# UNIVERSITY COLLEGE OF SWANSEA



# OCEANOGRAPHY DEPT

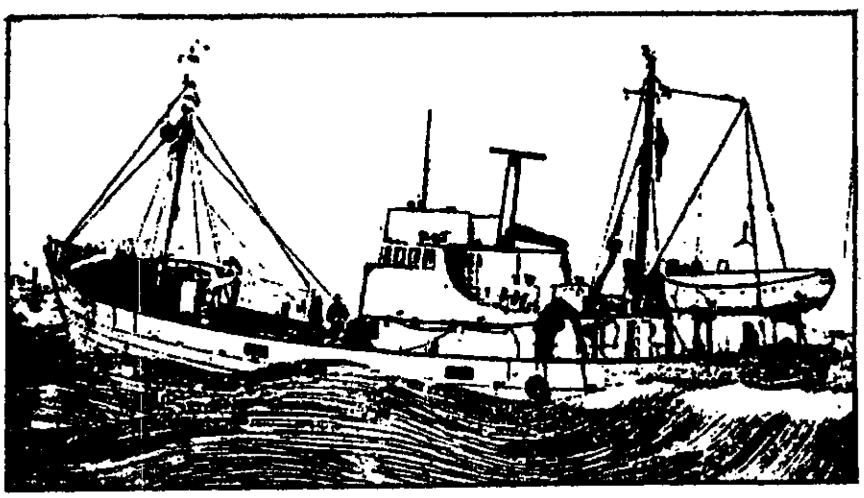
R.R.S. Shackleton Cruise 1/82:

Report, Part II (Sedimentological/Hydrographic)

by M.B. Collins, Senior Scientist.

(Part I Senior Scientist: Prof. M. Brooks)

# INTERNAL REPORT



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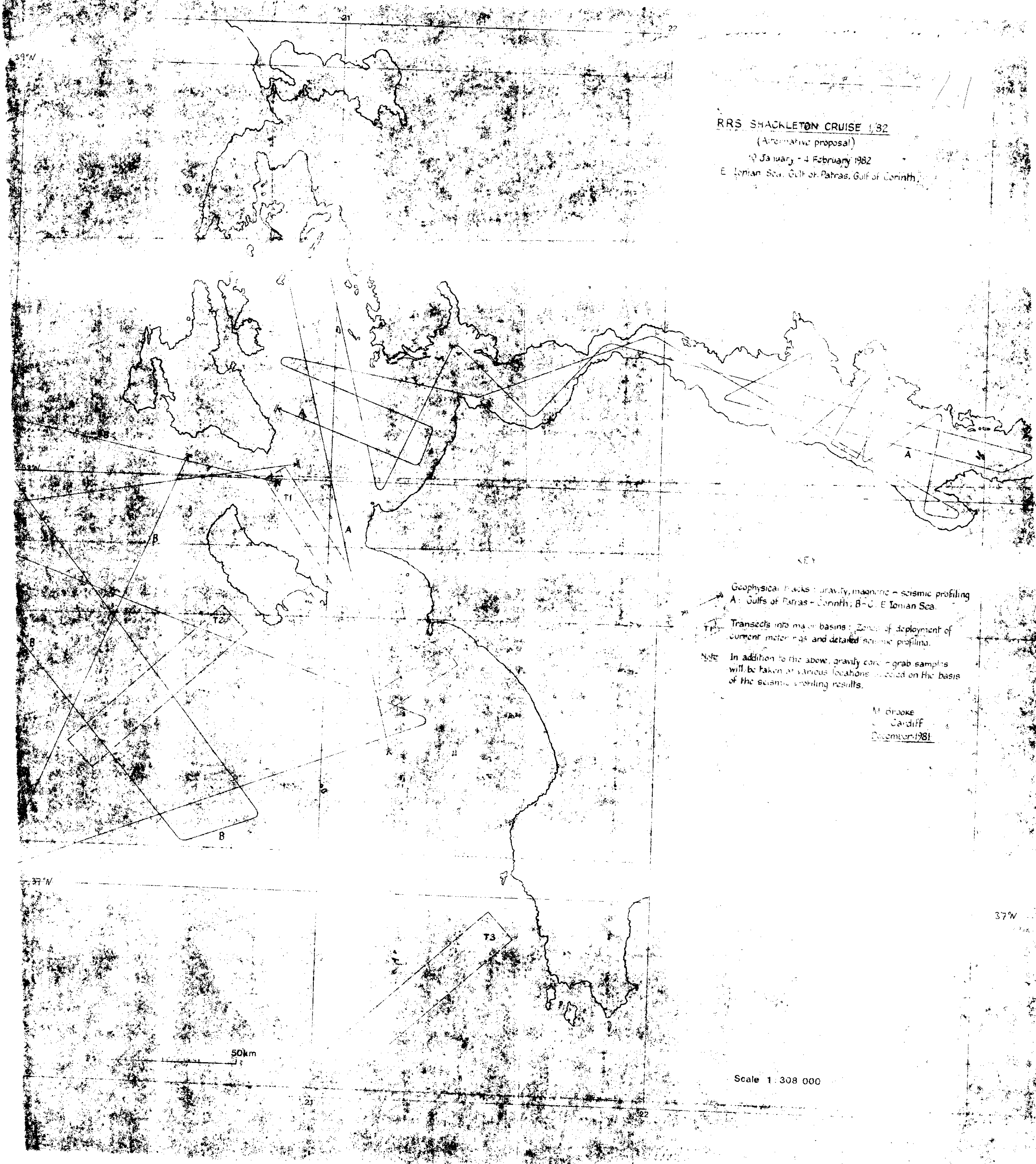
RRS SHACKLETON CRUISE 1/32
(Alternative proposal)
January - 4 February 1982
E. Ionian Sea, Gulf of Patras, Gulf of Corinth
KEY
Geophysical tracks: gravity, magnetic + seismic profiling
A: Gulfs of Patras + Corinth; B+C: E Ionian Sea.
Transects into major basins: Zones of deployment of current meter rigs and detailed seismic profiling.
Note In addition to the above, gravity core + grab samples will be taken at various locations on the basis of the seismic profiling results.
Cardiff
December 1981
39°N
37°N
21°
22°
A
B
T1
T2
T3
50km
Scale 1:308 000

1. CRUISE DATES (R.R.S. Shackleton 1/82)

10/1/82: Departed Naples, Italy

12/1/82: Deployment of first current meter array (I S /82/(C M )1)

22/1/82: Exchange of scientific personnel off Patras, by boat.

29/1/82: Recovery of last current meter array.

31/1/82: End of original cruise programme; further exchange of scientific personnel in Patras.

2/2/82: Extension of 1/82 Cruise.

5/2/82: End of Cruise in Patras, Greece.

