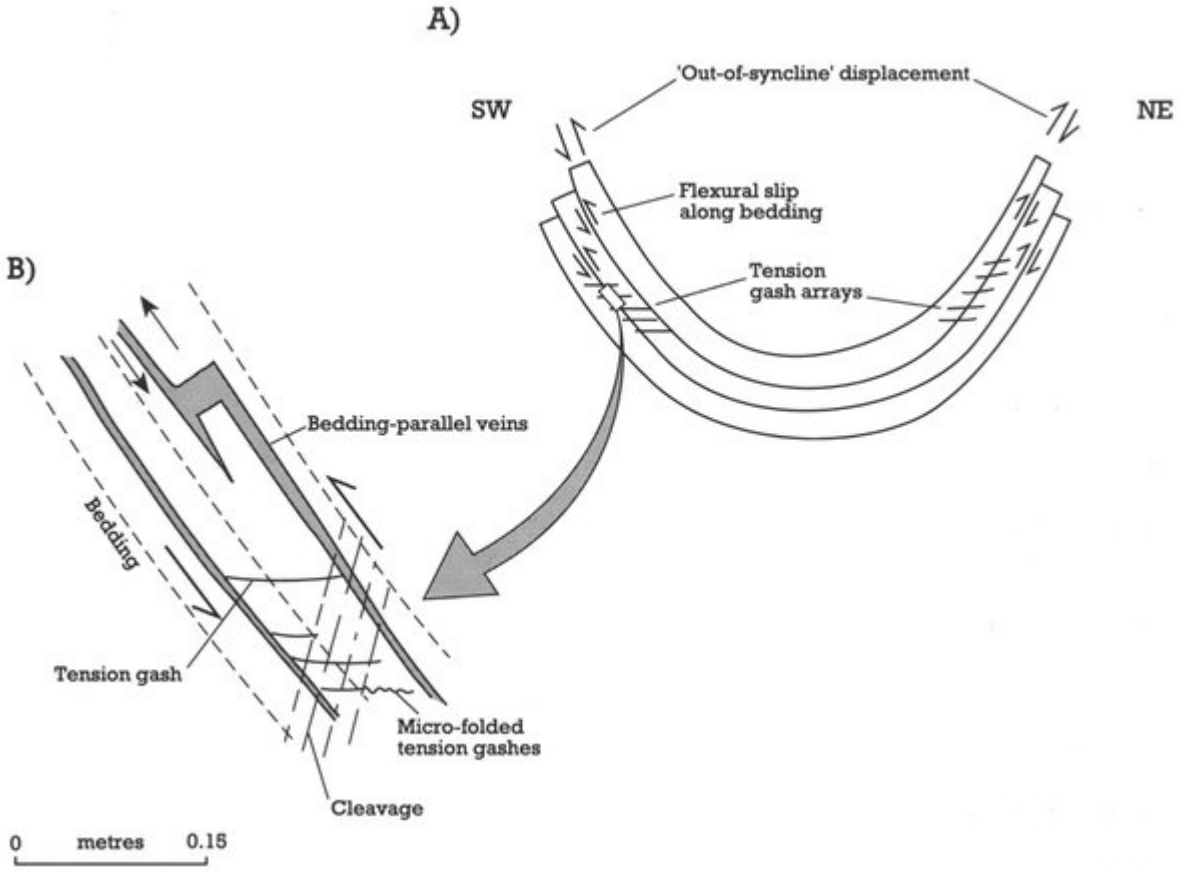


(Figure 4.4) View of Trum y Ddysgl looking south-west. Redrawn from Roberts (1979), after Shackleton (1959).

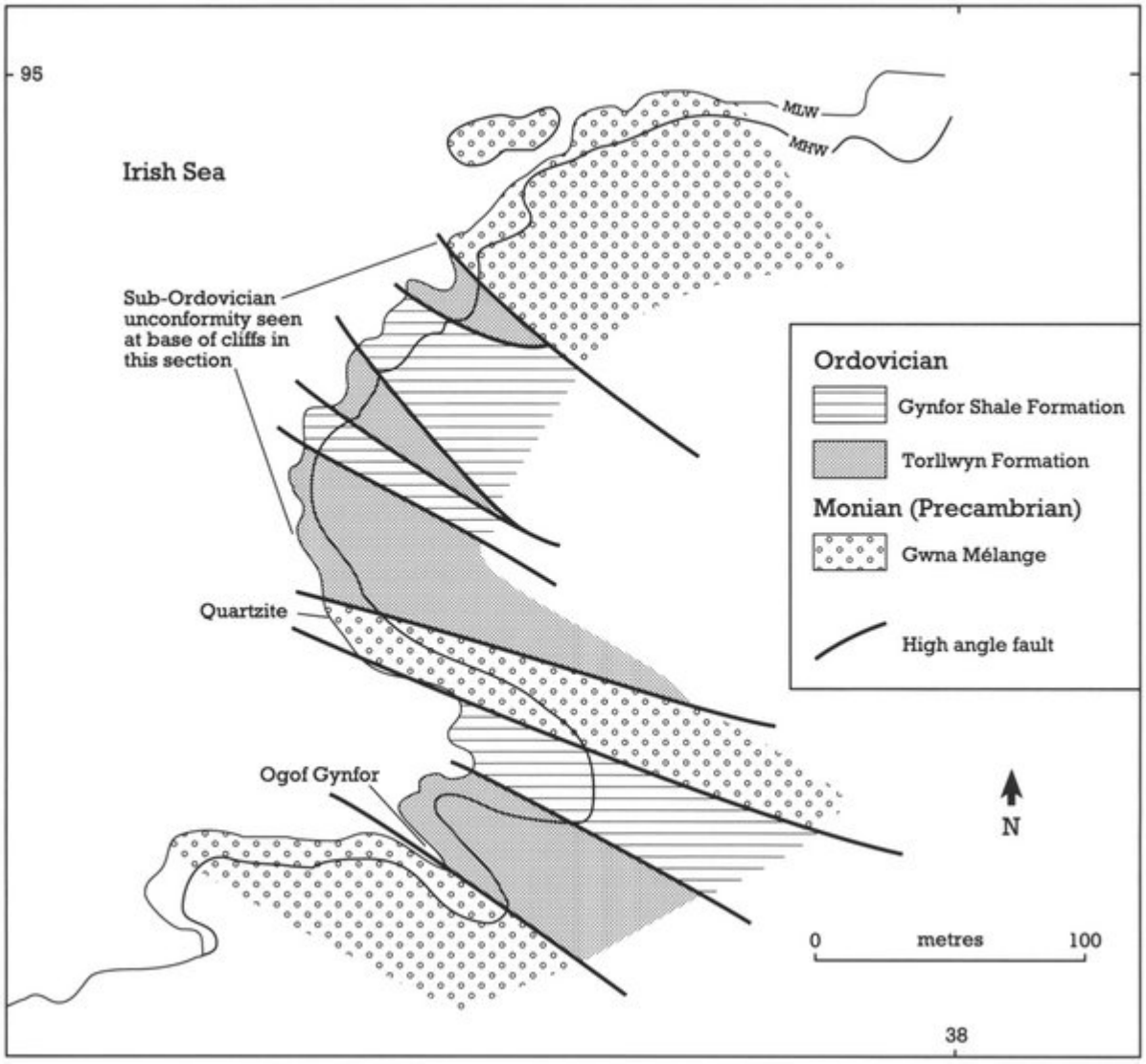
(Figure 4.5) Cwm Idwal, Gwynedd. The right- and left-sloping slabs above the central scree form the syncline hinge of one of the major Caledonian fold structures in Snowdonia, in Ordovician sediments and volcanics. View to south-west, cliff is approximately 300 m high. (Photo: S. Campbell.)



