THE GEOLOGICAL SUCCESSION

of the

CARBONIFEROUS LIMESTONE OF SOUTH COUNTY CLARE, IRELAND,

WEST OF THE RIVER FERGUS

by

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Mr. I.M. West was an endless source of information on petrology. He also sectioned most of the corals and many of the rock specimens.

Mr. M. Mitchell of the Geological Survey gave me help over the identification of corals and brachiopods. Dr. R. Goldring of Reading University identified the trilobites and they are now in his possession. Dr. R. Cummings of Glasgow University identified the foraminifera.

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I had an abundance of help, hindrance, advice, encouragement and Job's comfort from the least expected sources. This was an education in itself.

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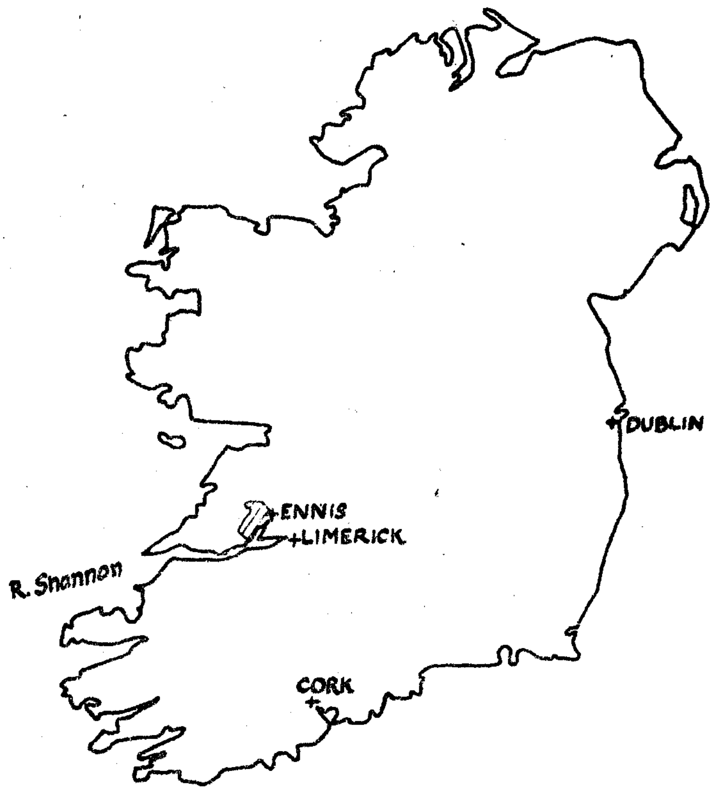


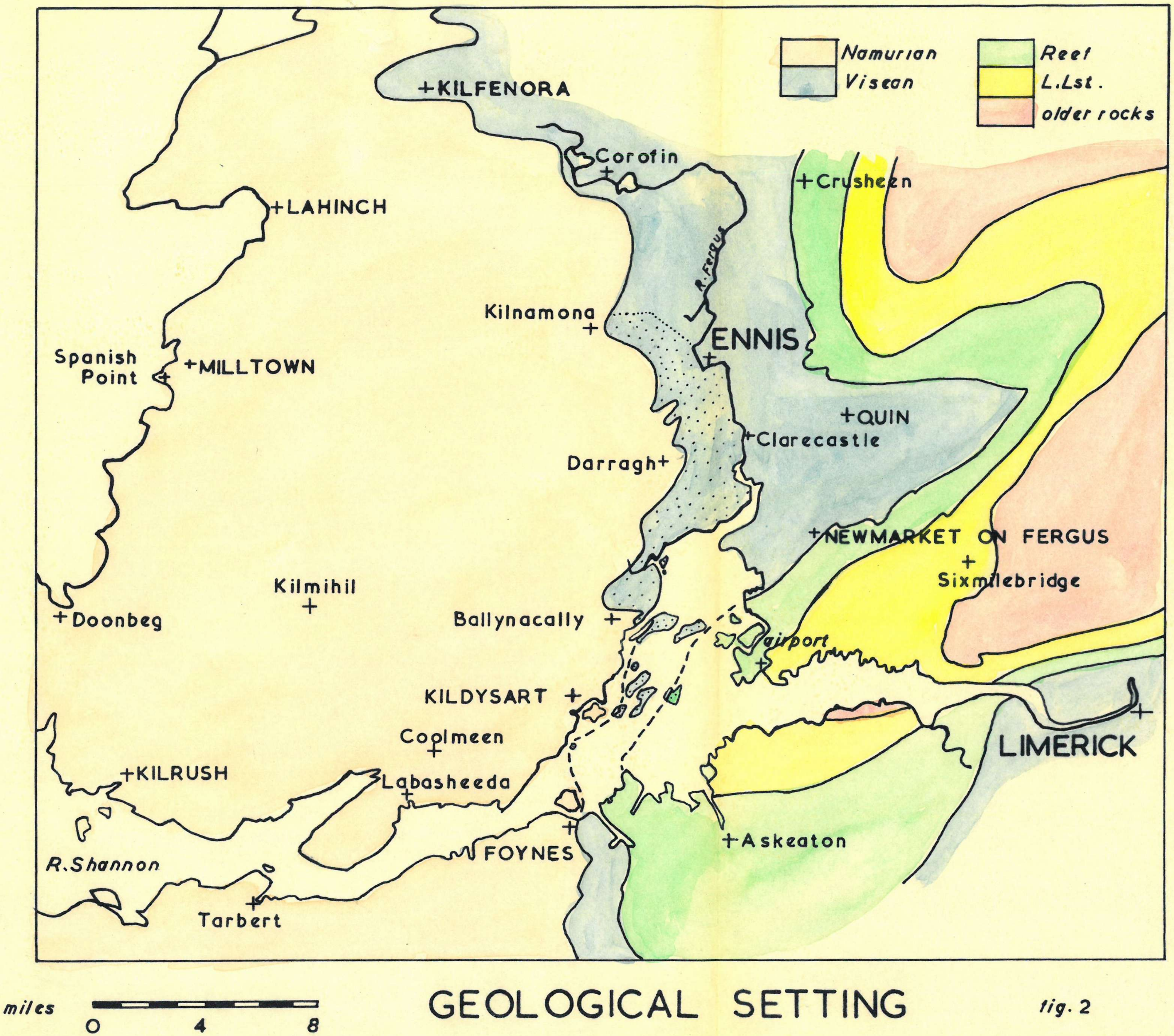
fig 1

CHAPTER I

INTRODUCTION

The district mapped lies west of the River Fergus in the south part of Co. Clare, Ireland. It is indicated by dotting in Text fig. 1. Between Kildysart and Ennis the limestone occupies fairly flat, low country bordering the river. This coastal strip is not usually more than two miles wide and is overlooked by the 2-300 feet high scarp of the Namurian sandstone which rises steeply from it.

North of Ennis the outcrop becomes very wide, and from there to Kilnamona the northern limit of the work, I have mapped only a thin strip, just wide enough to establish the age of the topmost beds. I have also mapped the islands in the estuary near Ballyncally and Kildysart.



Area mapped is dotted.

GEOLOGICAL SETTING

fig. 2

TOPOGRAPHY

On the mainland, limestone country is usually flat and low lying, at least where the limestone is evenly bedded and not much folded. South of Ennis it is often not above 50 feet, but reaches higher elevations further from the river.

In places reefs are developed and these give rise to a higher knolly topography. Also for much of the way along the top, ~~of~~ the limestone is very rich in chert and it may then form quite high hills, but these are never as high as the Namurian hills which always delimit the limestone outcrop on its western side. Any of these hills gives a good view of the limestone plain, scattered with rock outcrops and well covered with bushes. In places oval grassy hills rise up from the general level of the country. These are of drift and may be drumlins. Some of them are very large. Many of the hills outlined by the 50 foot contour on the 6 inch O.S. map are these. While on the subject of drift (which I have not paid much attention to) it is worth-while saying that besides occuring as isolated drumlins such as these, it also covers, in places, many acres of country without a break and some very large erratic blocks have been left behind. It gives an irregular moundy and bouldery topography, with thin stoney soil. Many acres of country N.W. of Ennis are smothered in drift like this.

The limestone of the islands is much folded, and but for these folds there may have been no islands, or at least they would have been a different shape. Inishmacowney and Shore Island are on the axes of anticlines. An S-shaped fold forms the backbone of Inishtubbrid while the limestone of

Deer Island and Canon Island curves gently. The shorelines follow closely the strike of the beds. Resistant horizons are easily known since they form hills headlands and shoals, while deep valleys and bays are etched out in the shaley sequences. Where the beds dip steeply they usually give unscaleable cliffs; this is so on the east shore of Inishtubbrid and the west shore of Inishmacowney, but where the dip is more gentle there is a wide pebbly strand, as at the south east side of Canon Island.

DRAINAGE

There are no streams on the islands and those on the mainland are of little importance as far as the present work goes. They may fall, as the Clareen River does, by high waterfalls down the Namurian scarp and then meander across marsh to the River Fergus. The largest River in the southern part of the area is the Owenslieve River which flows onto the limestone at Ballycorick Bridge and is tidal that far. From there it follows a winding course to the Fergus. The Inch River, which flows into the Fergus at Ennis follows the direction of folding in that area.

PREVIOUS WORK

Parts of County Clare were first mapped by the Irish Geological Survey in 1860 and then the Carboniferous Limestone was divided into Lower and Upper Limestone. These divisions were never particularly helpful. The only other work done on the limestone is by Douglas (1909). Using Vaughan's 1905 classification he produced a brief and reasonable account, that, as far as it goes, needs little alteration now. There are instances where I have done little more than to elaborate on it. It is apparent however that he did not spend much time in the south part of the county or visit the islands in the estuary, since the succession there is completely different from anything seen on the mainland, and he does not mention it.

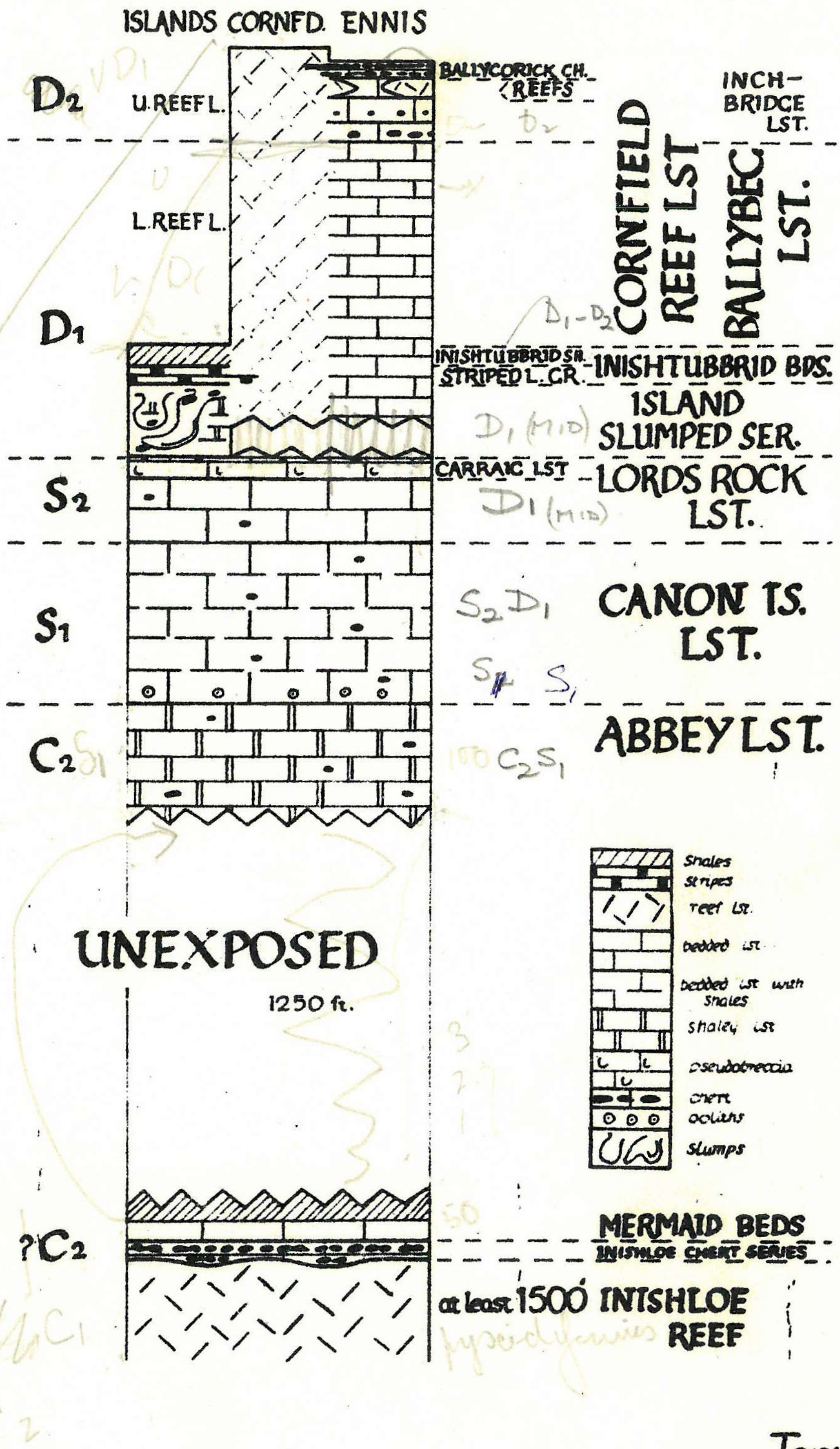
That there might be something odd about the succession in South Clare first became evident when Thorn (Thesis 1958, 1963) mapped the Carboniferous Limestone of Foynes Co. Limerick, almost directly across the R. Shannon from Kildysart. There he found it to be not in the least like that of N. Clare, as described by Douglas. He even failed to find really conclusive evidence of the existence of beds ~~even~~ as high as D1 (though he assumed it to be there), while Douglas claimed to find D3 near Ennis. Then Hodson and Lewarne (1960) working on the Clare Shales visited the island Inishtubbrid near Kildysart, and found the succession at the top of the limestone to be similar to that at Foynes but it was definitely D1 in age (proved then by the presence of <u>Beyrich oceras microntam gr.</u>) It was now obvious that the limestone succession in South Co. Clare would have to be thoroughly examined and the age of the topmost beds proved. This is what I have tried to do. It was also hoped that the work would throw some light on the reasons for the variations, in thickness and in age, of the base of the Clare Shales which are now well known, thanks to Hodson and Lewarne.

CHAPTER II

GEOLOGICAL SUCCESSION

The geological succession of the area is represented diagramatically in Text fig. 3. The lowest beds exposed belong to the top of the Waulsortian Reef Phase, they are followed (after a considerable gap about which nothing is known) by dark cherty bedded limestone containing abundant large corals and brachiopods. This is a normal marine phase and it continues to the top of the S zone, though towards the top large fossils are much less common. This far the succession is the same throughout the district but in the D zone three completely different sequences which pass into each other, are developed. They are:-

1) Bedded light grey limestone, usually darker and cherty at the top. Most of the limestone of the mainland is like this and


ISLANDS CORNFD. ENNIS
D2
U. REEF L.
BALLYCORICK CH.
REEFS
INCH-BRIDGE LST.
L. REEF L.
CORNFIELD REEF LST
BALLYBEG LST.
D1
INISHTUBBRID SH.
STRIPED L. CR.
INISHTUBBRID BDS.
ISLAND SLUMPED SER.
CARRAIC LST
LORDS ROCK LST.
S2
S1
CANON IS. LST.
C2
ABBEY LST.
UNEXPOSED
1250 ft.
?C2
MERMAID BEDS
INISHLOE CHERT SERIES
at least 1500' INISHLOE REEF
0 feet
250
500
1000
1500
Shales
Stripes
reef lst.
bedded lst.
bedded lst with shales
shaley lst
pseudobreccia
chert
ooliths
slumps

Text fig 3

it is the only type that Douglas describes.

2) A thick development of Reef in the cornfield area near Ballynacally.

3) A much thinner series of shales, limestone and shaley limestone exposed only in the islands.

It will be convenient to describe the areas where these different sequences are developed, separately and I will begin with the islands since the succession below D is not seen properly elsewhere.

PART 1

Succession in The Islands

There are seven habitable limestone islands in the estuary where the R. Fergus flows into the R. Shannon. Shore exposures are good so the succession is very clearly seen. EF. 6 and 7 are 6"/1 mile geological maps showing 6 of the islands.

Inishloe Reef Limestone

Reef limestone occupies the eastern ¾ of Inishloe and is still present ½ mile east of it, on Tine Island. How thick it is I do not know. Tine Island is probably nowhere near the base and between there and the top on Inishloe there could be 1500 feet but if it is folded (which it undoubtedly is) there is less.

Lithologically it is exactly like Waulsortian Reef from other parts of Ireland and elsewhere. That in Co. Limerick and East Clare has been thoroughly described by Lees 1959 and 1960 and anything I can say from my small knowledge will add nothing.

Most of the area mapped in Co. Limerick by Thorn (1963) is Reef limestone like this and he was able to sub-divide it into Lower, Middle and Upper Reef by the different fossil assemblages. I have made no attempt to sub-divide mine, it is all from near the top and it all looks the same, even the most easterly exposures on Tine Island, which are scarcely visible at high water.

Fossils occur mostly in pockets and are then enormously abundant. I collected the majority of corals and brachiopids from the south shore where the rock surfaces, polished by the waves show good sections through corals, brachiopods, coiled nautiloids and orthocones. Near the farm house in the eastern part of the island the rock is full of nautiloids and gastropods.

Fossils collected are listed below.

Fossils collected from the Inishloe Reef

S - also found in Salthill Knoll. C - also found in Coplow Knoll.

1. Amplexus coralloides Sow. S.C.
2. Caninia sp. C.
3. Michelinia megastoma Ph. S.
4. Rylstonia benecompacta Hudson & Platt.
5. Athyris planosulcata (Ph.)
6. A. sp.
7. Brachythyris spp. (smooth forms).
8. Dielasma hastata Sow. S.C.
9. Dictyoclostus multispiniferus. Muir-wood.
10. D. semireticulatus (Martin) S.C.
11. Eomarginifera derbiensis Muirwood.
12. E. lobatus var. laqueatus. Muirwood.
13. E. sp. S.C.
14. Plicatifera plicatilis J de C. Sow.
15. Pustula cf. pustulosa ph.
16. P. pyxidiformis de Kon. S.
17. P.sp.
18. Pugnax pugnus Martin S.
19. P. var. sulcatus Sow S.C.
20. Reticularia lobata Muirwood S.
21. R. spp.
22. Rhynchonella sp.
23. Schellweinella crenistria Ph.
24. Schizophoria resupinata Martin S.C.
25. Spirifer aff clathratus.
26. Spirifer subcinctus de Kon.
27. Sp. sp.
28. Aviculopecten bouei de Vern.
29. A. constans de Kon.
30. A.sp.
31. Conocardium hibernicum Sow. S.C.
32. Bellerophon sp. S.
33. Euomphalus catilliformis de Kon. C.
34. Loxonema Sp.
35. Naticopsis sp. S.C.
36. Straparollus convolutus de Kon.
37. Orthoceras spp. S.
38. Planetoceras cf. globatus Sow.
39. Vestinautilus cariniferus Sow. C.
40. Fenestella frutex M'Coy C.
41. F. plebeia M'Coy S.C.
42. F.cf plebeia M'Coy.
43. F.sp.
44. Platycrinus sp.
45. Goniatite indet.
46. Griffithides globiceps Ph. S.
47. other trilobite fragments.

Age and Correlations

There is nothing in the fossil collection to prove conclusively an age for the reef.

As Waulsortian Reef it compares in age with the Salthill and Coplow Reefs of Clitheroe, Lancashire, the only other reef limestone of this age with which I am familiar. The greyish yellow appearance and the fossils are similar in both areas. Using the faunal lists in Parkinson (1926) I have indicated on my list, which species are also present at Salthill and Coplow. The Salthill species are more abundantly represented. While this is reasonable, since the Salthill Knoll series is higher stratigraphically (C2) than the Coplow Series, it is not necessarily true, because I have a far smaller collection than Parkinson.

Most of the species I have found are facies fossils and turn up in reef limestone of any age. Many are present in the D. zone Cornfield Reef.

Concerning the corals, which I have found most useful for dating purposes, *Amplexus coralloides* is useless since it can be found in reef limestone of any age, and *Rylstonia benecompacta* has not previously been recorded below D1 though other species occur in the lower Tournaisian; *Michelinia megastoma* occurs in C1 and especially C2, in many districts. For instance it is present in the Slaidburn Reefs (Parkinson 1936) in C2 of the Mendips (Sibly 1906) and at the top of the C zone of Bristol (Vaughan 1905). On the other hand it comes in C2S1 of the Isle of Man (Lewis 1930) so its fidelity to the C zone is not beyond question.

This neither supports nor denies the theories of previous workers (Ashby 1939), Selwyn Turner (1939) and Thorn 1963) that the top of the reef in Ireland is C2S1 in age but from evidence that I have from elsewhere which will be discussed later, I would say that whatever the age of the top may be in other places, here it is no higher than C2.

Knoll structures on the reef top.

On the south shore, the unbedded light grey reef limestone is seen to pass laterally and vertically into bedded cherty limestone, called by me the Inishloe Chert Series. Also inside the island, rounded knolls of reef limestone, the beds dipping in all directions round the knoll, are separated from the main part of the reef by bedded cherts. There is a good ~~one~~ knoll just south of St. Senan's Bed. Lees and Thorn 1963 found the same structures in Co.Limerick. At first they were thought to be small folds but it was eventually concluded that the top of the reef was uneven and knolly and that the knolls were separated from each other, as well as overlain by cherty limestone so that there was both lateral and vertical transition from reef to cherts.

Inishloe Chert Series

50' to 60 feet of limestone belonging to this group succeeds the Inishloe Reef. It is best exposed on the south shore of Inishloe, the only island where it is seen at all, and Plate 1, figs 1 and 2 are two views of the exposures there. It is an evenly bedded dark limestone which weathers to a yellowish colour, but it is not dolomitic. The beds are one or two feet thick and are crammed with chert nodules. In thin section chert is seen to be scattered in small particles throughout the rock and this makes it very hard. Many fossil fragments, for instance brachiopods shells, are also seen in thin section, but larger, complete fossils are not common. Most of those present are corals and they are difficult to extract. They are usually silicified. Fossils collected are:-

Caninia cornucopiae gr. Michelin.
Caninia cp.
Claviphyllum sp.
Fasciculophyllum cf junctosepta Smyth.
Rotiphyllum sp.
? Brachythrid fragments.

This collection is too small to be of any use in determining the age.

The Mermaid Beds

The Mermaid Beds consist of 100' of limestone and brown shaley limestone. They are exposed only in the western and southern shores of Inishloe and are named after some rocks of the S.W. shore, on which a mermaid is reputed to sit.

The lowest 40 feet is of massive-bedded light grey limestone; the beds about 5 feet thick. It consists almost entirely of crinoid debris, set in a fine-grained matrix, is more or less identical in appearance to the crinoid limestone beds in the reef limestone, and could indicate a brief return to reef-forming conditions. It is overlain by 60 feet of thin bluish or brownish limestone, usually only a few inches thick, shaley limestones and beds of soft brown shale, which are exposed on the western shore only. Thin section shows both the limestone and shaley limestone to contain many sponge spicules in a micritic matrix, the dark or brown colour being due to organic matter. I have found no macrofossils except for a few stick bryozoa.

These are the highest beds seen on Inishloe and the next above are in the Abbey Limestone of Canon Island. Between the two there is a considerable gap about which nothing is known, because no limestone of this horizon is exposed elsewhere in the district. If the beds continue to dip under the river at 30^{o}-40^{o} as they do on both islands then there is room for about 1250 feet of limestone between the Mermaid Beds and the Abbey Limestone, but there is a possibility of folding or faulting and this would reduce the thickness. However, as neither folding nor faulting can be proved it is useless speculating about possible effects.

The Abbey Limestone

On Canon Island the succession is almost uninterrupted from the Abbey Limestone through the Island Slumped Series. The Abbey Limestone is seen nowhere else but Canon Island and is best exposed along the Shore east of the Abbey. In the southern part of the Island most of the exposures are below high water. Most of it is a shaley, dirty-looking, brownish-coloured limestone which breaks easily and is quite crumbly when weathered. It is usually in beds about a foot thick, but often less. Some beds are of coarse dark blue black limestone, and occasionally a few inches of brown shale may separate the thicker beds. In thin section the blue black limestone is seen to be made up of inumerable fossil fragments, mostly brachiopod shells and foraminifera in a sparry calcite matrix. It is typical marine limestone. On the other hand the brown shaley limestone, while it contains shell fragments, also contains some calcisphaers and the ground mass is micritic. This would indicate shallower conditions. Shee Chapter V for further information about this.

Fossils are fairly common in both limestone and shaley limestone. Those collected are:-

		Locality No.
1.	Siphonophyllia cylindrica Scouler	39
2.	S. sp	42
3.	Chonetes cf papilionacea Phillips	45,44,37,28,27
4.	Ch. sp	44,36
5.	Daviesiella destinetzi	42,41
6.	Dictyoclostus semireticulatus (Martin)	42
7.	Leptaena analoga	43
8.	Levitusia humerosa Sowerby	38
9.	Schuchertella wexfordensis Smyth	44,42
10.	Spirifer aff. clathratus	40,38
11.	indet. productid	45
12.	Fenestella frutex M'Coy	42
13.	Bellerophon sp	36A
14.	Straparollus sp	28
15.	Other small gastropods	28

This fauna is similar to that of C2 or at the highest C2/S1 limestone of other localities. For instance in C2 of the Mendips (Sibly 1906) Sp. aff clathratus, Chonetes cf. papilionacea, Ch. cf comoides, which is, or/is similar to D. destinetzi and Orthotetes cremistria which could be Schuchurtella wexfordensis, are present. O. crenistria, Ch-aff papilionacea and Ch.cf comoides are in the C limestone of Bristol (Vaughan 1905) and Ch.cf comoides are in the C limestone of Gower (Dixon 1911). So papilionaceous chonetes, thin strongly reflexed Daviesiellas and Schuchertellas are typical of the English C2.

In the Northern part of the Republic e.g. around Omagh and also in N. Ireland *D. destinetzi* occurs in C2/S1 beds and in his description of the type, Simpson (1953) regards it as a zone fossil of the Irish C2/S1.

The other interesting fossil from this collection is *Levitusia humerosa* and its occurrence in C2 beds was first described by Parkinson (1926) from the Clitheroe area. (See also Geol. Surv. Mem. 68 1961). It ranges over several hundred feet but is confined to C2. The lowest occurence is about 400 feet below the top of the Chatburn Limestone and the highest in bedded limestone associated with Worsaw Knoll. This upper one is the humerosa band proper.

It appears therefore that the age of the Abbey Limestone is C2. This is interesting, since as we have seen, the top of the reef is well below it so that must be at the highest C2 which is in contradiction to the opinions of other workers.

The Canon Island Limestone

The Abbey Limestone passes up into bedded cherty coarsely crystalline blue black limestone and shale. The limestone beds may be 2' or 3' thick, usually separated by thinner beds of dark brown to grey shaley limestone, or sometimes by black shale. The whole 500 feet is full of bryozoa, crinoid debris and large fossils, mostly brachiopods and corals. Both shale and limestone smell very sulphurous when freshly broken. Lithologically, individual beds are much like those of the Abbey Limestone, i.e. the limestone ones are almost entirely of shell fragments and foraminifera cemented by coarse sparry calcite while the shaley ones have a micritic matrix. It is only en masse that any difference can be seen and then the only difference I see is that shales beds are less common and blue black limestone is more common upwards. The change is not clearly defined and if the beds were badly exposed, would probably not be spotted at all, so a good fossil collection is essential.

The Group is best exposed in Canon Island, after which it is named. A little bit is probably present at the northern end of Inishmacowney, and most of the eastern part of Deer Island is Canon Island Limestone but it is not seen well there.

The Succession on Canon Island

There is an almost continuous section along the south shore and also on the eastern shore of the northern half. The most conspicous feature of the limestone and the one which I have used to identify it elsewhere is the presence of a great many huge solitary corals. Most of them are _Siphonophyllia cylindrica_ and _S.cf. cylindrica_. This is also present in the Abbey Limestone and the Lords Rock Limestone (I have one doubtful specimen) but it is more abundant in the Canon Island Limestone, particularly in the lowest 100' where it is associated with Palaeosmilia murchisoni and _P.multilamellata_ which rival it in size. These large corals are in both limestone beds and shales but are more common in, and better to get out, from the shales, where they may lie one upon another like old roots, sometimes reaching 12" in length. Also in these lower beds are _Cravenia Lamellata_ _Cr. lamellata var_ and

Lithostrotion martini and L. cf martini. This is the first appearance of lithostrotions in the succession and they continue upwards with varying abundance. They occur here as broken fragments and bushes in the position of growth.

Corals of the Zaphrentis enniskilleni group and Aulina sp. appear in the upper part. At the top there is a bed of Aulina sp. about a foot thick which I have traced for over 100 yds. up from the south shore but I have been unable to find it again anywhere else.

Brachiopods become more common towards the top, and where they are abundant there are usually fewer corals. I found them difficult to extract nicely.

Different species of Echinochonchus and Brachythyris *ovalis* are the most common types though *Avonia youngiana* and *Pustula spp.* are not infrequent. Chonetes is quite different from that of the Abbey Limestone. It is small and rounded while the Abbey Limestone one (which I have called *Ch cf papilionacea*) is wide and flat - and far more common.

A complete list of fossils occurring in the Canon Island Limestone, with the localities at which they were found is given over the page.

The Succession on Deer Island

The limestone is best seen on the Northern shore and is scrappily exposed on the eastern shore and inland. There are folds in it so the succession is not seen clearly as on Canon Island. Nevertheless it is easily recognised as Canon Island Limestone by the presence of large specimens of *Siphonophy* -

FOSSILS FROM THE CANON ISLAND LIMESTONE

	Canon Island Locality Numbers	Deer Island Locality nos.
Aulina cf. furcata Smith		3,10
Aulina sp	11,12C	9
Caninia benburbensis Lewis	11A,12D,24	
Clisiophyllum sp		2A
Clisiophyllid Lithostrotioh	23	
Cravenia lamellata Howell	23	
C Lamellata var Howell	46C	
Cyathaxonia cornu Michelin	20,46C	
Diphyphyllum sp	46D	
Koninckophyllum sp	loose on strand near 23	
Lithostrotion martini Edw. & Haime	14,20,26,46A,51,53	15
L. cf. martini E & H	46B,C	
L. sp	20	
Palaeosmilia murchisoni E & H	23,24,46F	
P murchisoni 'multilamellata' Gar	23,46E	
Siphonophyllia cylindrica Scouler	12C,14,21,23,24,46ACDF	2,9,10,15,17
cf cylindrica		9
Zaphrentis enniskilleni var enniskilleni Lewis	18,23,47B,51,52	2
Z.e.var ashfellense Lewis	14	
Z. enniskelleni gr	14,33	
S. sp	23	
Athyris sp	12C	
Avonia youngiana (Davidson)	16,17	
Brachythyris ovalis Phillips	12B,15,17,49,50	
Chonetes spp	16,17,23	
Daviesiella sp	12A,25	
Dielasma hastata Sowerby	18	
Dictyoclostus semireticulatus (Mar)	15,17	
D. sp		9
Echinoconchus elegans McCoy	15,17,18,49	
Echinoconchus punctatus Mar	17,29A,49	
Eomarginifera lobatus var laqueatus Muirwood	24	
Eom. sp		9

	Canon Island Locality Numbers	Deer Island Locality nos.
Giganoproductus cf θ Vaughan	21	
Leptaena analoga Phillips	12D,18,50	
Linoproductus sp	25	
Indet. productid	45	
Overtonia fimbriata (Sowerby J de C)	21	
Pustula spp	12C,14,24	
Rhipidomella michelini (L'Eveille)	12C	
Rhynconella sp	16	
Schellweinella crenistria Ph	12D, 24	
Capulus sp	14	
Eomphalus amaenus de Kon	34	
Natica sp	20	
Straparollus sp	14,19	
Indet gastropods	12B	
Fenestella frutex McCoy	14,47B and many other localities	
Fenestella sp	49)	
stenopora sp & stick bryozoa	14) and most other localities	
Phillipsia kellyi Portlock	15,17,18,24,33	
Phillipsid	17	
Fish spine	46F	
Archaeodiscus sp.	)	
Earlandia sp.	)	
Lipiniheila sp.	)	
Lituotubellid fragment	)	
Plectogyra spp.	)12X foraminifer identidied by Dr. Cummings	
Stacheia congesta Brady	)	
Telraxis conica Ehrenberg	)	
Calcisphaerids	)	

llia cylindrica and cf. cylindrica, Palaeosmilia murchisoni and Z enniskilleni group. Aulina sp is abundant near the top.

The Age of the Canon Island Limestone

In many districts C2 and S1 are impossible to separate. This was first pointed out by Dixey and Sibly (1917 p.24) who lumped the two together and called it C2S1. This usage has been adopted by later workers and George (1933) said they could only be divided when Lithostrotions were present.

The fauna collected from C2S1 limestone of many districts, for instance on the Isle of Man (Lewis 1930), South Wales, Carrick on Shannon (Caldwell 1959) and other parts of the north of Ireland, is much like that of the Canon Island Limestone.

Cravenia lamellata and var. occur in the C2 or C2S1 beds of Gower.

Zaphrentis enniskilleni var. enniskilleni and *var ashfellense* were first described from C2 and S1 of the Isle of Man (Lewis 1930).

Palaeosmilia murchisoni ranges from C1 to D2 but may be especially common in S1, while George (1958) regards *P. multilamellata* as a definitive fossil of the Upper Caninia Zone (i.e. C2S1). However there is doubt as to the validity of this species (see Palaeontology notes Chapter IV). The top of S1 has been regarded as being marked by the last appearance of large Siphonophyllids by George (1933) but they do occur sporadically above, in Wales and in the North of Ireland (doubtfully also in S. Clare). For this reason he said in 1958 that the top was better defined by the first appearance of the S2 fossils, *Cyrtina carbonaria* and *Lithostrotion minus*.

Since I find neither of these in my succession I must revert to the original idea and end S1 with the last appearance of large Siphonophyllids, in abundance.

Thus with the end of the Canon Island Limestone the S1 sub-zone also ends but the question "Is it all S1, or is it better called C2S1?" remains.

I have already pointed out that the fossil assemblage taken as a whole is almost identical to that of other limestone which has been called C2S1. The fossils as individuals are not very useful. The corals mostly may be C2 or S1; the common brachiopods, Echinoconchus elegans E. punctatus Overtonia fimbriata Avonia youngiana are also common in other C2S1 limestones. But if C2 and S1 are not divided elsewhere it is not possible to say whether these fossils indicate C2 or S1 or both. Since I consider the Abbey Limestone below to be readily recognizable as C2 and George (1933) maintains that S1 is indicated by the occurrence of typical specimens of Lithostrotion martini I propose to call the Canon Island Limestone S1.

THE Lord's Rock Limestone

The Lord's Rock Limestone is 270' to 450 feet thick. It is exposed on Canon Island, Inishmacowney, Shore Island and Deer Island. It is a thickly bedded limestone, more thickly bedded than the underlying Canon Island Limestone and without the intervening shaley beds. Chert is not present throughout as it is in the Canon Island limestone. Many feet of beds contain none, but where it is present there is a lot of it, often in enormous blue black nodules and in thick beds.

The limestone is very hard and blue-black or brown-black in colour and does not contain many fossils. In thin section a few shell fragments including ostracod shells, a few crinoid ossicls, some foraminifera and calcisphaers are seen in a micritic matrix. There is little sparry calcite. This is also obvious from the hand specimen which has rather a dull appearance and shows few fossil remains. It contrasts with the Canon Island Limestone which is crammed with all kinds of white fossil fragments which show up well against their sparkling blue black background.

It is resistant to weathering, particularly the beds with a lot of chert and these form prominent features through the Islands where they outcrop.

The fauna of the Lord's Rock Limestone is small see list page (   ). Some of the species continue up from the Canon Island Limestone but there is no comparison between the large numbers of specimens present there and the few here.

Fossils not found in the limestones below are listed:-

Caninia aff cornucopiae
C. lanceolata gr.
C. subibicina
Diphyphyllum smithi
Lithostrotioh pauciradiale
Michelinia favosa
Rylstonia sp.
Zaphrentids

Spirifer cf acutus
Platycrinus sp.
Actinocrinus sp.
Orthoceras sp.
Nautiloid.

None of these are common.

There is a complete absence of almost all the brachiopods and most of the corals which are typical of the Canon Island Limestone. The large Siphonophyllids are replaced by smaller fewer Caniniids. Palaeosmilia, Cravenia lamellata, Zaphrentis enniskilleni enniskilleni are absent. Lithostrotion martini and cf. martini are far from common.

Below the differences between the Canon Island limestone and the Lords Rock Limestone are summarized.

Canon Island Limestone	Lord's Rock Limestone
1. Beds 1'-2' or 3' thick separated by shale or sometimes shaley.	1. Beds up to 5' thick no shale or shaley beds.
2. Chert in small nodules throughout.	2. Chert not everywhere and in very large nodules & beds.
3. Lots of fossil debris.	3. Little.
4. Bryozoa very abundant throughout.	4. Very little.
5. Large Siphonophyilias	5. Rare or absent.
6. Large Palaeosmilias	6. None
7. Zaphrentids, Lithostrotiontids common.	7. Not
8. Many different brachiopods.	8. Few and rare.
9. Few caniniids.	9. More caniniids.
10. Only shaley beds micritic.	10. Micritic Matrix.

The succession varies from place to place but the top is always marked by a change in Lithology from massive limestone to dark brown or black shale with thin limestone beds.

<u>The Succession on Canon Island</u>.

On Canon Island the Lord's Rock Limestone is 270 feet thick. It forms the height of the hill which runs the length of the Island. The land slopes gently eastwards across the outcrop of the Canon Island Limestone from the hill-top, but on the western side falls steeply with the dip of the rock to a narrow valley occupied by the overlying shales. It is best exposed on the south shore, where the transition from Canon Island Limestone can be seen. The Canon Island Limestone becomes less shaley and more thickly bedded upwards to pass into the entirely thickly bedded Lord's Rock Limestone. I have taken the base arbitrarily as the top of the _Aulina_ bed previously mentioned, but this cannot be regarded as a marker band since I find it nowhere else, The same species of _Aulina_ is common for 50' below and I have found it above (in Inishmacowney). Not far below the bed _Siphonophyllia cylindrica_ and other S1 fossils appear, while above these are absent so the changeover is not too far away.

Most of the limestone is as I have described - very hard, dark coloured, not very fossiliferous and in thick beds 1' or 2' to 5' thick. Some beds contain chert and some do not, but the chert is rarely in very large nodules or thick beds.

Plate 2 fig. 2 shows the exposures on the south shore viewed from the east. The rock just visible at the left hand side of the picture is Lord's Rock (hence the name).

The Carraig Limestone.

Near the top is 21 feet of limestone qhite different from typical Lord's Rock limestone. It is a dolomitic pseudobreccia exactly like that described by Dixon (1911) from Gower. I have called it the Carraig Limestone (Carraig means Rock). Besides occupying the western side of the hill of Canon Island it continues through Inishmacowney and Shore Island. It is easily recognised in the field by its light grey yellow mottled colour, although an unweathered surface is fairly dark grey, the complete absence of chert, and the presence of many small corals, crinoid heads and stalks, orthocones and nautiloids (see fossil list). It occurs in beds 1'-3' thick. In thin section it is seen to be almost wholly of dolomite rhombs which surround undolomitized fossils and patches of micritic calcite. This gives it the appearance of a breccia.

At the south end of Canon Island on the side of the long inlet, it was quarried many years ago. Plate 2 fig. 1 shows some of the top beds of the pseudobreccia in the foreground. From here stone was taken by boat to build the seawalls at

Islandavanna during the famine. Since it weathers nicely it makes a clean attractive-looking building stone that has been used a lot in the district but not all has come from this quarry.

Eight feet of dark bedded limestone, like the rest of the Lord's Rock Limestone follows the Pseudobreccia. It contains some bands of chert and also very large nodules which stick out above and below the beds in which they occur. These beds are very resistant to weathering and the highest one which undulates gently, forms a steep cliff on the eastern side of the long inlet. They continue to form a steep westward-facing slope through the length of the island and have given rise to an acid soil on which heather and cross-leafed heath flourish.

The Succession on Inishmacowney

The succession is not so easily worked out on this island. There are no long exposures; the beds are folded into an anticline so the same ones are present on two shores and it is difficult to relate the two series; there are no marked fossils and the succession differs from that of Canon Island.

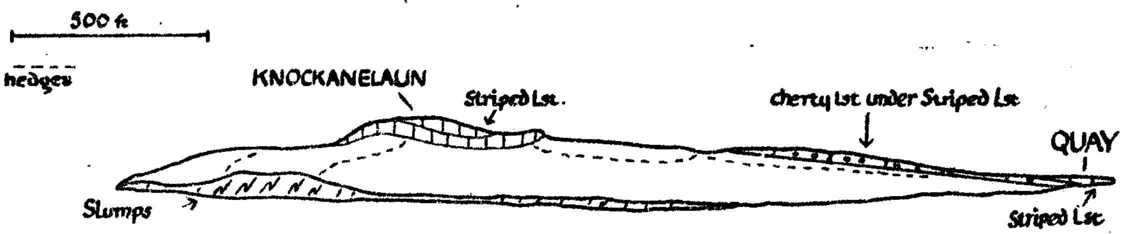
To begin with it is much thicker. There is about 450' as opposed to the 270' of Canon Island, and the Carraig Limestone is not at the top but 180' down. I imagine that the 270' of limestone below the pseudobreccia is the equivalent of that on Canon Island and the beds above are new. They are certainly different. The beds below are poorly exposed. That seen is bedded, dark-coloured blue-black to grey and cherty.

The only fossils I have found in it are a few small corals including _Zaphrentis enniskilleni gr?_ and crinoid debris. The chert occurs in smallish nodules but not all beds are cherty.

The _Carraig Limestone_ is best seen in the south of the Island, near the farmhouses where it was quarried. (Limestone from here built the quay at Kildysart). There is about the same amount as there is on Canon Island. It is in very thick beds and contains small brachiopods (unidentifiable) and _Orthoceras._ From this quarry which is more or less on the axis of the anticline, it can be followed with fair certainty on the north limb of the fold, passing to the east of Horse Island School and continuing out into the river east of Rinevaud Point. I have not seen it on the southern limb of the fold - its position on the map is only inferred.

The Limestone above the pseudobreccia beds.

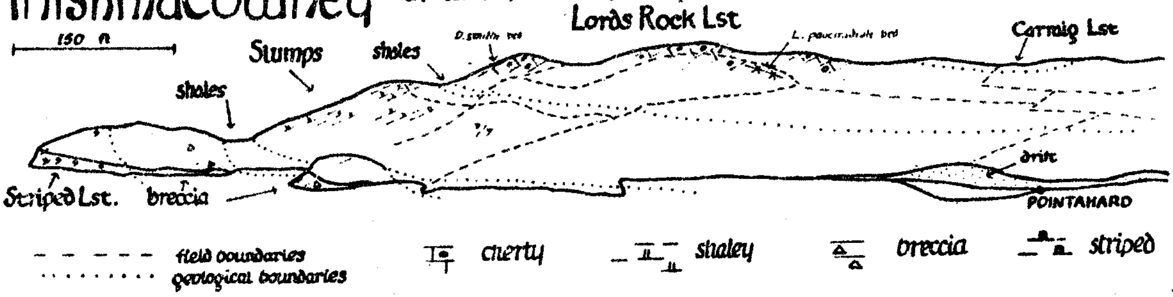
Above the Carraig Limestone are thickly bedded hard dark grey to blue black limestones with varying amounts of chert. They form the hills in the south part of the island where the more cherty beds outcrop in a series of ridges. The stepped nature of the topography is well seen when the island is viewed from the river as in text fig. 5. The lowest 90' is a very thick bedded, very dark coloured limestone which contains many huge nodules of blue black chert. It forms a prominent ridge, the most easterly of text fig. 5, and can be followed northwards through the fields near the west shore to Rinevaud Point. Most of the exposures on the



INISHTUBBRID viewed from the north-east

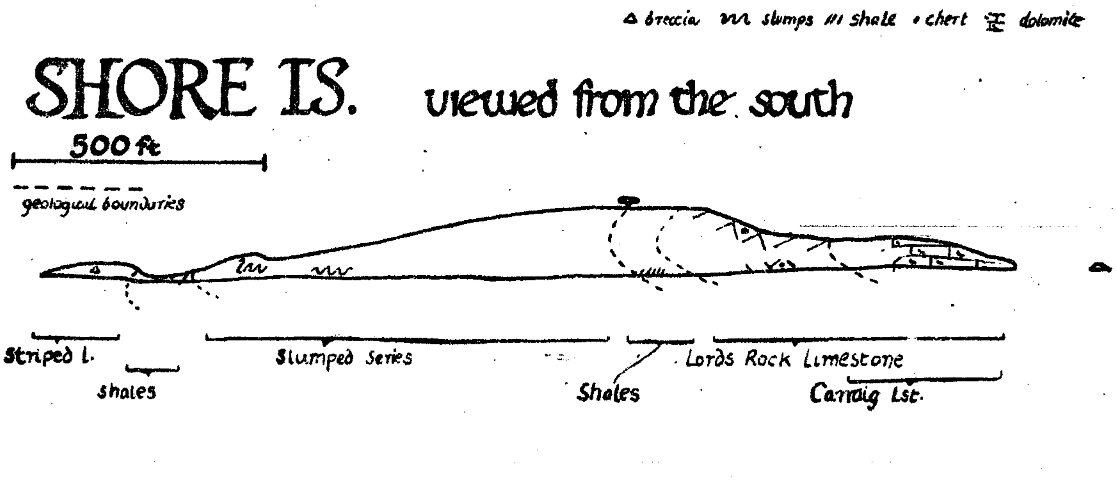
Text fig 4

INISHMACOWNEY viewed from the south



Text fig 5

SHORE IS. viewed from the south



Text fig 6

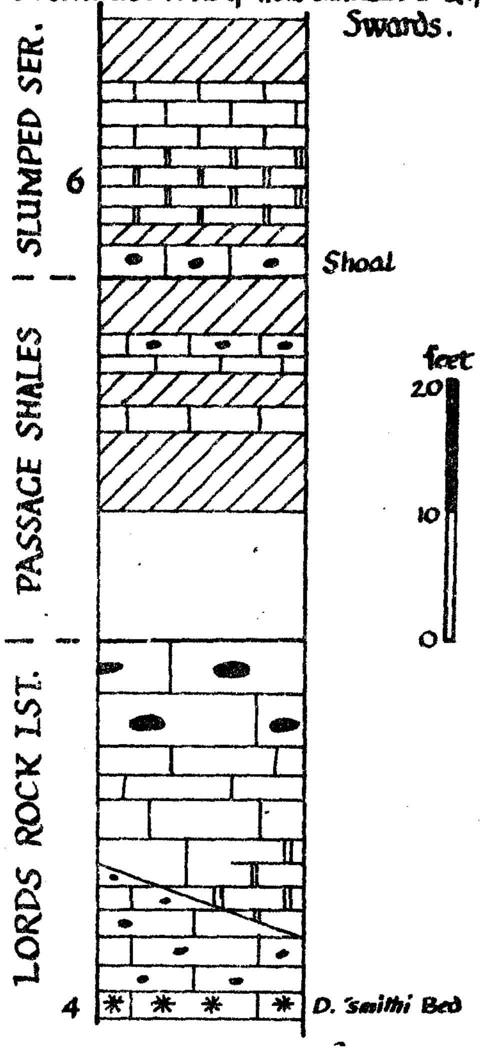
east shore are of this part of the limestone and I have collected a few fossils from it here namely Aulina sp. and a few small unidentifiable zaphrentids.

Above this, the limestone is not so thickly bedded and becomes shaley towards the top. Chert is in smaller nodules and is particularly common at two levels, one almost at the top of group, this forms two more features across the hill (Text fig. 5).

Some of the beds at about the middle of this upper group are seen on the east shore, a little north of Pointahard. They are dark finely crystalline limestones and contain Stenopora sp, other stick bryozoa and Z. enniskilleni var. ashfellense. The Zaphrentids are weathered out on the bedding plane and are all aligned in the same direction - narrow ends down dip. The beds here undulate quite deeply.

