A copy of the final report is held by IOS Library

PG

R.R.S. DISCOVERY CRUISE 136

(University of Keele)

OUTLINE REPORT

(Professor G. Kelling : Principal Scientist)

1. CRUISE DATES:

(Times and dates in this Report and on track-lines and station logs are in G.M.T. form).

Z DAY	JULIAN DAY	
119	29.4.83.	Departed Patras, Greece
120	30.4.83.	Commenced Messina Basin Plain study
124	4.5.83.	Completed Messina Basin Plain study
125	5.5.83.	Commenced Central Hellenic Trench study
134	14.5.83.	Completed Central Hellenic Trench study
135	15.5.83.	End of cruise in Patras, Greece

2. SCIENTIFIC PERSONNEL:

Department of Geology, University of Keele:-

Professor G. KELLING	Principal Scientist
Dr Lorraine CRAIG	
Mr Stuart HITCH	
Mr Tommy MCCANN	

Free University, Amsterdam:-

Mr L. KUILMAN

The Hydrographic Branch, Greek Navy:-

Dr G. ANASTASAKIS

Research Vessel Services, Barry:-

Mr S. JONES
Mr C. JACKSON
Mr G. KNIGHT
Mr S. SMITH
Mr J. STANWARD

The Institute of Oceanographic Sciences, Wormley:-

Mr D. BISHOP
Mr R. CLEMENTS
Mr D. PETERS
Mr R. WALLACE

3. OBJECTIVES:

A. Principal Scientific Aims:

This cruise was intended to furnish data and samples to contribute towards a detailed investigation of Pliocene and Quaternary slope and deep-sea sedimentation patterns associated with the central part of the Hellenic Trench system, in the eastern Mediterranean. Such data is required to evaluate the influence of climatic and structural controls on the dominant sedimentary processes and to elucidate the recent sedimentary evolution of this tectonically active region. It was intended to carry out a programme of high-resolution seismic reflection profiling,with air-gun and high-frequency (3.5 KHz) pinger sources, in order to determine the geometry and structure of sediments to depths of a few hundreds of metres below the sea-floor. Ship-board analysis of this profiling survey could then be used to select appropriate sites for piston-and gravity-coring, dredging and sea-floor photography.

Since a previous cruise on SHACKLETON in 1978 had provided a substantial body of data and samples from the axial part of the central Hellenic Trench, south of Crete, it was considered highly desirable to extend the investigation to associated geotectonic zones of the Trench system. Two appropriate regions were therefore identified:

(a) The Messina Basin Plain, lying south of the Mediterranean Ridge, but with a fill of Plio-Quaternary sediments that appears to be genetically linked with the evolution of the Hellenic Trench system. Specifically, it was hoped that a detailed study here would elucidate the history of recent uplift on the southern flank of the Mediterranean Ridge and the role of 'mudflows' in filling of the Messina Basin Plain.

(b) The inner slope of the central Hellenic Trench and the Kythera-Antikythera Ridge, to the south and west of western Crete, marked by a plexus of perched and accretionary basins in an obliquely subducting sector of the Trench. Here, it was

hoped to detail the processes of sediment transfer from shallow platforms into the deepest axial basins, and the mode and rates of sediment accumulation in intervening slope-basins (including determination of water-mass properties).

B. Secondary Aims:

Secondary aspects of the cruise, introduced at the request of Greek colleagues were:-

(a) Collection of surface-sediment samples from the Cretan region for geochemical analysis by Dr S.Varnavas, University of Patras.

(b) Detailed morphological and tectonic evaluation of the seafloor in the channels between Andikythera and Crete and between Pondikonisi Island and the northwestern tip of Crete, to be undertaken on behalf of the Greek National Electricity Corporation.

4. EQUIPMENT USED AND DATA/SAMPLES COLLECTED

(Items of equipment supplied by RVS Barry unless specified otherwise).

A. GEOPHYSICAL

(a) Bathymetry: Nearly 3400 line-kilometres were collected using the 12KHz outboard fish supplied by IOS (Wormley). This was recorded on a Mufax (later a Gifft) recorder.

