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The fossiliferous Silurian rocks of the Dunquin inlier, Dingle Peninsula, County Kerry, Ireland

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ABSTRACT: The history of investigation of the Silurian rocks of the Dunquin inlier, Dingle Peninsula, County Kerry, Ireland is briefly reviewed. The Dunquin Group of upper Wenlock (Homerian) to middle Ludlow (Ludfordian) sedimentary and volcanic rocks is divided into five formations: the Ferriters Cove, Clogher Head, Mill Cove, Drom Point and Croaghmarhin Formations, the last of which reaches the Ludlow and passes transitionally into the succeeding continental Dingle Group, probably largely Přídolí in age. The Dunquin group is of varied shallow marine sediments with a continental episode probably represented in the Mill Cove Formation. The biostratigraphy of the other four formations is considered in relation to a full faunal list. Details of representative sections and exposures are provided. There is brief comment on the palaeogeographical setting of the inlier.

KEY WORDS: biostratigraphy, Ludlow, Wenlock.

The Dingle Peninsula provides the westernmost outcrops of Silurian rocks in Europe. They are of palaeogeographical interest (see for example Holland 1969a,b; Ziegler 1970; Parkin 1976a) and yield the richest shelly faunas to be found in the Irish Silurian. The area is one of splendid scenery where the topography closely reflects the geology. To the N (Fig. 1), along the cliffs known in part as the Three Sisters, a discontinuous strip of unconformable Upper Old Red Sandstone faces the Atlantic. It is seen again at the northern end of the Blasket island of Inishtooskert. The uppermost Ludlow to largely Přídolí Dingle Group of purple, grey, and green clastic rocks, ranging from mudrocks to conglomerates, forms much of the higher ground of West Dingle including Mount Brandon, the second highest mountain in Ireland. The Dingle Group continues westwards from the western side of Smerwick Harbour to Sybil Point and from there to Inishtooskert. To the S of this is the Dunquin inlier of fossiliferous Wenlock and Ludlow rocks with which this paper is concerned. The inlier is named from the village of Dunquin which traditionally provides boat passage to the Blasket islands to the W—the 'ultimate shore' of the Old World. These fossiliferous and volcanic rocks are seen again at the northern tip of the Great Blasket and in the scattering of small islands to the N of it.

To the S again, the Dingle Group forms Mount Eagle and runs out from Slea Head to form the bulk of the Great Blasket. Another strip of more or less fossiliferous Wenlock and Ludlow rocks is seen in the inliers of Derrymore Glen, Annascaul, and Bull's Head described in detail by Parkin (1976a). These rocks are seen again in the southernmost Blasket island of Inishvickillane (Parkin 1974). Volcanic rocks related to those on Inishvickillane are found in the Foze rocks 4·3 to 5·6 km SW (Parkin 1976b). The Annascaul inlier is fault bounded on both sides, as is the small inlier at Bull's Head. At its eastern end, however, and also in Derrymore Glen, an unconformable contact with the Upper Old Red Sandstone is seen. To the S, beyond the main boundary fault of the Annascaul inlier, Upper Old Red Sandstone forms high ground along the northern margin of Dingle Bay and Castlemain Harbour.

In the Dunquin inlier, the Dingle Group is faulted against the Wenlock rocks of the Dunquin Group in the three coastal sections of Coosgorrib, Coosglass, and Coosshaun, as well as at the northern tip of the Great Blasket. Fortunately, inland exposures at the southern margin of the inlier show stratigraphical continuity from fossiliferous Ludlow rocks into the Dingle Group. The latter ranges upwards from the middle Ludlow and may even extend beyond the Přídolí into the Lower Devonian. There is no satisfactory biostratigraphical evidence from within the Dingle Group.

Relationships between the Dingle Group and the Dunquin Group have been described fully and with large-scale maps in a previous publication (Holland 1987) and details of the relevant coastal sections are not repeated here. The present paper includes a map of the whole inlier, large-scale maps of additional coastal sections, and a full account of the biostratigraphy. The rich development of acid, and to a small extent basic, volcanic rocks in the Dunquin inlier and their relationship to sedimentation are under investigation by R. J. Sloan of the University of Bristol.

1. History of investigation

The history of geological mapping in Ireland has been admirably recorded by Herries Davies (1983). There were early comments on the geology of the Dingle Peninsula by Hamilton and Weaver. Sedgwick visited Ireland in 1841 in the company of Richard Griffith. According to his biographers (Clark & Hughes 1890) he "appears to have been as much interested with the people and the scenery as with geology but wherever they went, the bad weather pursued them. . .". In the western part of the Dingle Peninsula they collected "some very curious fossils." At the time of publication of his quarter-inch map of the whole country in 1839, Griffith was aware that there might be further discoveries in Ireland of rocks belonging to the recently named Silurian System. "With this problem in mind he had obtained fossils from Dunquin, Ferriters Cove, and other sites in the Dingle Peninsula. . . , and these fossils he had dispatched to London for examination by William Lonsdale, by James de Carle Sowerby, and by Murchison himself. Their verdict was unanimous; the fossils were of Silurian age" (Herries Davies 1983, p. 70). In preparation of his famous map and during its subsequent continuous revision, Griffith relied very much upon the work of Patrick Ganly (see also Archer 1980; Herries Davies & Mollan 1980), who worked in the Dingle Peninsula at various times between 1838 and 1846. After the meeting of the British Association in Cork in 1843, Murchison went with John Phillip and Griffith on field work which included a visit to the peninsula. He was there again in 1856 with Jukes, Du Noyer, Griffith, and Salter and "at last secured Griffith's concession that, setting aside the undoubted Silurian strata around Dunquin and Ferriters Cove, it was better to regard the remaining rocks of the western half of the peninsula as being of Old Red Sandstone age rather than as being Silurian" (Herries Davies 1983, p. 169).

The official geological survey of the Dingle Peninsula was undertaken during the 1850s, particularly by Du Noyer. The one-inch maps were published in 1859; Jukes and Du Noyer reported to the British Association for the Dublin meeting in 1857 and referred to identifications by Salter; but for the first comprehensive work on the geology we must turn to the Geological Survey of Ireland's Memoir (Jukes & Du Noyer 1863). In terms of stratigraphy within the inlier, with which the present paper is concerned, we note that Jukes and Du Noyer divided the succession into Ferriter's Cove beds (supposedly Wenlock) and Croaghmarhin beds (supposedly Ludlow). The Dingle beds were placed between the latter and the Old Red Sandstone. The Croaghmarhin beds were said to "contain, occasionally, Pentamerus Knightii and other fossils, such as are found in the Ludlow rocks of Siluria." One of the beautifully executed drawings in the Memoir (Jukes & Du Noyer 1863, fig. 3) is a panoramic view of the western end of the Dingle Peninsula as seen from the Great Blasket. All the beds are shown as dipping uniformly southwards, consistently at least with the view of the authors that the northern outcrop of the Dingle Group (as we now know it), referred to by them as the Smerwick beds, represents an older unfossiliferous part of the Silurian, which is followed transitionally by the Ferriter's Cove beds. In the text, Jukes and Du Noyer do refer to a syncline and an anticline and to evidence for an inverted limb. They were clearly puzzled by the structural relationships to the N.

Gardiner and Reynolds (1902) gave a long account of the fossiliferous Silurian and associated igneous rocks of what they referred to as the Clogher Head district. They were impressed with the splendid development of acid volcanics. Immensely detailed descriptions were given of the various coastal sections and an attempt was made to equate these. On the map, however, no attempt was made to connect them with the few patches of exposed ground shown inland. Their summary of the stratigraphy again starts with the *Smerwick Beds*, above which the *Ferriter's Cove Beds* were now described as "Wenlock–Llandovery". The fauna of these, "though in the main of Wenlock type, contains some species which are generally regarded as distinctly Llandovery". Thus Cowper Reed, who had examined the fossils, recorded *Pentamerus oblongus*, *Stricklandinia lirata*, and *Stricklandinia lens* alongside fossils of Wenlock type and, elsewhere, supposedly mixing of Llandovery and Ludlow forms. Above their first division Gardiner and Reynolds had a *Clogher-Head Series* with ashes and rhyolites alternating with calcareous flags and slates with Wenlock fossils. Above these came an unnamed unfossiliferous series of red sandstones with numerous ash bands. This was capped by a green ash. Completing the Wenlock succession

