Keele UNIVERSITY

RECENT AND LATE QUATERNARY ECOLOGY, DISTRIBUTION AND PROVINCIALISM OF OSTRACODA IN THE NORTH ATLANTIC AND ARCTIC OCEANS

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CONTAINS MAPS IN BACK POCKET

VOLUME CONTAINS CLEAR OVERLAYS

OVERLAYS HAVE BEEN SCANNED SEPERATELY AND THEN AGAIN OVER THE RELEVANT PAGE

P A R T   I I

E C O L O G Y   A N D   D I S T R I B U T I O N
O F   T H E   O S T R A C O D A

C H A P T E R   I

S O U T H E R N   I R I S H   S E A

THE ENVIRONMENT

The geographical location of this study area is accurately documented in the Introduction (p.1 , Fig. 1). In essence,it covers some 4,500 sq. km. of the Irish Sea off S.E. and E. Ireland. The region is represented on Admiralty Charts 45 (Clogher Head to Burrow Head); 1410 (Carnsore Point to Braich-y-Pwll) and 1411 (Braich-y-Pwll to Glogher Head); scale 1:200,000 or approx. 5 miles to 1 inch.

Coastal Geomorphology

Three prominent rocky headlands, Cahore Point, Mizen Head and Wicklow Head dominate the coastline south of Dublin whereas, to the north of Howth, the distinctive coastal features are Glogher Head, Dunany Point and Saint John's Point. In addition, a shingle and gravel tombolo on the northern shore of Dublin Bay connects the Nose of Howth to the mainland of Ireland. These promontories are marked in this section on Figs. 17 and 18 and clearly exhibit a NE-SW 'Caledonian' trend. Indeed, with the exception of Carboniferous geology in the Dublin Bay area the remaining coastal regions of S.E. Ireland are mostly composed of sedimentary and isolated igneous Lower Palaeozoic rocks. Low cliffs and narrow shingle or sand beaches make up the coastal morphology between the headlands as far north as Dundalk Bay. However, in the northernmost region, between Carlingford Lough and Dundrum Bay, a number of precipitous cliffs sweep down to the sea from the Mourne Mountain complex. Large bays and estuaries and the more mature river drainage systems also occur in the northern province, shown on Fig. 17. This is evidenced by meandering of the R. Liffey before it enters Dublin Bay, the R. Boyne entering Drogheda Bay and by several smaller rivers that dissect the lowlands westward of Dundalk Bay. In contrast, rivers of the Wicklow Mt. drainage system to the south of Dublin are quite juvenile in development and exhibit truncation at the coast near Arklow, Wicklow and Bray. A more detailed account of regional geomorphology is given by Parish (ms. 1972, p. 2-3).

Sampling and Methods

Of Parish's (ms.) original 160 bottom samples, a total of 138 were examined in the present study. The top 1 cm of four core samples were also analysed. Each sample station is listed on Table 1 and is accompanied by the corresponding depth, latitude and longitude and the sampling method used (Appendix I). Additionally, these stations are shown on Figs. 17i, 18i.

Bathymetry

The 6 fm (10 m .) depth contour is marked, but thereafter the bathymetry is expressed in 10 fm (18 m.) intervals. These and the main submarine topographical features, are indicated on Figs. 17/ 18. Two distinct regions can be distinguished on the basis of sea floor relief and are broadly separated into a northern and southern province by lat. $53^{o}25'$N.

To the north of Dublin Bay the marine isobaths suggest a featureless shelf which slopes gradually seaward at approx. 1^{o} or less. The region has an average depth of 43 m, although there is a deep depression situated 40 km due east of Malahide. This, the Lambay Deep, has a NNW-SSE orientation and is more than 80 m deeper that the surrounding sea floor.

To the south of lat. $53^{o}25'$N the depth isobaths are much more irregularly disposed and exhibit an overall Caledonide, NNE-SSW, trend. The mean depth is 34.3 m and the sea floor relief evidences several major submarine features. These are imposed on an area of wide shelf that is situated above the 20 fm line off Wicklow and Bray. These features include a 30 m high discontinuous ridge found 15 km offshore and extending parallel to the coast for some 60 km, from Lambay Island to midway between Arklow and Cahore Point. This ridge is traced on Fig. 18 from N. to S. by the crests of Frazer, Bennet, Kish, Bray, India and Arklow Banks. On its western flanks and in the widest part of the 20 fm shelf are two very large depressions, Codling Deep and Wicklow Trough. These have a N-S trend and are between 50-70 m deeper than the surrounding sea floor. The Codling Deep is trifurcate in the northern aspect, though like the Lambay Deep and Wicklow Trough it closes simply at the southern extremity. The regional marine topography is discussed in greater detail by Parish (ms. 1972, p. 32-45).

Hydrography

Tidal information from the Hydrographic Office (1962) is presented on Figs. 17 and 18, from which it is apparent that there is considerable variation in the strength and influence of flood and ebb tides in the Irish Sea. This complicated tidal regime is caused by marine influence from opposing directions, from the north through North Channel and from the south through St. George's Channel. The two flood tides converge on the area between the Isle of Man and Dundalk Bay and then move eastward towards the British mainland. In the southern part of the study area currents become constricted between Carnsore

Point, S.E. Ireland and St. David's Head, S.W. Wales. This has resulted in an increase in tidal velocity of up to 4 kn or 2 m/sec and the funnelling of currents into the southern Irish Sea in a predominantly NNE-SSW direction. To the north of Dublin Bay the main currents are some distance offshore and have resulted in a much reduced tidal velocity, 0.2-1.8 km or 0.1-0.9 m/sec. Further, the current regime is effectively cancelled in the region of tidal convergence adjacent to Dundrum and Dundalk Bays. In the latter region a residual tidal vortex of only 0.25 m/sec is evidenced, which Parish (ms.) referred to as 'tidal shadow'. Harvey (1968) has confirmed this hydrodynamic pattern from experiements with tidal drifters. He noted that most water entering St. George's Channel was deflected away from the Irish coast by the Cahore Point, Mizen Head and Wicklow Head promontories. Harvey also commented that whereas surface water drifters were primarily motivated by the prevailing wind direction, the bottom current drifters followed trends in the main submarine relief and were directly associated with the major sedimentary bodies in the southern Irish Sea.

Sager (1961) and Allen and Milne (1967) report a very reduced tide range along the entire study area coast, from 1.0 m at Cahore Point to 3.5 m further north in the confines of Dundalk Bay. They also record mean tides of more than 8 m in adjacent areas between Solway Firth and Liverpool Bay. Parish (ms. 1972) proposed that this evidence added further weight in support of a tidal shadow region off S.E. Ireland. He also contended from the above tidal disparities that a large body of relatively slack water must remain trapped against the Irish coast during much of the tidal cycle.

Evolution of the Submarine Topography

Whittington (1977) considers that as the Lambay Deep, Codling Deep and Wicklow Trough are partially filled with Holocene sediments, their formation must have occurred in a period prior to the Flandrian sea level rise. He suggested three possible causes of the over-deepening.

1. Tidal scour during the early Holocene.
2. Subglacial stream erosion in the Late Glacial.
3. Sub-areal stream erosion in a period of lower sea level.

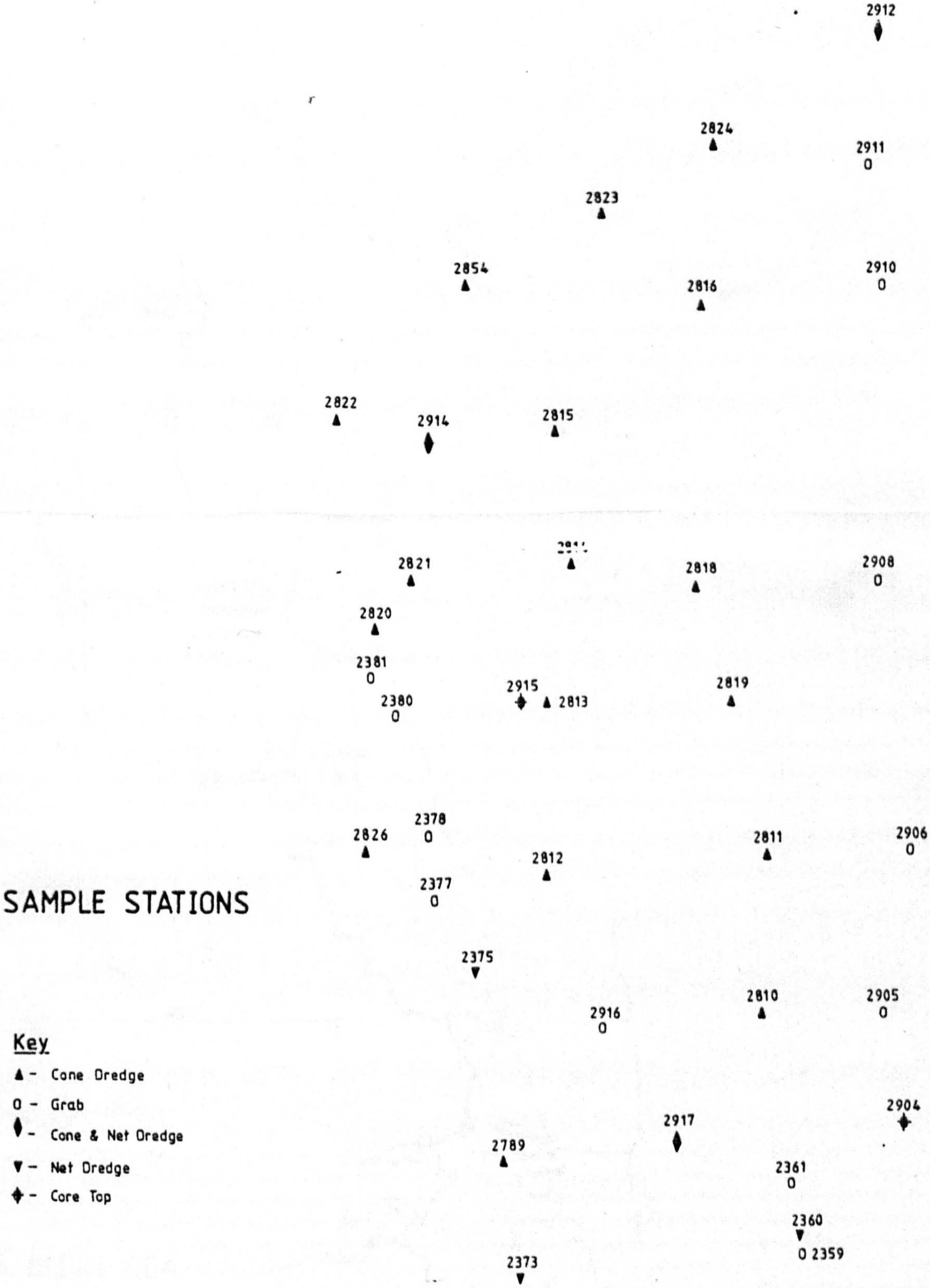
With regard to the first point, Whittington drew attention to the narrowness of St. George's Channel enhancing shallow marine tidal races to perhaps scouring pitch. He commented, however, that the sinuosity of the over deepened areas is a feature incompatible with the linear scouring motion of rip-tide conditions and so discounted tidal scour as their likely cause. Secondly, it was proposed that subglacial stream erosion was unlikely to produce these extensive areas of over deepening as glaciated valley systems tend to be sheer sided and linear in form. Lastly, the previous author detected that many rivers in the Wicklow Mt. drainage system were continued well offshore as submarine features. It was also suggested that these deepened channels were probably connected beneath superficial deposits with Codling Deep and Wicklow Trough. Whittington proposed, therefore, that these depressions were the product of intensive fluviatile erosion. Indeed, many authors consider that these features are part of a larger Late Glacial drainage system that flowed south under the influence of underlying geological structures.

The 60 km long ridge on the eastern flank of Codling Deep and Wicklow Trough is thought to be a tidal current structure, and, therefore, a product of wholly marine influence subsequent to the Flandrian transgression. This is discussed in detail by Parish (ms. 1972, p. 32-45, 129-135). He considered the near symmetrical form of the ridge to have developed from build-up of both sides by long standing N-S directed flood tides. Furthermore, the discontinuous nature of the ridge is thought to be the result of strong cross-currents. For instance, the breaching between India and Arklow banks is attributed to tidal scour caused by deflection of flood tides off Wicklow and Mizen Heads diagonally over the tide current ridge. These rip-tides also appear to have sculptured the Codling Bank into a streamlined sigmoidal shape. Lastly, Parish indicates that the smaller inshore sedimentary bodies like Burford Bank situated in the mouth of Dublin Bay and Glassgorman Bank to the south of Arklow are the product of strong ebb tide currents flowing back through breaches in the tide current ridge. Such features, therefore, developed quite recently subsequent to initiation of the prevailing tidal regime.

Conclusions and Summary

It is apparent that the regional drainage system of S.E. Ireland has exerted considerable influence in shaping the submarine topography southward of Dublin Bay. Stride (1963), Dobson et.al. (1971), Parish (ms. 1972) and Whittington (1977) consider the irregular sea floor development in this region to be caused by a combination of Late Glacial fluvial erosion and

Flandrian N-S directed tidal current action. The coastal morphology of St. George's Channel and the enhanced tidal flow in southern parts of the study area have had marked effect on the deposition of superficial sediments in the Irish Sea. Rapid flood and ebb tides have, in certain over deepened parts, actively winnowed out unconsolidated sediments and transported them towards the Irish coast and to the area northward of Dublin Bay (Parish, ms. 1972, p. 126, 130). Reduced current action and a region of tidal shadow occurs north of Howth. This has facilitated a blanket deposition of sediments that have completely infilled all but the deepest Late Glacial feature of the northern province, the Lambay Deep.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2824
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2380
2826
2378
2811
2906
2812
2377
SAMPLE STATIONS
2375
2810
2905
2916
Key
Cone Dredge
Grab
Cone & Net Dredge
Net Dredge
Core Top
2904
2917
2789
2361
2360
2359
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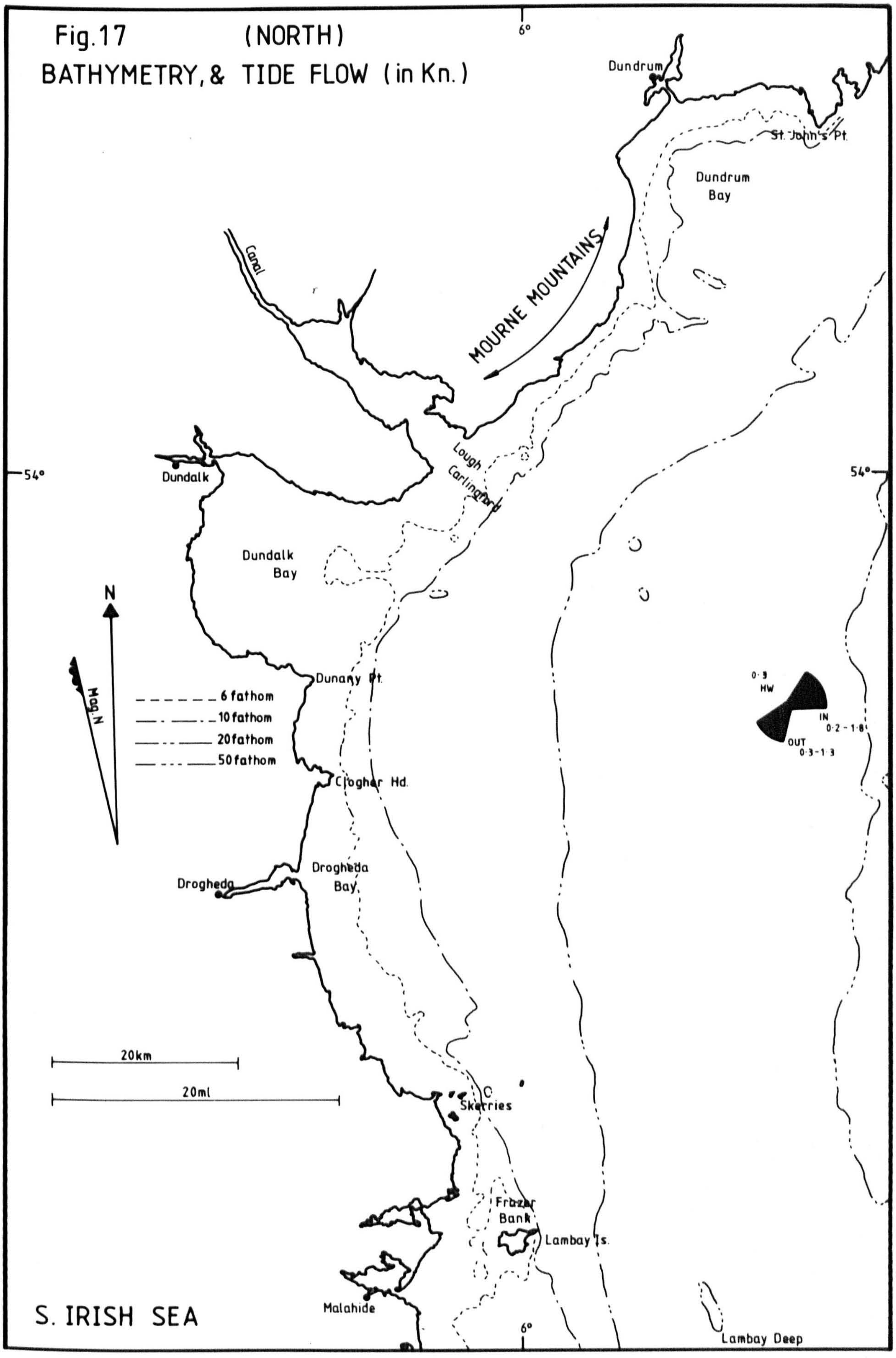


Fig.17 (NORTH)
BATHYMETRY, & TIDE FLOW (in Kn.)
6°
Dundrum
St. John's Pt.
Dundrum Bay
MOURNE MOUNTAINS
Canal
Lough Carlingford
54°
Dundalk
Dundalk Bay
N
Mag. N
Dunany Pt.
6 fathom
10 fathom
20 fathom
50 fathom
0·9 HW
IN 0·2 - 1·8
OUT 0·3 - 1·3
Clogher Hd.
Drogheda
Drogheda Bay
20km
20ml
Skerries
Frazer Bank
Lambay Is.
Malahide
S. IRISH SEA
Lambay Deep

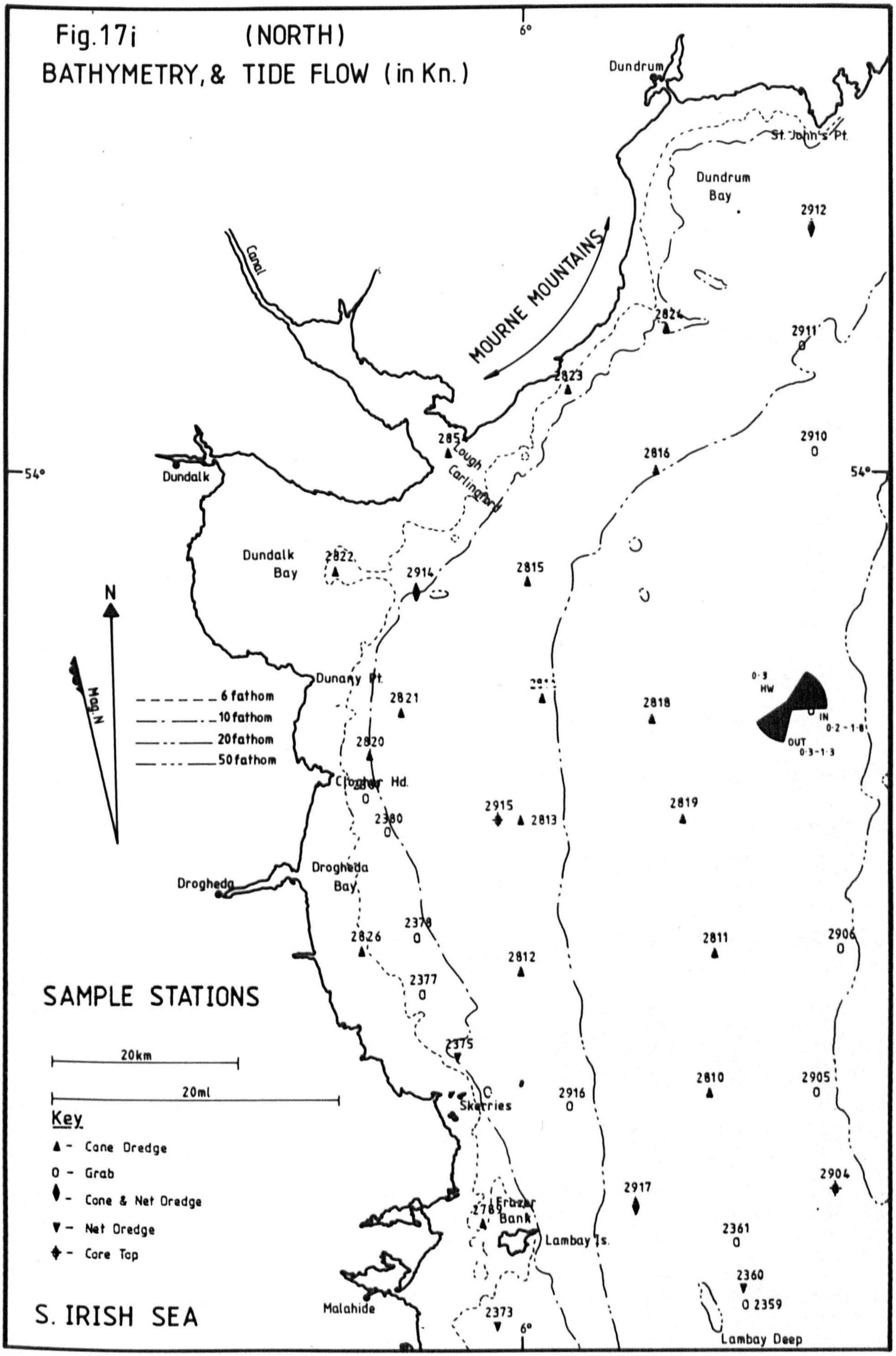
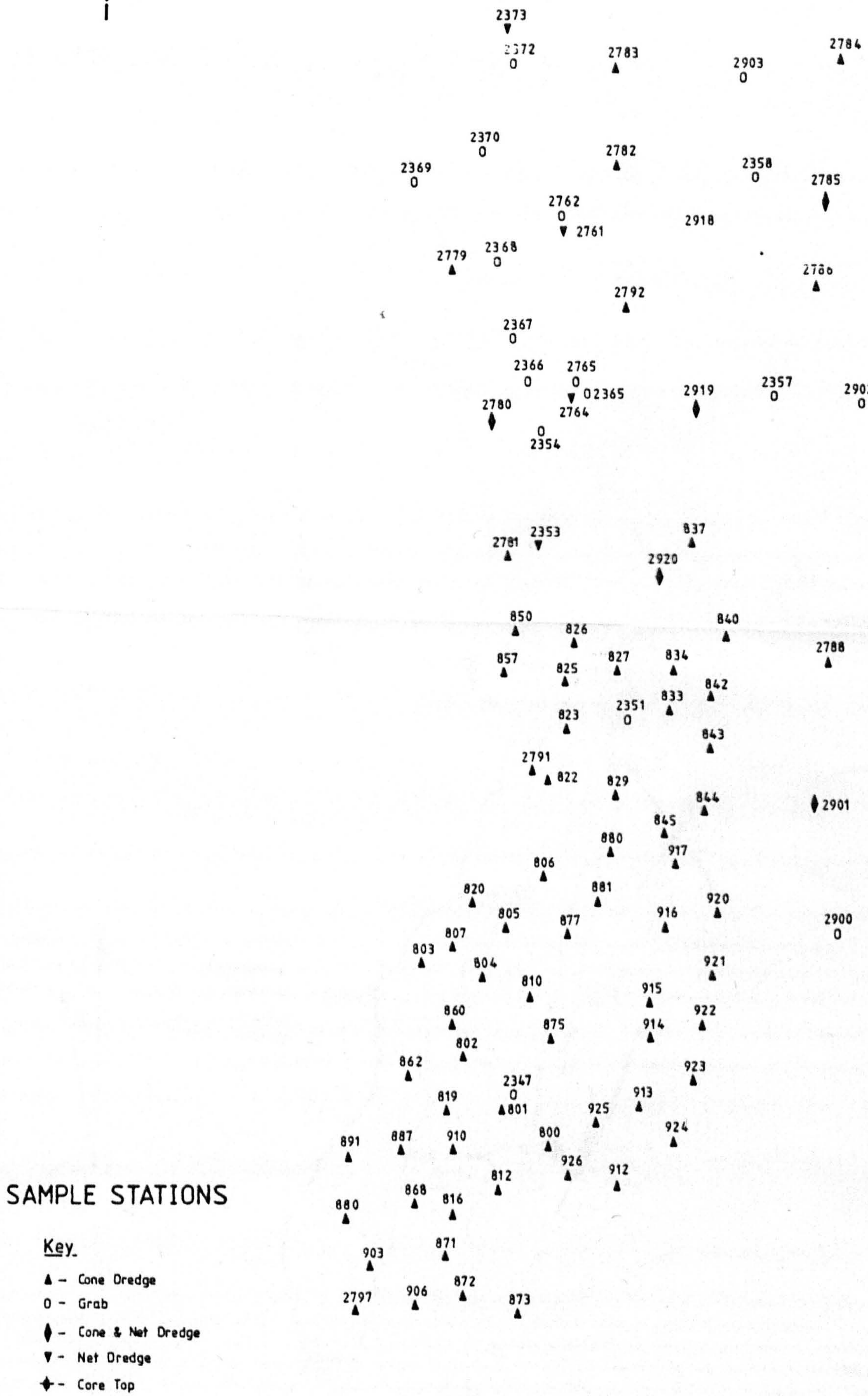


Fig.17i (NORTH)
BATHYMETRY, & TIDE FLOW (in Kn.)
Dundrum
St. John's Pt.
Dundrum Bay
2912
Canal
MOURNE MOUNTAINS
2824
2911
2823
2910
Lough Carlingford
2816
Dundalk
54°
6°
Dundalk Bay
2822
2914
2815
N
Mag. N
Dunany Pt.
0·3 HW
IN 0·2 - 1·8
OUT 0·3 - 1·3
6 fathom
10 fathom
20 fathom
50 fathom
2821
2818
2820
Clogher Hd.
2915
2813
2819
2380
Drogheda
Drogheda Bay
2378
2826
2811
2906
2812
2377
SAMPLE STATIONS
20km
20ml
2375
2810
2905
Skerries
2916
Key
▲ - Cone Dredge
O - Grab
♦ - Cone & Net Dredge
▼ - Net Dredge
✦ - Core Top
2917
2904
Frazer Bank
2789
Lambay Is.
2361
2360
0 2359
Malahide
2373
S. IRISH SEA
Lambay Deep

i



2373
2372
2783
2903
2784
2370
2782
2369
2358
2785
2762
2761
2918
2779
2368
2786
2792
2367
2366
2765
2365
2919
2357
2902
2780
2764
2354
2781
2353
837
2920
850
826
840
857
825
827
834
2788
842
833
2351
823
843
2791
822
829
844
2901
845
880
917
806
820
881
920
805
916
877
2900
807
803
804
921
810
915
860
922
875
914
802
923
862
2347
801
819
913
925
924
891
887
910
800
926
912
812
SAMPLE STATIONS
868
880
816
871
903
872
2797
906
873
Key
▲ – Cone Dredge
0 – Grab
♦ – Cone & Net Dredge
▼ – Net Dredge
✦ – Core Top

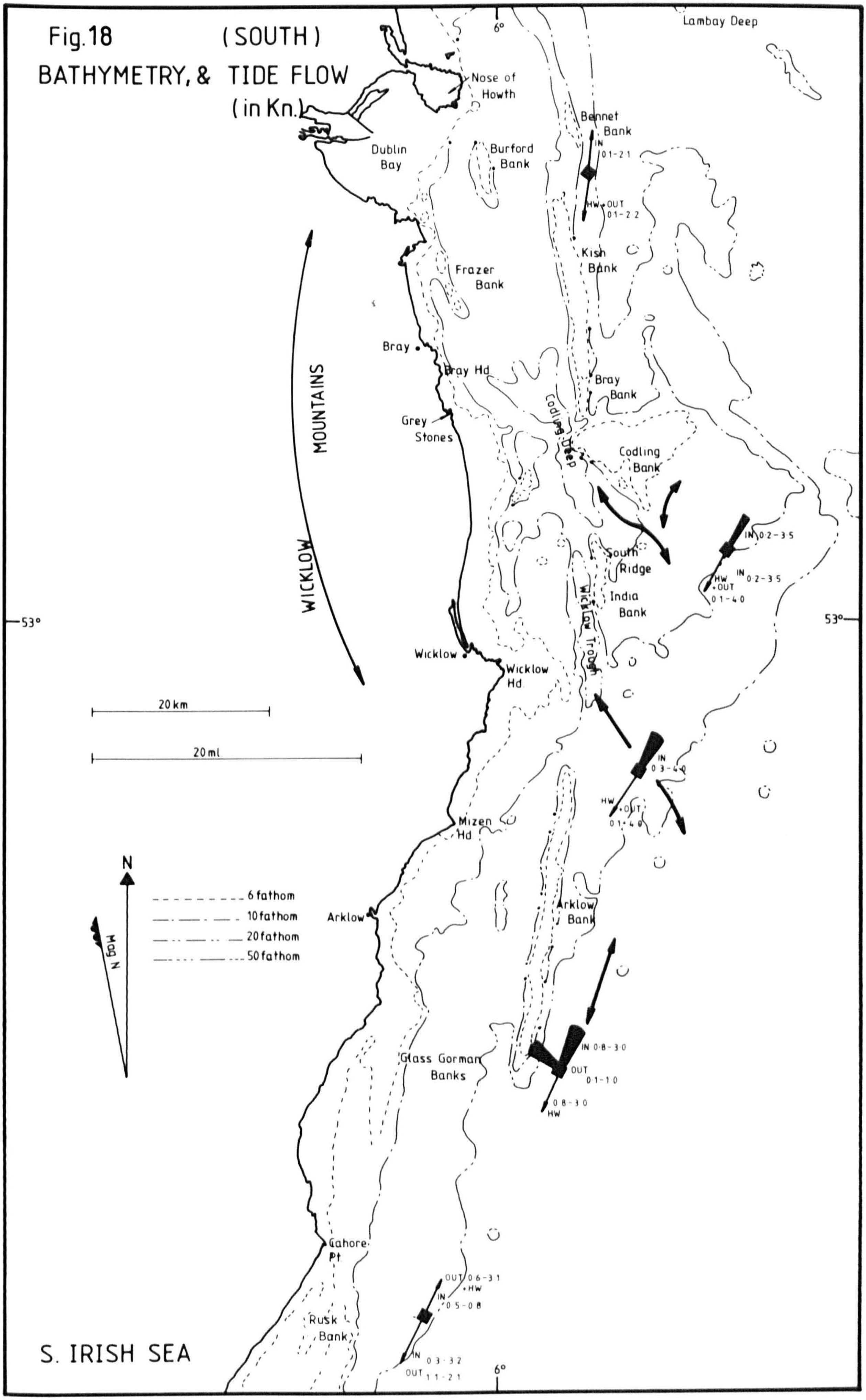


Fig.18 (SOUTH)
BATHYMETRY, & TIDE FLOW (in Kn.)

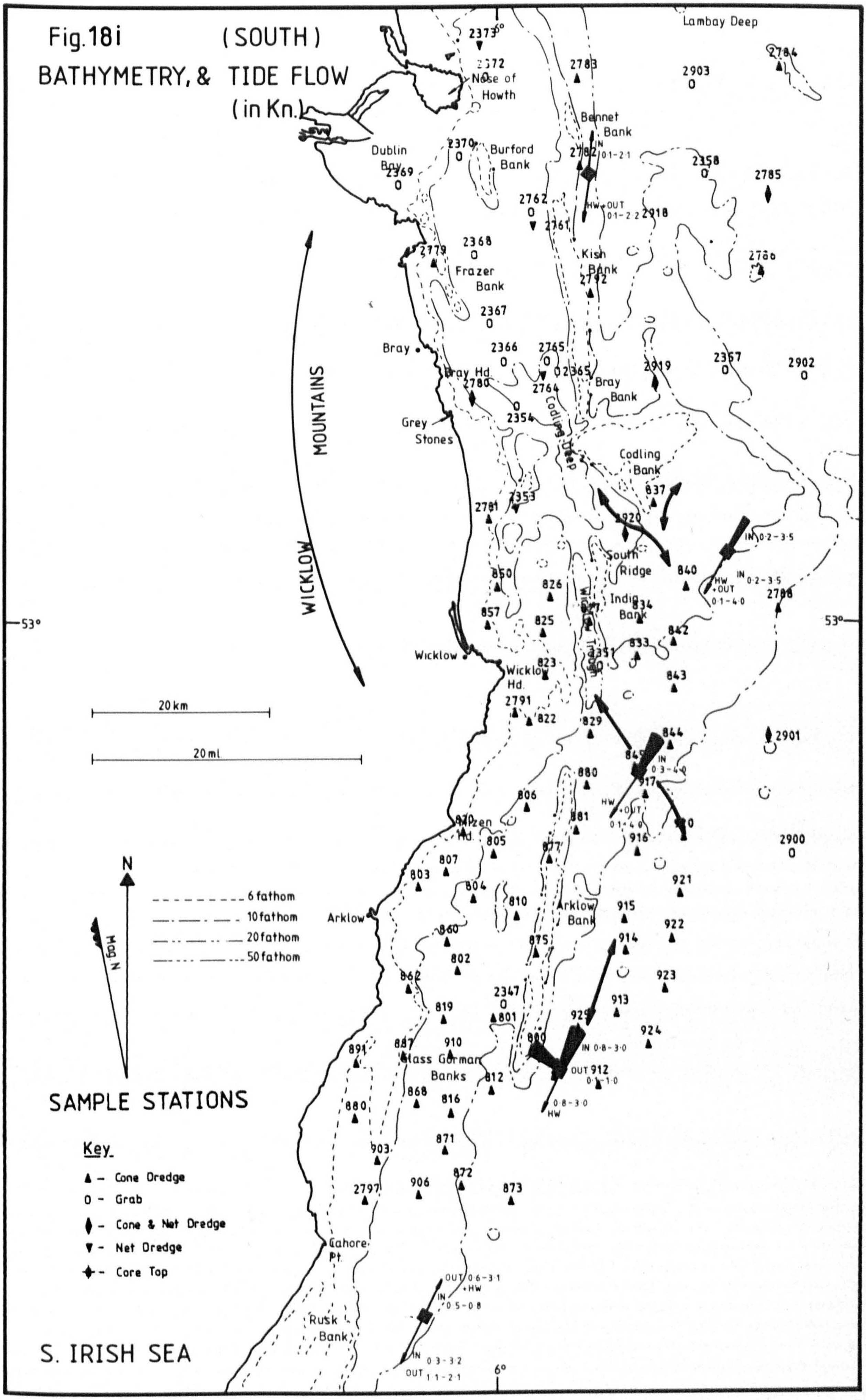


Fig. 18i (SOUTH) BATHYMETRY, & TIDE FLOW (in Kn.)

CHAPTER II

CAERNARVON BAY

The Environment

The Geomorphology in relation to Geology

Sampling and Methods

Bathymetry

Hydrography

Conclusions and Summary

THE ENVIRONMENT

The study area comprises the seaward approaches to and inner parts of Caernarvon Bay, some 5,500 sq.km. of shallow Irish Sea shelf off N.W. Wales. The region is accurately detailed on Admiralty Chart 1411 (Braich-y-Pwll to Clogher Head); scale 1:200,000 or 5 mls to 1 inch.

The Geomorphology in relation to Geology

The study area is represented on Fig.19 from which it can be seen that the Lleyn Peninsula dominates the landscape on the S.E. flanks of Caernarvon Bay. Precipitous cliffs composed of Pre-Cambrian metamorphic rocks and Lower Palaeozoic igneous and sedimentary rocks sweep down to the sea on its N.W. aspect. In marked contrast, low rocky cliffs and small sandy bays make up the remaining coastline of Anglesey and Holy Island. It is also evident that the N.E. parts of the study area have been extensively peneplained and near the shore comprise enumerable craggy promontories and havens with sandy beaches. These have been formed by rigorous differential erosion of the complicated regional geology. With the softer Ordovician and Carboniferous sedimentary rocks facilitating narrow inlets and coves and resistant Pre-Cambrian and Lower Palaeozoic rocks providing the intervening headlands. The overall geomorphology indicates a NE-SW 'Caledonian' trend and, with the exception of Lleyn Peninsula, no single feature evidences this orientation stronger than the Menai Straits. This narrow tidal waterway separates Anglesey from the mainland of Wales and provides access between Caernarvon Bay and Beaumaris Bay. Primarily, it outlines the trend of the Dinorwic

Fault, downthrust on the Anglesey side, that extends to the S.W. along the northern cliffline of Lleyn Peninsula and to the N.E. beneath superficial deposits of the northern Irish Sea. The entrance of the Menai Straits into Caernarvon Bay is almost entirely closed off by a small headland of Ordovician volcanics and by unconsolidated glacial outwash sediments banked against this structure. No major rivers flow into the study area, but are directed away from Snowdonia towards Beaumaris Bay. Indeed, the lack of stream erosion combined with the resistant nature of the N. Wales coastline has resulted in a very reduced amount of local terrigenous sediment input into the region since the Holocene.

Sampling and Methods

135 of the James (ms. 1973) bottom sediment samples were examined by the present author. These are plotted on the overlay to Fig. 19.

The sample stations are listed on Table 2 (Appendix I) with corresponding depth, latitude, longitude and the method of sample collection. A detailed account of sampling techniques is given in the General Introduction, p.3-6, and is well documented by James (ms. 1973, p. 14-18).

Bathymetry

The study area can be divided along long. 5°W into two bathymetric provinces. To the east of this division the close proximity of depth contours indicate a rapid sea floor decline down to some 20 fm. In addition, the sea floor topography is most irregular in the N.E. of Caernarvon Bay, wherein the 6 fm and 10 fm isobaths evidence a series of deep channels and ridges with a NE-SW Caledonian trend. These are considered to be submarine extensions of the very rugged coastline of S.W. Anglesey. At 10 km to the west of Holy Island the bathymetry descends to some 90 m into the N-S orientated Holyhead Deep. This depression is bifurcate in the northern part and closes simply at 20 km to the south.

In the province westward of long. 5^{o}W the bathymetry evidences a more gradual slope and the almost featureless nature of the Central Irish Sea Basin. For the most part, this shallow sided depression is situated below 50 fm and runs N-S in the study area for more than 100 km. Depth recordings indicate, however, a region of irregular topographical relief in the N.E. section of the basin. Indeed, an escarpment of 20-30 m in height extends around its margin upward towards the 50 fm contour. It connects in the extreme N.E. portion with a deeply incised and linear valley of approximately 30 km in length. The last feature has a NE-SW orientation that is obviously influenced by Caledonian aspects of the underlying geological structures.

Hydrography

It is apparent from the information presented on Fig. 19 that the predominant tidal regime is directly opposed north to south across the mouth of Caernarvon Bay. Further, the indicated mean ebb velocities are somewhat stronger, 0.1-2.1 m/sec, than the regional flood tide currents of 0.2-1.3 m/sec. Tidal co-range information from the Hydrographic Office (1962) suggests a regional tidal range of only 3.5-4 m. However, in the confines of Holyhead Bay a rather restricted tidal flow and rapid shallowing has culminated in a tidal range of more than 5 m together with a much reduced tidal volocity of 0.5 m/sec. In addition, there is a residual tidal drift in the study area of 0.5 m/sec. The latter follows the coast around from the headland of the Lleyn Peninsula to the inner parts of Caernarvon Bay and the promontory of N.W. Anglesey.

Most authors consider that this residual northern drift has had a marked effect on the distribution of superficial deposits. They also attribute the overall transportation of sediments northward, against the stronger southward ebb tide influence, to be directly related to the persistence of the northern tidal drift throughout the tidal cycle. Indeed, Johnson and Stride (1969) and James (ms. 1973, p. 34) propose the following in an attempt to explain this phenomenon. They comment that the exposed westerly aspect of Caernarvon Bay is susceptible to severe storms, high winds and strong wave action. Further, that these conditions enhance the sediment transport competence of the region's generally moderate hydrodynamic regime. It was also proposed that the residual tidal drift ensures that large amounts of sediment worked into suspension eventually migrates northward and into the northern Irish Sea. The work of Lee (1960) is in broad accord with these findings. From experimentation with current drifters he found that there was no radical difference between surface water currents and sea floor current in strength or direction. This, Lee proposed, would seem to indicate that the rather featureless sea floor relief of the open shelf is accessible to widespread and almost uninterrupted tidal and storm turbulence. He concluded that superficial sediments occurring in such exposed situations would be most prone to the effects of winnowing, even down to the considerable depths of the Central Irish Sea Basin.

Conclusions and Summary

The coastal geomorphology and inshore submarine topography evidence widespread modification during and subsequent to Pleistocene glaciation. Because of the minor amount of sea floor relief remaining in the deeper shelf areas, with the exception of that in the N.E. of the study area, the effects of glacial erosion on the Central Irish Sea Basin and adjacent parts is largely unknown. In addition, the regional bathymetry tends to reflect the underlying solid geology rather than the character of the superficial deposits. This would seem to indicate that only a veneer of Holocene or sub-Recent sediments have endured in the study area. In part, this reflects the lack of locally derived terrigenous sediment input, but is also a direct result of erratic hydrodynamic influence in the region since the Flandrian inundation. In quiescent climatic conditions the tidal regime is probably not strong enough to prevent sediment deposition, especially in the deeper waters. However, it is apparent that widespread areas of deep shelf have been affected by and are still actively subjected to regular storms, enhanced sediment mobilization and a periodically aggravated rate of tidal scour. Further, the exposed nature and featureless character of the open shelf westward of long. $5^{\circ}W$ has allowed residual bottom currents to transport most of the finer sediments northward into the northern Irish Sea. James (ms. p. 32) indicates that the effect of this main tidal action directly across the mouth of Caernarvon Bay has resulted in reduced current circulation in the area to the east of long. 5^{o}W. He described this effect within inner Caernarvon Bay as a region of 'ponding' and somewhat similar to areas of 'tidal shadow', as described by Parish (ms. 1972).

In conclusion, there appears to be two distinct provinces in the study area. These are broadly separated to the east and to the west of long. 5^{o}W and are primarily distinguished by certain respective differences in submarine topography and hydrography. The effects of these physical parameters upon the region's impoverished superficial sediments and associated ostracod microfaunas are discussed in Chapter IV.

SAMPLE STATIONS

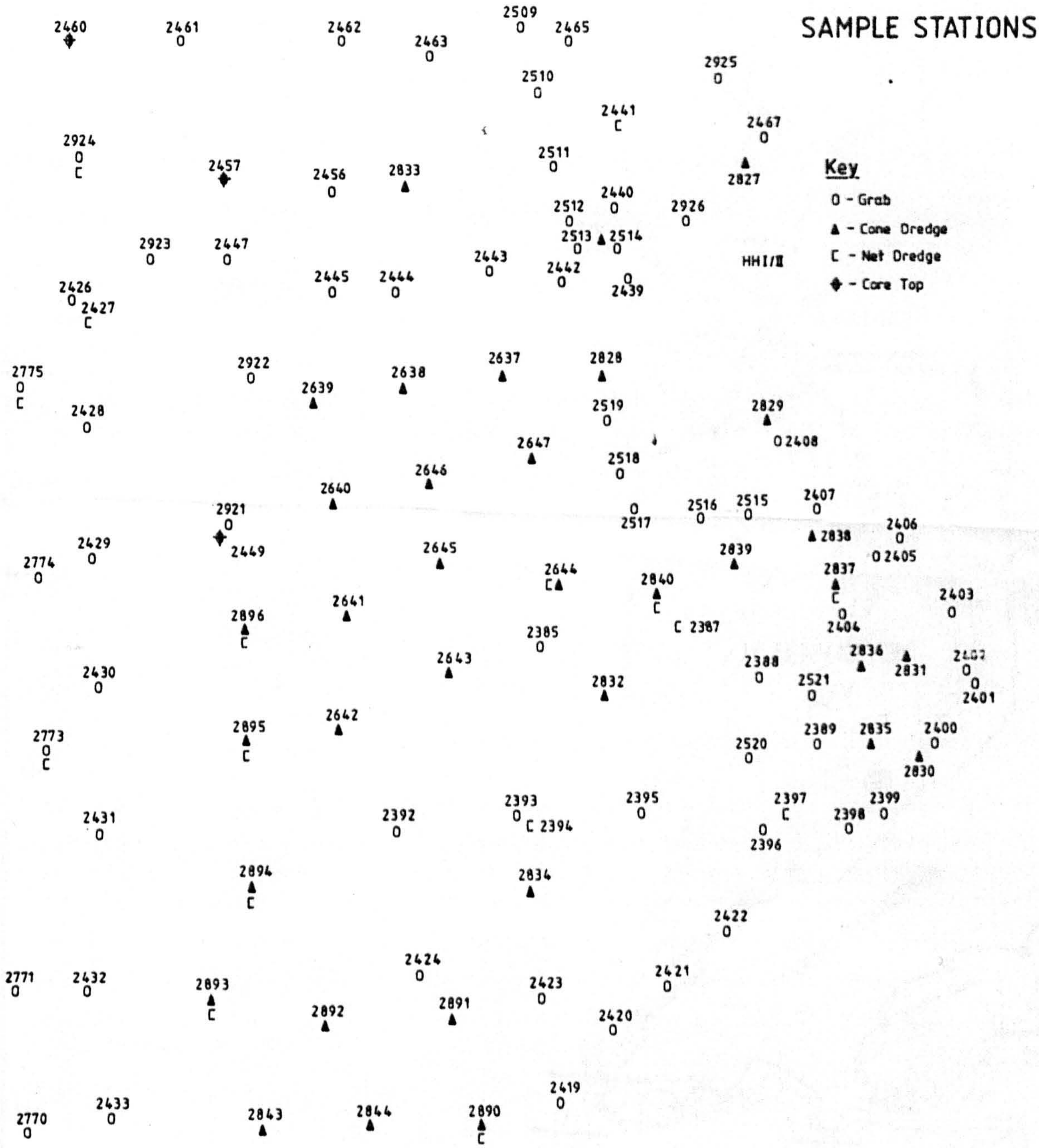
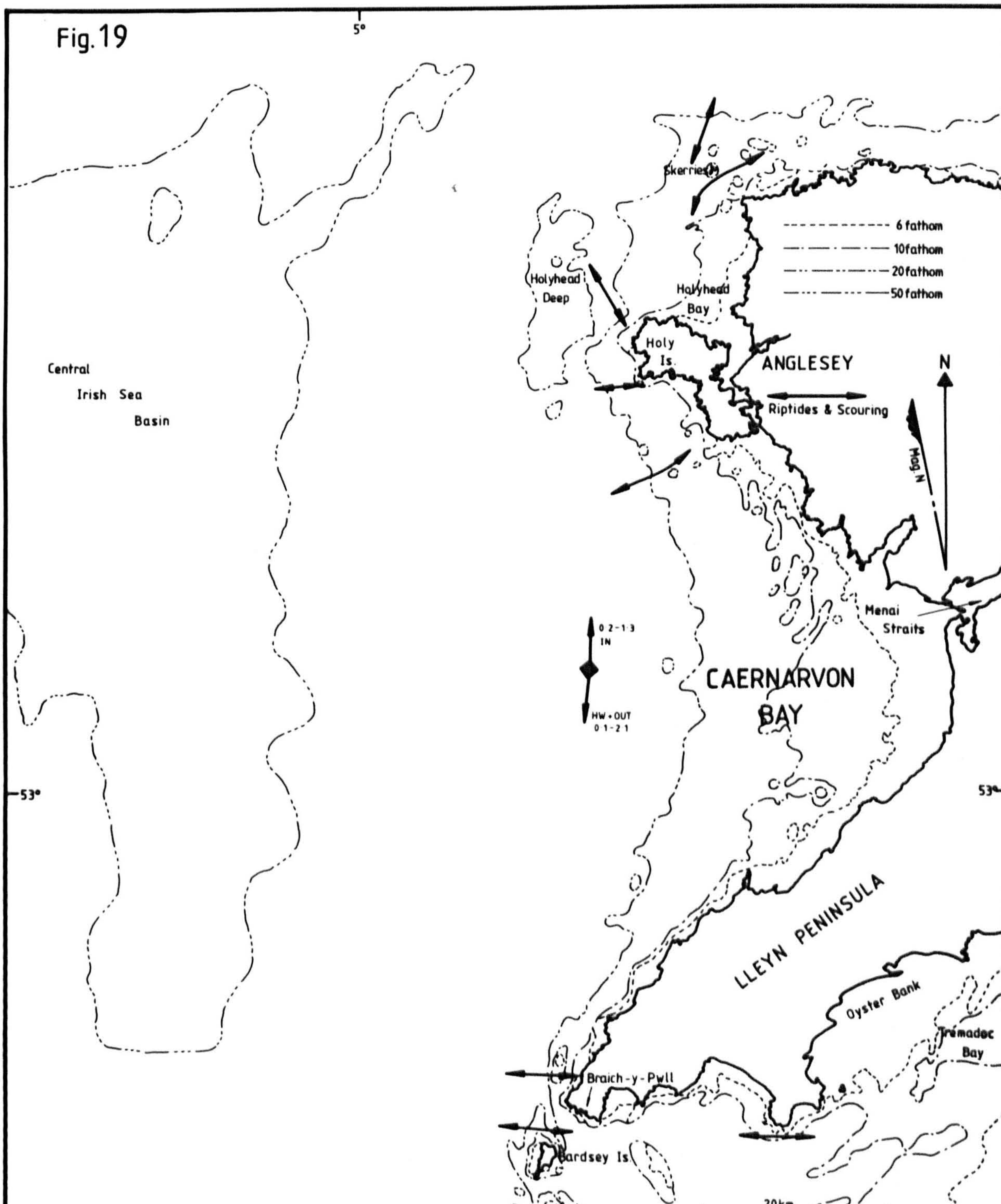


Fig. 19



BATHYMETRY, & TIDE FLOW (in Kn.)

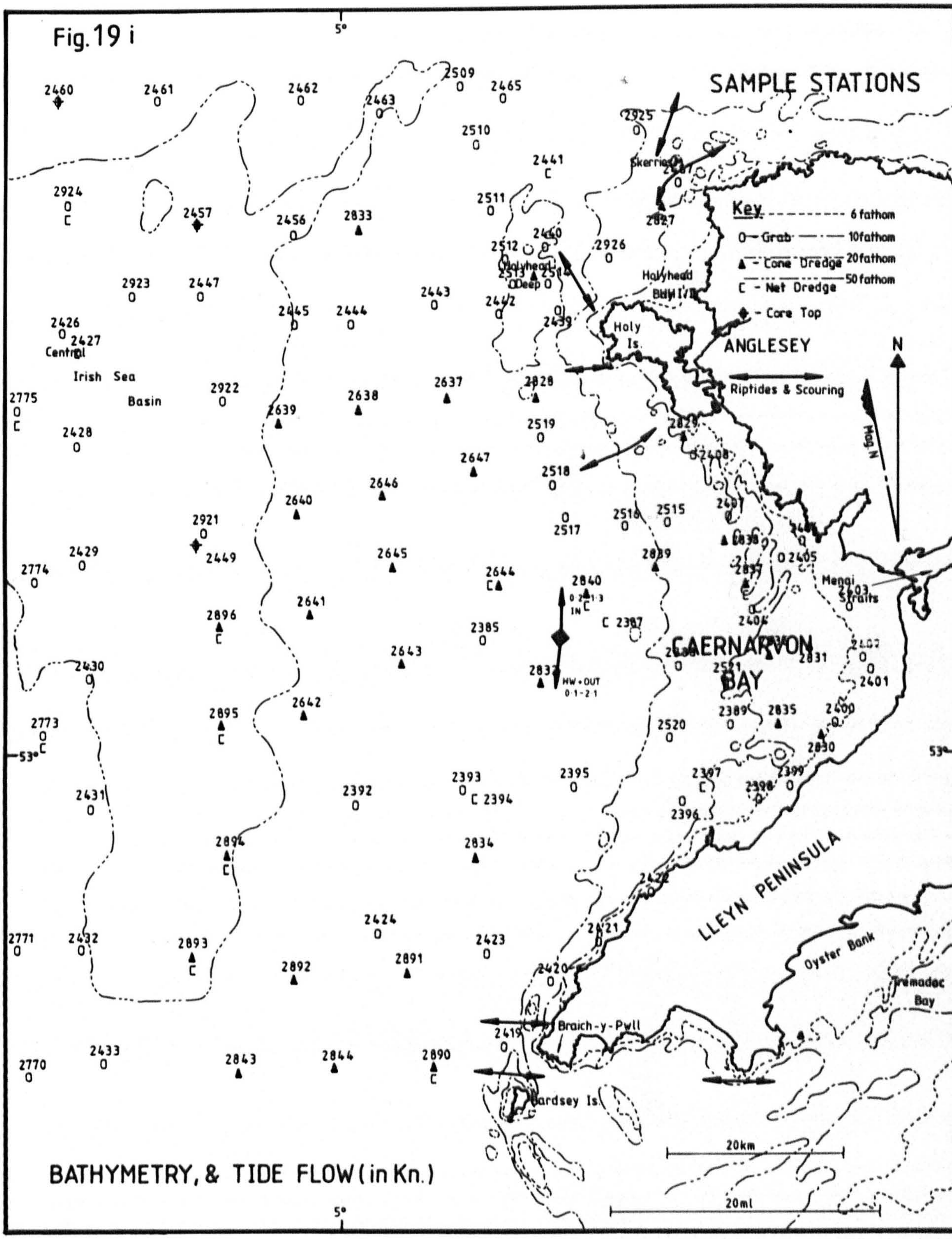


Fig. 19 i
SAMPLE STATIONS
Key
6 fathom
10 fathom
20 fathom
50 fathom
0 - Grab
▲ - Cone Dredge
C - Net Dredge
◆ - Core Top
Riptides & Scouring
N
Mag. N
Central Irish Sea Basin
Skerries
Holyhead Deep
Holyhead
Holy Is.
ANGLESEY
Menai Straits
CAERNARVON BAY
LLEYN PENINSULA
Oyster Bank
Tremadoc Bay
Braich-y-Pwll
Bardsey Is.
HW + OUT
IN
5°
53°
20km
20ml
BATHYMETRY, & TIDE FLOW (in Kn.)

CHAPTER III

MALIN SEA

The Environment

Sampling and Methods

The Geographical Situation

Geomorphology and Geology

Bathymetry in Relation to Submarine Geology

Hydrography

Conclusions and Summary

THE ENVIRONMENT

Some 22,800 sq. km. (9,650 sq. ml.) of the Malin Sea shelf, southward of Lat. 56°N are considered in this section. The geographical location is discussed in the Introducation (p.1-2, Fig. 1) and is documented on Admiralty Charts 2722 (Islay to Ardnamurchan Point); 2723 (Western Approaches to North Channel) and 2724 (Approaches to Firth of Clyde). A synopsis of this information is also presented herein on Fig. 20, scale 1:200,000 or approximately 5 miles to 1 inch.

Sampling and Methods

The present author has examined 114 of Pendlebury's (ms. 1974) 182 Cone and Net Dredge and Shipek Grab sediment samples. Two beach sand deposits from Islay were also studied. Each sampled station is listed on Table 3 (Appendix I) with the depth, geographical co-ordinates and sampling technique and is also diagramatically represented on Fig. 20i.

Geographical Situation

The southern limit of the study area is delimited by the rugged coast of Northern Ireland, from Bloody Foreland in the west to Fair Head in the east. The N.E. of the region is dominated by the large horse-shoe shaped island of Islay. Several smaller islands occur off the Irish coast. These include Tory Island, 10 miles to the north of Bloody Foreland, Inishtrahull some 8 miles N.E. of Malin Head and Rathlin Island, 8 miles north of Fair Head. The western aspect of the Malin Sea occupies a distinctly exposed situation being open to the full effects of the Atlantic. The study area becomes progressively more distant and mostly protected from this influence eastward of Long. $6^{O}30'$W in the approaches to the North Channel. The region is subjected to prevailing westerly winds and an annual rainfall of 50 inches. Only a small proportion of Northern Ireland's surface water run-off directly enters the Malin Sea, most being channelled towards the south and Lough Neagh. There are, indeed, only 3 major rivers entering the Malin Sea. The Rivers Swilly and Foyle drain respectively into Loughs Swilly and Foyle at more than 20 miles from the sea and the R. Bann discharges westward toward the mouth of Lough Foyle near Coleraine. No substantial rivers enter the study area from the N.E.

The Geomorphology and Geology

It is suggested that subsequent to extensive peneplaination only resistant igneous and metamorphic rocks now remain to form the island of Islay, the coastline of which is marked by precipitous rocky cliffs with few inlets or sandy beaches and is especially rugged on its more exposed western and S.W. shores. There are 3 major features that distinguish Islay on its S.W. front and together they evidence the strong NE-SW regional Caledonian trend. The first of these features Loch Indaal, marks the trend of a major Upper Palaeozoic crustal weakness that begins in the Scottish Highlands, almost bisects Islay and then ranges across the Malin Sea shelf towards N.W. Ireland. The western flank of Loch Indaal comprises upthrown Lewisian igneous intrusives and gneisses that make up the Rhinns headland. Lastly, the eastern flanks of Islay are composed of resistant Dalradian schists and form the Mull of Oa.

The province of Northern Ireland may also be separated into 3 topographic areas. To the west of Lough Foyle, widespread Dalradian greywackes evidence a period of considerable folding and faulting. As on Islay, the Dalradian rocks of Co. Donegal are schists and have adopted a characteristic Caledonian trend. A further N. to S. Caledonian structural influence is imposed on the region and is reflected in the orientation of certain features such as Sheep Haven and Lough Swilly. Localised granitic bodies of Late Carboniferous age are now developed into several coastal promontories and also from the headlands between a number of the larger tidal waterways.

The topography, however, radically changes to the east of Co. Donegal, in that Co. Londonderry is characterised by a landscape of gently rolling hills and sheltered valleys. The R. Foyle meanders through this county and has largely excavated the soft Liassic mudstones and Carboniferous Limestone.

The geology is younger further eastward with much of the basal cliff sections on the Co. Antrim coast being composed of diagenetically hardened Upper Cretaceous sediments. Unlike contemporaneous deposits of England the Chalk of N.E. Ireland is extremely resistant to erosion, impervious and has provided a competent platform for the 1,800 m of overlying Lower Tertiary rocks. These Palaeocene and Eocene rocks comprise a sequence of plateau basalts associated with swarms of N-S orientated doleritic dykes. On the Antrim coast a number of highly resistant volcanic plugs and vents occur as near vertical stacks and pinnacles. These have persisted in spite of widespread crustal downwarping of the eastern Malin Sea subsequent to the main eruptive phase. Their prominence, however, is the result of gross differential erosion during the Pleistocene. Otherwise, the inland areas of Northern Ireland are rendered a glacially truncated pavement, so eroded that most if not all Middle and Late Tertiary sediments are now entirely absent.

The spectacular scenery of the northern Irish coast and the Hebridean islands is largely the product of glacial process. Further, an understanding of the relationship between the complex regional solid geology and geomorphology is central to the interpretation of the Malin Sea's complicated bathymetry.

Bathymetry in Relation to Submarine Geology

Evans et.al. (1980) indicate that the major structure of the Malin Sea is governed by 5 Caledonian faults and a series of interposed Lower Palaeozoic crustal downwarpings. The Malin Deep (Lat. $55^{O}55$'N, Long. $8^{O}15$'W) in the N.W. and the Rathlin Deep (Lat. $55^{O}20$'N, Long. $6^{O}15$'W) in the approaches to North Channel are two of these synclinal structures. The former is approximately 170 m deep and the latter depression descends to 240 m, to form the deepest parts of two discernible bathymetric provinces. These occur respectively to the east and to the west of Long. $6^{O}30$'W. The division is further emphasised by a discontinuous submerged ridge situated between Malin Head on the Irish coast and the Rhinns headland of W. Islay.

In the western bathymetric province, the 20 fm and 50 fm isobaths reflect a widespread NE-SW trend of the open shelf. This orientation is obviously Caledonian in origin. This part of the shelf is undulating, though there is a gradual overall

N.W. slope towards the Continental Margin. To the south of Lat. 56^{O}N a double flexure of the 100 fm contour is interpreted by many authors as the heads of two submarine canyons. These features can be traced down to 1,500 fm (2750 m) and the canyons seem to terminate westward of the study area within the Rockall Trough. Two other areas of moderate sea floor relief are recorded in the western province. Firstly, an ox-bow shaped irregularity of the 50 fm isobath occurs at 30-50 km to the west of Tory Island. This feature is an isolated shallow basin with a number of radially arranged (fore-shortened) channels entering it from the 50 fm platform above. Secondly, Pendlebury (ms. 1974) remarked upon an area of irregular sea floor relief to the north of Islay. However, little of this structure is situated within the area sampled. In the eastern section of this province the shelf indicates a moderate break in slope towards the summits of the Malin Head to Rhinns divide. Unfortunately, only the crests of this ridge remain upstanding from the surrounding sea floor, though its form is broadly outlined by the 20 fm isobath which traverses NE-SW in the centre region of the study area.

The same 20 fm depth contour takes a most irregular course on its eastern profile. This may indicate that a thick blanket of superficial sediments is banked against the ridge in the area around Malin Head, Inishtrahull and Hempton Turbot Bank. The bathymetry also reflects a sharp break in slope to the east of the ridge, where the shelf descends steeply into a 50 fm+ basin and below towards the Rathlin Deep. Numerous deeply incised meandering channels enter the western parts of this basin from the N.E. and W. In addition, the close proximity and sub-parallel conformity of depth contours off the Antrim coast evidence a more precipitous descent of the slope into southern aspects of the eastern province. Indeed, merging isobaths off northern Rathlin Island suggest a steep submarine cliff line that rises almost vertically for perhaps 280 m from the deepest section of the Rathlin Deep. Other areas of considerable sea floor irregularity occur 10-15 km to the west of Rathlin Island. These features, namely the Rathlin Bank in the south, Shamrock Pinnacle and Laconia Bank in the north are believed to be volcanic sea-mounts which project abruptly some 80-130 m from the surrounding sea floor. Most authors consider them Lower Tertiary as they straddle the same crustal fracture which extends northward from the Giant's Causeway. Another, much larger region of rugged submarine topography is recorded further to the N.E. in the 50 fm basin. It comprises a radial array of deep ravines and interposed ridges around its margin. This structure, Middle Bank, rises in places to within 35 m of the sea surface and probably represents a Tertiary volcanic field of some 300 sq. km.

There are two other over deepened areas in the eastern province. A small depression of 50 fm+ depth occurs at 20 km to the S.W. of Rhinns headland. It has a featureless sea floor, occurs in an area of severe riptides and is also situated at a place where mainstream tidal influence breaches the Malin Head to Islay ridge. The other region of greater than 50 fm depth is found to the S.E. of Islay and ranges to the N.E. between the island of Jura and the Mull of Kintyre.

Hydrography

Tidal ranges are generally moderate, between 4.0-4.5 m, throughout the study area. However, information published in the Tide Atlas (1962) and represented on Fig.20 suggests that there exists a highly complex hydrographic regime in Malin Sea.

Tidal velocities on the open shelf are slight, 0.3-0.7 kn and almost negligible within the havens and loughs of Northern Ireland. There is a gradual increase in tidal velocity eastward to more than 1.0 kn or 0.5 m/sec. In addition, the ebb and flood tides of the western province have an elliptical pattern characteristic of oceanic conditions. However, a more rectalinear W-E tidal pattern develops as the flood tide velocities increase near to Malin Head. A deflection of the mainstream flow occurs off Inishtrahull and trends towards the N.E. along the western flanks of the Malin Head to Rhinns ridge. Though, other currents of up to 3.5 kn or 1.8 m/sec cross this submerged feature through both the Sound of Inishtrahull and the passage northward of Hempton Turbot Bank.

The tidal regime develops a unidirectional mode in the approaches to North Channel. Tidal velocities in the eastern province are moderate and rarely exceed 1.5 kn or 0.8 m/sec except immediately over the summits of the Rathlin Deep sea mounts. As in the western province, flood tides continue to maintain much of their influence close into the Irish coast as far south as the northern Irish Sea. Ebbing tidal waters enter the Malin Sea from the S.E. and maintain their maximum flow close to the Scottish coast. Some of the ebb tide is directed towards the east of Islay and through the Sound of Jura.

However, the major component of the ebb tide passes directly across the mouth of Loch Indaal towards the N.W. It then re-enters the western province primarily through the overdeepened N.E. section of the Rhinns to Malin Head ridge, but is also forced over the Rhinns Platform immediately to the north. All ebb tides, from the S.W. and S.E., finally merge on the western flank of the Rhinns headland and after much turbulence, exit the study area to the N.E. of Islay. Pendlebury (ms. 1974, p. 60) indicates that despite a perpetual swell in the Malin Sea there is a residual tidal drift in these waters of 0.5 kn or 0.25 m/sec. This persists throughout the tidal cycle and conforms to the main tide flow pattern. Pendlebury (ms. p. 11, fig. 1.4B) illustrates that the drift flows W. to E. along the northern Irish coast, rounds Fair Head and heads southward in the western reaches of North Channel. After encircling the northern Irish Sea the drift moves northward and, in keeping with the ebb tide, remains on the east side of North Channel and in the N.E. section of the study area.

Conclusions and Summary

Despite a moderate rainfall very little surface water run-off directly enters the Malin Sea. With the exception of Foyle and Swilly no other large estuaries or river mouths have developed in the rugged coastline that borders the study area. This must also be related to the highly resistant nature of the regional solid geology, comprising Pre-Cambrian metamorphic rocks in the N.E. and S.W. and recrystallised Mesozoic and Tertiary igneous rocks in south eastern parts. In addition, Northern Ireland and Islay are known to be extensively peneplained by Pleistocene glaciation and most if not all Tertiary sediments have been eroded. These sediments are probably incorporated with other glacial outwash material in the south towards Lough Neagh and are deposited in expansive loughs and havens of the Northern Irish coast. Their restricted access to open marine conditions and full tidal influence has ensured that the glacial sediments have remained trapped within these lakes and tidal backwaters. It would also seem that with the exception of localised rip-tides a moderately weak tidal regime, mostly less than 1.0 kn or 0.5 m/sec, prevails throughout the Malin Sea. Such a diminished tidal flow is considered by Belderson et.al. (1971) to be ineffectual in transporting any other than the finest grades of sediment. Therefore, it is concluded that very little locally derived terrigenous sediment has been introduced into the study area in the Recent. Also, since the development of the existing tidal regime there has been little sediment mobilization in either the deeper or more open shelf areas.

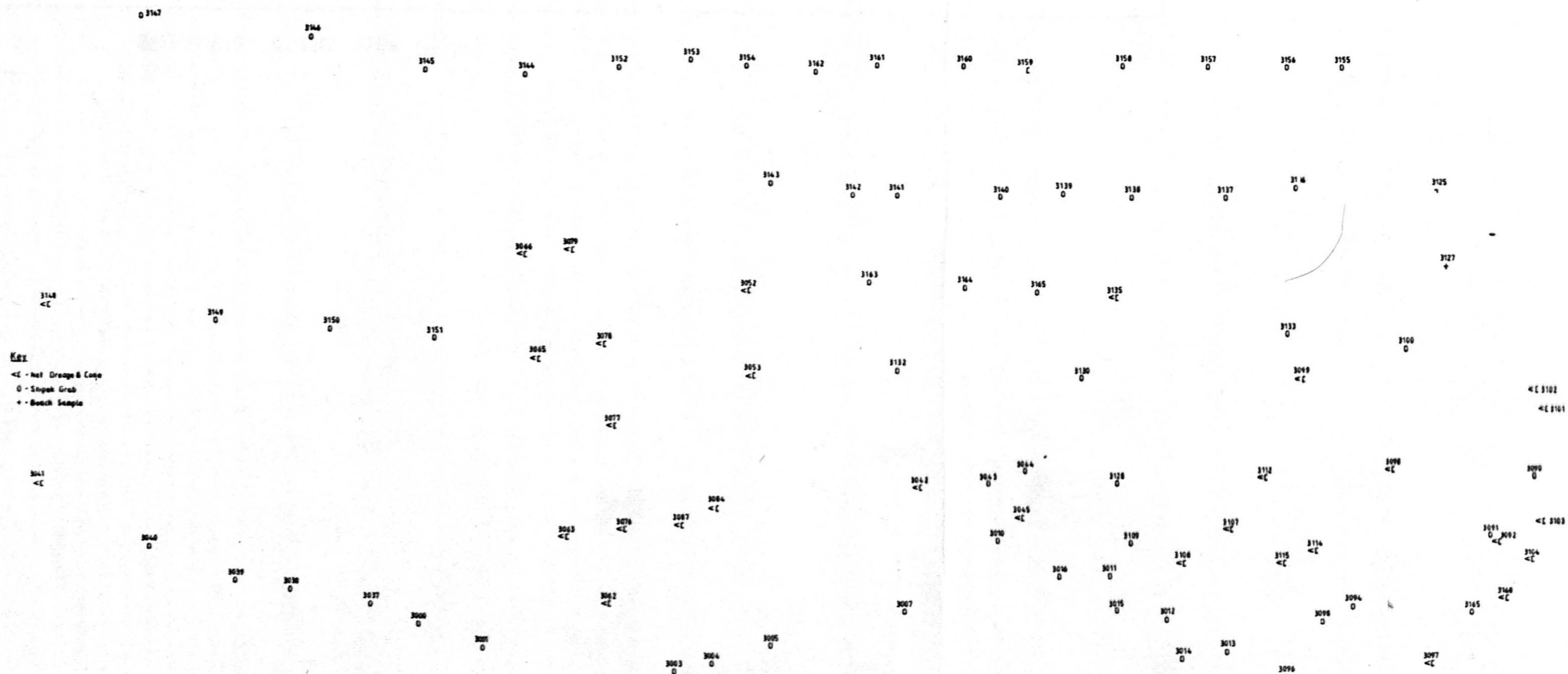
Two distinct provinces are distinguished and are broadly separated to the east and west of a submerged NE-SW trending ridge between Malin Head and the Rhinns of Islay. Their respective bathymetries are largely related to structural characteristics of the underlying solid geology. Submarine topography is closely related to adjacent coastal geomorphology. Therefore, it is probable that the complex sea floor relief is largely the product of regional glaciation. Marine processes developed in the Malin Sea since the Pleistocene have only slightly modified the sea floor relief.

However, certain difficulties arise in attempting an interpretation of the post Pleistocene environmental history. For instance, there is controversy concerning the superficial sediments of the western shelf and whether these deposits have been subjected to severe winnowing during a period of lower sea level. The 50 fm isobath indicates that an isolated area of deep channelling occurs between 35-50 km westward of Tory Island. Another area of submarine canyons is evidenced in the N.E. of the study area and is known to descend below 100 fm westward of the Continental Margin. These two regions of sea floor irregularity are situated at some distance from and well below the range of prevailing W. to E. hydrodynamic influence. Therefore, they may indicate a previous period of westward directed sediment transport. Further, these features may be associated with Late Glacial glacio-fluvial action, though it is difficult to see why such a drainage system should not have developed further eastward of the 50 fm depth contour as the ice receded. Some authors suggest that a more complete Late Glacial drainage network does occur on the western shelf and that it has been infilled by a thick blanket of Holocene sediments which has been smoothed over by the present elliptical tidal pattern of this region. However, Evans et.al. (1980) propose that the western province is a glacially cut pavement. These authors also infer that its mostly featureless nature has been further truncated as a wave-cut platform during and subsequent to a succession of Pleistocene interglacials. If Evans et.al. are correct the Late Glacial outwash structures would have been obliterated on the exposed western shelf in initial high energy stages of the Flandrian transgression. Therefore, although Pendlebury (ms. 1974, p. 79) and Evans et.al.

record few patches of exposed bed rock there is a possibility that the western shelf is covered only by a veneer of superficial sediments. Further, these deposits developed after early stages in the Flandrian advance and before the final deepening of the sea floor below the effective influence of wave or tidal current action.

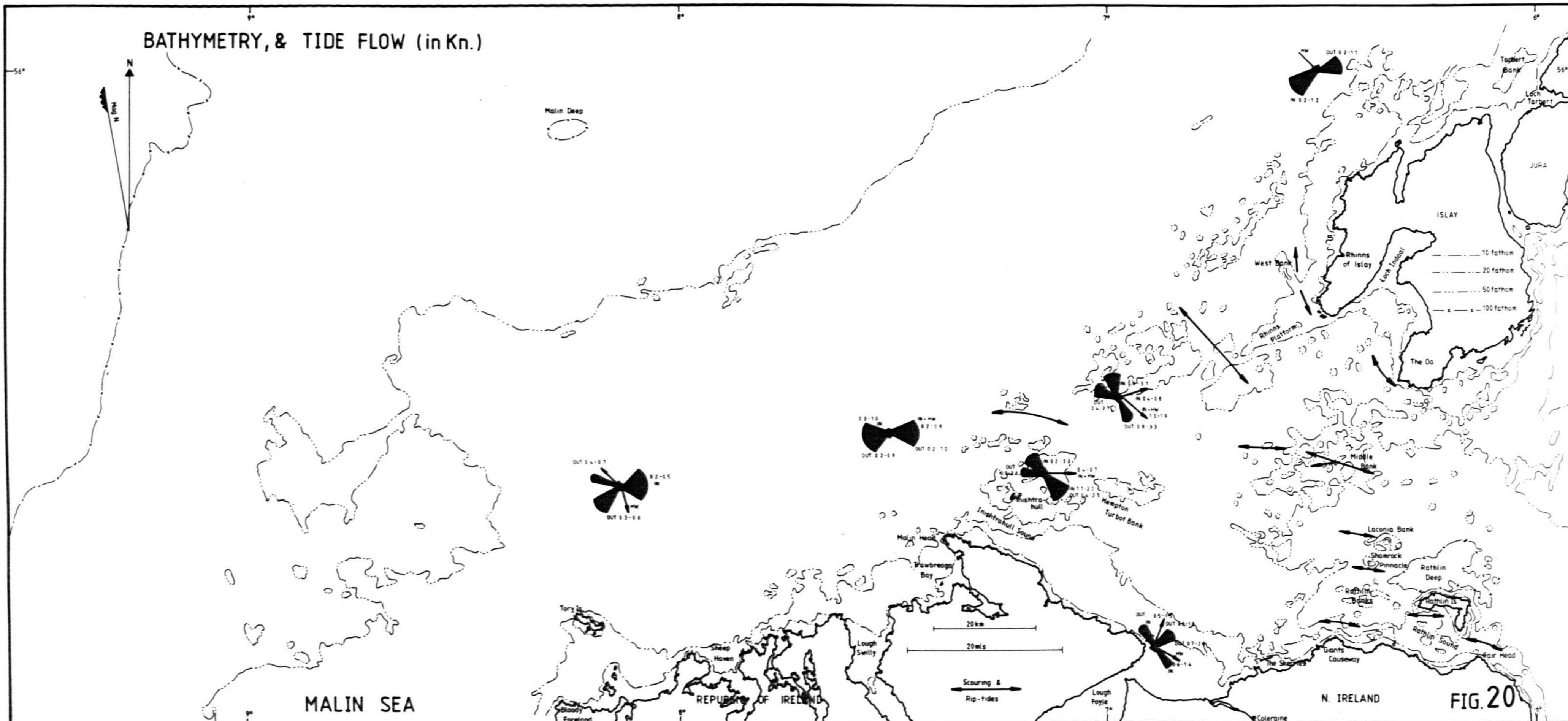
Other aspects of the post-Pleistocene environmental history are evidenced from examination of the eastern province and the submarged structure that divides the study area. The underlying solid geology exerts a dominant influence on the sea floor of this region and, therefore, the bathymetry is both sharply defined and highly distinctive. A series of deep channels enter the eastern province down the steep flanks of its western portion, from 20-50 fm depth. Their meandering nature suggest a fluvial origin rather than formation by tidal scour or glacial erosion, as the latter tend to adopt a more linear mode. It is proposed that these deep canyons formed after the Devensian ice retreat and before the present tidal regime developed eastward within the approaches to North Channel. Indeed, the 35 mile long Malin Head to Rhinns divide, which rises to within 15-20 fm of the present sea level, must have presented a considerable barrier to the advancing Flandrian sea. Therefore, these fluvial channels on the ridge's eastern flanks may have developed during the initial marine breaching of this feature and not later when water in the eastern province had risen above -20 fm OD. The bathymetry also evidences a thick blanket of sediment banked against the S.E. section of this structure. The effects of strong local tides on these unconsolidated sediments have probably contributed considerably to the formation of both Hempton Turbot and Inishtrahull Banks. In addition, these deposits appear to occur only on the upper slopes of the ridge. In accordance with Belderson et.al. (1971), the inability of coarse sediment to migrate eastward of the submerged crests is probably related to the rapid return to deeper environment with its slow and ineffectual tide regime. Therefore, though modified by prevailing tidal influence the age and origin of these superficial sediments remains difficult to determine. They may be the remnants of Late Devensian sediments which once extensively covered the study area. It is also possible that this material is mostly derived from outside the Malin Sea, perhaps swept in from the west towards the ridge during a period in the Holocene of enhanced tidal flow. Had these unconsolidated sediments been of Late Glacial age, subsequent breaching of the ridge would surely have washed much of the material further eastward. However, as the bathymetry shows that little superficial sediment has reached deeper areas such as the Rathlin Deep, it is suggested that these ridge deposits formed after the gradual inundation of the eastern province. Lastly, some authors suggest that the approaches to and deeper areas of North Channel were an ice-dammed lake in the Late Glacial or early Holocene. With steep flanks on all sides, this region may have endured as a restricted or sheltered basin throughout much of the period of increasing Flandrian marine influence.

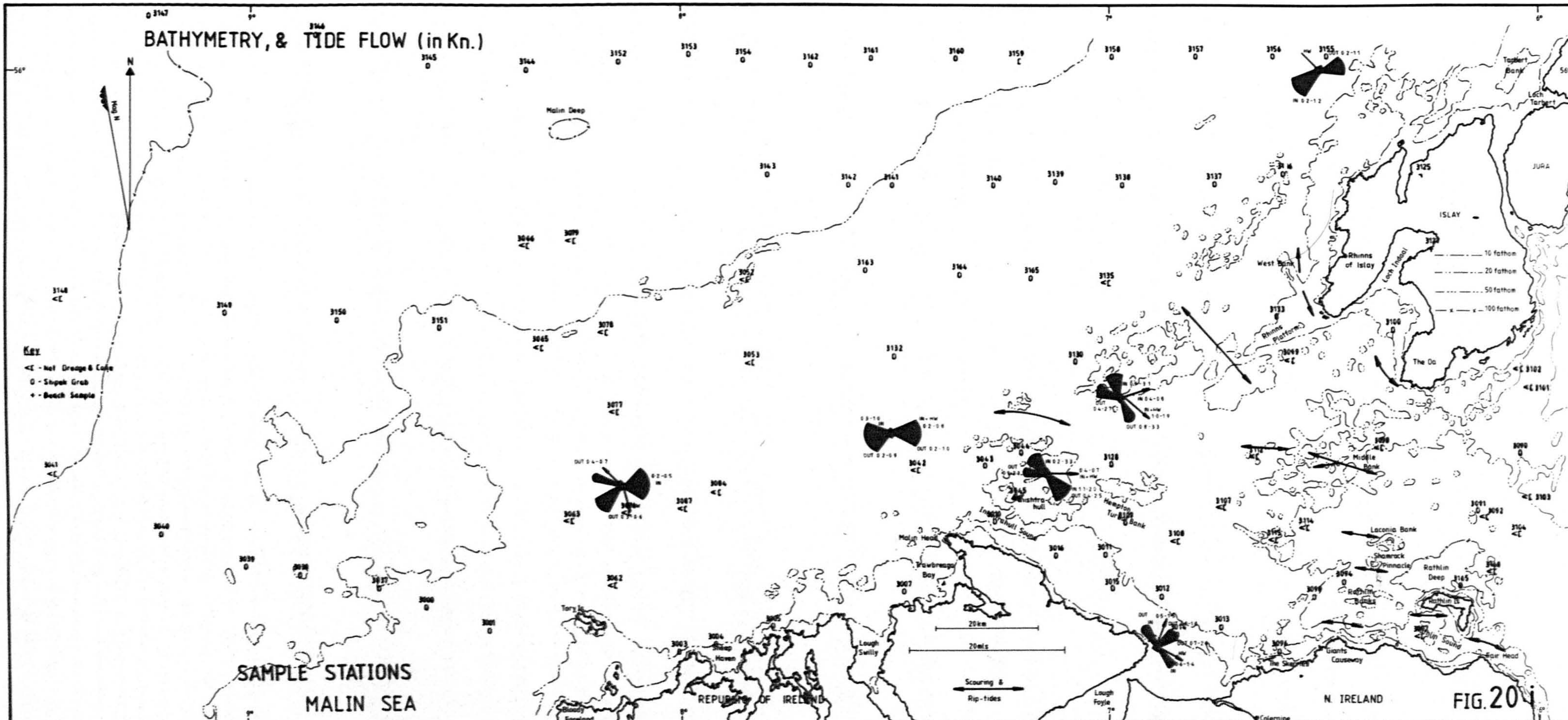
Unfortunately, many of the above conclusions are somewhat conjectural as they are based solely upon the remaining structural evidence within the study area. However, a detailed examination of the sediments and associated ostracod microfaunas is given in the following chapters. This should facilitate a more accurate interpretation of the post-Pleistocene environmental history of the Malin Sea.



SAMPLE STATIONS

i


BATHYMETRY, & TIDE FLOW (in Kn.)
N
Mag N
Malin Deep
MALIN SEA
Tory Is.
Bloody Foreland
Sheep Haven
REPUBLIC OF IRELAND
Lough Swilly
Malin Head
Trawbreaga Bay
Inishtrahull
Inishtrahull Sound
Hempton Turbot Bank
Lough Foyle
Coleraine
N. IRELAND
The Skerries
Giants Causeway
Rathlin Banks
Rathlin Sound
Rathlin Is.
Fair Head
Rathlin Deep
Shamrock Pinnacle
Laconia Bank
Middle Bank
West Bank
Rhinns Platform
Rhinns of Islay
Loch Indaal
The Oa
ISLAY
JURA
Tarbert Bank
Loch Tarbert
10 fathom
20 fathom
50 fathom
100 fathom
20km
20mls
Scouring & Rip-tides
56°
9°
8°
7°
6°
FIG. 20


BATHYMETRY, & TIDE FLOW (in Kn.)
SAMPLE STATIONS
MALIN SEA
Key
<C - hol Dredge & Core
O - Shipek Grab
+ - Beach Sample
N
Mag N
10 fathom
20 fathom
50 fathom
100 fathom
20km
20mls
Scouring & Rip-tides
Malin Deep
ISLAY
JURA
Rhinns of Islay
Loch Indaal
The Oa
West Bank
Rhinns Platform
Tarbert Bank
Loch Tarbert
Middle Bank
Laconia Bank
Shamrock Pinnacle
Rathlin Deep
Rathlin Banks
Rathlin Is.
Rathlin Sound
Fair Head
Giants Causeway
The Skerries
Coleraine
N. IRELAND
Lough Foyle
Hempton Turbot Bank
Inishtrahull
Inishtrahull Sound
Malin Head
Trawbreaga Bay
Lough Swilly
Sheep Haven
Tory Is.
Bloody Foreland
REPUBLIC OF IRELAND
FIG. 20 i

CHAPTER IV

SEDIMENTOLOGY

Introduction

South Irish Sea

Hydrodynamic Influence on Sedimentary Bed Forms
- Low Energy Environments
- Moderate Energy Environments
- High Energy Environments

Areal Distribution and Zonation of Sediments
- Coarse Sand + Gravel
- Mixed Sands
- Fine Sand
- Silt + Clay

Summary and Conclusions

Caernarvon Bay

Influence of Bed Forms on Sediment Distribution
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Summary and Conclusions

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- Late Devensian
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- Marine Holocene
- The Recent

SEDIMENTOLOGY

Introduction

The superficial sediments of the southern Irish Sea, Caernarvon Bay and Malin Sea are comprehensively reviewed by Parish (ms. 1972), James (ms. 1973) and Pendlebury (ms. 1974), respectively. However, these are essentially sedimentological studies based largely upon seismic data and are, therefore, of little value in the analyses of associated microfaunas. A re-examination of sediments collected by the above authors follows. The areal distribution of these sediments and their relationship to bed-form structures is discussed. An environmental and palaeo-environmental interpretation is given for each region of study.

The method of sediment preparation is discussed in Chapter I (p.6-8). Sediment residues of each sample were separated into the following Wentworth grades:

Coarse Sand + Gravel, (500 microns)	Medium Sand, (250 microns)	Fine Sand, (125 microns)	Silt, (67 microns)	Clay (67 microns)

The basic sediment data and an overall sample diagnosis is given in Tables 4, 5, 6 (Appendix I). These sediment diagnoses are abbreviated thus:

Coarse Sand with Gravel - Cs + Gvl; Mixed Sand - M x S;
Fine Sand - FS; Silt with Clay - S + C.

A synopsis of the overall sediment data (Tables 4, 5, 6) is presented as follows:

TABLE 7. Synopsis of Sediment Data

		Cs + Gvl		M x S		FS		S + C		
		Sample No.	% Wt.	Sample No.	% Wt.	Sample No.	% Wt.	Sample No.	% Wt.	Total Samples
Table 4	Southern Irish Sea	44	30.06	48	29.02	25	26.31	15	14.61	132
Table 5	Caernarvon Bay	67	52.37	35	31.29	6	12.73	-	3.57	108
Table 6	Malin Sea	50	48.86	35	21.11	16	20.49	3	9.54	104

These values to some extent reflect the density and method of sampling. However, despite such considerations Tables 4-7 show significant results, enumerated below:

1. The silts are, on average, less than 10% of the total study material.
2. The fines comprise less than 1% of the sediments examined from Caernarvon Bay and Malin Sea and are entirely lacking in 35% of the samples in these two provinces (Tables 5, 6).
3. When present, the finer sediments tend to be highly concentrated. For example, silt + clay is 80% by weight of samples 3152, 3153, 3154 (Malin Sea) and up to 95% of the sediments from samples 2380, 2381 and 2915 (southern Irish Sea).
4. 60-80% of the entire sediment examined was of coarser sand grades. These predominate in approximately 65-90% of the total 344 samples.

Clearly, a certain amount of sediment sorting and winnowing has affected widespread areas of the Irish and Malin Sea shelf. High concentrations of fine grained sediments and the widespread occurrence of coarse shelly sands indicates the influence of at least two, possibly distinct, marine processes; thus:

a. The study area has been subjected to a prolonged period of sediment mobilization and gradual winnowing since the onset of the prevailing tidal regime.

b. Parts of the study area have undergone an enhanced rate of sediment transport and sorting. This dynamic marine action was initiated before the onset of the prevailing tidal regime.

In order to test the validity of a. and b. above, it is considered necessary to determine the nature and extent of sediment mobility in the Irish and Malin Seas and to correlate this with the complex post-glacial environmental history of the study area. The relevant hydrographic data and bathymetry is shown on Figs. 21-24. The areal distribution of superficial sediments (from Tables 4-6) is represented on Figs. 25, 26 (southern Irish Sea), Fig. 27 (Caernarvon Bay) and Fig. 28 (Malin Sea). Bed form structures, from the seismic data of Parish (ms.), James (ms.) and Pendlebury (ms.), accompany Figs. 25-28. These maps demonstrate that the depositional environments of each study area are highly distinctive. For this reason, they are discussed separately.

Southern Irish Sea

Hydrodynamic Influence on Sedimentary Bed Forms

From the work of Belderson and Stride (1966), Parish (ms., p. 35-41) and Figs. 21, 22, 25, 26, it is apparent that certain types of sedimentary structure may be used to distinguish small changes in tidal velocity and, by implication, variations in energy. Several distinct regions of low, moderate and high energy were recognised and these are discussed below.

Low Energy Environment

Depth soundings taken northward of Howth indicate a largely plane sea floor. Which feature is the probable result of the weak elliptical tidal influence (0.5 kn) in that region. There are, however, several small-scale bed forms in this area of tidal shadow. A number of E-W aligned symmetrical sand waves occur 6 km southward of Carlingford Lough with two similar NE-SW orientated sand waves across the mouth of Dundalk Bay. These features are thought by Parish to have results from localised ebb-tides exiting from the shallow mouth of Carlingford Lough. Two other NE-SW trending symmetrical dune sets occur at 13 km N.W. of Lambay Deep. Parish maintains that these deep water features are still within the region of tidal shadow. However, Belderson and Stride indicate such bed forms develop in current velocities of 2.0 kn or 1.0 m/sec. This may, therefore, indicate the possibility of widespread bottom currents that are independent of the prevailing tidal shadow. Furthermore, the nature and scale of these sand waves suggest there is regular sediment mobilization north of Howth. Evidence of regular sediment mobilization indicates that parts of the seabed north of Howth are not so inactive an environment as previously documented.

Moderate Energy Environments

A large variety of bed forms occur south of Howth. To include, two N-S orientated symmetrical dune trains that run parallel to and east of Bennet, Bray and Kish Banks. These sand waves have developed from prevailing tide flow, up to 2.2 kn and indicate massive sediment mobilization between 20-40 fm north of Bray Head. Furthermore, tidal energy seems to increase marginally inshore. This is evident from the occurrence in the littoral of many N-S aligned asymmetrical sand waves. These large sand bodies are slowly migrating westward and to the south from Burford and Frazer Banks. It seems, therefore, that much of the sea bed north of Bray Head is outside the influence of mainstream tidal flow. In accord with Belderson and Stride, bed forms in this region indicate an environment of moderate energy.

High Energy Environments

Other sedimentary structures indicate that current flow up to 4.0 kn$^+$ or 2.0 m/sec$^+$ sweep the exposed sea bed south of Bray Head. This is indicated by widespread N-S aligned sand ribbons formed between Codling and Arklow Banks and the Irish coast. Parish proposed this as an area of high energy, tidal scour and bed-load parting. However, certain surviving E-W aligned asymmetrical sand waves suggest active sediment accumulation adjacent to and over Codling Bank, against the west flank of Arklow Bank and south of Wicklow Head. These large sand bodies indicate the occurrence of sheltered enclaves near areas of rugged submarine relief. The sheltered areas are further marked by high concentrations of dune trains, below 20 fm, to the south and east of Arklow Bank. The symmetry of these deep water features suggests no active sediment transport occurs and also indicates their formation before the onset of the moderate energy levels of the prevailing offshore tides. In addition to the E. of Cahore Point the dune trains are accompanied by widespread sand streaming that exits from the study area towards the N.E. Sand streams are considered to develop in enhanced tidal activity. It is, therefore, probable that many of the offshore sand bodies were fashioned at a higher energy level than prevails at present below 20 fm.

Areal Distribution and Zonation of Sediments

The distribution of superficial sediments off S.E. Ireland is very patchy. However, several distinct sediment zones were recognised. These are shown on Figs. 25, 26 and their distributions are discussed under the following headings.

Coarse Sand + Gravel

This sediment type is concentrated between Bray and Wicklow Heads and extends on the seaward side of Arklow Bank to the south and east limites of the study area. A tounge of shell sands extends northward from this main body at some 20 km east of Kish Bank. It is approximately 20 km in length. There are also smaller bodies of coarse shelly sediment. One of these occurs in line with and then southward from Arklow Bank. Another patch occurs in the tract of sand ribbons between the latter feature and the Irish coast. These coarse sand grades are, however, much less extensive north of Howth. To occur in isolated pockets in sublittoral rocky areas, west of Lambay Island, within the entrance of Carlingford Lough and on the south west shore of Dundrum Bay.

Mixed Sands

A veneer of these coarse clastics occurs along the western flanks of Arklow Bank and extends south and south east of Cahore Point. Another patch occupies a small area on the west margin of Wicklow Trough. A more continual belt of mixed sands lies seaward of the shoreline between Bray Head and Lambay Island. This feature includes Bennet, Kish, Bray, Burford and Frazer Banks and a high concentration of sand waves to the east. This sediment type also forms a discontinuous belt in shallow water from Dundalk Bay and around the Mourne Mt. coast into Dundrum Bay.

