

Scottish Marine Biological Association  
Dunstaffnage Marine Research Laboratory

R.R.S. CHALLENGER

Cruise 64/1977

4-12 April 1977.

1) Main objectives

- a) to obtain epibenthic sledge samples of the abyssal macrobenthos from the SMBA permanent station in the Southern Rockall Trough in order to continue a time series initiated in Nov. 1975.
- b) to carry out plankton sampling and exploratory bottom sampling in the Porcupine Bank area for Dr D.I. Williamson of Port Erin.
- c) to undertake analysis of halocarbons and nitrogen oxides from air and seawater samples from the waters to the west of the British Isles.
- d) to undertake trials of a newly constructed box core sampler for quantitative sampling of deepwater benthos.
- e) to obtain samples of the abyssal megafauna using an Agassiz trawl.

2) Geographical area, cruise track, stations and gear worked.

See Fig. 1 and Table 1.

3) Sampling gear used.

Epibenthic sledge, Agassiz trawl, large box corer, plankton net, Shipek and Smith McIntyre grabs.

4) Scientific participation

1. P. Balls, School of Environmental Sciences, Univ. of East Anglia.

2. J.D. Gage, SMBA, (Principal Scientist).
3. R.H. Lightfoot, SMBA/IFBS Millport.
4. P.S. Liss, School of Environmental Sciences, Univ. of East Anglia.
5. A.J. Lovelock, Bowerchalke, Salisbury.
6. J.E. Lovelock, Bowerchalke, Salisbury.
7. Margaret Pearson, SMBA.
8. K. Smith. IOS, Barry.
9. P.A. Tyler, Dept. of Oceanography, Univ. College of Swansea.
10. D.I. Williamson, Univ. Liverpool, Port Erin.

5) Sea and weather conditions.

Excellent until 6 April when it became rather poor with winds generally around force 6 and up to 7-8. A generally heavy North to Westerly swell continued until the ship reached sheltered waters.

6) Cruise narrative.

Challenger's scheduled sailing was delayed by crewing problems until 1800 hrs. 4 April. After launching the PES fish in the Bristol Channel she then steamed for the permanent station in the Southern Rockall Trough via the Celtic Sea and around the SW of Ireland. Heavy weather developed during 6 April when crossing Porcupine Bank, reducing speed to about 2 knots. Although the wind had freshened up to Force 3, sea state still allowed a plankton

haul to be made at 1753 hrs for Dr Williamson. Challenger resumed steaming at 1806 hrs and eventually arrived on 54°40'N 12°16'W (SMBA permanent station) at 0700 hrs 7 April.

An epibenthic sledge haul was started immediately, using the main wire, since there had been some slight improvement in the weather. A satisfactory haul was eventually recovered at 1121 hrs although the mouth closing gate had failed to close--as a consequence, it was discovered later, of current drain from the batteries powering the explosive release. No positive indication of the gear bottoming had been obtained from the pinger on the PES recorder and the reason for this became clear when the next deep tow was attempted (the wire metering was found to be underestimating actual payout).

This haul was followed by a plankton haul and then by a water bottle cast both on the hydrographic wire for the party from the University of East Anglia (UEA). Having obtained a satisfactory sledge haul, sufficient for the SMBA time series, it was decided to attempt a repeat of the successful Agassiz trawl haul at this station that had been first accomplished with help of Mr Frank Dunning, Fishing Mate, on RRS Shackleton's SMBA cruise earlier this year. However, after paying out an indicated 6000 m of wire the fresh state of the wire and the fact that only  $2\frac{1}{2}$  lays remained on the winch drum encouraged a suspicion that the metering was in error. Visual monitoring of the

wire whilst heaving confirmed an underestimation by approx. 42%; so that in fact more than 10,000 m had in fact been payed out!

A fair catch was eventually obtained when the gear was recovered, but the frequent stops had resulted in a winnowing of the sample so that only the relatively heavy elements remained.

Because of this only partial success, a second cast with the Agassiz was made at 1844 hrs, paying out an indicated 3480 m ( $\approx$  ca 6000 m actual) of wire, and again towing for one hour. However, the trawl was recovered at 2231 hrs damaged, the wire attaching the net bag to the frame eyelets having sheared at three corners.