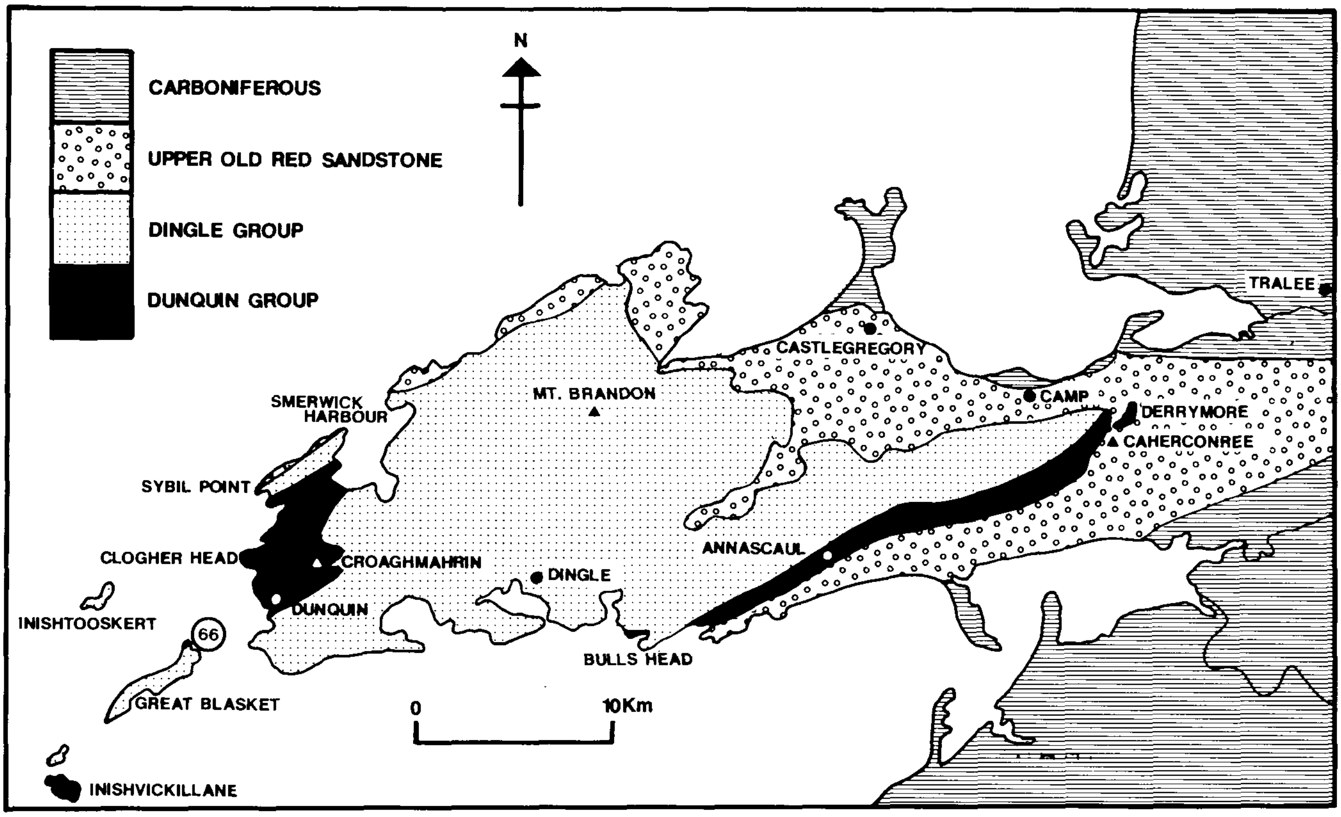

Figure 1 Geological sketch map of the Dingle Peninsula.

came the *Drom-Point beds* with little evidence of volcanicity and with "as a rule" few fossils except for "abundant worm tracks". The Ludlow *Croaghmarhin Beds* completed the fossiliferous succession.

Gardiner and Reynolds provided a section (1902, fig. 1) through the inlier showing a synclinal and anticlinal pair of folds because of which the conspicuous volcanic rocks of the Clogher-Head Series were repeated three times in the cliffs. The middle limb at Clogher Head was shown to be inverted.

Holland (1969a) gave evidence for relationships between the fossiliferous Silurian and the Dingle Group, as he now called it, involving faulting at all the coastal sections but continuity of stratigraphy to be seen inland, where the youngest fossiliferous beds with their middle Ludlow fauna gradually give way to the unfossiliferous rocks of the Dingle Group. The nomenclature for the whole succession, with the Dingle Group no longer seen as unconformable on the fossiliferous Dunquin Group below and the latter with its five constituent formations, was now given as in the present paper. The faunas were briefly summarised. The Dingle Peninsula was shown in palaeogeographical maps as on the southern side of the Lower Palaeozoic "geosyncline", the case for this having been developed in another paper (Holland 1969b). Ziegler (1970), on the other hand, following tectonic contributions by others, argued for a northern marginal position. Parkin (1976a) provided evidence from the Annascaul inlier to refute this. In a more recent summary of the Silurian succession in the Dingle Peninsula, Holland (1981) returned to a palaeogeographical picture involving a position on the southern side of the marine belt.

There has been another controversy, in this case concerning the small strip of red clastics along the northern cliffs of Clogher Head, which Jukes and Du Noyer (1863) took to be Dingle beds. Gardiner and Reynolds (1902) referred them to the Old Red Sandstone and Doran *et al.* (1973) came to the same conclusion. Horne (1974, 1976), on the other hand, argued for assignment to the Dingle Group. It may never be possible to offer proof, but on the grounds already stated in 1973, an Old Red Sandstone age is accepted again in what follows.

The Silurian shelly faunas of the Dingle Peninsula have long been known through such works as those of Griffith and M'Coy (1846) and Davidson (1867–1871). Modern palaeontological contributions on the Dunquin inlier have comprised a paper on the two endemic brachiopods *Rhipidium hibernicum* and *Holcospirifer bigugosus* by Bassett *et al.* (1976) and a treatment of marine "communities" by Watkins (1978).

The present paper is based upon the mapping of the coastal parts of the Dunquin inlier on the 25 inch to 1 mile scale (1:2534) and the inland area largely on the 6 inch to 1 mile scale (1:10,560). Apart from the mapping of the various formations, attention has been concentrated upon the rich shelly faunas.

2. Stratigraphical succession within the Dunquin Group

Holland (1969a) divided the Dunquin Group in the Dunquin inlier into five formations, employing as far as possible the names used by Gardiner and Reynolds (1902). With the main map (Fig. 2) and subsidiary maps (Figs 3, 4, and 5) now completed, the thicknesses of the formations have been revised from those given in Holland (1987) and earlier accounts. Because of the many minor faults to be seen along the coastal sections and the paucity of exposure inland, these figures must be regarded as approximate. The lithostratigraphy is now as follows:

Dunquin Group
(5) Croaghmarhin Formation (400 m)
(4) Drom Point Formation (300 m)
(3) Mill Cove Formation (100 m)
(2) Clogher Head Formation (200–600 m)
(1) Ferriters Cove Formation (600 m)

These formations are now described in turn.

2.1. Ferriters Cove Formation

The Ferriters Cove Formation (Fig. 2) crops out in the narrow peninsula of Doon Point; on the northern side of Ferriters Cove itself, along strike on the opposite southern shore; and in the low cliffs which form the south-eastern side of the entrance to the cove. It is not represented elsewhere in the Dunquin inlier. The shores of Ferriters Cove can be taken to provide a type section. Within the more sheltered confines of the cove there are good exposures in the ribs of rock which cross the sandy beach, though naturally the condition of these is variable.

The formation is characteristically of greenish grey, olive, greyish olive, or yellowish grey siltstones with subordinate sandstones, conglomerates, and tuffs. There is a rich brachiopod fauna, much of which is in the form of comminuted fragments, which give the rock a somewhat rubbly appearance. There is much evidence of bioturbation. Tabulate corals are also characteristic and there are abundant crinoid ossicles. The fauna also includes gastropods, trilobites, and bryozoa. The tabulate corals may be concentrated in layers of broken and disturbed material, for example of portions of halysitid chains laid flat. Some beds show concentrations of particular species of brachiopods. A full faunal list for this and other formations is given later in the paper.

Along the northern side of the Doon Point peninsula, closer to the faulted margin of the inlier, the siltstones are purplish to olive in colour with some bands of sandstone and of tuff or agglomerate. The oldest rock in the formation, and indeed in the Dunquin inlier, is the much weathered lava which appears to form the faulted core of an anticline to the N of which is a faulted strip of inverted beds of the much younger Drom Point Formation. Gardiner and Reynolds (1902) referred to the lava as a "labradorite porphyrite", whereas Horne (1976) recorded it as a porphyritic lava. To the S of this the beds of the Ferriters Cove Formation dip and young southeastwards.

A map of the section from the lava (PL on Fig. 2) and along the northern shore of Ferriters Cove is given in Holland (1987, fig. 3) and some localities are numbered there. The same arrangement of numbering selected localities is taken up again in the present paper in order to facilitate description and any future palaeontological work. The Ferriters Cove Formation in the line of low cliffs to the S of the cove is included in Figure 3 herein. The section is described in detail in a later part of the paper.