Fine Sand

The localities of fine sand occupy most of the regions in tidal shadow. These occur on the southern side of Howth and within Dublin Bay. Further, a horse-shoe shaped body of fine sand almost encircles a 20 m high sea floor rise at 8 km south west of Mizen Head. It may be joined to the patch of sandy mud on the leaside of Wicklow Head. By far the largest area of this sediment type occurs in a 70 km long eastward facing crescent that extends from the south of Lambay Deep to the mouth of Dundrum Bay. This belt makes up most of the sea bed between 20-40 fm north of Howth and at its widest advances into the sublittoral between Lambay Island and the Skerries.

Silt + Clay

There are two distinct regions of silt and clay and both these occur north of Howth. The silts have settled in the deepest section of shelf, below 40 fm, while an area of mostly clay extends from 10 fm into the littoral between Drogheda Bay and Dundalk Bay. Widespread N-S directed bottom current between 20-40 fm are considered responsible for much of this sorting of silt from clay. The clay sediments being maintained longest in suspension are, therefore, more susceptible to residual landward drift and so accumulate further inshore.

Summary and Conclusions

Table 8 shows the distribution of sediments and the nature of bed-forms off S.E. Ireland in a generalised way. Three distinct regional environments (A, B and C) are proposed and a number of conclusions are drawn below:

TABLE 8. Relationship of Energy and Bed Forms to the Distribution of Sediments

Environment	Region	Bed Form	Sedimentation Rate Transport	Sedimentation Rate Supply	Predominant Sediment Types	Hydrodynamic Energy
A	Bray Head to Cahore Point	Rock Subcrop Sand Ribbons Sand Streams Massive Sand Waves	High	Low	CS+GVl, MxS	High
B	Howth to Bray Head	High concentration Sand Waves + Sand Banks	Low	High	MxS	Moderate
C	St. Johns Point to Howth	Plane bedding Small symmetrical Sand Waves	Low	Low	FS, S+C	Low

1. The distribution of sediments from off S.E. Ireland is almost entirely in accord with the prevailing tide velocity gradient.
2. The rugged sea floor relief of the 20 fm platform and western flanks of the Central Irish Sea Basin indicates that region A has undergone considerable scouring. These areas have probably suffered intense winnowing since before the onset of prevailing tidal conditions.

3. Rapid sediment transport in the Recent appears to be restricted to the topmost sediment veneer. This comprises areas mostly of unstable mixed sand. Below this level the coarse sand and gravel seems relatively stable and cohesive.
4. Bed form structures indicate a high degree of sediment sorting occurs between Howth and Bray Head. This is largely due to the loose-packed nature of actively accumulating mixed sands in region B.
5. It has been established that extensive bottom currents influence much of region C. In some areas, these currents render the topmost layer of sediments highly unstable. A number of symmetrical bed forms have developed from these muds. Their structure indicates that little active sedimentation occurs north of Howth.

Caernarvon Bay

Influence of Bed Forms on Sediment Distribution

The distribution of sediments is given on Fig. 27. It shows several distinct zones of sediment. These comprise areas predominated by coarse sand and shelly gravel, mixed sand and fine sand with silt. These deposits are developed into a variety of bed forms that to some extent reflect the post glacial environmental history of the study area. Some characteristics of three sedimentary environments are discussed below.

Environment 1

This environment constitutes a zone of coarse sand with gravel that comprises up to 70% of the study area sediments (Table 7). These extend in a 30 km wide belt, N-S, throughout the study area. Its eastern margin broadly flanks the 20 fm isobath across the mouth of Caernarvon Bay, while the western flank is most irregular. To the extent that gravel sands are only exposed in patches below 50 fm and are abruptly truncated by a steep E-W scarp that closes the northern section of the Central Irish Sea Basin. Much of this cobble sand pavement is covered by N-S orientated bed forms. These include sand streams to the south and west of Lleyn Peninsula and sand ribbons in the approaches to Caernarvon Bay. A further patch of shell sand and subcrop occurs between 6-10 fm in the south of the inner bay. This feature trends N-S for 30 km from the northern shoreline of Lleyn Peninsula to an area off the mouth of the Menai Straits. It has a westerly aspect and is much exposed to storm and wave action.

Environment 2

This environment includes a discontinuous blanket of mixed sands. These floor the western margin of the Central Irish Sea Basin and skirt the open shelf above 50 fm in the north of the study area. This sediment type also occurs in the inner reaches of Caernarvon Bay. Massive sand streams cross the sea bed in exposed areas of these two regions. They indicate a northward movement of sediments that have, at some time, infilled the more depressed sections of sea floor. In addition, a large number of asymmetrical sand waves are developed from these sediments within the inner bay. These bed forms are E-W aligned and indicate substantial amounts of mixed sands are actively transported into the inner bay from the S.W. In addition, a high density of small symmetrical sand waves occur near the periphery of the 20 fm platform. These suggest that little of the sand sediment regains access to mainstream tidal influence outside the inner bay.

Environment 3

This environment is mainly of fine sand with silt. These sediments are formed into a horse-shoe shaped body in the northern section of inner Caernarvon Bay. The feature is open ended towards the S.W. and its two limbs extend for 20-25 km across the 20 fm shelf. These sandy muds are developed into a number of small symmetrical sand waves. It is widely documented that a restricted water circulation and a tidal shadow is in operation within Caernarvon Bay. However, the presence of such well defined bed forms in association with silty sediments indicates firstly, the influence of regular storm turbulence and secondly, a high rate of sediment sorting effects inner reaches of Caernarvon Bay.

Summary and Conclusions

It is evident (Figs. 23, 27) that much of the study area down to 130 m+ is predominated by shelly sands and large areas of rock subcrop. Fine grained sediments are almost entirely lacking in exposed shelf areas (James, p. 146). Silt and clay grade material remains only within inner Caernarvon Bay (e.g. samples 2389, 2407, 2839) and occurs to a lesser extent in deeper parts of the Central Irish Sea Basin (e.g. samples 2405, 2776, 2923).

Thus, it is necessary to determine the nature of marine influences and the energy levels responsible for this biased sediment distribution. For this purpose, the writer refers to the works on bed form structures by Belderson et.al. (1966, 1971). Certain conclusions are drawn and enumerated as follows:

1. Belderson et.al. indicate that streamlined bed forms, such as sand ribbons and sand streams, accompanied by areas of coarse shelly sand, are evidence of high energy. These features are characteristic of environment type A (Table 8) and are in common with a tide flow of 1.5 m/sec or 3.0 kn.
2. It is proposed that areas of mixed sand associated with coalescing sand streams and massive sand waves further indicate association with an A type environment. Such features are in broad accord with a current velocity of 1.0-1.5 m/sec or 2-3 kn.
3. From 1 and 2 above, there is overwhelming indication of widespread tidal scour down to 130 m+. This phenomenon is probably related to a period of high energy prior to the onset of the prevailing tidal regime (up to 1.0 m/sec).
4. A large concentration of small symmetrical and asymmetrical sand waves occurs in the inner reaches of Caernarvon Bay. These are associated with mixed and fine sands with silt and, together, these features characterise an environment type B of moderate energy with o.5-1.0 m/sec or 1-2 kn tidal flow.
5. The distribution of sediments is evidently modified by the prevailing tides. However, only the inner reaches of Caernarvon Bay are apparently undergoing active sedimentation. Sediments occurring in offshore areas of the

Central Irish Sea Basin and sediments situated in the approaches to Caernarvon Bay owe much of their present distributions to high energy marine processes. This is evidently related to tide flow up to 1.5 m/sec+, at some time before the onset of prevailing tidal influence (1.0m/sec.

Malin Sea

The Distribution of Superficial Sediments as Indicators of Late and Post Glacial Environmental History

In an attempt to survey the extensive Malin Sea, the sampling rate was reduced to a mean of 18 km intervals. On such a large scale most of the sedimentary boundaries appear diffuse and are so marked on Fig. 28. However, several broadly differentiated areas of coarse sand + gravel, mixed sand, fine sand and silt + clay were recognised. The characteristics of these 4 sediment types may be generally correlated with the findings of Harland and Hughes (1974) and Evans et.al. (1980). To represent a more or less complete Late Devensian to Recent depositional succession, as follows:

1. Cobble sand and shelly gravel pavement (Late Devensian).
2. Stiff sands and muds (Allerod Interstadial)
3. Unconsolidated fine sand + silts (Marine Holocene)
4. Mixed Sands (Recent/sub-Recent)

A synopsis of the findings is presented below and the environmental history of the study area is discussed.

Late Devensian

These deposits are exposed as large patches of coarse sand and shelly gravel. A large body of these sediments covers 70% of the shelf in the approaches to North Channel. It extends, E-W from the deepest section of Rathlin Deep (130 fm+) to the eastern flanks of the Rhinns to Malin Head ridge. This cobble sand pavement also ranges from the sublittoral off N. Ireland to the mouth of Loch Indaal, Islay. It floors Inishtrahull Sound and connects with a large area of shell sand westward of Malin Head. This tract is widest in the south off Co. Donegal and closes gradually in the north east, more than 100 miles away. Two smaller, E-W orientated sand patches occur below 50 fm in the far west of the outer shelf. One of these patches is 20 miles long and lies 60 miles WNW of Bloody Foreland, while the other is a belt 50 miles long and situated due west of Islay between Long. 8-9^{o}W.

The coarse sand + gravel is, therefore, concentrated in the southern part of the study area in regions influenced by mainstream tides (Fig. 24). However, the prevailing tidal flow (up to 2.0 kn) is not competent to have winnowed out all but these coarsest sediment grades. Indeed, Channon (1972) indicates sediment transport is unlikely in current velocities below 1.0 m/sec. The cobble sands are, therefore, a product of much higher energy.

From most documented evidence the Malin Sea, of average 85 m depth, has not deepened by more than 5-8 m in the last 6,000 years. Such a small rise in sea level since the sub-Recent would have little effect on the moderate energy levels of the prevailing tidal regime. The widespread winnowing of the coarse sand areas occurred, therefore, before 6,000 years BP and during a time of considerably lower sea level.

Evidence from the few remaining bed forms, below 50 fm, are in complete accord with enhanced tidal scour in the early post glacial. A number of sand streams and sand ribbons transverse the cobble sands off the northern Irish coast. These are considered by Belderson et.al. (1966, 1971) to indicate a high rate of sediment transport and a tide velocity of more than 3.0 kn+ or 1.5 m/sec. Such conditions are characteristic of environment type A (Table 8). Therefore, much of the Malin Sea cobble sand pavement may have formed in conditions similar to those prevailing at present between Bray Head and Cahore Point, southern Irish Sea. In these areas the sea floor is exposed to tidal scour of 4 kn+ in waters of 20 fm or less.

Allerod Interstadial

It is not possible to speculate upon the extent of these sediments in the Malin Sea. However, Pendlebury (ms., p. 109-112) indicates these stiff sandy muds are patchy. He recorded them flooring some tidal waterways along the northern Irish coast, at 20 fm off Tory Island and off N.W. Islay. The present author recovered similar deposits from Loch Indaal (sample 3127), from 46 m between Lough Swilly and Sheeps Haven (sample 3005) and from off S.E. Islay (sample 3101, 55 m).

The presence of these sandy muds in relatively shallow inshore waters indicates to some extent the far advanced limits of the sea over the shelf in the Allerod. Further, the fine grained nature of these sediments suggests this was a low energy period. It seems probable that most of the more exposed Allerod deposits were winnowed away during the Late Glacial. Comparable sediments were not found in the Irish Sea study areas.

Marine Holocene

These deposits occur below 50 fm in the northern section of the outer shelf. To comprise a peripheral region of fine sand and a central region of silt + clay that extends outward for 30 miles from an intersection between Long. 8°W and Lat. 56°N.

Pendlebury (ms. p. 220) considers these sediments to be entirely marine and reworked from underlying glacio-fluvial sediments. The fine grained and graded nature of these muds and the absence of bed forms indicates deposition after the high energy stage of the Flandrian advance. In accord with Table 8, this sediment unit incorporates many characteristics of environment type C. Therefore, it may have accumulated slowly in deep water with tide flow a little over 0.5 m/sec. These are marine processes only slightly more energetic than those prevailing at present west of Malin Head.

There is evidence from Channon's work (1972) that most sedimentation ended before the onset of the prevailing tide regime. In this light, the outer shelf muds are probably at least 6,000 years old. Similar sediments were not recovered from the deep water approaches to North Channel. The outer shelf muds may, therefore, relate to a period in the Holocene prior to the complete drowning of the Malin Head to Rhinns ridge.

The Recent

The Recent sediments comprise a patchy veneer of mixed sands. These are deposited directly upon the Late Devensian cobble pavement and extend from the continental margin eastward to North Channel. Pendlebury indicates, from seismic data, that these superficial sands are most thick on the outer shelf. The areal distribution shows mixed sands cover 60% of the western Malin Sea and this would seem to confirm Pendlebury's observations (Fig. 28).

Bed forms have not developed from these topmost sediments much below 40 fm. Those regions occurring deeper than 40 fm are probably outside the influence of the prevailing tidal flow. However, streamlined bed forms have developed from the mixed sands in more shallow areas of the Malin Sea. These shallow waters, mean 20 fm, occur over the Malin Head to Rhinns ridge and in the approaches to Lough Foyle. Sand waves and sand ribbons traverse this section of the study area. These are features in broad accord with the enhanced ebb and flow tides (up to 3.3 kn) over Hempton Turbot and West Banks, (Fig. 24). Furthermore, these massive sand banks are mostly situated between 10-20 fm and, therefore, must have formed during the latter stages of sea-level rise. That, being an event of the sub-Recent to Recent.

In view of the rather limited sedimentary discussion, herein, examination of the associated live and dead Ostracoda should shed further light on the post-glacial environmental history of the Malin and southern Irish Seas.

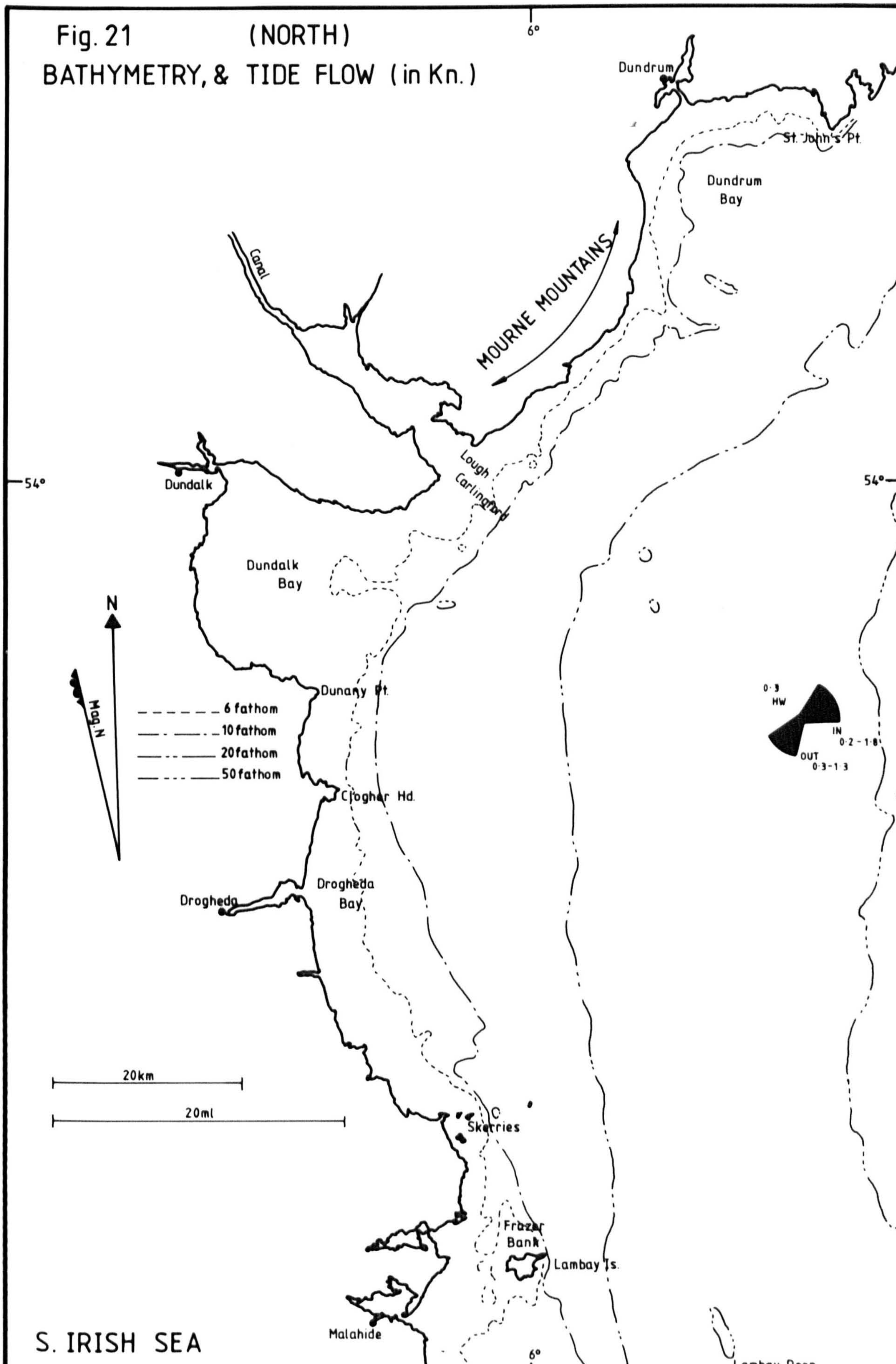


Fig. 21 (NORTH)
BATHYMETRY, & TIDE FLOW (in Kn.)
6°
Dundrum
St. John's Pt.
Dundrum Bay
MOURNE MOUNTAINS
Canal
Lough Carlingford
54°
Dundalk
54°
Dundalk Bay
N
Mag. N
Dunany Pt.
6 fathom
10 fathom
20 fathom
50 fathom
0·3 HW
IN 0·2 - 1·8
OUT 0·3 - 1·3
Clogher Hd.
Drogheda
Drogheda Bay
20km
20ml
Skerries
Frazer Bank
Lambay Is.
Malahide
S. IRISH SEA
6°
Lambay Deep

Fig. 22 (SOUTH) BATHYMETRY, & TIDE FLOW (in Kn.)

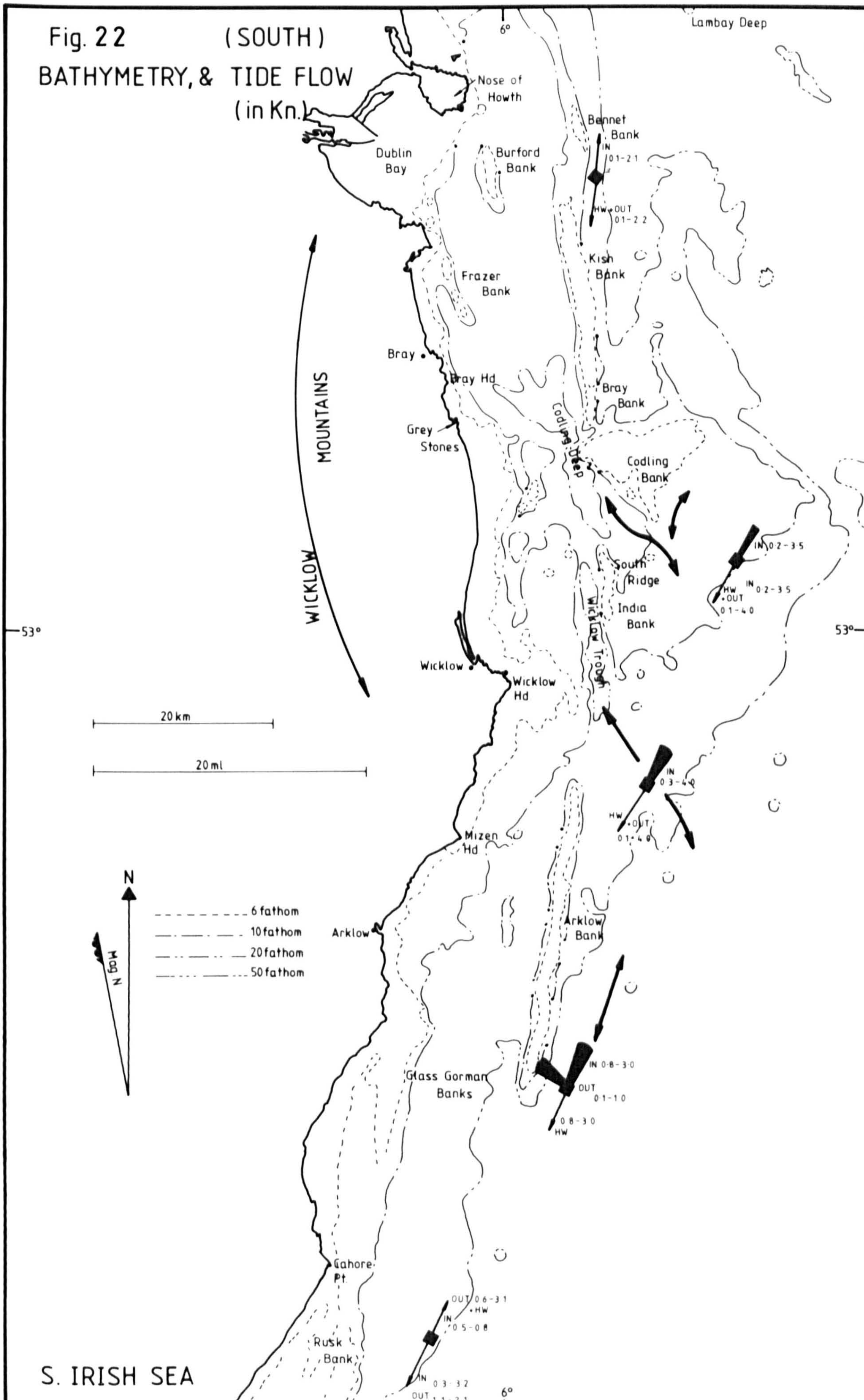
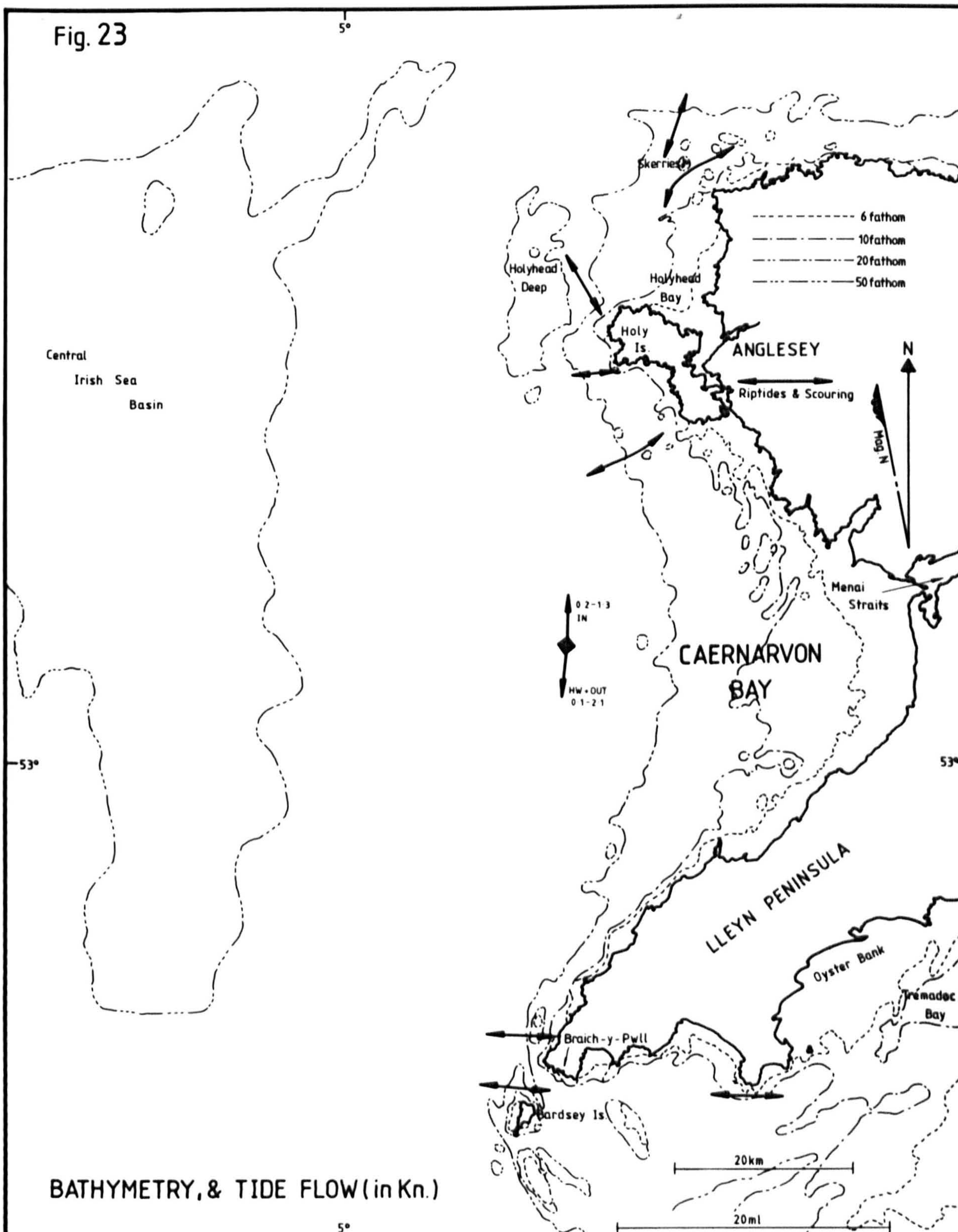
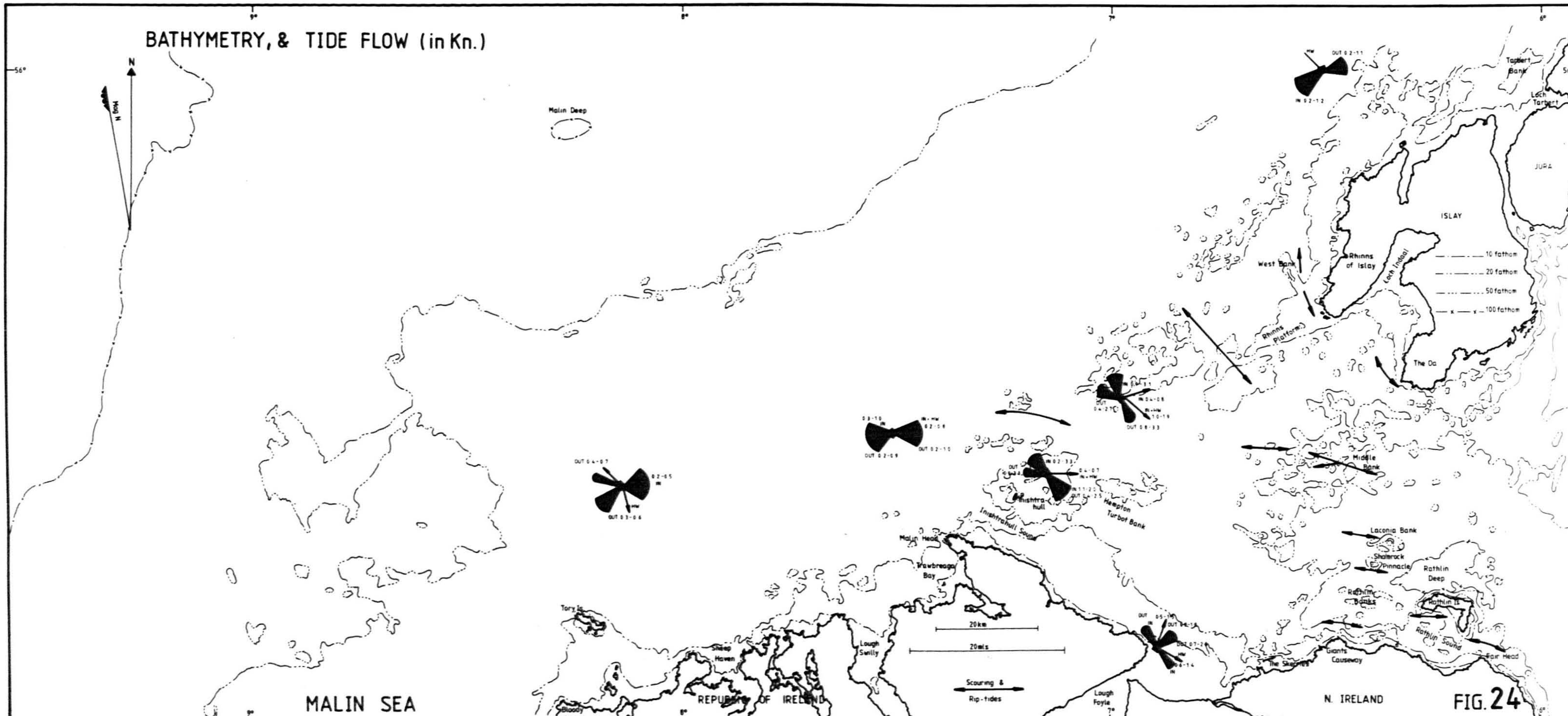


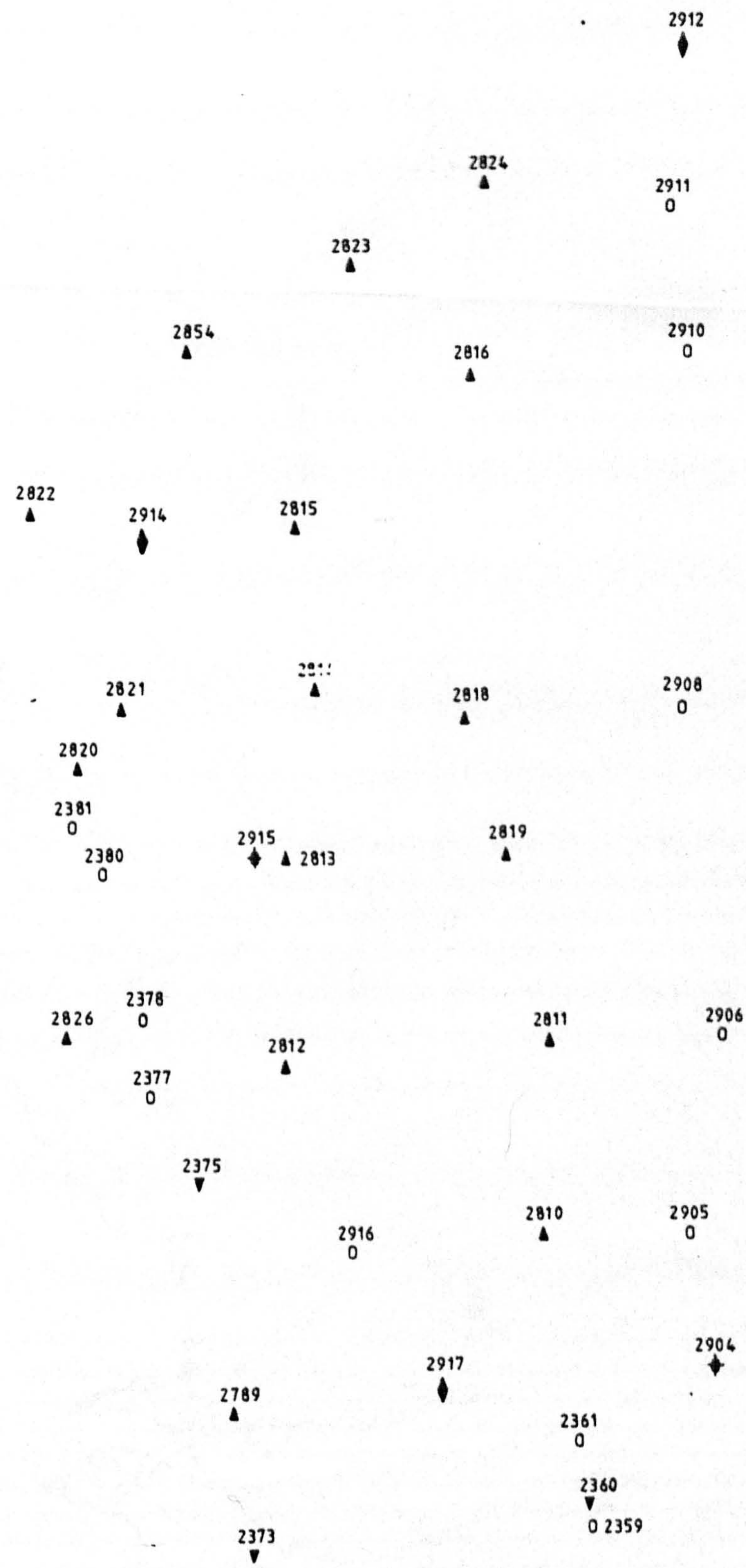
Fig. 23



BATHYMETRY, & TIDE FLOW (in Kn.)


BATHYMETRY, & TIDE FLOW (in Kn.)
N
Mag N
Malin Deep
MALIN SEA
Tory Is.
Bloody Foreland
Sheep Haven
REPUBLIC OF IRELAND
Lough Swilly
Trawbreaga Bay
Malin Head
Inishtrahull Sound
Inishtrahull
Hempton Turbot Bank
20km
20mls
Scouring & Rip-tides
Lough Foyle
Coleraine
N. IRELAND
The Skerries
Giants Causeway
Rathlin Sound
Fair Head
Rathlin Is.
Rathlin Banks
Rathlin Deep
Shamrock Pinnacle
Laconia Bank
Middle Bank
The Oa
Rhinns Platform
West Bank
Rhinns of Islay
Loch Indaal
ISLAY
JURA
Loch Tarbert
Tarbert Bank
10 fathom
20 fathom
50 fathom
100 fathom
56°
9°
8°
7°
6°
FIG. 24

i



SAMPLE STATIONS

<u>Key</u>

▲ - Cone Dredge

O - Grab

⧫ - Cone & Net Dredge

▼ - Net Dredge

✦ - Core Top

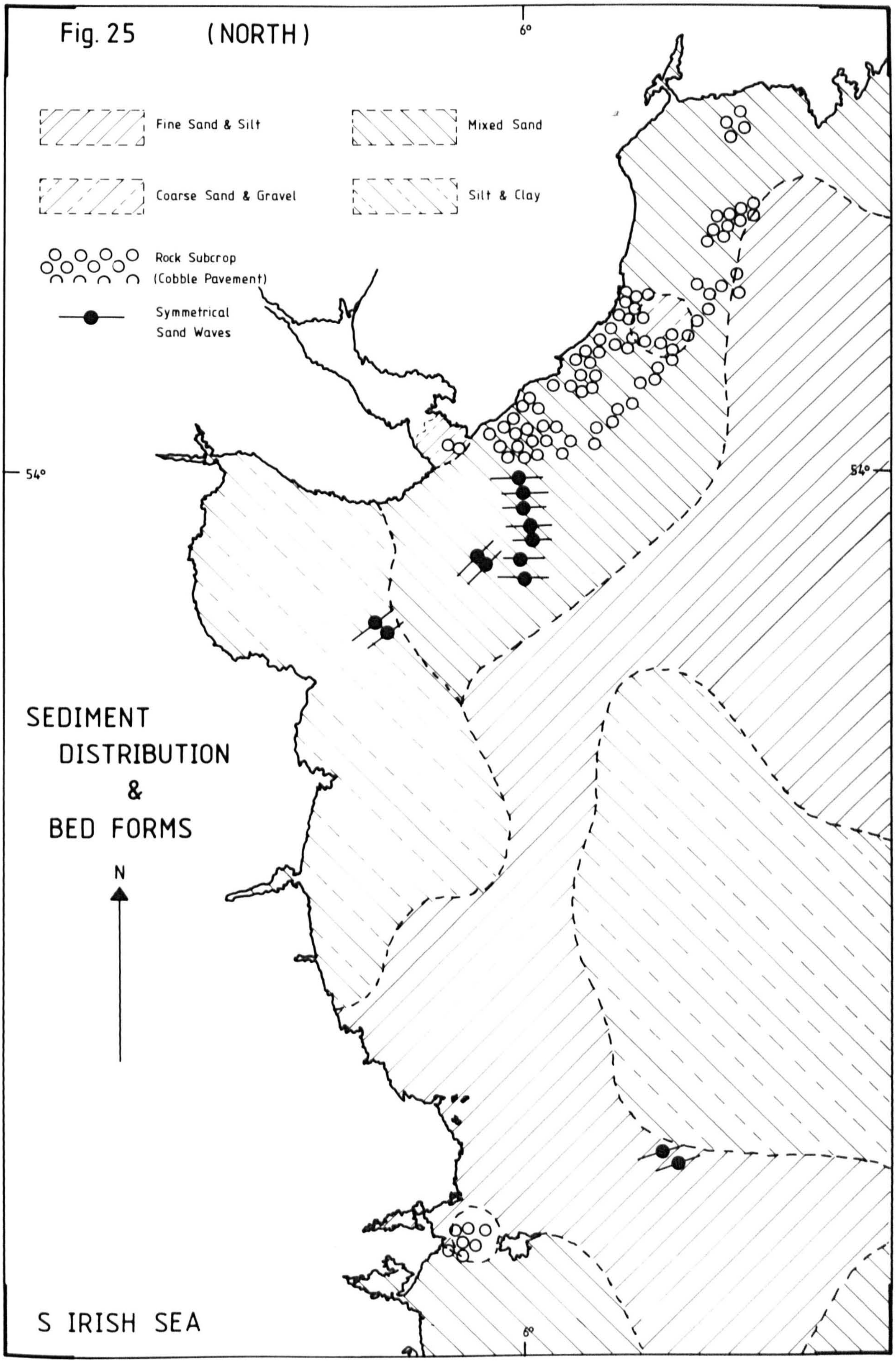


Fig. 25
(NORTH)
6°
Fine Sand & Silt
Mixed Sand
Coarse Sand & Gravel
Silt & Clay
Rock Subcrop
(Cobble Pavement)
Symmetrical
Sand Waves
54°
54°
SEDIMENT
DISTRIBUTION
&
BED FORMS
N
S IRISH SEA
6°

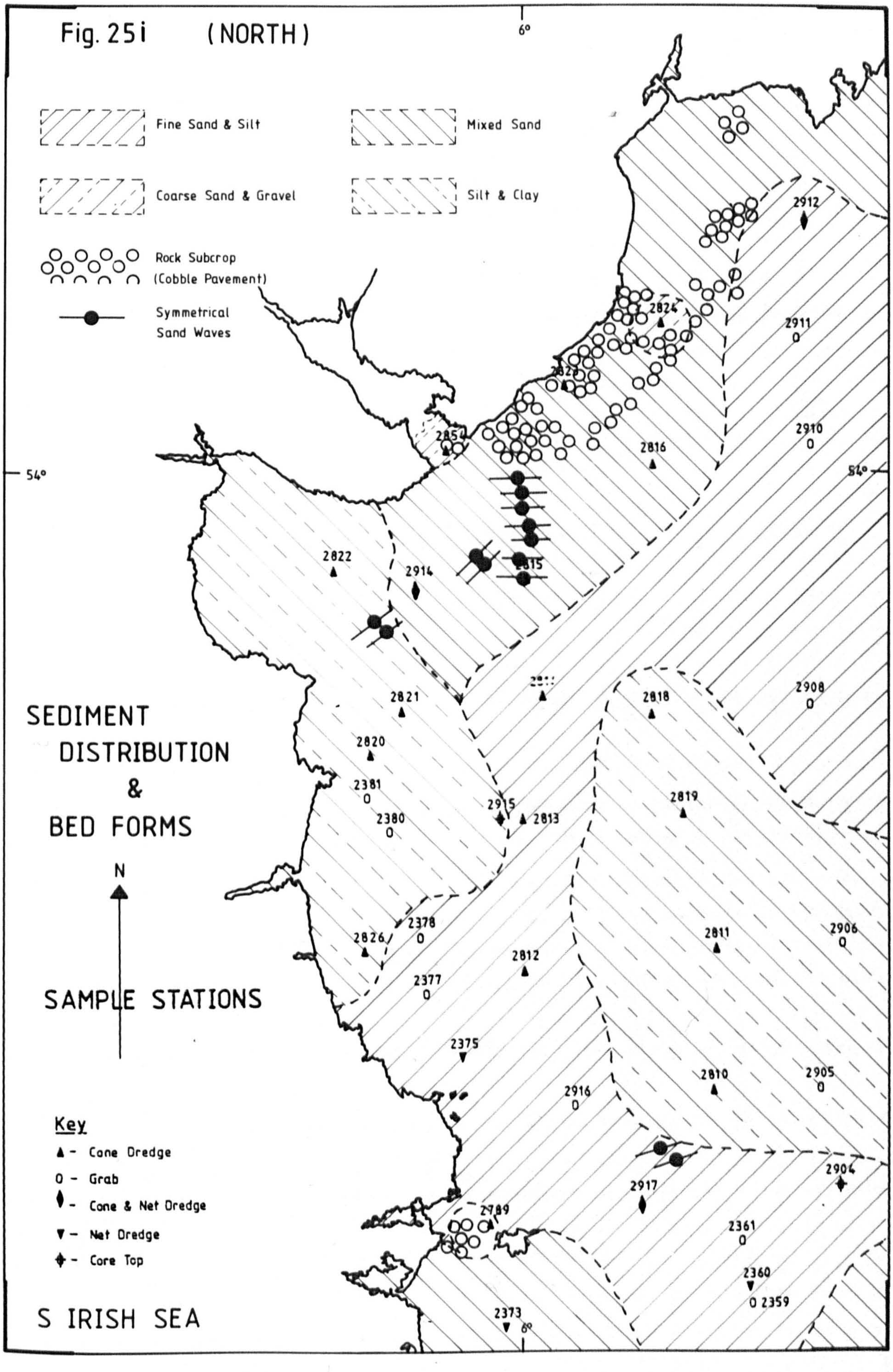
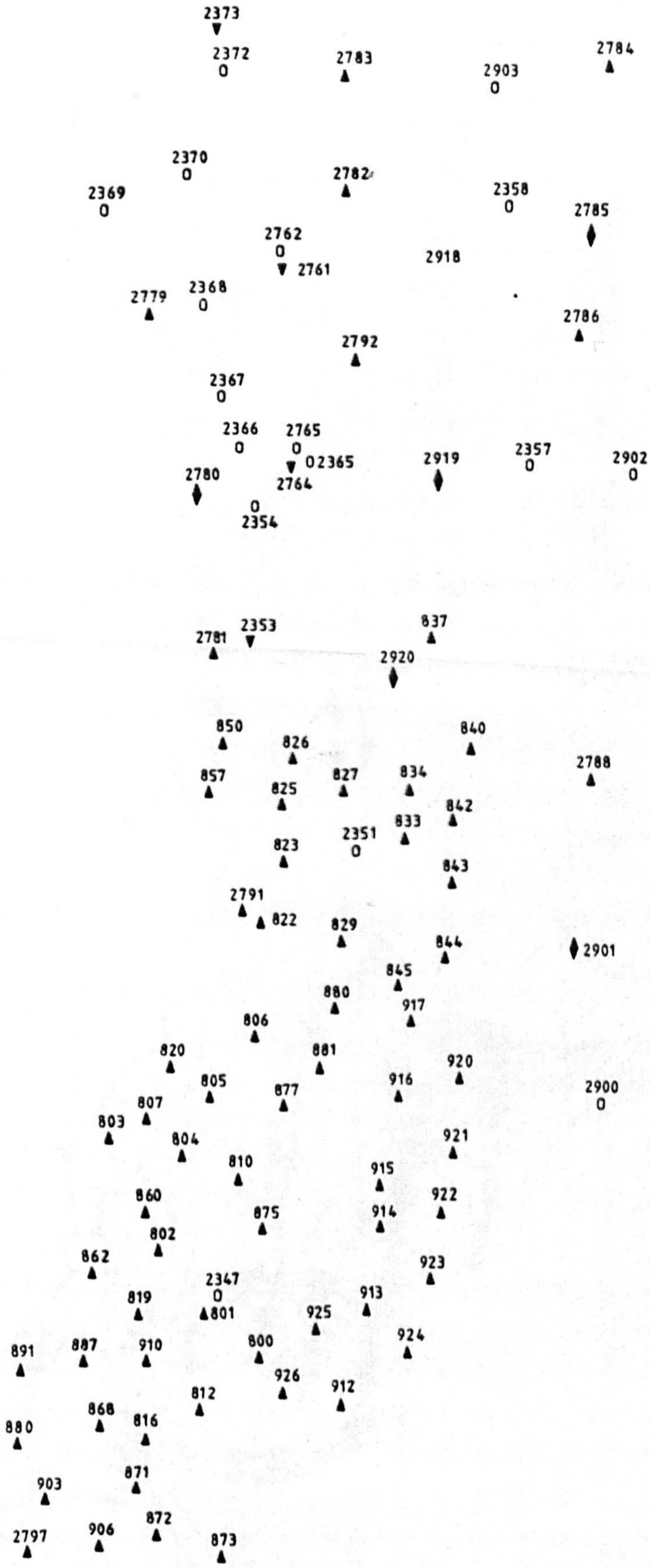


Fig. 25i (NORTH)
6°
54°
Fine Sand & Silt
Mixed Sand
Coarse Sand & Gravel
Silt & Clay
Rock Subcrop (Cobble Pavement)
Symmetrical Sand Waves
SEDIMENT DISTRIBUTION & BED FORMS
N
SAMPLE STATIONS
Key
▲ - Cone Dredge
O - Grab
Cone & Net Dredge
▼ - Net Dredge
Core Top
S IRISH SEA
2912
2824
2911
2823
2854
2910
2816
2822
2914
2815
2908
2818
2821
2820
2381
2380
2915
2813
2819
2378
2826
2812
2811
2906
2377
2375
2810
2905
2916
2904
2917
2789
2361
2360
2359
2373

i



SAMPLE STATIONS

Key

▲ – Cone Dredge
O – Grab
⧫ – Cone & Net Dredge
▼ – Net Dredge
✦ – Core Top

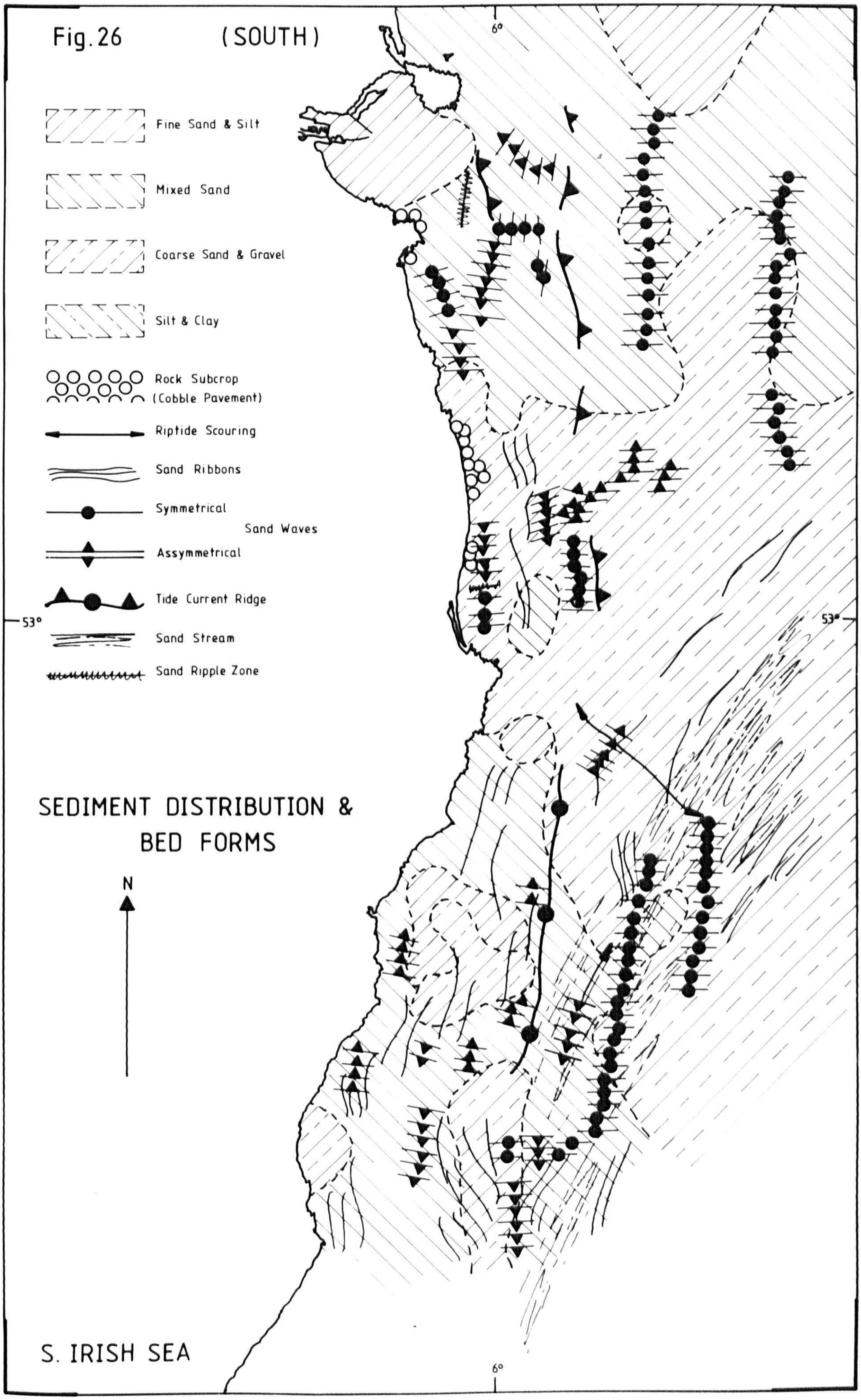


Fig. 26
(SOUTH)
Fine Sand & Silt
Mixed Sand
Coarse Sand & Gravel
Silt & Clay
Rock Subcrop (Cobble Pavement)
Riptide Scouring
Sand Ribbons
Symmetrical
Sand Waves
Assymmetrical
Tide Current Ridge
Sand Stream
Sand Ripple Zone
6°
53°
53°
6°
SEDIMENT DISTRIBUTION & BED FORMS
N
S. IRISH SEA

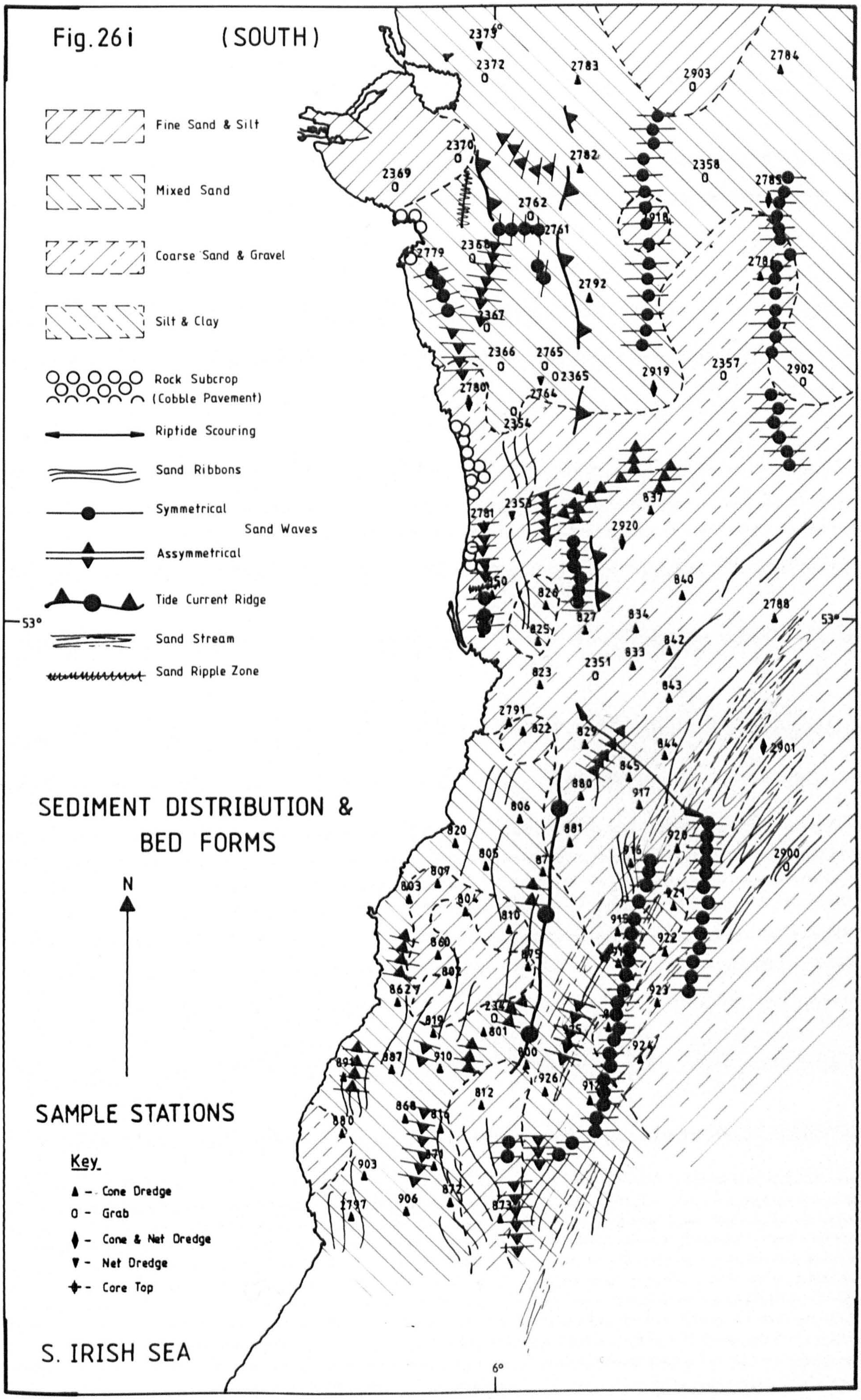
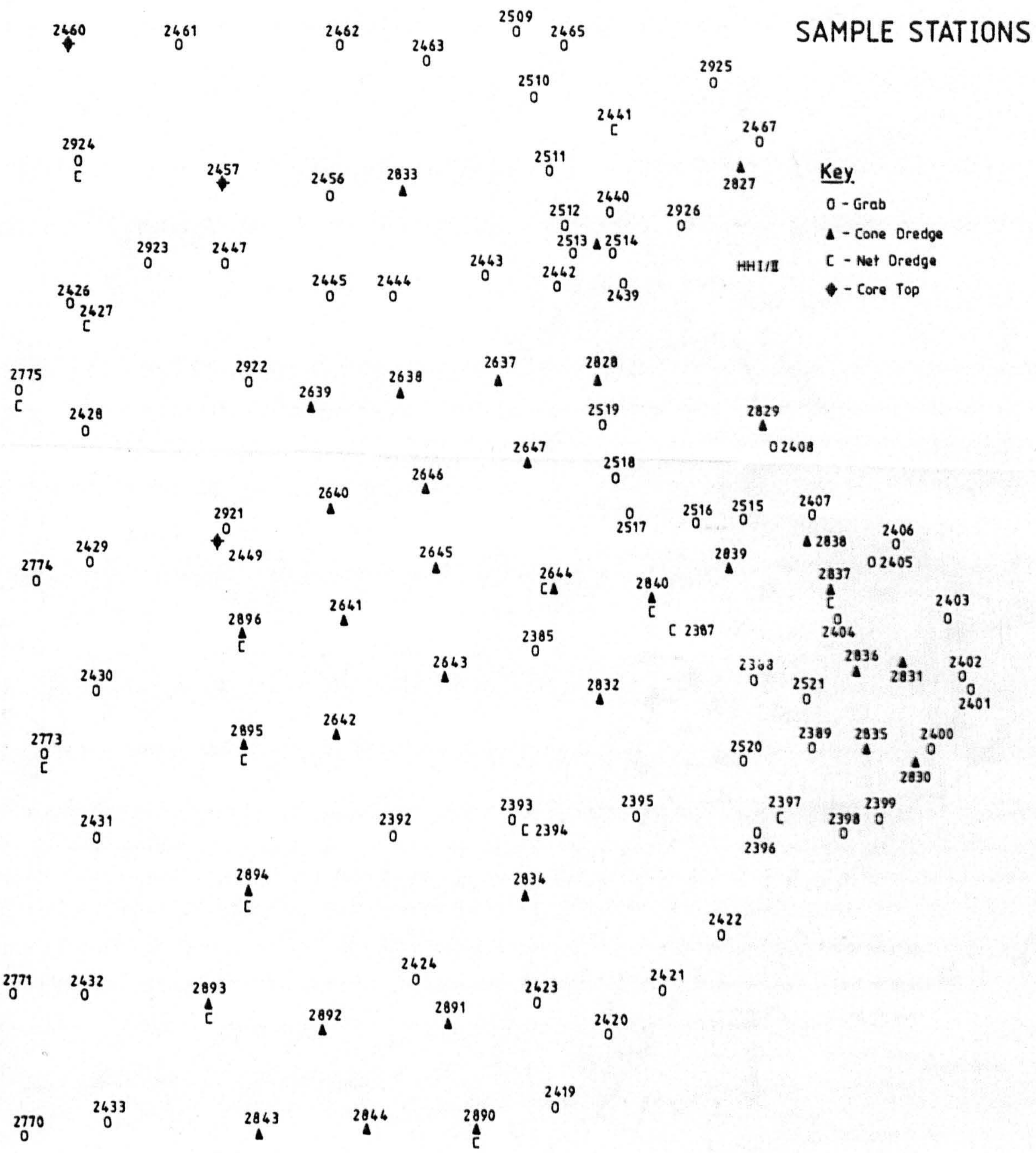


Fig. 26i (SOUTH)
Fine Sand & Silt
Mixed Sand
Coarse Sand & Gravel
Silt & Clay
Rock Subcrop (Cobble Pavement)
Riptide Scouring
Sand Ribbons
Symmetrical
Sand Waves
Assymmetrical
Tide Current Ridge
Sand Stream
Sand Ripple Zone
SEDIMENT DISTRIBUTION & BED FORMS
N
SAMPLE STATIONS
Key
▲ - Cone Dredge
O - Grab
♦ - Cone & Net Dredge
▼ - Net Dredge
✦ - Core Top
S. IRISH SEA
53°
6°

SAMPLE STATIONS



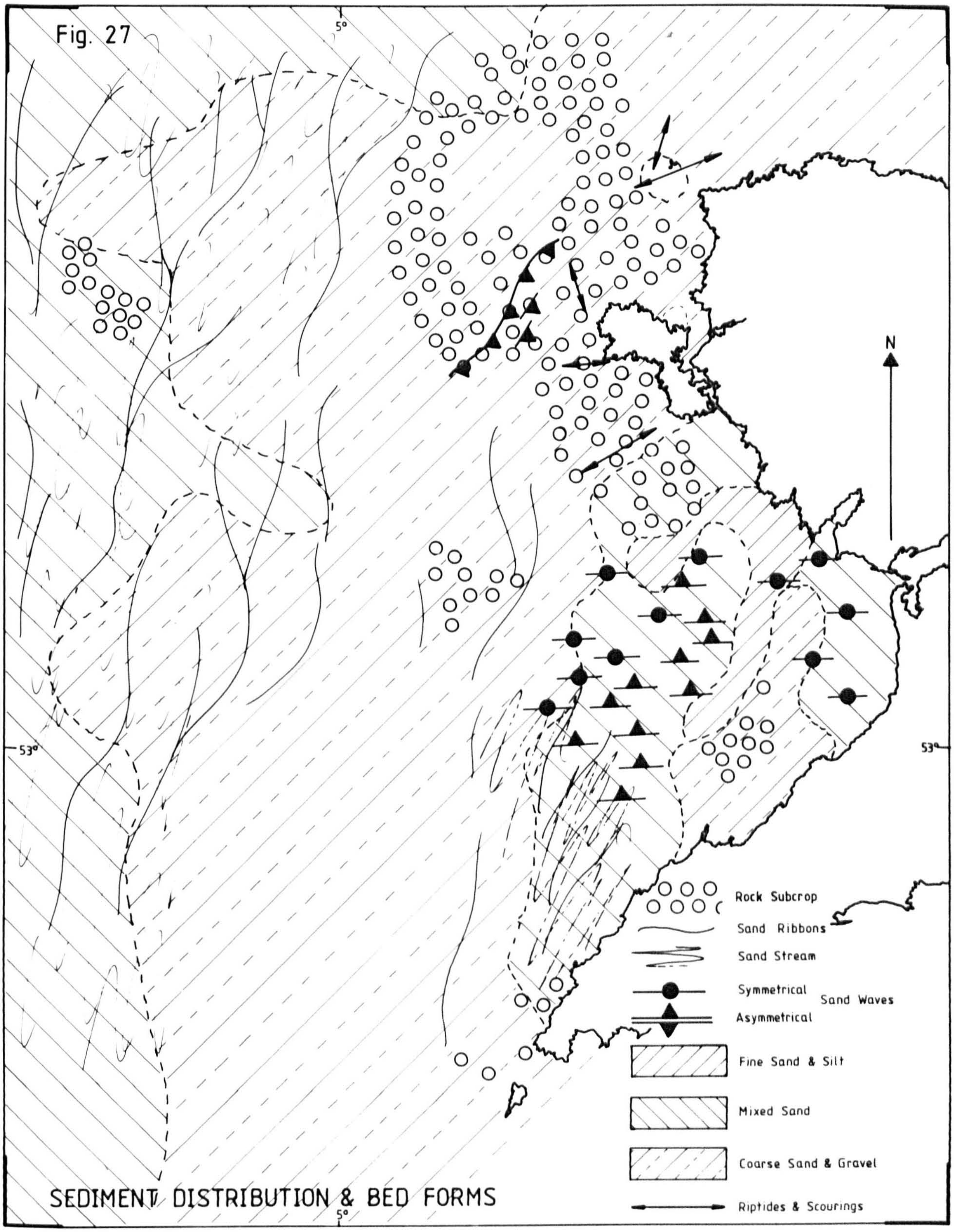


Fig. 27
5°
53°
53°
N
Rock Subcrop
Sand Ribbons
Sand Stream
Symmetrical
Sand Waves
Asymmetrical
Fine Sand & Silt
Mixed Sand
Coarse Sand & Gravel
Riptides & Scourings
SEDIMENT DISTRIBUTION & BED FORMS
5°

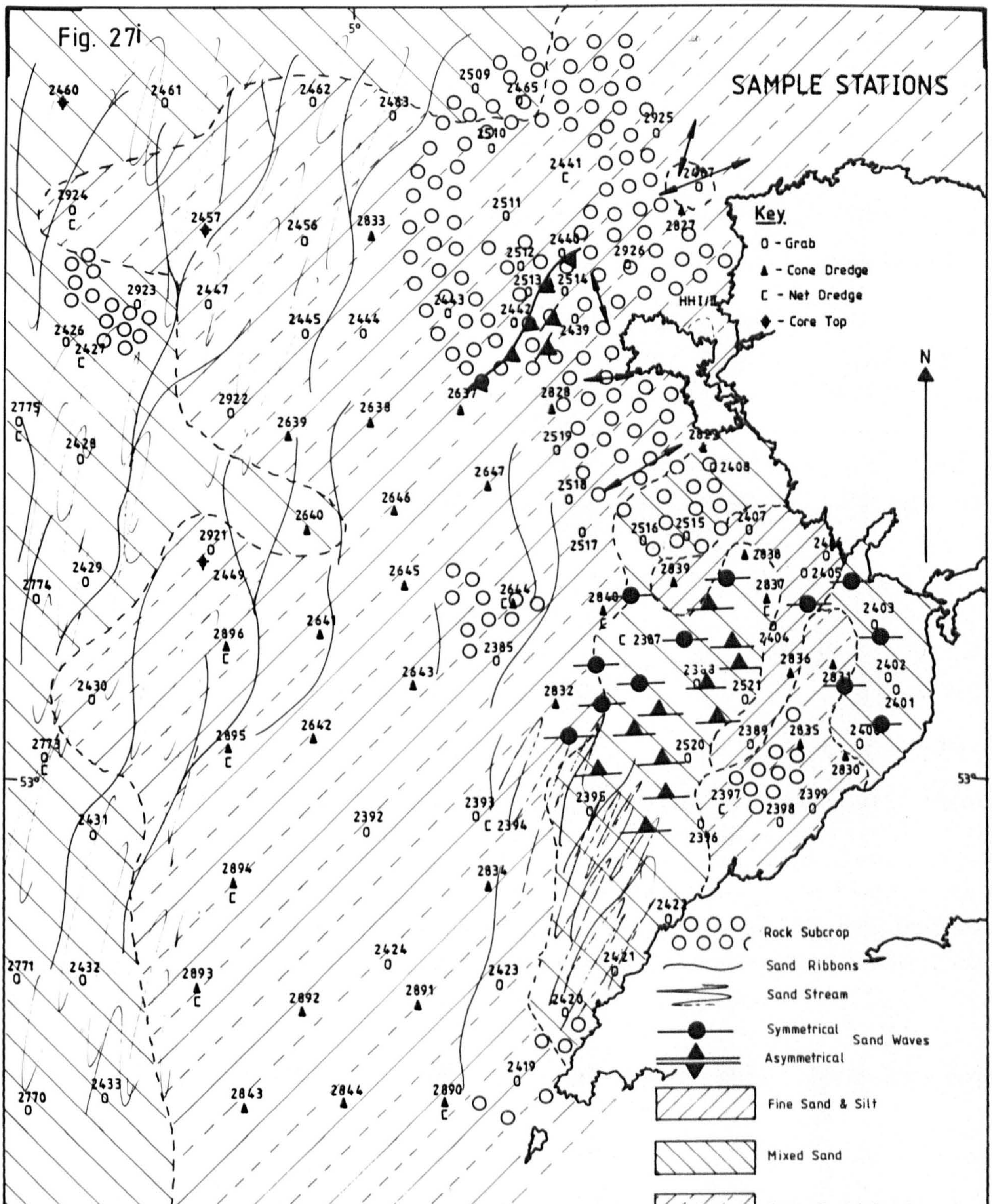
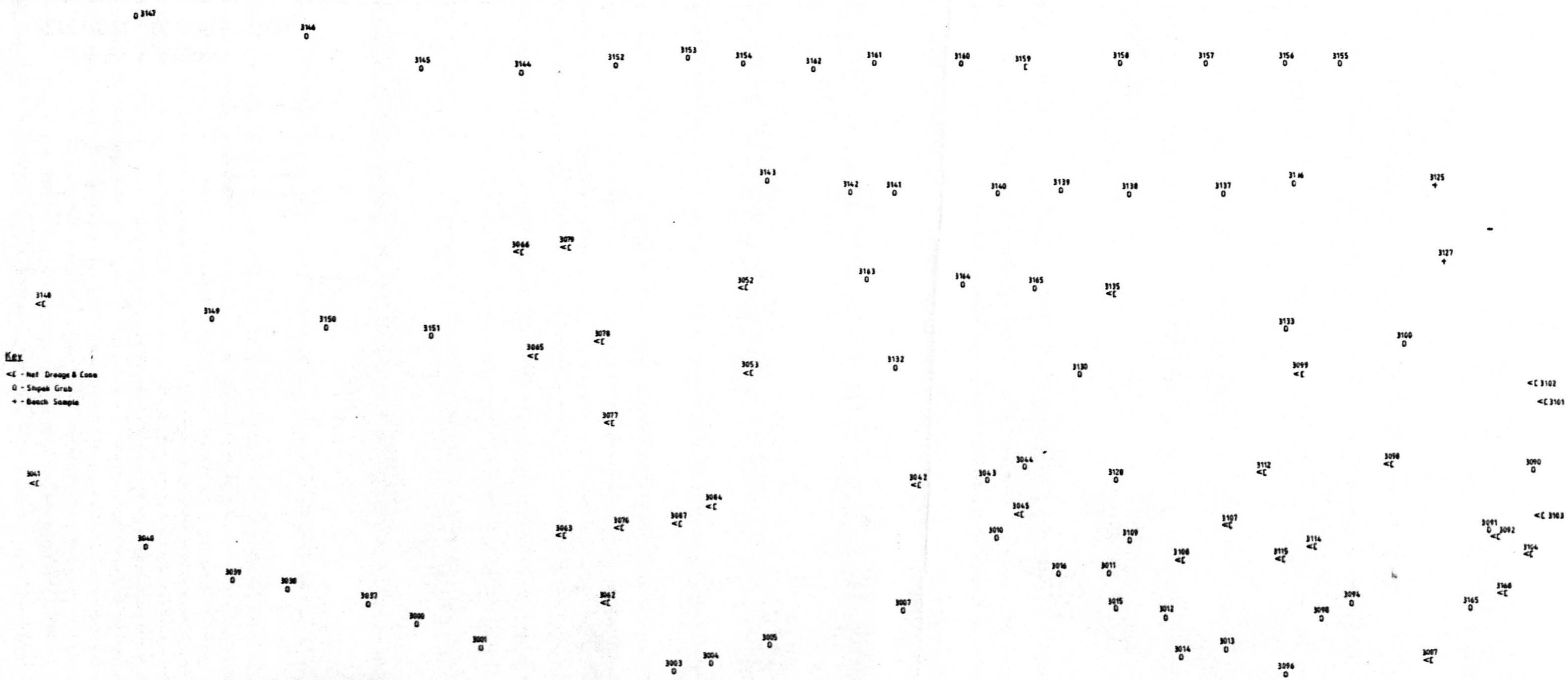
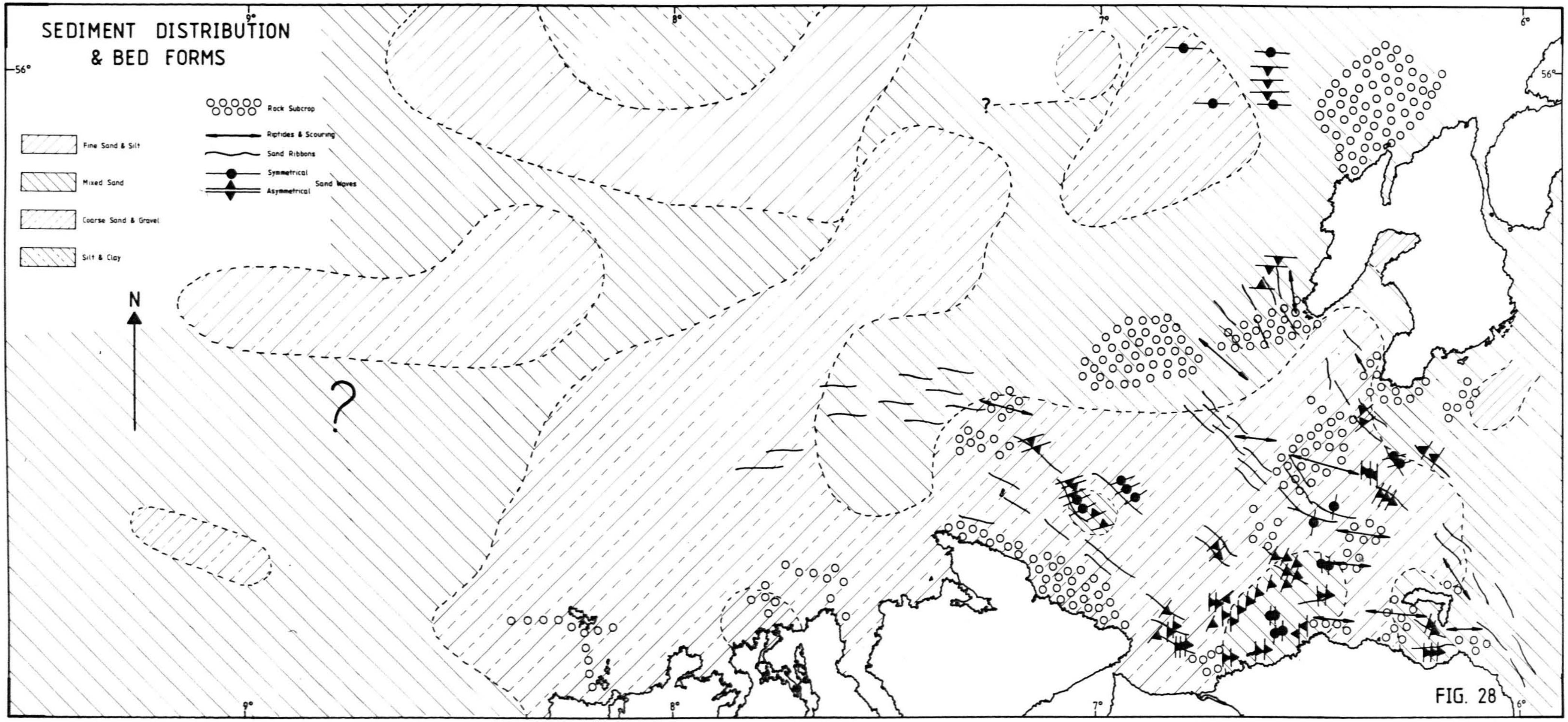


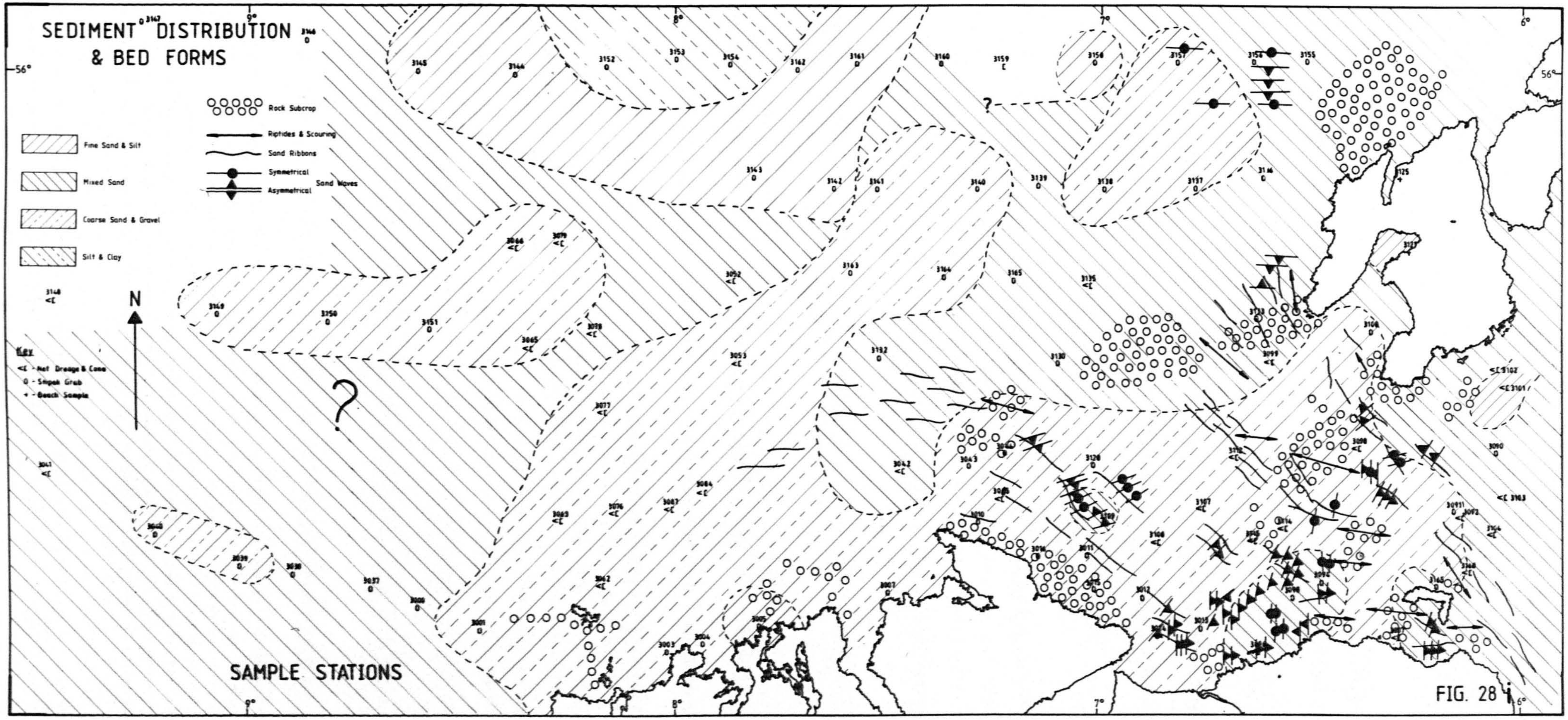
Fig. 27i
SAMPLE STATIONS
Key
0 - Grab
▲ - Cone Dredge
C - Net Dredge
◆ - Core Top
N
Rock Subcrop
Sand Ribbons
Sand Stream
Symmetrical
Asymmetrical
Sand Waves
Fine Sand & Silt
Mixed Sand
Coarse Sand & Gravel
Riptides & Scourings
5°
53°
SEDIMENT DISTRIBUTION & BED FORMS



SAMPLE STATIONS

i.


SEDIMENT DISTRIBUTION
& BED FORMS
Fine Sand & Silt
Mixed Sand
Coarse Sand & Gravel
Silt & Clay
Rock Subcrop
Riptides & Scouring
Sand Ribbons
Symmetrical
Asymmetrical
Sand Waves
N
?
9°
8°
7°
6°
56°
FIG. 28


SEDIMENT DISTRIBUTION
& BED FORMS
Fine Sand & Silt
Mixed Sand
Coarse Sand & Gravel
Silt & Clay
Rock Subcrop
Riptides & Scouring
Sand Ribbons
Symmetrical
Asymmetrical
Sand Waves
N
Key
<C - Net Dredge & Cone
0 - Shipek Grab
+ - Beach Sample
SAMPLE STATIONS
56°
9°
8°
7°
6°
FIG. 28 i

CHAPTER V

DISTRIBUTION OF THE OSTRACODA

DISTRIBUTION OF THE OSTRACODA

Introduction

The distribution of live and of dead Ostracoda is represented in Figs. 29-48 and Figs. A, B, C (Appendix II) and a synopsis of this data is given in Table 9 below. The principal features of these distributions are discussed separately and an attempt is made to explain the observed discrepancy between the biocoenosis and thenatocoenosis. Ostracod assemblages are delimited and both ecological and palaeoecological considerations are dealt with.

Table 9. Total Number of Live Individuals and Species

	Southern Irish Sea		Caernarvon Bay		Malin Sea	
	No. specimens	No. species	No. specimens	No. species	No. specimens	No. species
Total	9,113	111	2,900	103	5,041	140
Live	749	45	466	31	44	14
% Live	8.2	40.5	16.1	30.1	0.87	10.0

Distribution of Live Ostracoda

The distribution of live Ostracoda can be correlated with and seems to be largely controlled by depth, substrate, energy level and the occurrence of algae. Since only few of the samples were from the algal zone the parameters of depth, sediment type and hydrodynamic energy assume, in this study, special significance in the interpretation of the fauna of the open shelf.

Areal Distribution

The distribution of live Ostracoda in the southern Irish Sea is plotted on Figs. 29 and 30. The low incidence of live individuals in Caernarvon Bay and especially the Malin Sea (Table 9) precludes similar representation. Therefore, a total (live and dead) distribution is given for these latter regions. To include, the numerical abundance of individuals, Figs. 31-34 and species diversity, Figs. 35-38.

These maps represent the main features of the areal distribution of live Ostracoda in a generalised way. However, they indicate a very discontinuous distribution which to some extent reflects the methods and density of sampling and possible seasonal variation within the live faunas. It is also recognised that within a few feet from where each sample was collected the faunas may change to some extent . Despite these considerations the distribution charts give significant results.

Regions of High Ostracod Concentration

Very few samples had more than one or two live ostracods. However, on the open shelf of the Irish Sea study areas most of the live Ostracoda occurred in samples between 8-22 m and, with few exceptions, live individuals were recovered from areas above 25 fm (Figs. 39, 41, 43).

There were a number of stations with a high concentration of live specimens. Samples 917 (coarse sand + gravel, 35.1 m), southern Irish Sea and 2637 (coarse sand + gravel, 40 m), Caernarvon Bay, are typical and contain the following faunas:

Sample 917

Paradoxostoma normani	- 2 adults, 3 instars
Leptocythere tenera	- 2 adults
Loxoconcha rhomboidea	- 1 adult
Urocythereis britannica	- 1 adult
Bonnyannella robertsoni	- 1 adult
Paradoxostoma bradyi	- 2 instars

Paradoxostoma variabile	- 1 instar
Paradoxostoma sp. cf. *P. normani*	- 1 instar

Sample 2637

Cythere lutea	- 2 adults
Loxoconcha rhomboides	- 1 adult
Paradoxostoma ensiforme	- 1 adult
Paradoxostoma variabile	- 3 instars
Hirschmannia vividis	- 1 instar
Paradoxostoma normani	- 1 instar
Paradoxostoma bradyi	- 1 instar
Hemicytherura cellulosa	- 1 instar

These and the other high concentrations are mostly associated with the coarse grade sediments, in particular coarse sand + gravel and mixed sands (Figs. 40, 42, 44).

The samples with high concentrations are listed below. They are generally situated in areas of high energy (Figs. 21-24), offshore in areas affected by riptides and enhanced tide flow and inshore within the range of storm and wave turbulence. Further, high concentrations of live ostracods were mostly recovered near to large expanses of rock subcrop and prominent sand bodies (Figs. 25-28).

In Caernarvon Bay high concentrations are found on the southern margin of the Holyhead Platform (sample 2442 and 2637, 40-46 m) and off the N. Lleyn Peninsula (sample 2399 and 2400, 7-13 m). Off S.E. Ireland, similar rocky localities seem to be restricted inshore; samples 2779, 2780, 2791, 2854 (2.7-14 m). High concentrations in offshore areas of the southern Irish Sea are represented in sample 801, 805, 825, 872, 906, 917, 925, 926, 14.6-54.9 m. These were dredged south of Howth, on the flanks and to the west of the tide current ridges. This is an area of shelf covered by sand streams and large asymmetrical sand waves. This association is also evident in the Malin Sea. In this region, live individuals were found in a few isolated samples on the east flank of the Malin Head - Rhinns of Islay ridge (stations 3012, 3099, 3112, 47.6-82 m) and in sample 3097, 37 m from the rock platform between Rathlin Island and the mainland.

There are marked changes in the live faunas found in localities of fine grained sediments. These changes are well indicated in high concentrations found in fine sand + silt of stations 2839 (44 m), Caernarvon Bay and 2904 (80.5 m), N.E. of Lambay Deep, southern Irish Sea. They contain the live ostracods listed below:

Sample 2839

L. tenera	- 36 adults, 22 instars
Semicytherura striata	- 8 adults
B. robertsoni	- 7 adults
Semicytherura acuticostata	- 3 adults
Sclerochilus contortus	- 7 instars
Hemicythere villosa	- 1 instar

Sample 2904

L. tenera	- 9 adults
Lindisfarnia guttata	- 7 adults
Lindisfarnia laevata	- 6 adults
B. robertsoni	- 2 adults
Falunia emaciata	- 2 adults
S. striata	- 2 instars
P. sp. cf. P. normani	- 2 instars
Celtia quadridentata	- 1 instar
Sarsicytheridea bradii	- 1 instar
Robertsonites tuberculata	- 1 instar

These faunas include most of the significant live species in samples composed of fine sand + silt or silt + clay occurring in the Irish Sea study areas. Small scale asymmetrical and symmetrical bed forms occur in the vicinity of both samples 2839 and 2904. These indicate that a number of ostracod faunas living in the inner reaches of Caernarvon Bay and deep shelf north of Howth, are influenced by slow sedimentation and reduced tidal influence.

Thus, differences in the live ostracod faunas, between high concentrations prevailing on coarse sands and those associated with finer grade sediments, cannot be ascribed to any one dominant controlling factor. It seems likely that the variation in ostracod faunas is due to several interactive parameters. To include, changes of grain size and stability of the sediment substrate and energy.

Regions of Low Ostracod Concentration

In areas of shelf outside mainstream tidal influence (2 kn or less), west of the Rhinns - Malin Head ridge and north of Howth or regions of rapid sediment mobilization, east of Dublin Bay and the Central Irish Sea Basin, the numbers of live decline. In these areas there is little selectivity of sediment type or depth. The fine sand and silt grade samples usually contain fewer live individuals, though the majority of samples of various sediment types were barren of live ostracods (Figs. 25-29, 33-35, 37, 38).

Minor concentrations at stations 923 (coarse sand + gravel, 67.1 m) and 2788 (coarse sand + gravel, 34 m) occur to the east of the tide-current ridge off S.E. Ireland. These samples have been dredged from an area of dune trains and sand streams that mark where turbulent mainstream currents (3 kn +) are deflected away from the Irish mainland. The presence of these disjunct live faunas may, therefore, relate to a local increase in energy and, perhaps, food supply.

The Relative Abundance of Live Ostracods

There follows a discussion of the similarities and differences in the relative abundance of live ostracod species on the shelf in the three regions of study.

The ostracods represented live in the study material are given as percentages in Table 10. It shows the following significant things:

A total of 55 species were found living and all with the exception and Leptocythere sp. cf. L. macella, Paradoxostoma obliquum, Sclerochilus truncatus, Microcythere inflexa, M. helgolandica and Microcythere sp. cf. M. monstruosa are previously recorded live in British waters.

Furthermore, Bythocythere intermedia, Krithe glacialis, Pseudocythere sp.cf. P. caudata, Machaerina tennissima, Trachyleberis dunelunensis, Philomedes brenda and Cytherella sp.cf. C. scotia are new to the documented live Ostracoda fauna of the southern Irish and Malin Seas.

L. rhomboidea is by far the most abundant live species in the study. Of the total live ostracod fauna, it constitutes 32.26% in the southern Irish Sea, 33.59% in Caernarvon Bay and, as 11.36%, is second only in importance to Pseudocythere caudata in the Malin Sea.

The dominant live ostracod species from off S.E. Ireland and in Caernarvon Bay are virtually the same. The respective faunas include L. rhomboidea, L. tenera, S. contortus, B. robertsoni and H. villosa. In the former region they comprise 54.68% and in the latter region 78.46% of the total live Ostracoda recovered. However, of these species, only L. rhomboidea and L. terera figure prominent in the Malin Sea, as 22.72% of this region's live fauna.

P. caudata, L. rhomboidea, C. quadridentata, Paradoxostoma bradyi and L. laevata are, in order of numerical abundance, the most common live species in the Malin Sea material and, together, comprise 54.56% of the total fauna.

With the exception of S. contortus, the other paradoxostomatid species were found to be rarely common live. However, collectively (15 species) they constitute 15.49% in the southern Irish Sea, 17.54% in Caernarvon Bay and 20.49% of the Malin Sea live Ostracod fauna.

A number of species were found alive in only one area. These are given below as percentages:

Southern Irish Sea		Caernarvon Bay	
S. bradii	2.94%	Paradoxostoma sp.cf. P. arcuata	1.58%
L. guttata	2.54%	Xestoleberis depressa	0.86%
Semicytherura simplex	1.47%	S. acuticostata	0.64%
R. tuberculata	1.20%	C. lutea	0.43%
Pontocythere elongata	0.80%	L. macallana	0.43%
Paradoxostoma obliquum	0.67%	Philomedes brenda	0.43%
Paradoxostoma abbreviatum	0.53%	Microcythere sp.cf. M. mostruosa	0.24%
Falunia emaciata	0.40%	Paracypris polita	0.24%

Malin Sea	
Cytherella sp.cf. C. scotica	4.55%
Cytheropteron dorsocostatum	2.28%
Microcythere helgolandica	2.28%

The southern Irish Sea fauna includes isolated live individuals of a further 12 species. Of these, S. bradii, L. guttata, R. tuberculata, F. emaciata, Elofsonella concinna, Machaerina tenuissima and Trachyleberis dunelmensis are almost entirely recovered from fine sand, silt and clay, north of Howth. The causes of such high species diversity are not readily apparent as this region lies in tidal shadow and at some distance from high concentrations of live ostracods that occur predominantly south of Howth. However, the moderate numbers of live specimens may be due to an increase in food supply from effluent water entering from the north out of Lough Carlingford.

Other features of the live distribution, represented on Table 10 in conjunction with Figs. A, B, C; 39-44 are notated as follows:

1. L. rhomboidea is alive in 12 of the 45 Caernarvon Bay samples and in 35 of the 73 samples off S.E. Ireland. It therefore occurs in approximately 33% of the Irish Sea stations that incorporate live ostracods and, as such, L. rhomboidea is the most widespread live species encountered.
2. Solitary live individuals of L. rhomboidea were found in a number of samples in the southern Irish Sea (820, 823, 857, 2367, 2372, 2373, 2375). All of these were dredged between 8.2-30 m in mixed sand and fine sand +

silt rich in organic material, south of Howth.

3. Otherwise, L. rhomboidea was nearly always found live associated with coarse sands and, with one exception, (sample 857), alive on this sediment type with other ostracod species.

4. The most common species living with L. rhomboidea include B. robertsoni, S. contortus, H. villosa and L. tenera. Although L. rhomboidea is associated live with either B. robertsoni or H. villosa in more than 20 Irish Sea samples they are only living together in sample 2791 (9 m, coarse sand + gravel), off S.E. Ireland and in sample 2399 (7 m, coarse sand + gravel), Caernarvon Bay. The last two named may, therefore, be mutually exclusive when live with L. rhomboidea much below the turbulent surf zone.

5. A number of other species including L. laevata, S. striata, A. convexa, H. cellulosa and Paradoxostoma spp. were regularly encountered alive in the same Irish Sea samples. They occurred in a variety of sediments in less than 25 fm with L. rhomboidea.

6. The isolated incidence of the last named alive below 20 fm off S.E. Ireland is usually accompanied by species of Paradoxostoma, samples 925 (48.8 m), 926 (54.9 m).

7. Below 20 fm, south of Howth, L. rhomboidea occurs alive in a variety of sediments (10 samples) with P. normani and Paradoxostoma sp.cf. P. normani. This feature was only apparent in sample 2442, Caernarvon Bay.

8. With the exception of sample 3101 (91 m), Malin Sea, there is a noticable absence of L. rhomboidea alive in samples below 55 m throughout the study area.

9. In the Irish Sea live individuals belonging to the Paradoxostomatidae, mostly S. contortus and P. normani, are the only live ostracods regularly recovered from shelly sands below 25 fm (15 samples, to 110 m in Caernarvon Bay alone, i.e. 2770, 82.3 m).

10. Species of this family also form a large part of the live ostracod fauna (6 of the 14 live species) found in the Malin Sea. This high incidence of paradoxostomatids, 22.77%, is probably related to the fact that all but two of the Malin Sea samples were taken from below 20 fm.

11. P. caudata is the only other important addition to the deep water (20 fm+) coarse sand ostracod fauna of Caernarvon Bay and Malin Sea. This species is not live in samples from off S.E. Ireland. The writer suggests that P. caudata may not tolerate the high energy levels associated with coarse sand sediments south of Howth.

12. L. guttata is the most common live species associated with fine sand and silt with clay, north of Howth. Silt grade sediments are almost entirely lacking in Caernarvon Bay and it is probably this factor, above all others, that is related to the absence of this species and other species (C. quadridentata, K. glacialis) from the Caernarvon Bay live fauna.

13. Other species associated live with L. guttata include S. bradii, B. robertsoni and L. tenera (samples 2821, 2904, 24.4 m and 80.5 m respectively). These species and isolated numbers of R. tuberculata, C. quadridentata, F. emaciata, E. concinna, M. tenuissima and T. dunelemensis characterise the fine sand, silts and clay north of Howth

but, of these, only C. quadridentata and L. tenera were found live on fine sands near to the Malin Deep.

14. The low incidence of live individuals in 11 samples of fine grained sediments from the outer shelf seems to indicate these partially consolidated muds are not a particularly suitable substrate for most species of ostracod.

15. C. quadridentata was found live between 15.2-80.5 m, north of Howth and from 128-146.3 m of the northern Malin Sea. This would seem to suggest that for certain species, including K. glacialis, the nature of the sediment substrate is a more important control of live distribution than other ecological parameters such as depth.

