Cruise Report
TR 096 (ARC II)
21 February - 28 March 1971
R/V Trident

The TRIDENT spent 35 days conducting marine geological and geophysical investigations in the northern part of the Lesser Antilles Island Arc. To make the most efficient use of ship time, the programs of Fink and Johnston (Schilling-sponsor) were combined over the length of the whole cruise.

Schedule

Leg I 21 February - 10 March 1971
St. Thomas, V.I. to operating area, thence to Pointe-a-Pitre, Guadeloupe, F.W.I. (17 days)
including 24 February - 1 March in Pointe-a-Pitre for repairs
11 March
Pointe-a-Pitre

Leg II 12 March - 28 March
Pointe-a-Pitre to operating area, thence to Fort-de-France, Martinique, F.W.I. (16 days)

Scientific Party

Dr. L.K. Fink, Jr. (Legs I-II) Univ. of Maine chief scientist, Leg I USA
Thomas H. Johnston (Legs I-II) U.R.I. chief scientist, Leg II USA
Dr. Detmar Schnitker (Legs I-II) Univ. of Maine micropaleontology Germany
Dr. Michel Feuillard (Leg I) Univ. de Paris seismology France
Dr. Haraldur Sigurdsson (Leg II) Univ. of West Indies geology Iceland
C.K. Unni (Leg I) U.R.I. geochemistry India
David G. Johnson (Leg II) U.R.I. geochemistry USA
Charles Heinonen (Legs I-II) Univ. of Maine geology USA
Paul Rusanowski (Legs I-II) Univ. of Maine botany USA
James Martell (Leg I) George Washington Univ. geochemistry USA
Francois LeLann (Leg I) Bureau of Geology France
P-M. Thibaut (Leg II) BRGM, Fort-de-France geology France
Thomas Davis (Legs I-II) biology USA
Art Buddington (Legs I-II) U.R.I. marine technician USA
Mark Weishan (Legs I-II) U.R.I. marine technician USA

Ship's Company

C.W. Clampitt, master
R.W. Reusswig, chief mate
David LaCasse, second officer

Clifford Oatly, ordinary seaman
Pat Neves, steward
Oscar Ammons, second cook
SHIP'S COMPANY (Continued)

Kyle Birk, radio officer
Henry Martin, bos'n
Robert Jenkins, AB seaman
Frederick Russell, AB seaman
John Stolberg, Jr., AB seaman
Barry McGuire, ordinary seaman
Peter Miller, ordinary seaman

J.P. Symonds, chief engineer
R.S. Martin, first engineer
Theo. Surette, second engineer
Harry Rougas, electrician
Joe Moscatelli, oiler
Neal Hovey, oiler

UNDERWAY OPERATIONS (Dr. L.K. Fink, Jr.)

Purpose

Previous geophysical investigations have revealed the relationship between the pre-Miocene and Miocene - Recent island arc ridges in the vicinity of Guadeloupe. This cruise was conducted to extend this detailed study to the entire northern half of the arc complex and to substantiate the continuity of this relationship. In addition the first studies to resolve the nature of the Aves Ridge and it's relationship with the Lesser Antilles Island Arc were initiated. It is recognized that detailed and closely spaced geophysical data are necessary to adequately define the complex associations of this area.

Method

To define these upper crustal structural relations, continuous seismic reflection profiles, and continuous bathymetric and magnetic profiles were obtained along the lines indicated in Fig. 1. These data were then utilized to determine the best dredging sites for obtaining samples of the rocks comprising the island arc ridge and the Aves Ridge.

Preliminary Results

The continuous seismic profiles were of exceptional quality, penetration was up to 2.5 seconds in such areas as the Grenada Trough. The acoustic basement was reached in most instances. A preliminary interpretation of the records suggests a young origin for the Aves Ridge accompanied by extensional rifting in the interarc basin. On the arc ridge crest the unconformity between the volcaniclastic products of the older and younger volcanic centers is clearly revealed.

The magnetic profiles are generally subdued everywhere in the area with the exception of the arc ridge crest where short wave length variations on the order of 100 to 500 gammas are associated with volcanic centers and minor faults in the acoustic basement.

The bathymetric data will be combined with other data on hand to produce a detailed bathymetric chart for the area north of Dominica. In general the existing bathymetric charts are a poor representation of the topography.