2. SCIENTIFIC PERSONNEL (including <u>all</u> phases of the cruise)

From the Department of Geology, University College, Cardiff:

Prof. M. Brooks    Principal Scientist (Geophysical)

Mr. M. Fischer

Mr. J. Filbrandt

Mr. L. Kiriakidis

From the Department of Oceanography, University College, Swansea:

Dr. M.B. Collins    Principal Scientist (Sedimentology/Hydrography)

Dr. S.J. Wakefield

Mr. A. Cramp

Mr. C. Pattiaratchi

Mr. J. van Smirren

From the School of Environmental Sciences, University of E. Anglia:

Dr. P.N. Chroston

From the Department of Geology, University of Patras:

Dr. G. Ferentinos

Dr. S. Varnavas

Mr. P. Achillepoulos

Mr. N. Kastanos

From the Greek Institute of Oceanographic and Fisheries Research (IOKAE):

Mr. C. Tziavos

Mr. G. Chronis

From Research Vessel Services, Barry

Mr. I. Chivers

Mr. M. Beney

Mr. S. Jones

Mr. P. Taylor

Mr. R. Lloyd

## 3. INTRODUCTION AND CRUISE OBJECTIVES

The original cruise programme for R.R.S. Shackleton (1/82) was the proposed extension of the investigations carried out during cruise 7/78, from the same research vessel, in the N.W. Aegean Sea (see references listed in section 6). For both of the cruises, geophysical investigations were carried out under the direction of Prof. M. Brooks (U.C., Cardiff) and the sedimentological investigations under the supervision of Dr. M.B. Collins (U.C., Swansea). This report is concerned with the sedimentological aspects of the 1/82 cruise but, for completeness, the report of Prof. Brooks on the geophysical investigations is included as Appendix A.

In the original research proposal for the N.W. Aegean Sea, the following summary of methodology and approach was presented, for the overall objectives:

(i) detailed seismic profiling across the western and southern margins of the Sporadhes basin, North Aegean Trough;

(ii) sea-bed sampling and near-bed current meter observations in Thermaicos Bay and Sporadhes Basin;

(iii) seismic profiling, gravity/magnetic surveying and bottom sampling in Skiros Basin; and

(iv) seismic refraction of deep structure of North Aegean Trough.

In order to meet requirements (ii), listed above, current meter moorings arrays were requested, in May 1981,on the basis of their proposed deployment in the N.W. Aegean Sea.

In spite of what apppeared to be successful contacts maintained throughout the period of cruise planning by the Principal Scientists and various Greek Authorities, Prof. Brooks with the Institute of Geological and Mineral Exploration (I.G.M.E., Athens) and Dr. Collins with the Institute of Oceanographic and Fisheries Research (I.O.K.A.E., Athens), permission to carry out investigations in the Aegean Sea was not granted by the Greek Government. Permission was refused in November/December, 1981. Subsequently, an alternative cruise programme for the western Hellenic Arc and Gulfs of Patras and Corinth was prepared and submitted to NERC by the Principal Scientists on 20th November, 1981, to be carried out in association with the Dept. of Geology, University of Patras. The basis of this scientific programme was the proposal for a further research cruise in 1983/84. Details of the proposed sedimentological studies are as follows:

a) comparison between processes of sediment supply and dispersion in differing tectonic regimes of the E. Mediterranean. In particular, the sediment transport model developed for an active tectonic zone of extension (Brooks and Ferentinos, 1980) to be compared with similar processes in the western Helenic Arc in the following manner:

(i) analysis of modern and Holocene patterns of sedimentation, using sedimentological data;

(ii) investigation of near-bed and sub-surface water movements, using current meters.

and (iii) (integrated with the geophysical programme) studies of sub-surface sedimentary structures and sediment deformation by gravitational processes.

The revised programme for cruise 1/82 incorporated various aspects of the proposal for 1983/84. In particular, objectives of the part of the cruise relevant to this report is the 'investigation of sedimentary processes, sedimentary environments and underlying tectonic controls at the western Pelponnessus continental margin between 36$^{o}$N and 39$^{o}$N (Zante Channel and Gulfs of Patras and Corinth). Such a study complements and extends work carried out by other investigators in the eastern Ionian Sea and forms a natural extension of the interdisaplinary studies carried out by the Principal Investigators on the N.W. Aegean Sea. The two areas provide many points of similarity in terms of underlying tectonic control of sedimentary environments, the existence of deep basins nearshore, and an adjacent fluvial sediment supply. Within their regional tectonic setting, the N.W. Aegean Sea is within an extensional regime, whilst the western Hellenic Arc is a zone of compressional tectonics. The investigations form, therefore, parts of a comparative study".

In view of the various changes in scientific programmes between the alternative and original proposals, N.E.R.C. have been notified by the Principal Investigators of investigations which are outstanding for any subsequent research cruise in the region.

## 4. SCIENTIFIC INFORMATION COLLECTED

Data for the sedimentological and hydrographic research programme in the eastern Ionian Sea were collected using:

a) 16 Aanderaa self-recording current meters, with some fitted with pressure and conductivity sensors. The meters were deployed using a single rig mooring in all but one of the locations and were fitted with acoustic releases.

b) 2 UCM2 (Simrad) Ultrasonic current meters used to obtain supplementary information on the near-bed currents and turbulence. The meters were deployed using the systems adopted for the Aanderaa meters.

c) a Continuously Recording Thermosalinograph, in order to obtain information on the distribution of surface water salinity and temperature. This peice of equipment was run almost continuously throughout the duration of the cruise.

d) sea-bed sampling equipment, using Day and Shipek grabs and a U.M.E.L. underwater camera, together with gravity and piston coring arrangements.

e) O.R.E. and E.D.O. Western Pingers were used extensively, to examine the shallow sub-surface sedimentological nature of the sea-bed. This part of the investigation overlaps with the geophysical studies of the deeper geological structure, carried out by Prof. Brooks

and f) E.G. and G. Sidescan Sonar was tried in some of the shallower water areas.

All the equipment listed above was supplied by Research Vessel Services, Barry, in consultation with the Senior Scientists.

The overall cruise programme, involving both the sedimentological/ hydrographic and geophysical studies was organised by the Senior Scientists in association with R.V.S., Barry. In general, it was intended to deploy the current meters within the initial phase of the cruise programme and to collect them towards the end. In between, geophysical traverses and sea-bed sampling were undertaken.

The two main areas under investigation (Fig. 1) were: (i) the Zante Channel, lying between the island of Zante and the mainland, and extending from the continental shelf to a depth of the order of 2000m; and (ii) Corinthiacos Kolpos (Gulf of Corinth), with water depths extending to 900m. Both areas receive fluvial input from large river systems.

Current meters were deployed along the longitudinal axis of the Zante Channel, and at certain cross-sections, as shown in Fig. 2 and listed in Tables 1 and 2. All the current meter rigs were deployed and recovered, under the supervision of Mr. P. Taylor (R.V.S., Barry) and the data recovery is exceptionally high. Information from the Aanderaa meters is presently being processed, whilst that from the Ultrasonic meters is awaited from the manufacturers (Simrad, Norway).

Geophysical data collection is described in the section of the report presented by Prof. Brooks (see Appendix A) and the general availability of gravity, magnetic and shallow seismic(pinger)data is shown in Fig. 3. In all, well over 2000 line kilometres of profiling data were established.