2.2. Clogher Head Formation

The Clogher Head Formation is more widely exposed, though it is confined to the area to the W of the long approximately N–S fault which divides the Dunquin inlier (Fig. 2). As mentioned already, it is repeated through the three limbs of the major fold seen in the western cliffs. It varies considerably in thickness according to the extent of

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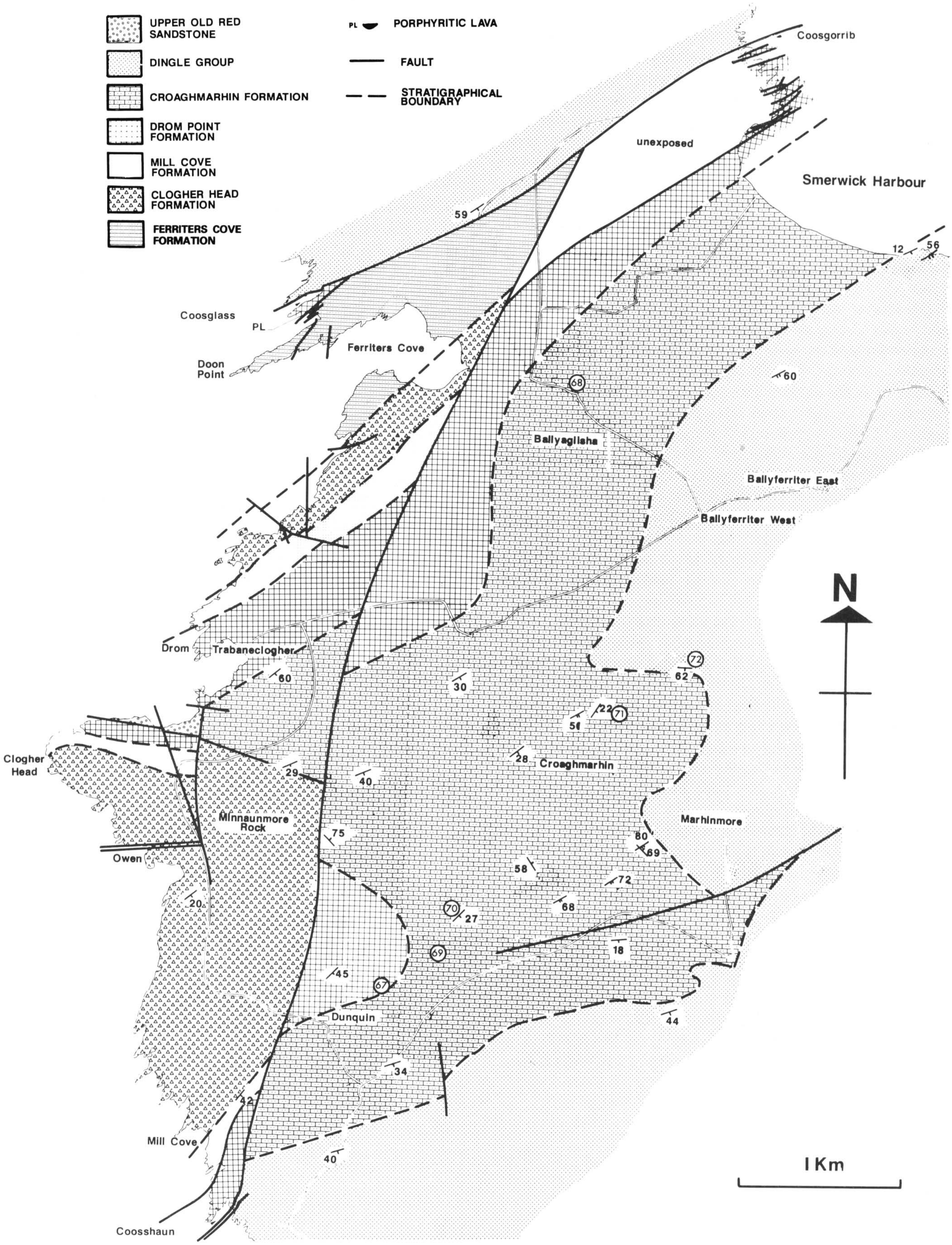

Figure 2 Geological map of the Dunquin inlier; numbers in circles in this and other figures refer to the localities mentioned in the text.

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the volcanicity. The volcanic rocks which are so characteristic of the formation are best seen in the inverted middle limb of the fold from Clogher Head inland to the prominent crags of Minnaunmore Rock, the former being the type locality.

The base of the Clogher Head Formation is taken at the base of a persistent thin rhyolitic rock which crops out on both sides of Ferriters Cove and may be traced from there southwestwards along the cliffs shown in Figure 3. The formation comprises beautifully displayed acid ignimbrites, some acid lavas, and associated pyroclastic rocks from agglomerates to tuffs. Some of the last are graded and rarely contain shelly fossils such as bryozoa and gastropods. There are some volcanic mudflows. Together with the volcanics there are associated sedimentary rocks best seen in the southern and especially northern limbs, where the volcanics are less well developed. They are thinly to medium bedded, greenish grey, light olive grey, dusky yellow, and dark yellowish brown siltstones which yield a shelly fauna similar to that of the Ferriters Cove Formation. Brachiopods, bryozoa, and crinoid ossicles are common. The seemingly endemic brachiopod *Holcospirifer bigugosus* is conspicuous on some bedding planes (Bassett *et al.* 1976). A greenish andesitic lava (greenstone) occurs at the top of the formation. It is particularly well seen in the central inverted limb of the major coastal fold. The top of the lava is vesicular. It penetrates irregularly into the beds below as is well displayed as the western end of Clogher Head and also in the northern limb of the fold. Detailed coastal sections (Figs 3 and 4) are described later.

2.3. Mill Cove Formation

Taken as a whole, the relatively thin Mill Cove Formation is characterised by red to purple colours and a lack of fossils. It follows directly upon the greenstone at the top of the Clogher Head Formation but is seen most typically and is most easily named at Mill Cove in the cliffs to the S of the Dunquin River (Fig. 5). The upper boundary of the formation here is faulted, but it is beautifully exposed in the promontory immediately to the NW of Drom Point, where a greenish grey tuff some 6 m thick is taken as forming the top of the formation and is succeeded by typical Drom Point Formation. Apart from the top tuff, the marked contrast between the red to purple colours of much of the Mill Cove Formation and the typical greenish grey of the Drom Point Formation is seen very well here, as also in the inverted section on the N side of Clogher Head (Fig. 4).

The Mill Cove Formation is of siltstones and sandstones, medium to thickly bedded and often laminated. A crude grading is seen in places, as is cross lamination. Some of the beds show honeycomb weathering. A few of the sedimentary rocks are pale grey to greenish grey rather than red to purple in colour. There are many associated tuffs and agglomerates of both colour ranges.

2.4. Drom Point Formation

The Drom Point Formation not only contrasts with the last but is also the most easily recognisable in the whole lithostratigraphical succession. Its base is taken as explained above. The formation is well displayed in the cliffs and adjacent surface exposures of Drom Point itself, which provides the type locality.

Tuffs and agglomerates are now few. The characteristic greenish grey to olive grey, more or less laminated, thinly to thickly bedded, more or less calcareous siltstones and fine sandstones weather to distinctive yellowish grey and yellowish brown colours, especially where they are attacked by the sea. Weathering also produces carious structures. Some of the beds are micaceous. Bands of yellowish or brownish rottenstone represent originally calcareous shelly lenses.

Brachiopods are common again, though some of those present in the Ferriters Cove Formation have now disappeared and a few others are more conspicuous. The most common forms present are *Atrypa reticularis* and *Sphaerirhynchia wilsoni*. There are also common bryozoa, crinoid ossicles, and tabulate corals. Some beds have a concentration of a particular brachiopod and there are thin bands made up of broken moulds of bryozoa.

The really diagnostic feature of the formation is the profusion of the trace fossil *Chondrites*. Simpson (1957) referred to this occurrence in his definitive paper on the genus. This abundance of *Chondrites* is seen not only at Drom Point, Clogher Head, and near Dunquin, but also in the much faulted section on the western shore of Smerwick Harbour (Fig. 2 and Holland 1987, fig. 2), where there are alternating strips of Drom Point and Mill Cove formations. In this section pyroclastic rocks in both formations are more conspicuous than elsewhere. The *Chondrites* rich beds are seen also at the northern end of the Great Blasket (Fig. 1), where they are faulted against the Dingle Group. Here they are associated with and succeeded by beds containing bands packed with the second endemic brachiopod of the inlier, *Rhipidium hibernicum* (Bassett *et al.* 1976). As noted elsewhere (Holland 1969a), it is of crucial importance that similar yellowish decalified banks of *Rhipidium hibernicum* have been traced in an exposure in the banks of the Dunquin River, where they are taken as forming the top of the Drom Point Formation.

2.5 Croaghmarhin Formation

The base of the Croaghmarhin Formation is seen only in the Dunquin River and there only in the sense that the *Rhipidium hibernicum* banks referred to above are succeeded by beds exposed intermittently in the stream. The formation forms the strikingly conical summit of Croaghmarhin Hill, after which it is named. Its lower part is well seen in this type area on the slopes and summit of the hill. It comprises medium but irregularly bedded, somewhat calcareous, greenish grey to light olive grey siltstones. These contain shell beds and lenses of brachiopods such as *Atrypa reticularis*, *Howellella*, and *Stronphonella euglupha*. There are characteristic layers rich in tabulate corals: favositids, halysitids, and heliolitids in the form of branching and broken hollow moulds coated in dusky yellow to yellowish brown coloration.