16. Isolated numbers only of K. glacialis and Cytherella sp. cf. C. scotica were found to tolerate the silts and clay samples 3153, 3154) east of Malin Deep. The low incidence of live ostracods may be related to inadequate sampling. However, this is a region of minimal sediment influx and energy. Therefore, a low concentration of selected species is possibly related to, amongst other factors, low food supply.

Conclusions

Most live ostracods were found above 10 fm and almost all of the live were recovered above 25 fm.

The live distribution is very patchy and thoroughly mixed. Certain localities of high concentration were identified. These are primarily associated with coarse shelly sand and high energy near to rock subcrop or prominent sand bodies. Many ostracods live interstitially in these conditions and may, therefore, be

TABLE 10.

Live Ostracoda in Order of Abundance

	SPECIES	S. IRISH SEA No. Specimens	S. IRISH SEA % Tot. Live	CAERNARVON BAY No. Specimens	CAERNARVON BAY % Tot. Live	MALIN SEA No. Specimens	MALIN SEA % Tot. Live
1.	L. rhomboidea	242	32.26	166	35.59	5	11.36
2.	L. tenera	59	7.88	72	16.46	5	11.36
3.	S. contortus	42	5.61	38	8.16	1	2.28
4.	B. robertsoni	32	4.27	38	8.16		
5.	H. villosa	31	4.13	24	5.15		
6.	H. albomaculata	4	0.53	23	4.94		
7.	S. bradii	22	2.94				
8.	L. guttata	19	2.54				
9.	P. normani	19	2.54	2	0.43		
10.	P. aradoxostoma sp. cf. P. normani	18	2.40	11	2.36		
11.	L. laevata	18	2.40	15	3.22	3	6.82
12.	A. convexa	14	1.87	11	2.36	1	2.28
13.	H. cellulosa	12	1.60	3	0.64		
14.	S. striata	12	1.60	10	2.41		
15.	S. simplex	11	1.47				
16.	L. marina	11	1.47	2	0.43		
17.	P. variabile	11	1.47	2	0.43	1	2.28
18.	R. tuberculata	9	1.20				
19.	P. bradyi	7	0.93	6	1.29	4	9.10
20.	P. caudata			7	1.50	7	15.92
21.	Pseudocythere sp.cf. arcuata			7	1.50		
22.	P. elongata	6	0.80				
23.	C. quadridentata	5	0.67			5	11.36
24.	K. glacilis	5	0.67			1	2.28
25.	P. ensiforme	5	0.67	4	0.86	2	4.55
26.	P. obliquum	5	0.67				
27.	L. confusa	1	0.13	4	0.86		
28.	P. abbreviatum	4	0.53				
29.	X. depressa			4	0.86		
30.	F. emaciata	3	0.40				
31.	S. acuticostata			3	0.64		
32.	Bythocythere sp.cf. B. turgida	2	0.27				
33.	B. bradyi	2	0.27			2	4.55
34.	B. intermedia	2	0.27				
35.	C. lutea			2	0.43		
36.	C. fischeri	2	0.27				
37.	Cytherella sp.cf. C. scotica					2	4.55
38.	E. concima	2	0.27				
39.	H. clathrata	2	0.27				
40.	L. macallana			2	0.43		
41.	M. tennissima	2	0.27				
42.	M. inflexa	1	0.13	2	0.43		
43.	P. brenda			2	0.43		
44.	S. truncatus	2	0.27	1	0.21	1	2.28
45.	C. dorsocostatum					1	2.28
46.	C. nodosum	1	0.13				
47.	H. viridis	1	0.13	1	0.21		
48.	L. pellucida	1	0.13				
49.	M. helgolandica					1	2.28
50.	Microcythere sp.cf. M. montruosa			1	0.21		
51.	P. polita			1	0.21		
52.	S. nigrescens	1	0.13				
53.	S. tela	1	0.13				
54.	T. tunelmensis	1	0.13				
55.	U. britannica	1	0.13				

largely unaffected by the rapid transport above of superficial sediments. In general, the numbers of live decline in fine sand sediments and in areas of sediment sorting and mobilization.

Certain species have a limited range of habitat. For example, L. guttata, S. bradii, R. tuberculata, C. quadridentata, K. glacialis, E. concinna, M. tenuissima and T. dunelmensis are associated live with fine sands and silts and moderate energy. C. quadridentata was not found in sediment with a high silt content, while K. glacialis and Cytherella sp.cf. C. scotica were restricted live to silts with clay. Not one of the dominant live species had a life habitat exclusive to coarse shelly sand. However, L. rhomboidea is primarily associated with this sediment type in high energy, while P. caudata seems restricted to coarse sands in low energy.

The recognition of such restricted life habitats is essential to the determination of post-mortem transport and facilitates the recognition of ostracod depth and facies assemblages.

The other dominant species, L. tenera, S. contortus, B. robertsoni, H. villosa and Paradoxostoma spp., live in a variety of depths and substrates and are, therefore, less useful to palaeoenvironmental interpretation.

Distribution of Dead Ostracoda

Introduction

The areal distribution of dead ostracods is shown in a generalised way on Figs. A, 31, 32, 35, 36, southern Irish Sea;

Figs. B, 33, 37, Caernarvon Bay and Figs. C, 34, 38, Malin Sea. A synopsis of the information contained in these maps and histograms appears as Table 11 below.

Table 11. Total Number of Dead Individuals and Species

	Southern Irish Sea		Caernarvon Bay		Malin Sea	
	No. Specimens	No. Species	No. Specimens	No. Species	No. Specimens	No. Species
Total	9,113	111	2,900	103	5,041	140
Dead	8,364	66	2,434	72	4,997	126
%Dead	91.8	59.9	83.9	69.9	99.1	90.0

Of the study Ostracoda (Table 11), a mean 91.6% of the total numerical abundance and 73.3% of species are exclusive to the thenatocoenosis. This high ratio (up to 9:1) of dead to live ostracods and the absence of live of many species may be accounted for in the following ways:

1. That the study area is inadequately sampled.

   The sampling techniques employed in this study are primarily designed with sediment analyses in mind. A more extensive use of net trawls, box corers and 'scuba' divers in areas below the algal zone may reduce the element of chance in recovering live ostracod faunas.

2. That the samples include an exotic ostracod fauna.

   It is probable that large numbers of dead ostracods are transported into the study area from outside under flood and ebb-tide influence. Taking into consideration such factors as species population, age structures and the ratios of adults : instars and values : carapaces, the writer hopes to identify and isolate certain of the foreign ostracod faunas from the indigenous Irish and Malin Sea Ostracoda.

3. That there are unrecognised or little sampled ostracod substrates was recognised by Whatley (1976) who recorded a number of ostracod species live from deep water and offshore animal substrates. They were firmly attached to a variety of stable sediments and rocky subcrops and are, therefore, difficult to locate and sample. When dead the hosts leave little trace of their existence and the associated Ostracoda are then dispersed into the adjacent sediments.
4. That faunal enrichment has effected parts of the study area. The superficial sediments flooring much of the Malin and Irish Seas are largely of early post-glacial and Holocene age rather than Recent. These and remnant deposits of the Pleistocene are to some extent reworked and, therefore, contain ostracods which must contribute greatly to the total of dead forms. In addition, these sediments contain ostracods, many species of which live in the study areas at present and are difficult to distinguish from those recently dead. For this reason, such factors as size sorting and population age structure and preservation of the dominant dead Ostracoda are considered.

It is probable that a more selected sampling programme would not entirely erase the gross disparity between the live and dead of a species. Therefore, in offshore waters the ostracod worker will nearly always have to deal with the overwhelming abundance of the dead Ostracoda. The points 1-4 above indicate some problems inherent in the study of the thenatocoenosis. However, it is proposed that the distributions of dead Ostracoda are of considerable significance in interpretation of the post-glacial palaeoecology of the Malin and Irish Seas. For this reason an analysis of the distributions of dead Ostracoda follows.

Areal Distribution

Regions of High Concentration

Off S.E. Ireland the greatest concentration of dead ostracods were recovered from samples 2369, 2370, Dublin Bay and down to 50 fm near the Lambay Deep (e.g. samples 2359, 2904, 2905). Other concentrations north of Howth (e.g. samples 2381, 2813, 2819, 2915) extend inshore from the 50 fm isobath towards Clogher Head and the mouth of Lough Carlingford (Figs. 31, 35). High concentrations also occur below 50 fm on the outer shelf east of Malin Deep (e.g. samples 3143, 3154, 3161, 3162) and in sample 3101, 55 m, from off S.E. Islay (Figs. 34, 38). These stations occur between 11-200 m+ and are almost entirely of silts with clay or fine sand with silt (Figs. 25, 28). Additionally, these localities are situated in areas furthest down the tide velocity gradient (0.5 m/sec). Therefore, most of the sedimentary characteristics indicate these deposits accumulated slowly in low energy conditions of the C type environment, see Table 8.

Table 12 indicates a number of high concentrations of dead ostracods. From which it is evident a large proportion of the dead valves and carapaces occurring north of Howth are immature. However, on the open shelf of the Malin Sea the proportion of adults to instars is greatly increased. Furthermore, Figs. 39, 41 and 43 show a large number of ostracods associated with these high concentrations are poorly preserved and have suffered at least some post-mortem transport.

Regions of Low Concentration

In the coarse sand and mixed sands fewer ostracods occur (Figs. 32-34, 36-38). Indeed, more than 40% of samples from outside the areas of fine sand with silt are devoid of Ostracoda. These barren or impoverished samples are associated with areas of highly mobile sands or they occur in featureless areas of sea floor where nearly all unstable sediments are winnowed away. The regions of low concentrations occur south of Howth, in the Central Irish Sea Basin, below 50 fm in Rathlin Deep and west of the Malin Head to Rhinns of Islay ridge.

Table 13 indicates a number of minor concentrations associated with sand. Off S.E. Ireland, they occur at the head of Codling Deep (samples 2365, 2375, 2780), below 20 fm east of Arklow Bank (sample 917) and in samples 801, 868 and 906, south of Arklow Bank (Figs. 32, 36). Minor concentrations also occur north of Lleyn Peninsula (samples 2399, 2830), mouth of Caernarvon Bay (samples 2393, 2395), below 20 fm from the Holyhead Platform (samples 2443, 2447) and in Holyhead Bay (sample HHII, Figs. 33, 37). In the Malin Sea isolated concentrations were found in samples 3012, 3090, 3099, 3102, 3140, 3141, 3147 (Figs. 34, 38). All of these stations, regardless of depth or remoteness, occur in areas adjacent to prominent submarine relief or on the brink of a steep decline in shelf slope. These are localities of moderate or high tidal energy when above 20 fm and localities of upwelling tidal waters (low energy) below 20 fm.

In sands from off S.E. Ireland and in the Malin Sea the ratios carapaces : values and of adults : instars are larger

TABLE 12.

Relative Abundance of Dead Ostracods in areas of high Silt content

SOUTHERN IRISH SEA					MALIN SEA				
Sample No.	Adult		Instar		Sample No.	Adult		Instar	
	C	V	C	V		C	V	C	V
2359	64	116	2	156	3101	40	972	26	3760
2369	1	13	1	61	3142	4	67	2	132
2370	7	32	1	80	3143	23	335	1	497
2381	22	66	8	236	3145	6	51	3	46
2813	5	129	3	1035	3152	7	159	4	161
2819	5	42	1	321	3153	6	98	5	205
2904	45	234	45	449	3154	4	227	8	494
2905	4	362	11	2608	3161	11	225	1	238
2915	86	440	23	3925	3162	12	409	9	492

C - carapace
V - valve

TABLE 13.

Minor Concentrations of Dead Ostracoda in Sand

SOUTHERN IRISH SEA					CAERNARVON BAY					MALIN SEA				
Sample No.	Adult		Instar		Sample No.	Adult		Instar		Sample No.	Adult		Instar	
	C	V	C	V		C	V	C	V		C	V	C	V
801	3	12	1	24	2393	1	9	4	91	3012	21	53	4	45
868	12	35	2	61	2395	5	9	2	53	3041	-	30	1	34
906	4	7	-	24	2399	8	75	2	278	3090	4	25	1	14
917	6	14	-	57	2443	2	5	2	69	3099	13	61	8	87
2365	27	105	10	294	2447	11	78	1	104	3103	29	62	2	75
2765	6	18	1	62	2830	23	80	8	267	3140	3	31	-	72
2780	7	16	-	111	HHII	21	104	8	372	3147	1	11	1	23

C - carapace
V - valve

than in samples with a high silt content. Therefore, both regions indicate the effects of size sorting and post-mortem transport of ostracods down the tide velocity gradient. However, the ratios adults : instars and of carapaces : valves (Table 13) from sands of Caernarvon Bay indicate a mixed fauna and much reduced size sorting of the dead ostracods. The ostracod thenatocoenosis of Caernarvon Bay may, therefore, be partly of ecological origin and which feature must related to weak tidal energy (<1.0 m/sec) in that region.

Ostracod Assemblages

Introduction

It can be seen from Figs. A, B and C that all samples with more than a few individuals have a distinct ostracod population. However, certain samples may be grouped into assemblages upon similarities in the ostracod fauna. The writer recognises that in certain localities post-mortem tranport has played an important role in the present distributions of some dead ostracods. However, these distributions do not entirely owe their existence to the effects of sedimentary processes. It is hoped the recognition of these assemblages more clearly defines the ecological factors operating.

A number of important factors are considered. These factors include the live:dead and carapace:instar ratios, population age structures and the preservation of hard parts of dominant and significant other species. Particular reference is made to the relative numerical abundance (expressed as a percentage) of the live and dead of dominant Ostracoda (Table 14).

Five ostracod faunal assemblages are recognised. Each assemblage is quite distinct and discussed in the following order:

1. Littoral
2. Inner Bay
3. Offshore
4. Outer Shelf and Deeps
5. Upper Bathyal

Littoral Assemblage

This assemblage is recognised in 4 samples. One of these (sample 3125) comprises mixed sand from N. Islay, with two more samples (HHI, HHII) of algal debris from Holyhead Harbour, N.W. Anglesey. There is also sample 2854 (2.7 m coarse sand + gravel) from the mouth of Carlingford Lough, S.E. Ireland. These stations are associated with rocky platforms within 2 fm and only sample 2854 occurs below the low water mark.

Samples HHI and HHII, with 58 species, contained the most diverse ostracod faunas recovered from any station in Caernarvon Bay. These two samples include more than 50% of all species recorded in this study area and which feature may be contrasted with the 13 species recovered from samples 3125 and 2854.

The Littoral Assemblage is dominated by, in order of numerical importance, adults and instars of L. rhomboidea, B. robertsoni, H. viridis, H. villosa, L. tenera, P. elongata and S. nigrescens. These species comprise nearly 50% of the dead ostracods in Holyhead Harbour. Small concentrations of P. variabile and H. albomaculata are most common in the mouth of Carlingford Lough. The occurrence of carapaces is almost entirely restricted to these dominant species.

Instars of many cytherurid species (most of these being members of the genera Semicytherura, Cytheropteron and Hemicytherura) and adults and instars of paradoxostomatid species are also significant in the littoral. Adults accompanied by some instars of such species as Xestoleberis aurantia, H. cellulosa, Leptocythere confusa, Callistocythere badia, Semicytherura sella and Philomedes brenda further distinguish the Littoral Assemblage.

Of 515 dead ostracods only 11 individuals were found live. These include solitary examples of L. laevata, L. marina, P. brenda, S. striata and L. rhomboidea in Holyhead Harbour and H. albomaculata, L. rhomboidea and S. simplex in sample 2854.

It is widely documented that littoral ostracod faunas are rarely, if ever, preserved (Wall, ms., p. 436). However, in low energy areas and in sheltered havens like Holyhead Bay, a rich and diverse ostracod thenatocoenosis may prevail. Nearly all the incorporated forms are phytal though few of them appear to live in algal debris. Furthermore, not all dead ostracods of the Littoral Assemblage are transported in more exposed areas of moderate or high energy. In these conditions, adults and instars of P. variabile, L. rhomboidea, H. albomaculata and S. simplex live interstitially in stable sands (sample 2854). These species are also well represented dead in sample 2854 by near complete population age structures. Thus, in certain areas of high and low energy the Littoral Assemblage may be preserved.

Inner Bay Assemblage

The Inner Bay Assemblage, as the name suggests, is associated with inshore waters to 20 fm. It occurs off S.E. Ireland and within Caernarvon Bay. Sampling was not conducted between the littoral and 20 fm in the Malin Sea. This assemblage was studied at 42 stations in the southern Irish Sea and comprises 16 samples of inner Caernarvon Bay. Particular reference is made to the ostracod faunas of samples 2822 (15.2 m, silt + clay), mouth of Dundalk Bay; 2826 (6.1 m, silt + clay), 8 miles south of Drogheda Bay; 2791 (9 m, coarse sand + gravel), 5 miles south of Mizen Head and 868 (18.3 m, mixed sand), Glassgorman Banks, from off S.E. Ireland. Samples 2399 (7 m, coarse sand + gravel) and 2830 (13 m, mixed sand), N. Lleyn Peninsula, Caernarvon Bay, are also of significance. This assemblage incorporates a variety of sediment substrates under the influence of high to low energy.

Very few samples of the Inner Bay assemblage are barren of Ostracoda. A total of 66 species (mean 11 species/sample) occurred in Caernarvon Bay. The species diversity is, therefore, similar in both study areas. However, a mean of 21 dead and 12 live individuals/sample occurred off S.E. Ireland while a mean 44 dead and 21 live ostracods/sample is recorded in the other named region. The greater incidence of dead ostracods from inner reaches of Caernarvon Bay may be explained thus. This region is situated in tidal shadow, wherein, waters that well-up during much of the tidal cycle may greatly restrict post-mortem tranposrt of the inner bay thenatocoenosis.

The dominant species are, in order of numerical abundance, *L. rhomboidea*, *H. villosa*, *B. robertsoni*, *L. laevata* and *A. convexa*. These forms represent up to 70% of dead Ostracoda in waters of less than 20 m. Other species with adults and instars, such as *H. albomaculata*, *H. cellulosa*, *L. tenera*, *P. normani*, *H. viridis*, *P. elongata*, *S. contortus* and *P. ensiforme* occur in smaller numbers. These species are common to both the Irish Sea study areas. They are nearly always present together in mixed and coarse sands and are considered to signify shallow waters of high to moderate energy (e.g. samples 2399, 2791).

There are important differences concerning the Inner Bay assemblage. A small concentration of adults and instars of *Carinocythereis carinata*, *Cytheropteron latissimum*, *R. tuberculata* and *L. laevata* and moderate numbers of immature *S. bradii* and *E. concinna* predominate in the silts from off S.E. Ireland (e.g. samples 2822, 2826). These species are almost entirely lacking in sands of inner Caernarvon Bay or in sand from elsewhere in the Irish Sea. Additionally, only isolated live of *R. tuberculata* and *L. laevata* were found. Indeed, size sorting indicates 80% of the Inner Bay assemblage north of Howth owes its existence largely to sedimentary processes.

Offshore Assemblage

This assemblage occurs at depths 20-100 m approximately over a variety of sediments from rock subcrop and coarse sand to silt with clay. It comprises 111 species (mean 13 species/sample) in the southern Irish Sea, 87 species (mean 11 species/sample) in Caernarvon Bay and 107 species (mean 15 species/sample) in the Malin Sea. In these areas and between these depths are the main concentrations of the dead Ostracoda.

In order to reduce the data to a workable amount a study was made of several typical samples. The significant samples are from stations 2365 (40 m, mixed sand), 10 miles east of Bray Head, 2813 (33.5 m, fine sand + silt), 18 miles east of Clogher Head; 2904 (80.5 m fine sand + silt) and 2905 (87.8 m, silt + clay), 15 miles east of the Skerries, southern Irish Sea. In Caernarvon Bay the assemblage is well represented in sample 2422 (23.8 m, mixed sand) 1 mile offshore of N. Lleyn Peninsula and 2839 (44 m, fine sand + silt), 20 miles west of Menai Strait. The Offshore Assemblage in the Malin Seas was studied at stations 3099 (77 m, mixed sand), 15 miles S.W. of the Rhinns Peninsula and 3101 (55 m, fine sand + silt), 18 miles east of the Oa, Islay.

The important Ostracoda of the Offshore Assemblage occur mainly in small concentrations. Individual species are rarely more than 10% of the dead ostracods in any one sample. They include adults and instars of, in order of numerical abundance, *L. rhomboidea*, *H. villosa*, *L. laevata*, *B. robertsoni*, *A. convexa*, *H. clathrata*, *S. acuticostata*, *B. bradyi* and *Paradoxostoma* sp. cf. *P. arcuata*. These forms are primarily associated with rock subcrop, coarse sands and mixed sands (samples 2365, 2442, 3099). There is an increased incidence of *S. contortus*, *P. ensiforme* and *B. bradyi* and isolated live individuals of these species below 30 fm (stations 2399, 68.3 m; 3103, 91 m). These are localities affected by mainstream tidal flow and moderate energy.

The majority of dead ostracods occur in areas of low energy and tidal shadow. For instance, high concentrations (500 dead ostracods) occurred in sample 2389, 44 m, Caernarvon

Bay and in sample 3101, 55 m, Malin Sea (2,500 dead ostracods). These stations are of fine sand with a high silt content. However, the dead Ostracoda of these two samples are for the most part distinct. Certain aspects of these distinctive ostracod faunas are discussed as follows.

The dominant species of sample 2839 are, in order of numerical importance, L. rhomboidea, L. tenera, S. contortus, B. robertsoni, H. clathrata, S. striata and B. bradyi. These forms are represented by adults and instars and the ratio carapaces:valves is high. Live individuals of all these species are present. Indeed, it can be seen that this fauna is very similar to that from the coarse sands and rock subcrop. The Offshore Assemblage is, therefore, considered to be predominantly Recent.

In contrast, sample 3101 includes population age structures of X. depressa, L. rhomboidea, R. tuberculata, S. acuticostata, Carinocythereis antiquata and P. polita. These are in order of numerical abundance and represent 40% of the total dead Ostracoda at this station.

Other species with adults and instars are E. bradii, L. guttata, H. villosa, L. laevata, C. latissimum, H. cellulosa, X. cuneiformis, P. variabile, B. robertsoni, U. britannica and Semicytherura sp.cf. S. acuticostata. These occur in smaller numbers, as 10% of the fauna. Live of these species were not found, the carapace:valve ratio is low and the preservation of hard parts is generally poor. Therefore, much of the ostracod thenatocoenosis in sample 3101 is probably reworked.

The presence in sample 3101 of such species as

Semicytherura undata, Loxoconcha multifora, Finmarchinella angulata, Pterygocythereis jonesii, Cluthia cluthae and adults and instars of 14 species of Cytheropteron is also highly distinctive. A cold water affinity is proposed.

Many of the reworked species occurring at stations 3101, including those forms mentioned above, also make up a moderate part of the Offshore Assemblage in samples 2813, 2904, 2905 (33.5-87.8 m). These are localities of high silt concentration to the north of Howth. However, the ostracod thenatocoenosis occurring there is highly distinctive. To include such species as E. concinna, E. bradii, T. dunelmensis, P. jonesii, R. tuberculata and C. carinata. Populations of these few species form more than 70% of the assemblage, between 20-100 m, north of Howth. In accord with the findings of other workers, much of the Offshore Assemblage north of Howth and approximately 50% of the dead ostracods from off S.E. Islay (sample 3101) are considered sub-Recent.

Outer Shelf and Deeps Assemblage

This assemblage is restricted to areas below 50 fm. From off S.E. Ireland, it has been studied in samples 2902 (109.7 m, mixed sand), 28 miles east of Brady Head and 2360 (137.5 m, fine sand + silt), Lambay Deep. Of the 15 stations below 100 m in Caernarvon Bay, samples 2447 (109.7 m, mixed sand), 2457 (120.7 m) and 2463 (131.7 m), coarse sand, are typical and for this reason they are analysed. They are from the N.W. of the Central Irish Sea Basin. In addition, a study was made of samples 3041 (182 m, mixed sand), west Malin Sea; 3152 (173.8 m, silt + clay), 3143 (146.3 m, fine sand + silt) and 3161 (128 m), northern Malin Sea.

The Outer Shelf and Deep Assemblage comprises a variety of sediments from coarse sand + gravel to silt with clay. However, the Ostracoda may be broadly grouped into two distinct faunas. One of these occurs in sediments with high silt content while other dead Ostracoda are primarily associated with pure sand. The 'sand' and 'silt' ostracod faunas are discussed separately.

54 species of Ostracoda were found in sands of the Central Irish Sea Basin and outer shelf of the Malin Sea. In which regions, small numbers of immature K. glacialis, E. concinna, T. dunelmensis, L. laevata, B. bradyi, C. nodosum and H. clathrata are most common (samples 2902, 3041, 2447, 2457, 2463). The valve:carapace ratio is high in these samples. This factor and poor preservation of a few adults indicates much of the 'sand' fauna owes its present distribution to the effects of sedimentary processes.

The 'silt' fauna is by far the greatest concentration of the thenatocoenosis in the study. 97 species were recorded below 128 m in muds of the outer shelf and deeps. In silts of the Malin Sea a mean 38 species and 140 individuals/sample may be compared with an average 7 species and 17 individuals/sample for the 'sand' fauna. The high incidence of dead ostracods in silts may be explained in the following way.

The silts of samples 3152, 3153 and 3154 are dominated by adults and instars of K. glacialis and Pterygocythereis siveteri. Other species, namely P. caudata, Cytheropteron voluntium, Parakrithe angusta, Kangarina abyssicola, Buntonia corpulenta, Normanicythere leioderma, Sarsicytheridea punctillata, Pellucistoma sp., Argilloecia sp.cf. A. conoidea and

Cytheropteron vespertilio occur in smaller numbers. Population age structures of another 42 ostracod species occur in samples 3152, 3153 and 3154 (170.1-173.8 m), though the number of individuals of any one species is small. The dominant forms occur together in only one other locality in the Malin Sea, sample 3101.

Most of the important ostracod species that occur in silts of the Outer Shelf and Deeps Assemblage indicate cold waters of moderate depth. They are not represented live in the study. Some of the above named may be pioneer species of the early post-glacial and water temperatures as low as $2-3^{o}$ are indicated.

Samples 3152, 3153 and 3154 also include large numbers (50+ individuals/sample) of immature C. nodosum, C. dorsocostatum, Cytheropteron latissimum, X. depressa and L. laevata. The species are size sorted and, therefore, have little ecological meaning.

An examination of samples 3143 and 3161 reveals important changes in the ostracod fauna. These are samples of fine sand + silt in the northern Malin Sea. At these stations the 'silt' fauna includes small populations of C. antiquata, F. emaciata, C. quadridentata, P. jonesii and L. guttata.

Adults and instars of other species, such as L. multifora, Jonesia simplex, Bythocythere sp.cf. B. turgida, P. polita, 17 species of Cytheropteron and 5 species of Eucythere, occur in smaller numbers. Most of these forms are also present in reduced numbers in fine sand + silt of stations 2360 (109.7 m) and 2904 from off S.E. Ireland.

Much of the ostracod fauna of samples 2360, 2904, 3143 and 3161 is considered to be sub-Recent. However, isolated live individuals of certain dominant sub-Recent species (e.g. R. tuberculata, S. bradii, C. quadridentata, L. guttata; see also Table 14) also occur at these stations and in other nearby localities of fine sand + silt. This feature is of particular significance. To indicate, that in low energy areas of the Outer Shelf and deeper Offshore Assemblages the mean winter temperature of 7°C is low enough for some cryophilic Ostracoda to remain active.

It is suggested that further sampling in these areas of relatively undisturbed sands and muds may bring to light other live Ostracoda, many species of which are documented extinct in the study area.

Upper Bathyal Assemblage

This assemblage is represented by only two stations. These are samples 3147 and 3148 (512.1 m, mixed sand) in the western Malin Sea. Depth seems to be the principal ecological factor operating in the Upper Bathyal Assemblage.

A total of 14 species and 27 individual ostracods occur in sample 3147 with a single adult found in sample 3148.

Live ostracods were not recovered.

Solitary individuals of X. depressa, S. contortus, Loxoconcha sp., S. punctillata, C. dorsocostatum, Cytheropteron inornatum, K. abyssicola, E. concinna, P. variabile, T. crenulata, L. multifora and Pellucistoma sp. comprise much of the fauna. This small concentration is situated in the N.W. Malin Sea, adjacent to the heads of two submarine canyons.

Additionally, the preservation of this material is poor and the ratios instars:adults and of valves:carapaces are high. All the above named species are common in silts of the outer shelf. The fauna in sample 3147 may, therefore, be reworked from the west from Malin Deep.

A small number of adults and instars of Mullerina abyssicola and solitary adults of Cytheropteron testudo and Krithe producta (lost in S.E.M.) are exclusive to sample 3147. Therefore, these species distinguish the Upper Bathyal Assemblage.

Distribution of Total Ostracoda

Figs. 31-38 show the distribution pattern of the total Ostracoda. By themselves, these maps are of little use to distinguish between concentrations due to animals living in an area or having accumulated there by sedimentary processes. However, the ratios carapaces:valves and of adults:instars are shown to be of value in this aspect as the sand areas, in which most of the study Ostracoda live, have the highest ratios.

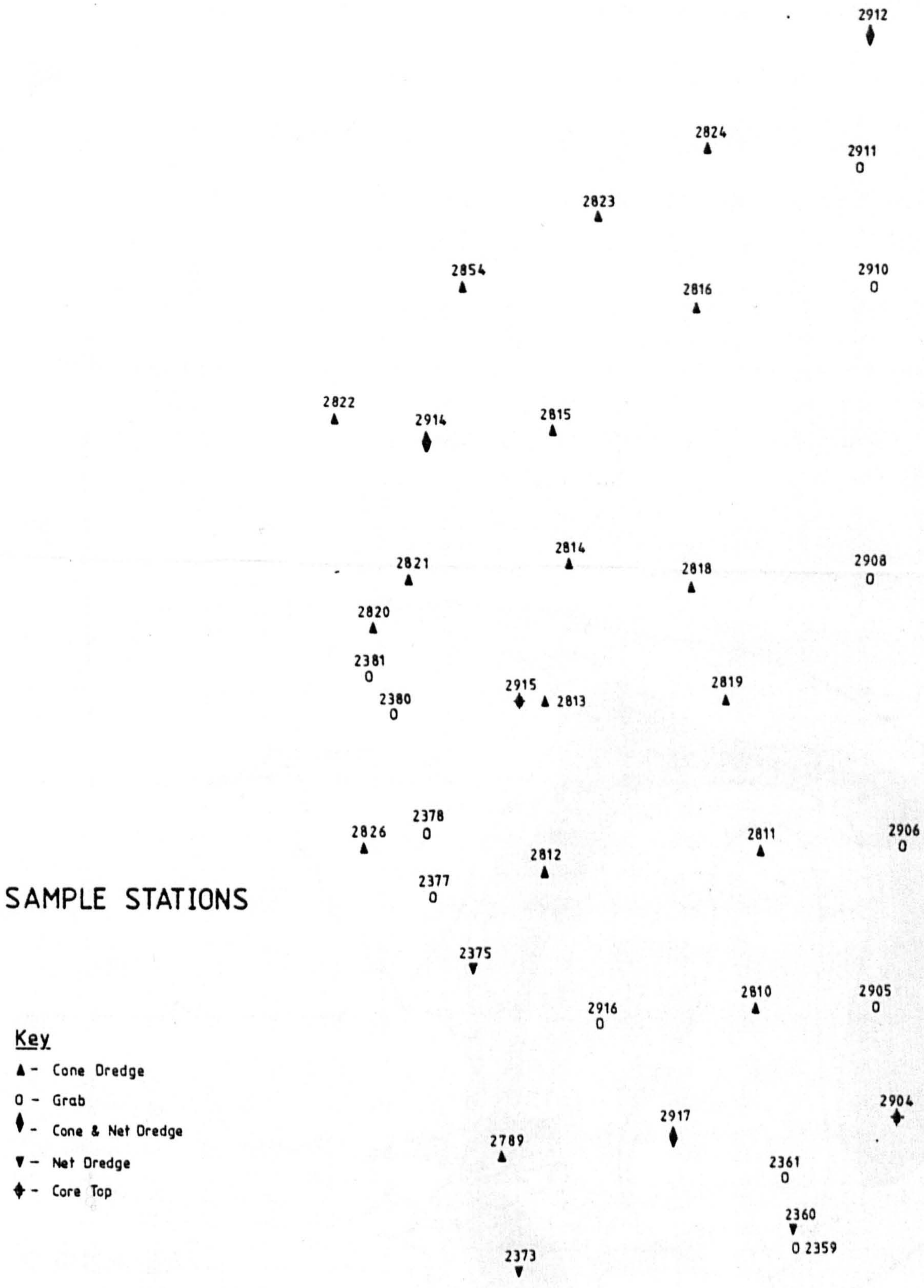
Wall (ms. 1969, p. 436) indicates that the areas of highest concentration of live Ostracoda, the sub-littoral and littoral zones, are rarely, if ever, fossilised. He argues that these are zones of high turbulence where the thenatocoenosis is quickly transported or destroyed. The present author suggests that in high energy areas below the algal zone individuals of many species may live interstitially throughout much of their ontogenetic development and adult life. These ostracod faunas may be preserved in high energy conditions in stable sands and gravels. Additionally, relatively few dead

TABLE 14.

Relative Numerical Live and Dead Abundance of Dominant Ostracoda

Rank Order Overall	SPECIES	SOUTHERN IRISH SEA				CAERNARVON BAY				MALIN SEA			
		DEAD		LIVE		DEAD		LIVE		DEAD		LIVE	
		Rank Order	% Total	Rank Order	% Total	Rank Order	% Total	Rank Order	% Total	Rank Order	% Total	Rank Order	% Total
1.	E. concima	1	28.11	31	0.27								
2.	X. depressa							16	0.86	1	23.61		
3.	S. bradii	2	12.91	6	2.94								
4.	T. dunelmensis	3	11.36	42	0.13								
5.	L. rhomboidea	4	8.97	1	32.26	1	36.15	1	35.59	2	10.81	4	11.36
6.	C. nodosum	5	6.34	35	0.13	6	6.41			6	5.40		
7.	P. jonesii	6	6.04							18	2.40		
8.	L. laevata	7	4.54	17	2.40	7	3.22	7	3.22	13	3.56	6	6.83
9.	R. tuberculata	8	4.30	16	1.20					16	2.56		
10.	C. carinata	9	3.80										
11.	C. latissimum	10	3.71							8	4.60		
12.	K. glacialis	20	1.52	21	0.67					3	5.90	12	2.28
13.	C. antiquata									4	5.80		
14.	S. contortus	19	1.51	3	5.61	3	11.84	4	5.84	9	4.12	15	2.28
15.	B. robertsoni	11	3.11	4	4.27	4	11.70	3	8.16				
16.	C. dorsocostatum	16	1.61							5	5.70	11	2.28
17.	L. multifora									7	5.40		
18.	L. guttata	12	2.89	7	2.54					11	3.80		
19.	S. acuticostata					5	9.86	18	0.64	10	4.80		
20.	S. striata	13	2.27	12	1.60			10	2.41				
21.	H. villosa	21	1.43	5	4.13			5	5.15	12	3.64		
22.	L. tenera	14	2.00	2	7.88	7	4.77	2	16.46	13	2.92	3	11.36
23.	H. clathrata	15	1.75	32	0.27					18	2.30		
24.	Loxoconcha sp.									14	2.76		
25.	H. cellulosa	17	1.60	11	1.60			17	0.64				
26.	S. undata									15	2.68		
27.	C. pseudocrassipimatum	18	1.54										
28.	C. quadridentata			20	0.67					17	2.50	2	11.36
29.	C. punctatum	22	1.33										
30.	U. britannica	23	1.30	43	0.13								
31.	S. angulata	24	1.22										
32.	F. emaciata			26	0.40						2.04		

i



2912
2824
2911
2823
2854
2816
2910
2822
2914
2815
2821
2814
2818
2908
2820
2381
2915
2813
2819
2380
2826
2378
2812
2811
2906
2377
SAMPLE STATIONS
2375
2810
2905
2916
Key
▲ - Cone Dredge
0 - Grab
♦ - Cone & Net Dredge
▼ - Net Dredge
♦ - Core Top
2904
2917
2789
2361
2360
0 2359
2373

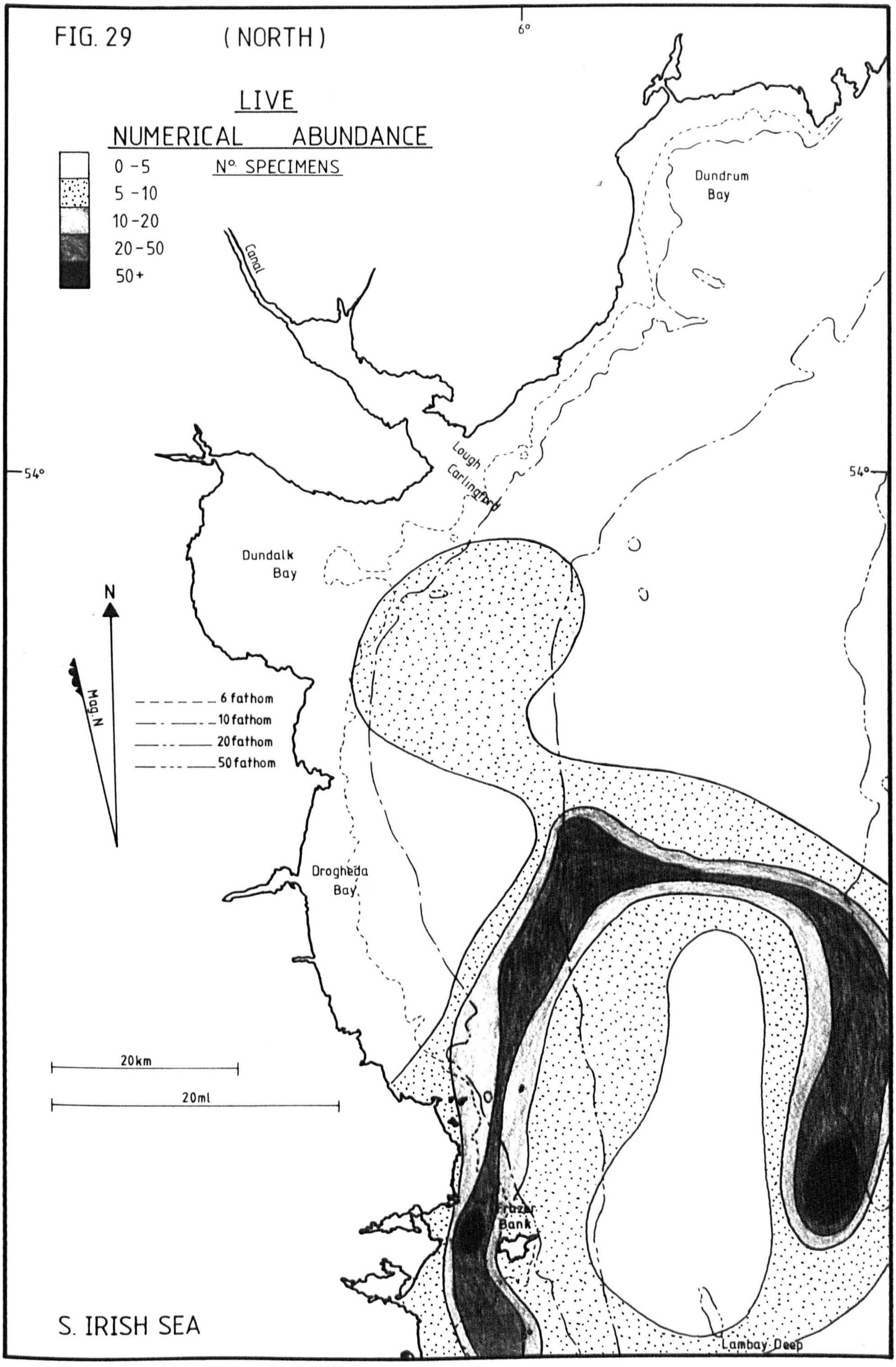
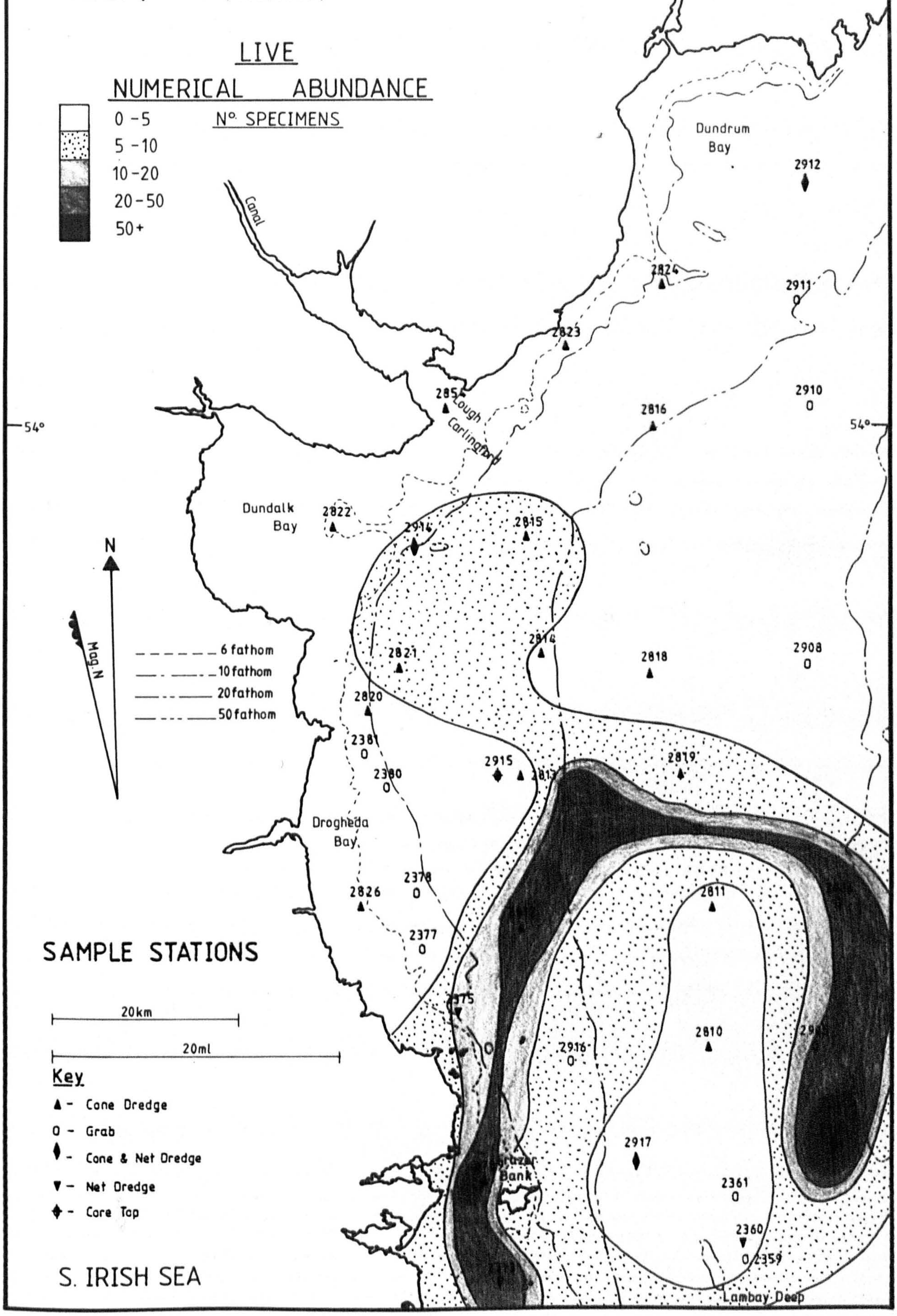
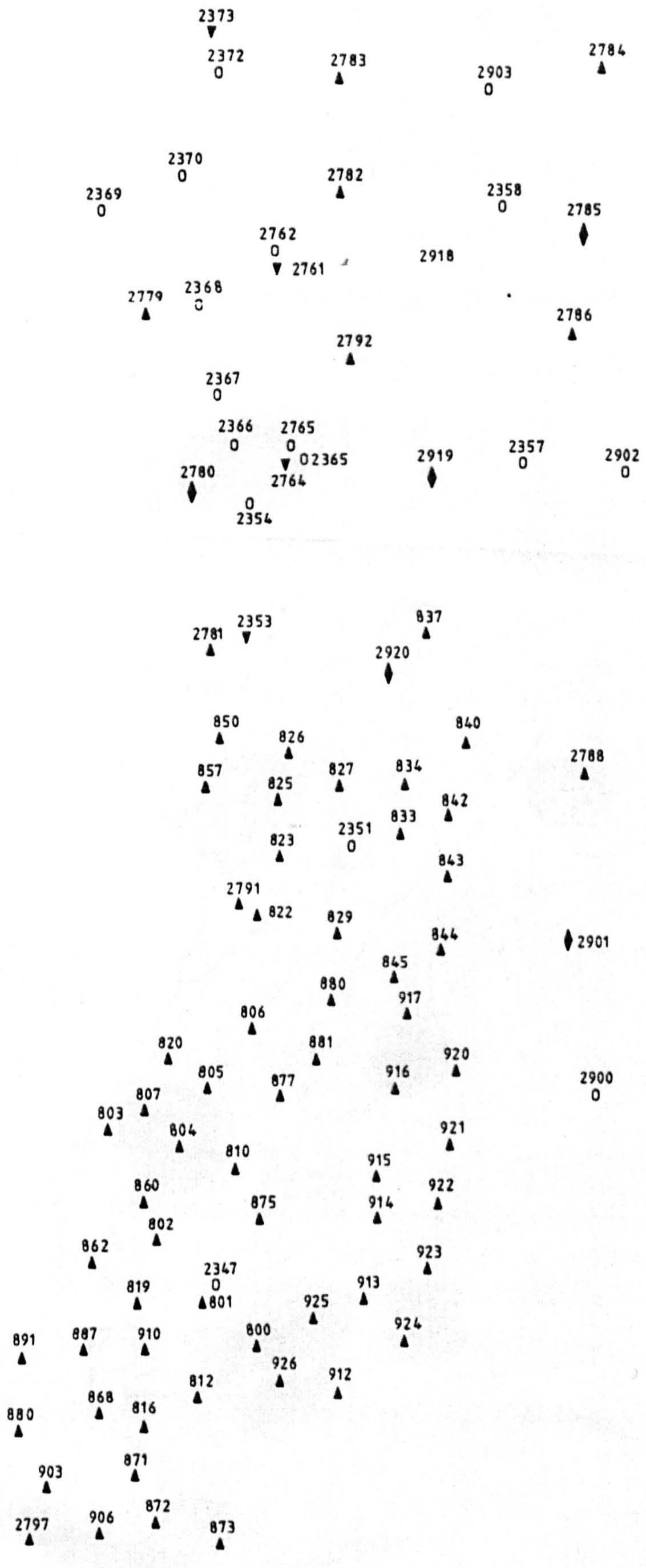


FIG. 29
(NORTH)
LIVE
NUMERICAL ABUNDANCE
N° SPECIMENS
0 -5
5 -10
10 -20
20 -50
50+
6°
Dundrum Bay
Canal
Lough Carlingford
54°
54°
Dundalk Bay
N
Mag. N
6 fathom
10 fathom
20 fathom
50 fathom
Drogheda Bay
20km
20ml
Frazer Bank
Lambay Deep
S. IRISH SEA

FIG. 29 i (NORTH)





SAMPLE STATIONS

Key.

▲ – Cone Dredge

O – Grab

♦ – Cone & Net Dredge

▼ – Net Dredge

✦ – Core Top

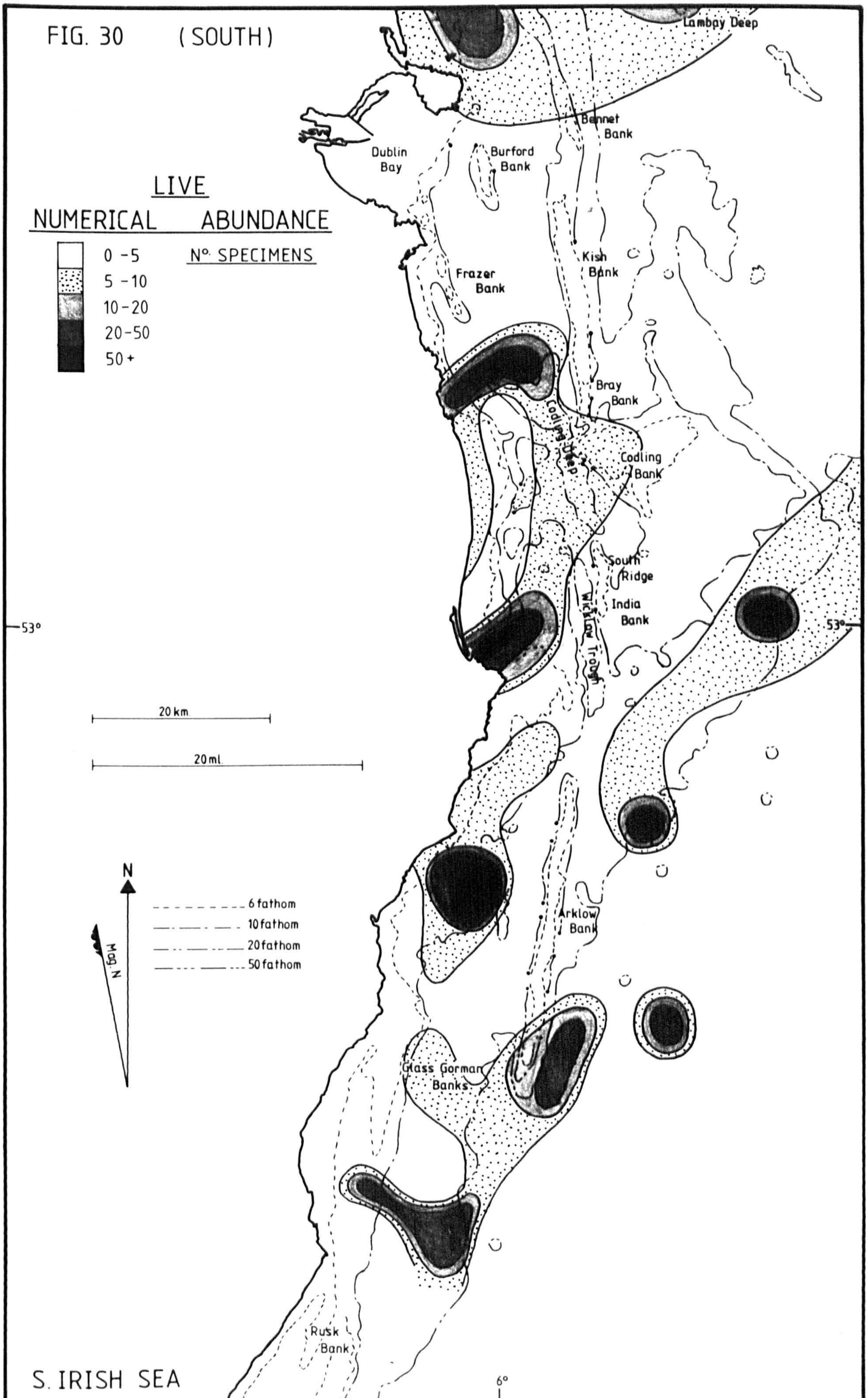


FIG. 30 (SOUTH)
LIVE
NUMERICAL ABUNDANCE
N° SPECIMENS
0 -5
5 -10
10-20
20-50
50+
Lambay Deep
Bennet Bank
Dublin Bay
Burford Bank
Kish Bank
Frazer Bank
Bray Bank
Codling Deep
Codling Bank
South Ridge
India Bank
Wicklow Trough
53°
20 km.
20 ml.
N
Mag. N
6 fathom
10 fathom
20 fathom
50 fathom
Arklow Bank
Glass Gorman Banks
Rusk Bank
S. IRISH SEA
6°

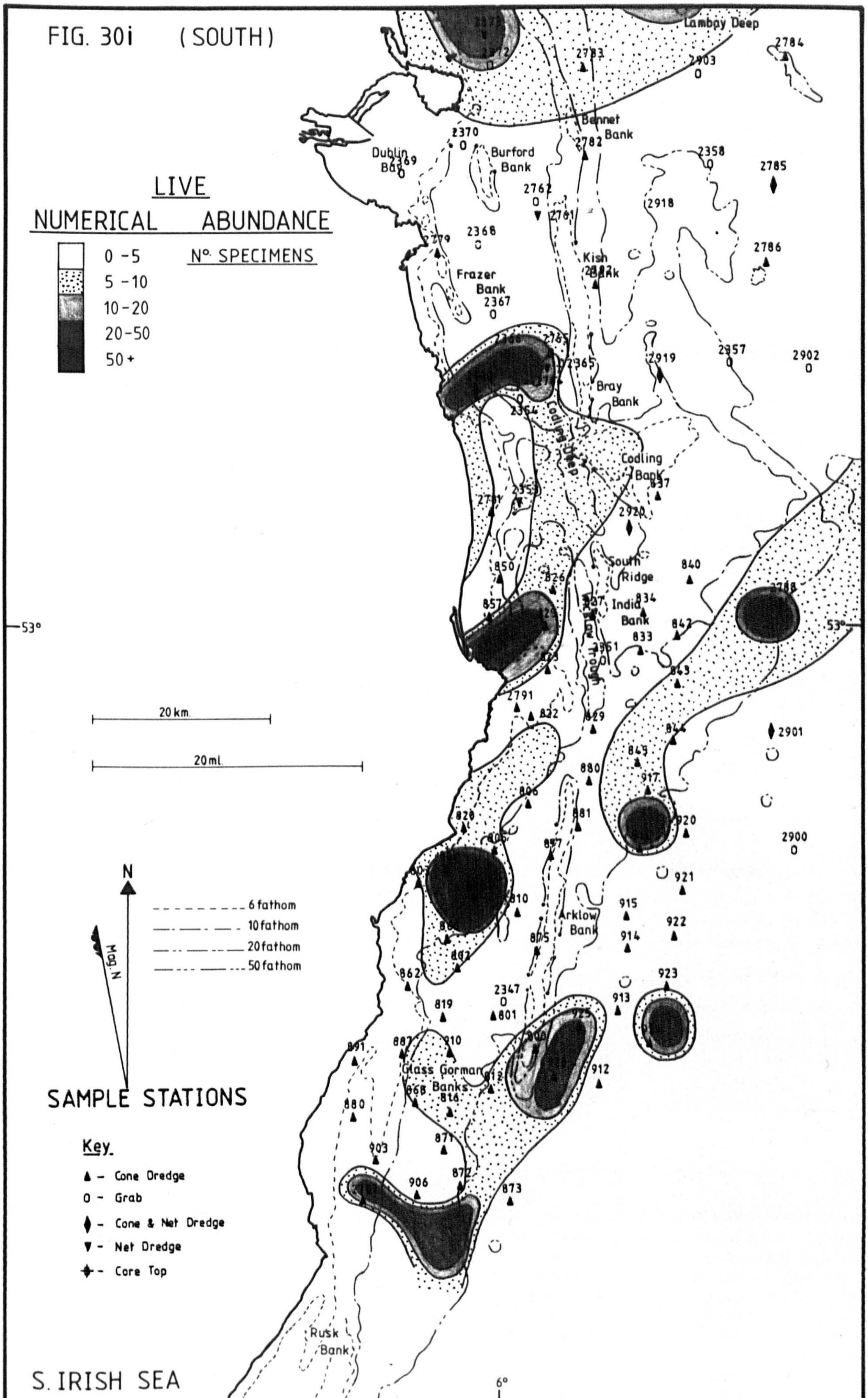
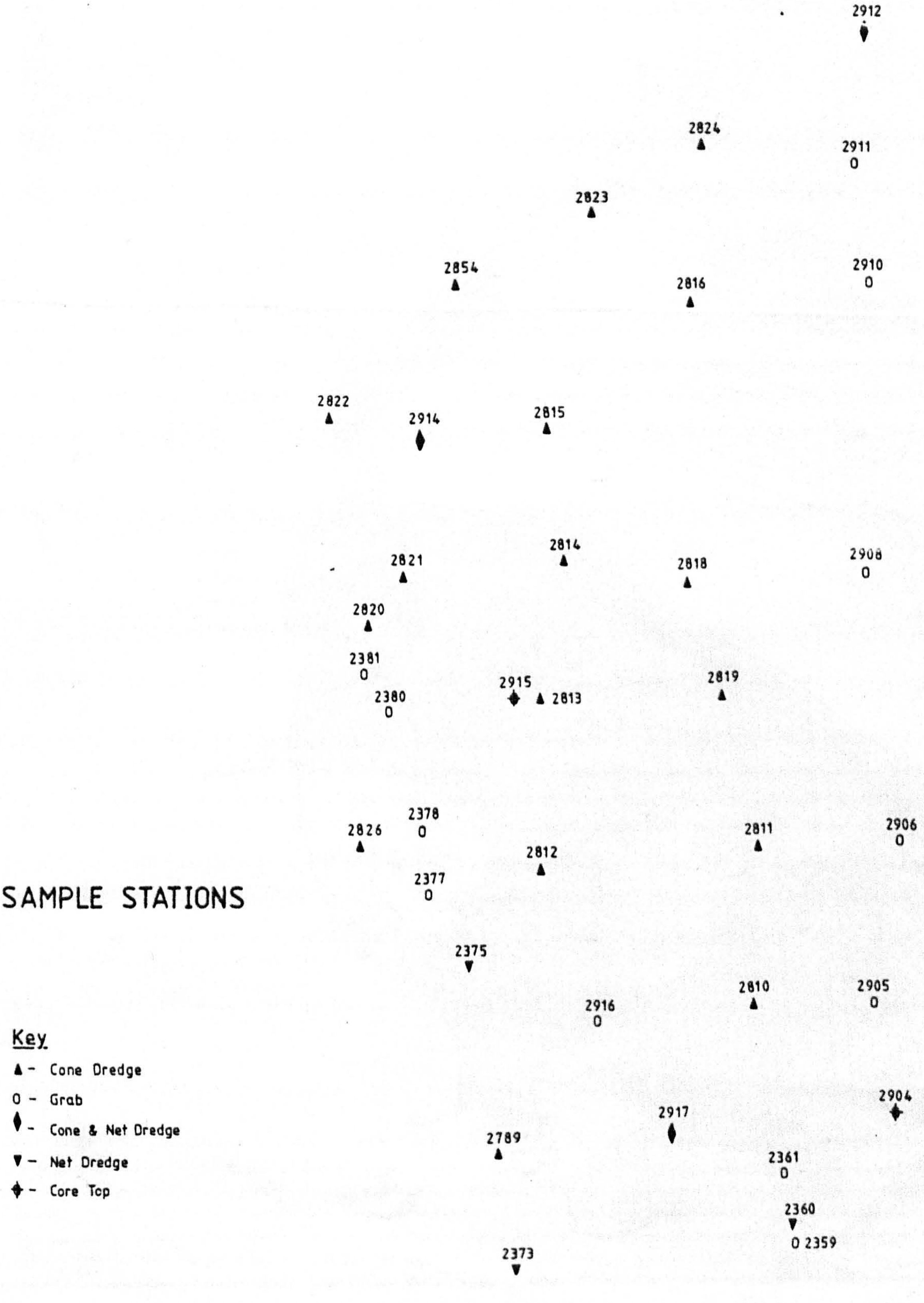


FIG. 30i (SOUTH)

i

SAMPLE STATIONS



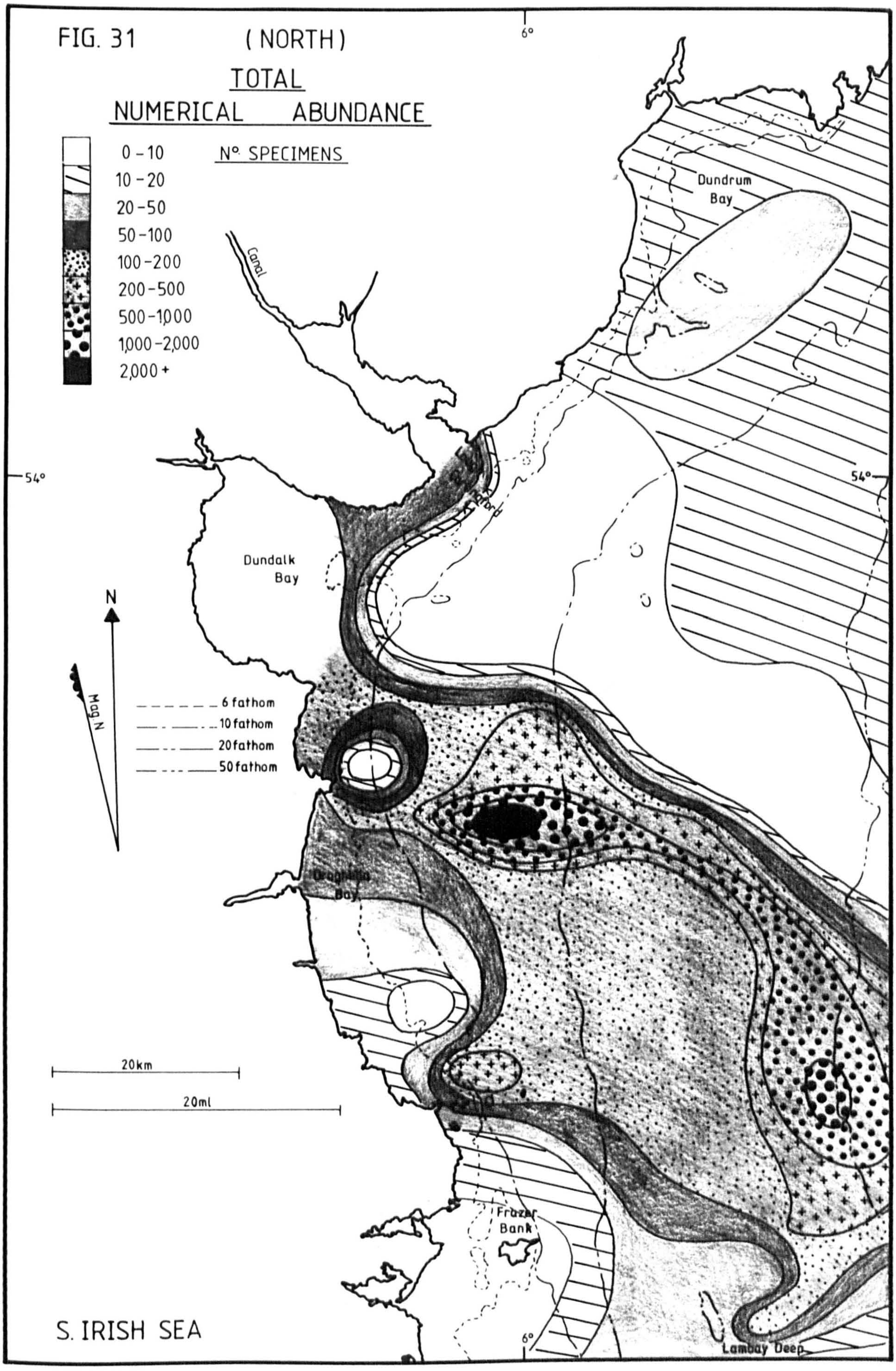


FIG. 31
(NORTH)
TOTAL
NUMERICAL ABUNDANCE
N° SPECIMENS
0 - 10
10 - 20
20 - 50
50 - 100
100 - 200
200 - 500
500 - 1,000
1,000 - 2,000
2,000 +
6°
Canal
Dundrum Bay
54°
Dundalk Bay
N
Mag N
6 fathom
10 fathom
20 fathom
50 fathom
20km
20ml
Frazer Bank
Lambay Deep
S. IRISH SEA

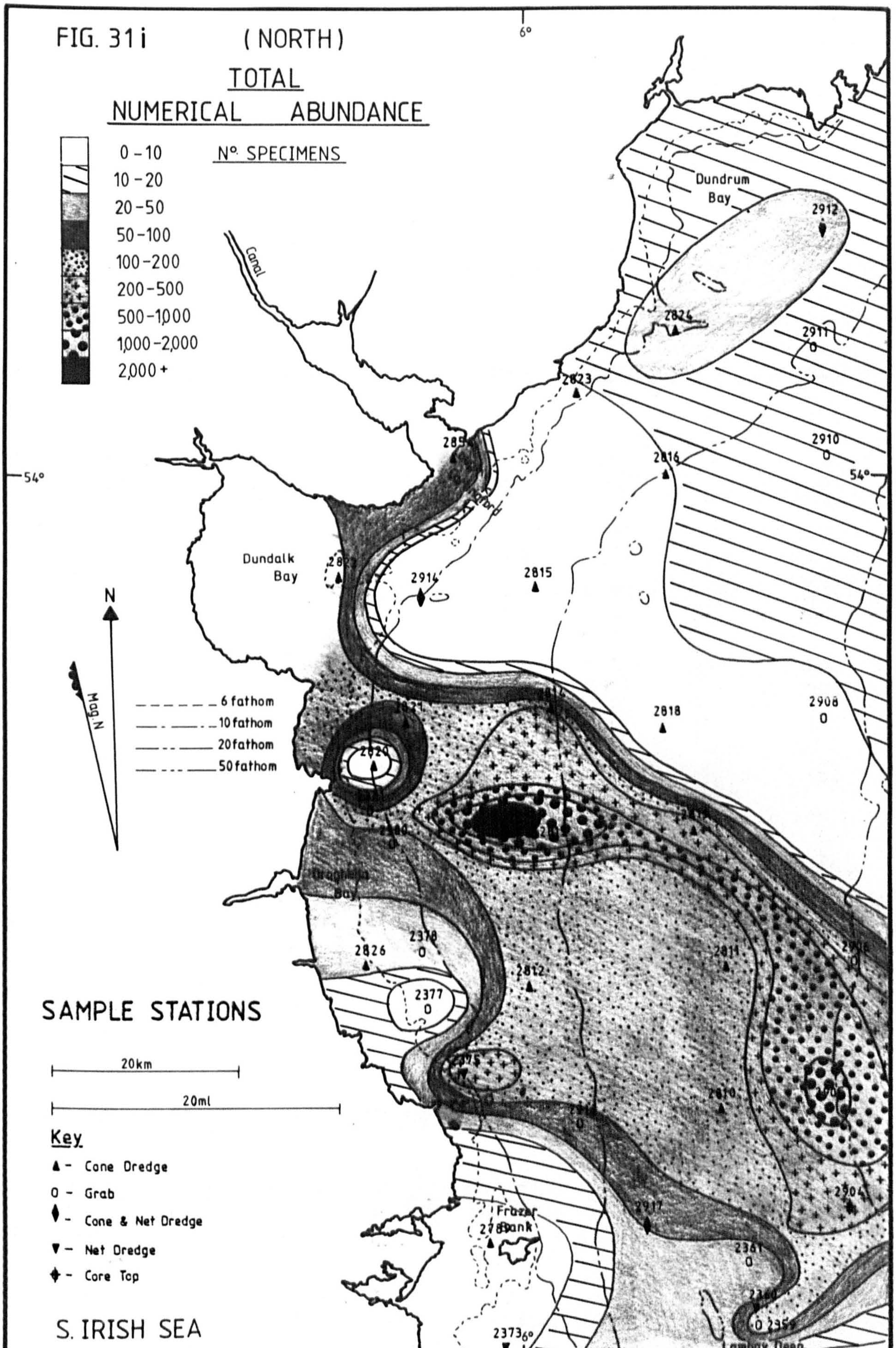


FIG. 31i (NORTH)
TOTAL
NUMERICAL ABUNDANCE
N°. SPECIMENS
0 - 10
10 - 20
20 - 50
50 - 100
100 - 200
200 - 500
500 - 1,000
1,000 - 2,000
2,000 +
Canal
Dundrum
Bay
Dundalk
Bay
6 fathom
10 fathom
20 fathom
50 fathom
Mag.N
N
54°
6°
SAMPLE STATIONS
20km
20ml
Key
▲ - Cone Dredge
O - Grab
♦ - Cone & Net Dredge
▼ - Net Dredge
✦ - Core Top
S. IRISH SEA
Lambay Deep
2912
2824
2911
2823
2910
2816
2815
2914
2818
2908
2826
2378
2812
2377
2811
2810
2917
2361
2360
2373

i

SAMPLE STATIONS

Key

▲ – Cone Dredge

0 – Grab

♦ – Cone & Net Dredge

▼ – Net Dredge

✦ – Core Top

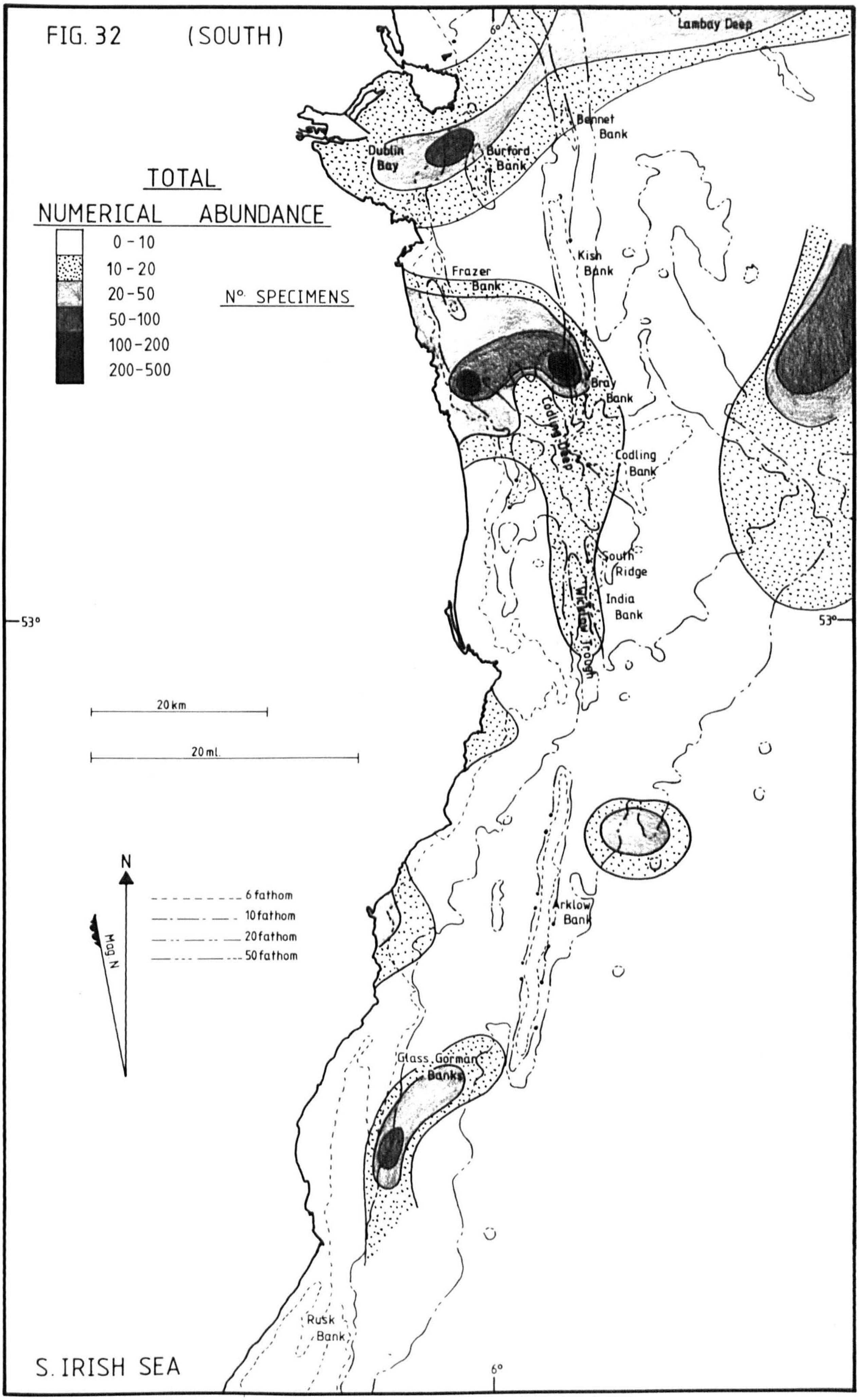


FIG. 32 (SOUTH)
TOTAL
NUMERICAL ABUNDANCE
0 - 10
10 - 20
20 - 50
50 - 100
100 - 200
200 - 500
N° SPECIMENS
Lambay Deep
Bennet Bank
Dublin Bay
Burford Bank
Kish Bank
Frazer Bank
Bray Bank
Codling Deep
Codling Bank
South Ridge
India Bank
Wicklow Trough
53°
53°
20 km
20 ml.
N
Mag N
6 fathom
10 fathom
20 fathom
50 fathom
Arklow Bank
Glass Gorman Banks
Rusk Bank
S. IRISH SEA
6°
6°

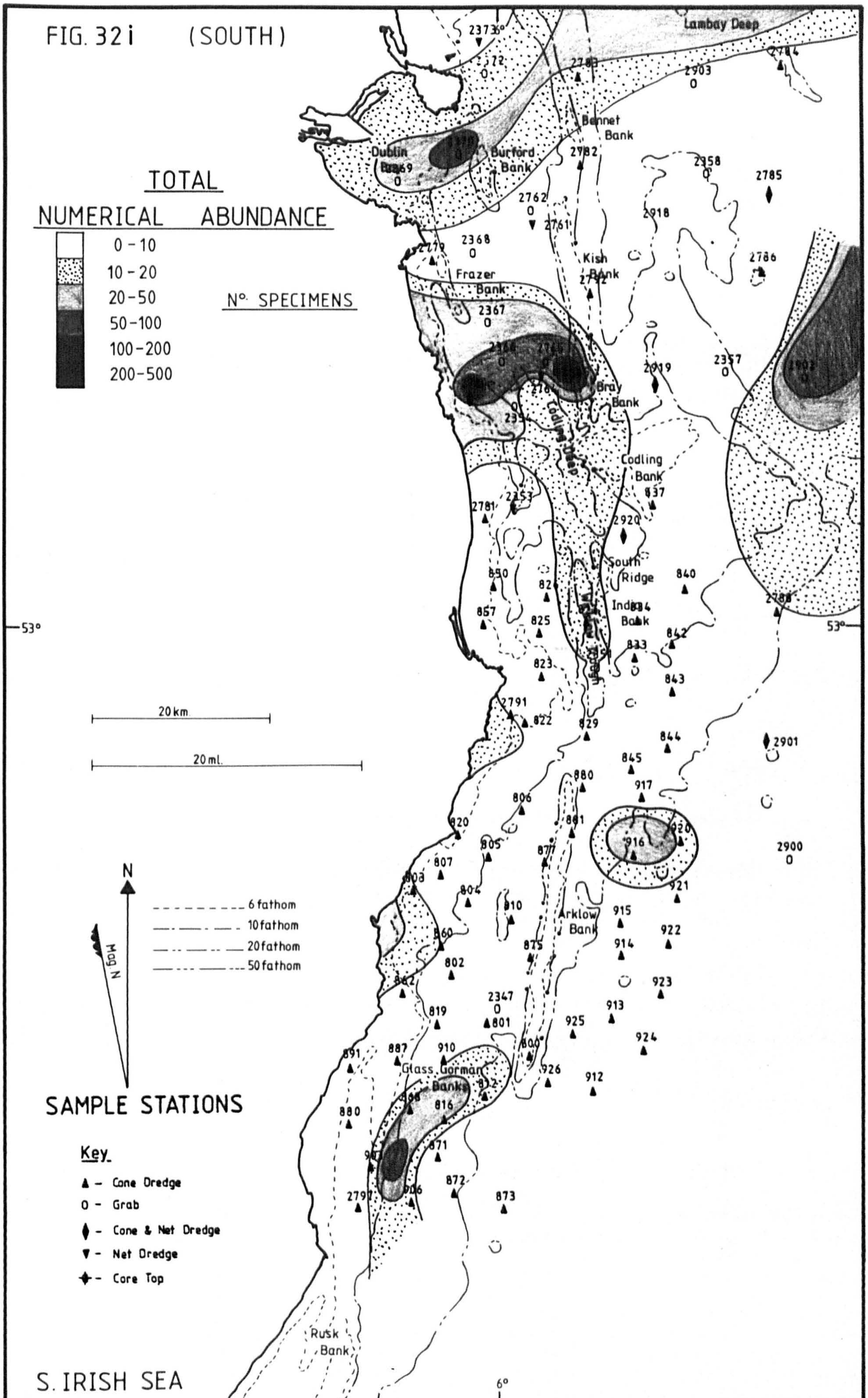


FIG. 32i (SOUTH)
TOTAL NUMERICAL ABUNDANCE
0 - 10
10 - 20
20 - 50
50 - 100
100 - 200
200 - 500
N° SPECIMENS
Lambay Deep
Dublin Bay
Burford Bank
Bennet Bank
Kish Bank
Frazer Bank
Bray Bank
Codling Deep
Codling Bank
South Ridge
India Bank
Arklow Bank
Glass Gorman Banks
Rusk Bank
20 km
20 ml.
53°
6°
N
Mag N
6 fathom
10 fathom
20 fathom
50 fathom
SAMPLE STATIONS
Key
▲ - Cone Dredge
O - Grab
♦ - Cone & Net Dredge
▼ - Net Dredge
✦ - Core Top
S. IRISH SEA

SAMPLE STATIONS

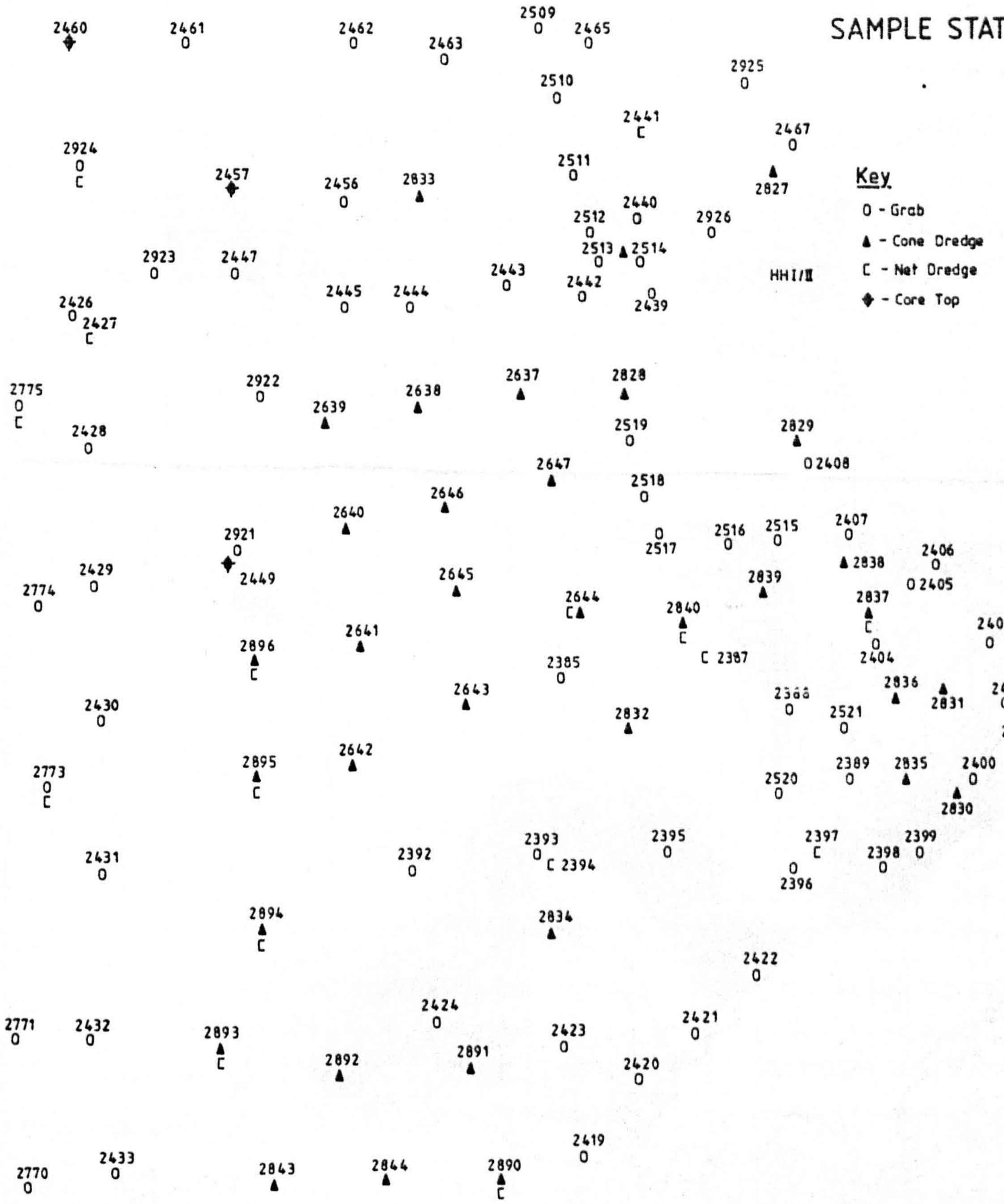
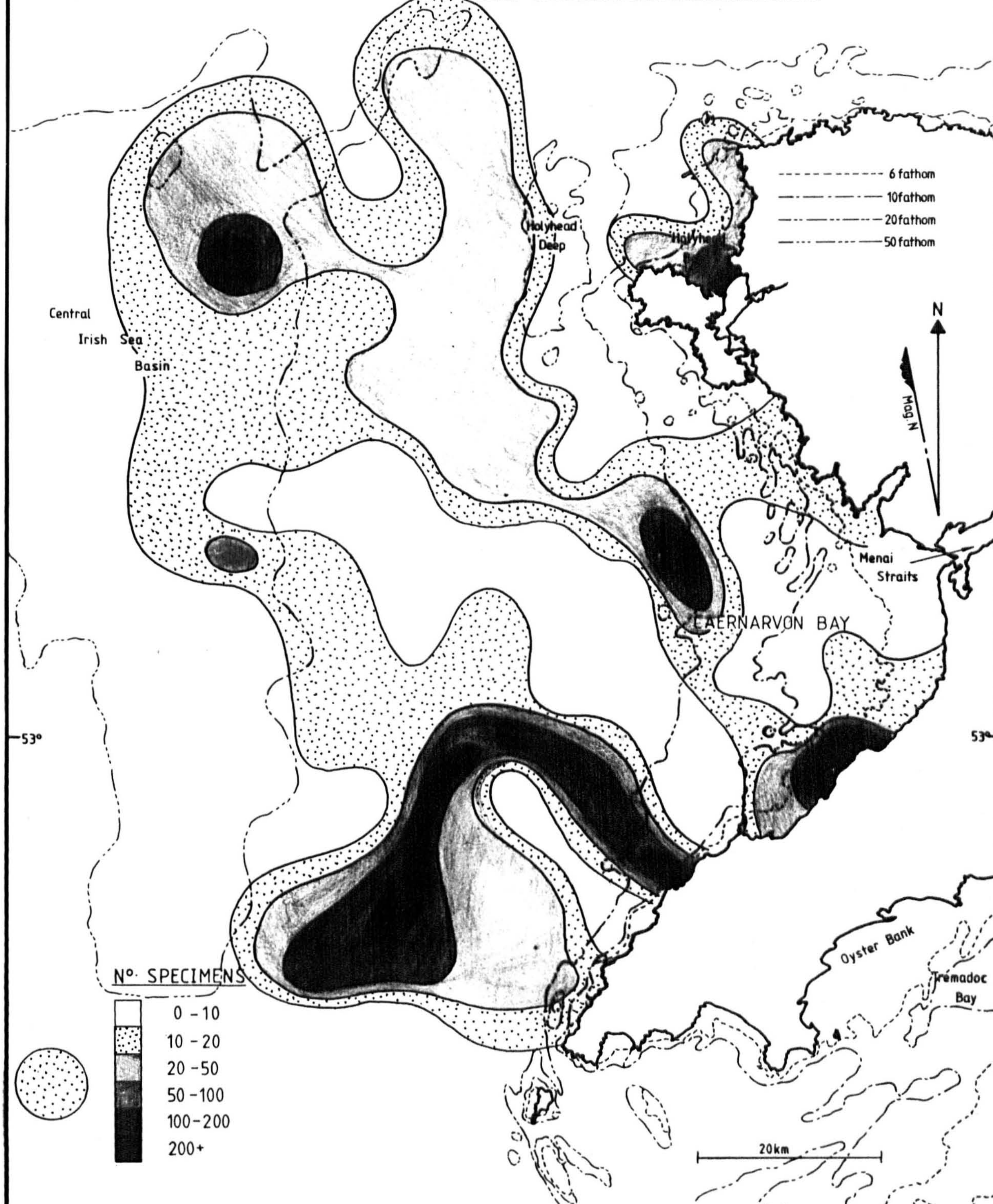


FIG. 33

TOTAL NUMERICAL ABUNDANCE



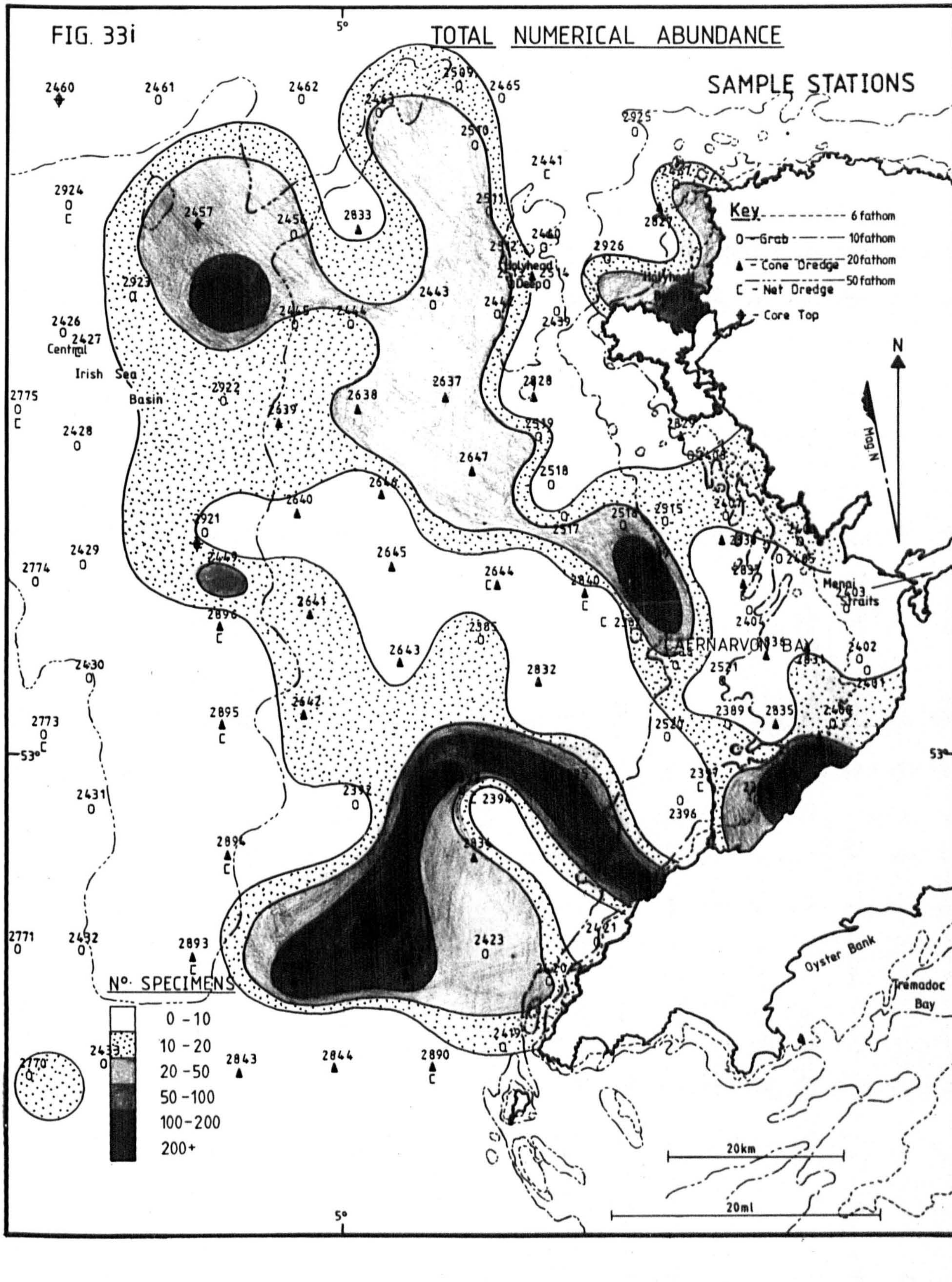
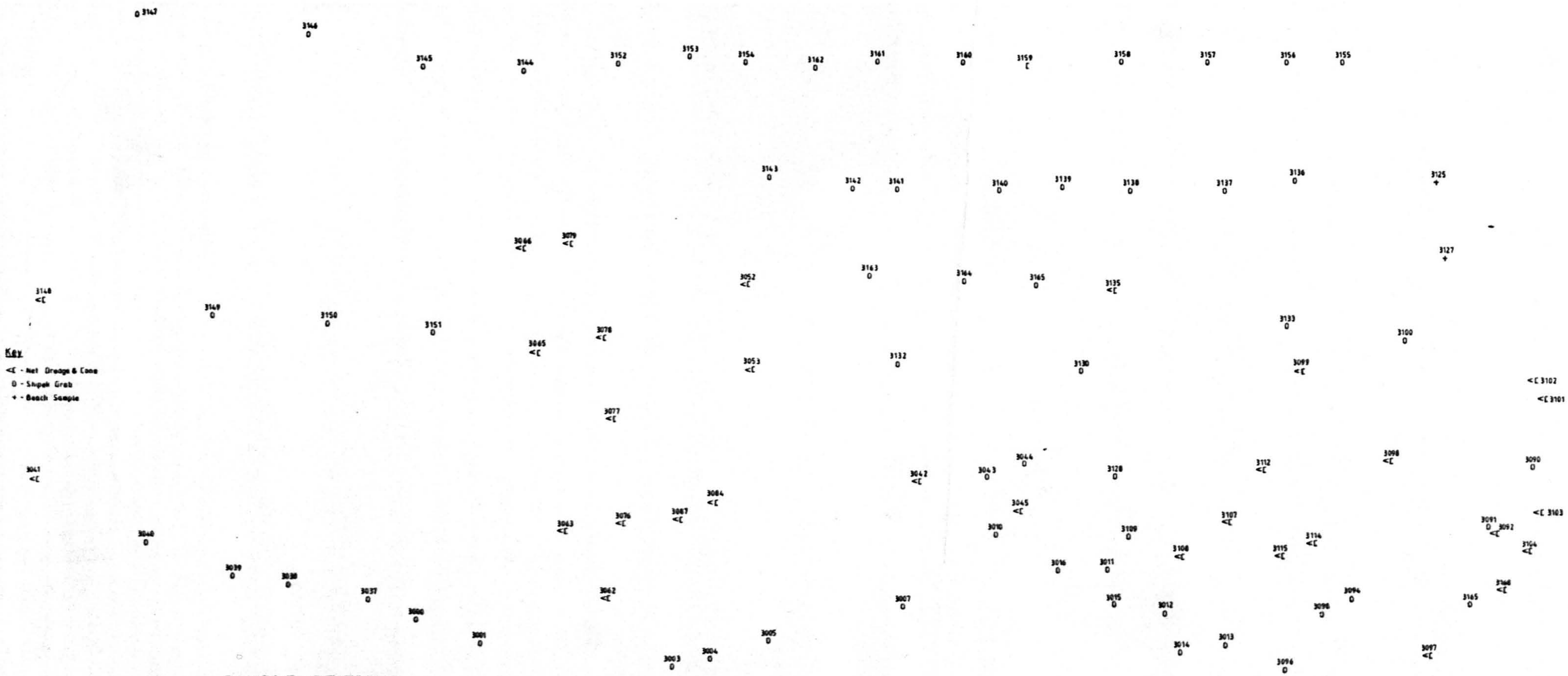
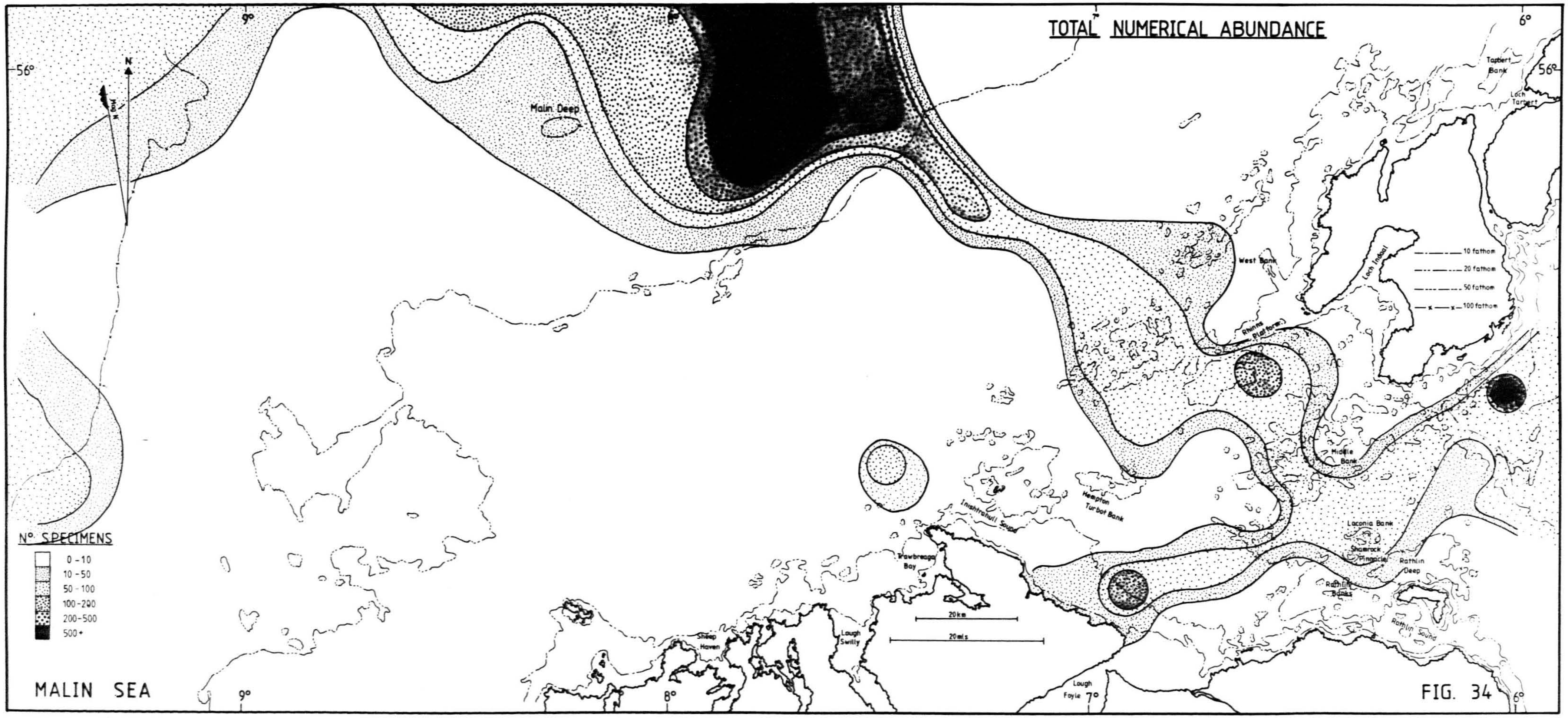
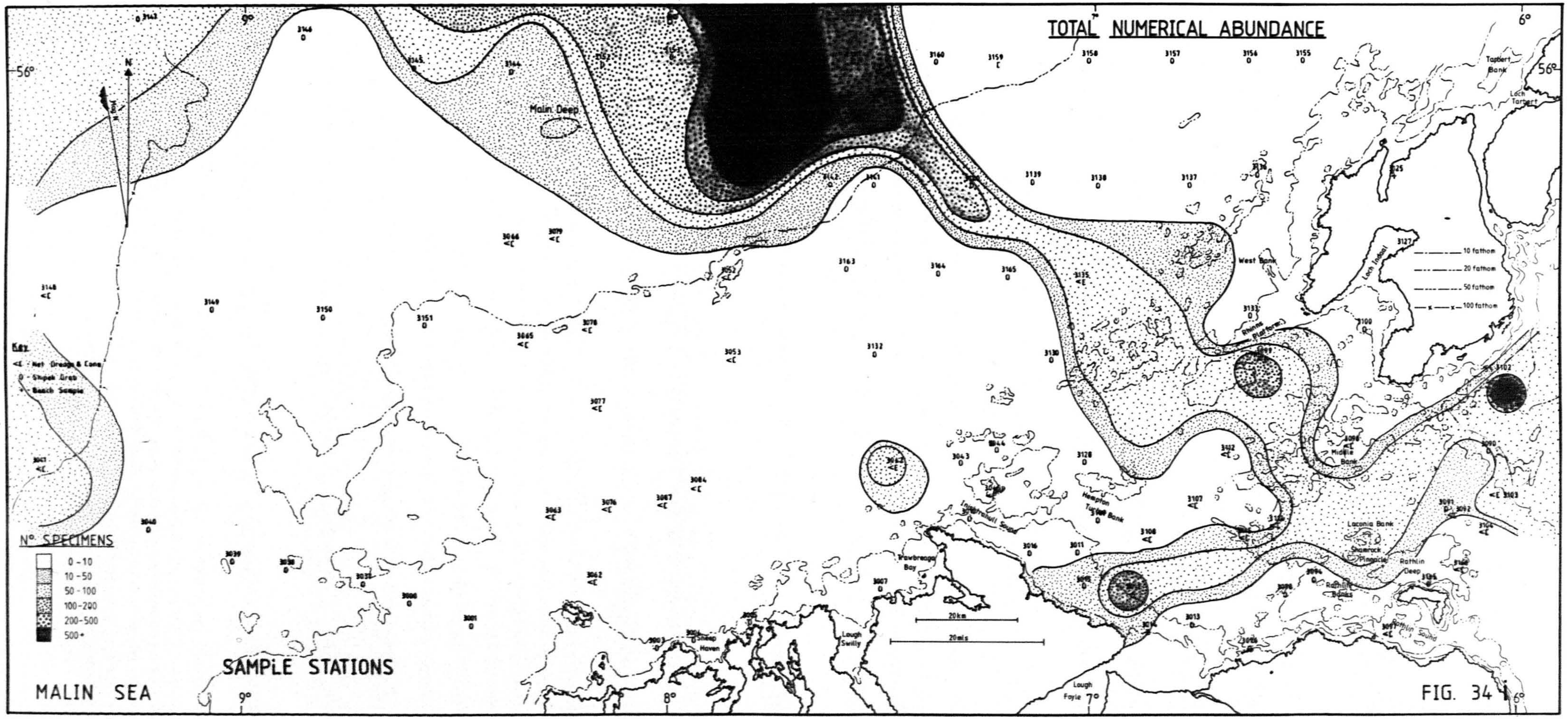


