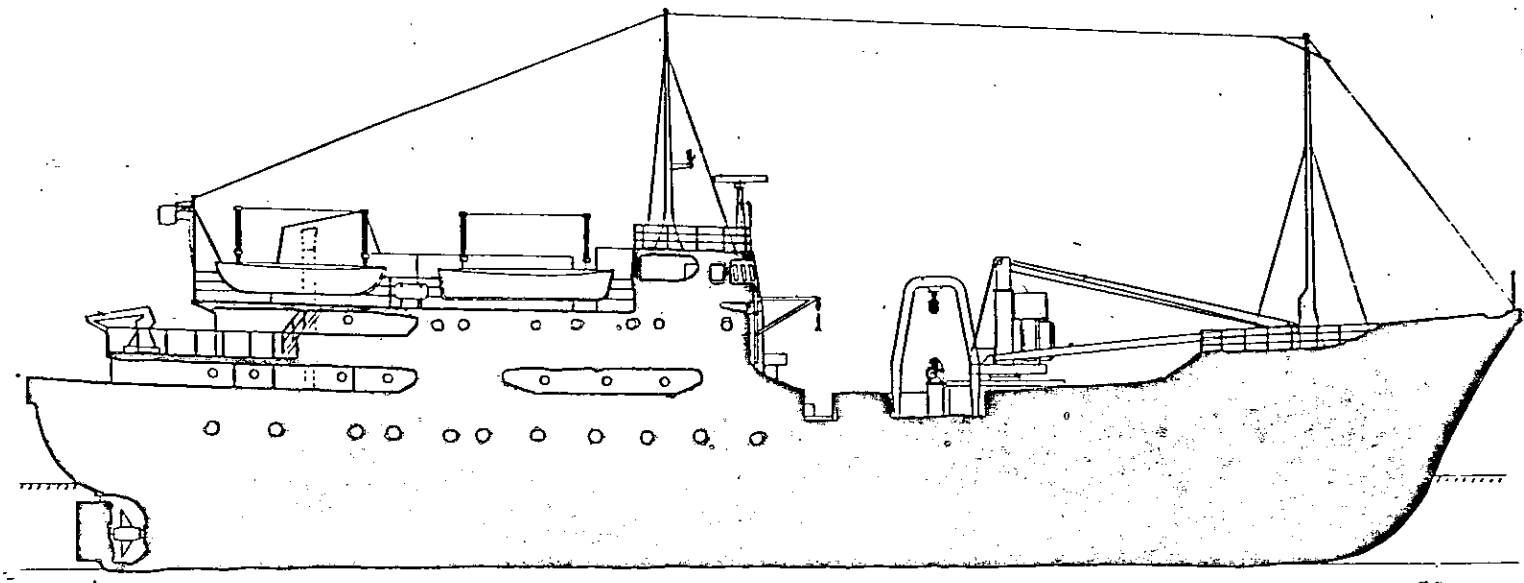
SCIENTIFIC CRUISE REPORT

Shackleton 4/78



Dr. T P Scoffin
University of Edinburgh

Sept. 1979

Shackleton 4/78 Scientific Cruise Report

T.P. Scoffin, Geology Department, University of Edinburgh.
16 September 1979

1. AREA

Inner Hebrides, Malin and Hebridean Shelf, Rockall Bank.

The cruise track is shown in Figure 1 and data sheets in the appendix indicate station positions.

2. PURPOSE OF RESEARCH AND METHODS

The purpose of this work was to observe and collect samples of sediment and organisms from the sea bed on the shelf and shelf edge west of Scotland. The observations were made by underwater television and 70 mm still camera and the sediment samples collected by grabbing, dredging and coring. Our research focused on the nature and origin of the carbonate sediments to further our understanding of modern depositional processes and cold-water limestone formation. We especially hoped to locate and study coral banks on the shelf edge. Information on sediment thickness and bedforms were obtained by geophysical profiling including, side-scan sonar, pinger, sparker and depth recording. Shipboard work included sampling, recording, station plotting, identification of specimens, aquaria experiments, preliminary sedimentological analyses; subsequent labwork has involved the identification of biota and description of environments from videotape playback, textural, mineralogical and component analyses of the sediments, plus computer analysis of sediment data.

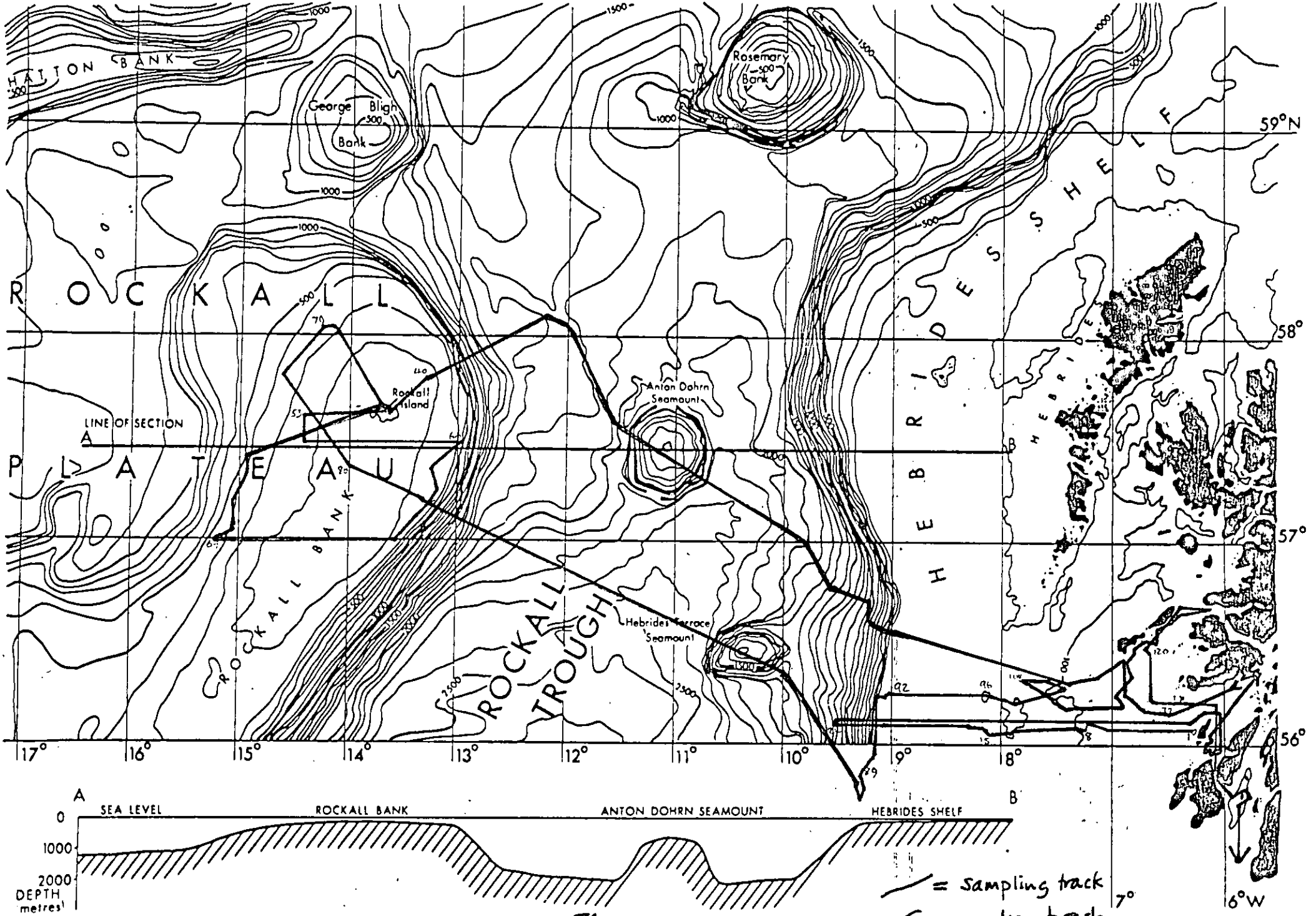

HATTON BANK
George Bligh Bank
Rosemary Bank
ROCKALL PLATEAU
ROCKALL BANK
ROCKALL TROUGH
HEBRIDES SHELF
Rockall Island
Anton Dohrn Seamount
Hebrides Terrace Seamount
LINE OF SECTION
A
B
59°N
58°
57°
56°
17°
16°
15°
14°
13°
12°
11°
10°
9°
8°
7°
6°W
SEA LEVEL
ROCKALL BANK
ANTON DOHRN SEAMOUNT
HEBRIDES SHELF
0
1000
2000
DEPTH metres
= sampling track
= sparker track

Fig. 1

3. OPERATIONAL CONDITIONS

Throughout, the wind was rarely less than force 5 and was gale force for several days. A heavy swell prevailed for much of the open sea work. Coral banks were not located on the Malin Shelf edge and two rock dredges were lost attempting to sample this area. When the weather deteriorated two alternatives were open to us:- either the vessel could move inshore and work in the shelter of the Inner Hebrides or could head into the wind towards Rockall Bank where coral banks were known to occur, travelling during the bad weather hoping conditions would improve on arrival. The latter was the better course to adopt, for two reasons. Firstly, to work inshore with Shackleton would be a waste of such a large ship and secondly for scientific reasons Rockall Bank held great prospect, in that it is a shallow platform isolated from terrigenous sediment from mainland Britain and likely to be accumulating benthic carbonate sediments as yet undescribed. Weather conditions improved sufficiently for us to operate most of our equipment most of the time and a large amount of valuable data was collected. The stability of the ship and the midships 'A' frame made underwater T.V. work possible under conditions of considerable swell.

