A BATHYMETRIC AND GEOMAGNETIC SURVEY OF THE NEW ENGLAND SEAMOUNT CHAIN

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Mr. CARTER is a graduate of the University of Cincinnati where he obtained a B. S. in geology in 1958. He was employed at the Army Map Service until entering the Oceanographic Office in 1960. As a geologist in the Bathymetric Section he has participated in a number of hydrographic surveys.

Introduction

During June, July, and August of 1962, the U. S. Naval Oceanographic Office assigned a survey ship, the *USS Sheldrake AGS-19*, to conduct a systematic bathymetric and geomagnetic survey of the New England Seamount Chain. The location of the surveyed areas is shown in figure 1. Four of the six tracks which were run between these areas and the mainland also are shown in figure 1. Data records were processed aboard ship and the information was later plotted and contoured at the Oceanographic Office.

Description of Features, Area One

Included in Area One (figure 2) are six distinct seamounts rising abruptly from the abyssal plain of the North American Basin. In general, the individual seamounts in Area One all have smooth-topped elongated peaks and uniform slopes. The Total Magnetic Intensity anomalies (figure 3) show the close correlation that would be expected over features of volcanic origin.

The most striking observation is the apparent deviation of the trend of San Pablo and Manning seamounts (figure 3) from the northwest-southeast trend of the entire New England Seamount Province. The presence of a previously unconfirmed seamount was established while surveying Area One. It is situated at 38° 25′ N and 62° 11′ W and tentatively