FIG. 33i
TOTAL NUMERICAL ABUNDANCE
SAMPLE STATIONS
Key
6 fathom
O - Grab
10fathom
▲ - Cone Dredge
20fathom
C - Net Dredge
50fathom
◆ - Core Top
N
Mag N
Central
Irish Sea
Basin
Holyhead Deep
Holyhead
Menai Straits
CAERNARVON BAY
Oyster Bank
Tremadoc Bay
5°
53°
20km
20ml
N°. SPECIMENS
0 -10
10 - 20
20 - 50
50 -100
100-200
200+

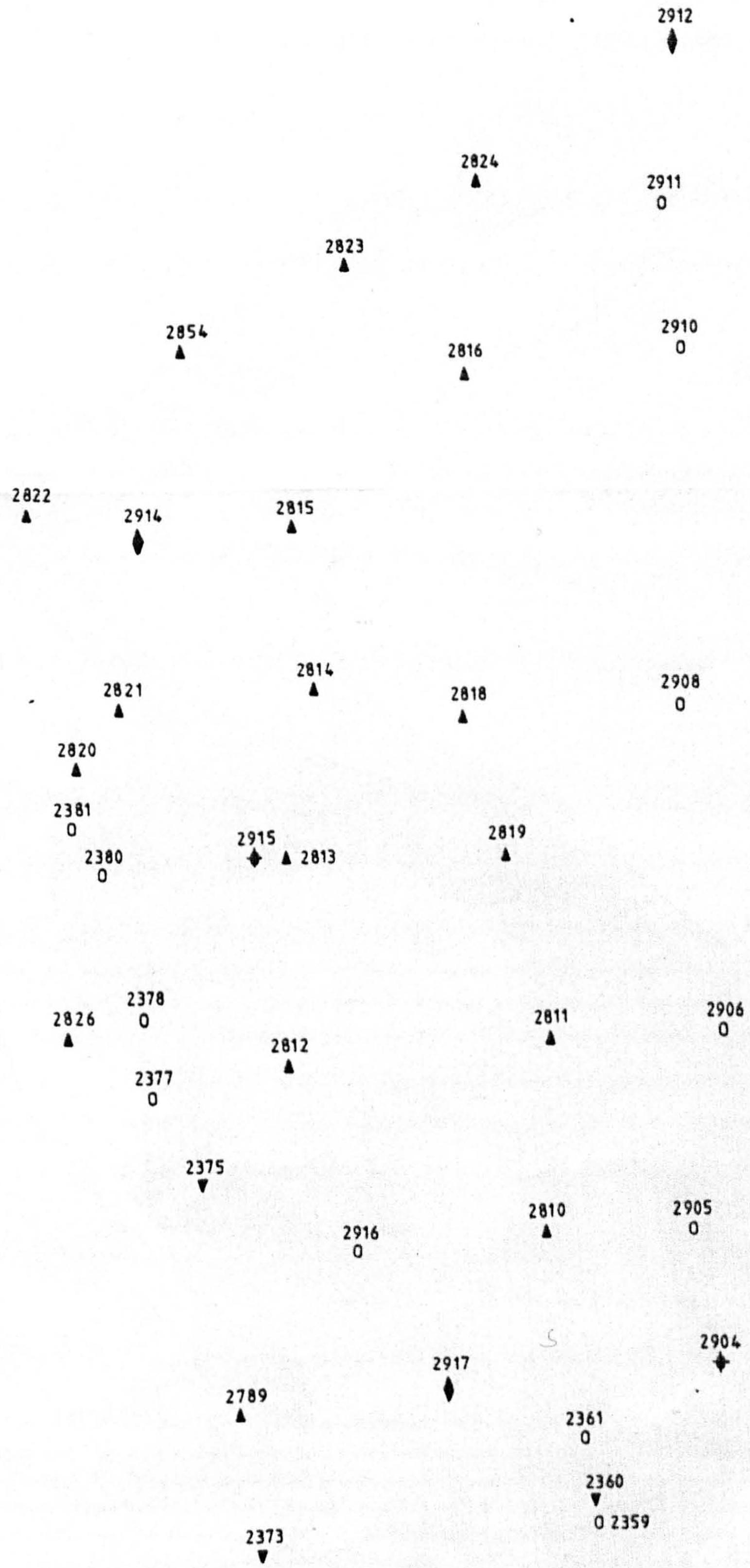


SAMPLE STATIONS


TOTAL NUMERICAL ABUNDANCE
N
Mag N
56°
9°
8°
7°
6°
Malin Deep
Tarbert Bank
Loch Tarbert
Loch Indaal
West Bank
Rhinns Platform
Middle Bank
Laconia Bank
Shamrock Pinnacle
Rathlin Deep
Rathlin Banks
Rathlin Sound
Hempton Turbot Bank
Inishtrahull Sound
Trawbreaga Bay
Lough Swilly
Sheep Haven
Lough Foyle
10 fathom
20 fathom
50 fathom
100 fathom
20km
20mls
N° SPECIMENS
0 - 10
10 - 50
50 - 100
100 - 200
200 - 500
500 +
MALIN SEA
FIG. 34


TOTAL NUMERICAL ABUNDANCE
MALIN SEA
SAMPLE STATIONS
FIG. 34
N° SPECIMENS
0 - 10
10 - 50
50 - 100
100 - 200
200 - 500
500+
Key
10 fathom
20 fathom
50 fathom
100 fathom
20km
20mls
Malin Deep
West Bank
Loch Indaal
Tarbert Bank
Loch Tarbert
Middle Bank
Laconia Bank
Shamrock Pinnacle
Rathlin Deep
Rathlin Banks
Rathlin Sound
Lough Foyle
Lough Swilly
Sheep Haven
Trawbreaga Bay
Inishtrahull Sound
56°
9°
8°
7°
6°

i



SAMPLE STATIONS

Key

▲ - Cone Dredge

O - Grab

♦ - Cone & Net Dredge

▼ - Net Dredge

✦ - Core Top

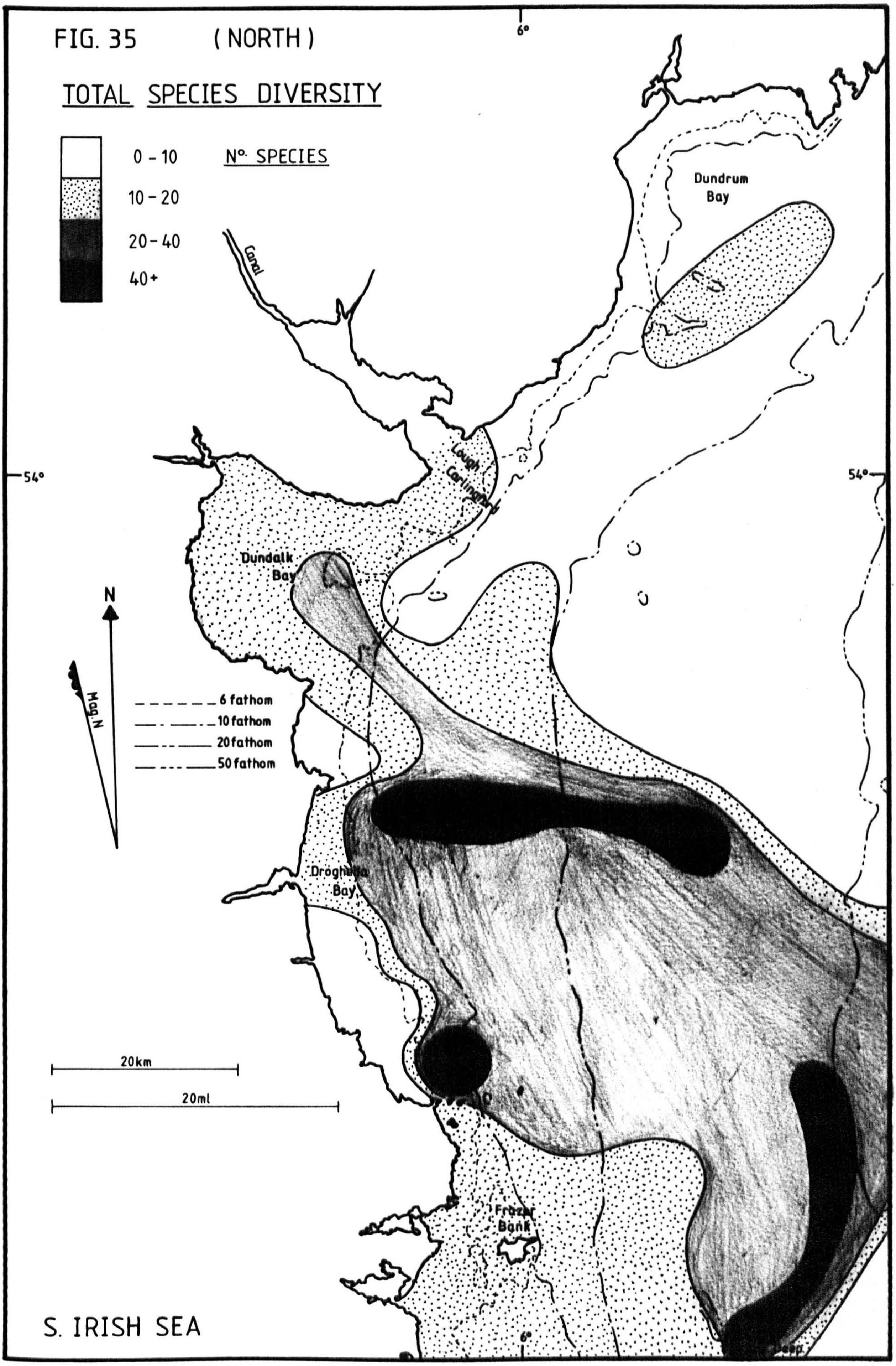


FIG. 35
(NORTH)
TOTAL SPECIES DIVERSITY
0 - 10
10 - 20
20 - 40
40+
Nº. SPECIES
6°
Dundrum Bay
Canal
Lough Carlingford
54°
54°
Dundalk Bay
N
Mag. N
6 fathom
10 fathom
20 fathom
50 fathom
Drogheda Bay
20km
20ml
Frazer Bank
S. IRISH SEA
6°

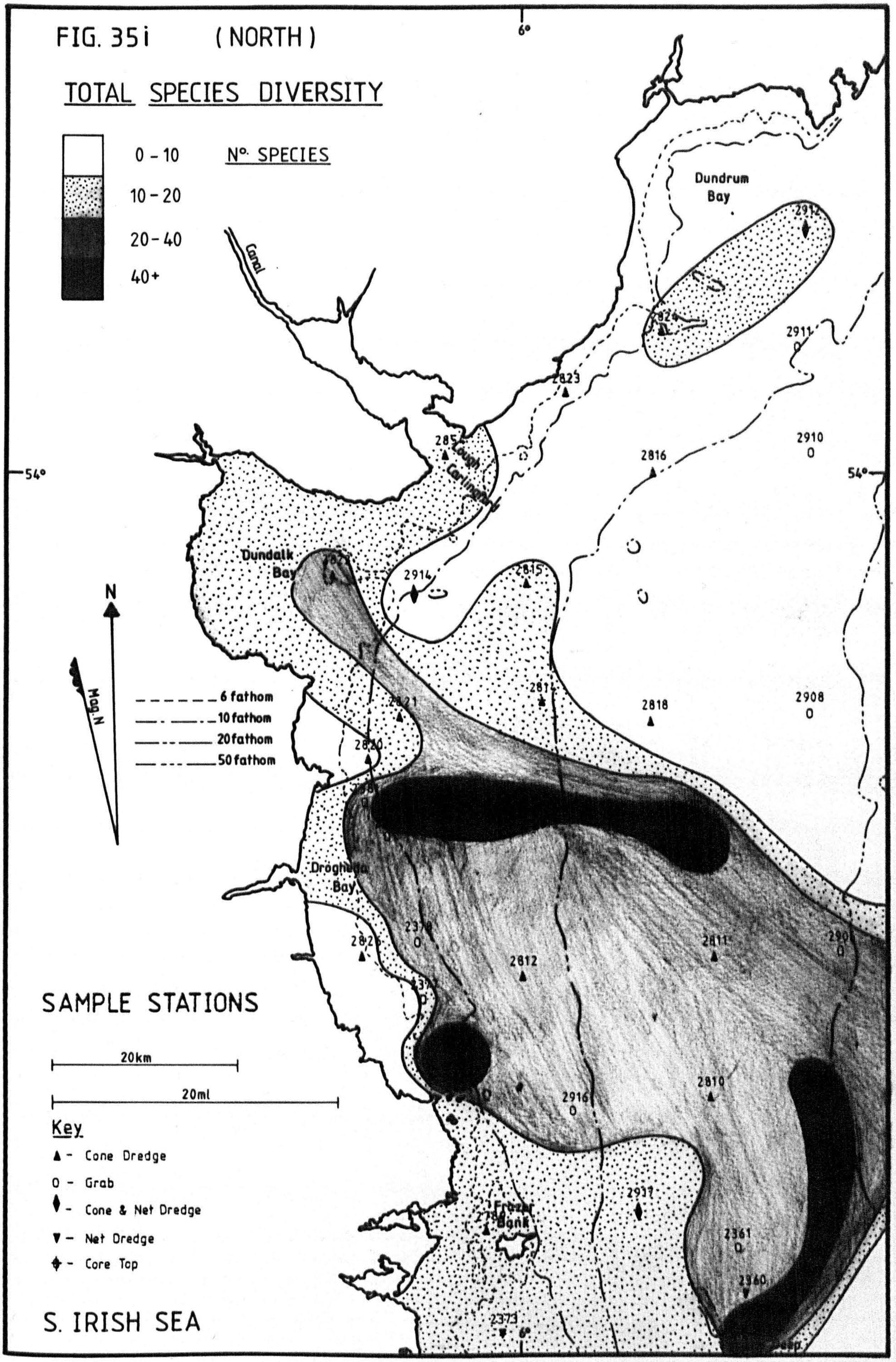
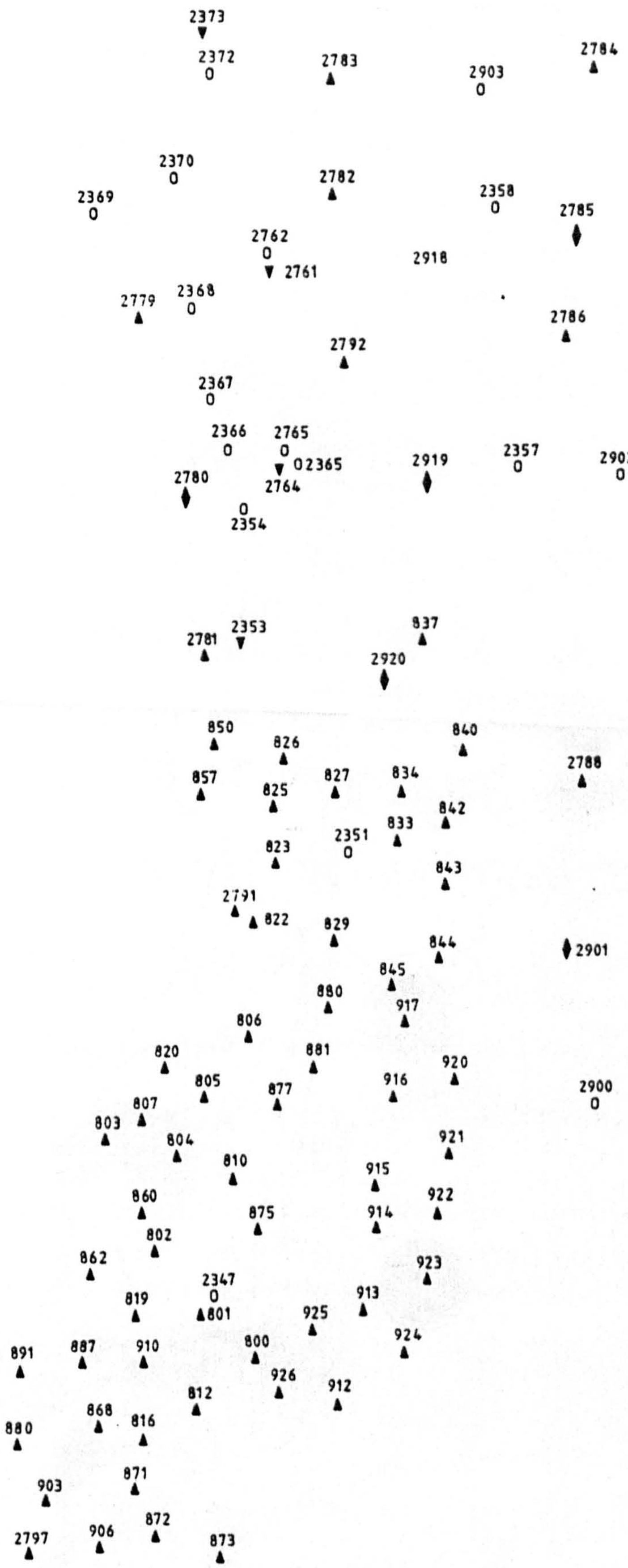


FIG. 35i (NORTH)
TOTAL SPECIES DIVERSITY
N°. SPECIES
0 - 10
10 - 20
20 - 40
40+
Dundrum Bay
Canal
Lough Carlingford
Dundalk Bay
Drogheda Bay
Frazer Bank
N
Mag. N
6 fathom
10 fathom
20 fathom
50 fathom
54°
6°
2912
2911
2910
2908
2823
2816
2815
2914
2818
2821
2820
2379
2812
2811
2810
2916
2937
2361
2360
2373
SAMPLE STATIONS
20km
20ml
Key
▲ - Cone Dredge
O - Grab
Cone & Net Dredge
▼ - Net Dredge
Core Top
S. IRISH SEA

i



SAMPLE STATIONS

Key

▲ – Cone Dredge
O – Grab
⧫ – Cone & Net Dredge
▼ – Net Dredge
✦ – Core Top

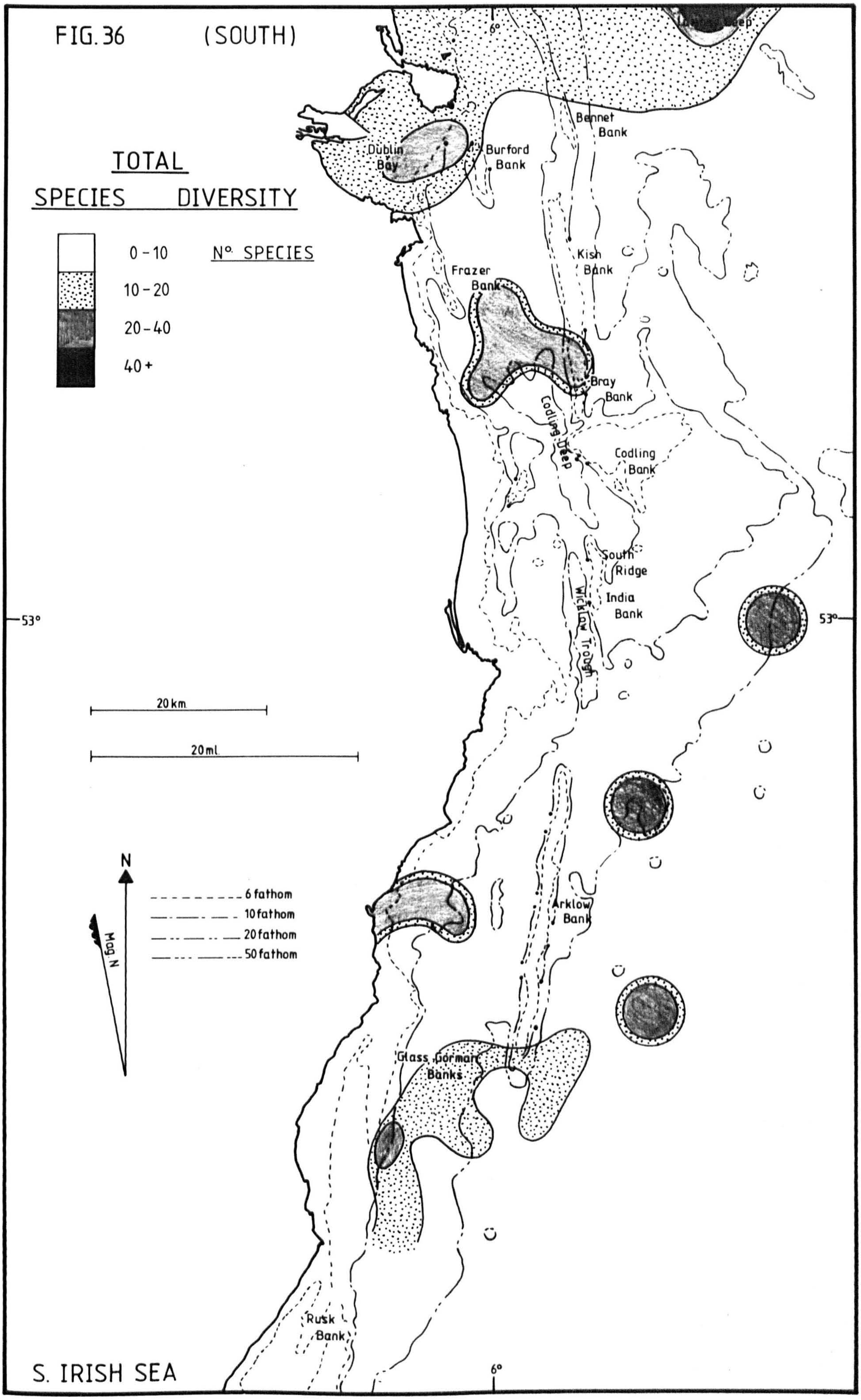


FIG. 36
(SOUTH)
TOTAL
SPECIES DIVERSITY
0 - 10
10 - 20
20 - 40
40 +
N° SPECIES
6°
Bennet Bank
Dublin Bay
Burford Bank
Kish Bank
Frazer Bank
Bray Bank
Codling Deep
Codling Bank
South Ridge
India Bank
Wicklow Trough
53°
53°
20 km
20 ml.
N
Mag. N
6 fathom
10 fathom
20 fathom
50 fathom
Arklow Bank
Glass Gorman Banks
Rusk Bank
S. IRISH SEA
6°

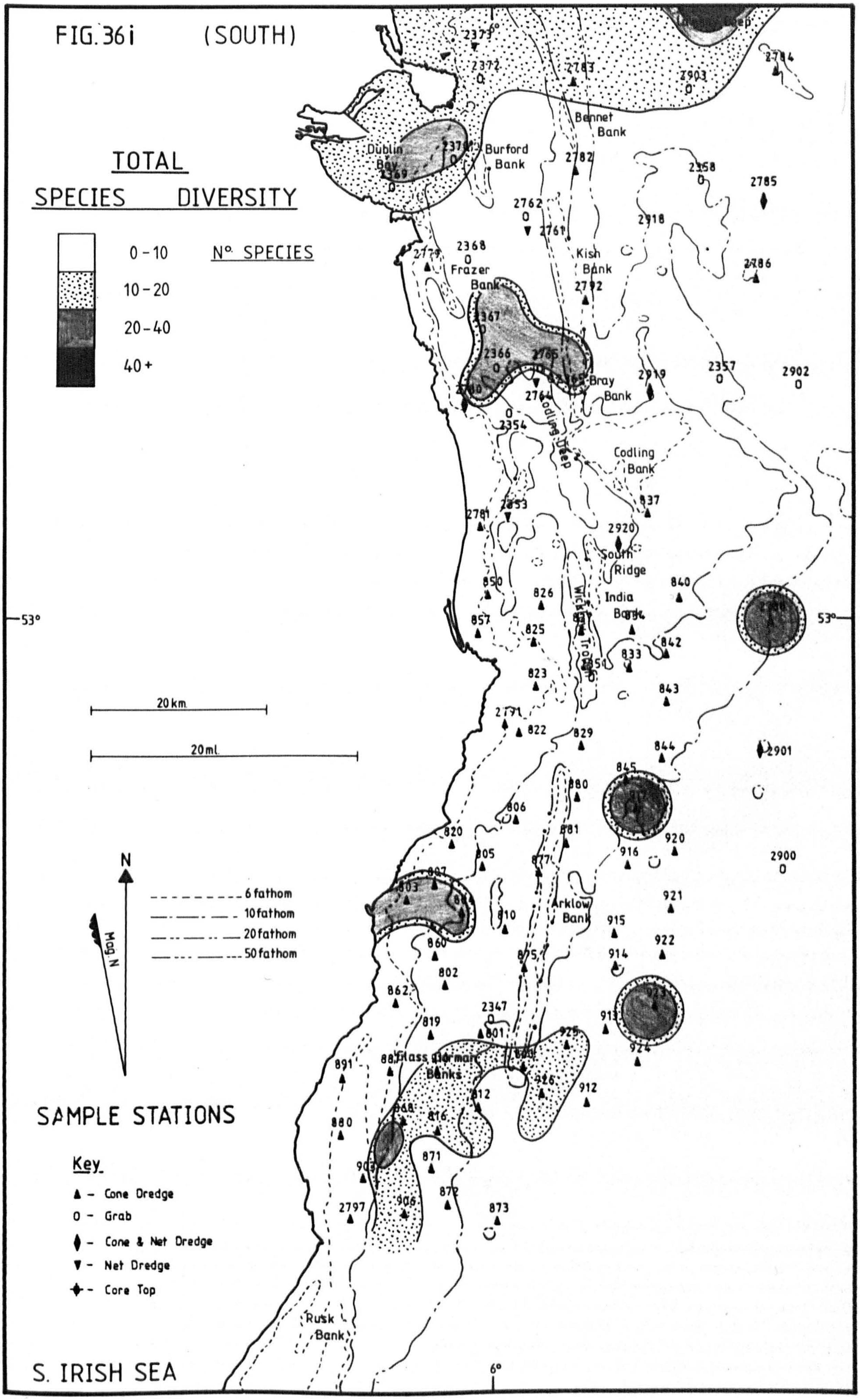
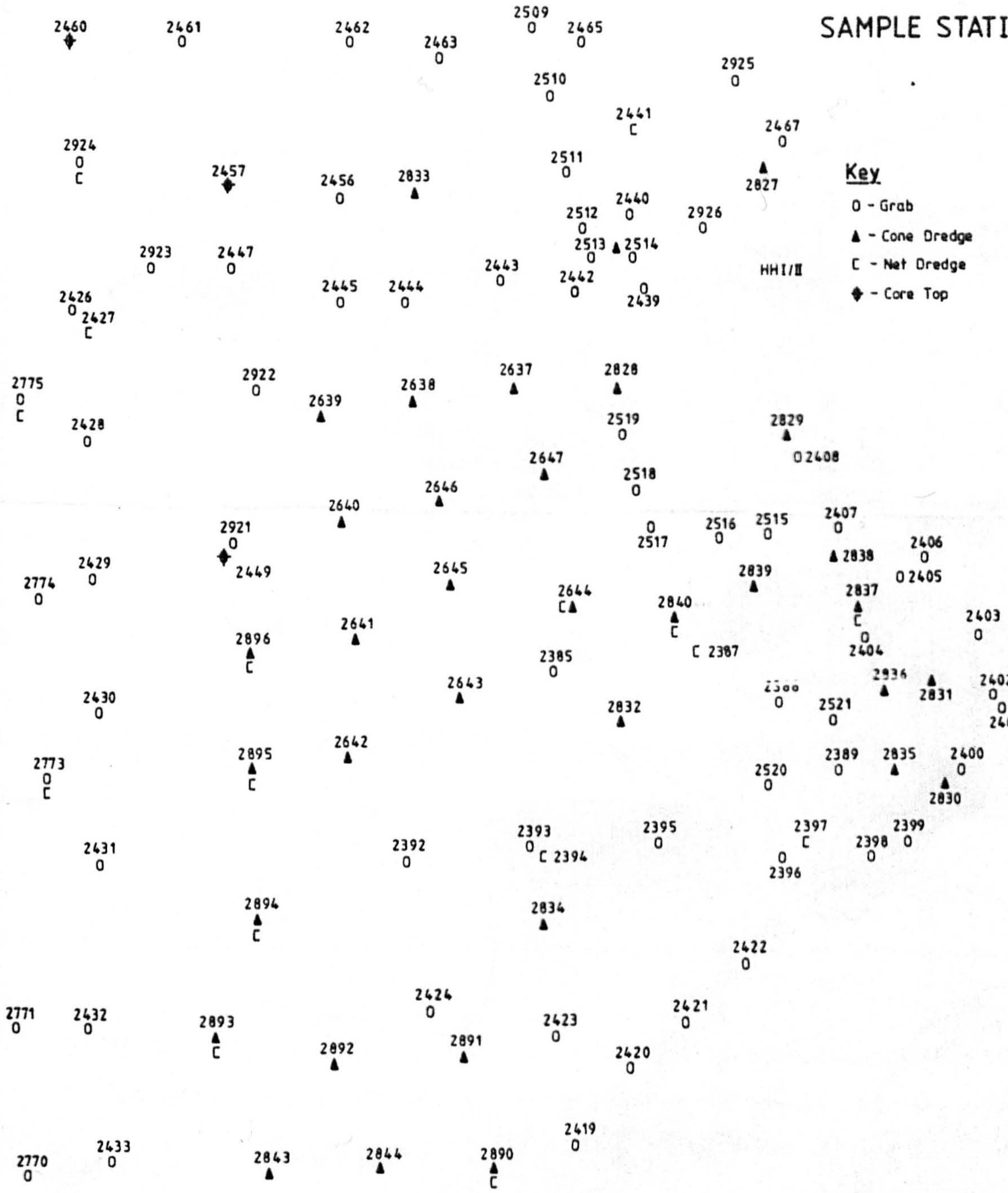


FIG. 36i (SOUTH)
TOTAL SPECIES DIVERSITY
0 - 10
10 - 20
20 - 40
40 +
Nº SPECIES
20 km.
20 ml.
N
Mag. N
6 fathom
10 fathom
20 fathom
50 fathom
SAMPLE STATIONS
Key
▲ - Cone Dredge
O - Grab
♦ - Cone & Net Dredge
▼ - Net Dredge
✦ - Core Top
S. IRISH SEA
53°
6°
Dublin Bay
Burford Bank
Bennet Bank
Kish Bank
Frazer Bank
Bray Bank
Codling Deep
Codling Bank
South Ridge
India Bank
Wicklow Trough
Arklow Bank
Glassgorman Banks
Rusk Bank

i

SAMPLE STATIONS



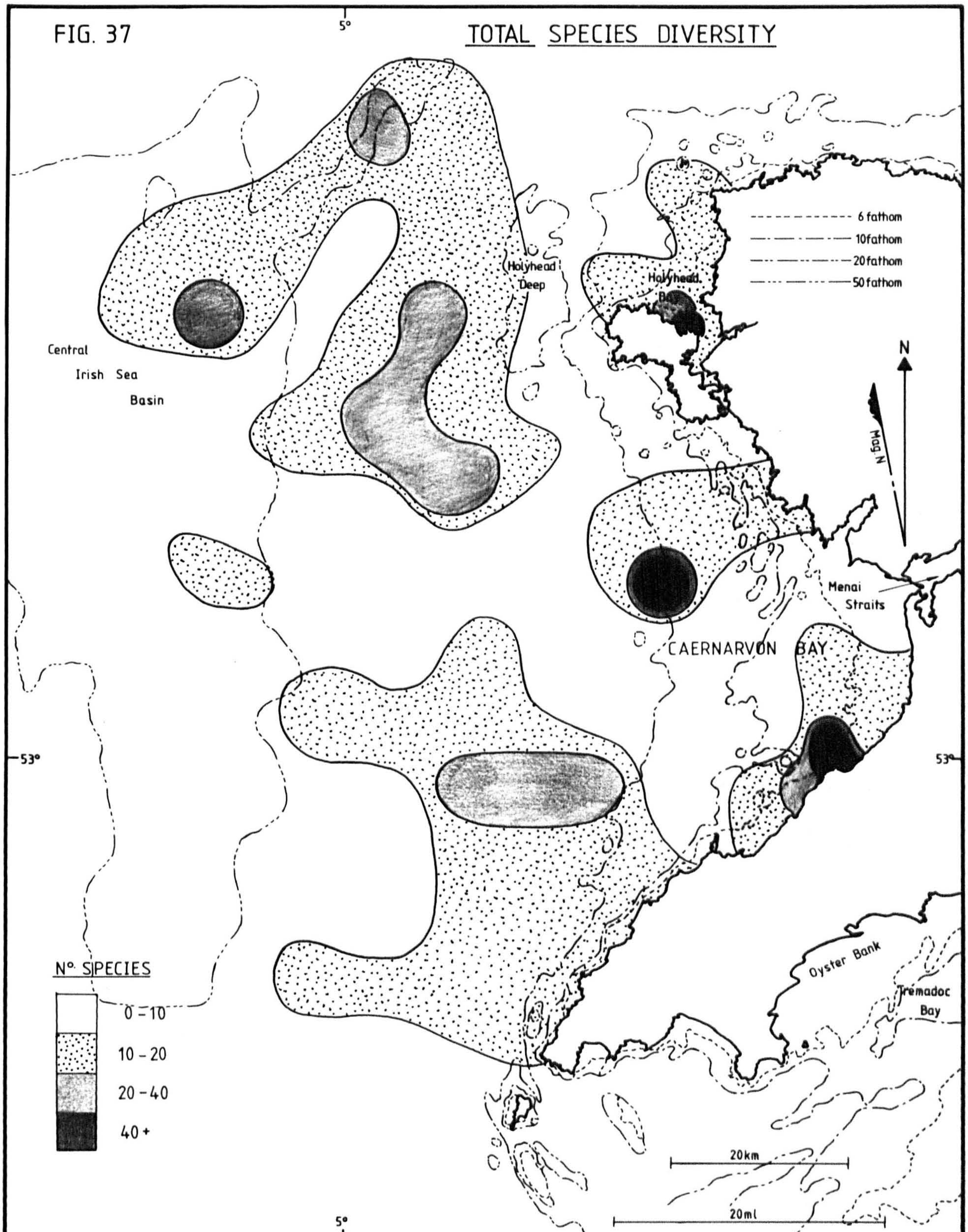


FIG. 37
TOTAL SPECIES DIVERSITY
5°
Central
Irish Sea
Basin
Holyhead
Deep
Holyhead
Bay
6 fathom
10fathom
20fathom
50fathom
N
Mag. N
Menai
Straits
CAERNARVON BAY
53°
Oyster Bank
Tremadoc
Bay
N° SPECIES
0 - 10
10 - 20
20 - 40
40 +
20km
20ml

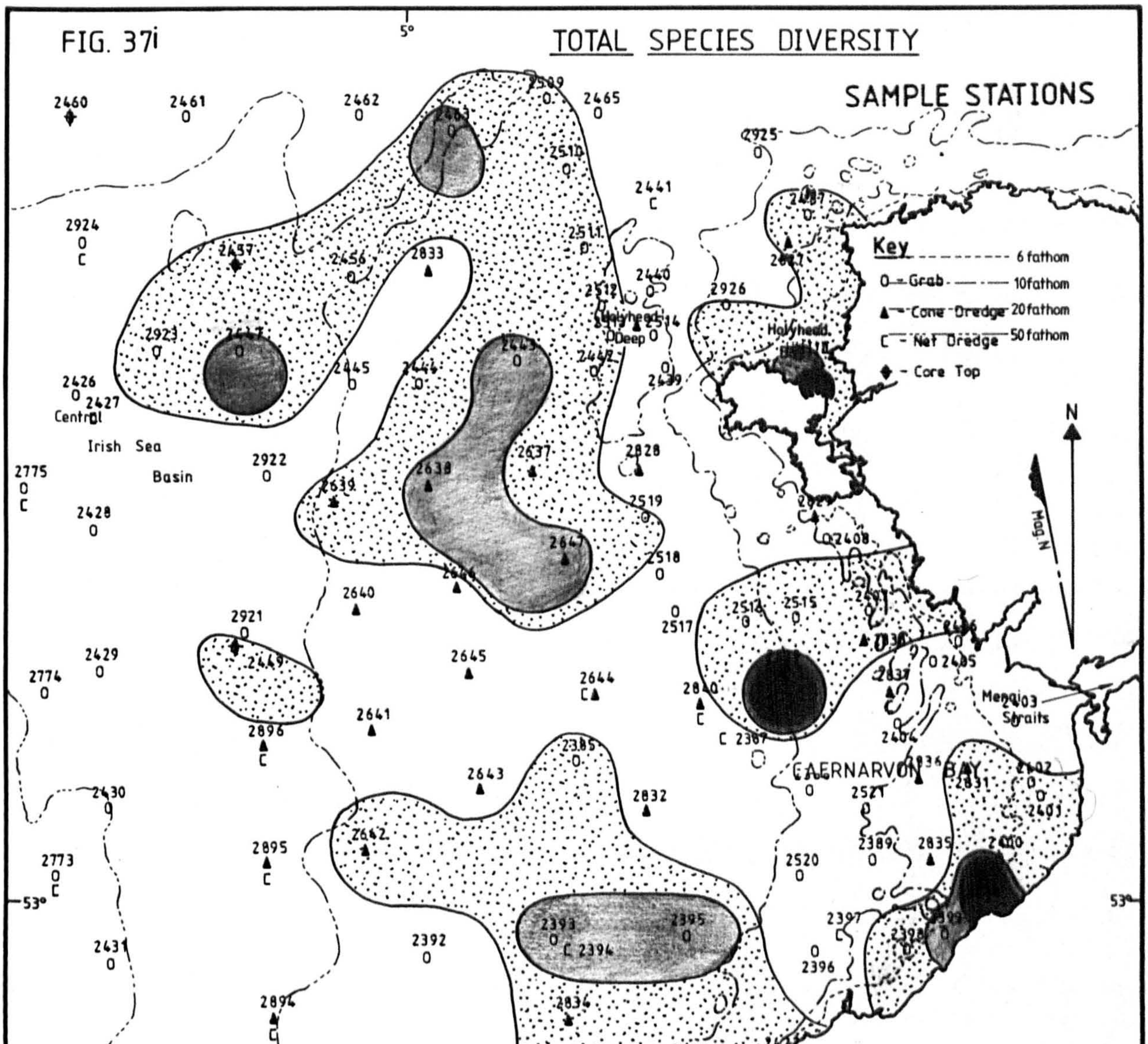
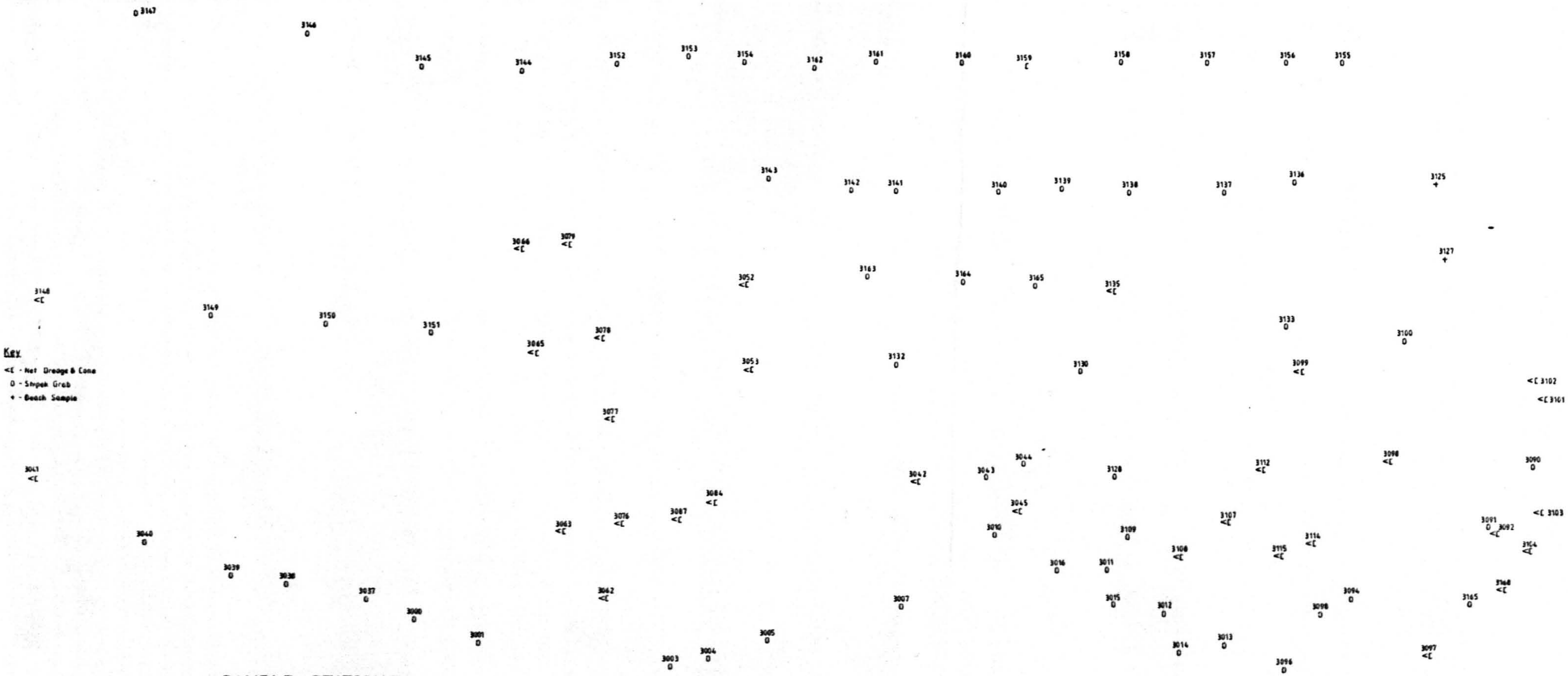


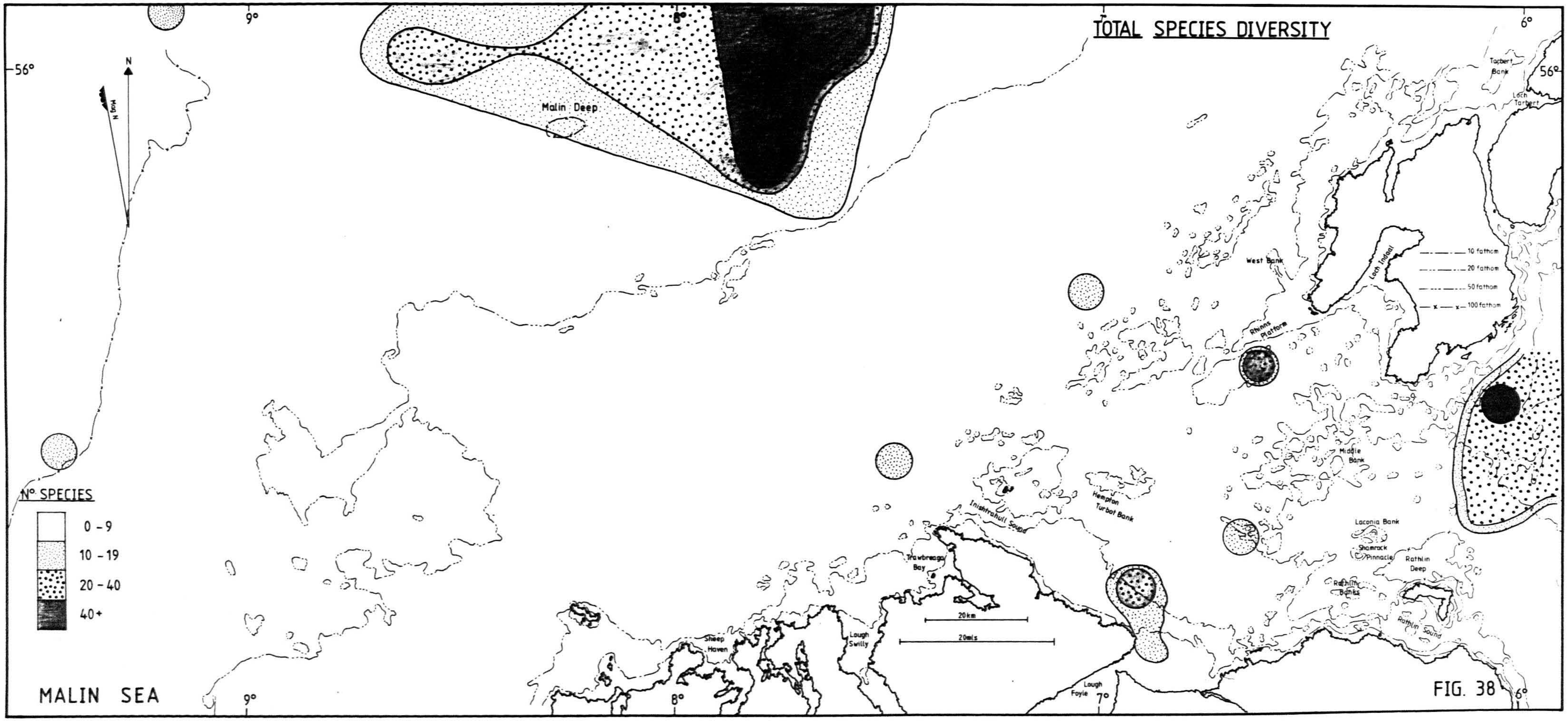
FIG. 37i
TOTAL SPECIES DIVERSITY
SAMPLE STATIONS
Key
6 fathom
O - Grab
10 fathom
▲ - Cone Dredge
20 fathom
C - Net Dredge
50 fathom
◆ - Core Top
Central Irish Sea Basin
Holyhead Deep
Holyhead
Menai Straits
CAERNARVON BAY
Oyster Bank
Tremadoc Bay
Mag N
N
20km
20ml
5°
53°
Nº. SPECIES
0 - 10
10 - 20
20 - 40
40 +



SAMPLE STATIONS

Key

<C - Net Dredge & Cone
O - Shipek Grab
+ - Beach Sample


TOTAL SPECIES DIVERSITY
Nº SPECIES
0 - 9
10 - 19
20 - 40
40+
MALIN SEA
N
Mag N
Malin Deep
56°
9°
8°
7°
6°
Tarbert Bank
Loch Tarbert
Loch Indaal
10 fathom
20 fathom
50 fathom
100 fathom
West Bank
Rhinns Platform
Middle Bank
Laconia Bank
Shamrock Pinnacle
Rathlin Deep
Rathlin Banks
Rathlin Sound
Hempton Turbot Bank
Inishtrahull Sound
Trawbreaga Bay
20km
20mls
Lough Swilly
Sheep Haven
Lough Foyle
FIG. 38

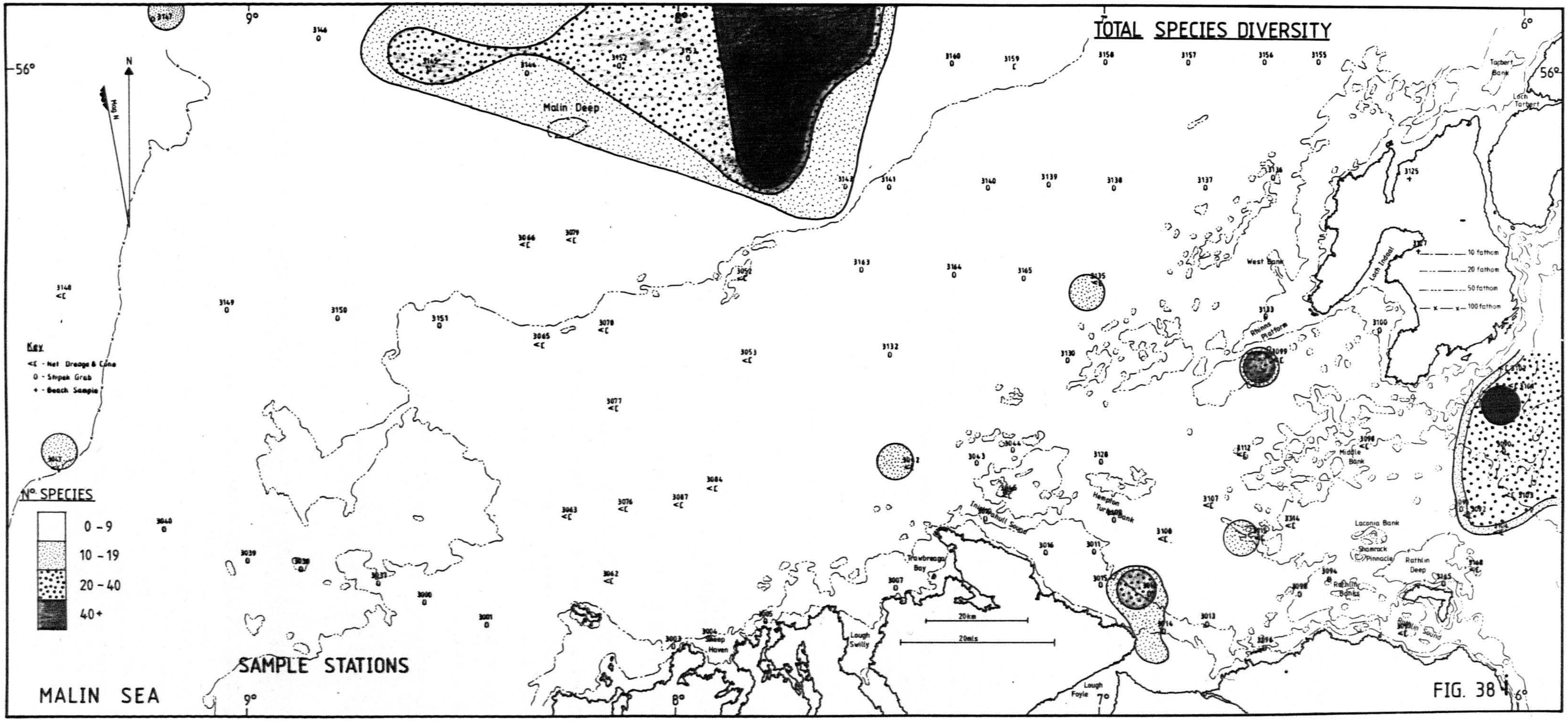


FIG. 38 TOTAL SPECIES DIVERSITY

FIG. 39

South IRISH SEA

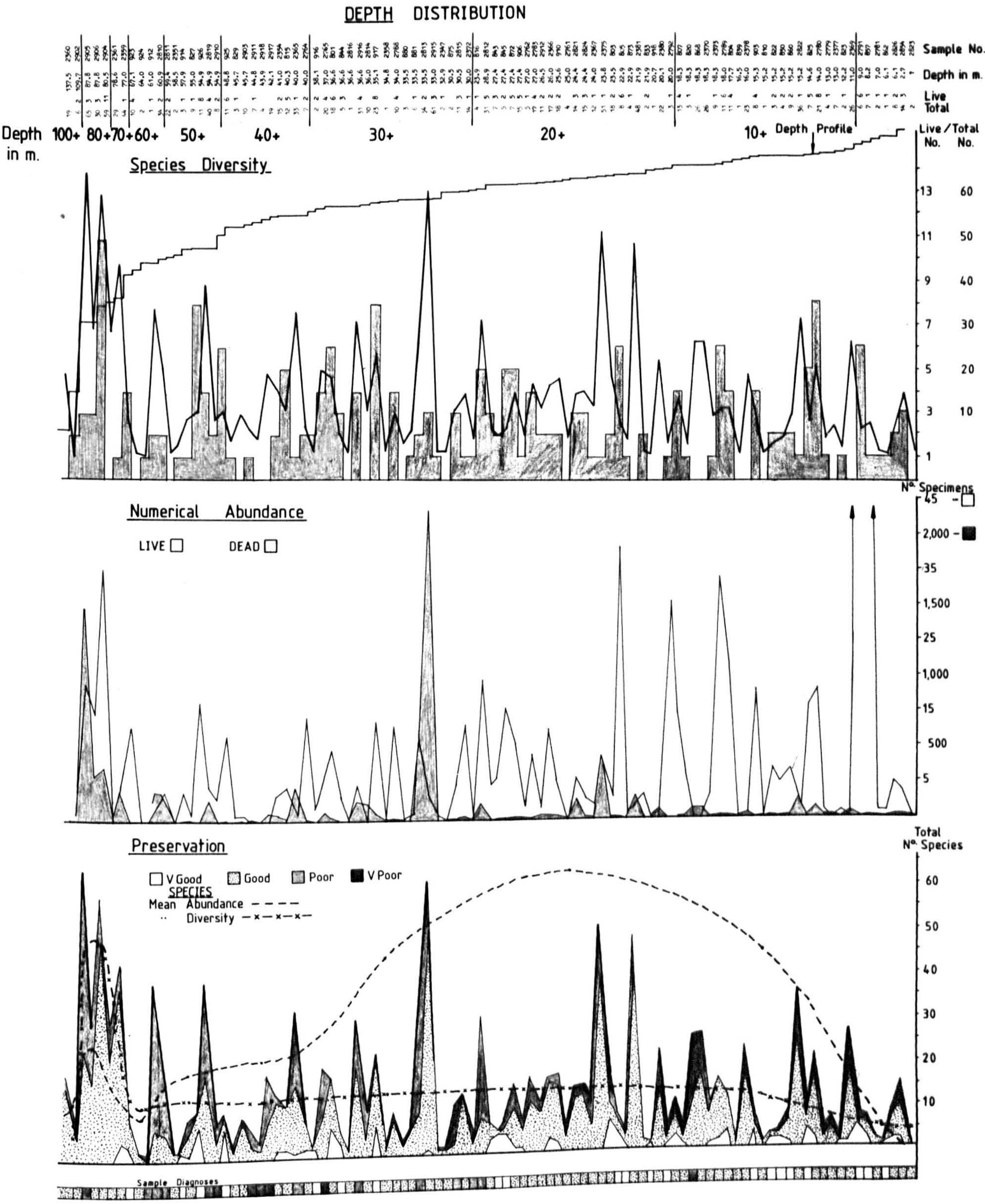


FIG. 40

South IRISH SEA

DISTRIBUTION and SEDIMENT TYPE

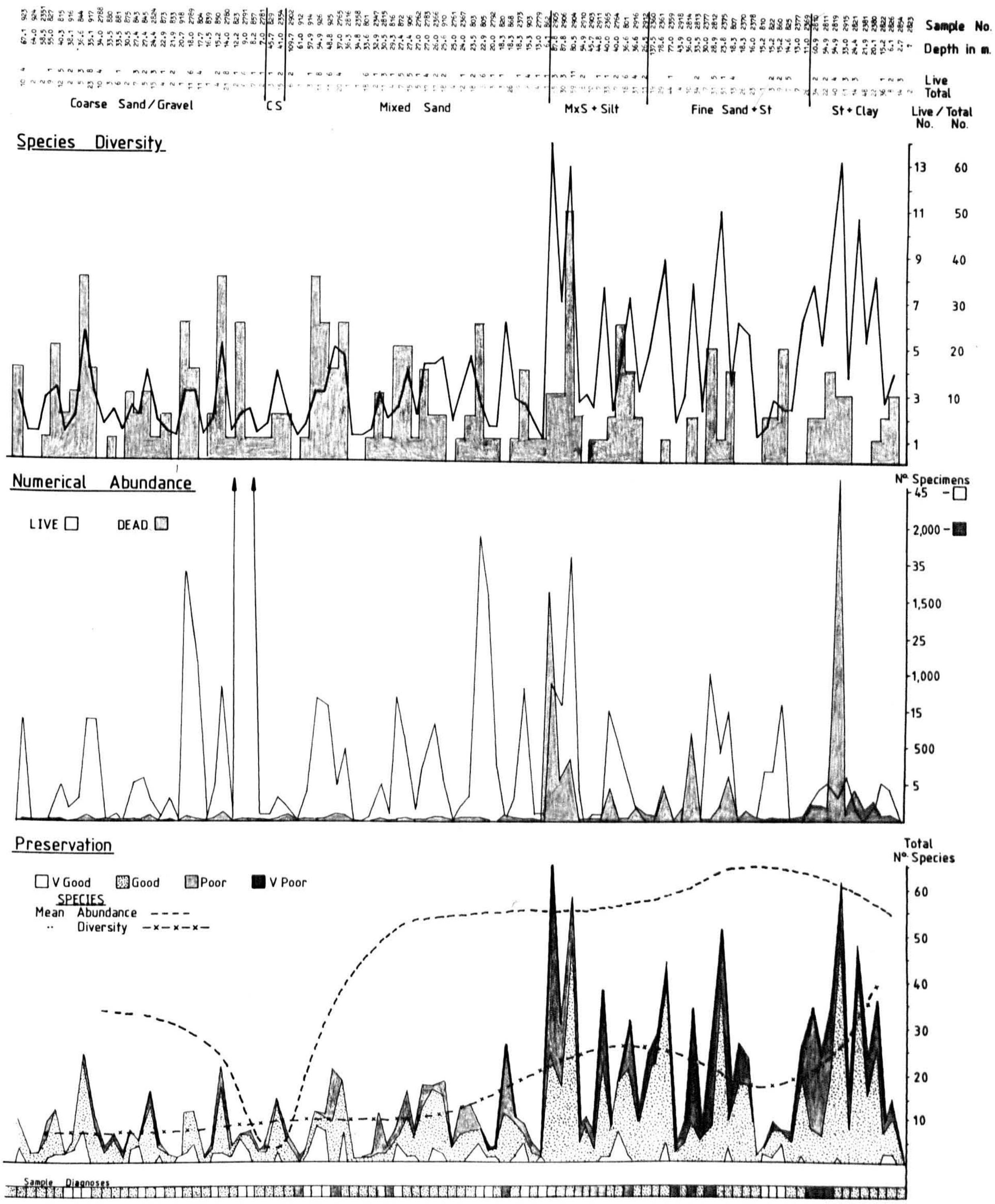


FIG. 41

CAERNARVON BAY

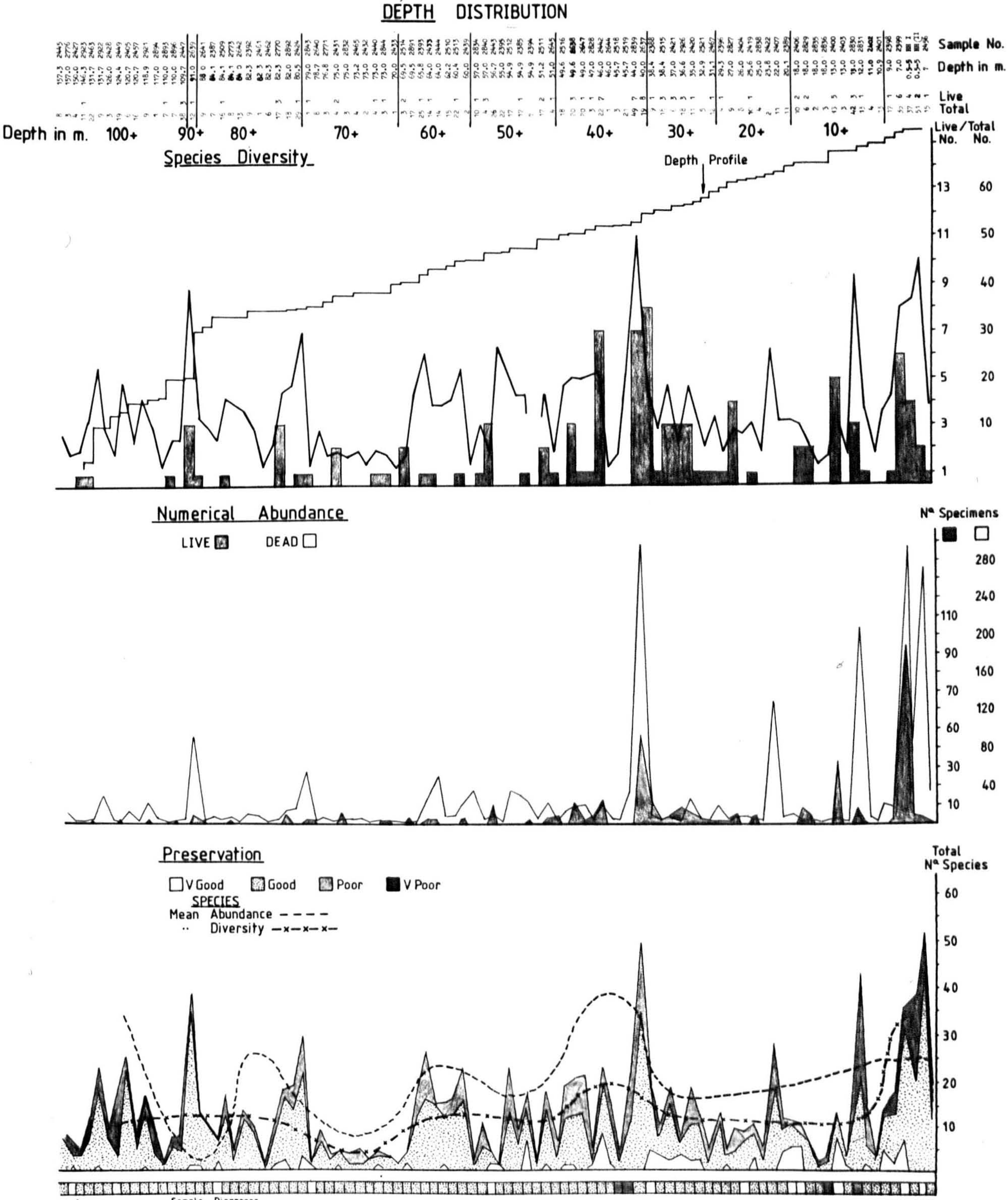


FIG. 42

CAERNARVON BAY

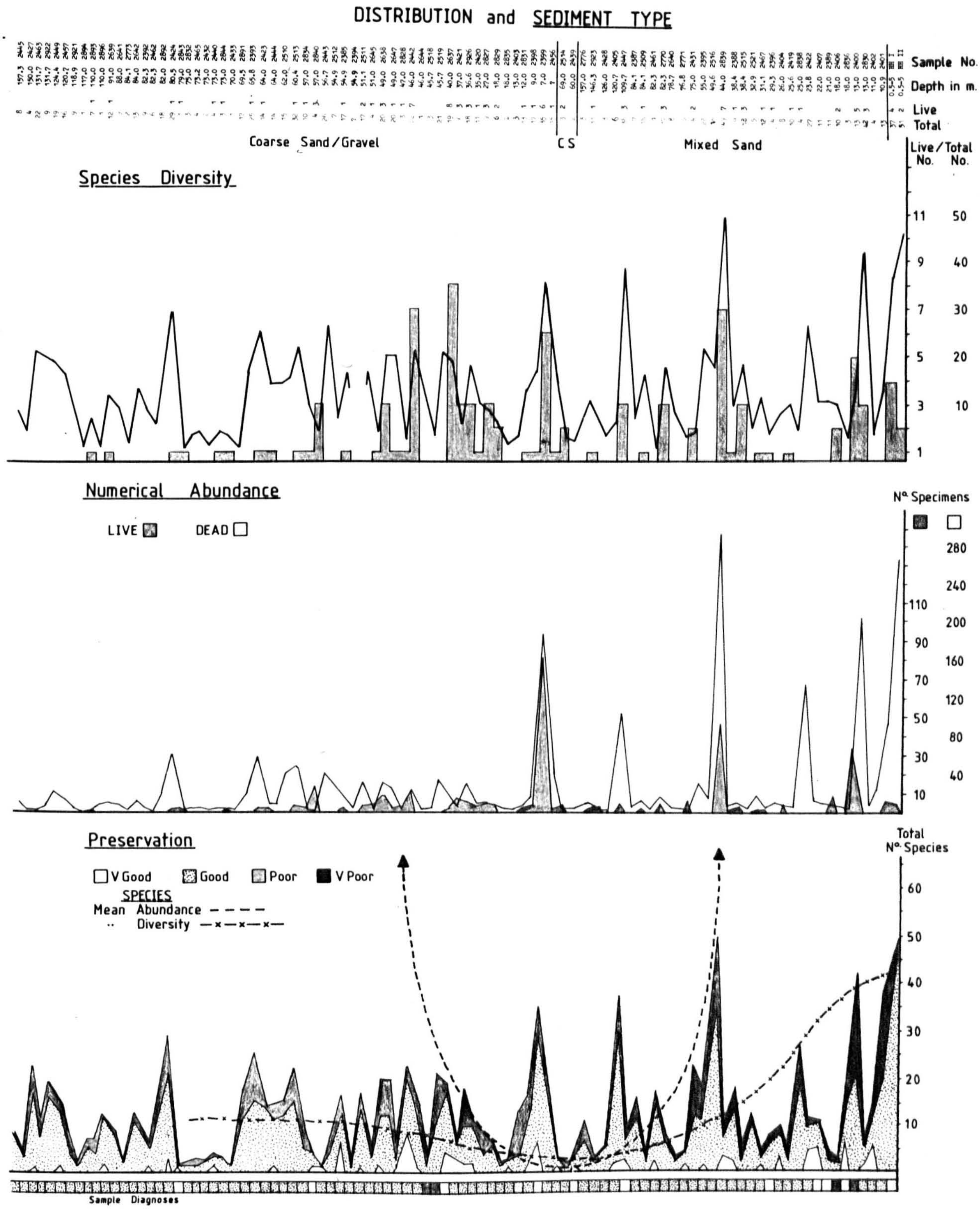


FIG. 43

MALIN SEA

DEPTH DISTRIBUTION

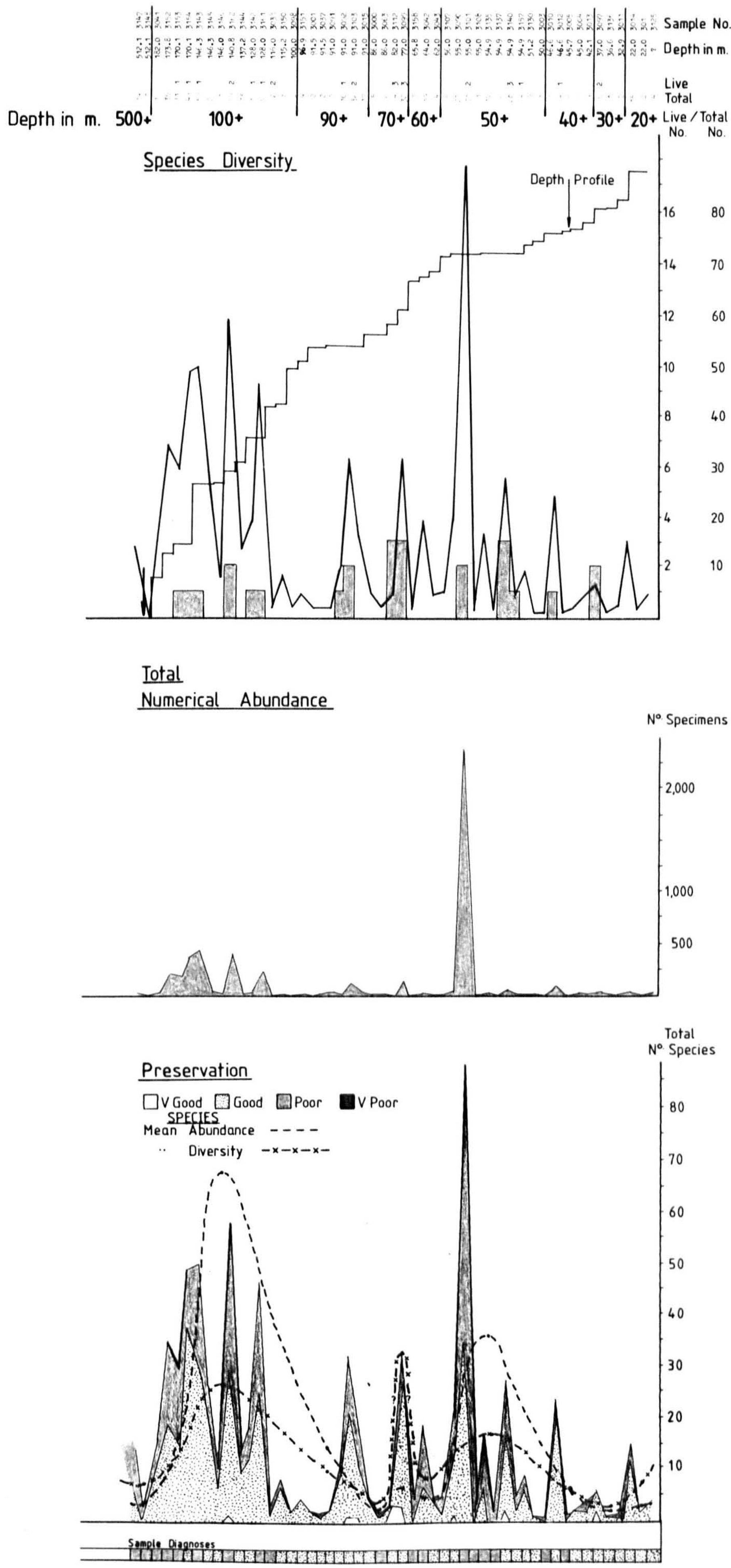
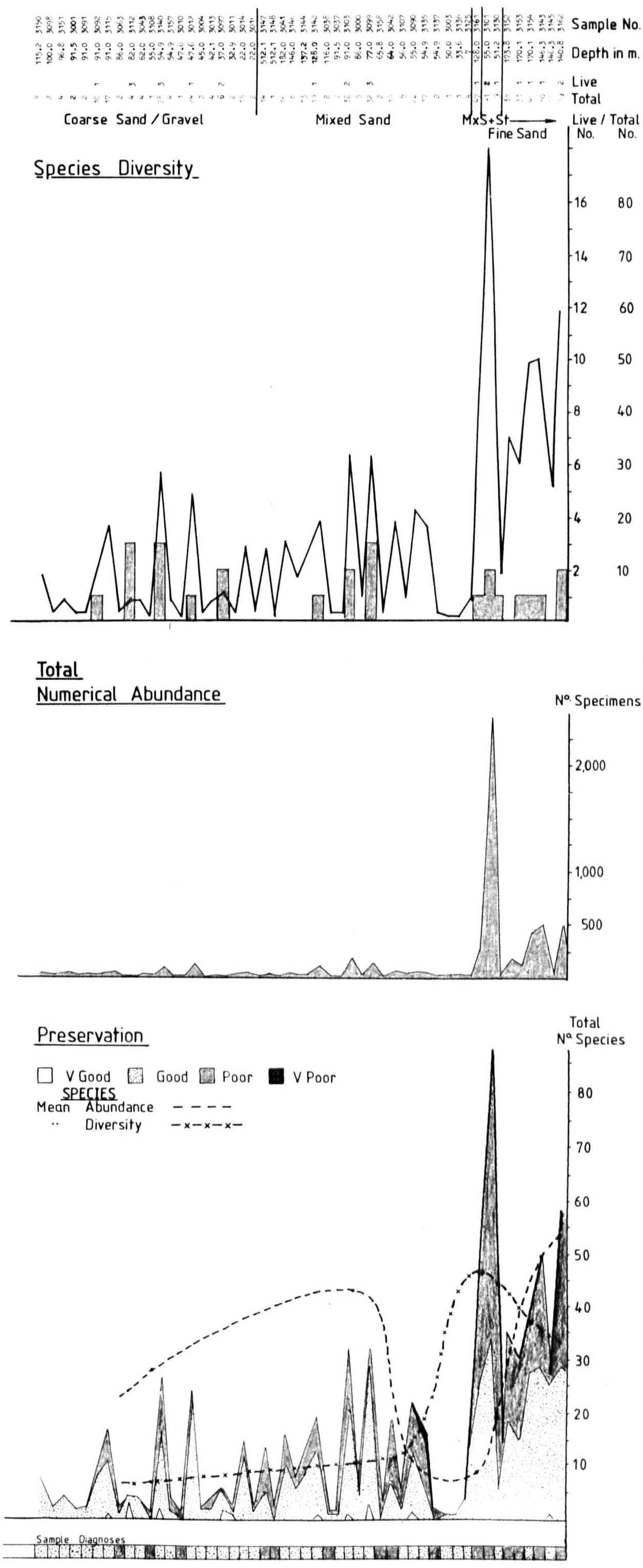


FIG. 44

MALIN SEA

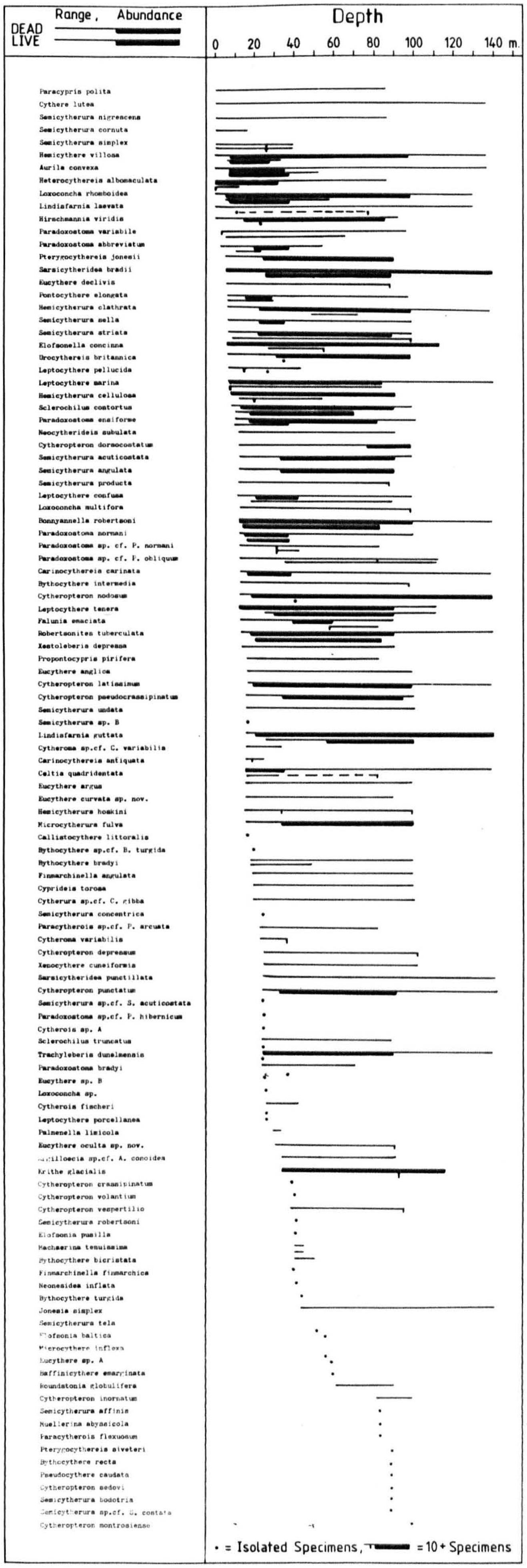
DISTRIBUTION and SEDIMENT TYPES



RANK ORDER of SPECIES by DEPTH

FIG. 45

SOUTHERN IRISH SEA



RANK ORDER of SPECIES by DEPTH

FIG. 46

CAERNARVON BAY

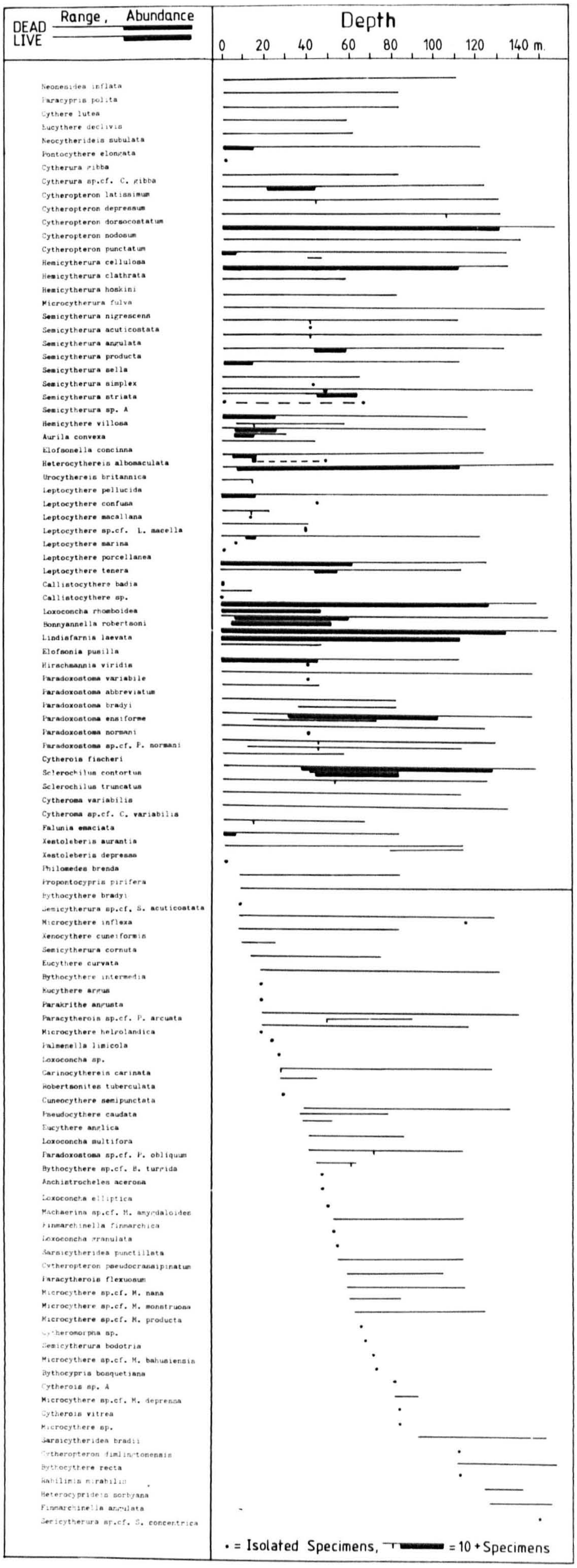


FIG. 47

RANK ORDER of SPECIES by DEPTH

MALIN SEA

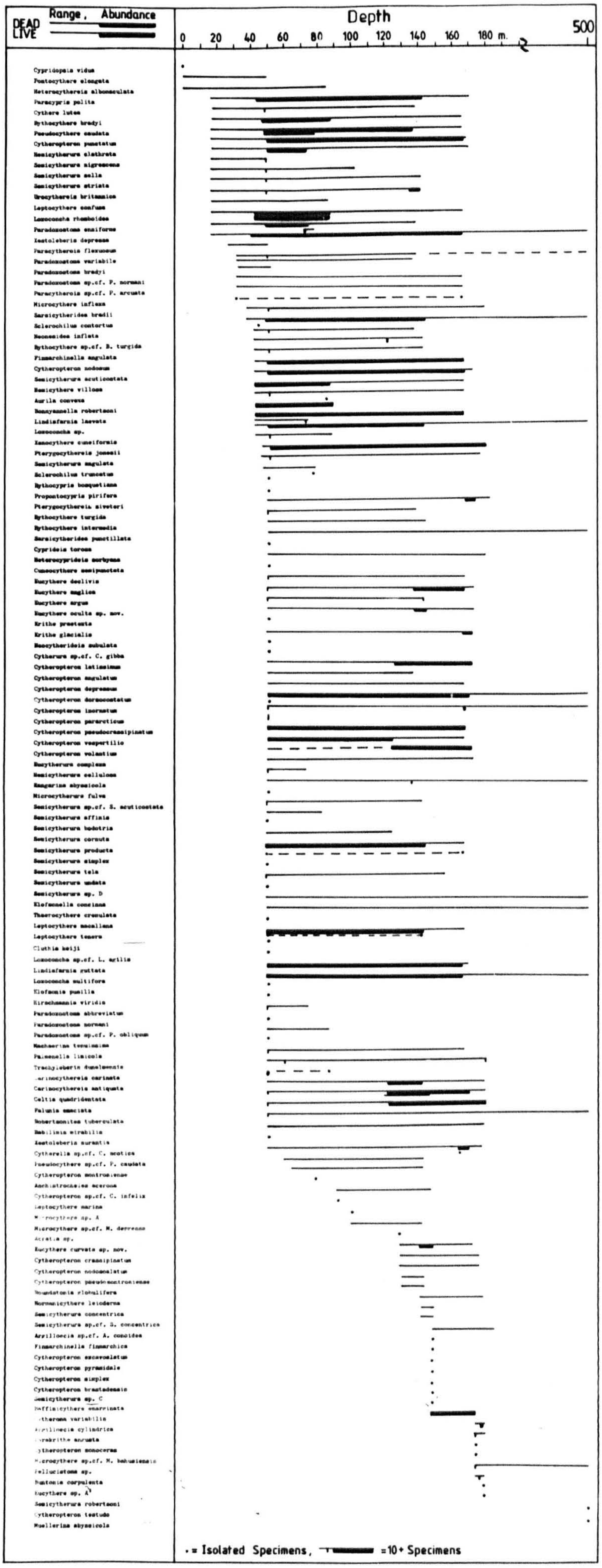
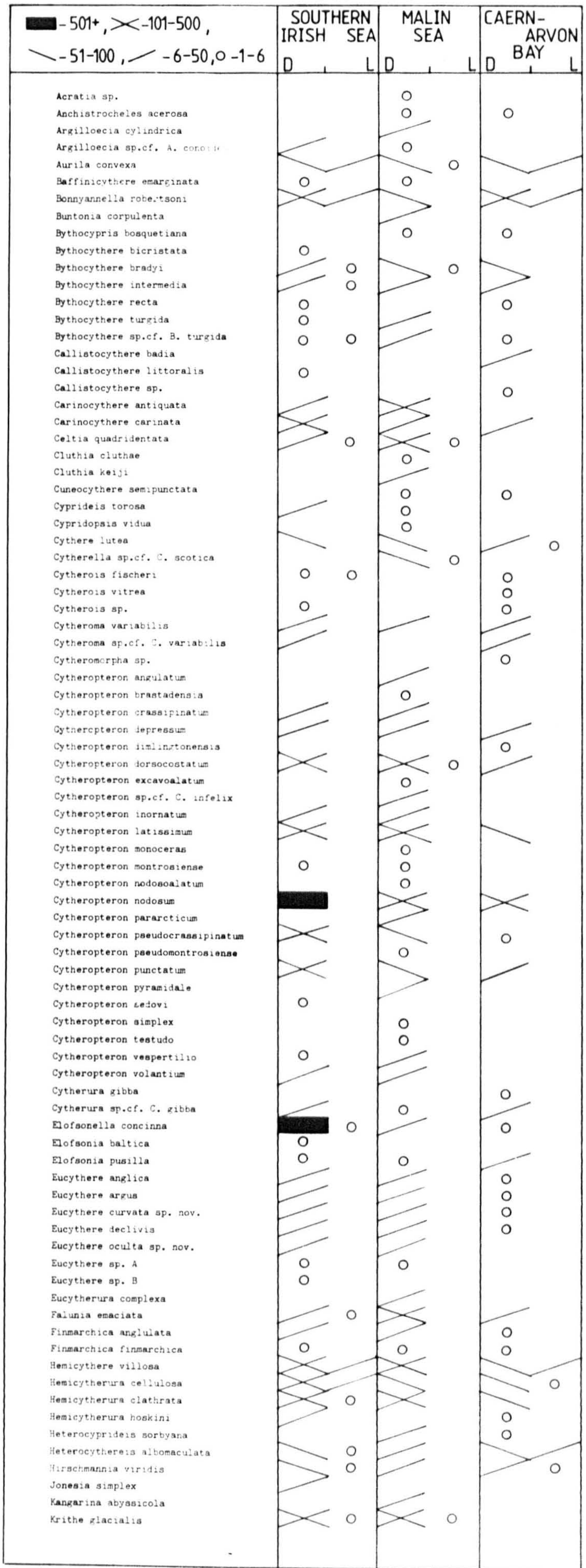


FIG. 48a

TOTAL LISTED SPECIES

NUMBER of SPECIMENS

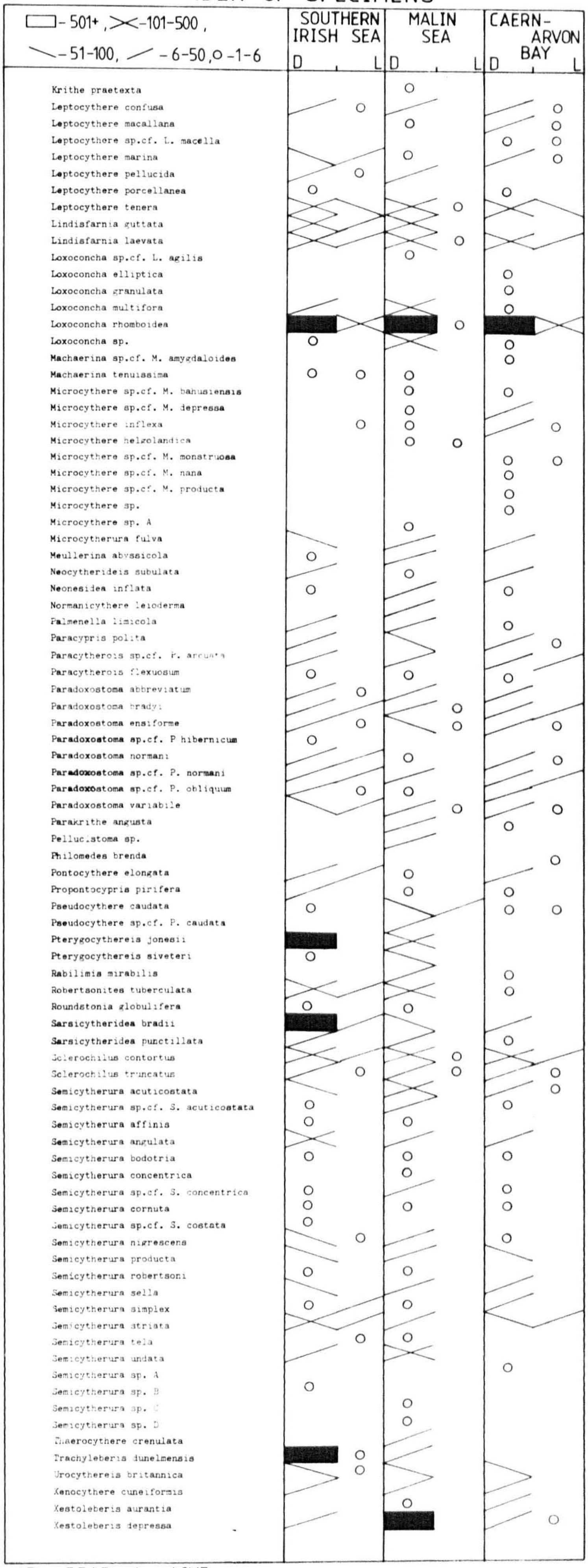


D - DEAD L - LIVE

FIG. 48b

TOTAL LISTED SPECIES

NUMBER of SPECIMENS



D - DEAD L - LIVE

B I B L I O G R A P H Y

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PLATE 1

Neonesidea inflata (Norman) 1862 — figs. a-d

Figs.			
a.	Female right valve. Lateral view.	Ref. 9.13/13A.	x 44
b.	Female left valve. Lateral view.	Ref. 10.10/10A.	x 45
c.	?Male right valve. Lateral view.	Ref. 10.11/11A.	x 50
d.	Penultimate instar left valve. Lateral view.	Ref. 10.12/12A.	x 57