Sea-bed sampling was carried out in the Zante Channel (Fig. 4) and in a restricted transect (the so-called Sector T4) across the Gulf of Corinth. The overall availability of sea-bed samples is listed in Table 3 and relates to some 38 m. of core material. 35mm still B/W photographs were obtained from each of the Day grab stations. In addition to core material available from the specific coring operations in the Zante Channel, sub-sampling of the Day grabs was carried out; this provided cores of approx. 20-30cm in length from a virtually undisturbed sample of the sea-bed. The short core lengths will be invaluable in examining modern sedimentation processes in the area, utilising sedimentological and geochemical analytical techniques.

The detailed sampling programme carried out in the Gulf of Corinth (Fig. 5) was in association with the Dept. of Geology, University of Patras. Shipek grabs were collected from this area, in addition to the use of gravity coring and Day grabs as in the Zante Channel. Piston coring was tried unsuccessfully here. Sampling was carried out along this transect to investigate both natural and artificial sedimentation processes. Natural processes relate to the transport and deposition of fine-grained material from river inputs to a deep basin; this is supplemented by output from an artificial aluminium mining operation along the northern coastline, based upon the local bauxite deposits.

It should be noted that it was possible to collect only a few piston cores throughout this part of the investigation, limited to 0.95m maximum length.

Sub-samples from the Day grab recoveries from the Zante Channel and from the grabs and tops of the cores from the Gulf of Corinth have been supplied to the Dept. Geology, University of Patras.

Continuous surface temperature and conductivity data were collected throughout the cruise, with availability corresponding with the geophysical track plots (Fig. 3).

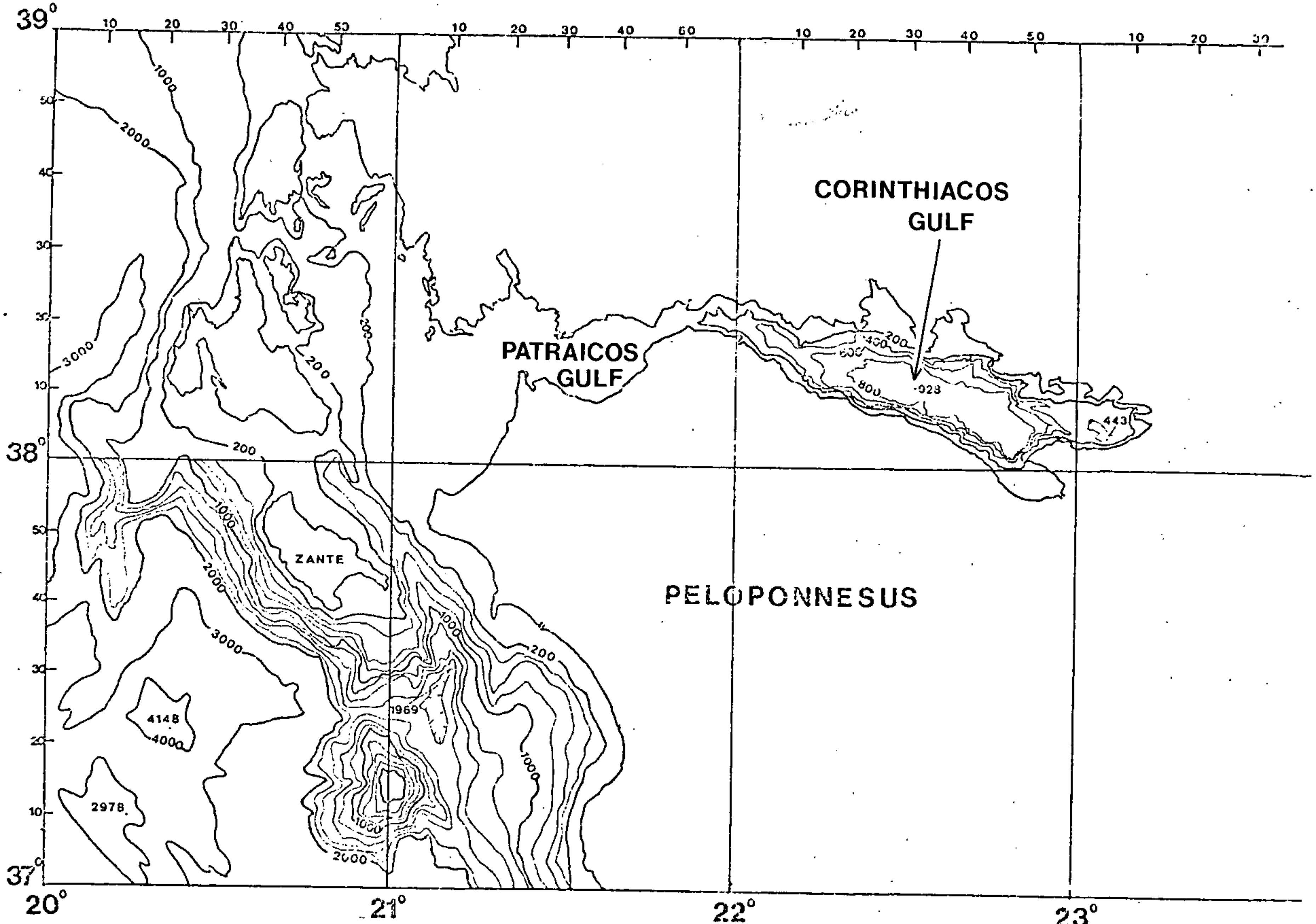


Fig. 1: R.R.S. Shackleton 1/82: General Bathymetry of the Cruise Area, abstracted from U.S. Hydrographic Chart No. (NAR-8) 3407

