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by

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A REVISED BATHYMETRY OF THE MID-CAYMAN RISE AND CENTRAL CAYMAN TROUGH USING LONG RANGE SIDE-SCAN SONAR

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1989

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A revised bathymetry of the Mid-Cayman Rise and central Cayman Trough using long range side-scan sonar.

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ABSTRACT

A new bathymetry of the central Cayman Trough at a scale of 1:375,000, has been produced by combining conventional wide-beam echo-soundings, contoured with the aid of an interpreted long-range side-scan sonar (GLORIA) mosaic and a multibeam bathymetric survey along the present-day spreding axis. The overview given by the sonar mosaic has enabled the contouring, at an interval of 250m, to more accurately reflect the morphotectonic features of the ocean floor than would have been possible using wide-beam soundings alone.

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CONTENTS

INTRODUCTION

The Cayman Trough is a deep, elongate basin trending ENE-WSW, lying in the west-central Caribbean Sea (*Fig.1* , separate chart, scale 1:375,000). In detail it is made up of a central area of oceanic crust, bounded to both the north and south by sublinear trenches and steep scarp slopes. To the north, the Trough is flanked by the Cayman Ridge, whilst to the south lies the Nicaraguan Rise. Both these shoals rise to less than 2000m.

Previous bathymetric maps over this area have been limited to either large-scale regional compilations (*e.g.* Holcombe *et al.* 1973, Flanagan *et al.* 1981), or small-scale localised surveys (CAYTROUGH 1979). This compilation focusses on the central portion of the Cayman Trough, and covers most of the area that displays an oceanic spreading fabric similar to that developed on the flanks of other medium to slow spreading mid-ocean ridges. The Trough encompasses the plate boundary between the North American and Caribbean plates. In this area, the plate boundary lies along the Oriente and Swan Transform Fault Zones, and the Mid-Cayman Rise spreading centre (Holcombe *et al.* 1973).

SURVEY DATA

Data used in this compilation of bathymetry included conventional 10- and 12kHz wide-beam echo-soundings, U.S. Navy (SASS) multibeam swath-mapping data (*Fig.2*), and sonographs obtained during a GLORIA (Somers *et al.* 1978) long-range side-scan sonar survey (Kenyon *et al.* 1986) (*Fig.3*). The conventional echo-soundings were compiled, then contoured using an interpreted sonograph mosaic (Edgar *et al.* in prep) as a guide to the morphological trends of bathymetric features. The sonographs were interpreted using airgun seismic reflection, 3.5 and 10kHz profiles collected simultaneously with the GLORIA data. A number of other published (Talwani 1974) and unpublished airgun profiles were also used to aid interpretation.

The GLORIA survey of the Cayman Trough was completed in 1985 . The effective range of the sonar was about 18km to either side of the survey vessel. A survey speed of 8knots. reduced along-track resolution of the system to approximately 100m in the near-field, which decreased to approximately 1km at

far range. Resolution perpendicular to the track is about 50m, and about 25cm in the vertical plane. Standard geometric corrections were applied to account for both along-track variations in ship's speed and slant-range distortions, prior to interpretation of the data.

Due to the configuration of the sonar, insonification of targets which are oriented sub-parallel to the path of the vehicle proves to be more successful than for those at a high angle to the track. Therefore in order to obtain satisfactory cover of both the spreading fabric and any orthogonal transform structures, track orientation was maintained at approximately 45° to each of the major structural elements.

SUMMARY

This new bathymetry of the Central Cayman Trough has been produced using a combination of multibeam and conventional wide-beam echosoundings, contoured with the aid of an interpreted long-range sidescan sonar mosaic. The detailed overview of the tectonic fabric given by the sonar mosaic has allowed interpretation of the soundings with an accuracy unprecedented in comparison to that obtained by conventional means alone. This bathymetry is but one of a series of maps produced in conjunction with the United States Geological Survey, of interpreted geophysical data in the central Cayman Trough (Edgar *et al.* 1990, Dillon *et al.* 1990a, Dillon *et al.* 1990b).

