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PALEOCEANOGRAPHIC MAPPING PROJECT
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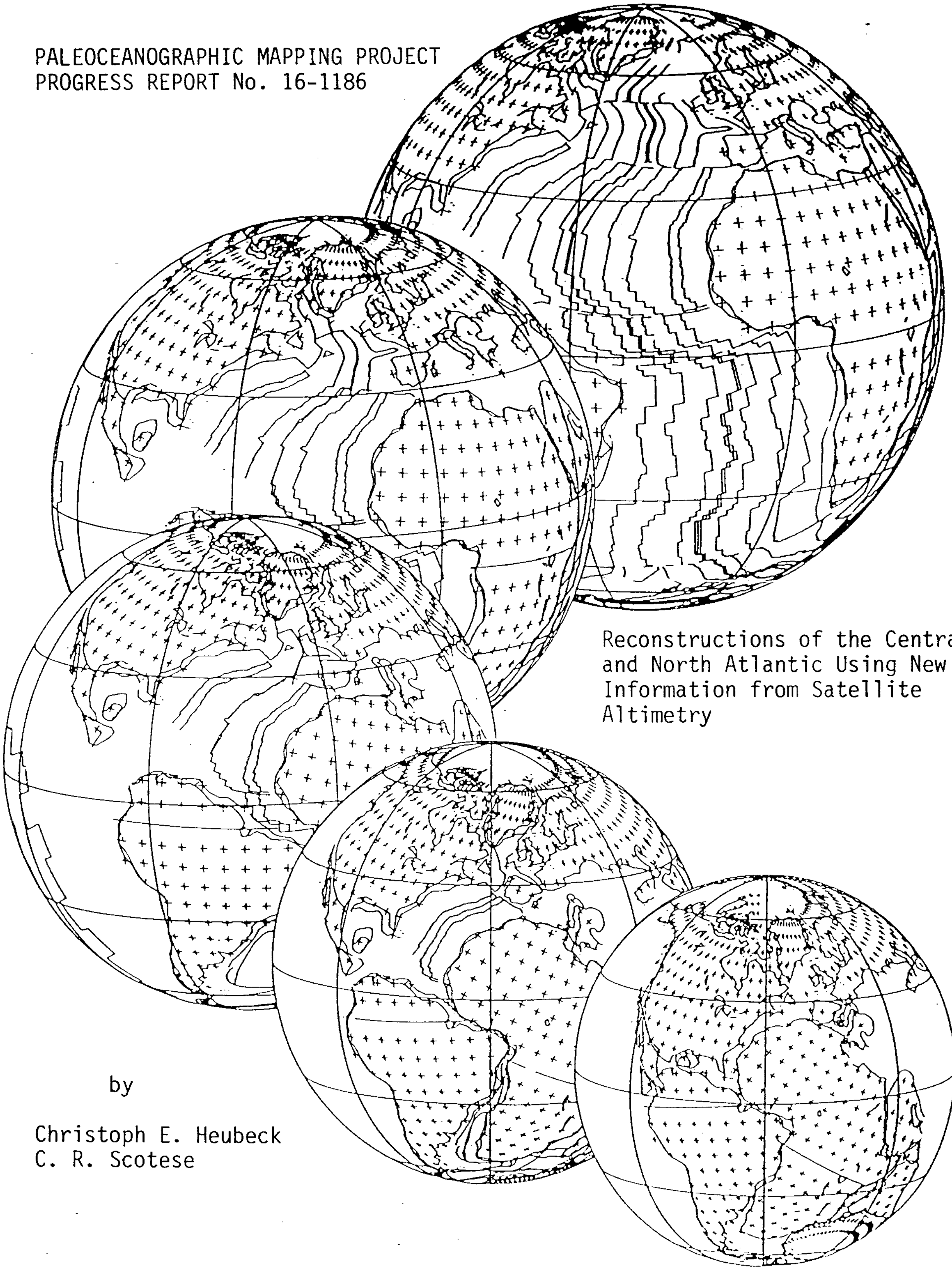

Reconstructions of the Central and North Atlantic Using New Information from Satellite Altimetry

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Central and North Atlantic

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This series of maps illustrates the tectonic evolution of the Central and North Atlantic for anomaly times A13, A25, A34, M16, and M25 (Figures 1-11). In addition to modeling the relative motions of the five major blocks of continental lithosphere (Europe, Greenland, North America, Africa, Iberia) an attempt was made to reconstruct the tectonic evolution of more complex areas such as northwest Africa, the western Mediterranean, the Norwegian Sea, and the Caribbean.

A precise description of the evolution of the North and Central Atlantic through time is crucial for the following reasons:

- The motions of Europe with respect to Africa constrain the tectonic evolution of the Mediterranean Sea and give clues to the reconstruction of the Tethys.
- The motions of the blocks bordering the North Atlantic provide the framework for the evolution of the Arctic.
- The relative motions of North America to Africa, combined with the relative motion of Africa to South America, provide the framework for the evolution of the Caribbean.

The magnetic anomalies in the Central Atlantic are from Klitgord and Schouten (1986); data for the North Atlantic were compiled from a variety of sources (Klitgord & Schouten 1986, Nunns 1983, Savostin et al. 1986, Srivastava & Tapscott 1986, Unternehr 1982). Special thanks to Josie Kriest (Royal Dutch Shell) for assembling magnetic lineations in the North Atlantic, and to Dave Rowley (U of Chicago) for allowing us to use parts of his unpublished tectonic model of the North Atlantic (Rowley et al., in prep.).

Fracture zones are derived from analysis of SEASAT altimetry data (deflection of the vertical). In the Central Atlantic, these lineations are fairly distinctive and were used to estimate the precise location of the major fracture zones (Figure 6). In the North Atlantic, the lineations are less complete and coherent, and the identification of fracture zones proved to be more difficult. The lineations in the North Atlantic (Figure 1) are based on the deflection of the vertical, and are parallel to, but do not represent actual fracture zones

In the future we plan to to refine the reconstructions by accounting for movements of smaller blocks in the first stages of the opening of the Atlantic Ocean and by generating more maps for different time slices. We will reconstruct a fit of the continents, and finally intend to produce a computer-generated animation illustrating the evolution of the Atlantic Ocean.

