

CRUISE REPORT - M/V UNITEDGEO I

71005-

LEG 5 - IDOE

LIBERIAN CONTINENTAL MARGIN

October 29 - November 20, 1971

SCHEDULE

The cruise was divided into two main parts, geophysical profiling along the Liberian continental margin the first 17 days and dredging plus profiling the remaining 5 days of the cruise. Geophysical measurements included gravity, magnetics, continuous seismic reflection and seismic refraction profiles.

- 29 October 1971 Depart Monrovia and profile
- 2 November 1971 Arrive Monrovia to let off one of staff
- 2 November 1971 Depart Monrovia to profile
- 7 November 1971 Arrive Greenville to let off one of staff
- 7 November 1971 Depart Greenville and profile
- 9 November 1971 Arrive Greenville with broken generator
- 9 November 1971 Proceed to Monrovia for generator repairs
- 10 November 1971 Arrive Monrovia
- 11 November 1971 Depart Monrovia and profile
- 16 November 1971 Begin dredging
- 16-20 November 1971 Dredging and profiling from Cape Palmas to Cape Mount
- 20 November 1971 Arrive Monrovia to terminate cruise

SCIENTIFIC PARTY

- Dr. John S. Schlee, USGS, Chief Scientist, Woods Hole
- *Dr. John C. Behrendt, USGS, Denver
- James Robb, USGS, Woods Hole
- Charles J. O'Hara, USGS, Woods Hole
- Frank Jennings, USGS, Woods Hole
- *Ray Martin, USGS, Corpus Christi
- James Pearl, USGS, Menlo Park
- William Todd, USGS, Menlo Park
- Harry Hill, USGS, Menlo Park
- James Nicholson, USGS, Menlo Park
- *Jenkins Dunbar, Liberian Geological Survey, Monrovia
- Jaime Garcia, Instituto Geologico y Minero de Espana, Madrid

* Participated in first part of cruise.

OPERATIONS

Leg 5 is intended to investigate the structural-stratigraphic framework of the continental margin adjacent to Liberia. We are interested in the nature of the transition from the pre-Cambrian Shield area on land to the ocean floor and in particular how ancient deep sea fracture zones connected with the opening of the Atlantic tie in with continental geology.

Geophysical profiles were oriented normal to the coast and extended far enough seaward to intersect magnetic anomalies shown by Behrendt and Woterson in their studies of the regional magnetics and gravity of Liberia. Cross tie profiles subparallel to the coast were made along most of the margin to provide control in matching anomalies (gravity and magnetics) and to look for any major submarine canyons.

Dredge stations were selected using the continuous seismic profiles as a guide. Dredging was upslope (normal to the contours) and covered an interval 200-500 meters. A Benthos chain bag dredge was used to obtain as much rock and as little sediment as possible.

An ITT satellite navigation system was used to obtain position. On the shelf we relied heavily on an ITT sonar doppler system to correct for current or wind set, and keep the vessel on the intended line. Longshore currents are particularly strong on the shelf (up to 2-3 kts), hence a correction of as much as several degrees was necessary to compensate for them.

Equipment

1. Edo 3.5 khz echo sounding system. Hull mounted transducers.
2. Teledyne sparker system (40 to 140 kj) with Raytheon recorder, multisensor hydrophone array and 1 to 4 seismic sparker arrays towed astern.
3. LaCoste-Romberg gravimeter
4. Varian Magnetometer
5. Sonobuoy
6. Chain Bag dredge coupled to an Alpine winch.

Sampling. Seven dredge stations were occupied -- mainly on the upper continental slope. Two came back with rocks (Table 1), and one with traces of sandy gray-green clay; the remainder yielded nothing. On the next last station, the dredge hung up on a Pleistocene(?) reef in 92 m depth, the weak link broke and, though the sample (if any) was lost, the dredge was recovered.

Narrative

We departed Monrovia on October 29 at 1935 local time under cloudy skies and calm sea. We deployed gear (magnetometer, hydrophones and sparker cables) and began profiling at 0053(Z). Ran first two profiles with minor difficulty. The profiles showed over 2 seconds of sediments above acoustic basement beneath the continental rise. November 1 we profiled along shelf through the sites of holes drilled on the shelf by Chevron and Union Carbide, in order to have some stratigraphic information to tie our acoustic reflectors to. Upon completion of profile 10 on November 2, we headed into Monrovia to disembark one of the scientists who could stay only for the first week of the cruise.

We left Monrovia at 1715 on November 2 to begin line 11. This line and the next ten lines were oriented normal to the coast between Monrovia and Greenville (150 miles down the coast); they were intended to show the thickness of sediment above acoustic basement for margin. They showed a thick prism of sediment on the continental rise, slumping and minor faulting beneath the slope and poor acoustic penetration (ringing) beneath the shelf. Toward the southeast (Greenville) the slope began to show an increasingly thick accumulation of sediment, warpage and diaper-like structures on the lower and middle slope.

On November 9, during line 23, the generator began to have great difficulty supplying power for the sparker. We went into Greenville on the ninth and phoned Monrovia to see if a new generator might be available there. It was and we proceeded there, arriving the morning of the 10th. The generator was delivered that evening, installed the next day and we departed the evening of the 11th.