The upper part of the formation is best seen in scattered exposures on Coumleague Hill to the S of Croaghmarhin. The rocks are thinner and more evenly bedded and less calcareous. The fauna, too, has changed, with *Dayia navicula*, *Isorthis orbicularis*, and *Shaleria ornatella* conspicuous among the brachiopods and with pterineid bivalves and crinoid ossicles quite common. The range of colour is again greenish grey to olive grey with fossil moulds in dusky yellow and yellowish browns. At the top the fauna declines until only a few small rhynchonellids and scattered crinoid ossicles remain. It is capped by a resistant, micaceous light greenish siltstone which in a very few exposures can be seen to be followed directly upwards by characteristic purple and greenish beds of the Dingle Group. Details of this transition are given in an earlier paper (Holland 1987).

3. Biostratigraphy

As shown in the faunal list, the Ferriters Cove, Drom Point and Croaghmarhin Formations are richly fossiliferous. The Clogher Head Formation with its high proportion of volcanic rocks is less so, though its less diverse fauna is conspicuous in certain beds. The Mill Cove Formation appears to be unfossiliferous. The shelly fauna of the Dunquin Group as a whole is dominated by brachiopods, corals, crinoid ossicles, and poorly preserved bryozoa. Though some of the genera have longer ranges, the succession is clearly Silurian in age.

Gardiner and Reynolds (1902) recorded *Pentamerus oblongus* and *Stricklandia lens* from the Ferriters Cove Formation and thus presumed it to be at least partly upper Llandovery. Neither is present. There are internal moulds of other pentamerids comparable with *Gypidula*. It is possible that large specimens of *Atrypa reticularis,* which are characteristic of these beds, when tectonically stretched longitudinally, may have been mistaken for *Stricklandia.* In fact, the brachiopod and coral faunas of the Ferriters Cove Formation are typically Wenlock and closely comparable with those of the type and standard area in the Welsh Borderland (Bassett *et al.* 1975). However, such characteristic Sheinwoodian forms as *Eoplectodonta duvalii, Isorthis elegantulina* and *Resserella sabrinae* have not been recorded and, more significantly, the most useful indicator of the Homerian Stage of the Wenlock Series, *Meristina obtusa* is already present in the Ferriters Cove Formation. Poorly-preserved gastropods are common. They include *Poleumita discors*, again indicating a Wenlock rather than an earlier age.

The more restricted brachiopod fauna of the Clogher Head Formation is not distinguishable biostratigraphically from that of the Ferriters Cove Formation. A rhynchonellid comparable with *Ferganella borealis* is common in places. Though the species has been recorded throughout the Silurian, it is especially characteristic of the Much Wenlock Limestone Formation (Homerian). A very rare find of a form comparable with *Nucleospira pisum* provides a further hint of a Homerian assignment. Certain beds within this predominantly volcanic formation are rich in rhynchonellids or in the endemic brachiopod *Holcospirifer bigugosus,* which latter is also common in the underlying Ferriters Cove Formation. Apart from the brachiopods, it is worth noting a very rare record of the Wenlock to Ludlow trilobite species *Calymene lata* and the presence of the bivalve *Pteronitella retroflexa.* Changing conditions have affected the coral fauna, which is now almost confined to rare favositids.

Though the record is not significant in terms of correlation, the Drom Point Formation can itself be recognised by an abundance of the trace fossil *Chondrites* which is locally confined to it. The richly fossiliferous shelly bands and lenses of the formation again are characteristically Homerian and there is no diagnostically biostratigraphical separation from the Clogher Head Formation, or indeed from the older Ferriters Cove Formation. However, there are differences in emphasis. Thus the significant brachiopod *Meristina obtusa* is now common. *Atrypa reticularis* is common again as it was in the Ferriters Cove Formation; "*Camarotoechia*" *nucula* has appeared; *Howellella* has become common; and *Sphaerirhynchia wilsoni,* not present below, is very common in the Drom Point Formation. *Ferganella* cf. *borealis* and *Holcospirifer bigugosus* have disappeared. The distinctive and confined presence of banks of the other endemic brachiopod *Rhipidium hibernicum* at the top of the Drom Point Formation has been mentioned already. As in the Clogher Head Formation, the coral fauna of the Drom Point Formation is almost confined to favositids.

In the type and standard area in the Welsh Borderland the base of the Ludlow series has been taken at the base of the Lower Elton Formation, which comes immediately above the Much Wenlock Limestone Formation. The fauna of the former is largely of small brachiopods and trilobites and retains a Wenlock flavour (Holland *et al.* 1963). The graptolite biozonal boundary is between the *ludensis* and *nilssoni* Biozones. In the absence of graptolites and in the continuing calcareous siltstone facies of the Croaghmarhin Formation it is difficult to trace the boundary. A single clue is the presence of very rare *Dicoelosia biloba* in the poorly exposed lowest beds of the formation. This species is characteristically Wenlock, but does stray rarely into the lowest beds of the Ludlow, as for instance in the Ludlow district and in Gotland (Bassett 1972). Thus the basal beds of the Croaghmarhin Formation are likely to be at the top of the Wenlock or in the lowest part of the Ludlow. On balance one is inclined to suggest the former. There is no continuous coastal section in the Croaghmarhin Formation and it is difficult to be precise about the relative levels of the scattered inland exposures. Thus it is possible only to generalise about the fauna of the lower part of the formation. Its brachiopods are very similar to those of the underlying Drom Point Formation, except that *Meristina tumida* is now very rare. Characteristically, there are beds of fragmentary tabulate corals including the very common *Heliolites grayi* and rarely the Bohemian form *Stelliporella.* The greatest change in the biostratigraphy of the Dunquin Group comes in the upper part of the Croaghmarhin Formation, where appears a brachiopod fauna containing *Amphistrophia funiculata, Chonetes lepismus, Dayia navicula, Isorthis orbicularis, Shaleria ornatella, Sphaerirhynchia wilsoni,* and more rarely *Howellella* cf. *elegans,* and *Protochonetes ludloviensis.* Still present and very common are *Atrypa reticularis,* "*Camarotoechia*" *nucula,* and *Howellella* sp.

The brachiopod fauna of the upper part of the Croaghmarhin Formation is closely comparable with that of the Lower Leintwardine Formation of the Ludlow district. Of the eight brachiopods listed as "very common" or "common" at Ludlow, only *Leptaena depressa* is not also so designated in the Croaghmarhin Formation, though it is recorded as rare. Of the eight brachiopods listed as "very common" or "common" in the Croaghmarhin Formation, only *Howellella* sp. does not find its place in the Ludlow list.

Wood (1900) listed *Monograptus leintwardinensis* var. *incipiens* as confined to the *leintwardinensis* Biozone. Earp (1944) and Holland (1959, 1962), discussing the graptolite sequence in the Ludlow rocks, particularly in the basin facies of central Wales and the Welsh Borderland, recognised a level containing mainly spinose graptolites of "*Monograptus chimaera* type" as falling between the *nilssoni-scanicus* and *leintwardinensis* assemblages. At Knighton, *M. chimaera* var. *semispinosus* is common at this intermediate level. There remains some confusion in the identification of these semispinose graptolites, but at Knighton it was clear that *M. leintwardinensis* var. *incipiens* came at a higher stratigraphical level than did *M. chimaera* var. *semispinosus* and was in fact in the *leintwardinensis* Biozone. At Usk, Walmsley (1959) recorded *Monograptus* cf. *leintwardinensis* var. *incipiens* in both the Lower and Upper Llanbadoc Beds, which would fall respectively below and above the Gorstian/Ludfordian boundary. At Ludlow we listed the variety itself as "present" in the Upper Bringewood Formation of uppermost Gorstian age (Holland *et al.* 1963). Certainly the very rare record from one locality only in the Dunquin inlier of a form identified by Dr D. C. Palmer as comparable with *M. leintwardinensis* var. *incipiens* is not necessarily in conflict with the evidence from the rich brachiopod fauna that the upper part of the Croaghmarhin Formation is of early Ludfordian age.

4. Details of exposures

4.1. Ferriters Cove to Trabaneclogher (Figs 3 and 4)

The coastal section through the faulted contact between the Dingle Group and the Dunquin Group to the N of Ferriters Cove has been described previously (Holland 1987). The section from the southern side of the cove to Trabaneclogher splendidly displays the Ferriters Cove, Clogher Head, Mill Cove, and Drom Point Formations of the Dunquin Group.

The section begins at its north-eastern end in the Clogher Head Formation represented by thin rhyolitic rocks at Localities 31 and 33, the latter being taken as the base of the formation. Between are intermittent exposures of grey, yellow weathering siltstones and some tuffs. Rhynchonellids comparable with *Ferganella* are common at Locality 32.

