fering amounts of dietary calcium on the CaBP of bone, we placed chicks on a standard rachitogenic diet (*16*) for 2 weeks, and then for 4 weeks on either a high calcium (2 percent) or a low calcium (0.1 percent) diet with 0.4 percent phosphorus. During the final 2 weeks the chicks were given 1.3 nmole of vitamin D_3 daily. At 6 weeks of age the chicks were killed, the tibias were excised and extracted, and the supernatant solutions were assayed for CaBP by radioimmunoassay as described above. Table 1 shows (experiment B) that the tibias from chicks fed a low calcium diet had approximately a fourfold greater content of CaBP (460 ng per milligram of protein) than tibias from chicks fed a high calcium diet (101 ng/mg). Serum calcium and duodenal CaBP for the chicks on these diets are also shown in Table 1. Clearly, the concentrations of CaBP in both bone and intestine adapt inversely to reflect the level of dietary calcium.

When the individual segments of tibias obtained from rachitic (− D) or D-replete chicks were analyzed for CaBP, we found that, in the − D state, CaBP was evenly distributed at a very low level (2.0 to 4.5 ng) in the cartilage plate, spongiosa, metaphysis, and diaphysis (see Fig. 1). After 1.3 nmole of vitamin D_3 was given daily for 2 weeks, the greatest concentration of CaBP was in the spongiosa (125 ng) and in the cartilage plate (83 ng) (Fig. 1).

When bone extracts were assayed at several dilutions the immunodisplacement curve was always parallel to that of pure intestinal CaBP. According to Berson and Yalow (*17*) this suggests apparent identity of immunochemical reactivity between bone and highly purified CaBP. The molecular weight of immunoreactive CaBP in bone was estimated by gel filtration on a calibrated Sephadex G-100 column (1.5 by 85 cm) equilibrated with 0.1*M* sodium phosphate buffer, *p*H 7.4. Two separate preparations of bone were homogenized (50 percent, weight to volume) in 0.1*M* phosphate buffer, *p*H 7.4, and the extracts were centrifuged at 38,000*g* for 30 minutes. Two milliliters of the supernatant solution were applied to the column and 1.2-ml fractions were collected. The concentration of CaBP in the various fractions was determined by radioimmunoassay. The peak of immunoreactive CaBP from the bone extracts consistently eluted earlier than the immunoreactive CaBP peak from duodenal extracts. The bone CaBP (Fig. 2) had an estimated molecular weight of 34,000 daltons as compared to duodenal CaBP which is 29,000 daltons on our column. [Taylor and co-workers reported a molecular weight of 28,000 for intestinal CaBP (*3*).] The different molecular weights suggest that the bone CaBP is not identical to the intestinal CaBP. Also, the calcium binding property of this protein was demonstrated through use of the Chelex ion exchange binding assay (*18*).

Neither the role of vitamin D in bone metabolism nor the function of intestinal CaBP in intestinal calcium translocation is clear. Thus the bone CaBP might be involved in any number of metabolic activities in bone including bone formation and resorption. Certainly the identification of the existence of a bone CaBP enables us to initiate new biochemical studies on the effect and mechanism of action of vitamin D and its metabolites on bone, both in normal development and in conditions of bone disease. To our knowledge this represents the first unequivocal demonstration of a vitamin D–dependent protein in bone.

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18. A modification of the Chelex ion exchange assay of Wasserman and Taylor (*1*) was used to evaluate the calcium binding properties of the putative bone CaBP. The immunoreactive peaks from the Sephadex G-100 column chromatography of bone supernatant (see Fig. 2) were pooled, dialyzed against H_2O, lyophilized, and suspended in 1.0 ml of buffer (1.0 mg of protein per milliliter). To this test sample or 1 ml of buffer, or 1 ml of buffer with bovine serum albumin at the same concentration (1 mg/ml), as well as a sample of duodenal supernatant from a +D chick, was added 0.2 ml of Chelex − 100 resin (Calbiochem) suspension (containing 0.1 ml of packed resin) followed by carrier-free ^{45}Ca (223,000 count/min). The samples were vigorously vortexed for 15 seconds and centrifuged at 1500 rev/min for 10 minutes. The ^{45}Ca in the supernatant phase in a 0.2-ml portion was determined by liquid scintillation counting. The percentage of total ^{45}Ca in the supernatant phase of the resin assay system is a measure of the CaBP in that phase. With buffer alone, 4.2 percent of the counts remained in the supernatant. With bovine serum albumin (1 mg/ml) in the buffer, 7.2 percent of the total counts remained in the supernatant; the supernatant of the sample of bone CaBP had 12.4 percent of the total added counts present and the + D duodenal supernatant had 52.8 percent. The results demonstrate that the protein present in the bone supernatant has a capability to bind calcium.
19. The work reported here was supported by PHS grant AM-09012.

