Chapter 4 The Harlech dome road circuit

It is possible to examine eight of the formations that comprise the Harlech Grits and Mawddach groups, in addition to a number of other interesting features, at roadside localities around the Harlech dome. The complete circuit is about 65 km. It can be started at any point, but to do it more or less in stratigraphical order it is best to start at Harlech (Figure 39) and travel anticlockwise.

Locality 1 Harlech Castle [SH 5808 3132] Park at the Watergate entrance near the level crossing. The castle is built on a crag, which in historic times was a sea cliff, and the weathering of the rocks in the cliff is typical of a coastal outcrop. The castle is now separated from the sea by a broad flat of Recent sediments and sand dunes. The lower part of the exposure in the car park is in one of the rare silty horizons within the Rhinog Formation, here dipping at 30° ESE. The dark grey, cleaved silty mudstone contains thin beds of coarse-grained greywacke turbidites. The beds are graded, and the bases show moulds of scatch marks which are mostly load deformed. About 9 m from the base the thickly bedded, coarse-grained turbidites typical of the formation occur. The Rhinog Formation is also exposed in the cutting opposite Theatr Ardudwy.

Locality 2 The Llanbedr Formation is exposed in the disused slate quarry [SH 5900 2670] south-east of Llanbedr. South from Llanbedr take the first turn left after Capel Moriah. The quarry is situated about 0.5 km to the east of the main road, and the waste tip lies to the north of the road. The formation consists of massive blue-grey mudstone with a closely-spaced, well-developed cleavage. There is little indication of bedding except on the western end of the quarry, where purplish grey mudstone and thin green sandy bands are interbedded. A thin dolerite sill, about 6 cm thick, crosses the quarry face and can be seen lensing out. Minor faults can also be seen.

The road south from Llanbedr skirts the edge of the Recent estuarine sediments, and the break in slope between these and the boulder clay, resting on Harlech Grits Group, roughly marks the line of the Mochras Fault. The exact throw of this fault is not known, but is in excess of 2000 m. A borehole drilled on Mochras (Shell) Island proved this thickness of Mesozoic and Tertiary sediments beneath the drift cover.

Locality 3 St John's Church, Barmouth [SH 6130 1595] Between this locality and Aber Amffra Harbour on the eastern side of town all formations from Hafotty to Maentwrog are exposed. At this locality the lower part of the Hafotty Formation, with the manganese ore-bed near the base, is exposed. Full details of it are given under Locality 1, Excursion 2.

Locality 4 Porkington Terrace [SH 6189 1560] Park in the lay-by opposite the houses, and from there visit the several exposures in the Barmouth and Gamlan formations in the roadside, on the sea shore and near the bridge. At the western end of the road cutting immediately west of Porkington Terrace, the junction between the Barmouth and Gamlan formations is exposed. Two beds of coarse-grained turbiditic sandstone separated by 53 cm of grey siltstone are the uppermost beds of the Barmouth Formation. A minor fault coincides with the top of the lower of the two beds. At the base of the Gamlan Formation, 30 cm of fine sandstone are overlain by light greenish grey, banded siltstone. Beds of sandstone up to 60 cm thick are present at intervals above this. Also in this cutting are two nearly vertical normal faults throwing down to the east, one with a quartz vein along it.

Many characteristics of the Gamlan Formation are displayed on the weathered exposures along the beach below this cutting. Thin beds of slumped sandstone (Figure 40) and turbidites are interbedded with cleaved siltstone. The rocks are folded, and both cleavage refractions and the fan-like orientation of axial plane cleavage in a fold are well displayed (Figure 41). Near the railway bridge the siltstone is purple, and contains sparse green sandy beds with plentiful yellowish pink nodules as well as thin beds and laminae of spessartine rock.

Locality 5 Aber Amffra Harbour [SH 6226 1574] There is a parking area at the start of a picturesque footpath which leads up a wooded valley to Panorama Hill. On the western side of the valley and in adjacent road cuttings the black silty mudstone of the Clogau Formation, which conformably overlies the Gamlan Formation, is exposed. The mudstone locally contains thin lenses of pyrite and pyrrhotite with minor quantities of other sulphides. On the eastern side of the valley

(Figure 42) there is an excellent small outcrop in an anticline in the basal Maentwrog Formation (see Excursion 3). Beds of fine quartzose sandstone up to 15 cm thick alternate with very dark silty mudstone. Some beds, probably turbidites, are massive, others display cross-lamination, rippled tops and convoluted lamination (see p. 24). The bases of the beds are load deformed with additional, later, tectonic deformation. Unlike the sandstone, the mudstone displays a strong cleavage.