The underlying Ferriters Cove Formation is well seen to the W. Two exposures of agglomerate are indicated on the map, the more conspicuous labelled as Locality 35. At Locality 34, in the top part of the formation, are fossiliferous yellow weathering siltstones. The bedding and lamination if present are rather irregular, the fossils occurring as scattered and disseminated material. There is much bioturbation. *Holcospirifer bigugosus* is very common in some beds. Also present are *Atrypa reticularis*, *Protochonetes*, *Rhynchotreta*, *Salopina* cf. *conservatrix*, *Sphaerirhynchia*, and the bivalve *Actinopteria sowerbyi*. Farther W and lower in the succession at Locality 36 the beds are even more fossiliferous, though typically the material is comminuted. The rocks are somewhat darker and may be carious. There is some tuffaceous material. The faunal list is as follows: *Favosites*, *Heliolites* cf. *interstinctus*, *H.* cf. *murchisoni*, *Palaeofavosites asper*, *Rhabdocyclus binus*, *Syringopora*, bryozoa, *Atrypa reticularis*, *Fardenia*, *Hesperorthis davidsoni*, *Meristina obtusa*, orthoid ribbing, cf. "*Bembexia*" *loydii*, other gastropods, *Encrinurus*, and crinoid ossicles. Beyond the agglomerate, to the NW of Locality 36, the coastline swings southwestwards and some slightly older beds of the Ferriters Cove Formation are seen. Here the siltstones show purple and greenish colours. The generally uniform southwesterly trend of the beds is interrupted by a swing of strike E of the island of Carrignanoon and there is evidence of fracturing and veining. At Locality 37 there are carious yellowish siltstones as well as purple laminated micaceous beds and pale tuffs. The last form a clear cliff opposite Carrignaman. At Locality 38 there is a full display of lithologies with purple, greenish, and grey siltstones together with tuffs and agglomerates. The grey siltstones are richly fossiliferous yielding the same taxa as at Locality 36 on the northeastern coast. Finally, typical Ferriters Cove Formation may be seen in the rocky headland at Locality 39. There are some magnificent bedding planes here. Cleavage within the Dunquin inlier is usually seen to be concentrated in discrete belts. At the head of the inlet of Foilteela a zone of cleavage dips southeastwards more steeply than the bedding. At Locality 40 is seen the same rhyolitic rock as was first encountered at Locality 33 to the NE and once again it is taken to mark the base of the succeeding Clogher Head Formation.

Steeply dipping cleavage is well seen at Locality 41, where there are extensive bedding planes of resistant greenish siltstones and fine sandstones of the Clogher Head Formation. Repeated small scale cross-stratification indicates that the beds young to the SE. There are some carious bryozoan bands and one of *Favosites crispata*. Other fossils here include *Entelophyllum*, *Howellella latiplicata*, rhynchonellid fragments, and poorly preserved bivalves. Well bedded olive grey to brownish, thinly to medium bedded siltstones, carious lower down and well laminated higher, are seen at Locality 42. There are some very fossiliferous rottenstone bands in which *Ferganella* cf. *borealis* is very common. In this northern limb of the main coastal fold, the Clogher Head Formation shows less well developed volcanic components, though at Locality 43 fossiliferous siltstones with ash bands are succeeded south-eastwards by a massive pale tuff and agglomerate. At Locality 44, a thin purple rhyolitic rock rests upon cross-stratified greenish sandstone and tuff, with thinly bedded pale tuff below and, below this, the massive tuff already referred to. The fauna at Locality 43 includes *Atrypa reticularis*, *Holcospirifer bigugosus*, *Mesopholidostrophia*, *Protochonetes*, *Sphaerirhynchia* and other rhynchonellids, together with *Calymene*, a crinoid stem, and crinoid ossicles.

Beyond a N–S fault which is seen to displace the pale tuff and rhyolite mentioned above, fossiliferous yellowish, olive grey, or brownish fine sandstones and tuffs are seen at Locality 45. There are some extensive bedding planes in the outer islands. The sandstones are very fossiliferous in places particularly with indeterminable rhynchonellids. Also present are *Holcospirifer bigugosus*, *Howellella* cf. *latiplicata*, *Protochonetes*, and crinoid ossicles. Similarly fossiliferous beds are seen at Locality 46. To the SE is a somewhat confusing area with fracturing and veining between the main fault and its southerly branch, which are shown on the map. The main fault must have been a fracture in Wenlock times as sharply beyond it to the S the Clogher Head Formation is dominated by volcanic rocks. The "greenstone" lava which is taken as the top of the formation is seen between the main fault and its branch and again to the SW of the latter. The rhyolitic lavas and ignimbrites and their associated purple tuffs and agglomerates and pale tuffs are well displayed in the cliffs at Localities 48 and 49. Some of the rhyolites show columnar structure. Pale tuffs and siltstones form the NW-facing cliffs from Foilwee to opposite Doonycoovaun and are seen in the island. The greenstone is very well seen again in the long inlet at Locality 51. As seen at Locality 50, and also at Locality 47, it shows a complex penetration into the rocks below.

The purple siltstones, sandstones, tuffs, and agglomerates of the succeeding Mill Cove Formation now form the cliffs and rocky platform above (Localities 52 and 53). The boundary with the Drom Point Formation, here in its type area, is seen at Locality 54, where the typical purple rocks of the Mill Cove Formation are capped by the 6 m pale tuff, which makes a clear feature and is taken as its top. It contrasts, as more obviously does the bulk of the Mill Cove Formation, with the resistant, medium to thickly and smoothly bedded, greenish siltstones of the Drom Point Formation with their typical fauna. The beds here are crudely cleaved. The fauna is best seen in the rocky headland of Drom Point (Locality 55) where the following are present: *Favosites*, bryozoa, *Atrypa reticularis, Meristina obtusa, Sphaerirhynchia wilsoni, Murchisonia, Dalmanites caudatus, Encrinurus*, crinoid ossicles, and *Chondrites*. At Locality 56 the yellowish, medium to thickly bedded siltstones or fine sandstones show cross-stratification indicating southeasterly younging. There are bands of crinoid ossicles. A bed of the large *Atrypa reticularis*, which is so characteristic of the inlier, is seen at Locality 57. Richly fossiliferous siltstones with *Atrypa reticularis, Dalmanites*, and abundant *Chondrites* are found at Locality 58, beyond a reverse fault with associated imbrication.

4.2. Clogher Head

To the S of Trabaneclogher, high cliffs or steep seaward slopes reveal the strip of red conglomerates indicated as Upper Old Red Sandstone on Figure 2. They are partly faulted against, partly unconformable upon, the Drom Point Formation (see Doran *et al.* 1973). To the S the succession from the Clogher Head Formation, through the Mill Cove Formation, to the Drom Point Formation is seen again but now in reversed order in the more steeply dipping beds of the inverted middle limb of the coastal fold.

From the northern face of Clogher Head is seen the contrast between the predominantly purple beds of the Mill Cove Formation and the greenish-grey beds of the Drom Point Formation in both northern and central (inverted) limbs of the fold. Ignimbrites and other volcanic rocks are particularly well displayed on Clogher Head and inland in the crags of Minnaunmore Rock. At the western end of the headland there are again complex penetrative relationships at the base of the greenstone which forms the top of the Clogher Head Formation. In the high and irregular cliffs from Clogher Head to Owen, well bedded yellowish siltstones, greenish tuffs, and purple rhyolitic rocks are seen. The dip is steeply south–southeastwards and there are zones of cleavage.

To the S of the brecciated, sheared, and cleaved rocks in the narrow faulted strip at Owen, cross-stratification indicates that the beds are no longer inverted. The fault zone at Owen has replaced the hinge of the major fold. As explained earlier, detailed descriptions of the volcanic rocks along this coast are not given here. A good section through the upper part of the Clogher Head Formation, the type sequence of the Mill Cove Formation, and the basal part of the Drom Point Formation is described in what follows.

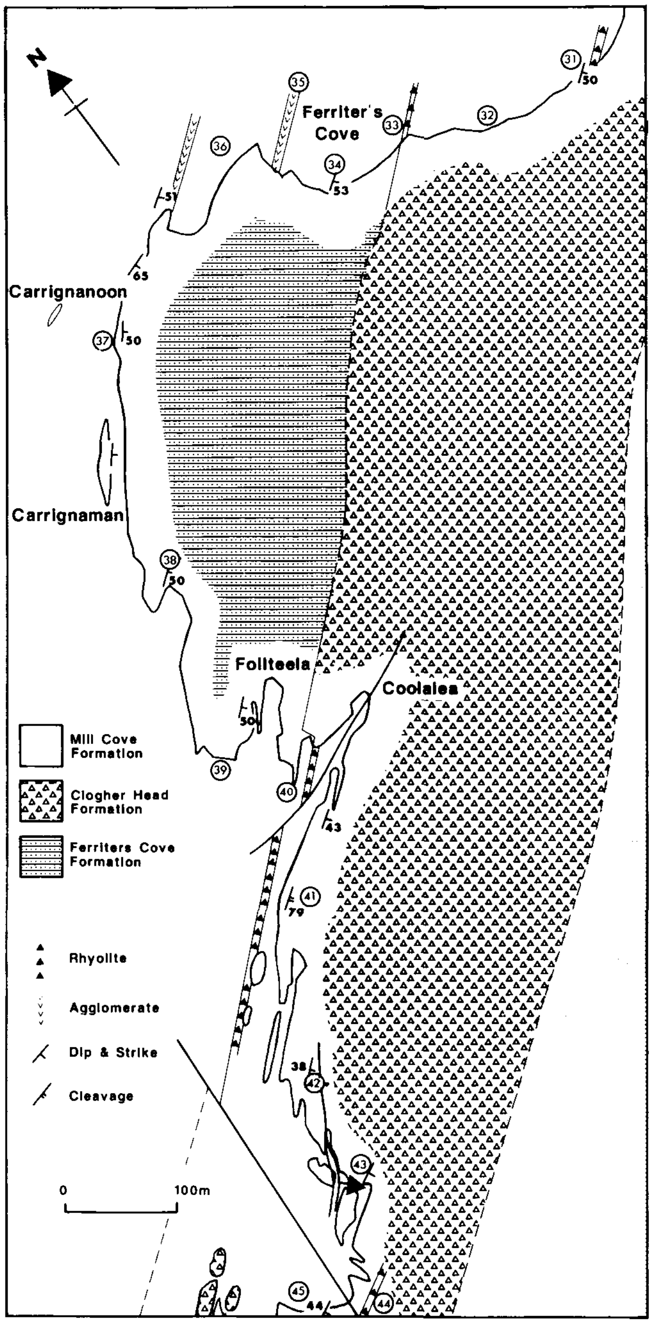

Figure 3 Geological map of the coastal section from Ferriters Cove southwestwards to the area shown in Figure 4; for details concerning this and later figures, see text.