References:

Canadian Hydrographic Service (1981), General Bathymetric Map of the Oceans (GEBCO) 1 : 10000000.

Klitgord, Kim D., & Schouten, Hans (1986), Plate Kinematics of the Central Atlantic; in: Vogt, P.E. & B.E. Tucholke, eds., The Western North Atlantic Region. - Geol Soc. America DNAG Vol. M, p. 351 - 378.

Nunns, A.G. (1983), Plate Tectonic Evolution of the Greenland - Scotia Ridge and Surrounding Regions. - in : Bott, M., S. Saxov, M. Talwani, J. Thiede, eds., Structure and Development of the Greenland - Scotia Ridge, p. 11 -30.

Savostin, Leonid A. et al. (1986), Kinematic evolution of the Tethys belt from the Atlantic Ocean to the Pamirs since the Triassic. - Tectonophysics, V. 123, p.1-35.

Srivastava, S.P., & C.R. Tapscott (1986), Plate Kinematics in the North Atlantic; in : Vogt, P. R. & b.e. Tucholke, eds., The Western North Atlantic Region. - Geol. Soc. America DNAG Vol. M, p. 379 - 404.

Unternehr, Patrick (1982), Etude structurale et cinematique de la mer de Norvege et du Groenland; Evolution du microcontinent de Jan Mayen. - Ph.D. Diss. (unpublished), Brest.