(b) High-resolution Sub-bottom Profiling: The IOS 3.5KHz towed-fish EDO-Western Pinger was used for this purpose, and data was recorded on an EPC recorder, with a signal correlator attachment. More than 3300 line-kilometres of good records were obtained, at water depths of up to 4200m. Maximum penetration achieved was approximately 120 msec and average resolution was excellent,at about 0.5-1.0msec.

(c) Continuous Seismic Profiling: The Bolt Air-Gun was deployed for this purpose, in conjunction with a Geomechanique 30m hydrophone streamer. The 40 cu.ins. source, fitted with a wave-shape kit, proved to be most successful, and some 2080 line kilometres of good-quality records were obtained. Maximum penetration of 1.2 secs. two-way travel time was achieved, with

good average resolution of 5-10 msec.

(d) Side-Scan Sonographs: The IOS designed hull-mounted side-scan sonar instrument was used extensively throughout the cruise in a starboard-looking wide-beam or a vertical narrow-beam mode. Insonification power was generally maintained at 30 - 35KHz. Nearly 900 kilometres of narrow-beam and 2180 kilometres of wide-beam sonographs were obtained (the latter being collected in water depths ranging from 250-2000m). Average quality of the records was good to very good.

(e) Gravity data: The La Coste Gravity Meter was in continuous use during the cruise and yielded more than 3400 line-kilometres of data, calibrated against a local base-station established at the new St Andrews cathedral in Patras.

(f) Magnetic data: Some 1400 line-kilometres of magnetic data were obtained from the towed Varian Magnetometer. Most of this data was collected in the Messina Basin Plain and across the Mediterranean Ridge on passage to the south Cretan area, but additional magnetic records were obtained from the slope-basins off western Crete and Andikythera.

B. BOTTOM-SAMPLING

A total of 22 major stations were occupied for bottom-sampling and involved 31 lowerings of apparatus to a maximum water depth of 4120 m and a minimum of 477m. Maximum length of wire-out was 4550m (Station 2).

(g) Piston-cores: This cruise provided the first opportunity to use the re-designed RVS piston-corer for extended scientific purposes and it proved to be highly successful. A total of 17 piston-cores (excluding trigger-cores) was obtained from 19 lowerings, with a maximum recovered length of 8.82m (Station 2). Disturbance is appreciable in only 2 cores and thick sands and even fine gravels were recovered in several of the Hellenic Trench cores.

(h) Gravity-cores: The GPC gravity corer was used with approximately 1000lbs. weight and 7 gravity-cores were obtained from 7 lowerings, ranging in length from 272-15cm.

(i) Dredging: The rock-dredge was deployed at only one station (No. 9). Approximately 1.5km of seafloor was traversed on a moderate, stepped slope and about 150kg of material recovered, most of this being clay but with some fine gravel.

(j) Seafloor Photography: The UMEL 35mm still underwater camera was lowered at 4 stations (11, 15, 20, 22) and about 30 exposures were made at 30-60 sec. intervals at each station. Usable frames were obtained at each station, the number varying from 3 (sta. 15) to 18 (sta. 22).

C. NAVIGATION:

During both parts of the cruise two main navigational systems (DR and Loran) were in simultaneous use, supplemented by radar-ranging in nearshore areas. The DR system utilised SATNAV fixes with interpolated locations derived from ship's speed, heading and meteorological data and integrated on the RVS ship-board computer. The LORAN-C system was used in the form of 2-5 minute 'picks' of lat./long. printouts. For profiling purposes the LORAN data proved to be more useful than the DR, although some signal-reception problems were encountered in the Messina Basin Plain area. A comparison of LORAN with back-corrected DR and radar-fixes in the western Crete region indicated a systematic shift of about 400m to the southeast of the LORAN fixes, with respect to 'real' positions.