(Figure 4.6) Cwm Idwal. Geological map showing the positions of Localities A–F described in the text.

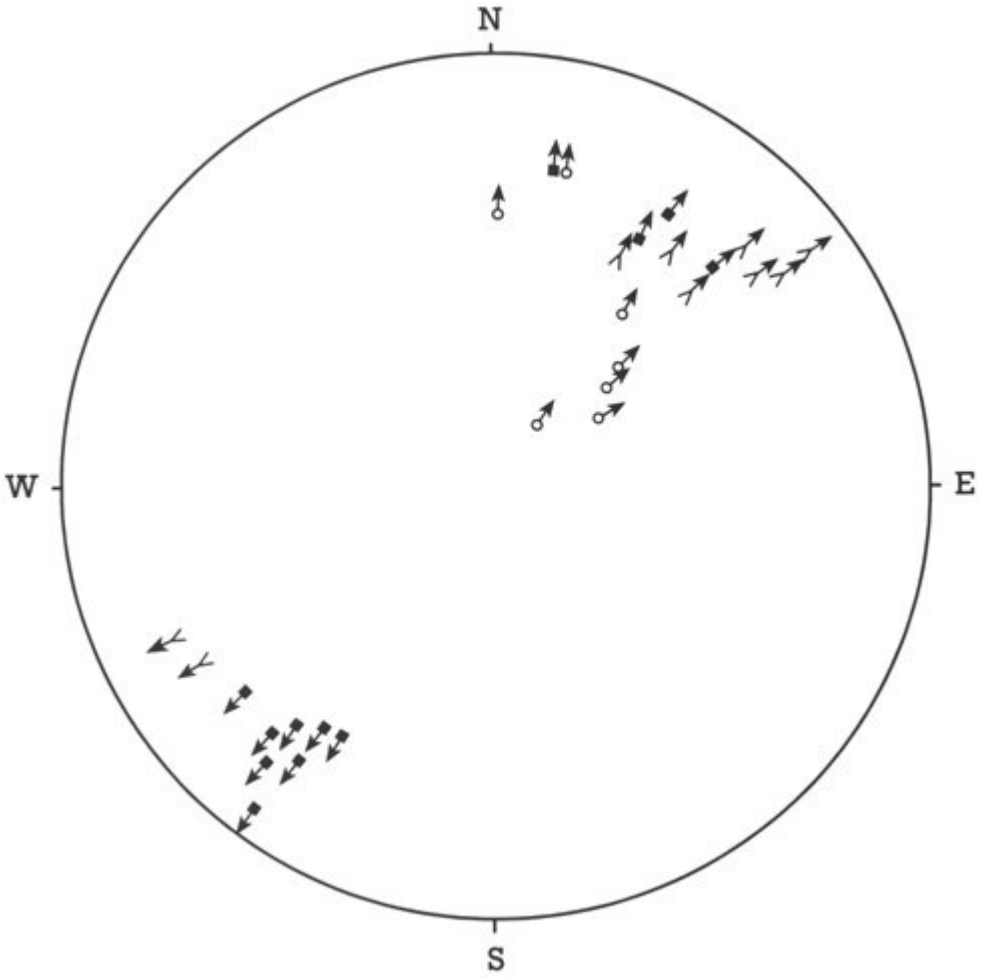


(Figure 4.7) Cwm Idwal. (A) 'Out-of-syncline' flexural slip and tension gash arrays in the 1dwal Syncline. (B) Combination of en bayonet bedding-parallel veins and tension gashes, south-east limit of Idwal Syncline (Locality A).

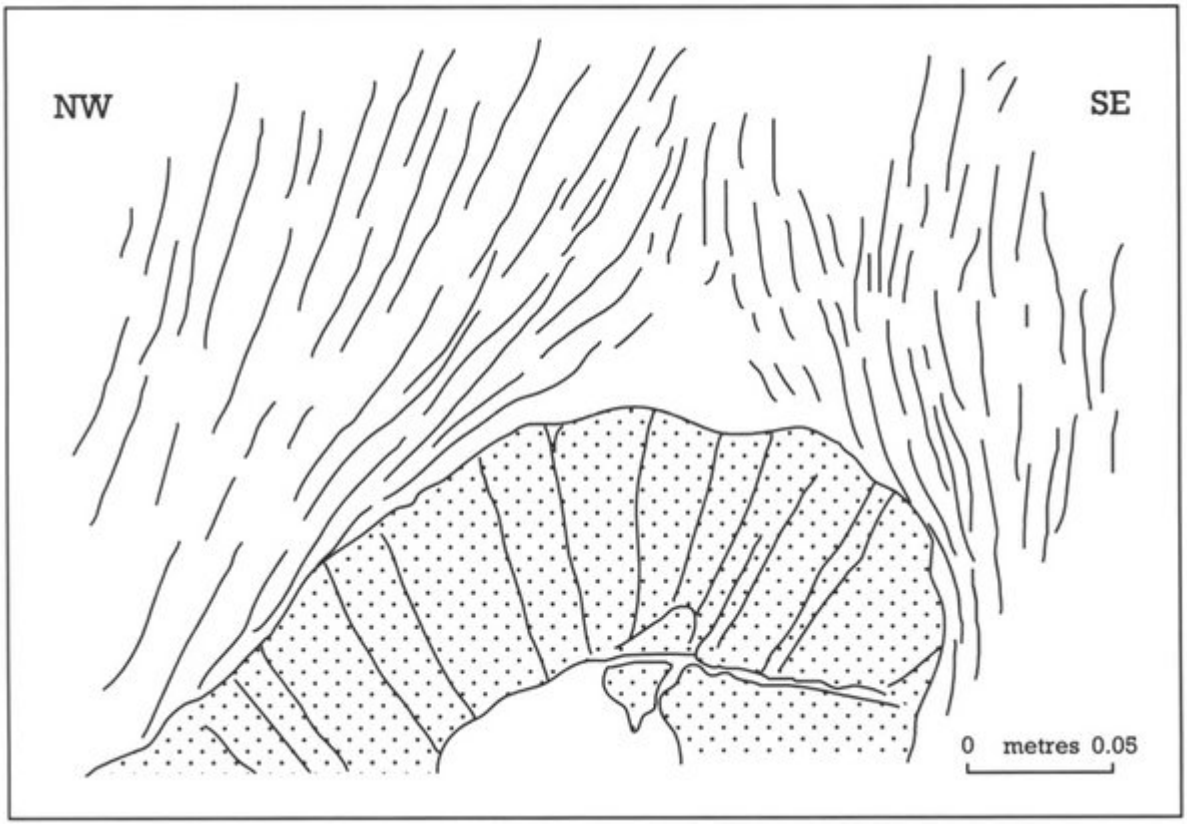


(Figure 4.8) Geology of the Ogof Gynfor site.