4.3. Coastal section NW and SE of Mill Cove (Fig. 5)

At Locality 59 a yellowish grey mudflow contains angular and some more rounded clasts of tuff in a tuffaceous matrix. It follows a less coarse and more purple coloured agglomerate. The dip is now uniformly south-eastwards at a less steep angle than in the inverted limb to the N. The mudflow is followed by about a metre of yellowish fossiliferous siltstone and this by a metre or so of yellowish grey siltstones in which there are many fossils in bands of brownish moulds. There are well displayed bedding planes of this material on which the fossils are variously oriented and more or less broken. The following have been recorded: *Acervularia luxurians, Favosites ?hisingerii, Rhabdocyclus binus*, bryozoa, *Ancillotoechia* sp., *Atrypa reticularis, Holcospirifer bigugosus, Howellella, Isorthis, Leptaena, Leptostrophia filosa, Nucleospira* aff. *pisum, Rhynchotreta* cf. *cuneata, Salopina* cf. *conservatrix, Poleumita discors, Pteronitella retroflexa*, an orthocone, *Calymene lata, Encrinurus*, and crinoid ossicles. The fossiliferous beds pass up into tuffs and in the inlet to the S of Locality 59 there is a zone of cleavage. Interbedded siltstones and pale tuffs follow. Purple agglomerates followed by pale yellowish grey tuffs and mudflows form the headland at Locality 60. Locality 61 shows a typical example of the very numerous minor faults of the area. Its plane dips southeastwards and there is a thin development of fault breccia. Beyond are a few metres of agglomerate followed by purple ignimbrites and lavas. The greenstone lava at the top of the Clogher Head Formation is well exposed on the northern side of Mill Cove and in part of the bank of the Dunquin River. Rhyolitic rocks are well seen at the bathing place and to the S the base of the greenstone is marked by a 3 m fault zone in which is sheared purple rhyolitic and greenstone material.

The purple siltstones of the Mill Cove Formation which follow the greenstone are exposed by the Dunquin River

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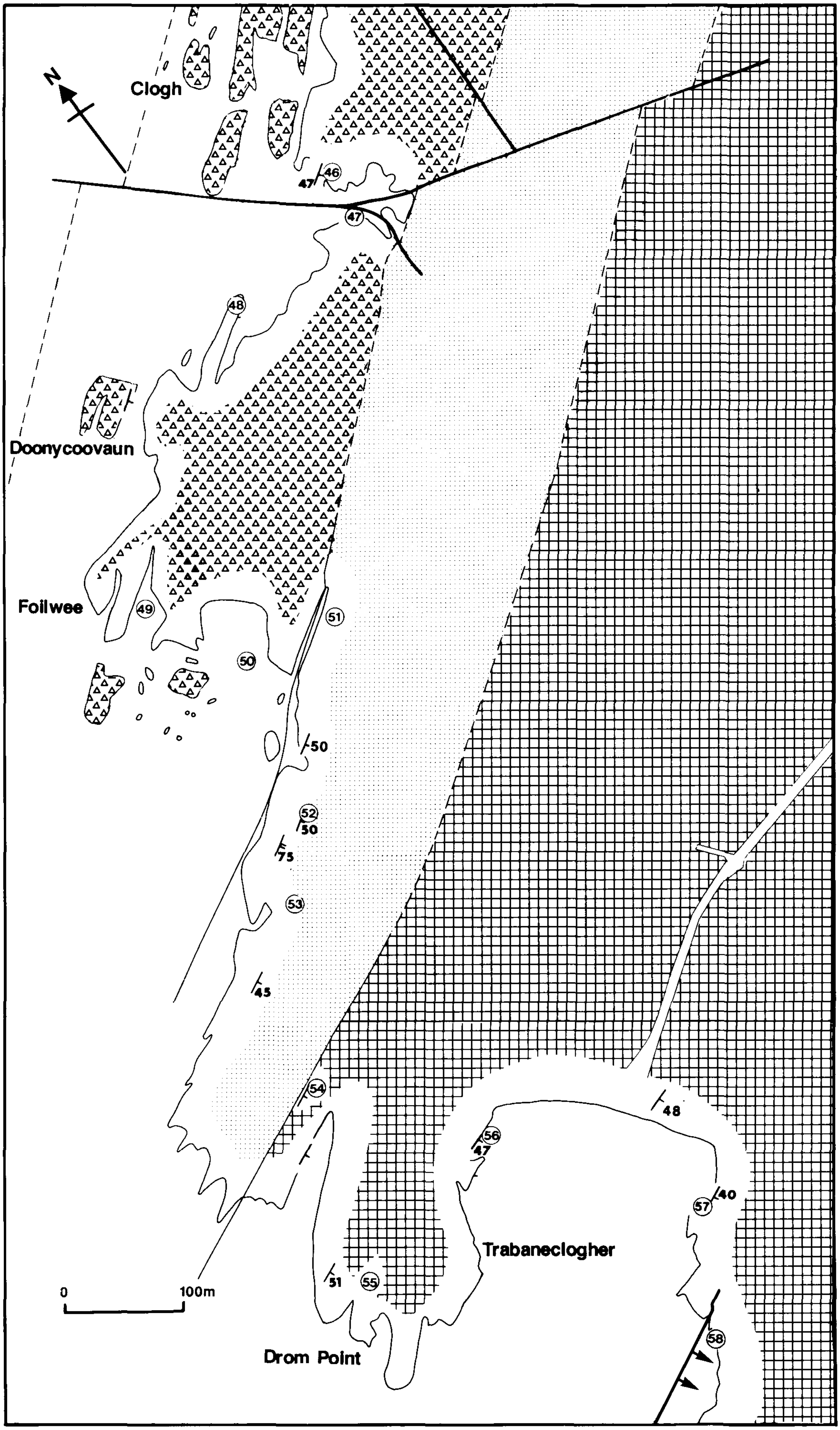

Figure 4 Geological map of the coastal section between the area shown in Figure 3 and Trabaneclogher.

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and in the cliff section to the S of here, which displays the beds to advantage. The dip has now decreased. There is an intricate sequence of purple siltstones, tuffs, and agglomerates. Some of the siltstones are finely laminated. There is medium to thick bedding. At Locality 64 a crude cleavage is seen. There is channelling with water laid tuffs cutting down into laminated siltstones. Cross-stratification indicates that the beds young to the SE.

The base of the Drom Point Formation at Locality 65 is faulted. Purple honeycombed siltstones are followed southwards by a narrowing downwards slice of fractured siltstone. Above, and also dipping southwards, is a zone of fault debris with signs of imbrication. Beyond this the Drom Point Formation dips somewhat anomalously, finally turning in towards the last fault plane. The beds now seen are typical of the Drom Point Formation, with cleaved yellow weathering siltstones, slightly micaceous or calcareous in places. There are fossiliferous brown rottenstones. *Chondrites* is very common. Other fossils are present but tend to be broken. Present are: bryozoa, *Atrypa reticularis, Meristina obtusa, Sphaerirhynchia wilsoni,* gastropods, a dalmanitid, and the ubiquitous crinoid ossicles.

The fault between the Mill Cove Formation and the Drom Point Formation referred to above eventually curves southwestwards as is shown in figure 4 of Holland (1987). The section illustrated and described there runs southwards through the remainder of the Drom Point Formation and across the faulted boundary with the Dingle Group on the southern side of the Dunquin inlier.