21 February 1978; revised 24 May 1978

Grand Banks and J-Anomaly Ridge

Based on two lines of evidence, Gradstein *et al.* (*1*) interpreted the J-anomaly ridge in the vicinity of Deep Sea Drilling Project (DSDP) site 384, which bottomed in basalt (*2*), as having been part of the Grand Banks continental block in the Early Cretaceous. The first line of evidence is that the total subsidence of the Puffin and Tern wells on the Grand Banks is similar to that observed at site 384. The second is based on extrapolation of seismic data measured on the southern Grand Banks to the drill site locations.

In the absence of other data, these lines of evidence might imply that the magnetic J-anomaly is situated on continental crust. However, they are insufficient to dispel what is now a well-established sequence of magnetic anomalies created by sea-floor spreading processes (*3, 4*). Similarity between the subsidence at site 384 and that on the Grand Banks continental block does not necessarily imply that the DSDP site is situated on continental crust. Indeed, rather large amounts of subsidence of other aseismic ridges that are situated on oceanic crust are well documented (*5*). Furthermore, the seismic profile shown in figure 5 of Gradstein *et al.* (*1*) does not traverse site 384 but lies close to the strike of the Newfoundland Ridge. Any controversy with respect to the nature of the seaward-dipping reflectors beneath reflector C in that figure pertains, therefore, to the nature of the Newfoundland Ridge and not the J-anomaly ridge, which traverses normal to it.

The J-anomaly is a high-amplitude linear magnetic anomaly observed on both sides of the North Atlantic Ocean north of the New England Seamounts–Canary

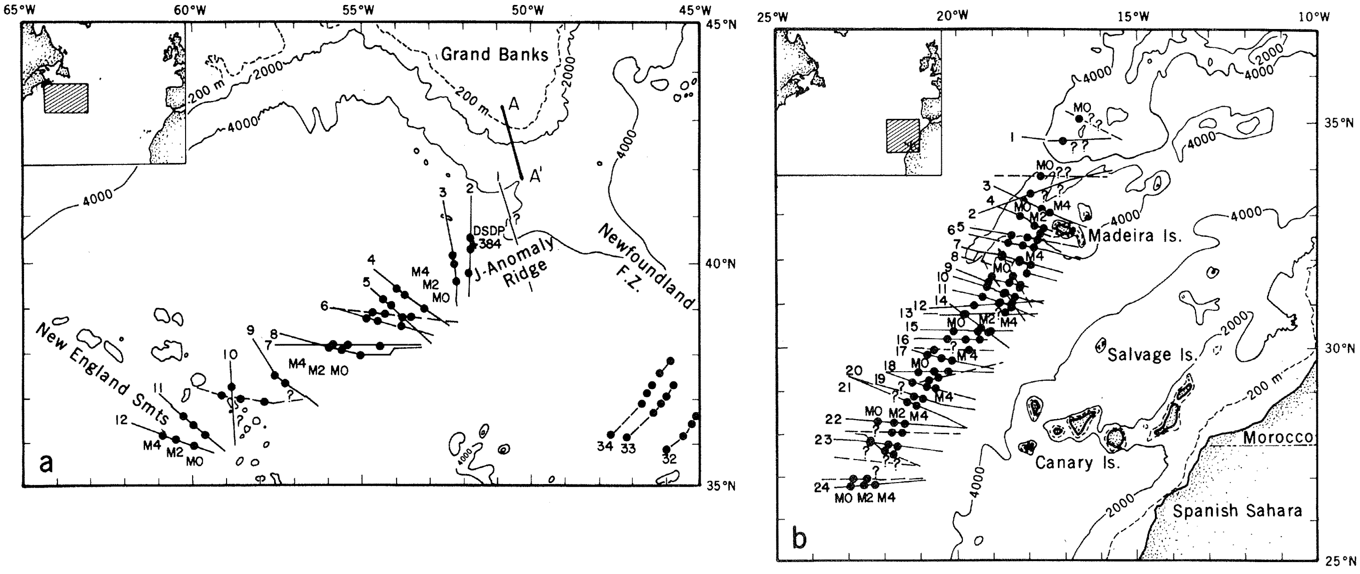
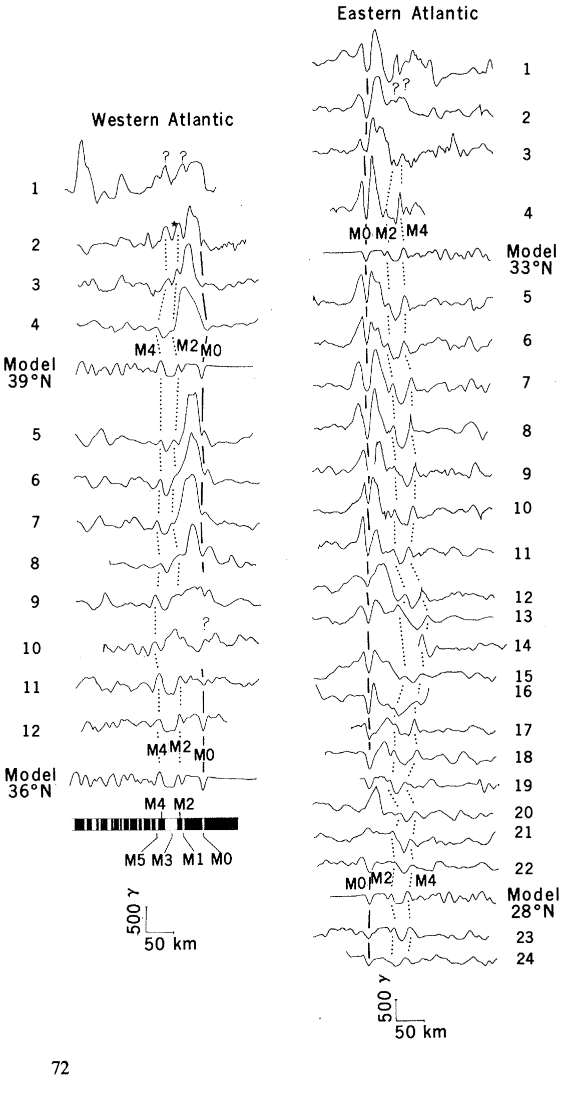