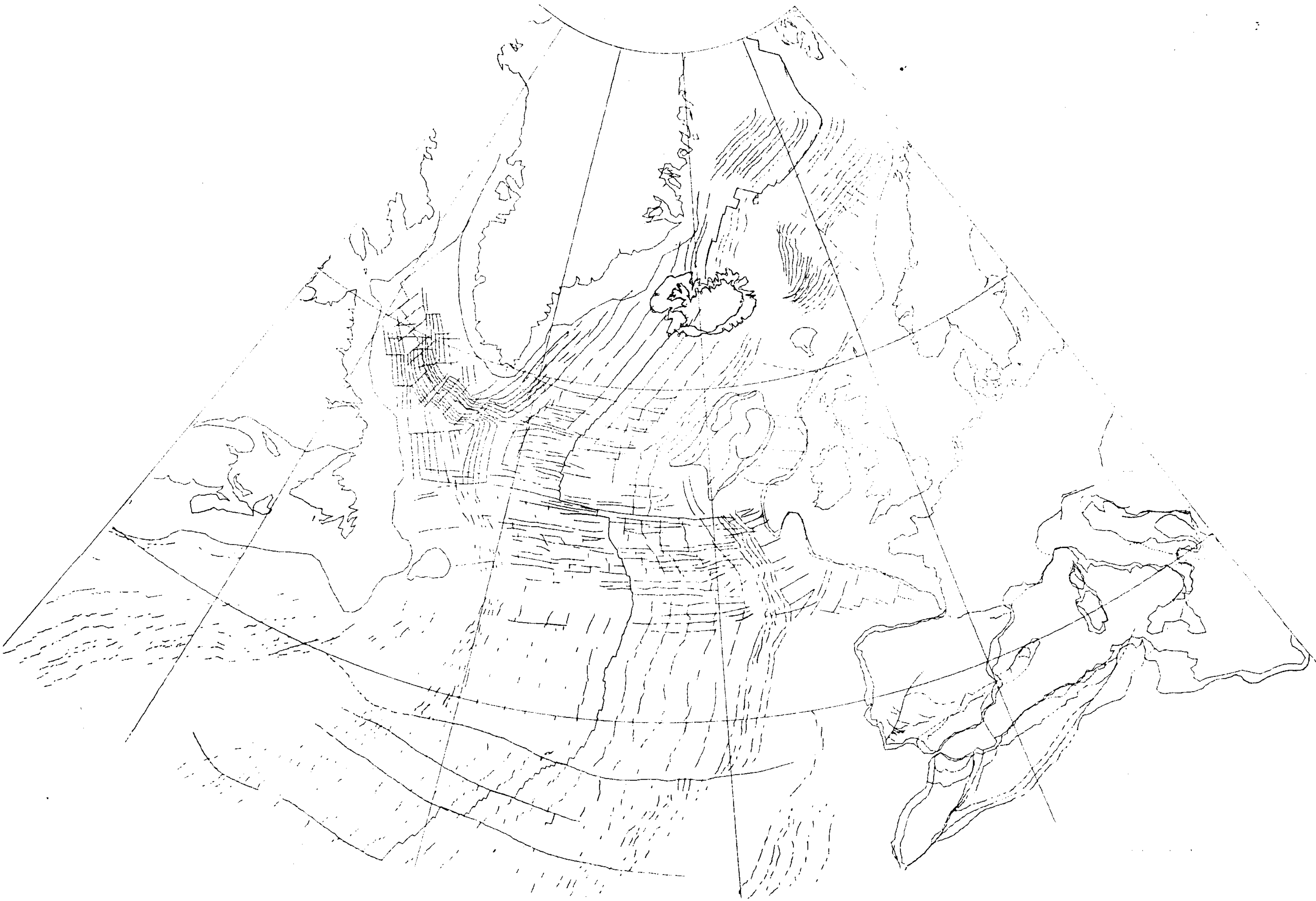

FIGURE 1. Present Day

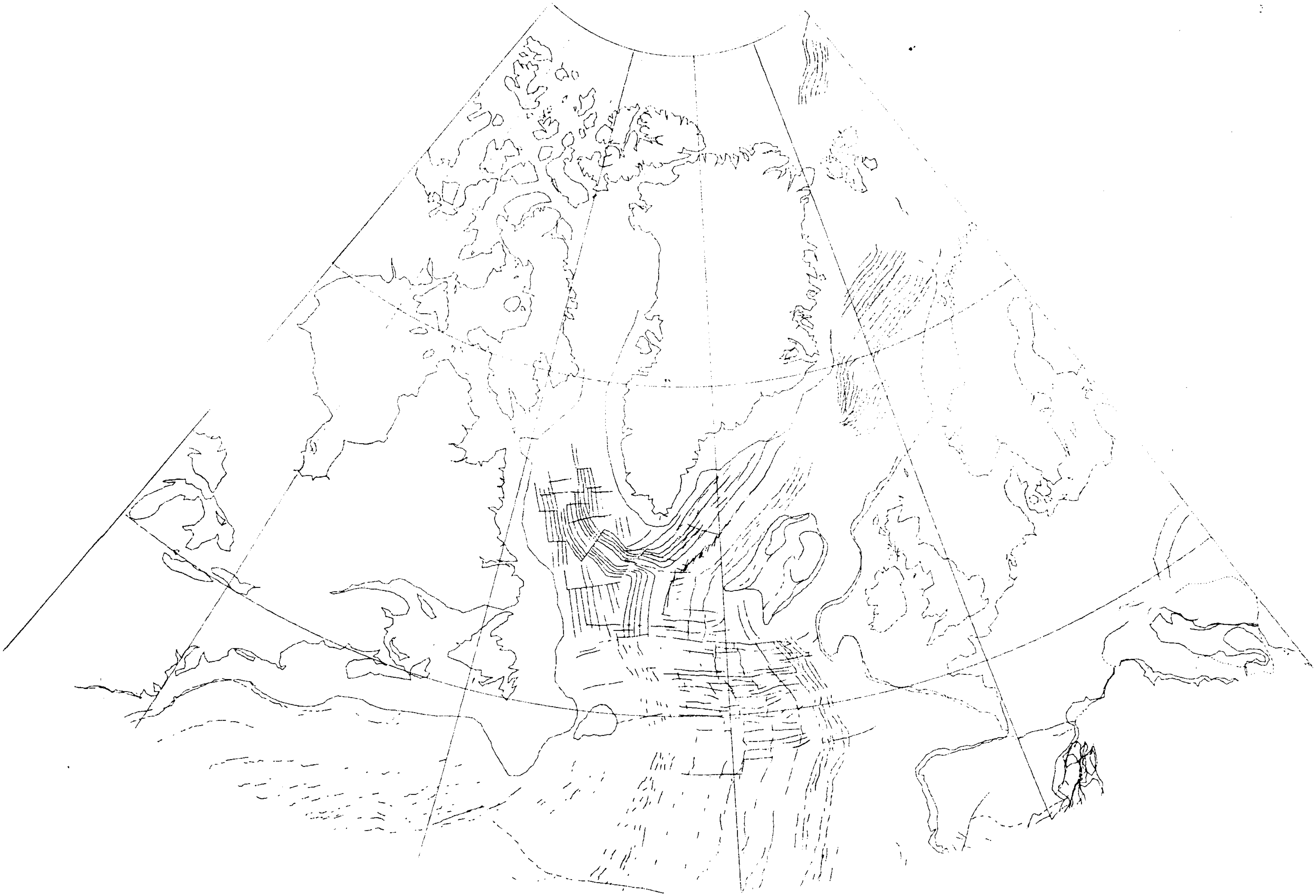

FIGURE 2. Anomaly A13, Rupelian (35.9)

FIGURE 3. Anomaly A25, Thanetian (59.2 Ma)