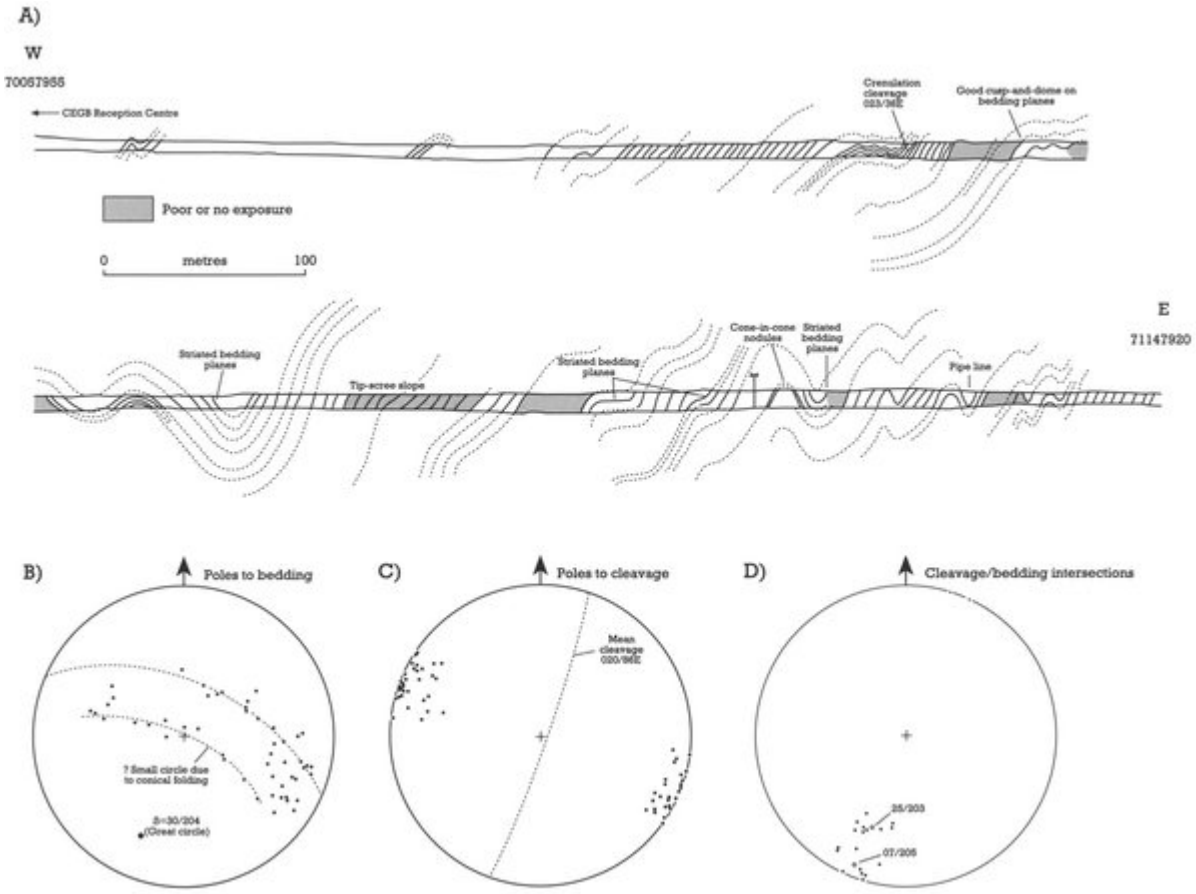
(Figure 4.9) Rhosneigr, Anglesey. Tight minor folds in thin sandstones exemplify the intensity of the deformation in north-west Wales. The enclosing slates have been the subject of studies on the nature of slaty cleavage and strain variations around folded layers (penknife, centre, is 6 cm long). (Photo: J. Treagus.)



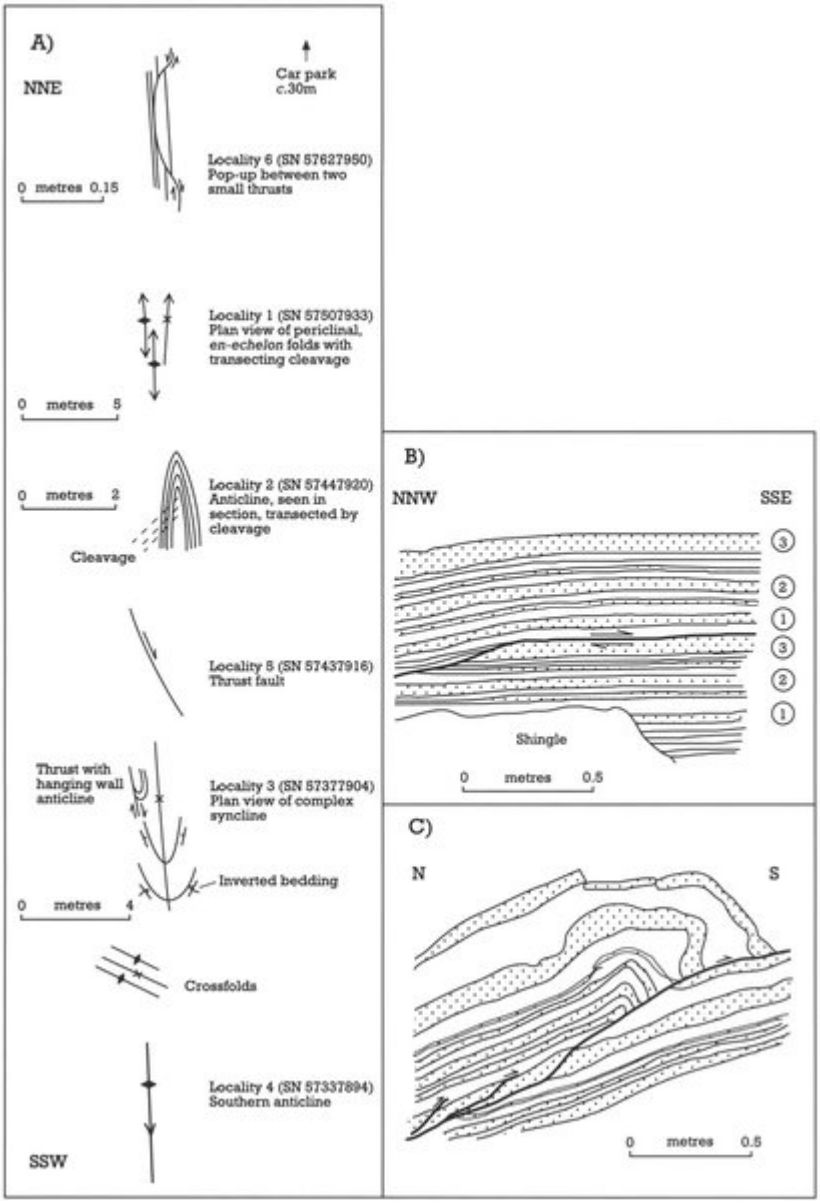
(Figure 4.10) Equal-area stereographic projection of the plunge of minor fold axes at Rhosneigr. The site measurements are represented by the head of the arrow, and are divided into three subareas; circles = central, squares = NE and Vs = SW.



