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FINAL REPORT

Correlation Between Co-Registered SeaMARC II, Seabeam and  
SeaMARC I Sonar Data of the Same Seafloor on the Crest and Flanks  
of the East Pacific Rise: Quantitative Comparisons of System  
Resolution and Imaging of Seafloor Microtopography

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LONG-TERM SCIENTIFIC OBJECTIVES

To quantify the differences in the way several high-resolution swath mapping systems resolve the detailed morphology of seafloor terrain and evaluate numerical models that predict seafloor roughness by using actual data of several types in areas where models have been developed.

PROJECT OBJECTIVES

The research objectives for this small study were to compare and analyze co-registered SeaMARC and Seabeam bathymetric datasets over an area of the East Pacific Rise between 13°-15°N, where a large NSF-funded Sea MARC II survey had been carried out in 1987 (Fornari et al., 1988; Figure 1).

Current Status and Progress

Statistical analysis of the Sea MARC II (SM-II) bathymetric data, as part of the PhD thesis of Margo Edwards at Lamont (see also Malinverno, 1990), resulted in the development of a 2-D filter that, in a first-order manner, helped minimize the noisiness of the data especially on the port side. The data were linearly interpolated in the across-track direction and sampled at a regular spatial interval, converted to frequency domain data, low-pass filtered, inverse transformed and output at the same sampling interval. The low-pass filtering was tried for frequencies corresponding to wavelengths of 300 m, 250 m, and 200 m. The tests of 300 m and 250 m filters were most successful at removing noise while preserving the longer wavelength signal (Figure 2). SM-II bathymetric data were mosaiced, gridded and statistically compared with lines of Seabeam data that cross the SM-II survey area (Goff et al, submitted). The comparison between SM-II data and synthetic data generated using the Seabeam parameters indicates that the inversion technique of Goff and Jordan (1988) underestimates the characteristic abyssal hill length. Stochastic parameters of the seafloor in the study area were also correlated to geologic features (pseudofaults and change in character of the EPR crest at 14°N) and provide an initial attempt to quantify the relationships between statistical analysis of seafloor roughness and geologic processes along the MOR crest.

References

Fornari, D.J., Edwards, M.H., Malinverno, A., Madsen, J.A., Gallo, D.G., Perfit, M.R., Shor, A.N., 1988, Morphology of the East Pacific Rise from the axis to seafloor 4 ma old between 13-15°N: bathymetric anomalies and local variations in subsidence along a ridge segment, Am. Geophys. Union, 69, 1484.

Malinverno, A., Edwards, M.H., and W.B.F. Ryan, 1990, Processing of SeaMARC swath sonar data, IEEE J. Ocean. Engin., 15, 14-23.

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## Correlation Between Co-Registered SeaMARC II, Seabeam and SeaMARC I Sonar Data of the Same Seafloor on the Crest and Flanks of the East Pacific Rise: Quantitative Comparisons of System Resolution and Imaging of Seafloor Microtopography

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### Submitted/In Press Papers:

Edwards, M.H., Fornari, D.J., Malinverno, A., Ryan, W.B.F., Madsen, J.A., Gallo, D.G., Perfit, M.R., and A. N. Shor, High-resolution swath mapping using Sea MARCH II over an intermediate to fast spreading segment of the East Pacific Rise 13° - 15°N: Quantitative structural data and implications for the fine-scale tectonic evolution of the mid-ocean ridge crest and flank, Proceedings of IGARSS-89/12th Canadian Symposium on Remote Sensing, Vancouver, July, 1989.

Goff, J.A., Jordan, T.H., Edwards, M.H., and D.J. Fornari, Stochastic modeling of seafloor morphology: comparison of a stochastic seafloor model with Sea MARCH II bathymetry and Sea Beam data near the East Pacific Rise 13°-15° N, Jour. Geophys. Res., (submitted).

### Invited Presentations at Scientific Meetings:

Edwards, M.H., Fornari, D.J., Malinverno, A., Ryan, W.B.F., Madsen, J.A., Gallo, D.G., Perfit, M.R., and A. N. Shor, High-resolution swath mapping using Sea MARCH II over an intermediate to fast spreading segment of the East Pacific Rise 13° - 15°N: Quantitative structural data and implications for the fine-scale tectonic evolution of the mid-ocean ridge crest and flank, IGARSS-89/12th Canadian Symposium on Remote Sensing, Vancouver, July, 1989.

### Contributed Presentations at Scientific Meetings:

Goff, J.A., Jordan, T.H., Edwards, M.H. and Fornari, D.J., Comparison of a stochastic seafloor model with a Sea MARCH II survey near the East Pacific Rise, Am. Geophys. Union, v. 70, 467, 1989.