Fig. 1. (a) Location of magnetic data in the western Atlantic Ocean. (b) Location of magnetic data in eastern Atlantic Ocean. Solid lines are the profiles shown in Fig. 2. Dashed lines are additional profiles not shown here. Heavy black dots are the locations of anomalies M0, M2, and M4, identified in Fig. 2. The locations of multichannel seismic profile *A–A'* (*1*) and DSDP site 384 (*2*) are also shown.



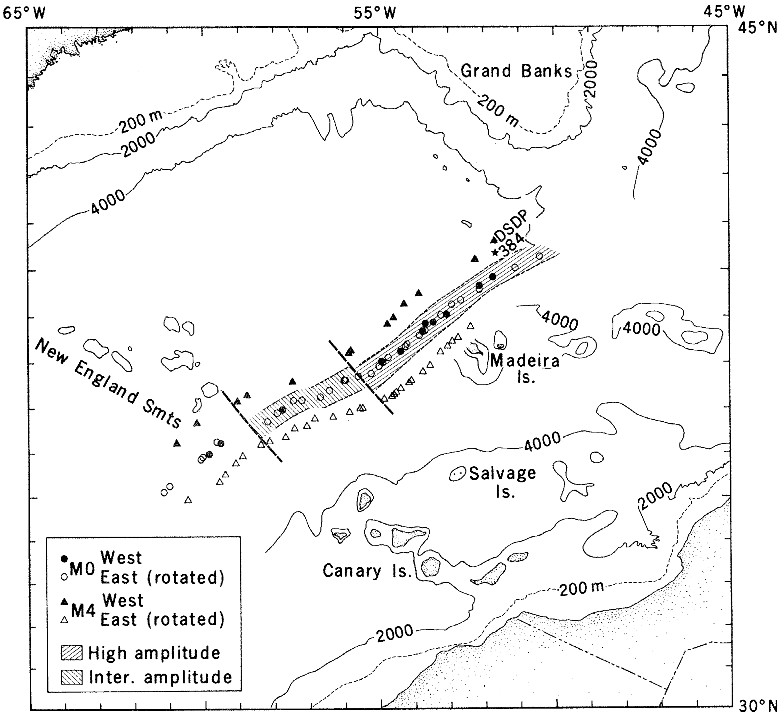


Fig. 2 (left). Total intensity magnetic anomaly profiles projected with azimuths of 140° (western) and 110° (eastern). The profiles have all been transformed to the Lower Cretaceous paleomagnetic pole (72°N, 184°E) (*8*). Identifications are shown for anomalies M0, M2, and M4. Model parameters: top of layer, 6 km; layer thickness, 0.5 km; remanent magnetization intensity, 0.01 emu/cm^3; θ, 0°; spreading rates, 0.85 cm/year in the western Atlantic and 0.80 cm/year in the eastern Atlantic, based on Mesozoic polarity reversal time scale (*9*); blocks of normal polarity are black. The star on profile 2 (western Atlantic) indicates the position of DSDP site 384. Fig. 3 (right). Reconstruction for anomaly M0 time (~ 108 million years before present). North America is kept fixed. Locations of anomalies M0 and M4 (open circles and triangles) and major bathymetric features on the African plate have been rotated by −55.0° about a pole at 65.6°N, 20.2°W (*7*). The extent of high- and intermediate-amplitude regions at M0 time is indicated by cross-hatching.

Islands lineament (Fig. 1) and can be modeled by a zone of anomalous magnetization distribution between about M0 and M1 of the Mesozoic sequence of anomalies (*4*). Total intensity residual magnetic anomaly profiles across the J-anomaly are shown transformed to the pole (*6*) in Fig. 2.

After comparing the transformed profiles from south of the New England Seamounts–Canary Islands lineament with the model profiles, we can identify the anomalies M0 to M4 as shown in Fig. 2. We can then trace these anomaly lineations northward into the region where the high-amplitude J-anomaly had been previously identified. A positive anomaly is observed over crust just younger than M0 (especially in the eastern Atlantic) and can be shown to be an artifact of the magnetization changes (or crustal structure) considered responsible for the unique character of the J-anomaly and not a manifestation of a field reversal (*4*).

We have reconstructed the North Atlantic to its configuration at M0 time, using a finite rotation obtained from well-determined M0 lineations south of the New England Seamounts and Canary Islands (*7*) (Fig. 3). The locations of the anomaly we have identified as M0 within the J-anomaly align very well in this reconstruction. This, we feel, confirms our interpretation of anomaly M0 within the J-anomaly.