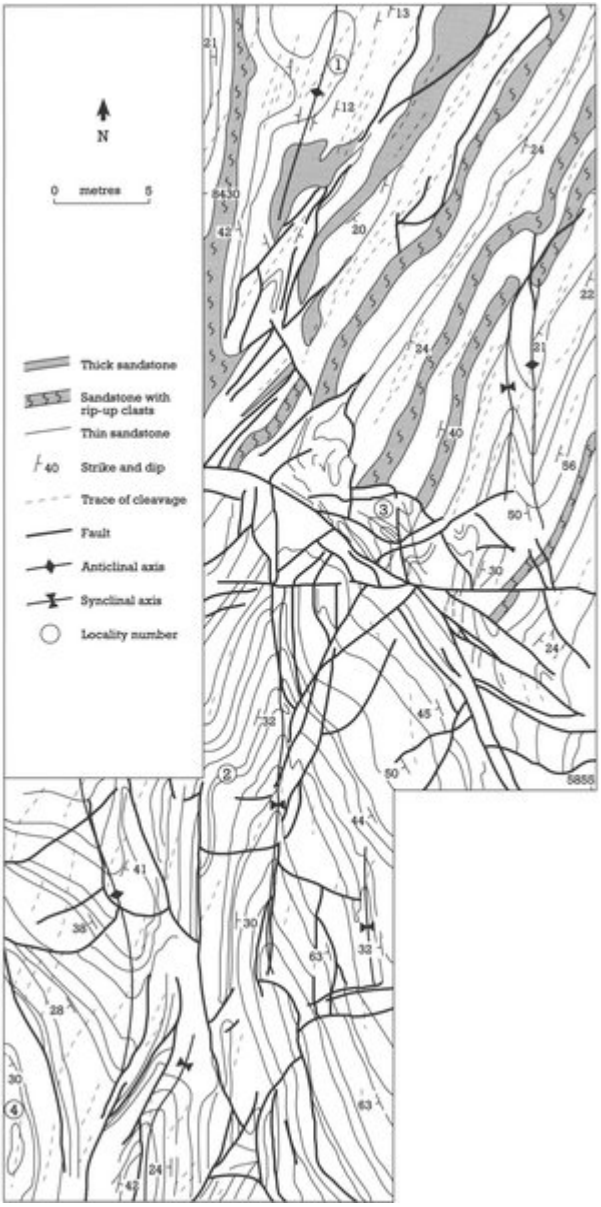
(Figure 4.11) Rhosneigr. Line-drawing illustrating the strong cleavage refraction associated with the hinge of a meso-scale fold delineated by sandstone surrounded by pelite. A photograph of this fold appears in Ramsay and Huber (1983, figure 10.18).



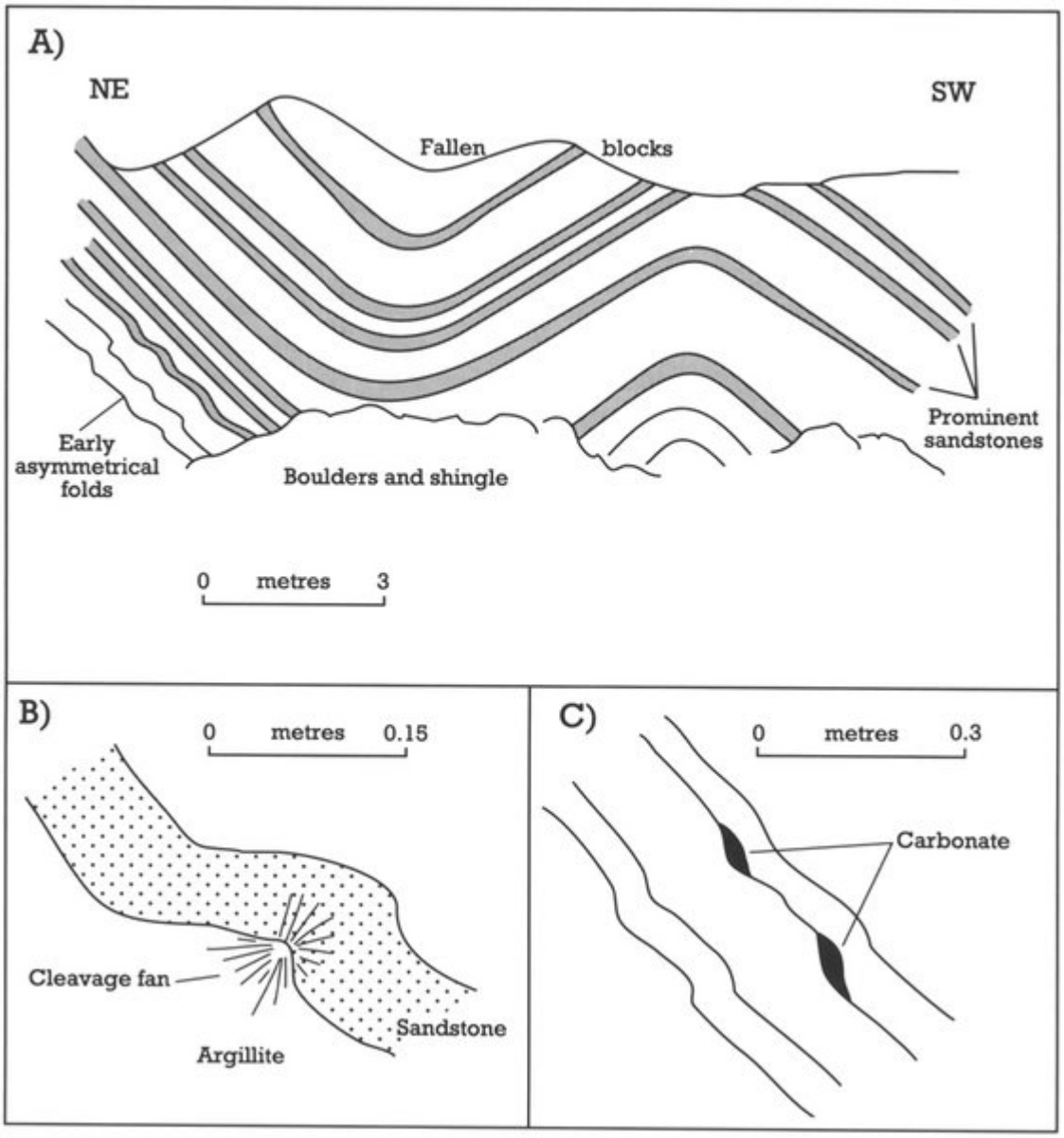
(Figure 4.12) Cwm Rheidol. (A) Section along track showing bedding attitudes in siltstones and mudstones. Parts (B), (C) and (D) are equal-area stereographic projections of poles to bedding, poles to cleavage, and cleavage-bedding intersections respectively. (B) Dashed lines show great circle and small circle limits of the distribution and the large filled circle gives the pole to the great circle. (C) Dashed line represents mean cleavage attitude. (D) The two mean plunges of the cleavage-bedding intersections (open circles) can be seen to lie on the mean cleavage of (C) as does the pole to the bedding readings in (B).