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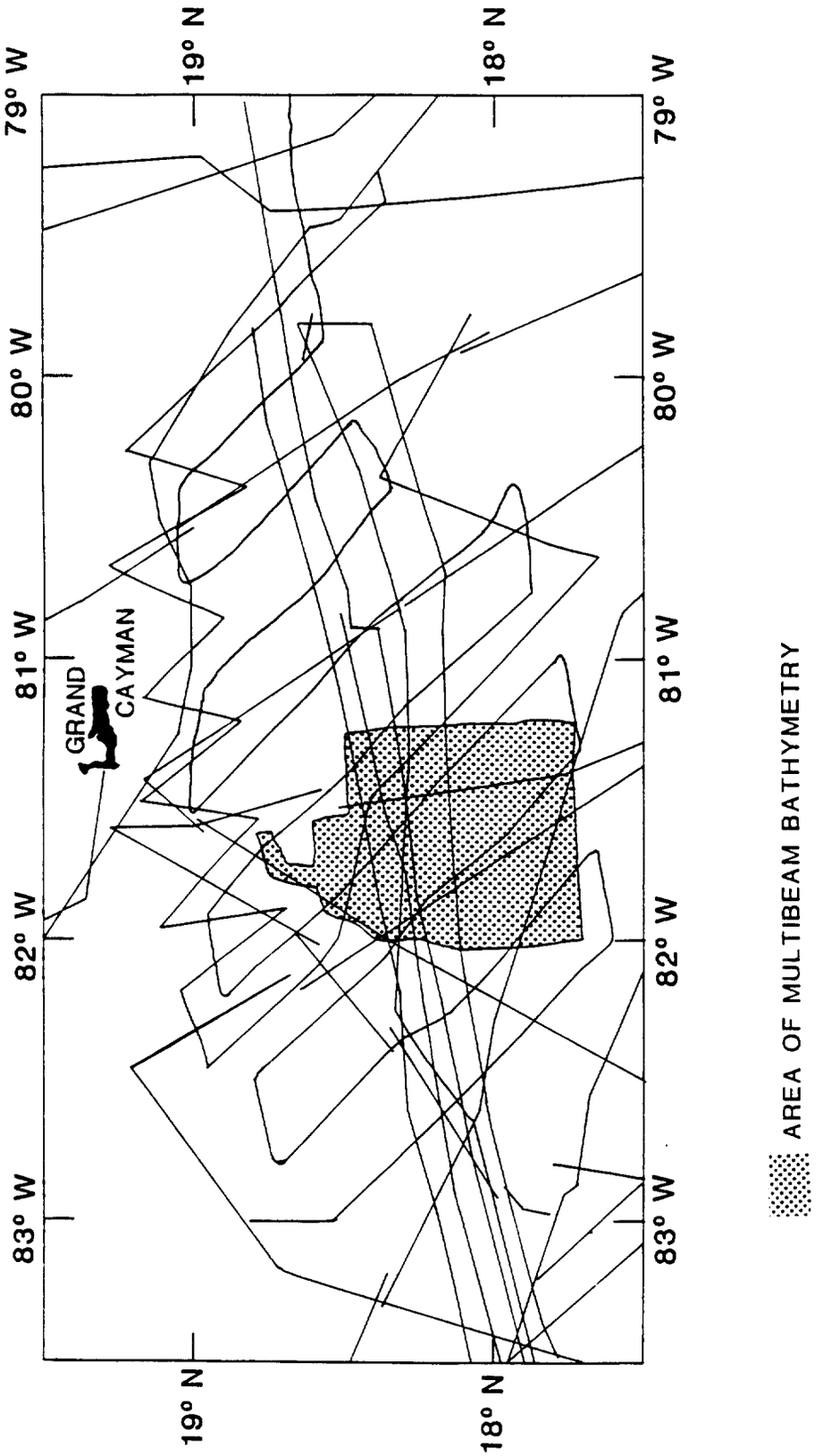


Figure 2. Chart showing the density of tracks, and the extent of the multibeam bathymetric survey.