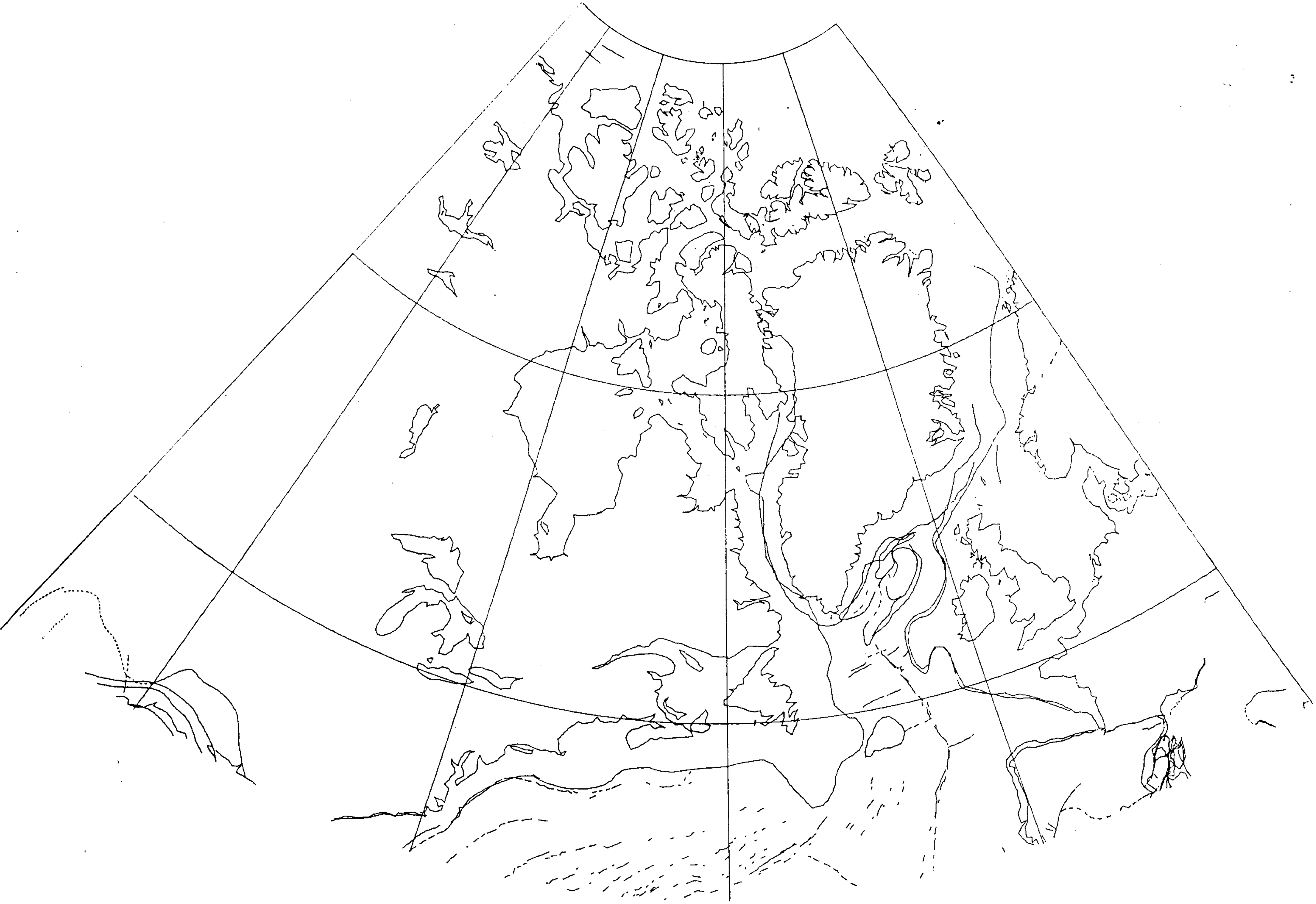

FIGURE 4. Anomaly A34, Santonian (84.0 Ma)

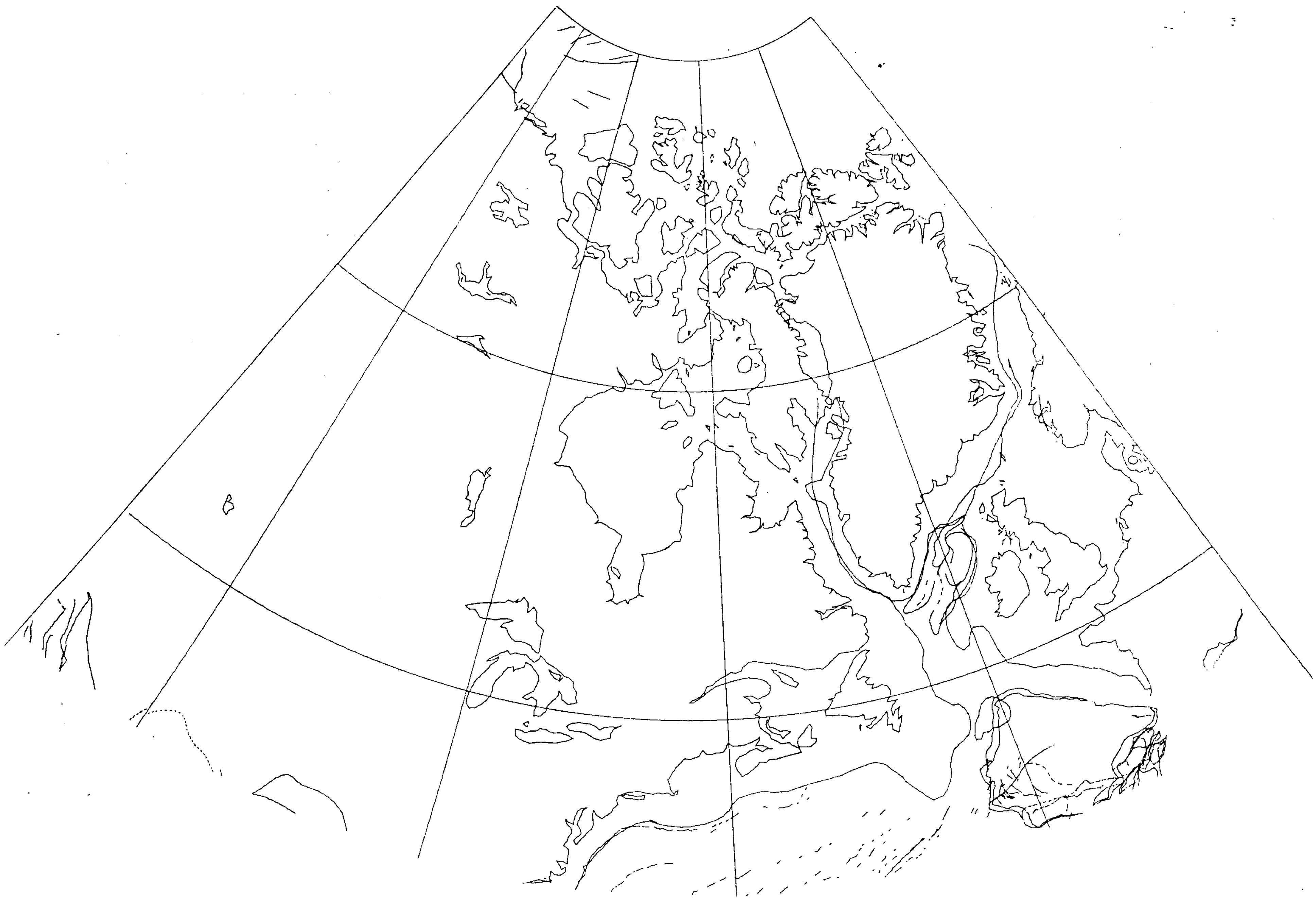

FIGURE 5. Anomaly M16, Berriasian (141.9)