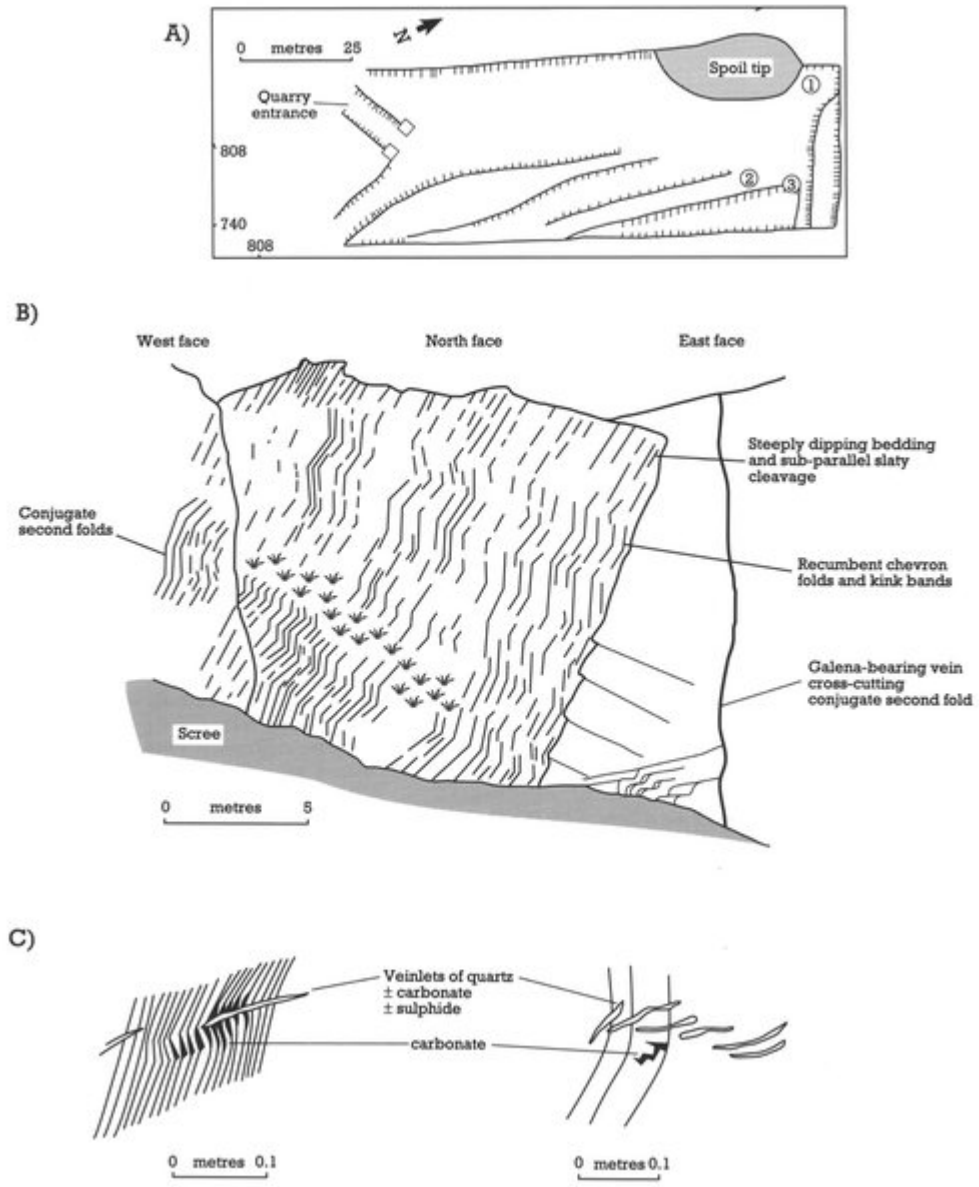
(Figure 4.13) Allt Wen. (A) shows the relative positions of Localities 1–6 and sketches of the structures described in the text. Total length of the section is approximately 250 m. (B) Thrust seen at Locality 5 (after Cave and Haim, 1986, plate 23; Fitches et al., 1986, figure 4C). (C) Thrust and hanging-wall anticline seen at Locality 3 (after Fitches et al., 1986, figure 4D).



(Figure 4.14) North Clarach. Fold–cleavage–fault relationships on wave-cut platform (modified from map produced by R Johnson, University College of Wales, Aberystwyth, 1977). Localities 1–4 referred to in the text.

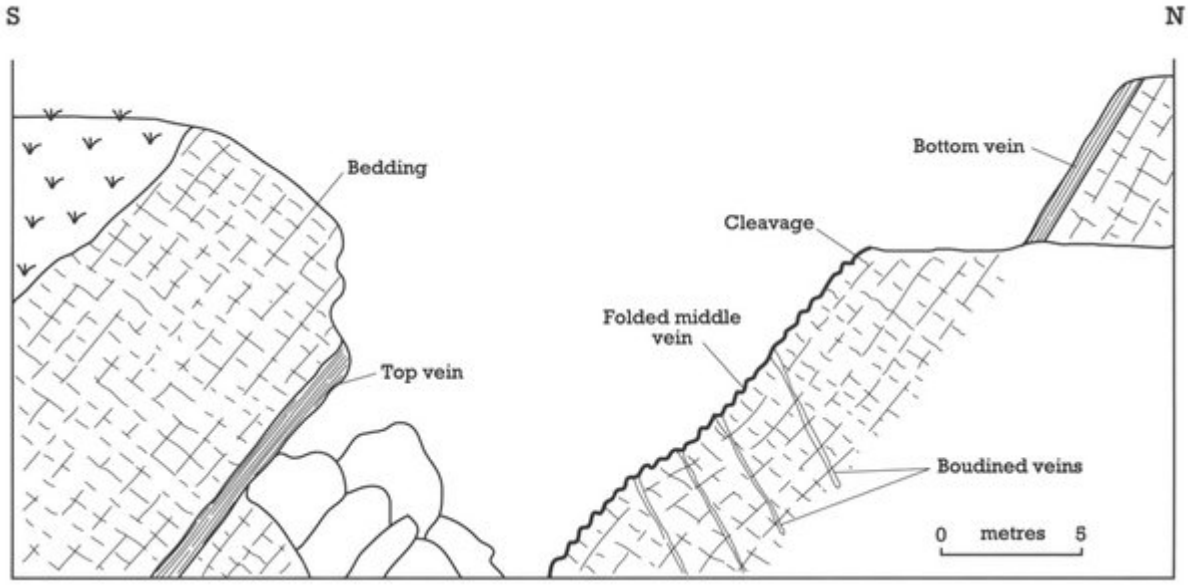


(Figure 4.15) Craig y Fulfran. (A) Regional deformation folds with early asymmetrical small-scale folds on the northeastern limb, further illustrated in (B) and (C). (B) shows cleavage fans and (C) saddle-reefs in hinge zones (after Fitches et al., 1986, figures 6(A), (C), and (B)).