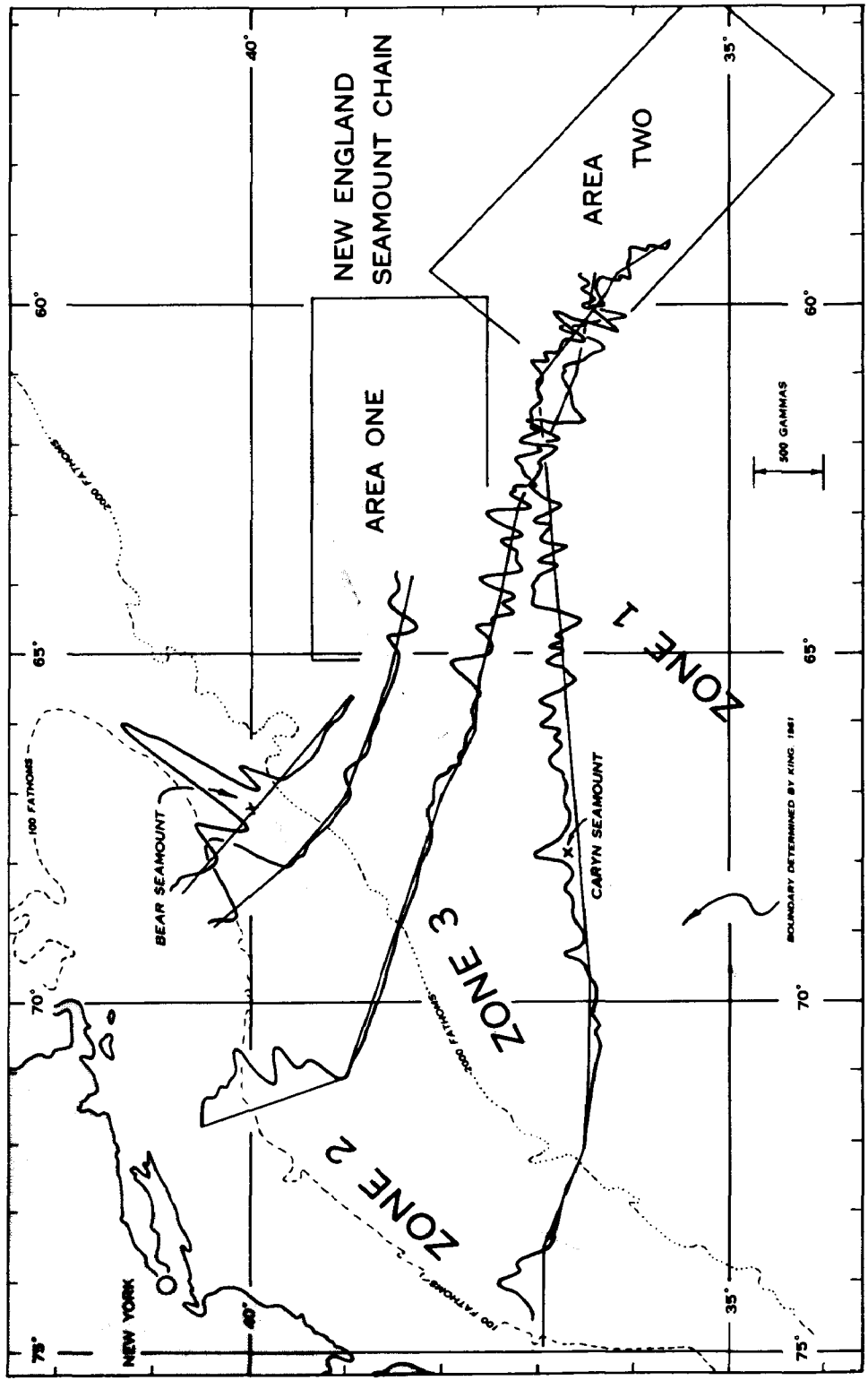

FIG. 1. — Location Chart — New England Seamount Chain Survey.
Magnetic profiles are shown along ships' tracks to and from the survey areas.
Zones indicate areas of differing magnetic character.