4. PERSONNEL

Name	Institution	Role	Main scientific interests listed in 5 below
T.P. Scoffin	Univ. of Edinburgh	Principal Scientist	i, ii, iii, iv, vii, x
G.E. Farrow	Univ. of Glasgow	Scientist	ii, vii, ix, x
G.E. Bowes	Univ. of Strathclyde	Scientist	i, ii,
J. Clokie	Marine Lab. Millport	Scientist	vii, viii
J.D. Milliman	Woods Hole Ocean. Inst.	Scientist	i, ii, v, x
E.T. Alexandersson	Univ. of Uppsala	Scientist	iii
M. Pye	Univ. of Glasgow	Res. student	vi, vii
D. Bishopp	Univ. Coll. London	Res. student	ix, x
V. Beekes	Univ. of Bristol	Student	xi station plotting
J. Gomberg	Univ. of Edinburgh	Student	x station plotting
S. Laidlaw	Univ. of Strathclyde	Technician	i
R. Powell	N.E.R.C. Barry	Technician	
J. Taylor	N.E.R.C. Barry	Technician	
A. Clark	N.E.R.C. Barry	Technician	

5. SUMMARY OF SCIENTIFIC RESULTS

i) Sediment composition (Data from laboratory analyses of grabbed and dredged samples)

a. Inner Hebrides (depth 16 m - 200 m)

There is a great variation in $CaCO_3$ content from 30% to 100% which relates to several factors:-

- the abundance of glacial terrigenes
- a variety of skeletal production sites
- diverse hydrographic settings.

Rocky exposures produce sediment rich in barnacles and molluscs. Areas of strong currents but low wave-energy favour the development of banks of calcareous branching red algae. Shallow sheltered zones are richest in molluscs and foraminifera.

b. Malin Shelf (depth 50 m - 200 m)

Lithic gravels dominate the area with fine sands in hollows though locally rocky highs have carbonate-rich peripheries.

The lithic gravels have admixtures of the following carbonate skeletons: molluscs, bryozoans, scaphopods, echinoderms and foraminifera.

Rocky prominences (e.g. at Stanton Banks and at the shelf edge) are rich in serpulids, bryozoans, molluscs and echinoderms.

c. Rockall Bank (80 m - 300 m deep)

This boulder-strewn bank is currently being swamped by gravel- to silt-sized sediments containing 40% to 98% $CaCO_3$. The carbonates show roughly concentric zones with serpulids and bryozoans dominant at the centre, giving way to a mollusc-rich zone surrounded by a benthic foraminifera dominated area and rimmed by pelagic ooze. Lophelia corals occur in patches at the margins of the bank between 200 m and 400 m depth. There

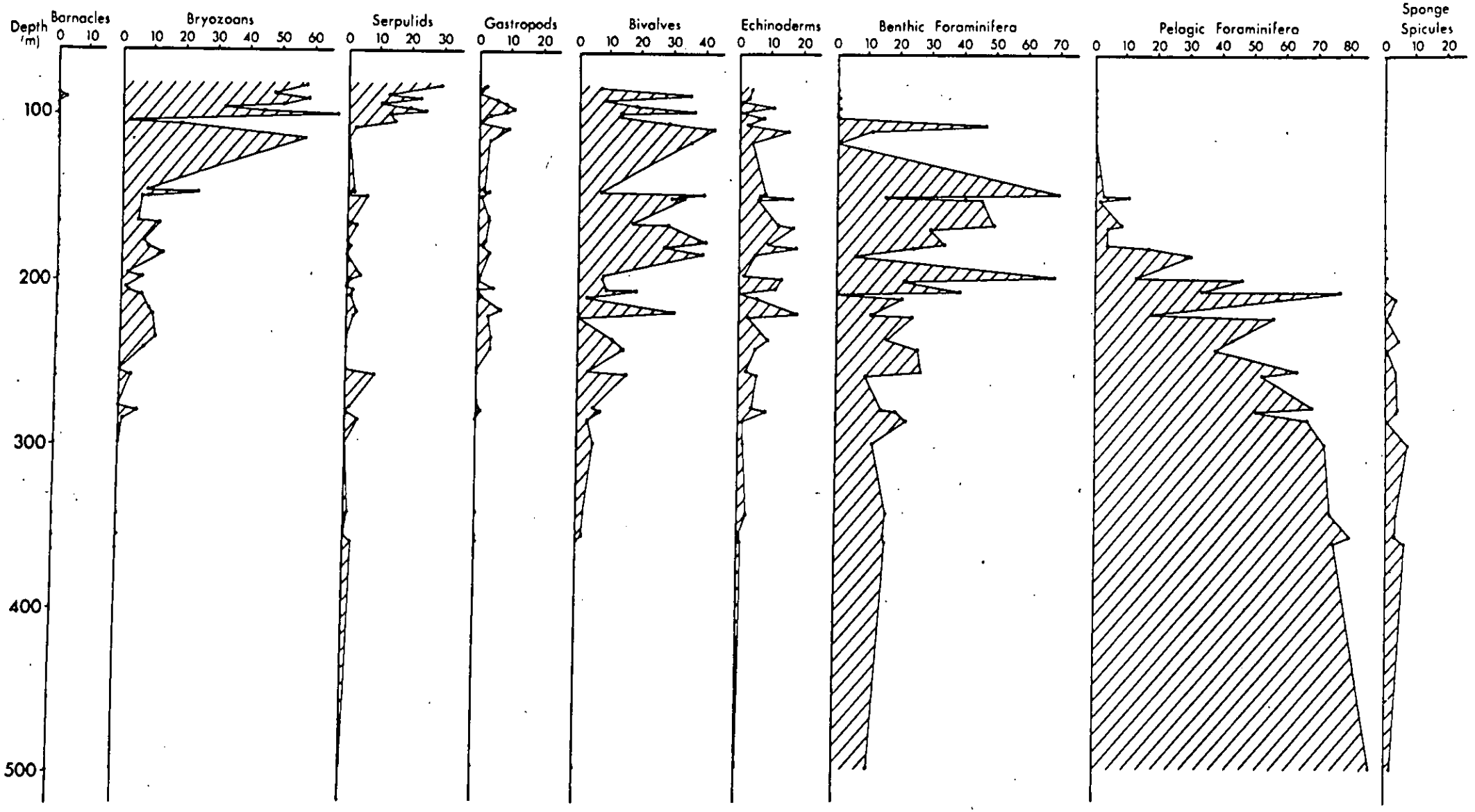

Depth (m)
Barnacles
0 10
Bryozoans
0 10 20 30 40 50 60
Serpulids
0 10 20 30
Gastropods
0 10 20
Bivalves
0 10 20 30 40
Echinoderms
0 10 20
Benthic Foraminifera
0 10 20 30 40 50 60 70
Pelagic Foraminifera
0 10 20 30 40 50 60 70 80
Sponge Spicules
0 10 20
100
200
300
400
500

Fig. 2

is an absence of calcareous algae and barnacles which are both very common inshore on the shelf.

The abundance of major components against depth is shown in figure 2 and lithofacies represented in figure 3.

ii) Sedimentary structures and textures (Data from T.V., side-scan, sediment analysis)

a. Inner Hebrides

exposed - coarse sorted gravels and sands with traction current structures such as megaripples linguoid ripples etc.

sheltered - bioturbation of silts and muds by decapods and worms.

b. Malin shelf

Poorly sorted gravels and sands locally rippled

c. Rockall Bank

Shallow zone - coarse boulders swamped by well sorted sands and gravels with starved wave-induced megaripples

Deep zone - poorly sorted sediment with scattered boulders, sand and silt, extensive bioturbation by fish, echinoids and decapods.

iii) Diagenesis of sediments (Data from S.E.M. and petrological microscope)

Bioerosion by boring algae is common on the inner shelf. Bioerosion by fungi and sponges is common on Rockall between 150 and 300 m depth, the shallow zone is too mobile for borers to attach. Maceration of carbonate grains is common though irregular in distribution, wholesale inorganic solution (or precipitation) of $CaCO_3$ was not evident down to 400 m depth. Pelagics commonly are infilled by, or altered to, glauconite below 200 m on Rockall Bank.

