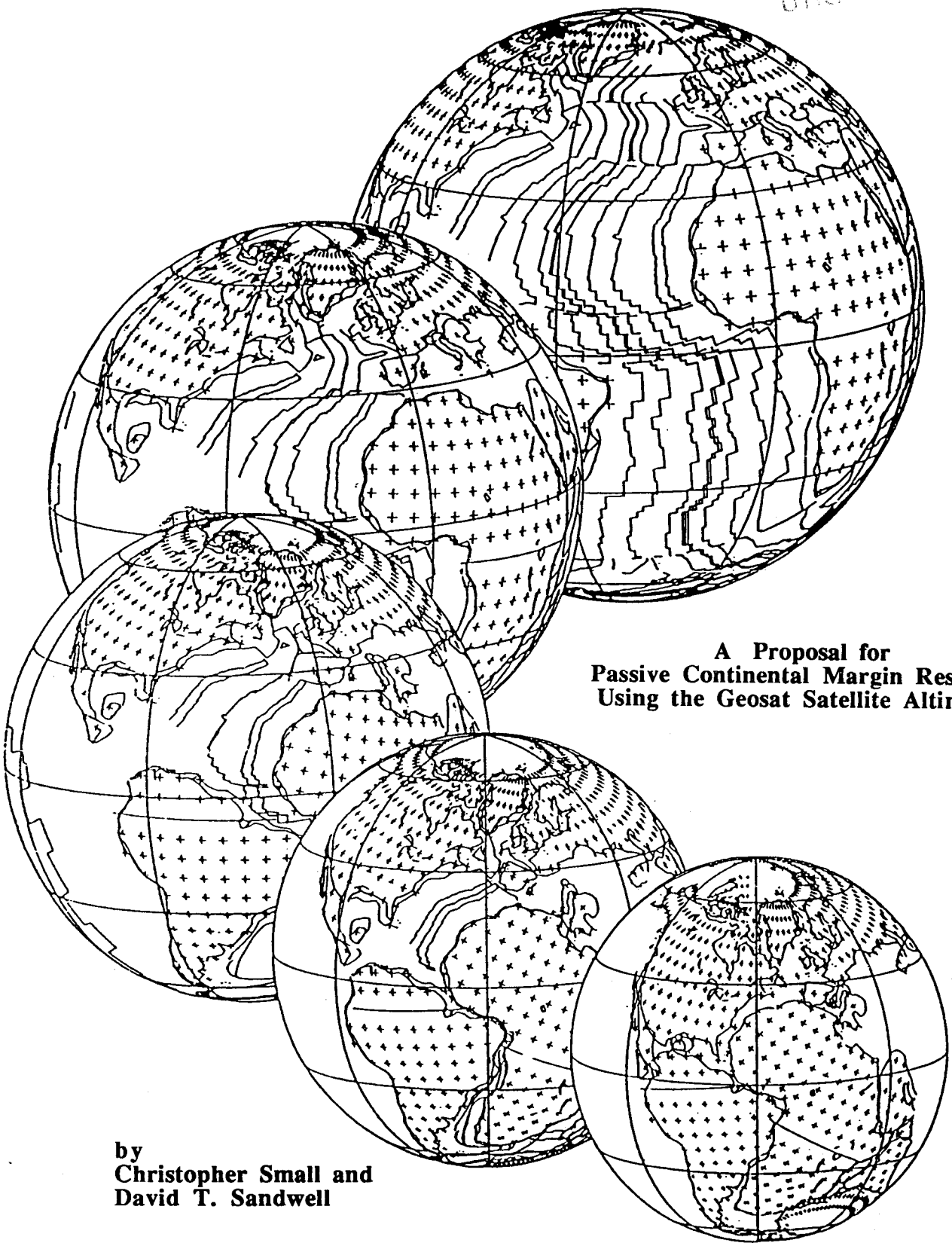
PALEOCEANOGRAPHIC MAPPING PROJECT
PROGRESS REPORT No. 45 - 0888



A Proposal for Passive Continental Margin Research Using the Geosat Satellite Altimeter

by
Christopher Small and
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An understanding of the evolution of passive continental margins is a vital key to the understanding of the processes of continental rifting and sedimentary basin development. At the present time however, our understanding of margins is mainly derived from individual studies of a few select areas. In order to develop a complete model for the evolution of the passive margin, a global study is needed. We propose such a global study of passive margins using gravity data obtained by the Geosat radar altimeter.

To calibrate the relationship between known margin structure and margin gravity, the initial phase of our research will involve a detailed investigation of the Atlantic margin of the United States. The high density of available geologic and geophysical data for the Atlantic margin makes this a logical starting point. In this initial phase of the project we will compare altimeter data with data derived from other geophysical surveys (reflection seismic, large aperature seismic, shipboard gravity, magnetic). The presence of detailed well data in several of the large sedimentary basins along the margin will help constrain the structural and stratigraphic parameters as well as the tectonic history of the margin.