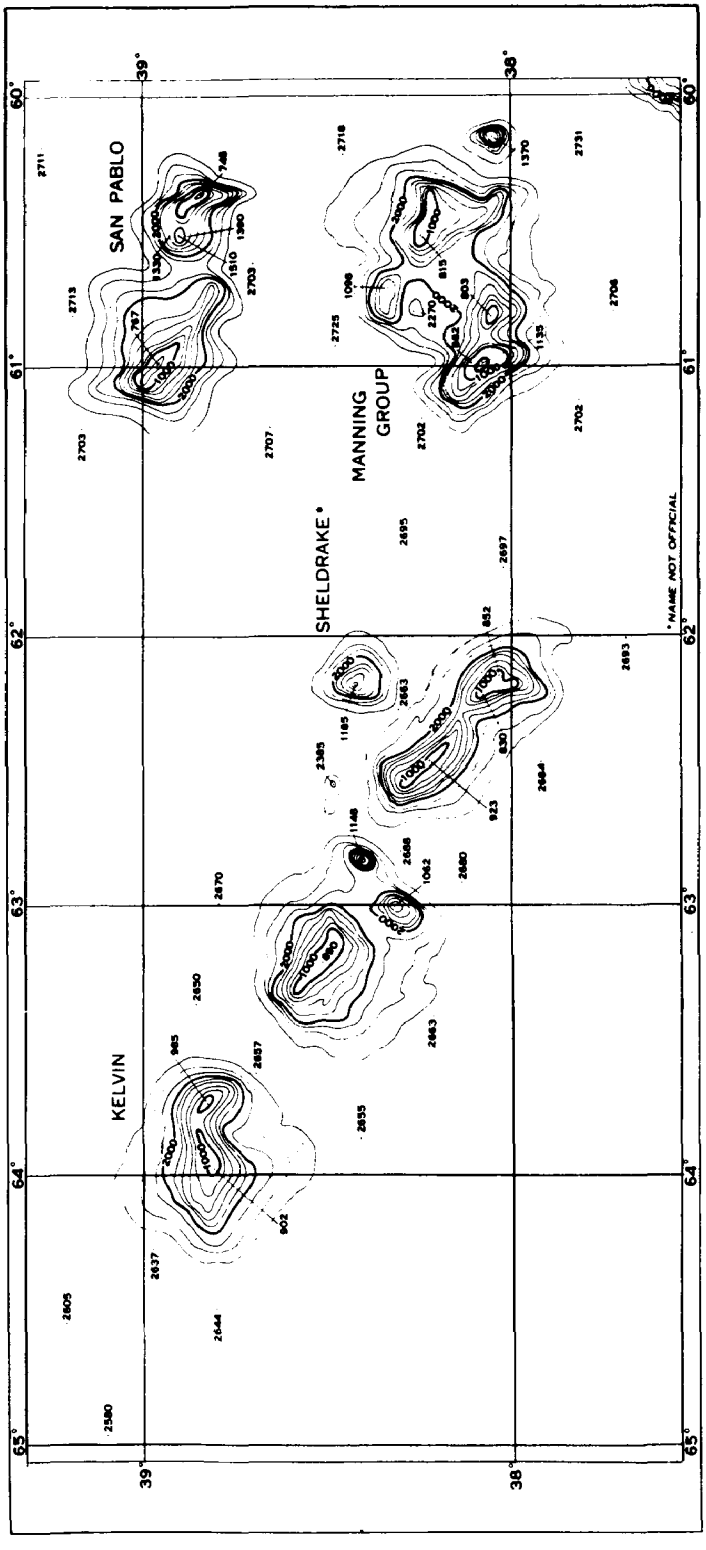

FIG. 2. — Bathymetric Contour Chart New England Seamount Chain, Area One.
Contour interval : 200 fathoms.