The highest beds of the Lord's Rock Limestone are separated from the lowest beds of the Slumped Series by a few feet of shale which weather out into a hollow, inland. They are exposed on the N.West shore just south of Ginnane's Quay. The succession exposed there is represented diagrammatically in Text Fig (7). The lowest bed seen is crammed with Diphyphyllum smithi and this is traceable for some way up the hill to the south. The Diphyphyllum bed is followed by about 30 feet of thick bedded cherty limestones which are the top beds of the group and which form a feature when they outcrop in land. They are succeeded by 26' of brown paper

Succession on the W. shore of Inishmacowney from Cimmanes Qy. Swards.



Text fig 7

shale with thin limestones which pass into the shaley limestone of the slumped series. These passage shales are not seen much of elsewhere. A few feet are exposed on Shore Island. I have seen none on Canon Island but there is a very wide gap which must be occupied by them and this allows room for a greater thickness than is present here.

The Succession on Shore Island.

The lowest beds present on Shore Island belong to the Carraig Limestone. This is seen around the bay at the northern end of the island near high water mark. Although I collected no fossils, sections of Orthocones, nautiloids and brachiopods are seen on the surfaces worn smooth by the tide. One hundred and fifty feet of Upper Lord's Rock Limestone follow it. This is well exposed in the cliffs at the northern end of the

Island.

As on Inishmacowney, the beds following the pseudobreccia are full of chert. The limestone is in 1'-2" thick beds. The chert is in bands, usually around 3" thick, close to the top and bottom of most of the limestone beds, also in very large nodules often wider than the beds in which they occur. Usually the chert in bands is completely rotten so the limestone, which is hard and dark, has soft, brownish yellow edges, and appears to be more thinly bedded than it actually is. Occassionally the nodules are rotted, leaving huge irregular holes. The lowest 80' of Upper Lord's Rock Limestone is like this. Above it there is less chert and it is quite fresh. There are also some small erosion hollows and near the top the bedding is undulating and bolsters are developed.

(This probably compares with the undulating beds north of Pointahard, Inishmacowney). The limestone of the bolstered beds has two sets of joints not quite at right angles which divide up the beds into diamond shapes. These are tension joints and are often developed on thick bolstered limestone beds in the overlying slumped series (see Plate 3 fig. 2 of joints in the Slumps of Canon Island). The joints of Shore Island are unusual in that each diamond shape is weathered onion-fashion.

The Succession on Deer Island.

On Deer Island the Lord's Rock Limestone returns to the thickness it is on Canon Island. It is poorly exposed, outcropping scrappily on the north shore and mostly obscured by bushes inland. I have not seen the pseudobreccia.

Fossils collected from the different localities are listed on page 75 . The small number from Shore Island does not reflect the unfossiliferous nature of the rocks there. The island is just awkward to get at.

The Age of the Lord's Rock Limestone.

None of the fossils found are reliable zonal forms though Caninia benburbensis and Diphyphyllum smithi are usually abundant in S2. Cyrtina carbonaria and Lithostrotion minus which prove S2 are not present here though Douglas (1909) finds L. minus in North Clare, with Zaphrentis aff. enniskilleni. He says of what he calls S2 that productids are rare (this agrees with the Lord's Rock Limestone) and that pale grey finely crystalline limestones are present near the top. This could be the Carraig Limestone in which case the succession on Canon Island should be regarded as typical (which I have done) while the beds above, of Inishmacowny and Shore Island are a local addition.

Since the S1 zone is considered to end with the Canon Island Limestone and the overlying Slumped Series, have been proved to be D1 by the presence of Dibunophyllum bourtonense it seems reasonable to suppose that this group should be S2 in age even if it cannot be proved.

FOSSILS FROM THE LORD'S ROCK LIMESTONE.

	Canon Is. Loc. Nos.	Inishmacowney Locality Nos.	Deer Is. Loc. nos	Shore Is.
Aulina sp		23		
Caninia benburbensis gr	9	15		
Caninia aff comucopicæ Mich		21		
C. lanceolata gr	7+			
C. subibicina McCoy		15		
Diphyphyllum smithi Hill		4		
Diphyphyllum sp	7+			
Lithostrotion martini Edw & Haime	55+			
L. cf Martini Edw & Haime		17		
L. pauciradiale McCoy		15		
Lithostrotion sp	7+			
Michelinia favosa (Goldfuss)	55+			
Rylstonia sp		11		
Zaphrentis enniskilleni var ashfellense (Lewis		16		
Z. enniskilleni gr		10		
Zaphrentids	7+,9,8, 55+,30+	12	8	
Trilobite remains	9,10		7	
Fenestella sp		10		
?Stenopora & other stick bryozoa	8	15,16		
Platycrinius sp	7+			
Actinocrinus sp	7+			
Gastropods		16,17		
Orthoceras sp	7+	22+		+
Nautiloid	7+	22+		
Dictyoclostus sp		16	7	
Spirifer cf. acutus de Kon		16		
Archaeodiscus sp) Brunsia sp) Calcisphaerids)	9 foramarifera identified by Dr. Cummings			

+ locality in the Carraig Limestone

The Island Slumped Series

The Slumped Series is a collection of about 220 feet of thick limestone beds, dark shaley limestone beds, thin limestones, and brown or black shales. At three levels intraformational slumps are developed involving 20 feet to 30 feet of beds each and they are separated by unslumped horizons. It is difficult to measure accurately the thickness of beds involved in the slumping since beds are repeated by folding and normal bedding is interferred with by changes in lithology, but the middle one (called Slump Group II) is the thickest.

The folding ranges from gentle undulations of the bedding to large bolsters. The limestone beds outline the fold while the axes above and below are filled by the thickening or the development of shaley beds. An undulating or bolstered limestone bed usually has diamond joints on the curved surfaces. In a bolster the topmost limestone bed which defines it, is much thickened and bowed out so that the succeeding beds are either absent or very thin above it, while the ones below are thickened, thus several feet of beds may be affected, depending on its size. Where bolstered beds follow each other the bolsters alternate, and in between large ones there are often small knife folds.

Erosion hollows are also common. These are lens shapes of shale or shaley limestone between limestone beds. Sometimes the limestone beds bordering the lens may continue unbroken round it, other times some of them pass into shale, or end abruptly against it.

LIST OF FOSSILS FROM THE ISLAND SLUMPED SERIES

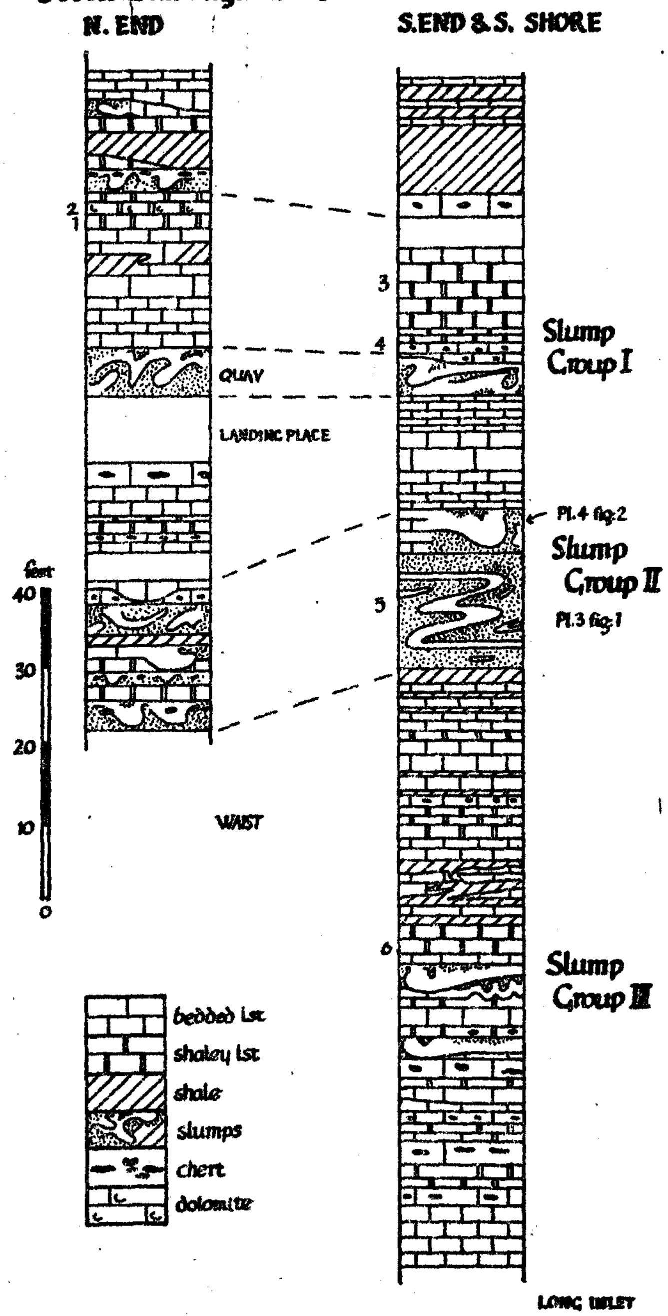
	Localities				
	Canon Is.	Inish macow-ney	Inish tubbrid	Shore Is.	Deer Is.
Caninia amplexoides var. Wilmore	5	-	12,15		
Caninia benburbensis Lewis					12
Caninia cf densa Lewis		2			
Caninia sp.					12
Carcinophyllum cf. vaughani Salée.....		8			
Claviphyllum sp ...			12		
Dibunophyllum bourt-onense Garwood & Goodyear..........	2	8			12
Koninckophyllum sp.			15		
diphymorphic koninckophyllum ...		7			
Lithostrotion martini Edwards & Haime.....	2				
L. cf. martini E & H		8			11,14
Michelinia favosa Goldfuss				2	
Rhopalolasma sp. nov.	4	5		2	
Rotiphyllum sp.					12
Zaphrentids		6,19	16		
Athyris sp		7			
Brachythyris spp (smooth forms)	5	6,14	12,15	2	
Eomarginifers sp ...				2	
Leptaena analoga Phillips		18	16		
Lingula sp		1			
Overtonia sp........		7			
Productids		1,2	12		12
Rhipidomella michelini L'Eveille		7,8		2	
Rh. sp	5	5			12
Rhynconella sp		1,2			
Schellweinella crenistria Phillips	2				
Schizophoria resupinata Martin		7			
Spirifer bisulcatus Sowerby		5,8	12	2	12
Sp. sp.				2	
Fenestella polyporata Phillips		5			

	Canon is.	Inish macow-ney	Inish tubbrid	Shore Is.	Deer Is.
Stenopora sp		7			
Other bryozoans....	3	7,3,2,19	11		11
Trilobite remains..		1,3			
Orthoceras sp......	2,4	6			
Bellerophon sp.					

The limestone beds are very variable. The thinner ones are mostly of a fine dark blue-grey limestone which is brownish in colour when weathered. In thin section it is seen to contain a great many calcisphaers and ostracods and sponge spicules sometimes, but little else, in a fine micritic ground mass. The thicker beds may be more coarsely crystalline and some are conglomeratic. The conglomerates contain shell fragments and intraclasts which have frayed edges (see plate 14 fig. 1). These are set in micritic matrix. The shaley beds contain small zaphrentid-clisiophyllid phase corals, brachiopods and bryozoa (see faunal list pp.78 &79).

The fact that most of the limestones are calcisphaer-ostracod limestones indicates that the beds were deposited under shallow water conditions. (See Chapter V for further

CANON ISLAND W. SHORE (S. half)
sections through the SLUMPED SERIES



Text fig-8

information about this).

The Slumped Series are exposed on Inishtubbrid, Inishmacowney, Canon Island, Shore Island, and Deer Island.

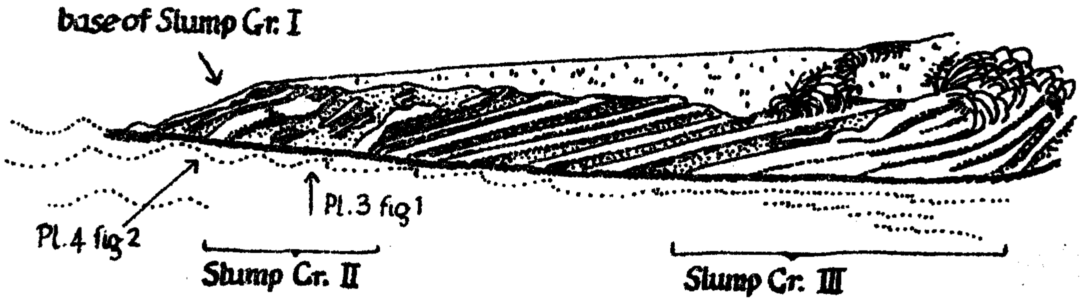
<u>The Succession on Canon Island</u>.

The most complete succession through the slumps is seen on the west and south shores of Canon Island, in the south part of the Island. It is less clearly seen in the north part. Inland it forms a ridged hill over 50' in height separated from the Lord's Rock Limestone hill by the deep valley previously mentioned. The ridges are caused by the slumped groups.

Text fig. 8 represents diagrammatically the succession that is exposed on the south shore. Plate 2 fig. 1 is a view of the south shore taken from the quarry in the pseudobreccia

SLUMPED SERIES on the S. shore of CANON ISLAND

explanation of Pl 2 fig 1



Text fig 9

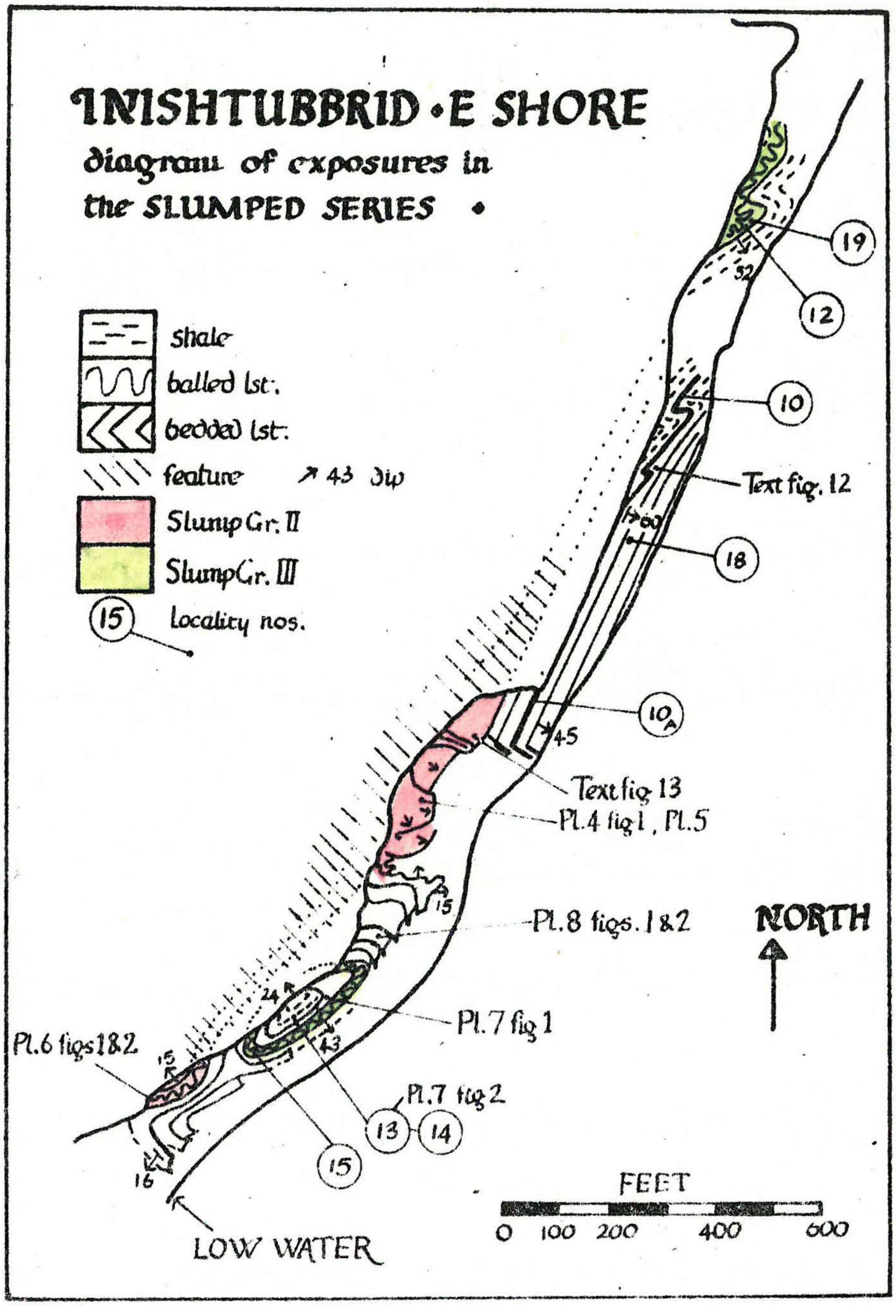
An explanation of the plage is given in Text fig. 9

Plate 3 fig. 1 and Plate 4 fig. 2 are photographs of Slump Group II. The Slump Groups can be followed inland and I have identified them on the north west facing shore of the south part of the island. Plate 3 fig. 2 is of diamond jointing on a bed a little north of the quay. It is approximately the equivalent of bed (4) on the south shore.

The succession in the northern half of the Island is not well exposed. Slump Group I does not appear to be present, instead there is about 50 feet of brownish coloured thinly-bedded limestones with some shale near the base, down to the top of Slump Group II.

The Succession in Inishtubbrid

The finest slumps of all are seen on the east shore of

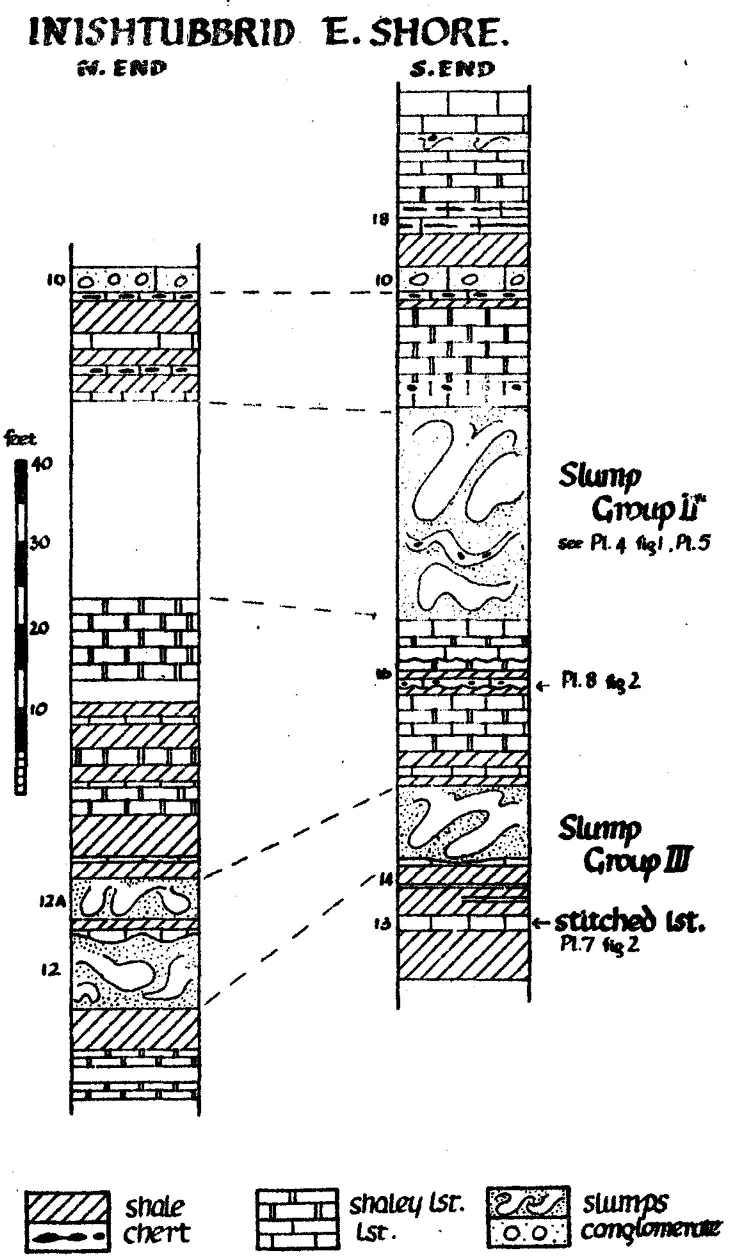

INISHTUBBRID • E SHORE
diagram of exposures in
the SLUMPED SERIES •
shale
balled lst.
bedded lst.
feature
43 dip
Slump Gr. II
Slump Gr. III
15
locality nos.
19
12
52
10
Text fig. 12
60
18
10A
45
Text fig 13
Pl. 4 fig 1, Pl. 5
15
Pl. 8 figs. 1 & 2
NORTH
24
Pl. 7 fig 1
43
Pl. 6 figs 1 & 2
15
Pl. 7 fig 2
13
14
15
16
LOW WATER
FEET
0 100 200 400 600

Text fig 10

Inishtubbrid. Because of the shape of the shoreline the succession repeated both north and south. The succession at the two ends is represented diagrammatically in Textfig. 11. This serves to show the variation that takes place in a short distance, in this case less than half a mile. A map of the exposures on the east shore is given in Text fig. 10.

Claviphyllum sp., Caninia amplexoides, Spirifer bisulcatus, Koninckophyllum sp., and Brachythyris sp. were collected from the shaley limestone of Slump Group III.

Some enormous slumps belonging to Slump Group II are exposed in large bay in the middle of the east shore. The Photographs Plate 4 fig. 1 and Plate 5 are two views of one of these large slumps. It appears from these photographs that the slumping is towards the viewer but


INISHTUBBRID E. SHORE.
N. END
S. END
18
10
10
feet
40
30
20
10
Slump
Group II
see Pl. 4 fig1, Pl.5
Pl. 8 fig 2
Slump
Group III
12A
12
14
13
←stitched lst.
Pl.7 fig 2
shale
chert
shaley lst.
lst.
slumps
conglomerate

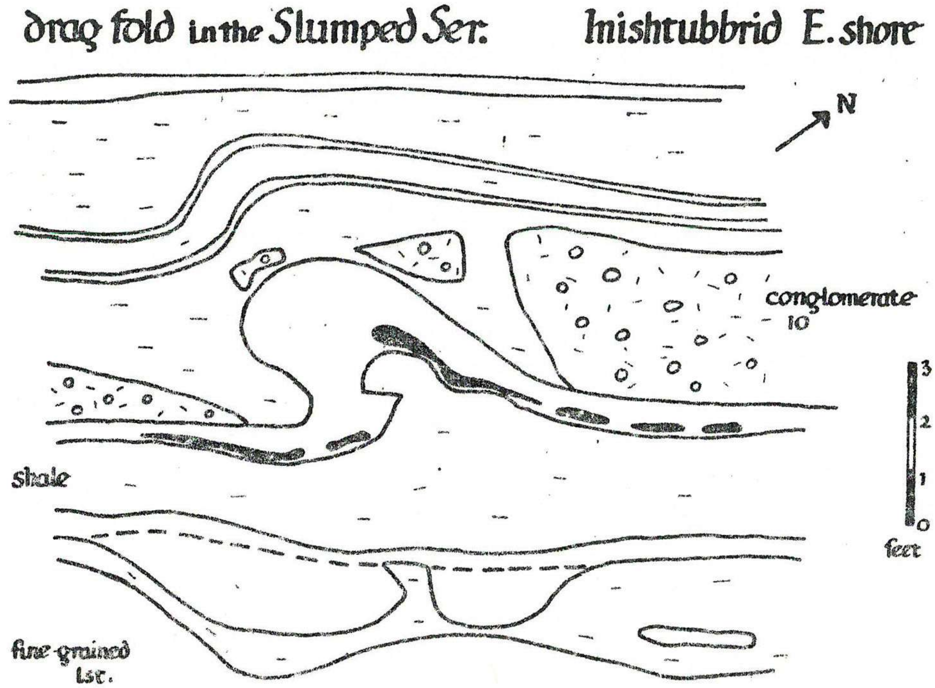
Text fig 11

this is not so. In the bedded limestone below are some sharp folds which come from the opposite direction. These are shown in Plate 8 fig. 1. From this it is assumed that the large fold is an underneath fold, i.e. one that faces opposite to the direction from which the forces that cause the slumping come. The slumping is in the same direction as it is on Canon Island, that is towards the west. Also in the bedded limestone below, which consists of an alternation of limestone beds which may contain chert, discontinuous chert beds, brown shale and black shaley limestone, some of the limestone beds have uneven bottoms (photographed plate 8 fig. 2.)

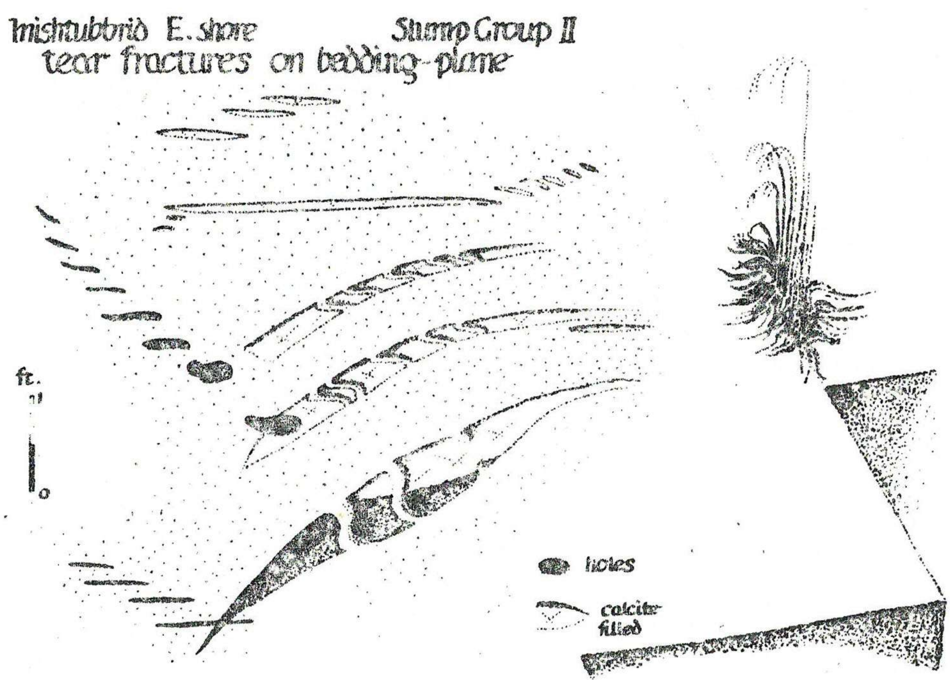
Some stick-like trace fossils, burrows of some sort (Plate 13 fig 2) are present on the undersurface of some of the shaley beds below Slump Group III. A limestone bed associated with these shaley limestones has the curious calcite-filled tension gashes which look like stitching shown in Plate 7 fig. 2. Large, curved tension gashes are shown in Text fig. 13. These occur on a slightly undulating limestone bed in Slump Group II.

Where Slump Group II reappears at the southern end of the east shore it is a jumbled mass of rolls and wedges of limestone separated by shale and shaley limestone. It is about 23 feet thick. (See Plate 6 fig. 1 and ~~Plate~~ fig. 2).

The whole structure of Inishtubbrid is very complicated. The regional dip of the Slumped Series on the east shore is to the East (Minor tectonic folds interfere with this, ~~and~~ for instance the anticline shown in Plate 7 fig. 1) while



Text fig 12



Text fig 13

the Inishtubbrid beds above dip to the west. The lowest limestone of the Inishtubbrid beds tops the hill Knockanelaun and there is a gap of only 35 yards between this and the first exposures of eastward dipping slumps. I can only suggest that the Slumped Series folds over sharply to dip under the Inishtubbrid Beds. There is just enough room to fit the necessary beds in. This fold apparently dies out to the north since it is not seen on Inishmacowney. The series must have formed an incompetent horizon during the folding.

The Succession on Inishmacowney

The slumps on Inishmacowney are exposed inland North of Pointahard and on the west shore from the bay, northwards to where they pass into the shales above the Lord's Rock Limestone, south of Ginnane's Quay. They reappear again on the shore north of this quay and continue along the shore for 200 yards north of School Quay. The succession south of Ginnane's Quay is presented diagrammatically in Text fig. 7 There is more shale in the succession and slumping is less well developed than it is on either Canon Island or Inishtubbrid. The only decent slumps are in Slump Group II. Plate 9 figs 1 & 2 are two views of one slump from the Group.

Slump Group I is represented by interdigitating shales and limestone with many erosion hollows. Slump Group III is mostly of fairly evenly bedded shales and limestone, but balled limestone is present north of Ginnane's Quay. In the shaley limestone corals, brachiopods and bryozoans are common.

The Succession on Shore Island

The slumped series occupies the southern part of the

Island and is exposed on the west and east shores. The succession resembles that of Inishmacowney. At the top is bedded limestone sometimes balled, interdigitating with shale followed by black and brown shaley limestone with thin dark limestone beds, the limestones often broken and folded and the edges bent. This is the equivalent of Slump Group I. The only fossils I have from here are Rhopalolasma sp. nov. Brachythyris sp., and Michelinia favosa. This is followed by a gap and the next exposures are of bolstered limestone with big chert nodules which probably belongs to Slump Group II. The strike of this limestone more or less follows the east shore so the same bed is exposed for some distance and forms an undulating cliff. The same beds are recognisable on the west shore also, because the island is on the axis of an anticline. Nothing further is seen until some bedded limestones and shales are exposed on the east shore almost opposite Horse Island School. These are near the base.

The Succession on Deer Island.

The Slumped Series occupies a thin strip of low ground crossing the Island. It occurs on the south shore by the farm south of the sluice and on the north shore east of Carrignahurragh, but it is not well seen in either of these places. The best exposures are on the sides of the valley east of the ruined church where they are entirely of dark grey or black shaley limestone with calcite veins and plenty of fossils. Fossils collected include Caninia benburbensis? Dibunophyllum bourtonense, and Rhipidomella michelini (see also the list). The limestone on the south shore is undulating but slumps are not developed elsewhere, though it may look this way because exposures are poor.

Summary

The Slumps are at their largest and most complicated on Inishtubbrid and from there they fade out northwards. On Inishmacowney slumping is only well developed in the middle group and the rest of the succession is more shaley. There is less slumping still on Shore Island while on Deer Island definite slumps are absent and the succession is almost entirely of shaley limestone. All the slumping is towards the west. The limestone belongs to a calcisphaer-ostracod phase which indicates deposition in shallow water. Macro fossils are mostly small zaphrentids and clisiophyllids and brachiopods not productids.

The Age

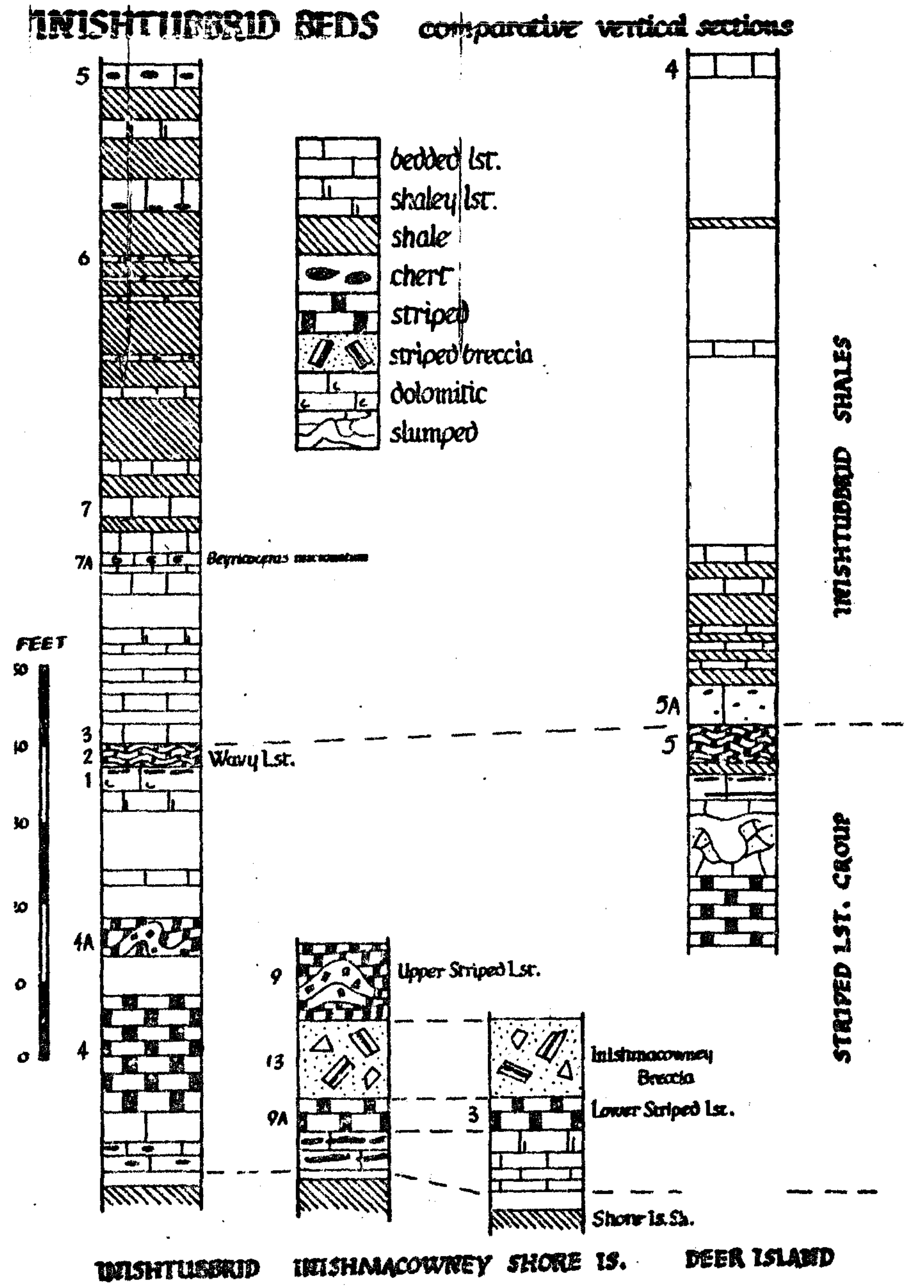
There is no doubt about the age. D1 is proved by the presence of Dibunophyllum bourtonense. It occurs at many localities especially near the top. Carcinophyllum vaughani which I have from Inishmacowney is at its most abundant, for instance, at Bristol in D 1. Caninia cf. densa is regarded as a D1 fossil. (Hudson & Cotton 1944).

The Shore Island Shales

Both the Island Slumped Series and the Inishtubbrid beds form definite features and these are separated by a valley occupied by shale. On Shore Island, which is the only place where they are decently exposed, they are thinly bedded unfossiliferous black brittle and irony. They form a rusty cliff over 7' high on the south-west shore overlooking the 'knob'. There is about 10' present, which pass up from the Slumped Series. On Inishmacowney some brown shales with a thin bed of conglomerate resembling that of the Slumps, may be at a higher horizon. No contact between the shales and the Inishtubbrid beds is known of.

The Inishtubbrid Beds.

The Inishtubbrid Beds fall into two lithological groups, the lower Striped Limestone Group and the upper Inishtubbrid Shales and Limestone. Comparative vertical sections through the Inishtubbrid beds on the four islands on which they are seen, are given in Textfig. 14 . The four islands are, Inishtubbrid, Inishmacowney, Shore Island and Deer Island.



INISHTUBBRID BEDS comparative vertical sections
bedded lst.
shaley lst.
shale
chert
striped
striped breccia
dolomitic
slumped
FEET
Wavy Lst.
Upper Striped Lst.
Inishmacowney Breccia
Lower Striped Lst.
Shore Is. Sh.
INISHTUBBRID SHALES
STRIPED LST. GROUP
INISHTUBBRID
INISHMACOWNEY
SHORE IS.
DEER ISLAND

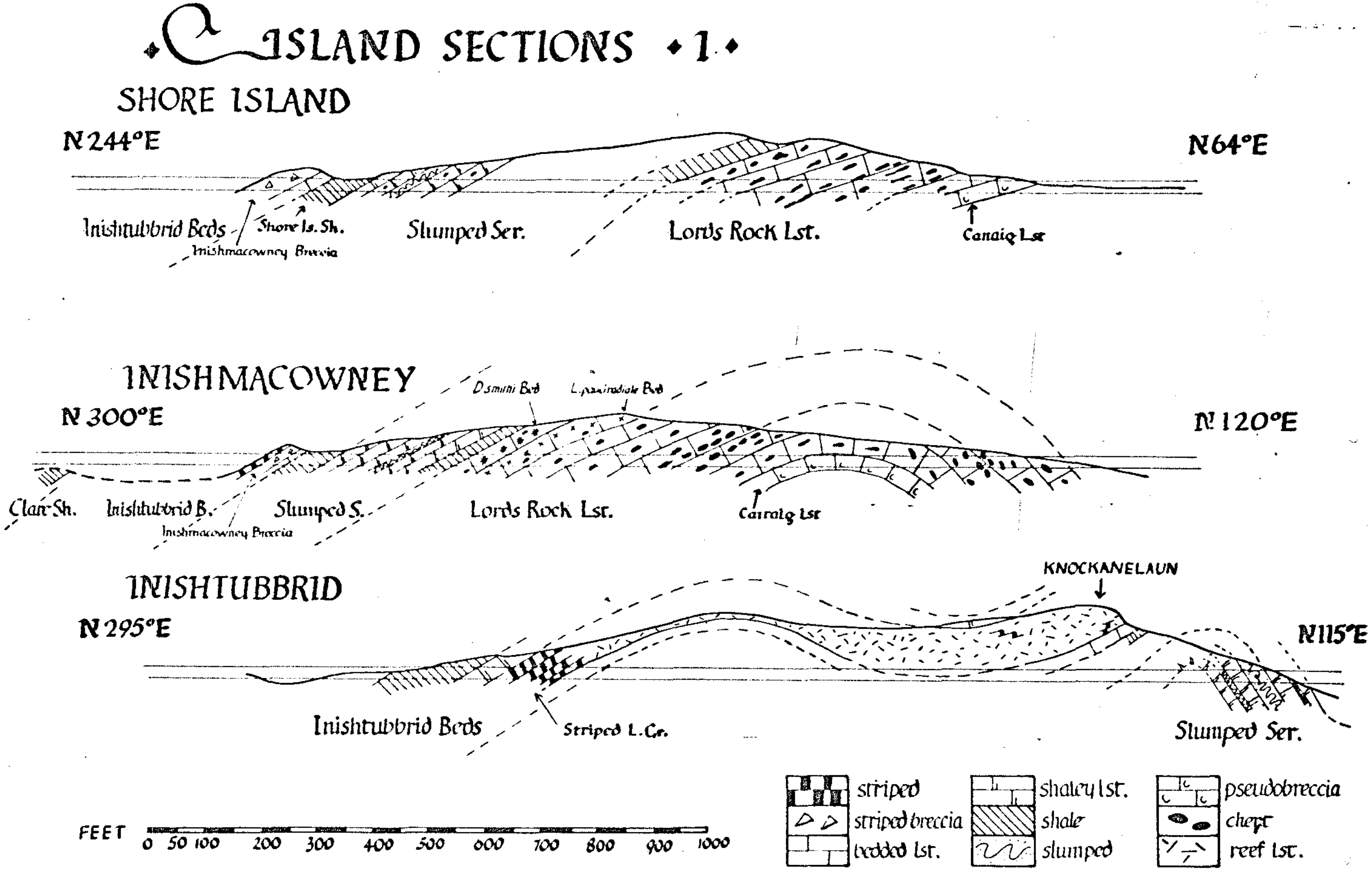
Text fig 14

The Striped Limestone Group

The Striped Limestone is already familiar to geologists. Its presence in this area was first mentioned by Lewarne and Hodson (1961). It has been described by Thorn (1963) from Co. Limerick and it also occurs at Ballybunion (Kelk unpublished Thesis 1961).

The base of the group is marked by thin dark coloured flaggy limestones which may contain chert which may be followed by 4 feet of thinly laminated limestones, the Lower Striped Limestone. More thickly laminated limestones (Laminae 3-4 mm wide rather than 1-2mm) may or may not follow this. This is the Upper Striped Limestone and the laminated limestones from elsewhere are like this. Above the Upper Striped Limestone are some thick beds of smooth grey limestone and the top of the group is marked by what I have called the Wavy Limestone. This is laminated limestone like the Striped Limestones below, but there is not much variation in colour and the laminae are crinkled, the crinkles being of a similar order of size to corrugated iron.

The Striped Limestone is, apart from a few quartz crystals, entirely of recrystallized calcite. The crystals are all almost exactly the same size and they have curved boundaries. No sign of the striping can be seen in thin section, it is only in hand specimens that the dark grey and white laminae are seen. The differences in colour are due to variations in the amount of organic matter and nothing else. The rock is often riddled with stylolites. Some are vertical and some horizontal. The horizontal ones often


ISLAND SECTIONS • 1 •
SHORE ISLAND
N 244°E
N 64°E
Inishtubbrid Beds
Shore ls. Sh.
Inishmacowney Breccia
Slumped Ser.
Lords Rock Lst.
Canaig Lst
INISHMACOWNEY
N 300°E
N 120°E
D. smithi Bed
Clare Sh.
Inishtubbrid B.
Inishmacowney Breccia
Slumped S.
Lords Rock Lst.
Cairaig Lst
INISHTUBBRID
KNOCKANELAUN
N 295°E
N115°E
Inishtubbrid Beds
Striped L.Cr.
Slumped Ser.
FEET
0 50 100 200 300 400 500 600 700 800 900 1000
striped
striped breccia
bedded lst.
shaley lst.
shale
slumped
pseudobreccia
chert
reef lst.

Text fig 15

occur between laminae. The laminae may have fairly plane or landscaped boundaries and they are continuous over long distances. The only fossils are a few ostracods, a few calcisphaers and some algae remains. The sequence resembles Dixon's Lagoon Phases of Gower (1911). Thorn (1963) also points this out. What evidence I have certainly indicates that the water at the time of deposition was pretty shallow and pretty clean and very little disturbed by currents. These conditions must have prevailed over a wide area since similar limestones are present in Co. Limerick and Ballybunion.

Thorn (1963) and all other geologists I have consulted consider that they were built up by algae living on mud flats, the laminae indicating changes in seasons or tides or both which caused changes in the growth rate and death of the algae. This is happening in subtropical seas at the present time and it could have happened here but we are not to know what was originally deposited because it is all recrystallized now.

Photographs of striped limestone are on Plate 15 figs. 1 and 2 and plate 16 figs. 1 & 2.

The Succession on Inishtubbrid

The succession through the Striped Limestone Group as seen on the west shore of Inishtubbrid has already been recorded by Lewarne & Hodson (1961). The thinly laminated Lower Striped Limestone is absent and limestone of the Upper Striped type rests directly on bedded limestone with chert which is seen at the back of the farmhouse. The Striped

Limestone is thicker on this island than anywhere else. At the Landing Place there is about 15 feet of limestone which is very evenly striped and the stripes are more or less horizontal but south of here on the shore the stripes are slumped and folded. This is the "striped limestone with disturbed bedding" of Lewarne & Hodson (1961). South again the striping is more or less lost - the limestone is grey and white mottled recrystallized calcite mudstone crossed horizontally and vertically by stylolites (Pl 16 fig 1). This continues to the top of the Upper Striped Limestone. Above it are bedded grey limestones to the wavy Limestone. The bed immediately below the Wavy Limestone is coursely crystalline and conglomeratic. It contains crinoid debris and small chert nodules. The other beds are calcite mudstone and contain neither chert nor fossils.

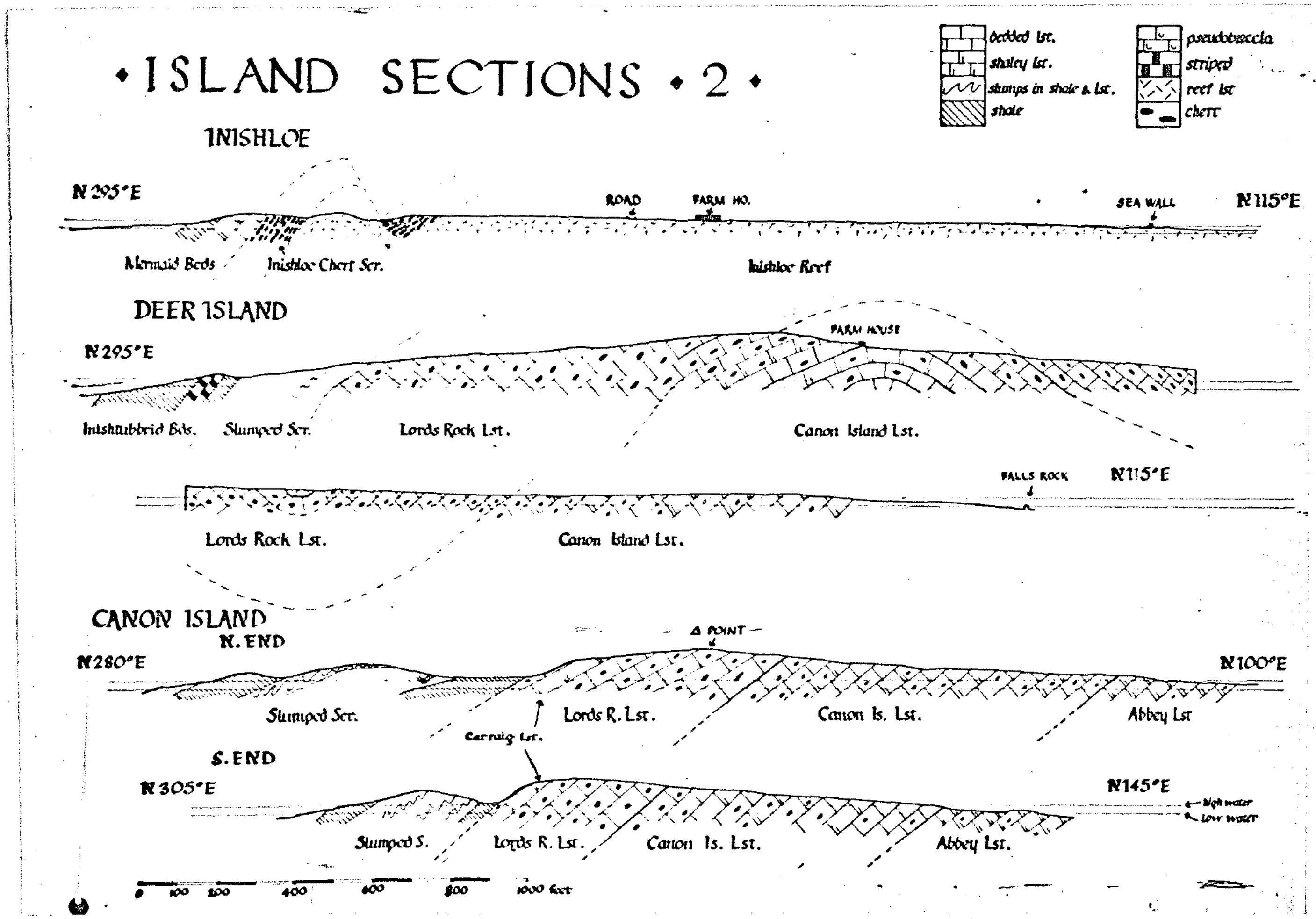
From their exposures at the northern end of the west shore the Striped Limestones curve inland in a perfectly diagrammatic S-shaped fold to form the highest part of the Island, Knockanelaun which is 134 feet high. On the east side of this hill they outcrop in a 30 foot high vertical cliff. The limestone at the base of the cliff, especially at the northern end is fairly regularly striped, but southwards and upwards it becomes mottled and very stylolitic and ends up as a smooth light grey calcite mudstone with algal growths, almost undistinguishable from reef limestone. This is seen in exposures south and west of the hill. There is therefore a transition upwards but more especially southwards from striped limestone through mottled limestone to reef-like limestone. The next exposures southwards are on the Island Inishmurry about five miles south of here. The Limestone there is typical reef limestone and is very fossiliferous so the fact that the Striped Limestone change into what looks like reef limestone may not be as ridiculous an idea as it first seems.

The Succession on Inishmacowney

On this island the Striped Limestone forms a prominent feature and cliffs almost opposite Doon Island. The basal beds of the group are of thickly bedded dark limestone which contains large chert nodules. This is followed by the four foot Lower Striped Limestone, which is separated from the Upper Striped Limestone by the Inishmacowney Breccia. The Lower Stripes differ from the Upper Stripes not only in having thinner laminae but also in there being less colour contrast - the laminae alternate in light and dark grey rather than white and dark grey. Plate 15 figs. 1 & 2 are of Upper and Lower Striped Limestone. The Upper Striped Limestone forms cliffs on the shore opposite Doon Island. It is violently slumped and the beds in the cores and on the axes of the slumps have been broken up and recemented loosely so large chunks of striped limestone lie in all directions. This Slump breccia is different from the underlying breccia.