The road along the Mawddach estuary, though it crosses the Caerdeon syncline and skirts the end of the Dolwen pericline, remains within the Maentwrog Formation as far as Ganllwyd. There are numerous exposures, many of them stabilised with rock anchors, and all aspects of the formation may be examined.

Locality 6 [SH 6793 1888] Park in the lay-by where the road has been re-routed. In this southern part of the Harlech dome the upper part of the Maentwrog Formation contains very little interbedded sandstone and coarse quartzose siltstone. The outcrop is typical of the upper part of this formation. The dark grey banded silty mudstone is intruded by a 20-m thick sill of grey, altered, pyritic microtonalite, and the contact is exposed. The rock is typical of the numerous intrusions which are co-magmatic with the Rhobell Volcanic Group lavas. In the drift above the outcrop a channel, filled with rounded boulders and cobbles in a clayey matrix, occurs below the scree or head. There are several similar examples along this road (see *Locality 9*). They represent active subglacial drainage channels which were filled with alluvium, and which were eventually covered by scree following deglaciation.

Locality 7 [SH 7011 1954] About 40 m along a Forestry Commission road on the north side of the A496 is a bricked-up entrance to a level in the Prince of Wales gold mine. There are numerous levels on the hillside in this area all worked in a group of E–W-trending quartz veins carrying galena, pyrite and chalcopyrite. Voel Mine, near the top of Foel Ispri, is included in the New Precipice Walk (Excursion 13). The veins have been mined since the middle 18th century, though work at the Prince of Wales mine began only in 1836. Efforts to make them profitable continued until 1903. Very little gold was found, and throughout their history lead, zinc and silver were the main products.

About 30 m beyond the adit is a 4 to 5-m section through boulder clay which shows a crude layering. There is a dominance of rounded exotic cobbles in silty clay in the lower part and locally derived angular boulders and cobbles in the upper part. The boulder clay is overlain by about 1 m of soliflucted debris with incorporated waste from mine workings.

Locality 8 [SH 7107 1937] This relatively new road cutting alongside a scree retaining wall is a good place to examine the upper part of the Maentwrog Formation. The section exposes dark grey mudstone with silty laminae, laminae and thin beds of coarse quartzose siltstone, and two beds, up to 26 cm thick, of fine quartzose sandstone showing convoluted lamination in the upper parts. The mudstone is locally pyritic with lenses, disseminated crystals and some 1 cm cubes. The outcrop is crossed by a 50-cm thick fault-zone with an easterly downthrow and several parallel fractures. A strong N–S tectonic lineation is apparent on bedding surfaces, but no cleavage is visible in outcrop.

Locality 9 [SH 7212 2047] Near the north end of the long road cutting north of Llanelltyd is another example of a filled subglacial drainage channel. Here a winding channel eroded into the Maentwrog Formation is filled with a mixture of boulders, cobbles and sand, in places with a hard ferruginous cement. The scree which covered the channel was stripped off during road widening.

Locality 10 [SH 7283 2445] Just north of the Tyn-y-groes hotel the Mawddach valley widens. From this point to the confluence of the Afon Eden, about 1.5 km N, it is filled with terraced deposits of late or post-glacial sands and gravels, in places with a hard ferruginous or manganiferous cement. Details of this locality are given on p. 72.

The Maentwrog Formation, exposed in the river bed here, contains many fossils but of few species. *Homagnostus obesus* and *Olenus* species are the commonest forms and have been found at many localities. One of the earliest to be discovered was on the banks of the river 700 m N of the Tyny-groes hotel.