4.4. Great Blasket

The fault between the Dunquin Group and the Dingle Group can be projected southwestwards to the northern end of the Great Blasket, where the sections show a fault of this orientation crossing the island and separating fractured purple siltstones of the Dingle Group to the S from typical Drom Point Formation to the N (Fig. 1). The fault dips south-southeastwards at about 40 degrees. Most of the island is of the Dingle Group. The Drom Point Formation is of medium bedded, somewhat micaceous, olive grey siltstones weathering to rich yellow or brown colours. The trace fossil *Chondrites* is abundant and there is a typical associated fauna of *Favosites,* bryozoa, *Atrypa reticularis,*

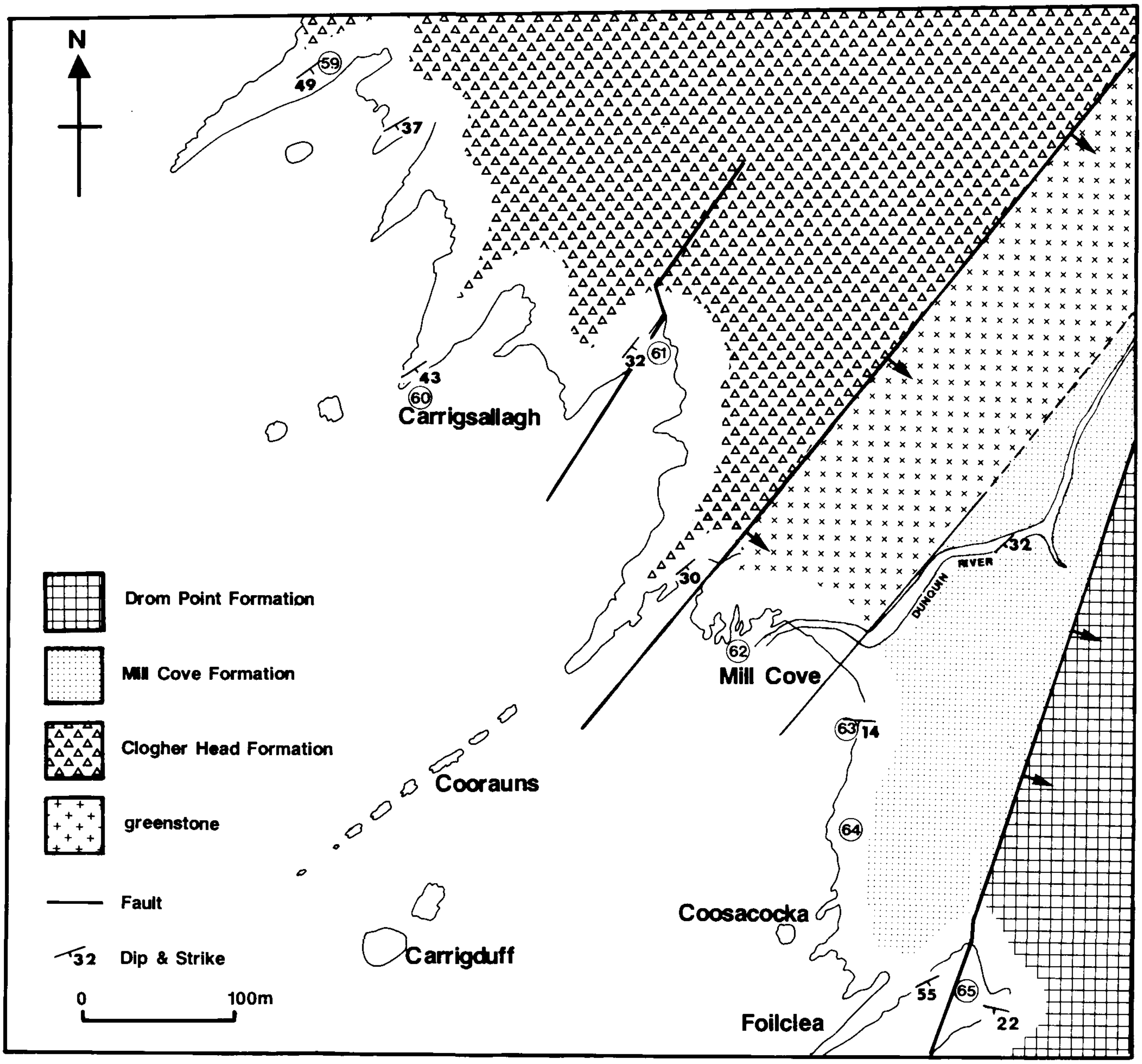

Figure 5 Geological map of the coastal section NW and SE of Mill Cove.

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Isorthis, Leptaena depressa, Meristina obtusa, gastropods, and bands of crinoid ossicles. But, of great importance, there are also bands of *Rhipidium hibernicum,* seen especially well in the bright yellow sea washed material at the northern tip of the island (Locality 66).

4.5. Inland exposures

The major fault referred to above, in its course northwards through the inlier, conspicuously affects the topography. In particular, the prominent craggy feature of Minnaunmore Rock is cut off by a hollow to the E. The fault does not involve significant lateral movement. The major fold pattern with its easterly plunge and inverted middle limb is maintained, though, as a result of the easterly downthrow, the inland area beyond the fault is largely of Croaghmarhin Formation, the top formation of the Dunquin Group not so far encountered in these descriptions of specific localities. Exposures in the southern part of the outcrop between Marhinmore and Dunquin have been described previously (Holland 1987), where a detailed map is given. There may be seen the critical sections which demonstrate that there is a stratigraphical continuity from Dunquin Group to Dingle Group. Elsewhere there are scattered exposures in the Dunquin River and around Croaghmarhin; but, farther N, exposure is very poor. Some important localities are mentioned in the remainder of this part of the present paper, using additional locality numbers which are indicated on the main map (Fig. 2).

The most critical exposure (Locality 67) is in the Dunquin River, 270 m NW of Dunquin Church and 470 m NE of the bridge where the main road crosses the river. Here ochreous material like that from the northern end of the Great Blasket may be obtained by breaking through the grey lichen coated crust of the rock. Recorded from here are: *Favosites gothlandicus,* a solitary coral, bryozoa, *Atrypa reticularis, Howellella, Isorthis, Leptaena depressa,* a gastropod, and crinoid ossicles; but many of the fossils are comminuted. There are also beds of *Rhipidium hibernicum* which provide a vital clue in linking the occurrence at the top of the Drom Point Formation in the Great Blasket with the Croaghmarhin Formation which now follows in the inland exposures. Davidson (1867) figured another specimen of *Rhipidium hibernicum* from the townland of Ballyaglisha. The exposure has not been found again but the approximate position is consistent with the structure of the area as shown in Figure 2.

There is a group of exposures of the Drom Point Formation N of Ballyaglisha. Small-scale cross-stratification here indicates that the beds young to the SE. There is a variably developed fracture cleavage which dips in approximately the same southeasterly direction as the bedding but at a very steep angle. At Locality 68 a group of low crags rises from the surrounding peat bog just N of the road. The exposures evidently represent a relatively resistant horizon which forms a V across the old valley now filled with peat. The rocks are more or less calcareous, medium to thickly bedded siltstones which are somewhat micaceous. Colours vary from grey or olive grey in the fresher rock to a brown rottenstone. The fossil list from here comprises: *Favosites forbesi, Syringopora,* solitary corals, bryozoa, *Atrypa reticularis, Howellella, Leptaena depressa, Sphaerirhynchia wilsoni,* gastropods, *Ptychopteria,* an orthocone, very common crinoid ossicles, and poorly preserved *Chondrites.* Some of the bryozoa here are as hollow moulds with a dark greenish black crystal lining of glauconite or possible chlorite. Such moulds may have been responsible for the earlier view that graptolites are a little more widely present in the Dunquin inlier than is in fact the case.

Four localities are now mentioned additional to those in Holland (1987). Farther up the Dunquin River from Locality 67 and in its tributary streams and steep banks there are various exposures of the lower part of the Croaghmarhin Formation. At Locality 69 in a deeply eroded stream entering from the S are olive grey siltstones with some good examples of the characteristic beds of broken favositids and *Heliolites grayi* in the form of yellowish brown moulds. Also present are bryozoa and crinoid ossicles. At Locality 70, in a branch of the river 200 m NNE, more of the coral beds are seen containing *Stelliporella.* Locality 71 shows thickly-bedded, grey, laminated micaceous siltstones in which cross-stratification clearly indicates that the beds are the right way up. There is a spread of crags on the slope here and there are scattered boulders. In places the rock is reduced to a brown rottenstone. Present are *Howellella, Camarotoechia nucula, Protochonetes ludloviensis,* an orthocone, *Tentaculites,* and crinoid ossicles. Finally, at Locality 72 cross-stratification in purple siltstones of the Dingle Group indicates that the beds, which dip southwards at 62 degrees, are in the inverted limb of the main fold.

5. Facies patterns in the Dunquin Group

Watkins (1978) has written at length on Silurian marine "communities" in the Dunquin inlier. He includes useful tables and photographs. His studies were confined to coastal sections and thus excluded the Croaghmarhin Formation.

His identification of only three communities within the whole succession gives an over simplified impression, brought about by his restricted sampling. He lists less than thirty samples, most of which are stated to represent collections from single lenses of transported shells. Notes concerning the present project include about 160 localities within the inlier and in most of these it would be possible to take numerous bulk samples. In fact, as will be seen from the details of exposures described above, there is much local variation in representation.