D. COMPUTING:

Extensive use was made of the two PDP-11 ship-board computers supplied by RVS, primarily for data-logging and storing purposes. Rapid turn-round was achieved on navigational back-correction and daily track-plots (incorporating both back-corrected DR and LORAN fixes) were obtained from the graphic plotter. The graphic plotter was also used to obtain enlarged plotting-sheets for sub-areas. A particularly useful facility for station-keeping was the provision of a large-scale track-plot displayed on a V.D.U. in the scientific chart-room and up-dated every minute. This enabled station-drift to be estimated accurately and greatly facilitated re-positioning, when necessary. It is a pleasure to acknowledge the skill and enthusiam

of Messrs Jackson and Knight in meeting all aspects of our computing requirements.

5. ASSESSMENT OF CRUISE RESULTS AND PERFORMANCE

A. EQUIPMENT PERFORMANCE

Almost all the equipment deployed worked up to (and in some cases, beyond) prior expectations. This level of performance, together with the excellent weather conditions that prevailed throughout the cruise ensured that all primary and most secondary objectives were achieved, including the collection of surface-sediment geochemical samples, some 18 of which were handed over to Dr Varnavas at the end of the cruise.

Exclusion of the ship from Greek territorial waters made it impossible to obtain the data requested by the National Electricity Corporation from the Pondikonisi Channel, although useful records were collected in the Andikythera Straits. Conditions (related to submarine cables) imposed by the Italian authorities on bottom-sampling in the Messina Basin Plain also led to a more restricted programme of coring than had been planned. However, neither of these problems seriously interfered with achievement of the main scientific goals.

Some minor and temporary problems were encountered with the bottom-camera and the side-scan sonar but these were quickly rectified by Messrs Bishop and Jones and did not materially affect overall performance. One 3m piston-core barrel was damaged at Station 5, but was efficiently replaced from the spares by Messrs Smith and Stanward.

The only disappointing aspect of the cruise from the standpoint of equipment was the unavailability of the deep-water CTD unit, which meant that the planned investigation of water-mass properties in two isolated slope-basins on the Cretan margin could not be undertaken.

It is a particular pleasure to be able to report the excellent results obtained from the modified RVS piston-corer. This success was achieved through the combined efforts of many people but particular credit must accrue to Mr S. Smith and Mr J. Stanward (RVS) who were responsible for preparation and retrieval of the corer, and the IOS winch-team of Messrs Peters, Wallace and Clements who displayed impressive skills in the over-side handling of this gear.

B. CRUISE PLANNING AND SHIP OPERATIONS

The political and the logistical requirements of this cruise called for a high degree of skill and diplomacy from all concerned in its planning, and particularly from the administrative staff at R.V.S. Barry and in IOS Wormley. The success of this endeavour thus owes much to the prior efforts of Mr C. Adams and Mr I. Innes of RVS and Mr A. Fisher, Dr S. Rusby, Dr B. McCartney and Mr N.H. Kenyon of IOS.

We are especially indebted to Dr A.S.Laughton, Director of IOS, for his ready agreement to make available the IOS side-scan sonar and 3.5KHz profiling equipment, together with the technical personnel to operate these and the heavy winches.

Ship-board operations and handling were undertaken with highly commendable efficiency and flexibility by the Master, Captain Maw, his officers and crew. The only problem encountered in this area was the oil-leak from a stern-gland, sustained in mid-cruise as the result of DISCOVERY fouling an (unmarked) fishing-line south of Crete. However, despite some anxieties, this unfortunate occurrence did not curtail or inhibit the remaining scientific programme. Throughout the cruise the deck-crew worked hard, with efficiency and good humour.

As indicated earlier, the successful achievement of all major scientific objectives of the cruise was due to the skill and efforts of the academic participants and especially of the technical support personnel from RVS and IOS. All these colleagues worked long and hard and it is a pleasure to acknowledge their outstanding contribution to what was a demanding and ambitious scientific programme.

Gilbert Kelling.
10th December, 1983.