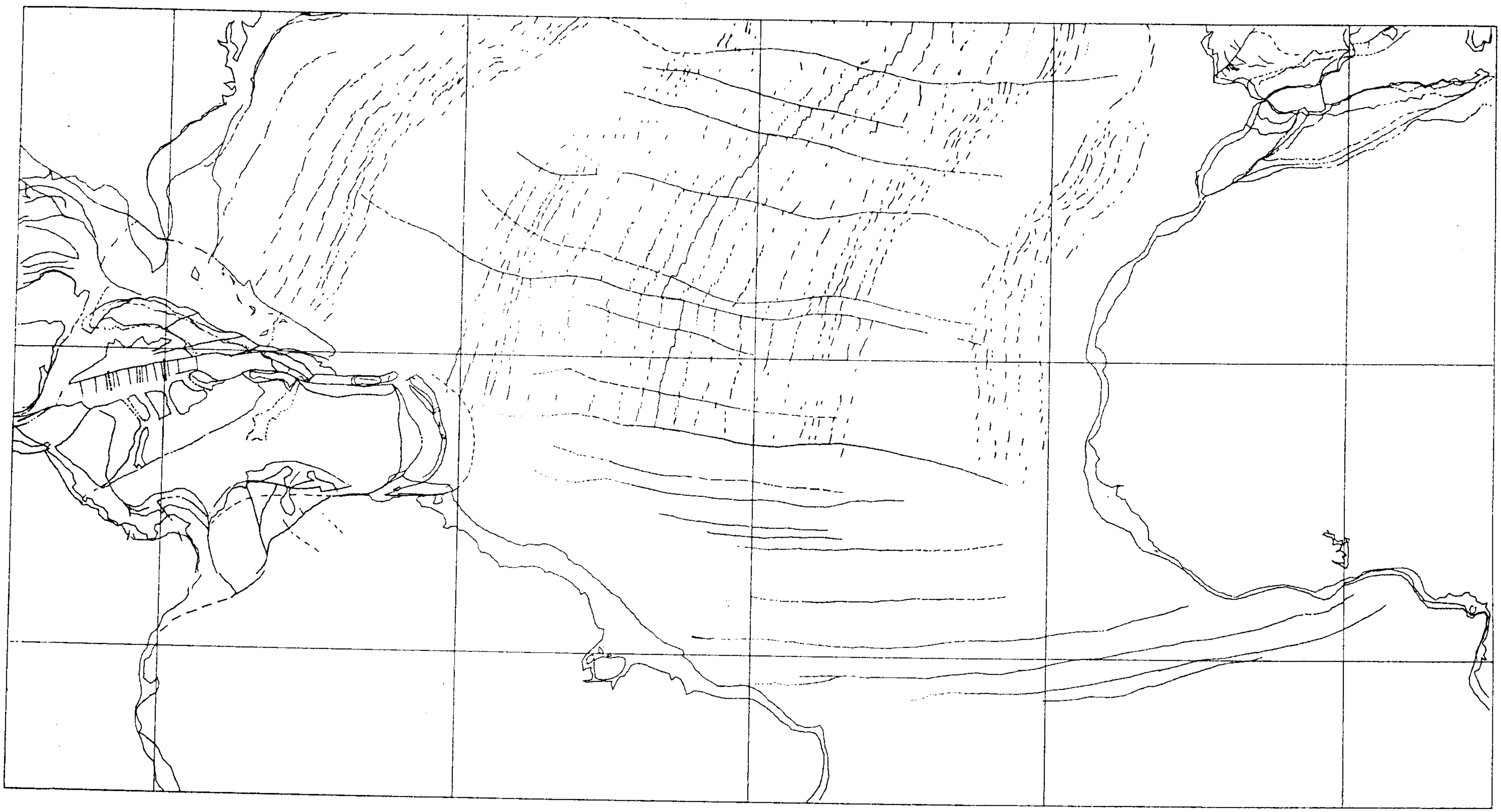

FIGURE 6. Present Day

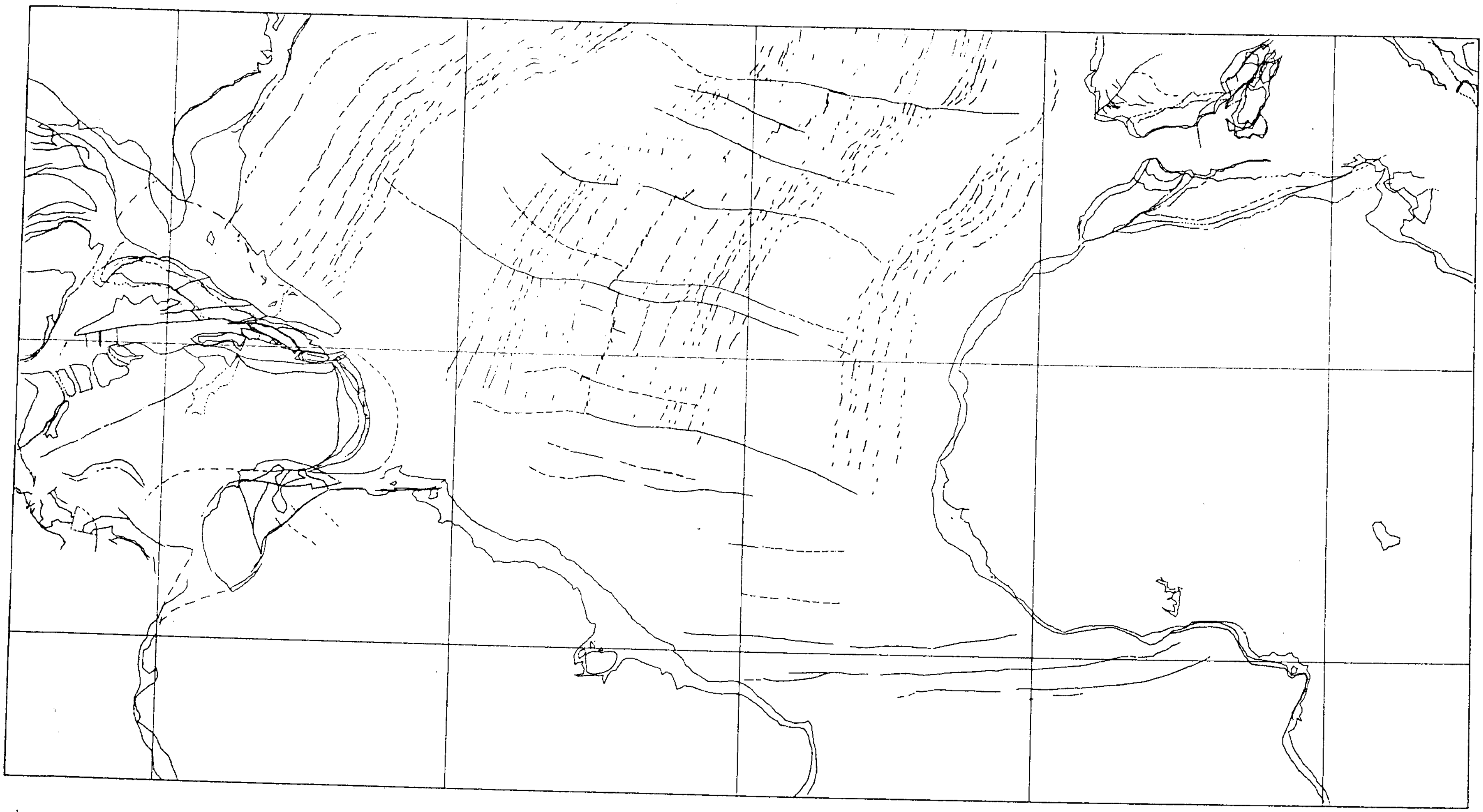