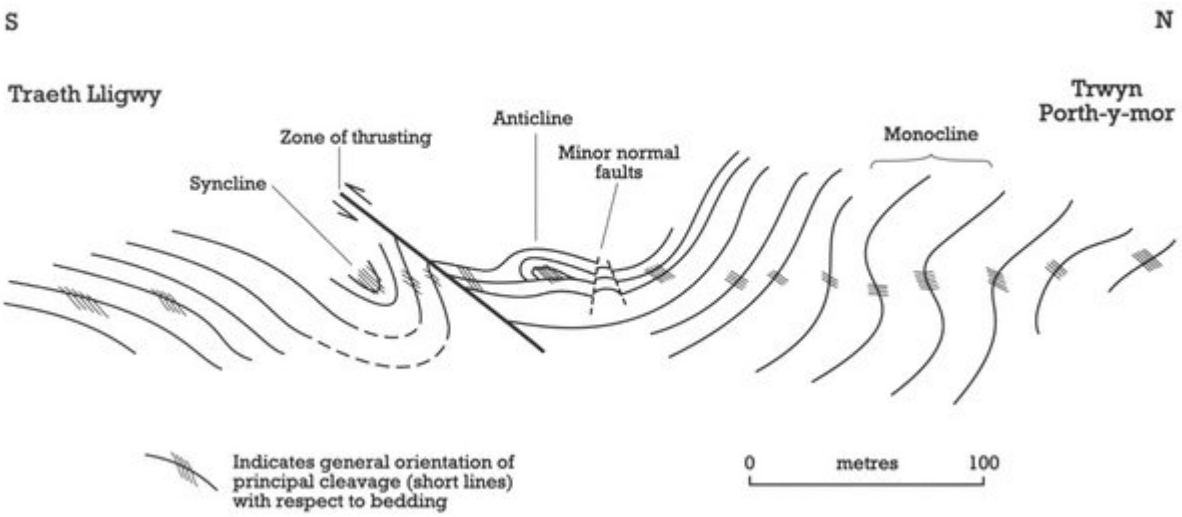


(Figure 4.16) Ponterwyd Quarry. (A) Plan of quarry showing the three localities described in the text. (B) Locality 2; steeply dipping bedding and subparallel slaty cleavage deformed by recumbent second-phase chevron folds and kink bands (after Fitches, 1978, figure 1). (C) Locality 3; saddle-reefs and tension gashes (after Fitches, 1972, figure 2).

(Figure 4.17) Ca'er-hafod. Part of the quarry showing bedding dipping steeply south, and cleavage gently north. The outcrop of the central vein (top left to centre) shows minor folds plunging towards the observer, and ridge-and-groove lineation almost at right-angles to this. View looking east. (Photo: R. Nicholson.)

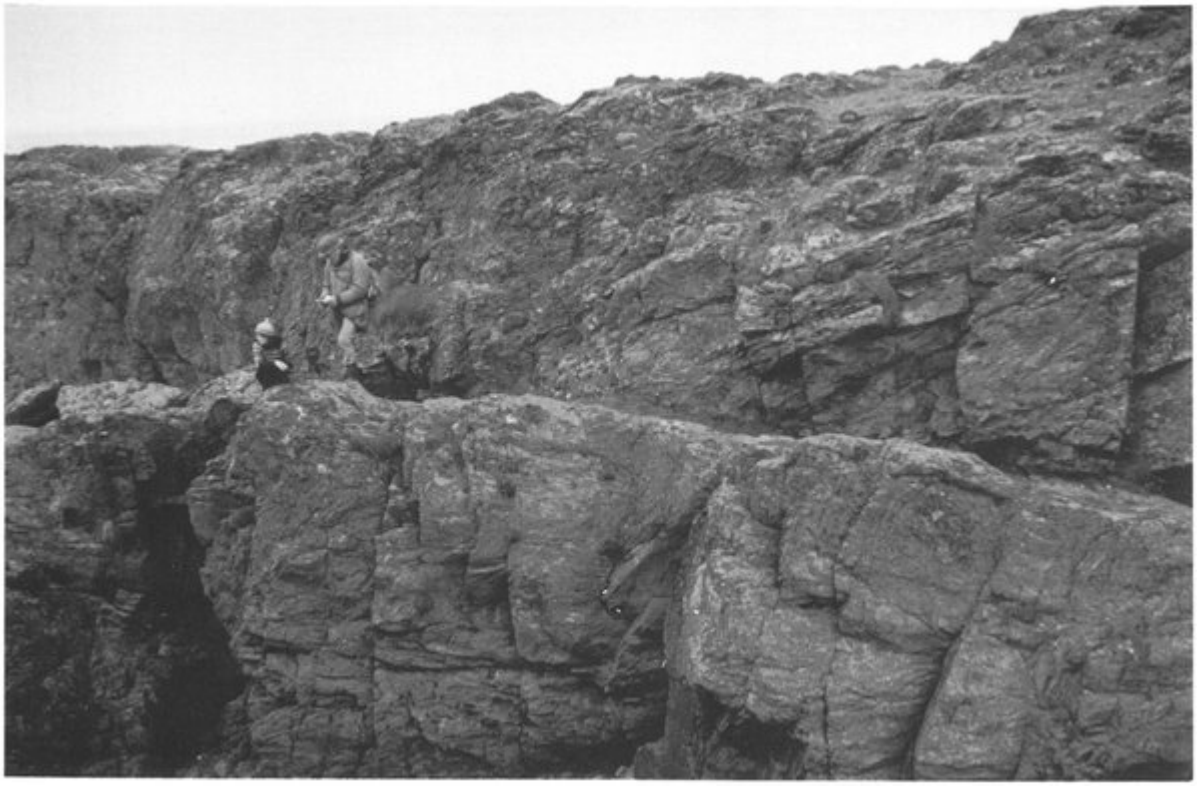


(Figure 4.18) View looking west at Ca'er-hafod Quarry (Llangollen) showing steeply dipping Wenlock country rocks and spar beds (veins).