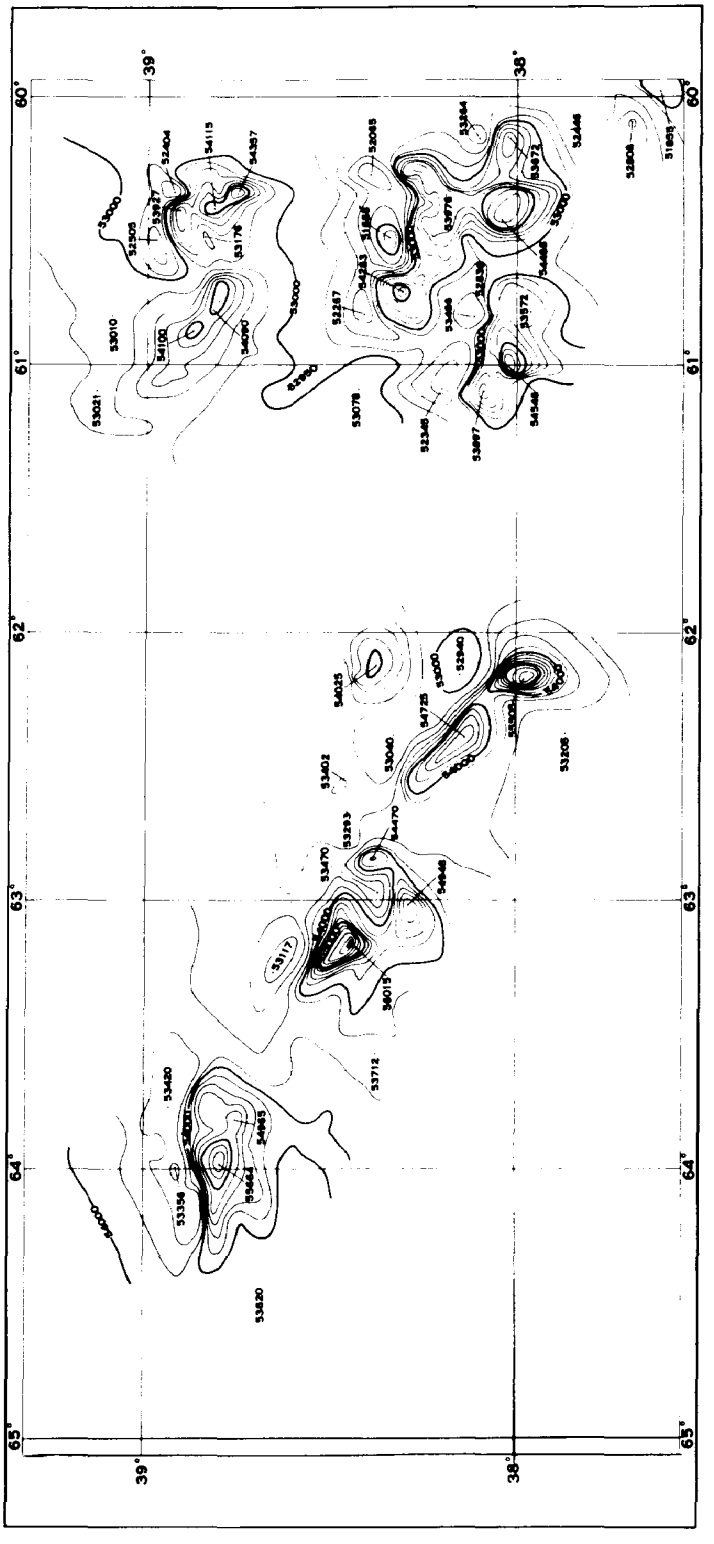

Fig. 3. — Total Magnetic Intensity
Contour Chart New England Seamount Chain, Area One.
Contour interval : 200 gammas.

has been assigned the name *Sheldrake Seamount.* It is clear that Kelvin Seamount and the seamounts at 38° 30′ N, 63° 10′ W and 38° 10′ N, 62° 20′ W are individual features separated by abyssal depths. This observation differs from the notion that the three seamounts form a *Tri-peaked Bank* as indicated by NORTHROP, 1962, and PRATT, 1962.

Description of Features, Area Two

The seamounts in Area Two (figure 4), with the exception of Rehoboth Seamount, generally have less relief than those in Area One. Also the NW-SE axial trend becomes less pronounced in Area Two. The most significant feature in Area Two is the massive Nashville *seamount.* More appropriately, it should be termed a *ridge* as its long axis extends virtually unbroken for 75 nautical miles, and its average width is 10 nautical miles. The abyssal plain in Area Two grades gently from 2700+ fathoms in the northwest to over 2 900 fathoms in the southeast.

The total magnetic intensity anomalies in Area Two (figure 5) are correspondingly less intense (with the exception of the Rehoboth Seamount anomaly) but still show close correlation with the bottom features.

Enroute Profile Data

Geomagnetic data are superimposed on the ship's enroute tracks in figure 1 to show the three zones of differing magnetic character of the earth's crust. These zones were first described by KING, 1961. Zone 1, *The Bermuda High,* is characterized by closely spaced anomalies of rather uniform size. Zone 2 includes the broad anomalies of variable amplitude which are characteristic of the continental shelf. Zone 3, lying between the first two zones, is characterized by relatively smooth profiles. Exceptions to the smooth nature of the magnetic field in Zone 3 are the anomalies associated with Caryn and Bear Seamounts.

Conduct of Survey

The survey covered and area of more than 30 000 square nautical miles, much of which has never before been included in a planned survey. The *Sheldrake* ran lines perpendicular to the axial trend of the seamounts at a spacing of approximately five nautical miles using Loran-A for navigational control. Continuous total magnetic intensity and sounding data were recorded throughout the survey.