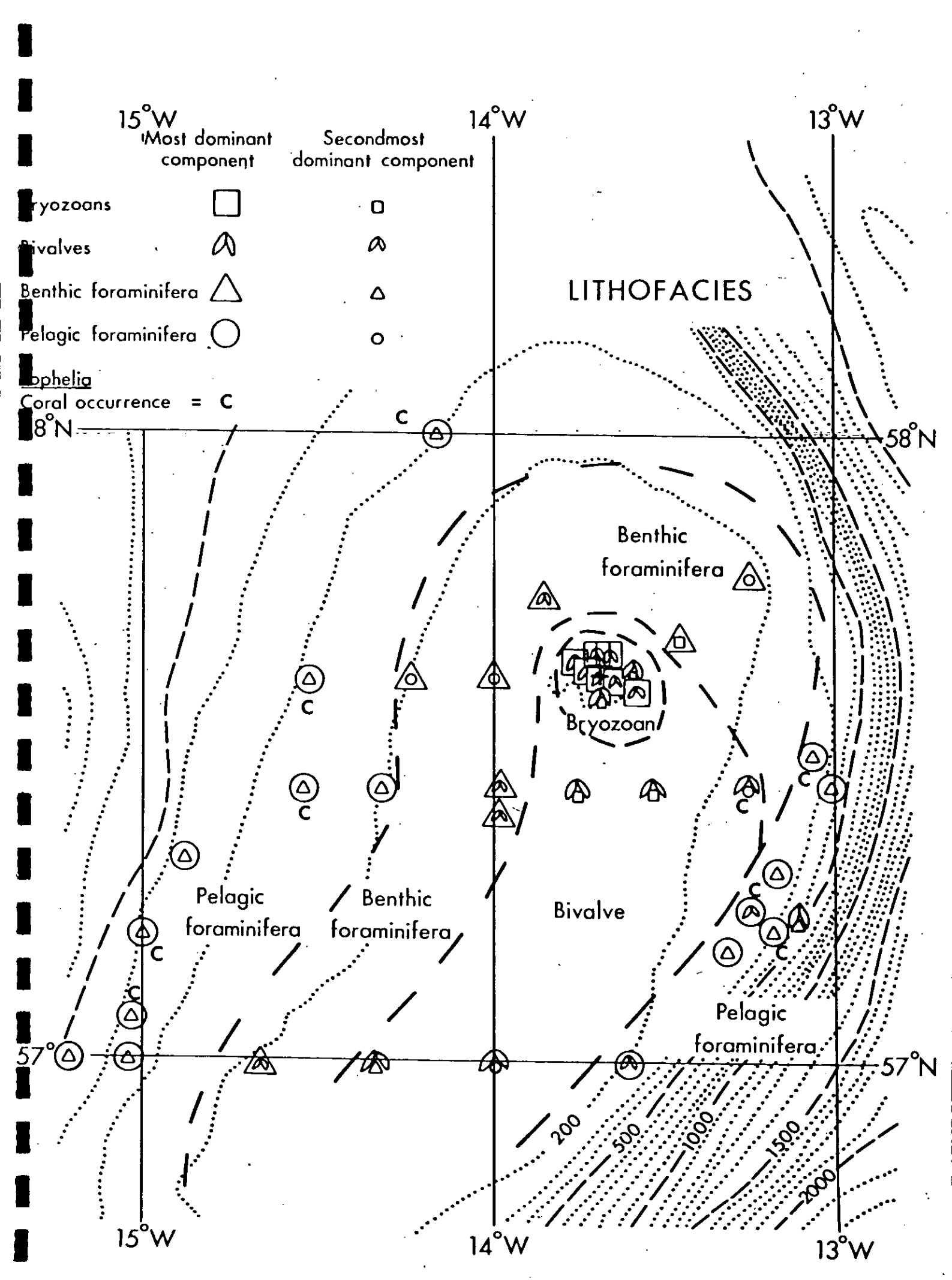

15°W
14°W
13°W
Most dominant component
Secondmost dominant component
Bryozoans
Bivalves
Benthic foraminifera
Pelagic foraminifera
Lophelia
Coral occurrence = C
LITHOFACIES
58°N
57°N
Benthic foraminifera
Bryozoan
Pelagic foraminifera
Benthic foraminifera
Bivalve
Pelagic foraminifera
200
500
1000
1500
2000
C

Fig. 3

iv) Mineralogy of carbonates (Data from staining and X-ray diffractometry)

Inshore gravels and sands are rich in calcite (from barnacles) with local Mg calcite concentrations (from calcareous algae and echinoderms) and aragonite (from molluscs).

Muds and silts in deep water contain about 30% $CaCO_3$ which is dominantly calcite.

Rockall Bank carbonates are mainly calcitic - some aragonite is supplied by molluscs in shallow zones and locally from corals in deep zones, and some Mg calcite is supplied from echinoderms and benthic foraminifera.

v) Suspended matter

Water samples were collected at 18 stations. Measurements of suspended particulates showed that concentratons in the surface waters of Rockall Bank generally range from 0.5 to 0.85 mg/l; most concentration levels decrease with increasing depth, although near bottom samples at several stations (50, 57, 65) have distinctly higher values perhaps related to resuspension of bottom sediment. For the most part we assume the high values relate directly to the higher productivity of bank waters caused by upwelling.

vi) Box cores

Muds derived chiefly from the erosion of glacial deposits are found extensively in the sealochs and coastal sounds of the West Scottish Shelf. Large burrows are excavated in the sediment by fish and crustaceans (chiefly Nephrops norvegicus). The polychalte/mollusc/echinoderm element of the fauna corresponds to Thorson's "Amphiura" community. Although some carbonate is transported from higher energy

environments, biogenic breakdown of shells in situ occurs by crustacean and fish predation. Fragile (e.g. Abra sp. and Thracia convexa) plus strong (e.g. Nucula sp. and Arca islandica) shells are found fragmented in the sediment.

vii) Living fauna (Data obtained from T.V. and film records, and identification of dredged and grabbed samples)

Closest attention was given to the carbonate-producing organisms and those soft bodied forms that directly influence sedimentation. Two groups are important carbonate producers here: those attached to rocks and those living on and in the sediment. Planktonic foraminifera that have drifted down from the surface waters constitute most of the carbonate sediment at depths greater than 200 m.

The rock dwellers that contribute most material in shallow waters (< 40 m) are barnacles, molluscs and echinoderms whereas at intermediate depths (40 m to 100 m) bryozoans, serpulids and echinoderms are more common. Rocks at depths greater than 100 m have sparse encrustations of rock oysters, brachiopods and solitary corals. Small patches 1.5 m high and 20 m wide of the branching coral Lophelia were found living in an annular zone between about 200 m and 400 m around Rockall Bank. (None was found at the shelf edge at this depth in the region of our survey). These colonies grow on a sea bed of ooze and harbour many organisms including:- worms, bryozoans, anemones, decapods, hydroids and sponges.

The calcareous in-fauna at shallow depths (< 40 m) is dominated by molluscs, though banks of free-living branched red algae locally produce large quantities of lime in regions of high currents and low wave action. In deep open water the calcareous sand dwellers are mainly molluscs, echinoids and benthic foraminifera. The specific

types of each group varies according to many local conditions including currents, sediment size, rate of sediment supply etc.

The common soft-bodied organisms were also identified, the significance of algae in providing a stable substrate in shallow water and the influence of various grazers and burrowers particularly fish, echinoderms and decapods in remobilizing sediment were noted.

Abbreviated faunal lists are incorporated in the data sheets in the appendix.

viii) Living flora (Dredged and grabbed samples, T.V. records)

The photic limit as defined by the presence of living algae was determined across the shelf and on Rockall Bank at the approximate latitude of 56°N to be as follows:-

Near shore	40 m
Colonsay sea	46 m
Blacksones	50 m
W. Colonsay	53 m
Off Skerryvore	57 m
Stanton Banks	78 m
Rockall Bank	91 m

Inshore, Conchocoelis is the algal species which penetrates deepest but on Rockall Bank Phymatolithon rugulosum and Rhodophysema elegans were the deepest living algae found.

ix) Solid Geology and Glacial deposits (Data from dredged samples, T.V. and geophysical records)

Large quantities of lithic boulders were sampled partly for observations of epilithic organisms and partly to contribute to the study of the solid geology. Doubtless most boulders are glacial eratics indicated by the shape and heterogeneous composition from basalts and gneisses to chalks and sandstones. However T.V. observations indicated locations and outcropping nature of in situ rocks which

along with dredged samples are being used in solid geology reconstruction.

x) Geophysical Studies

The sparker, pinger, sidescan and precision echo sounder devices were all to aid in a fuller understanding of the sediment distribution, surface morphology and subsurface structure. They were distinct benefits in shallow water and certain deep-water cases (e.g. the location of the slumps on the E of Rockall Bank by sparker) but for much of the cruise we were in too deep water to resolve the detail of the seabed we required with the equipment we had. Ideally we should have used a deep-tow boomer and a deep-tow sidescan rather than the ORE 3.5 KHz pinger and MS 47 sidescan.

xi) Underwater cine/current meter testing

An underwater time lapse cine camera coupled with a recording current meter (belonging to Dr.D. Hamilton of Bristol University) was deployed for an 11 day test period in 80 m of water 7 miles SW of Skerryvoe. Dr Hamilton reports that though a trigger failed causing no cine film to be obtained the tests were most valuable in pointing out the defects in the aparatus prior to the cruise for which the equipment was originally designed and that on correction of these faults excellent results have been obtained subsequently in the SW Approaches.

GENERAL CONCLUSIONS

Sediments rich in carbonate of skeletal origin are accumulating in-shore, on the shelf (at 56°N) and on Rockall Bank having $CaCO_3$ percentages ranging from 30% to 100%.

On the shelf, carbonate abundance and component type relate closely to local conditions particularly:- depth - degree of exposure - speed of currents - nature of substrate - these factors in turn are governed by the geological strucure, recent sculpturing during glaciation and regional climatic setting. The in-shore fine terrigenes of reworked glacial sediments and the off-shore lag gravels are currently being masked by modern skeletal carbonates most of which are supplied from rocky substrates.