?Acratia sp. — figs. e-g

e.	Adult left valve. Lateral view.	Ref. 25.42A.	x 104
f.	Adult left valve. Detail of internal indicating the muscle scar pattern, large normal pores and a portion of the adont hingement.	Ref. 32.18A/19.	x 270
g.	Adult left valve. Detail of external indicating a normal pore sieve plate.	Ref. 25.1	x 5,175

Bythocypris bosquetiana (Brady) 1865 — figs. h-j

h.	Juvenile left valve. Lateral view	Ref. 24.42/42A.	x 100
i.	Juvenile left valve. Detail of internal indicating the muscle scar pattern and numerous minute normal pores.	Ref. 32.22A/23.	x 500
j.	Juvenile left valve. Detail of external indicating simple and open normal pores, each surrounded by a slightly raised margin.	Ref. 27.4A/5.	x 2,800

Anchistrochelles acerosa (Brady) 1868 — figs. k-n

k.	Adult right valve. Lateral view.	Ref. 25.40A/41.	x 145
l.	?Juvenile left valve. Lateral view.	Ref. 25.41A/42.	x 150
m.	Adult right valve. Detail of internal indicating the muscle scar pattern as an indistinct cluster of depressions in the bottom right and top left of the picture.	Ref. 32.21A/22.	x 800
n.	Adult right valve. Detail of external indicating one of the few normal pores.	Ref. 30. 5/5A.	x 11,000

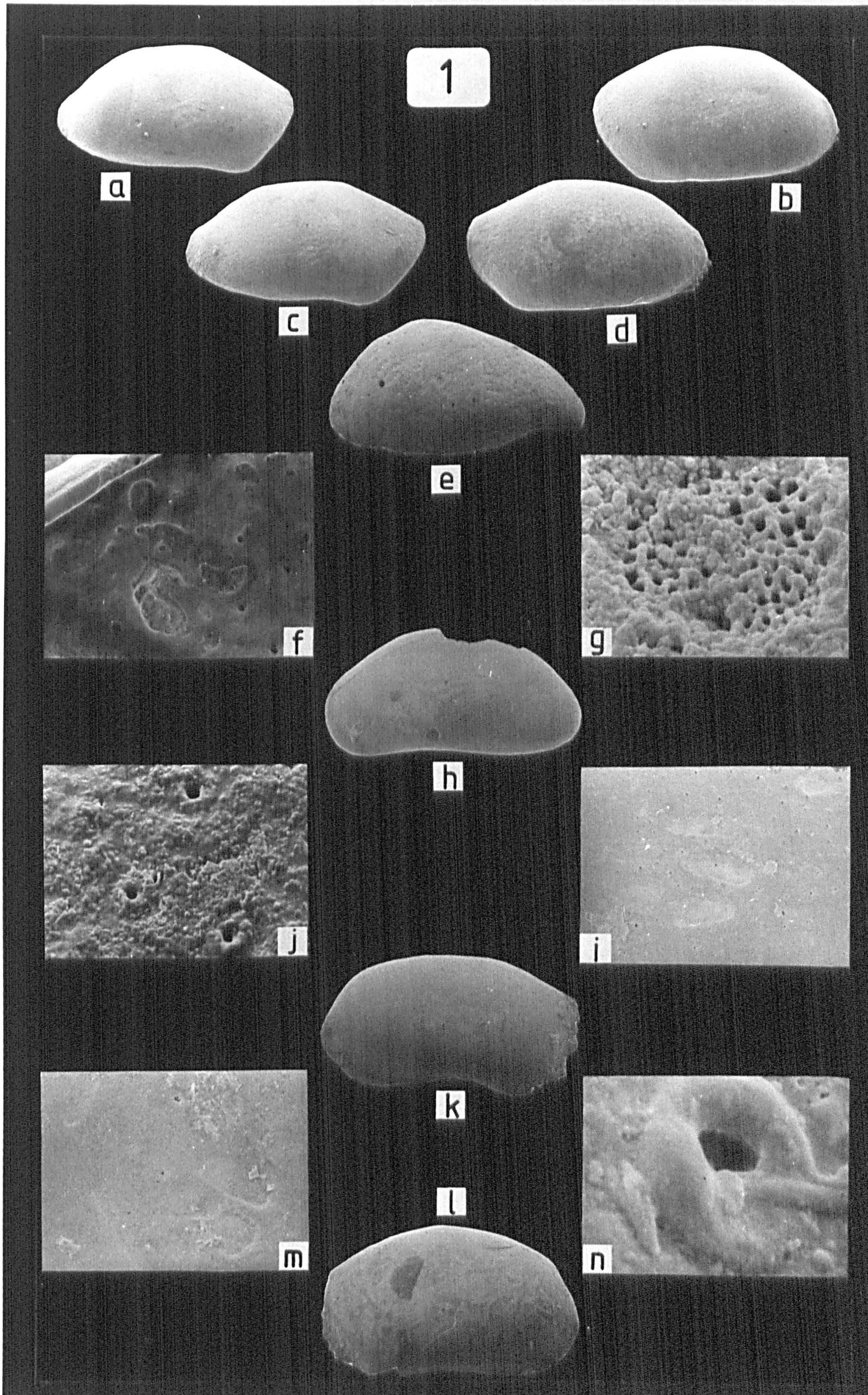
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PLATE 2

Cypridopsis vidua (O.F. Müller) 1776 — figs. a-b

Figs.			
a.	Female right valve. Lateral view.	Ref. 22.11A/12.	x 62
b.	Female left valve. Lateral view.	Ref. 22.10A/11.	x 62

Paracypris polita Sars 1866 — figs. c-d

c.	Juvenile (A-3) right valve. Lateral view.	Ref. 9.-	x 72
d.	Juvenile (A-3) left valve. Lateral view.	Ref. 9.42/42A.	x 71

Argilloecia cylindrica Sars 1865 — figs. e-h

e.	Penultimate? instar right valve. Lateral view.	Ref. 25.35A/36.	x 112
f.	Penultimate instar left valve. Lateral view.	Ref. 25.36A/37.	x 110
g.	Juvenile (-2?) right valve. Lateral view.	Ref. 25.39A/40.	x 128
h.	Juvenile right valve. Detail of internal indicating the characteristic rounded arrangement of adductor muscle scars.	Ref. 30.6/6A.	x 690

Argilloecia sp. cf. A. conoidea Sars 1923 — figs. i-l

i.	Female right valve. Lateral view.	Ref. 25.32A/33.	x 102
j.	Female left valve. Lateral view.	Ref. 25.33A/34.	x 112
k.	Male left valve. Lateral view.	Ref. 25.34A/35.	x 112
l.	Female right valve. Detail of internal indicating the muscle scar pattern.	Ref. 30.7/7A.	x 540

Propontocypris pirifera (G.W. Müller) 1894 — figs. m-n

m.	Penultimate instar right valve. Lateral view.	Ref. 7.41A/42.	x 73
n.	Juvenile (A-2) left valve. lateral view.	Ref. 7.1.	x 80

Cythere lutea O.F. Müller 1785 — figs. o-t

o.	Female right valve. Lateral view.	Ref. 22.6A/7.	x 81
p.	Female left valve. Lateral view.	Ref. 22.7A/8.	x 79
q.	Male right valve. Lateral view.	Ref. 22.4A/5.	x 75
r.	Male left valve. Lateral view.	Ref. 22.5A/6.	x 75
s.	Penultimate instar right valve. Lateral view.	Ref. 22.9A/10.	x 96
t.	Penultimate instar left valve. Lateral view.	Ref. 22.8A/9.	x 94

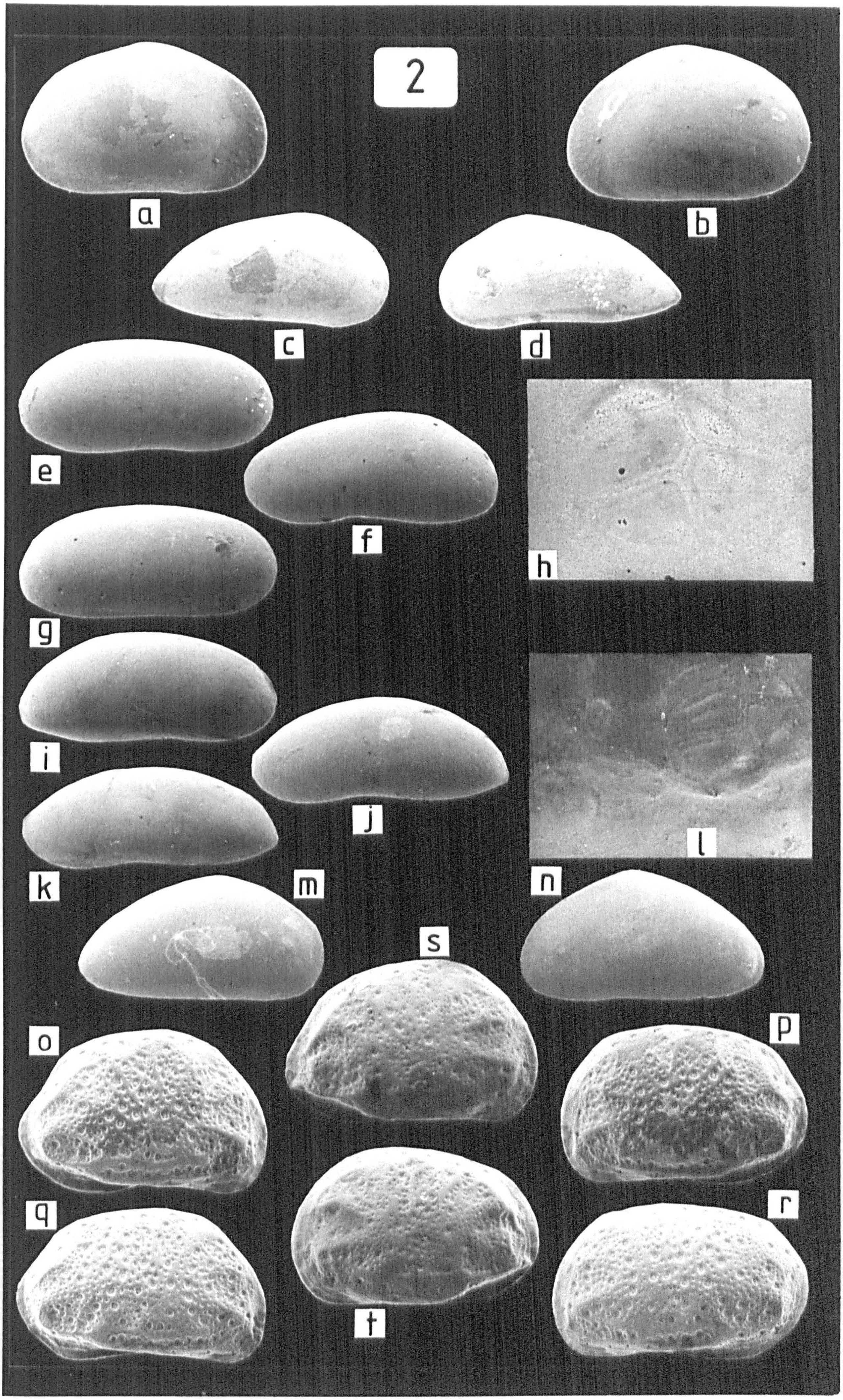
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PLATE 3

Figs.	<u>Pterygocythereis</u> <u>jonesii</u> (Baird) 1850	figs. a-j	
a.	Female right valve. Lateral view.	Ref. 6.15A/16.	x 49
b.	Female left valve. Lateral view.	Ref. 6.16A/17.	x 49
c.	Male right valve. Lateral view.	Ref. 6.14A/15.	x 44
d.	Male left valve. Lateral view.	Ref. 6.13A/14.	x 44
e.	Male carapace. Dorsal view.	Ref. 6.12A/13.	x 43
f.	Penultimate instar right valve. Lateral view.	Ref. 26.28/28A.	x 74
g.	Penultimate instar left valve. Lateral view.	Ref. 6.17A/18.	x 65
h.	Penultimate carapace. Dorsal view.	Ref. 6.11A/12.	x 53
i.	Juvenile (A-3) right valve. Lateral view.	Ref. 6.19A/20.	x 100
j.	Juvenile (A-3) left valve. Lateral view.	Ref. 6.20A/21.	x 100
		fig. s	
s.	Juvenile (A-3?) carapace. Dorsal view.	Ref. 6.21A/22.	x 85
	<u>Pterygocythereis</u> <u>siveteri</u> Athersuch 1978	figs. k-r	
k.	Female right valve. Lateral view.	Ref. 6.3A/4.	x 49
l.	Female left valve. Lateral view.	Ref. 6.4A/5.	x 49
m.	Male right valve. Lateral view.	Ref. 6.5A/6.	x 49
n.	Male left valve. Lateral view.	Ref. 6.6A/7.	x 49
o.	Male right valve. Dorsal view.	Ref. 6.10A/11.	x 39
p.	Male left valve. Dorsal view.	Ref. 6.9A/10.	x 38
q.	Juvenile (A-2) right valve. Lateral view.	Ref. 6.7A/8.	x 83
r.	Juvenile (A-2) left valve. Lateral view.	Ref. 6.8A/9.	x 83

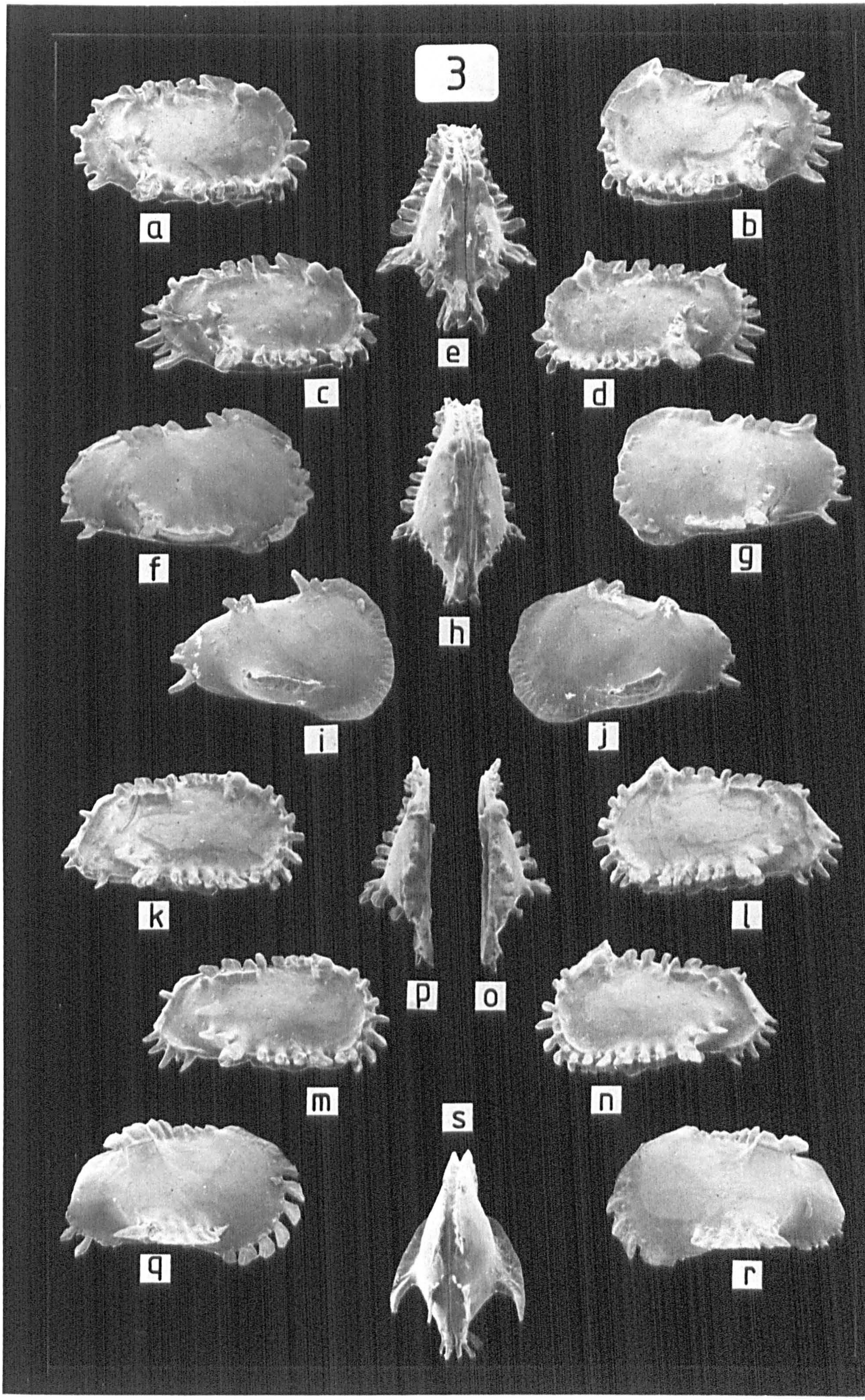
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PLATE 4

	Bythocythere turgida Sars 1866	Figs. a-e	
Figs.			
a.	Male right valve. Lateral view.	Ref. 24.19/19A.	x 55
b.	Female left valve. Lateral view.	Ref. 24.21/21A.	x 61
c.	Male left valve. Lateral view.	Ref. 24.18/18A.	x 55
d.	Penultimate instar right valve. Lateral view.	Ref. 24.20/20A.	x 60
e.	Penultimate instar left valve. Lateral view.	Ref. 24.22/22A.	x 61

	Bythocythere sp. cf. *B. turgida* Sars 1866	Figs. f-n	
f.	Female right valve. Lateral view.	Ref. 27.31A/32.	x 78
g.	Female left valve. Lateral view.	Ref. 27.32A/33.	x 78
h.	Male right valve. Lateral view.	Ref. 27.29A/30.	x 77
i.	Male left valve. Lateral view.	Ref. 27.30A/31.	x 72
j.	Penultimate instar right valve. Lateral view.	Ref. 24.15/15A.	x 89
k.	Penultimate instar left valve. Lateral view.	Ref. 24.16/16A.	x 87
l.	Female right valve. Detail of internal indicating the muscle scar pattern.	Ref. 27.30/30A.	x 500
m-n.	Female right valve. Detail of internal indicating anterior (Fig. m) and posterior (Fig. n) terminal elements of a lophodont hingement. Fig. m	Ref. 27.31/31A.	x 500
	Fig. n	Ref. 27.32/32A.	x 408

	Bythocythere bicristata Brady and Norman 1889	Figs. o-p	
o.	Female right valve. Lateral view.	Ref. 24.40/40A.	x 128
p.	?Juvenile left valve. Lateral view.	Ref. 24.41/41A.	x 113

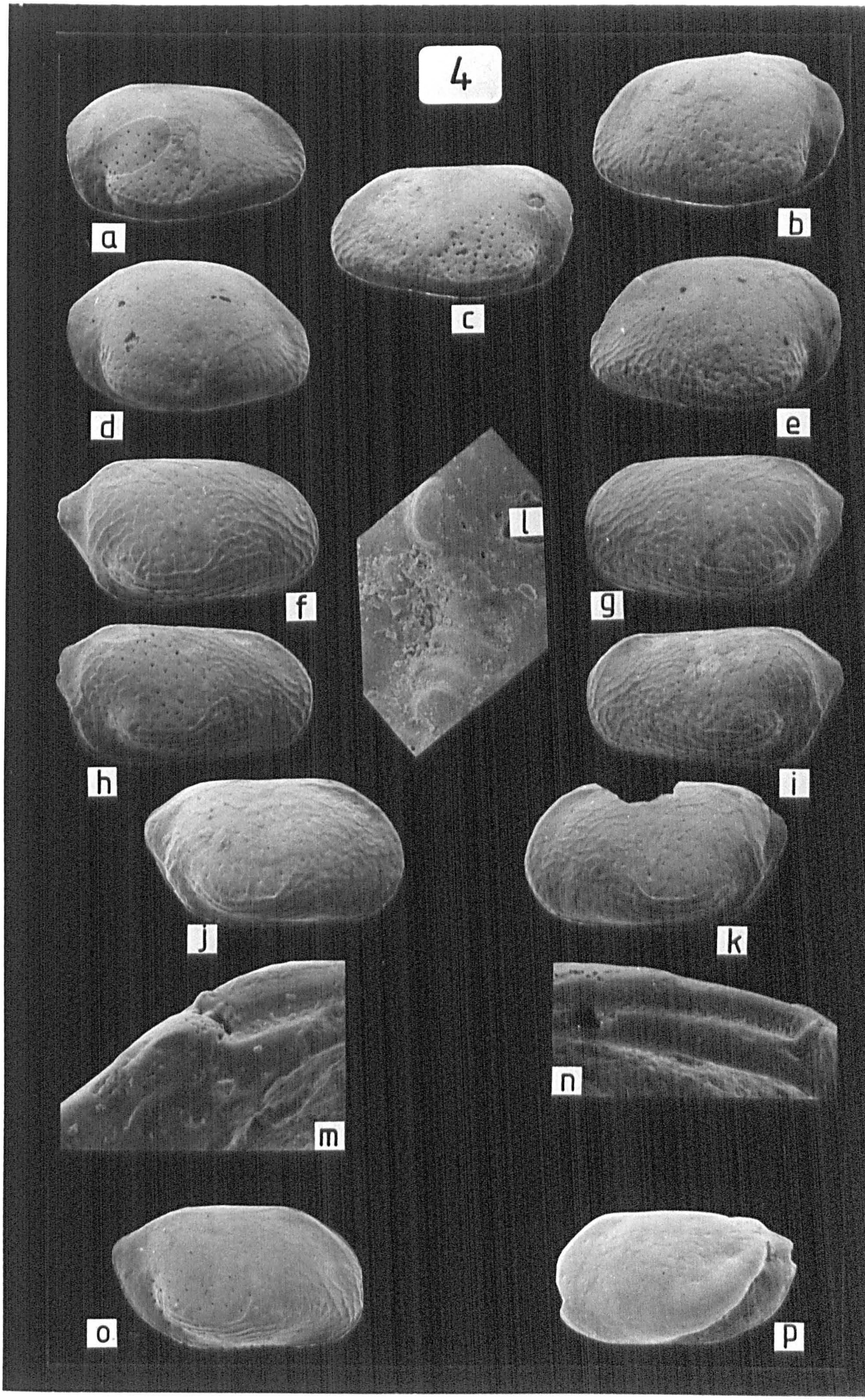
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PLATE 5

<u>Bythocythere</u> <u>bradyi</u> Sars 1928 — Figs. a-f

Figs.			
a.	Female right valve. Lateral view.	Ref. 24.37/37A.	x 87
b.	Female left valve. Lateral view.	Ref. 24.36/36A.	x 85
c.	Male right valve. Lateral view.	Ref. 24.35/35A.	x 91
d.	Male left valve. Lateral view.	Ref. 24.34/34A.	x 94
e.	Penultimate instar right valve.	Ref. 23.39/39A.	x 101
f.	Penultimate instar left valve.	Ref. 24.38/38A.	x 100

<u>Bythocythere</u> <u>intermedia</u> Elofson 1938 — Figs. g-l

g.	Female right valve. Lateral view.	Ref. 24.30/30A.	x 71
h.	Female left valve. Lateral view.	Ref. 24.29/29A.	x 66
i.	Male right valve. Lateral view.	Ref. 24.28/28A.	x 70
j.	Male left valve. Lateral view.	Ref. 24.27/27A.	x 54
k.	Penultimate instar right valve. Lateral view.	Ref. 24.31/31A.	x 84
l.	Penultimate instar right valve. Lateral view.	Ref. 24.32/32A.	x 84

<u>Bythocythere</u> <u>recta</u> (Brady) 1868 — Figs. m-t

m.	Female right valve. Lateral view.	Ref. 24.25/25A.	x 117
n.	Female left valve. Lateral view.	Ref. 24.23/23A.	x 115
o.	Male right valve. Lateral view.	Ref. 24.24/24A.	x 113
p.	Juvenile instar left valve. Lateral view.	Ref. 24.26/26A.	x 150
q.	Female right valve. Detail of interior indicating the muscle scar pattern.	Ref. 27.6A/7.	x 890
r-s.	Female right valve. Interior view indicating anterior (Fig. r) and posterior (Fig. s) terminal elements of a poorly preserved merodont/lophodont hingement. Fig. r	Ref. 27.7A/8.	x 1,780
	Fig. s	Ref. 27.8A/9.	x 1,750
t.	Male right valve. External view indicating a normal pore structure.	Ref. 27.5A/6	x 5,000

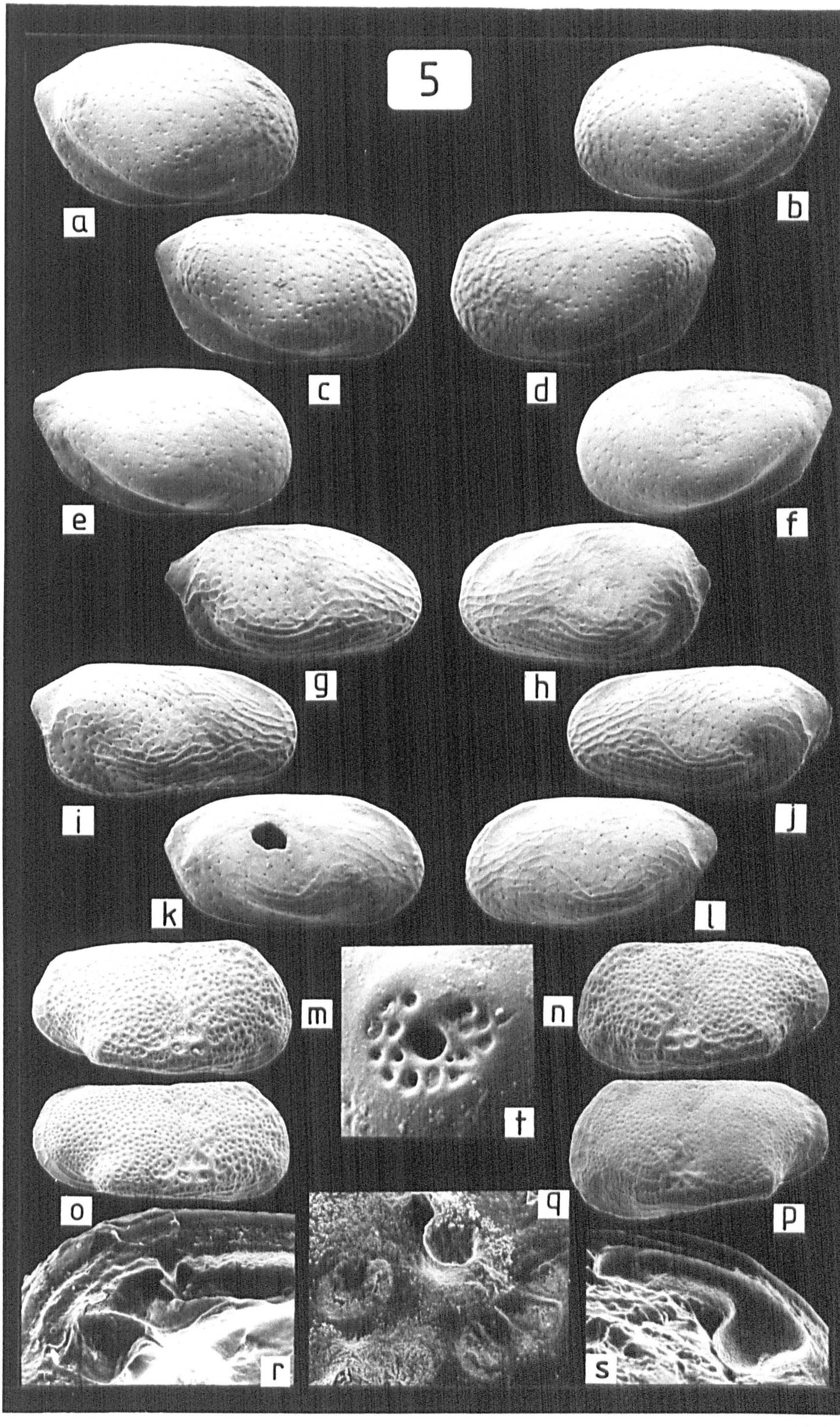
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PLATE 6

Figs.	<u>Jonesia</u> <u>simplex</u> (Norman) 1865	Figs. a-d	
a.	Female right valve. Lateral view.	Ref. 11.31A/32.	x 42
b.	Female left valve. Lateral view.	Ref. 11.32A/33.	x 42
c.	Male right valve. Lateral view.	Ref. 11.29A/30.	x 39
d.	Male left valve. Lateral view.	Ref. 11.30A/31.	x 39
	<u>Pseudocythere</u> <u>caudata</u> Sars 1866	Figs. e-f	
e.	Female right valve. Lateral view.	Ref. 6.25A/26.	x 105
f.	Male? right valve. Lateral view.	Ref. 7.36A/37.	x 100
	<u>Pseudocythere</u> sp. cf. <u>P</u>. <u>caudata</u> Sars 1866	Figs. g-h	
g.	Female right valve. Lateral view.	Ref. 7.38A/39.	x 115
h.	Female left valve. Lateral view.	Ref. 7.37A/38.	x 123
	<u>Sarsicytheridea</u> <u>bradii</u> (Norman) 1865	Figs. i-n	
i.	Female right valve. Lateral view.	Ref. 17.20A/21.	x 63
j.	Female left valve. Lateral view.	Ref. 17.19A/20.	x 63
k.	Male right valve. Lateral view.	Ref. 17.18A/19.	x 57
l.	Male left valve. Lateral view	Ref. 17.17A/18.	x 58
m	Penultimate instar right valve. Lateral view.	Ref. 17.21A/22.	x 75
n.	Penultimate instar left valve. Lateral view.	Ref. 17.22A/23.	x 75
	<u>Sarsicytheridea</u> <u>punctillata</u> (Brady) 1865	Figs. o-s	
o.	Male right valve. Lateral view.	Ref. 17.11A/12.	x 75
p.	Female right valve. Lateral view.	Ref. 17.12A/13.	x 78
q.	Male left valve. Lateral view.	Ref. 17.10A/11.	x 70
r.	Penultimate? instar right valve. Lateral view.	Ref. 17.13A/14.	x 99
s.	Penultimate? instar left valve. Lateral view.	Ref. 17.14A/15.	x 95

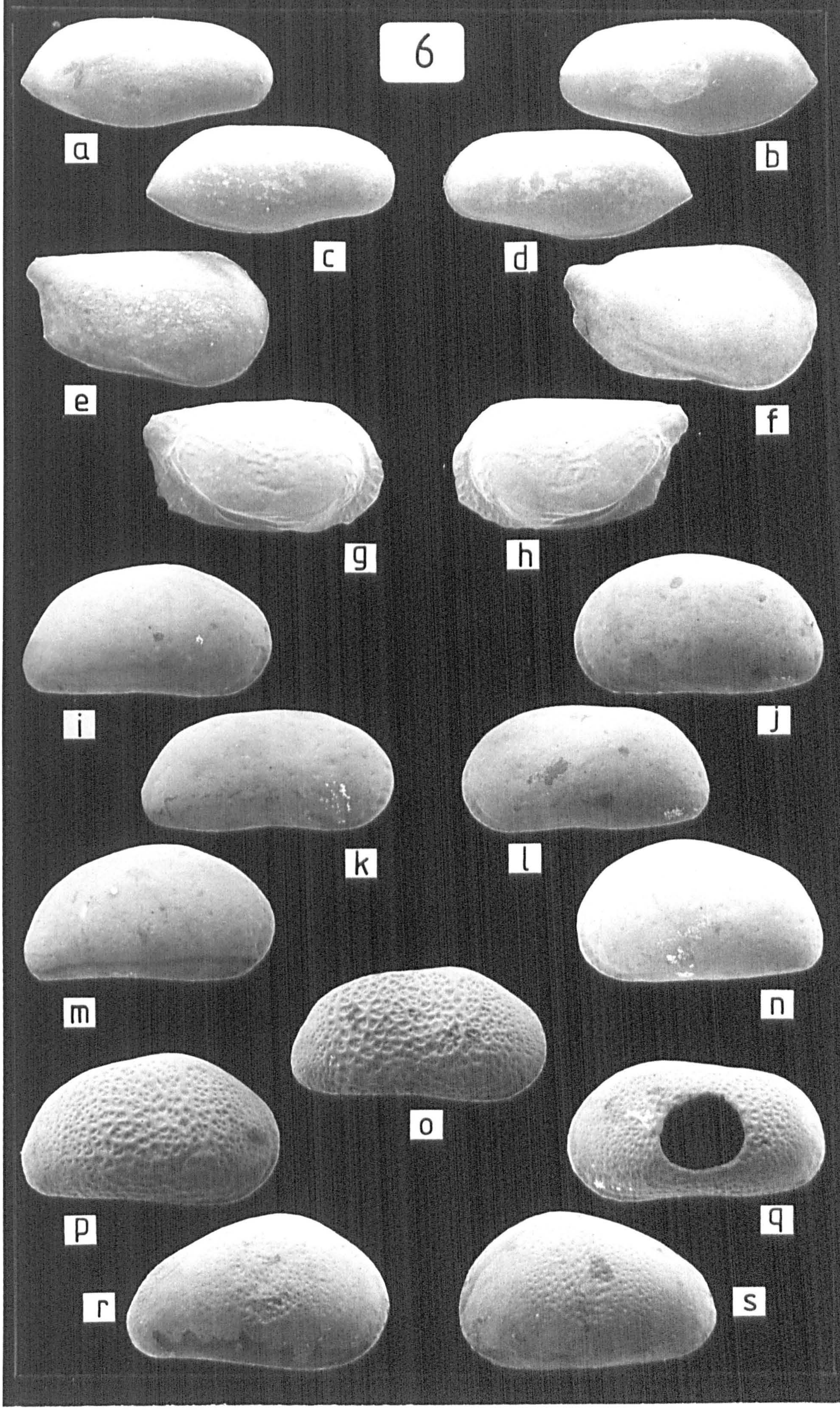
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PLATE 7

<u>Cyprideis torosa</u> (Jones) 1850 — Figs. a-c

Figs.			
a.	Female right valve. Lateral view.	Ref. 22.12A/13.	x 110
b.	Juvenile (A-2) right valve. Lateral view.	Ref. 22.13A/14.	x 115
c.	Juvenile (A-3) left valve. Lateral view.	Ref. 22.14A/15.	x 113

<u>Heterocyprideis sorbyana</u> (Jones) 1856 — Figs. d-i

d.	Female right valve. Lateral view.	Ref. 15.28/28A.	x 65
e.	Female left valve. Lateral view.	Ref. 15.26/26A.	x 60
f.	Male right valve. Lateral view.	Ref. 15.24/24A.	x 63
g.	Male left valve. Lateral view.	Ref. 15.25/25A.	x 63
h.	Juvenile (-2?) left valve. Lateral view.	Ref. 15.29/29A.	x 100
i.	Male left valve. Detail of external indicating a normal pore sieve plate.	Ref. 17.23A/24.	x 2,500

<u>Cuneocythere semipunctata</u> (Brady) 1868 — Figs. j-m

j.	Female right valve. Lateral view.	Ref. 23.24A/25.	x 110
k.	Female left valve. Lateral view.	Ref. 23.22A/23.	x 104
l.	Male left valve. Lateral view.	Ref. 23.23A/24.	x 94
m.	Penultimate instar right valve. Lateral view.	Ref. 23.25A/26.	x 112

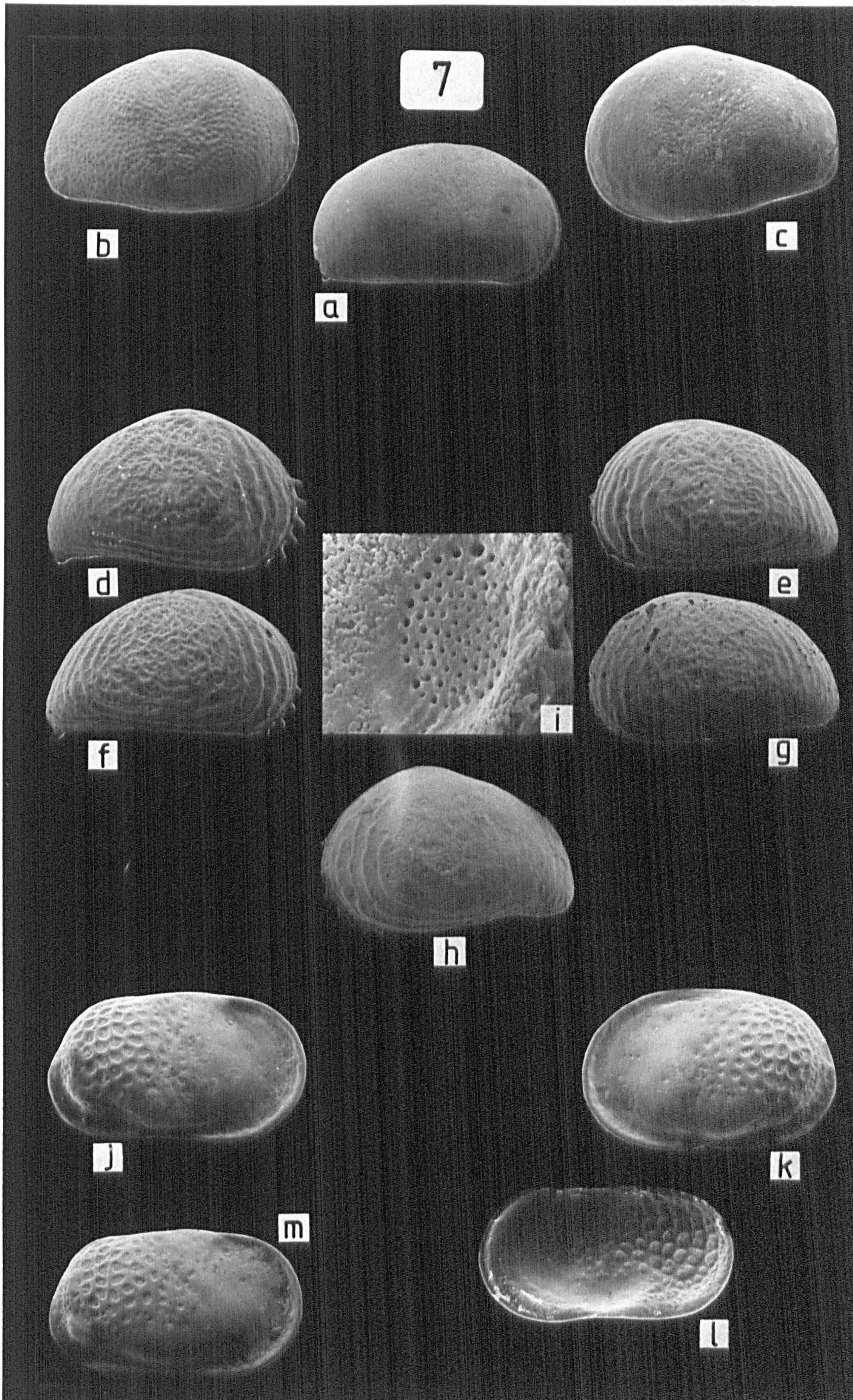
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PLATE 8

Eucythere declivis (Norman) 1865 — Figs. a-k

Figs.				
a.	Female right valve. Lateral view.		Ref. 18.-	x 93
b.	Female left valve. Lateral view.		Ref. 18.42/42A.	x 90
c.	Male right valve. Lateral view.		Ref. 18.41/41A.	x 98
d.	Male left valve. Lateral view.		Ref. 18.40/40A.	x 98
e.	Juvenile (A-2) right valve. Lateral view.		Ref. 18.1/1A.	x 143
f.	Juvenile (A-2) left valve. Lateral view.		Ref. 18.2/2A.	x 139
g.	Female right valve. Detail of internal indicating the muscle scar pattern.		Ref. 28.32/32A.	x 420
h-i.	Female right valve. Detail of internal indicating anterior (Fig. h) and posterior (Fig. i) terminal elements of a lophodont hingement.	Fig. h	Ref. 28.34/34A.	x 1,275
		Fig. i	Ref. 28.33/33A.	x 1,125
j.	Female right valve. Detail of internal indicating several deep, open and large normal pores and terminal sieve plates.		Ref. 28.31/31A.	x 700
k.	Female left valve. Detail of internal indicating a large, sub-circular, sieve plate to a normal pore.		Ref. 28.30/30A.	x 2,800

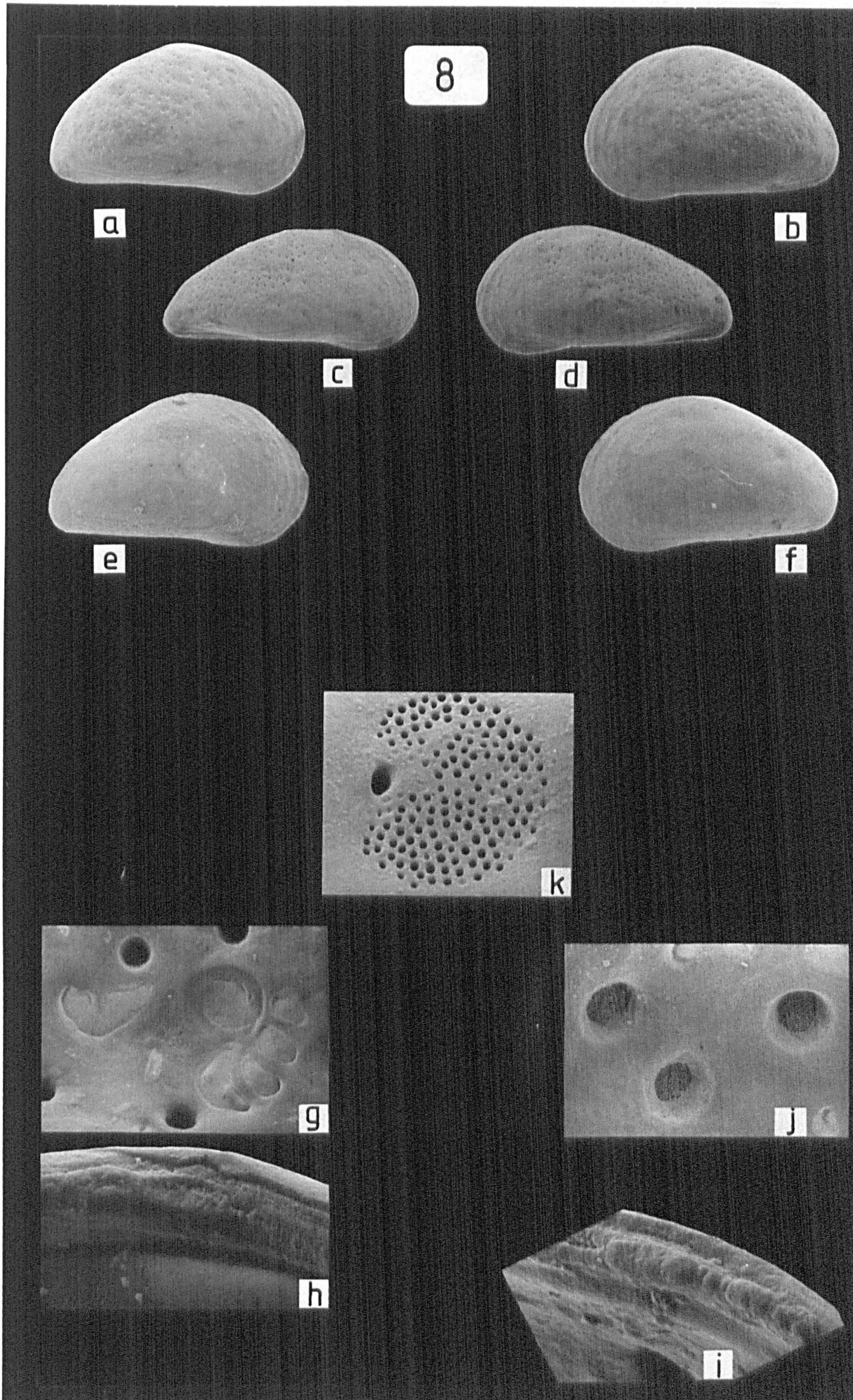
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PLATE 9

<u>Eucythere</u> <u>anglica</u> Brady 1868 — Figs. a-h

Figs.			
a.	Female left valve. Lateral view.	Ref. 18.16/16A.	x 123
b.	Male right valve. Lateral view.	Ref. 18.15/15A.	x 114
c.	Male left valve. Lateral view.	Ref. 18.14/14A.	x 110
d.	Male right valve. Detail of internal indicating the muscle scar pattern.	Ref. 28.1/1A.	x 455
e-g.	Male right valve. Detail of internal indicating the distinctive anterior (Figs. e, f) and posterior (Fig. g) terminal elements of a lophodont or antimerodont hingement. Fig. e	Ref. 28.7/7A.	x 1,210
	Fig. f	Ref. 28.6/6A.	x 3,025
	Fig. g	Ref. 28 4/4A.	x 2,250
h.	Female left valve. Detail of external indicating a typical normal pore sieve plate.	Ref. 28.-	x 4,200

<u>Eucythere</u> <u>argus</u> (Sars) 1866 — Figs. i-p

Figs.			
i.	Female right valve. Lateral view.	Ref. 18.12/12A.	x 100
j.	Female left valve. Lateral view.	Ref. 18.11/11A.	x 100
k.	Male right valve. Lateral view.	Ref. 18.9/9A.	x 105
l.	Male left valve. Lateral view.	Ref. 18.10/10A.	x 105
m.	Female right valve. Detail of internal indicating the muscle scar pattern.	Ref. 28.40/40A.	x 450
n-o.	Female right valve. Detail of internal indicating the anterior (Fig. n) and posterior (Fig. o) terminal elements of an antimerodont hingement. Fig. n	Ref. 28.42/42A.	x 800
	Fig. o	Ref. 28.41/41A.	x 900
p.	Female left valve. Detail of external indicating a number of sieve plates to normal pores, each bearing a rosette of distinctive and irregular depressions about the periphery.	Ref. 28.39/39A.	x 775

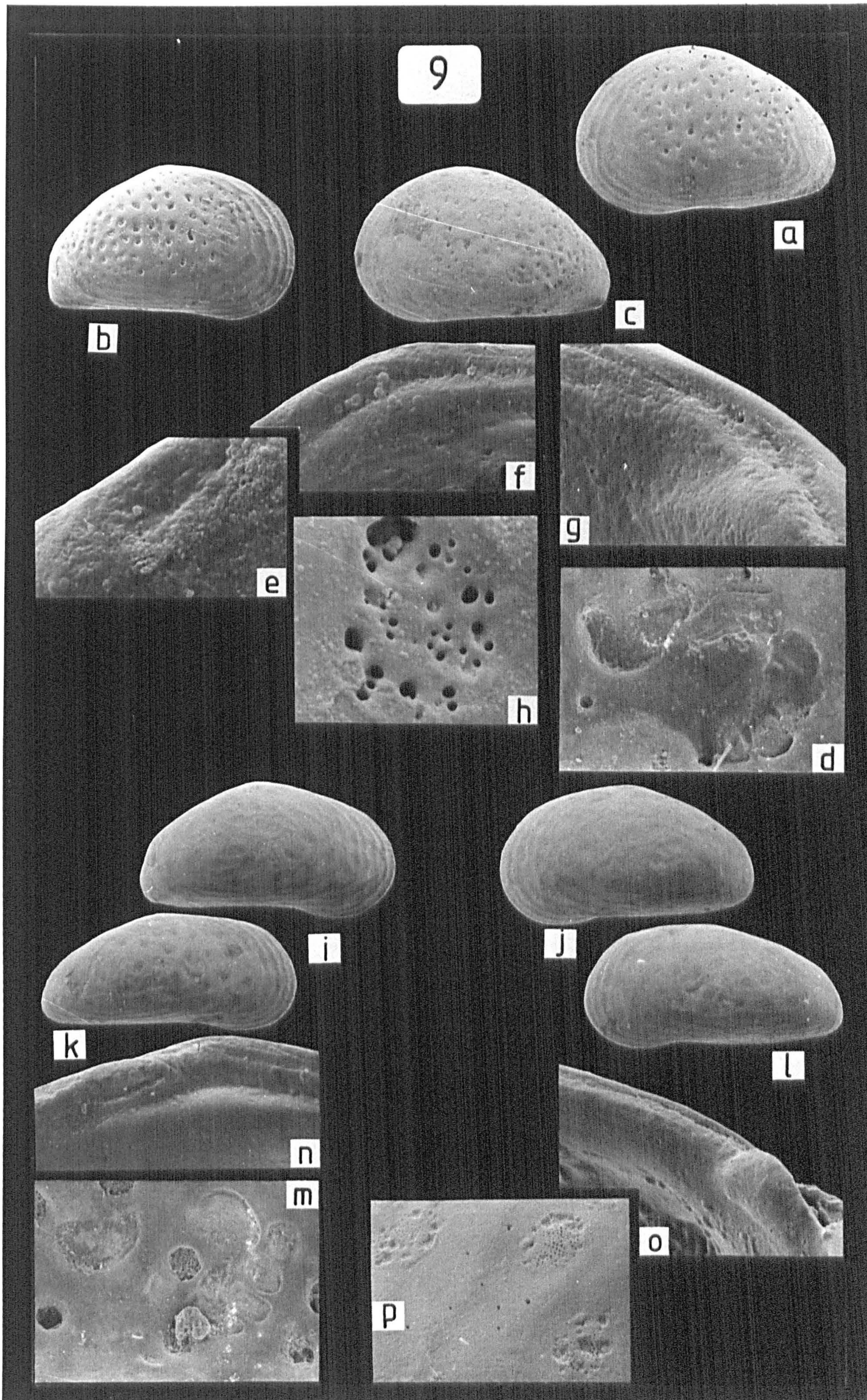
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PLATE 10

<u>Eucythere</u> <u>curvata</u> n.sp. Figs. a-j

Figs.			
a.	Female right valve (HOLOTYPE). Lateral view.	Ref. 18.5/5A.	x 100
b.	Female left valve (HOLOTYPE). Lateral view.	Ref. 18.6/6A.	x 103
c.	Male right valve (PARATYPE). Lateral view.	Ref. 18.4/4A.	x 118
d.	Male left valve (PARATYPE). Lateral view.	Ref. 18.3/3A.	x 115
e.	Penultimate instar right valve (PARATYPE). Lateral view.	Ref. 18.7/7A.	x 125
f.	Juvenile (A-2) left valve (PARATYPE). Lateral view.	Ref. 18.8/8A.	x 140
g-h.	Female right valve. Detail of internal indicating the anterior (Fig. g) and posterior (Fig. h) terminal elements of a lophodont hingement. Fig. g	Ref. 28.37/37A.	x 675
	Fig. h	Ref. 28.36/36A.	x 675
i.	Female right valve. Detail of internal indicating the honeycomb nature of a normal pore sieve structure.	Ref. 28.38/38A.	x 3,500
j.	Female left valve. Detail of external indicating a typical zone of perforations which may be a sieve type structure to a normal pore.	Ref. 28.35/35A.	x 1,625

<u>Eucythere</u> <u>occulta</u> n.sp. Figs. k-r

k.	Female right valve (HOLOTYPE). Lateral view.	Ref. 18.39/39A.	x 135
l.	Female left valve (HOLOTYPE). Lateral view.	Ref. 18.38/38A.	x 130
m.	Male? right valve (PARATYPE). Lateral view.	Ref. 18.36/36A.	x 130
n.	Male? left valve (PARATYPE). Lateral view.	Ref. 18.37/37A.	x 125
o-p.	Female right valve. Detail of internal indicating the anterior (Fig. o) and posterior (Fig. p) terminal elements of a lophodont or merodont hingement. Fig. o	Ref. 32.38A/39.	x 760
	Fig. p	Ref. 28.27/27A.	x 3,125
q.	Female right valve. Detail of internal indicating the muscle scar pattern and several large, open, normal pores.	Ref. 32. 39A/40.	x 495
r.	Female left valve. Detail of external indicating a typical rounded sieve plate to a normal pore.	Ref. 28.26/26A.	x 5,950

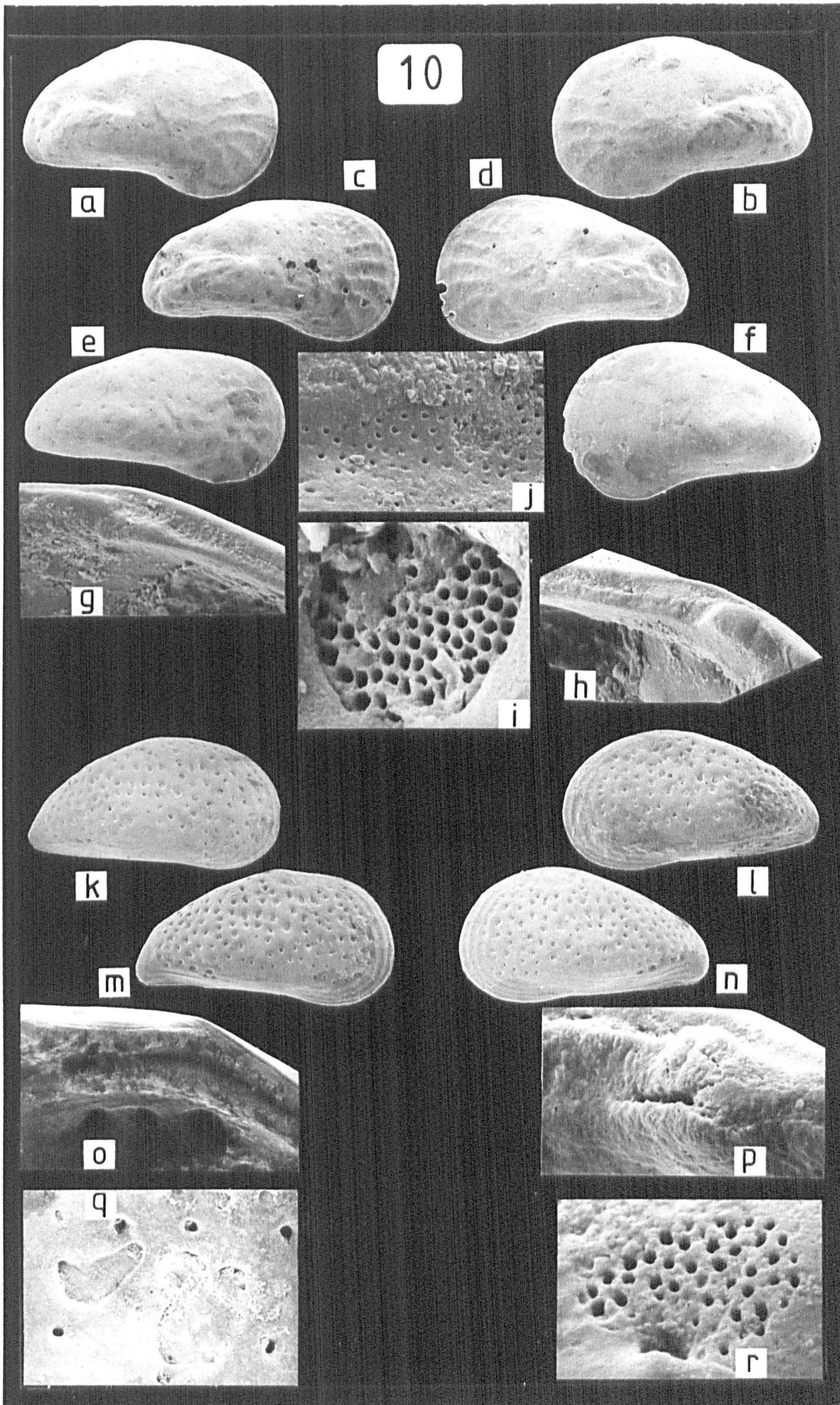
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PLATE 11

<u>Eucythere</u> <u>sp.A.</u> Figs. a-c

Figs.			
a.	Juvenile right valve. Lateral view.	Ref. 18.35/35A.	x 100
b.	Juvenile left valve. Lateral view.	Ref. 18.34/34A.	x 73
c.	Juvenile right valve. Detail of internal vaguely indicating the muscle scar pattern.	Ref. 32.37A/38.	x 305

<u>Eucythere</u> <u>sp.B.</u> Figs. d-f

d.	Adult right valve. Lateral view.	Ref. 18.33/33A.	x 63
e.	Adult right valve. Detail of external indicating the arrangement of sieve plates.	Ref. 28.24/24A.	x 675
f.	Adult right valve. Detail of external indicating the radiate nature of a normal pore sieve structure.	Ref. 28.25/25A.	x 1,950

<u>Krithe</u> <u>praetexta</u> (Sars) 1866 Figs. g-l

g.	Male right valve. Lateral view.	Ref. 14.4A/5.	x 71
h.	Penultimate instar right valve. Lateral view.	Ref. 14.5A/6.	x 85
i.	Male right valve. Detail of internal indicating the muscle scar pattern and minute normal pores.	Ref. 32.1.	x 270
j-k.	Male right valve. Detail of internal indicating the anterior (Fig. j) and posterior (Fig. k) terminal elements of a weakly crenulate but essentially adont hingement. Fig. j	Ref. 32.42A.	x 740
	Fig. k	Ref. 32.41A/42.	x 250
l.	Male right valve. Detail of external indicating a typical normal pore, often partially surrounded by smaller perforations.	Ref. 28.8/8A.	x 8,850

<u>Krithe</u> <u>glacialis</u> Brady, Crosskey and Robertson 1874 Figs. m-r

m.	Female right valve. Lateral view.	Ref. 14.1.	x 78
n.	Female left valve. Lateral view.	Ref. 14.1A/2.	x 78
o.	Male right valve. Lateral view.	Ref. 14.41A/42.	x 85
p.	Male left valve. Lateral view.	Ref. 14.42A.	x 85
q.	Juvenile (A-2) instar right valve. Lateral view.	Ref. 14.2A/3.	x 124
r.	Juvenile (A-2) instar left valve. Lateral view.	Ref. 14.3A/4.	x 124

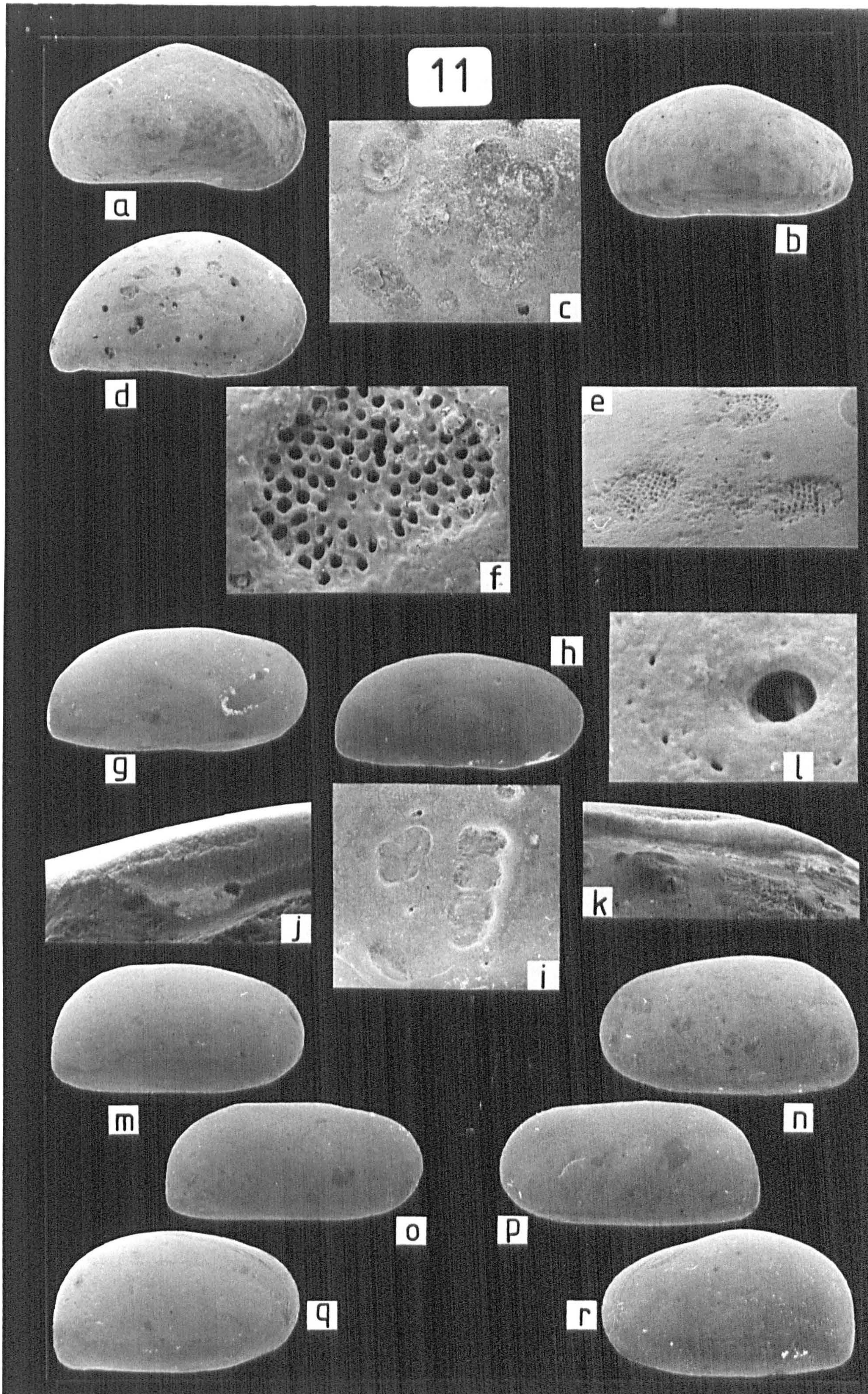
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PLATE 12

Figs.	*Parakrithe angusta* (Brady and Norman) 1889	Figs. a-e	
a.	Female? left valve. Lateral view.	Ref. 7.11A/12.	x 128
b.	Male? right valve. Lateral view.	Ref. 7.10A/11.	x 123
c.	Male? left valve. Lateral view.	Ref. 7.9A/10.	x 123
d.	Penultimate instar? left valve. Lateral view.	Ref. 7.14A/15.	x 163
d.	Female left valve. Detail of external indicating a normal pore sieve structure.	Ref. 7.12A/13.	x 6,375
	Neocytherideis subulata (Brady) 1867	Figs. f-i	
f.	Female right valve. Lateral view.	Ref. 10.17/17A.	x 98
g.	Female left valve. Lateral view.	Ref. 10.18/18A.	x 98
h.	Male right valve. Lateral view.	Ref. 10.14/14A.	x 98
i.	Male left valve. Lateral view.	Ref. 10.13/13A.	x 98
	Pontocythere elongata (Brady) 1868	Figs. j-o	
j.	Female right valve. Lateral view.	Ref. 22.18A/19.	x 52
k.	Female left valve. Lateral view.	Ref. 22.17A/18.	x 52
l.	Male right valve. Lateral view.	Ref. 22.16A/17.	x 46
m.	Male left valve. Lateral view.	Ref. 22.15A/16.	x 46
n.	Penultimate instar right valve. Lateral view.	Ref. 26.-	x 69
o.	Penultimate instar left valve. Lateral view.	Ref. 22.19A/20.	x 78
	Cytherura gibba (O.F. Müller) 1785	Fig. p	
p.	Juvenile (A-2?) left valve. Lateral view.	Ref. 1.32/32A.	x 63
	Cytherura sp. cf. *C. gibba* (O.F. Müller) 1785	Figs. q-x	
q.	Female? right valve. Lateral view.	Ref. 19.1/1A.	x 160
r.	Female? left valve. Lateral view.	Ref. 19.-	x 150
s.	Male? right valve. Lateral view.	Ref. 3.38/38A.	x 163
t.	Male? left valve. Lateral view.	Ref. 3.39/39A.	x 163
u.	Female? right valve. Detail of internal indicating the muscle scar pattern.	Ref. 32.36A/37.	x 180
v-w.	Female? right valve. Detail of internal indicating the anterior (Fig. v) and posterior (Fig. w) terminal elements of a modified entomodont hingement. Fig. v	Ref. 28.22/22A.	x 2,080
	Fig. w	Ref. 28.23/23A.	x 2,080
x.	Female? left valve. Detail of external indicating the general ornament.	Ref. 28.21/21A.	x 500

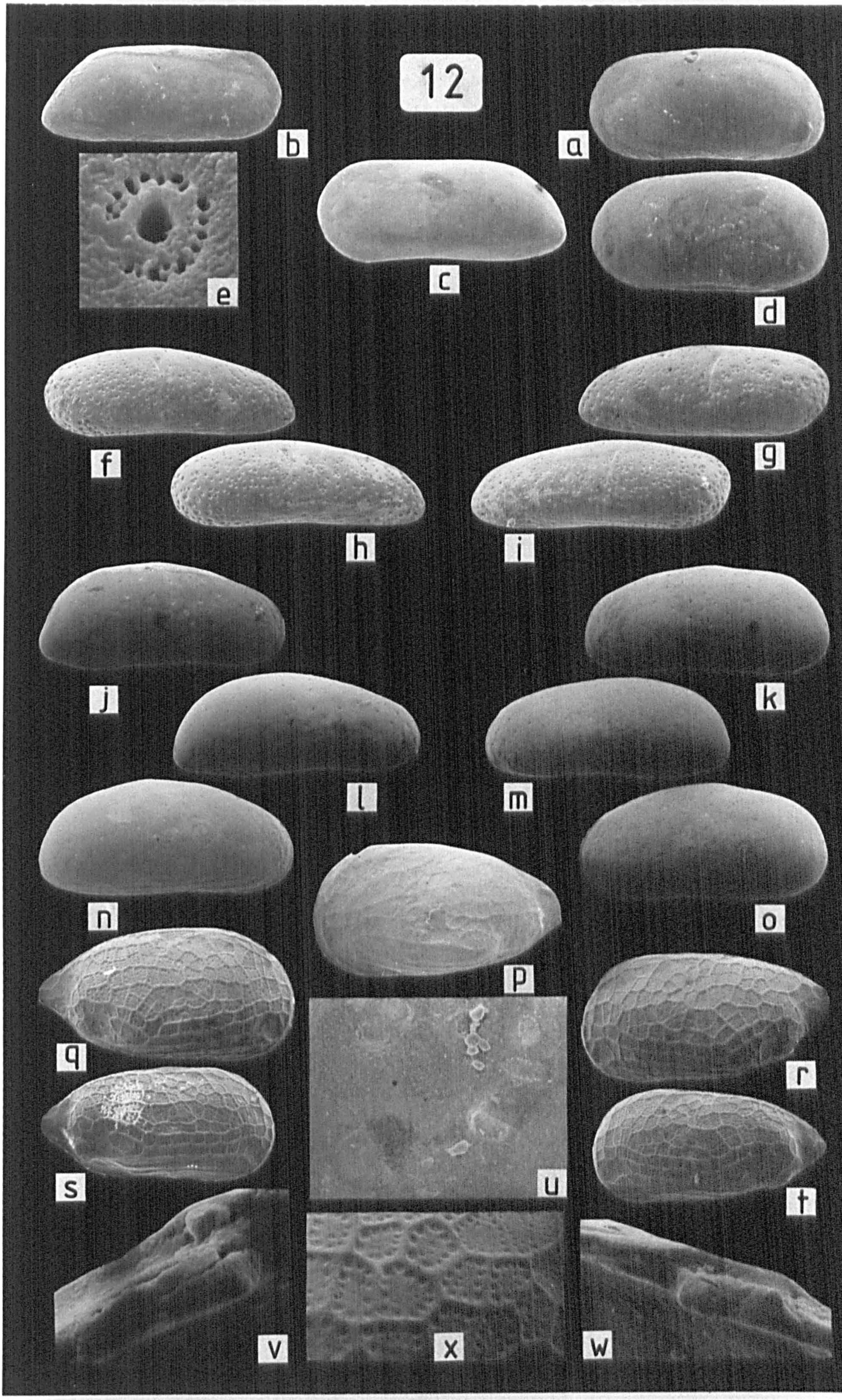
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PLATE 13

Cytheropteron latissimum (Norman) 1864 — Figs. a-f

Figs.			
a.	Female right valve. Lateral view.	Ref. 20.17A/18.	x 84
b.	Female left valve. Lateral view.	Ref. 20.16A/17.	x 85
c.	Adult right valve. Lateral view.	Ref. 20.15A/16.	x 85
d.	Adult left valve. Lateral view.	Ref. 20.14A/15.	x 90
e.	Penultimate instar right valve. Lateral view.	Ref. 20.18A/19.	x 118
f.	Penultimate instar left valve. Lateral view.	Ref. 20.19A/20.	x 118

Cytheropteron angulatum Brady and Robertson 1872 — Figs. g-i

g.	Adult right valve. Lateral view.	Ref. 21.8/8A.	x 120
h.	Penultimate instar left valve. Lateral view.	Ref. 21.11/11A.	x 125
i.	Juvenile (A-2) left valve. Lateral view.	Ref. 21.10/10A.	x 126

Cytheropteron crassipmatum Brady and Norman 1889 — Figs. j-m

j.	Adult right valve. Lateral view.	Ref. 21.5/5A.	x 127
k.	Adult left valve. Lateral view.	Ref. 21.4/4A.	x 125
l.	Penultimate instar right valve. Lateral view.	Ref. 21.7/7A.	x 155
m.	Penultimate instar left valve. Lateral view.	Ref. 26.42/42A.	x 192

Cytheropteron depressum Brady and Norman 1889 — Figs. n-r

n.	Female right valve. Lateral view.	Ref. 21.-	x 143
o.	Female left valve. Lateral view.	Ref. 21.1/1A.	x 143
p.	Male? left valve. Lateral view.	Ref. 21.41/41A.	x 126
q.	Penultimate instar right valve. Lateral view.	Ref. 21.2/2A.	x 163
r.	Penultimate instar left valve. Lateral view.	Ref. 21.3/3A.	x 154

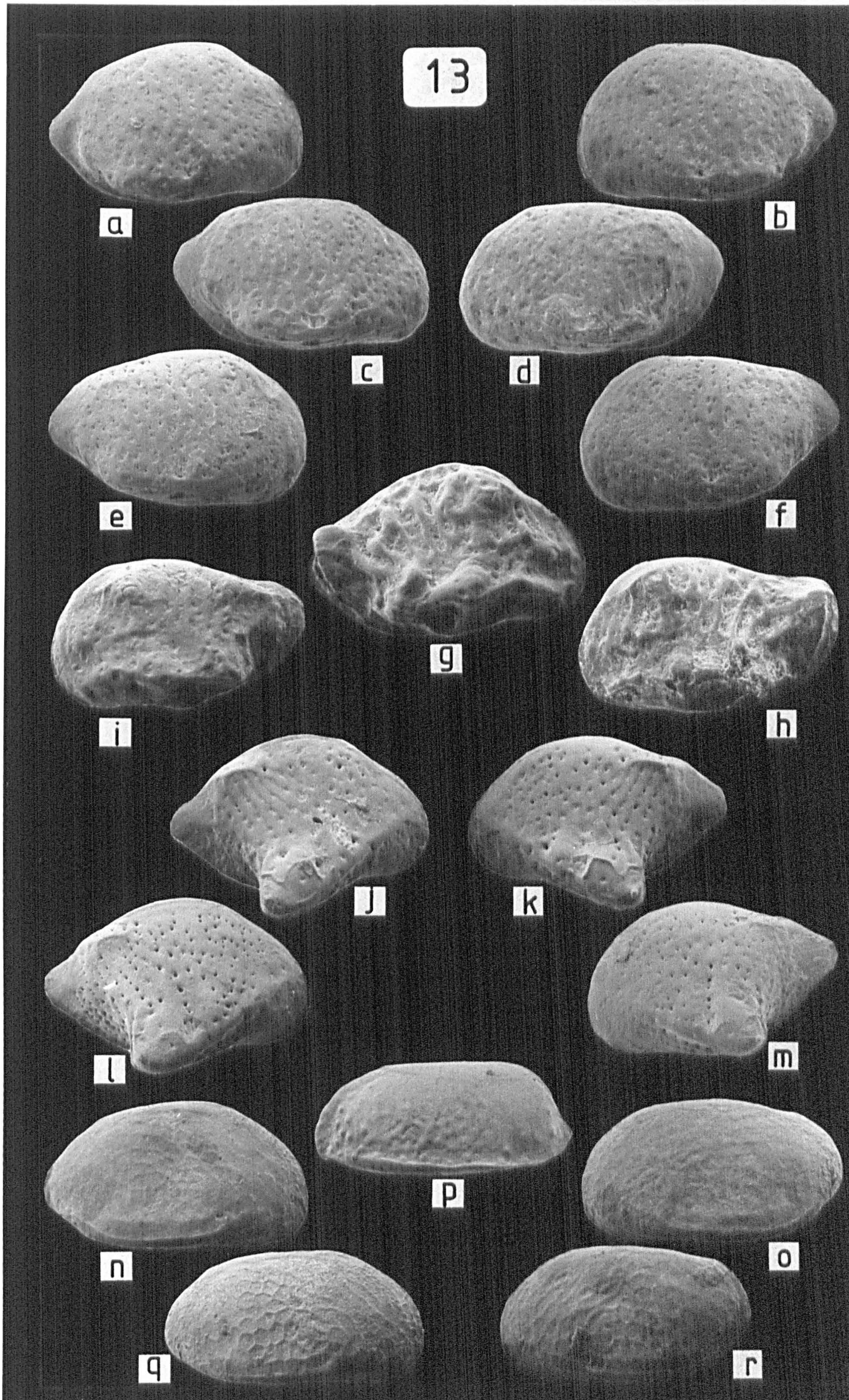
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PLATE 14

<u>Cytheropteron</u> <u>dimlingtonensis</u> Neale and Howe 1973 Figs. a-d

Figs.			
a.	Adult? right valve. Lateral view.	Ref. 19.4/4A.	x 103
b-c.	Adult? right valve. Detail of internal indicating the anterior (Fig. b) and posterior (Fig. c) terminal elements of an entomodont hingement. The dentition of this species is typical of the genus <u>Cytheropteron</u> Sars. Fig. b	Ref. 32.35A/36.	x 300
	Fig. c	Ref. 32.34A/35.	x 300
d.	Adult right valve. Detail of external indicating the general ornament pattern.	Ref. 28.20/20A.	x 500

<u>Cytheropteron</u> <u>dorso</u> <u>costatum</u> Whatley and Masson 1979 Figs. e-h

e.	Adult right valve. Lateral view.	Ref. 21.34/34A.	x 124
f.	Adult left valve. Lateral view.	Ref. 21.35/35A.	x 126
g.	Juvenile (A-2) right valve. Lateral view.	Ref. 21.37/37A.	x 150
h.	Juvenile (A-2) left valve. Lateral view.	Ref. 21.36/36A.	x 150

<u>Cytheropteron</u> <u>excavo</u> <u>alatum</u> Whatley and Masson 1979 Fig. i

i.	Adult? left valve. Lateral view.	Ref. 21.33/33A.	x 90

?<u>Cytheropteron</u> sp. cf. <u>C</u>. <u>infelix</u> Bonaduce, Ciampo and Masoli 1975 Figs. j-l.

j.	Adult left valve. Lateral view.	Ref. 21.30/30A.	x 125
k.	Penultimate instar right valve. Lateral view.	Ref. 21.32/32A.	x 108
l.	Penultimate instar left valve. Lateral view.	Ref. 21.31/31A.	x 108

<u>Cytheropteron</u> <u>inornatum</u> Brady and Robertson 1872 Figs. m-o

m.	Adult left valve. Lateral view.	Ref. 20.20A/21	x 128
n.	Penultimate instar right valve. Lateral view.	Ref. 26.41/41A.	x 175
o.	Penultimate instar left valve. Lateral view.	Ref. 20.23A/24.	x 163

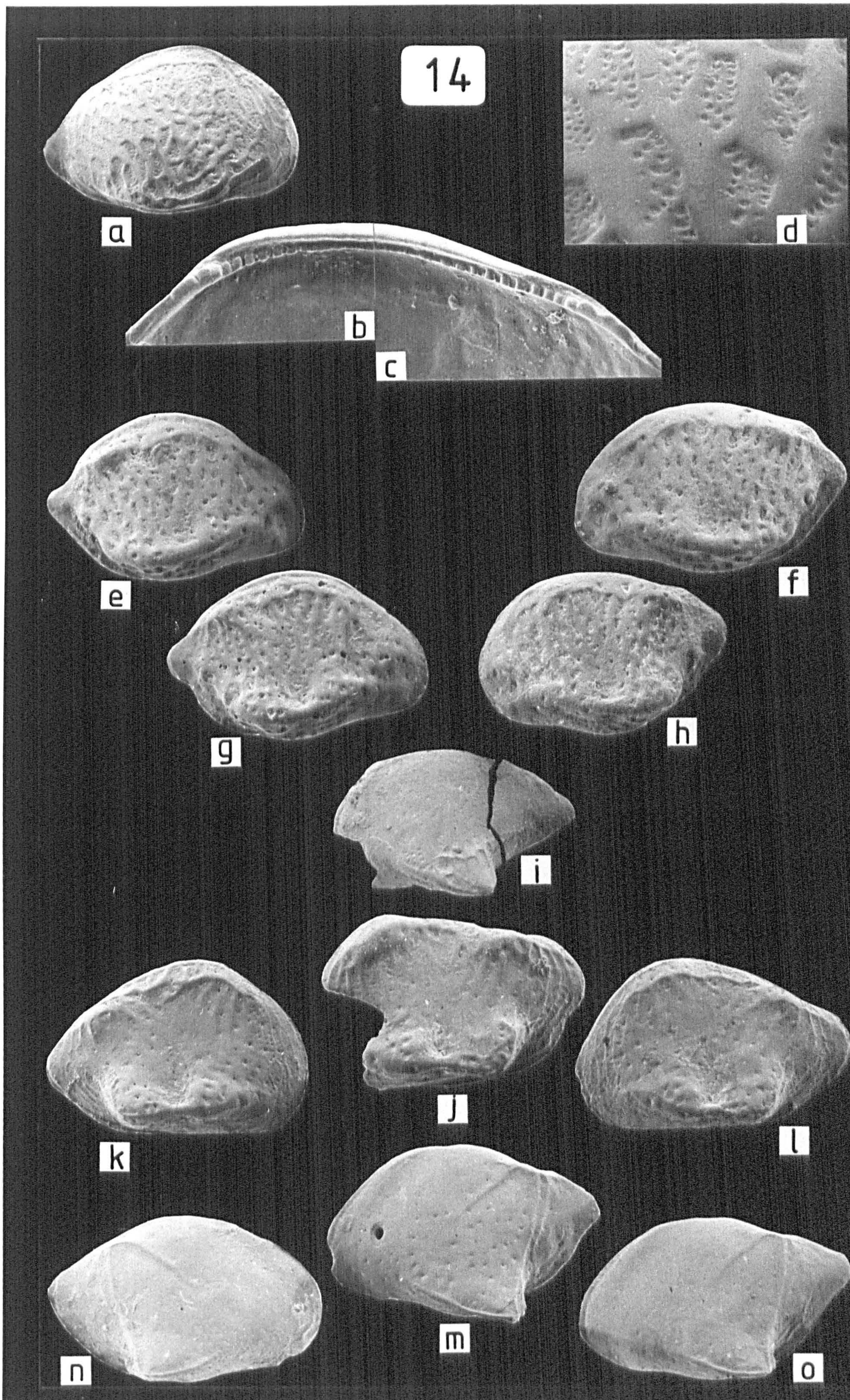
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PLATE 15

<u>Cytheropteron</u> <u>monoceras</u> Bonaduce, Ciampo and Masoli 1975 Figs. a-b

Figs.			
a.	Adult right valve. Lateral view.	Ref. 20.13A/14.	x 133
b.	Adult left valve. Lateral view.	Ref. 20.12A/13.	x 140

<u>Cytheropteron</u> <u>montrosiense</u> Brady, Crosskey and Robertson 1874 Figs. c-d

c.	Adult right valve. Lateral view.	Ref. 20.9A/10.	x 99
d.	Adult left valve. Lateral view.	Ref. 20.10A/11.	x 101

<u>Cytheropteron</u> <u>nodoso-alatum</u> Neale and Howe 1973 Fig. e

e.	Adult right valve. Lateral view.	Ref. 19.18/18A.	x 78

<u>Cytheropteron</u> <u>pyramidale</u> Brady 1868 Fig. f

f.	Adult left valve. Lateral view.	Ref. 19.19/19A.	x 88

<u>Cytheropteron</u> <u>nodosum</u> Brady 1868 Figs. g-l

g.	Adult right valve. Lateral view.	Ref. 20.1A/2.	x 100
h.	Adult left valve. Lateral view.	Ref. 20.2A/3.	x 88
i.	Penultimate instar right valve. Lateral view.	Ref. 20.3A/4.	x 108
j.	Penultimate instar left valve. Lateral view.	Ref. 20.4A/5.	x 108
k.	Juvenile (A-3) right valve. Lateral view.	Ref. 20.5A/6.	x 150
l.	Juvenile (A-4) left valve. Lateral view.	Ref. 20.6A/7.	x 175

<u>Cytheropteron</u> <u>pararcticum</u> Whatley and Masson 1979 Figs. m-r

m.	Adult right valve. Lateral view.	Ref. 20.37A/38.	x 88
n.	Adult left valve. Lateral view.	Ref. 20.38A/39.	x 103
o.	Penultimate instar right valve. Lateral view.	Ref. 20.41A/42.	x 103
p.	Penultimate instar left valve. Lateral view.	Ref. 20.40A/41.	x 103
q.	Juvenile (A-3) right valve. Lateral view.	Ref. 20.1.	x 202
r.	Juvenile (A-3) left valve. Lateral view.	Ref. 20.42A.	x 208

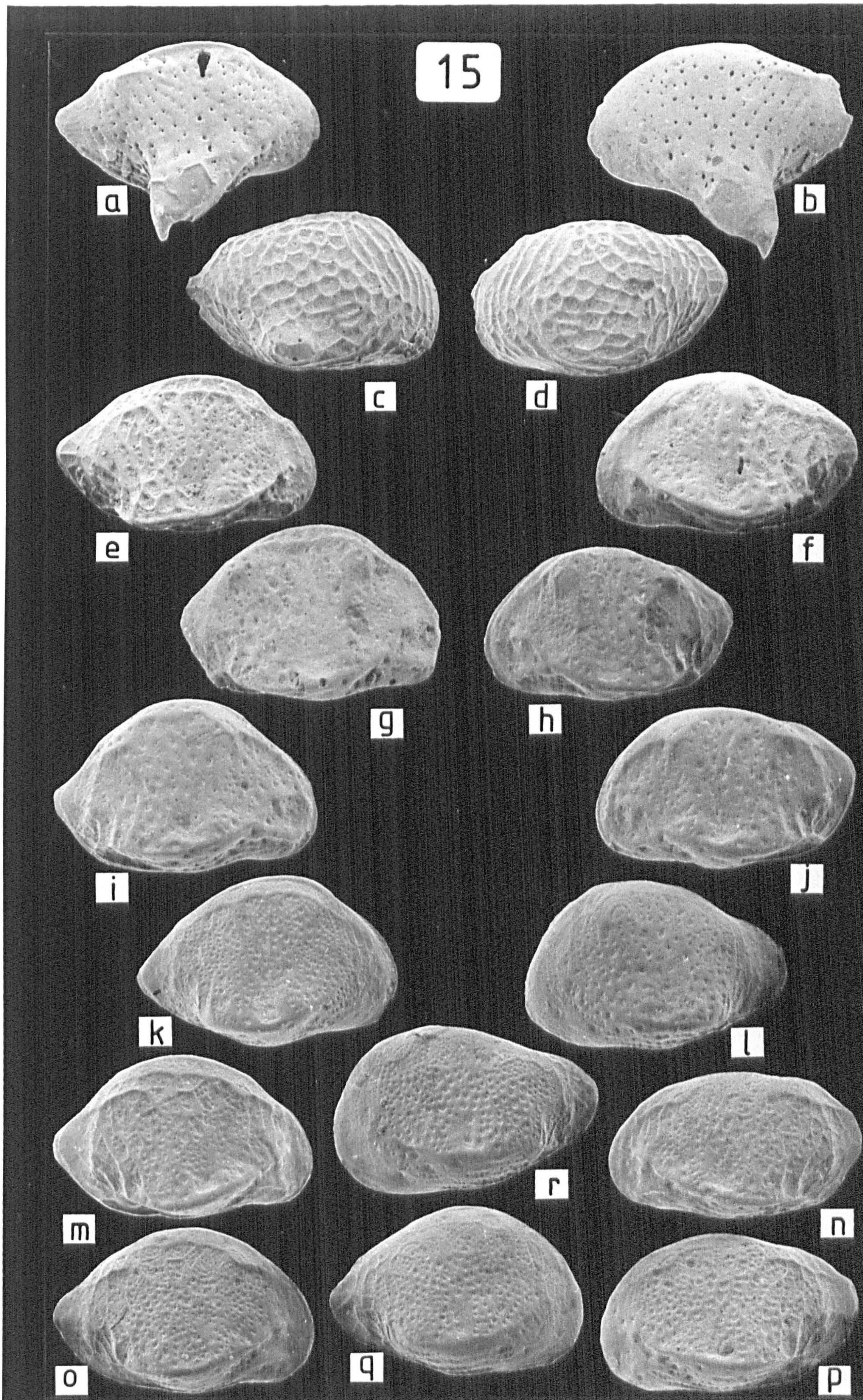
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PLATE 16

Cytheropteron pseudo crassipinatum Whatley and Masson 1979 — Figs. a-d

Figs.			
a.	Adult right valve. Lateral view.	Ref. 20.34A/35.	x 130
b.	Adult left valve. Lateral view.	Ref. 20.33A/34.	x 125
c.	Penultimate instar right valve. Lateral view.	Ref. 20.35A/36.	x 170
d.	Penultimate instar left valve. Lateral view.	Ref. 20.36A/37.	x 165

Cytheropteron pseudo montrosiense Whatley and Masson 1979 — Figs. e-h

e.	Female? right valve. Lateral view.	Ref. 19.26/26A.	x 230
f.	Adult left valve. Lateral view.	Ref. 19.28/28A.	x 252
g.	Male? right valve. Lateral view.	Ref. 19.27/27A.	x 250
h.	Penultimate instar left valve. Lateral view.	Ref. 19.29/29A.	x 298

Cytheropteron punctatum Brady 1868 — Figs. i-n

i.	Adult right valve. Lateral view.	Ref. 19.20/20A.	x 120
j.	Adult left valve. Lateral view.	Ref. 19.21/21A.	x 120
k.	Adult right valve. Lateral view.	Ref. 19.22/22A.	x 118
l.	Adult left valve. Lateral view.	Ref. 19.23/23A.	x 130
m.	Juvenile (A-2) right valve. Lateral view.	Ref. 19.24/24A.	x 175
n.	Juvenile (A-2) left valve. Lateral view.	Ref. 19.25/25A.	x 177

Cytheropteron pyramidale Brady 1868 — Fig. o

o.	Adult right valve. Lateral view.	Ref. 20.7A/8.	x 88

Cytheropteron nodosoalatum Neale and Howe 1973 — Fig. p

p.	Adult left valve. Lateral view.	Ref. 20.8A/9.	x 88

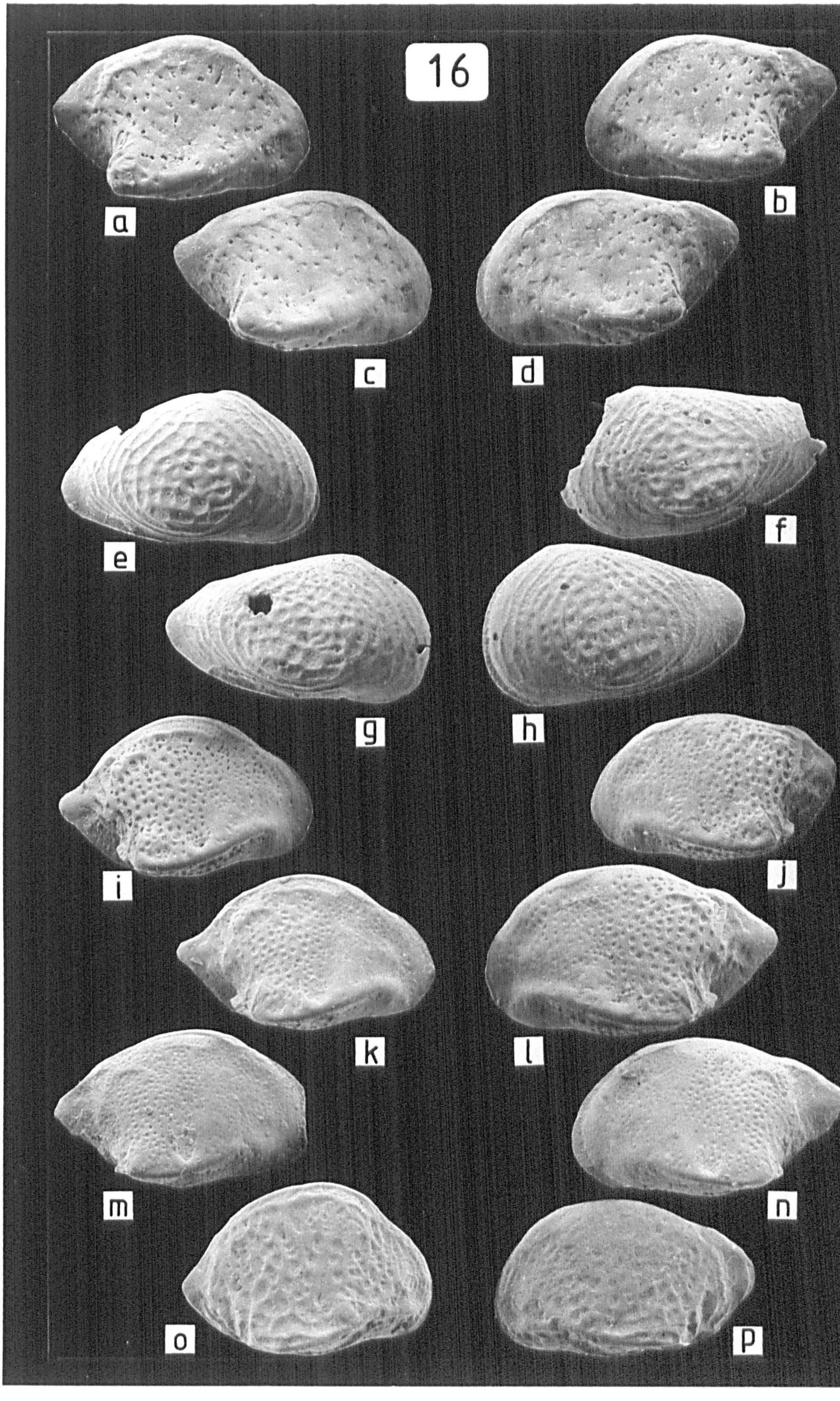
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PLATE 17