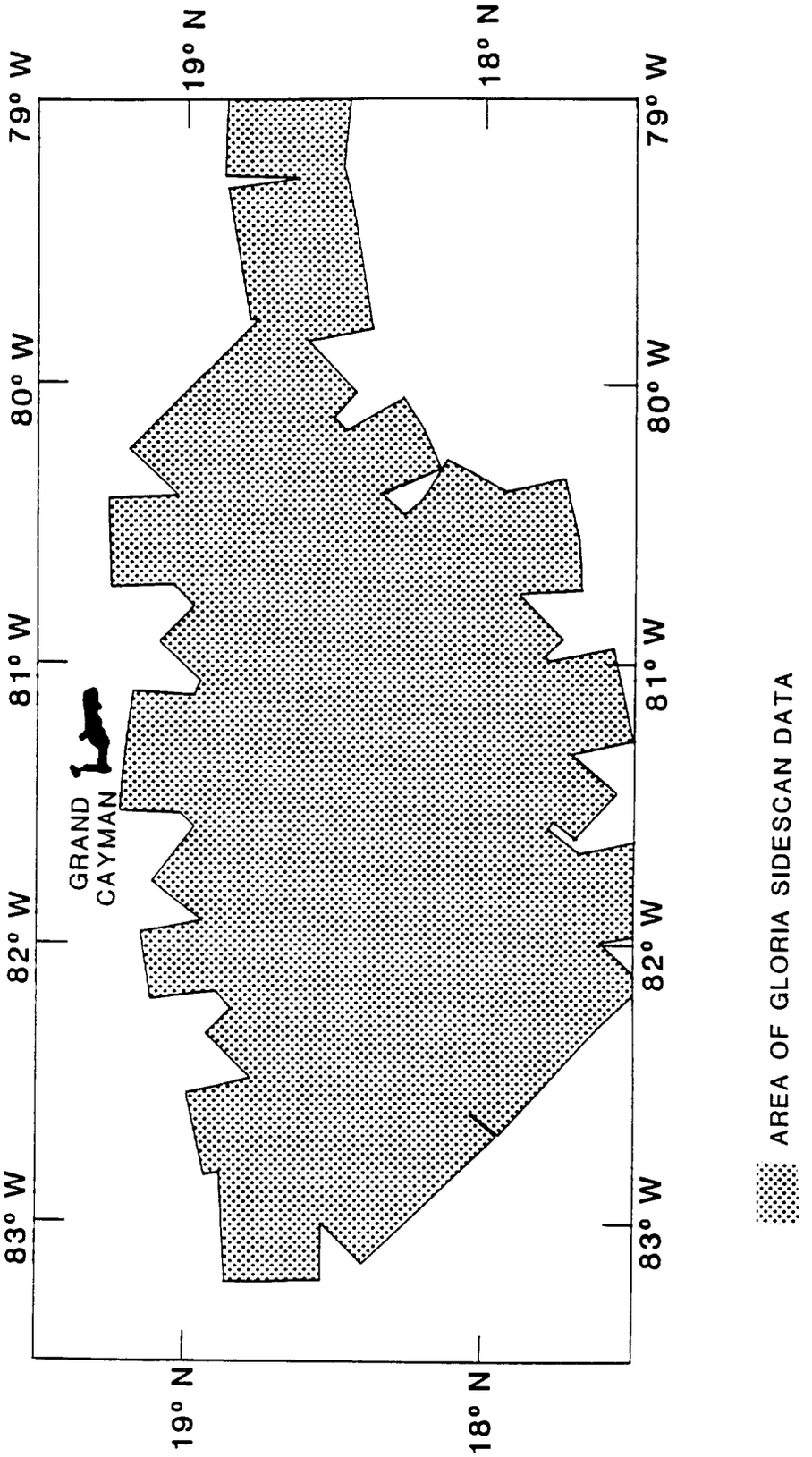
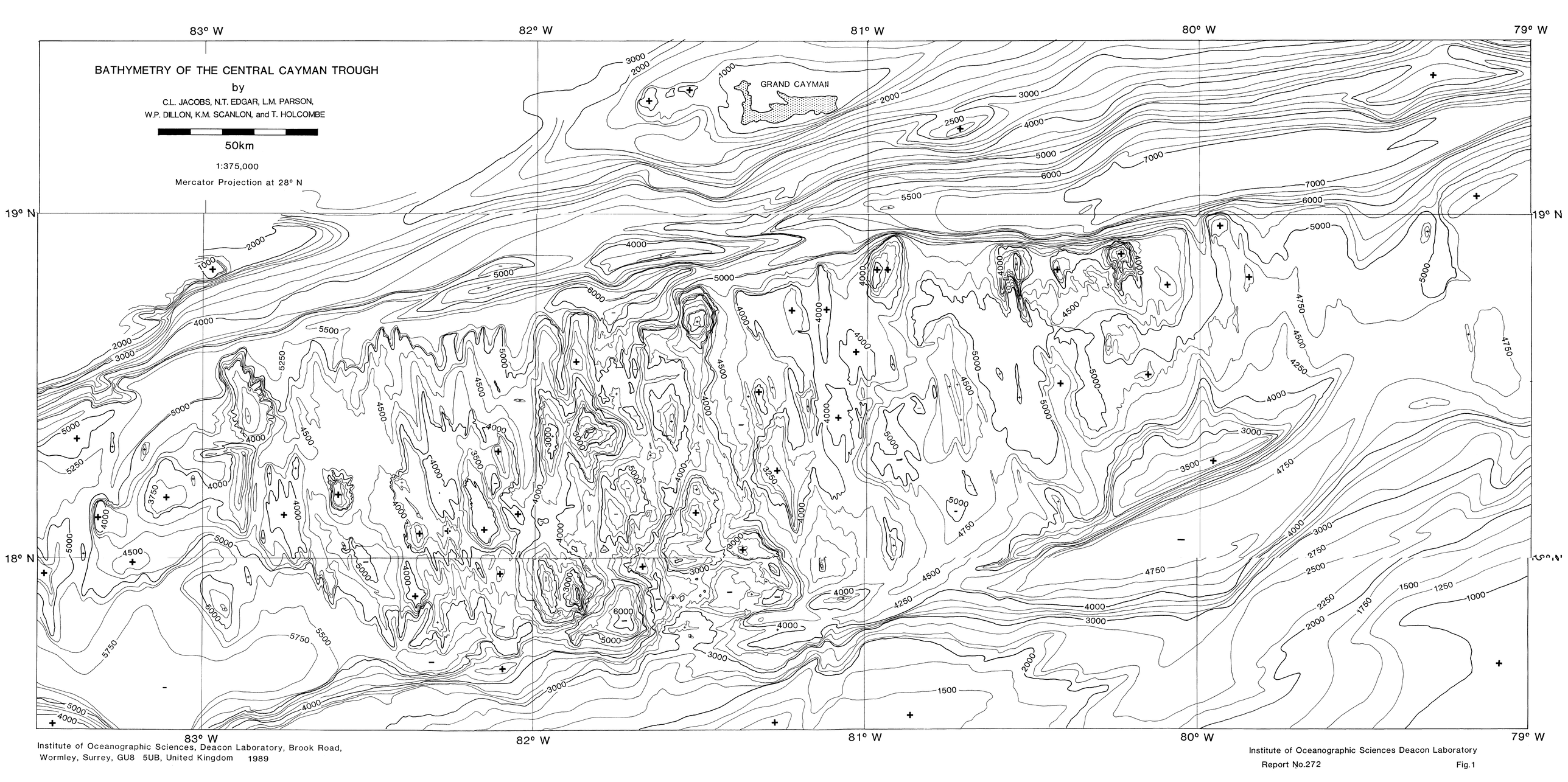


Figure 3. Map showing the extent of GLORIA sidescan coverage.



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