DISCOVERY CRUISE 136 (APRIL-MAY, 1983)

TABLE 1 : BOTTOM SAMPLING STATIONS

STATION NO AND DAY	LOCATION	LAT. (N)	LONG. (E)	WATER DEPTH	TIME ON BOTTOM	TIME OFF BOTTOM	EQUIPMENT	RESULTS
1 (122)	SE MESSINA BASIN PLAIN	35°10.5′	18°45.2′	3875m	08.19	08.20	Gravity Corer (3m)	2.8m of core and catcher samples
2 (122)	MESSINA BASIN PLAIN	35°48.7′	18°35.0′	3935m	16.20	16.22	Piston Corer (9m)	9m recovered and 1m of trigger core.
3 (123)	NE MESSINA BASIN PLAIN	36°00.2′	18°37.0′	3975m	07.52	07.33	Piston Corer (9m)	Approx. 4m of core + 1m of Trigger. Some flowage.
4 (123)	POND IN NE MESSINA BASIN	36°13.8′	18°55.8′	3560m	21.52	21.53	Piston Corer (9m)	Approx 9m and 1 m of Trigger core.
5 (125)	CENTRAL PART GAVDOS TRENCH	34°40.1′	24°18.9′	3601m	18.21	18.22	Gravity Corer (2m)	1m Approx.
6 (126)	NE OF GAVDOS TRENCH FESTOS BASIN	34°41.2′	24°25.6′	3300m	08.41	08.43	Gravity Corer (2m)	1m recovered.
6 (126)	FESTOS BASIN	34°41.2′	24°26.4′	3297m	12.23	12.24	Piston Corer (6m)	Approx 5½m recovered and 0.5m Trigger.
7 (127)	EAST GAVDOS TRENCH (SW)	34°35.8′	24°13.2′	3515m	08.26	08.28	Piston Corer (6m)	Approx 6m recovered and 0.75 Trigger.
8 (127)	WEST GAVDOS TRENCH	34°42.1′	23°44.4′	3487m	14.43	14.46	Piston Corer (6m)	5.5m recovered and Trigger.
9 (128)	SOUTH GAVDOS SLOPE	34°38.4′ 34°39.5′	23°55.1′ 23°55.0′	2250m- 1925m	08.24	09.27	Chain Dredge	Rock fragments and clay recovered.
10 (128)	ACCRETIONARY BASIN WSW OF GAVDOS	34°46.0′	23°50.1′	1942m	12.48	12.49	Gravity Corer (2m)	< 1m recovered.
11 (128)	WEST GAVDOS SHELF	34°55.6′	23°48.9′	477m	16.33	16.36	Piston Corer (6m)	Approx. 1.5m of disturbed lower layer and sapropel. Few cm of Trigger.
11 (128)	WEST GAVDOS SHELF	34°55.6′ 34°55.4′	23°49.7′ 23°50.2′	605m- 745m	17.58	18.50	Mono 35mm Camera	28 Photos.
12 (129)	CENTRAL MESSARA BASIN	34°47.7′	24°36.2′	2650m	07.44	07.46	Gravity Corer (3m)	Approx. 1.3m recovered.
13A(129)	NW MESSARA BASIN	34°52.3′	24°33.6′	2620m	11.01	11.03	Gravity Corer (2m)	15cm recovered.
13B(129)	NW MESSARA BASIN	34°51.5′	24°34.7′	2635m	18.08	18.09	Piston Corer (6m)	4m recovered and 20 cm in Trigger
14 (129)	CENTRAL VALLEY OF SOUTH CRETAN BASIN	35°02.8′	24°19.1′	1415m	22.44	22.45	Gravity Corer (2m)	Almost 1m
15 (130)	TRENCH AND WEST SOUTH CRETAN BASIN JUNCT.	35°04.0′	23°27.9′	3510m	14.47	14.49	Piston Corer (6m)	Approx. 4.5m Empty Trigger.