On Rockall Bank concentric zones of modern skeletal carbonates swamp boulders of glacial origin. The dominant components of the zones follow the sequence from shallow to deep water of: serpulids, bryozoans, gastropods, bivalves, echinoderms, benthic foraminifera, pelagic foraminifera. Patches of Lophelia coral are abundant between 200 m and 400 m surrounding Rockall Bank.

These shallow-water temperate carbonates differ from shallow tropical carbonates in a few major aspects which are summarised in the table below:

		TROPICAL	TEMPERATE
1.	Composition:	skeletal + inorganic grains (oolites, grapestones muds etc)	entirely skeletal grains
2.	Major skeletal components:	green algae, corals, molluscs, benthic foraminifers	barnacles, red algae, molluscs, bryozoans
3.	Major mineral phase:	aragonite + Mg calcite	calcite
4.	Inorganic precipitation:	present as discrete grains and cements	absent
5.	Grain size:	wide range but muds abundant	gravels, sands and silts - no muds
6.	Profile of banks:	flat or concave, due to rapid sediment supply and lithification at margins and damming by reefs	convex due to slow rate of sediment supply. Marginal corals do not support precipitous margins
7.	Centre of banks:	low-energy lagoonal muds	coarse high-energy gravels

Most of these differences relate to the higher supersaturation of sea water with respect to $CaCO_3$ in warm seas. The differences diminish in progressively deeper water.

Porcupine Bank is an obvious choice for the next phase of these studies:-

1) It is close to Britain

2) The position, depth and separation from land favour the accumulation of skeletal carbonates in significant quantities.

3) The sediments in the adjacent shallow inshore seas off Connemara, Eire, are very rich in carbonates and well documented but nothing is known of the sediments beyond the range of divers. (Cooperation is forthcoming from the geologists who have working in the inshore areas)

4) Lophelia patches are known to occur around the bank edge, but their precise distribution composition and structure are unknown.

5) The sub-surface structure of this area is presently studied by marine geophysicists at Edinburgh University under the direction of Dr Roger Scrutton.

Sediments on banks or sea mounts of similar hydrographic setting but other latitudes should then be compared with those presently described in order to balance the bias (towards shallow tropical seas) in our understanding of carbonate sedimentation. Banks of 40 m to 400 m depth have been neglected in carbonate studies partly because they are inaccessible to SCUBA divers and partly because submersible studies are in their infancy and up to now have focused on specific problems requiring both direct observation and direct sampling, rather than regional aspects of sedimentation. There are several banks and sea mounts at appropriate depths in various latitudes that are not receiving large quantities of terrigenous sediment and are not sites of active vulcanism (e.g. Faroes Bank 61°N, Flemish Cap 47°N, Madiera-Tore Rise 36°N, Argus Bank 32°N, Meteor Bank 30°N) where benthic skeletons are accumulating in sufficient quantities to form limestones. Doubtlessit would be of great value in ancient limestone interpretation to learn more of the nature of such deposits.

Station	Date time	Position Lat / Long	Depth m	bottom Sample	water Sample	TV, Still Lights	Constituent composition : percent	Sort. Ac	Biota dredge / T.V.		Textures	CaCO3 %	Remarks : Geophys
1	18 6 78	56°06.0'N				C.M.							PES
	13.50	06°17.5'W	50	g									
				A.d.			broken shells, ferruginous staining						
	W. Colonsay						rounded & subang. lithic gravel						
2	18.6.78	56°05.0'N											PES
	15.02	06°24.5'W	50	g.									
							M. & f sand high CaCO3 content						
	W. Colonsay						+ shells						
3	18.6.78	56°05.0'N							Hydroids, bivalves oph.				PES
	1630	06°38.0'W	37	g.					asteroids, bryozoans,				
				A.d.			Rocky little sediment		decapods gastr., barn.				
									sol. coral. flat fish.				
4	18.6.78	56°06.3'N	51	g									PES
	1840	06°43.5'N		A.d.									
							Med. sand. 5% shell debris		Ophiuroids, echinoids				
							Natica bore holes in shells		Arctica islandica Venus				
5	18.6.78	56°05.5'N	68	g.									PES
	2020	06°50.5'W		A.d.									
	Between Dubh						Fine sand & silt + broken shells		Worm tubes, small bivalves				
	Artach and Blackstones						lithics 80% CaCO3 20% Biv, + bry.					20	
6	18.6.78	56°04.8'N	83	g									PES
	2120	06°57.8'W											
	Between Dubh						Fine sand & silt, broken & whole shells		Echinocardium, worm				
	Artach and Blackstones						50% CaCO3 23% Biv, 9.7 Bry 1.7 Foram, 2. gast		tubes			50	
7	18.6.78	56°05.7'N	43	g					Barnacles, branching				PES
	2200	07°04.8'W		R.d					& encrusting calcareous				
							Rocky with local sand		bryozoans. Sea [illegible]				
	Blackstones						67% Carb. 31% Biv Bry 7% 5% gast.		Marthasterias glacialis (starfish)			67	

Station	Time date	position Lat & Long	Depth m	bottom Sample	water Sample	TV	Still cam	constituent composition: percent	[illegible]	BIOTA dredge / T.V.		Terrigenous	$CaCO_3$ %	Remarks; Geophys
7a	19.6.78 0030	56°08.0'N 07°06.2'W	74	g				Well washed shell sand + smooth cobbles						PES
8	19.6.78 0150	56°03.4'N 07°09.3'W	68	A.d						Molluscs Foliaceous & stick bryozoans - *Flustra* & *Filograna*				PES
9	19.6.78 0300	56°05.4'N 07°09.3'W	102	g A.d.				Cobbles.		Lace bryozoan, Chiton, enc. bryz. hydroids, bivalves brittle stars.				PES
10	19.6.78 0500	56°05.2'N 07°24.2'W	106	g A.d				Gravel with little mud (over compacted clay)		Algae, Serpulids bryozoans, Molluscs				PES
11	19.6.78 0620	56°04.7'N 07°31.2'W	114	g R.d.				Hard bottom. Some fine sand.		Coral, Sponge Bryozoan Brachiopods.				PES
12	19.6.78 0910	56°04.8'N 07°38.5'W	147	g				Fine sand with shells 35% $CaCO_3$ Biv, Bry, forams		Shell debris, worm tubes			35	PES
13	19.6.78 10	56°04.6'N 07°46.3'N	100	g A.d				35% $CaCO_3$ bry biv gast		Bryozoans, hydroids Small piece of dead branching coral			35	PES

CHARTWELL TIME-TABLE (GANTT) CHART No. 7020

Station	Date Time	Position Lat. Long	Depth m	Bottom Sample	Water Sample	TV Still cam.	constituent composition: percent	Total	Biota dredge / T.V.		Tenighs	$CaCO_3$ %	Remarks: Geophys
14	19.6.78	56 03.3 N	112	g									Side Scan PES
	1250	07 54.4 W	↓	Ad									
			95				(75% $CaCO_3$) 37% bryz.					75	
							foram 20% biv.						
15	19.6.78	56 03.4 N	163	g					Echinies, Calc. bryoz.				Side Scan PES
	1600	08 05.3 W	125	g					Ophiuroids, Scaphopods				
			143	g			med.-fine skeletal sand (75% $CaCO_3$) 24% biv, 9% gast		Sol. coral			75	
			142	Ad			22 bryz. 8% dentalium, 2% foram						
16	19.6.78	56°08.1'N	115	Ad					Asteroids, bryozoa.				Side scan PES
	1900	08°10.0'W	100	g					Serpulids				Pinger
			112	A.d.			Cobbles + bioclastic sand & gravel.						
							(50% $CaCO_3$) 13% bryoz. 7.2 Biv 6.7 [illegible] 2% [illegible]					50	
17	19.6.78	56 07.0 N	126	g					bryzo. sponges				Side Scan PES
	21.20	08 17.8 W		Ad					serpulids				Pinger
							Stones + m-f Sand						
							Moll, bry, corals, brach, forams						
18	19.6.78	56 07.3 N	125	g					Enc. bryzo, Serpulids				Sidescan PES
	22 55	08 27.0 W		Ad.									Pinger
							Stones + gravel						
							10 $CaCO_3$ bryozoan dominant					10	
19	20.6.78	56 07.0 N	125	g					Aporrhais				Sidescan PES
	0040	08 37.5 W											Pinger
							[illegible]% $CaCO_3$ + lithic gravel well washed						
							bryozoans dominant					30	
20	20.6.78	56 05.5 N	125	g									Sidescan PES
	0150	08 45.0 W											Pinger
							m-c. Carbonate sand					90	
							rich in echinoid debris						