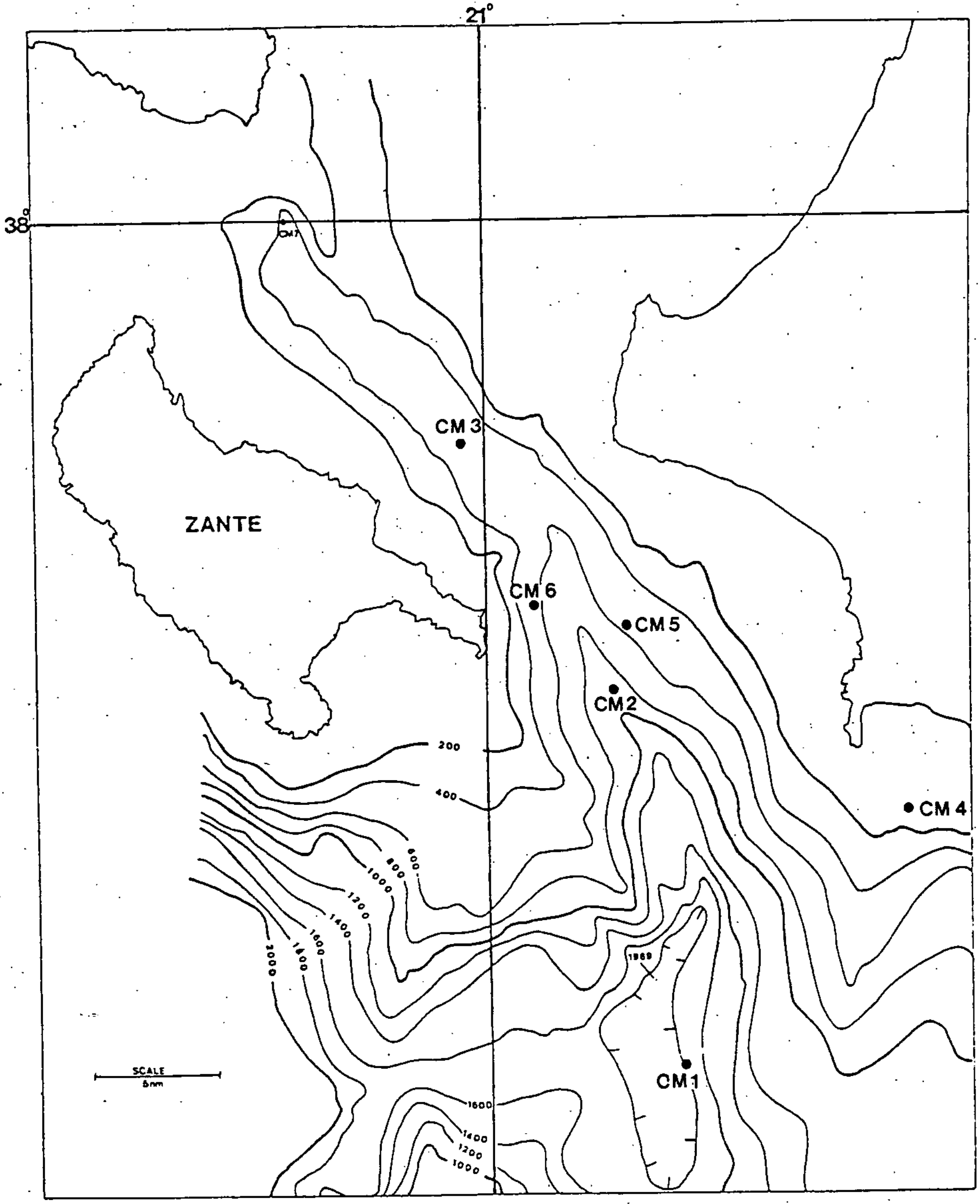


Fig. 2: R.R.S. Shackleton 1/82: Current Meter Locations in the Zante Channel. (Bathymetry abstracted from U.S. Hydrographic Chart No. (NAR-8) 3407 and Admiralty Chart No. 207.

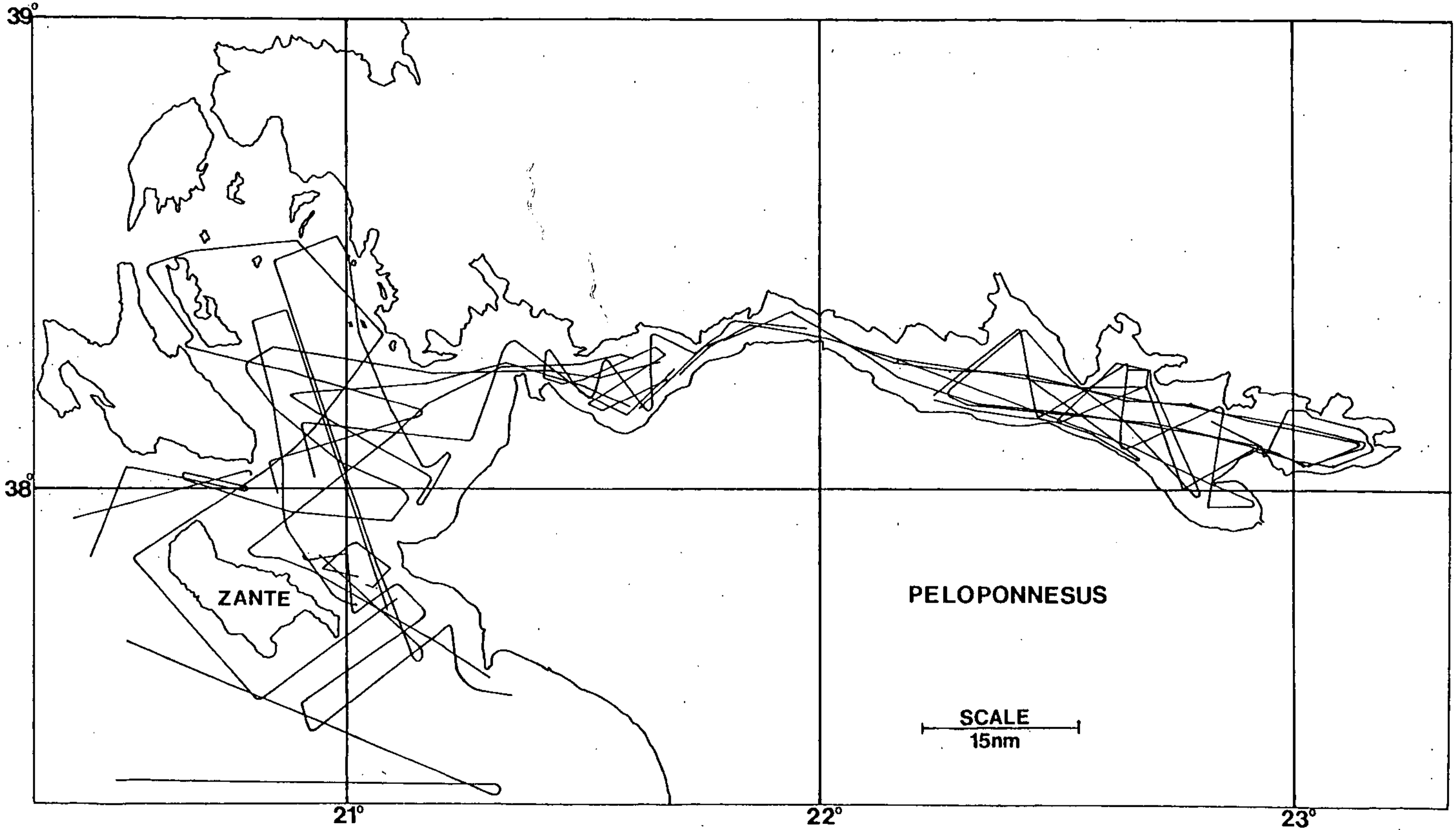


Fig. 3: R.R.S. Shackleton 1/82: Track plots for geophysical and T/S data.