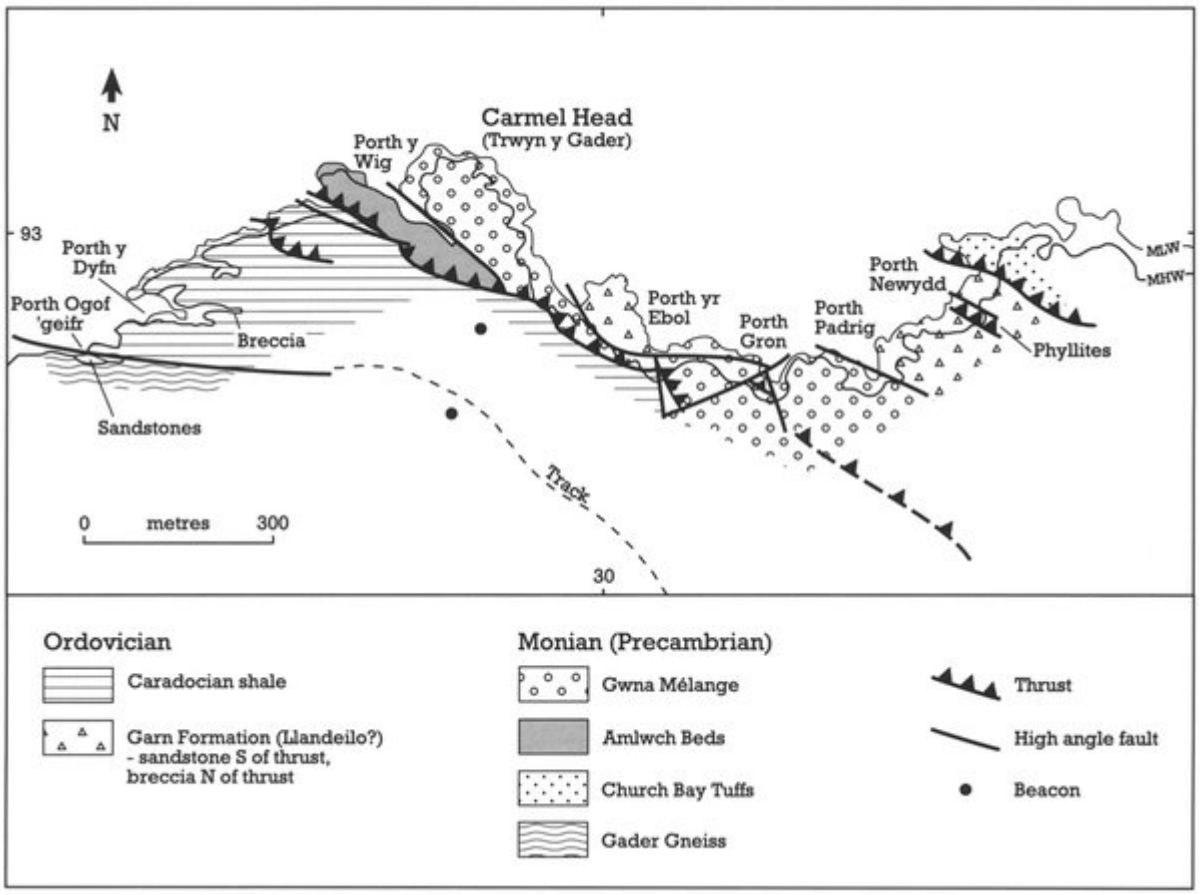


(Figure 4.19) Sketch section illustrating the structure of the Devonian rocks on the north side of Lligwy Bay.

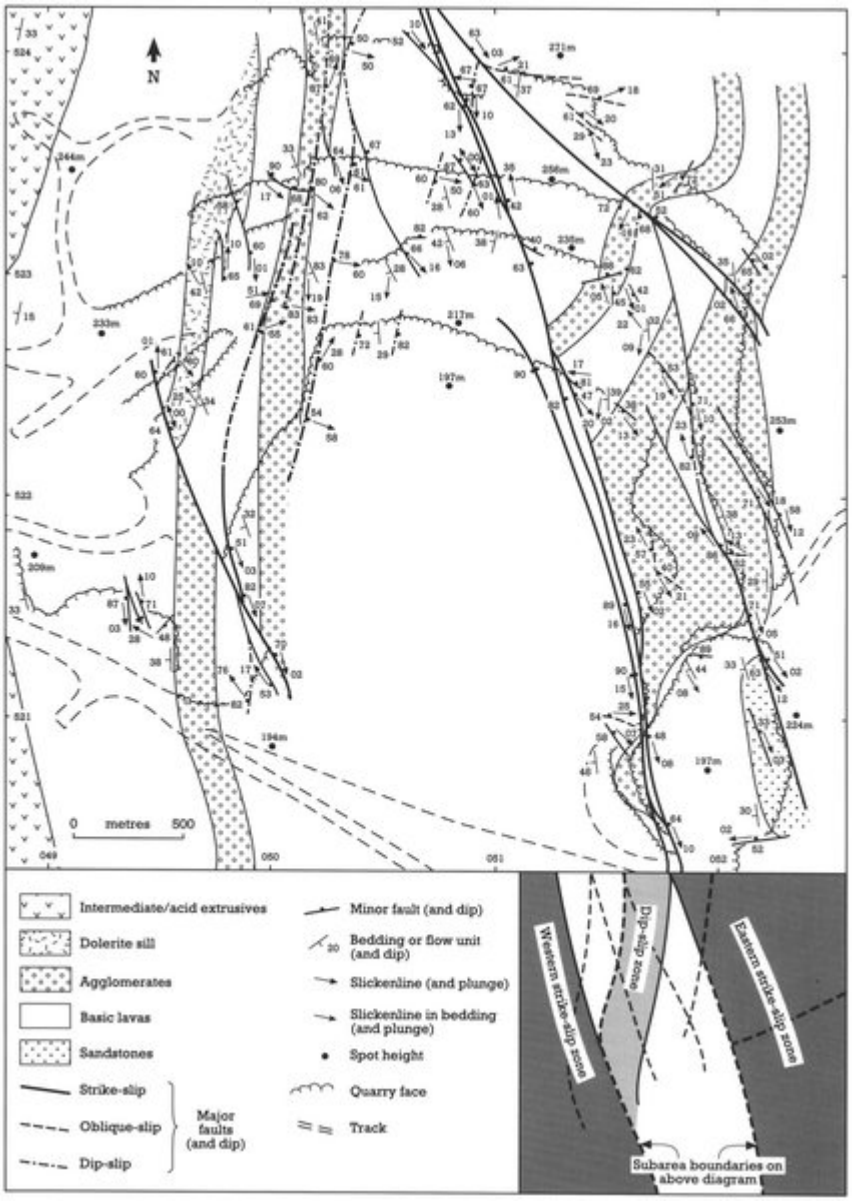
(Figure 4.20) Lligwy Bay, Anglesey. Strongly developed, spaced cleavage in ?Devonian siltstones dips to the north in the hinge of a south-facing monocline. (Photo: J. Treagus.)



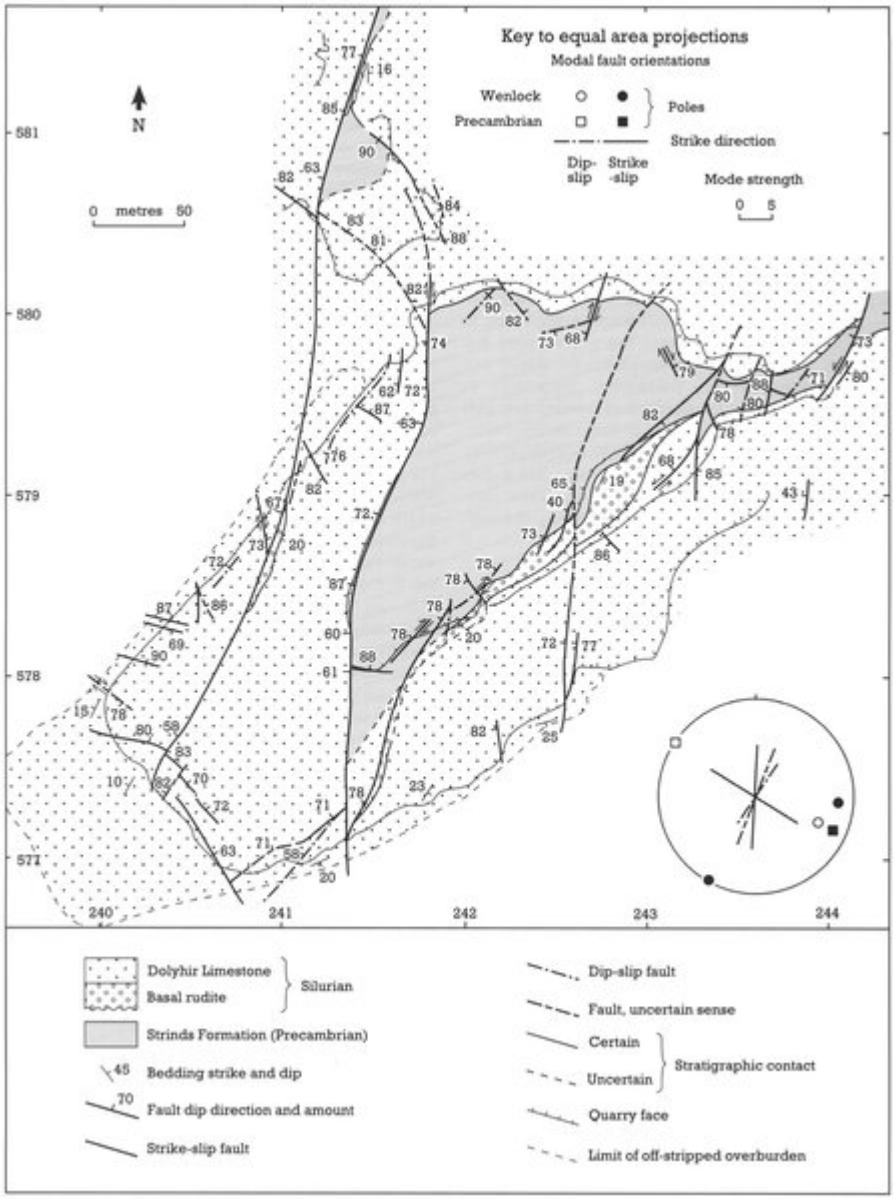
(Figure 4.21) Carmel Head, Anglesey. Figure standing on the low-angle fault plane which has thrust Precambrian schists over Ordovician shales. (Photo: J. Treagus.)