TABLE 1 (CONTINUED)

15 (130)	TRENCH AND WEST SOUTH CRETAN BASIN JUNCT.	35°04.6′	23°29.0′	3505m	17.51	18.37	Mono 35mm Camera	30 photos.
16 (131)	S END OF WEST CRETAN BASIN	35°17.8′	23°19.2′	3225m	07.46	07.48	Piston Corer (6m)	50cm in trigger with small piece of pumice on top.
16A (131)	S END OF WEST CRETAN BASIN	35°17.5′	23°19.1′	3225m	11.57	11.59	Piston Corer (6m)	5½m and 60cm in Trigger.
17 (131)	WEST CRETAN BASIN CENTRAL	35°23.6′	23°16.5′	3115m	17.29	17.31	Piston Corer (6m)	Approx. 1m of highly disturbed sand and 0.7m of Trigger.
18 (132)	BASIN - W. END OF SEA OF CRETE	35°58.2′	23°30.8′	1310m	10.17	10.18	Piston Corer (6m)	50cm and 50cm of Trigger.
18A (132)	BASIN - W. END OF SEA OF CRETE	35°58.29′ 35°58.34′	23°29.13′ 23°29.11′	1314m	13.44	13.46	Piston Corer (9m)	4m recovered and 50cm in Trigger.
19 (132)	HIGH, E END ANTIKYTHIRA STRAIT	35°50.8′	23°39.6′	430m	19.31	19.33	Gravity Corer (2m)	Approx. 1.m with sapropel at base.
20 (133)	SW OF ANTIKYTHIRA STRAIT	35°42.8′	23°14.5′	620m	10.16	10.17	Piston Corer (9m)	Approx. 5m recovered and 50cm of Trigger.
20 (133)	SW OF ANTIKYTHIRA STRAIT	35°42.9′	23°14.1′	598m	11.39	12.03	Mono 35mm Camera	14 photos.
21 (133)	SLOPE BASIN W OF ANTIKYTHIRA	35°53.9′ 35°53.8′	23°02.3′ 23°02.3′	1043m	14.55	14.57	Piston Corer (9m)	4.5m recovered. Approx. 40cm Trigger.
22 (134)	PLATFORM SW OF KYTHIRA	36°01.17′ 36°01.06′	22°48.70′ 22°48.44′	325m	11.47	12.23	Mono 35mm Camera	20 photos.

DISCOVERY CRUISE 136 (APRIL-MAY, 1983)

TABLE 2 : CAMERA STATIONS

Station No.	11		15		20		22	
DAY	128		130		133		134	
Location	W. Gavdos Shelf		W and Gavdos Trench		S.W. of Antikythira St.		Platform SW of Kythira	
Lat.	34°55.6′	34°55.4′	35°04.6′		35°42.9′		36°01.2′	36°01.1′
Long.	23°49.7′	23°50.2′	23°29.0′		23°14.1′		22°48.7′	22.48.4′
Equipment	Mono 35mm		Mono 35mm		Mono 35mm		Mono 35mm	
Results	28 photos.		30 photos.		14 photos.		22 photos.	
	TIME	DEPTH	TIME	DEPTH	TIME	DEPTH	TIME	DEPTH
1	1758	605m	1751	3505m	1139	595m	1147	325m
2	1801	605m	1753		1140		1149	
3	1803	615m	1754		1142		1150	
4	1806	630m	1754		1144		1151	
5	1807	635m	1756		1145		1153	
6	1812	655m	1758		1146		1155	
7	1814	660m	1800		1148		1157	
8	1815	665m	1802		1150		1158	
9	1817	670m	1804		1153		1200	340m
10	1819	673m	1805		1155		1201	
11	1820	675m	1807		1157		1204	
12	1822	678m	1808		1158		1205	345m
13	1823	680m	1810		1159		1207	
14	1824	683m	1812		1202	585m	1209	
15	1826	687m	1814				1211	
16	1828	690m	1815	3500m			1212	350m
17	1830	695m	1817				1214	
18	1832	698m	1819				1217	
19	1834	705m	1820				1219	
20	1836	710m	1823				1220	
21	1838	715m	1824				1222	355m
22	1839	717m	1825					
23	1841	722m	1827					
24	1842	728m	1829					
25	1844	733m	1830					
26	1847	735m	1832					
27	1849	740m	1833					
28	1850	740m	1834					
29			1836					
30			1837					
31								