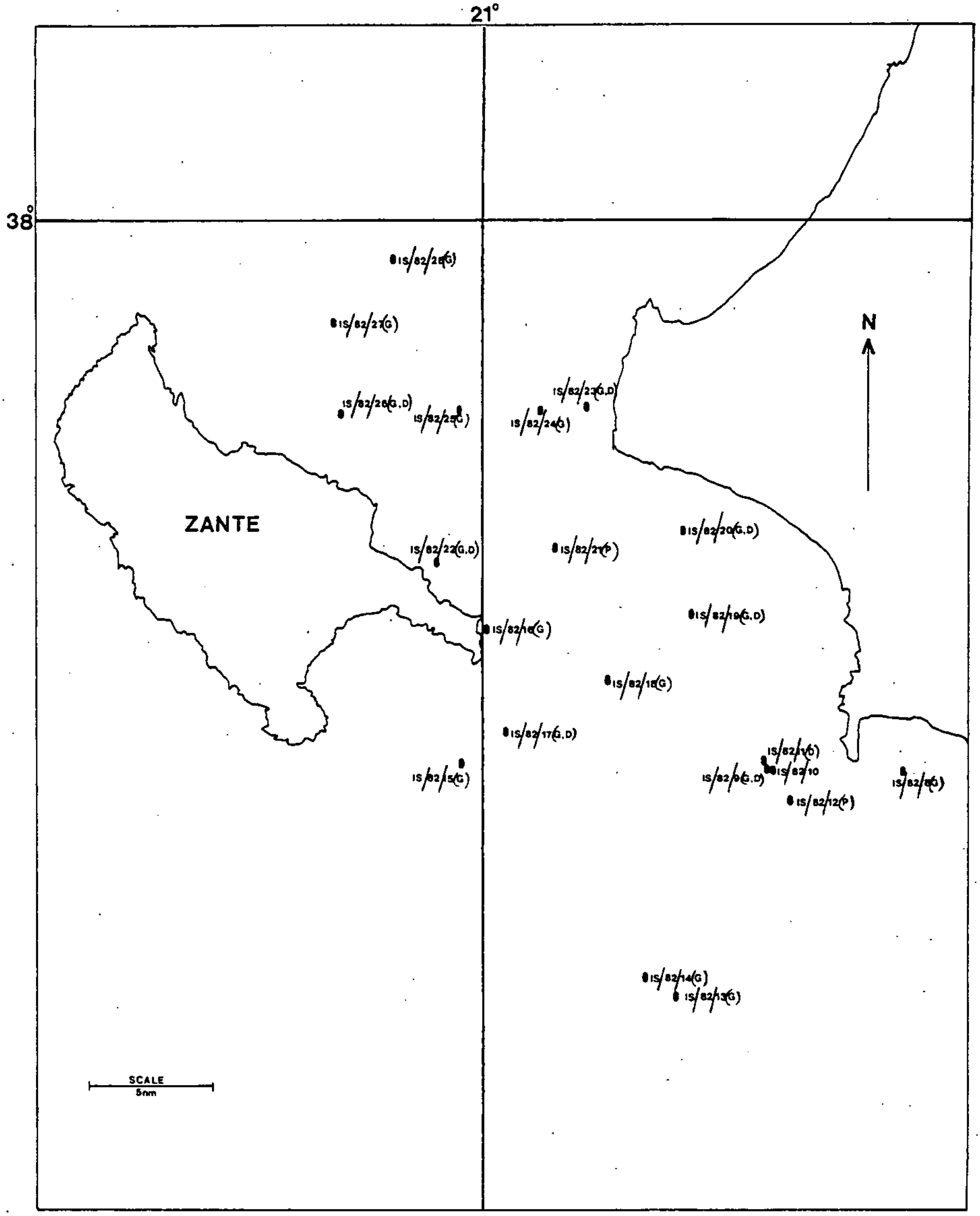


Fig. 4: R.R.S. Shackleton 1/82 - Sea bed sampling sites in the Zante Channel.

Key: G - gravity core; P - piston core; D - Day grab.

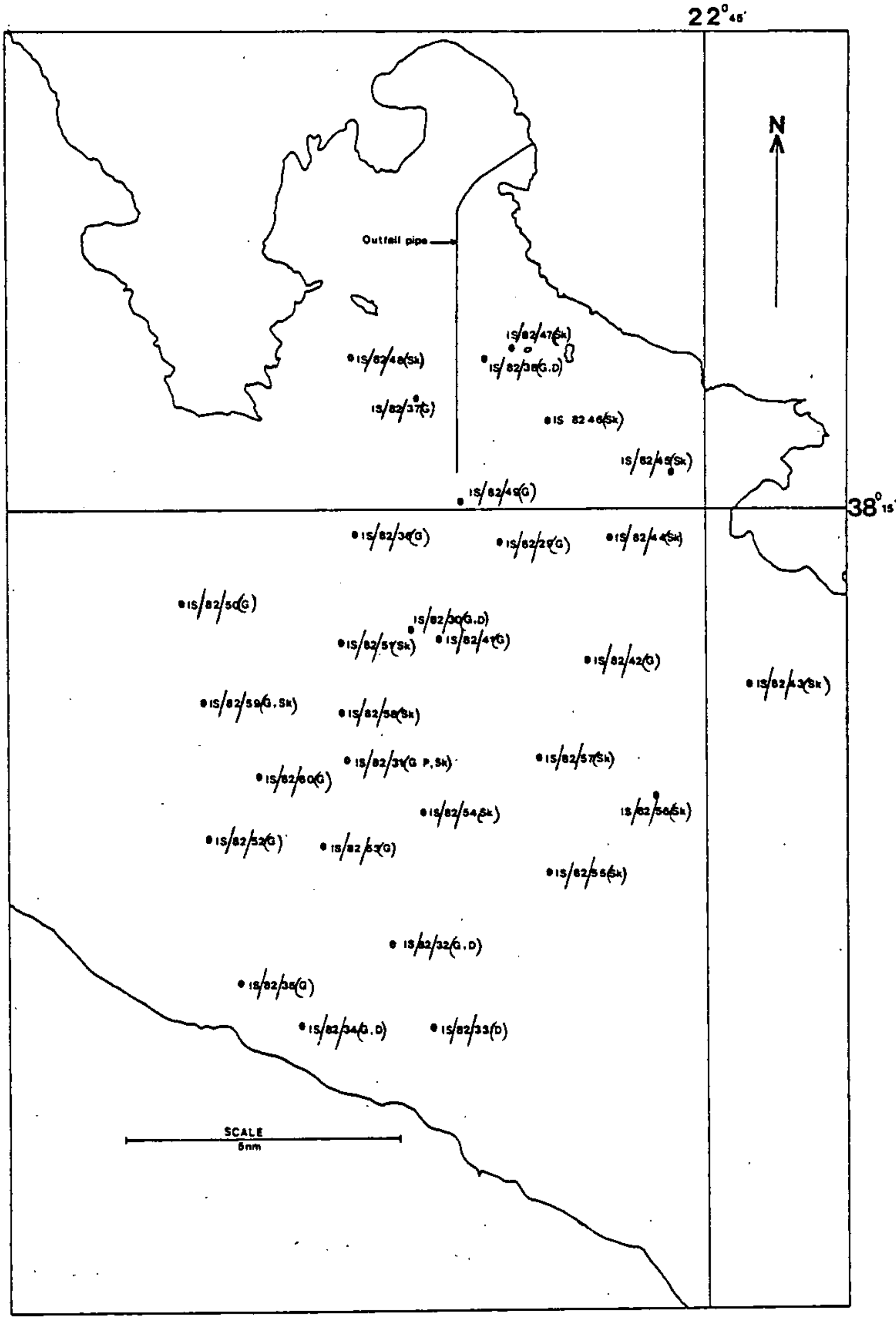


Fig. 5: R.R.S. Shackleton 1/82 - Sea bed sampling sites in Sector T4, Gulf of Corinth.