Because of heavy weather, further operations were postponed until the following morning. At 0810 hrs another plankton haul for Dr Williamson was made before steaming South for the Porcupine Bank. The bosun and deck crew then kindly repaired the Agassiz, replacing the wire with shackles to allow the gear to be used for Dr Williamson.

Challenger arrived at the first of Dr Williamson's stations on the Porcupine Bank at 1210 hrs 8 April, and a plankton cast was made followed by water bottle casts for dissolved halocarbon and nitrogen oxide analysis by the party from UEA and Bowerchalke. On the advice of Capt. Maw it was then decided to give the new box corer a trial, since the weather prospects might <sup>have</sup> precluded further opportunities.

Although the good pinger indication of gear bottoming was

obtained during the subsequent lowering of the heavy gear, no useful information from the wire tension meter was obtained despite attention by K. Smith. This malfunction remained until the end of the cruise. (It was eventually found by Mr J. Price of IOS, Barry, that severe corrosion due to water leakage around the load cells was shorting out the signal).

The gear was recovered safely, but found to have closed incorrectly so that most of the sandy sample obtained had washed out. Removal of metal from the release head assembly was considered might solve the problem and, with the kind efforts of the second engineer, this was done while a haul was made with the Agassiz trawl for Dr Williamson. The trawl was recovered at 1554 hrs, after a half-hour bottom tow, with a small catch. This was followed by another water bottle cast for Dr Liss and Prof. Lovelock and their team. On completion at 1623, Challenger proceeded to her next Porcupine station arriving at 2122 hrs. After another plankton haul in order to detect crab larvae with the same negative results as from previous hauls, the Agassiz was shot with a 1-hour tow on the bottom. Again a rather small catch was obtained. Challenger then made course back to the northern slope of the Porcupine Bank. En route <sup>plankton</sup> a haul was made at 0900 9 April, arriving at the station position on the upper continental slope at 1332 hrs. Because of a slight improvement in sea state, it was decided to attempt a further box corer trial. Since the depth was

only ca 400 m it was felt that the lack of a wire tension indication, although very desirable, was not so critical as in deeper water. But no sample was obtained, it was assumed because of a failure of the release mechanism.

The Agassiz was then deployed at 1638 hrs in an attempt to collect a sample for Dr Williamson. Soon after heaving the gear became fast but was eventually recovered, thanks to quick action by Capt. Maw, <sup>by</sup> manoeuvring the ship back over the gear. The Agassiz was eventually recovered with the frame badly damaged and the net in shreds. Pieces of the stony coral Dendrochylia cornigera, entangled in the netting, indicated that the gear probably had come fast on a coral bank. However, amongst the fauna entangled in the net was a single specimen of the small deepwater majid crab, Echynochus thompsoni that on examination by Dr Williamson was thought a very likely contender as the adult stage of the crab larvae that he had been searching for in the plankton.

Shipek and Smith McIntyre grabs were then used in a vain attempt to collect more material.

Finally, Challenger steamed for the permanent station for one further box corer trial in deep water, arriving at 0904 hrs 10 April. However, no indication of the gear bottoming was obtained from the pinger despite paying out what was calculated <sup>as</sup> more than 60 m in excess of bottom depth. In the absence of any wire tension indication and because of the doubts about the metering correction, the

gear was winched back inboard and found not to have released. This at least proved the reliability of the bottom-contact release in preventing pre-firing of the gear as a result of the ship's motion being transmitted down the wire. A final plankton haul was made for Dr Williamson followed by a water bottle cast. On completion at 1315 hrs, a course was set for Dunstaffnage, with further water bottle casts being accomplished on the shelf early the next morning, also taking this opportunity to recover the PES fish. On reaching the Firth of Lorne at 1430 hrs, a final series of water bottle casts were made, and then Challenger steamed to sheltered water in Loch Linnhe for further box corer trials in 75 m depth. The first three drops failed, but the fault was finally rectified, recovering a good, relatively undisturbed,  $0.25\text{m}^2$  sample of the soft mud bottom at 1946 hrs 11 April. After a further successful box corer drop, Challenger hove to for the night, steaming for Ardmucknish Bay at ca 0400 hrs 12 April, then followed a final trial with the box corer at 0936 hrs, recovering a good sample. Challenger was eventually allowed to enter Dunstaffnage Bay at 1200 hrs, finally berthing at 1300 hrs.