CHARTWELL TIME-TABLE (GANTT) CHART No. 7020

Station	Date / time	Position lat/long	Depth m	Bottom sample	Water sample	TV / Still cam.	Constituent composition : percent	Core	BIOTA dredge / T.v.		Temp/Sal	CaCO3 %	Remarks : Geophys
21	20.6.78	56°06.0'N	144	g									PES, pinger
	0330	08°56.6'W											
							80% CaCO3 m. biogenic sand						
							+ lithics					80	
22	20.6.78	56°05.7'N	187	g									PES pinger
	0450	09°06.5'W											
				g			30% CaCO3 - sandy mud + c. biv.					30	
				g			80% CaCO3 - shelly sand biv, scaph.						
23	20.6.78	56°05.6'N	770	g									PES pinger
	0640	09°16.0'W											
	Shelf Edge												
23 (B)	20.6.78	56°04.3'N	320	g					Serpulids + bryoz				PES pinger
	0745	09°17.9'W	345	g					encrusting lithics				
				A.d.			Pebbles + biogenic debris		Squat lobster, Chlamys,				
	Shelf Edge						+ mud balls		Venus,				
24	20.6.78	56°04.0'N	1240	A.d.									PES pinger
	1400	09°26.0'W											
							Pebbles + mud						
	Shelf Edge												
25	20.6.78	56°04.3'N	1135	R.d.					Bryozoans				PES pinger
	16.40	09°27.5'W	to										
			1165				Small rocks.						Sparker run
	Shelf Edge												across shelf.
26	21.6.78	55°58.3'N	30	g	W.S.	T.V.			Modiolus				PES pinger
	20.43	06°07.4'W	–			S.C. B/W 11			hydroids, brecci				Sidescan
	Colonsay Sea		40				Qtz-rich sand + shells		Ophiuroid.				
		Sound of Islay											

Station	Date time	Position Lat / Long	Depth m	Bottom Sample	Water Sample	TV Strip c.	Constituent composition : percent	Core	BIOTA dredge / TV		Terrigenous	$CaCO_3$ %	Remarks: Geophys
27	21·6·78	55° 57·9' N	45	g		TV 30 mins							PES, pinger
	20·40	06° 11·2' W				S C B/W 22							Sicles can
						ripple sand	M. Sand + Shells		Arthrica, Scaphopod				
	Colonsay Sea	Sound of Islay							Echinocardium.				
28	21·6·78	55° 57·1' N	40	g		TV (4) 30 mins							PES pinger
	23·20	06° 12·9' W	fo										Sicles can
			46			S. C B/W 38	M. Sand + Shells						
	Colonsay Sea	Sound of Islay				ripples							
29	22·6·78	55° 57·3' N	23	g		TV (5) 30 mins			Modiolus				PES
	01·20	06° 06·8' W	fo			S C B/W 26			Starfish Abundant				
			26				M. Sand + Shells						
30	22·6·78	55° 57·5' N	22	g		TV 2 mins			laminarian Saccharina				PES
	0210	06° 06·0' W	22	g		S C B/W 1			Lanicine Arbs				
	N. Entrance		18	g			Qtz + $CaCO_3$ Sand		Phymatolithon (Crustose)				
	Sound of Islay		20	g			Phymatolithon + Shells		Glyptonema				
31	22·6·78	55° 57·4' N	38	g		TV			L. saccharina, Lanicine				PES
	0257	06° 04·3' W				S C B/W 6			Hobby, Shells				
	Sound of Islay.					? megaripples	M-f Sand 75% $CaCO_3$ so Biv, 8 Gast, 9 Bry, + Oph Sponge Scaphopods					75	
32	22·6·78	55° 58·1' N	35	g									PES Simrad
	0515	06° 10·6' W	37	g									
							M-f Sand + Shells modiolus + Serpulids						
33	22·6·78	55° 58·5' N	40	g									PES Simrad
	0536	06° 10·7' W		g									
							m-f Lithic sand + Ca/b. debris + terrigenous						
	Colonsay Sea												

Station	Date Time	position lat / long	depth m	bottom Sample	water Sample	TV mins / Still Cam B/W No.	Constituent composition : percent	CaCO3	BIOTA Dredge / T.V.		[illegible]	CaCO3 ;	Remarks/ geophysics
34	22.6.78 0603 Colonsay Sea - S of Islay	55°58.6'N 06°11.8'W	45	g g			M-sand + Shell debris						PES Simrad
35	22.6.78 0700 Colonsay Sea S. of Islay.	55°56.9'N 06°05.0'W	16	g		TV 15 mins SC B/W 11	C. Sand Plymatolithon + Shells + lithics.		Plymatolithon Glycymeris holothurian				PES Simrad
36	22.6.78 0821	55°58.2'N 06°02.2'W	28	g			Poorly sorted lithic sand, Phym. cobbles.		Plymatolithon calc. Turritella Laniche				PES Simrad
37	22.6.78 2052 SW Passage of Tiree	56°08.9'N 06°30.0'W	54	g			Muddy sand + shell debris		Arctica Islandica Polychaetes				PES Simrad
38	22.6.78 2200 SW Passage of Tiree	56°11.1'N 06°38.3'W	67 35 65 42	g g g g		TV (?) SC Col	Barnacle debris + shells + stones + qtz.		Barnacles on stones Algcon. + coral.				PES Simrad
39	23.6.78 0100 Skerryvore	56°14.1'N 06°47.6'W	51	g(4) g(4) g(4)									PES Simrad
39(a)	23.6.78 1605 Skerryvore	56°15.3'N 07°17.2'W	86			Time lapse cine camera station.							PES Simrad Sparker run to Rockall via Anton Dohrn

Station	Date / Time	Position Lat / Long	depth m	bottom Sample	Water Sample	T.V.	Still cam	Barnacles	Bivalve	[illegible]	Lithics	Echinoids	Gastropods	Serpulids	Bryozoa	Algae	Benthic foram	Pelagic foram	Sponge	Misc	Coral	BIODATA dredge / TV	Terrigenous	$CaCO_3$ in sand	Remarks/ geophysics
40	26.6.78	57°50.8'N	214	g				0	54.6	2.2	35.15	7.01	3.16	0	1.51	0	24.18	20.85	0	0		cup corals, anemones	cobbles	65	Pinger PES
	0150	13°15.0'W	210	g				0	9.5	/////	/////	11.2	5.0	0	2.5	0	38.7	33.2	0	0		bryozoa, serpulids, cidaris			Sidescan
			205	Rd, p.d.				(P) Foram sand + Scaphopods														starfish, crabs, bivalve			
	N.E. Rockall Bank																					Sponge, *Ophiactis balli* (1)			
41	26.6.78	57°45.0'N	148	g(1)				0	3.5	30.6	24.1	3.9	0.6	1.1	3.7	0	31.5	1.3	0	0		*Echinocyamus pusillus*		76	Pinger PES
	0526	13°26.7'W	147	Rd.				0	7.6	/////	/////	8.5	1.3	2.4	8.1	0	68.4	2.7	0	0					Sidescan
								(B) Foram Sand																	
	NE Rockall Bank																								
42	26.6.78	57°37.7'N	96	g	WS			0.4	28.0	7.7	14.8	0.7	8.0	15.4	25.0	0	0.1	0	0	0			cobbles	85	Pinger PES
	0739	13°37.3'W	96	Rd				.5	36.1	/////	/////	.9	10.3	19.8	32.3	0	0.1	0	0	0			boulders		Sidescan
				p.d.				C. biodetrital sand																	
	Rockall Bank																								
43	26.6.78	57°37.4'N	95	g																					Pinger PES
	0923	13°36.8'W																							Sidescan
								Biogenic sand (trace)																	
	Rockall Bank																								
44	26.6.78	57°36.9'N	113	Rd.				.5	27.7	4.5	29.1	9.9	6.3	1.7	12.0	0	7.4	0	0	0		*Ophiactis balli* (1)		70	Pinger PES
	1033	13°39.5'W		p.d				.7	42.1	/////	/////	15.0	9.5	2.6	8.9	0	11.2	0	0	0					Sidescan
								Biodetrital Sand																	
	Rockall Bank																								
45	26.6.78	57°38.6'N	95	p.d.	WS																	Enc. bry	boulders		Pinger PES
	1200	13°37.3'W	to																						Sidescan
			106					coarse biodetrital sand + lithics																	
	Rockall Bank																								
46	26.6.78	57°39.2'N	83	g(1)				0.5	12.2	2.8	5.7	7.2	8.0	22.9	40.6	0	0	0	0	0.1			boulders	94	Pinger PES
	13.50	13°42.0'W		Rd.				.6	13.4	/////	/////	7.9	8.7	24.5	44.5	0	0	0	0	0.1					Sidescan
				p.d.				C. bryozoan Sand / f. gravel																	
	Rockall Bank																								