Outline from Admiralty Chart 1600.

Key: G - gravity core; P - piston core; D - Day grab; SK - Shipek grab

TABLE 1: AANDERAA CURRENT METER DEPLOYMENTS

| STATION | METER NO. | HEIGHT ABOVE SEA BED(m) | SAMPLING INTERNAL (MINS ) | NO. OF OBS. | DURATION OF USEFUL DATA | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | START | | FINISH | |
| IS/82/(CM)1 | 5227 | 3.5 | 5 | 4528 | 1450 | 12/1/82 | 0800 | 28/1/82 |
| IS/82/(CM)2 | 5381 | 5.0 | 5 | 4505 | 1910 | 12/1/82 | 1013 | 28/1/82 |
| IS/82/(CM)2 | 4374 | 300.0 | 5 | 4505 | 1910 | 12/1/82 | 1030 | 28/1/82 |
| IS/82/(CM)2 | +3260S | 695.0 | 5 | 4505 | 1910 | 12/1/82 | 1030 | 28/1/82 |
| IS/82/(CM)3 | 5319 | 5.0 | 5 | 4723 | 0000 | 13/1/82 | 0930 | 29/1/82 |
| IS/82/(CM)3 | *5332S | 200.0 | 5 | 4723 | 0000 | 13/1/82 | 0930 | 29/1/82 |
| IS/82/(CM)3 | +3258S | 400.0 | 5 | 4723 | 0000 | 13/1/82 | 0930 | 29/1/82 |
| IS/82/(CM)4 | *5331S | 5.0 | 5 | 4257 | 1200 | 13/1/82 | 0640 | 28/1/82 |
| IS/82/(CM)4 | +3261S | 50.0 | 5 | 4257 | 1200 | 13/1/82 | 0640 | 28/1/82 |
| IS/82/(CM)5 | 3927 | 5.0 | 5 | 4278 | 1815 | 13/1/82 | 1440 | 28/1/82 |
| IS/82/(CM)5 | 4817 | 205.0 | 5 | 4278 | 1815 | 13/1/82 | 1440 | 28/1/82 |
| IS/82/(CM)5 | 3308 | 405.0 | 5 | 4278 | 1815 | 13/1/82 | 1440 | 28/1/82 |
| IS/82/(CM)6 | 4780 | 5.0 | 5 | 4501 | 1700 | 13/1/82 | 0800 | 29/1/82 |
| IS/82/(CM)6 | 5228 | 205.0 | 5 | 4501 | 1700 | 13/1/82 | 0800 | 29/1/82 |
| IS/82/(CM)6 | 3259S | 405.0 | 5 | 4501 | 1700 | 13/1/82 | 0800 | 29/1/82 |
| IS/82/(CM)7 | 3926 | 3.5 | 5 | 4441 | 0000 | 14/1/82 | 1000 | 29/1/82 |

+ Conductivity and pressure probes included. * Pressure sensor only

TABLE 2: DEPLOYMENT OF ULTRASONIC (SIMRAD) CURRENT METERS

| Station | Meter | Water Depth | Meter Height, above sea-bed (m) | Record Length |
|---|---|---|---|---|
| IS/82/(CM)1 | UCM23 | 2000 | 1.5 | 16 days + |
| IS/82/(CM)4 | UCM21 | 200 | 1.5 | 15 days + |

+Note: processed data not yet available.

TABLE 3. GRAB AND CORE SAMPLE LOCATIONS.

| Station No. | Latitude (N) | Longitude (E) | Water Depth (m) | Type of Operation and Core Length (m) |
|---|---|---|---|---|
| IS/82/8 | 37°35.49 | 21°22.11 | 86 | Gravity Corer (0.85). |
| IS/82/9 | 37°37.26 | 21°14.76 | 488 | Gravity Corer (1.45) |
| | | | | Day Grab & Camera. |
| IS/82/10 | 37°37.26 | 21°14.79 | 590 | Camera Testing. |
| IS/82/11 | 37°37.75 | 21°14.73 | 630 | Day Grab. |
| IS/82/12 | 37°36.44 | 21°15.33 | 580 | Piston Corer (0.95). |
| IS/82/13 | 37°28.71 | 21°09.90 | 1880 | Gravity Corer (1.27). |
| IS/82/14 | 37°29.24 | 21°08.47 | 1880 | Gravity Corer (1.44). |
| IS/82/15 | 37°38.14 | 20°59.27 | 200 | Gravity Corer (1.50). |
| IS/82/16 | 37°43.92 | 20°00.15 | 72 | Gravity Corer (0.71). |
| IS/82/17 | 37°39.57 | 21°01.11 | 105 | Day Grab & Camera. |
| IS/82/18 | 37°41.34 | 21°06.11 | 720 | Gravity Corer (1.32). |
| IS/82/19 | 37°44.23 | 21°10.69 | 220 | Day Grab & Camera. |
| IS/82/20 | 37°47.18 | 21°10.07 | 90 | Day Grab & Camera. |
| IS/82/21 | 37°46.90 | 21°03.78 | 590 | Piston Corer (0.88). |
| IS/82/22 | 37°46.38 | 20°57.93 | 90 | Day Grab & Camera. |
| IS/82/23 | 37°52.58 | 21°05.54 | 80 | Day Grab & Camera. |
| IS/82/24 | 37°52.32 | 21°02.97 | 200 | Gravity Corer (1.09). |
| IS/82/25 | 37°52.32 | 20°59.14 | 585 | Gravity Corer (1.54). |
| IS/82/26 | 37°52.22 | 20°52.75 | 309 | Day Grab & Camera. |
| IS/82/27 | 37°55.91 | 20°52.63 | 420 | Gravity Corer (0.85). |
| IS/82/28 | 37°58.76 | 20°55.55 | 265 | Gravity Corer (1.22). |
| IS/82/29 | 38°14.83 | 22°39.98 | 510 | Gravity Corer (1.97). |
| IS/82/30 | 38°13.32 | 22°39.32 | 690 | Gravity Corer (1.28). |
| | | | | Day Grab & Camera. |
| IS/82/31 | 38°11.48 | 22°37.74 | 855 | Gravity Corer (0.61). |
| | | | | Piston Corer (0.15).- |
| | | | | Shipek Grab. |
| IS/82/32 | 38°07.65 | 22°38.56 | 510 | Gravity Corer (-) |
| | | | | Day Grab & Camera. |
| IS/82/33 | 38°06.08 | 22°38.05 | 550 | Day Grab & Camera. |
| IS/82/34 | 38°06.00 | 22°35.74 | 130 | Gravity Corer (0.79). |
| | | | | Day Grab & Camera. |
| IS/82/35 | 38°07.36 | 22°34.23 | 675 | Gravity Corer (-). |
| IS/82/36 | 38°15.16 | 22°37.65 | 550 | Gravity Corer (1.10). |
| IS/82/37 | 38°17.17 | 22°38.58 | 150 | Gravity Corer (1.34). |
| IS/82/38 | 38°17.50 | 22°39.40 | 170 | Gravity Corer (1.32). |
| | | | | Day Grab & Camera. |
| IS/82/39 | 38°16.40 | 21°33.51 | 75 | Gravity Corer (1.10). |
| IS/82/40 | 38°17.99 | 21°36.64 | 65 | Gravity Corer (1.21). |
| IS/82/41 | 38°13.10 | 22°38.16 | 680 | Gravity Corer (1.17). |
| IS/82/42 | 38°12.00 | 22°42.22 | 650 | Gravity Corer (1.10). |
| IS/82/43 | 38°12.04 | 22°45.99 | 595 | Shipek Grab. |
| IS/82/44 | 38°14.90 | 22°42.58 | 520 | Shipek Grab. |
| IS/82/45 | 38°15.97 | 22°44.36 | 430 | Shipek Grab. |
| IS/82/46 | 38°16.52 | 22°41.62 | 160 | Shipek Grab. |
| IS/82/47 | 38°17.41 | 22°40.60 | 140 | Shipek Grab. |
| IS/82/48 | 38°18.36 | 22°36.65 | 80 | Shipek Grab. |
| IS/82/49 | 38°14.56 | 22°39.92 | 560 | Gravity Corer (1.19). |
| IS/82/50 | 38°13.84 | 22°33.82 | 850 | Gravity Corer (0.90). |
| IS/82/51 | 38°13.96 | 22°37.47 | 820 | Shipek Grab. |
| IS/82/52 | 38°10.00 | 22°33.63 | 850 | Gravity Corer (0.92). |
| IS/82/53 | 38°10.22 | 22°35.74 | 850 | Gravity Corer (Catcher only). |