FIGURE 7. Anomaly A13, Rupelian (35.9 Ma)

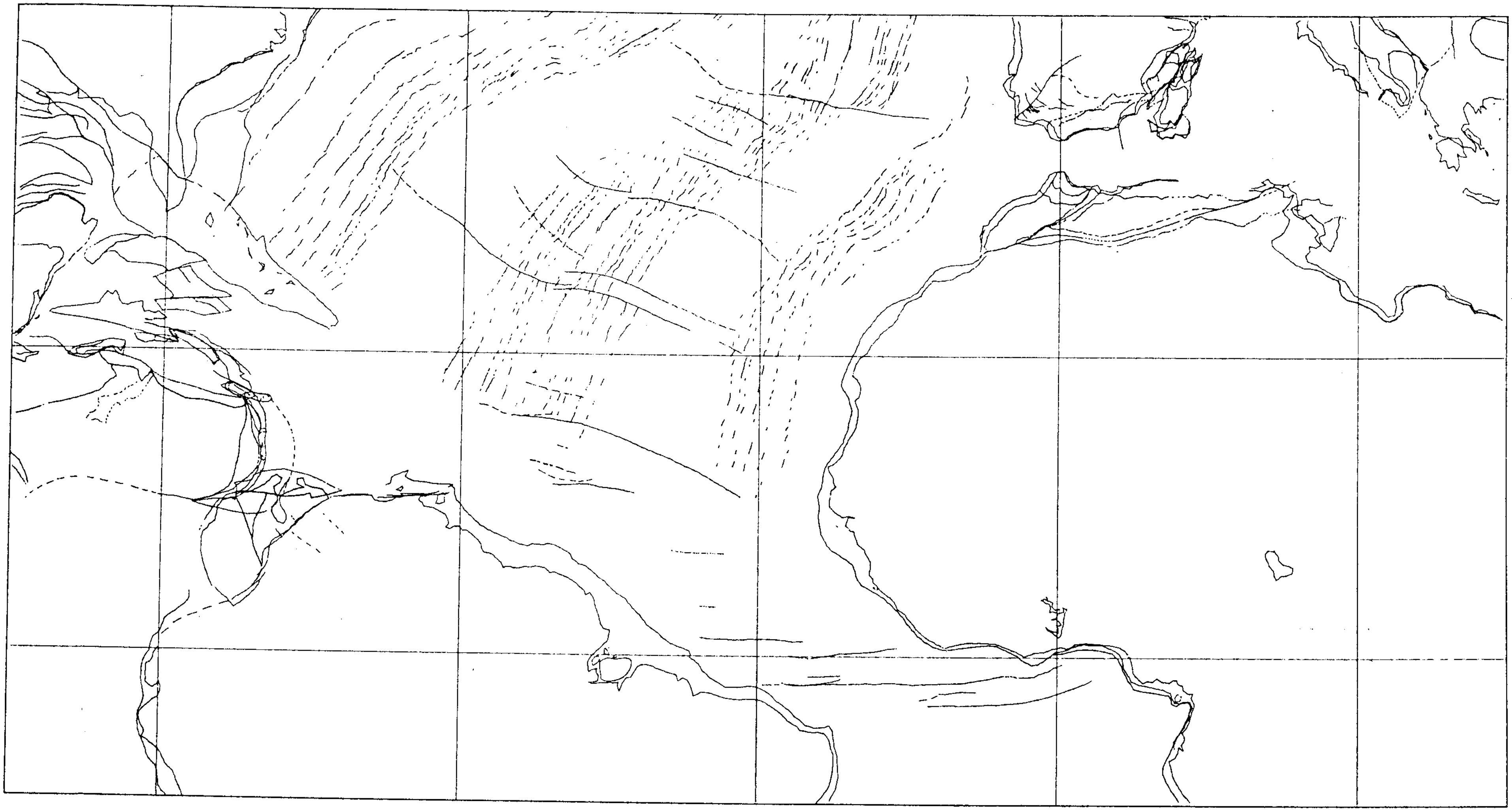

FIGURE 8. Anomaly A25, Thanetian (59.2 Ma)