Cytheropteron? sedovi Schneider 1969 — Fig. a

Figs.			
a.	Adult left valve. Lateral view.	Ref. 19.17/17A.	x 125

Cytheropteron simplex Whatley and Masson 1979 — Fig. b

b.	Juvenile left valve. Lateral view.	Ref. 19.16/16A.	x 131

Cytheropteron testudo Sars 1869 — Fig. c

C.	Adult left valve. Lateral view.	Ref. 19.15/15A.	x 90

Cytheropteron vespertilio (Reuss) 1850 — Figs. d-j

d.	Adult right valve. Lateral view.	Ref. 19.12/12A.	x 88
e.	Adult left valve. Lateral view.	Ref. 19.13/13A.	x 88
f.	Adult right valve. Lateral view.	Ref. 19.10/10A.	x 88
g.	Adult left valve. Lateral view.	Ref. 19.11/11A.	x 88
h.	Adult right valve. Dorsal view.	Ref. 27.35A/36.	x 75
i.	Adult left valve. Dorsal view.	Ref. 27.34A/35.	x 75
j.	Penultimate instar left valve. Lateral view.	Ref. 19.14/14A.	x 114

Cytheropteron volantium Whatley and Masson 1979 — Figs. k-p

k.	Adult right valve. Lateral view.	Ref. 19.6/6A.	x 98
l.	Adult left valve. Lateral view.	Ref. 19.5/5A.	x 95
m.	Penultimate instar right valve. Lateral view.	Ref. 19.9/9A.	x 113
n.	Penultimate instar left valve. Lateral view.	Ref. 26.39/39A.	x 121
o.	Adult right valve. Dorsal view.	Ref. 27.37A/38.	x 85
p.	Adult left valve. Dorsal view.	Ref. 27.36A/37.	x 81

Cytheropteron brastadensis Lord 1981 — Fig. q

q.	Adult right valve. Lateral view.	Ref. 20.22A/23.	x 115

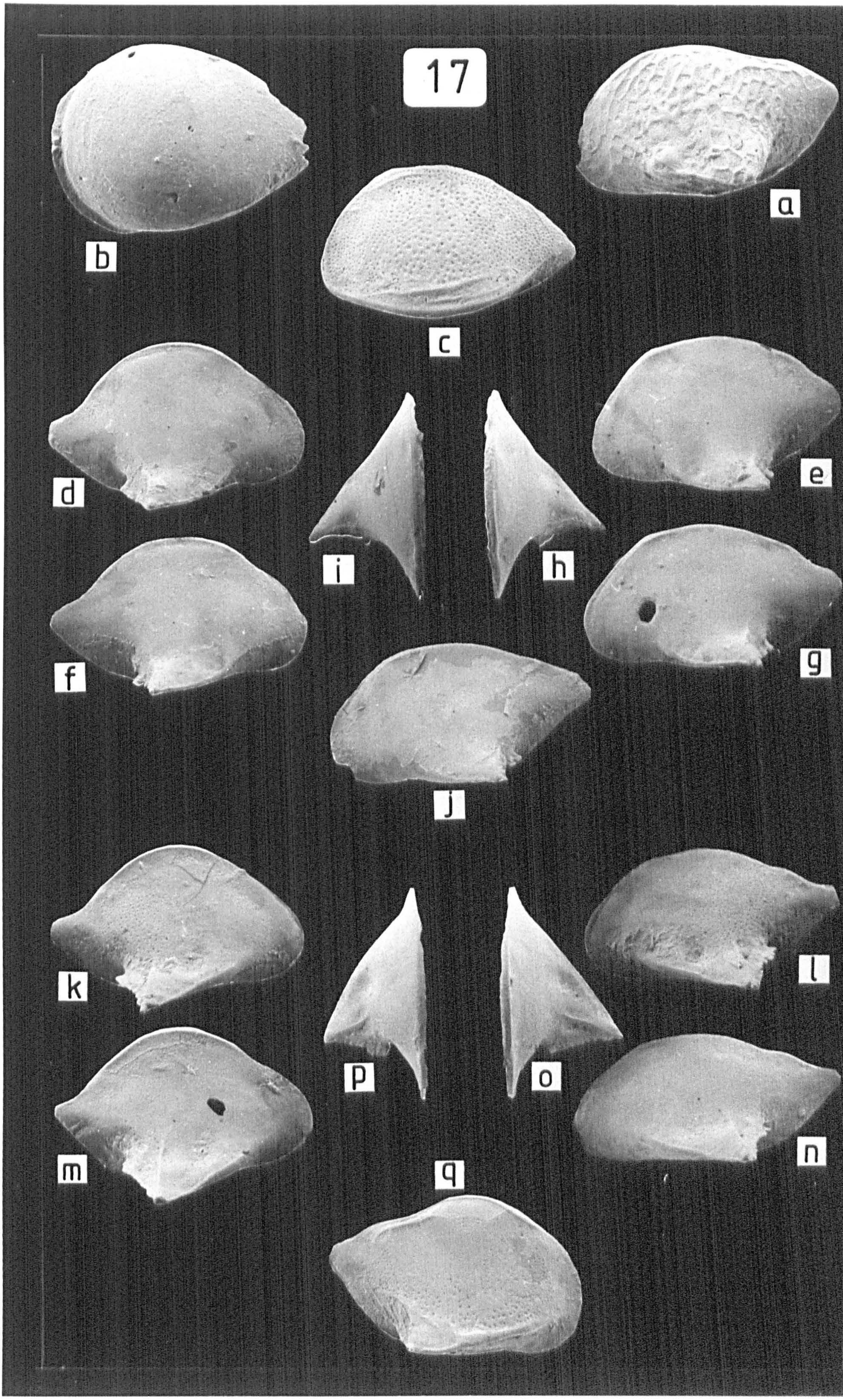
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PLATE 18

Figs.	*Eucytherura complexa* (Brady) 1866)	Figs. a-d	
a.	Female? left valve. Lateral view.	Ref. 16.25A/26.	x 168
b.	Male? left valve. Lateral view.	Ref. 16.26A/27.	x 170
c.	Penultimate instar right valve. Lateral view.	Ref. 16.27A/28.	x 175
d.	Penultimate instar left valve. Lateral view.	Ref. 16.28A/29.	x 185

	Hemicytherura cellulosa (Norman) 1865	Figs. e-j	
e.	Female right valve. Lateral view.	Ref. 16.1.	x 155
f.	Female left valve. Lateral view.	Ref. 16.1A/2.	x 160
g.	Male right valve. Lateral view.	Ref. 16.41A/42.	x 175
h.	Male left valve. Lateral view.	Ref. 16.42A.	x 170
i.	Penultimate instar right valve. Lateral view.	Ref. 16.2A/3.	x 175
j.	Penultimate instar left valve. Lateral view.	Ref. 16.3A/4.	x 175

	Hemicytherura clathrata (Sars) 1866	Figs. k-p	
k.	Female right valve. Lateral view.	Ref. 16.38A/39.	x 115
l.	Female left valve. Lateral view.	Ref. 16.37A/38.	x 115
m.	Male right valve. Lateral view.	Ref. 16.36A/37.	x 120
n.	Male left valve. Lateral view.	Ref. 26.38/38A.	x 118
o.	Penultimate instar right valve. Lateral view.	Ref. 16.39A/40.	x 130
p.	Penultimate instar left valve. Lateral view.	Ref. 16.40A/41.	x 130

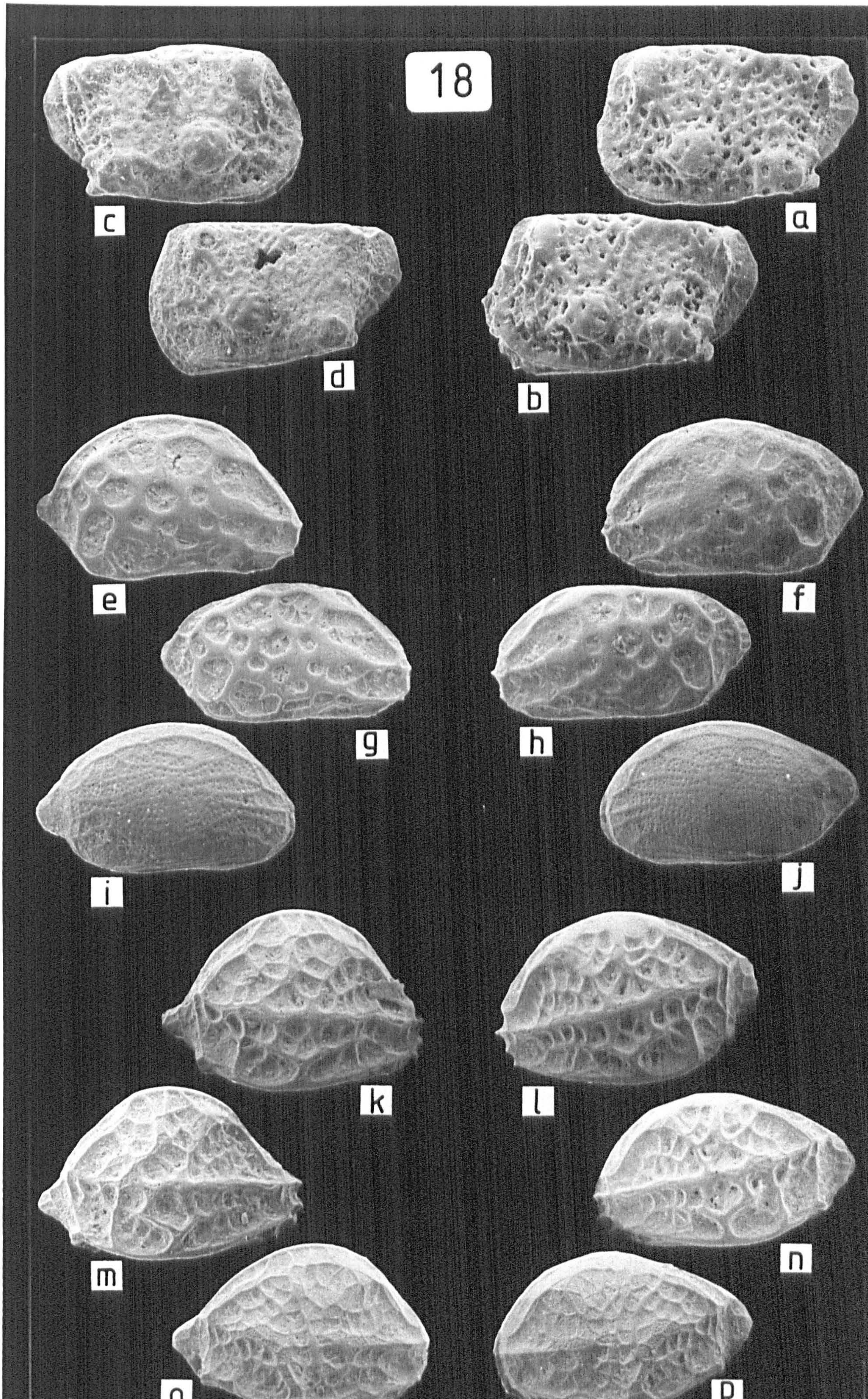

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PLATE 19

Hemicytherura hoskini Horne 1981 — Figs. a-d

Figs.				
a.	Female right valve.	Lateral view.	Ref. 15.33/33A.	x 175
b.	Female left valve.	Lateral view.	Ref. 15.32/32A.	x 185
c.	Male right valve.	Lateral view.	Ref. 15.30/30A.	x 200
d.	Male left valve.	Lateral view.	Ref. 15.31/31A.	x 220

Kangarina abyssicola (G.W. Müller) 1894 — Figs. e-j

e.	Female? right valve.	Lateral view.	Ref. 14.8A/9.	x 145
f.	Female? left valve.	Lateral view.	Ref. 14.9A/10.	x 145
g.	Male? right valve.	Lateral view.	Ref. 14.7A/8.	x 150
h.	Male? left valve.	Lateral view.	Ref. 14.6A/7.	x 150
i.	Penultimate instar right valve.	Lateral view.	Ref. 14.10A/11.	x 168
j.	Penultimate instar left valve.	Lateral view.	Ref. 14.11A/12.	x 168

Microcytherura fulva (Brady and Robertson) 1874 — Figs. k-p

k.	Female right valve.	Lateral view.	Ref. 10.29/29A.	x 165
l.	Female left valve.	Lateral view.	Ref. 10.30/30A.	x 160
m.	Male right valve.	Lateral view.	Ref. 10.28/28A.	x 155
n.	Male left valve.	Lateral view.	Ref. 10.27/27A.	x 155
o.	Penultimate instar right valve.		Ref. 10.32/32A.	x 170
p.	Penultimate instar left valve.		Ref. 10.31/31A.	x 170

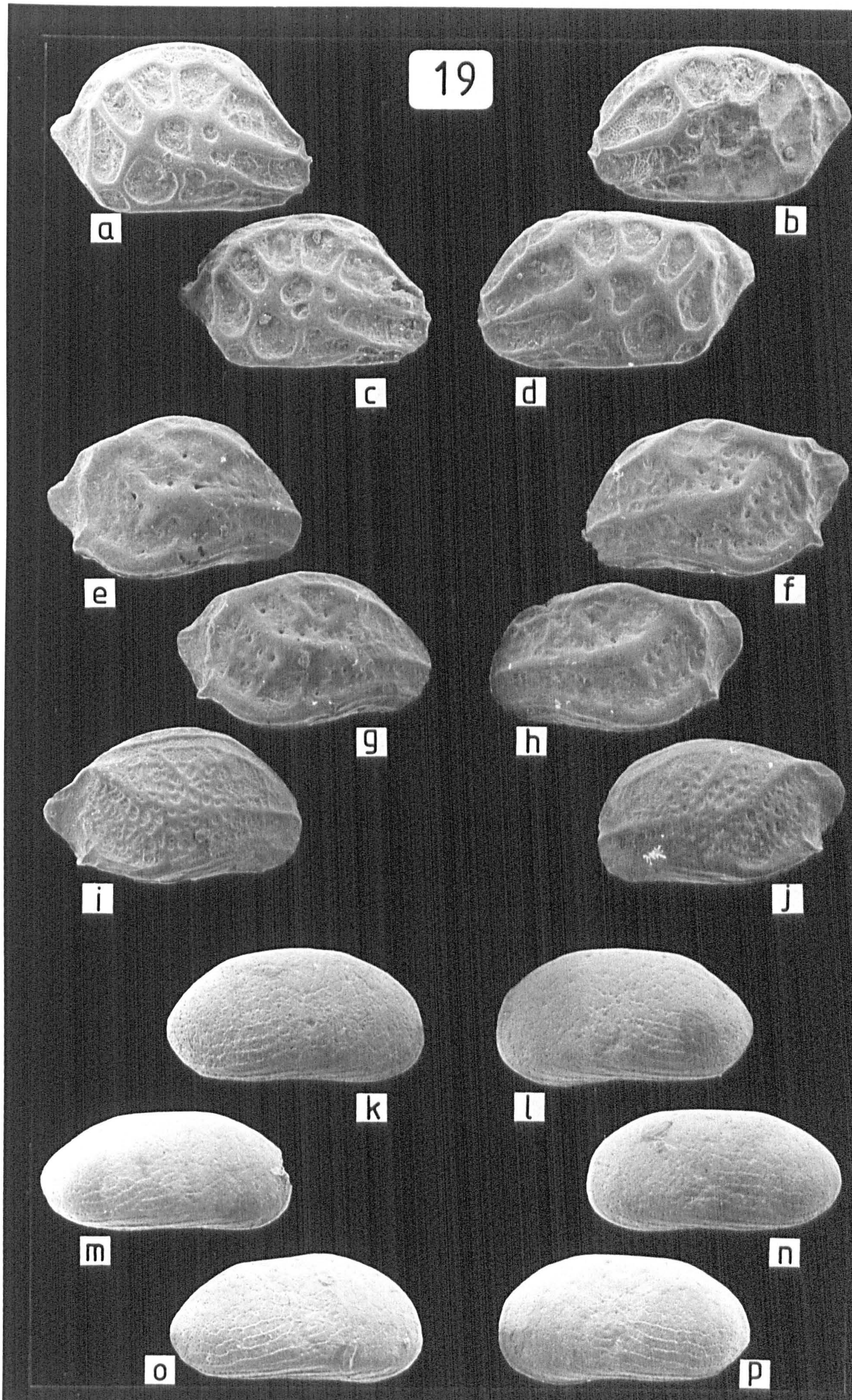
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PLATE 20

?Cytheromorpha sp. — Figs. a-f

Figs.				
a.	Adult right valve. Lateral view.		Ref. 6.22A/23.	x 250
b.	Adult left valve. Lateral view.		Ref. 6.24A/25.	x 250
c.	Adult right valve. Detail of internal indicating the muscle scar pattern and a number of large, open, normal pores.		Ref. 33.9/9A.	x 1,125
d-e.	Adult right valve. Detail of internal indicating the anterior (Fig. d) and posterior (Fig. e) terminal elements of a gongylodont hingement.	Fig. d	Ref. 31.40/40A.	x 1,760
		Fig. e	Ref. 31.-	x 1,680
f.	Adult left valve. Detail of external indicating the nature of surface ornament and a circular, finely perforated sieve plate and pore.		Ref. 6.23A/24.	x 2,500

Semicytherura nigrescens (Baird) 1838 — Figs. g-k

g.	Female right valve. Lateral view.		Ref. 4.3A/4.	x 130
h.	Female left valve. Lateral view.		Ref. 4.2A/3.	x 145
i.	Male right valve. Lateral view.		Ref. 4.5A/6.	x 145
j.	Male left valve. Lateral view.		Ref. 4.4A/5.	x 130
k.	Penultimate instar right valve. Lateral view.		Ref. 4.7A/8.	x 155

Semicytherura sp. cf. *S. affinis* (Sars) 1865 — Figs. l-r

l.	Female right valve. Lateral view.		Ref. 3.31/31A.	x 78
m.	Male right valve. Lateral view.		Ref. 4.33A/34.	x 100
n.	Penultimate instar? left valve. Lateral view.		Ref. 3.33/33A.	x 109
o.	Female right valve. Detail of internal indicating the pattern of muscle scars.		Ref. 33.25/25A.	x 530
p-q.	Female right valve. Detail of internal indicating the anterior (Fig. p) and posterior (Fig. q) terminal elements of a merodont hingement.	Fig. p	Ref. 33.24/24A.	x 440
		Fig. q	Ref. 33.23/23A.	x 440
r.	Penultimate instar? left valve. Detail of external indicating a simple, open, normal pore.		Ref. 31.18/18A.	x 10,000

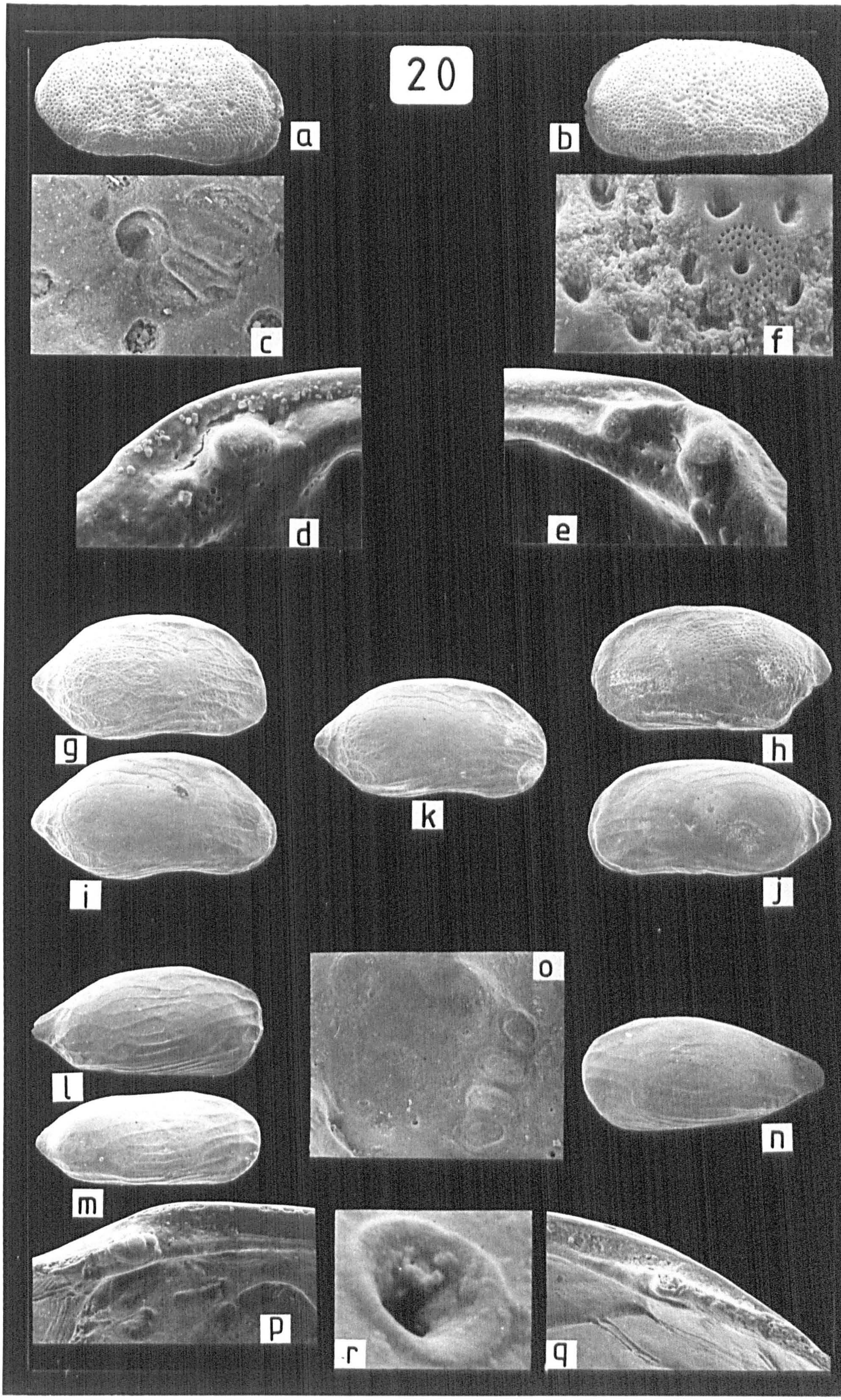
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PLATE 21

Semicytherura acuticostata (Sars) 1866 — Figs. a-m

Figs.				
a.	Female right valve. Lateral view.		Ref. 5.9/9A.	x 120
b.	Female left valve. Lateral view.		Ref. 5.8/8A.	x 115
c.	Male right valve. Lateral view.		Ref. 5.6/6A.	x 110
d.	Male left valve. Lateral view.		Ref. 5.7/7A.	x 110
e.	Penultimate instar right valve. Lateral view.		Ref. 5.12/12A.	x 270
f.	Penultimate instar left valve. Lateral view.		Ref. 5.13/13A.	x 270
g.	Juvenile (A-2) left valve. Lateral view.		Ref. 5.11/11A.	x 180
h.	Female right valve. Dorsal view.		Ref. 33.11/11A.	x 114
i.	Female right valve. Detail of internal indicating the muscle scar pattern.		Ref. 31.4/4A.	x 730
j-k.	Female right valve. Detail of internal indicating the anterior (Fig. j) and posterior (Fig. k) terminal elements of what appears to be a merodont hinge.	Fig. j	Ref. 31.3/3A.	x 810
		Fig. k	Ref. 31.2/2A.	x 810
l.	Female left valve. Detail of external in the postero-ventral region indicating the distinct ornament and several boss-like normal pores.		Ref. 31.-	x 405
m.	Female left valve. Detail of external indicating a raised tubercle with a normal pore canal.		Ref. 31.1/1A.	x 4,050

Semicytherura sp. cf. S. acuticostata (Sars) 1866 — Figs. n-x

n.	Female right valve. Lateral view.		Ref. 3.7/7A.	x 88
o.	Female left valve. Lateral view.		Ref. 3.8/8A.	x 88
p.	Male right valve. Lateral view.		Ref. 3.5/5A.	x 75
q.	Male left valve. Lateral view.		Ref. 3.6/6A.	x 80
r.	Penultimate instar right valve. Lateral view.		Ref. 3.10/10A.	x 113
s.	Penultimate instar left valve. Lateral view.		Ref. 3.9/9A.	x 113
t.	Juvenile (A-2) right valve. Lateral view.		Ref. 3.11/11A.	x 128
u.	Female right valve. Dorsal view.		Ref. 33.10/10A.	x 180
v.	Female right valve. Detail of internal indicating the muscle scar pattern.		Ref. 31.7/7A.	x 638
w-x.	Female right valve. Detail of internal indicating the anterior (Fig. w) and posterior (Fig. x) terminal elements of an antimerodont hingement.	Fig. w	Ref. 31.6/6A.	x 640
		Fig. x	Ref. 31.5/5A.	x 1,000

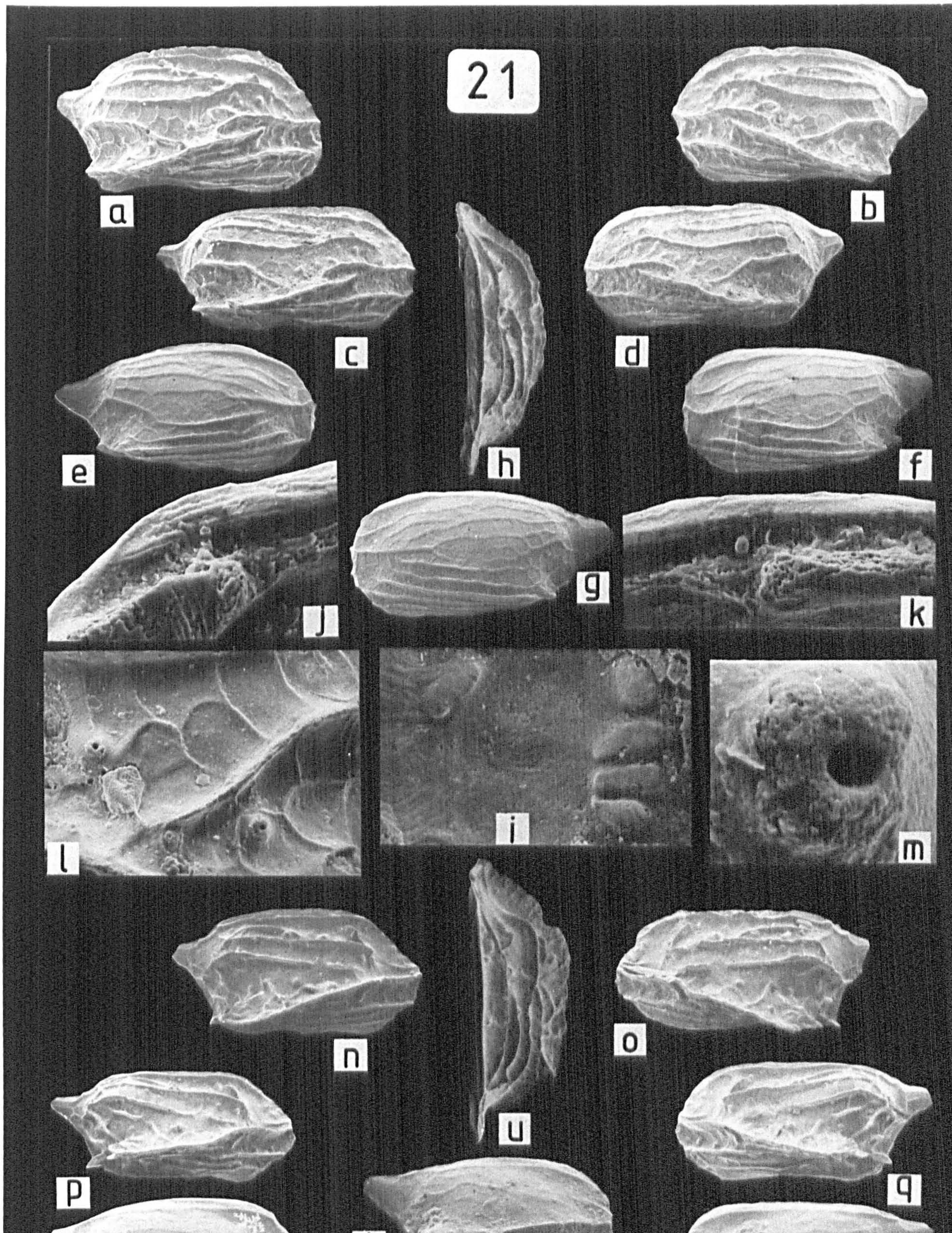
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PLATE 22

Figs.	<u>Semicytherura</u> <u>angulata</u> (Brady) 1868		Figs. a-f	
a.	Female right valve. Lateral view.		Ref. 4.27A/28.	x 130
b.	Female left valve. Lateral view.		Ref. 4.26A/27.	x 130
c.	Male right valve. Lateral view.		Ref. 4.24A/25.	x 126
d.	Male left valve. Lateral view.		Ref. 4.25A/26.	x 126
e.	Penultimate instar right valve. Lateral view.		Ref. 26.26/26A.	x 163
f.	Penultimate instar left valve. Lateral view.		Ref. 26.25/25A.	x 163

	<u>Semicytherura</u> <u>bodotria</u> (Scott) 1890		Figs. g-n	
g.	Adult right valve. Lateral view.		Ref. 4.22A/23.	x 126
h.	Adult left valve. Lateral view.		Ref. 4.21A/22.	x 145
i.	Penultimate instar right valve. Lateral view.		Ref. 4.23A/24.	x 126
j.	Adult left valve. Ventral view.		Ref. 31.12/12A.	x 101
k.	Adult left valve. Details of external indicating the pattern of ornament on the posterior portion of the valve.		Ref. 31.8/8A.	x 258
l.	Adult left valve. Details of external indicating the longitudinal ribs and the development of tubercles and boss-like structures associated with normal pore canals.		Ref. 31.9/9A.	x 470
m-n.	Adult left valve. Detail of external indicating the characteristic tuberculation of both the closed form (Fig. m) and the open form (Fig. n).	Fig. m	Ref. 31.11/11A.	x 4,325
		Fig. n	Ref. 31.10/10A.	x 3,250

	<u>Semicytherura</u> <u>cornuta</u> (Brady) 1868		Figs. o-q	
o.	Female right valve. Lateral view.		Ref. 4.9A/10.	x 120
p.	Female left valve. Lateral view.		Ref. 4.10A/11.	x 120
q.	Male right valve. Lateral view.		Ref. 4.11A/12.	x 98

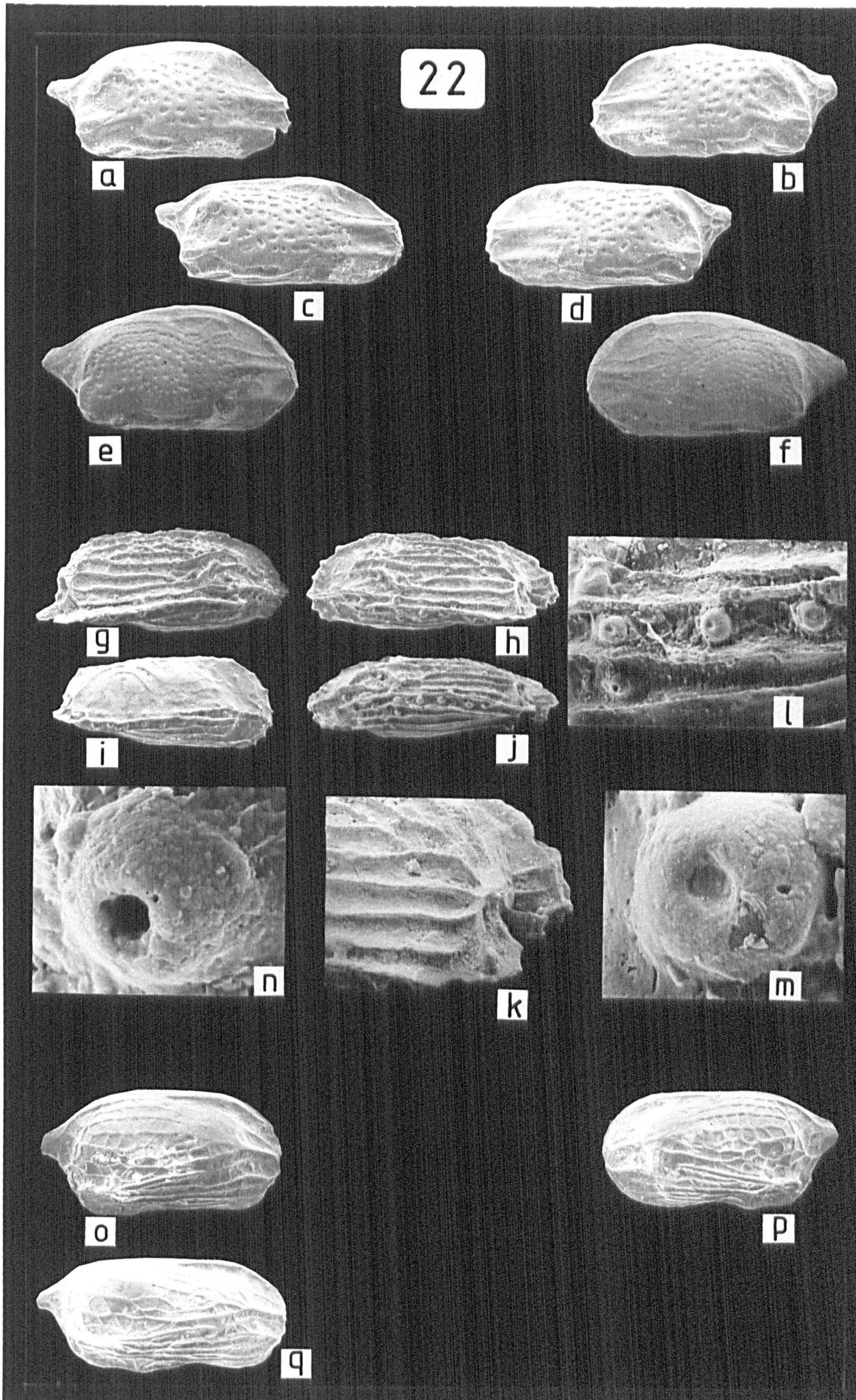
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PLATE 23

Semicytherura concentrica (Brady, Crosskey and Robertson) 1874

Figs. a-d

Figs.				
a.	Female? right valve. Lateral view.		Ref. 4.19A/20.	x 123
b.	Female? left valve. Lateral view.		Ref. 4.16A/17.	x 105
c.	Adult left valve. Lateral view.		Ref. 4.20A/21.	x 123
d.	Penultimate instar right valve. Lateral view.		Ref. 1.29/29A.	x 126

Semicytherura sp. cf. S. concentrica (Brady, Crosskey and Robertson) 1874

Figs. e-l

e.	Adult right valve. Lateral view.		Ref. 1.27/27A. 28/28A.	x 126
f.	Adult right valve. Lateral view.		Ref. 4.15A/16.	x 120
g.	Adult left valve. Lateral view.		Ref. 4.14A/15.	x 120
h.	Adult right valve. Detail of internal indicating the muscle scar pattern.		Ref. 33.16/16A.	x 433
i-j.	Adult right valve. Detail of internal indicating the anterior (Fig. i) and posterior (Fig. j) terminal elements of a merodont hingement.	Fig. i	Ref. 33.15/15A.	x 975
		Fig. j	Ref. 33.14/14A.	x 975
k.	Adult left valve. Detail of external indicating the ornament and normal pore canals.		Ref. 31.13/13A.	x 1,150
l.	Adult left valve. Detail of external indicating the aperture and raised margin of a typical normal pore canal in the antero-dorsal region.		Ref. 31.14/14A.	x 8,800

Semicytherura sp. cf. S. costata (G.W. Müller) 1894 Figs. m-p

m.	Adult left valve. Lateral view.		Ref.4.34A/35.	x 126
n.	Adult right valve. Detail of internal indicating the muscle scar pattern.		Ref. 33.19/19A.	x 418
o-p.	Adult right valve. Detail of internal indicating the anterior (Fig. o) and posterior (Fig. p) terminal elements of a merodont hingement.	Fig. o	Ref. 33.18/18A.	x 860
		Fig. p	Ref. 33.17/17A.	x 860

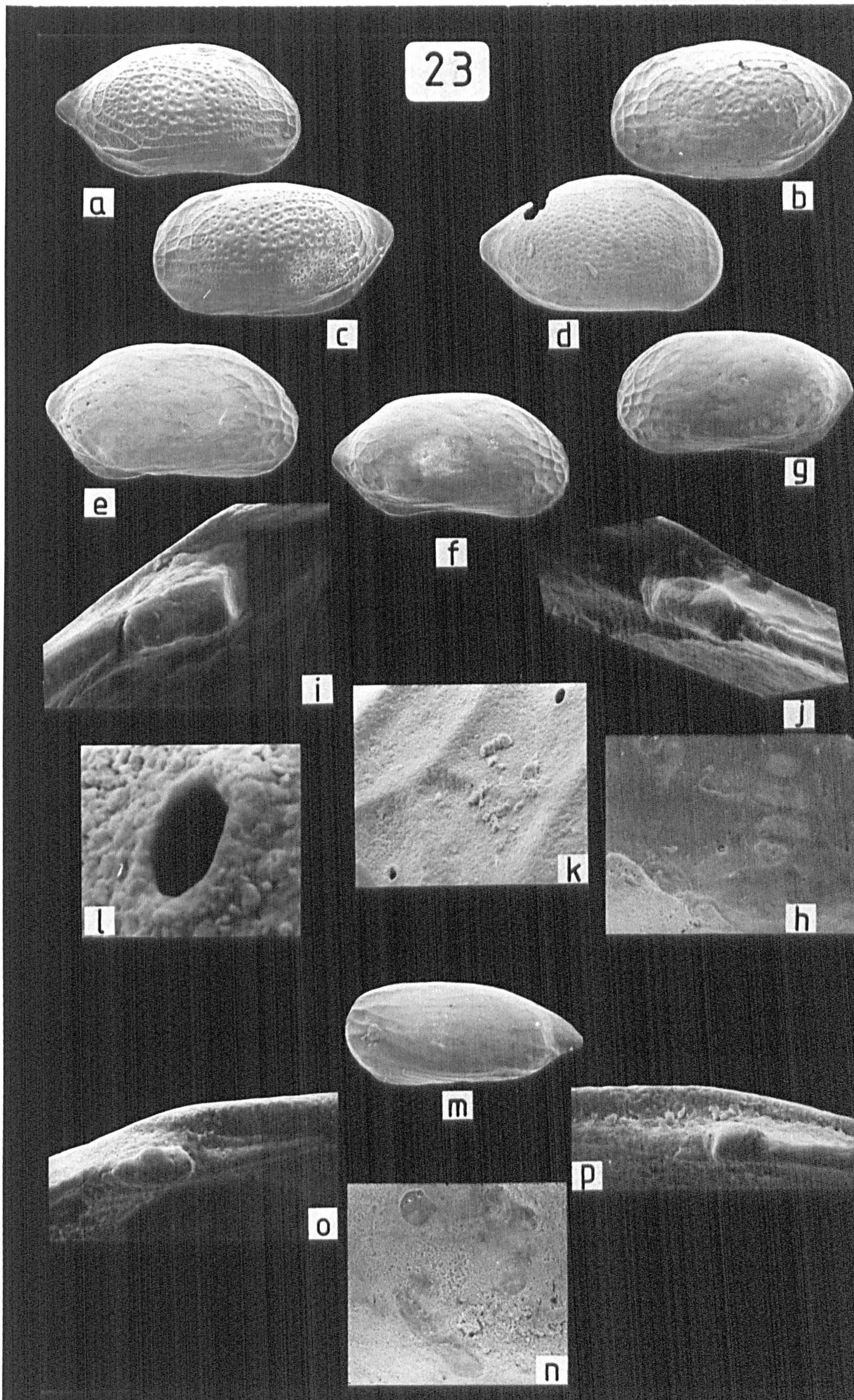

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PLATE 24

<u>Semicytherura</u> <u>producta</u> (Brady) 1868 — Figs. a-h

Figs.			
a.	Female right valve. Lateral view.	Ref. 4.39A/40.	x 115
b.	Female left valve. Lateral view.	Ref. 4.40A/41.	x 115
c.	Male right valve. Lateral view.	Ref. 4.41A/42.	x 115
d.	Male left valve. Lateral view.	Ref. 4.42A.	x 115
e.	Male right valve. Lateral view, highly ornamented form.	Ref. 4.38A/39.	x 118
f.	Male left valve. Lateral view, highly ornamented form.	Ref. 4.37A/38.	x 112
g.	Penultimate instar? right valve. Lateral view.	Ref. 4.1/1A.	x 160
h.	Penultimate instar? left valve. Lateral view.	Ref. 4.2.	x 165

<u>Semicytherura</u> <u>robertsoni</u> (Brady) 1868 — Figs. i-o

i.	Female left valve. Lateral view.	Ref. 4.35A/36.	x 101
j.	Penultimate? instar left valve. Lateral view.	Ref. 4.36A/37.	x 128
k.	Female left valve. Detail of internal indicating the muscle scar pattern.	Ref. 33.22/22A.	x 740
1-m.	Female left valve. Detail of internal indicating the anterior (Fig. 1) and posterior (Fig. m) terminal elements of an entomodont hinge. Fig. 1	Ref. 33.20/20A.	x 605
	Fig. m	Ref. 33.21/21A.	x 605
n.	Female left valve. Detail of external indicating the general ornament pattern and normal pore canals. (Dorso-median area)	Ref. 31.16/16A.	x 470
o.	Female left valve. Detail of external indicating one of the large normal pores.	Ref. 31.17/17A.	x 363

<u>Semicytherura</u> <u>sella</u> (Sars) 1866 — Figs. p-v

p.	Female right valve. Lateral view.	Ref. 26.24/24A.	x 138
q.	Female left valve. Lateral view.	Ref. 3.37/37A.	x 123
r.	Male right valve. Lateral view.	Ref. 3.35/35A.	x 115
s.	Male left valve. Lateral view.	Ref. 3.34/34A.	x 118
t.	Penultimate instar? right valve. Lateral view.	Ref. 3.23/23A.	x 155
u.	Penultimate instar? left valve. Lateral view.	Ref. 3.24/24A.	x 155
v.	Juvenile (A-2)? right valve. Lateral view.	Ref. 3.40.	x 155

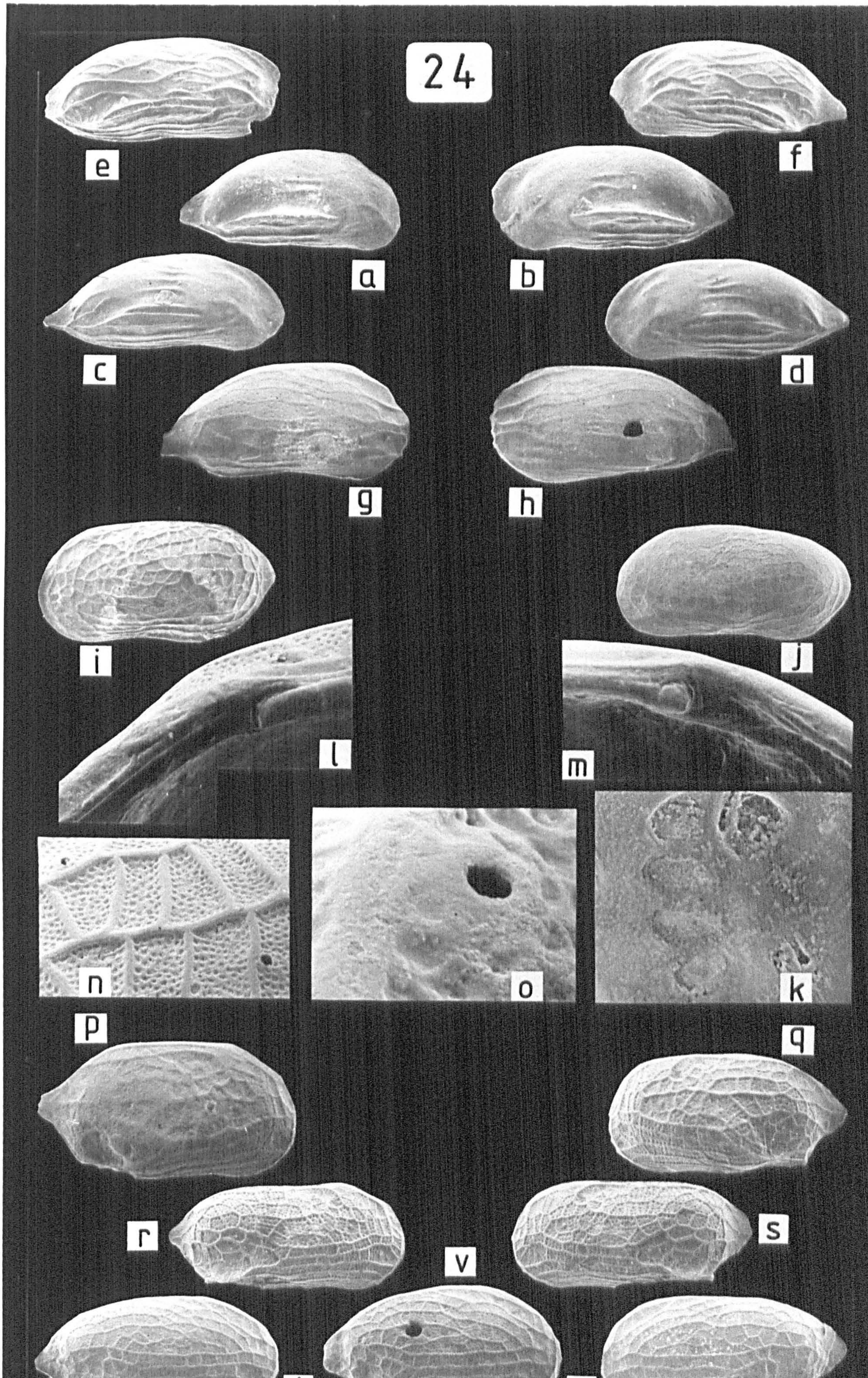
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PLATE 25

Figs.	Species / description		
	Semicytherura simplex (Brady and Norman) 1889	Figs. a-b	
a.	Penultimate instar right valve. Lateral view.	Ref. 3.28/28A.	x 175
b.	Penultimate instar left valve. Lateral view.	Ref. 3.27/27A.	x 175
	Semicytherura striata (Sars) 1866	Figs. c-f	
c.	Female right valve. Lateral view (ventral tilt)	Ref. 3.21/21A.	x 125
d.	Female carapace left valve. Lateral view (ventral tilt)	Ref. 3.22/22A.	x 125
e.	Male right valve. Lateral view.	Ref. 3.19/19A.	x 120
f.	Male left valve. Lateral view.	Ref. 3.20/20A.	x 120
	Semicytherura tela Whittaker 1972	Figs. g-h	
g.	Female right valve. Lateral view.	Ref. 3.13/13A.	x 150
h.	Female left valve. Lateral view.	Ref. 3.12/12A.	x 150
	Semicytherura undata (Sars) 1866	Figs. i-m	
i.	Female right valve. Lateral view.	Ref. 26.22/22A.	x 138
j.	Female left valve. Lateral view.	Ref. 2.-	x 63
k.	Male right valve. Lateral view.	Ref. 2.40/40A.	x 63
l.	Male left valve. Lateral view.	Ref. 2.41/41A.	x 63
m.	Penultimate instar left valve. Lateral view.	Ref. 2.1/1A.	x 63
	Semicytherura sp.A.	Figs. n-p	
n.	Adult right valve. Lateral view.	Ref. 4.6A/7.	x 145
o.	Female left valve. Lateral view.	Ref. 3.16/16A.	x 160
p.	Male left valve. Lateral view.	Ref. 3.15/15A.	x 145
	Semicytherura sp.B.	Figs. q-r	
q.	Adult right valve. Lateral view.	Ref. 4.12A/13.	x 125
r.	Adult left valve. Lateral view.	Ref. 4.13A/14.	x 123
	Semicytherura sp.C.	Figs. s-t	
s.	Adult right valve. Lateral view.	Ref. 26.23/23A.	x 126
t.	Adult right valve. Lateral view.	Ref. 2.39/39A.	x 63
	Semicytherura sp.D.	Fig. u	
u.	Adult left valve. Lateral view.	Ref. 1.35/35A.	x 63

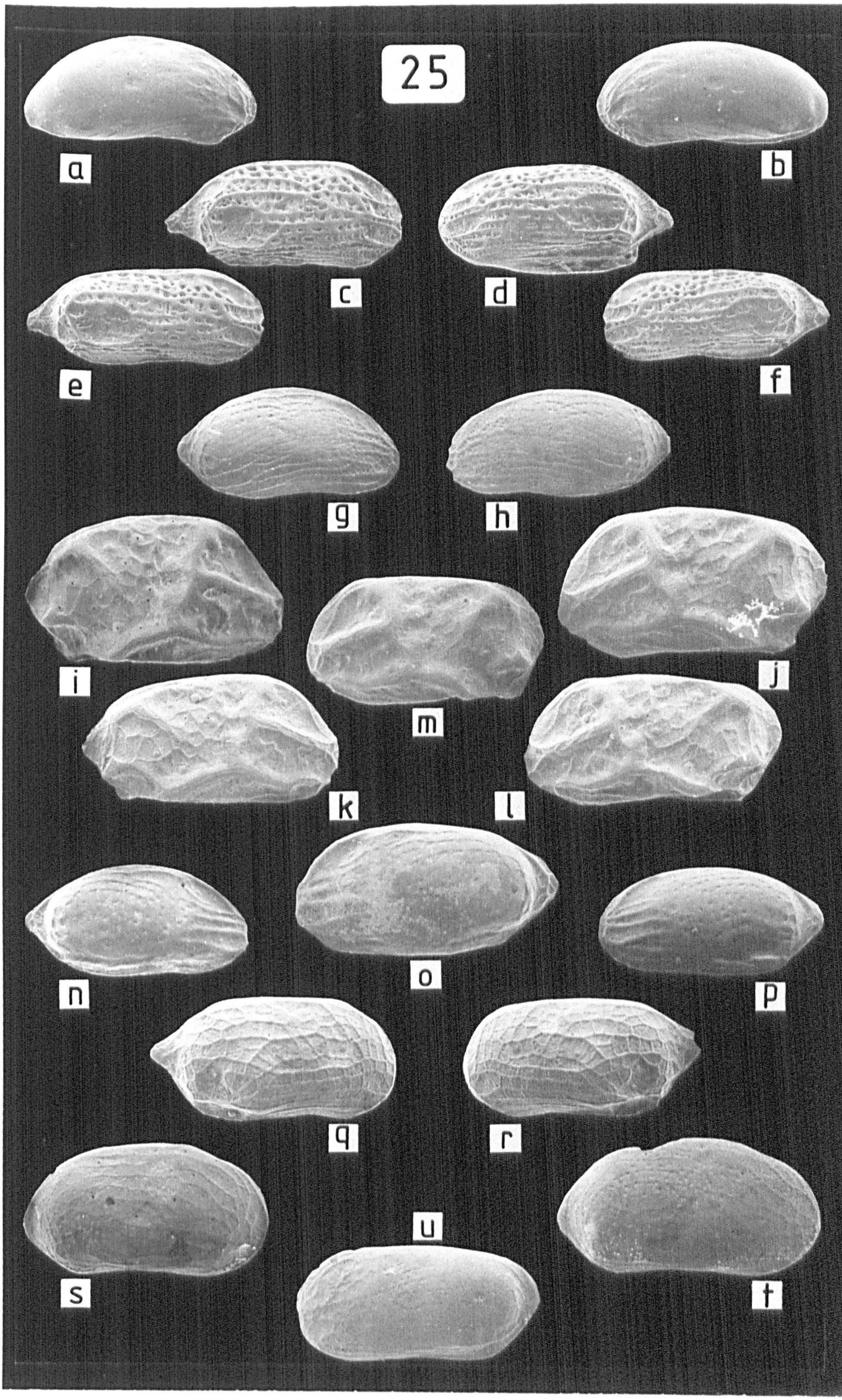
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PLATE 26

Hemicythere villosa (Sars) 1866 — Figs. a-f

Figs.			
a.	Female right valve. Lateral view.	Ref. 16.7A/8.	x 85
b.	Female left valve. Lateral view.	Ref. 16.6A/7.	x 83
c.	Male right valve. Lateral view.	Ref. 16.5A/6.	x 88
d.	Male left valve. Lateral view.	Ref. 16.4A/5.	x 88
e.	Penultimate instar right valve. Lateral view.	Ref. 16.9A/10.	x 110
f.	Penultimate instar left valve. Lateral view.	Ref. 16.8A/9.	x 105

Aurila convexa (Baird) 1850 — Figs. g-j

g.	Female right valve. Lateral view.	Ref. 24.7/7A.	x 69
h.	Female left valve. Lateral view.	Ref. 24.8/8A.	x 69
i.	Penultimate instar right valve. Lateral view.	Ref. 27.33A/34.	x 91
j.	Penultimate instar left valve. Lateral view.	Ref. 24.9/9A.	x 87

Baffinicythere emarginata (Sars) 1865 — Figs. k-n

k.	Male left valve. Lateral view.	Ref. 24.5/5A.	x 42
l.	Juvenile left valve. Lateral view.	Ref. 24.6/6A.	x 175
m.	Male left valve. Detail of external indicating the ornament pattern and typical situation of a normal pore canal.	Ref. 30.8/8A.	x 580
n.	Male left valve. Detail of external indicating intricate sieve plate structure situated deep within the normal pore.	Ref. 30.9/9A.	x 2,700

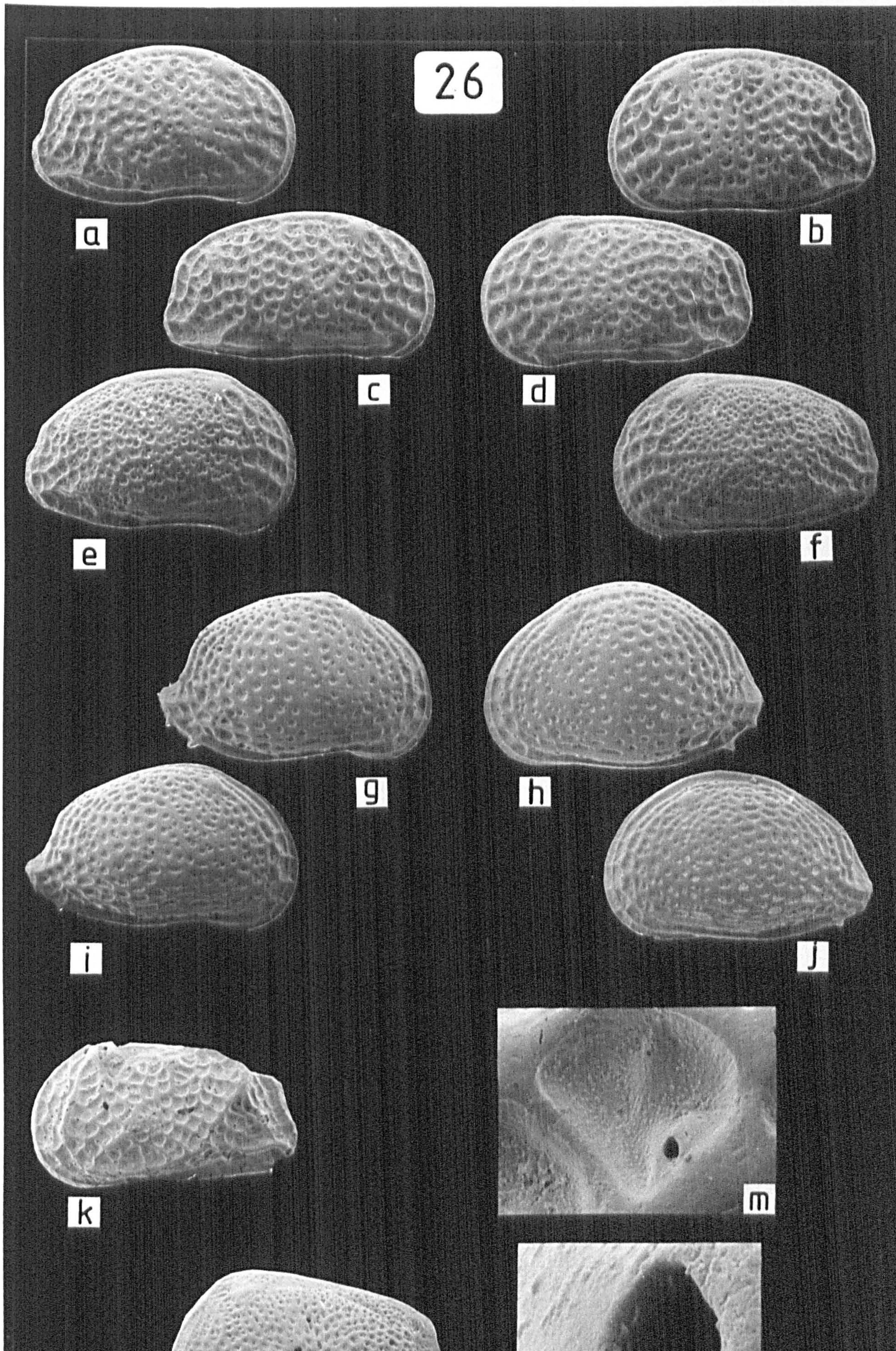

PLATE 27

Figs.	Elofsonella concinna (Jones) 1857	Figs. a-f	
a.	Female right valve. Lateral view.	Ref. 19.38/38A.	x 62
b.	Female left valve. Lateral view.	Ref. 19.37/37A.	x 62
c.	Male right valve. Lateral view.	Ref. 19.35/35A.	x 63
d.	Male left valve. Lateral view.	Ref. 19/36/36A.	x 63
e.	Juvenile (A-2) right valve. Lateral view.	Ref. 19.39/39A.	x 100
f.	Juvenile (A-2) left valve. Lateral view.	Ref. 19.40/40A.	x 100

	Finmarchinella finmarchica (Sars) 1866	Figs. g-h	
g.	Male left valve. Lateral view.	Ref. 16.11A/12.	x 89
h.	Penultimate instar left valve. Lateral view.	Ref. 16.12A/13.	x 91

	Finmarchinella angulata (Sars) 1866	Figs. i-n	
i.	Female right valve. Lateral view.	Ref. 16.16A/17.	x 88
j.	Female left valve. Lateral view.	Ref. 16.15A/16.	x 88
k.	Male right valve. Lateral view.	Ref. 16.13A/14.	x 85
l.	Male left valve. Lateral view.	Ref. 16.14A/15.	x 76
m.	Juvenile (A-2) instar right valve. Lateral view.	Ref. 16.17A/18.	x 125
n.	Juvenile (A-2) instar left valve. Lateral view.	Ref. 16.18A/19.	x 134

	Heterocythereis albomaculata (Baird) 1838	Figs. o-t	
o.	Female right valve. Lateral view.	Ref. 15.21/21A.	x 65
p.	Female left valve. Lateral view.	Ref. 15.20/20A.	x 65
q.	Male right valve. Lateral view.	Ref. 15.18/18A.	x 60
r.	Male left valve. Lateral view.	Ref. 15.19/19A.	x 59
s.	Juvenile (A-2) right valve. Lateral view.	Ref. 15.22/22A.	x 100
t.	Juvenile (A-2) left valve. Lateral view.	Ref. 15.23/23A.	x 93

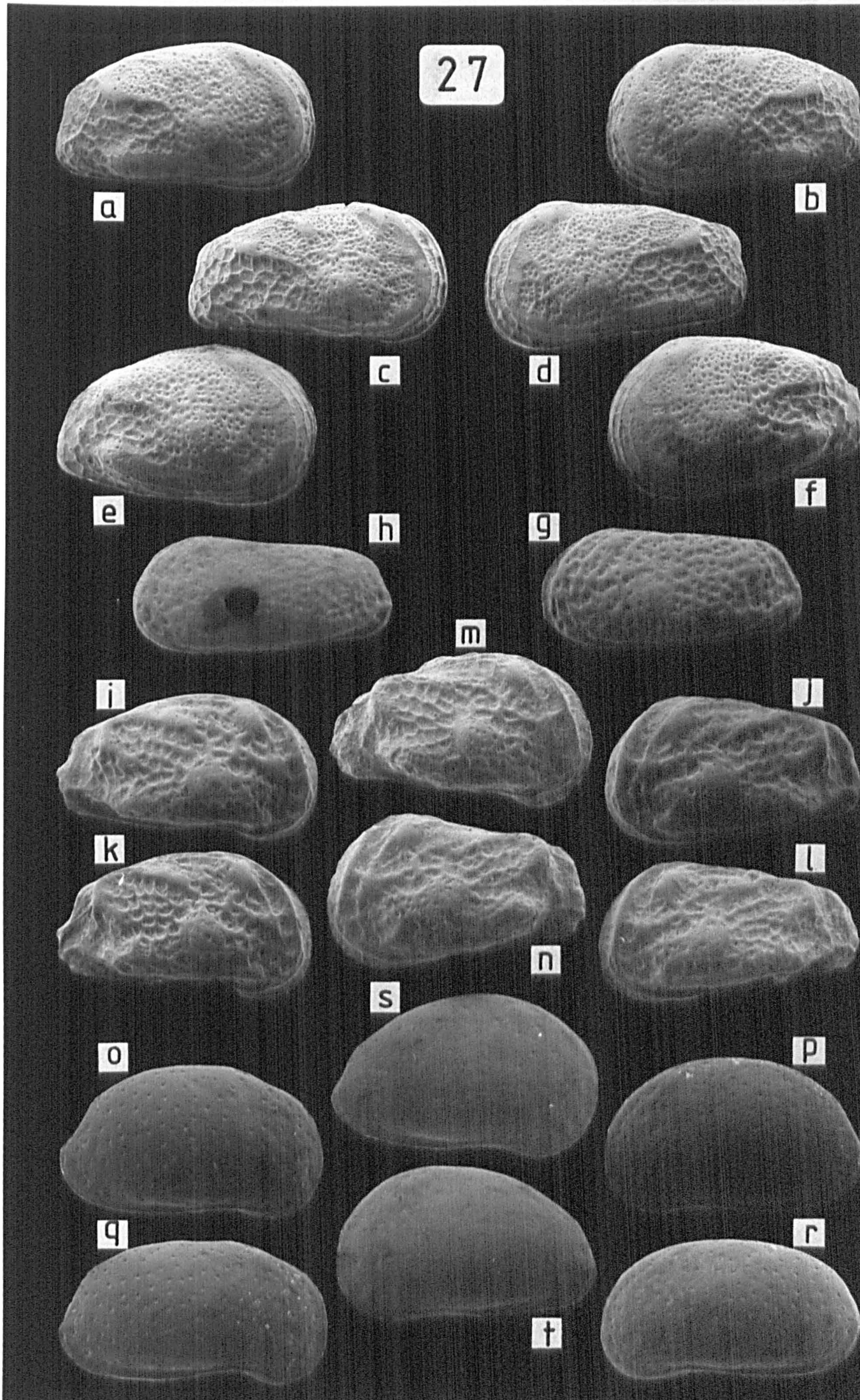
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PLATE 28

Muellerina abyssicola (Sars) 1865 — Figs. a-e

Figs.			
a.	Female right valve. Lateral view.	Ref. 10.21/21A.	x 75
b.	Male right valve. Lateral view.	Ref. 10.20/20A.	x 75
c.	Male left valve. Lateral view.	Ref. 10.22/22A.	x 75
d.	Penultimate instar right valve. Lateral view.	Ref. 10.24/24A.	x 88
e.	Penultimate instar left valve. Lateral view.	Ref. 10.23/23A.	x 88

Normanicythere leioderma (Norman) 1869 — Figs. f-h

f.	Penultimate instar right valve. Lateral view.	Ref. 9.9/9A.	x 59
g.	Juvenile (A-2) right valve. Lateral view.	Ref. 9.11/11A.	x 88
h.	Juvenile (A-2) left valve. Lateral view.	Ref. 9.10/10A.	x 88

Thaerocythere crenulata (Sars) 1865 — Figs. i-k

i.	Female left valve. Lateral view.	Ref. 26.20/20A.	x 74
j.	Male left valve. Lateral view.	Ref. 2.30/30A.	x 63
k.	Penultimate? instar right valve. Lateral view.	Ref. 3.3/3A.	x 78

Urocythereis britannica Athersuch 1977 — Figs. l-q

l.	Female right valve. Lateral view.	Ref. 2.29/29A.	x 75
m.	Female left valve. Lateral view.	Ref. 2.17/17A.	x 73
n.	Male right valve. Lateral view.	Ref. 2.15/15A.	x 78
o.	Male left valve. Lateral view.	Ref. 2.16/16A.	x 78
p.	Penultimate instar right valve. Lateral view.	Ref. 2.19/19A.	x 88
q.	Penultimate instar left valve. Lateral view.	Ref. 2.20/20A.	x 88

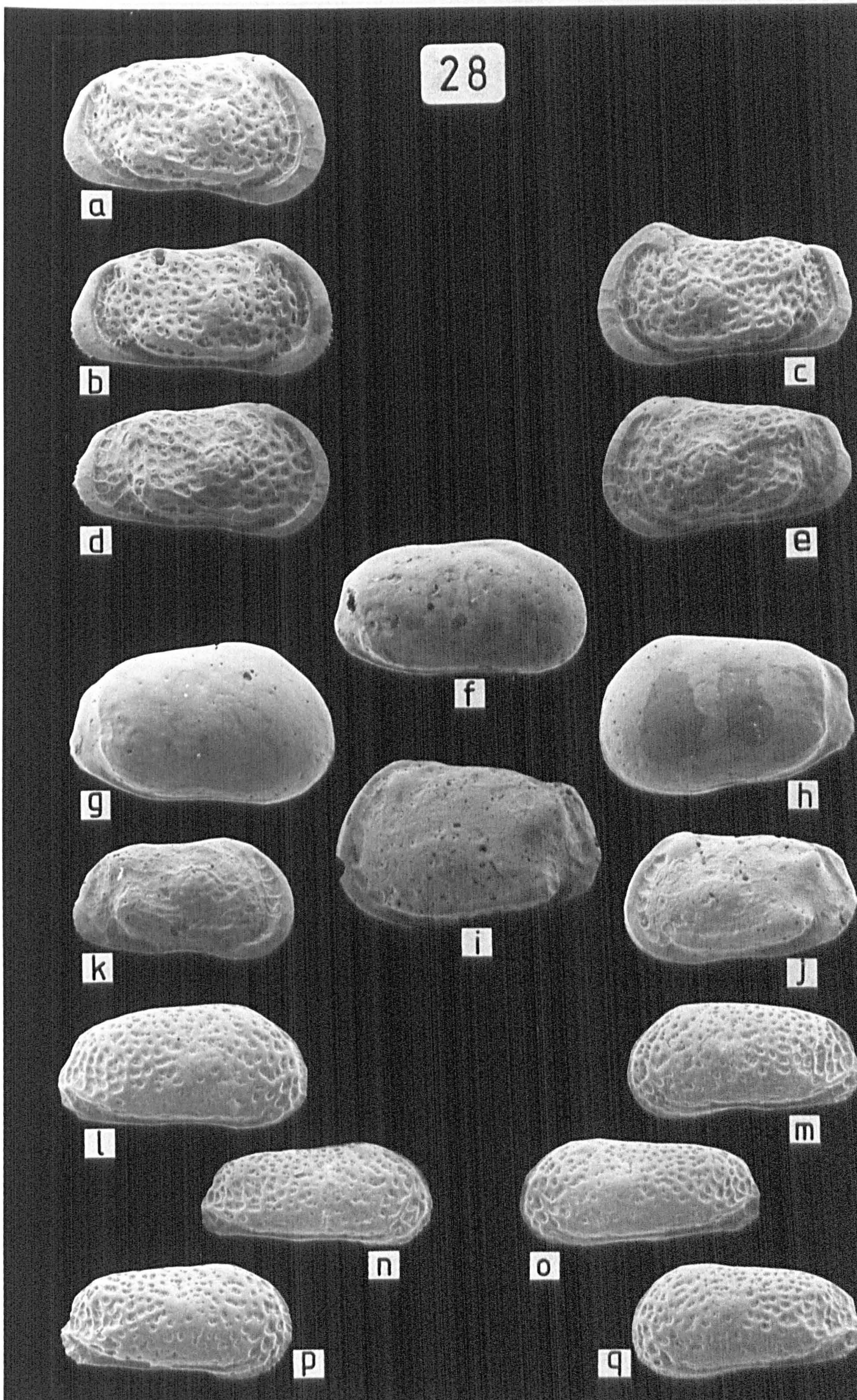
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PLATE 29

	Leptocythere pellucida Baird 1850		Figs. a-f	
Figs.				
a.	Female right valve.	Lateral view.	Ref. 13.8A/9.	x 88
b.	Female left valve.	Lateral view.	Ref. 13.7A/8.	x 88
c.	Male right valve.	Lateral view.	Ref. 13.6A/7.	x 88
d.	Male left valve.	Lateral view.	Ref. 13.5A/6.	x 85
e.	Penultimate instar right valve. Lateral view.		Ref. 13.10A/11	x 103
f.	Penultimate instar left valve. Lateral view.		Ref. 13.9A/10.	x 103
	Leptocythere confusa (Brady and Norman) 1889		Figs. g-k	
g.	Female right valve.	Lateral view.	Ref. 14.39A/40.	x 98
h.	Female left valve.	Lateral view.	Ref. 14.40A/41.	x 98
i.	Male right valve.	Lateral view.	Ref. 14.38A/39.	x 100
j.	Male left valve.	Lateral view.	Ref. 14.37A/38.	x 100
k.	Penultimate instar right valve. Lateral view.		Ref. 14.21A/22.	x 88
	Leptocythere macallana (Brady and Robertson) 1869		Figs. l-n	
l.	Female right valve.	Lateral view.	Ref. 14.33A/34.	x 105
m.	Male right valve.	Lateral view.	Ref. 14.35A/36.	x 115
n.	Male left valve.	Lateral view.	Ref. 14.36A/37.	x 115

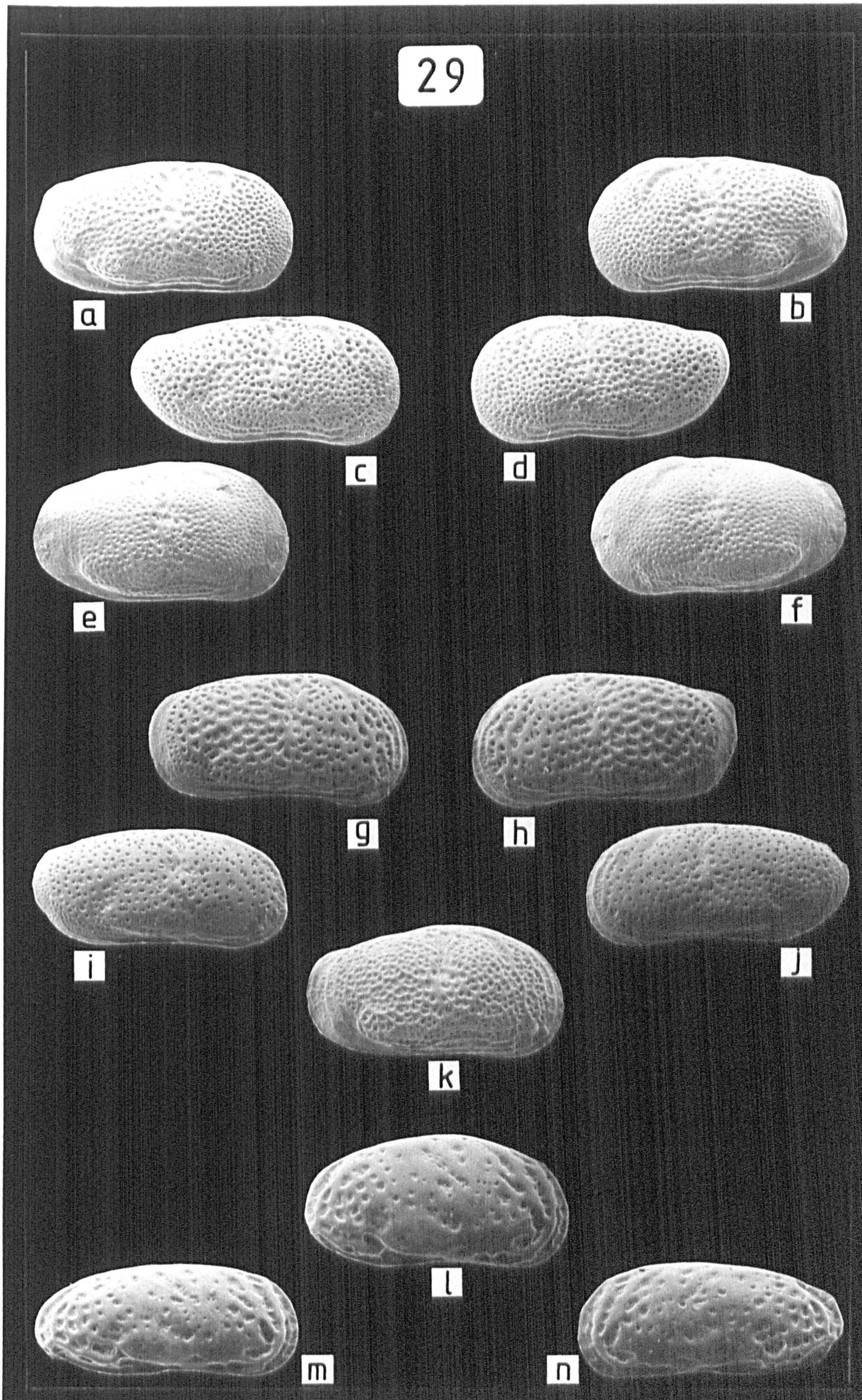
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PLATE 30

Leptocythere sp. cf. L. macella Ruggieri 1975 — Figs. a-g

Figs.				
a.	Female left valve. Lateral view.		Ref. 13.35A/36.	x 140
b.	Male right valve. Lateral view.		Ref. 13.34A/35.	x 130
c.	Male left valve. Lateral view.		Ref. 13.33A/34.	x 130
d.	Male right valve. Detail of internal indicating the muscle scar pattern.		Ref. 29.1/1A.	x 800
e.	Male right valve. Detail of internal indicating the anterior (Fig. e) and posterior (Fig. f) elements of a modified entomodont hingement.	Fig. e	Ref. 29.2/2A.	x 1,000
		Fig. f	Ref. 29.3/3A.	x 1,200
g.	Male right valve. Detail of internal indicating the deeply recessed sieve structure of a normal pore.		Ref. 29.-	x 8,850

Leptocythere marina Whittaker 1972 — Figs. h-m

h.	Female right valve. Lateral view.	Ref. 14.27A/28.	x 84
i.	Female left valve. Lateral view.	Ref. 14.26A/27.	x 85
j.	Male right valve. Lateral view.	Ref. 14.24/25.	x 83
k.	Male left valve. Lateral view.	Ref. 14.25A/26.	x 85
l.	Penultimate instar right valve. Lateral view.	Ref. 14.28A/29.	x 100
m.	Penultimate instar left valve. Lateral view.	Ref. 14.29A/30.	x 100

Leptocythere porcellanea (Brady and Robertson) 1869 — Figs. n-o

n.	Female right valve. Lateral view.	Ref. 13.4A/5.	x 100
o.	Female left valve. Lateral view.	Ref. 13.3A/4.	x 100

Leptocythere tenera (Brady) 1868 — Figs. p-u

p.	Female right valve. Lateral view.	Ref. 13.38A/39.	x 118
q.	Female left valve. Lateral view.	Ref. 13.39A/40.	x 118
r.	Male right valve. Lateral view.	Ref. 13.37A/38.	x 120
s.	Male left valve. Lateral view.	Ref. 13.36A/37.	x 120
t.	Juvenile (A-2?) right valve. Lateral view.	Ref. 13.1.	x 170
u.	Juvenile (A-2?) left valve. Lateral view.	Ref. 13.42A.	x 170

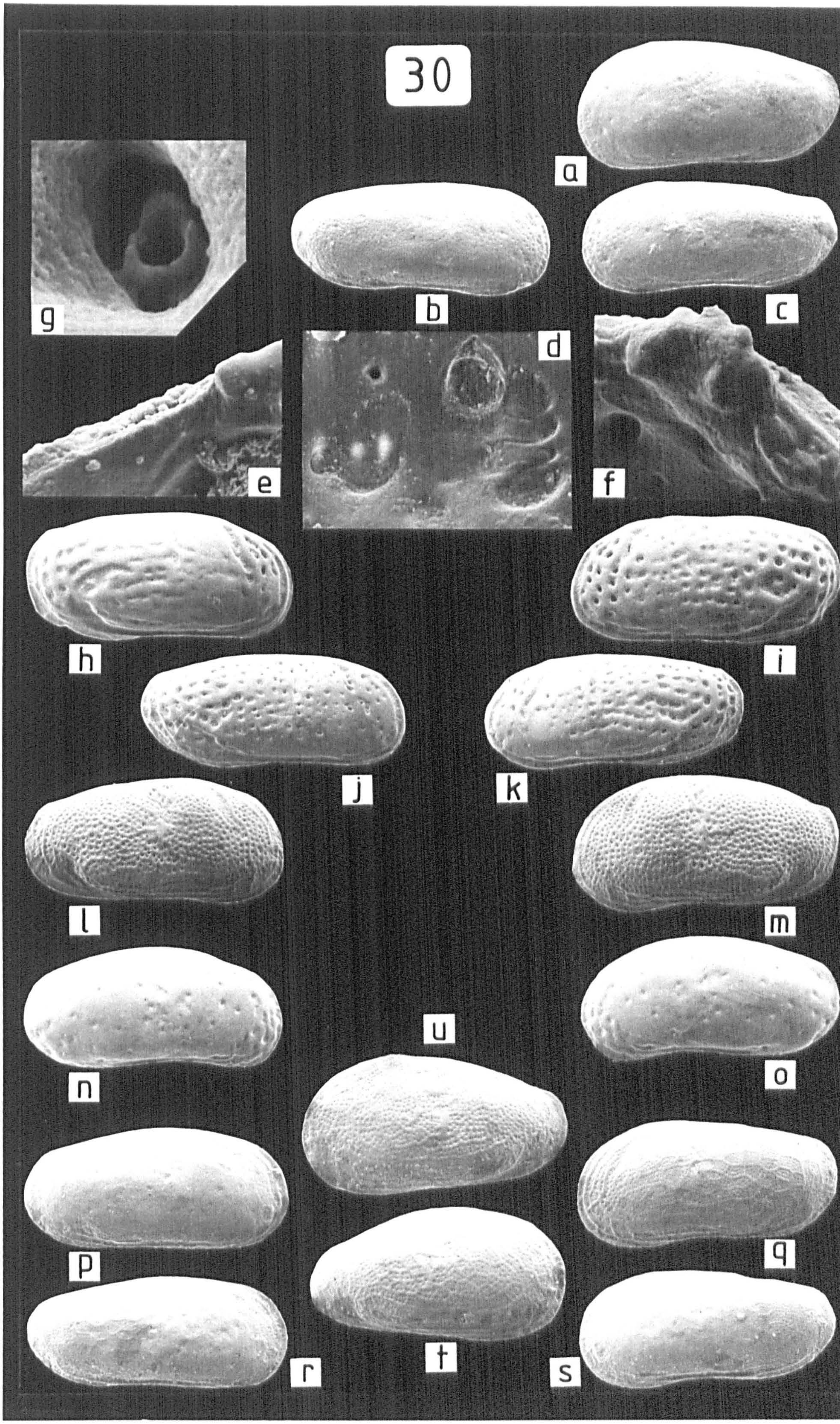
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PLATE 31

Figs.	Callistocythere badia (Norman) 1862	Figs. a-f	
a.	Female right valve. Lateral view.	Ref. 31.23/23A.	x 103
b.	Female left valve. Lateral view.	Ref. 31.24/24A.	x 103
c.	Male? right valve. Lateral view.	Ref. 27.25A/26.	x 105
d.	Male? left valve. Lateral view.	Ref. 27.26A/27.	x 105
e.	Penultimate instar right valve. Lateral view.	Ref. 27.27A/28.	x 128
f.	Penultimate instar left valve. Lateral view.	Ref. 27.28A/29.	x 125
	Callistocythere littoralis (Brady) 1868	Fig. g	
g.	Female? instar left valve. Lateral view.	Ref. 26.6/6A.	x 148
	Callistocythere sp. cf. L. macallana sensu Wall (ms.) 1969	Figs. h-i	
h.	Female? right valve. Lateral view.	Ref. 14.34A/35.	x 118
i.	Female? left valve. Lateral view.	Ref. 14.32A/33.	x 105
	Cluthia cluthae (Brady, Crosskey and Robertson) 1874	Fig. j	
j.	Female left valve. Lateral view.	Ref. 6.40A/41.	x 150
	Cluthia keiji Neale 1975	Figs. k-n	
k.	Female right valve. Lateral view.	Ref. 23.28A/29.	x 170
l.	Female left valve. Lateral view.	Ref. 23.29A/30.	x 170
m.	Male right valve. Lateral view.	Ref. 23.27A/28.	x 170
n.	Male left valve. Lateral view.	Ref. 23.26A/27.	x 170
	Loxoconcha rhomboidea Fischer 1855	Figs. o-t	
o.	Female right valve. Lateral view.	Ref. 12.33/33A.	x 88
p.	Female left valve. Lateral view.	Ref. 12.34/34A.	x 84
q.	Male right valve. Lateral view.	Ref. 12.32/32A.	x 78
r.	Male left valve. Lateral view.	Ref. 12.31/31A.	x 75
s.	Penultimate instar right valve. Lateral view.	Ref. 12.35/35A.	x 100
t.	Penultimate instar left valve. Lateral view.	Ref. 12.36/36A.	x 100

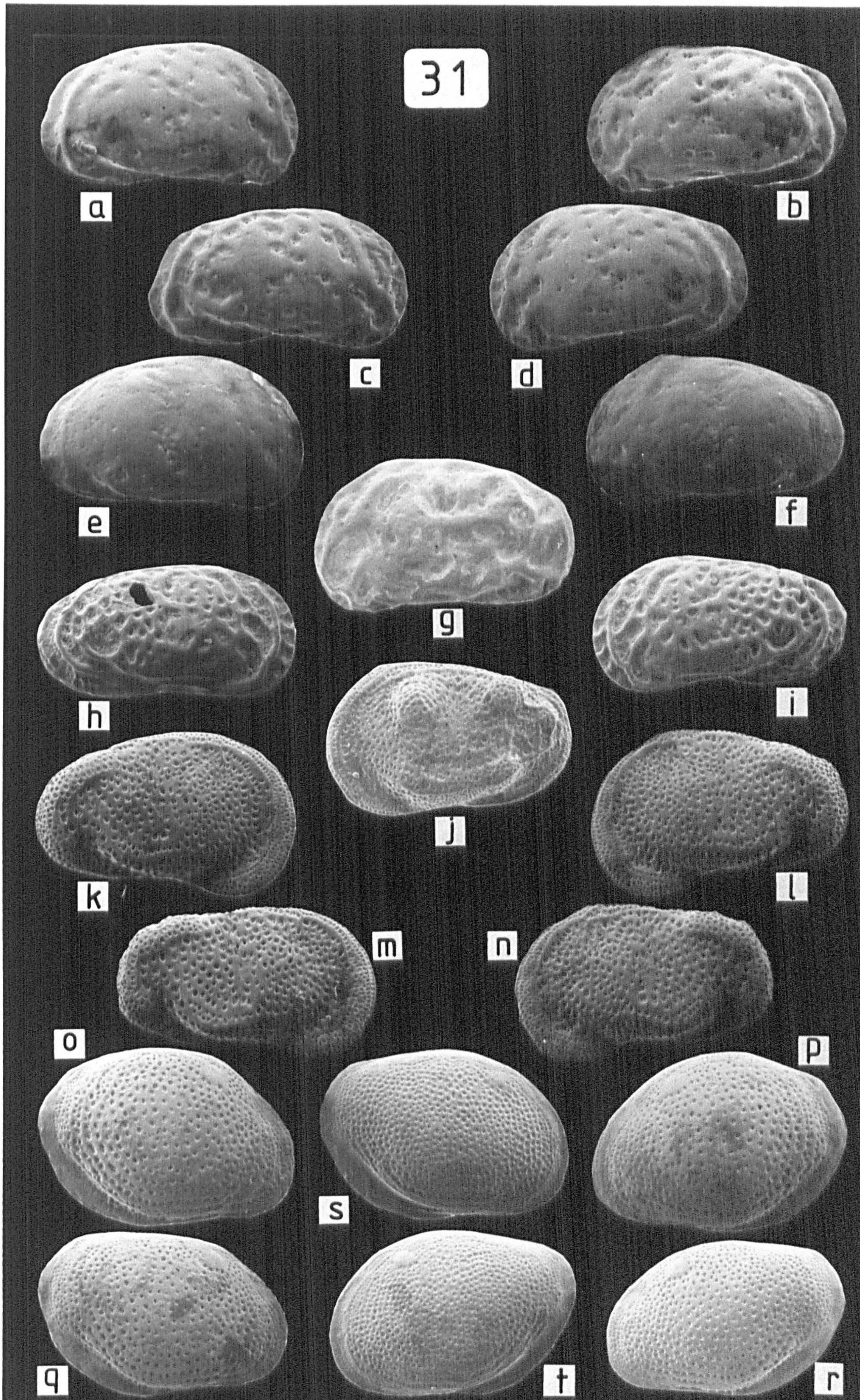
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PLATE 32

Loxoconcha sp. cf. *L. agilis* Ruggieri 1967 — Figs. a-f

Figs.				
a.	Female? right valve. Lateral view.		Ref. 11.36A/37.	x 128
b.	Male? right valve. Lateral view.		Ref. 11.37A/38.	x 123
c.	Penultimate, instar left valve. Lateral view.		Ref. 11.38A/39.	x 128
d-e.	Female right valve. Detail of internal indicating the anterior (Fig. d) and posterior (Fig. e) terminal elements of a gongylodont hingement.	Fig. d	Ref. 29.9/9A.	x 500
		Fig. e	Ref. 29.8/8A.	x 800
f.	Female right valve. Detail of internal indicating the pattern of muscle scars.		Ref. 29.7/7A.	x 600

Loxoconcha elliptica (Brady) 1868 — Fig. g

g.	Penultimate instar? right valve. Lateral view.	Ref. 13.30A/31.	x 110

Loxoconcha granulata Sars 1866 — Figs. h-j

h.	Female right valve. Lateral view.	Ref. 13.29A/30.	x 88
i.	Male right valve. Lateral view.	Ref. 13.27A/28.	x 93
j.	Male left valve. Lateral view.	Ref. 13.28A/29.	x 93

Lindisfarnia guttata (Norman) 1865 — Figs. k-p

k.	Female right valve. Lateral view.	Ref. 13/23A/24.	x 98
l.	Female left valve. Lateral view.	Ref. 13.24A/25.	x 98
m.	Male right valve. Lateral view.	Ref. 13.21A/22.	x 88
n.	Male left valve. Lateral view.	Ref. 13.22A/23.	x 88
o.	Penultimate instar right valve. Lateral view.	Ref. 13.26A/27.	x 126
p.	Penultimate instar left valve. Lateral view.	Ref. 13.25A/26.	x 128

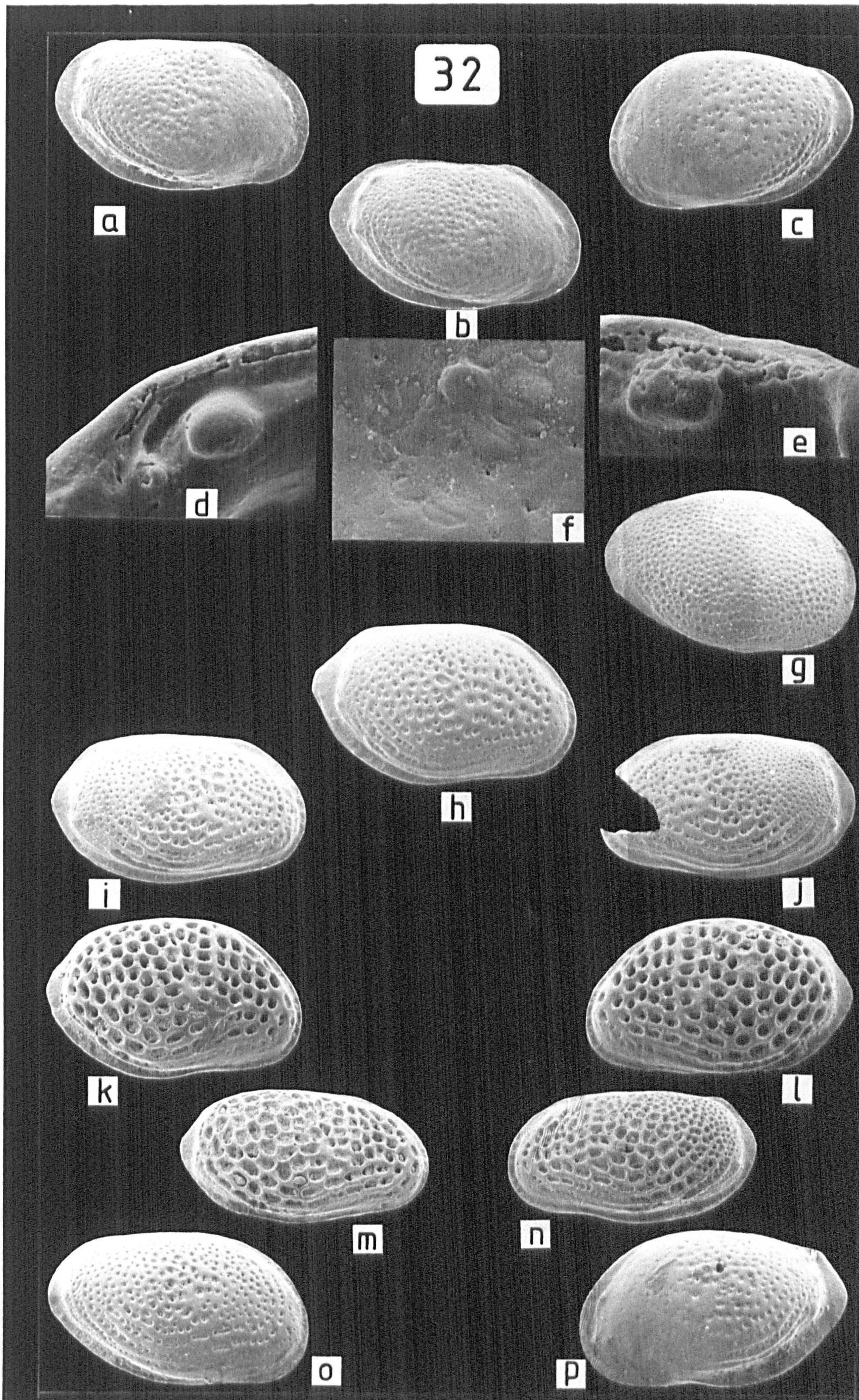
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PLATE 33

Figs.	<u>Loxoconcha</u> <u>multifora</u> (Norman) 1865	Figs. a-f	
a.	Female right valve. Lateral view.	Ref. 26.34/34A.	x 143
b.	Female left valve. Lateral view.	Ref. 12.39/39A.	x 133
c.	Male right valve. Lateral view.	Ref. 12.37/37A.	x 126
d.	Male left valve. Lateral view.	Ref. 12.38/38A.	x 125
e.	Penultimate instar right valve. Lateral view.	Ref. 12.41/41A.	x 155
f.	Penultimate instar left valve. Lateral view.	Ref. 12.40/40A.	x 150

	<u>Bonnyannella</u> <u>robertsoni</u> (Brady) 1868	Figs. g-l	
g.	Female right valve. Lateral view.	Ref. 12.27/27A.	x 120
h.	Female left valve. Lateral view.	Ref. 12.28/28A.	x 125
i.	Male right valve. Lateral view.	Ref. 12.26/26A.	x 124
j.	Male left valve. Lateral view.	Ref. 12.25/25A.	x 126
k.	Penultimate instar right valve. Lateral view.	Ref. 12.29/29A.	x 143
l.	Penultimate instar left valve. Lateral view.	Ref. 12.30/30A.	x 135