J.D. Gage.

18 April 1977.

7) Participants' Reports.

A) Halocarbons and nitrous oxides in the air and in the sea; measurements during Challenger's cruise 6A/77.

The purpose of our participation in this cruise was to measure the abundance of certain halocarbons and nitrous oxide in the air and in the sea, both at the surface and at depth. From the results we hoped to gather further knowledge about the flux on these compounds between the air and sea and some indications of the relative contribution of the natural and man-made sources and sinks. We were equipped to measure fluorocarbons, methyl iodide and chloride, methyl chloroform, carbon tetrachloride and nitrous oxide.

The analysis of the data gathered may take several weeks on shore in our laboratories, but we are pleased that all indications from the raw data are of a successful trip.

The highlights are:

- 1) Fluorocarbon 11, one of the two principal compounds, alleged to threaten stratosphere ozone, is distributed uniformly down to 500 m in the Western approaches. From the simultaneous air and seawater measurements we hope to deduce the flux of this gas from the air to the sea.
- 2) The natural hydrocarbons, methyl iodide and methychloride, were low in abundance both in the air and in the sea. It now looks probable that the large concentrations of methyl chloride in the air come from natural and man induced grass and forest fires rather than the sea as was

previously thought.

- 3) Nitrous oxide was found at all stations and from the data the flux of this gas between the air and sea also will be deduced.
- 4) An unexpected and interesting finding was the presence of a gas, tentatively identified as nitric oxide (NO) in seawater, but not in the air. This gas was most abundant at depth and in the deeper waters off the continental shelf. The quantity of 'NO' in the sea appears to be large and, if confirmed, its abundant presence may resolve a number of uncertainties concerning the natural cycle of nitrogen.
- 5) We used some modified polypropylene IOS water bottles to collect water at the stations where biological sampling took place. The bottles were redesigned so as to collect water for trace gas analysis without contamination. This was their first trial and it seems to have been successful. When further proven these modified bottles will serve for other organic and trace gas analysis experiments at sea.

We all wish to express our grateful thanks to Captain Maw and to the officers and men of the Challenger for kindness and help in this fruitful voyage. We also are indebted to Dr Gage for his unstinted help and for providing a place for us on this cruise.

P. Balls and P.S. Liss, Univ.  
of East Anglia.  
A.J. and J.E. Lovelock, Bowerchalke,  
Salisbury, Wilts.

B) A unique crab larva, with 15 carapace spines instead of the usual 4, has excited my interest since I first saw a specimen in 1959. I proposed a new family on the basis of the larva in 1974. The crab which gives rise to the larva remains unknown. A few live larvae were obtained over the Rockall Trough in 1973, but attempts to rear them were unsuccessful, and no live larvae have been obtained since.

Plankton tows on all sides of the Porcupine Bank during Cruise 6A/77 yielded no larvae, but an Agassiz trawl sample on the north slope of the bank included one specimen of the small spider crab Dorhynchus thompsoni. The Agassiz trawl did not survive the experience, but the crab did. The living specimen shows several features not apparent in the brief published descriptions, and the shape and colour of the eye in particular strongly suggest that this is the crab which gives rise to the peculiar larva. If so, its present classification in the Majidae must be questioned. This specimen does not carry eggs. Attempts to dredge ovigerous females from which to hatch larvae will be made on Cruise 6B/77.

Dr. D.I. Williamson.