CHARTWELL TIME-TABLE (GANTT) CHART No. 7020

Station	Date / time	Position lat / long	depth m	bottom sample	water sample	T.V. / Still cam.	Constituent composition: percent — Forams	Bivalves	[illegible]	[illegible]	[illegible]	Gastropods	Serpulids	Bryozoa	Algae	Plankt. forams	[illegible]	Sponge	Misc	Coral	Biota dredge / TV	Terrigenous	$CaCO_3$ % in sand	Remarks / geophysics
47	26.6.78	57°39.2'N	84	g	W.S.		2.2	7.3	7.5	4.3	1.4	5.2	20.0	51.7	0	0.4	0	0	0		Henricia sanguinolenta (1)		96	Pinger PES
	1510	13°41.2'W		Rd			2.5	8.3			1.6	5.9	22.6	58.6	0	0.4	0	0	0		(Starfish)			Sidescan
			90	pd			c. bryozoan sand																	
	Rockall Bank																							
48	26.6.78	57°39.0'N	100	Rd			0	12.4	5.7	1.9	2.3	2.5	12.1	61.3	0	0.4	0	0	0		H. sanguinolenta (1)		98	Pinger PES
	1630	13°44.0'W		pd			0	13.4			2.4	3.1	13.1	67.4	0	.5	0	0	0		Stichastrella rosea (2)			sidescan
							c. bryozoan/echin sand														(Starfish)			
	Rockall Bank																							
49	26.6.78	57°38.7'N	93	Rd			.9	15.6	2.7	11.5	9.2	7.1	9.2	42.7	0	1.1	0	0	0				88	Pinger PES
	17.40	13°42.9'W		pd			1.4	15.1			10.8	8.3	10.7	45.7	0	1.3	0	0	0					sidescan
							c. bryozoan sand/ltgravel																	
	Rockall Bank																							
50	26.6.78	57°38.2'N	115	g	W.S.		0	33.5	3.9	0.2	3.9	3.3	0.1	55.1	0	0	0	0	0				99	Pinger PES
	1930	13°42.0'W		g			0	35.0			4.1	3.5	0.1	57.5	0	0	0	0	0					sidescan
							coarse biodetrital sand																	
	Rockall Bank																							
51	26.6.78	57°36.9'N	164	g			.3	17.2	3.4	35.4	10.4	2.8	1.8	7.4	0	18.2	2.5	0	.8			igneous	65	Pinger PES
	2105	14°01.8'W		g			0.5	28.			17.1	3.9	3.0	12.1	0	39.8	4.1	0	1.4			pebbles		sidescan
							f- biodetrital sand																	
	Rockall Bank																							
52	26.6.78	57°36.6'N	197	g	W.S.		0	6.5	0.9	25.1	1.1	0.7	3.5	1.4	0	50.3	9.7	0.1	0				75	Pinger PES
	2232	14°15.2'W		g			0	8.8			1.5	0.9	4.7	1.9	0	68.0	13.2	1.1	0					Sidescan
							m-f foram sand																	
	Rockall Bank																							
53	27.6.78	57°34.9'N	256	g			see 53 (B)																	Pinger PES
	0030	14°30.8'W	265	p.d.																				sidescan
			260	g																				
	Rockall Bank		247			TV(f) SC2														C				

CHARTWELL TIME-TABLE (GANTT) CHART No. 7020

Station	Date time	position lat / long	depth m	Bottom Sample	Water Sample	T.V.	Still cam	Constituent composition : percentage													Co R Ag	BIOTA dredge / T.V.		Terrigenes	CaCO3 % in sand	Remarks / geophysics
53 (8)	27.6.78	57°35.0'N						0	2.2	.5	33.1	3.7	0.8	1.2	4.5	0	13.7	37.5	2.4	0				Basalt	67	PES
	0300	14°24.5'W	230	g				0	3.3			5.5	1.3	1.8	6.8	0	20.6	57.1	3.6	0	C			breccia		pinger
	0436		210	Rd.				fine-muddy foram sand													C					
	Rockall Bank			p.d.																	(l)					
54	27.6.78	57°26.4'N	221	g				0	.5	1.3	31.2	2.1	2.1	1.7	7.1	0	16.0	37.2	0.4	.4		Encrusting fauna of		lg. bould	69	Pinger
	0658	14°29.5'W		Rd				0	0.7			3.1	3.2	2.5	10.5	0	23.7	55.1	.6	0.6		sponge, bryo, serpulids				PES
				pd				Foram sand														on boulders				
	Rockall Bank																									
55	27.6.78	57°28.8'N	199	g	W.S			0	5.3	0.9	34.5	8.5	0	0.9	4.5	0	14.0	29.4	0	2.2					65	Pinger PES
	1000	14°16.8'W		g				0	8.1			13.2	0	1.3	6.9	0	21.6	45.4	0	3.4						
								fine-foram sand																		
	Rockall Bank																									
56	27.6.78	57°27.1'N	150	g				0.6	8.3	2.5	34.4	16.7	0.7	0.6	5.3	0	25.4	1.1	0.5	0				cobbles	66	Pinger PES
	1140	14°00.0'W		g				0.8	29.0			17.0	1.1	0.9	8.5	0	40.2	1.8	0.8	0				pebbles		
								M- moll sand + big ech foram																		
	Rockall Bank																									
57	27.6.78	57°27.0'N	147	g	W.S.		C.m	0.1	30.3	2.8	19.5	3.6	2.6	0.8	18.9	0	11.7	8.3	0	1.3					80	Pinger PES
	1255	13°46.0'W		g.c.				0.1	39.4			6.7	3.4	1.1	24.8	0	15.1	10.7	0	1.7						
				g.c.				biodetrital sand																		
	Rockall Bank																									
58	27.6.78	57°26.4'N	177	g				.3	19.5	4.4	40.4	4.7	1.2	0.4	3.6	0	16.2	1.9	0.1	0.3					60	Pinger PES
	1530	13°31.1'W						0.5	45.5			9.8	2.5	0.8	7.4	0	33.7	4.0	0.3	0.5						
								lithic sand - gravel																		
	Rockall Bank																									
59	27.6.78	57°26.9'N	210	Rd				0.6	17.8	2.4	38.7	10.8	4.3	2.0	5.5	0	6.4	10.8	0.9	0	C	Soft anemone cucumarian	Ophiura texturata (?)		61	Pinger PES
	1650	13°17.2'W		pd				1.0	30.4			18.3	7.3	3.3	9.4	0	10.9	18.4	1.6	0	(d)	sea slugs, saddle oyster,	Ophiactis balli (20)			
																						inc. bryozoa, dead Lophelia	Ophiopholis aculeata			
	Rockall Bank							M-c sand - mollusc/foram sand														Stichopus hemula (Ao1)	Pseudarchaster parelli (2)			

CHARTWELL TIME-TABLE (GANTT) CHART No. 7020

Station	Date time	position lat / long	depth	bottom Sample	water Sample	T.V. Still Cam.	Constituent composition: percent	CORAL	BIOTA dredge / TV		Terrigenes	CaCO3 % in sand	Remarks / Geophysics
60	27·6·78	57°26·1'N	280	Rd			[illegible]		Cidaris cidaris (80)			65	PES pinger
	1910	13°01·8'W		g			[illegible]						
							Foram sand						
	Rockall Bank												
61	27·6·78	57°28·8'N	235	Rd.			[illegible]	C	Bryozoa, serpulids,	Ophiactis balli (2)	Boulders	69	pinger, PES
	2120	13°07·2'W		pd			[illegible]		corals, cushion star	Ophiothrix fragilis, Pseud. parvata (?)			simrad
							Foram sand		Ceramaster placenta	Ophiura carinata & Stich. rosea (2)			
	Rockall Bank								(echinoderm)	Cidaris cidaris			
62	78·6·78	57°16·6'N	278	g			[illegible]		cidaris, sponges		Boulders	39	pinger, PES,
	0020	13°06·9'W		Rd			[illegible]		Amphiura filiformis		cobbles		simrad.
				pd			Foram sand	C	(dead fragments) Lophelia		Lewisian granite schist, gneiss		
	Rockall Bank										various calc. sands		
63	28·6·78	57°07·7'N	242	Rd			[illegible]		Cidaris (41)		variety of	62	pinger PES
	0450	13°20·7'W		pd			[illegible]		Basket star:		rocks		simrad
							Foram sand		Gorgonocephalus eucnemis.				
	Rockall Bank												
64	28·6·78	57°00·9N	205	g	w.s.		[illegible]					40	pinger PES
	0700	13°18·1'W		g			[illegible]						simrad
							Lithic-foram sand						
	Rockall Bank												
65	28·6·76	57°00·1'N	184	g	ws		[illegible]					40	pinger PES
	0930	14°00·2W		g			[illegible]						Simrad
							Fine sand and biodetrital debris						
	Rockall Bank												
66	28·6·78	57°00·1'N	180	g	ws.	Tv (1)	[illegible]					93	pinger PES
	1130	14°18·1'W		g			[illegible]						Simrad.
							Biodetrital-foram sand						
	Rockall Bank												