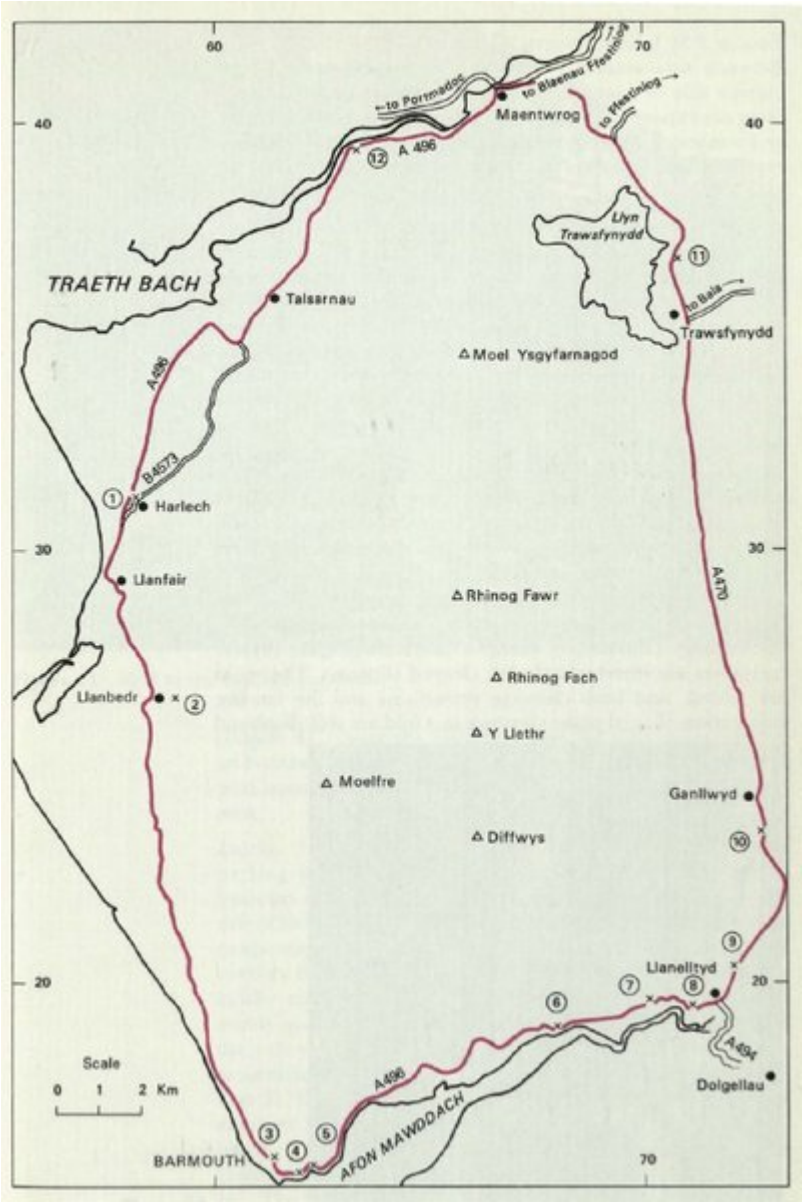
North of Ganllwyd, about 1.5 km beyond the forest [SH 7135 3055], there is a splendid view of the Rhinogs. The axis of the Dolwen pericline lies along the valley floor to the west. Bedding along the Rhinogs dips generally west, whereas on Craig-y-Penmaen, the craggy hill to the east of this locality, bedding dips east.

Locality 11 [SH 7068 3667] On the east side of the road, opposite a lay-by, is a recently made cutting in the Rhinog Formation. The coarse-grained greywacke shows many of the features typical of turbidites (p. 15, (Figure 9)).