The magnetic anomalies in the region of the J-anomaly fit very well the models of the Mesozoic sequence of sea-floor spreading magnetic anomalies. We believe that reconstruction to Mesozoic time, together with the deep-sea drilling results, unequivocally demonstrates that these anomalies are indeed part of the Mesozoic sequence. Consequently, we conclude that the basement beneath this region is oceanic, rather than continental as suggested by Gradstein *et al.* (*1*).

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27 January 1978

In our recent report (*1*), we noted that there is a conflict between the extrapolated results of "shelf-based" geological and geophysical studies of the area south of the Grand Banks and the conventional interpretation of magnetic anomalies in that area. We welcome the concise discussion by Rabinowitz *et al.* of the magnetic lineation in the vicinity of the J-anomaly ridge and of the mirror-image nature of the lineation on both sides of the Atlantic Ocean at latitudes 35° to 40°N. Despite these authors' conclusion regarding an oceanic origin, we think the anomalous geological and geophysical aspects of the J-anomaly ridge area are too important to be disregarded in favor of a geomagnetic model, however elegant. For example, the distinctive topographic and structural features associated with the J-anomaly (*2*) cannot be dismissed as artifacts of magnetization changes or crustal structure. Also, in defining the J-anomaly ridge as an aseismic ridge, Rabinowitz *et al.* introduce even more complexity. Detrick *et al.* (*3*) noted that all the aseismic ridges they studied appear to be aligned along fracture zones. According to conventional interpretation (*4, 5*), the Newfoundland Ridge is a fracture zone that lies normal to the trend of the J-anomaly ridge.

One of us (A.C.G.) has discussed multichannel seismic data from the area of the Newfoundland Ridge in more detail (*6*). It is now clear that before a more comprehensive geological history of the region is attempted, much more has to be learned about the physiographic relationship between the Newfoundland Ridge and the J-anomaly ridge. Further multichannel seismic investigations are needed to determine whether the apparent physiographic connection between these features reflects structural affinity as well.

There is no conventional oceanic or continental model that fits all the available geomagnetic data on the J-anomaly ridge. This is a ridge close to the shelf that (i) originated near sea level, (ii) subsided about as much as the adjacent shelf, (iii) appears physiographically to be connected with the Newfoundland Ridge, which shows "intrabasement" reflectors reminiscent of sedimentary stratification, (iv) has a strong positive magnetic anomaly that may be due to the as yet unknown crustal structure, and (v) as far as known aligns with the documented magnetic lineation in the area.

We hope debate on this juxtaposition of oceanic and continental features will prompt further investigation.

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18 July 1978