Station	Date time	position Lat / Long	depth	bottom Sample	water Sample	TV Still Cam.	constituent composition : percent	CORAL	BIOTA dredge / TV		Terrigenes	CaCO3 % in Sand	Remarks / geology
67	28.6.78	56°59.9'N	163	g	W.S.		7 13.9 2.2 18.2 9.7 2.6 1.0 8.6 0 39.7 6.8 0 8		bryozoa encrusting cobbles		Metamor.	8 2	pinger, PES.
	1450	14°40.4'W		Rd			9 17.4 //// //// 7.1 3.2 1.3 5.5 0 49.9 8.5 0 1.0				cobbles		Simrad
				pd			foram sand						
	Rockall Bank			g									
68	28.6.78	56°59.9'N	300	Rd			0 4.6 1.3 12.7 1.7 0.2 0.6 0 0 11.0 61.5 6.3 0.3	C	Spatangus ech.		lithified	8 7	pinger PES
	1740	14°59.8'W		pd			0 5.2 //// //// 2.0 0.3 0.5 0 0 12.8 71.7 7.3 0.3	l.d.	live & dead Lophelia with		burrows.		Simrad
							f. foram sand		sponge boring, bryozoa				
	Rockall Bank												
69	28.6.78	57°00.7'N	499	Rd			0 7 0 6.8 1.0 0 0 0 0 10.8 71.8 1.8 0		Sol. corals att. to rock	Stichopus	?phosphatic	9 3	pinger PES
	2150	15°12.4'W		pd			0 7 //// //// 1.1 0 0 0 0 11.5 83.4 2.0 0		Terebratulids, cup	tremulus (Holothurian)	hardground		Simrad
				g			f. foram sand		Sponges, cidaris, saddle	Ophiactis ball.? pseudarchaster	?glauconitic dolostone		
	Rockall Bank								oyster, ophiuroid, holoth. gastr.	parelii	chalk		
70	29.6.78	57°03.3'N	355	Rd			0.4 2.0 0.1 5.9 0.1 0 0 0.1 0 14.4 74.4 2.9 0	C	Enr. sol. corals, bry, serpulids	O. balli (c)	Cobbles	9 4	pinger PES
	0150	15°00.5'W					0.1 2.2 //// //// 0.1 0 0 0.1 0 15.3 79.1 3.1 0	(d)	Lophelia dead, Terebratulids	Spatangus			Simrad
							f. foram sand		Spatangus, Antipatharian?	raschi			
	Rockall Bank								Alcyonarian, ophiuroids, sponge				
71	29.6.78	57°09.2'N	355	g	W.S.		0 2.4 0.6 6.8 2.8 0 1.1 0 0 14.9 68.0 3.3 0.1		Terebratula - clumps bry		ang. basalt +	9 3	pinger PES
	0450	14°57.6'W	360	Rd	Temperature: C 8.5		0 2.6 //// //// 3.0 0 1.2 0 0 16.1 73.4 3.5 0.1		epifauna, Spatangus,		phosphatic		Simrad.
			370	Pd	110 9.5		f. foram sand		Cidaris.		fossiliferous rock/sst.		
	Rockall Bank				330 11.0								
72	29.6.78	57°19.5'N	360	Rd			0 0.2 0.1 12.3 1.0 0 2.8 0 0 13.9 64.7 5.3 0		Sponge, serpulid on rock	S. raschi	phosphatic	8 8	Pinger PES
	0830	14°51.6'W		p.d.			0 0.2 //// //// 1.2 0 3.0 0 0 15.8 73.9 6.0 0		with Terebratula	Cidaris cidaris	Sdst.		
							foram sand.		Echinus elegans	Ophiura albida?			Sparker run
	Rockall Bank									Ceramaster balteatus			to Rockall Is.
73	29.6.78	57°37.7'N	93	g (4)					Stone encrusted w. bryo.		1 stone		Pinger PES
	17.40	13°41.8'W		g									
	Rockall Bank												

CHARTWELL TIME-TABLE (GANTT) CHART No. 7020

Station	Date time	Position lat / long	depth m	bottom sample	water sample	TV Still Cam light met.	[illegible]	bivalve	[illegible]	lithic	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	sponge	misc	S	Biota dredge / TV	Terrigenous	$CaCO_3$ % in sand	Remarks / geophysics
74	29.6.78	57°37.3'N	80	g(1)			0	31.7	2.2	0.4	2.4	0.3	12.7	48.8	0	0.8	0	0	0.3		Cushion stars, venus	f.g	99	PES, pinger
	18.30	13°38.6'W	73	g			0	35.2	////	////	2.9	0.5	13.0	47.2	0	0.9	0	0	0.3			gabbro cobble		simrad.
			87	Rd			bryozoan f. gravel																	
	Rockall Bank			?d.																				
75	29.6.78	57°37.0'N	82	Rg		TV (tape 7 20.5)	0	7.5	1.9	0.1	4.0	2.3	28.2	56.1	0	0	0	0	0		1 Echinus every 20m or so		100	Side scan,
	1940	13°36.3'W		?d		S.C. (Col) 25	0	7.7	////	////	4.0	2.4	28.7	57.2	0	0	0	0	0		Asterias rubens (1); Porania pulvillus 2			pinger, PES.
						Rippled sand	bryozoan f. gravel														Henricia sanguinolenta (1)			
	Rockall Bank					between boulders															Echinus esculentus (1); Echinocardium flavescens (1)			
76	29.6.78	57°39.0'N	106			TV (tape 8 0-11)															Cup sponge			Side Scan, PES
	2140	13°39.8'W				S.C (Col)															Echinus			pinger
						Encrusted rocky	Possible dykes + dipping strata														Cushion star.			
	Rockall Bank					substrate	+ massive igneous																	
77	29.6.78	57°48.2'N	104	g		TV (tape 8 11-23)	0	6.5	25.2	52.0	1.2	0	3.4	1.0	0	10.7	0.1	0	0		Cup sponges, bryozoa		48	Side Scan PES
	2340	13°50.8'W				S.C (Col) 23	0	31.5	////	////	5.2	0	15.0	4.2	0	43.0	0.2	0	0		encrusting rock.			pinger
							lithic - foram sand														Cushion star			
	Rockall Bank																				fish			
78	30.6.78	57°59.9'N	255	g		TV (tape 8 25-32, tape 9 0-19)	0.4	3.4	0.3	10.1	2.1	0	0.4	0	0	23.9	56.4	3.0	0	c	Spatangus, cidaris		90	Side Scan PES
	0250	14°09.1'W				S.C (Col) 52	0.4	3.8	////	////	2.4	0	0.4	0	0	26.7	62.9	3.4	0	(d)	1/m²			pinger
						Dense pock marks	angular boulders in														(dead coral on TV)			
	Rockall Bank					Spat. traces mud & rock	sandy mud																	
79	30.6.78	58°05.1'N	300			TV (tape 9 19-[illegible], 10)														c	Lophelia reef, Hake.			Side Scan PES
	0600	14°10.9'W				S.C (Col)														(d)	Cidaris rare Spatangus			pinger
																					+ fish: pollack.			
	Rockall Bank																							
80	30.6.78	57°26.1'N	150	g		TV (tape 11 0-11)	0	20.4	11.2	27.3	3.4	0.8	4.0	4.1	0	27.8	1.2	0	0		Cup sponges & branching		73	Side Scan PES
	1420	14°00.0'W				S.C (Col) 30	0	33.1	////	////	5.5	1.2	6.5	6.6	0	45.1	2.0	0	0		bryozoa encrusting rock			pinger
						f.s.d coats rock and rippled sand. Some	Coarse sand with rock debris														Hake, Norwegian Cod, Antedon sp			
	Rockall Bank					incrustation on rocky parts	lithic fragments & forams														Flatfish feeding.			

Station	Date time	position lat / long	depth m	bottom sample	water sample	TV Still Cam.	constituent composition: percent	CORAL	Biota dredge / TV	Terrigenous	CaCO3 in sand	Remarks / geophys
81	30.6.78 1920 E. Rockall Bank	57°13.5'N 13°12.1'W	257	g		TV (tape 12) (11→) S.C. (col) 45	1.1, 9.2, 9.0, 32.3, 3.5, 0, 5.6, 2.5, 0, 5.3, 30.5, 2.1, 0 0.1, 5.7, ////, 5.9, 0, 9.6, 4.3, 0, 9.0, 51.9, 3.6, 0 foram sand	C	Lophelia Cidaris Spatangus < 2/m²		68	pinger, PES, Side scan
82	30.6.78 2140 E Rockall Bank	57°12.5'N 13°08.5'W	336	g(l) g		TV (tape 13) SC (col) 23	lithic/bioclastic gravel 85% boulders 15%	C	Cidaris < 2/m² Spatangus Lophelia			pinger PES Side scan
83	30.6.78 2330 E Rockall Bank	57°12.4'N 13°09.6'W	285	g		TV SC (col) 30	0, 2.2, 7.3, 42.8, 0.9, 0, 2.2, 0.8, 0, 11.0, 32.9, 0, 0 0, 4.3, ////, 1.7, 0, 4.4, 1.6, 0, 22.0, 66.0, 0, 0 f. foram sand		Cidaris < 5/m² Shrimp, gastropod		57	
84	1.7.78 1410 Mid - Rockall Trough	56°35.0'N 10°51.0W			W.S.							Long Sparker run from Rockall to Shelf via Hebrides Terrace Seamount
85	2.7.78 0200 Malin Shelf Edge NW Tory Is	55°40.3'N 09°21.3'W	311	g		TV SC (col) 30	M-C qtz rich sand, moll, foram, serpulid, bry, ech, otolith.					Pinger PES Side Scan
86	2.7.78 0430 Malin Shelf Edge NW Tory Is	55°44.8'N 09°20.7'W	275	g		TV (16) SC (col) 20 Coarse sed. few shells ? lineation on bottom	M-C. qtz rich sand with forams & mollusc debris					Pinger PES Sidescan.
87	2.7.78 0550 Malin Shelf Edge NW Tory Is	55°44.4'N 09°20.1'W	255	g		TV S.C (f) Gravel and stones	m-c qtz sand with moll, foram, bryoz, lithics, otolith					Pinger PES Sidescan