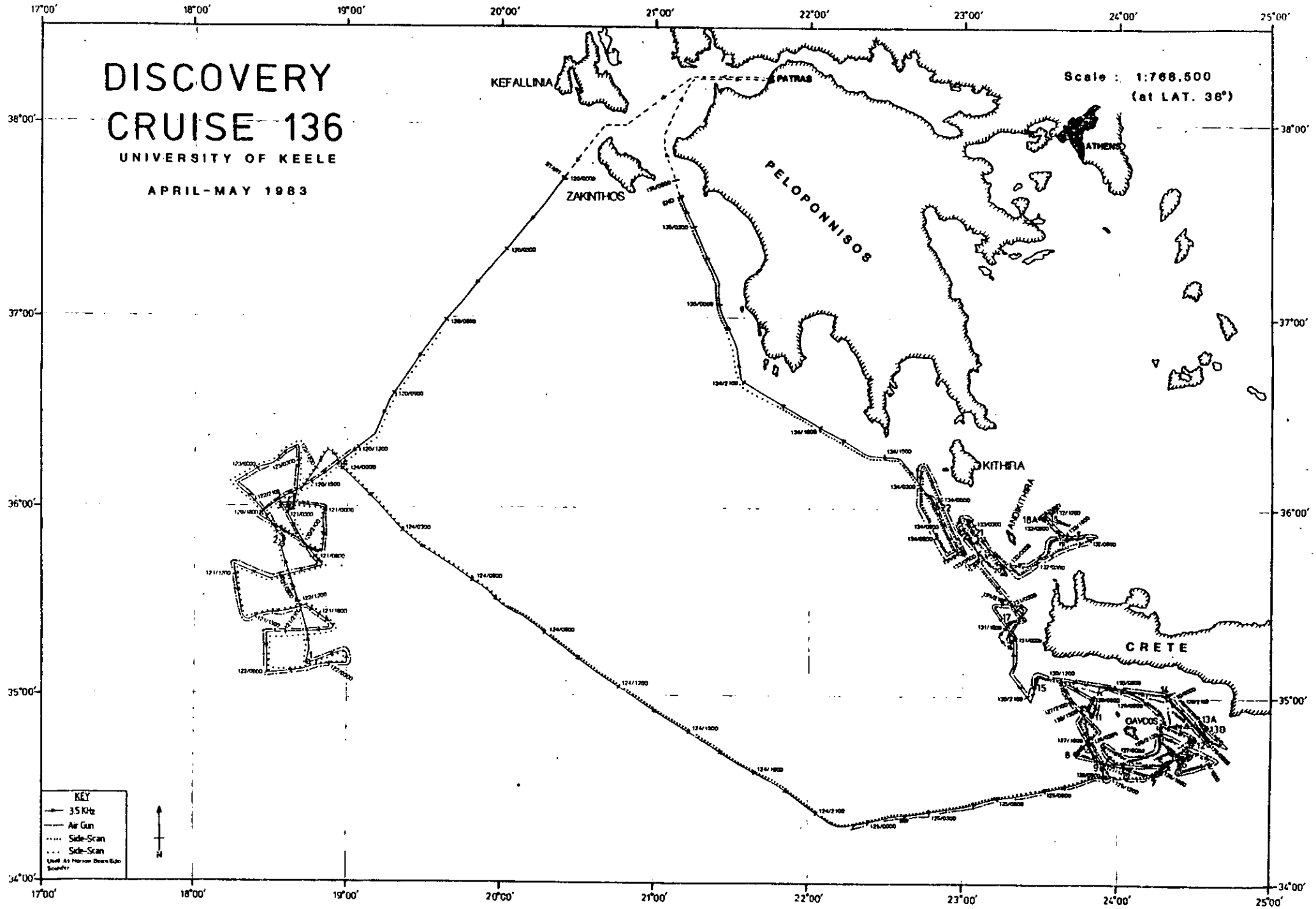

FIG. 1. : General Track Line and Bottom-Sampling Stations for DISCOVERY CRUISE 136.

FIG. 2. : Track Line and location of Stations for Hellenic Trench Section of DISCOVERY CRUISE 136.