Once the relationship of the geoid to the large scale structure of the margin is understood, it may be possible to infer the nature of unsurveyed passive margins such as those in the Arctic and Antarctic. In addition, an understanding of this relationship may allow additional constraints to be placed on existing sparse datasets such as low density seismic surveys. We believe that the marine geoid is sensitive to factors such as sediment thickness, degree of crustal extension and degree of isostatic compensation, a global study of this nature has the ablity to place important constraints on the factors controlling the evolution of passive continental margins.

One of the primary advantages of the Geosat satellite altimeter is that it provides uniform, consistent coverage of all of the world's margins including those remote margins for which no data are currently available. One such example is the Antarctic margin which is still largely unexplored despite its importance in the breakup of Pangaea. Another advantage of the Geosat altimeter over previous radar altimeter missions (Geos 3, Seasat) is its improved accuracy and coverage (MacArthur et al., 1987; Sailor and LeSchack, 1987; Sandwell and McAdoo, in press). The long duration of the Geosat mission has provided

28 repeat cycles which are stacked to create a high resolution image of the marine geoid. At this time no such study of the geoid of passive continental margins exists. We expect that a global study of this nature will provide important constraints for the evolution of passive continental margins.

The enclosed figures show Geosat tracks across three passive continental margins. The data are shown as the deflection of the vertical (the slope of the sea surface). There are noticeable variations along the strike of the margins. Figure 1 shows deflection of the vertical profiles off the northeast coast of North America, a very well-known margin. Figures 2 and 3 show part of the southern margin off Australia and its conjugate margin along Antarctica.

The research described above will be performed by Christopher Small under the direction of David Sandwell to fulfill the requirements for a Master of Science degree through the Department of Geological Sciences at the University of Texas at Austin. The initial phase of the research is now under way and the project is expected to be completed by September of 1989.

References

MacArthur, J.L., Marth Jr., P.C. and Wall, J.G., 1987. The Geosat radar altimeter. John Hopkins Appl. Phys. Lab. Tech. Dig., 8: 176-181.

Sandwell, D.T. and McAdoo, D.S. in press. Marine gravity of the Southern Ocean and Antarctic margin from Geosat. J. Geophys. Res.

Sailor, R.V. and LeSchack, A.R., 1987. Preliminary determination of the Geosat radar altimeter noise spectrum. John Hopkins Appl. Phys. Lab. Tech. Dig., 8: 182-183.

Figure Captions

Figure 1. Geosat deflection of the vertical profiles of the eastern coast of North America, near Washington, D.C. The high density of available geologic and geophysical data for this margin makes it a logical starting point for our study. All three sets of profiles are from the ascending set of Geosat tracks.

Figure 2. Geosat deflection of the vertical profiles off the coast of southern Australia, near the Great Australian Bight.

Figure 3. Geosat deflection of the vertical profiles off the coast of Antarctica, near Wilkes Land. This margin, which is conjugate to the margin in Figure 2, is very poorly known.