	<u>Lindisfarnia</u> <u>laevata</u> (Norman) 1865	Figs. m-r	
m.	Female right valve. Lateral view.	Ref. 11.4A/5.	x 98
n.	Female left valve. Lateral view.	Ref. 11.3A/4.	x 93
o.	Male right valve. Lateral view.	Ref. 11.1A/2.	x 99
p.	Male left valve. Lateral view.	Ref. 11.2A/3.	x 100
q.	Penultimate instar right valve. Lateral view.	Ref. 11.5A/6.	x 113
r.	Penultimate instar left valve. Lateral view.	Ref. 11.6A/7.	x 118

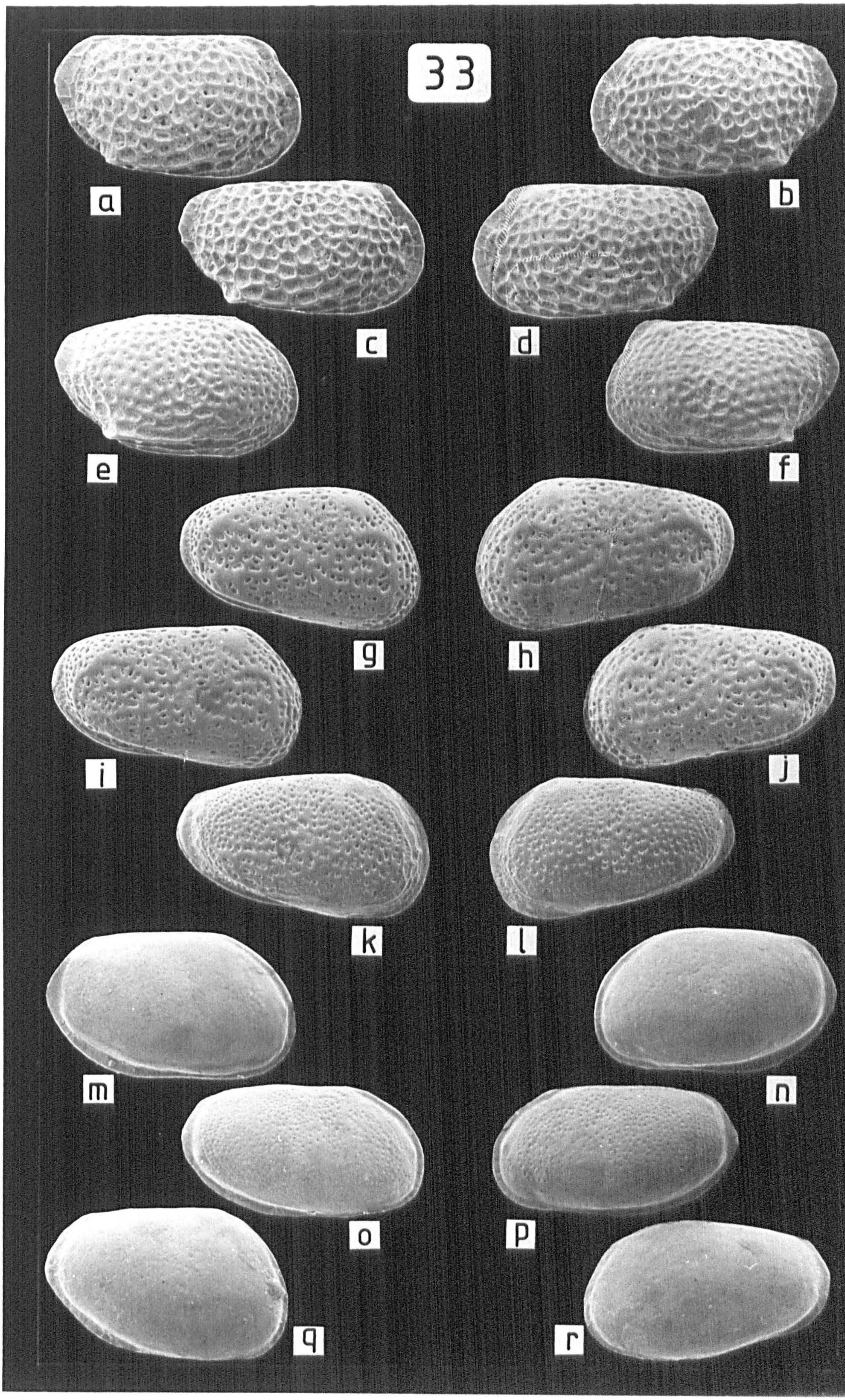
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PLATE 34

<u>Loxoconcha</u> sp. — Figs. a-h

Figs.			
a.	Female right valve. Lateral view.	Ref. 11.41A/42.	x 115
b.	Female left valve. Lateral view.	Ref. 11.42A.	x 123
c.	Male right valve. Lateral view.	Ref. 11.40A/41.	x 103
d.	Male left valve. Lateral view.	Ref. 11.39A/40.	x 88
e.	Juvenile instar left valve. Lateral view.	Ref. 11.1.	x 178
f.	Female right valve. Detail of internal indicating the muscle scar pattern.	Ref. 29.4/4A.	x 650
g-h.	Female right valve. Detail of internal indicating the anterior (Fig. g) and posterior (Fig. h) terminal elements of a gongylodont hinge. Fig. g	Ref. 29.6/6A.	x 900
	Fig. h	Ref. 29.5/5A.	x 1,035

<u>Elofsonia</u> <u>baltica</u> (Hirschmann) 1909 — Figs. i-j

i.	Female right valve. Lateral view.	Ref. 18.25/25A.	x 145
j.	Juvenile (A-2?) right valve. Lateral view.	Ref. 18.26/26A.	x 100

<u>Elofsonia</u> <u>pusilla</u> (Brady and Robertson) 1870 — Figs. k-p

k.	Female right valve. Lateral view.	Ref. 18.22/22A.	x 125
l.	Female left valve. Lateral view.	Ref. 18.21/21A.	x 135
m.	Male right valve. Lateral view.	Ref. 18.20/20A.	x 127
n.	Male left valve. Lateral view.	Ref. 18.19/19A.	x 125
o.	Penultimate instar right valve. Lateral view.	Ref. 18.24/24A.	x 150
p.	Penultimate instar left valve. Lateral view.	Ref. 18.23/23A.	x 148

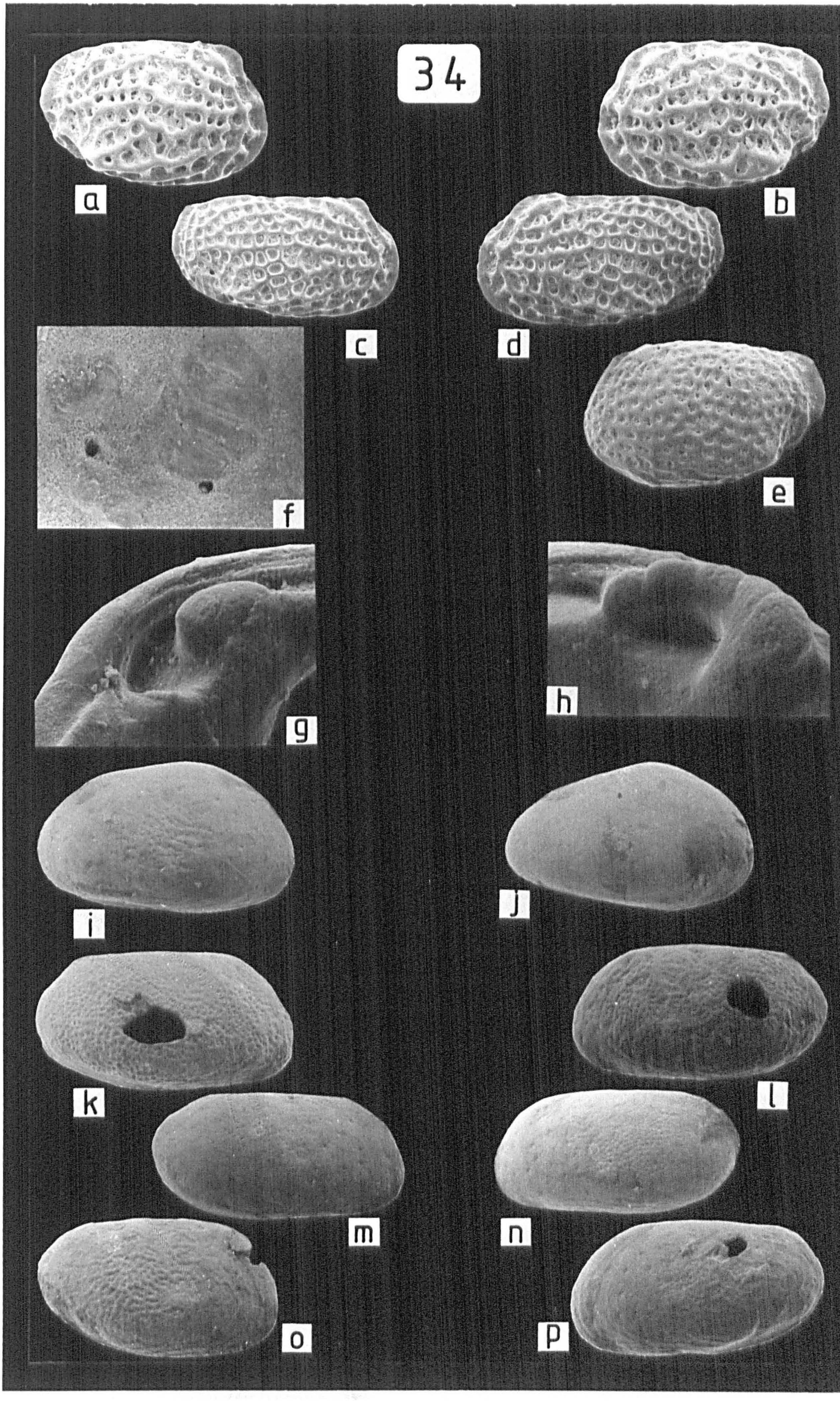
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PLATE 35

<u>Hirschmannia</u> <u>viridis</u> (O.F. Müller) 1785 — Figs. a-f

Figs.			
a.	Female right valve. Lateral view.	Ref. 26.37/37A.	x 130
b.	Female left valve. Lateral view.	Ref. 14.13A/14.	x 120
c.	Male right valve. Lateral view.	Ref. 14.12A/13.	x 120
d.	Male left valve. Lateral view.	Ref. 26.36/36A.	x 123
e.	Juvenile (A-2) right valve. Lateral view.	Ref. 15.16/16A.	x 176
f.	Juvenile (A-2) left valve. Lateral view.	Ref. 15.17/17A.	x 175

<u>Roundstonia</u> <u>globulifera</u> (Brady) 1868 — Figs. g-h

g.	Female right valve. Lateral view.	Ref. 6.39A/40.	x 120
h.	Female left valve. Lateral view.	Ref. 6.38A/39.	x 120

<u>Paradoxostoma</u> <u>variabile</u> (Baird) 1835 — Figs. i-n

i.	Female right valve. Lateral view.	Ref. 7.18A/19.	x 75
j.	Female left valve. Lateral view.	Ref. 7.17A/18.	x 75
k.	Male right valve. Lateral view.	Ref. 7.16A/17.	x 73
l.	Male left valve. Lateral view.	Ref. 26.30/30A.	x 69
m.	Penultimate instar right valve. Lateral view.	Ref. 7.20A/21.	x 81
n.	Penultimate instar left valve. Lateral view.	Ref. 7.19A/20.	x 88

<u>Paradoxostoma</u> <u>abbreviatum</u> Sars 1866 — Figs. o-t

o.	Female right valve. Lateral view.	Ref. 9.31/31A.	x 110
p.	Female left valve. Lateral view.	Ref. 9.29/29A.	x 120
q.	Male right valve. Lateral view.	Ref. 9.28/28A.	x 120
r.	Male left valve. Lateral view.	Ref. 9.30/30A.	x 110
s.	Penultimate instar right valve. Lateral view.	Ref. 9.32/32A.	x 145
t.	Penultimate instar left valve. Lateral view.	Ref. 9.33/33A.	x 145

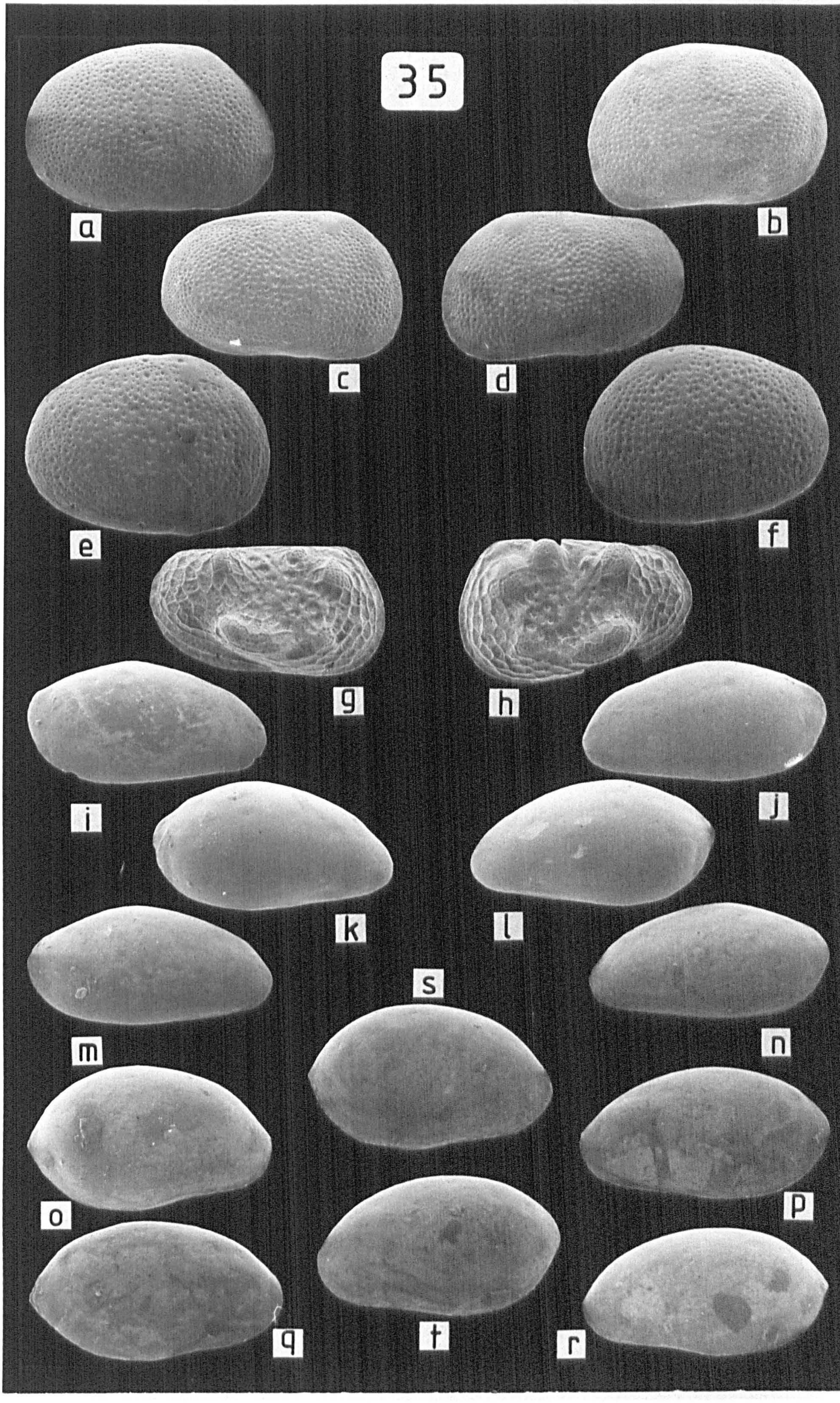
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PLATE 36

Figs.			
	Paradoxostoma bradyi Sars 1928	Figs. a-d	
a.	Female right valve. Lateral view.	Ref. 9.25/25A.	x 88
b.	Male right valve. Lateral view.	Ref. 9.23/23A.	x 75
c.	Penultimate instar right valve. Lateral view.	Ref. 9.26/26A.	x 98
d.	Penultimate instar left valve. Lateral view.	Ref. 9.27/27A.	x 90
	Paradoxostoma ensiforme Sars 1928	Figs. e-i	
e.	Female right valve. Lateral view.	Ref. 8.11A/12.	x 68
f.	Female left valve. Lateral view.	Ref. 8.10A/11.	x 68
g.	Male right valve. Lateral view.	Ref. 8.8A/9.	x 68
h.	Male left valve. Lateral view.	Ref. 8.9A/10.	x 68
i.	Penultimate instar left valve. Lateral view.	Ref. 8.11A/12.	x 68
	Paradoxostoma sp. cf. P. hibernicum Brady 1868	Figs. j-m	
j.	Female? right valve. Lateral view.	Ref. 1.22/22A.	x 63
k.	Female? left valve. Lateral view.	Ref. 1.19/19A.	x 63
l.	Adult? right valve. Lateral view.	Ref. 1.20/20A.	x 63
m.	Adult? left valve. Lateral view.	Ref. 1.21/21A.	x 63
	Paradoxostoma sp. cf. P. obliquum Sars 1865	Figs. n-v	
n.	Female? right valve. Lateral view.	Ref. 8.25A/26.	x 75
o.	Female? left valve. Lateral view.	Ref. 8.27A/28.	x 80
p.	Male? right valve. Lateral view.	Ref. 8.28A/29.	x 80
q.	Male? left valve. Lateral view.	Ref. 8.23A/24.	x 78
r.	Penultimate? instar right valve. Lateral view.	Ref. 8.2A/3.	x 93
s.	Penultimate? instar left valve. Lateral view.	Ref. 8.4A/5.	x 90
t.	Female? right valve. Detail of internal indicating the muscle scar pattern.	Ref. 33.3/3A.	x 765
u-v.	Female? right valve. Detail of internal indicating the anterior (Fig. u) and posterior (Fig. v) terminal elements of a weak lophodont hingement. Fig. u	Ref. 33.4/4A.	x 1,100
	Fig. v.	Ref. 33.5/5A.	x 790

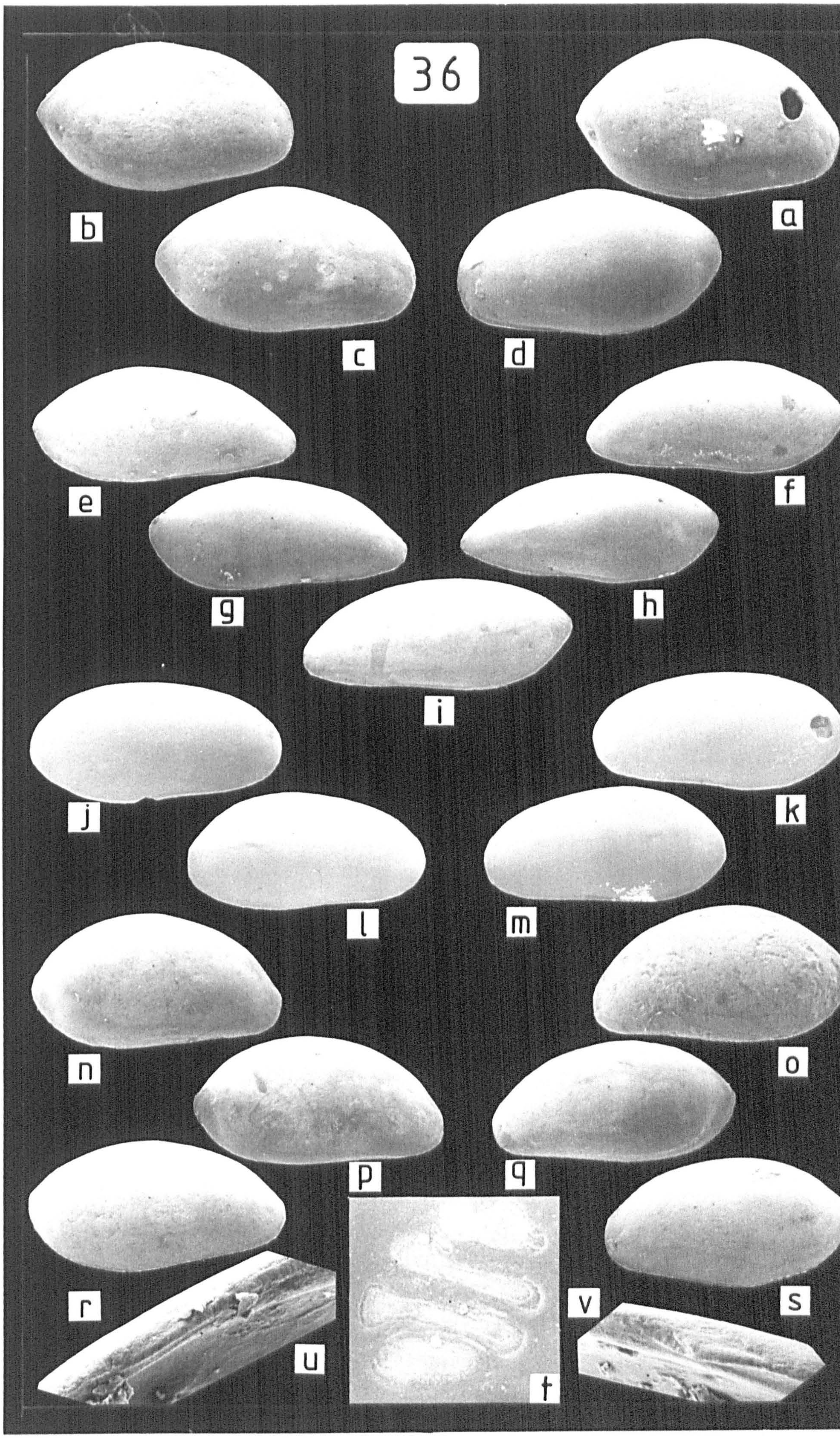
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PLATE 37

Figs.	Paradoxostoma normani Brady 1868		Figs. a-f	
a.	Female right valve. Lateral view.		Ref. 8.33A/34.	x 90
b.	Female left valve. Lateral view.		Ref. 8.32A/33.	x 93
c.	Male right valve. Lateral view.		Ref. 8.31A/32.	x 95
d.	Male left valve. Lateral view.		Ref. 8.30A/31.	x 98
e.	Penultimate instar right valve. Lateral view.		Ref. 8.35A/36.	x 110
f.	Penultimate instar left valve. Lateral view.		Ref. 8.34A/35.	x 110
	Paradoxostoma sp. cf. P. normani		Figs. g-m	
g.	Adult right valve. Lateral view.		Ref. 8.5A/6.	x 93
h.	Adult left valve. Lateral view.		Ref. 8.3A/4.	x 93
i.	Penultimate? instar right valve. Lateral view.		Ref. 8.38A/39.	x 113
j.	Penultimate? instar left valve. Lateral view.		Ref. 8.39A/40.	x 113
k.	Adult right valve. Detail of internal indicating the muscle scar pattern.		Ref. 33.1A.	x 500
l-m.	Adult right valve. Detail of internal indicating the anterior (Fig. l) and posterior (Fig. m) terminal elements of a lophodont hingement.	Fig. l	Ref. 32.7A/8.	x 705
		Fig. m	Ref. 32.6A/7.	x 625
	Cytherois fischeri (Sars) 1866		Figs. n-o	
n.	Juvenile (A-3) right valve. Lateral view.		Ref. 22.37A/38.	x 145
o.	Penultimate instar left valve. Lateral view.		Ref. 22.34A/35.	x 118
	Cytherois vitrea (Sars) 1865		Figs. p-q	
p.	Female left valve. Lateral view.		Ref. 21.23/23A.	x 113
q.	Female left valve. Detail of internal indicating the muscle scar pattern.		Ref. 32.23A/24.	x 590

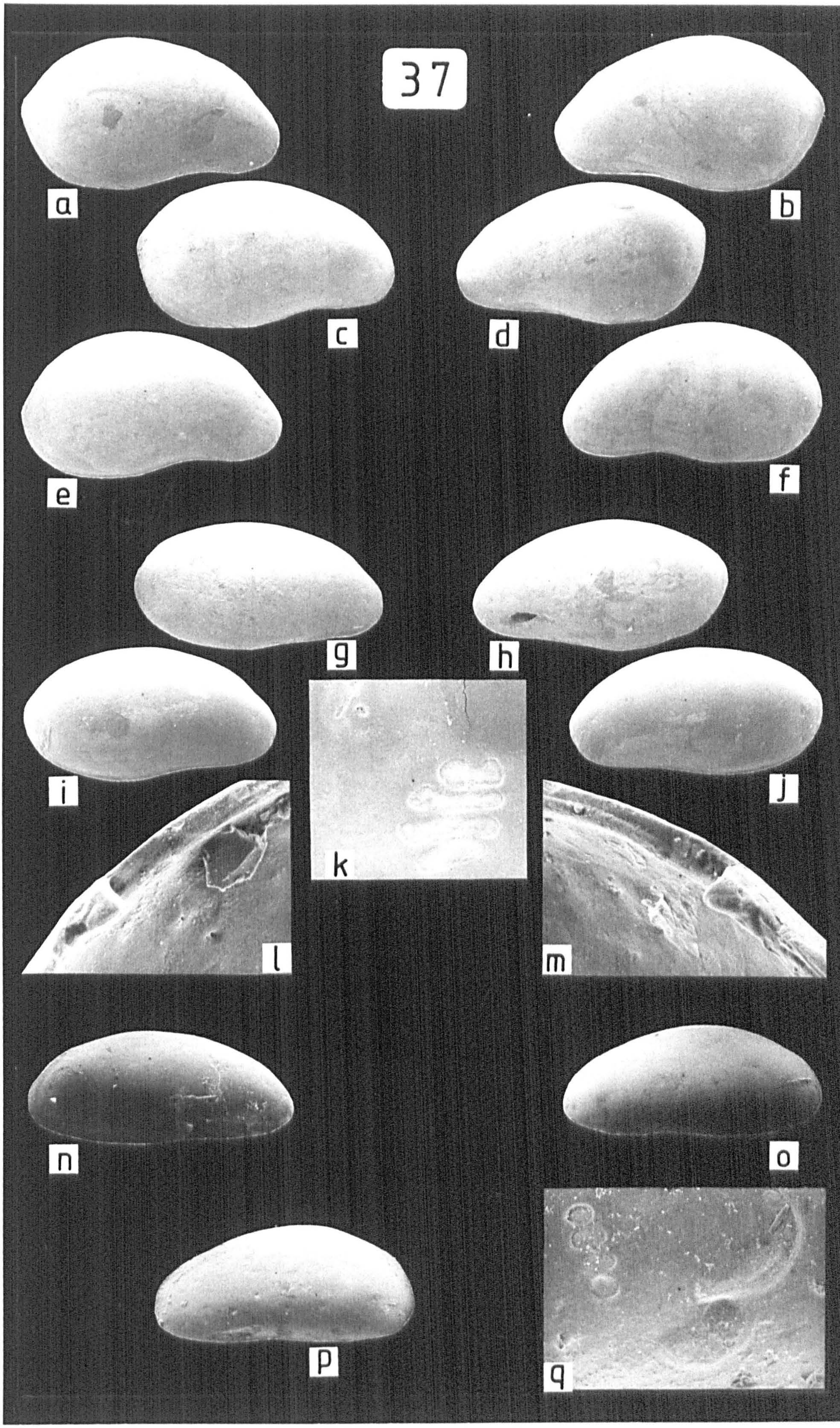
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PLATE 38

Figs.	Cytherois sp.		Figs. a-d	
a.	Adult right valve. Lateral view.		Ref. 21.21/21A.	x 89
b.	Adult right valve. Detail of internal indicating the muscle scar pattern.		Ref. 27.35/35A.	x 638
c-d.	Adult right valve. Detail of internal indicating the anterior (Fig. c) and posterior (Fig. d) terminal elements of a lophodont hingement.	Fig. c	Ref. 32.25A/26.	x 1,000
		Fig. d	Ref. 32.24A/25.	x 1,540

	Paracytherois flexuosum (Brady) 1866	Figs. e-g	
e.	Female right valve. Lateral view.	Ref. 9.34/34A.	x 100
f.	Female left valve. Lateral view.	Ref. 9.35/35A.	x 98
g.	Female right valve. Detail of external indicating the pattern of ornament so typical of the genus.	Ref. 9.36/36A.	x 975

	Paracytherois sp. cf. P. arcuata (Brady) 1868	Figs. h-l	
h.	Female right valve. Lateral view.	Ref. 9.38/38A.	x 93
i.	Female left valve. Lateral view.	Ref. 9.39/39A.	x 110
j.	Male left valve. Lateral view.	Ref. 9.37/37A.	x 88
k.	Penultimate instar right valve. Lateral view.	Ref. 9.40/40A.	x 123
l.	Penultimate instar left valve. Lateral view.	Ref. 9.41/41A.	x 125

	Sclerochilus contortus (Norman) 1862	Figs. m-r	
m.	Female right valve. Lateral view.	Ref. 5.23/23A.	x 80
n.	Female left valve. Lateral view.	Ref. 5.22/22A.	x 80
o.	Male right valve. Lateral view.	Ref. 5.21/21A.	x 73
p.	Male left valve. Lateral view.	Ref. 5.20/20A.	x 73
q.	Penultimate instar right valve. Lateral view.	Ref. 5.25/25A.	x 105
r.	Penultimate instar left valve. Lateral view.	Ref. 5.24/24A.	x 105

	Sclerochilus truncatus (Malcomson) 1886)	Figs. s-x	
s.	Female right valve. Lateral view.	Ref. 5.17/17A.	x 115
t.	Female left valve. Lateral view.	Ref. 5.16/16A.	x 123
u.	Male right valve. Lateral view.	Ref. 5/15/15A.	x 123
v.	Male left valve. Lateral view.	Ref. 25.27/27A.	x 122
w.	Penultimate instar right valve. Lateral view.	Ref. 5.19/19A.	x 143
x.	Penultimate instar left valve. Lateral view.	Ref. 5.18/18A.	x 143

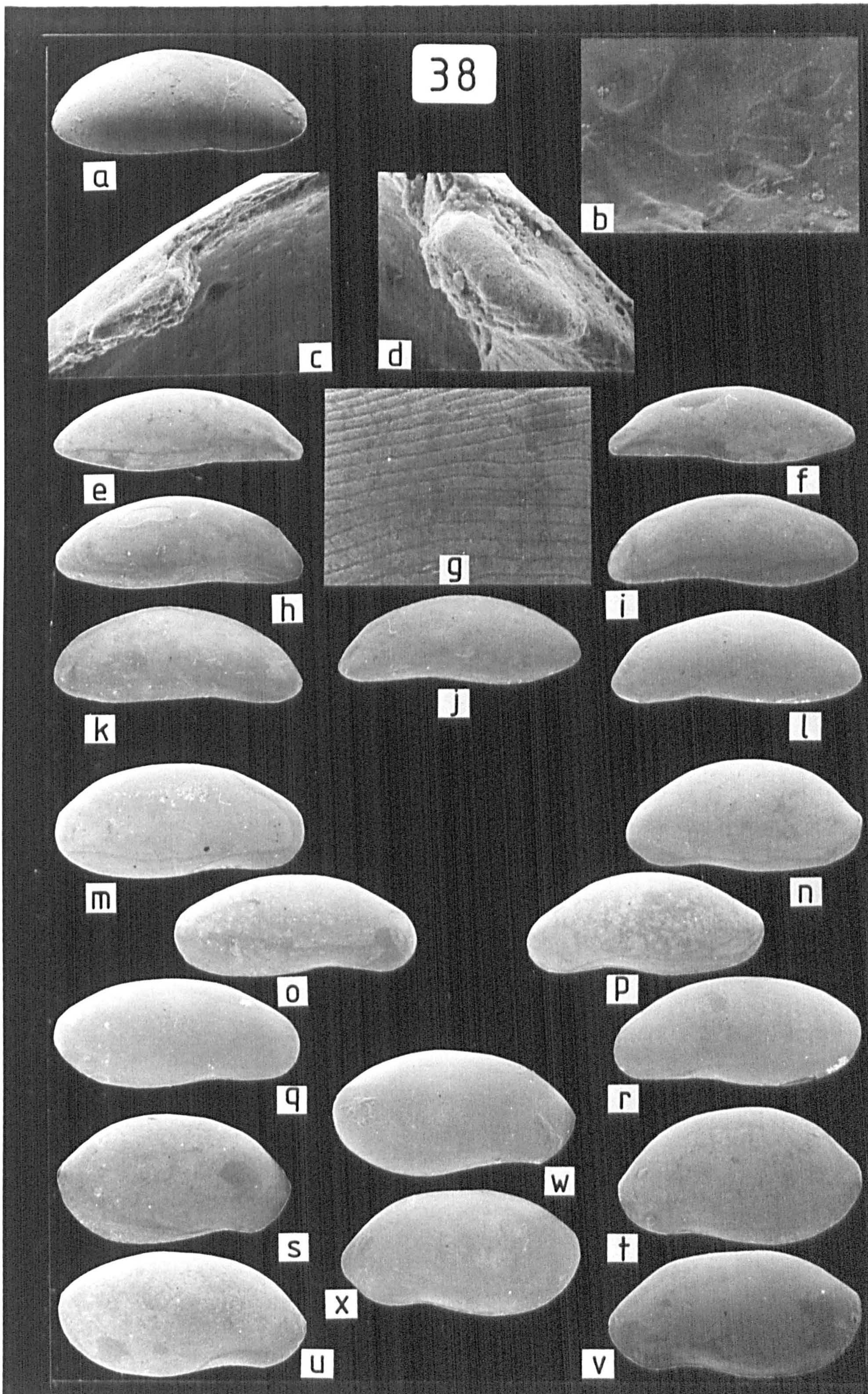

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PLATE 39

Machaerina tennissima (Norman) 1869 — Figs. a-b

Figs.			
a.	Female right valve. Lateral view.	Ref. 11.34A/35.	x 46
b.	Female left valve. Lateral view.	Ref. 11.33A/34.	x 46

Machaerina amygdaloides (Brady) 1870 — Figs. c-d

c.	Adult left valve. Lateral view.	Ref. 11.35A/36.	x 81
d.	Adult left valve. Detail of internal indicating the muscle scar pattern.	Ref. 32.1A/2.	x 750

Microcythere inflexa Müller 1894 — Figs. e-k

e.	Female right valve. Lateral view.	Ref. 11.20A/21.	x 155
f.	Female left valve. Lateral view.	Ref. 11.19A/20.	x 155
g.	Male right valve. Lateral view.	Ref. 11.18A/19.	x 150
h.	Male left valve. Lateral view.	Ref. 11.17A/18.	x 145
i.	Female right valve. Detail of internal indicating the muscle scar pattern.	Ref. 30.2/2A.	x 975
j-k.	Female right valve. Detail of internal indicating the anterior (Fig. j) and posterior (Fig. k) terminal elements of a lophodont hingement. Fig. j	Ref. 30.4/4A.	x 1,700
	Fig. k	Ref. 30.3/3A.	x 1,700

Microcythere sp. cf. M. bahusiensis Elofson 1944 — Figs. l-q

l.	Female? right valve. Lateral view.	Ref. 10.39/39A.	x 170
m.	Female? left valve. Lateral view.	Ref. 10.40/40A.	x 170
n.	Male? left valve. Lateral view.	Ref. 10.41/41A.	x 180
o.	Female? right valve. Detail of internal indicating the muscle scar pattern.	Ref. 30.21/21A.	x 1,080
p-q.	Female? right valve. Detail of internal indicating the anterior (Fig. p) and posterior (Fig. q) terminal elements of a lophodont hingement. Fig. p	Ref. 30.20/20A.	x 1,180
	Fig. q	Ref. 30.19/19A.	x 1,180

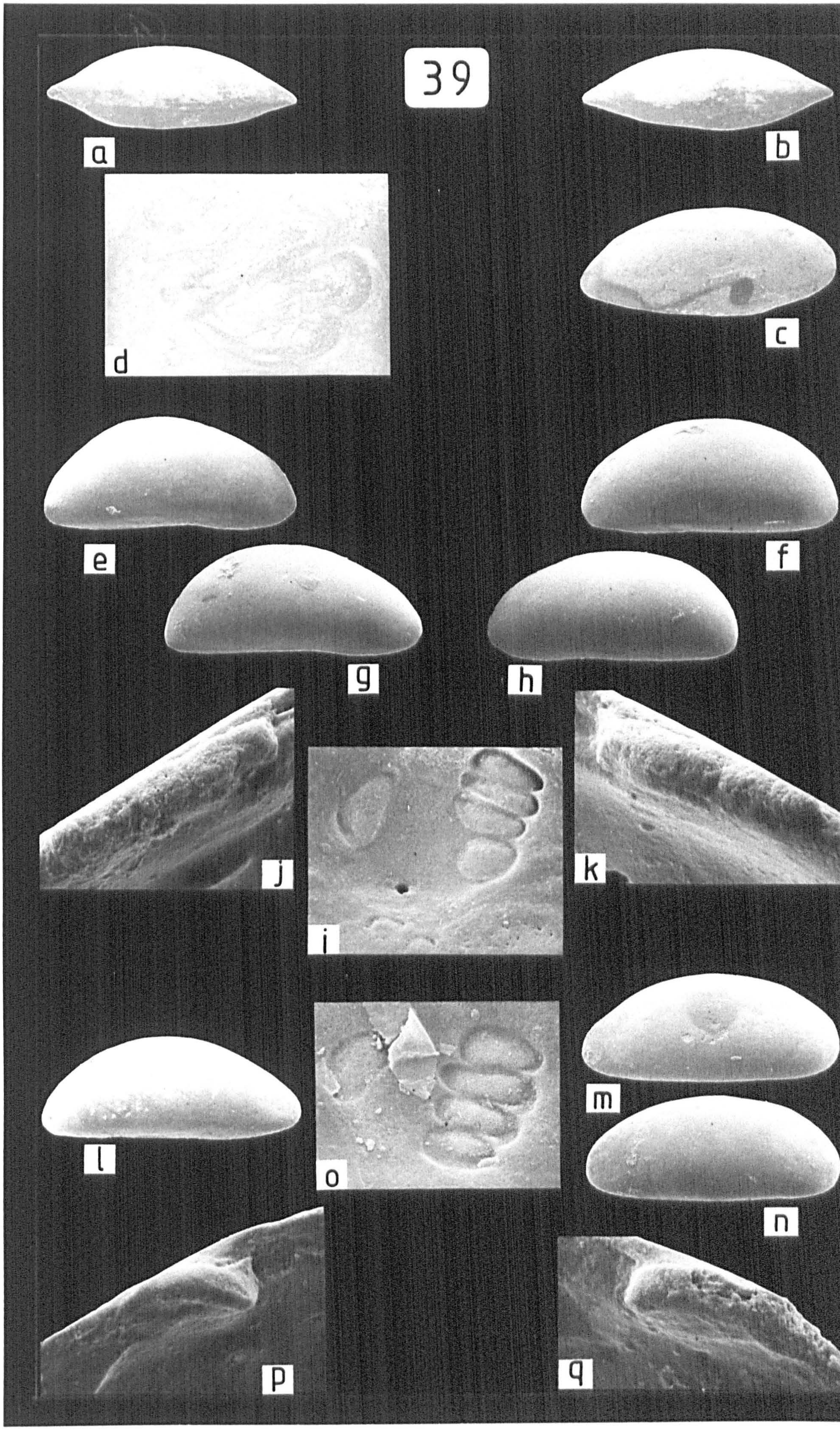

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PLATE 40

<u>Microcythere</u> <u>sp</u>. cf. <u>M</u>. <u>depressa</u> Müller 1894 Figs. a-e

Figs.				
a.	Female right valve. Lateral view.		Ref. 11.25A/26.	x 205
b.	Female left valve. Lateral view.		Ref. 11.26A/27.	x 200
c.	Male? left valve. Lateral view.		Ref. 11.28A/29.	x 210
d.	Male? left valve. Detail of internal indicating the muscle scar pattern.		Ref. 32.4A/5.	x 1,040
e.	Female right valve. Detail of external indicating a characteristic normal pore canal with a whorl shaped margin.		Ref. 29.10/10A.	x 6,500

<u>Microcythere</u> <u>helgolandica</u> Klie 1936 Figs. f-m

f.	Female right valve. Lateral view.		Ref. 11.14A/15.	x 140
g.	Female left valve. Lateral view.		Ref. 11.13A/14.	x 135
h.	Male right valve. Lateral view.		Ref. 11.16A/17.	x 170
i.	Male left valve. Lateral view.		Ref. 11.15A/16.	x 175
j.	Female right valve. Detail of internal indicating the muscle scar pattern.		Ref. 30.15/15A.	x 965
k-1.	Female right valve. Detail of internal indicating the anterior (Fig. k) and posterior (Fig. 1) terminal elements of the poorly preserved lophodont? hingement.	Fig. k	Ref. 30.13/13A.	x 2,510
		Fig. 1	Ref. 30.14/14A.	x 1,470
m.	Female left valve. Detail of external indicating a typical rounded and partially closed normal pore canal.		Ref. 30.12/12A.	x 11,000

<u>Microcythere</u> <u>sp</u>. cf. <u>M</u>. <u>monstruosa</u> Elofson 1944 Figs. n-u

n.	Female? right valve. Lateral view.		Ref. 10.34/34A.	x 175
o.	Female? left valve. Lateral view.		Ref. 10.36/36A.	x 170
p.	Male? left valve. Lateral view.		Ref. 10.35/35A.	x 170
q.	Penultimate instar right valve. Lateral view.		Ref. 10.37/37A.	x 210
r.	Penultimate instar left valve. Lateral view.		Ref. 10.38/38A.	x 215
s.	Female right valve. Detail of internal indicating the muscle scar pattern.		Ref. 30.24/24A.	x 930
t-u.	Female right valve. Detail of internal indicating the anterior (Fig. t) and posterior (Fig. u) terminal elements of a modified lophodont hingement.	Fig. t	Ref. 30.23/23A.	x 1,375
		Fig. u	Ref. 30.22/22A.	x 1,475

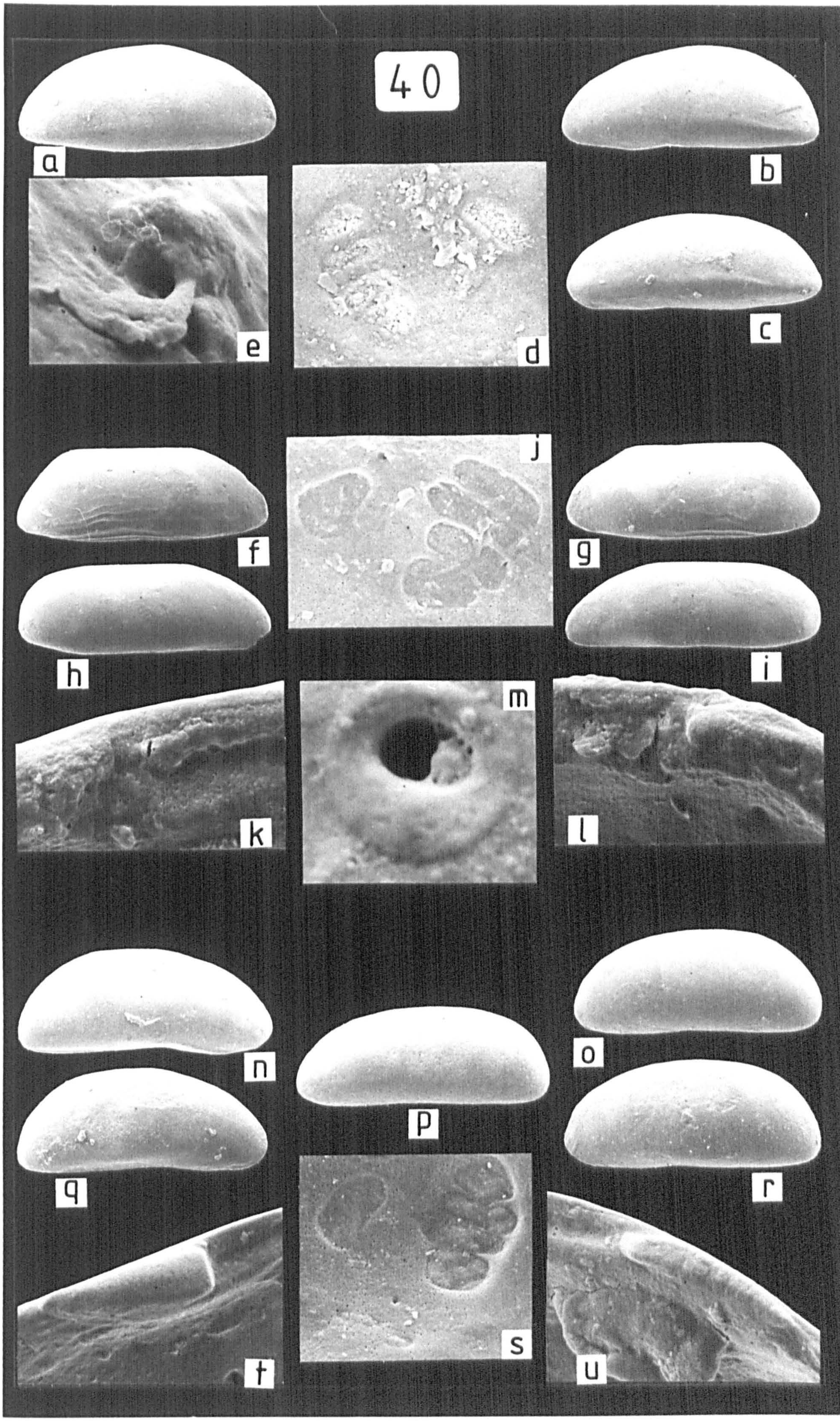
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PLATE 41

	Microcythere sp. cf. M. nana Müller 1894		Figs. a-g	
Figs.				
a.	Female right valve. Lateral view.		Ref. 11.23A/24.	x 155
b.	Female left valve. Lateral view.		Ref. 11.24A/25.	x 150
c.	Male? right valve. Lateral view.		Ref. 11.22A/23.	x 176
d.	Male? left valve. Lateral view.		Ref. 11.21A/22.	x 170
e.	Female right valve. Detail of internal indicating the muscle scar pattern.		Ref. 30.-	x 1,125
f-g.	Female right valve. Detail of internal indicating the anterior (Fig. f) and posterior (Fig. g) terminal elements of a modified lophodont hingement.	Fig. f	Ref. 30.1/1A.	x 1,550
		Fig. g	Ref. 30.0/0A.	x 1,250
	Microcythere sp. cf. M. producta Elofson 1944		Figs. h-o	
h.	Female? right valve. Lateral view.		Ref. 10/42/42A.	x 155
i.	Female? left valve. Lateral view.		Ref. 10.-	x 155
j.	Male? right valve. Lateral view.		Ref. 10.1/1A.	x 205
k.	Male? left valve. Lateral view.		Ref. 10.2/2A.	x 205
l.	Female? right valve. Detail of internal indicating the muscle scar pattern.		Ref. 32.5A/6.	x 1,150
m-n.	Female? right valve. Detail of internal indicating the anterior (Fig. m) and posterior (Fig. n) terminal elements of the lophodont hingement.	Fig. m	Ref. 30.18/18A.	x 1,440
		Fig. n	Ref. 30.17/17A.	x 1,440
o.	Female? left valve. Detail of external indicating a prominent ridge in the postero-dorsal region of the valve.		Ref. 30.16/16A.	x 2,530
	Microcythere sp.		Fig. p	
p.	Adult right valve. Lateral view.		Ref. 10.33/33A.	x 255
	Microcythere sp.A.		Fig. q	
q.	Adult left valve. Lateral view.		Ref. 11.27A/28.	x 150

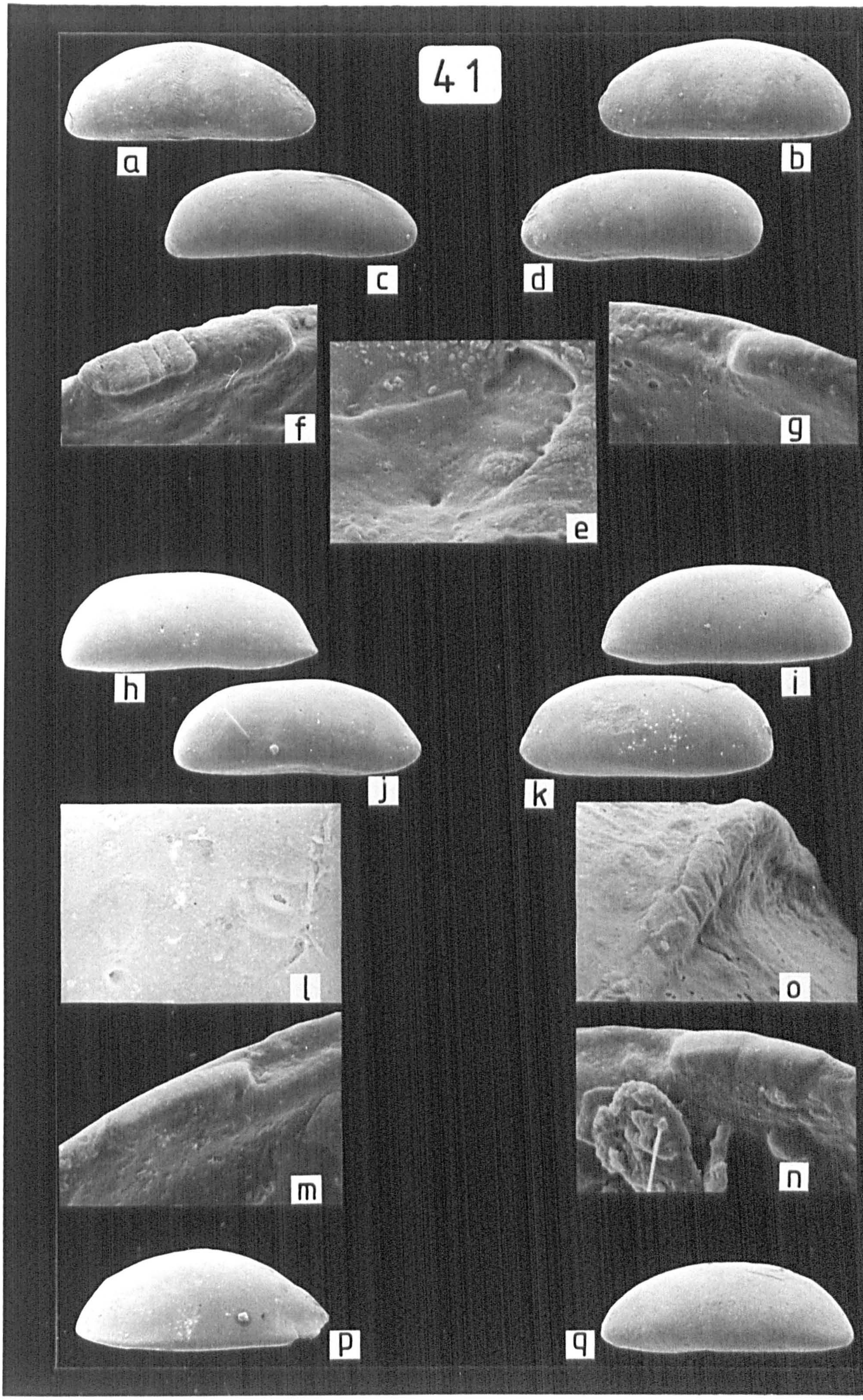
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PLATE 42

Cytheroma sp. cf. C. variabilis Müller 1894 — Figs. a-e

Figs.				
a.	Female right valve. Lateral view.		Ref. 21.20/20A.	x 125.
b.	Female left valve. Lateral view.		Ref. 21.19/19A.	x 125
c.	Male right valve. Lateral view.		Ref. 21.17/17A.	x 130
d.	Male left valve. Lateral view.		Ref. 21.18/18A.	x 130
e.	Female right valve. Detail of internal indicating the muscle scar pattern.		Ref. 32.28A/29.	x 750

Cytheroma variabilis Müller 1894 — Figs. f-m

f.	Female right valve. Lateral view.		Ref. 21.15/15A.	x 108
g.	Female left valve. Lateral view.		Ref. 21.14/14A.	x 108
h.	Male right valve. Lateral view.		Ref. 21.12/12A.	x 108
i.	Male left valve. Lateral view.		Ref. 21.13/13A.	x 108
j.	Penultimate instar right valve. Lateral view.		Ref. 21.16/16A.	x 142
k.	Female right valve. Detail of internal indicating the muscle scar pattern.		Ref. 27.36/36A.	x 813
1-m.	Female right valve. Detail of internal indicating the anterior (Fig. 1) and posterior (Fig. m) terminal element of a weak lophodont hingement.	Fig. 1	Ref. 32.30A/31.	x 750
		Fig. m	Ref. 32.29A/30.	x 750

Pellucistoma sp. — Figs. n-u

n.	Female? right valve. Lateral view.		Ref. 7.7A/8.	x 110
o.	Female? left valve. Lateral view.		Ref. 7.6A/7.	x 110
p.	Adult right valve. Lateral view.		Ref. 7.4A/5.	x 100
q.	Adult left valve. Lateral view.		Ref. 7.5A/6.	x 100
r.	Penultimate instar right valve. Lateral view.		Ref. 26.31/31A.	x 138
s.	Female? right valve. Detail of internal indicating the muscle scar pattern.		Ref. 26.39/39A.	x 580
t-u.	Female? right valve. Detail of internal indicating the anterior (Fig. t) and posterior (Fig. u) terminal elements of a fragile merodont? hingement.	Fig. t	Ref. 31.38/38A.	x 1,160
		Fig. u	Ref. 31.37/37A.	x 975

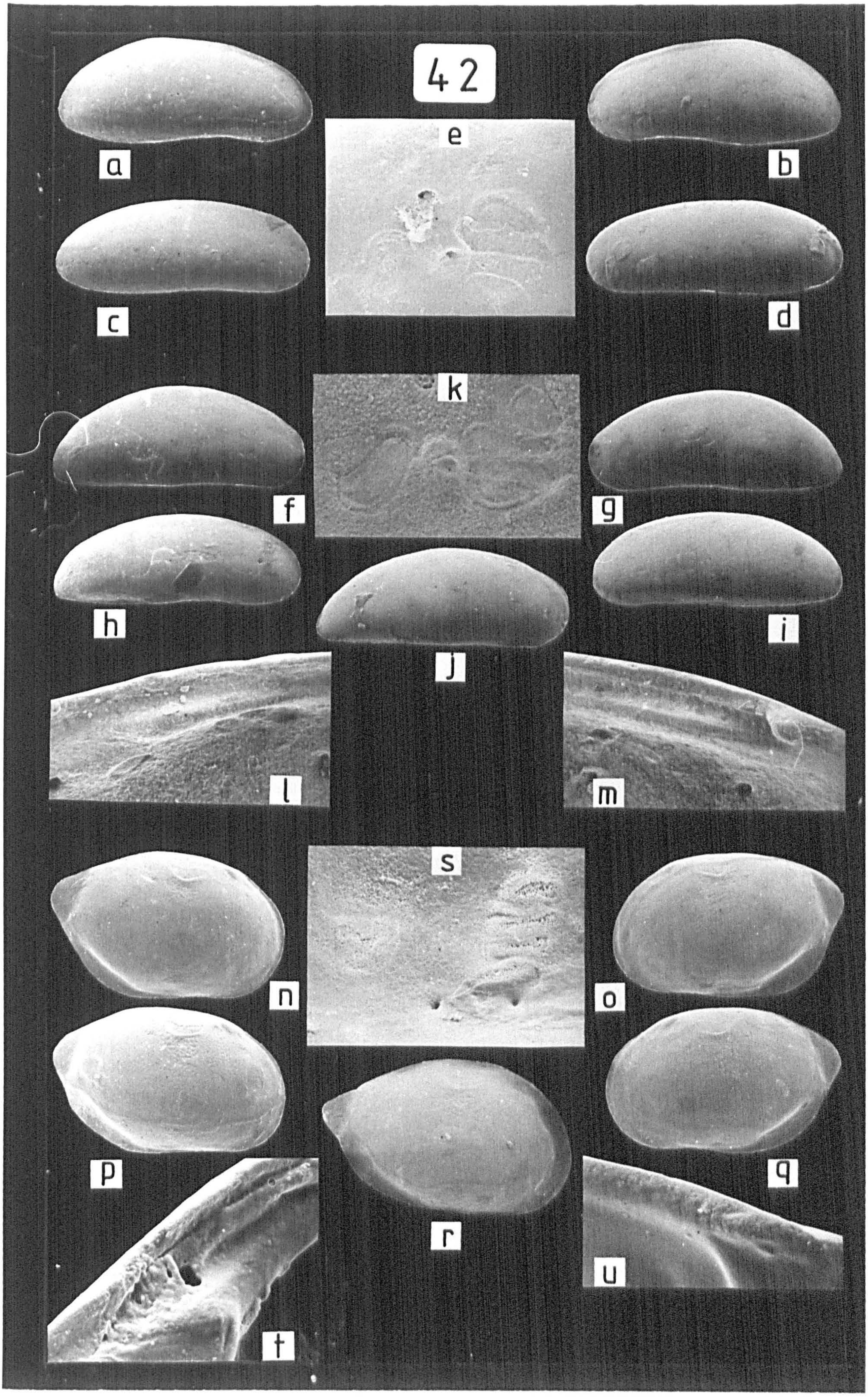
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PLATE 43

Figs.	*Xenocythere cuneiformis* (Brady) 1868	Figs. a-f	
a.	Female right valve. Lateral view.	Ref. 2.11/11A.	x 78
b.	Female left valve. Lateral view.	Ref. 2.10/10A.	x 78
c.	Male right valve. Lateral view.	Ref. 2.9/9A. 7/7A.	x 100
d.	Male left valve. Lateral view.	Ref. 2.8/8A. 6/6A.	x 88
e.	Juvenile (A-2) right valve. Lateral view.	Ref. 2.14/14A.	x 135
f.	Juvenile (A-2) left valve. Lateral view.	Ref. 2.12/12A.	x 135

	Palmenella limicola (Norman) 1865	Figs. g-j	
g.	Female right valve. Lateral view.	Ref. 9.4/4A.	x 85
h.	Male left valve. Lateral view.	Ref. 9.3/3A.	x 85
i.	Penultimate instar right valve. Lateral view.	Ref. 9.5/5A.	x 108
j.	Penultimate instar left valve. Lateral view.	Ref. 9.6/6A.	x 108

	Trachyleberis dunelmensis (Norman) 1865)	Figs. k-q	
k.	Female right valve. Lateral view.	Ref. 31.20/30A.	x 64
l.	Female left valve. Lateral view.	Ref. 2.23/23A.	x 63
m.	Male right valve. Lateral view.	Ref. 2.22/22A.	x 60
n.	Male left valve. Lateral view.	Ref. 2.21/21A.	x 60
o.	Penultimate instar right valve. Lateral view.	Ref. 2.25/25A.	x 75
p.	Penultimate instar left valve. Lateral view.	Ref. 2.26/26A.	x 75
q.	Juvenile (A-4) right valve. Lateral view.	Ref. 2.27/27A.	x 128

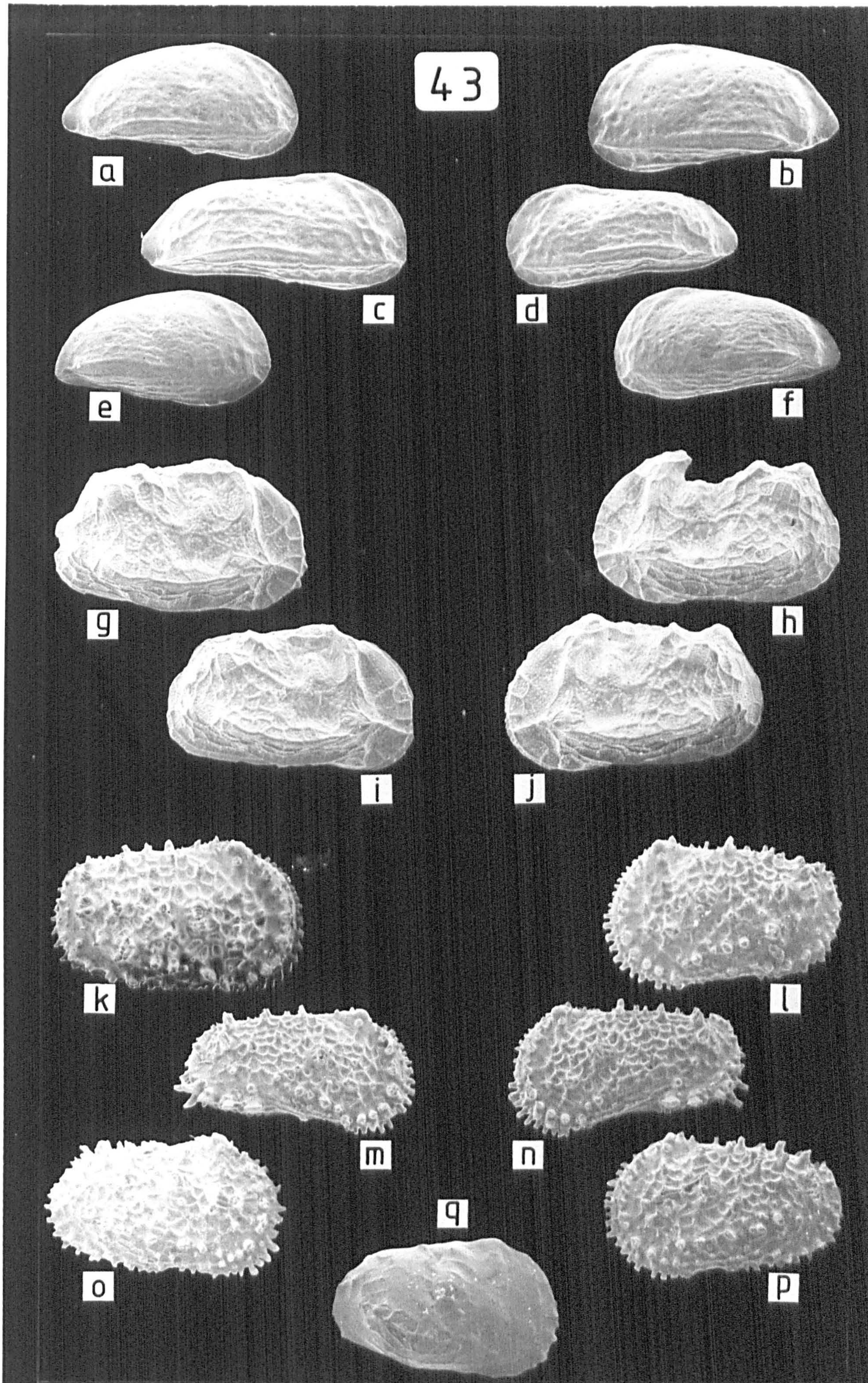
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PLATE 44

Buntonia corpulenta (Brady and Norman) 1889 Figs. a-i

Figs.			
a.	Female right valve. Lateral view.	Ref. 24.2/2A.	x 118
b.	Female left valve. Lateral view.	Ref. 24.3/3A.	x 113
c.	Male right valve. Lateral view.	Ref. 24.1/1A.	x 109
d.	Male left valve. Lateral view.	Ref. 24.-	x 111
e.	Penultimate instar left valve. Lateral view.	Ref. 24.4/4A.	x 131
f.	Female right valve. Detail of internal indicating the muscle scar pattern.	Ref. 30.11/11A.	x 563
g-h.	Female right valve. Detail of internal indicating the anterior (Fig. g) and posterior (Fig. h) terminal elements of a holamphidont hingement. Fig. g	Ref. 27.3A/4.	x 960
	Fig. h	Ref. 27.2A/3.	x 1,139
i.	Male left valve. Detail of external indicating a typical, simple, normal pore canal.	Ref. 30.10A/11.	x 8,850

Carinocythereis carinata (Roemer) 1838 Figs. j-o

j.	Female right valve. Lateral view.	Ref. 23.38A/39.	x 62
k.	Female left valve. Lateral view.	Ref. 23.39A/40.	x 62
l.	Male right valve. Lateral view.	Ref. 23.36A/37.	x 57
m.	Male left valve. Lateral view.	Ref. 23.37A/38.	x 57
n.	Penultimate instar right valve. Lateral view.	Ref. 23.41A/41.	x 73
o.	Penultimate instar left valve. Lateral view.	Ref. 23.41A/42.	x 73

Carinocythereis antiquata (Baird) 1850 Figs. p-v

p.	Female right valve. Lateral view.	Ref. 26.4A/5.	x 44
q.	Female left valve. Lateral view.	Ref. 26.5A/6.	x 40
r.	Male right valve. Lateral view.	Ref. 23.42A.	x 47
s.	Male left valve. Lateral view.	Ref. 23.1.	x 47
t.	Juvenile (A-2) right valve. Lateral view.	Ref. 26.3A/4.	x 97
u.	Juvenile (A-2) left valve. Lateral view.	Ref. 31.22/22A.	x 86
v.	Juvenile (A-5)? left valve. Lateral view.	Ref. 26.2A/3.	x 150

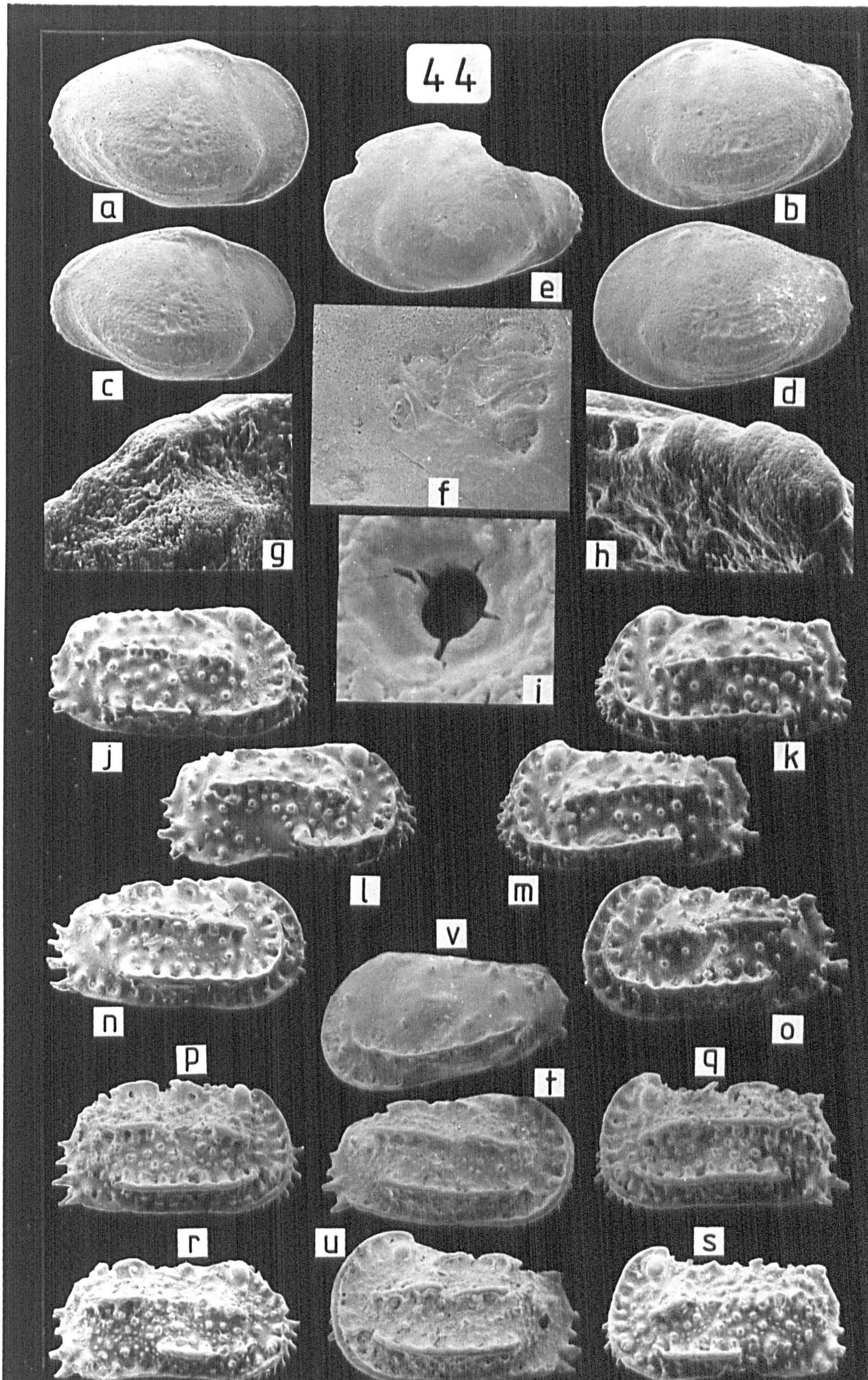
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PLATE 45

Celtia quadridentata (Baird) 1850 — Figs. a-f

Figs.			
a.	Female right valve. Lateral view.	Ref. 23.32A/33.	x 65
b.	Female left valve. Lateral view.	Ref. 23.33A/34.	x 65
c.	Male right valve. Lateral view.	Ref. 23.30/31.	x 69
d.	Male left valve. Lateral view.	Ref. 23.31A/32.	x 69
e.	Penultimate instar right valve. Lateral view.	Ref. 23.35A/36.	x 79
f.	Penultimate instar left valve. Lateral view.	Ref. 23.34A/35.	x 81

Falunia emaciata (Brady) 1868 — Figs. g-l

g.	Female right valve. Lateral view.	Ref. 16.21A/22.	x 63
h.	Female left valve. Lateral view.	Ref. 16.22A/23.	x 63
i.	Male right valve. Lateral view.	Ref. 16.20A/21.	x 64
j.	Male left valve. Lateral view.	Ref. 16.19A/20.	x 64
k.	Penultimate instar right valve. Lateral view.	Ref. 16.23A/24.	x 84
l.	Penultimate instar left valve. Lateral view.	Ref. 16.24A/25.	x 84

Robertsonites tuberculata (Sars) 1866 — Figs. m-t

m.	Female right valve. Lateral view.	Ref. 6.32A/33.	x 50
n.	Female left valve. Lateral view.	Ref. 6.33A/34.	x 50
o.	Male right valve. Lateral view.	Ref. 6.31A/32.	x 50
p.	Male left valve. Lateral view.	Ref. 6.30A/31.	x 50
q.	Penultimate instar right valve. Lateral view.	Ref. 6.34A/35.	x 73
r.	Penultimate instar left valve. Lateral view.	Ref. 6.35A/36.	x 73
s.	Juvenile (A-5) right valve. Lateral view.	Ref. 6.37A/38.	x 163
t.	Juvenile (A-5) left valve. Lateral view.	Ref. 6.36A/37.	x 163

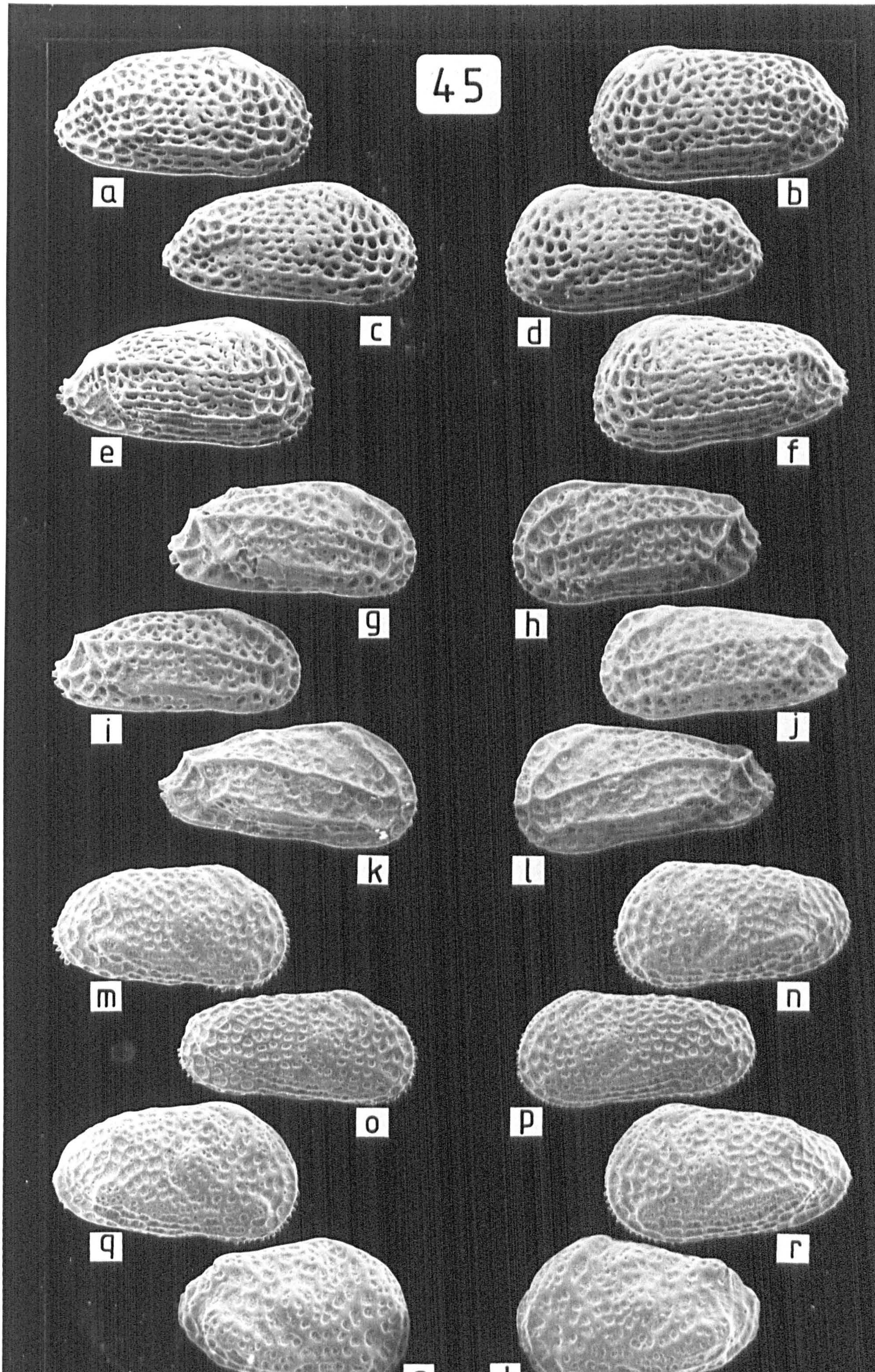
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PLATE 46

Figs.	Rabilimis mirabilis Brady 1868	Figs. a-d	
a.	Female right valve. Lateral view.	Ref. 6.42A.	x 43
b.	Female left valve. Lateral view.	Ref. 6.41A/42.	x 43
c.	Juvenile (A-2?) right valve. Lateral view.	Ref. 6.1.	x 71
d.	Juvenile (A-3?) left valve. Lateral view.	Ref. 6.1A/2.	x 90

	Xestoleberis aurantia (Baird) 1838	Figs. e-k	
e.	Female right valve. Lateral view.	Ref. 1.-	x 60
f.	Female left valve. Lateral view.	Ref. 1.42/42A.	x 60
g.	Male right valve. Lateral view.	Ref. 1.41/41A.	x 60
h.	Male left valve. Lateral view.	Ref. 1.1/1A.	x 60
i.	Penultimate instar right valve. Lateral view.	Ref. 1.2/2A.	x 75
j.	Penultimate instar left valve. Lateral view.	Ref. 1.4/4A.	x 75
k.	Female right valve. Detail of external indicating a typical normal pore seive plate.	Ref. 1.3/3A. 8/8A.	x 1,500

	Xestoleberis depressa Sars 1865	Figs. l-q	
l.	Female right valve. Lateral view.	Ref. 1.7/7A.	x 44
m.	Female left valve. Lateral view.	Ref. 1.9/9A.	x 44
n.	Male right valve. Lateral view.	Ref. 1.6/6A.	x 50
o.	Male left valve. Lateral view.	Ref. 1.5/5A.	x 50
p.	Penultimate instar right valve. Lateral view.	Ref. 1.10/10A.	x 75
q.	Penultimate instar left valve. Lateral view.	Ref. 1.11/11A.	x 63

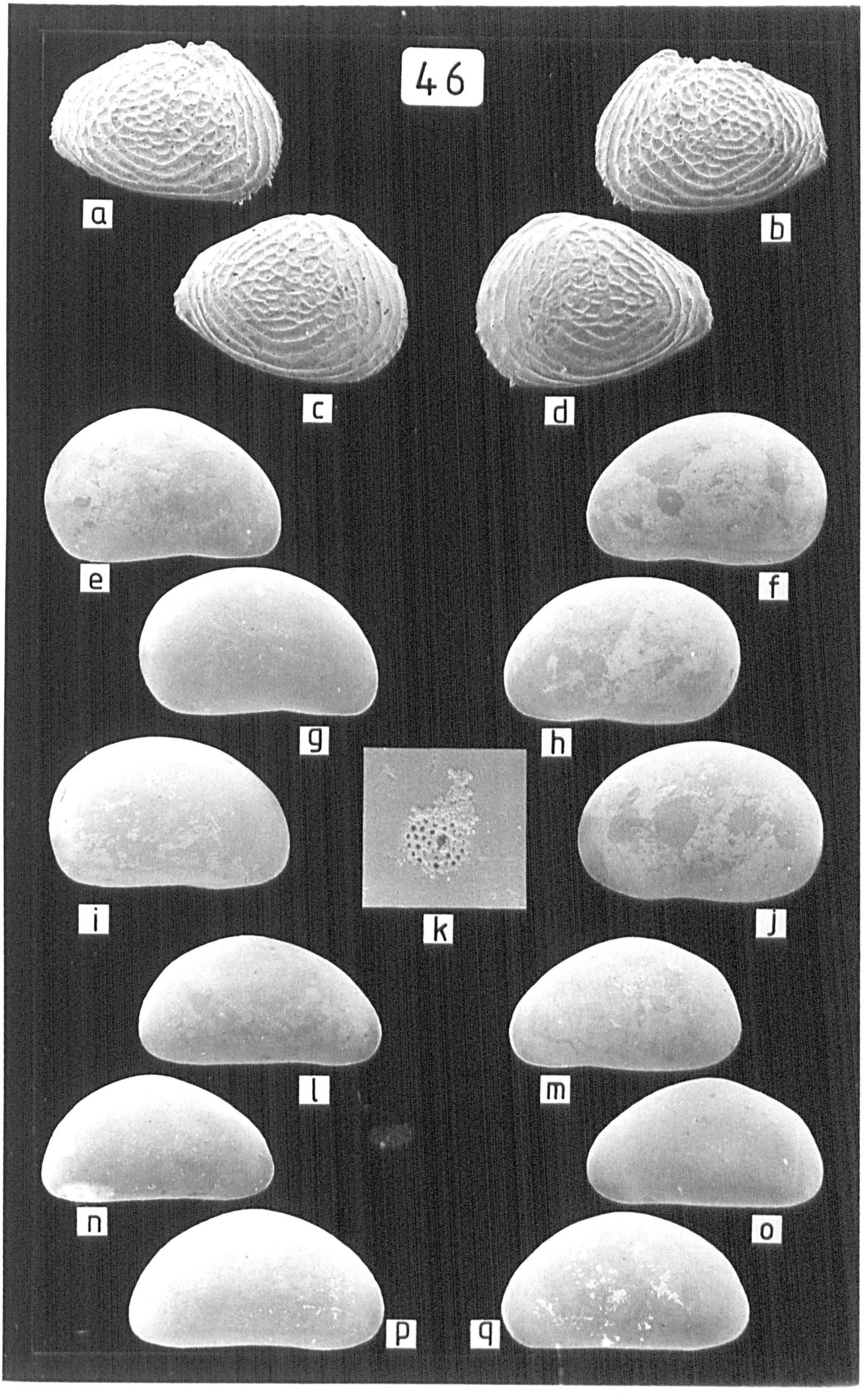
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PLATE 47

Cytherella sp. cf. C. scotica Brady 1866 — Figs. a-h

Figs.			
a.	Female right valve. Lateral view.	Ref. 22.39A/40.	x 63
b.	Female left valve. Lateral view.	Ref. 22.40A/41.	x 63
c.	Male right valve. Lateral view.	Ref. 22.41A/42.	x 64
d.	Male left valve. Lateral view.	Ref. 22.42A.	x 64
e.	Juvenile (A-2) right valve. Lateral view.	Ref. 22.1A/2.	x 89
f.	Juvenile (A-2) left valve. Lateral view.	Ref. 22.1.	x 89
g.	Female right valve. Detail of internal indicating the muscle scar pattern.	Ref. 27.34/34A.	x 425
h.	Male left valve. Detail of external indicating a typical simple, normal pore canal, which latter are often constricted medianly and possess a partially raised lip around the margin.	Ref. 27.33A/34.	x 645

Philomedes brenda (Baird) 1850 — Figs. i-j

i.	Female carapace left valve. Lateral view.	Ref. 7.2A/3.	x 46
j.	Female carapace left valve. Detail of external indicating the general ornament of circular calcitic plates. The largest of which is paired with that of the right valve to form the carapace ocular structure.	Ref. 7.3A/4.	x 225

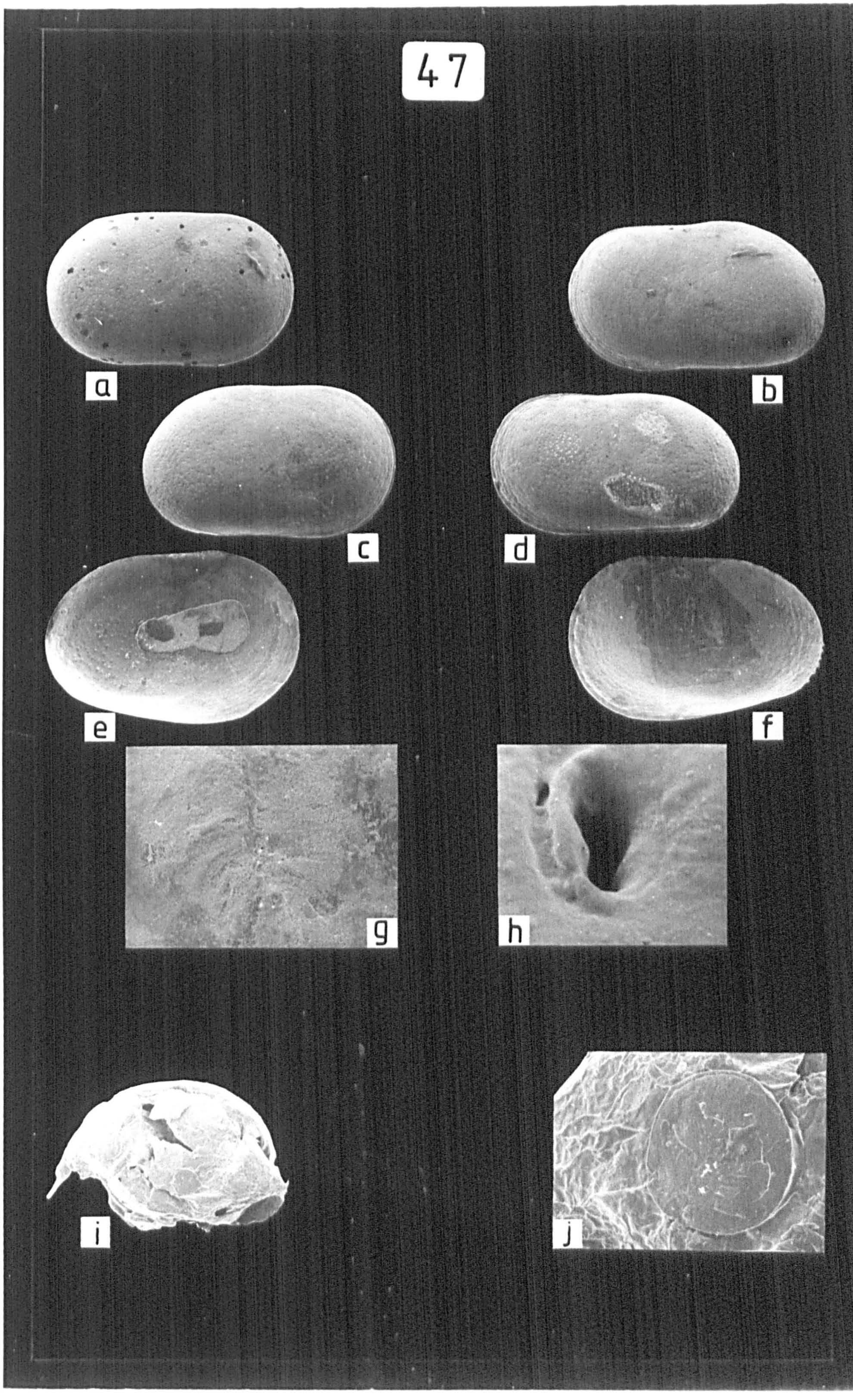
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TABLE 1

SAMPLE NO.	DEPTH IN M	LATITUDE ° ' "	LONGITUDE ° ' "	SAMPLE NO.	DEPTH in M	LATITUDE ° ' "	LONGITUDE ° ' "
800	36.6	52 40 24	05 40 24	801	33.5	52 42 15	06 01 51
802	29.0	52 43 54	06 03 54	803	23.5	52 44 18	06 05 00
804	17.7	52 47 54	06 02 39	805	22.9	52 49 30	06 01 30
806	21.3	52 51 27	03 59 24	807	18.3	52 48 21	06 05 06
810	15.2	52 46 36	06 00 12	815	40.3	52 38 22	06 01 48
816	29.3	52 37 32	06 04 58	819	27.4	52 42 12	06 05 33
820	18.3	52 50 36	06 03 08	822	15.2	52 56 30	05 56 42
823	12.2	52 57 21	05 57 12	825	14.6	52 59 36	05 57 30
826	12.8	53 01 03	05 57 15	827	55.0	52 59 46	05 54 27
829	45.7	52 55 12	05 54 06	833	21.9	52 57 54	05 05 48
834	18.3	52 59 59	05 51 30	837	12.2	53 05 36	05 49 36
839	16.5	53 03 48	05 47 00	840	18.3	53 02 30	05 47 08
842	20.1	52 58 00	05 47 58	843	27.4	52 57 00	05 48 12
844	36.6	52 54 38	05 47 34	845	27.4	52 53 42	05 51 36
850	15.2	53 01 24	06 00 48	857	8.2	52 59 24	06 01 48
860	15.2	52 45 34	06 05 33	862	6.1	52 43 39	06 08 09
868	18.3	52 37 56	06 07 30	871	32.9	52 35 30	06 05 31
872	27.4	52 34 24	06 04 14	873	22.9	52 34 58	06 01 14
875	30.5	52 44 40	05 58 15	877	29.0	52 48 34	05 57 12
880	33.5	52 52 18	05 54 12	881	33.5	52 51 24	05 54 42
887	7.9	52 40 00	06 08 14	891	11.0	52 39 32	06 11 09
903	15.2	52 34 30	06 09 00	906	27.4	52 34 42	06 07 12
910	25.6	52 40 18	06 05 12	912	61.0	52 40 06	05 53 12
913	61.0	52 43 52	05 52 30	914	57.9	52 45 24	05 52 06
915	45.7	52 47 42	05 51 33	916	38.1	52 50 48	05 49 24
917	35.1	52 52 58	05 48 00	918	20.7	52 52 18	05 49 00
920	45.1	52 50 24	05 48 12	921	48.2	52 48 18	05 48 30
922	61.0	52 46 00	05 49 00	923	67.1	52 43 40	05 49 30
924	64.0	52 43 32	05 49 34	925	48.8	52 42 24	05 55 30
926	54.9	52 39 48	05 56 18	2347	32.9	52 43 50	05 59 38
2351	58.5	52 57 46	05 53 42	2353	23.0	53 08 00	05 59 22
2354	41.0	53 08 58	05 58 47	2357	47.6	53 11 00	05 45 12
2358	34.8	53 04 12	05 50 00	2359	77.0	53 26 09	05 49 18
2360	137.5	53 26 35	05 47 48	2361	78.6	53 29 42	05 48 48
2365	40.0	53 09 14	06 01 42				
2366	26.1	53 11 42	06 00 18	2367	24.1	53 13 06	06 01 25
2368	27.4	53 16 00	06 02 36	2369	11.0	53 17 24	06 06 12
2370	18.3	53 20 24	06 03 25	2372	30.0	53 24 36	06 02 13
2373	18.3	53 25 14	06 02 10	2375	23.8	53 36 06	06 05 48
2377	13.0	53 38 42	06 08 10	2378	16.0	53 40 42	06 08 42
2380	20.1	53 44 42	06 10 12	2381	21.9	53 46 36	06 11 12
2761	25.0	53 17 24	05 58 54	2762	27.0	53 17 24	05 59 12
2764	40.0	53 10 54	05 57 18	2765	37.0	53 11 24	05 57 12
2779	13.0	53 15 48	06 05 28	2780	14.0	53 10 00	06 02 24
2781	7.0	53 04 42	06 01 18	2782	15.0	53 19 54	05 55 18
2783	27.0	53 19 54	05 55 18	2784	27.0	52 23 48	05 40 06
2785	55.0	53 18 25	05 41 00	2786	37.0	53 14 40	05 41 00
2788	34.0	53 00 55	05 40 75	2789	18.0	53 30 30	06 01 99
2790	22.0	53 35 05	06 25 58	2791	9.0	52 57 06	05 58 18
2792	20.0	53 14 15	05 54 05	2797	18.0	52 33 48	06 10 48
2810	60.9	53 35 30	05 49 54	2811	59.4	53 40 18	05 48 12
2812	28.9	53 39 24	06 00 42	2813	33.5	53 45 00	05 59 24
2814	36.0	53 50 30	05 52 30	2815	30.5	53 56 00	05 58 45
2816	36.6	53 59 53	05 50 00	2818	50.3	53 49 45	05 50 00
2819	54.9	53 45 45	05 49 45	2820	19.5	53 48 08	06 10 52
2821	24.4	53 50 08	06 08 30	2822	15.2	53 56 15	06 12 30
2823	15.0	54 07 23	05 56 58	2824	24.4	54 05 37	05 49 23
2825	18.0	54 09 45	05 48 30	2826	6.1	53 41 30	06 05 48
2854	2.7	54 01 20	06 05 90	2900	67.7	52 50 12	05 40 06
2901	36.6	52 54 48	05 40 48	2902	109.7	53 24 18	05 37 30
2903	45.7	53 23 06	05 48 24	2904	80.5	53 30 00	05 40 12
2905	87.8	53 34 18	05 42 12	2906	87.8	53 39 24	05 40 48
2907	82.3	53 32 24	05 43 00	2908	84.1	53 55 48	05 24 06
2910	54.9	54 02 00	05 25 48	2911	44.8	53 41 30	06 05 48
2912	26.5	54 10 12	05 40 12	2914	21.9	53 55 00	06 06 30
2915	33.0	53 44 18	06 01 48	2916	36.6	53 20 12	06 01 42
2917	42.1	53 29 36	05 53 48	2918	43.9	53 17 12	05 50 24
2919	16.5	53 09 30	05 49 30	2920	31.1	53 03 00	05 51 12