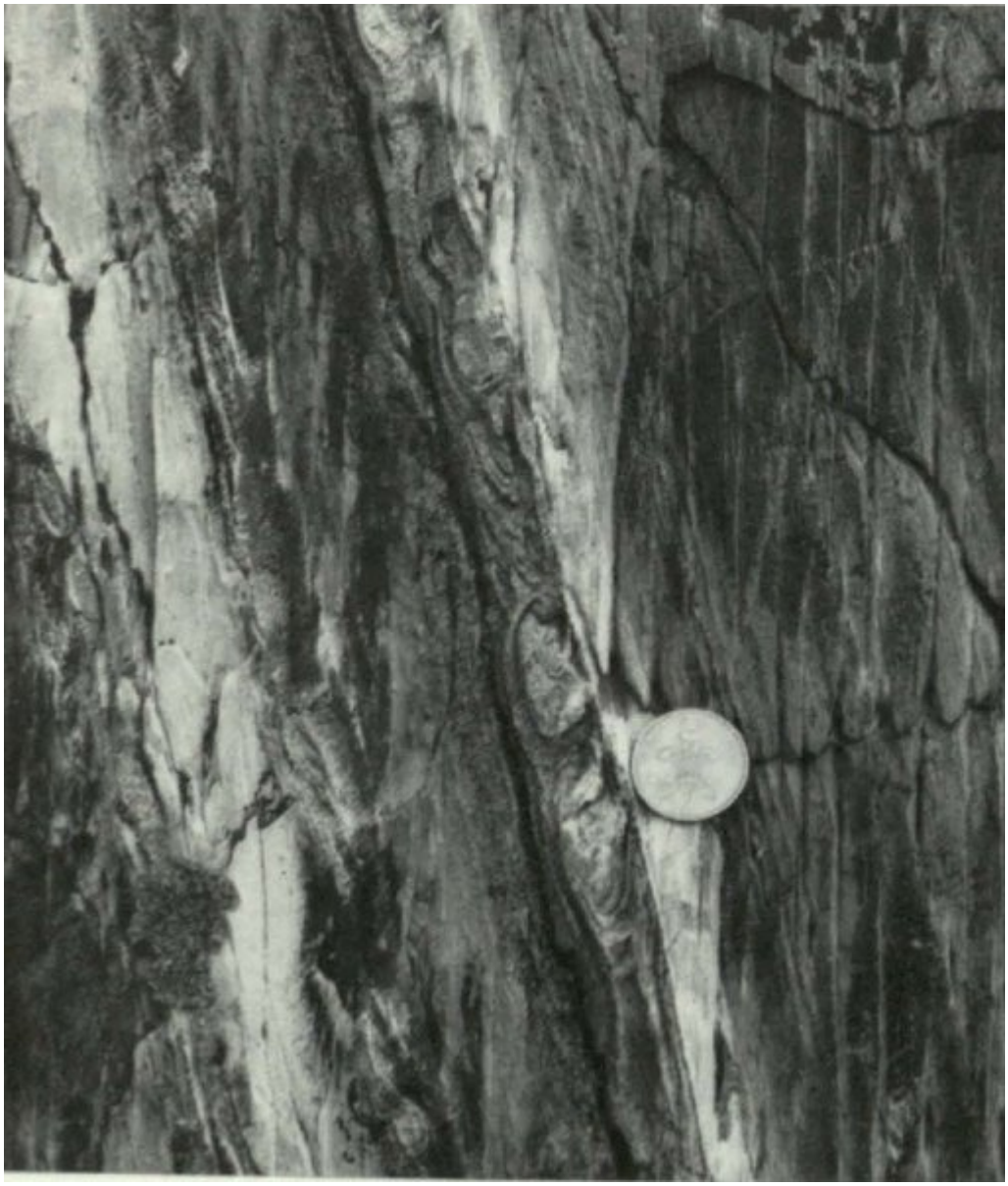
Locality 12 [SH 6315 3940] Park in a lay-by on the north side of the road. The Ffestiniog Flags Formation is well exposed, and consists of dark grey, cleaved mudstone thinly interbedded with coarse siltstone up to 15 cm thick dipping generally northwards. Most of the sedimentological characteristics of this formation (p. 28) can be examined here. At this locality crenulations and a strong tectonic lineation are imposed on the sedimentary structures.

(Figure 61) Convolute lamination.