DREDGING OPERATIONS (T.H. Johnston)

This work has been carried out under the supervision of Dr. J-G. Schilling, U.R.I., and supported by his Office of Naval Research contract No. N00014-68-A-0215-0003.
Purpose

The subduction of oceanic lithosphere beneath island arcs is predicted by hypotheses of sea floor spreading and plate tectonics. Evolution of an island arc may involve melting of old oceanic lithosphere or spatially associated mantle at several levels. Dredging transverse fracture zones cross cutting the front of island arcs may expose either the basal part of such old volcanic edifice material or old oceanic crust.

Method

The dredging effort centered on the Desirade Scarp east of Guadeloupe. Five successful hauls here during TR 079 obtained greenstones, metagabbro, and quartz keratophyres. Further work was desirable to search for other rock types and possible layering by dredging along traverses at several depths. Along this scarp, the east flank of the arc edifice is offset, and a 40-km section of crustal interior exposed.

Preliminary Results

Five sub-bottom profiles (270 km) across the scarp were made, augmenting traverses obtained on TR 079. Nineteen dredge hauls were attempted on the scarp, of which 10 were successful, recovering a total of about 600 kg metamorphic and igneous rock. Rock types identified by preliminary inspection include greenstones, gabbros, basalts, and chert, some very fresh and others altered or sheared.

Three successful camera stations were completed, of which two cover sites dredged, and show the nature of outcrops on the scarp.

A one-day visit was made to Desirade Island. Samples related to those dredged were collected, and their field relationships observed.

Six successful dredge stations were completed near Montserrat and other locations in the Northern Lesser Antilles and Venezuela Basin, where the sub-bottom survey suggested exposed basement. Coquina and foraminiferal sediment were recovered, but not outcropping igneous rock.

Sediment cores were taken for benthic foraminifera studies at locations on the Atlantic floor and in the Venezuela Basin.
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<th>Type*</th>
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<td>Samples Recovered: 40 kg greenstones, metagabbros, and metabasalt</td>
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*D=dredge, C=camera, G=gravity core
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<td>200 kg amygdaloidal basalt, gabbro, altered basalt, chert, and well lithified sediments</td>
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<td></td>
</tr>
<tr>
<td>30</td>
<td>D</td>
<td>3/22</td>
<td>18°30.5′</td>
<td>62°28.5′</td>
<td>3200</td>
</tr>
<tr>
<td>Site</td>
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</tr>
<tr>
<td>Samples Recovered:</td>
<td>none</td>
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Site: Anguilla Ridge, north scarp
<table>
<thead>
<tr>
<th>Station</th>
<th>Type</th>
<th>Date (1971)</th>
<th>Latitude (North)</th>
<th>Longitude (West)</th>
<th>Depth (meters)</th>
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<tbody>
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<td>31</td>
<td>D</td>
<td>3/22</td>
<td>18°28.0'</td>
<td>62°29.6'</td>
<td>2300</td>
</tr>
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<td>Samples Recovered: 25 kg tan foraminiferal ooze</td>
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<tr>
<td>32</td>
<td>D</td>
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<td>18°21.5'</td>
<td>62°20.4'</td>
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<tr>
<td>33</td>
<td>G</td>
<td>3/23</td>
<td>18°38.4'</td>
<td>62°17.9'</td>
<td>5970</td>
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<td>Site</td>
<td>Atlantic floor, east of Anguilla</td>
<td>Samples Recovered: none</td>
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<td>34</td>
<td>G</td>
<td>3/23</td>
<td>18°38.4'</td>
<td>62°18.4'</td>
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<td>Samples Recovered: 1-1/2 meter light brown foraminiferal ooze</td>
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<tr>
<td>35</td>
<td>G</td>
<td>3/27</td>
<td>16°33.5'</td>
<td>64°19.7'</td>
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<tr>
<td>36</td>
<td>G</td>
<td>3/27</td>
<td>16°33.5'</td>
<td>64°20.0'</td>
<td>3500</td>
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<tr>
<td>Site</td>
<td>Venezuela Basin</td>
<td>Samples Recovered: 2 meters light brown foraminiferal ooze</td>
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<td>37</td>
<td>G</td>
<td>3/27</td>
<td>16°34.2'</td>
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