Of much more significance is Watkins' identification of four facies in the area. The first of these, which is confined to the Ferriters Cove Formation and accounts for most of this, is of intensely bioturbated siltstones with abundant disseminated shells. He sees it as corresponding to settling of mud and silt below wave base off shore. The fossils are regarded as a disturbed neighbourhood assemblage mixed only through bioturbation. His second facies occurs in various places in the succession but is especially characteristic of the Drom Point Formation. Here originally laminated sediments may be bioturbated by layers of *Chondrites.* Some of the laminated beds have erosive bases and burrowed tops. Fossils mostly occur as discrete lenses of more or less broken shells. A shallow shelf environment is suggested, with periods of rapid sedimentation during storms. The third facies is essentially the probably non-marine red sediments and pyroclastics of the Mill Cove Formation. The fourth is of the brown siltstones of the Clogher Head Formation which are laminated, lack bioturbation, and are transitional to the volcanic units which characterise this formation.

According to Watkins, there is an environmental gradient from offshore silts, through storm dominated nearshore silts and sands, to non-marine sediments. There is a decrease in diversity of fauna from offshore to near shore.

Collections made during the present research confirm this fall off in diversity from the Ferriters Cove Formation to the volcanic rich Clogher Head Formation. This becomes even more obvious when those forms which are listed as common or very common are considered. In the Clogher Head Formation such elements are confined to the endemic *Holcospirifer bigugosus*; the opportunistic rhynchonellids, many of which are identifiable as *Ferganella* cf. *borealis*; and crinoid ossicles. Diversity then recovers again in the Drom Point Formation. There are slightly more taxa than in the Clogher Head Formation but very common or common forms are more numerous than they were even in the Ferriters Cove Formation. Highest diversity in terms of both common and rarer taxa is seen in the coquinoid siltstone facies of the Croachmarhin Formation. This is of storm-deposited sediments, perhaps somewhat farther from the shore than those represented in the Drom Point Formation. With volcanic conditions now over, corals flourished again as they did during the time of deposition of the Ferriters Cove Formation. In the end there is a gradual silting up of the area leading to the deposition of the continental Dingle Group.

Parkin (1976a) related the Silurian succession in the Dunquin inlier with those he described in the Annascaul inliers and on Inishvickilane. A north-easterly facing palaeoslope is suggested and a position on the southern side of the marine trough or "geosyncline". Watkins (1978) employed coefficients of association to assess similarity of the Wenlock faunas sampled in the Dunquin inlier with those in Canada, Gotland, and the Welsh Borderland. Some of the results were inconclusive but, at the level of the Drom Point Formation, there are identical to very close matches with "communities" in the Wenlock of the Welsh Borderland and Gotland. Comments concerning the Croaghmarhin Formation have been given already.

Thus a reasonable picture emerges of similar shallow water faunas extending along the shelf areas of Wenlock times from the Dingle Peninsula northeastwards. Watkins notes the presence in the Dunquin inlier of the endemic brachiopods already referred to earlier in this paper and suggests deposition in isolated areas related to volcanic islands. We mentioned this in our description of the two endemic species (Bassett *et al.* 1976).

Wenlock volcanicity from Inishvickillane (Parkin 1974) to the Dunquin inlier varies from intermediate to acid with a minor basic component. Kokelaar (1988), discussing tectonic controls of Ordovician volcanicity in Wales, sees changing sites of this as caused by transfer of active extrusion from one fracture to another, following systems probably related to the Pre-Cambrian basement. A similar system of variably operative fractures may explain the varied Silurian volcanicity of the Dingle Peninsula. The general NE to SW Caledonoid trend which is seen in most of the British Isles, in the S of Ireland, as in SW Wales, changes to an approximately E–W alignment.

6. Faunal list

A reference collection upon which identifications listed here are based is housed in the Geological Museum, Trinity College Dublin with specimen numbers TCD 30138–30337. Most of the material used in the descriptions of *Holcospirifer bigugosus* and *Rhipidium hibernicum* is also held at Trinity College Dublin, but there are a few specimens in the collections of the National Museum of Ireland and the British Museum (Natural History). Details are given in Bassett *et al.* (1976).

Key:
vr = very rare   c = common
r = rare   vc = very common

	Ferriters Cove Formation	Clogher Head Formation	Mill Cove Formation	Drom Point Formation	Croaghmarhin Formation
Coelenterata					
Acervularia luxurians (Eichwald)		vr			
Coenites sp.	vr				
Entelophyllum sp.		vr			
Favosites crispata Edwards and Haime		vr			vr
Favosites forbesi Edwards and Haime		vr		vr	vr
Favosites gothlandicus Lamarck		r		r	r
Favosites hisingeri Edwards and Haime		vr			
Favosites multipora Lonsd				vr	
Favosites sp.	c	r		c	c
Halysites catenularius (Linne)	vr				r
Halysites sp.	vr				c
Heliolites grayi Edwards and Haime	r				vc
Heliolites cf. *interstinctus* (Linne)	vr				
Heliolites cf. *murchisoni* Edwards and Haime	vr				
Heliolites sp.	vr				r
Palaeofavosites asper (d'Orbigny)	vr				
Rhabdocyclus binus (Lonsdale)	c	r			
Stelliporella sp.	vr				r
Syringopora bifurcata Lonsdale					r
Syringopora sp.	r			r	
Solitary corals	vr			r	r
Stromatoporoids					r
Bryozoa					
Fistulipora sp.					vr
Undetermined bryozoa	vc	r		vc	vc
Brachiopoda					
Amphistrophia funiculata (M'Coy)					c
Amphistrophia sp.	vr				
Ancillotechia sp.		vr			
Atrypa reticularis (Linne)	vc	r		vc	vc
Brachyprion sp.	r				
"*Camarotechia*" *nucula* (J. de C. Sowerby)				vr	vc
"*Camarotechia*" sp.				c	vr

	Ferriters Cove Formation	Clogher Head Formation	Mill Cove Formation	Drom Point Formation	Croaghmarhin Formation
Brachiopoda (*contd*)					
Chonetes lepismus (J. de C. Sowerby)					c
Dalejina sp.				vr	
Dayia navicula (J. de C. Sowerby)					vc
Dicoelosia biloba (Linne)					r
Dolerorthis sp.	vr				
Enteletacean	vr				r
Fardenia sp.	vr				
Ferganella cf. *borealis* (Schlotheim)		c			
Ferganella sp.	vr				vr
cf. *Ferganella*	vr	vr			
cf. *Gypidula*	r				r
Hesperorthis davidsoni (de Verneuil)	r				
Holcospirifer bigugosus (M'Coy)	vc	vc			
Howellella cf. *elegans* (Muir Wood)					vr
Howellella cf. *latiplicata* Bassett ms.		vr			
Howellella sp.	r	vr		c	vc
Hyattidina cf. *canalis*				vr	
cf. *Hyattidina*				vr	
Isorthis cf. *amplificata* Walmsley					vr
Isorthis cf. *clivosa* Walmsley	vr				vr
Isorthis orbicularis (J. de C. Sowerby)	vr				vc
Isorthis sp.		r	r		
Janius sp.					vr
Leptaena depressa (J. de C. Sowerby)	r			r	r
Leptaena sp.		vr		vr	
Leptostrophia filosa (J. de C. Sowerby)	vr	vr		r	r
Lingula lewisi J. de C. Sowerby					vr
Meristina obtusa (J. Sowerby)	r			c	vr
Mesopholidostrophia sp.		vr			
Neucleospira aff. *pisum* (J. de C. Sowerby)		vr			
Orthoid ribbing	vr				
Pentameroids					r
Protochonetes ludloviensis Muir-Wood					r
Protochonetes sp.	vr	r		c	
cf. *Protochonetes*	vr				
Resserella sp.				vr	vr
Rhipidium hibernicum Bassett, Cocks, and Holland				c	
Rhynchonellids	c	vc		vc	vr
Rhynchotreta cf. *cuneata* (Dalman)	c	vr			
Salopina cf. *conservatrix* (McLearn)	r	vr			
cf. *Shagamella*					vr
Shaleria ornatella (Davidson)					c
Sphaerirhynchia wilsoni (J. Sowerby)				vc	c
Sphaerirhynchia sp.	vr	r			
Gastropoda					
cf. "*Bembexia*" *lloydi* (J. de C. Sowerby)	r				
Loxonema sp.		vr			
Murchisonia sp.				vr	
Poleumita discors (J. de C. Sowerby)	c	vr			vr
Undetermined gastropods	c			vc	c
Bivalvia					
Actinopteria sowerbyi (M'Coy)	vr				r
Cypricardinia sp.				vr	vr
?*Limopteria fimbriata* (M'Coy)					vr
Pteronitella retroflexa (Wahlenberg)		r			
Ptychopteria sp.				c	
Undetermined bivalves	vr	r		r	r
Cephalopoda					
Undetermined orthocones	vr	vr		vr	c
Trilobita					
Calymene sp.		r		vr	
Dalmanites caudatus (Brunnich)				r	vr
Dalmanites sp.	r			r	
Encrinurus sp.	c	vr		r	vr
Illaenus sp.		vr			
Proetid	vr				vr
Trilobite fragments	vr			r	vr
Ostracoda					
Undetermined beyrichian					vr
Echinodermata					
Crinoid ossicles	vc	vc		vc	vc
Pentagonal crinoid ossicles					r
Graptoloidea					
Saetograptus cf. *leintwardinensis incipiens* Wood					vr
Miscellanea					
Tentaculites sp.	vr			vr	vr
Trace fossils					
Chondrites				vc	

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