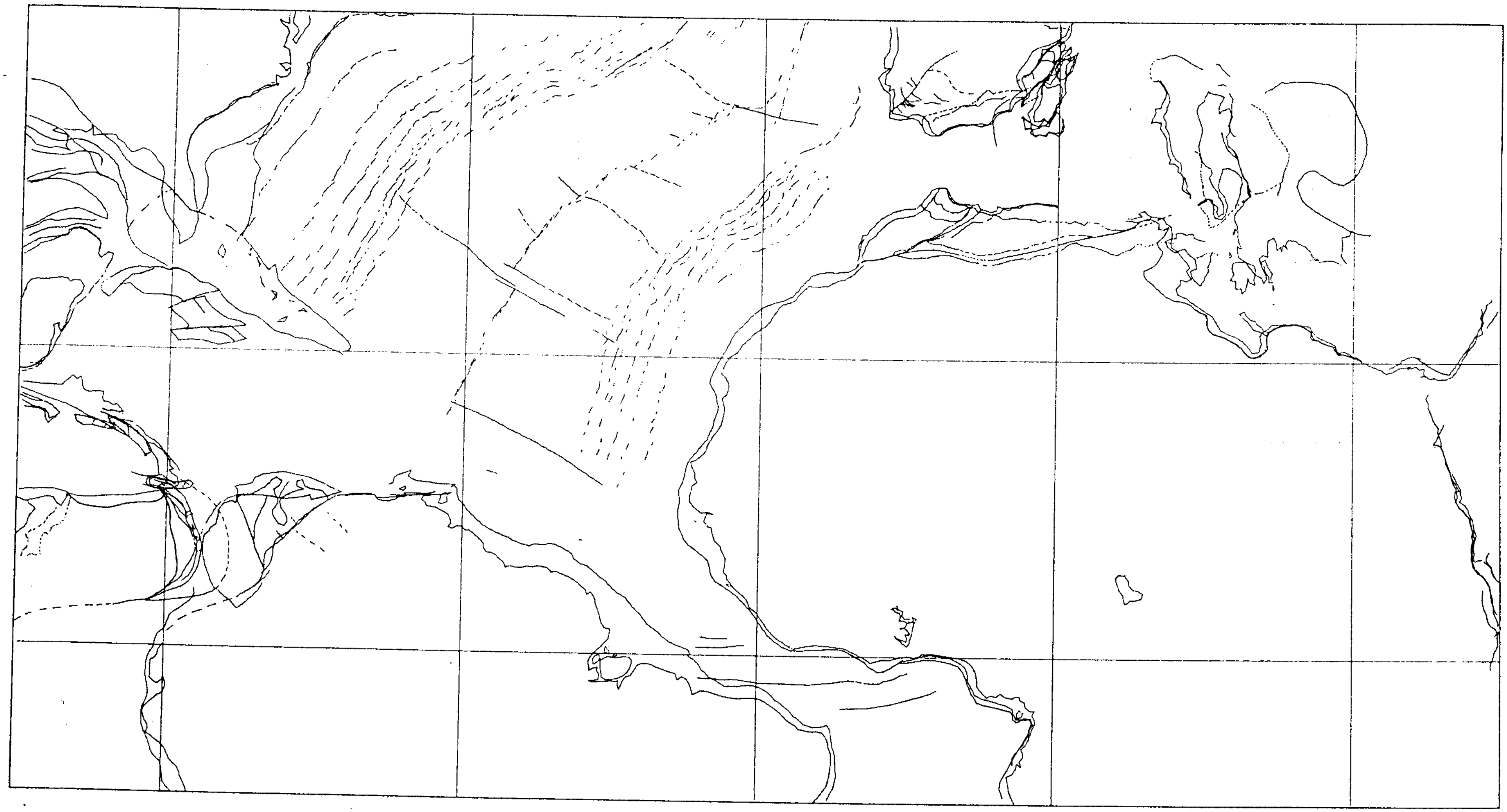

FIGURE 9. Anomaly A34, Santonian (84.0 Ma)