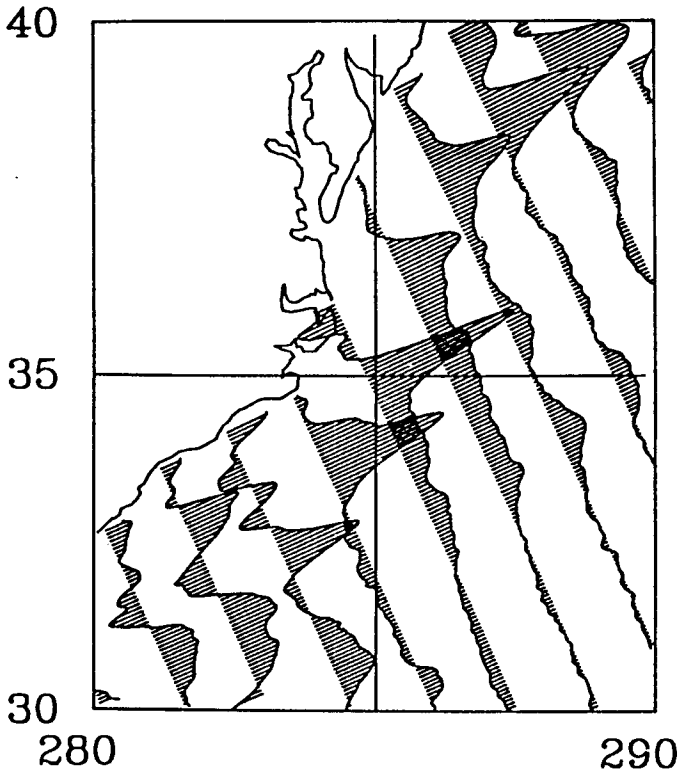

Figure 1

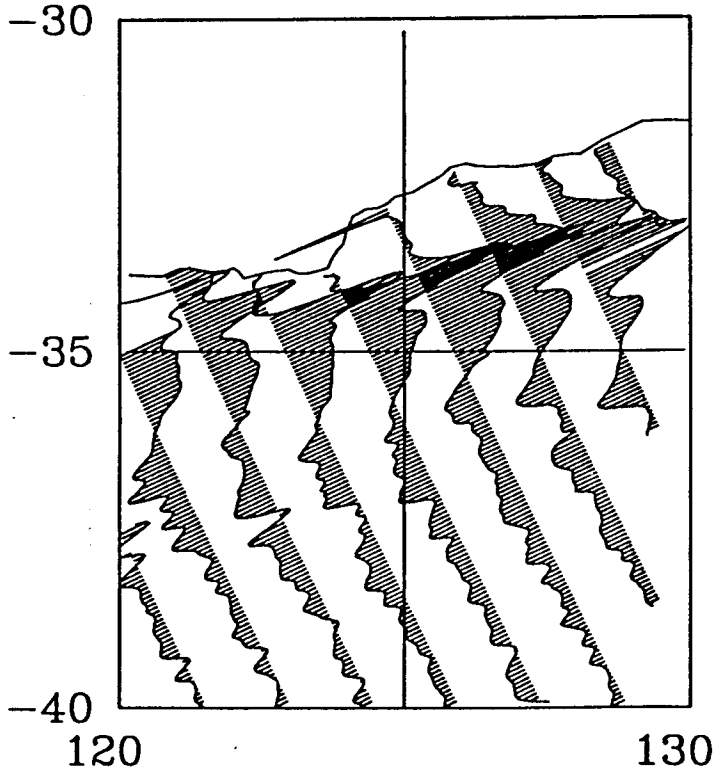

Figure 2

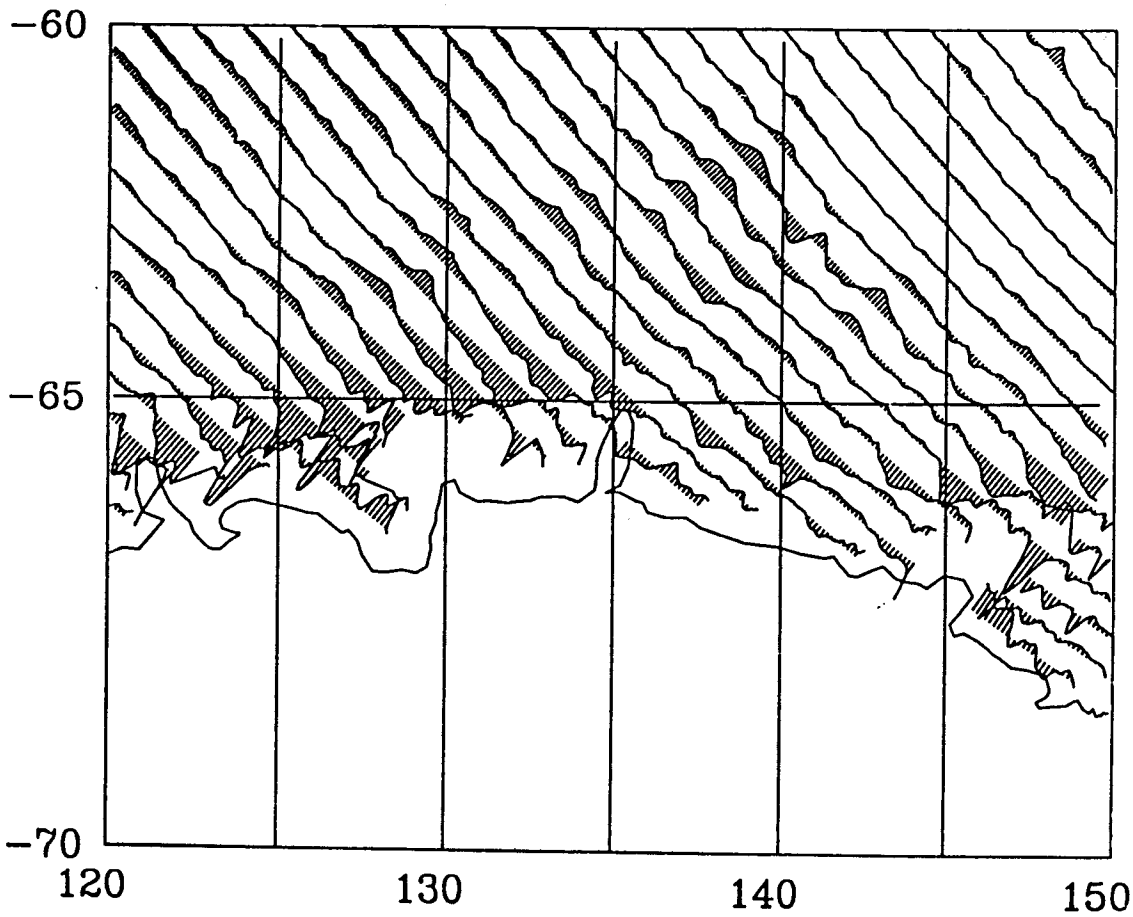

Figure 3