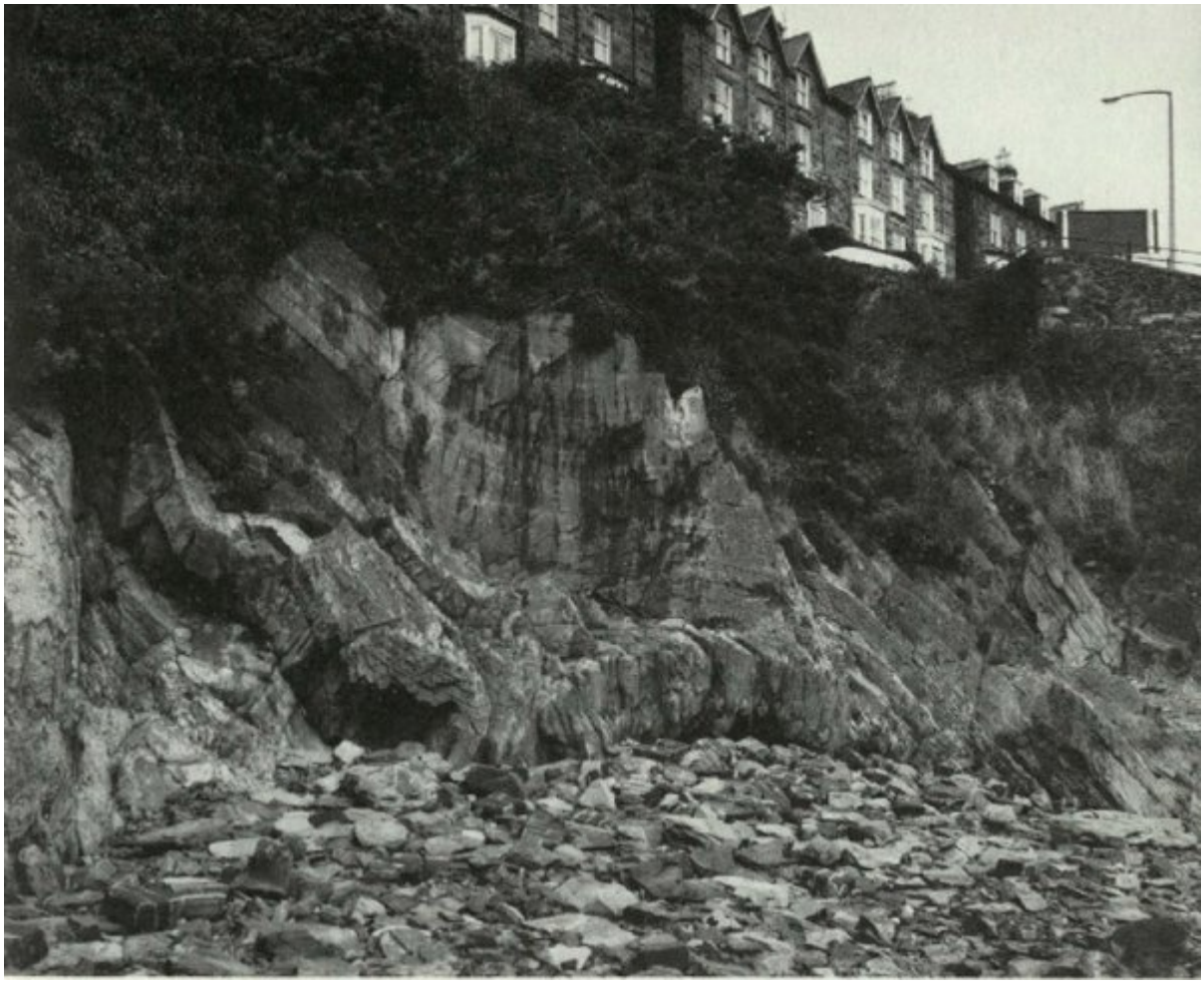
References



(Figure 39) The Harlech dome circuit.