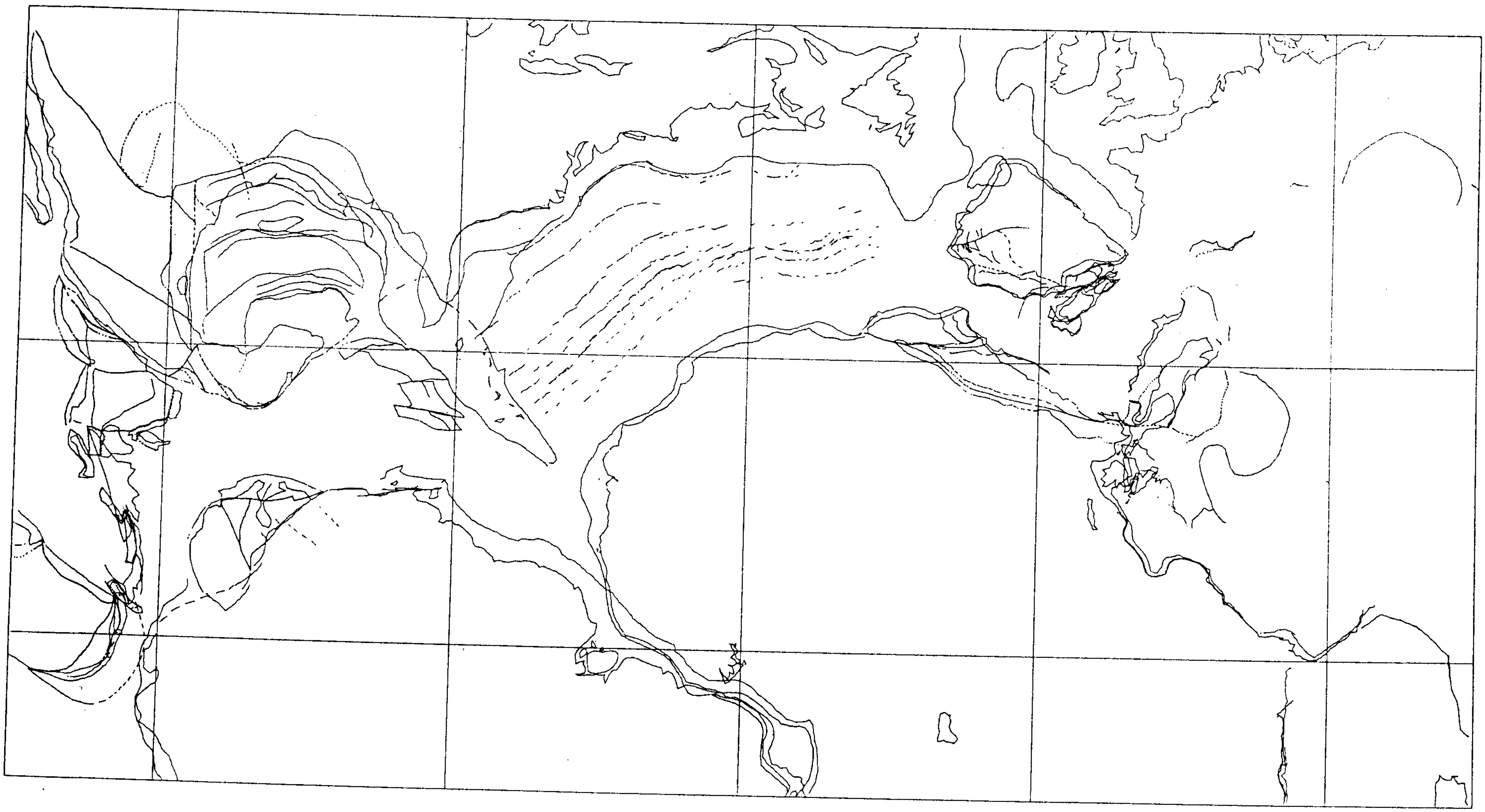

FIGURE 10. Anomaly M16, Berriasian (141.9 Ma)

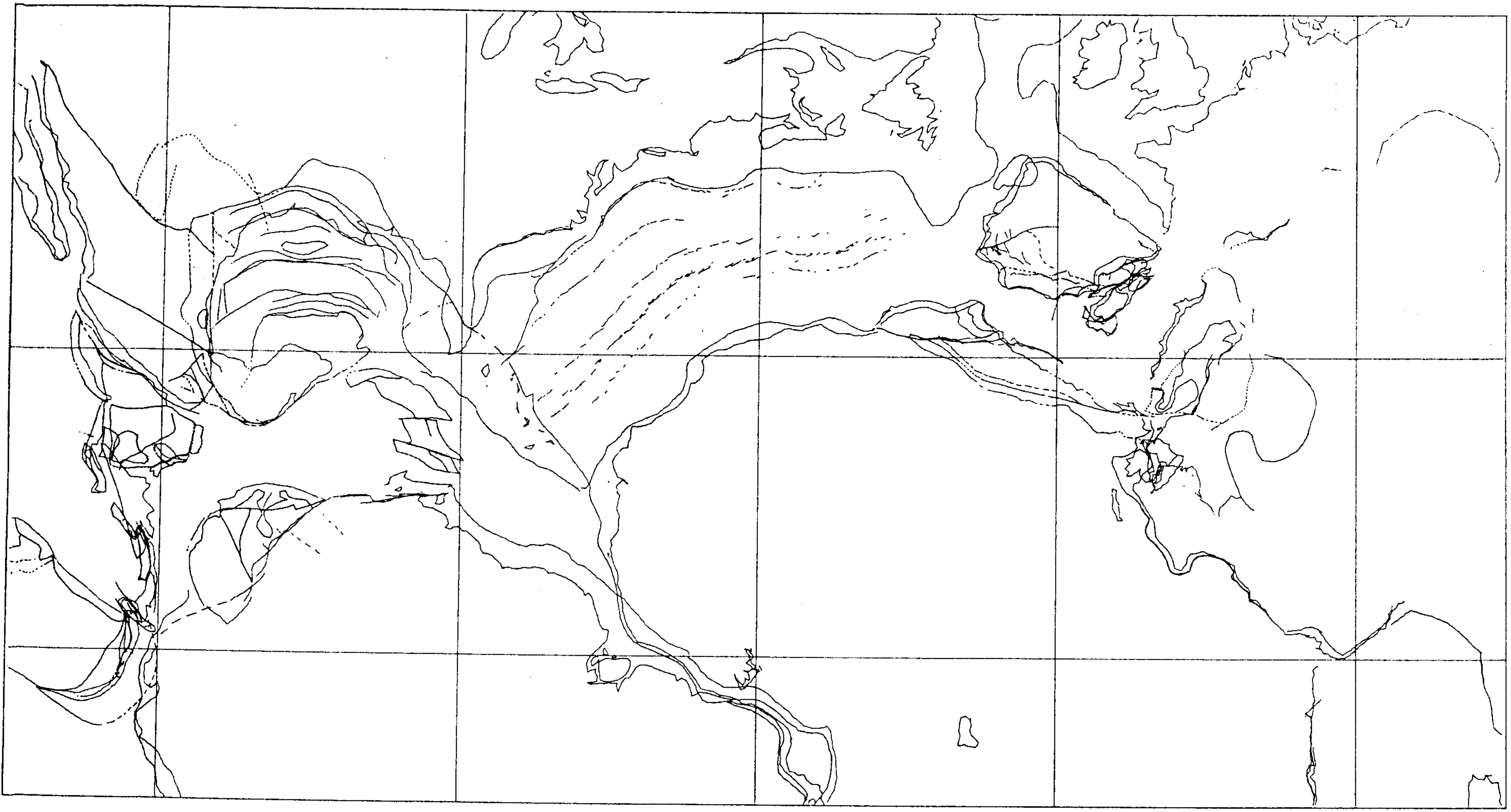

FIGURE 11. Anomaly M21, Tithonian (149.9 Ma)