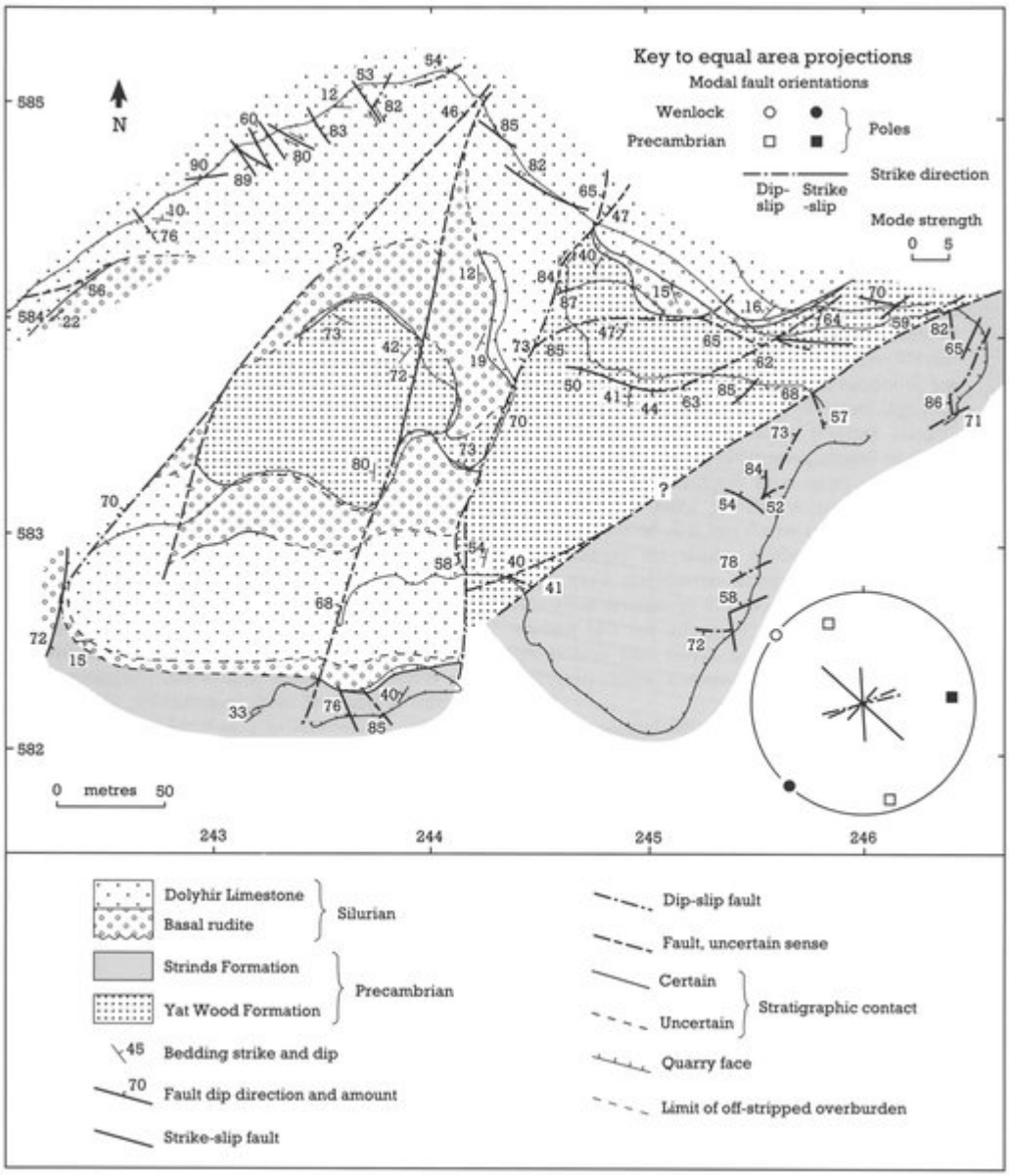
(Figure 4.22) Geology of the Carmel Head site.



(Figure 4.23) Geological map of the main Llanelwedd Quarry with inset summary of main kinematic zones (after Woodcock, 1987b).



(Figure 4.24) Structural map of Strinds Quarry with inset stereogram showing modal orientations of strike-slip and dip-slip faults (after Woodcock, 1988).



(Figure 4.25) Structural map of Dolyhir Quarry with inset stereogram showing modal orientations of strike-slip and dip-slip faults (after Woodcock, 1988).

Stratigraphy and timing of events	Description of deformation phase	Phase numbering and contributions by various workers					
		Simpson (1967)	Soper (1970) and others (see text)	Moseley (1972)	Roberts (1977)	Webb and Cooper (1988)	This volume
	FAULTING dominantly N and NW trends						
	N-S FLEXURES with weak fracture cleavage				D_4		D_3
	RECLINED FOLDS with flat crenulation cleavage		D_2		D_3		D_2
Late Early Devonian intrusion of Shap (394Ma) and Skiddaw (398Ma) Granites							
MAIN END-CALEDONIAN PHASE: (Pridoli) WINDERMERE GROUP (Mid-Caradoc)	UPRIGHT FOLDS Major and minor, with transecting cleavage, trending NE to E	F_3	D_1	Phase 3 Related to collision	D_2	D_3	D_1
VOLCANO-TECTONIC FLEXURING AND TILTING							
(Early Caradoc) BORROWDALE VOLCANIC GROUP (Llandeilo)	Open E-W folding, block faulting		E-W folds large scale, no cleavage	Phase 2 Related to subduction and closure	Not recognised in Skiddaw Group	D_2	Volcano-tectonic deformation (Branney and Soper, 1988)
VOLCANO-TECTONIC UPLIFT BEGINS?	INITIATION OF ENE-TRENDING LAKE DISTRICT ANTICLINE?						
(Llanvirn) (Arenig) SKIDDAW GROUP (Tremadoc) ?	N-TRENDING FOLDS no cleavage	F_1 and F_2 (descriptions as D_1 and D_2 this volume)	N-S folds minor, no cleavage	Phase 1 N-S folds, minor in largely unconsolidated sediments	D_1 N-S folds, recumbent and minor, in largely unconsolidated sediments	D_1 N-S folds (but variable), large and small scale submarine slides and slumps	D_0 Large and small scale slumps as Webb and Cooper (1988), early small scale slumps

(Table 3.1) Deformation sequences in the Lake District as interpreted by various authors; the last column shows the system adopted in the present volume.