TABLE 2

SAMPLE NO.	DEPTH IN M.	LATITUDE ° ' "	LONGITUDE ° ' "	SAMPLE NO.	DEPTH IN M.	LATITUDE ° ' "	LONGITUDE ° ' "
2385	54.9	53 04 36	04 51 36	2387	84.1	53 04 46	04 43 36
2388	38.4	53 03 09	04 37 26	2389	20.1	53 01 08	04 33 48
2392	82.3	53 12 00	04 36 49	2393	65.8	52 58 12	04 52 36
2394	54.9	52 57 59	04 51 24	2395	55.0	52 58 24	04 44 00
2396	29.3	52 58 10	04 35 37	2397	16.5	52 58 12	04 34 30
2398	9.0	52 58 14	04 31 00	2399	7.0	52 58 36	04 46 48
2400	13.0	53 02 00	04 26 00	2401	10.9	53 04 32	04 23 42
2402	11.0	53 04 36	04 23 54	2403	13.0	53 05 18	04 28 18
2404	26.0	53 06 06	04 32 42	2405	12.7	53 06 24	04 33 00
2406	18.0	53 09 48	04 28 18	2407	22.0	53 10 18	04 34 24
2408	25.6	53 12 54	04 36 24	2419	58.0	52 48 36	04 49 06
2420	35.0	52 50 30	04 45 30	2421	37.0	52 53 12	04 42 12
2422	23.78	52 54 30	04 39 30	2423	64.0	52 52 24	04 50 12
2424	80.5	53 18 00	05 04 30	2426	150.0	53 17 12	05 21 54
2427	150.0	53 17 06	05 22 00	2428	126.0	53 12 06	05 21 48
2429	119.0	53 07 18	05 21 24	2430	88.0	53 52 12	05 20 48
2431	75.0	52 56 36	05 21 48	2432	73.0	52 51 48	05 20 36
2433	70.0	52 46 50	05 02 24	2439	60.0	52 43 48	05 19 48
2440	73.0	53 21 48	04 46 24	2441	55.5	53 24 06	04 47 24
2442	46.0	53 18 48	04 50 24	2443	56.7	53 18 34	04 55 24
2444	64.0	53 19 00	05 00 30	2445	157.3	53 18 02	05 07 36
2447	109.7	53 18 54	05 12 48	2449	124.4	53 08 36	05 11 36
2456	?	NO ACCURATE LOG		2457	120.7	53 21 48	05 13 48
2460	82.3	53 27 48	05 22 36	2461	82.3	53 27 50	05 14 24
2462	82.3	52 28 00	o5 06 24	2463	131.7	53 26 48	04 58 24
2465	73.2	53 28 48	04 50 00	2467	31.1	53 24 12	04 38 18
2509	84.1	53 28 48	04 52 24	2510	62.2	53 26 22	04 50 24
2511	51.2	53 23 18	04 49 24	2512	54.9	53 23 18	04 49 24
2513	60.4	53 20 12	04 48 18	2514	69.5	53 20 48	04 45 54
2515	38.4	53 09 48	04 37 00	2516	49.4	53 09 48	04 41 36
2517	54.9	53 09 58	04 45 06	2518	95.7	53 11 42	04 45 42
2519	45.7	53 13 24	04 46 18	2520	36.6	53 11 42	04 42 12
2521	32.9	53 13 18	04 39 30	2637	40.0	53 15 42	04 53 06
2638	49.0	53 14 42	04 59 24	2639	91.0	53 13 42	05 05 30
2640	78.7	53 09 48	05 05 00	2641	88.0	53 05 42	05 04 18
2642	84.0	53 01 12	05 03 18	2643	55.0	53 03 48	04 56 30
2644	46.0	53 06 46	04 50 06	2645	51.0	53 07 48	04 57 48
2646	51.0	53 10 12	04 58 12	2647	49.0	53 12 30	04 52 24
2770	82.3	52 47 06	05 24 42	2771	76.82	52 53 18	05 24 30
2773	84.1	53 00 30	05 23 36	2774	120.0	53 07 06	05 24 30
2776	157.0	53 14 24	05 24 42	2827	27.0	53 22 00	04 37 54
2828	47.0	53 16 00	04 46 34	2829	18.0	53 14 00	04 36 36
2830	13.0	53 20 12	04 37 12	2831	12.0	53 05 18	04 27 24
2832	75.0	53 02 42	04 45 30	2833	48.0	53 22 36	04 5 00
2834	57.0	52 55 06	04 51 12	2835	18.0	53 02 12	04 30 18
2836	18.0	53 03 49	04 31 00	2837	23.0	53 07 12	04 32 48
2838	25.0	52 58 36	04 28 24	2839	44.0	53 08 18	04 40 18
2840	57.0	53 06 42	04 43 23	2843	79.0	53 04 36	04 42 24
2844	73.0	53 05 24	04 35 48	2890	73.1	52 26 12	04 41 48
2891	69.5	52 33 00	04 51 12	2892	82.0	52 31 48	05 02 22
2893	110.0	52 33 30	05 09 48	2894	117.0	52 38 24	05 06 30
2895	101.0	53 01 12	05 10 18	2896	110.0	53 05 00	05 10 36
2921	118.9	53 08 54	05 11 36	2922	131.7	53 02 24	05 10 24
2923	146.3	53 18 54	05 16 12	2924	109.7	53 22 48	05 22 12
2925	55.0	53 27 12	04 41 42	2926	36.60	53 21 12	04 41 48
HHI	0.5	NO ACCURATE LOG		HHII	0.5	NO ACCURATE LOG	

TABLE 3

SAMPLE NO.	DEPTH IN M.	LATITUDE ° ' "	LONGITUDE ° ' "	SAMPLE NO.	DEPTH IN M.	LATITUDE ° ' "	LONGITUDE ° ' "
3000	86.0	55 17 35	08 39 36	3001	91.5	55 16 24	08 31 00
3003	50.0	55 14 48	08 05 18	3004	45.0	55 15 24	07 57 36
3005	45.7	55 16 24	07 16 24	3007	34.8	55 18 54	07 32 48
3010	47.6	55 26 36	07 20 12	3011	32.9	55 21 48	07 06 00
3012	47.6	55 19 00	06 58 12	3013	42.0	55 17 00	06 51 18
3014	22.0	55 16 24	06 57 18	3015	22.0	55 19 24	07 05 12
3016	22.0	55 21 36	07 10 48	3037	91.0	55 19 30	08 46 30
3038	116.0	55 20 36	08 57 06	3039	102.4	55 21 36	09 04 12
3040	136.0	55 23 42	09 11 18	3041	182.0	55 27 36	09 32 50
3042	64.0	55 30 54	07 28 24	3043	62.0	55 31 42	07 22 06
3044	51.2	55 33 30	07 17 12	3045	29.3	55 28 18	07 16 30
3052	91.5	55 42 08	07 53 30	3053	73.2	55 35 46	07 52 30
3062	62.2	55 17 18	08 15 18	3063	86.0	55 25 00	08 19 18
3065	91.4	55 37 48	08 23 00	3066	106.0	55 14 57	08 27 12
3076	78.7	55 25 42	08 22 24	3077	80.5	55 33 24	08 13 24
3078	91.5	55 39 18	08 15 00	3079	115.0	55 25 24	08 17 36
3080	73.2	55 28 00	07 56	3084	73.2	55 28 00	07 56 30
				3087	78.7	55 27 00	08 03 00
3090	55.0	55 33 24	06 10 30	3091	91.0	55 27 12	06 16 00
3092	91.0	55 27 00	06 15 18	3094	91.0	55 20 00	06 30 00
3095	79.0	55 17 48	06 35 36	3096	42.0	55 15 08	06 40 42
3097	32.0	55 15 36	06 21 34	3098	100.0	55 32 08	06 26 00
3099	77.0	55 36 20	06 35 00	3100	46.0	55 38 48	06 25 00
3101	55.0	55 33 42	06 33 42	3102	46.0	55 25 30	05 57 06
3103	46.0	55 28 20	06 03 00	3104	82.0	55 23 30	06 07 00
3107	56.0	55 28 24	06 49 00	3108	55.0	55 23 48	06 55 00
3109	27.0	55 26 42	07 00 36	3112	82.0	55 32 30	06 41 48
3114	82.0	55 27 48	06 31 24	3115	91.0	55 23 36	06 37 36
3125	-	55 51 39	06 20 59	3127	-	55 45 42	06 13 16
3128	73.2	55 32 10	07 05 30	3130	51.2	55 37 00	07 07 75
3132	65.8	55 37 70	07 32 25	3133	49.4	55 42 00	06 41 70
3135	34.9	55 43 00	07 04 49	3136	36.6	55 50 30	06 40 30
3137	54.9	55 49 00	06 50 20	3138	49.4	55 48 80	07 00 12
3139	62.2	55 49 30	07 10 99	3140	54.9	55 47 90	07 19 50
3141	73.2	55 48 20	07 30 30	3142	128.0	55 48 20	07 41 30
3143	146.3	55 48 80	07 52 22	3144	137.2	55 52 12	08 26 01
3145	146.3	55 53 00	08 35 25	3146	146.0	55 47 00	07 25 40
3147	512.1	55 47 50	07 31 00	3148	512.1	55 42 60	09 23 12
3149	115.2	55 41 35	09 08 25	3150	115.2	55 40 40	08 54 05
3151	96.9	55 40 00	08 41 75	3152	173.8	55 53 10	08 15 10
3153	170.1	55 54 85	08 06 75	3154	170.1	55 55 20	07 57 00
3155	51.2	55 55 35	06 32 25	3156	32.0	55 55 36	06 42 36
3157	54.9	55 54 31	06 52 35	3158	65.8	55 54 50	07 03 01
3159	76.8	55 54 85	07 13 75	3160	87.8	55 55 00	07 23 20
3161	128.0	55 54 80	07 34 49	3162	140.8	55 30 08	07 44 30
3163	60.40	55 42 80	07 35 50	3164	65.80	55 42 55	07 23 90
3165	54.90	55 42 75	07 14 25	3168	247.0	55 20 77	06 12 50

TABLE 4

SAMPLE NO.	TOT. WT. = 100%	30 Gm.	30 %	60 Gm.	60 %	100 Gm.	100 %	230 Gm.	230 %	FINES Gm.	FINES %	SEDIMENT TYPE
800	28.95	15.52	53.61	12.24	42.28	0.50	1.73	0.02	0.07	0.67	2.31	Cs + Gvl
801	19.95	10.5	52.63	2.9	14.54	4.71	23.61	1.80	9.02	0.04	0.20	Mx S
802	29.06	18.39	63.28	5.1	17.55	2.6	8.95	1.89	6.60	1.08	3.72	Cs + Gvl
803	25.94	0.4	1.54	14.9	57.44	10.34	39.86	0.08	0.31	0.23	0.85	Mx S
804	11.97	8.0	66.83	1.32	11.03	2.11	17.63	0.23	1.92	0.31	2.59	Cs
805	8.54	3.74	43.79	1.35	15.80	3.11	36.43	0.34	3.98	-	-	Mx S
806	21.73	6.52	30.00	2.78	12.79	11.56	53.20	0.41	1.89	0.46	2.12	Mx S
807	20.94	3.50	16.71	2.0	9.55	14.45	69.01	0.31	1.48	0.68	3.25	Fs
810	17.75	0.50	2.82	0.94	5.30	15.95	89.86	0.11	0.61	0.25	1.41	Fs
815	21.44	17.52	81.72	2.0	9.33	1.14	5.32	0.46	2.15	0.32	1.48	Cs + Gvl
816	22.27	13.01	58.69	4.40	19.76	4.29	19.26	0.51	2.29	-	-	Mx S
819	22.32	0.89	3.99	18.7	83.78	2.60	11.65	0.03	1.13	1.00	0.45	Cs
820	24.62	8.02	32.58	6.48	26.32	9.8	39.81	0.13	0.53	0.19	0.76	Mx S
822	26.99	15.50	57.43	3.46	12.82	1.31	4.85	0.09	0.33	6.63	2.46	Cs + Gvl
823	10.51	3.97	19.36	1.88	9.17	0.83	4.05	0.10	0.48	13.73	66.94	Fs + St

TABLE 4

SAMPLE NO.	TOT. WT. = 100%	30		60		100		230		FINES		SEDIMENT TYPE
		Gm.	%	Gm.	%	Gm.	%	Gm.	%	Gm.	%	
825	8.17	3.27	40.02	2.25	27.54	2.4	29.38	0.06	0.73	0.19	2.33	Mx S
826	4.56	2.85	62.50	0.3	6.58	0.68	14.91	0.02	0.44	0.71	15.57	Mx S
827	26.66	7.57	28.39	11.80	44.26	5.9	22.13	0.19	0.71	1.2	4.50	Cs + Gvl
829	7.65	4.53	59.22	1.62	21.18	1.12	14.64	0.09	1.18	0.29	2.78	Cs
833	34.13	23.85	69.88	8.75	25.64	0.96	2.81	0.03	0.09	0.54	1.58	Cs + Gvl
834	27.48	21.82	79.40	4.83	17.58	0.51	1.86	0.05	0.18	0.27	0.98	Cs + Gvl
837	34.97	29.6	84.64	3.15	9.01	0.27	0.77	0.01	-	1.5	5.58	Cs + Gvl
839	37.25	22.8	61.21	13.10	35.17	1.2	3.23	-	-	-		Cs + Gvl
840	18.08	11.11	61.25	5.0	27.65	1.89	10.46	0.08	0.44	-	-	Cs + Gvl
843	28.07	20.61	73.42	5.69	20.27	0.82	2.92	0.33	1.18	0.62	2.21	Cs + Gvl
844	27.74	19.51	70.33	6.39	23.04	1.26	4.54	0.21	0.76	0.37	1.33	Cs + Gvl
845	37.03	19.09	51.55	14.23	38.54	3.1	8.37	0.1	0.27	0.47	1.27	Cs + Gvl
850	23.41	18.28	78.09	4.92	21.02	0.09	0.38	0.12	0.51	-	-	Cs + Gvl

TABLE 4

SAMPLE NO.	TOT.WT. =100%	30 Gm.	30 %	60 Gm.	60 %	100 Gm.	100 %	230 Gm.	230 %	FINES Gm.	FINES %	SEDIMENT TYPE
857	23.05	17.33	75.78	4.90	21.26	0.53	2.30	0.07	0.30	0.22	0.96	Cs + Gvl
860	28.96	2.20	7.60	0.70	2.42	23.50	81.15	2.40	8.29	0.16	0.55	Fs + St
862	31.90	0.10	0.31	20.42	64.01	11.11	34.83	0.01	0.03	0.26	0.82	Mx S
868	35.03	0.11	0.31	24.20	69.08	5.79	16.53	0.24	0.69	4.69	13.39	Mx S
871	32.87	10.10	30.74	18.09	55.03	4.60	13.99	0.08	0.24	-	-	Mx S
872	34.95	18.51	52.95	9.52	27.24	5.81	16.62	0.20	0.57	0.91	2.60	Mx S
873	27.93	22.0	78.77	5.61	20.09	0.31	1.10	0.07	0.04	-	-	Cs + Gvl
875	31.93	18.94	59.32	12.49	39.12	0.13	0.41	0.01	0.03	0.36	1.12	Cs + Gvl
877	31.56	1.00	3.16	16.50	52.13	13.90	43.93	0.11	0.35	0.14	0.44	Mx S
880	28.05	23.70	84.49	2.88	10.27	1.10	3.92	0.08	0.29	0.29	1.03	Cs + Gvl
881	24.50	13.70	55.92	8.50	34.69	2.09	8.53	0.12	0.49	0.09	0.37	Cs + Gvl
887	28.54	-	-	5.48	19.20	21.45	75.16	1.55	5.43	0.06	0.21	Mx S
891	27.95	0.11	0.39	7.13	25.52	19.23	68.80	1.08	3.86	0.40	1.43	Mx S
903	30.14	8.00	26.54	10.57	35.07	10.20	33.84	0.70	2.32	0.67	2.22	Mx S
906	34.95	17.68	50.59	4.10	11.73	11.06	31.64	1.62	4.64	0.49	1.40	Mx S

TABLE 4

SAMPLE NO.	TOT.WT. =100%	30 Gm.	30 %	60 Gm.	60 %	100 Gm.	100 %	230 Gm.	230 %	FINES Gm.	FINES %	SEDIMENT TYPE
910	20.94	5.70	27.22	4.85	23.16	9.03	43.13	1.11	5.30	0.25	1.19	Mx S
912	28.99	1.09	3.76	23.48	80.99	4.38	15.12	0.01	0.03	0.03	0.10	Mx S
913	34.27	32.22	94.02	1.63	4.75	0.42	1.23	-	-	-	-	Cs + Gvl
914	27.56	6.83	24.70	14.50	52.44	6.0	21.70	0.24	0.87	0.08	0.29	Mx S
915	29.65	12.42	41.89	16.43	55.41	0.53	1.79	0.01	0.03	0.26	0.88	Cs + Gvl
916	30.03	12.70	42.29	17.03	56.71	0.30	1.00	-	-	-	-	Cs + Gvl
917	19.25	12.76	66.29	2.12	11.01	3.05	15.84	0.98	5.09	0.34	1.77	Cs + Gvl
918	35.05	26.0	74.18	8.41	23.99	0.60	1.72	-	-	0.04	0.11	Cs + Gvl
920	31.95	18.70	58.53	13.0	40.69	0.13	0.40	-	-	0.12	0.38	Cs + Gvl
921	28.70	0.28	0.98	23.09	80.45	4.98	17.35	-	-	0.35	1.22	Mx S
922	29.97	0.57	1.90	27.52	91.82	1.50	5.01	-	-	0.38	1.27	Cs
923	27.28	11.61	42.56	10.00	36.66	0.90	3.30	-	-	0.77	17.48	Cs + Gvl
924	24.67	20.60	83.50	2.53	10.26	1.04	4.21	0.01	0.04	0.49	1.99	Cs + Gvl
925	4.56	1.91	41.88	1.40	30.70	0.95	20.83	0.13	2.86	0.17	3.73	Mx S
926	28.19	13.24	46.97	9.61	34.09	5.00	17.74	-	-	0.34	1.20	Mx S

TABLE 4

SAMPLE NO.	TOTAL.WT. =100%	30 Gm.	30 %	60 Gm.	60 %	100 Gm.	100 %	230 Gm.	230 %	FINES Gm.	FINES %	SEDIMENT TYPE
2347	20.62	5.20	25.22	2.80	13.58	6.61	32.06	3.55	17.21	2.46	11.93	Mx S
2351	34.17	28.10	82.24	4.30	12.58	1.52	4.45	0.11	0.32	0.14	0.41	Cs + Gvl
2353	27.04	2.20	8.14	24.40	90.24	0.30	1.10	-	-	0.14	0.52	Cs + Gvl
2354	26.95	2.60	9.65	7.22	26.79	13.60	50.46	2.90	10.76	0.63	2.31	Mx S
2357	28.86	20.22	69.32	7.34	26.17	0.70	2.43	-	-	0.60	2.08	Cs + Gvl
2358	28.70	0.02	0.07	5.06	17.63	23.08	80.42	0.35	1.22	0.19	0.66	Mx S
2359	25.95	0.31	1.19	0.65	2.50	14.30	55.11	9.81	37.80	0.88	3.39	Fs + St
2360	27.20	0.32	1.18	1.41	5.17	14.29	52.54	9.65	35.48	1.53	5.63	Fs + St
2361	23.65	0.34	1.44	0.59	2.49	16.28	68.84	5.72	24.19	0.72	30.04	Fs + St
2365	26.0	3.43	13.19	2.70	10.39	13.0	50.00	5.90	22.69	0.97	3.73	Mx S
2366	28.43	3.30	11.61	2.10	7.39	17.55	61.72	4.90	17.24	0.58	2.04	Mx S
2367	29.76	3.31	11.12	4.70	15.79	14.21	47.75	7.08	23.79	0.46	1.55	Mx S
2368	29.79	0.08	0.27	17.96	60.29	10.0	33.57	0.51	1.71	1.21	4.16	Mx S
2369	25.51	0.07	0.27	0.08	0.31	5.03	19.73	18.63	73.03	1.70	6.66	Fs + St
2370	24.45	1.60	6.54	0.43	1.76	12.43	50.84	8.65	35.38	1.34	5.48	Fs + St

TABLE 4

SAMPLE NO.	TOT.WT. =100%	30 Gm.	30 %	60 Gm.	60 %	100 Gm.	100 %	230 Gm.	230 %	FINES Gm.	FINES %	SEDIMENT TYPE
2372	24.53	1.40	5.71	1.41	5.75	18.92	77.12	2.57	10.48	0.23	0.94	Mx S
2373	29.73	0.30	1.01	0.22	0.74	18.31	61.59	7.68	25.83	3.22	10.83	Mx S
2375	25.15	1.52	5.81	0.88	3.37	8.48	32.43	14.10	53.92	1.17	4.47	Fs + St
2377	27.14	0.30	1.11	0.06	0.22	14.34	52.84	12.33	45.42	0.11	0.41	Fs + St
2378	27.07	0.18	0.66	0.60	2.22	12.52	46.25	13.52	49.94	0.25	0.92	Fs + St
2380	25.30	0.09	0.36	0.02	0.08	0.10	0.40	22.21	87.79	2.88	11.37	S + C
2381	26.63	0.13	0.49	0.04	0.15	0.51	1.92	24.99	93.84	0.96	3.60	S + C
2761	29.38	6.39	21.75	10.50	35.74	11.09	37.75	0.30	1.02	1.10	3.74	Mx S
2762	30.50	6.58	21.57	8.60	28.20	14.18	46.49	0.03	0.10	1.11	3.64	Mx S
2764	30.37	14.0	46.10	5.41	27.81	9.70	31.94	0.63	2.07	0.63	2.08	Mx S
2765	33.79	14.21	42.06	5.73	16.96	13.20	39.06	0.63	1.86	0.02	0.06	Mx S
2779	13.72	10.30	75.07	0.31	2.26	1.20	8.75	0.85	6.18	1.06	7.73	Mx S
2780	24.36	15.50	63.63	2.90	11.90	1.90	7.80	2.81	11.54	1.25	5.13	Cs + Gvl
2781	29.64	27.13	91.53	2.12	7.16	0.20	0.67	-	-	0.19	0.64	Cs + Gvl
2782	19.66	0.20	1.02	3.60	18.31	15.30	77.82	0.08	0.41	0.48	2.44	Mx S

TABLE 4

SAMPLE NO.	TOT.WT. =100%	30 Gm.	30 %	60 Gm.	60 %	100 Gm.	100 %	230 Gm.	230 %	FINES Gm.	FINES %	SEDIMENT TYPE
2783	25.25	1.90	7.52	2.35	9.31	19.70	78.02	0.69	2.73	0.61	2.42	Mx S
2784	30.17	0.20	0.66	21.51	71.30	8.01	26.55	-	-	0.75	1.49	Mx S
2785	24.65	0.24	0.98	17.30	70.18	7.10	28.80	-	-	0.01	0.04	Mx S
2786	27.46	11.07	40.31	15.48	56.37	0.81	2.95	-	-	0.10	0.36	Cs + Gvl
2788	28.25	11.04	39.08	14.22	50.34	2.50	8.84	0.18	0.64	0.31	1.10	Cs + Gvl
2789	24.86	15.17	61.02	4.25	17.10	3.54	14.24	1.14	4.58	0.76	3.06	Cs + Gvl
2791	27.95	19.41	69.45	3.28	11.74	3.07	10.98	0.01	0.04	2.18	7.80	Cs + Gvl
2792	2.413	0.23	0.95	13.76	57.02	8.75	36.26	-	-	1.39	5.76	Mx S
2797	36.05	8.18	22.69	3.00	8.32	22.20	61.58	0.31	0.86	2.36	6.55	Mx S
2810	16.10	0.43	2.67	0.29	1.80	0.55	3.42	11.03	68.51	3.80	23.60	S + C
2811	11.83	0.30	2.54	0.35	2.96	0.40	3.38	50.81	49.11	4.97	42.01	S + C
2812	24.45	0.30	1.23	0.37	1.51	8.81	36.03	11.40	46.63	3.57	14.60	Fs + St
2813	17.07	0.50	2.93	0.38	2.23	0.56	3.28	12.17	71.29	3.46	20.27	Fs + St
2814	11.15	0.20	1.79	0.23	2.06	0.43	3.86	5.78	51.84	4.51	40.45	Fs + St
2815	23.25	7.51	32.30	5.62	24.17	4.55	19.59	2.50	10.76	3.07	13.20	Mx S
2816	31.35	9.16	29.22	9.61	30.65	8.55	27.88	1.39	4.43	2.64	8.42	Mx S
2818	2.94	0.16	5.44	0.20	6.80	0.20	6.80	0.42	14.29	1.96	66.67	S + C

TABLE 4

SAMPLE NO.	TOT.WT. =100%	30 Gm.	30 %	60 Gm.	60 %	100 Gm.	100 %	230 Gm.	230 %	FINES Gm.	FINES %	SEDIMENT TYPE
2819	7.25	0.20	2.76	0.11	1.52	0.20	2.76	0.30	4.14	6.44	88.82	S + C
2820	21.84	1.02	4.67	0.41	1.88	0.83	3.80	14.53	66.76	5.00	22.89	S + C
2821	14.67	0.80	5.54	0.77	5.25	0.43	2.93	6.70	45.67	5.97	40.70	S + C
2822	15.46	0.41	2.65	0.35	7.26	0.40	7.59	5.26	34.02	9.04	58.47	S + C
2823	0.30	-	-	-	-	0.27	89.0	0.03	11.0	-	-	St
2824	20.34	13.18	64.18	3.58	17.60	1.47	7.23	0.12	0.59	0.19	9.78	Cs + Gvl
2826	24.47	0.21	0.86	0.12	0.49	1.30	5.32	19.33	78.99	3.51	14.34	S + C
2854	35.27	24.84	70.43	8.22	23.31	1.10	3.13	0.10	0.28	1.01	2.86	Cs + Gvl
2900	33.22	4.78	14.39	24.37	73.36	2.15	6.47	-	-	1.92	5.78	Cs + Gvl
2901	31.44	6.61	21.03	22.72	72.26	0.91	2.89	-	-	1.20	3.82	Cs + Gvl
2902	33.45	7.25	21.68	17.18	51.36	7.32	21.88	0.02	0.06	1.68	5.02	Mx S
2903	28.60	1.06	3.71	1.07	3.74	19.90	69.58	5.40	18.88	1.17	4.09	Fs + St
2904	28.26	0.35	1.24	0.30	1.06	12.35	43.70	11.92	42.18	3.34	11.82	Fs + St
2905	24.26	0.52	2.14	0.29	1.20	1.10	4.53	17.01	70.12	5.34	22.01	S + C

TABLE 4

SAMPLE NO.	TOT.WT. =100%	30 Gm.	30 %	60 Gm.	60 %	100 Gm.	100 %	230 Gm.	230 %	FINES Gm.	FINES %	SEDIMENT TYPE
2906	16.56	0.21	1.27	0.70	4.22	1.09	6.58	6.40	38.65	8.16	49.28	S + C
2908	3.72	0.59	15.86	0.45	12.10	0.39	10.48	0.29	7.80	2.00	53.76	Fs + St
2910	30.45	0.31	1.02	1.30	4.27	21.07	69.20	4.66	15.30	3.11	10.21	Fs
2911	28.35	0.23	0.81	1.10	3.88	15.80	55.73	7.50	26.46	3.72	13.12	Fs
2912	28.35	0.10	0.35	0.42	1.48	17.91	63.17	5.20	18.34	4.72	16.65	Fs
2914	32.45	0.50	1.54	18.42	56.76	11.82	36.43	0.05	0.15	1.66	5.12	Mx S
2915	27.34	0.39	1.55	0.19	0.44	0.40	0.78	20.90	81.75	5.46	15.48	S + C
2916	29.05	0.15	0.52	0.54	1.86	19.70	67.81	7.10	24.44	1.56	5.37	Fs + St
2917	29.55	0.35	1.18	0.40	1.35	22.45	75.98	5.10	17.26	1.25	4.23	Fs + St
2918	17.25	1.32	4.84	1.90	6.98	19.43	71.30	4.31	15.82	0.29	1.06	Fs + St
2919	33.55	10.49	31.27	6.19	18.45	14.20	42.32	1.04	3.10	1.63	4.86	Mx S
2920	37.53	19.23	51.24	10.42	27.76	5.17	13.78	0.73	1.94	1.98	5.28	Cs + Gvl

TABLE 5

SAMPLE NO.	TOT.WT. =100%	30 Gm.	30 %	60 Gm.	60 %	100 Gm.	100 %	230 Gm.	230 %	FINES Gm.	FINES %	SEDIMENT TYPE
2385	33.41	16.31	48.87	13.80	41.26	2.00	5.98	0.92	2.75	0.38	1.14	Cs + Gvl
2887	30.30	6.38	21.06	10.79	35.61	11.30	37.29	1.60	5.28	0.23	0.76	Mx S
2388	31.67	3.58	11.30	22.88	72.23	4.30	13.59	0.61	1.93	0.30	0.95	Mx S
2389	35.29	8.81	1.55	23.88	38.06	2.19	54.78	0.03	4.06	0.38	1.55	Mx S
2392	35.77	28.08	78.50	6.26	17.50	0.93	2.60	0.32	0.90	0.18	0.50	Cs + Gvl
2393	31.72	17.51	55.21	11.49	36.19	1.10	3.47	0.62	1.95	1.00	3.15	Cs + Gvl
2394	32.93	23.40	71.06	7.04	21.40	1.58	4.80	0.64	1.92	0.27	0.82	Cs + Gvl
2395	33.22	11.88	35.76	15.70	47.26	5.11	15.38	0.35	1.06	0.18	0.54	Mx S
2396	19.20	9.89	33.87	14.09	48.19	5.00	17.10	0.18	00.70	0.04	0.14	Mx S
2397	29.91	24.91	83.28	4.33	14.49	0.60	2.00	0.07	0.23	-	-	Cs + Gvl
2398	33.91	20.72	61.10	11.91	35.12	0.55	1.62	0.59	1.74	0.14	0.41	Cs + Gvl
2399	29.28	11.03	37.72	12.73	43.54	3.59	12.11	1.60	5.47	0.34	1.16	Cs + Gvl
2400	30.57	15.60	51.03	4.40	14.39	9.11	29.79	2.12	3.66	0.34	1.13	Mx S
2401	37.01	21.83	58.98	6.94	18.74	5.50	14.88	2.74	7.40	-	-	Mx S
2402	38.90	18.76	48.23	9.40	24.16	8.12	20.87	2.38	6.12	0.21	0.62	Mx S

TABLE 5

SAMPLE NO.	TOT.WT. =100%	30 Gm.	30 %	60 Gm.	60 %	100 Gm.	100 %	230 Gm.	230 %	FINES Gm.	FINES %	SEDIMENT TYPE
2403	32.96	27.93	84.74	3.70	11.23	1.00	3.03	0.25	0.76	0.08	0.24	Cs + Gvl
2404	30.81	0.22	0.79	6.90	24.30	22.60	72.40	-	-	0.79	2.57	Fs
2405	30.58	2.40	2.85	5.90	19.29	18.21	59.55	3.70	12.10	0.37	1.21	Fs
2406	34.01	0.71	2.09	15.29	44.96	14.64	43.04	2.99	8.79	0.38	1.12	Fs
2407	31.24	2.60	8.32	8.20	26.24	19.28	61.73	0.70	2.24	0.46	1.47	Fs
2408	16.40	8.28	50.49	3.10	18.91	4.43	17.02	0.41	2.50	0.18	1.08	Fs
2419	1.83	0.78	42.62	0.90	49.18	-	-	0.08	4.38	0.07	3.82	Cs + Gvl
2420	31.40	6.71	21.37	22.21	70.53	1.83	5.82	0.51	1.61	0.14	0.45	Cs + Gvl
2421	32.67	9.60	29.37	18.28	55.94	4.09	12.52	0.60	1.84	0.10	0.31	Mx S
2422	14.73	5.50	37.34	1.70	11.54	5.01	34.02	2.18	14.79	0.34	2.31	Mx S
2423	36.50	25.69	70.38	8.40	23.02	0.52	1.42	0.51	1.40	1.38	2.78	Cs + Gvl
2424	30.71	20.93	68.13	8.13	16.50	0.71	2.31	0.73	2.38	0.21	0.68	Cs + Gvl
2426	37.35	10.71	28.67	23.39	62.69	2.88	7.72	0.12	0.32	0.25	0.60	Mx S
2427	33.71	12.20	36.19	16.86	50.07	3.02	8.90	1.39	4.13	0.24	0.71	Mx S

TABLE 5

SAMPLE NO.	TOT.WT. =100%	30 Gm.	30 %	60 Gm.	60 %	100 Gm.	100 %	230 Gm.	230 %	FINES Gm.	FINES %	SEDIMENT TYPE
2428	31.61	2.60	8.23	22.20	70.15	6.00	18.96	0.62	1.96	0.19	0.70	M x S
2430	35.91	27.39	76.14	8.51	23.58	-	-	-	-	0.01	0.28	Cs + Gvl
2431	5.29	1.07	20.23	3.19	60.29	0.73	13.80	0.29	5.49	0.01	0.19	M x S
2432	33.99	13.80	35.10	14.88	46.41	4.89	16.84	0.29	1.09	0.13	0.56	M x S
2433	31.59	6.75	21.36	24.52	77.72	0.30	0.94	0.02	0.06	-	-	M x S
2439	8.89	7.62	85.71	1.01	11.36	-	-	0.23	2.59	0.03	0.34	Cs
2440	22.81	18.59	81.42	3.95	17.30	0.10	0.44	0.13	0.58	0.04	0.18	Cs + Gvl
2442	26.68	20.23	75.80	04.92	18.45	0.62	2.33	0.58	2.18	0.33	1.24	Cs + Gvl
2443	27.38	19.94	72.83	5.10	18.63	0.98	3.58	0.60	2.19	0.76	2.77	Cs + Gvl
2444	35.00	22.51	64.31	9.61	27.48	2.30	6.58	0.41	1.14	0.17	0.49	Cs + Gvl
2445	26.74	14.44	54.00	9.30	34.78	2.57	9.61	0.38	1.42	0.05	0.19	Cs + Gvl
2447	29.09	17.49	60.12	5.47	18.82	3.68	12.66	1.99	6.83	0.46	1.58	Cs + Gvl
2449	22.93	17.34	75.62	4.46	19.45	0.60	2.62	0.46	2.00	0.07	0.31	Cs + Gvl
2456	26.18	17.18	65.62	5.58	31.32	2.51	9.59	0.70	2.67	0.21	0.80	Cs + Gvl
2457	24.66	13.29	53.89	7.13	28.90	2.01	8.16	1.68	6.83	0.55	2.23	Cs + Gvl

TABLE 5

SAMPLE NO.	TOT.WT. =100%	30 Gm.	30 %	60 Gm.	60 %	100 Gm.	100 %	230 Gm.	230 %	FINES Gm.	FINES %	SEDIMENT TYPE
2460	26.60	5.80	22.59	16.59	61.92	3.83	12.08	0.22	2.23	0.22	1.18	M x S
2461	30.23	7.34	24.47	18.45	60.98	3.49	11.54	0.40	1.32	0.55	1.82	M x S
2462	34.42	29.19	84.81	3.30	9.60	1.21	3.52	0.58	1.66	0.14	0.41	Cs + Gvl
2463	25.41	17.63	69.38	7.02	27.66	0.14	0.53	0.53	2.09	0.09	0.35	Cs + Gvl
2465	30.40	13.98	45.99	15.39	50.63	0.81	2.66	0.22	0.72	-	-	M x S
2467	3.48	1.41	40.46	1.37	39.37	0.52	14.94	0.18	5.17	-	-	M x S
2509	33.87	16.22	47.84	10.81	31.95	5.80	17.12	0.82	2.42	0.22	0.64	M x S
2510	31.11	19.08	61.34	9.63	30.96	1.38	4.45	0.71	2.29	0.31	1.61	Cs x Gvl
2511	36.43	28.68	78.74	6.30	17.30	0.88	2.41	0.50	1.72	0.07	0.19	Cs + Gvl
2512	28.72	28.11	97.88	0.48	1.67	-	-	0.01	0.31	0.04	0.14	Cs + Gvl
2513	18.04	11.03	61.14	4.70	26.04	1.72	9.53	0.50	2.77	0.09	0.52	Cs + Gvl
2514	7.02	6.50	92.59	0.35	4.99	-	-	0.17	2.42	-	-	Cs
2515	28.20	3.02	10.71	8.71	30.92	15.10	53.61	1.18	4.09	0.19	0.67	M x S
2516	29.49	10.70	36.28	5.88	19.96	11.03	37.39	1.60	5.42	0.28	0.95	M x S
2517	38.51	32.12	83.41	4.69	12.19	1.11	2.87	0.59	1.53	-	-	Cs + Gvl
2518	42.82	29.30	68.43	13.19	30.79	-	-	0.25	0.59	0.08	0.19	Cs + Gvl

TABLE 5

SAMPLE NO.	TOT.WT. =100%	30 Gm.	30 %	60 Gm.	60 %	100 Gm.	100 %	230 Gm.	230 %	FINES Gm.	FINES %	SEDIMENT TYPE
2519	32.10	25.00	77.88	3.41	10.64	1.69	5.24	1.30	4.06	0.70	2.18	Cs + Gvl
2520	30.40	2.86	9.41	23.99	78.93	3.17	10.43	0.22	0.70	0.16	0.53	M x S
2521	32.85	4.94	15.04	17.89	54.39	8.89	17.13	1.09	3.32	-	-	M x S
2637	31.51	22.61	71.75	6.69	21.24	0.80	2.54	1.21	3.84	0.2	0.63	Cs + Gvl
2638	31.12	24.90	80.01	4.85	15.58	0.31	1.00	0.89	2.86	0.1	0.55	Cs + Gvl
2639	34.92	18.34	51.52	12.83	36.69	2.49	7.18	1.02	2.92	0.24	0.69	Cs + Gvl
2640	28.85	5.22	18.04	18.01	62.49	4.29	14.81	1.11	3.85	0.22	0.76	M x S
2641	28.86	18.00	62.37	6.30	21.86	2.89	10.03	0.75	2.60	0.92	3.14	Cs + Gvl
2642	34.40	25.45	73.98	7.33	21.93	1.14	3.32	0.40	1.14	0.08	0.23	Cs + Gvl
2643	32.51	25.12	77.37	6.68	20.47	0.43	1.32	0.28	0.84	-	-	Cs + Gvl
2644	33.86	28.80	84.96	4.40	12.98	0.20	0.69	0.31	0.94	0.15	0.44	Cs + Gvl
2645	34.77	27.89	80.21	5.73	16.50	-	-	0.62	1.78	0.53	1.33	Cs + Gvl
2646	34.28	27.39	78.88	6.03	17.61	-	-	0.29	0.85	0.57	1.66	Cs + Gvl
2647	28.87	18.98	65.74	8.90	30.79	0.61	2.15	0.30	1.04	0.08	0.28	Cs + Gvl

TABLE 5

SAMPLE NO.	TOT.WT. =100%	30		60		100		230		FINES		SEDIMENT TYPE
		Gm.	%	Gm.	%	Gm.	%	Gm.	%	Gm.	%	
2780	36.47	20.72	53.83	7.38	20.24	6.64	18.19	1.56	4.27	0.17	0.47	M x S
2771	26.41	10.94	41.42	10.48	39.67	3.20	12.13	1.70	6.44	0.09	0.34	M x S
2773	17.42	5.03	18.87	11.10	63.72	-	-	1.13	6.49	0.16	0.92	M x S
2774	33.49	4.40	13.04	28.21	84.35	-	-	0.60	1.77	0.28	0.84	M x S
2776	29.31	6.53	22.28	8.18	27.89	13.41	45.77	1.10	3.75	0.09	0.31	M x S
2827	30.10	18.55	61.63	7.20	23.93	3.62	12.02	0.39	1.19	0.34	1.13	Cs + Gvl
2828	20.65	18.00	87.17	0.50	2.42	0.18	0.88	0.10	0.48	1.87	9.05	Cs + Gvl
2829	26.34	19.92	75.60	3.11	11.82	2.99	11.36	0.32	1.22	-	-	Cs + Gvl
2830	34.70	27.67	79.74	1.78	5.12	2.21	6.36	2.52	7.26	0.52	1.50	Cs + Gvl
2831	37.65	29.89	79.51	3.41	9.07	3.88	10.31	0.21	0.41	0.26	0.69	Cs + Gvl
2832	36.39	29.68	81.56	3.90	10.73	1.90	5.20	0.30	0.83	0.61	1.68	Cs + Gvl
2833	33.38	20.40	61.11	9.79	29.32	2.18	6.54	0.19	0.57	0.82	2.46	Cs + Gvl
2834	35.10	28.20	80.34	5.81	16.55	0.61	1.74	0.29	0.83	0.19	0.54	Cs + Gvl
2835	37.50	29.07	77.52	7.64	20.40	0.68	1.82	-	-	0.11	0.26	Cs + Gvl
2836	37.50	1.49	3.97	17.52	46.78	11.42	30.49	0.07	0.17	7.00	18.59	M x S

TABLE 5

SAMPLE NO.	TOT.WT. =100%	30 Gm.	30 %	60 Gm.	60 %	100 Gm.	100 %	230 Gm.	230 %	FINES Gm.	FINES %	SEDIMENT TYPE
2837	31.32	0.30	0.96	14.99	47.90	15.70	50.08	0.12	0.38	0.21	0.68	M x S
2838	30.08	0.91	3.02	10.33	34.30	18.39	61.08	0.30	1.00	0.15	0.60	M x S
2839	21.02	2.00	9.51	3.40	16.14	10.32	49.12	4.76	22.66	0.54	2.57	Fs + St
2840	18.80	16.50	87.77	0.71	3.78	0.28	1.49	0.11	0.58	1.20	6.38	Cs + Gvl
2843	26.00	20.52	78.90	5.40	10.79	0.08	0.31	-	-	-	-	Cs + Gvl
2844	36.32	27.92	76.89	5.42	14.91	0.27	0.74	0.13	0.36	2.38	7.10	Cs + Gvl
2890	34.90	24.11	69.08	9.61	27.58	0.98	2.81	0.20	0.53	-	-	Cs + Gvl
2891	35.03	23.60	67.37	10.50	29.93	0.49	1.40	0.23	0.70	0.21	0.60	Cs + Gvl
2892	32.32	24.49	75.80	6.21	19.19	0.62	1.92	0.70	2.16	0.30	0.93	Cs + Gvl
2893	34.32	27.12	79.02	6.40	18.66	0.64	1.86	0.10	0.29	0.06	0.17	Cs + Gvl
2894	32.61	28.28	86.48	4.00	12.28	0.25	0.77	0.08	0.23	0.08	0.25	Cs + Gvl
2895	31.82	28.43	89.38	2.30	7.22	0.22	0.69	0.10	0.31	0.77	2.42	Cs + Gvl
2896	31.80	26.34	82.83	4.86	15.28	0.41	1.29	0.19	0.60	-	-	Cs + Gvl
2921	29.68	21.82	73.52	5.98	20.15	1.20	4.04	0.28	0.94	0.40	1.35	Cs + Gvl
2911	28.20	19.70	69.86	4.98	17.65	2.67	9.48	0.59	2.09	0.26	0.92	Cs + Gvl

TABLE 5

SAMPLE	TOT.WT.	30		60		100		230		FINES		SEDIMENT
NO.	=100%	Gm.	%	Gm.	%	Gm.	%	Gm.	%	Gm.	%	TYPE
2923	30.96	9.60	31.01	9.61	31.04	10.53	34.01	0.92	2.97	0.30	0.97	M x S
2924	36.10	18.45	51.11	13.41	37.15	3.50	9.70	0.61	1.68	0.13	0.36	Cs + Gvl
2925	26.89	24.90	92.60	1.93	7.18	0.06	0.22	-	-	-	-	Cs + Gvl
2926	30.29	18.93	62.50	7.72	25.48	2.82	9.31	0.50	1.65	0.32	1.06	Cs + Gvl

TABLE 6

SAMPLE NO.	TOT.WT. =100%	30 Gm.	30 %	60 Gm.	60 %	100 Gm.	100 %	230 Gm.	230 %	FINES Gm.	FINES %	SEDIMENT TYPE
3000	19.43	7.32	37.63	7.69	39.60	4.05	20.86	0.15	0.78	0.22	1.13	M x S
3001	33.80	30.78	91.07	1.45	4.28	0.95	2.81	-	-	0.62	1.84	Cs + Gvl
3003	20.65	13.20	63.89	5.80	28.12	1.51	7.31	-	-	0.14	0.68	Cs + Gvl
3004	11.70	10.70	91.38	0.53	4.53	0.43	3.68	0.01	0.09	0.04	0.34	Cs + Gvl
3005	20.72	0.40	1.93	1.69	8.16	10.43	50.30	7.29	35.21	0.91	4.40	Fs + St
3007	0.32	0.21	65.63	0.10	31.25	0.01	3.12	-	-	-	-	Cs + Gvl
3010	31.35	20.02	63.86	8.29	16.44	2.94	9.38	0.10	0.32	-	-	Cs + Gvl
3011	27.89	23.92	85.74	2.90	10.41	0.81	2.91	0.26	0.94	-	-	Cs + Gvl
3012	43.80	28.15	64.27	9.90	22.57	4.19	9.60	0.10	0.23	1.45	3.33	Cs + Gvl
3013	28.61	19.95	69.73	3.90	13.65	3.80	13.26	0.90	3.15	0.06	0.21	Cs + Gvl
3014	26.25	14.60	55.62	6.20	23.62	2.50	9.53	2.60	9.90	0.36	1.33	Cs + Gvl
3015	31.80	24.88	17.24	4.90	15.39	1.06	3.38	1.10	0.31	0.86	2.70	Cs + Gvl
3016	24.38	0.10	0.41	0.42	1.72	21.19	86.92	2.67	10.95	-	-	Fs + St
3037	28.83	5.65	19.60	11.23	38.93	11.50	29.91	0.45	1.56	-	-	M x S
3038	19.30	19.03	64.98	8.98	30.62	1.27	4.33	0.02	0.07	-	-	M x S
3039	25.43	13.95	54.86	9.10	35.79	2.20	8.65	0.10	0.39	0.08	0.31	Cs + Gvl

TABLE 6

SAMPLE NO.	TOT.WT. =100%	30		60		100		230		FINES		SEDIMENT TYPE
		Gm.	%	Gm.	%	Gm.	%	Gm.	%	Gm.	%	
3041	18.31	2.15	11.74	3.71	10.28	8.41	45.92	3.30	18.02	0.74	4.40	M x S
3042	25.40	6.50	25.54	5.92	23.32	10.00	39.40	3.85	11.23	0.13	0.51	M X S
3043	25.37	22.88	90.19	1.67	6.58	0.70	2.76	0.12	0.47	-	-	Cs + Gvl
3044	31.54	27.62	87.57	3.45	10.94	0.35	1.11	-	-	0.12	0.38	Cs + Gvl
3045	25.39	15.88	62.52	8.90	35.07	0.50	1.97	0.04	0.16	0.07	0.28	Cs + Gvl
3052	23.80	12.25	51.47	9.39	39.46	2.05	8.61	0.11	0.46	-	-	Cs + Gvl
3053	8.03	7.10	88.42	0.71	8.84	0.10	1.25	-	-	0.12	1.49	Cs + Gvl
3062	31.80	31.80	100.00	-	-	-	-	-	-	-	-	Cs + Gvl
3063	66.80	49.75	74.42	7.64	11.46	9.00	13.50	0.32	0.48	0.09	0.14	Cs + Gvl
3065	32.22	32.22	100.00	-	-	-	-	-	-	-	-	Cs + Gvl
3066	28.50	23.39	82.07	4.38	15.37	0.47	1.65	-	-	0.26	0.91	Cs + Gvl
3076	2.00	1.98	99.00	0.02	1.00	-	-	-	-	-	-	Cs
3077	0.45	0.40	88.89	0.03	6.67	0.02	4.44	-	-	-	-	Cs
3079	1.00	0.91	91.00	0.03	3.00	0.06	6.00	-	-	-	-	Cs
3080	25.60	1.05	4.10	15.50	60.52	8.40	32.84	0.08	0.31	0.57	2.23	M x S
3084	17.80	17.80	100.00	-	-	-	-	-	-	-	-	Cs + Gvl

TABLE 6

SAMPLE NO.	TOT.WT. =100%	30 Gm.	30 %	60 Gm.	60 %	100 Gm.	100 %	230 Gm.	230 %	FINES Gm.	FINES %	SEDIMENT TYPE
3087	20.39	20.39	100.00	-	-	-	-	-	-	-	-	Cs + Gvl
3090	17.53	3.42	19.57	4.71	16.85	8.18	46.63	1.22	6.95	-	-	M x S
3091	22.70	13.00	57.23	7.05	31.09	2.64	11.64	0.01	0.04	-	-	Cs + Gvl
3092	78.19	66.64	85.17	6.20	7.94	4.25	5.48	1.10	1.41	-	-	Cs + Gvl
3094	24.62	0.50	2.07	18.61	75.56	5.38	21.84	0.10	0.41	0.03	0.12	M x S
3095	17.11	0.97	5.67	5.96	34.81	10.00	58.47	0.18	1.05	-	-	M x S
3096	24.05	4.42	18.35	13.90	57.82	5.25	21.84	0.08	0.33	0.40	1.66	M x S
3097	18.00	13.62	75.83	2.36	13.12	1.60	8.88	0.39	2.17	-	-	Cs + Gvl
3098	34.09	25.05	73.48	6.50	19.07	2.16	6.33	0.32	0.94	0.06	0.18	Cs + Gvl
3099	17.00	1.84	10.86	2.49	14.64	8.70	51.16	3.84	22.58	0.13	0.76	M x S
3100	11.60	11.60	100.00	-	-	-	-	-	-	-	-	Cs + Gvl
3101	19.96	0.32	1.60	0.40	2.00	3.10	15.53	16.10	80.66	0.11	0.21	Fs + St
3102	54.73	26.18	47.91	14.08	15.60	9.32	17.06	4.73	8.66	0.42	0.77	M x S
3103	43.10	23.10	53.60	10.94	25.38	6.31	14.64	1.67	3.87	1.08	2.51	M x S
3107	2.93	2.80	95.63	0.04	1.37	0.05	1.71	0.08	0.27	0.03	1.02	Cs + Gvl
3108	5.05	4.90	97.02	0.10	1.99	0.02	0.40	-	-	0.03	0.59	Cs + Cvl

TABLE 6

SAMPLE NO.	TOT.WT. =100%	30 Gm.	30 %	60 Gm.	60 %	100 Gm.	100 %	230 Gm.	230 %	FINES Gm.	FINES %	SEDIMENT TYPE
3109	27.91	5.90	21.14	21.62	77.40	0.39	1.46	-	-	-	-	M x S
3112	16.28	12.90	79.24	1.63	10.02	1.32	8.10	0.43	2.64	-	-	Cs + Gvl
3114	11.10	10.00	90.10	0.70	6.30	0.30	2.70	0.10	0.90	-	-	Cs + Gvl
3115	58.60	48.34	82.45	2.84	4.86	5.31	9.08	2.07	3.54	-	-	Cs + Gvl
3125	8.77	1.03	11.74	2.41	17.47	4.59	52.35	0.69	7.87	0.05	0.57	M x S
3127	0.71	0.05	7.04	0.06	8.45	0.01	1.41	0.59	83.10	-	-	Fs + St
3128	4.31	4.23	98.14	0.08	1.86	-	-	-	-	-	-	Cs
3130	4.20	1.59	37.86	0.90	21.43	1.25	29.76	0.42	10.00	0.04	0.95	M x S
3132	27.93	3.11	11.13	17.05	61.04	7.52	26.90	0.02	0.07	0.24	0.86	M x S
3133	28.12	3.38	12.02	16.51	58.78	7.99	28.34	0.05	0.18	0.19	0.68	M x S
3135	57.80	37.35	64.62	7.62	13.17	9.70	16.78	2.92	5.05	0.21	0.36	M x S
3136	34.82	16.68	47.94	13.62	39.09	4.40	12.63	0.12	0.34	-	-	M x S
3137	5.13	4.21	82.07	0.30	5.85	0.42	8.19	0.20	3.89	-	-	Cs + Gvl
3138	29.01	21.40	73.75	6.41	22.11	2.08	3.73	-	-	0.12	0.41	Cs + Gvl
3139	62.68	20.01	31.73	13.98	22.37	28.19	45.10	0.5	0.80	-	-	M x S
3140	47.42	41.08	86.63	3.75	7.90	1.88	3.97	0.51	1.08	0.20	0.42	Cs + Gvl

TABLE 6

SAMPLE NO.	TOT.WT. =100%	30 Gm.	30 %	60 Gm.	60 %	100 Gm.	100 %	230 Gm.	230 %	FINES Gm.	FINES %	SEDIMENT TYPE
3141	34.79	30.21	86.70	3.43	9.73	1.01	2.90	0.02	0.06	0.22	0.63	Cs + Gvl
3142	22.43	1.10	4.90	2.23	9.91	16.99	75.78	2.00	8.92	0.11	0.49	Fs
3143	20.77	0.53	2.55	0.73	3.51	7.10	34.15	12.43	59.79	-	-	Fs + St
3144	20.00	0.88	4.40	3.50	17.50	13.52	67.60	2.08	10.40	0.02	0.10	M x S
3145	17.70	0.63	3.55	3.92	22.15	11.51	65.03	1.40	7.91	0.24	1.36	Fs + St
3146	26.18	13.51	51.60	9.46	36.14	3.03	11.57	0.18	0.69	-	-	M x S
3147	28.49	4.40	15.44	4.89	17.13	13.86	48.66	4.93	17.30	0.42	1.47	M x S
3148	32.13	4.74	14.75	6.90	21.46	19.68	61.27	0.79	2.46	0.02	0.06	M x S
3149	32.48	31.34	96.45	1.02	3.14	0.12	0.37	-	-	-	-	Cs + Gvl
3150	36.09	23.92	68.17	6.50	18.52	1.15	3.28	0.05	0.14	3.47	9.89	Cs + Gvl
3151	34.40	23.28	67.64	7.45	31.68	3.30	9.60	0.11	0.32	0.26	0.76	Cs + Gvl
3152	19.91	0.30	1.51	1.01	5.07	3.68	18.47	14.91	0.01	0.01	0.05	St
3153	16.30	0.62	3.80	1.10	6.68	2.00	12.26	12.51	76.69	0.07	0.43	St
3154	28.70	1.82	6.34	1.29	4.49	2.50	8.70	23.08	80.44	0.01	0.03	St
3155	28.80	13.60	47.25	12.00	41.64	3.00	10.41	0.10	0.35	0.10	0.35	M x S
3156	32.50	1.19	3.67	15.04	46.32	15.50	47.64	0.71	2.19	0.06	0.18	M x S

TABLE 6

SAMPLE NO.	TOT.WT. =100%	30 Gm.	30 %	60 Gm.	60 %	100 Gm.	100 %	230 Gm.	230 %	FINES Gm.	FINES %	SEDIMENT TYPE
3157	46.11	37.90	82.14	2.12	4.60	5.70	12.37	0.22	0.48	0.19	0.41	Cs + Gvl
3158	28.60	0.20	0.70	1.30	4.55	26.18	91.53	0.84	2.94	0.08	0.28	Fs
3159	31.74	3.52	11.09	12.12	38.18	15.79	49.75	0.20	0.63	0.11	0.35	M x S
3160	28.80	4.01	14.96	10.51	39.23	11.90	11.39	0.20	0.75	0.18	0.67	M x S
3161	25.44	0.40	1.57	3.69	14.50	18.40	72.33	2.74	10.77	0.21	0.83	Fs
3162	21.13	0.26	1.23	1.08	5.11	7.41	35.48	12.30	58.18	-	-	Fs + St
3163	33.20	27.03	81.43	5.24	15.77	0.83	2.50	0.10	0.30	-	-	Cs + Gvl
3164	30.65	15.11	49.30	11.40	37.21	3.70	12.06	0.40	1.30	0.04	0.13	Cs + Gvl
3165	31.99	2.01	6.29	22.59	70.58	7.29	22.82	0.10	0.31	-	-	M x S
3168	27.86	22.30	80.04	3.03	10.88	1.40	5.02	0.32	1.15	0.91	2.91	Cs + Gvl

SALINITY AND TEMPERATURE TOLERANCE OF THE STUDY OSTRACODA

Range ————————

Abundance ——▬▬▬▬▬

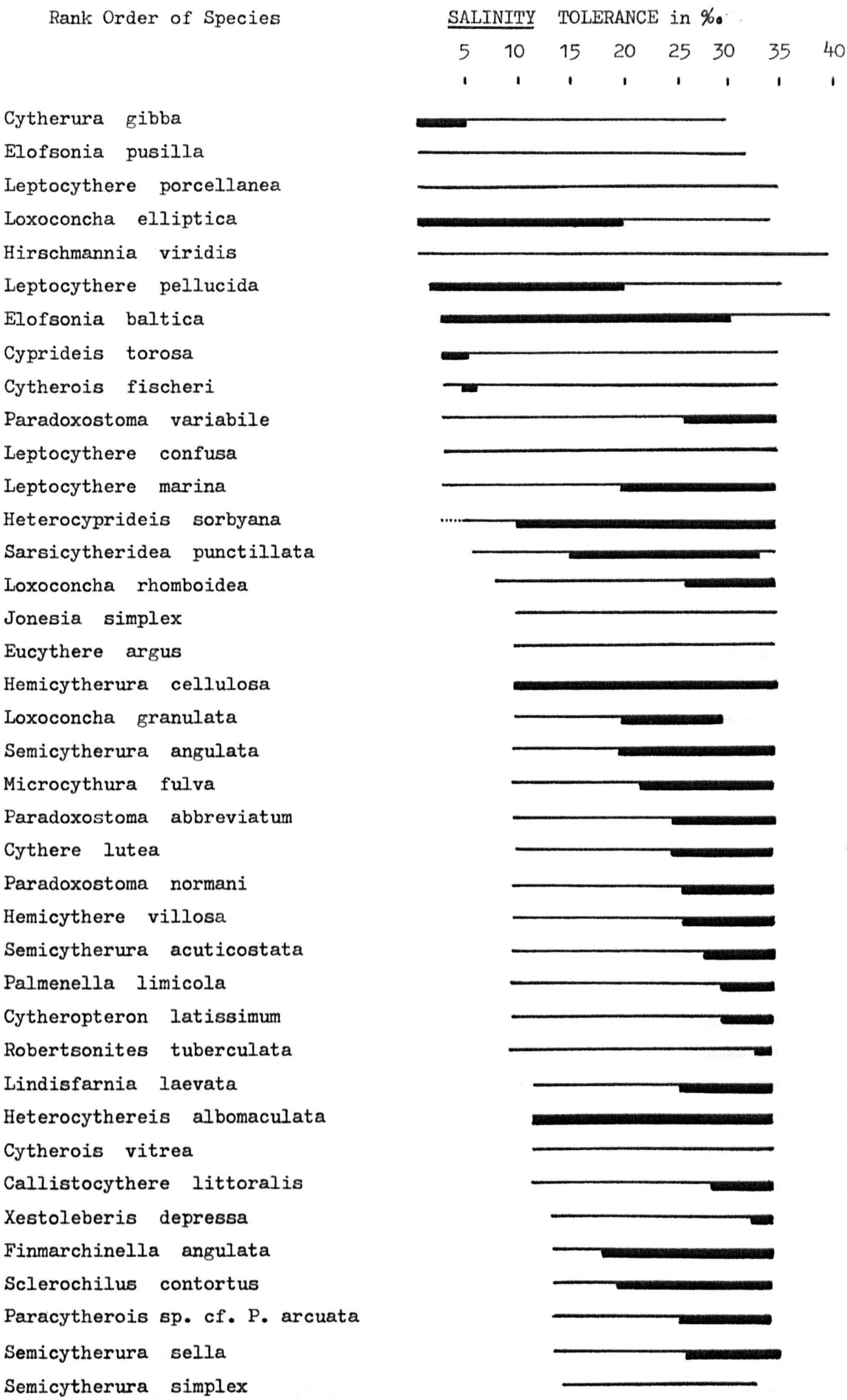
A - Arctic

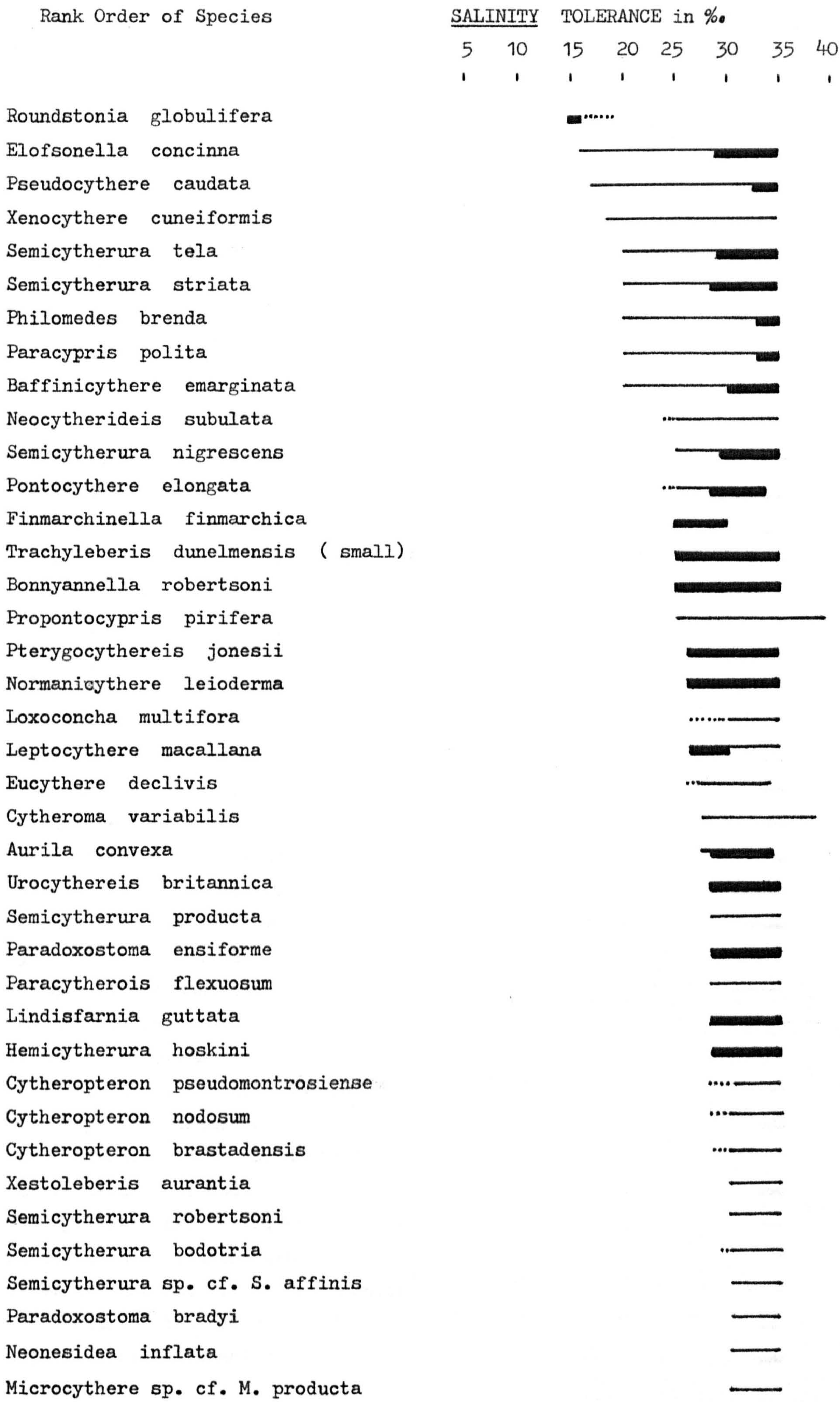
B - Boreal

C - Cool Temperate

D - Warm Temperate

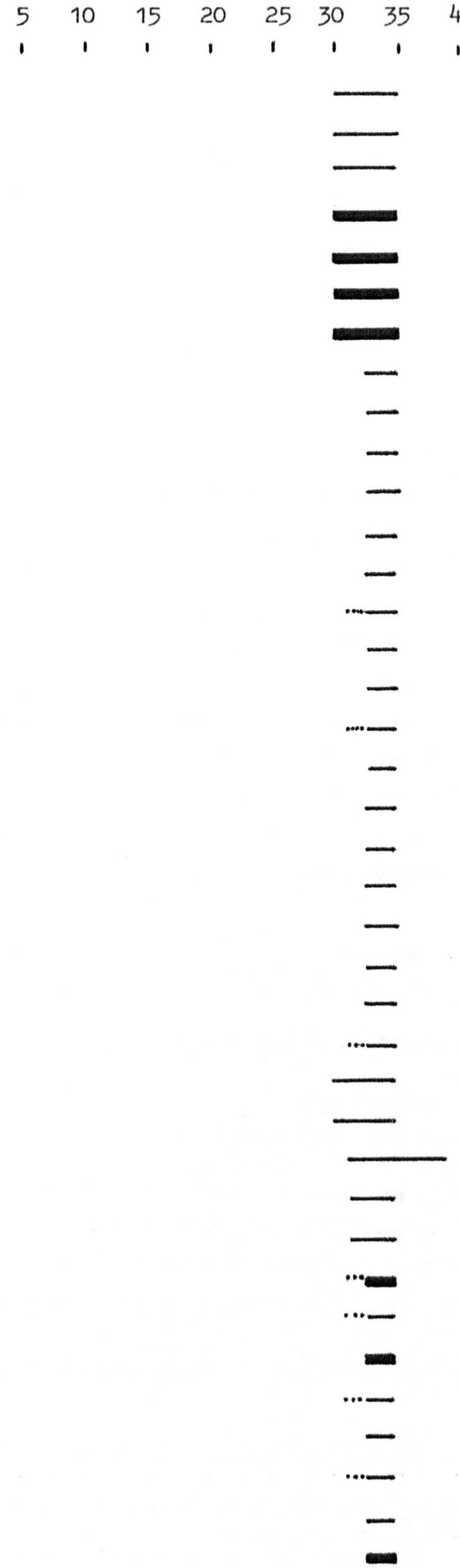
___ = concentration


Rank Order of Species
SALINITY TOLERANCE in ‰
5 10 15 20 25 30 35 40
Cytherura gibba
Elofsonia pusilla
Leptocythere porcellanea
Loxoconcha elliptica
Hirschmannia viridis
Leptocythere pellucida
Elofsonia baltica
Cyprideis torosa
Cytherois fischeri
Paradoxostoma variabile
Leptocythere confusa
Leptocythere marina
Heterocyprideis sorbyana
Sarsicytheridea punctillata
Loxoconcha rhomboidea
Jonesia simplex
Eucythere argus
Hemicytherura cellulosa
Loxoconcha granulata
Semicytherura angulata
Microcythura fulva
Paradoxostoma abbreviatum
Cythere lutea
Paradoxostoma normani
Hemicythere villosa
Semicytherura acuticostata
Palmenella limicola
Cytheropteron latissimum
Robertsonites tuberculata
Lindisfarnia laevata
Heterocythereis albomaculata
Cytherois vitrea
Callistocythere littoralis
Xestoleberis depressa
Finmarchinella angulata
Sclerochilus contortus
Paracytherois sp. cf. P. arcuata
Semicytherura sella
Semicytherura simplex


Rank Order of Species
SALINITY TOLERANCE in ‰
5 10 15 20 25 30 35 40
Roundstonia globulifera
Elofsonella concinna
Pseudocythere caudata
Xenocythere cuneiformis
Semicytherura tela
Semicytherura striata
Philomedes brenda
Paracypris polita
Baffinicythere emarginata
Neocytherideis subulata
Semicytherura nigrescens
Pontocythere elongata
Finmarchinella finmarchica
Trachyleberis dunelmensis (small)
Bonnyannella robertsoni
Propontocypris pirifera
Pterygocythereis jonesii
Normanicythere leioderma
Loxoconcha multifora
Leptocythere macallana
Eucythere declivis
Cytheroma variabilis
Aurila convexa
Urocythereis britannica
Semicytherura producta
Paradoxostoma ensiforme
Paracytherois flexuosum
Lindisfarnia guttata
Hemicytherura hoskini
Cytheropteron pseudomontrosiense
Cytheropteron nodosum
Cytheropteron brastadensis
Xestoleberis aurantia
Semicytherura robertsoni
Semicytherura bodotria
Semicytherura sp. cf. S. affinis
Paradoxostoma bradyi
Neonesidea inflata
Microcythere sp. cf. M. producta

Rank Order of Species

SALINITY TOLERANCE in %.



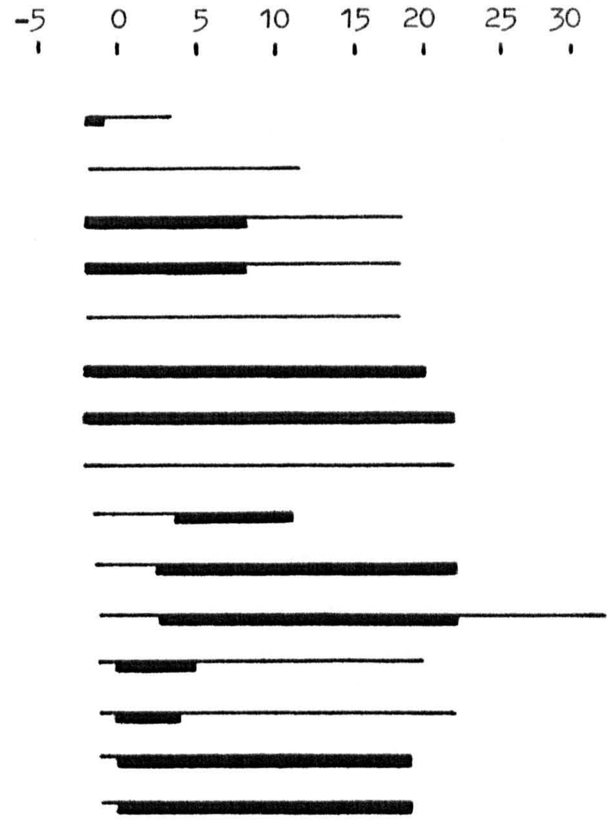
Microcythere sp. cf. M. nana
Microcythere sp. cf. M. monstruosa
Microcythere inflexa
Leptocythere tenera
Krithe sp. cf. K. praetexta
Krithe glacialis
Hemicytherura clathrata
Cytheropteron volantium
Cytheropteron vespertilio
Cytheropteron testudo
Cytheropteron sedovi
Cytheropteron pyramidale
Cytheropteron punctatum
Cytheropteron pseudocrassipinatum
Cytheropteron pararcticum
Cytheropteron nodosoalatum
Cytheropteron montrosiense
Cytheropteron monoceras
Cytheropteron inornatum
Cytheropteron sp. cf. C. infelix
Cytheropteron excavoalatum
Cytheropteron dorsocostatum
Cytheropteron dimlingtonensis
Cytheropteron crassipinatum
Cytheropteron angulatum
Bythocythere turgida
Bythocypris bosquetiana
Callistocythere badia
Argilloecia cylindrica
Argilloecia sp. cf. A. conoidea
Thaerocythere crenulata
Semicytherura sp. cf. S. costata
Semicytherura cornuta
Semicytherura sp. cf. S. concentrica
Semicytherura concentrica
Semicytherura sp. cf. S. acuticostata
Sclerochilus truncatus
Sarsicytheridea bradii

Rank Order of Species | SALINITY TOLERANCE in ‰

5 10 15 20 25 30 35 40

Rabilimis mirabilis
Pterygocythereis siveteri
Pseudocythere sp. cf. P. caudata
Pellucistoma sp.
Parakrithe angusta
Paradoxostoma sp. cf. P. obliquum
Paradoxostoma sp. cf. P. normani
Paradoxostoma hibernicum
Mullerina abyssicola
Microcythere helgolandica
Microcythere sp. cf. M. depressa
Microcythere sp. cf. M. bahusiensis
Machaerina tenuissima
Machaerina sp. cf. M. amygdaloides
Loxoconcha sp. cf. L. agilis
Leptocythere sp. cf. L. macella
Kangarina abyssicola
Falunia emaciata
Eucytherura complexa
Eucythere curvata n.sp.
Eucythere anglica
Cytherura sp. cf. C. gibba
Cytheroma sp. cf. C. variabilis
Cytherella sp. cf. C. scotica
Cuneocythere semipunctata
Cluthia cluthae
Celtia quadridentata
Callistocythere sp.
Carinocythereis carinata
Carinocythereis antiquata
Bythocythere sp. cf. B. turgida
Bythocythere recta
Bythocythere intermedia
Bythocythere bradyi
Bythocythere bicristata
Buntonia corpulenta
Anchistrocheles acerosa

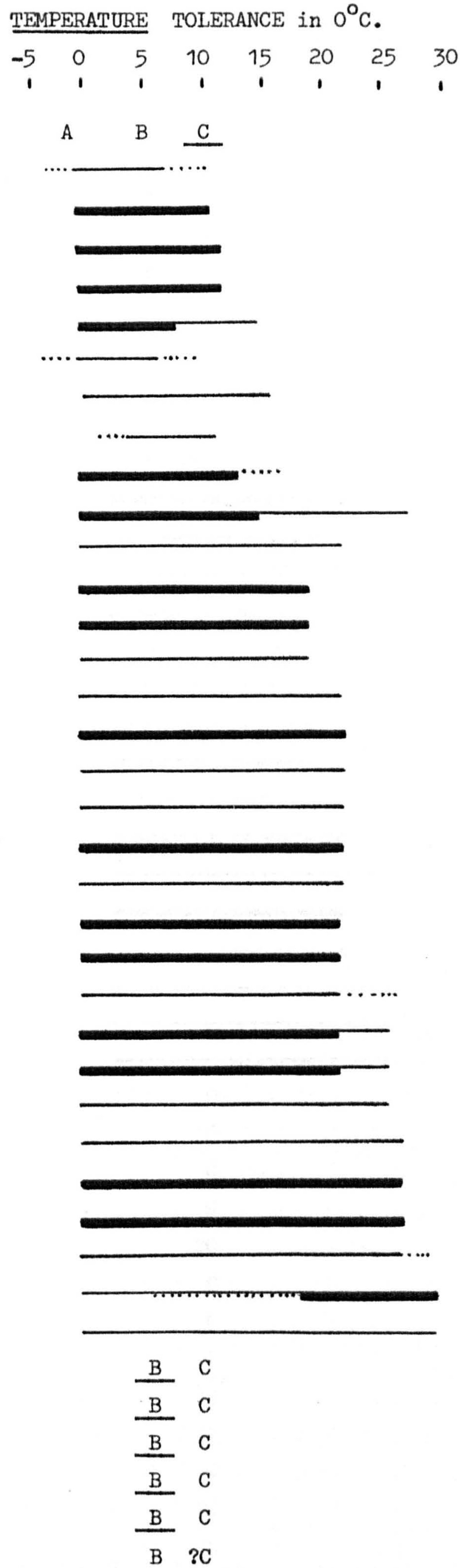
Rank Order of Species — TEMPERATURE TOLERANCE in $0^{o}C$.



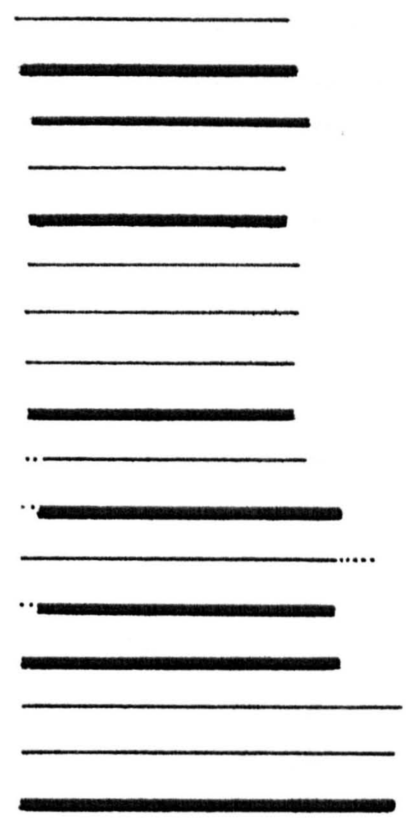
Species			
Rabilimis mirabilis			
Palmenella limicola			
Philomedes brenda			
Robertsonites tuberculata			
Semicytherura acuticostata			
Finmarchinella angulata			
Normanicythere leioderma			
Xestoleberis depressa			
Trachyleberis dunelmensis			
Pseudocythere caudata			
Hirschmannia viridis			
Baffinicythere emarginata			
Semicytherura undata			
Heterocyprideis sorbyana			
Sarsicytheridea bradii			
Paradoxostoma sp. cf. P. obliquum	A	B	C
Cytheropteron nodosum	A	B	C
Cytheropteron nodosoalatum	A		
Krithe glacialis	A	B	C
Cytheropteron punctatum	A	B	
Cytheropteron pseudomontrosiense	A	B	
Cytheropteron dimlingtonensis	A	B	
Semicytherura sp. cf. S. affinis	A	B	
Cytheropteron volantium	?A	B	
Cytheropteron sedovi	A	B	
Cytheropteron pyramidale	A	B	
Cytheropteron pararcticum	A	?B	
Cytheropteron montrosiense	A	B	
Cytheropteron excavoalatum	A	B	
Cytheropteron angulatum	A	B	
Bythocythere recta	A	B	
Semicytherura sp. cf. S. acuticostata	?A	?B	
Parakrithe angusta		B	
Microcythere sp. cf. M. bahusiensis		B	
Cytheropteron pseudocrassipinatum		B	
Cytheropteron brastadensis		?B	
Buntonia corpulenta		B	
Bythocypris bosquetiana		B	
Argilloecia sp. cf. A. conoidea		B	

Rank Order of Species

Neonesidea inflata
Roundstonia globulifera
Mullerina abyssicola
Thaerocythere crenulata
Cytheropteron simplex
Cluthia cluthae
Loxoconcha multifora
Jonesia simplex
Argilloecia cylindrica
Pontocythere elongata
Finmarchinella finmarchica
Sarsicytheridea punctillata
Elofsonella concinna
Lindisfarnia laevata
Paradoxostoma bradyi
Xestoleberis aurantia
Sclerochilus contortus
Semicytherura nigrescens
Semicytherura angulata
Paradoxostoma normani
Paradoxostoma abbreviatum
Hemicytherura cellulosa
Hemicythere villosa
Paradoxostoma ensiforme
Leptocythere pellucida
Leptocythere confusa
Cytherois fischeri
Paradoxostoma variabile
Loxoconcha rhomboidea
Leptocythere marina
Elofsonia pusilla
Cytherura gibba
Loxoconcha elliptica
Semicytherura concentrica
Cytheropteron latissimum
Bythocythere turgida
Bythocythere intermedia
Bythocythere bradyi
Cytheropteron dorsocostatum



Rank Order of Species	TEMPERATURE TOLERANCE in $0^{o}C$. -5	0	5	10	15	20	25	30
Semicytherura bodotria			B	C				
Microcythere sp. cf. M. producta			B	C				
Microcythere sp. cf. M. monstruosa			B	C				
Microcythere helgolandica			B	C				
Eucythere argus			B	C				
Cytherella sp. cf. C. scotica			B	C				
Semicytherura simplex			B	C		D		
Microcythere inflexa			B	C		D		
Eucythere declivis			B	C		D		
Krithe sp. cf. K. praetexta								
Loxoconcha granulata								
Bonnyannella robertsoni								
Semicytherura striata								
Pterygocythereis jonesii								
Xenocythere cuneiformis								
Paracypris polita								
Cytherois vitrea								
Trachyleberis dunelmensis (small)								
Semicytherura cornuta								
Paracytherois sp. cf. P. arcuata								
Leptocythere porcellanea								
Heterocythereis albomaculata								
Cythere lutea								
Elofsonia baltica								
Callistocythere littoralis								
Aurila convexa								
Semicytherura robertsoni				C				
Semicytherura sp. cf. S. concentrica				C				
Sclerochilus truncatus				C				
Pseudocythere sp. cf. P. caudata				C				
Pellucistoma sp.				?C				
Paradoxostoma sp. cf. P. normani				C				
Paradoxostoma hibernicum				C				
Leptocythere macallana				C				
Eucythere curvata n.sp.				?C				
Eucythere anglica				?C				
Cytherura sp. cf. C. gibba				C				
Cytheropteron crassipinatum				?C				
Callistocythere sp.				?C				



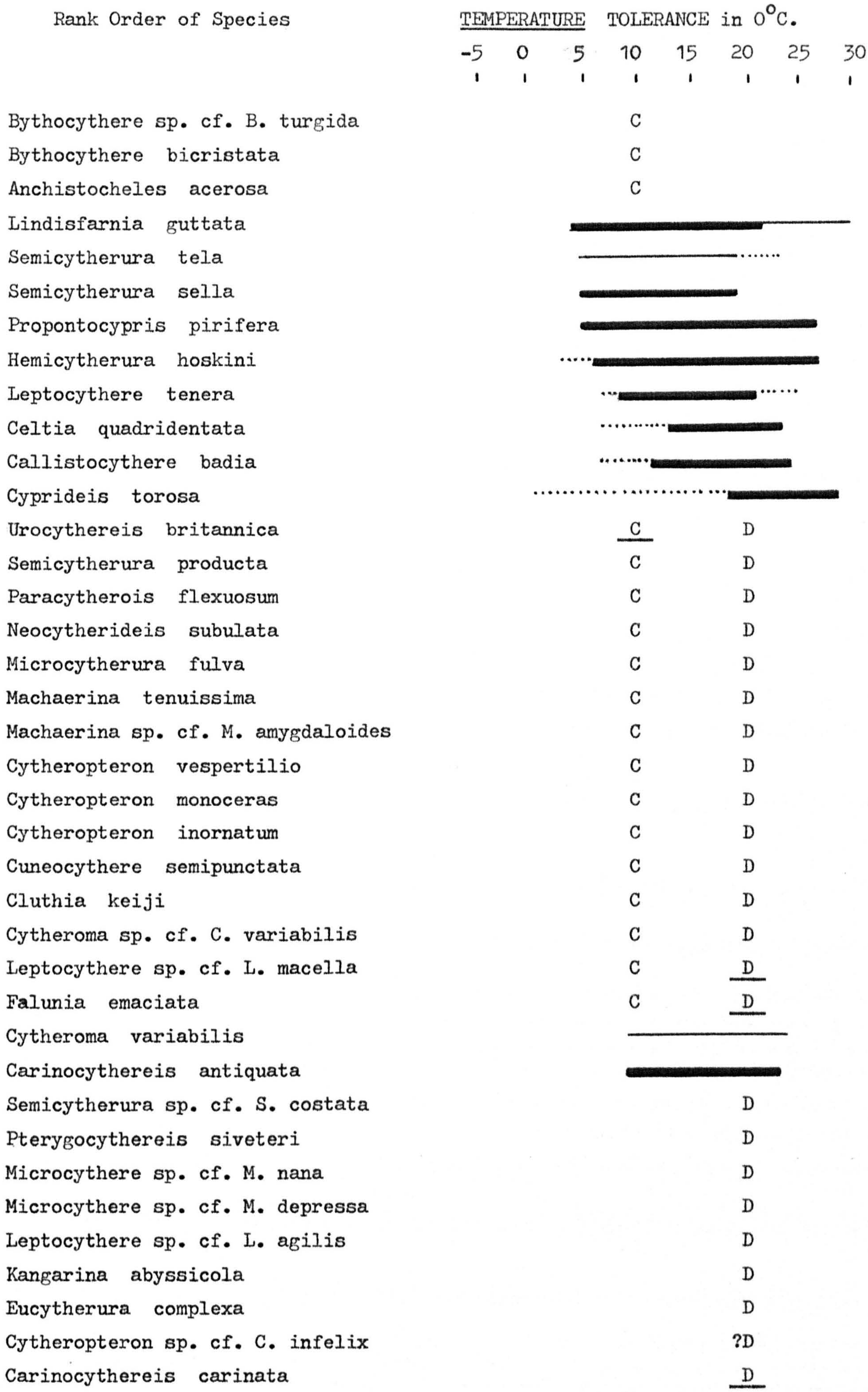

Rank Order of Species
TEMPERATURE TOLERANCE in ^{o}C.
-5 0 5 10 15 20 25 30
Bythocythere sp. cf. B. turgida C
Bythocythere bicristata C
Anchistocheles acerosa C
Lindisfarnia guttata
Semicytherura tela
Semicytherura sella
Propontocypris pirifera
Hemicytherura hoskini
Leptocythere tenera
Celtia quadridentata
Callistocythere badia
Cyprideis torosa
Urocythereis britannica C D
Semicytherura producta C D
Paracytherois flexuosum C D
Neocytherideis subulata C D
Microcytherura fulva C D
Machaerina tenuissima C D
Machaerina sp. cf. M. amygdaloides C D
Cytheropteron vespertilio C D
Cytheropteron monoceras C D
Cytheropteron inornatum C D
Cuneocythere semipunctata C D
Cluthia keiji C D
Cytheroma sp. cf. C. variabilis C D
Leptocythere sp. cf. L. macella C D
Falunia emaciata C D
Cytheroma variabilis
Carinocythereis antiquata
Semicytherura sp. cf. S. costata D
Pterygocythereis siveteri D
Microcythere sp. cf. M. nana D
Microcythere sp. cf. M. depressa D
Leptocythere sp. cf. L. agilis D
Kangarina abyssicola D
Eucytherura complexa D
Cytheropteron sp. cf. C. infelix ?D
Carinocythereis carinata D

Fig. A

TOTAL DISTRIBUTION OF SPECIES IN SOUTH IRISH SEA

PRESERVATION - [A] V. GOOD [B] GOOD [C] POOR [D] V. POOR

LIVE OCCURENCE - [/]

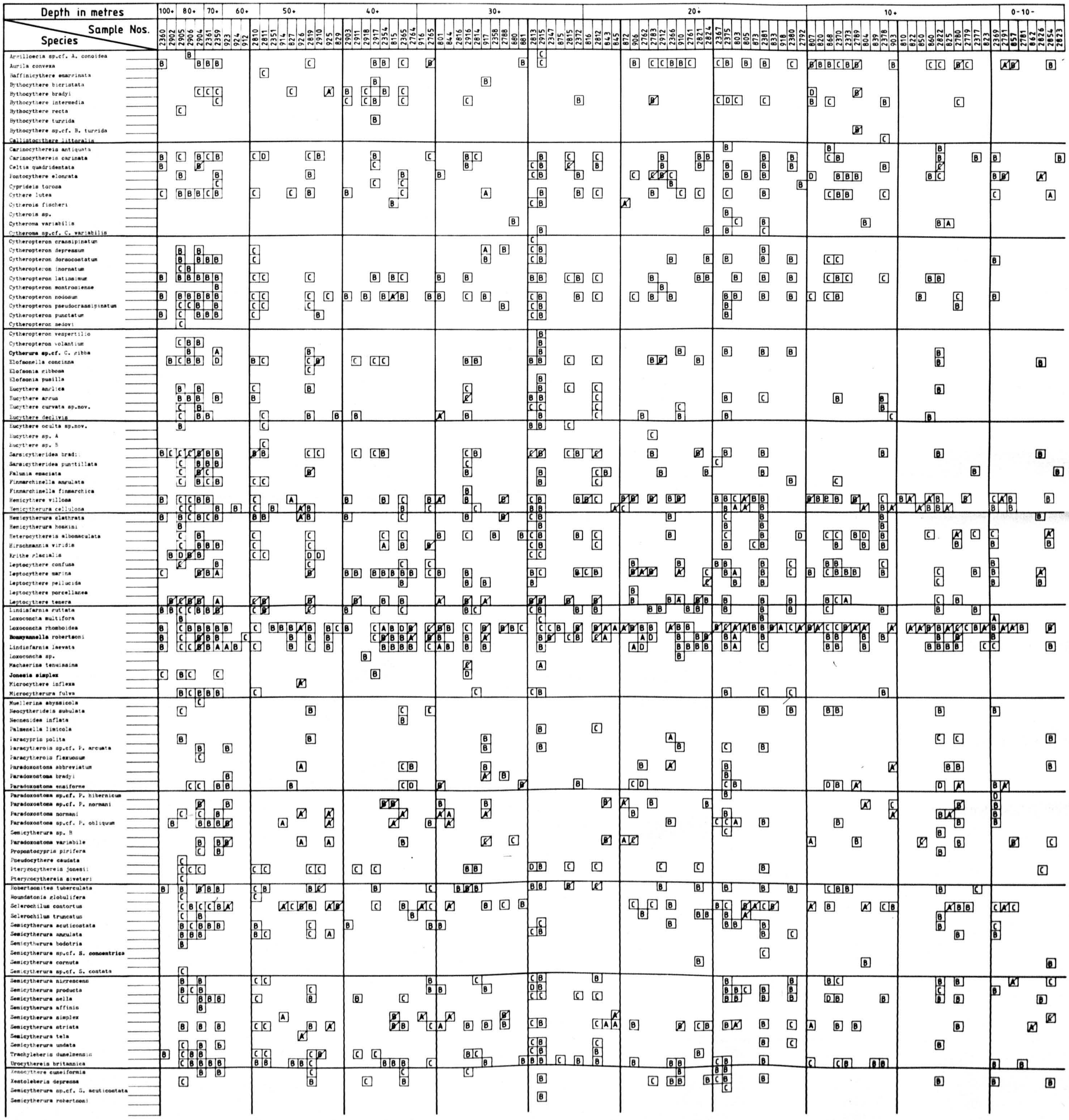


Fig. B

TOTAL DISTRIBUTION OF SPECIES IN CAERNARVON BAY

PRESERVATION - [A] V. GOOD [B] GOOD [C] POOR [D] V. POOR

LIVE OCCURENCE - [⁄]

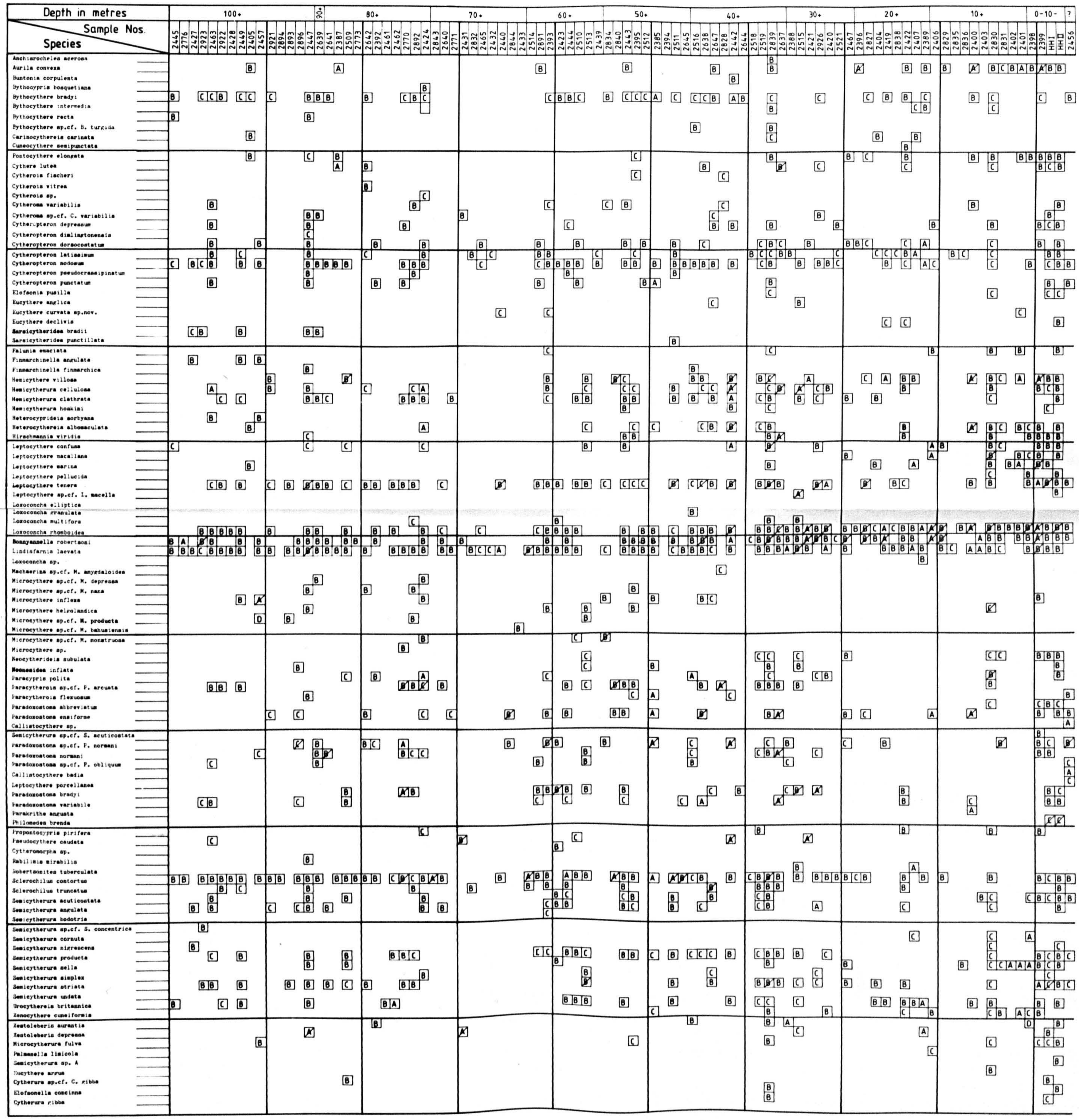


Fig. C

TOTAL DISTRIBUTION OF SPECIES IN MALIN SEA

PRESERVATION - A V. GOOD B GOOD C POOR D V. POOR

LIVE OCCURENCE - ⧄