<u>The Inishmacowney Breccia</u> (Photographs plate 17 figs 1&2

This is even more of mystery packet than the Striped Limestone. It is 10 feet thick and rests without any sign of disturbance or unconformity on the Lower Striped Limestone.



• ISLAND SECTIONS • 2 •
bedded lst.
shaley lst.
slumps in shale & lst.
shale
pseudobreccia
striped
reef lst
chert
INISHLOE
N 295°E
ROAD
FARM HO.
SEA WALL
N 115°E
Mermaid Beds
Inishloe Chert Scr.
Inishloe Reef
DEER ISLAND
N 295°E
FARM HOUSE
Inishmubbrid Bds.
Slumped Scr.
Lords Rock Lst.
Canon Island Lst.
FALLS ROCK
N 115°E
Lords Rock Lst.
Canon Island Lst.
CANON ISLAND
N. END
Δ POINT
N 280°E
N 100°E
Slumped Scr.
Lords R. Lst.
Canon Is. Lst.
Abbey Lst
Carrulg Lst.
S. END
N 305°E
N 145°E
high water
low water
Slumped S.
Lords R. Lst.
Canon Is. Lst.
Abbey Lst.
0 100 200 400 600 800 1000 feet

Text fig 16.

On a weathered surface it is white, crumbly and full of holes but a fresh surface is yellow-looking and very hard. The fragments are of striped limestone and some are very large. They are cemented by yellowish coloured calcite. As with the striped limestone, no structures are visible in thin section, both intraclasts and matrix are of the same grain size of calcite. There are no fossils except a few questionable algal strands and the only impurity is a few euhedral quartz crystals.

If this is a contemporaneous breccia then the Striped Limestones must have been well able to hold their shape from an early stage, which lends support to the theory that they were formed by algal mats. No horizons higher than the Upper Striped Limestone are present on Inishmacowney.

The Succession on Shore Island

The knob of the west shore of Shore Island is formed by the Striped Limestone Group. The basal limestones, the Lower Striped Limestones and the Inishmacowney Breccia are like that of Inishmacowney but the basal limestones do not contain chert. No higher beds are seen.

The Succession on Deer Island

The group outcrops along the west shore for some way before turning inland. Carrignahurragh is of striped limestone and from there the beds form a ridge, at first parallel to the shore, which develops into a high hill rising steeply from the low-lying Inishtubbrid Shales land, east of the ruined church. From there it forms a less remarkable feature and outcrops only once more, in a small quarry north of the farm on the south shore (the farm south of the Quay).

This striped limestone does not much resemble that seen on the other islands. There is no Lower Striped Limestone and undulating unevenly bedded striped limestone, which also contains disarranged fragments, follows the cherty, basal beds. It must have been disturbed by slumping and it is 9'-10' thick. There is no Inishmacowney Breccia. Over this, more slumped limestone is followed by bedded limestone with chert and finally the Wavy Limestone, just like Inishtubbrid.

The Inishtubbrid Shales and Limestone

This is the highest division of the Carboniferous Limestone seen in the locality. It is 80' thick and consists of brown shales with many thin and a few thick limestone beds. They are seen only on Inishtubbrid and Deer Island.

The Succession on Inishtubbrid

When Hodson and Lewarne (1961) listed the succession, they remarked on the occurrence of *Beyrichoceras cf. micronotum* and other unidentifiable goniates in various limestones in the sequence. On one particular bed (the one marked 7A) they are coiled all over the bedding plane but are horribly difficult to extract whole. Each limestone bed is different from the next one. Some of the thin ones (i.e. ones not more than 6" thick) are dark, blue-grey, calcisphaer-ostracod limestones. The thicker beds may be of smooth light grey calcite-mudstone which breaks with a conchoidal fracture, Some are grey and coarsely crystalline, others are conglomeratic.

The coarser or conglomeratic beds have a normal marine fauna of corals, which includes Dibunophyllum bourtonense and Diphyphyllum lateseptatum.

The calcite mudstones contain ostracods and lamellibranchs, while the shales are apparently unfossiliferous. These variations in lithology and fauna indicate that conditions of deposition were variable and the water depth fluctuating all the while deepening from the shallowness of Striped Limestone times.

The Succession on Deer Island

Only a few isolated beds are seen on Deer Island. The highest one exposed is of a dark brown and black mottled limestone, which contains ostracods, lamellibranchs and a smooth trilobite which Dr. R. Goldring identifies as Liobole sp. He says it is unusual. The Limestone is a micrite.

Fossils collected are listed below:

FOSSILS FROM THE INISHTUBBRID SHALES

	Inishtubbrid.	Deer Is.	Rosscliff
Caninia cf. densa Lewis....		5	
C. lanceolata Hudson			1
Dibunophyllum bourtonense Garwood & Goodyear	7		
Diphyphyllum lateseptatum M'Coy	7		
Koninckophyllum cf proprium Sibly.............	7		
K. sp.	7		
Zaphrentids			1
Orthoceras sp.			1
Liobole sp.		4	
Leiopteria lunulata Phillips		4	
Posidonia cf. becheri Bronn		4	
P. cf. lamellosa de Koninck		4	
P. sp. ,....................	9		
Posidoniella sp.	9		
Beyricoceras micronotum gr.	7A		

The Age of the Inishtubbrid Beds.

Dibunophyllum bourtonense proves that these beds are of D1 age. The coral occurs within 50 feet of the top exposures so it is unlikely that any higher sub-zone is present. The presence of Caninia cf. densa and Beyricoceras micronotum gr also reinforce this. This Beyricoceras is usual in B1 which is about the equivalent of D1.

The Striped Limestone Group is also D1 in age of course.

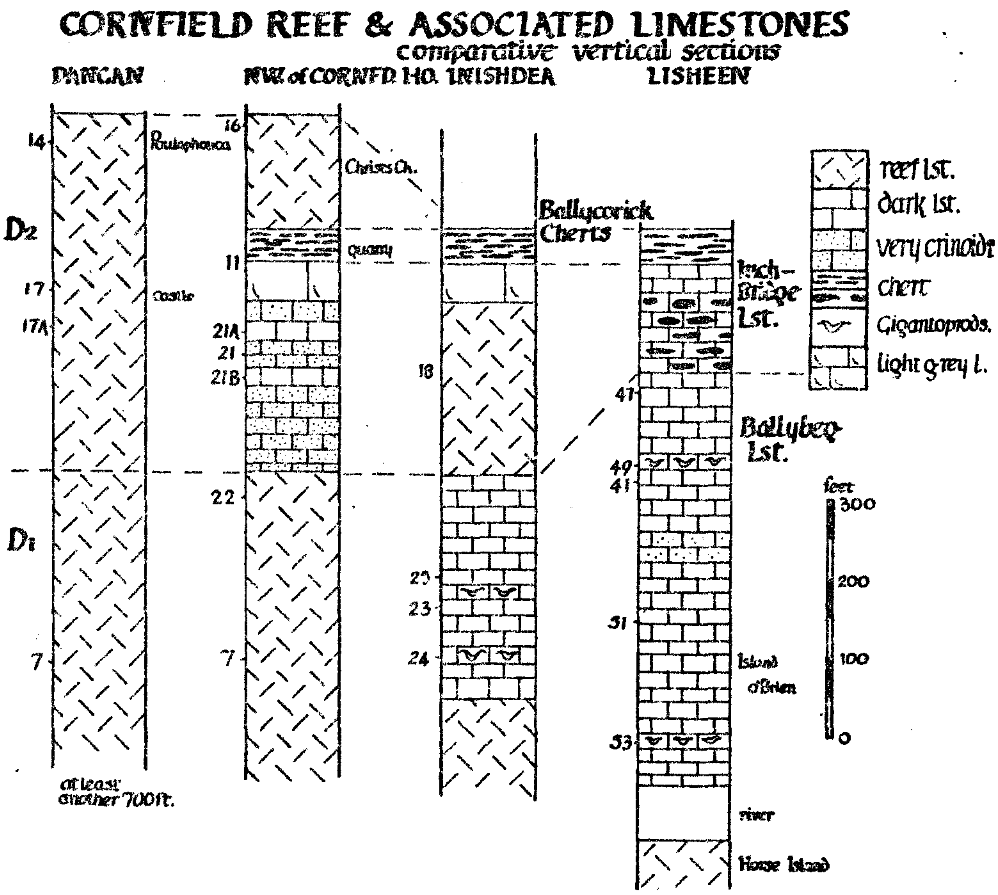
PART II

The Succession on the Mainland around Cornfield.

In the townlands of Cornfield, Crininish, Fort Fergus, Inishdea, Poulaphouca and Rosscliff, almost the whole of the limestone exposed is reef limestone - it covers an area of about two square miles and extends down to the river. It is the first limestone encountered on the mainland when travelling north from Kildysart. The coast road passes onto reef limestone at Dangan Castle and from there northwards most of the land east of the road, and some west of the road is in limestone.

Apart from the hill with the limekiln opposite Dangan Castle which is a little over 100 feet high and the top of the reef in Poulaphouca which reaches a height of 178' near the fort, the land occupied by the reef is fairly flat and low lying. The top of the limestone is well defined, as it is separated by a marshy valley occupied by the Clare Shales, from the Namurian Sandstone scarp. Plate 11 fig 1 shows the top of the reef at Poulaphouca. The sheep are grazing on the reef limestone. This is where Lewarne & Hodson (1961) find the Clare Shales to be at their narrowest. They did not arrive at any conclusions about why this should be but it is now apparent that the growth of reef limestone affected their deposition.

Most of the reef limestone is a light grey or white rather siliceous calcite mudstone. There is plenty of reef tufa in it, a lot of algal growths, and fossils are very common in pockets. Many fossils and algal growths are filled with sparry calcite. The type of sedimentary structures present are those already described in reefs elsewhere. On the northern flank the reef begins to pass into more bedded limestone (see text fig.17). A few beds of dark blue limestone containing giganteid productids occur on the north shore of Inishdea, and north west of Cornfield House bedded limestone topped by limestone containing beds of chert, appears within the reef. I have called this the cherty limestone the Ballycorick Chert Series. About 15' of it (it is about 30' thick here altogether) is exposed in the quarry near Christ's Church, Ballycorick (see Plate 12). At least 50% of the rock is chert and it occurs in thin bands. There are no fossils apart from a few ostracods. It lies on unbedded blue calcite-mudstone which shows current bedding. This also contains a few ostracods but nothing else. It is


CORNFIELD REEF & ASSOCIATED LIMESTONES
comparative vertical sections
DANGAN
NW of CORNFD HO.
INISHDEA
LISHEEN
D2
D1
Poulaphouca
Christs Ch.
quarry
Castle
Ballycorick Cherts
Inch-Bridge Lst.
Ballybeg Lst.
Island o'Brien
river
Horse Island
at least another 700ft.
reef lst.
dark lst.
very crinoidr
chert
Gigantoprods.
light g-rey l.
feet
300
200
100
0

Text fig 17

about 50' thick. Below this a few beds of crinoidal limestone and smooth dark blue limestone occur which pass downwards and laterally into reef limestone. The dark coloured limestones contain a few Zaphrentids. Text fig. 17 shows the variation in the reef.

The fauna from this reef (together with that from other reefs in the district) is listed on pages 143-145. In Appendix II the species collected at some of the more fossiliferous localities are enumerated. The most interesting finds are:-

1) enormous numbers of heads of Rhodocrinus sp. near Fort Fergus. They are associated with Orbitremites ellipticus and various productids and lamellibranchs (see Appendix II under localities 9 & 10 for complete collection).

2) Four feet of limestone east of Cornfield House which is

full of Beyricoceras micronotum gr. (see Localities 7 & 7A).

3) Dibunophyllum bourtonense. This was found near the shore of Inishdea near Poulnagat,which is the lowest reef limestone exposed and again just below the dark-coloured limestones previously mentioned in connection with theBallycorick Chert Series. There is associated with Gigantoproductus cf maximus and other gigantoproductids (see locality 19).

The presence of B. micronotun group and D. bourtonense indicate that the whole of the reef at least as far up as the bedded limestone below the Ballycorick Cherts is D1 in age i.e. the same age as the Slumps and Inishtubbrid Beds of the Islands. Does the reef succeed the island beds or is there a lateral passage between the two? Since the base of the reef is not seen it is possible to assume that it rests on anything but I think it more likely that the island beds pass into the reef limestone even though this involves thickening from 350' to about 1000' in a short distance. (It is difficult to estimate the thickness of the reef because no two dips are the same). This figure is arrived at by assuming it to be the same thickness as the bedded limestone into which it passes northwards - see later and Text figs.17&18.

Crininish and Rosscliff are the nearest parts of the reef to the Islands and here it is possible to pick out certain beds which are exactly like some on Deer Island.

At the southern end of Crinish are some flaggy limestones, a bed of wavy limestone and a few patches of striped limestone interbedded with normal reef limestone. In Rosscliff Caninia lanceolata and Zaphrentids form the top beds of the limestone. These are Inishtubbrid Shales. Separated from them by reef limestone are Striped Limestones.

It is therefore apparent that at least the Inishtubbrid Beds pass into reef and probably the slumps do also. None of the D1 beds of the Islands occur north of the reef because the reef passes northwards into D1 bedded limestone and in Craggykerrivan where no reef is present, this lies on bedded limestone of S age (see part III).

When describing the Striped Limestone of Inishtubbrid it was pointed out that this changes into reef limestone, and reef limestone occurs on Inishmurry. The Striped Limestone must have some connection with these reefs which border it. Fossils collected from Inishmurry are given in the list on pages

From evidence that will be described later (part III) it is concluded that the Ballycorick Cherts Series with the bedded limestone below it, is of D2 age. This means that the knoll on which Dangan Castle stands, a small knoll immediately below the chert in Inishdea and the reefs at the top in Poulaphonca are all D2. Dangan knoll and Inishdea knoll do contain more spiney and pustulose productids than the reef limestones below and these are usually more common in D2 than D1 reefs but they do not afford conclusive evidence on their own.

The limestone in Poulaphonca contains few large fossils and is not a really typical reef limestone. It is very siliceous, contains pyrite, a lot of organic matter which makes it dark coloured, ostracods and ?algalfilaments. It must be a shallow water deposit, & the water was not too clean.

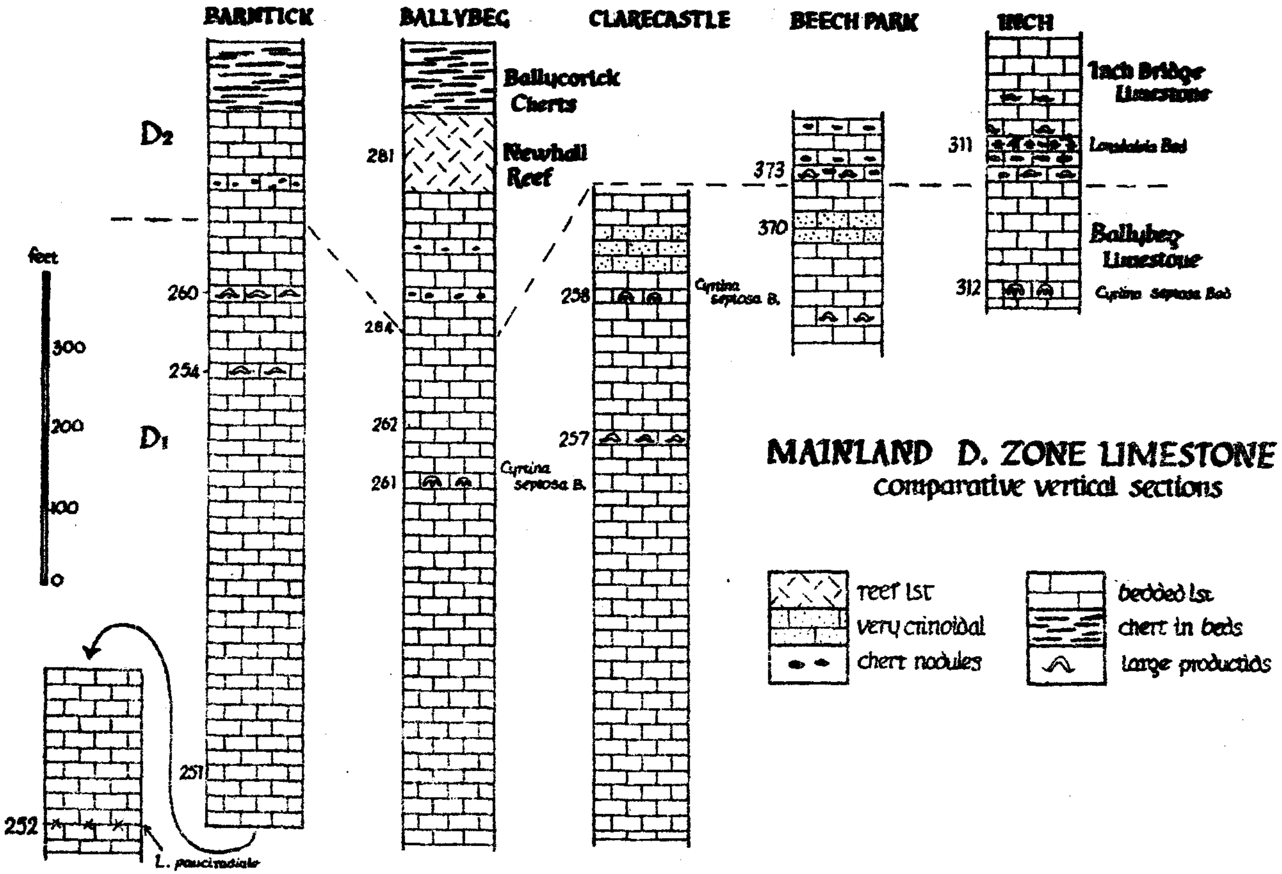
PART III

The Mainland Succession North of Cornfield

North of Cornfield the reef passes into bedded limestone. This falls into two groups, the lower Ballybeg Limestone which is D1 in age and varies in thickness from a few feet where it is first developed, to possibly over 1000' around Ennis; and the upper Inch Bridge Limestone which has the Ballycorick Chert Series at the top. At its thickest there is about 220'. The variations in the succession are shown in Text fig. 18.& 17

The Ballybeg Limestone

The Ballybeg Limestone outcrops over many acres of the low lying country which borders the River Fergus from Lisheen townland to Ennis. It is an evenly bedded crinoidal limestone. The beds one to two or three feet thick, finely as well as coarsely crystalline in texture and lightish grey in colour.



MAINLAND D. ZONE LIMESTONE
comparative vertical sections

Text fig 18

It contains no chert. Towards Ennis, in Ballybeg townland it becomes very thickly bedded and then occupies more elevated country. It contains a normal marine limestone fauna of corals and brachiopods. In Lisheen townland where it is first seen in any thickne s it is rather acutely folded so it is difficult to say exactly how much there is - there may be about 500'. It lies on Cornfield Reef Limestone which is exposed below it on Horse Island. It has been extensively quarried. Fossils are not too common. Most are brachiopods and they include big <u>Gigantoproductus sp</u>., <u>Daviesiella cf. comoides</u> and <u>linoproductus hemisphericus</u>. Some beds contain nothing but these brachiopods while others are completely devoid of any recognizable fossils that can be seen without a microscope. The Gigantoproductids usually have their thick pedicle valves downwards; this indicates deposition under quiet conditions. Near the top I have found Lithostrotion maccoyanum, Palaeosmilia murchisoni and a doubtful specimen of Dibunophyllum bourtonense, the only fossil which gives a definite indication of age.

Fortunately, when these beds are traced northwards, they become more fossiliferous and contain more zone fossils. Dibunophyllum bourtonense is plentiful, so is Lithostrotion junceum. (This is never found lower than the D. zone), and Cyrtina Septosa is abundant in some beds.

Cyrtina Septosa is a fossil of the North-West Province according to Garwood and Goodyear (1924 p. 198). It ranges through 25'-30', 80'-100 feet from the top of D_1. It is most abundant in a bed at the top though there is a second maximum lower down. I have found the fossil at many different localities often within 100' of what I take to be the top of D1, and I think it must be the same bed. However, sometimes, as at Aughandayand near Ennis, there is a good deal more than 100' of D1 above it, but then, the whole D1 succession is much thicker here than in other places.

The most southerly occurrence of Cyrtina septosa is near the farm at Clareen Bridge on the Clare Road and from there I find it again in Ballyea, in Ballaghafadda, in Aughandayand Bridge Quarry, in Poulnagolour Quarry (Noaff, near Inch Bridge) and near Claremount House.

At Clareen farm it is associated with Striatifera striatus. There is about 1000' of bedded grey limestonebelow. This contains occassional specimens of Lithostrotion martini and cf. martini and some beds are full of unidentifiable brachiopods. The lowest beds in the Ballybeg Limestone are exposed in Clareen River near the sluice in Islandavanna wall. Then off-shore below the adjoining wall which surrounds Drumquin Point, a few feet of bedded dark blue-black limestones are exposed. These contain chert, many bushes of Lithostrotion cf. martini and Siphonophyllia cylindrica. This must be the S1 Canon Island Limestone. There is just room to fit in the S2 beds between these and the Ballybeg Limestone. The D1 reef has been entirely replaced by bedded normal marine limestones.

At Aughandayand Bridge Quarry Cyrtina septosa is associated with other large productids, Palaeosmilia Murchisoni and Alveolites septosa.

Pounagolour Quarry is large and arc-shaped and on the axis of the Inch Bridge anticline so the beds are almost horizontal. The quarry face is 20'-30" high and the lowest 15" is of hard unbedded crinoidal limestone, blue grey in colour. It contains large thick shelled productids which include Gigantoproductus sp.(with thick pedicle valves downwards), Linoproductus hemisphericas and Cyrtina septosa. Palaeosmilia murchisoni and Alveolites septosa are also present. Near the top of the quarry is Syringopora cf. ramulosa. Above the quarry more thinly bedded limestone containing many brachiopods is exposed scrappily between bushes. There is about 100' to the base of D2.

In Ballaghafadda West townland, the fields between Ballybeg Lough and the Clare Road are rocky, especially on the slope down to the lough. All loose or easily dislodged lumps have been gathered into heaps and I collected the following fossils:-

Dibunophyllum bourtonense Garwood & Goodyear
Lithostrotion junceum Fleming
Palaeosmilia murchisoni Edwards & Haime
Syringopora reticulata Goldfuss
Cyrtina Septosa Phillips
Linoproductus hemisphericus gr.

Lithostrotion junceum and S. reticulata are enormously abundant. The limestone is coarsely crystalline light or dark grey and very crinoidal.

The Limestone continues northwards on the west side of the Clare Road and everywhere contains many fossils. It is, and has been quarried extensively. McCarthys of Ennis have a large quarry overlooking Clare Road and crossing the Rockmount Bridge Road. A little further north is a disused quarry in which about 25' of beds have been worked. The lowest 10', which have been quarried at the northern end only, are of thickly bedded limestone containing brachiopods. The top bed has a hummocky surface with the top few inches rough and rotten. The curved pedicle valves of gigantoproductids stick out on this surface. A 10' thick bed of grey limestone with a plane lower surface lies on this and the hollows between the hummocks are filled in with soft shale. This 10' bed is crossed by vertical calcite veins and long lens shaped, calcite-filled, horizontal tension gashes. It contains large coral bushes in the position of growth.

Above this bed the limestone is more thinly bedded and contains brachiopods.

Fossils collected are Dibunophyllum bourtonense, Lithostrotion junceum, L. martini, L. cf. Martini, and Palaeosmilia murchisoni. The Lithostrotions are very common and can be clearly seen growing up through the limestone.

The best specimens of <u>Cyrtina septosa</u> occur in a 3' thick bed just north of Claremount House, and it can be traced north for half a mile. The specimens of <u>Cyrtina</u> are very large and are associated with <u>Gigantoproductus sp</u>. and <u>Linoproductus hemisphericus</u>. The Ballybeg Limestone around Claremount House and westwards to Clarecastle is separated from that already described by a more or less north/south fault.

A complete list of fossils is in Appendix III and specimens from the quarries etc. mentioned above are enumerated in Appendix II.

<u>The Inch Bridge Limestone</u>

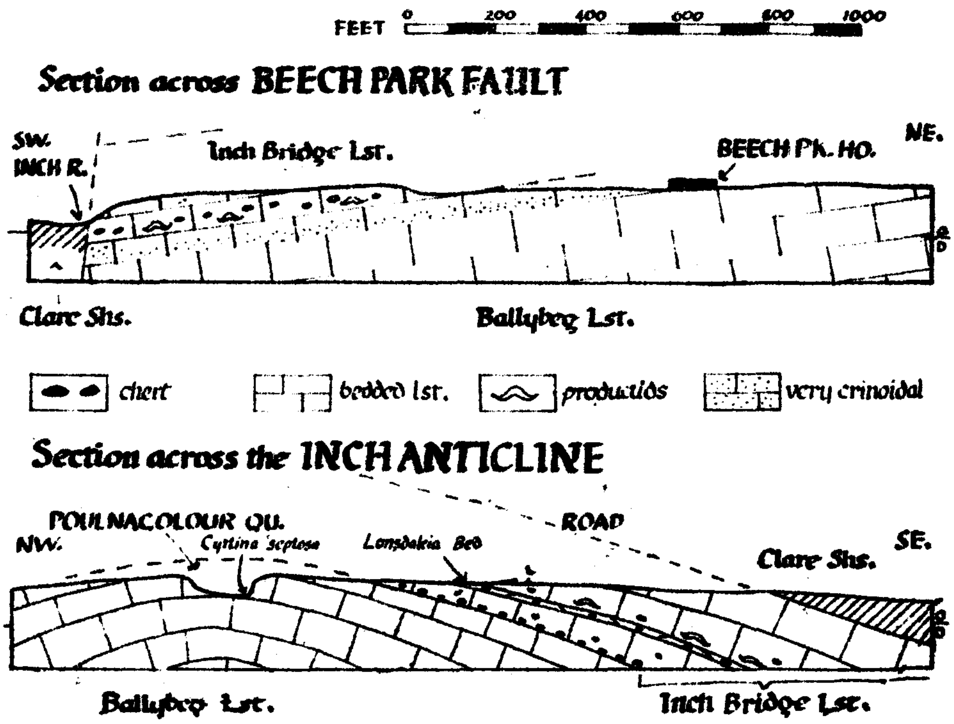
The Inch Bridge Limestone contains chert. At the top is the Ballycorick Chert Series and underneath this in a few places, small reefs are developed.

From its beginning on the northern flank of the Cornfield Reef, the Ballycorick Chert continues along the top of the limestone to Kilnamona which is as far as I have worked, but it is absent in two places, around Teirmaclane, and around Inch. Wherever it is present it forms a well marked feature and it is about 50' thick.

In Lisheen townland, the lowest 40' of the Inch Bridge Limestone contains enormous blue-black chert nodules but I have found no fossils in it. It is a dark grey limestone and has been quarried in a few places. A similar thickness of thickly bedded limestone without chert follows it. In this limestone small zaphrentoid corals of _Claviphyllum sp._ and _Rotiphyllum spp._ are common. So also are shell fragments. Much of the limestone is fine frained, clean and breaks with a conchoidal fracture, but some beds are dirty looking. Above this are the Ballycorick Cherts which contain a few ostracods but I have found no other fossils.

North of Killone Lough, chert in small nodules occurs at various levels in the limestone below the Ballycorick cherts and is not confined to the lowest 40'. In pale grey calcite mudstone below, or associated with, the Ballycorick Cherts are zaphrentid corals like those collected in Lisheen. Immediately below the Chert Series and overlooking Ballybeg Lough is a small reef. Another small reef occurs near Bushy Park House and there are reefs above and below the Chert Series in Cragbrien Townland.

In the limestone between Killone Lough and Ennis I have found few good fossils though fragments of undentifiable brachiopods are common and thin section shows many shell fragments and foraminfera. West of Ennis around Inch the Ballycorick Chert Series is not devèloped and chert is scattered sporadically in nodules which may be large, throughout the Inch Bridge Limestone, though there is less near the top. In this area the limestone is fossiliferous. Some beds are full of brachiopods, the most common being Linoproductus hemisphericus , but I have not attempted to identify any others. Lonsdaleia duplicata duplicata occurs in two localities that I know of. It is most common in the beds which cross the road leading to Poulnagolour Quarry. Here a bed of limestone contains large chert nodules and Lonsdaleia together with Syringopora sp.and brachiopods is in the chert nodules. This bed is not too far from the top of limestone.


FEET
0
200
400
600
800
1000
Section across BEECH PARK FAULT
SW.
INCH R.
Inch Bridge Lst.
BEECH PK. HO.
NE.
Clare Shs.
Ballybeg Lst.
chert
bedded lst.
productids
very crinoidal
Section across the INCH ANTICLINE
POULNACOLOUR QU.
NW.
Cyrtina septosa
Lonsdaleia Bed
ROAD
Clare Shs.
SE.
Ballybeg Lst.
Inch Bridge Lst.

Text fig 19

Beds near the top of the Inch Bridge Limestone are quarried in the hill north of Inch Bridge and it is from here that Douglas (1909) records Lonsdaleia but I have not found it there. The limestone is pale grey, fairly coarsely crystalline and contains no chert. Unidentified brachiopods are common. I have found a few corals one of these I call Koninckophyllum columatum This district is shown in the map EF8, with sections in Text fig. 19.

The Ballycorick Chert Series reappears again south of Bushy Park House. Below it is a few feet of bedded pale brownish grey limestone which contains gastropods, algal growths, small zaphrentoid corals which include Claviphyllum sp. and Rotiphyllum sp., Caninia aff. cornucopiae and Lonsdaleia duplicata duplicata. These beds undulate over the tops of reef knolls underneath. I have seen no limestone below the reefs. The reef limestone contains an abundant brachiopod fauna (see pages 143-145) list) as far as I have mapped and lies on bedded grey limestone which contains small zaphrentoid corals. (See the map E.F.9).

The presence of _Lonsdaleia duplicata duplicata_ indicates that the Inch Bridge Limestone is D2 in age.

Although fossils, particularly brachiopods, are plentiful in the reefs, there are none which really prove D2. Spinose and pustulose productoidea are supposed to be more typical of D2 than D1 according to the ranges given in Muirwood (1940) but in many different parts of England and Ireland they occur commonly in limestone of both subzones. However, _Krotovia spinulosa_, _Overtonia fimbriata_, _Brachythyris integricosta_, _Buxtonia sp._ and _Avonia Sp._ are found only in the D2 reefs in this area. _Dictyoclostids_, _Echinochonchids_ and species of _Antiquatonia_ are far more common in the D1 Cornfield reef though they do occur in the D2 reefs.

Notable absentees from the D2 bedded limestone are the large _Gigantoproductids_ and _Daviesiellas_ which are so common in the Ballybeg Limestone.

Summary

The Inch Bridge Limestone is separated from the Ballybeg Limestone by its different fauna and the presence of chert. Like the Ballybeg Limestone, it is, at least in the lower part, a normal, bedded, marine limestone with a fauna of brachiopods, corals, gastropods and formainifera. Where the Ballycorick Chert Series is not developed the limestone continues this way to the top. I think the Ballycorick Cherts are a shallow water, lagoonal facies. This is indicated by the poor fauna which is mostly of ostracods. The first signs that the water is shallowing are given by the bedded limestone below the Chert Series which contains small zaphrentoid corals.

REEF FAUNA

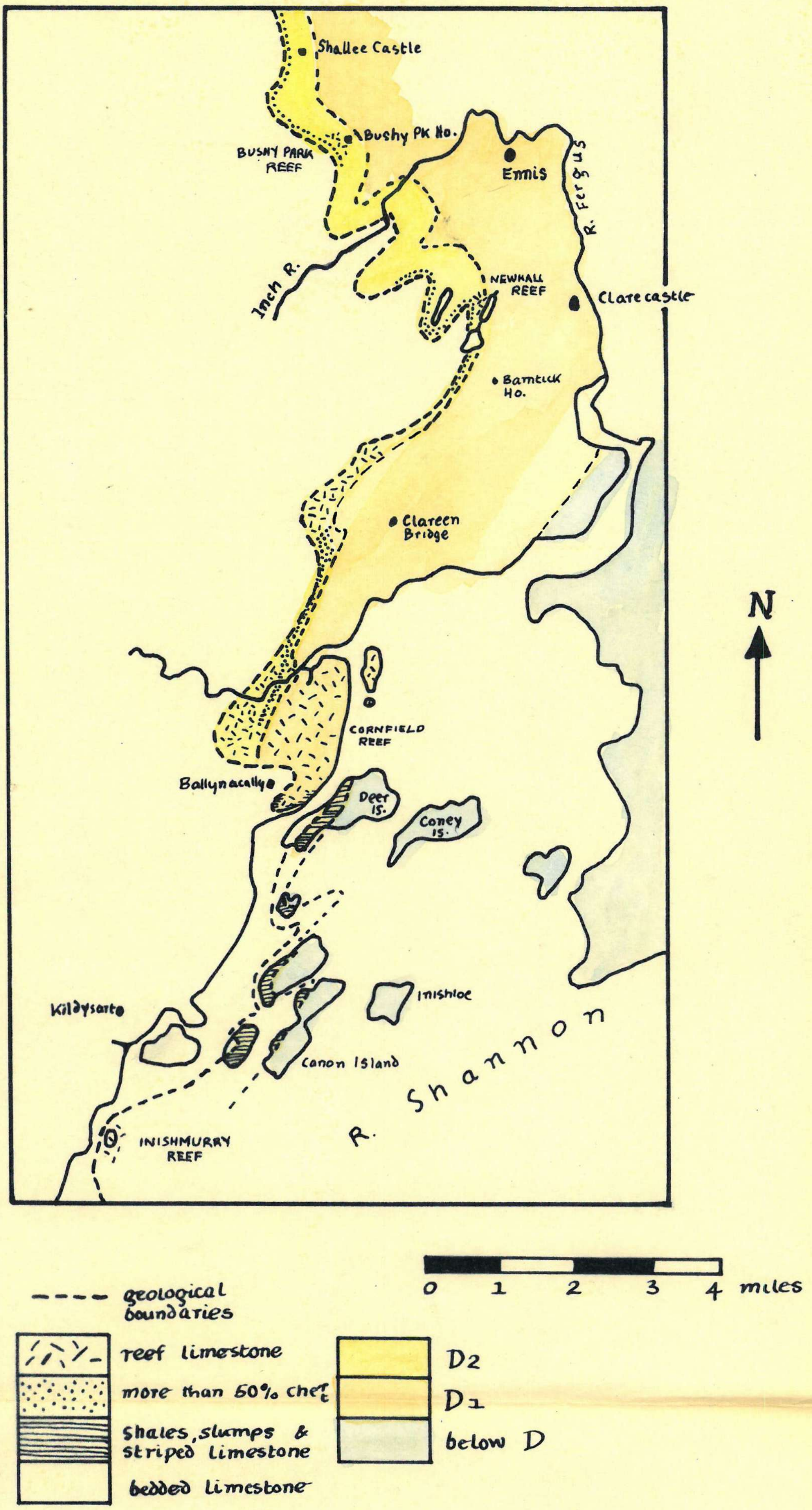
KEY

A	-	Lower Cornfield
B	-	Upper Cornfield
C	-	Cragbrien
D	-	Ballybeg
E	-	Bushy Park
F	-	Inishmurry
G	-	Inishloe

Reef fauna	A	B	C	D	E	F	G
Amplexus coralloides J Sow	X	X					X
Caninia sp			X				X
Dibunophyllum bourtonense G & G	X						
Dibunophyllum sp						X	
Michelinia megasto ma Ph							X
M. cf rennisepta Ph		X					
Rylstonia benecompacta Hudson & Platt							X
Zaphrentis ch Konincki E & H		X					
Alifera expansa de Kon	X						
Antiquatonia insculpta Muirwood		X					
A. sulcata (Sowerby)		X					
A cf sulcata (Sowerby)		X			X		
A. sp	X	X	X		X	X	
Athyris planosulcata (Ph)		X				X	X
A. cf expansa (Ph)		X					
A. sp	X						X
Avonia cf davidsoni (Jarosz)				X			
Avonia sp					X		
Brachythris integricosta Ph		X		X	X		
B. cf planicosta McCoy						X	
Brachythris spp incl. smooth forms		X				X	X
Buxtonia sp			X	X			
Camaraphoria globulina Mar		X					
Dielasma hastata (J de C. Sowerby)	X	X	X		X		X
Dictyoclosus multi spiniferus Muirwood							X
D. pinquis Muirwood	X						
D. semireticulatus (Martin)							X
D. sp	X						
Echinoconchus venustus ch	X						
E. sp	X						
Eomarginifera cf derbensis Muirwood							X
E cf carbonarius			X				
E lobatus var laqueatus Muirwood							X
E. Longispinus Sow		X					
E. cf praecursor Muirwood	X						
E. sp							X
Gigantoproductus aff crassiventer Prentice	X						
G. lattissimus gr						X	
G. cf maximus	X						
Krotovia spinulosa (Sow)		X		X	X		
Linoproductus hemisphericus gr	X		X				
L. sp	X	X	X		X		
Orbiculoidea sp	X						
Overtonia fimbriata (J de C Sow)		X	X	X	X		
Overtonia sp	X						
Plicatifera plicatilis J de C Sow		X					X
Plicochonetes sp	X						
Proboscidella proboscidea de Vern	X	X					
Productus productus Martin	X						
Pustula pustulosa (Ph)		X					

	A	B	C	D	E	F	G
P. cf pustulosa (Ph)							X
P. pyxidiformis de Kon							X
Pustula sp	X						
Pugnax pleurodon McCoy						X	
Pugnax pugnus Martin		X	X	X			X
P.p. var sulcatus Sow						X	X
Pugnoides triplex McCoy	X						X
Reticularia lobata Muirwood							
R. spp	X						X
Rhynconella sp					X		X
Schellweinella crenistria Ph							X
Schizophoria resupinata Mar	X	X			X		X
Spirifer attenuatus Sow							X
Sp. bisulcatus Sow	X			X	X		
Sp. octoplicata Sow		X					
Sp. sexradiatis Ph	X						
Sp. striatus gr.	X	X			X		
Sp. subcinctus de Kon							X
Spirifer Sp				X	X		X
Tylothyris planisulcatus North			X				
Aviculopecten bouei de Vern.							X
A. constans de Kon.							X
A nobilis de Kon.			X				
A nodulosus de Kon.	X						
A. sp.							X
Conocardium hibernicum Sow							X
Edmondia maccoyii Hind	X						
Leiopteria laminosa Ph	X						
Myalina cf lamellosa de Kon	X						
Parallelodon squamifera Ph	X						
Pinna sp	X						
Bellerophon sp							X
Euomphalus catilliformis de Kon							X
Naticopsis sp	X						X
Straparollus convolutus de Kon							X
St. sp	X						
Loxonema sp							X
Orthoceras sp	X			X	X		X
Planetoceras cf globatus Sow							X
Vestinatilus cariniferus Sow							X
Beyricoceras micronotum gr	X						
Goniatites maximus Bisat	X						
Orbitrimites ellipticus Sow	X						
Platycrinus sp.							X
Rhodocrinus sp.	X						
Fenestella frutex McCoy	X						X
Fenestella plebeia McCoy							X
F. cf plebeia McCoy							X
F. polyporata Ph.	X						
F. sp.	X	X					X
Other Bryozoa	X	X			X		X
Griffithides globisceps Ph.							X
Griffithides sp	X						

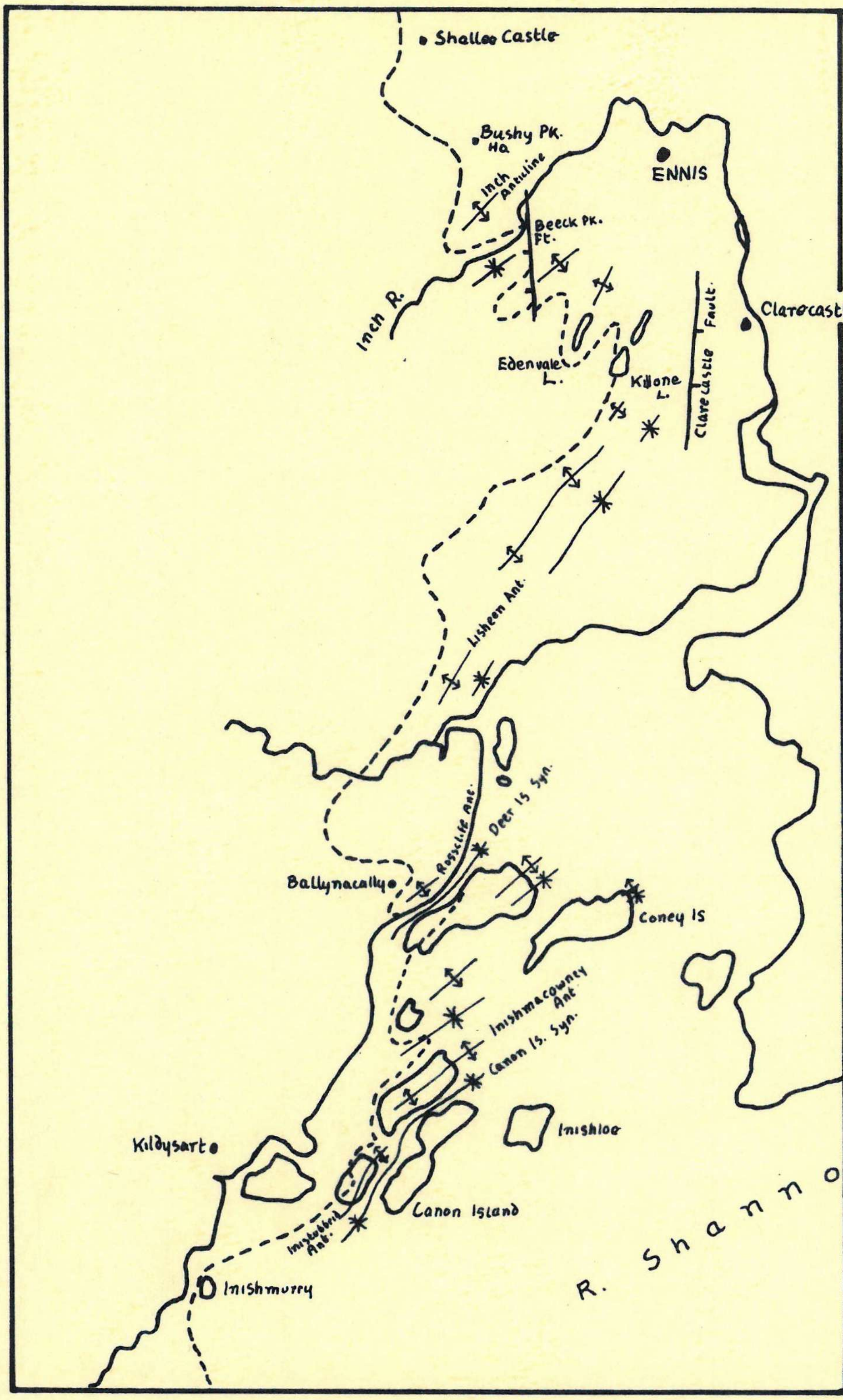
FACIES VARIATIONS in the D. ZONE



Text fig 20

The Deer Island - Cornfield area is shown in more detail in Map EF. 7.

STRUCTURAL MAP.



anticlines

synclines

faults

top of the limestone

0 1 2 3 4 miles

Text fig 21

CHAPTER III

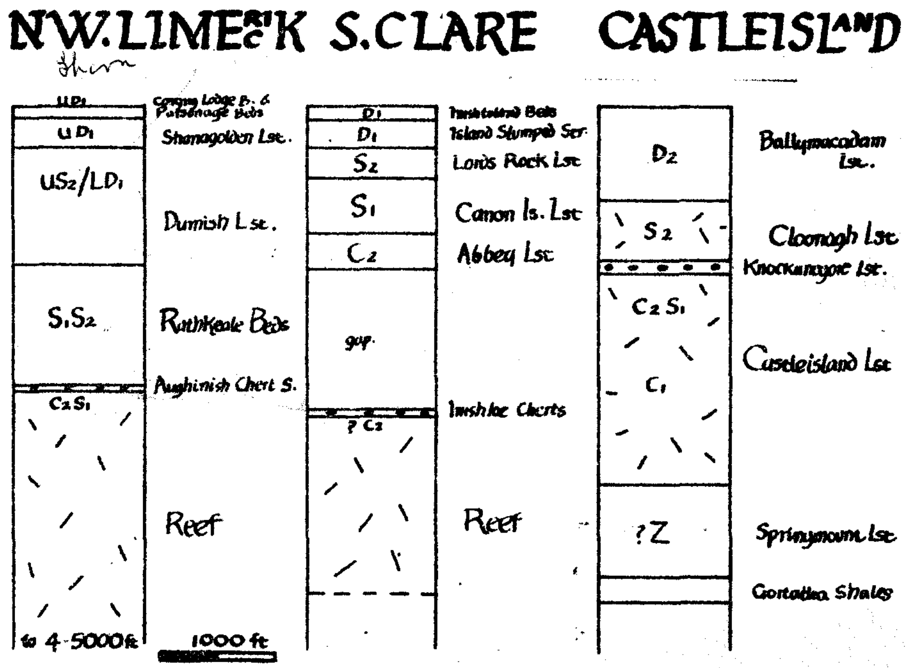
Comparisons with other areas.

Comparison with Douglas' (1909) Work.

Douglas records many fossils which I have not found and omits some that I have. From what he calls S1 he has collected Caninophyllum bristolense (he calls it Caninia cylindrica mutation S1), Michelinia sp., and Syringopora sp., (he says this is very common) which I have not. He says Orthotetes Crenistria and Daviesiella cf. Comoides are common at the base. These are probably Schuchertella Wexfordensis and Daviesiella destinezi so his S1 also includes C2. His S2 is not very fossiliferous and in this it compares with mine. He describes D as entirely of bedded limestone, no reef or shale, so he apparently did not venture much further south than Ennis, and his description of the zone, with the cherty limestone at the top compares well with what I find around and to the north of Ennis. However, he considers Cyrtina septosa to be a D2 fossil and this upsets his dating. He also reported D3 around Bushy Park House but I see no evidence for this, but the Ballycorick Chert Series is like the Black Lias of Gower, in appearance (see later).

The next nearest Carboniferous Limestone is in Co. Limerick around Foynes. This was mapped by Thorn (1963). The succession is almost identical with that of the Islands, but we do not agree about the ages of the groups. His succession is represented diagrammatically in Text fig. 22.

The Aughinish Cherts are obviously equivalent to my Inishloe Cherts, lying as they do at the top of the reef.


NW. LIMERICK
S. CLARE
CASTLEISLAND
UD1
Shanagolden Lst.
US2/LD1
Durnish Lst.
S1S2
Rathkeale Beds
Aughinish Chert S.
C2S1
Reef
to 4-5000ft
1000 ft
D1
Island Slumped Ser.
S2
Lords Rock Lst
S1
Canon Is. Lst
C2
Abbey Lst
gap.
Inishloe Cherts
? C2
Reef
D2
Ballymacadam Lst.
S2
Cloonagh Lst
Knockanagore Lst.
C2 S1
Castleisland Lst
C1
?Z
Springmount Lst
Gortatlea Shales

Text fig 22

I find nothing comparable with the overlying Rathkeale Beds - their equivalents must lie in the gap, between the Mermaid beds and the Abbey Limestone. The Durnish Limestone follows which he says is US2 to D1 though D1 is not proved. I think this is C2S1S2 i.e. the Abbey, Canon Island, and Lord's Rock Limestone. That is why he finds no Dibunophyllum bourtonense of any other definite D1 fossil in it. Although he has some fossils in this limestone that are strange to Clare, many of them I record from the Canon Island Limestone also - e.g. Caninia cf. cylindrica, Cravenia lamellata var. Palaeosmilia murchisoni, Zaphrentis enniskilleni, Echinoconchus punctatus and Brachythyris ovalis.

The Shanagolden Limestones are black, well bedded and have a Zaphrentid-cyathoxonid phase fauna.

Although they are not slumped they are probably equivalents of my Island Slumped Series. The Parsonage Beds are obviously the same as the Striped Limestone Group. This rock type is quite unmistakable. Above, the Corgrig Lodge Beds are the equivalent of the Inishtubbrid Shales and like them contain *Beyricoceras micronotum gr.*

Comparison with Co. Cork.

