

Cruise Report R/V Robert D. Conrad by Alain Mauffret

RC26-05

3 April - 4 May, 1985

Conrad 26-05 was a leg devoted to SeaBeam and single channel seismic survey of the Caribbean zone, the main targets were:

- 1) The volcanism of the lesser Antilles - 4 days.
- 2) The structural framework of the Anegada Passage off the Virgin Islands, where are presumably located a strike slip fault and extensional features - 10 days.
- 3) The Muertos Trench south of Puerto Rico and its termination on land in Hispaniola - 5 days.
- 4) Beata Ridge which a large feature separating Columbia and Venezuelan Basin - 5 days.

The equipment used for these surveys were:

SeaBeam multi-beam / narrow beam echo sounder.

3.5 Khz. wide beam echo sounder.

High speed single channel seismic profiling.

Magnetics

Gravity

The French scientific community working in the caribbean in various fields were represented;

B.R.G.M. (Bureau de recherche Geologique et Miniere) - volcanism in the lesser Antilles.

I.F.P. (Institute Francais du Petrole) - submarine and land geology of the caribbean.

Universite de Brest - land geology.

Universite de Paris - submarine and land geology.

IFREMER - geophysics of the caribbean zone.

Scientific accomplishments of the cruise

During cruise RC26-05 we were able to meet all of the primary objectives. We accomplished the following surveys;

Keikem Jenny

The only active submarine volcano off the lesser Antilles was surveyed with the SeaBeam system. XBT measurements were made with one showing temperatures in excess of 35 deg. C - probably connected with a hot spring.

Qualibou

Qualibou off St. Lucia where is presumably located half of a caldera, the other half existing on land. The SeaBeam map showed some small volcanic peaks, but a ring structure is not obvious.

Guadeloupe

This survey shows a large volcanic feature now extinct as well as a prominent scarp.

Anegada Passage

We surveyed for 9 days using single channel seismics and seabeam. The single channel seismics were all acquired using 2 80 cu.in. water guns. The guns were towed with a french designed fish which provided stable high speed performance while maintaining a constant depth, as well as a special streamer designed for high speed towing, both provided excellent performance up to 10 knots. The seismic records show evidence of an extensional process along the 4000 meter deep St. Croix Basin. The main structural orientation is E - W rather than NW - SE was expected. A bank as shallow as 200 meters was discovered. We will be able to make an accurate analysis of the extensional process, using the SeaBeam and seismic data gathered in this area.

Muertos Trench

We followed the front of the deformed belt which lies south of Puerto Rico. The western extension of the prism has already been studied on land in Hispaniola. We mapped with SeaBeam and seismics the interface between the land structure and the structure at sea. The western termination of the prism is probably due to the collision of Beata Ridge and Hispaniola. We followed the contact between the prism and Beata and at this location a prominent curve to the north was traced.

Beata Ridge

This prominent morphological feature separates Venezuelan and Columbian basins. Two surveys were performed in preparation for a diving cruise with a french submersible. The first survey was a long the western side of the Beata Ridge, which showed some precipitious scarps. In the second survey in the middle of the ridge, the seismic sections show a recent cover, yet some outcropping does exist along some of the escarpments.

The tectonic pattern is complicated in this area with a convergence along many different orientations, without Seabeam we would not have been able to delineate these different trends.

In summary we gathered a wealth of new geophysical and geological data over a large part of the Caribbean Sea, from several thematic points of view; strike slip and extension, accretionary prism, collision and intraplate tectonics, island arc volcanism.

Ship operation

The operation of the R/V Conrad was excellent, the crew is capable and highly skilled. The survey was well done with the aid of conventional radar, satellite navigation (GPS and Transit) and a three axis doppler speed log. We did however lose some time due to a delayed departure from Barbados, due to radar repairs. This however was not the major problem on the cruise, the main air conditioning unit in the electronics lab had a compressor failure several days before our scheduled port call in St. Thomas. The engineers had a small unit which they rigged in the lab which allowed us to continue the survey, but the working conditions were extreme for the personnel. The port call in St. Thomas which was originally scheduled to be only long enough to embark and debark personnel, was extended to allow for a new compressor to arrive and be installed. We had another unrelated failure later in the leg, for which we had to shut down the logging system for a short time.

Scientific operations

The French equipment (streamer, gun fish and tow cable/shot line) designed to operate at high speeds (10 knots) worked well. The performance of the French water gun was poor, we initially thought that it would only be used as a spare. The Lamont gun according to Martin Iltzsche performed better than in the past (70K shots as apposed to 40K normally seen).

The French and American technicians worked together without any kind of problems. The seismic acquisition was performed by Jim Smith and Joe Stennett, while Frank Robinson was invaluable in helping us learn about the lab operations aboard the Conrad. In general all of the American technicians were a large help in making the cruise a success.

Profile recording

There are too many recorders in the main lab and they broke down quit often in the first part of the cruise which prevented a good homogeneity of the records. The vertical exaggeration is too high, except on the LSR. However the records are generally good and at high speed we had some good penetration (up to 1.5 sec.).

Gravity and Magnetics

The gravity and magnetics recording apparently worked well. We had some interruptions in the analog recording of the magnetics as well as a gyro failure in the BGM-3 which caused a 2 hour lose of data.

SeaBeam system

The SeaBeam system had no problems, except for a grave failure which jeopardize three days of data. The vertical reference had a gyro and synchro problem which introduced a systematic 3 deg. difference between the real vertical and the vertical given to the system. When the error was detected Jim Smith and Dan Chayes repaired the vertical referance and calibrated the system as best they could at sea. Dan Chayes wrote a program to correct for this error, this program worked well.

The plotting of the SeaBeam data and navigation was made quickly by Joyce Miller, Jim Smith with the assistance of Guy Hall and Gerard Riou.

The 3.5 Khz. and the water gun shots occasionally interfered with the SeaBeam data, if care was taken in synchronizing the SeaBeam emission and the seismic shots we were able to prevent most of the noise artifacts.

Navigation

Except for some erratic values the GPS worked well. The only major problem occurred during the two first surveys. The Furuno speed log was trying to work in bottom track mode which due to the topography of the area and the shallow water depth was very poor for dead reconing. The first SeaBeam data plotted was very bad, a first improvement was made by integrating radar fixes from the bridge. Then Jim Smith worked hard to improve the result by matching the different swaths, the final product was perfect.

Working environment

The watch standers had a hard time in the lab when the air conditioning failed as well as a high noise level.

There are not enough rooms available for working in real time and the wet lab should be improved to favor a scientific analysis of the first results. However most of the SeaBeam maps have been contoured.

Clearances

We had to change our survey plans because the Venezuelan government would not let us work off of Aves Island and we canceled a survey off of Columbia. But fortunately we found an interesting place to perform an alternate survey.

Deck equipment

We had no problem working with the deck equipment provided for scientific operations. The two small cranes for the water guns were very useful. We had one failure where a tow boom broke, but this proved to be only a minor problem.

General conclusions

The R/V Conrad is a very efficient ship, both the crew, LD60 and URI technicians were help full in making the cruise a success, any problem that did arise were quickly solved. .

On any scientific vessel it is difficult to avoid the clearance problem and this cruise was no exception. It is too early to have a complete view of the scientific results, but what we have seen so far seems important and the main objectives have been reached.