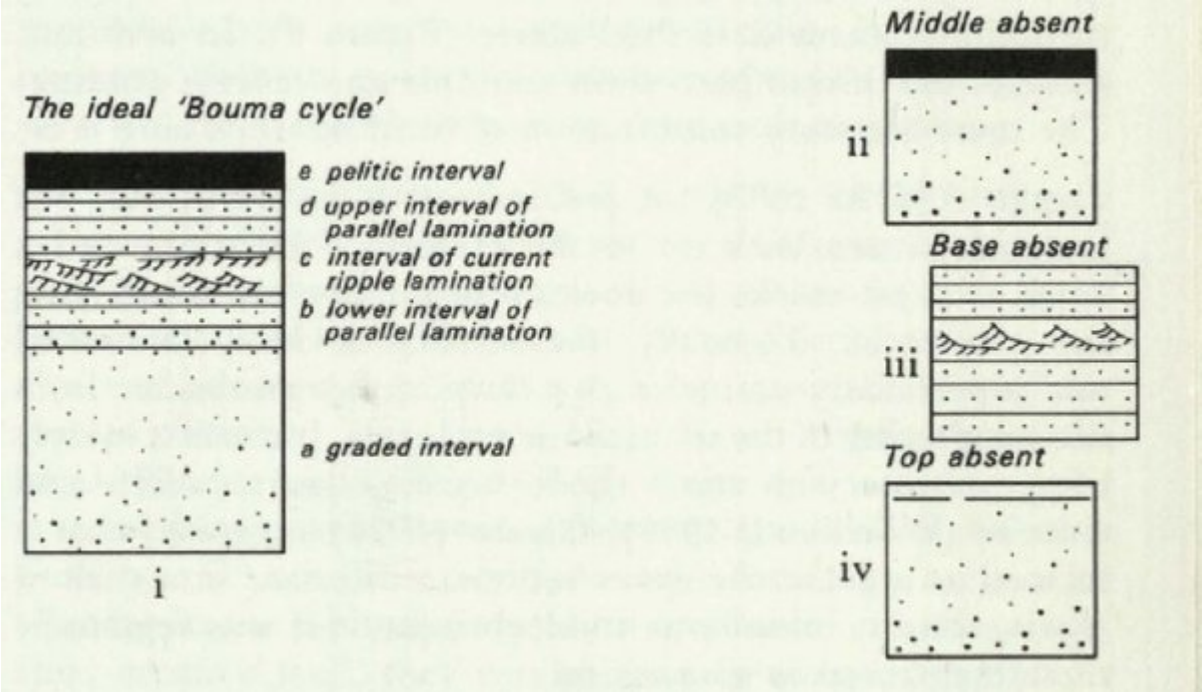


(Figure 40) Slumped sand stone bed in the Gamlan Formation.

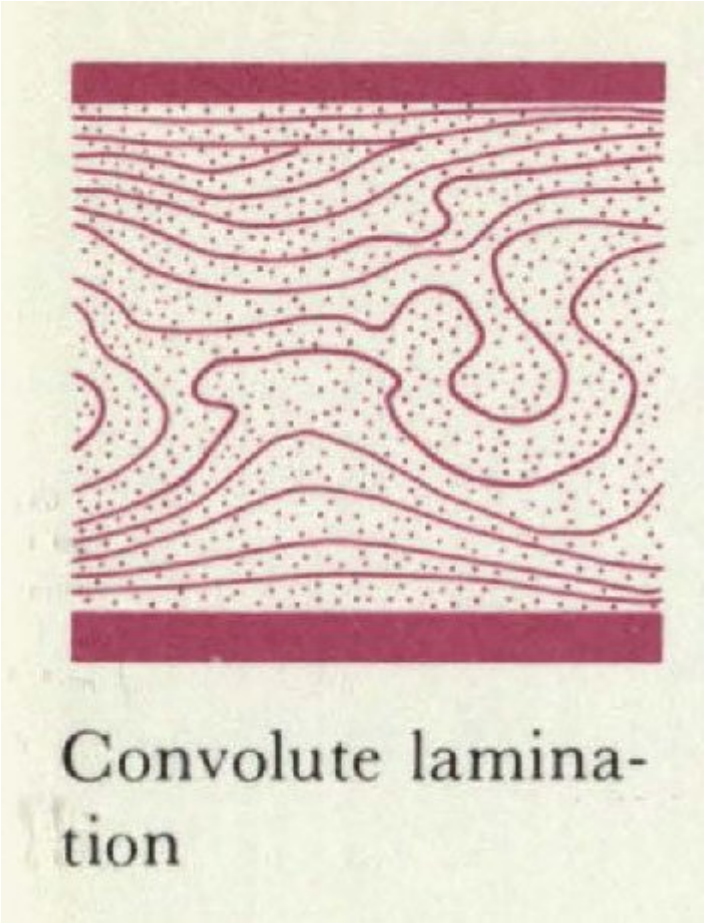


(Figure 41) Fold in the Gamlan Formation.

(Figure 42) Basal Maentwrog Formation at Aber Amffra harbour.



(Figure 9) Internal features of turbidites Superficially, turbidite may appear as a monotonous sequence of greenish grey greywackes bed but in detail there is much variation within individual bed . This has been described by a number of author but is now often referred to as the 'Bouma-cycle'. The 'ideal' sequence (i) consists of five intervals labelled a, b c, d , e. Numerous combination of these are possible and some of the most common seen in the Harlech area are shown in (ii to iv).



(Figure 61) Convolute lamination.