There is a good deal less bedded limestone above the Waulsortian Reef here than there is in Co. Clare or Co. Limerick. Selwyn Turner (1937) finds *Lithostrotion irregulare*, *Caninia juddi* and *Siphonophyllia cylindrica* in the reef, together with many other fossils that George (1958) considers to be Tournaisian forms - e.g. *Spirifer aff. clathratus* and *Dictyoclostus cf. Vaughani.*

Many of the species he records are found also in Clare. The reef is therefore Tournaisian-Viséan in age and Selwyn Turner thinks it ends in C2S1. This conclusion is based on the occurrence of large caniniids and siphonophyllids at the top. Also there is only 230' of S zone bedded limestone above. The S limestone is poorly fossiliferous and contains <u>Lithostrotion irregulare</u> and <u>L. cf. martini</u>. It could be anywhere in S. The D1 Limestone is 300' thick with some beds of pseudobreccia at the top and bottom. The age is proved by the presence of <u>Dibunophyllum cf. bourtonense.</u>

<u>Comparison with Hook Head</u>.

Smyth (1930) considered the highest beds at Hook Head to be C2 in age but George (1960) says the succession is entirely Tournaisian.

It consists of unevenly bedded dark limestones and shales. Fossils found there include:- Spirifer tornacensis, Schuchertella wexfordensis, Leptaena analoga, Zaphrentid corals and Rylstonia. This does appear to be like the Abbey Limestone and it is certainly no higher. It could be represented by reef limestone in Clare.

There is no reef at all in Hook Head, but by analogy with nearby districts, e.g. Ardmore (Smyth 1939), reef comes in above the sequence exposed there and is entirely Visean (George 1960).

Comparison with Co. Kerry

The succession in the Castleisland area, according to Brennand (Thesis 1962) is shown diagrammatically in Text fig. 22. The Castleisland Limestone is Waulsortian Reef. The

100' thick Knockanegore Limestone which contains much chert, could be the equivalent of the Inishloe Chert Series, but he has it a different age. It is followed by 500' of reef limestone which he says is S2 in age. This date is based on the occurrence of a specimen of Beyricoceras cf. hodderense in shales that are presumed to be equivalent. This may or my or may not be so, but in any case the succession is different from Clare. He records no D1 but his Ballymacadam Limestone is divisible into an upper cherty group and a lower group without chert but with many colonial corals. This is like the D zone of Clare, the lower group being D1 and the equivalent of the Ballybeg Limestone.

Morton (Thesis 1962) working east of Brennand in Co. Cork and Co. Kerry, saw the top of the Limestone in a few places. It contains chert and it is D1 (witnessed by *Dibunophyllum bourtonense*).

Comparison with the north of Ireland.

In the north of the country there is no Waulsortion Reef. Instead the succession is of bedded limestones, shales and deltaic sandstones which follow, unconformably, the Old Red Sandstones or Moinian. The lowest beds recorded (in Omagh) are Upper Tournaisian. The Pettigo Limestone of Omagh (Simpson 1954) and the Ballyshannon Limestone of north of the Ox Mountains (Oswald 1955), are similar to the Abbey and Canon Island Limestones. They are both dated as C2S1 and contain many fossils that I have found - for instance:- *Siphonophyllia cylindrica*, *Palaeosmilia multilamellata*, *Zaphrentis enniskilleni*, and *Daviesiella destinezi*. *Siphonophyllias* are evidently as abundant in the Ballyshannon Limestone as they are in the Canon Island Limestone, but in this part of the country, they and large Caniniids persist into D1. Small patch reefs occur in the D1 limestones around Carrick-on-Shannon (Caldwell 1959) and north of the Ox Mountains in the Dartry Limestone (also D1). In the xupper part of the Dartry limestone chert forms 50% of the rock.

Comparison with Co. Dublin.

In Co. Dublin (Matley & Vaughan, 1906 and 1908, Turner, 1938 and 1950) there is sometimes reef limestone in C1.

The Holmpatrick Limestone and the Kate and Carlyan Limestones are equivalent in age to the Abbey and Canon Island Limestones. They have a number of fossils in common. It is partly by coparison with the Cyathaxonia beds of Rush that Douglas (1909) arrived at the notion that there were D3 limestones in Clare (near Bushy Park House). The *Cyathaxonia* beds were described by Matley & Vaughan (1906) who considered them to be D3 in age. I do not think the resemblance between them and the limestone at Bushy Park is particularly striking and even if it is, Turner (1938) proves the Cyathaxonia beds to be below D2 in age by finding *Goniatites sphaericus* above. This indicates subzone P1b or D2. The Cyathaxonia beds are probably S2-D1.

Comparison with the North-west of England.

The entire succession in the N.W. of England (Garwood 1912) is of bedded limestone, so in the lower part, it is not in the least like that of Co. Clare. The C2S1 limestones of the NW and also of the Isle of Man (Lewis 1926) contain many fossils which are present in the Canon Island Limestone.

Large Caniniids or Siphonophylliids are abundant, there are many lithostrotions and Zaphrentis enniskelleni vars. pustulids, Echinochonids and Brachythyrids are common. The zone fossils used here (Daviesiella carinata and Clisiophyllum multiseptatum) are not found in Clare. Like the Lord's Rock Limestone, the S2 limestones of N.W. England are rather poor in fossils but they do contain the zonal species Cyrtina carbonaria and Lithostrotion minus, the first of which is not found in Clare.

The D limestones are like those of the mainland around Ennis, in having Cyrtina septosa Limestones followed by limestone with Lonsdaleia, but I have not found Girvanella in between. As in Co. Clare, Cyrtina septosa is associated with

Daviesiella aff comoides and Striatifera striatus. Also in the D1 limestones are Lithostrotion martini, L. junceum, Alveolites sp., Palaeosmilia murchisoni, Dibunophyllum bourtonense and Gigantoproductus maximus, a fauna like that of the Ballybeg Limestone.

Garwood (1912) says the Cyrtina septosa band is 15'-20' below the top of D1, though the fossil appears before, but the situation in Co. Clare is more in keeping with that of Settle (Garwood & Goodyear 1924) where Cyrtina Septosa occurs 80-100' from the top and ranges through 25'-30' (this has already been mentioned page). Above the Cyrtina band are pseudobreccias containing Linoproductus hemisphericus and Gigantoproductus cf. maximus. There are no pseudobreccias in D1 in Clare.

in D1 in Clare.

<u>Comparison with the Clitheroe District</u>

Levitusia humerosa occurs in the bedded Chatburn Limestone below the reef series and again, about 400' above, in limestone passing into Worsaw Knoll (Parkingon 1927). (see also page 35). If the Abbey Limestone of Co. Clare is the equivalent of this limestone here, then the Inishloe Reef is at a lower horizon than the Salthill and Coplow Reefs. Nevertheless they have many fossils in common, see list page 33, but more specimens and species are found at Clitheroe. This is due to poor collecting and less exposures in Clare. Shales with a Goniatite fauna, and a few limestones follow the reefs around Clitheroe. This type of lithology does not appear in Co. Clare until B1 times, with the Inishtubbrid Shales.

Comparison with the South-West of England

Around Bristol (Vaughan 1905) there is no reef and the Viséan is a series of massive limestones with shales, dolomites, and oolites. The fauna of C which is undivided is listed below:-

+ Orthotetes crenistria mut. C
+ Chonetes aff. papilionacea
+ C. cf. comoides
  Syringothyris cuspidata
+ Productus semireticulatus
  Syringopora cf. reticulata
x Michelinia megastoma
x Amplexus coralloides
x Zaphrentids
+ Caninia cylindrica mut. C.

+ those found in the Abbey Limestone
x those found in Inishloe Reef.

Chonetes cf. comoides is, or is similar to Daviesiella destinesi. C. cylindrica mut C is Siphonophyllia cylindrica proper. The maximum in Bristol occurs at the base of C, in Clare in S1. In the S1 of Bristol Caninia archaici bristolense (called C. cylindrica mut S1 by Vaughan) is at its maximum. I do not find this in Clare.

O. crenistria mut C. is Schuchertella wexfordensis

S2 has a fauna of Lithostrotion martini, seminulids, and productids with Cyrtina carbonaria near the base in the Mendips (Sibly 1906).

Many fossils recorded from D1 also occur in Clare. From Bristol are:-

+ Gigantoproductus sp.
+ Chonetes aff. comoides
+ Linoproductus hemisphericus
+ Palaeosmilia murchisoni
+ Dibunophyllum bourtonense

+ species occurring in Clare

D. bipartitum bipartitum

+ Alveolites sp.

Syringopora cf. distans

+ S. cf. geniculata

+ Lithostrotion martini

+ L. irregulare

+ L. junceum.

Although they have these fossils in common the D limestone of Co. Clare more closely resembles that of the North of England in having Cyrtina Septosa and Lonsdaleia duplicata duplicata.

The D2 corals from Bristol (Lonsdaleia floriformis and Palaeomsilia regia) are not found in South Clare (Douglas 1909 find P. regia in the Burren). In D2 of the Mendips, Echinoconchus punctatus, Overtonia fimbriata and Buxtonia scabricala recall the D2 reefs of Co. Clare.

Comparison with South Wales

The succession in the east is fairly easily related to that in Bristol, while in Prembrokeshire it begins to show some similarities with the Irish succession.

In Glamorgan C2 and S1 are indistinguishable so are lumped together by George (1933). Siphonophyllia cylindrica is abundant up to the top of S1, but also occurs above. Cyrtina carbonaria appears in S2 and in Pembrokeshire (Dixon 1921), S2 begins with the seminula oolite and is followed by a Lagoon Phase. In D1 there are some dolomitic pseudobreccias, which are less well developed higher up.

The top 50' of D2 are thick bedded limestones containing a lot of black chert, followed by argillaceous limestone and shales with chert. This is the equivalent of the Black Lias of Gower.

The limestone of Pembrokeshire is similar in some ways to that of Ireland:-

1) Dark limestone with chert and Lonsdaleia occurs in D2 in the Bosherston area.

2) There is no chert in D1 and Cyrtina septosa is present near the top and also lower down.

3) There are pseudobreccias in D1 as at Little Island, Co. Cork.

4) Siphonophyllia cylindrica continues into S2.

5) The fauna of S1 includes abundant Siphonophyllia cylindrica Palaeosmilia murchisoni and Lithostrotion martini.

6) Reef Limestones are developed in C1 and C2.

The fauna of the D1 limestone of Gower (Dixon 1911) is like that of the Ballybeg Limestone. Fossils collected include:- Alveolites septosa, Palaeosmilia murchisoni, Lithostrotion martini, L. junceum, Dibunophyllum bourtonense, Linoproductus hemisphericus, gigantoproductus sp., Daviesiella aff. comoides.

Domomitic pseudobreccias are developed in D1 and these are exactly like those of Co. Clare. Dixon's Plate XXXIX could be a photograph of a thin section of Carraig Limestone.

D2 contains some of the D1 corals and also a narrow Syringopora and Michelinia tenuisepta, and Lithostrotion portlocki. The brachiopods are different and include Buxtonia and spiriferids. D3 is the Black Lias. It consists of alternating beds of limestone and shale with a lot of chert which may be weathered to a soft brown, or a brittle siliceous rottenstone. Fossils found are cyathaxonids and zaphrentids - Z. enniskilleni, Z. oystermouthensis, Rotiphyllum charlstonense AND Caninia aff. cornucopieae. Common brachiopods are the scabriculate and punctate productids, and spiriferids. No species of Lithostrotion or Lonsdaleia are present. Doughlas (1909) thought the limestone around Bushy Park House to be very like this (p. 569). He mentions finding Cyathaxonid phase corals including various zaphrentids and Caninia aff. Cornucopiae. Immediately below the Ballycorick Cherts in this area I have found limestone containing Rotiphyllum spp. and a coral close to Douglas' C. aff. cornucopiae so I think it must be the same limestone but I have also found in it <u>Lonsdaleia duplicata duplicata</u>, so whether the Ballycorick Chert Series and beds below resemble the Black Lias or not, and whatever age the Black Lias may eventually turn out ot be, the Ballycorick Cherts are D2 in age.

<u>SUMMARY</u>

Waulsortian Reef limestone is developed in many parts of the South of Ireland but most workers consider the age of the top to be C2S1 so either I am wrong or the age varies. It is followed By C2S1 bedded limestones which are similar to beds of the same age in England, Wales and Northern Ireland. Although in comparison with S1 or D1, S2 is everywhere poor in fossils, in S. Clare it is very improverished indeed. It

has a pseudobreccia at the top. In another parts of Southern Ireland, S. Wales and the North of England preud-breccias are developed in D1. The D1 succession of the Islands and the D1 and D2 Cornfield Reef is quite different from anything seen outside Ireland. The Mainland bedded limestone succession is more like that of the North of England than anywhere else, at least as far as the fauna goes. Beds with a lot of chert tend to be developed at the top of the limestone regardless of age, but in South Clare they are D2.

CHAPTER IV

Palaeontology

CORALS

CLISIOPHYLLIDS

Clisiophyllum sp. 6863 Canon Island Limestone, Deer Island. loc. 2A , pl. 24 fig. 4.

This is a small conical coral about 3cms. long showing rejuvanescence. At a diameter of 17mms. there are 34 major speta. The minor septa are short and do not project much beyond the dissepimental area. There are about two series of dissepiments. It has a thickened median plate prolonged by a thin lamella and numerous tabellae. The lamellae, which are thin, are about five in number on each side of the median plate. This central area is much like that of other S. clisiophylla but the coral differs in other respects. It is most like C. curkeenense Vaughan, 1906 p. 320. pl. fig. 2,2a, but this has thickened septa and does not show rejuvanescence. C. multiseptatum Garwood has too many septa.

Dibunophyllum bourtonense Garwood and Goodyear.

6790 Slumped Series, Canon Island, loc.2 Pl.26 fig.3.
6791 ditto
6899 Slumped Series, Deer Island, loc.12. Pl.26 fig.7.
6915 Inishtubbrid Shales, Inishtubbrid, loc 7. Pl.28.fig 3
6916 ditto. Pl.28 fig. 2
2467 Ballybeg Lst. Clonroad, loc. 322.
2477 Ballybeg Lst., old quarry loc. 321. Pl.30. fig. 1.

The specimens agree with descriptions and figures of the species in that the central area is small and not well marked from the outside, and that the median plate is long and thick. 6915 is almost exactly like Dixon's specimen

1911, pl xl, fig. 7.

The coral is fairly common everywhere and even occurs in the D1 reef limestone. In the Slumped Series it is found with small zaphrentid corals such as Rhopalolasma sp. and Claviphyllum sp., small Caninias and small brachiopods, but in the Ballybeg limestone, its associates are Palaeosmilia murchisoni, Lithostrotion martini, and L. junceum.

Koninckophyllum cf.θ Vaughan

6575 Slumped Series, Inishmacowney, loc.8. Pl.26. fig. 8.

This coral has a look of Vaughan's species 1905, pl. xxii, fig. 4, with its long major septa and stout columella but it has fewer septa at a similar diameter, and short minors. In having short minors it differs from other Koninckophylla too. K. magnificum Thomson and Nicholson is rather like K.θ but it is a larger coral, the septa are withdrawn from the centre in the adult stages and it has a great many dissepiments. Also dissepiment-like blisters are separated from the sides of the septa so that the septa are traced with difficulty through the dissepimentarium. Unfortunately my specimen is badly preserved so I cannot say that the minor septa look short because of this. The coral could be a young K. magnificum see Hill 1938, pl. iii, fig. 15, but again it has too few septa for its diameter (36 as opposed to 44).

Koninckophyllum cf. proprium Siblyy.

6914 Inishtubbrid Shales, Inishtubbrid, loc. 7. Pl.27. fig. 3.

The major septa are short leaving an open area with just a few tabulae surrounding the short stout columella. Dissepiments are small, numerous and arranged herringbone fashion. The minor septa are rather indeterminate. The open area and stout columella are features of K. proprium but in Sibly's specimen (1908, p.70, pli. fig. 3) the minor septa are better to see. Also at a diameter of 1.9cms. it has 48 major septa while mine has only 50 at a diameter of 2.5cms.

Koninckophyllum columatam George

2439 Inch Bridge Limestone, near Inch Bridge 310.
Pl. 34 fig. 2.

This is a small coral with 34 major septa at a diameter of 11 mms. The major septa are long but are not continuous with the columella which is large and spindle shaped like that of Carruthersella. It has herring-bone dissepiments. Probably some of the outer part of the coral is missing.

In his description of the species, George 1927, p.86 pl. II, figs 1-5 says it has an outer zone of lonsdaleoid dissepiments and the columella may vary from one with a simple form like K.θ Vaughan to one like Carruthersella. For this reason Hill 1938, p.89 says it is three species, K.θ Vaughan. K. proprium Sibly, and Carruthersella. It ranges from upper D1 to Lower D2. My specimen has a larger columella than any of George's figured specimens.

Koninckophyllum sp.

2372. South shore of Canon Island near locality 23.
pl. 23. fig. 2

This specimen was found lying on the shore at the south end of Canon Island, so its exact horizon is not certain. However it is unlikely to have come from very far away since other corals found in enormous number with it on the shore occur in beds in situ nearby. The reason I include it is that it shows peripheral budding. It is a large coral with many septa some of which have dissepiment-like blisters on their sides as is sometimes seen in K. magnificum Thom. and Nich.

Koninckophyllum sp.

6930 Slumped Series, Inishtubbrid loc. 15.
Pl. 26. Fig. 1.

This small conical coral with its thick columella surrounded by a few lamellae and tabellae is probably a young Koninckophyllum. It is 9 mms. in diameter, has 30 septa of each order and three series of more or less concentric dissepiments.

diphymorphic Koninckophylla.

6569 Slumped Series, Inishmacowney, loc. 8.
Pl. 25. fig. 5.
6879 Canon Island Limestone, Deer Island, loc. 9.

Corals which I include here probably are of different varieties if not species. They are conical becoming cylindrical, reaching a diameter of something like 15 mms. in 3 or 4 cms. They have numerous long septa and sometimes a small columella. Mr. M. Mitchell suggested the name. They are fairly common at several different horizons.

Cravenia lamellata and var. Howell.
6616 Canon Island Limestone, Canon Island, loc. 46D.
Pl. 19. fig. 6.
2371 ditto. loc. 23. Pl. 24. fig. 2

Cravenia lamellata Howell, 1938 p. 1-22 has 40-42 thick major septa, short minors and a large axial structure, made up of numerous lamellae and tabulae surrounding a thin median plate. 2371 resembles this in the thin median plate, but it has fewer lamellae and tabulae and 44 major septa. 6616 is probably C. lamellata var. which differs from C. lamellata in having the central area an assymetrical mass of lamellae and tabulae. The central area in 6616 occupies slightly more than half the diameter of the coral. The lamellae and tabullae are rotated and there is no median plate. There are 56 major septa, again different from the type.

The central area of C. lamellata is something like that of C. tela Hudson, 1928 but it has more major septa. (C. tela has about 34) and shorter minors.

CANINIIDS

Siphonophylia cylindrica Scouler

6609	Canon Island Limestone,	Canon Island, loc. 46F.
6620	ditto	Canon Island, loc. 46C.
6692	ditto	Canon Island, loc. 21. pl.19.fig.5.
6697	ditto	Canon Island, loc. 22.
6867	ditto	Deer Island, loc. 2.

The specimens agree with S. cylindrica as described by Lewis 1927, and with Vaughan's mutation, though the specimen he figures, 1905, pl xxiii, fig. i. is smaller and has a circular cross-section, while mine are compressed in the counter-cardinal direction. Verylarge ones(6687 has a long diameter of 8 cms.) are enormously abundant in places in the Canon Island Limestone, S1, and I have not found it certainly above. This contrasts with its occurrence in the Bristol area, where it is at a maximum in horizon, and in northern Ireland, where it continues to be common at higher levels.

6620 is about 24 cms. long and is not complete.

<u>S. cf. cylindrica Scouler</u>

6879 Canon Island Limestone. Deer Island, loc. 9.

This differs from <u>S. cylindrica</u> in having no minor septa (Lewis 1927) . It is similar in other respects but I do not think it is as common.

<u>Caninia benburbensis Lewis</u>

6675. Canon Island Limestone. Canon Island, loc.24. Pl. fig. 3.
6698. Island Slumped Series, Deer Island, loc. 12.

When the outer dissepimental zone is missing it is not always easy to distinguish this species from <u>S. cylindrica</u> since the principle difference between them is that S. cylindrica has a wide outer zone of lonsdaleiod dissepiments, and C.

benburbensis has inosculating dissepiments. However, always in S. cylindrica the minor septa project into the tabularium, but in C. benburbensis they may not. Also in C. benburbensis the septa may be more thickened. (Lewis 1927).

In none of the specimens I have collected is the outer dissepiment zone present, but the septa are very thick and the minors do not always project into the tabularium. Specimen 6675 is much like the one figured by Hill, 1938, pl. v. fig. 2_0. It occurs unusually low for the species since the normal range is from S2 upwards.

Caninia subibicina M'coy and C. subibicina var densa Lewis.

6547. Lord's Rock Limestone, Inishmacowney, loc. 2.
6584. ditto. Inishmacowney, loc. 15.
6879. Inishtubbrid Shales, Deer Island, loc. 5.

C. subibicina M'coy is recognized by its concentric dissepiments and thin septa. Lewis's variation has more septa, (66 at a diameter of 32 mms. whilst M'coy's species has only 55 at the same diameter), and appears in the S1 of the Isle of Man. Lewis, 1930, p.268, pl. xx. fig. 3a-d. The same form comes in again in D and seems to be particularly characteristic of D.1. (Hudson and Cotton, 1944, p.306, footnote). They call it <u>C. cf. densa</u>.

6879 is <u>C. cf. densa.</u> Unlike most other figured specimens it is slightly compressed so that in T.S. it is not completely circular. At its largest it has along diameter of 19 mms. When the diameter is 17 mms. x 15 mms. it has 46 major septa., and this makes it close to Lewis's variety. The only figures I have seen of a compressed specimen is Douglas' (1909, pl. xxvii, fig. 13, P.580). He calls it <u>Diphyphyllum</u>

aff. subibicinum butit is undoubtely *C. cf. densa.* (Hill 1938, p. 106). It has 50 major septa at a diameter of 18 mms. He records it from the base of D2, but as some of what he calls D2 is D1 this specimen is likely to be from D1.

6547 which I call *C. subibicina* has fewer septa even than M'coy describes. Quite a number of specimens were found in the same spot, all lying sideways and all compressed. 6547 is the largest, is cylindrical, and when the diameter is 28 mms. x 22 mms. it has 38 major septa, which come close to the centre.

6584 I have called *C. subibicina* because it does not appear to have very closely set septa, but it is too delapidated to be quite certain.

Caninia amplexoides Wilmore.

6781,6782,6783.	Island Slumped Series, Canon Island, loc.5 6783 pl. 26 fig. 6.
6924	Inishtubbrid, loc. 12. Island Slumped Series.
6929	" " 15. " " "

These are small conical corals with prominent rugae on the epitheca. 6783 reaches a diameter of 19 mms. and then has 22 major septa which do not come to the centre, and which are very much dilated in the counter quadrants. All the septa are dilated in the young stages, see 6782 and 6924, and 6929.

There are no minor septa and only a few dissepiments in the adult stages. This agrees with Wilmore's description, 1910, p. 509, pl. xxxviii, figs. 1-9.

I have found it only in the Slumped Series, where it is very common, and is associated with other small corals such as Claviphyllum sp. and Rhopalolasma sp., both of which are described later.

Caninia lanceolata gr. Hudson

6797. Inishtubbrid Shales, Rosscliff, loc. 1. pl.27. fig. 1.

This coral is at first conical and then becomes cylindrical. At a diameter of 21 mms. it has 32 major septa which are long and thin. The cardinal septum is short in a conspicuous fossula. The minor septa are also very short, or absent. It has a few dissepiments.

Caninia aff. cornucopiae Michelin

2520 Inch Bridge Limestone, near Bushy Park House, loc.336. Pl. 34 fig. 5.

2520 is a conico-cylindrical coral, with 32 major speta at a diameter of 13 mms. The major septa are long and come close to the middle. The minor septa are about half the length of the majors and some are contratingent. Even in the young stages the minors are long. There are no dissepiments but lots of tabular intersections.

It differs from typical Caninia cornucopiae in having long minor septa and an inconspicuous fossula.

C. minor Lewis, 1924, p.267 pl. 1-1h, from the D1 of the Isle of Man has a well marked zone of dissepiments.

C. cornucopiae var. brockleyensis (Thomson) from D2 or D3 has long minor septa but two or three series of dissepiments, (see Hill, p.107, pl. v, figs. 10-15). According to Hill Douglas's C. aff. cornucopiae (1909. p. 579, pl.xxviii) and a specimen of Dixon's from Gower (1911, p. 555, pl. xl, figs. 3a-c) are var. brockleyensis, but neither have so many dissepiments nor such well developed minors.

This specimen of mine is more like Douglas's specimen than any other but it is not so very much like it either. Although they both have long major septa Douglas's has fewer, (27 at a diameter of 18 mms.) and it has no minor septa at all. Douglas records his specimen from near Bushy Park House, and it could be that it came from the same locality as mine.

C. cornucopiae var irregulare Smyth.

2391. Lord's Rock Limestone, Inishmacowney, loc. 21.

This is a small cylindrical coral showing rejuvanescence. It is 6.5 cms. long and reaches a diameter of 16 mms. Then there are 27 major septa which do not come to the middle. It has one or two series of dissepiments, some of which are lonsd-aleoid, and the minor septa are very short. In vertical section the tabulae are seen to be incomplete. They consist of an outer domed series and an inner flat series which are spaced at about 9 in. 10 mms.

The nearest to this, that I have seen described in Smyth's specimen from the C1 of Malahide. (see Smyth 1920, pl. 1, figs. 7-9) It has similar flat tabulae, some lonsdaleoid dissepiments and irregular growth, but it has more septa than mine (37 at a diameter of 17 mms.)

PALAEOSMILIIDS

Palaeosmilia murchisoni Edwards & Haime and var. multilamellata (M'coy)

6630. Canon Island Limestone, Canon Island, loc46E.pl.20.fig.1
6631. as 6630. Pl. 21. fig. 1.
6688. Canon Island Limestone, Canon Island, loc. 24.
2366. Canon Island Limestone, Canon Island, loc. 23.
2367. as 2366.

2397. Canon Island Limestone, Canon Island, loc. 47.

2405. Canon Island Limestone, Canon Island, loc. 46F.

2470. Ballybeg Limestone, Ballybeg old quarry, loc.322. Pl.30. fig. 3.

Vaughan, 1905 p. 274. distinguishes Cyathophyllum Ø which occurs in C2/S1 of the Bristol area, from C. murchisoni and Hudson and Dunnington 1944 p.210 use this name to designate C2 forms. The differences are (Vaughan p.274):-

1. low broad incomplete tabulae in P.Ø; many arched tabellae in P.murchisoni.

2. The septa do not usually reach the centre in P.Ø.

Hill 1938, p.120 considers the species to be indistinguishable, and in any case to be of no value stratigraphically. Specimens with and without tabulate central areas occur at both C2/S1 and D horizons. Most of my specimens are from S1 and I find that they are extremely variable in this and other respects. I call them all, with the exception of 6630 and 6631, from whatever horison, P. murchisoni.

6630 and 6631 are very like P. var. multilamellata (M8 coy). (See Garwood 1912, p.562 pl. 1. figs. 5-7). This is supposed to differ from P. murchisoni in having a more conspicuous fossula and fewer septa. While it has indeed a more distinct fossula, neither his specimen nor mine have any fewer septa than other Palaeosmilieas. This is evident from the following table:

SPECIMEN	HORIZON	DIAM. IN MMS.	NO. OF SEPTA
Garwoods fig. of multilamellata	UC2	32	82
6630	S1	37	80
6631	S1	35	74
Vaughan's fig of P.Ø	C2/S1	31	83
6688	S1	38	70
2405	S1	66	84
2470	D1	39	72

The table also serves to show the variability in my specimens from S1.

Although the variety may be statistically undefinable, the coral has a different appearance from <u>Palaeosmilia murchisoni</u>, and ones like it are typical of the Upper Caninia Zone (George 1958 p.238) so I too am using the name.

LITHOSTROTIONTIDS

Lithostrotion martini Edwards & Haime

6730 Canon Island Limestone, Canon Island, loc. 14.
Pl. 22, figs. 2 & 2a.

2222. Ballybeg Limestone, Craggykerrivan, loc. 241. Pl. 31, fig. 2.

2357. ditto. Ballybeg old quarry, loc. 321.

2394. Canon Island Limestone, Canon Island, loc. 53.

2412. Ballybeg Limestone, Drumquin, loc. 61.

2487. Ballybeg Limestone, Ballybeg old quarry, loc. 321.
Pl. 32, fig. 1.

L. martini is very common in S1 and in the D1 standard limestone of the mainland. It is a variable species, and in some specimens the corallites differ greatly in size. 6730 has very widely spaced corallites, all much the same size. In 2394 some of the corallites are very small. 2222, 2357, and 2412 are more like the typical L. martini as figured by Edwards and Haime, Pl. 40, figs. 2-2g. 2487 is approaching

L. basaltiforme.

L. cf. martini and L. pauciradiale (M'Coy)

6614. Canon Island Limestone, Canon Island, loc. 46C, Pl. 22. figs. 1-1b.

6900. Island Slumped Series, Deer Island, loc. 14.

2225. Ballybeg Limestone, Buncraggy, loc. 252.

2358. Ballybeg Limestone, Ballybeg old quarry, loc. 321, pl. 32, fig. 3.

2406. Ballybeg Limestone, Craggykerrivan, loc. 242.

L. pauciradiale as described by Hill 1938, p. 169 is a D2 fasciculate lithostrotion with a diameter of 4-5.5 mms, but lithostrotions with similar dimensions occur below. These cannot be called L. irregulare (see Hill 1938. p. 170). Hudson 1930 calls those from S2/D1 L. cf. martini, and I have applied this name also to specimens from S1, but I only use the name for specimens with more than one series of dissepiments, (L. pauciradiale has one series only).

All the specimens I have collected from S1 or S2, and all except one from D1 are L. cf. martini. 2225 from Buncraggy appears to have only one series of dissepiments so I have called it L. pauciradiale.

Lithostrotion junceum Fleming

2138. Cragbrien 220. Pl. 33. fig. 2.
2360. Ballybeg Limestone. Ballybeg old quarry, loc. 321.
2458. Ballybeg Limestone, Ballaghfadda, loc. 260.
2491. ditto. loc. 261
2495. Ballybeg Limestone, Ballybeg old quarry, loc. 321. Pl. 33, fig. 1.

These specimens of L. junceum differ in size and preservation. Some are small and broken, while others from Ballybeg old quarry are larger and in the position of growth. This will be evident from figures 1 and 2 of Pl. 33.

Lithostrotion maccoyanum Edwards & Haime

2253. Ballybeg Limestone, Lisheen, loc. 41. Pl.32. figs. 2A&2B.

This is the only massive Lithostrotion I have found. The corallites are small, 1.5-3 mms. in diameter, and 5 or 6 sided. There are 12-14 septa of each order. The major septa are thin and many reach the columella; the minor septa are about 2/3 the length of the majors. There are two series of dissepiments and the walls between the corallites are thin, or occasionally, almost non-existent.

In vertical section two series of closely set tabulae are seen, an inner highly arched series and an outer more or less flat series.

The specimen is part of small bush which was about 8 cms. high and twice as wide. It agrees fairly well with Edwards and Haimes' figures, Pl. 42, figs. 2-2b. p. 195.

<u>Aulina sp.</u>

6754. Canon Island Limestone, Canon Island 11. Pl.23. fig. 1.
6882. ditto. Deer Island. 10.
2390. ditto. Canon Island. 12.
2369. Lord's Rock Limestone, Inishmacowney 23.

This fasciculate <u>Aulina</u> is particularly common at the top of the Canon Island Limestone.

The diameter of the corallites varies from 4-7.5mm. the aulos has a diameter of between 2 and 3 mm. There are about 20 major septa and some dissepiments but the structure has been partly destroyed by silicification, especially in 6754, so it is not possible to see it all. In vertical section the aulos is seen to be variable in width and is crossed by horizontal tabulae of which there are 30 to 32 in 10 mms.

It differs from Aulina furcata Smith 1925 p.485 pl. xxiv in having a larger diameter and more closely-set tabulae. A furcata has a diameter of between 2 and 6 mms. and 20-24 tabulae in 10 mms. and it comes from D2.

It is smaller than A. Horsfieldi Smith & Yu 1943 p.49 pl. x figs. 3-6, which is usually 10-12 mms. in diameter, although it can be as small as 8 mm. A. horsfieldi ranges from C1 through C2S1 and possible occurs in D1.

Hill (1938) records Aulina sp. nov. from C2S1. It is not described but it could be this one.

2369 from S2 has a little larger diameter than the S1 specimens I have.

Diphyphyllum smithi Hill

6549. Lord's Rock Limestone. Inishmacowney 4. Pl.24. figs. 6&7.

This is exactly like smith's S2 species of Diphyphyllum which he figures, 1928 p.112. It is called smithi by Hill (1938)

Diphyphyllum lateseptatum M'coy

6918 Inishtubbrid Shales & Limestone, Inishtubbrid 7. Pl.28 figs. 1a-b.

This is a variable species and this specimen falls well within the range.

The corallites vary from 3-7 mm in diameter - most being around 6 mm. They are fairly widely spaced. The minor septa are short, being half the length of the majors or less. There are one or two series of dissepiment. The tabulae are in two series and outer flat, and an inner domed.

<u>Lonsdaleia duplicata duplicata Martin</u>

2440-2444. Inch Bridge Limestone. loc.311. 2440 pl.34 fig. 1.
2500 ditto. Loc. 287.
2518. ditto. Loc. 330.

The specimens from Inch Bridge agree with Smith's description (1915, p.238 pl.xvii, figs. 1-4). Specimens 2500 and 2518 are juvenile.

<u>Rylstonia benecompacta Hudson & Platt</u>

6534. Inishloe Reef Limestone, Inishloe.
6535 ditto Plate 29, fig. 4.
6537 ditto
6549 ditto.

This long curved coral is more like <u>benecompacta</u> than other species of <u>Rylstonia</u>. It reaches a diameter of 2 cms. and has 31 thick major septa. The minor septa are very short, just projections from the thick epitheca. There are 2-3 series of dissepiments. The cardinal septum is shorter and thicker than the major septa. It has a solid columella shaped like a thin egg, but with a point at the broad cardinal end. It is 4.5 mm long and 2.5 mm. wide. The outline is smooth but is without a lot of the tabular thickening which gives the columella of R. benecompacta its similar shape. R. benecompacta has a 28 major septa, a conspicuous fossula and a few dissepiments. It has only previously been recorded from the D zone (Hudson 1927 p.39). My specimens cannot be var. dentata Hudson & Platt since this has a vesicular columella with a dentate outline. Var tenuicolumna Smyth 1930 p.555 pl. xvii figs. 2-5 is from lower down (Z2). The columella is much smaller than in these reef forms.

ZAPHRENTOID GENERA

Zaphrentis enniskilleni group

The varieties of Z. enniskilleni were described by Lewis (1930 p. 277 pl. xxiii) and I have found var. enniskilleni and var. ashfellense which he records from C2S1 and S1 respectively in the Canon Island Limestone.

Z. enniskilleni var enniskilleni

6711	Canon Island Limestone,	Canon Island 51. pl.19. figs. 1&2
6862	ditto	Deer Island 2.
2382, 2384, 2386	ditto	Canon Island 29A

6711 which is figured has 43 major septa which are more or less straight. The other specimens are similar. Z.e. var. e. according to Lewis is the one with most septa i.e. over 40.

Z. enniskilleni var ashfellense

6735 Canon Island Limestone, Canon Island 14. pl.19. fig. 3

5488)
)Lord's Rock Limestone, Inishmacowney 16.
6590)

These agree with Lewis' diagnosis in having 40 major septa which are flexed. The specimens from the Lord's Rock Limestone are outside the normal range.

Zaphrentis cf. Konincki Edwards & Haime

1854 Bedded Lime stone associated with D2 Cornfield Reef.
loc. 21A, Plate 35. fig. 1.

I have doubts about this coral being correctly named, as Z. Konincki is a Z2 fossil. Nevertheless they are similar in appearance. See Carruthers 1908 p.67. pl.v. figs. 1-4. 1854 resembles Edwards & Haime's species in being a middle-sized conico-cylindrical coral with the fossula on the convex side. It also has long thin major septa which are dilated at both ends and fused round the cardinal fossula. The fossula has a thick stereoplasmic lining in the type specimen and is wide at the middle. This is not noticeable in my specimen. They also have in common the long contratingent minor septa and the thick epitheca.

RHOPALOLASMA

Rhopalolasma sp. nov.

6554. Island Slumped Series, Inishmacowney 5. Pl. 26. fig. 5 (Text fig. 23).

6459. ditto. Shore Island. 2. Pl.26. fig. 4.

6784 ditto. Canon Island 4.

This Rhopalolasma (specimen 6554) is a small conical coral with 26 major septa and short minors. Tachylasmoid septal development is confined to the cardinal lateral sectors. There are five clauate major septa. Cardinal laterals 4 & 5 are contratingent and counter lateral 2 is short. The seven counter lateral septa are not dilated and of these counter lateral 2 is short.

The septal formula is given below.

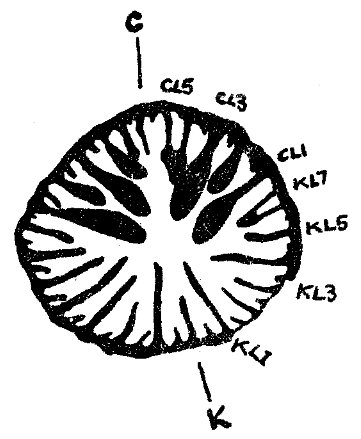
(K)KL1(2).3.4.5.6.7.CL.1.(2).3.4.5.(C)

6554 differs from Hudson's species in many ways. The septal formula of *R. tachyblastum* Hudson (1935) is

(K) KL1 2 3 4 5 6 7 8 CL1 2 3 4 (C)

R. sympecta Hudson is (K) KL1 2 3 4 5-8 CL1 2 3 4 5 (C) and of *R. bradbournense* (Wilmore) is (K)KL1 (2 3) 4 8 CL1 (2-3) 4 6 (C).

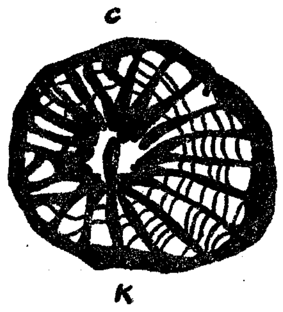
R. sp. nov. differs from these in having no dilated septa in the counter quadrants, in having cardinal laterals 2 & 5 dilated and in having longer minor septa. KL1, KL4 and CL1 are accelerated in all. *R. sympecta* has CL4 longer than CL3. The new



x3

6554

Text fig 23.



2521

x3

Text fig 24.

species is like R. tachyblastum in having CL3 longer than CL4.

6459 and 6784 are probably the same as 6554.

Calviphyllum spp.

6491 Inishloe Chert Series. Inishloe 9. Pl. 24 fig. 1.

6922 Island Slumped Series, Inishtubbrid 9. Pl. 26. fig. 2.

2127 Inch Bridge Limestone loc. 48. Pl. 35. fig. 2.

2521 Inch Bridge Limestone loc. 336. Text fig. 24.

None of these agree with the described species (Hudson & Fox 1943) ~~but I~~ call them Claviphyllum on account of the long rhopaloid counter septum which they all have, though it is difficult to see in the photograph of 6922.

Fasciculophyllum junctosepta Smyth & sp.

6508 Inishloe Chert Series, Inishloe 9. Pl. 29. fig. 2.

This could be F. junctosepta. It has a wide fossula with a stereoplasmic lining like Smyth's species, but the cardinal septum is short. In the type it may extend the length of the fossula (see Smyth 1920 p.19. pl. 1 figs. 1-4).

2139. Inch Bridge Limestone, 218. pl. 35. fig. 6.

I call this Fasciculophyllum sp. because it has curved septa which do not form a stereocolumn.

Rotiphyllum spp.

These are all small conico-cylindrical corals with septa, which may be dilated, fused to form a central stereo column. The cardinal fossula is narrow and reaches the axis.

R. cf. nodosum. Smyth

6858. Inishloe Reef. Inishloe 7. Pl. 29. fig. 5.
6894. Island Slumped Series, Deer Island 12. Pl. 25. fig. 3.
2130. Inch Bridge Limestone, 48. Pl. 35. fig. 3.

These all have short minor septa and the major septa are dilated in the middle, and very thin towards the axis. They all, but particularly 6894, have a thick epitheca. R. nodosum

Smyth 1915 p.556 pl. xxxvi fig. 13 has dilated septa like these. The type is from C.

R. cf. densum Carruthers.

2132. Inch Bridge Limestone, 48. Plate 35. fig. 4.

This has a wide sterocolumn and thick septa like R. densum (Carruthers 1908 p.29) which is common in the Tournaisian but has been found in D1 and D2 in the North of England.

Rotiphyllum cf. granulate Thomson

2143. Inch Bridge Limestone, 218. Pl. 35 fig. 5.

The type of R. granulate is from E1. The major septa are straight. Some are swollen at the axis and united there in groups. Although 2143 is not a clear specimen it bears some resemblande to those figured by Hill 1938, p.139, pl.vii figs. 64-72.

BRACHIOPODS

In the identification of the Brachiopods I made use of Muirwood (1928) Muirwood & Cooper (1960), Thomas (1914) Davidson (1858) and Paekelmann (1930), and various papers mentioned in the references.

The only brachiopods I found stratigraphically useful were Cyrtina septosa Phillips, Daviesiella destinetzi (Vaughan) and Levitusia humerosa, Sowerby.

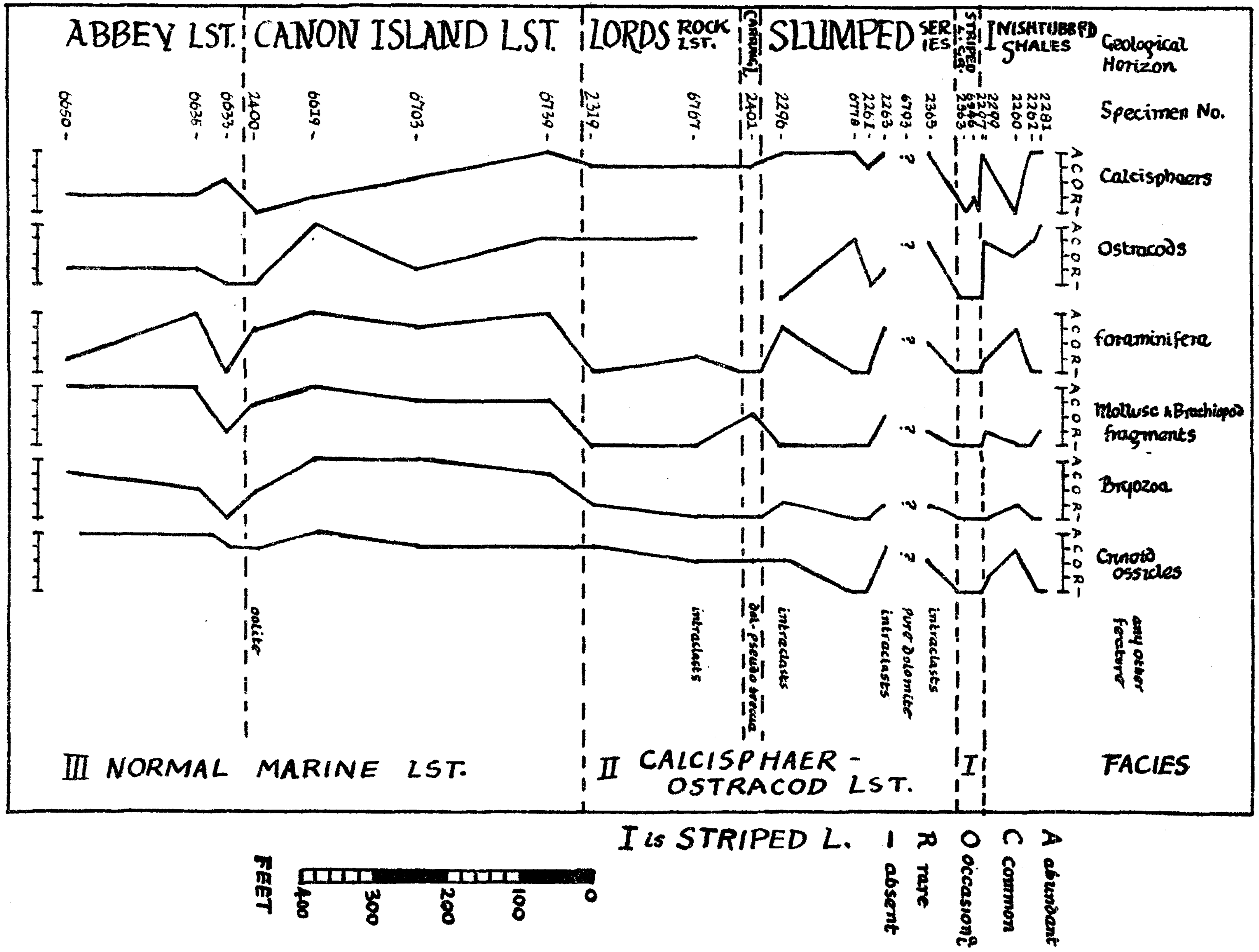
L. humerosa is figured in Davidson Pl. xxxvl figl. This can be compared with my specimen 6646 from the Abbey Limestone.

Simpson (1953 p.194) describes D. destinezi. It is also figured by Davidson pl. XLVI. figs. 1 & 2. I think 6641 from the Abbey Limestone is this species.

CHAPTER V

PETROLOGY

In a sequence of such a variety of limestones, each one of which appears to be different from the next, it was essential to find some sort of pattern into which the rocks could be fitted, in broad groups at least. It would be all the better if these groups had some bearing on conditions of deposition at the time. I decided to make use of the microfossils, but without going into much detail, so at the suggestion of Mr. I.M. West, selected a few easily recognized sorts and recorded there relative abundance in different specimens. The results are graphed against the geological horizon, in text fig. 25. The groups chosen were



MICRO-FOSSILS IN THE ISLANDS SECTION

Text fig 25

Calcisphaers, Ostracods, formanifera, Brachiopod and mollusc shell fragments, Bryozoa and crinoid ossicles.

Calcisphaers and ostracods are indicators of shallow water, especially when they are present more abundantly than, or to the exclusion of, normal marine fossils. (By normal I mean corals, brachiopods, bryozoa, foraminifera, etc. of the sort found in standard limestone.) Dixon 1911 records them 'in abundance' from the Modiola phases of Gower. He says that they not only indicate shallow water, they also indicate lagoonal conditions since many standard limestones are shallow water deppsits.

Using this information I have been able to group the island limestones into three facies:-

I. Striped Limestone.

II. Calcisphaera-ostracod Limestone.

III. Normal marine limestone.

III. Normal marine limestone. The Abbey Limestone and Canon Island Limestone belong to this facies. Micro-fossils of all the groups are plentiful, but the normal marine ones more so. There are of course variations, 6633, for instance. This presumably indicates a local approach to calcisphaer-ostracod conditions. It must be remembered that this is not a detailed study and there are many such variations. A calcisphaer-ostracod bed can be recognized in the field. It is usually a dirtier, more brownish colour than the normal marine limestone which is dark blue-black and shiney because of the sparry calcite cement. The calcisphaer-ostracod limestones are micritic

The facies also contains a standard fauna of macro-fossils which include large productids and large corals, chiefly Caniniids and Palaeosmilias. The normal marine productids and large corals, chiefly Caniniids and Palaeosmilias. The normal marine limestones are biosparudites on Folks 1959 Classification (see Text fig. 26). There are also occassional limestones containing Pellets and an oosparite.

II. Calcisphaer-ostracod Limestone

The Lord's Rock Limestone and the Slumped Series belong to this facies. Calcisphaers and ostracods are the most common, occasionally the only micro-fossils. The normal marine fauna is reduced or absent. This is also noticeable among the macro-fossils and the feature was used in the stratigraphy, when the base of the Lord's Rock Limestone was taken as where large corals and productids disappear. The

R.L.FOLK'S Classification of Limestones and Dolomites. B.A.A.P.G 43.1. fig-1 1959.