### Figure Captions

Figure 1- Map showing the area covered by the Sea MARCH II survey Fornari et al., (1988) (diagonal lines). The EPR crest is outlined by the stippled area (depths < 3000 m). Area covered by Seabeam data is enclosed by fine solid line. Seabeam data used for the comparison were from a long E-W line just north of 13°N, and three short E-W lines at: 13.5°N, 14°N and 14.75°N. Inset shows survey area with respect to major transforms in the eastern Pacific.

Figure 2- Profiles of Sea MARCH II bathymetric data before (top) and after (bottom) using a 250 m wavelength cutoff low-pass filter.

STATEMENT "A" Per Dr. Joseph Kravitz  
ONR/Code 1125GG  
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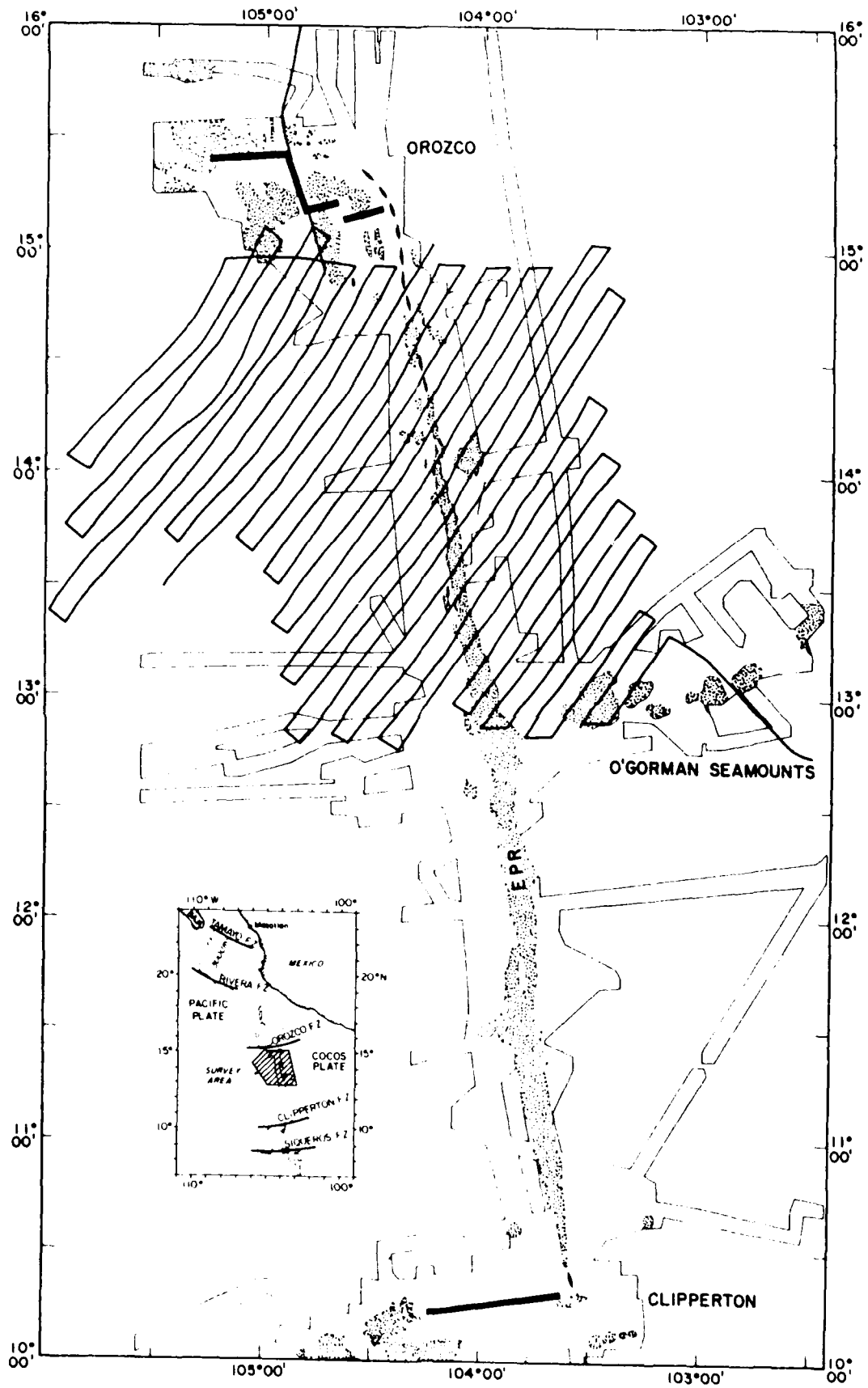
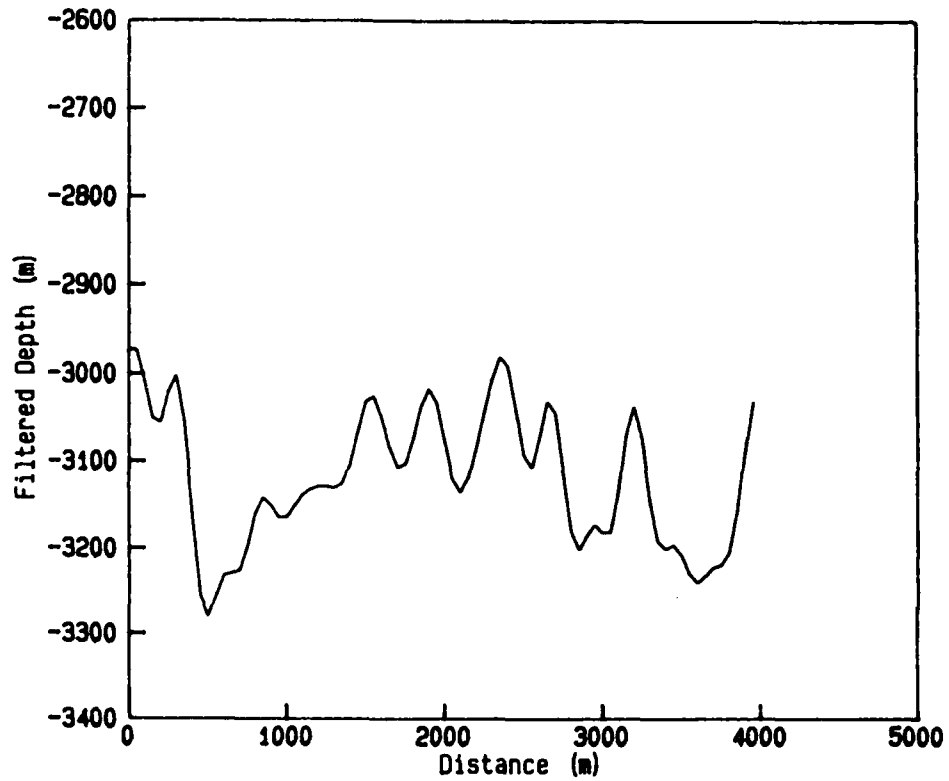
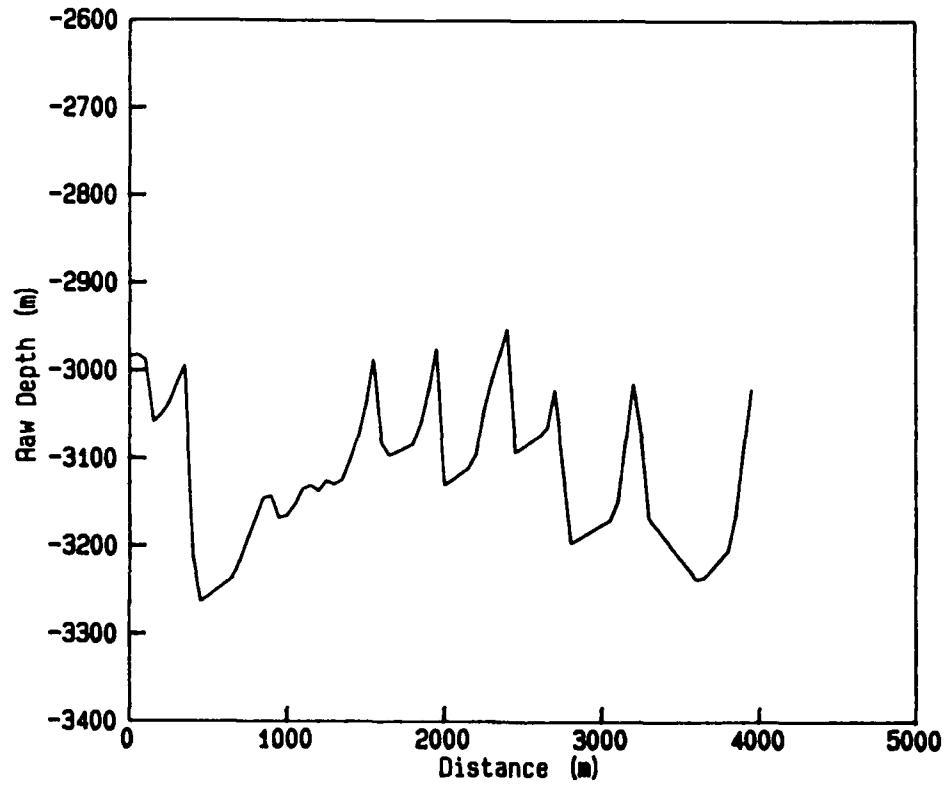


Fig 1



PORT SIDE 0 KM FROM TOP OF SWATH  
250 m WAVELENGTH CUTOFF

Fig 2