TABLE 3.(CONTINUED).

| Station No. | Latitude (N) | Longitude (E) | Water Depth (m) | Type of Operation and Core Length (m) |
|---|---|---|---|---|
| IS/82/54 | 38°11.18 | 22°38.08 | 855 | Shipek Grab. |
| IS/82/55 | 38°08.38 | 22°41.18 | 850 | Shipek Grab. |
| IS/82/56 | 38°09.53 | 22°43.98 | 860 | Shipek Grab. |
| IS/82/57 | 38°10.84 | 22°41.26 | 850 | Shipek Grab. |
| IS/82/58 | 38°11.62 | 22°36.51 | 850 | Shipek Grab. |
| IS/82/59 | 38°12.00 | 22°33.75 | 850 | Gravity Corer (0.57). Shipek Grab. |
| IS/82/60 | 38°11.54 | 22°35.16 | 850 | Gravity Corer (0.49) |
| IS/82/61 | 38°15.15 | 22°20.58 | 720 | Gravity Corer (0.62). |
| IS/82/62 | 38°14.85 | 22°16.83 | 620 | Gravity Corer (1.06). |
| IS/82/63 | 38°13.06 | 22°12.41 | 160 | Gravity Corer (1.43). |
| IS/82/64 | 38°15.10 | 22°10.76 | 305 | Gravity Corer (1.09). |
| IS/82/65 | 38°18.89 | 22°02.51 | 300 | Gravity Corer (1.29). |

## 5. SUMMARY AND RECOMMENDATIONS

### 5.1. Equipment Performance.

The results from the Aanderaa current meter deployments could not be bettered; those from the U.C.M.2. meters are awaited eagerly for comparative purposes.

Sea-bed samples collected using the Day grab appeared to be recovered virtually undisturbed and were sub-sampled. The U.M.E.L. camera attatched to the Day grab frame was a highly successful method of obtaining sea-bed photographs. No problems were encountered using the Shipek grab.

The gravity coring arrangement functioned well but, in contrast the piston coring facilities were woefully inadequate. It must be stressed that criticism of the piston coring system in no way detracts from the very considerable efforts of the technician responsible for its organisation and operation on board ship (Mr. I. Chivers) who could not have been more helpful or concerned; possibly, it is a reflection of N.E.R.C. policy on expenditure on the purchase and testing of such equipment? It is a ludicrous state of affairs when one of the major research vessels available to Institutes and Universities in Britain is unable to collect cores more than 2m in length. Indeed visiting American Scientists on a previous cruise apparently had no problem in obtaining considerably longer piston cores, using their own equipment. This deficiency should be examined by N.E.R.C., as a matter of urgency.

Limitations in the piston coring facilities available on Cruise 1/82 might be tolerated, if isolated. However, there is a frustrating record of this equipment failure and critical comment presented by

Senior Scientists over the past 10 years. For example, the following are abstracted from R.R.S. Shackleton cruise reports submitted by Dr. G. Evans (G.E.) of Imperial College and Dr. H. Elderfield (H.E.) of the University of Leeds:

5-17th Sept. 1972 (G.E.): "piston coring gear must be carried; it need not be very ambitious but merely gear to collect 5-10m. cores. This is standard gear on most oceanographic ships of other countries".

1-10th June, 1974 (G.E.) "Unfortunately, the shear-piston did not work adequately and this would appear to need some further modifications (perhaps this has already been done). Again, as with the gravity cores, the barrels did not fit the weight stand and a considerable amount of filing and drilling had to be done before the cores could be put together. Problems were also encountered with the core nose. It was fairly apparent that the cores had never been assembled before putting on the ship".

30th April to May 25th, 1976 (H.E.): "Firstly, it was not possible to carry out piston coring which was an important part of the proposed programme ........ As with a previous cruise, the barrels for the piston cores were in a bad state of repair and arrangements had to be made for their cleaning in Callao. The coring equipment on R.R.S. Shackleton may well be satisfactory for sedimentological or general geochemical studies, but leaves much to be desired for careful geochemical work. In many ways the coring equipment is obsolete and it is recommended that steps be taken to investigate the coring facilities required by N.E.R.C. ship users for the next decade".

From the above summaries, it is evident that piston coring facilities on board R.R.S. Shackleton have been inadequate since, and before, 1972!

The thermosalinograph was a useful piece of equipment, particularly to define areas influenced by surface freshwater input from rivers. It might be advantageous to link a digital recording system to the existing analogue output, also to increase the range of the instrument to > 38$^{o}$/oo.

Finally, as experienced on the 7/78 cruise, the side-scan sonar system available to scientists on R.R.S. Shackleton is virtually useless. The width of the chart output of the recorder imposes a severe limitation on the analysis of results. This restriction, combined with the fact that the existing equipment, without a deep-tow facility, cannot operate in other than very shallow water, renders this facility unusable. As with piston coring, the provision of the deep-tow side-scan sonar equipment should be a basic requirement for sedimentological/geological research programmes.