Volumetric composition of allochems	Limestones, partially dolomitized lsts, & primary dolomites: >10% Allochems - Allochemical Rocks: Sparry Calcite Cement > Microcrystalline Ooze matrix. Sparry allochemical Rocks	>10% Allochems - Allochemical Rocks: Microcrystalline Ooze matrix > Sparry Calcite Cemt. Microcrystalline allochemical Rocks	<10% Allochems - Microcrystalline Rocks: 1 - 10% allochems (Most abundant allochem)	<10% Allochems - Microcrystalline Rocks: < 1% allochems	Undisturbed bioherm rocks	Replacement Dolomites: Allochem Ghosts (Recognizable or dominant allochem)	Replacement Dolomites: No Allochem Ghosts
>25% intraclasts	Intrasparrudite Intrasparite	Intramicrudite Intramicrite	Intraclast-bearing micrite or micrudite.	Micrite, Dismicrite, Dolomicrite	Biolithite	Intraclastic dolomite	aphanocrystalline <4μ
<25% intraclasts; >25% ooliths	Oosparrudite Oosparite	Oomicrudite Oomicrite	Oolith bearing micrite or micrudite			Oolitic dolomite	V. finely crystalline 4-16μ
<25% intraclasts; <25% ooliths; Vol. ratio of fossils to pellets >3:1	Biosparrudite Biosparite	Biomicrudite Biomicrite	Fossiliferous micrite or micrudite.			biogenic dolomite	finely crystalline 16-62½μ medium crystalline 62½μ-¼mm.
<25% intraclasts; <25% ooliths; Vol. ratio of fossils to pellets 3:1-1:3	Biopelsparrudite Biopelsparite	Biopelmicrudite Biopelmicrite	Pelletiferous micrite or micrudite			Pellet dolomite	coarsely crystalline ¼-1mm
<25% intraclasts; <25% ooliths; Vol. ratio of fossils to pellets <1:3	Pelsparrudite Pelsparite	Pelmicrudite Pelmicrite					V. coarsely crystalline 1-4mm. extremely coarsely crystalline >4mm.

Text fig. 26.

Lord's Rock Limestone has a very poor fauna indeed, especially on Canon Island where these samples were taken. Most of the limestones are biomicrudites or intra biomicrudites (Folk's Classification Text fig. 26). The intraclasts of 6767 are finer and darker than the matrix and probably formed in situ.

The macrofauna of the slumps is of a zaphrentid-clisiophyllid phase type and most of the limestones are biomicrites. In hand specimen these are dull, dirty looking and dark greyish blue in colour like 2261. There are some conglomerate beds of which 2263 is the best example. This is an intra biomicrudite on Folk's Classification. It is figured Plate 14. There are occassional beds of pure dolomite.

The Carraig Limestone is a dolomitized pseudobreccia like those described by Dixon 1911, p.507 plate XXXIX, from the D1 of Gower. It probably started out as an intrabiomicrudite something like 6767 from the Lord's Rock Limestone. The matrix is completely replaced by dolomite rhombs. The undolomitized intraclasts are of micrite with a calcisphaer-ostracod fauna. Crinoid and shell fragments remain undolomitized or with rhombs just beginning to penetrate at the edges.

I. The Striped Limestone

The Striped Limestones have many features in common with the lagoonal despoits as described by Dixon (1911) for instance, they are laminated calcite mudstones and have few fossils apart from clacisphaers or ostracods and these are rare. They also contain a few algal growths. Since the rock has been entirely recrystallized it is impossible to say what it originally was. Other fossils could have been destroyed in the process but since a few have not been it seems unlikely that there were every many. There are no other recrystallized limestones in the succession. This suggests that the striped limestones were different from the start. They contain plenty of organic matter (causing the darker bands) and pyrite but not enough to suppose that conditions were so reducing as to present life. It has already been suggested that the banding was caused by the growth and death of algae in the tidal zone, but there is also the possibility that the water was a little deeper and supported plankton. When this died and fell to the sea-bed it formed the darker bands.

SUMMARY

The normal marine limestones were deposited in an open clear shallow sea. The shallowness is indicated by the presence of pellets in some of the limestones and the bed of oosparite (2400). From this the water gradually shallowed into a reef bordered lagoon in which the Striped Limestone was deposited, passing through the calcisphaer-ostracod stage on the way. The striped limestone lagoon was an endpoint in the sequence and the Inishtubbrid Shales and Limestone belong to a different setup where the water level was fluctuating and deepening; the Limestones vary from normal marine limestones to calcisphaer-ostracod limestones.

Petrology of the mainland Limestones

I have not worked on these in much detail, but the

Ballybeg Limestone and the Inch Bridge Limestone are apparently normal marine limestones. However, the banded nature of the chert, and the lack of fossils apart from ostracods, indicates that the Ballycorick Chert Series are much shallower water deposits. The top of the D2 Cornfield Reef in Poulaphouca contains remains of algal resembling charophytes, as well as a lot of organic matter and pyrite so the water there must have been shallow too, and very likely not far from land.

The places from which the rock specimens used in this analysis were collected, are listed below. For the whereabouts of the locality numbers see Appendix 1.

6546,	micrite.	Inishmacowney 9
6619,	Biosparudite.	Canon Island 46C
6633,	Biosparudite.	Canon Island 44.
6635,	Biopelsparudite.	Canon Island 43
6650,	Biosparudite.	Canon Island 37
6703,	Biosparudite.	Canon Island 19
6739,	Biomicrite.	Canon Island 12x
6767,	Intrabiomicrudite,	Canon Island 9
6778,	Biomicrite.	Canon Island 5
6793,	Dolomite.	Canon Island 2
2260,	Dolomitic biomicrudite	Inishtubbrid 6
2261,	Biomicrite,	Inishtubbrid 18
2262,	Biomicrite.	Inishtubbrid 5
2263,	Intrabiomicrudite.	Inishtubbrid 10
2281,	Biomicrudite.	Deer Island 4
2296,	Intrabiomicrudite.	Deer Island 1
2297,	micrite.	Deer Island 5
2299,	Biomicrudite.	Deer Island 5A
2319,	Biomicrudite.	Deer Island 8
2365,	Intrabiomicrudite	Inishmacowney 20.
2400	Oosparite.	Canon Island 26A
2401	Intraclastic dolomite	Canon Island 7
2563	Intraclastic micrite	Inishmacowney 13.

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Abbreviations used in the list of references.

A.M.N.H.	Annals and Magazine of Natural History
Ann. M.R. d'Hist. N. Belge.	Annales du Mussee Royal d'Histoire Naturelle de Belgique.
B.A.A.P.G.	Bulletin of the American Association of Petroleum Geologists.
G.M.	Geological Magazine.
J. Manch G.A.	Journal of the Manchester Geological Association.
J.P.	Journal of Palaeontology.
J. Sed. Pet.	Journal of Sedimentary Petrology.
Liv. & Manch. G.J.	Liverpool and Manchester Geological Journal.
M.G.S.U.K. Pal. Pal.	Memoir of the Geological Survey of Great Britain (Palaeontology);
Pal.	Palaeontology.
Pal. Soc. Monog.	Palaeontographical Society Monograph.
P.G.A.	Proceedings of the Geologists Association.
P. Leeds Phil. S.	Proceedings of the Leeds Philosophical Society.
P.R.I.A.	Proceedings of the Royal Irish Academy.
P.Y.G.S.	Proceedings of the Yorkshire Geological Society.
Q.J.G.S.	Quarterly Journal of the Geological Society of London.
Sc. P.R. Dublin S.	Scientific Proceedings of the Royal Dublin Society.
Tr. Leeds G.A.	Transactions of the Leeds Geological Association.

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APPENDIX I

This describes the whereabouts of every numbered locality from which fossils and other specimens have been collected. Most of these localities are mentioned in the text or marked on the maps.

Sheet numbers are of the Clare 6" maps.

MAINLAND

Sheet No. 50.

1. Small quarry 250 yds. N.E. of where the road from Ballynacally reaches the shore opposite Deer Island, Rosscliff Td.

1A. Near the top of the hill, by the "l" of Rosscliff.

2. Quarry 200 yds. S. of W. of Cornfield House.

3. Quarry S. of Cornfield House.

4. 260 yds E of Cornfield House.

5. 250 yds. North of first "n" in Crinish.

6. 320 yds. N. of second "n" in Crinish.

7. 80 yds. SSE. of the small house which is 300 yds. NE. of Cornfield House.

8. 200 yds. S. of the first "f" in Fort Fergus.

9. Near the wall 100 yds. N. of the first "f" in Fort Fergus.

10. Beside the wall 120 yds. N. of "Fo" in Fort Fergus.

11. Quarry N. of the road to Inishdea, 330 yds. S.E. of Christs Church, Ballycorick.

12. In the middle of the field 1/4 mile NE. of Cornfield House.

13. 120 yds. E. of the sluice near the mouth of Ballycorick Creek, Crininish.

14. 140 yds. N. of the lane 1/2 mile from where it joins the Ennis road opposite Cornfield gate.

15. In the laneside, near the farm 220 yds. N. of the "l" of Poulaphuca.

16. 200 yds. E. of Ballycorick Dispensary.

17. The cliff under Dangan Castle, 1/2 mile N. of Ballynacally.

17A Hill with the limekiln. Opposite Dangan Castle but on the other side of the road.

18. In Inishdea td. where Butter Creek meets Ballycorick Creek.

18B Ditto, but 30 yds. SE. of the confluence of Ballycorick and Butter Creeks.

19. 1/3 mile NNE. of Cornfield House.

20. 100 yds. W. of the shore of Inishdea, a little S. of Bush Island.

21. South of the road to Inishdea, 100 yds west of the cresent shaped paIntation.

21B 250 yds. north of the "fi" in Cornfield.

21A South of the road to Inishdea, 220 yds. west of the cresent-shaped plantation.

22. Beside the cart house to Cornfield House.

23. 50 yds. east of the long inlet from Ballycorick Creek and 200 yds. from the sluice at its head. Inishdea townland.
24. 400 yds north of the "s" of Inishdea.
25. Near the sluice at the end of the inlet from Ballycorick Creek, Inishdea.
26. In the bank of Ballycorick Creek just north of where it meets Butter Creek.
28. Near the shore of Inishdea opposite the south end of Horse Island, about 30 yds south of Poulnagat.
29. 150 yds. north of the "s" in Inishdea.
31. Rock in Ballycorick Creek, near the second "l" in Ballycorick.
32. ¼ mile west of the end of the seawall, 130 yds. north of the "d" in Inishdea.
33. 100 yds. north of the "e" of Inishdea.
34. 200 yds. in from the shore of Inishdea, opposite the south end of Bush Island.
41. Alongside the lane to the farm, about 200 west of the quay to Island O'Brien.
42. 120 yds. east of Lissduff, Lisheen townland.
43. On the west bank of Ballycorick Creek, 300 yds. ENE. of Lissduff.
44. In the field east of the Kildysart-Ennis road, 60 yds. north of the road junction which is 1 mile north of Ballycorick Bridge.
45. 220 yds. north of the junction of the road to Killea with

the Kildysart-Ennis Road.

46. In the stream, immediately south of where it crosses the Ennis road, 1 mile north of Ballycorick Bridge.

47. 150 yds. down the lane on the south-east side of the Kildysart-Ennis road, 1½ miles north of Ballycorick Bridge.

48. 250 yds. NNW of the junction of the road to Killea with the Kildysart-Ennis road.

49-49C Old quarry, 50 yds east of the second 2E2 in Lisheen.

50. In Island o'Brien, 30 yds west of the east shore.

51. In Island o'Brien, 300 yds, south of the "n" in Lisheen.

53. On the east shore of Island o'Brien, towards the north end.

54. In Island O'Brien, 300 yds. NNW. of the sluice.

60. At the south end of Drumquin shore, overlooking Island o'Brien.

61. On the shore, 600 yds, south of Drumquin Point.

Sheet No. 41

210. Hill with small quarry, 200 yds. NNE. of Killerk school, Cragbrien townland.

211. 100 yds. SE. of Killerk School.

213. 120 yds. north of the "e" of Kilmore.

214. In the lane beside the "r" of Kilmore.

215. In the field 150 yds. south of Castlepark Cottage.

216. 100 yds. SW. of 215.

217. Old quarry on the south side of the road leading to Cragbrien Castle, about 300 yds. from the lodge.

218. In the field 250 yds. west of the Kildysart-Ennis road, 300 yds. south of the road through Cragbrien.

219. 50 yds. east of the "g" in Cragbrien.

220. On the hill 200 yds. NW. of Cragbrien House.

222. 200 yds. NE. of the north lodge to Cragbrien House.

223. 260 yds. west of Clareen Bridge, behind the farm house.

223A 200 yds. west of Clareen Bridge, beside the lane to the farm.

224. ¼ mile NW. of Clareen Bridge.

231. In the field north of the pond, 260 yds. NNW. of Teermaclane Cottage.

232. 300 yds. north of the first "t" in Teermaclane Cottage.

233. In the field south of "Ho" of Teermaclane House.

241. Large disused quarry near Clareen River, Craggykerrivan townland.

242. In the bank of Clareen river, 80 yds. from the sluice in the wall to Islandavanna.

250. On the east side of the road, 300 yds. north of the constabulary barrack, Teermaclane.

251. 300 yds. NW. of Buncraggy House.

254. 200 yds. south of the "r" in Barntick.

255. On the east side of the Kildysart-Ennis road, opposite the cottage 550 yds SW. of Hempfield Cottage.

256. Beside the first "s" of Lissan East, near Clarecastle.

257. 330 yds. ESE. of Claremount House, near Clarecastle.

258. In the field immediately north of Claremount Ho.

259. Old Quarry on the NE. side of the Ennis road, about 350 yds. from the church, Clarecastle.

260. ¼ mile south of Killone Lough, 60 yds. west of the Kildysart-Ennis road.

261. In the field between Ballybeg Lough and the Kildysart-Ennis road, 100 yds north of the first "l" in Ballaghafadda west.

262. In the field between Ballybeg Lough and the Kildysart-Ennis road 60 yds. south of the "B" of Ballaghafadda West.

280. 100 yds. north of St. Johns Well, at Killone Abbey.

281. ½ mile NNE. of St. Johns Well, and 100 yds west of the lane leading from there past Ballybeg Lough.

282. 300 yds. NNE. of Newhall House.

283. 80 yds. north of the pheasantry to Edenvale House.

285. 330 yds. East of Edenvale House.

287. 70 yds. north of the "b" of the Childrens Burial Ground, Inch Beg.

290. 50 yds. south of the "ba" in Ballybeg.

Sheet No. 33

310. Hillside around the triangulation point, 600 yds. NNW. of Inch Bridge.

311. On the track to Poulnagollour quarry. 30 yds. from where it joins the lane from Inch Bridge.

313. At the top of Poulnagollour quarry, Nooaff East townland.

315. 80 yds east of the last "y" in Ballylanidry.

320. Old quarry, 500 yds. west of Cahircalla Lough, Cahircalla More townland.

321. Old quarry, 220 yds. west of Clare road, ½ mile south of St. Flannan's College, Ennis.

322. Old quarry in Clonroad townland, 30 yds. south of the Rockmount Bridge road, 600 yds. west of Abbey View.

323. Old quarry beside Aughandayand Bridge.

330. 300 yds. SW. of Cragleagh House, 60 yds east of the road to Shallee.

330A 400 yds. SSW. of Cragleagh House, 130 yds. east of the road to Shallee.

331. The hill 100 yds. east of the road to Shallee, 450 yds. SSW. of Cragleagh House.

332. 430 yds. SW. of Bushy Park House, 20 yds. west of the road to Shallee.

333. On the hill north of the crossroads 300 yds. south of the "B" in Bushy Park, and 260 yds. east of the 'e' in Gortmore.

334. 350 yds. SW. of Bushy Park House, 50 yds. east of the road to Shallee.

335. Old quarry on the NW. side of Cairn Hill, 100 yds. south of the Kilnamona road near the "e" of Ballyniellan.

336. 330 yds. WSW. of Bushy Park House, 50 yds east of the road to Shallee.

337. Beside the road, 350 yds. WSW. of Bushy Park House.

340. In Shallee River, at the bridge north of where the lane from Shallee Castle meets the Kilnamona road.

370. Old quarry on the south side of the Miltown Malby road, 250 yds. SSE. of Beech Park House.

371. 30 yds. NE. of Lissanard, near Beech Park House.

372. Old quarry, 150 yds. NW. of the lodge to Beech Park House.

373. At the side of the field, 250 yds. south of the "r" of Beech Park.

Sheet No. 42.

400. Old quarry 300 yds SW. of Ballyhannan House, near Quin.

401. Joy Lodge quarry, Newmarket-on-Fergus.

ISLANDS

Sheet No. 50.

Deer Island

1. On the south east shore, 300 yds. SW. of the sluice.

2. On the east shore, about 350 yds. south of the northern headland.

2A. ditto. 200 yds. south of the northern headland.

3. On the north shore, 800 yds east of Carrignahurragh.

4. On the NW. shore 600 yds SW. of Carrignahurragh.

5. On the NW. shore, 380 yds. SW. of Carrignahurragh.

5A The bed immediately above 5.

6. On the NW. shore, 200 yds. SW. of Carrignahurragh.

7. On the north shore, 230 yds. east of Carrignahurragh.

8. On the north shore, $\frac{1}{4}$ mile east of Carrignahurragh.

9. On the north shore, 750 yds. east of Carrignahurragh.

10. On the north shore, 550 yds. east of Carrignahurragh.

11. 60 yds. east of the NW. shore, 450 yds. NE. of the ruined church.

12. 350 yds. west of the triangulation point.

14. On the north shore, 100 yds. east of Carrignahurragh.

15. At the most northerly tip of the east shore.

16. Near the hedge 200 yds. south of the triangulation point.

17. 120 yds. south of the north shore, 600 yds. east of carrignahurragh.

Coney Island

1. At the northern end of the east shore, out towards Sheep Rock.

2. On the south shore where the road comes down to the strand.

3. On the north shore, 400 yds. SW. of Sheep Rock.

Sheet No. 60.

Shore Island

1. On the west shore, 90 yds. from the northern end.

2. On the south shore, 200 yds. east of the knob.

2A. On the west shore, 70 yds. north of the knob.

3. On the east side of the knob.

Inishloe.

1. On the west shore of the headland which juts out in the north-west of the island, 160 yds. south of its northern end.

2. On the shore 100 yds. north of where the road comes down to the strand on the north side of the island.

4. On the south shore, 10 yds. from its western end.

5. On the south shore, 12 yds. from its western end.

6. On the south shore, 60 yds. from its western end.

7. On the south shore, 250 yds. from its western end.

7A. On the south shore, ¼ mile from its eastern end.

8. 20 yds. west of the "n" of Inishloe.

9. On the south shore 160 yds. from its western end.

10. Alongside the wall 75 yds. west of the shore, 50 yds. north of the road to Bergers Island.

11. Tine Island, about ½ mile east of Inishloe.

Inishmacowney

1. On the west shore, 230 yds. north-east of Ginnane's quay.
2. ditto. 200 yds. north-east of Ginnane's quay.
3. ditto. 80 yds. north-east of Ginnane's quay.
4. ditto. 130 yds. south of Ginnane's quay.
5. On the west shore, a little north of the bay opposite the north tip of Doon Island.
6. On the west shore, 60 yds. south of the shoal of rock which parallels the shore near Ginnane's quay.
7. A little above the 50' contour line, 400 yds. NNW. of pointahard.
8. On the west shore on the east side of the bay which opens northwards opposite the north end of Doon Island.
9. On the west shore opposite the northern end of Doon Island.
9A. 30 yds. in from the west shore, opposite Doon Island.
10. On the 130 yds. east of Rineavaud Point.
11. On the south-east shore, 130 yds. north east of Pointahard.
12. ditto. $\frac{5}{8}$ mile north-east of Pointahard.
13. On the west shore, on the third point north of Pointahard.
14. 50 yds. in from the west shore, 250 yds. NNW. of Pointahard.
15. Close to the west side of the wall south of the 100' contour, 350 yds. north of the "i"in Pointahard.
16. On the south-east shore, 400 yds. north-east of Pointahard.
17. 50 yds. south-west of the fort.
18. On the west shore, west of the first "i" of Inishmacowney.
19. On the west shore, 500 yds south of Rinevaud Point.

20. In the bay which opens northwards opposite the north tip of Doon Island.
21. On the south-east shore, 300 yds. south of the fort.
22. Old quarry in the hillside near the house 175 yds. west of the castle.
23. 200 yds. south of the fort.

Inishtubbrid

1. On the west shore 230 yds. south of the quay.
2. ditto. 250 yds south of the quay.
3. ditto. 270 yds. south of the quay.
4. ditto. 150 yds. south of the quay.
4A. ditto. 100 yds. south of the quay.
5. ditto. 460 yds. south of the quay.
6. ditto. ¼ mile south of the quay.
7. ditto. 350 yds. soth of the quay.
7A. ditto. 340 yds. south of the quay.
8. 50 yds. east of the west shore, 360 yds. south-west of the quay.
9. Crag 230 yds. south-west of Knocknalenaun.
10. On the east shore, 200 yds. from the northern end.
11. ditto. 130 yds. from the northern end.
12. ditto. 160 yds. from the northern end.
13. On the east sore, 120 yds. south of the large bay, 2 feet above high water.
14. ditto. 6 feet above high water.
16. The point at the south end of the large bay on the east shore.

17. The big slump in the large bay, 40 yds. from the southern end of the bay.
18. On the east shore more or less opposite the house on Canon Island.
19. On the east shore, 100 yds. from the northern end.

Canon Island

1. On the west shore by the quay in the south half.
2. On the west shore 120 yds. south of the quay.
3. On the south shore, 60 yds. west of the long inlet.
4. ditto. 50 yds. west of the long inlet.
5. ditto. 30 yds. west of the long inlet.
6. The west shore of the long inlet.
7. Old quarry on the east side of the long inlet, a little west of Lord's Rock.
8. On the south shore a little west of Lord's Rock.
9. On the south shore, opposite Lord's Rock.
10. On the south shore, 80 yds. east of Lord's Rock.
11. On the south shore, 100 yds. east of Lord's Rock.

12A-E. On the south shore, 135 to 150 yds. east of Lord's Rock.

13. On the south shore, 160 yds. east of Lord's Rock.
14. ditto. 200 yds. east of Lord's Rock.
15. ditto. 205 yds. east of Lord's Rock.
16. ditto. 210 yds. east of Lord's Rock.
17. ditto. 215 yds. east of Lord's Rock.
18. ditto. 220 yds. east of Lord's Rock.

19. On the south shore, 250 yds. east of Lord's Rock.

20. ditto. 300 yds. east of Lord's Rock.

21. ditto. 330 yds. east of Lord's Rock.

22. ditto. 360 yds. east of Lord's Rock.

23. ditto. At the east end, about $\frac{1}{4}$ mile east of Lord's Rock.

24. ditto. At the east end, at the top of the cliff where the wall runs along by the shore.

25. 20 feet below 24.

26. 10 feet below 25.

27. On the east shore, $\frac{1}{2}$ mile south of the waist.

28. 15 yds. off the east shore, $\frac{1}{2}$ mile south of the waist.

29. On the east shore, 330 yds. south of the waist.

29A. ditto. 150 yds. south of the waist.

30. On the west shore, 60 yds. south of the first "n" in Canon Island.

31. ditto. 40 yds. east of the abbey.

32. On the east shore, 60 yds. south of the end of the point to the north end of the shore.

33. 2 feet below 32.

34. On the east shore, 100 yds. east of the abbey.

35. On the east shore, on the north side of the promontory opposite the houses south of the abbey.

36. At the tip of the promontory.

37. On the south side of the promontory, 50 yds. from the tip.

38. ditto. 55 yds. from the tip of the promontory.

39-42 75 yds. to 100 yds. from the tip of the promontory.

43. On the shore south of the houses, 50 yds. east of the "d" of Canon Island.

44. On the shore 60 yds. SE. of the "D" of Canon Island.

45. On the shore 60 yds. south of the "d" of Canon Island.

46A-F. On the east shore around the promontory 160 yds. south of the second "an" in Canon Island.

47. On the east shore, 130 yds. north east of the shoal near the waist.

48. ditto. 115 yds. NE. of the shoal.

49. ditto. 100 yds. NE. of the shoal.

50. ditto. 50 yds. NE. of the shoal.

51. ditto. 30 yds. NE. of the shoal.

52. On the east shore of the waist.

53. 325 yds. south of the triangulation point, 120 yds. west of the east shore.

54. On the west shore, 210 yds. north of the first "t" in Tobernamonastragh.

55. ditto. 200 yds. NNW. of the first "t" in Tobernamonastragh.

56. ditto. 150 yds. NW. of the "C" in Canon Island.

<u>Sheet No. 59</u>.

<u>Inishmurry</u>

1. On the west shore, opposite the quay on the mainland.

2. On the point forming the west side of the bay at the southern end of the island.

A P P E N D I X II.

Species collected from the more folliliferous localities in the area. For the whereabouts of the localities see Appendix I. The numbers following the names refer to specimens in the collection in the Geology Department, Southampton University, except for trilobites which are in the possession of Dr. R. Goldring, at Reading.

Locality

D2 INCH BRIDGE LIMESTONE

311	Lonsdaleia duplicata duplicata (Martin) 2438-2444
	Syringopora cf. geniculata Phillips, 2456.
	Linoproductus hemisphericus gr.
330 & 336	Caninia aff. cornucopia Michelin 2520
	Claviphyllum sp. 2513.
	Rotiphyllum sp. 2522.
	Lonsdaleia duplicata duplicata (Martin) 2518.
	zaphrentoids.

D2 REEF LIMESTONE

Bushy Park Reef.

334	Antiquatonia cf. sulcata Sowerby. 2527.
	A. sp. 2525.
	Avonia sp.

	Brachythyris integricosta Phillips. 2547.
	Dielasma Hastata (J de C. Sowerby) 2559.
	Krotovia spinulosa (Sowerby). 2517, 2540.
	Linoproductus sp. 2527, 2524, 2545.
	Overtonia sp.
	indeteminable productids.
	Spirifer bisulcatus Sowerby. 2550.
	S. octoplicatus (Sowerby). 2537.
	S. striatus gr. 2537.
	Fenestella sp.
	trilobite pygidium.
Newhall Reef	
28.	Avonia cf. davidsoni (Jarosz). 2232.
	Brachythyris integricosta Phillips. 2234.
	Buxtonia sp.
	Overtonia fimbriata (J. de C. Sowerby).
	Productus sp.
	Pugnax pugnus (Martin).
	Schizophoria resupinata (Martin). 2230.2228.
	Spirifer bisulcatus Sowerby. 2226, 2235.
	Spirifer sp.
	Orthoceras sp.
	Griffithides sp. pygidium. 2231.
Cragbrien Reefs	
210,222 and 211.	Antiquatonia sp.
	Buxtonia sp.

Dielasma hastata (J. de C. Sowerby).

2192, 2193, 2161-3.

Linoproductus hemisphericus gr.

L. sp. 2171, 2172, 2188.

Overtonia fimbriata (J. de C. Sowerby).

Productus aff. carbonarius de Koninck. 2195.

Pugnax pugnus (Martin).

Tylothyris cf. plicatosulcatus North. 2178.

Caninia sp.

Orthoceras sp.

gastropod.

indet. goniatite.

<u>Lisheen Reef</u>

44. Antiquatonia insculpta (Muir-wood) 2111.

Overtonia fimbriata (J. de C. Sowerby) 2117.

Productus sp.

Pugnax pugnus (Martin). 2112.

Spirifer octoplicatus (Sowerby) 2118.

<u>Cornfield Reef</u>

Inishdea townland.

18. Eomarginifera longispina Sowerby. 2095.

E. sp.

Krotovia spinulosa (Sowerby). 2096.

Spirifer cf. bisulcatus Sowerby.

26. Athyris sp.

Brachythyris integricosta Phillips 2097.

Proboscidella proboscidea de Vernieul.

31. Antiquatonia insculpta (Muir-Wood). 2083.

Pugnax pugnus (Martin). 2084.

Cornfield townland.

17. Michelinia cf. tenuisepta (Phillips). 6991.

Pustula pustulose (Phillips). 6992.

17A Antiquatonia sp.

Brachythyris sp. 7000.

Overtonia fimbriata (J. de C. Sowerby). 6998

Plicatifera plicatilis (J. de C. Sowerby). 6995.

Pugnax Pugnus (Martin. 6994.

Schizophoria respinata (Marton).

Spirifer striatus gr. 6999.

Poulaphouca townland.

16. Antiquatonia cf. sulcata Sowerby. 1855.

A. sulcata Sowerby. 1856.

A. sp.

Camaraphoria globulina Phillips.

Dielasma hastata (J. de C. Sowerby). 1867-1870.

Linoproductus sp. 1863.

Proboscidella proboscidea de Vernieul.

D1 REEF LIMESTONE

Cornfield reef.
Cornfield and Fort Fergus townlands.

4.	Antiquatonia sp.
	Spirifer striatus gr. 6977.
	Sp. bisulcatus Sowerby.
	Orthoceras sp.
5.	Brachythyris triradialis var. sexradialis Phillips. 6988.
	B. sp.
	Schizophoria resupinata (Martin).
	Spirifer bisulcatus Sowerby. 6984.
6.	Antiquatonia sulcata Sowerby.
	Proboscidella proboscidea de Vernieul. 6983.
7;	Antiquatonia sp.
	Athyris sp. 1949.
	Dielasma hastata (J. de C. Sowerby). 1937.
	Straparollus sp. 2056. 2057.
	Beyrichoceras micronotum gr. 1939-1948. 1950-1953.
8.	Antiquatonia sulcata Sowerby.
	A. cf. sulcata Sowerby.
	Athyris sp.
	Brachythyris sp. 6945.
	Dielasma hastata (J. de C. Sowerby).
	Schizophoria resupinata (Martin). 6943, 6948, 6946.
	Spirifer bisulcatus Sowerby. 6942.

Productus productus Martin. 6933.

P. sp. 6953.

Pustula sp.

Reticularia sp. 6947.

Algal growths.

Amplexus coralloides Sowerby. 6957.

Fenestella sp.

Beyrichoceras micronotum gr. 6962, 6968, 6960.

Leiopteria cf. laminosa Phillips.

Myalina lamellosa de Koninck.

Parallelodon squamifera Phillips.

Pinna sp.

Naticopsis sp.

9. Athyris sp.

Antiquatonia cf. sulcata Sowerby. 1878.

A. sp.

Brachythyris sp. 1923.

Dielasma hastata (J. de C. Sowerby). 1913.

Echinochonchus venustus Thomas. 1901.

E. sp.

Overtonia sp.

Productus (Alifera) expansus. de Koninck. 1879.

Pugnoides triplex. M'coy.

Pugnax pugnus (Martin). 1921.

Fenestella polyporata (Phillips). 1880, 1902.

Orbitremites ellipticus Sowerby 1904,1918.

Rhodocrinus sp. heads. 1911,1912,1926-1936.

algal growths.

Aviculopecten nodulosus de Koninck.

A. sp.

Edmondia maccoyii Hind.

10. Antiquatonia cf. sulcata Sowerby.

A. sp.

Pugnax pugnus (Martin).

Amplexus coralloides Sowerby.

Fenestella sp.

Aviculopecten sp.

Parallelodonsp.

Rhodocrinussp. heads. 1882-1887,1889, 1898-1900,1891,1892,1893-1895,2421,2422, 2426,2427,2429,2430.

12. Dielasma hastata (J. de C. Sowerby). 1875.

Productus productus Martin. 1872.

Amplexus coralloides, Sowerby.

Fenestella sp.

Rhodocrinus sp. 1872, 1874.

19. Antiquatonia sp.

Athyris. sp.

Gigantoproductus aff. crassiventer (Prentice) 1847.

G. cf. maximus M'coy. 1849, 2414.

G. cf. striato-sulcatus Schwetz. 2416.
Straparollus sp. 2418.
Dibunophyllum bourtonense Garwood and Goodyear, 2325.

22. Antiquatonia cf. sulcata Sowerby. 1851.
Athyris sp.
Linoproductus sp.
Beyricoceras micronotum gr. 1853.

Inishdea townland.

28. Brachythyris sp.
Dictyoclostus Pinquis Muir-wood. 2089.
Pustula pustulosa (Phillips) 2088.
Dibunophyllum bourtonense Garwood and Goodyear.

34. Athyris sp.
Dielasma hastata (J. de c. Sowerby).
Schizophoria resupinata (Martin). 2060, 2065, 2066, 2068.
Pustula cf. pustulosa (Phillips). 2082.
Aviculopecten nobilis de Koninck.
Orthoceras sp.
Goniatites maximus Bisat, 2173.
indet. goniatite.
Griffithides sp.

Horse Island — Athyris sp.

Brachythyris sp.

Dielasma hastata (J. de C. Sowerby). 2108.

Productus sp.

Reticularia sp.

Amplexus coralloides Sowerby. 2109.

Fenestella sp.

D?1 or D?2 REEF LIMESTONE

Inishmurry.

Dibunophyllum sp.

Antiquatonia aff. sulcata Sowerby.

A. sp.

Brachythyris cf. planicosta M'coy.

B. sp.

Gigantoproductus latissimus gr.

Pugnax pugnus (Martin).

Pugnax pleurodon (Phillips).

Spirifer bisulcatus Sowerby.

Sp. sp.

D1 BALLYBEG LIMESTONE

Clareen Bridge.

223A. — Buxtonia scabricula Sowerby. 2218.

Cyrtina septosa Phillips. 2342.

Spirifer cf. bisulcatus Sowerby.

Striatifera striatus Fischer. 2216.
Linoproductus sp.

Clonroad quarry.

322. Dibunophyllum bourtonense Garwood and Goodyear. 2467.
Palaeosmilia murchisoni Edwards and Haime. 2470.
Syringopora cf. reticulata. Goldfuss, 2466, 2464.
Giganteid productids.

Ballaghafadda West.

261 & 262. Dibunophyllum bourtonense Gar. and Good. 2559.
Lithostrotion junceum Fleming. 24912458.
Palaeosmilia murchisoni Edwards & Haime. 2463.
Syringopora cf. reticulata Goldfuss. 2469.
Cyrtina septosa Phillips. 2558.
Linoproductus hemisphericus gr.
Striatifera striatus Fischer.
giganteid productids.

Ballybeg old quarry.

321. Dibunophyllum bourtonense Gar and Good. 2477.
Lithostrotion martini Edwards & Haime 2487, 2457.
L. cf. martini Edw. and H. 2358.
L. junceum Fleming. 2495, 2360.

Palaeosmilia murchisoni Edw. and H.

Linoproductus sp.

Daviesiella sp.

giganteid productids.

Poulogolour quarry.

312 & 313 Alveolites septosa Fleming, 2451,2446.

Palaeosmilia murchisoni Edw. & H. 2454.

Syringopora cf. ramulosa Goldfuss. 2450, 2431.

caniniid.

Cyrtina septosa Phillips, 2452, 2453.

giganteid and smaller productids.

ISLANDS

Shore Island

D1 SLUMPED SERIES

2 Michelinia favosa (Goldfuss). 6454.

Eomarginifera sp. 6457.

Brachythyris spp. 6464, 6463, 6465.

Spirifer bisulcatus Sowerby.

S. sp.

Rhipidomella michelini (Levielle).

Rhopalolasma sp. 6459.

Inishmacowney

D1. SLUMPED SERIES

5. Rhopalplasma sp. 6554.

Rhipidomella sp.

Spirifer bisulcatus Sowerby.

Fenestella polyporata (Phillips). 6558,2332.

7. Diphymorphic koninckophyllum 6569.

Athyris sp.

Overtonia sp.

Rhipidomella michelini. (Levielle). 6565.

Schophoria resupinata (Martin).

Stenopora sp.

Other bryozoa.

8. Koninckophyllum cf. Vaughan. 6575.

Carcinophyllum cf. Vaughan. 6572.

Lithostrotion cf. martini Edw. and H.

Rhipidomella michelini (Levielle). 6571.

Spirifer bisulcatus Sowerby.

Bellerophon sp.

18. Leptaena analoga. Phillips, 6454.

S2. LORD'S ROCK LIMESTONE

4. Diphiphyllum smithi Hill. 6549,6550,6555.

15. Caninia subibicina M'coy. 6584.

C. benburbensis gr.

Lithostrotion pauciradiale M'coy.

16. Amplexi-zaphrentis enniskilleni var. ashfell-ense Lewis 6589,6590.

Zaphrentid 6593.

Zpirifer cf. attenuatus Sowerby. 6592.

Stenopora and other bryozoa. 6586, 2370.

Deer Island

D1. INISHTUBBRID SHALES

4. Posidonia cf. becheri Bronn.
P. cf. laminosa de Koninck.
Leiopteria lunulata Phillips.
Liobole sp. 2336.

5. Caninia cf. densa Lewis 6872.

D1. SLUMPED SERIES

12. Caninia benburbensis Lewis. 6898.
C. sp.
Dibunophyllum bourtonense Garwood and Goodyear, 6894, 6899.
Rotiphyllum sp. 6894.
Rhipidomella sp.
Spirifer bisulcatus Sowerby.

11. Lithostrotion cf. martini Edw. and H. 6884.
Bryozoa.

14. Lithostrotion cf. martini Edw. and H. 6900.

S1. CANON ISLAND LIMESTONE

2. Siphonophyllia cylindrica Scouler. 6867.
Amplexi-zaphrentis enniskilleni var enniskilleni. Lewis. 6862.

9. Aulina cf. furcata Smith. 6877.
Siphonophyllia cf. cylindrica Scouler. 6876.
S. sp.

Eomarginifera sp.

Inishtubbrid	D1. INISHTUBBRID SHALES
7.	Dibunophyllum Bourtonense Gar. & Good. 6915, 6916.
	Diphyphyllum lateseptatum M'Coy. 6918.
	Koninckophyllum cf. proprium Sibly. 6914.
	K. sp.
9.	Posidonia sp.
	Posidoniella sp.
	D1. SLUMPED SERIES
12.	Caninia amplexoides Wilmore, 6924.
	Claviphyllum sp. 6922.
	Brachythyris sp.
	Productus sp.
	Spirifer bisulcatus Sowerby.
15.	Caninia amplexoides Wilmore. 6929.
	young Koninckophyllum sp.
	Brachythyris sp.
Canon Island.	
	D1. SLUMPED SERIES
2.	Dibunophyllum bourtonense Garwood and Goodyear. 6790, 6791.
	Lithostrotion martini Edw. and H.
	Schellweinella crenistria Phillips.
	Orthoceras sp. 6788.

4. Rhopalplasma sp. 6784.

5. Brachythyris sp.

Rhipidomella sp.

Caninia amplexoides Wilmore. 6781-3.

S2. CARRAIG LIMESTONE

7. Caninia sp.

Diphiphyllum sp.

Actinocrinus sp. 6776.

Platycrinus sp. 6775.

55. Michelinia favosa (Goldfuss).2392,2393.

Lithostrotion martini Edw. & H.

S2. LORD'S ROCK LIMESTONE

8 & 9 Caninia benburbensis gr. 6766.

Zaphrentid. 6768.

trilobite pygidium.

Archaeodiscus sp. Brunsia sp. Calcishaerids 6767.

S1. CANON ISLAND LIMESTONE

11. Aulina sp. 6754.

Siphonophyllia sp.

12A. Daviesiella sp. 6740.

12C. Aulina sp.

Siphonophyllia cylindrica Scouler.

Pustula cf. pustulosa (Phillips). 6742.
Rhipidomella michelini (Levielle).
Athyris sp.
12D. Daviesiella sp.
Leptaena analoga Phillips.
Schellweinella crenistria Phillips.
Caninia Benburbensis (Lewis).
Aulina sp. 2390.
Lithostrotion martini Edw. and Haime.
14. Lithostrotion Martini Edw. and H. 6730.
Siphonophyllia sp.
Amplexi-zaphrentis enniskilleni var ash-
fellense Lewis. 6732,6735,6736.
Overtonia fimbriata (J. de C. Sowerby).
Pustula sp.
Fenestella frutex M'coy. 6733.
Stenopora sp. 6733.
Straparollus sp.
algal growth.
15. Dictyoclostus semireticulatus (Martin).
Echinoconchus elegans (M'coy).
Brachythyris ovalis Phillips.
Phillipsia kellyi Portlock. 6727.

16. Avonia youngiana (Davidson) 6723.
Brachythyris ovalis Phillips.
Rhynconellid.
small Chonetes.

17. Avonia youngiana (Davidson). 6723.
Brachythyris ovalis Phillips.
small chonetes.
Dyctyoclostus semireticulatus (Martin).
Echinoconchus punctatus (Martin). 6712.
Phillipsia kellyi Portlock.

18. Amplexi-zaphrentis enniskilleni var. enniskilleni Lewis. 6710. 6711.
Dielasma hastata (J. de C. Sowerby).
Echinoconchus elegans M'coy). 6706,6709.
Leptaena analoga Phillips. 6705.
Phillipsia kellyi Portlock. 6707.

20. Cyathaxonia cornu Michelin. 6689.
Lithostrotion martini Edw. and H.
L. sp.
Straparollus sp.
Natica sp.

21. Siphonophyllia cylindrica Scouler. 6692.
Gigantoproductus O Vaughan. 6696.
Overtonia fimbriata (J. de C. Sowerby)6695.

23. Cravenia lemellata Howell. 2371.
Siphonophyllia cylindrica Scouler.

Caninia sp.
clisiophyllid lithostrotion.
Amplexi-zaphrentis enniskilleni Lewis.
small chonetes.

24. Caninia benburbensis Lewis. 6675.
C. sp.
Siphonphyllia cylindrica Scouler.
Palaeosmilia murchisoni Edw. & H. 6688.
Brachythyris ovalis Phillips.
Eomarginifera lobatus var. laqueatus Muir-wood. 6680-6683.
Schellweinella crenistria Phillips.
Pustula pyxidiformis (de Koninck).
Phillipsia kellyi Portlock. 6679.

33. Amplexi - zaphretis enniskilleni gr. 6659.
Phillipsia kellyi. Portlock. 6658.6655.

46A Lithostrotion martini Edw. and H.
Siphonophyllia cylindrica Scouler.

46C. Cyathaxonia cornu Michelin. 6617.
Cravenia lamellata var. Howell. 6616.
Lithostrotion cf. martini Edw. and H. 6614.
Siphonophyllia cylindrica Scouler. 6620.

46D & E. Diphyphyllum sp. 6611, 6612.
Siphonophyllia cylindrica Scouler.
Palaeosmilia multilamellata. Garwood. 6630, 6631.

46F.	Siphonophyllia cylindrica Scouler.
	Palaeosmilia murchisoni Edw. and H. 2405.
47.	Amplexi zaphrentis enniskilleni var. enniskilleni Lewis.
	Palaeosmilia murchisoni Edw. and H. 2397.
	Fenestella frutex. M'coy. 6606.
	gastropods.
49.	Brachythyris ovalis Phillips.
	Dictyoclostus semireticulatus (Martin).
	Echinoconchus elegans (M'coy).
	E. Punctatus (Martin).
	Fenestella sp.

C2. ABBEY LIMESTONE

28.	Chonetes cf. papilionacea Phillips. 6670.
	Straparollus sp.
	small gastropods.
37 & 38.	Chonetes cf. papilionacea Phillips.
	Levitusia humerosa Sowerby. 6646.
	Spirifer aff. clathratus M'coy.
	SP. clathratus gr.
41 & 42.	Daviesiella destinezi Vaughan. 6641.
	Dictyoclostus semireticulatus (Martin).
	Schuchertella wexfordensis Smyth. 6640.
	Siphonophyllia sp.
	Fenestella frutex M'coy.

APPENDIX III

Complete faunal list.

1. Inishloe reef. 2. Inishloe chert Series. 3. C2/S1 Limestone, Canon Island. 4. C2/S1 Limestone, Deer Island. 5. Lord's rock Limestone, Canon Island. 6. The same Inishmacowney. 7. the same, Deer Island. 8-12. Island Slumped Series. 8. Canon Island. 9. Inishtubbrid. 10. Inishmacowney. 11. Deer Island. 12. Shore Island. 13-15. Inishtubbrid Shales. 13. Inishtubbrid. 14. Deer Island 15. Rosscliff. 16. Cornfield Reef, upper part. 17. Cornfield Reef, lower part. 18. Lisheen, Island o'brien and Drumquin. 19. Cragbrien Reefs. 20 & 21. Ballybeg Limestone. 20. Teermaclane and Clareen. 21. Buncraggy and Barntick. 22. Newhall Reef. 23. Inishmurry reef. 24-27 Ballybeg Limestone. 24. Ballaghafadda West. 25. Clonroad and Ballybeg. 26. Cahircalla and Aughandayand. 27. Poulagollour Quarry. 28-30. Inch Bridge Limestone. 28. Inch Bridge. 29. Children's Burial Ground, Inch Beg. 30. Bush Park. 31. Bush Park Reef. 32. Ballybeg Limestone, Clarecastle.

District 18 includes both D2 and D1 limestone.

		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.	Alveolites septosus Fleming										
2.	Amplexus coralloides Sowerby	x									
3.	Aulina cf. furcata Smith				x						
4.	Aulina sp.			x	x		x				
5.	Caninia amplexoides Wilmore								x	x	
6.	Caninia benburbensis (Lewis)			x	x	x					
7.	C. benburbensis gr.					x					
8.	C. cf. densa Lewis										
9.	C. lanceolata										
10.	C. subibicina M'coy					x					x
11.	C. cornucopiae gr.		x								
12.	C. aff. cornucopiae Michelin										
13.	C. cf. irregularis gr.										x
14.	C. sp.	x	x								
15.	Carcinophullum cf. O Vaughan									x	
16.	Claviphyllum sp.		x								
17.	Clisiophyllum sp.										
18.	Cravenia lamellata Howell			x							
19.	Cravenia lamellata var.Howell			x							
20.	Cyathaxonia cornu Michelin			x							
21.	Dibunophyllum bourtonense (Goodyear & Garwood)								x	x	x
22	.D.sp.										
23.	Diphyphyllum lateseptatum M'Coy										
24.	D. smithi Hill						x				

	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1.																x	x					
2.						x	x															
3.																						
4.																						
5.																						
6.	x																					
7.	x																					
8.				x																		
9.					x																	
10.																						
11.																						
12.																				x		
13.																						
14.																						
15.																						
16.																						
17.																				x		
18.																						
19.																						
20.																						
21.	x		x				x	x						x	x	x						
22.												x										
23.			x																			
24.																						

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
25. D. sp.			x					x		
26. Fascicullophyllum juncto-septatum Smith.		x								
27. F. sp.										
28. Koninckophyllum cf. Vaughan										x
29. K. columatum George										
30. K. cf. proprium Sibly										
31. diphymorphic Koninckophyllum				x	x					x
32. K. sp. young									x	
33. Lithostrotion junceum Fleming										
34. L. maccoyanum Edw. & Haime										
35. L. martini Edw. & Haime			x	x		x		x		
36. L. cf. martinit Edw. & H.			x	x		x		x		x
37. L. pauciradiale (M'coy)										
38. L. sp.			x	x	x					
39. Lonsdaleia duplicata var. (duplicata(Martin).										
40. Michelinia favosa (Goldfuss)					x					
41. M. megastoma (Phillips)	x									
42. M. cf. tenuisepta (Phillips)										
43. Palaeosmilia murchisoni (Edw. & Ha.)			x	x						
44. P. multilamellata (M'Coy)			x							
45. Rhopalolasma sp.(Carruthers)								x		x
46. Rotiphyllum cf. densum										
47. R. nodosum (Smyth)										
48. R. aff. nodosum (Smyth)	x									

	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
25.																						
26.																						
27.																				x		
28.																						
29.																		x				
30.			x																			
31.																						
32.																						
33.									x		x			x	x							
34.								x														
35.								x			x				x							x
36.								x														
37.	x																					
38.																						
39.																		x	x	x		
40.		x																				
41.																						
42.								x														
43.														x	x	x	x					
44.																						
45.		x																				
46.								x														
47.	x							x														
48.																						

