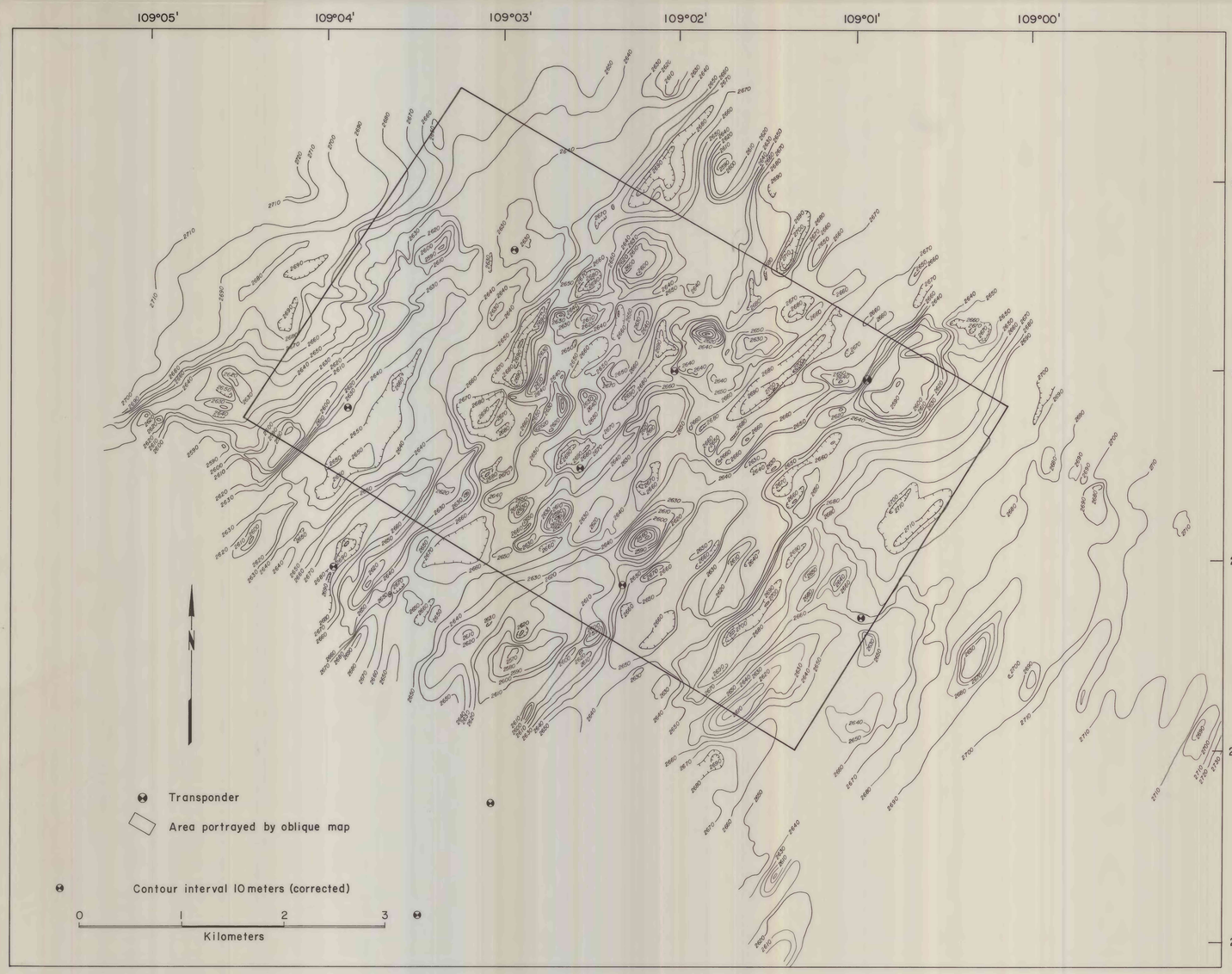

Figure 2 Planimetric map

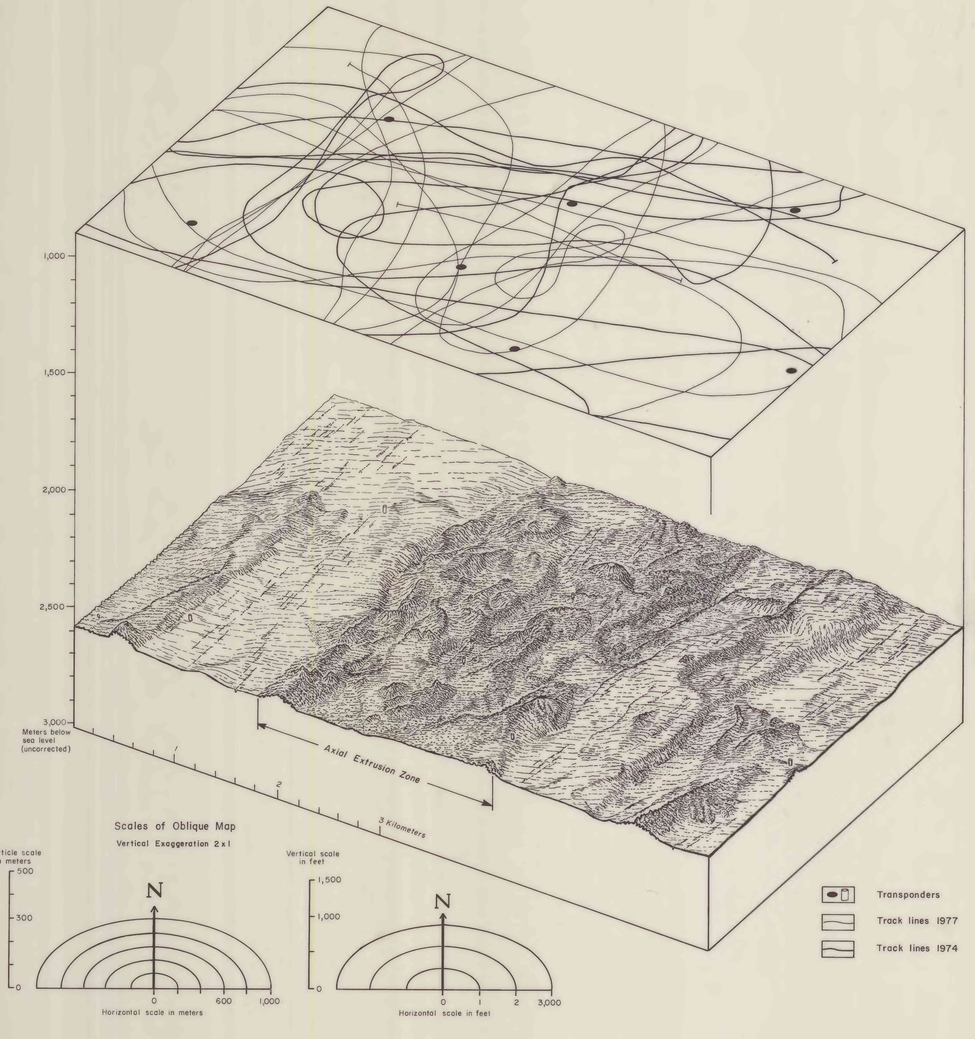

Figure 3 Oblique map

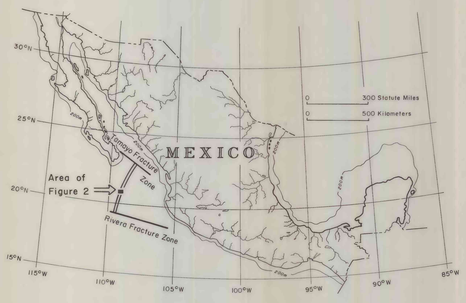

Figure 1 Index map

The East Pacific Rise north of the Rivera fracture zone (20° N Lat.) is a broad topographic swell 500 to 800 m high and 300 km wide at the mouth of the Gulf of California. The flanks of the rise bordering the crestal region have low local relief of several hundred meters associated with elongate, fault-bounded abyssal hills and less common isolated small seamounts (Larson, 1971, 1972). This segment of the East Pacific Rise is a medium-rate (6 cm/yr) spreading center. It has neither a prominent axial rift valley, typical of slow-spreading ridges, nor an axial horst, typical of fast-spreading rises. It initially formed when the Baja California peninsula rifted away from the mainland of Mexico about five million years ago (Larson, 1972; Normark, 1976), and the rate of separation across the spreading center has remained relatively constant to the present at 62 mm/yr (Larson et al., 1968; Klitgord et al., 1972). The crestal area of the East Pacific Rise near 21° N Lat. (Fig. 1) has been examined in detail using deeply-towed geophysical instruments. The crest is relatively free of sediment (<3m) with extensive outcrops of basaltic pillow lavas (Larson, 1971; Normark, 1976; Moore et al., 1977). Local topographic relief, of both volcanic and structural origin, is generally less than 100 m at the crest (Fig. 2).

