

9/15/68

R.R.S. "JOHN MURRAY" CRUISE No. 10/68

GEOPHYSICAL AND GEOLOGICAL INVESTIGATIONS IN THE SEA OF THE
HEBRIDES AND THE MINCH

20th SEPTEMBER to 3rd NOVEMBER, 1968

PRELIMINARY REPORT

Institute of Geological Sciences
LONDON, S.W.7.

November, 1968

R.R.S. "JOHN MURRAY" CRUISE No. 10/68

GEOPHYSICAL AND GEOLOGICAL INVESTIGATIONS IN THE
SEA OF THE HEBRIDES AND THE MINCH

Cruise 10/68 of R.R.S. "John Murray" was allocated to the Institute of Geological Sciences (I.G.S.) for a geophysical and geological sampling project to investigate the sub-surface geological structure and sea-bed geology of areas in the Sea of Hebrides and the Minch. Additional geophysical observations were planned for the return passage from the Sea of Hebrides to Plymouth, including detailed survey of a small area in the southern Irish Sea. Operations were based in Oban and the scientific programme, which was organised jointly by the Marine Geophysics Unit (London) and the Continental Shelf II Unit (Edinburgh), was arranged into four separate legs as indicated below.

<u>Leg</u>	<u>Period</u>	<u>Primary Objectives</u>	<u>Senior Scientist</u>
1	20 Sept. - 4 Oct.	Geophysical surveys in Sea of Hebrides and Minch	R. McQuillin
2	6 - 15 Oct.	Geological sampling in Sea of Hebrides and Minch	R.A. Eden
3	17 - 25 Oct.	Ditto	R.A. Eden
4	27 Oct - 3 Nov.	Completion of geophysical work in Sea of Hebrides and Minch, geophysical work on passage to Plymouth	M.C. Tully

During Leg 1, it was planned to survey about 1,500 miles of track using gravity meter, magnetometer, sparker and precision depth recording (PDR) equipments. Almost all this work was accomplished and by analysing the geophysical records as the survey progressed, a fairly comprehensive plan for the geological sampling programme was prepared. In every respect, the work accomplished during Leg 1 was most satisfactory.

The first major difficulties occurred shortly after Leg 2 commenced (Legs 2 and 3 are separately reported on by Mr. R.A. Eden). Faults developed on both the main hydraulic winch and the hydrographic winch and after a number of unsuccessful attempts to repair these, it was eventually decided to abandon the geological sampling programme and to extend the programme of geophysical work. At this juncture Mr. M.C. Tully was recalled to the ship.

Geophysical work continued during Leg 4 with completion of a close network of tracks in the Sea of Hebrides and Minch. The passage to Plymouth was hampered by bad weather, but a detailed survey of an area in the southern Irish Sea was nevertheless successfully accomplished. (Leg 4 reported on by Mr. M.C. Tully).

Altogether, fifteen scientists participated in the cruise; nine being geophysicists including two women, Miss Susan E. Arnold and Miss Eve A. Atitullah; three being geologists from Continental Shelf II Unit in Edinburgh, and three being technicians from the Research Vessels Maintenance Unit.

Throughout the cruise, responsibility for operation of the Askania sea gravity meter was with Mr. M.C. Tully and all comments on the performance of this equipment are included in his report on Leg 4.

SEA OF HEBRIDES AND MINCH

LEG 1 OF I.G.S. CRUISE ON R.R.S. "JOHN MURRAY"

20th Sept. - 4th Oct. 1968

The tracks followed during this leg of the cruise are shown in Fig. 1. This area has previously been surveyed by airborne magnetometer (Aeromagnetic Map of Areas in Great Britain and Northern Ireland, National Grid Diagram Edition: Scale 1:250,000, Sheets 10 and 12), and regional gravity surveys have been completed recently in adjacent parts of the Scottish mainland and in the Hebridean Islands. In this marine study, priority was allocated to obtaining good gravity results with the sea gravity meter. To this end, course changes were kept to a minimum, the ship was not turned about or taken off line because of temporary faults on other geophysical equipment, and a number of brief visits were made to harbour gravity bases in parts adjacent to the survey area (Oban, Stornoway and Mallaig) so that close control could be kept on gravity meter drift.

SCIENTIFIC PERSONNEL

Leg 1: 20th Sept. - 4th Oct.

Mr. R. McQuillin	I.G.S. (Geophysics)	Senior Scientist
Mr. M.C. Tully	I.G.S. { " }	
Mr. P.D. Brearey	I.G.S. { " }	
Dr. A.J. Burley	I.G.S. { " }	
Mr. N. Kenolty	I.G.S. { " }	
Mr. R.A. Eden	I.G.S. { Continental Shelf II }	
Dr. G. Gauss	I.G.S. { " " }	
Mr. J. Bulled	R.V.U.	

METHODS AND EQUIPMENT

More than 1,600 statute miles of track were surveyed (see table 1) using gravity meter, magnetometer, sparker and depth recorder. Lines were pre-plotted on Admiralty charts and on Decca Mk 12 track-plotter rolls. A ship speed of about 6 knots was maintained during the survey, this being the maximum speed at which relatively noise-free seismic profiling is possible. Operations continued for 24 hours each day and a continuous two-scientist watch was maintained.

Position Fixing. For the entire survey, two Decca Mk 12 receivers were operated and logged at 10 minute intervals, one set being linked to the track-plotter. One receiver was timed to Decca Chain 3B/MP (North West British) the other to Chain 6C/MP (North Scottish). In general, and in particular at night, signals on the North West British Chain were more reliable and more stable than on the North Scottish Chain, but neither chain gave completely satisfactory position-fixing control, and considerable effort was concentrated on supplementing the Decca information with good radar and visual fixes. In most of this area, numerous good prominent cliffs, small islands, lights and lighthouses provide satisfactory reference objects. Only in the area south of Barra was it necessary to rely almost entirely on Decca, and positioning here is less reliable than farther north. All fixes were plotted on specially prepared 1 in-to-1 mile Decca Charts on the British National Grid projection.

Gravity measurements. The Askania Gss-2 Sea gravity meter used was loaned to I.G.S. by the Department of Geodesy and Geophysics, University of Cambridge, together with a cross-coupling computer developed at Cambridge. Continuous records of gravity and cross-coupling correction were obtained along the tracks shown on Fig. 1 and listed in Table 1. The gravity survey was linked into the British land gravity network through I.G.S. base stations in Oban, Mallaig and Stornoway, drift between base readings proving quite low. Some instrumental troubles occurred but none led to gaps in the record on any of the lines listed in Table 1. A few hours were spent in port on one occasion