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
49. R. sp. (Hudson & Platt)	x									
50. Rylstonia benecompacta	x									
51. R. sp.						x				
52. Siphonophyllia cylindrica (Scouler)			x	x						
53. S. cf. cylindrica (Scouler)				x						
54. Syringopora cf. geniculata (Phillips)										
55. S. cf. ramulosa Goldfuss										
56. S. reticulata Goldfuss.										
57. S. sp.										
58. Zaphrentis enniskilleni var. ashfellense Lewis)			x			x				
59. Z. enniskilleni enniskilleni Lewis			x	x						
60. Z. enniskilleni gr.			x							
61. Z. cf. konincki Edw. & H.										
62. zaphrentids.			x		x	x				
63. Alifera expansa de Koninck										
64. Antiquatonia insculpta (Muir wood)										
65. A. sulcata Sowerby										
66. A.cf. sulcata Sowerby										
67. A. sp.										
68. Athyris planosulcata (Phillips)										
69. A. cf. expansa (Phillips)										
70. A. sp.	x		x							x

	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
49.								x												x		
50.																						
51.																						
52.																						
53.																						
54.																		x				
55.																	x					x
56.														x		x						
57.											x											x
58.																						
59.																						
60.																						
61.						x																
62.			x																	x		
63.							x															
64.						x																
65.						x																
66.							x														x	
67.						x	x	x					x								x	
68.						x	x	x	x				x									
69.							x	x														
70.	x	x				x	x	x														

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
71. Avonia cf. davidsoni (Jarosz)										
72. A. youngiana (Davidson)			x							
73. A. sp.										
74. Brachythyris integricosta (Phillips)										
75. B. ovalis Phillips			x							
76. B. cf. planicosta M'coy										
77. B. sexradialis Phillips.										
78. B. spp.	x							x	x	x
79. Buxtonia scabricula (Martin)										
80. B. sp.										
81. Camaraphoria globulina Martin										
82. Chonetes cf. papilionacea (Phillips)			x							
83. small chonetes			x							
84. Cyrtina septosa (Phillips)										
85. Daviesiella destinezi (Vaughan)			x							
86. D. cf. comoides Sowerby										
87. D. sp.			x							
88. Dielasma hastata (J.deC.Sowerby)	x		x							
89. Dictyoclostus multispiniferus (Muir-wood)	x		x							
90. D. semireticulatus (Martin)	x		x							
91. D. pinquis Muir-wood										
92. D. sp.				x						
93. Echinoconchus elegans (M'coy)			x							
94. E. punctatus (Martin).			x							

	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	32
71.												x									x	
72.																						
73.						x															x	
74.						x	x					x									x	
75.																						
76.													x									
77.							x															
78.	x	x			x			x		x			x									
79.												x										
80.												x										
81.						x																
82.																						
83.																						
84.										x				x		x	x				x	
85.																						
86.								x														
87.															x							
88.						x	x		x		x										x	
89.																						
90.																						
91.							x															
92.							x															
93.																						
94.																						

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10
95. E. venustus Thomas										
96. E. sp.										
97. Eomarginifera derbiensis (Muir-wood)	x									
98. E. lobatus var. laqueatus (Muir-wood)	x		x							
99. E. longispinus Sowerby										
100.E. cf. precursor (Muir-wood)										
101.E.sp.	x			x						
102.Gigantoproductus aff. crassiventer (Prentice)										
103.G.latissimus gr.										
104.G.cf. maximus M'coy										
105.G.cf.striatosulcatus (Schwetz)										
106.G.cf. Vaughan			x							
107.G. sp.										
108.Girtyella saccula (Martin)										
109.Krotovia spinulosa (Sowerby)										
110.Leptaema analga Phillips			x		x			x		
111.Levitusia humerosa (Sowerby)			x							
112.Linoproductus hemisphericus gr.										
113.L. sp.										
114.Orbiculoidea sp.										
115.Overtonia fimbriata (J. de C. Sowerby)										
116.O. sp.			x							
117. Pliochonetes sp.										
118.Plicatifera plicatilis (J. de C. Sowerby)		x								

	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	32
95.							x															
96.							x															
97.																						
98.																						
99.						x																
100							x															
101		x					x															
102							x															
103												x										
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105							x															
106																						
107								x		x												
108								x														
109						x															x	
110																						
111																						
112							x			x											x	
113						x	x	x	x												x	
114							x															
115						x		x														
116							x														x	
117							x															
118						x																

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10
119. Proboscidella proboscidea de Vernieul										
120. Productus cf. carbonarius de Koninck.										
121. P. productus Martin.										
122. Pugnax pugnus (Martin)	x									
123. P. var. sulcatus Sowerby	x									
124. P. pleurodon (Phillips)										
125. Pugnoides triplex M'coy										
126. Pustula pustulose (Phillips)										
127. P. cf. pustulosa (Phillips)	x									
128. P. pyxidiformis (de Koninck)	x									
129. P. sp.	x		x							
130. Reticularia lobata Muir-wood	x									
131. R. sp.										
132. Rhipidomella michelini(Levielle)					x					x
133. Rhynconella sp.	x		x							
134. Schellwienella crenistria Phillips								x		
135. Schizophoria resupinata (Martin	x									x
136. Schuchertella wexfordensis Smyth	x		x							
137. Spirifer attenuatus Sowerby										
138. Sp. bisulcatus Sowerby									x	x
139. Sp. aff. clathratus M'coy.	x		x							
140. Sp. octoplicatus (Sowerby)										
141. Sp. striatus gr.										
142. Sp. subcinctus de konick	x									

	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
119						x	x															
120									x													
121							x															
122							x		x			x										
123							x															
124													x									
125						x																
126						x																
127																						
128																						
129							x					x										
130																						
131							x															
132	x	x																				
133							x											x				
134									x													
135						x	x			x												
136																						
137																						
138	x	x					x			x		x	x									
139																						
140						x															x	
141						x	x														x	
142																						

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10
143.Sp. sp.	x									
144.Striatifera striata Fischer										
145.Tylothyris plicatosulcatus (North)										
146.Aviculopecten bouei de Verneil	x									
147.A. constans de Koninck	x									
148.A. nobilis de Koninck										
149.A. nodulosus de Koninck										
150.A. sp.										
151.Conocardium hibernicum(Sowerby)	x									
152.Edmondia maccoyii Hind										
153.Leiopteria laminosa Phillips										
154.L. Lunulata Phillips										
155.Myalina cf. lamellosa de Koninck										
156.Parallelodon squamifera Phillips										
157.Pinna sp.										
158.Posidonia cf. becheri. Bronn										
159.P. cf. lamellosa de Koninck.										
160.P.sp.										
161.Posidoniella sp.										
162.Bellerophon sp	x		x							x
163.Euomphalus catilliformis de koninck	x									
164.E. amaenus de Koninck			x							
165.Loxonema sp.	x									
166.Naticopsis sp.	x		x							

	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
143						x	x					x	x									
144										x		x		x								x
145									x													
146																						
147																						
148							x															
149							x															
150							x															
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153							x															
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158				x																		
159				x																		
160			x	x																		
161			x																			
162																						
163																						
164																						
165																						
166							x															

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10
167. Straparollus convolutus de Koninck	x									
168. St. sp.			x							
169. Orthoceras sp.	x		x		x			x	x	
170. Planetoceras cf. globatus (Sowerby)	x									
171. Vestinautilus cariniferus	x									
172. Beyrichoceras micronotum gr.										
173. Goniatites maximus Bisat.										
174. Fenestella frutex M'coy	x		x							
175. F. cf. frutex M'coy					x	x				
176. F. plebeia M'coy	x									
177. F. polyporata (Phillips)						x				
178. F. sp.	x		x						x	
179. Stenopora sp. & other stick bryozoa			x		x					
180. Actinocrinus sp.					x					
181. Platycrinus sp.	x				x					
182. Rhodocrinus sp.										
183. Orbitremites ellipticus Sowerby										
184. Griffithides globisceps Phillips	x									
185. G. sp.										
186. Liobole sp.										
187. Phillipsia kellyi Portlock			x							
188. Phillipsid			x							
189. trilobite fragments	x		x			x				

	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	32
167																						
168							x															
169			x		x		x														x	
170																						
171																						
172			x				x															
173							x															
174							x															
175							x															
176																						
177						x																
178						x	x	x													x	
179																						
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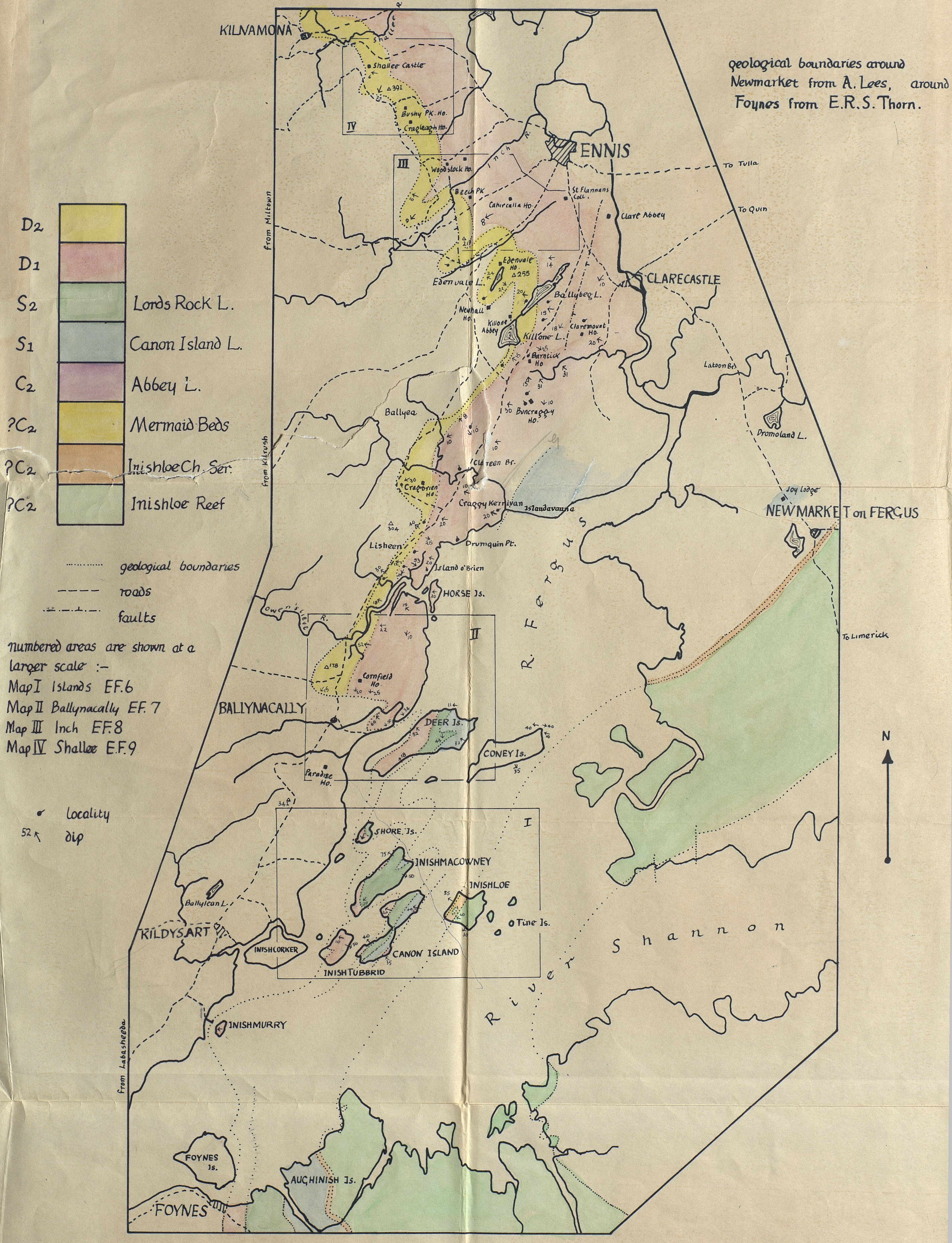
181																						
182																						
183							x															
184							x															
185																						
186							x															
187				x																		
188																						
189												x									x	

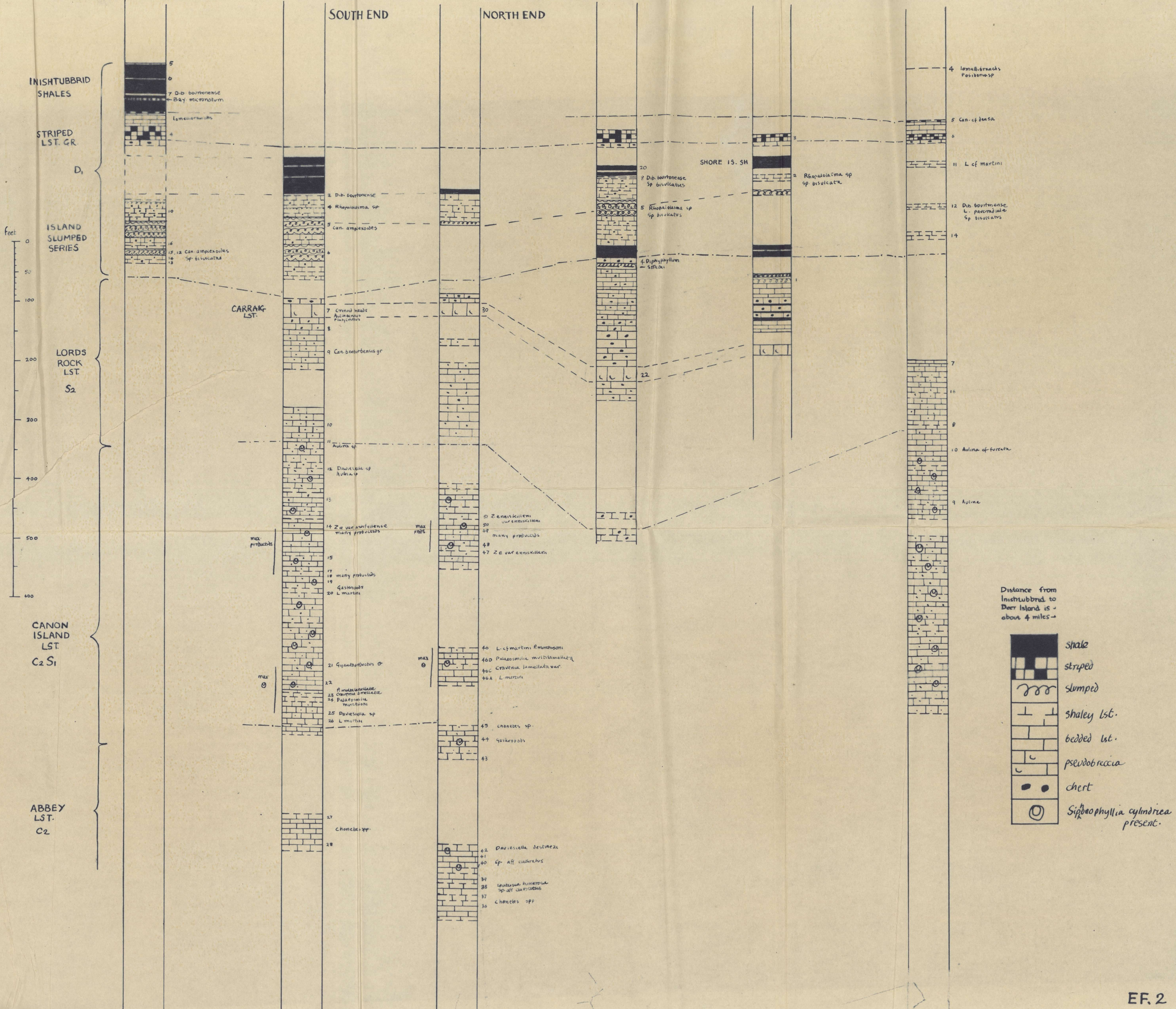
GEOLOGICAL MAP of SOUTH CO. CLARE

with part of Co. Limerick

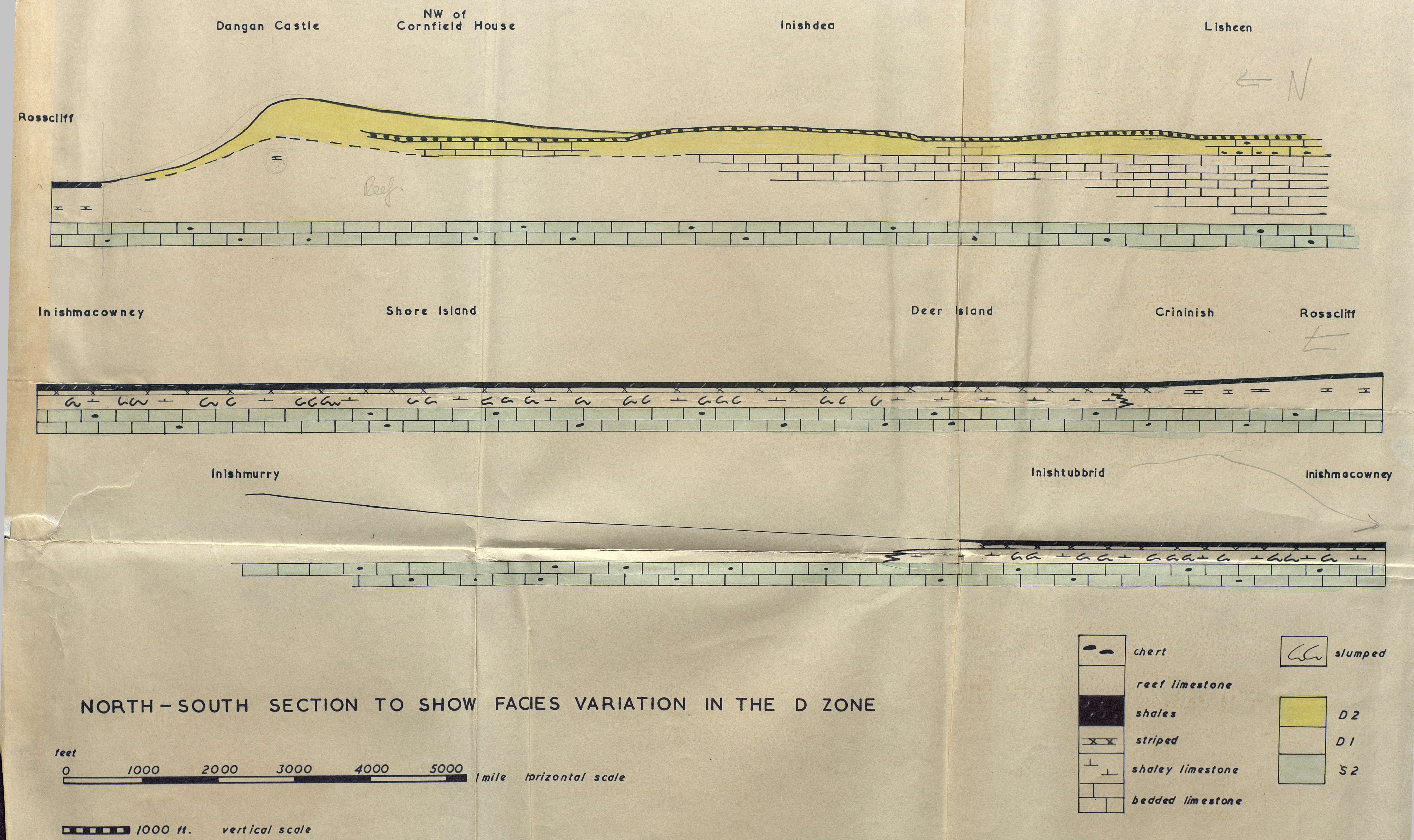


EF. 1

INISHTUBBRID - CANON ISLAND - INISHMACOWNEY - SHORE ISLAND - DEER ISLAND

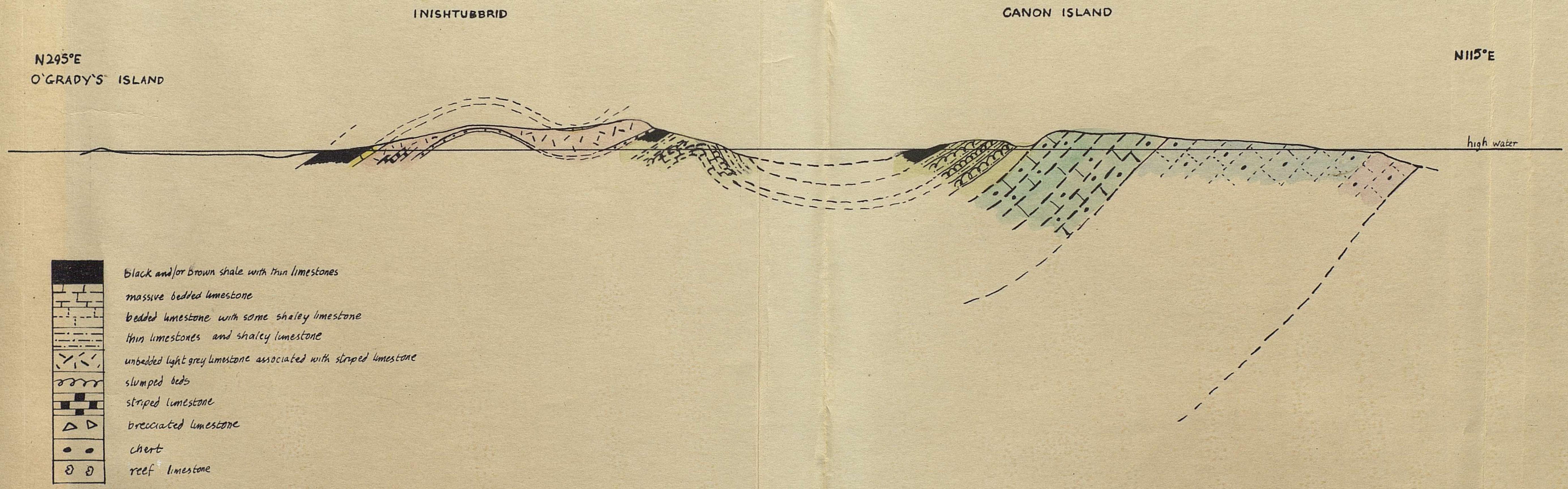


EF. 2



NORTH – SOUTH SECTION TO SHOW FACIES VARIATION IN THE D ZONE

EF. 3



SECTION - O'GRADYS IS. to CANON IS.

Scale as EF.5

EF. 4

SECTION – DOON ISLAND to BERGERS IS.

Legend as EF.4

EF.5

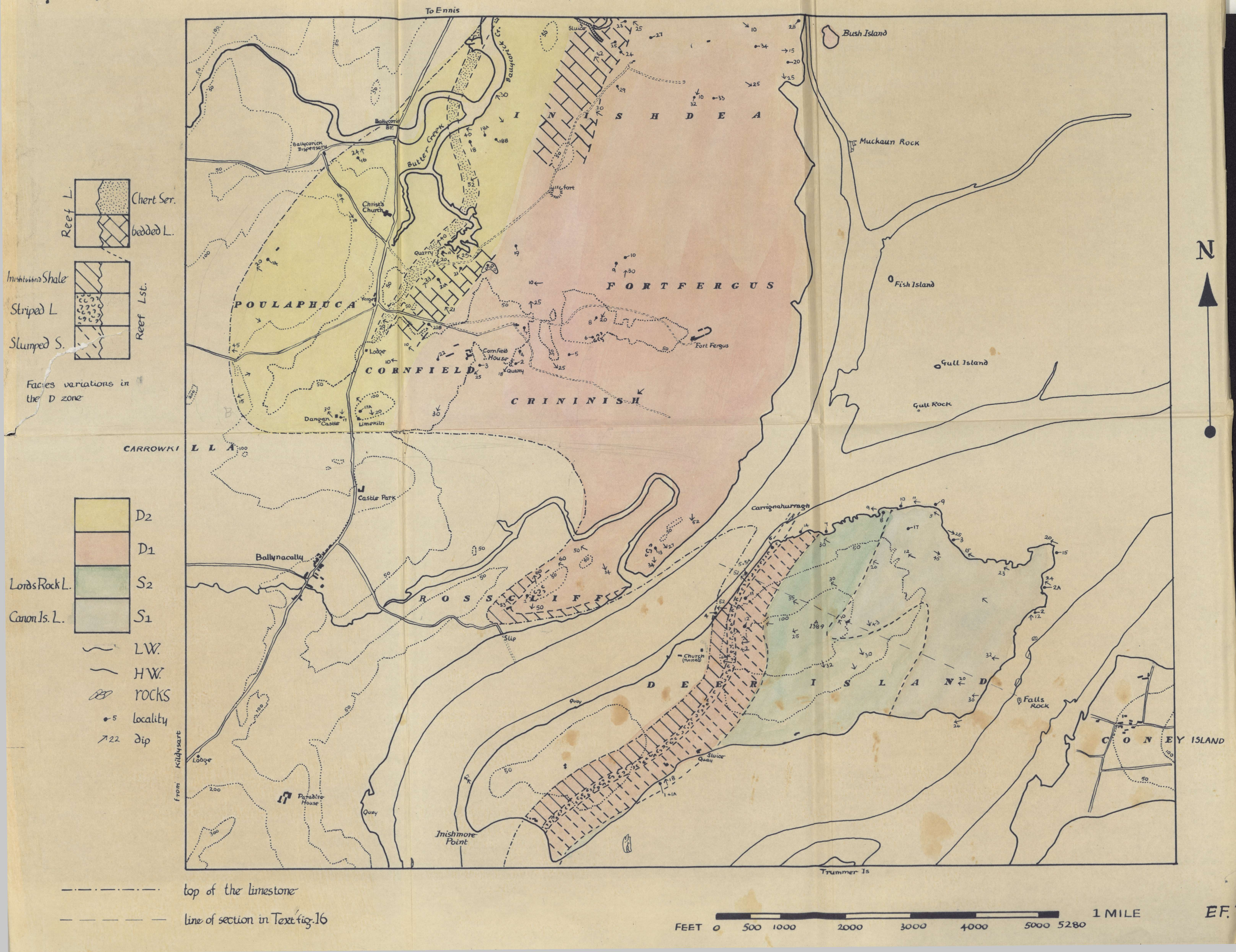
MAP·I · ISLANDS ·

Lines of sections in Text figs 15 & 16.

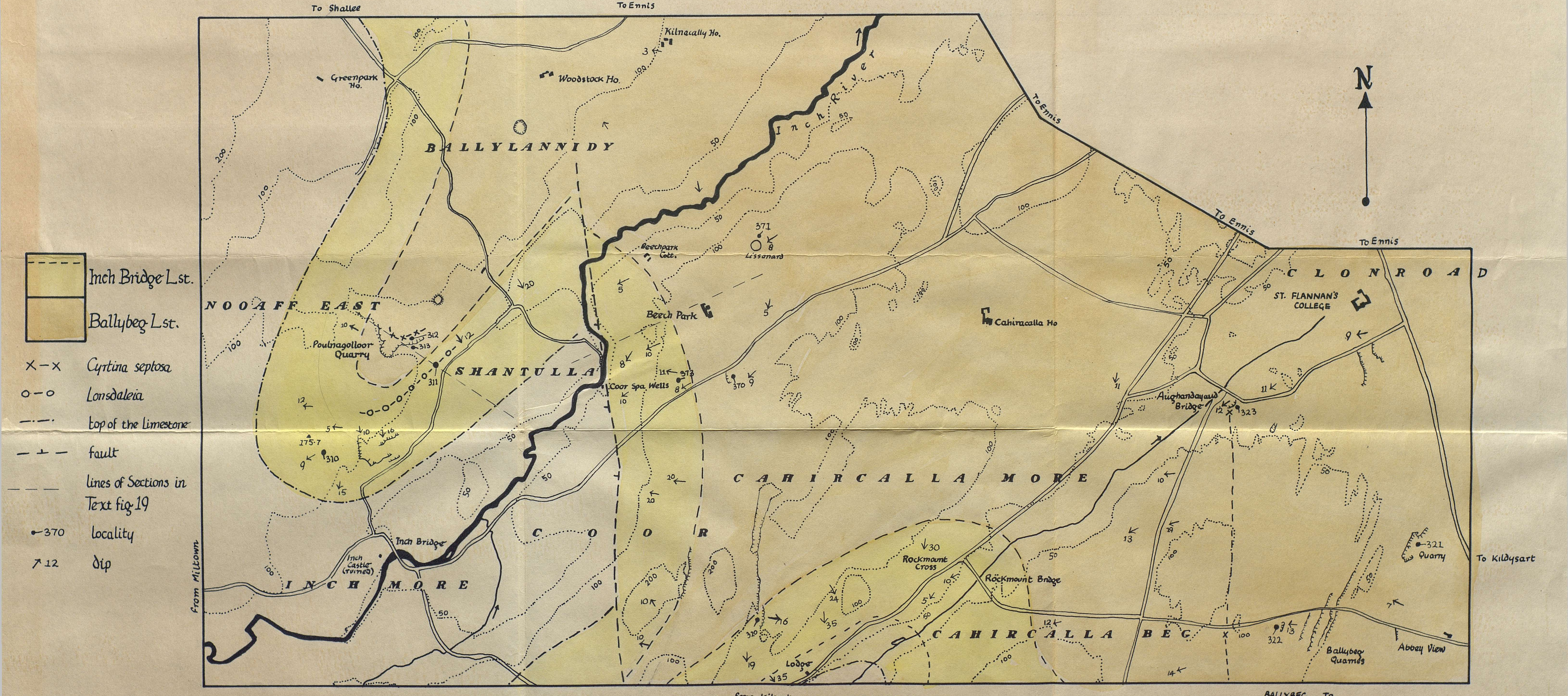
FEET 0 500 1000 2000 3000 4000 5000 5280 1 MILE

EF. 6

MAP II • BALLYNACALLY AREA



Map III · Inch ·



1 MILE

FEET 0 500 1000 2000 3000 4000 5000 5280

EF. 8

MAP IV • SHALLEE

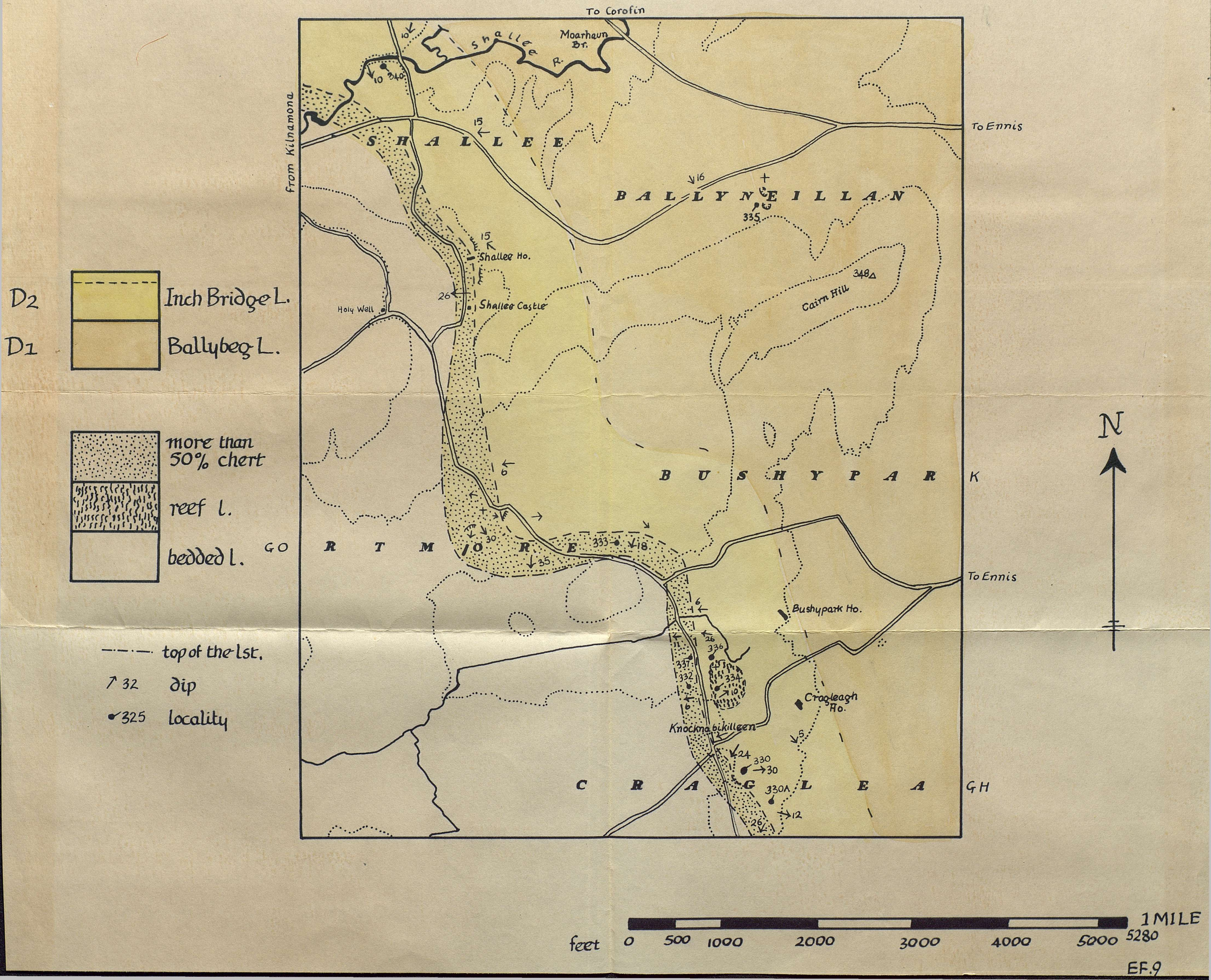
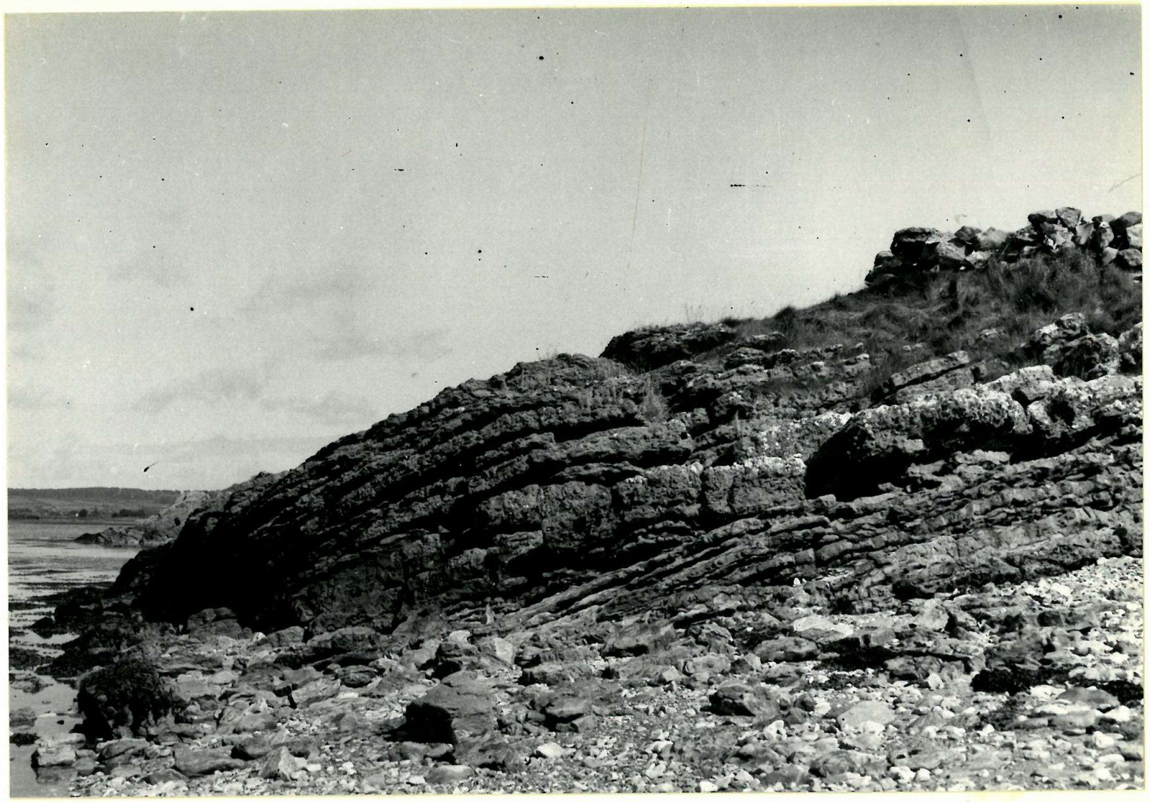
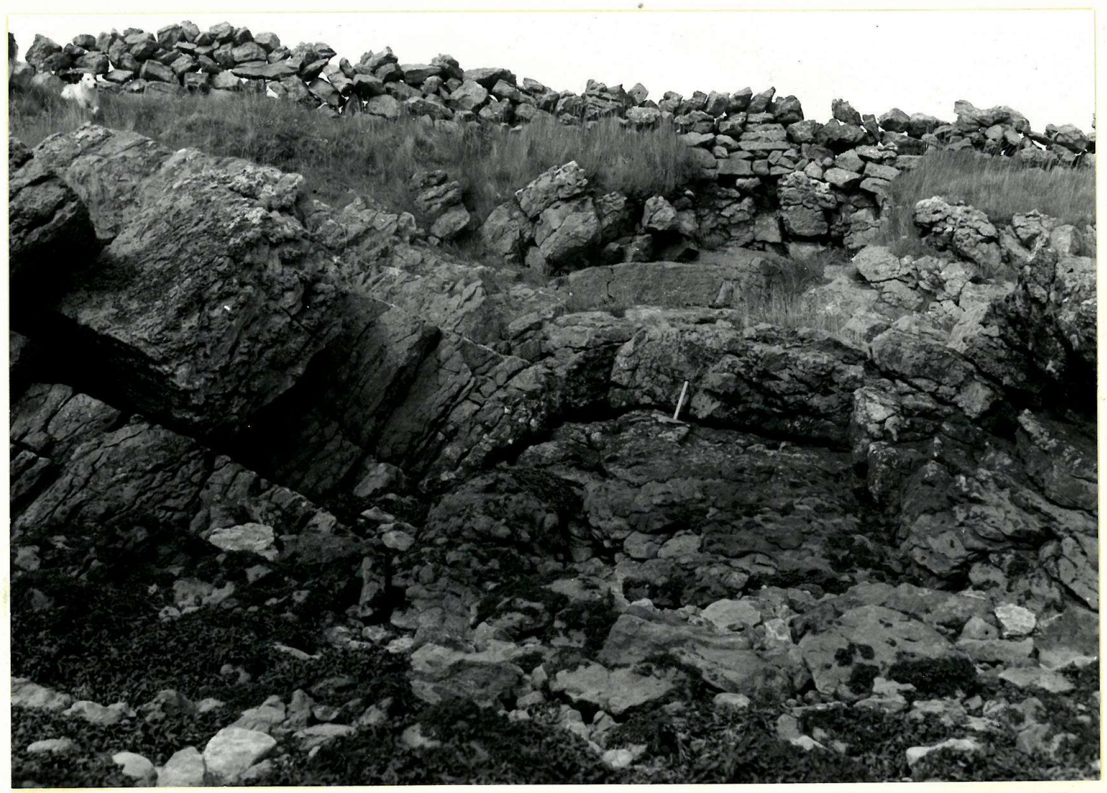


PLATE 1



1



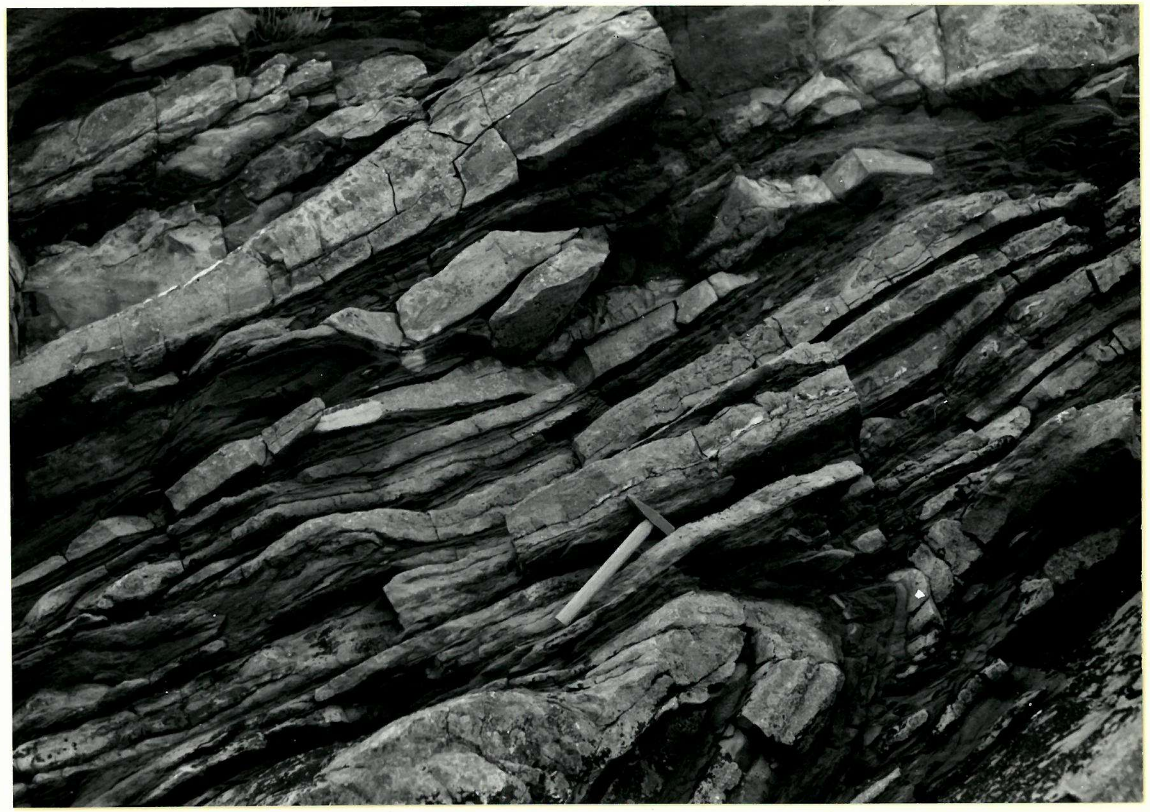
2

PLATE 2

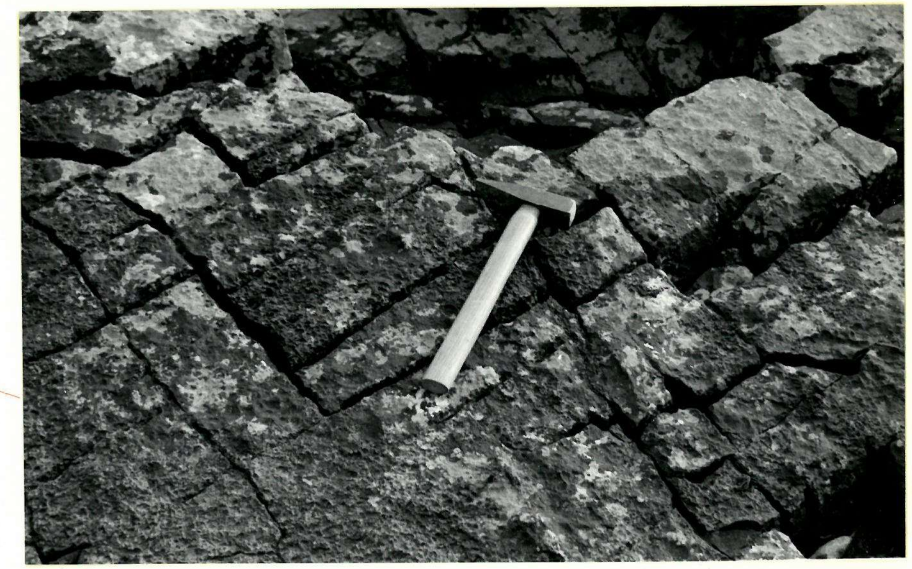
1

2

PLATE 3



1



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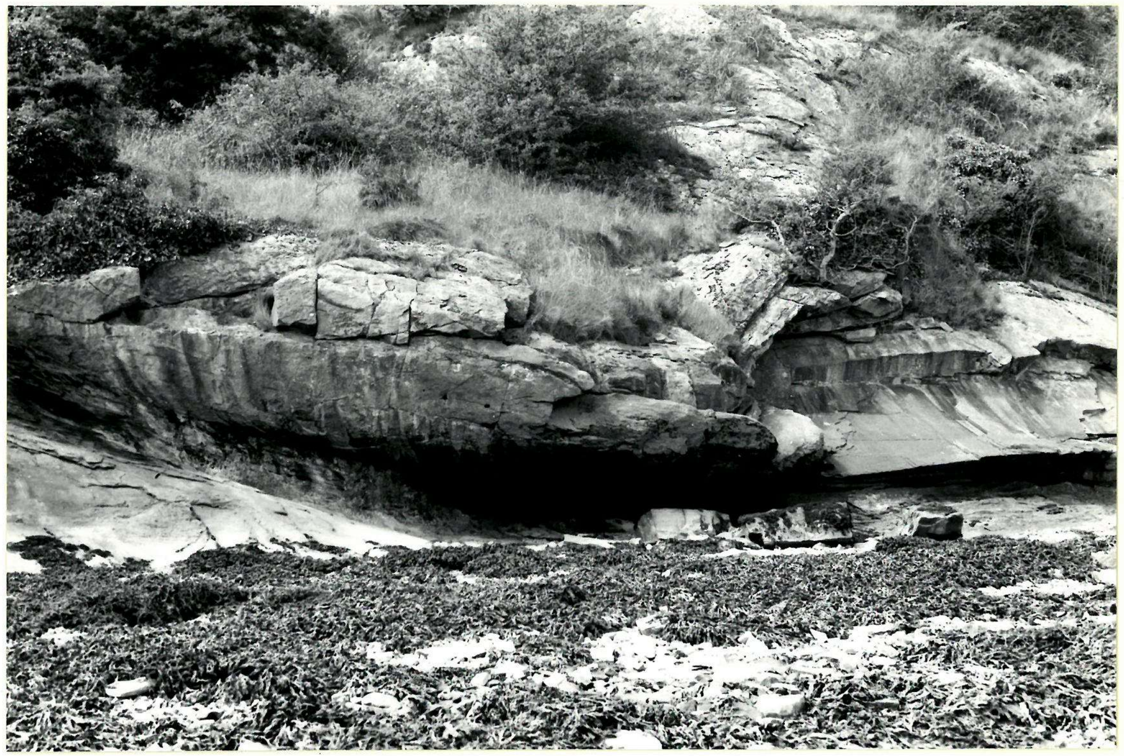

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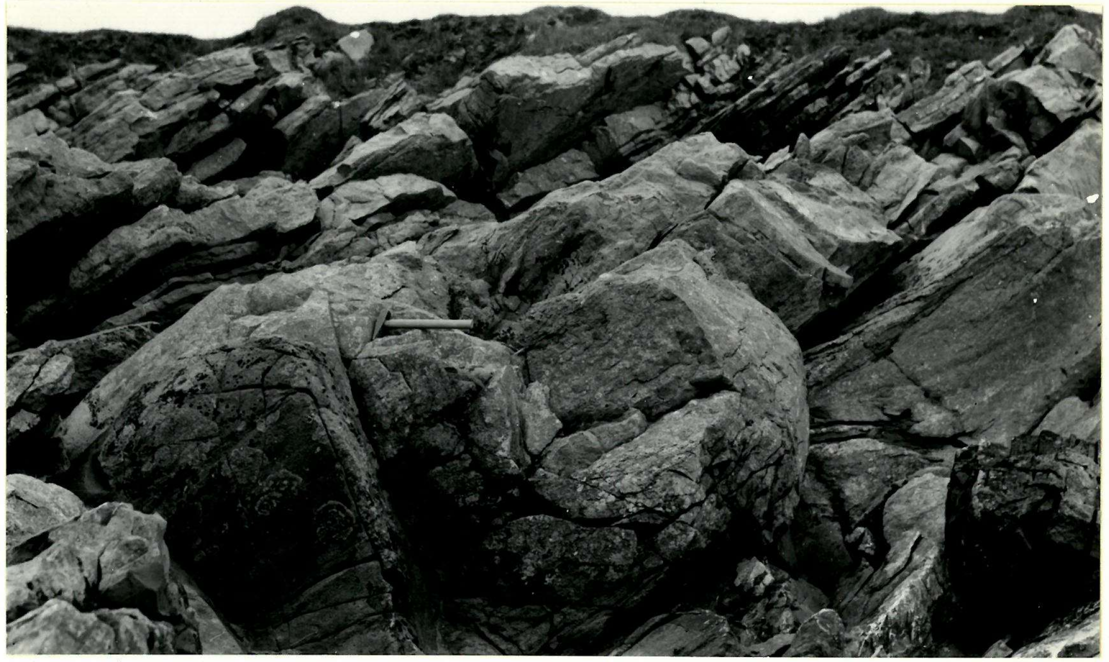