The planimetric contours of the rise crest (Fig. 2) are based on narrow-beam, precision-navigated echo-sounding data obtained with the deep-tow instrument package of the Marine Physical Laboratory of Scripps Institution of Oceanography (Spiess et al., 1976). The area was surveyed during two expeditions conducted by the Marine Physical Laboratory; COCOTOW IA in September, 1974, and FRANCIS DRAKE VI in June, 1977. Both expeditions were conducted on vessels operated by the Scripps Institution of Oceanography and were financed by the National Science Foundation.

The bathymetric data for the planimetric map (Fig. 2) were obtained from the track line coverage shown on the oblique map projected at the 914 m (500 fm) depth in Figure 3. For much of the survey, the deep-tow observations were made within 50 m of the sea floor. The deep-tow positions for the surveys are based on 2800 acoustic transponder positions with an average error between 10 and 20 m. There were no common transponders between the 1974 and 1977 surveys, so the two data sets were positioned with respect to each other by matching common sea-floor features observed on photographs and side-scanning sonar records during both surveys. The planimetric map was prepared using a Mercator map projection and the soundings were converted to corrected meters using the sound velocity relation derived by Larson (1971). The construction of the oblique map utilizes an isometrograph (Dufour, 1917; Alpha and Winter, 1971), which allows the contours from the planimetric map to be foreshortened by a constant angle of 30° from the horizon (a parallel perspective), while expanding the contour interval to a vertical exaggeration of two to one (2:1). This framework of expanded contours on which the oblique map is based has the property of a constant scale throughout along any azimuth. The surface texture is based on side-scan sonar and over 6,000 bottom photographs and attempts to differentiate between hard, resistant, extrusive volcanic rock and partly mud-covered volcanic terrain in low relief areas. Open cracks are shown by fine lines; most linear scarps are believed to be fault scarps.

REFERENCES

Alpha, T. R. and Winter, R. E., 1971, Quantitative Physiographic Method of Landform Portrayal: The Canadian Cartographer, v. 8, no. 2, p. 126-136.

Dufour, P. T., 1917, Les perspectives - reliefs. Revue de Geographie, v. 8, no. 4, Librairie, Delagrave, Paris, 38 p.

Klitgord, K. D., Hudie, J. D., and Normark, W. R., 1972, Magnetic Lineations Observed Near the Ocean Floor and Possible Implications on the Geomagnetic Chronology of the Gilbert Epoch: Geophys. J. R. astr. Soc., v. 28, p. 35-48.

Larson, R. L., 1971, Near-Bottom Geologic Studies of the East Pacific Rise Crest: Geol. Soc. Amer. Bull., v. 82, p. 823-842.

Larson, R. L., 1972, Bathymetry, Magnetic Anomalies, and Plate Tectonic History of the Mouth of the Gulf of California: Geol. Soc. Amer. Bull., v. 83, p. 3345-3360.

Larson, R. L., Menard, H. W., and Smith, S. M., 1968, Gulf of California: A Result of Ocean-Floor Spreading and Transform Faulting: Science, v. 161, p. 781-784.

Moore, J. G., Normark, W. R., Hess, G. R., and Meyer, C. E., 1977, Petrology of Basalt from the East Pacific Rise near 21° North Latitude: Jour. Res. U.S. Geol. Surv., v. 5, no. 6, p. 753-759.

Normark, W. R., 1976, Delineation of the Main Extrusion Zone of the East Pacific Rise at Lat. 21°N: Geology, v. 4, p. 681-685.

Spiess, F. N., Lowenstein, C. D., Boegeman, D. E., and Madie, J. D., 1976, Fine-Scale Mapping near the Deep-Sea Floor: Proceedings Oceans '76 MTS-IEEE Annual Meeting, p. 8A1-8A9.

Map showing the crest of the East Pacific Rise near the mouth of the Gulf of California

by

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