We ran along the shelf, along one oil company profile and drill site, back to the termination of the last line, southeast of Greenville.

From November 12th through 16th, we ran lines 25-35, roughly normal to coast between Greenville and Cape Palmas. One sparker transformer went out on November 12, to reduce our power 1/3 to 80 kj, so we rigged up two additional banks in an auxiliary van, and utilizing the ship's generator, boosted power to 140 kj. The profiles show a marked steeping of the slope off Cape Palmas, large gravity and magnetic anomalies, the presence of a submarine canyon oblique to the coast (opening and deepening to the west) and a slumping of a thinned sediment cover.

The first dredge station (Nov. 16) was made at the shelf break off Cape Palmas but yielded no rock samples. The next station in the same general area, but in much deeper water, did yield a few pieces of indurated calcareous ooze and claystone, some with a brown shiny coating. Subsequent dredge (Nov. 17) on the outer shelf again brought back no rock samples. Hence, we made the remainder of the dredges on the slope in areas where the continuous seismic profiles indicated older rock near the surface, by virtue of later erosion or slumping. The fourth dredge (November 18) yielded a bag full of many different kinds of rocks, mostly fossiliferous sedimentary types and one group of schists or meta diabase.

Following this station we profiled to the next dredge site, off Buchanan. The last seismic line was along the slope and rise up to the Sierra Leone - Liberia boundary. Here we made two more unsuccessful dredge stations and proceeded to Monrovia the afternoon of November 20th.

RESULTS

With only the shipboard examination of data, our results are preliminary and sketchy.

1. Pronounced magnetic anomalies on inner shelf are probably the seaward continuation of diabase intrusives on land, detected in aeromagnetic survey published by Behrendt and Wotorson.
2. A progradation of the shelf and slope along the central third of the Liberian continental margin.
3. Presence of a submarine canyon oblique to the coast off Cape Palmas. The same area is marked by steepened eroded slope, crumpling and faulting of strata, and marked gravity and magnetic anomalies.
4. A thick section of sedimentary rocks beneath much of the outer continental shelf, capped by gently dipping Pleistocene(?) terrace deposits at the shelf break.

TABLE 1. DREDGE STATIONS

<u>Number</u>	<u>Provisional Latitude</u>	<u>Position Longitude</u>	<u>Date 1971</u>	<u>Time on Bottom (Z)</u>	<u>Depth Interval (m)</u>	<u>Remarks</u>
1	4°10.4'N	7°32.3'W	Nov 16-17	2300-0030	120-350	Sandy grayish green clay on dredge. Saved.
2	4°07.'N	7°27'W	Nov 17	1145-1540	1200-1800	12 pieces of indurate claystone, and punky calcareous ooze
3	4°11.6'N	7°53.6'W	Nov 17	2005-2045	130-352	one pinnate crinoide(?)
4	4°21.2'N	8°31.5'W	Nov 18	1055-1146	850-1250	80-100 liters of rocks - claystone dolomite, quartzose schist, sandstone and conglomerate
5	5°44.0'	10°35.4'W	Nov 19	1535-1645	500-1050	two holothurians(?)
6	6°40.8'	11°40.0'	Nov 20	0830-0950	90-650	nothing
7	6°24.8'	11°19.7'	Nov 20	1405-1525	250-600	nothing

TABLE 2. SEISMIC PROFILES

<u>Line No.</u>	<u>Date (1971)</u>	<u>Time</u>	<u>Distance (Nautical miles)</u>
1	October 30	053-1520	114.5
2	October 30-31	1520-0459	114.4
3	October 31	0543-1219	56.6
4	October 31	1219-2005	59.0
5	October 31- November 1	2005-0326	57.0
6	November 1	0326-1136	61.5
7	November 1	1136-2026	54.0
8	November 1	2026-2217	14.8
9	November 1-2	2217-0115	18.4
10	November 2	0128-1040	67.6
11	November 2-3	1908-0719	97.6
12	November 3	0722-1926	91.8
13	November 3-4	1930-0408	66.0
14	November 4	0411-1144	60.0
15	November 4	1255-1448	19.2
16	November 4-5	1451-0442	106.0
17	November 5	0445-1908	111.8
18	November 5-6	1910-0745	95.5
19	November 6	0800-1916	96.7
20	November 6-7	1919-0432	74.8
21	November 7	0442-1222	67.2
22	November 7-8	2343-1134	90.1
23	November 8-9	1223-0450	109.4
24	November 9	0505-0749	23.7
25	November 12-13	0116-0130	177.1
26	November 13	0134-1110	70.7
27	November 13	1203-2010	68.9
28	November 13-14	2010-0838	98.9
29	November 14	0840-1835	84.5
30	November 14-15	1838-0406	76.7
31	November 15	0410-1148	64.7
32	November 15	1212-2206	76.4
33	November 15-16	2208-0648	74.3
34	November 16	0652-1435	56.7
35	November 16	1442-2200	54.0
36	November 18-19	1508-1431	183.1
37	November 19-20	1803-0600	98.3
		Total	2911.9