Table 1 Station positions and gear worked (all depths given uncorrected)

| Date    | Operation<br>No | Time Hrs<br>BST | SMBA<br>Stn No | Position            | Depth<br>m | Gear                      | Result                                                                  |
|---------|-----------------|-----------------|----------------|---------------------|------------|---------------------------|-------------------------------------------------------------------------|
| 6 April | 1               | 1753            | -              | 54°13'N 12°00'W     | -          | Plankton net (PN)         | No crab larvae                                                          |
| 7 April | 2               | 0716            | ES 129         | 54°39.4'N 12°16.5'W | 2900       | Epibenthic sledge         | Satisfactory haul                                                       |
| " "     | 3               | 1125            | -              | 54°41'N 12°18'W     |            | PN                        | No crab larvae                                                          |
| " "     | 4               | 1150            | -              | 54°41'N 12°19'W     |            | Water bottle cast<br>(HC) | Satisfactory                                                            |
| " "     | 5               | 1240            | AT 130         | 54°46'N 12°19'W     | 2900       | Agassiz trawl (AT)        | Winnowed sample - mainly fi                                             |
| " "     | 6               | 1844            | AT 131         | 54°49'N 12°19'W     | .          | AT                        | Small catch - net pulled<br>of frame                                    |
| 8 April | 7               | 0810            | -              | 53°45'N 13°48'W     |            | PN                        | No crab larvae                                                          |
| " "     | 8               | 0825            | -              | " "                 |            | "                         | " " "                                                                   |
| " "     | 9               | 1215            | -              | 53°15'N 14°15'W     |            | "                         | " " "                                                                   |
| " "     | 10              | 1230            | -              | 53°14'N 14°15'W     |            | HC                        | Satisfactory                                                            |
| " "     | 11              | 1415            | -              | 53°14.3'N 14°15.0'W | 225        | Spade box corer (SBC)     | Improper closure, washed samp                                           |
| " "     | 12              | 1503            | AT 132         | 53°14'N 14°16'W     | 225        | AT                        | Small haul dominated by<br>actinians.                                   |
| " "     | 13              | 1606            | -              | 53°15'N 14°18'W     |            | HC                        | Satisfactory                                                            |
| " "     | 14              | 2145            | AT 133         | 52°30'N 14°01'W     | 317        | AT                        | Fairly rich sample includin<br>many molluscs, holothuria<br>and fishes. |

| Date     | Operation<br>No | Time Hrs<br>B:Y | SMBA<br>Str No | Position            | Depth<br>m | Gear                               | Result                                  |
|----------|-----------------|-----------------|----------------|---------------------|------------|------------------------------------|-----------------------------------------|
| 9 April  | 15              | 1332            | -              | 53°56.4'N 12°06.6'W | 410        | SBC                                | Released but no sample                  |
| " "      | 16              | 1520            | -              | 54°04.4'N 12°04.5'W | 835        | SBC                                | " " " "                                 |
| " "      | 17              | 1638            | -              | 54°05'N 12°06'W     | 785        | AT                                 | Gear came fast and<br>recovered damaged |
|          | 18-25           | 2027            | -              | 54°03'N 12°04'W     | 400-600    | Shipek and Smith<br>McIntyre grabs | No useful material<br>recovered         |
| 10 April | 26              | 0904            | -              | 54°39.1'N 12°18.4'W | 2912       | SBC                                | Gear had not bottomed?                  |
| " "      | 27              | 1220            | -              | 54°38'N 12°18'W     |            | PN                                 | No crab larvae                          |
| " "      | 28              | 1245            | -              | " "                 |            | HC                                 | Satisfactory                            |
| 11 April | 29              | 0835            | -              | 55°55.3'N 07°09.6'W |            | HC                                 | Satisfactory                            |
|          | 30              | 1430            |                | 56°17.2'N 05°50.2'W |            | HC                                 | "                                       |
|          | 31              | 1746            | -              | 56°31.4'N 05°32.5'W | 75         | SBC                                | No release                              |
|          | 32              | 1845            | -              | " "                 | "          | "                                  | "                                       |
|          | 33              | 1858            | -              | " "                 | "          | "                                  | "                                       |
|          | 34              | 1945            | -              | " "                 | "          | "                                  | Good sample                             |
|          | 35              | 2037            | -              | " "                 | "          | "                                  | "                                       |
| 12 April | 36              | 0922            | -              | 56°26.0'N 05°27.0'W | 50         | SBC                                | Good sample                             |

10°W

60°N

Fig. 1