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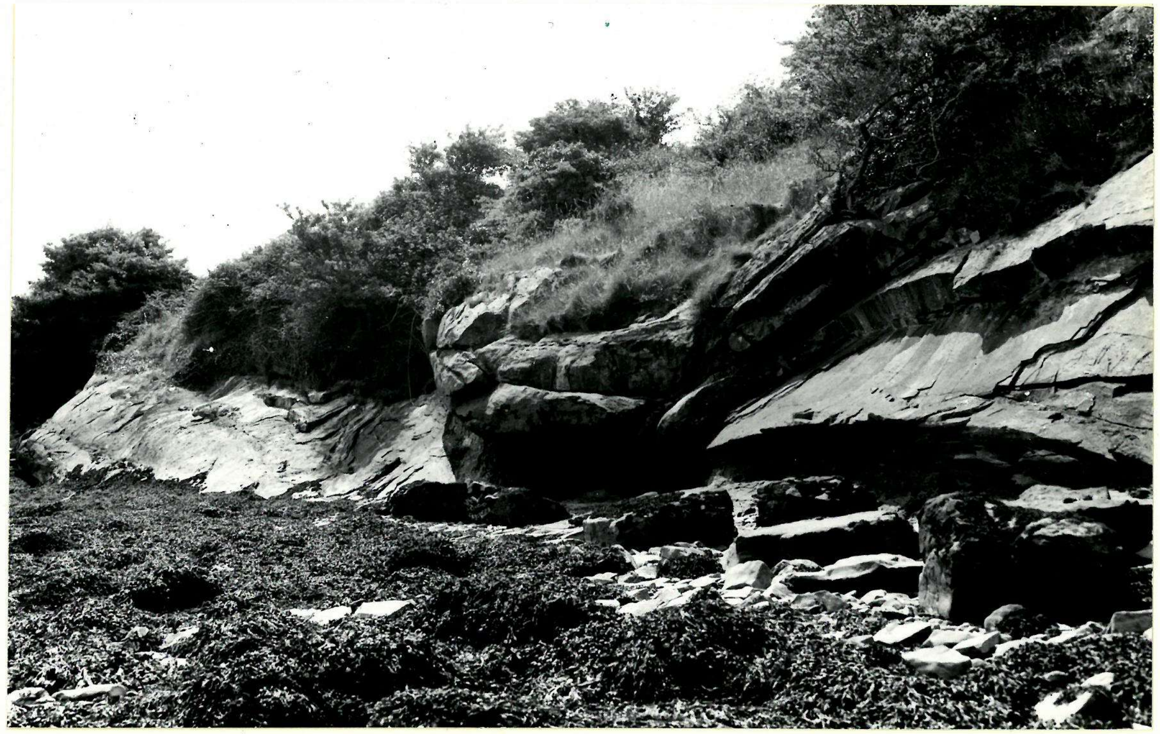

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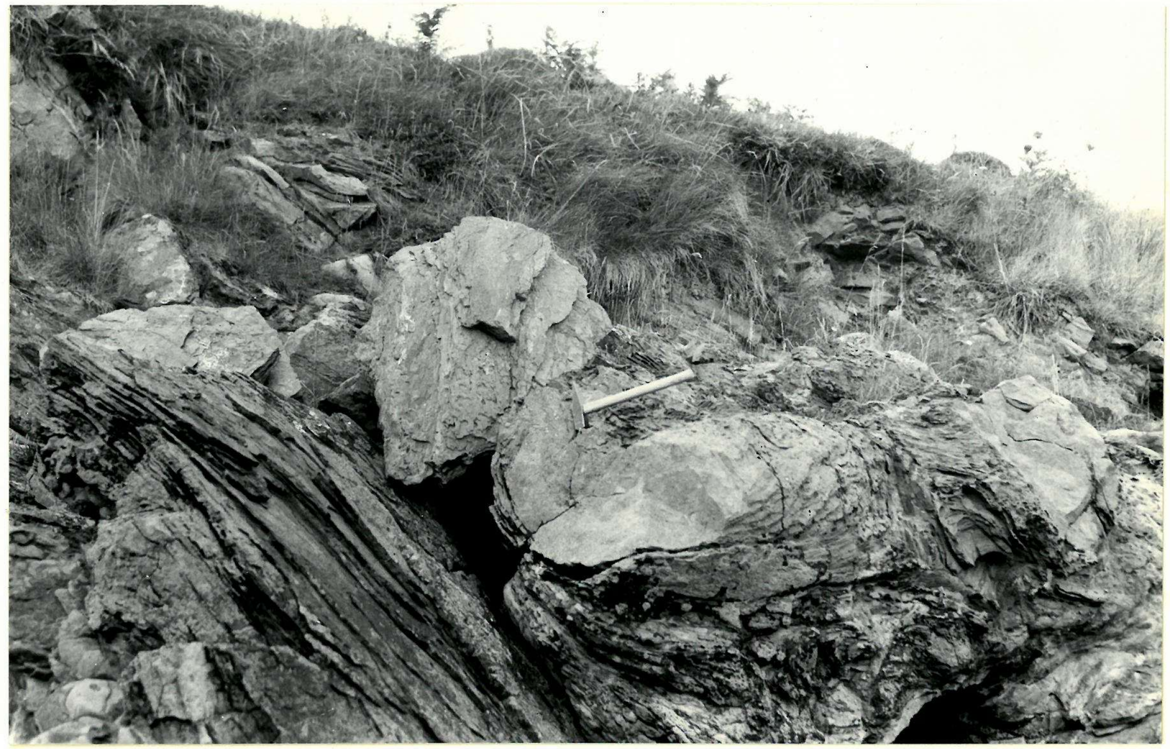

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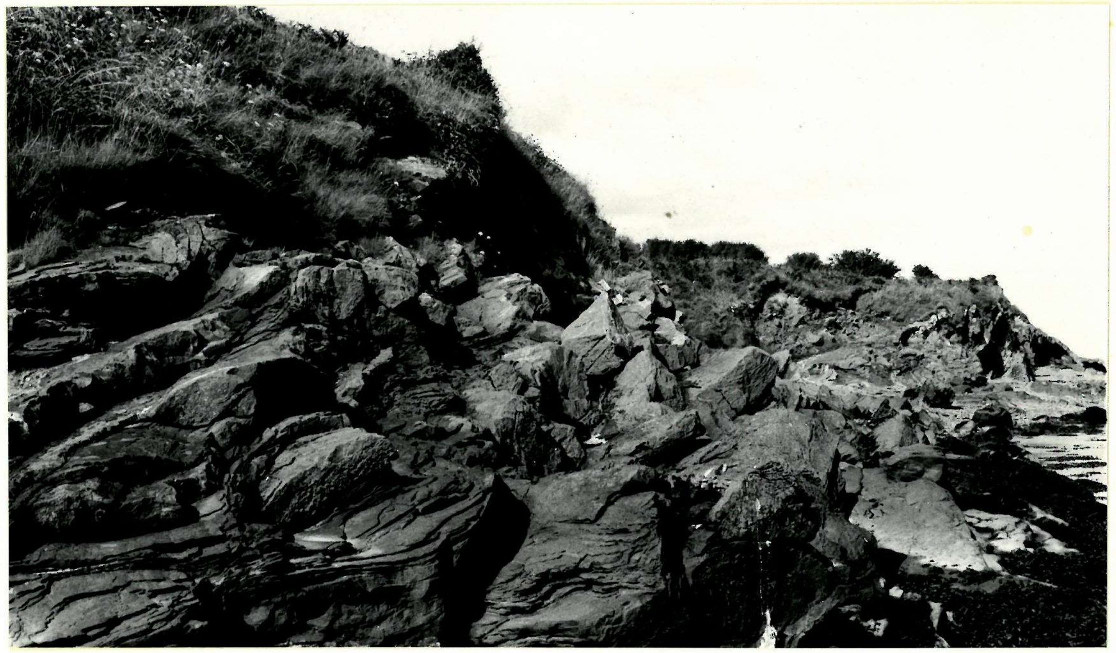

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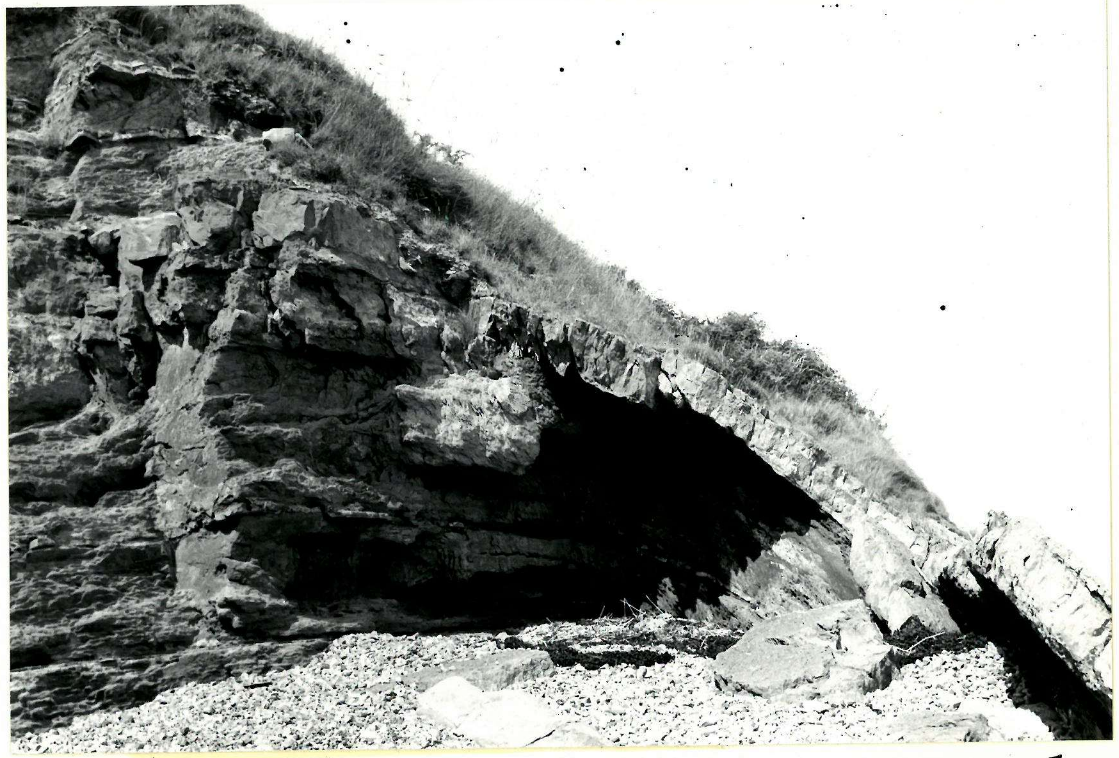

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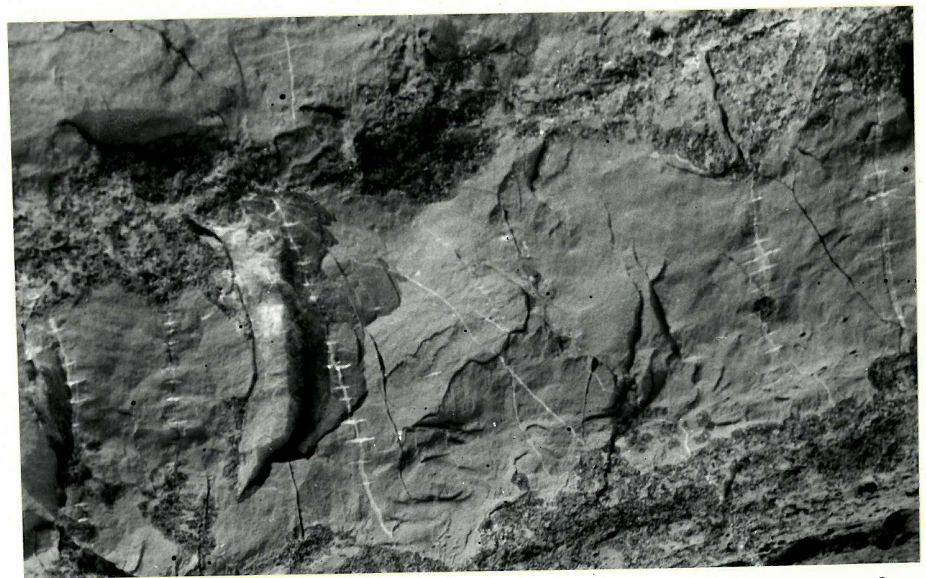

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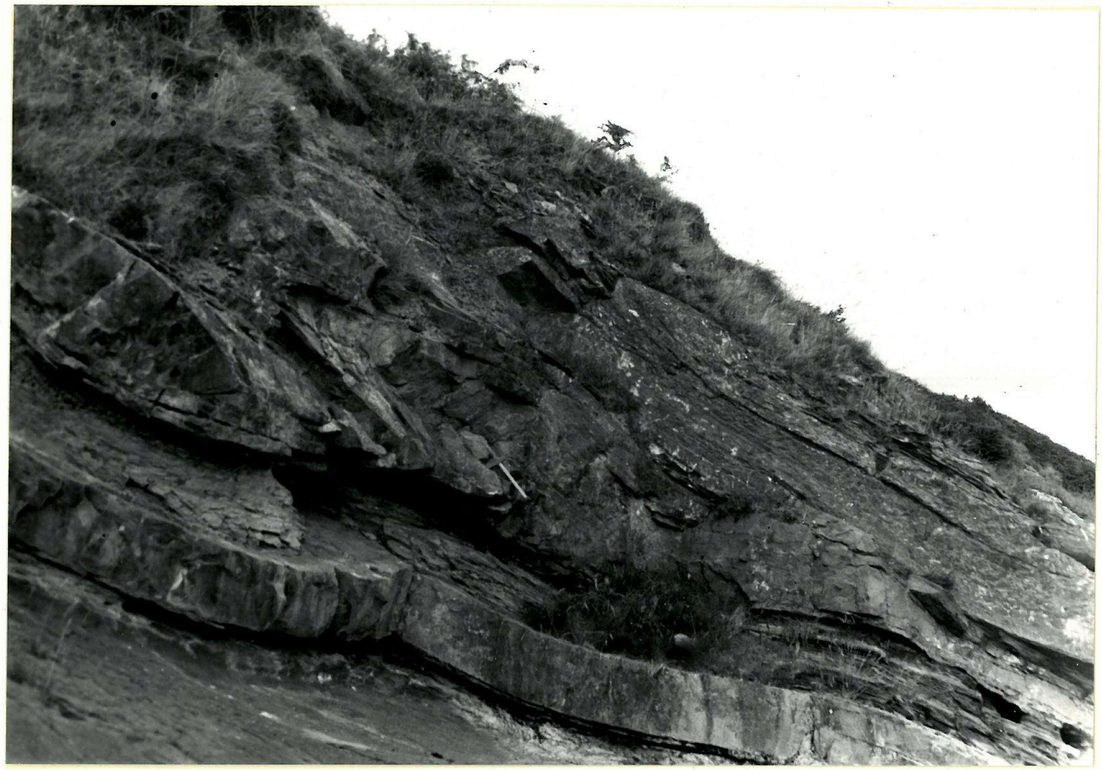

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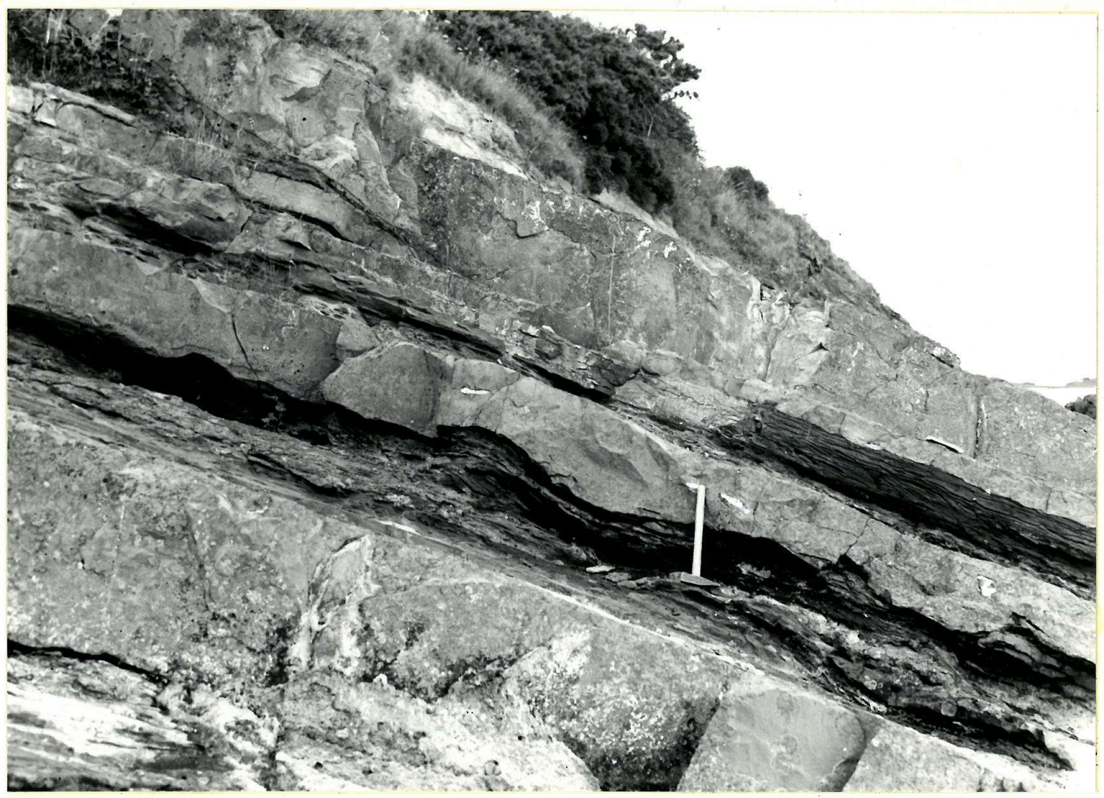

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PLATE 9

1

2

PLATE 10

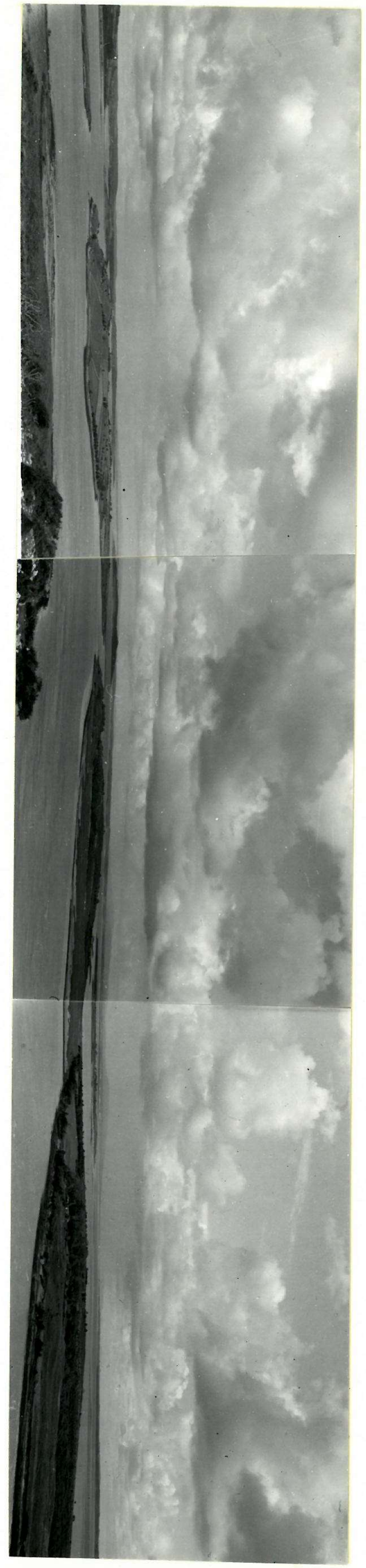

PLATE 11

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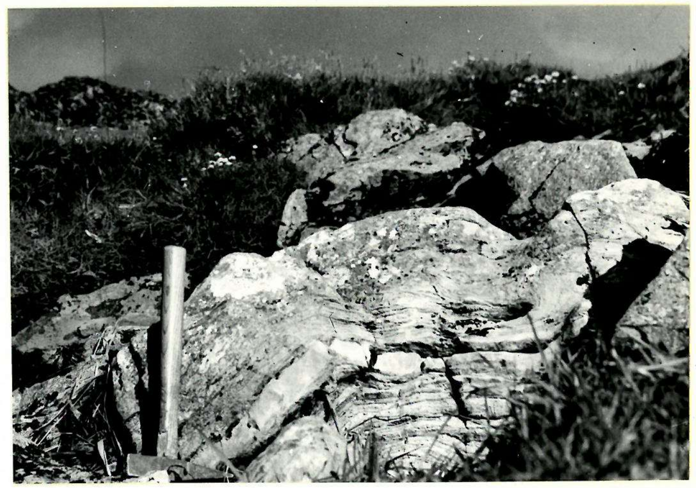

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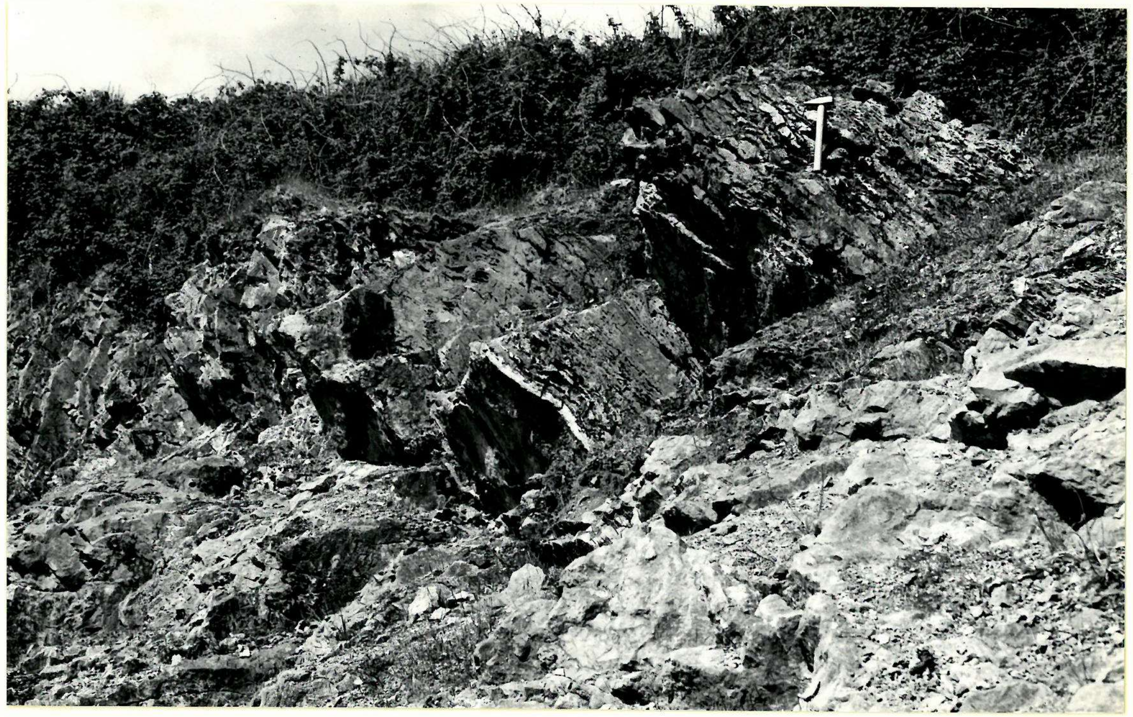

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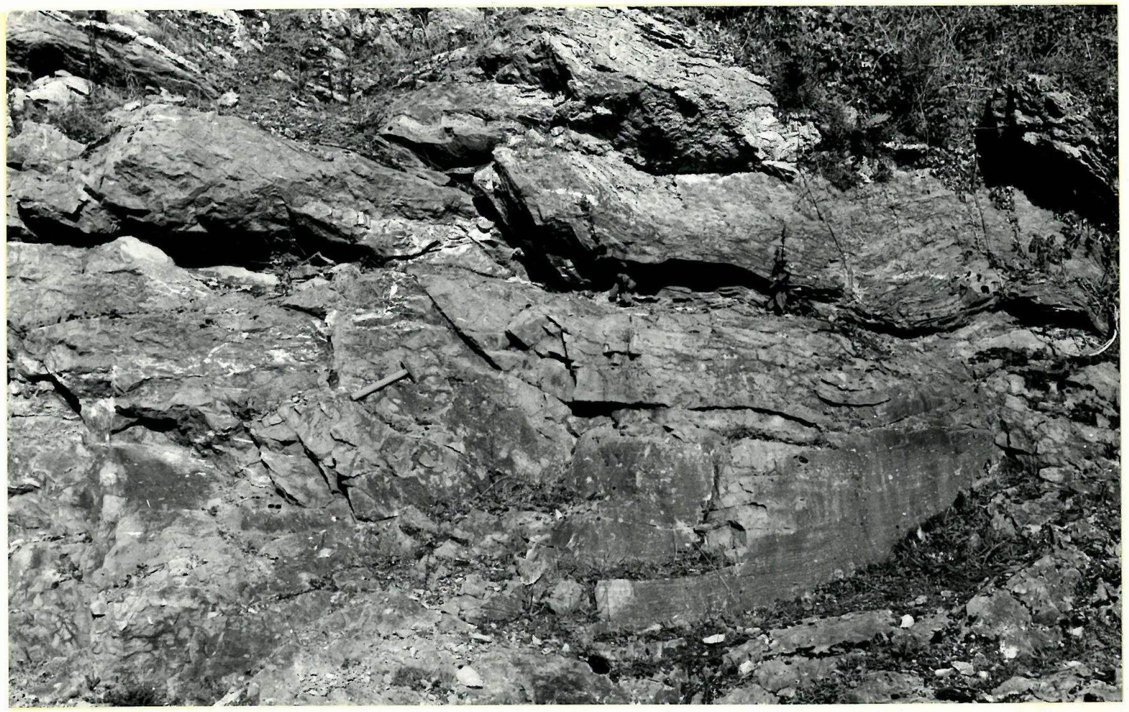

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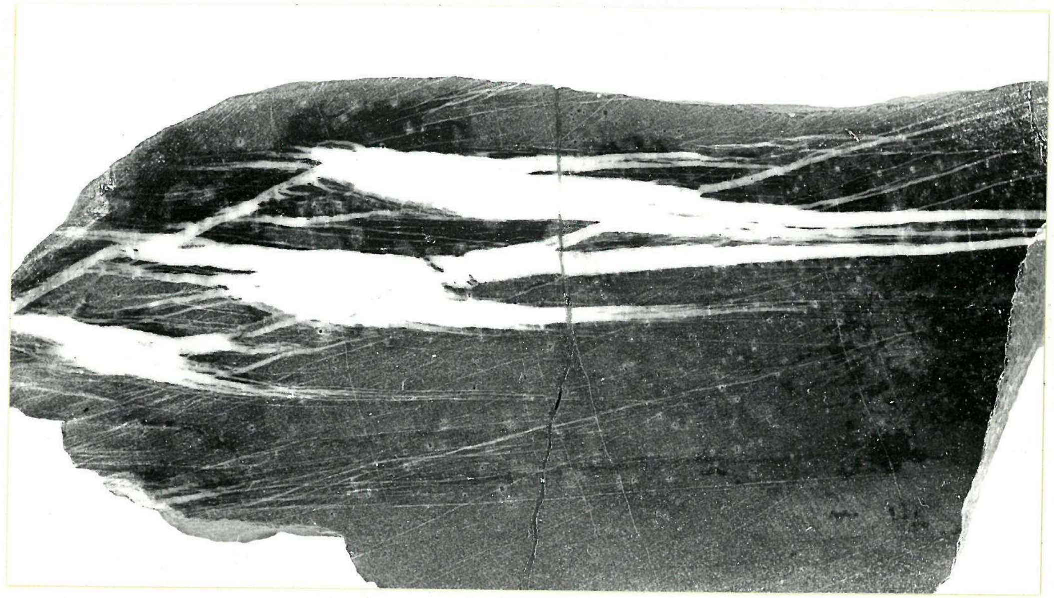
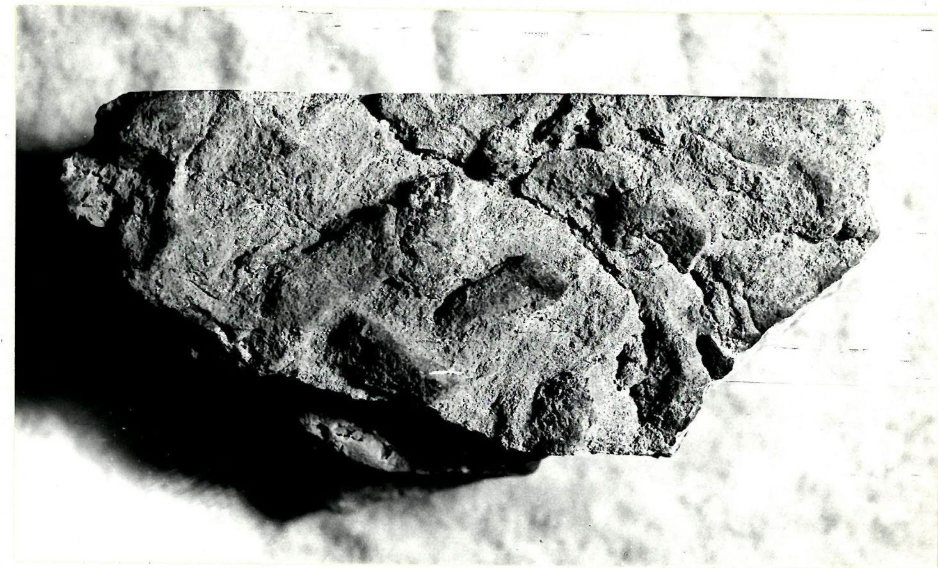


1 cm.

1

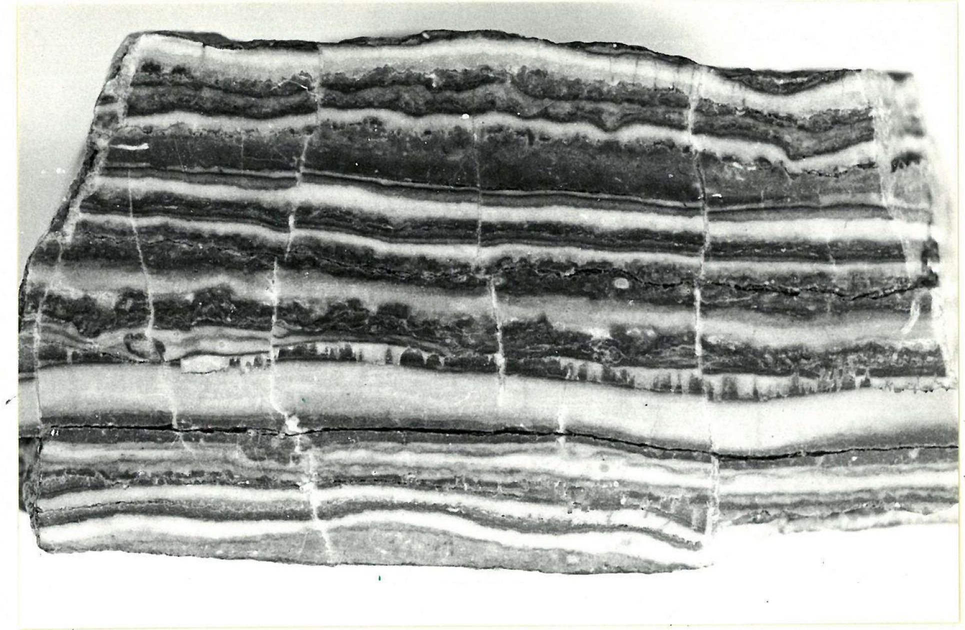


1 Cm.

2.

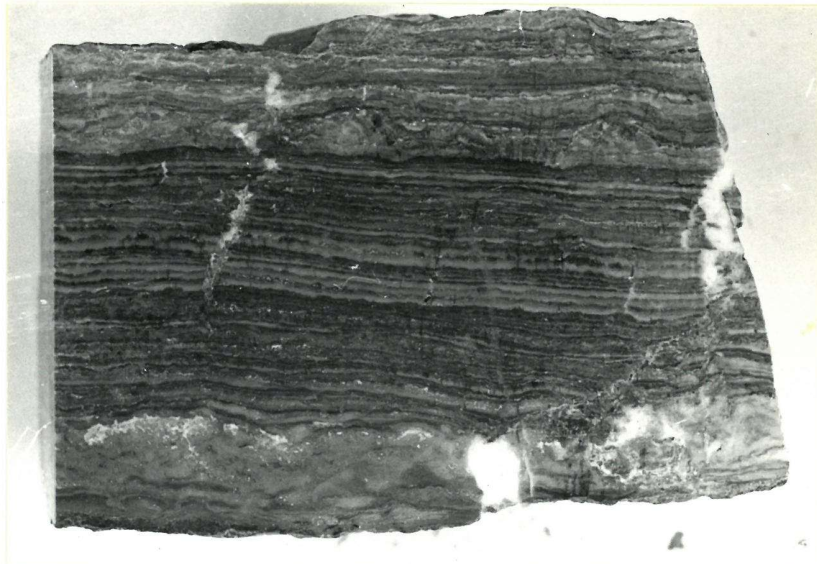
PLATE 14

PLATE 15.



1 cm.

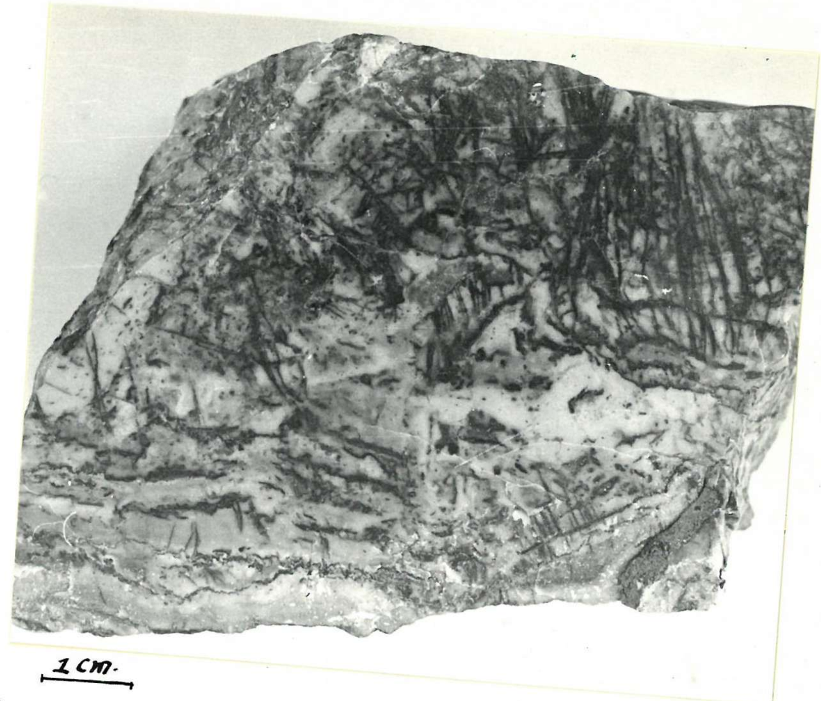
1.



1 cm.

2.

PLATE 16.



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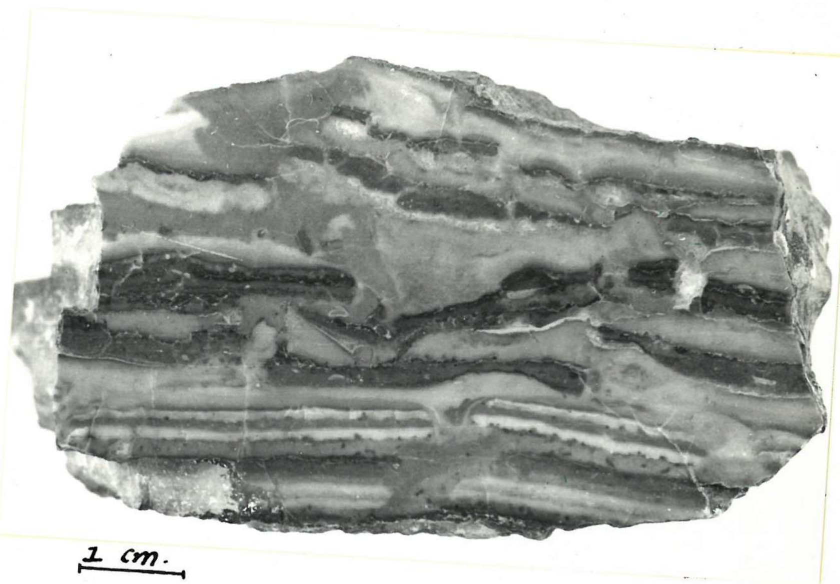

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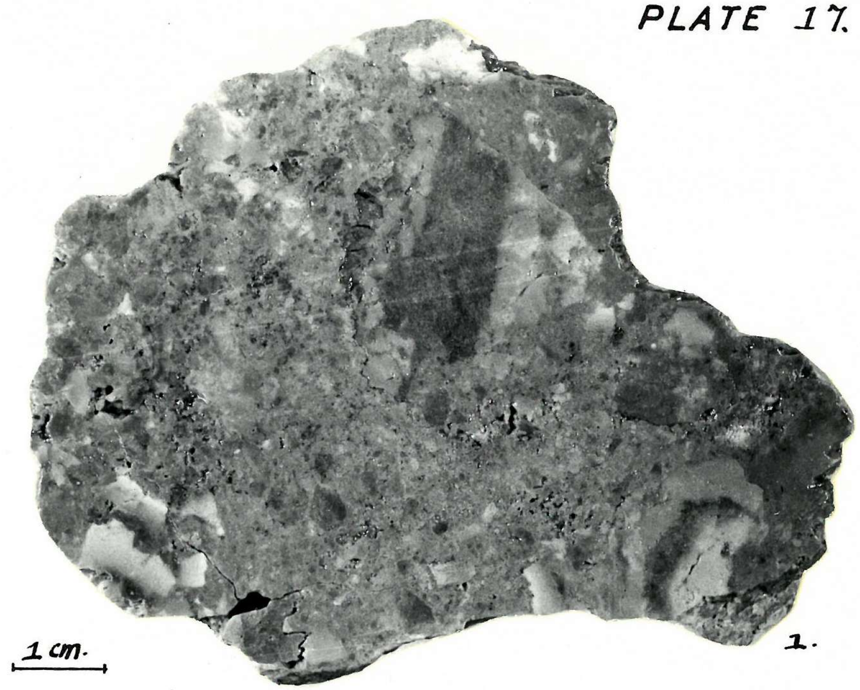
PLATE 17.



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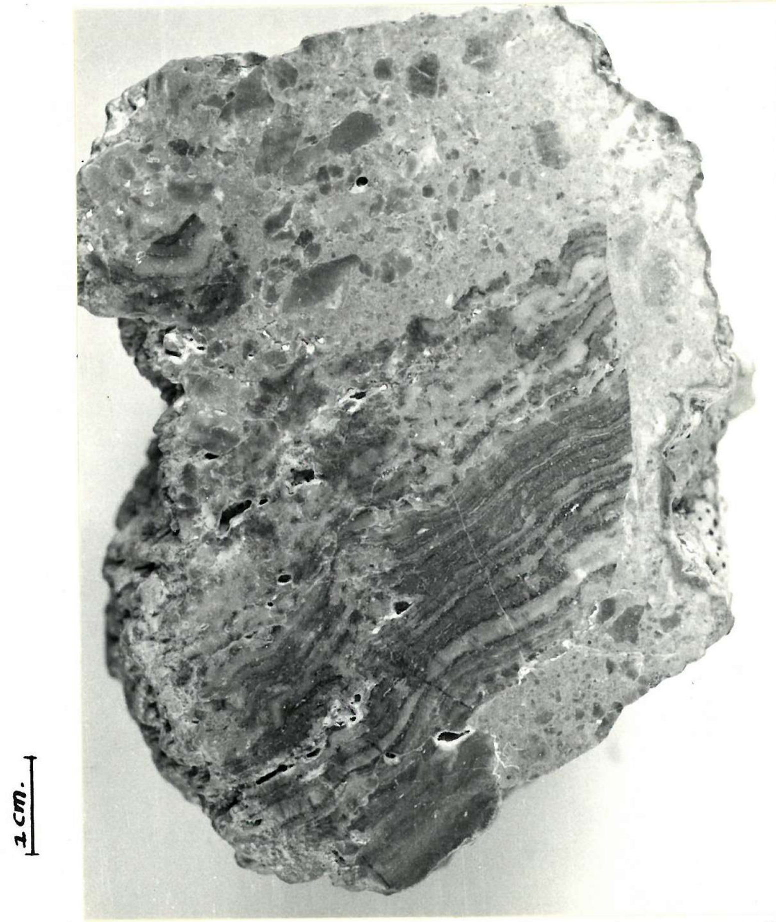

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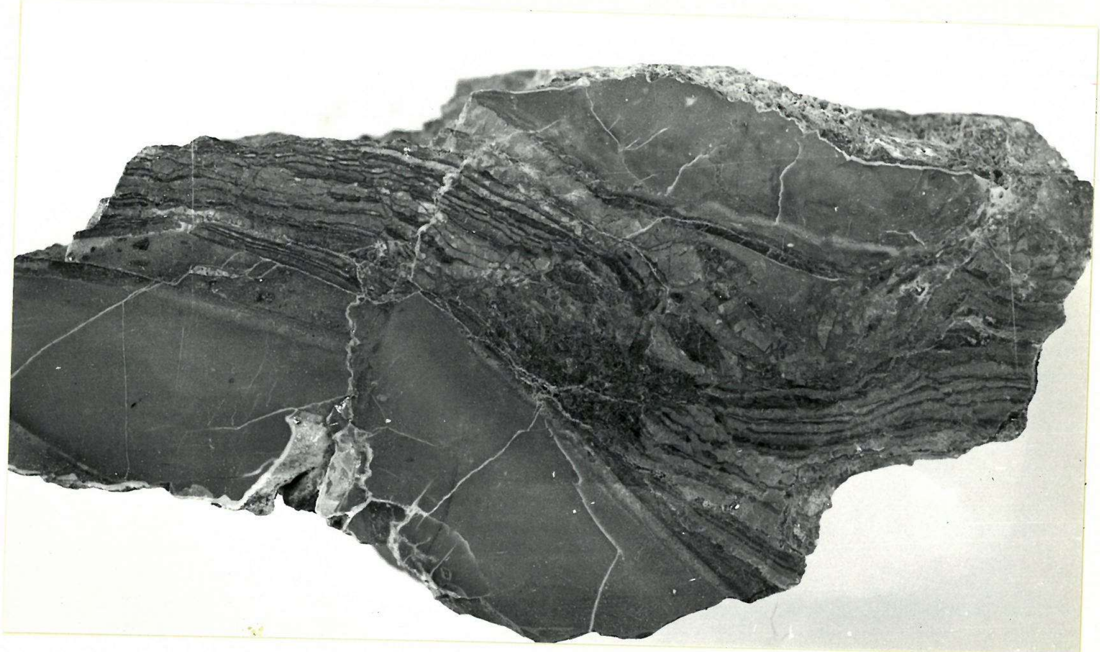


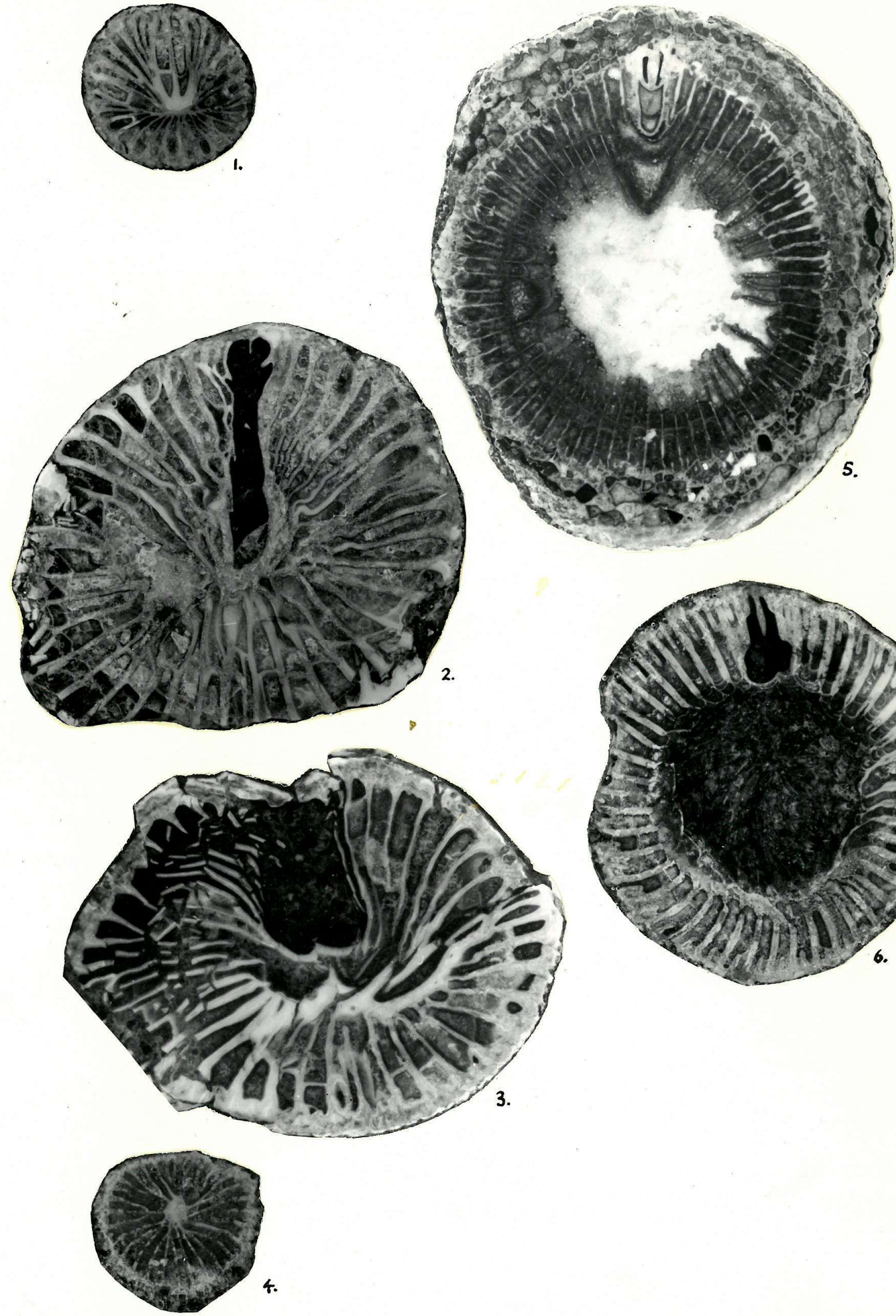
1 cm.

1

1cm.

2.

PLATE. 19.