5.2. Cruise Planning and Operation

The overall cruise programme was completed successfully, in spite of last minute problems produced by the refusal of the Greek Government to grant permission to carry out research in the N.W. Aegean. The success was in no small part due to the contribution made by R.V.S. Barry and, in particular, Mr. C. Adams in keeping constantly in touch with the situation. Indeed, regular meetings held between R.V.S. staff and the Senior Scientists, throughout the period of cruise planning, were found to be invaluable in discussing the overall ship strategy and equipment requirements. Such contact should be encouraged with other ship users.

On board the research vessel, there were no problems whatsoever in terms of ship's performance and the ability of the Master, officers and crew to respond to requests for rescheduling parts of the programme. It is a pleasure, therefore, to acknowledge the help afforded to us by the officers and crew of R.R.S. Shackleton. The Master, Capt. M. Harding is thanked warmly for his cooperation. Throughout the cruise, the deck crew were cheerful, hardworking and uncomplaining.

It is difficult to praise too highly the contribution made by the technical support staff of R.V.S. Barry to the overall success of the cruise, both in terms of preparation of equipment prior to the cruise and its use in the field. Mr. P. Taylor carried out the preparatory work on the current meters with great skill and success rate of data recovery is, in no small part, a tribute to his efforts. In spite of the problems involved in the piston coring, which in no way reflect his considerable effort and determination on board ship and attempts to derive a working system prior to sailing, Mr. I. Chivers is acknowledged warmly for the sea-bed sampling programme. Mr. S. Jones was invaluable throughout in his manipulation of the geophysical equipment and general sea-going experience. Whenever needed during the hydrographic/sedimentological phase of the cruise, Messrs Beney and Lloyd provided their assistance with enthusiasm.

Overall, the cruise was carried out with good humour and a considerable amount of endeavour within the framework of a detailed and ambitious scientific programme. All concerned should be thanked warmly for their various contributions to the success of the research cruise.

Finally, it is strongly recommended that, for future cruises, attention should be paid to equipment deficiencies regarding side-scan sonar data collection and piston coring facilities. The latter having been inadequate over the last <u>10 years</u>. Such limitations imposed in a major British research vessel cruise are incompatible with the costs of running the vessels.

M.B. Collins

28th July, 1982

Swansea.

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## APPENDIX A. CRUISE 1/82 REPORT PART 1 (Geophysical).

## SUBMITTED TO NERC, BY PROF. M. BROOKS, ON 7th MAY 1982.

As with earlier Shackleton cruise 7/78 to the northern Aegean, two distinct components of work were carried out during cruise 1/82, under the direction of different Principal Scientists: Professor Brooks of U.C. Cardiff was responsible for geophysical investigations of the geology and structure of the cruise area, and Dr Collins of U.C. Swansea was in charge of sedimentological study of caynon environments at the continental margin (in Zante Channel) and within the Gulf of Corinth. The present report is restricted to the geophysical work, and a separate report of the sedimentological work will be submitted shortly by Dr Collins, who is currently on study at the University of Patras.

The main objectives of the geophysical work were to define the major neotectonic structures of the continental margin and gulfs, with a view to elucidating the Late Cenozoic evolution of this part of the Aegean 'plate'. It had been planned to cover a transect extending westwards to the axis of the Hellenic trench in water depths locally reaching about 4 km. In the event, although early tracks were taken into selected deep basins, the geophysical results encountered inside the offshore islands (Zante, Cephalonia, Ithaca) and within the Gulfs were of such great scientific interest and high quality that it was decided to concentrate on this shallow water area and to map out the major neotectonic structures in these areas in considerable detail. Owing to the good weather and the absence of major equipment failures, well over 2000 line kilometres of gravity, magnetic (in places) and high quality single-channel air gun profiling data were established. In addition, a new ADC system developed jointly by U.C. Cardiff and R.V.S. Barry was used successfully to digitally record multichannel reflection profiling data along 350 km of track. Over and above the main scientific programme, field trials of a Sodera 15 in3 water gun and comparative tests of several seismic sources were carried out, and accounts of these activities form the basis of separate reports to R.V.S. Barry.

Final track plots and processed gravity data are still awaited, and multichannel seismic data have yet to be processed by Horizon Exploration Ltd. The present report is therefore restricted in scope to a preliminary account of the single-channel reflection records and monitor records of the multichannel surveys.

Most of the single-channel profiling was carried out using a 40 $in^3$ air gun source, fitted with a wave shape kit, and a Geomechanic 30-metre hydrophone streamer. The quality of the seismic records is excellent in terms of both resolution (5-10 msec) and penetration (up to 1 sec two-way time). Several structural basins have been identified for detailed investigation, as summarised below:

Gulf of Corinth. The north and south flanks of the Gulf are defined by major E-W trending fault zones interpreted as manifestations of the N-S extension that characterises the present day Aegean area. The deep abyssal plain of the Gulf, at the depth of about 800m, is underlain by thick sequences of parallel strata interpreted as turbidites. Occasional debris flow intercalations extend outwards across the abyssal plain for several kilometres from the steep basin margins. The maximum thickness of post-orogenic sediments exceeds 1.5km and the entire sedimentary pile is affected by synsedimentary tectonics including growth faulting, listric faulting, 'growth folding' (supratenuous folding) and numerous intraformational unconformaties. Lateral variations of reflection character reveal subtle differences of depositional environment and resulting lithostratigraphy across the Gulf.

Gulf of Patras. In marked contrast to the Gulf of Corinth, the Gulf of Patras is characterised by shallow water (everywhere less than 100m). Nevertheless zones of neotectonic activity, typically marked by small half grabens defined by growth faults, have been traced across the Gulf. A spectacular sequence of foresets and associated prodelta deposits underlies the seabed beyond the modern Acheloos delta on the north coast of the Gulf, and these deltaic and prodeltaic sediments pass out into an active major half graben structure north of Zante Channel. In the Gulf of Patras individual fault zones can be traced onshore and follow-up structural work on land is now being planned.

<u>North-south channel inside the islands of Zante, Cephalonia and Ithaca.</u>
This channel is occupied by two large half-graben structures marked by zones of deep water separated by a bank (Hydra bank) representing a central horst block. The structures have N-S trend, and one of the major aspects of subsequent geological analysis will be to assess the significance of the 90° change of neotectonic structural trend between this area and the Gulf of Corinth. It is possible that the N-S grabens represent major accommodation structures associated with Aegean overthrusting in the western Hellenic arc: although the near surface tectonics are shown by the cruise data to be entirely extensional, earthquake focal mechanisms in this area are indicative of thrust faulting at depth. The flanks of the half grabens are characterised by a wide-range of slope failure mechanisms and these will be compared in detail with slope failure mechanisms in the North Aegean trough recorded on sparker records collected during Shackleton cruise 7/78.