CHARTWELL TIME-TABLE (GANTT) CHART No. 7020

Station	Date time	position Lat / Long	depth m	bottom Sample	water Sample	T.V. Still Cam.	constituent composition : percentage	Biota dredge / TV			$CaCO_3$ % in sand	Remarks / geophys
88	2·7·78	55°45·2'N	180	g		TV		Ophiuroids				Pinger PES
	0820	09°18·4'W										Sidescan
						Monotonous cobble muddy sand,	Quartzose sand with lithic frag. Moll, bry. and foram debris					Simrad
	Malin shelf	Edge NW Tory I.										
89	2·7·78	55°55·5'N	195			TV						Pinger - PES
	1025	09°10·4'W				SC (15)						sidescan
							Qtz sand with foram, Serp, Moll, Sca phopod debris. Few encrusted stones					Simrad
	Malin Shelf	Edge										
90	2·7·78	56°15·4'N	270			TV						Pinger PES
	1350	09°09·9'W	200			SC (25)						Sidescan
			195	g			Terrigenous sand with bio debris foram, serpulid, moll, scaphopod					Simrad
	Malin Shelf		193	g								
91	2·7·78	56°17·9'N	150	g		TV		Encrustations of Serp. cup Sponges, Alcyonium sp Cidaris - dead bivalves				Pinger PES
	1610	09°02·7'W		g (H)		SC						Sidescan
				g (H)		boulder, cobble, stony gravel + sand in hollows	Coarse pebbly sand - gravel Moll. debris. (Shipeck sample 400 not shown where shown on TV)					Simrad
	Malin shelf											
92	2·7·78	56°16·6'N	143	g		TV		Serpulids on stones				Pinger PES
	1800	08°56·8'W				SC						Sidescan
						Cobble covered area of rippled sand	Eth sand + moll, bry, Serp, Scaph, Eth, foram. Stones with Serp. encrust.					Simrad
	Malin Shelf											
93	2·7·78	56°15·3'N	135	g		TV						Pinger PES
	2030	08°41·4'W		g		SC						Sidescan
				g			Terrigenous sand with Moll foram, bry, Ech, Scaphopods					Simrad
	Malin Shelf											
94	2·7·78	56°17·3'N	130	g				Small live solitary corals on small cobbles + few gastropods				Pinger PES
	2230	08°28·1'W		g								Sidescan
	Malin Shelf - Stanton Bank											Simrad

CHARTWELL TIME-TABLE (GANTT) CHART No. 7020

Station	Date time	Position lat / long	depth m	bottom sample	water sample	TV Still Cam	Constituent Composition: percent	Corg %	Biota dredge / TV		Terrigenous	CaCO3 % in sand	Remarks
95	3.7.78	56°16.1'N	157	g		TV							Pinger PES
	0010	08°16.3'W				SC							Sidescan
							Muddy cobbly gravel						Simrad
96	3.7.78	56°14.3'N	135	g		TV							Pinger PES
	0200	08°04.5'W				SC.							Simrad
							lithic sand & gravel. c.25% Carb shell debris						Sidescan
97	3.7.78	56°12.9'N	105	g		TV							Pinger PES
	0320	07°57.1'W		g		SC.							Simrad
							C. biodetrital sand with Moll. barn. serp. bryo.						Sidescan
	Stanton Banks												
98	3.7.78	56°14.6'N	84			TV			Ophiuroids, starfish				Pinger PES
	0430	07°52.4'W	80	g g g		SC			bryoz. Cup sponge				Sidescan
			94	g g		Rock bottom	trace Shell sand						Simrad
	Stanton Banks		68	g g									
99	3.7.78	56°16.7'N	50	g									Pinger PES
	0810	07°46.9'W											Sidescan
													Simrad
	Stanton Banks												
100	3.7.78	56°17.9'N	67	g 4									Pinger PES
	1230	07°18.4'W		g 4									Sidescan
				g 4									Simrad
101	3.7.78	56°17.0'N	77	g		TV.							Pinger PES
	1430	07°20.9'W		g									Sidescan Simrad
							lithic pebbles + biogenic sand of epifauna – bry. Moll, serpulids						

station	Date time	position lat / long	depth m	bottom Sample	water Sample	T.V. Still Cam.	constituent composition: percent	Core	Biota dredge / Tr.		Terrigenous	Calcs % in Sand	Remarks
102	3·7·78	56 19·6 N	126	g									Pinger PES
	1540	07 26·1 W											Simrad, SideScan
							Muddy, likic carb. sand						
103	3·7·78	56 21·7 N	160	g									Pinger PES
	1635	07 28 5 W											Simrad SideScan
							f. sand, muddy, with moll debris						
104	3·7·78	56 20·4 N	190	g									Pinger PES
	1820	07 42·0 W											Simrad SideScan
							f-m sand with ech. moll fragm debris.						
105	3·7·78	56 15·5 N	129	g									Pinger PES
	1940	07 33 1 W											Simrad SideScan
							f-m sand with 2 pelican foot dashords.						
106	3·7·78	56 11·4 N	115	g g g									Pinger PES
	2020	07 28 2 W											Simrad SideScan
							C. sand with shells overlying a compact clay (? Pleistocene)						
107	3·7·78	56 10·9 N	100	g									Pinger PES
	2130	07 18·2 W											Simrad SideScan
							c sand with whole & broken shells						
108	3·7·78	56 11·4 N	82	g									Pinger PES
	2230	07 08·4 W											Simrad SideScan
							M-sand with shell fragments						

Station	Date time	position Lat / long	Depth m	bottom sample	water sample	T.V. Still Cam.	constituent composition : percent	Core	BIOTA dredge / TV		Terrigenous	Ca CO_3 % in sand	Remarks
109	3.7.78	56° 12.0' N	70	g							Volcanic pebbles		Pinger PES
	2310	06° 58.5' W											Sidescan Simrad
							6 small stones, lithic sand with shell frag.						
110	4.7.78	56° 13.4' N	65	g									Pinger PES
	0010	06° 52.1' W											Sidescan Simrad
							C. carb sand with bivalves barnacles. (c. 70 % carb.)						
111	4.7.78	56° 16.5' N	63	g									Pinger PES
	0110	06° 53.0' W											Sidescan Simrad
							Carb. sand with Moll, bry serp. + a few enc. pebbles						
112	4.7.78	56° 19.8' N	75	g									Pinger PES
	0210	06° 51.1' W											Sidescan Simrad
							Muddy - f. sand (c. 20 % carb)						
113	4.7.78	56° 34.2' N	75	g									Pinger PES
	0300	06° 50.4' W		g									Sidescan Simrad
							f. sand - muddy						
114	4.7.78	56° 27.7' N	30 to 64	g x 14									Pinger PES
	0400	06° 46.0' W											Sidescan Simrad
							Some encrustations of rocks otherwise barnacle gravel.						
115	4.7.78	56° 27.9' N	38 to 55	g x 8		T V							Pinger PES
	0550	06° 46.9' W				S. C.							Sidescan Simrad
						Coarse shelly sand with ripples	c. Shelly sand						

Station	Date time	position lat / long	depth m	bottom Sample	water sample	TV Still cam.	Constituent composition : percent	COPAL	BIOTA dredge / TV		Terrigenous	$CaCO_3$ / insand	Remarks
116	4.7.78	56° 27.6' N	47	g									Pinger PES
	1710	06° 47.5' W		g									Simrad Sidescan
							c. barnacle with sand + debris						
	Passage of Tiree												
117	4.7.78	56° 27.9' N	25			TV			laminaria				Pinger PES
	0820	06° 51 4' W	25	g		SC			red algae				Simrad Sidescan
	Passage of Tiree												
118	4.7.78	56° 29.9' N	40			TV							Pinger PES
	1000	06° 45.5' W	38	g		SC							Simrad Sidescan
							Some mud - c shelly sand						
	Passage of Tiree												
119	4.7.78	56° 31.3' N	57			TV							Pinger PES
	1130	06° 40.7' W	63	g		SC							Simrad Sidescan
							Muddy sand with shell debris						
	Passage of Tiree												
120	4.7.78	56° 31 0' N	60			TV							Pinger PES
	1210	06° 38.6' W	92	g		SC							Simrad Sidescan
							Muddy sand with shell debris						
	Passage of Tiree												
121	4.7.78	56° 33 4' N	102			TV							Pinger PES
	1350	06° 34.6' W	112	g		SC							Simrad Sidescan
							Muddy sand with shell debris						
	Passage of Tiree												
122	4.7.78	56° 35.0' N	186			TV							Pinger PES
	1500	06 32.9' W	174	g		SC							Simrad Sidescan
							Muddy, terrigenous sand c. 10-20% $CaCO_3$						
	Passage of Tiree												

Station	Date time	position lat / long	depth m	bottom sample	water sample	T.V. Still Cam	Constituent composition : percent	C org %	Biota dredge / TV		Terrigenous	$CaCO_3$: in sand	Remarks Geophysics
123	4·7·78	56°35·0'N	78			TV							
	1650	06°28·3'W	93	g		Sc							
							Carbonate sand with lithic						
	Passage of Tiree						pebbles (c. 30% $CaCO_3$)						
124	4·7·78	56°40·2'N				TV (4)							
	1820	06°25·8'W	67			Sc (4)							
			72				M-C sand with burr. + moll.						
	Passage of Tiree						Shells & stones encrusted with serpulids						
125	5·7·78	56°39·9'N	67	Rd		TV (4)			Nephrops				
		06°06·2'W	66	box core		Sc							
			65	" "			Mud						
	Loch Sunart	Mull	75	" "									
126													
	Sound of Jura												