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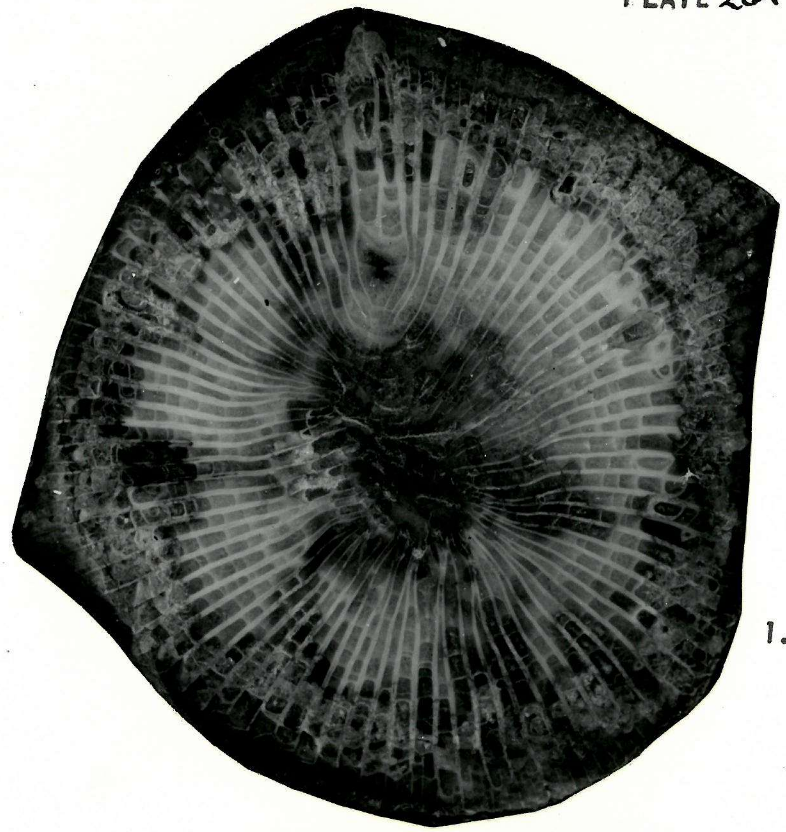

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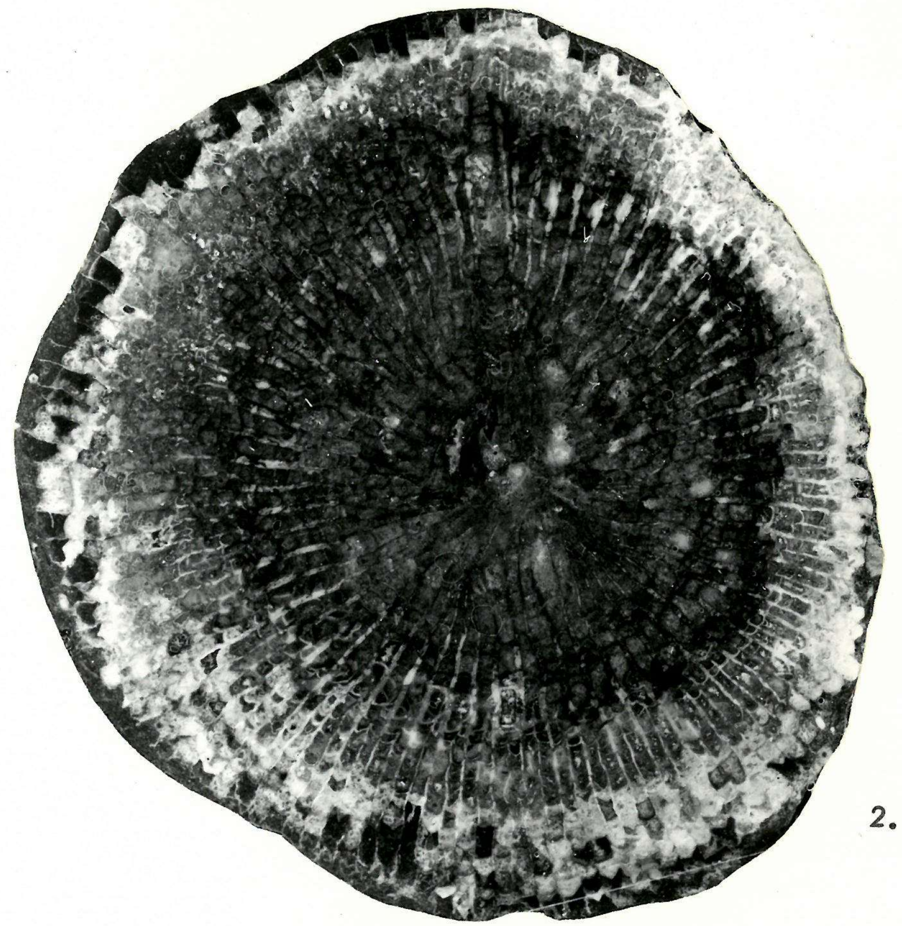
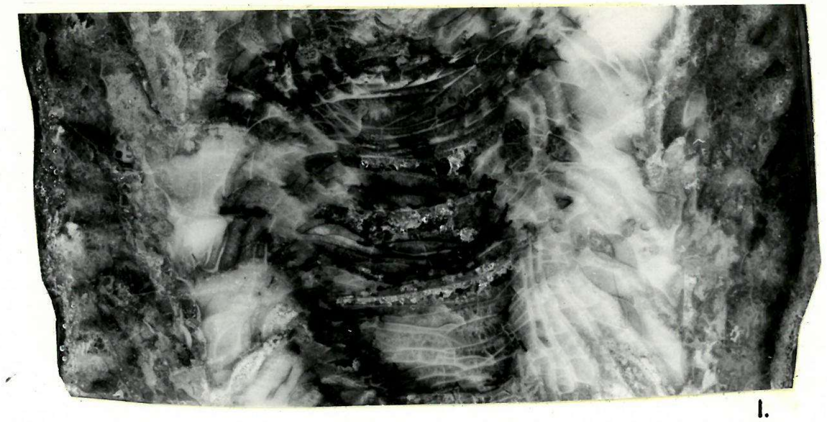


2.

PLATE 21



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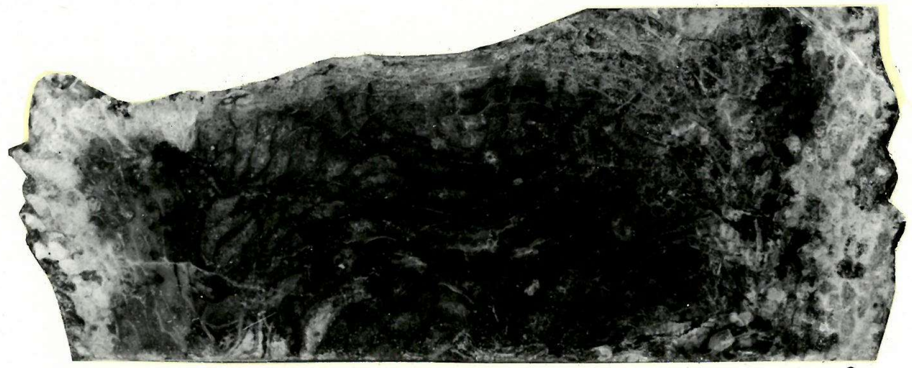

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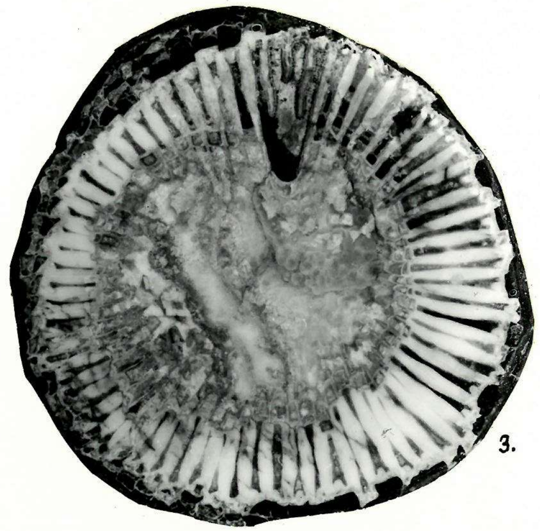

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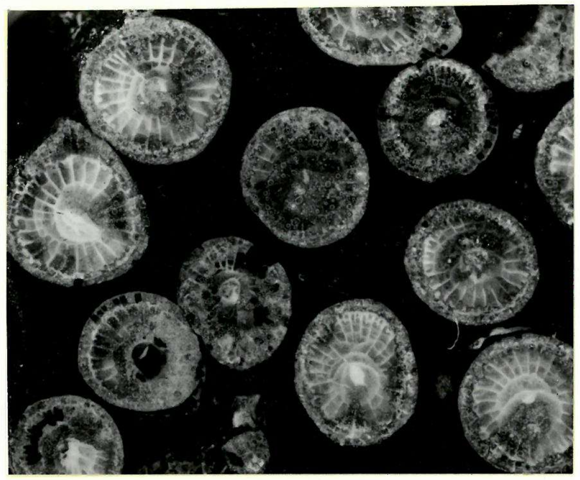

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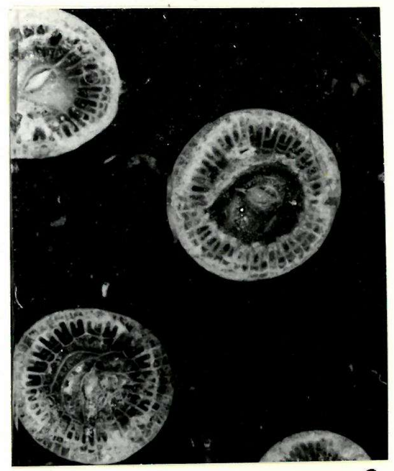
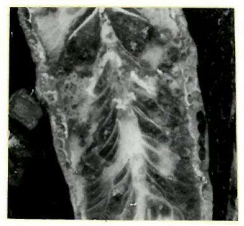


2.

1a.



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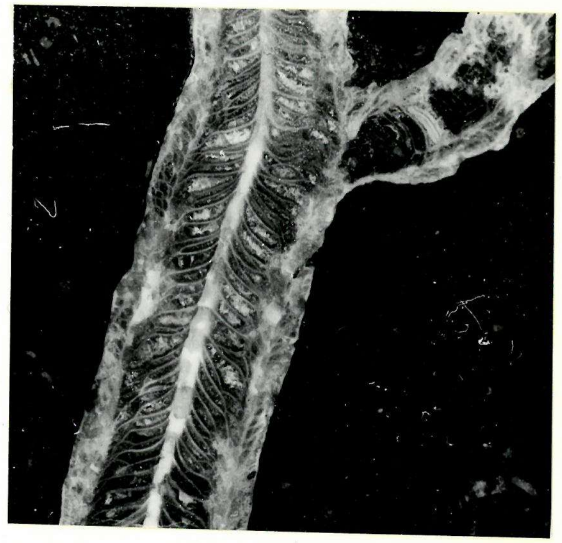
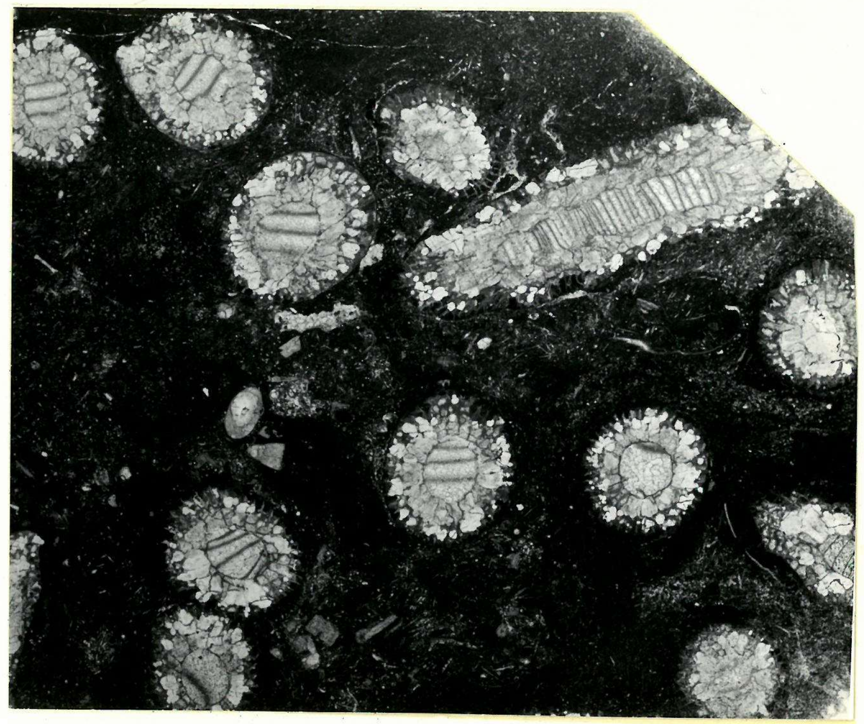


2a.

PLATE 23.



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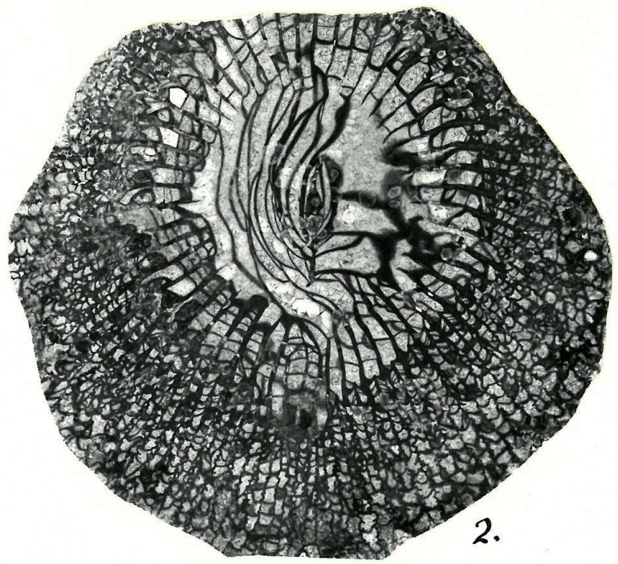
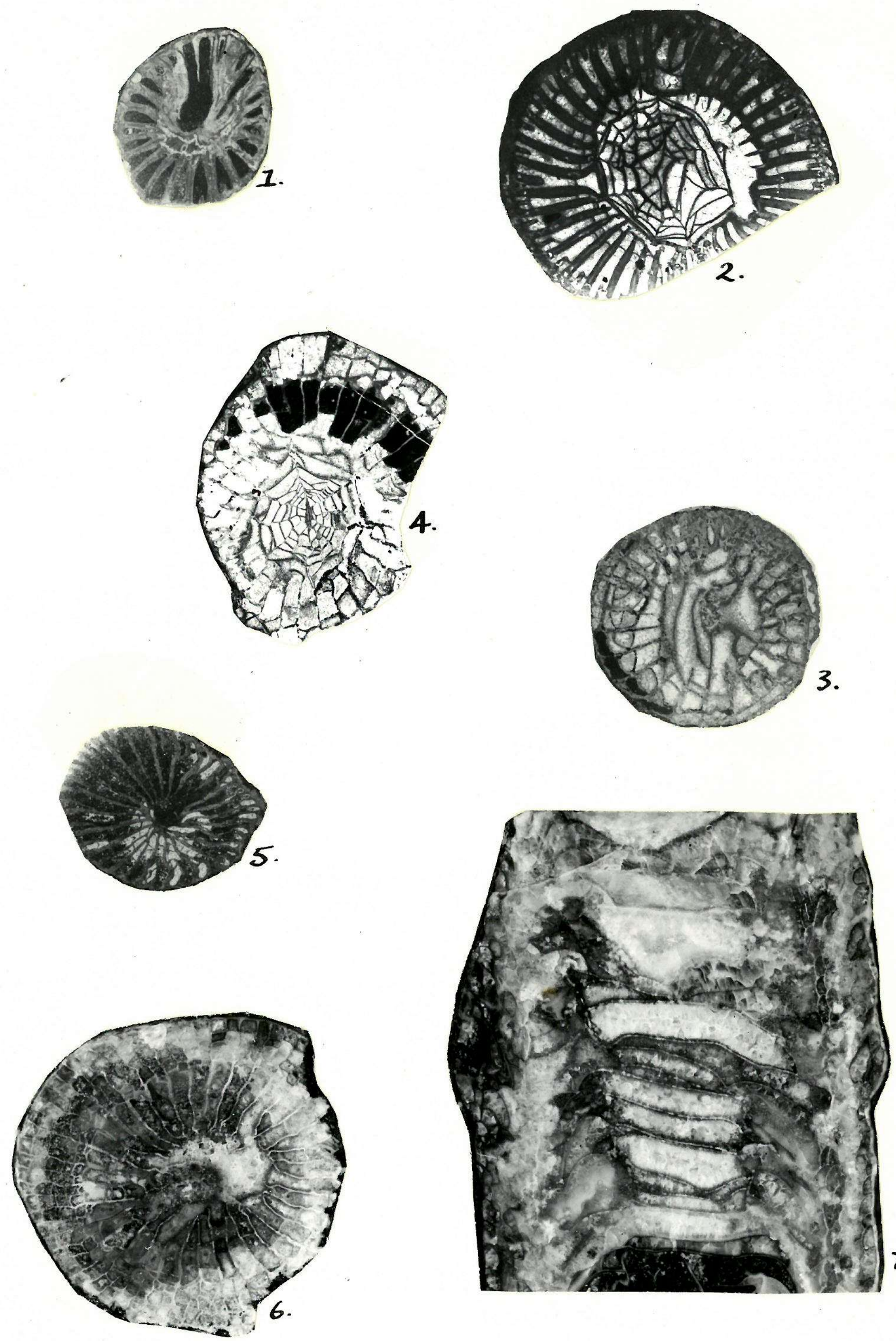


2.

PLATE 24



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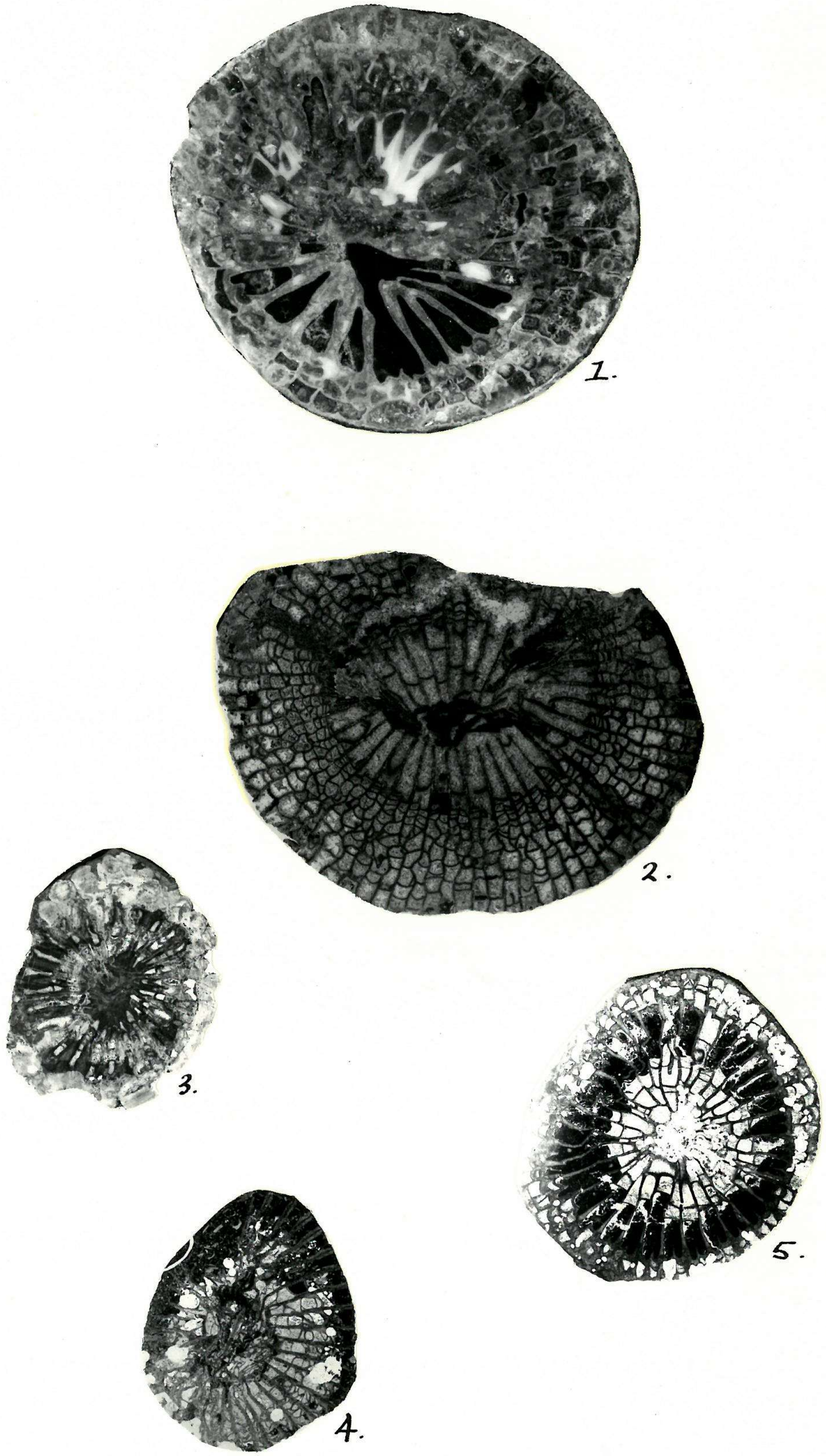

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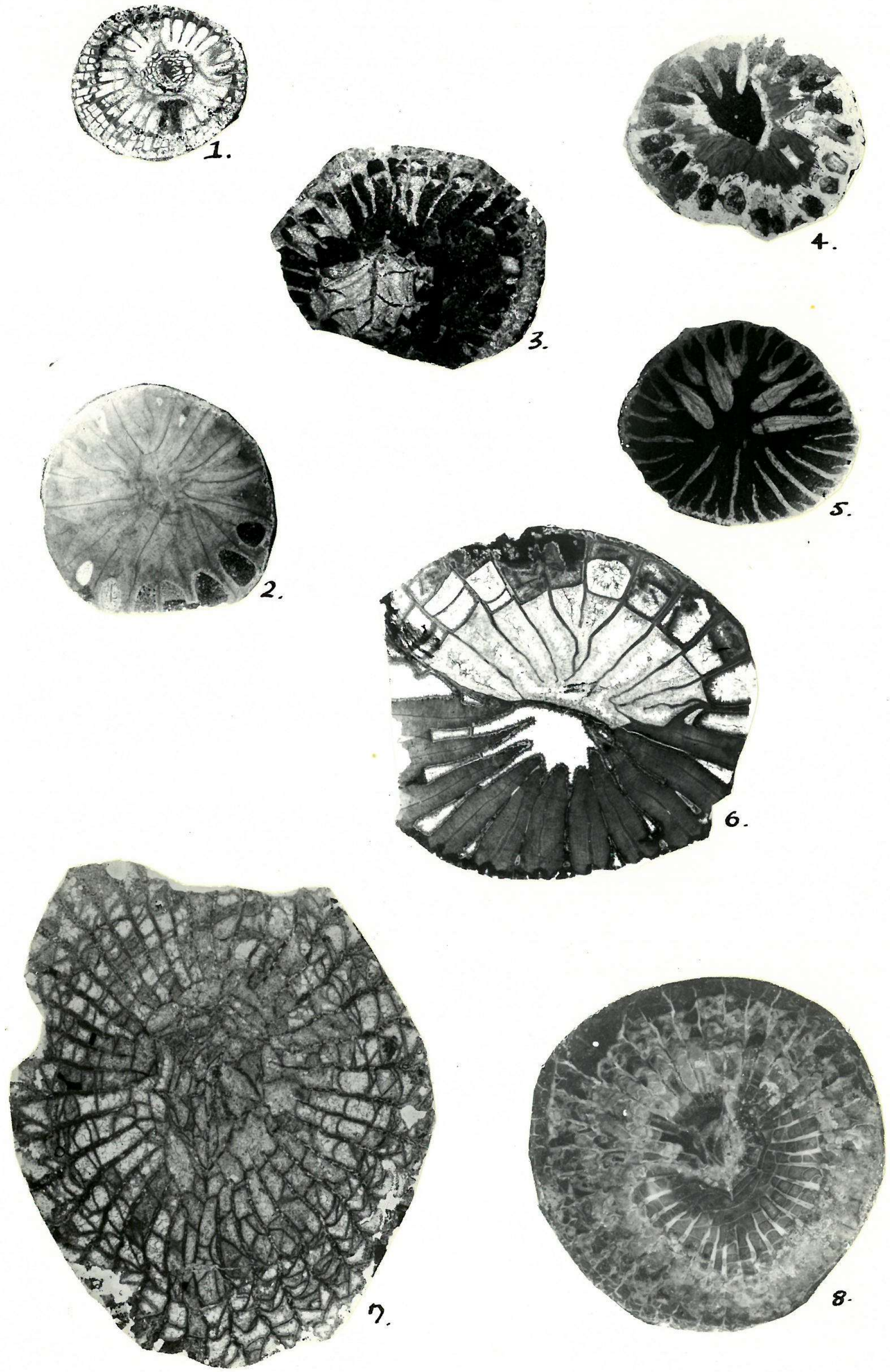

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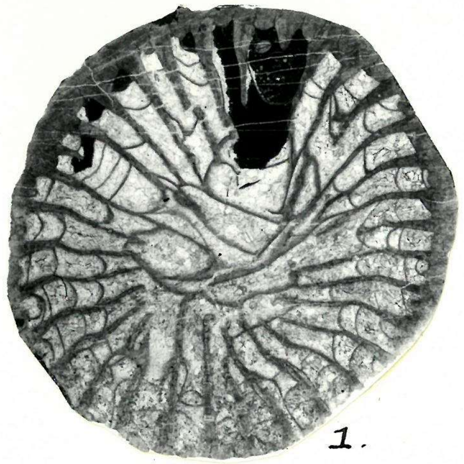

1.

2a.

2b.

3.

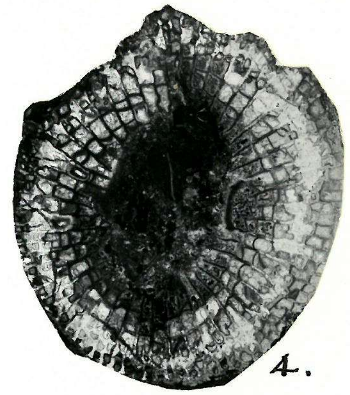

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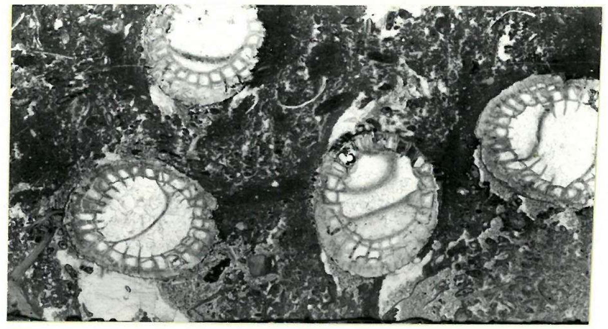
PLATE 28.



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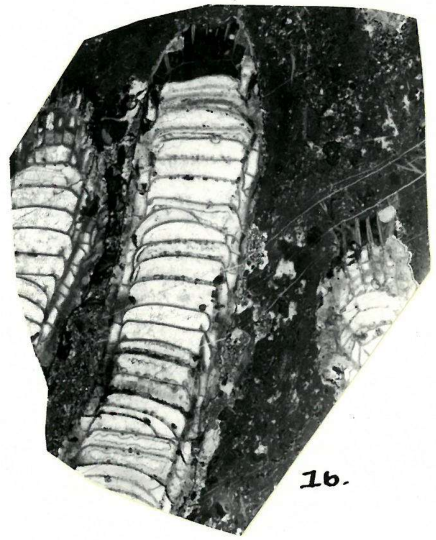

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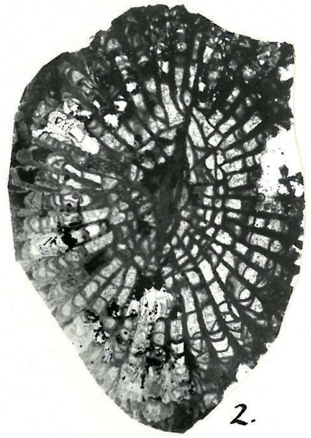

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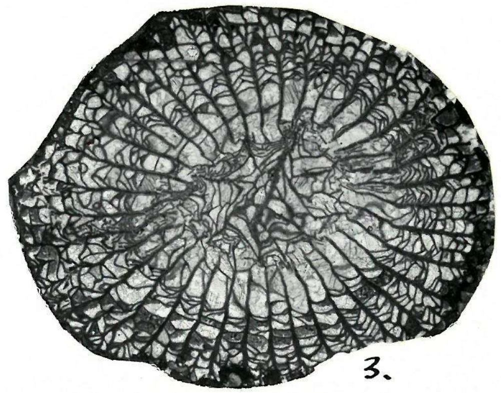
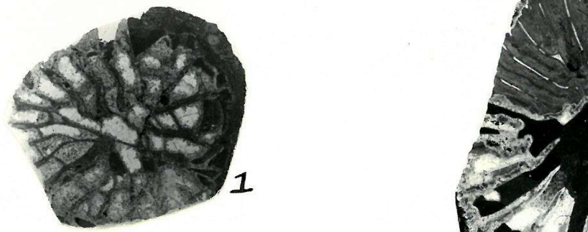


3.

PLATE 29.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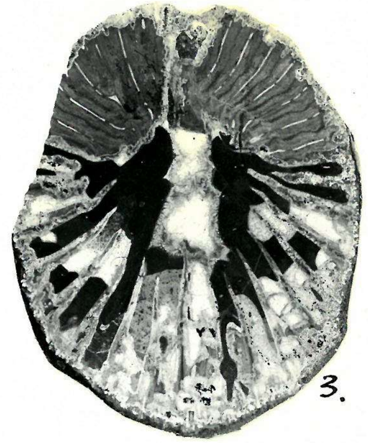
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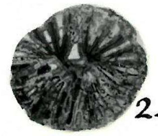
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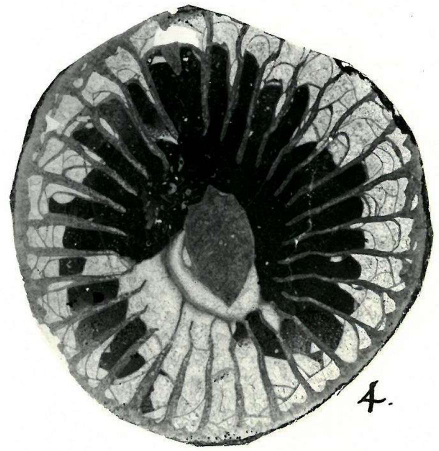
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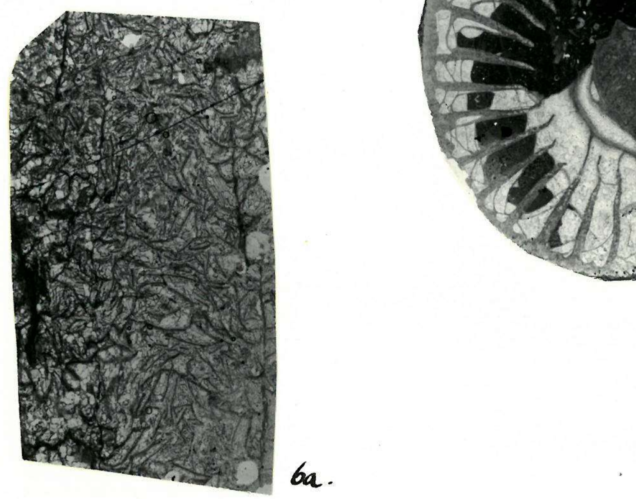

6a.


5.

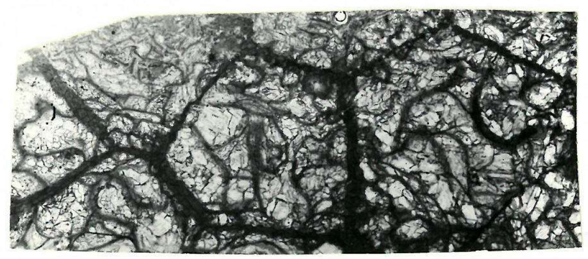
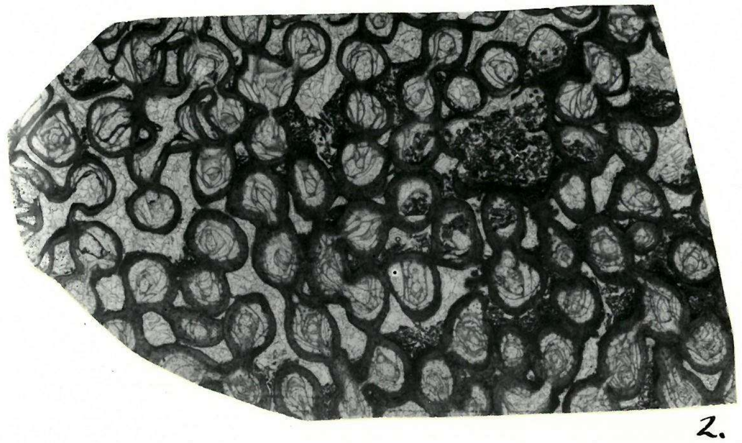

6b.

PLATE 30.

1



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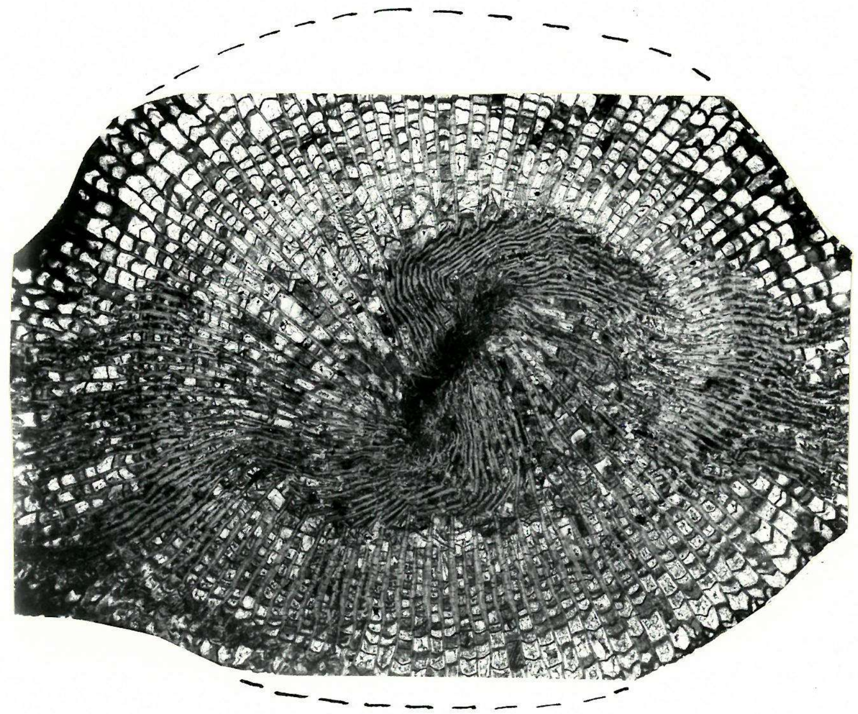
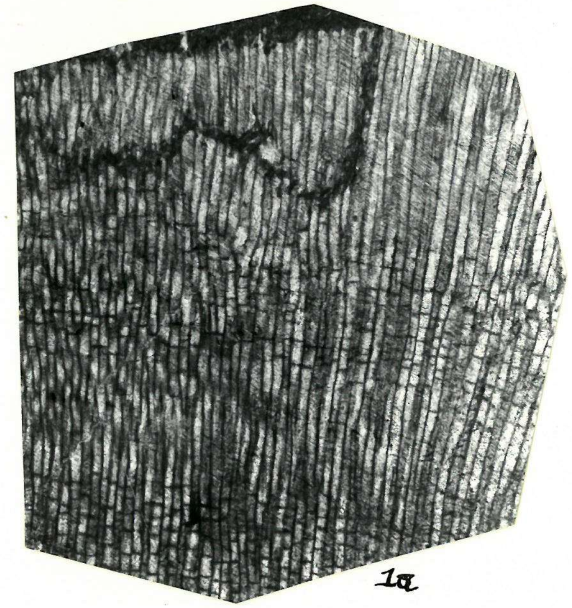


PLATE 31.



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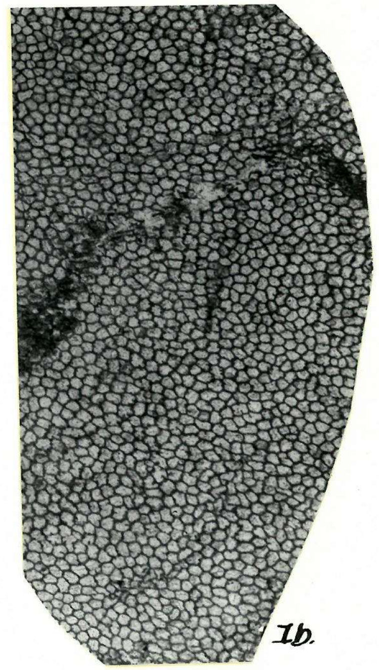

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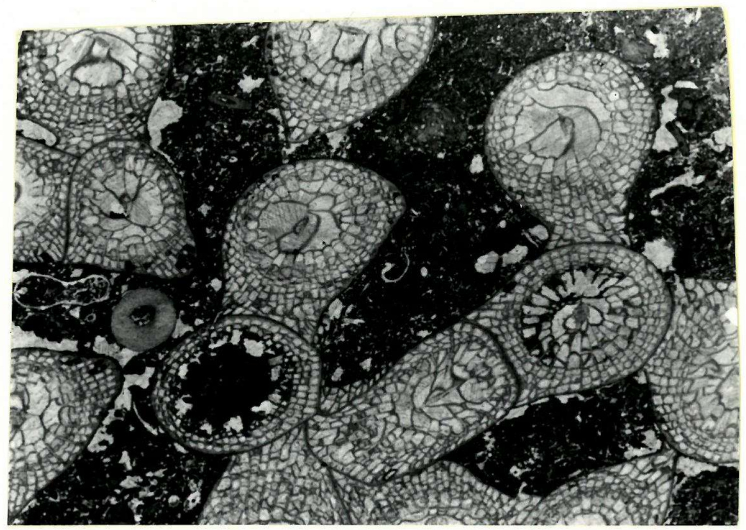
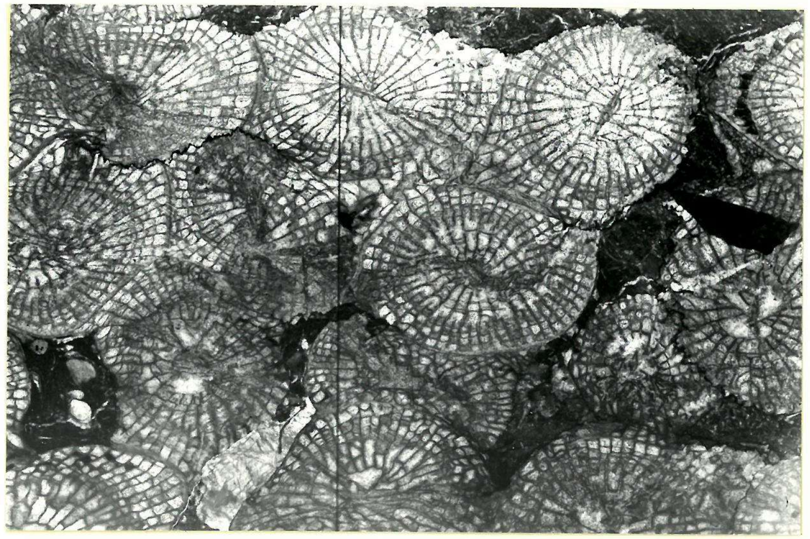


2.

PLATE 32.



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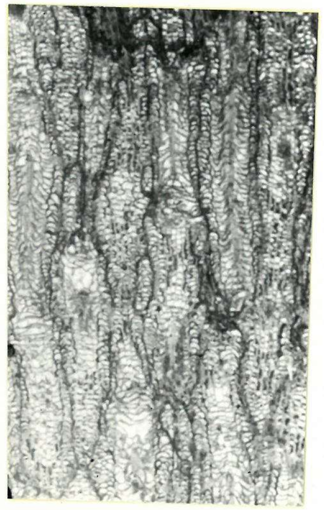

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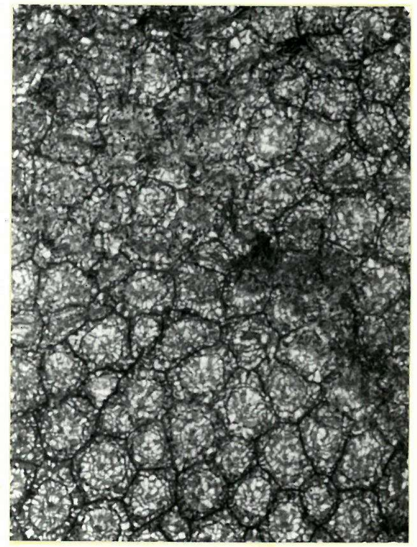

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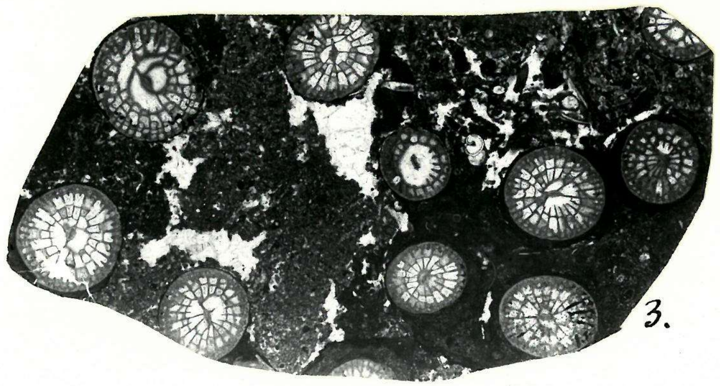

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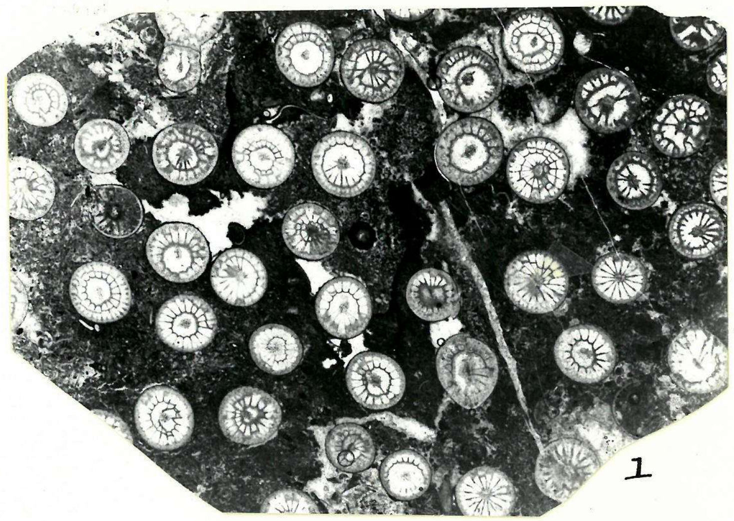
PLATE 33.



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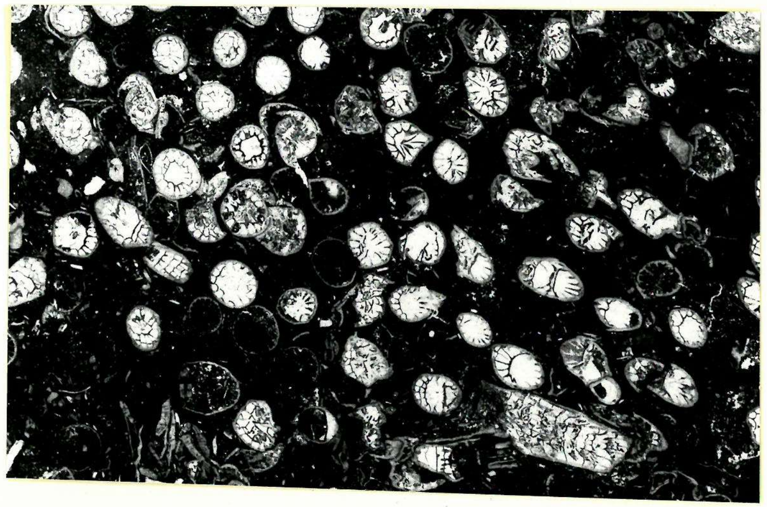

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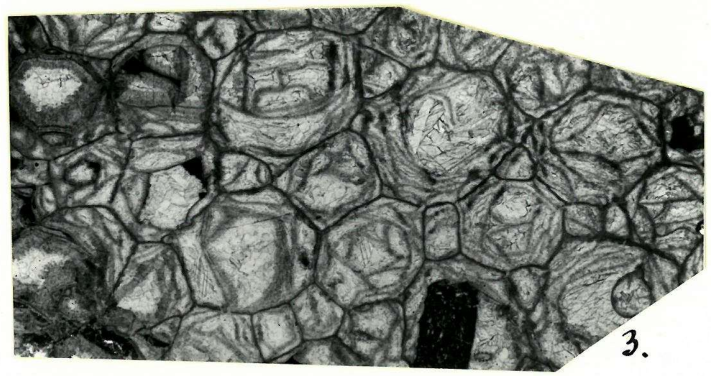
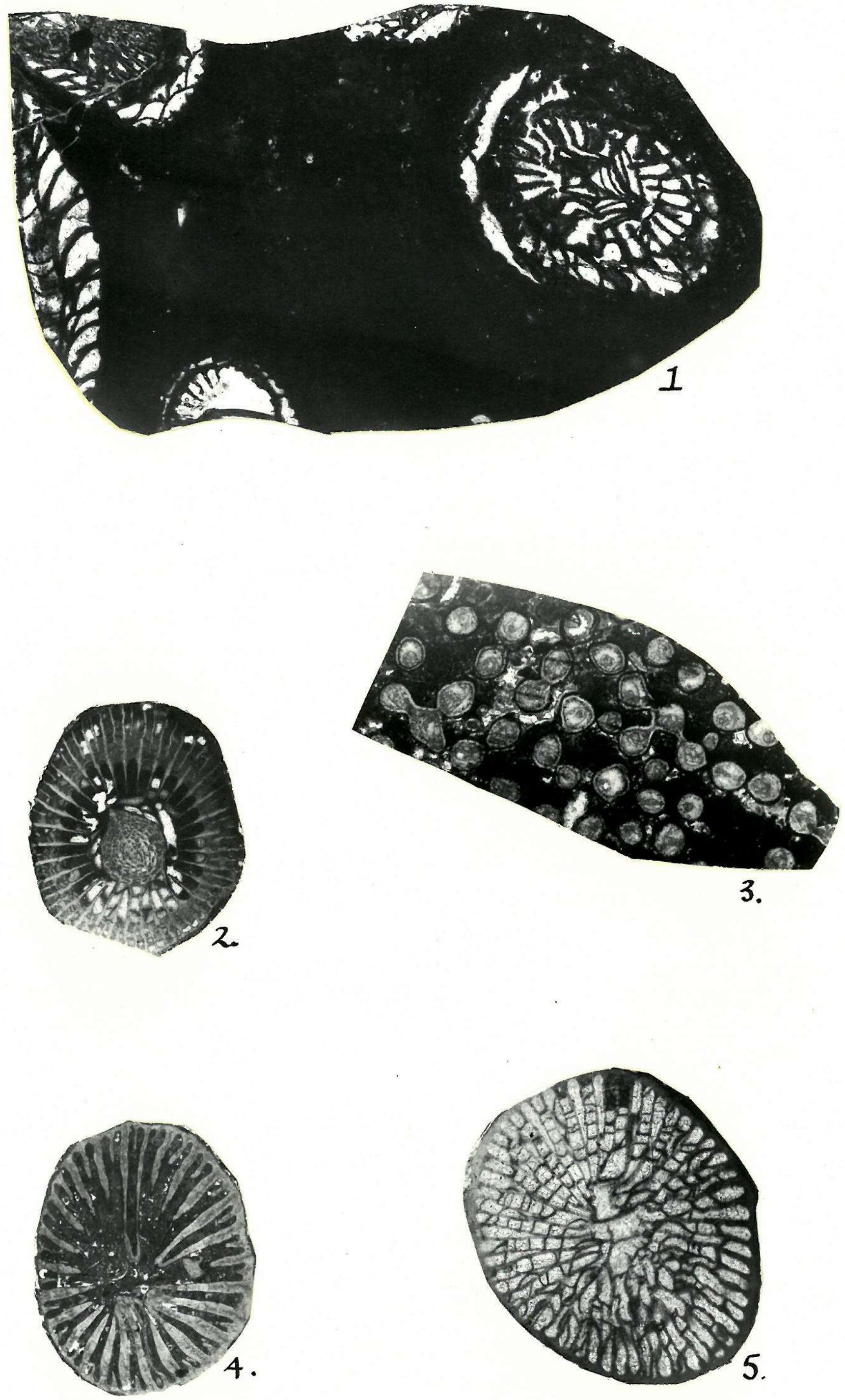


3.

PLATE 34.



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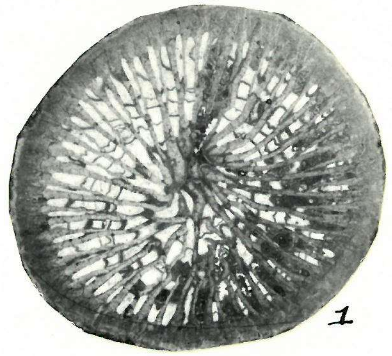

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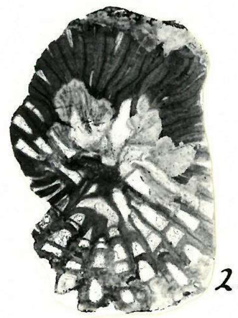

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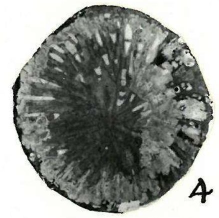
3.



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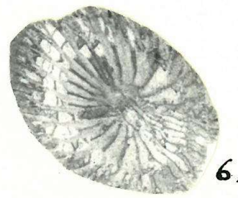

6.