Loran coverage was good except for the 1H1 rate which plotted consistently 2-5 miles west of the other stations. Fixes were taken at half-hour intervals throughout the survey during periods of good Loran reception. Between sunset and sunrise extreme difficulty was encountered in Loran reception because of local weather conditions and the presence of numerous sky waves. During periods of poor Loran reception, tracks were continued by dead reckoning methods, but holding course was

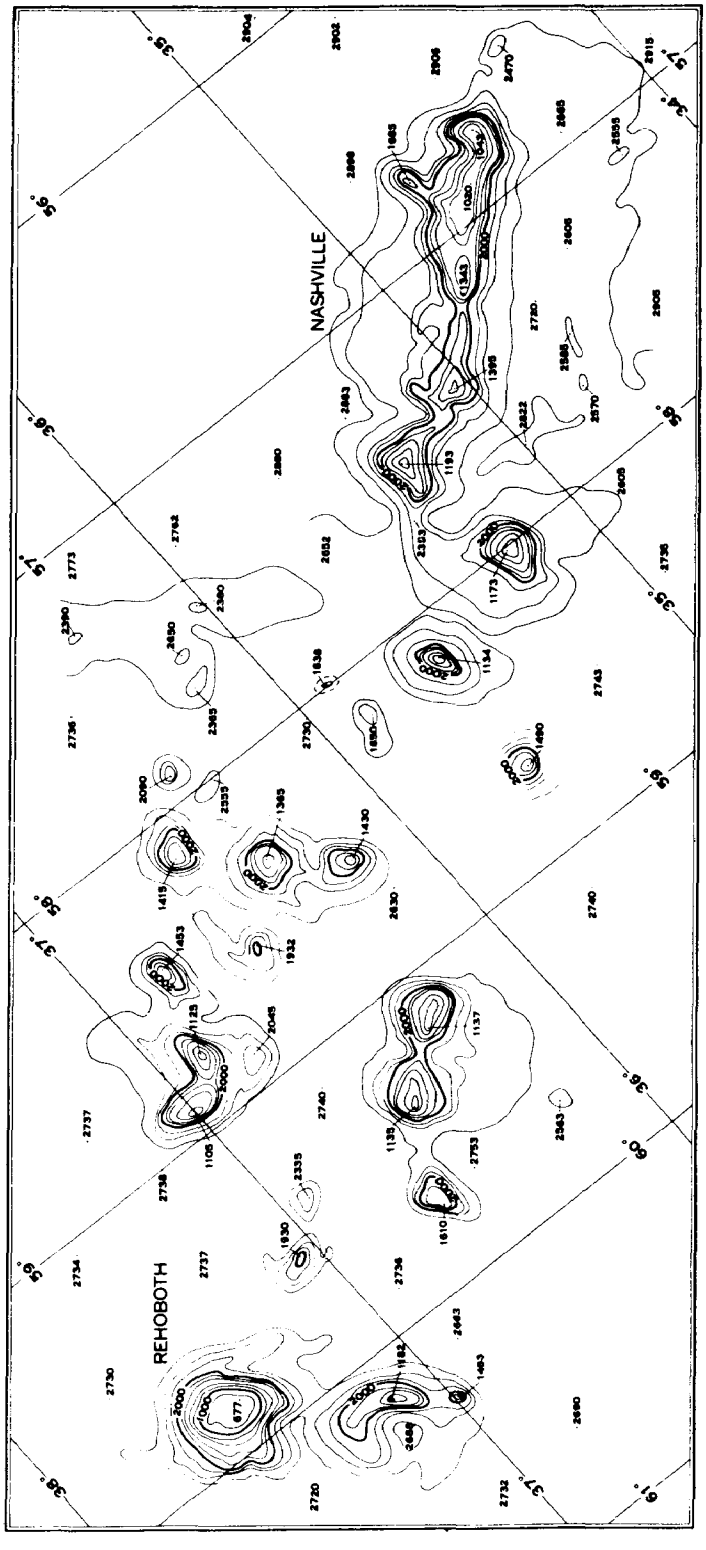

FIG. 4. — Bathymetric Contour Chart New England Seamount Chain, Area Two.
Contour interval : 200 fathoms.

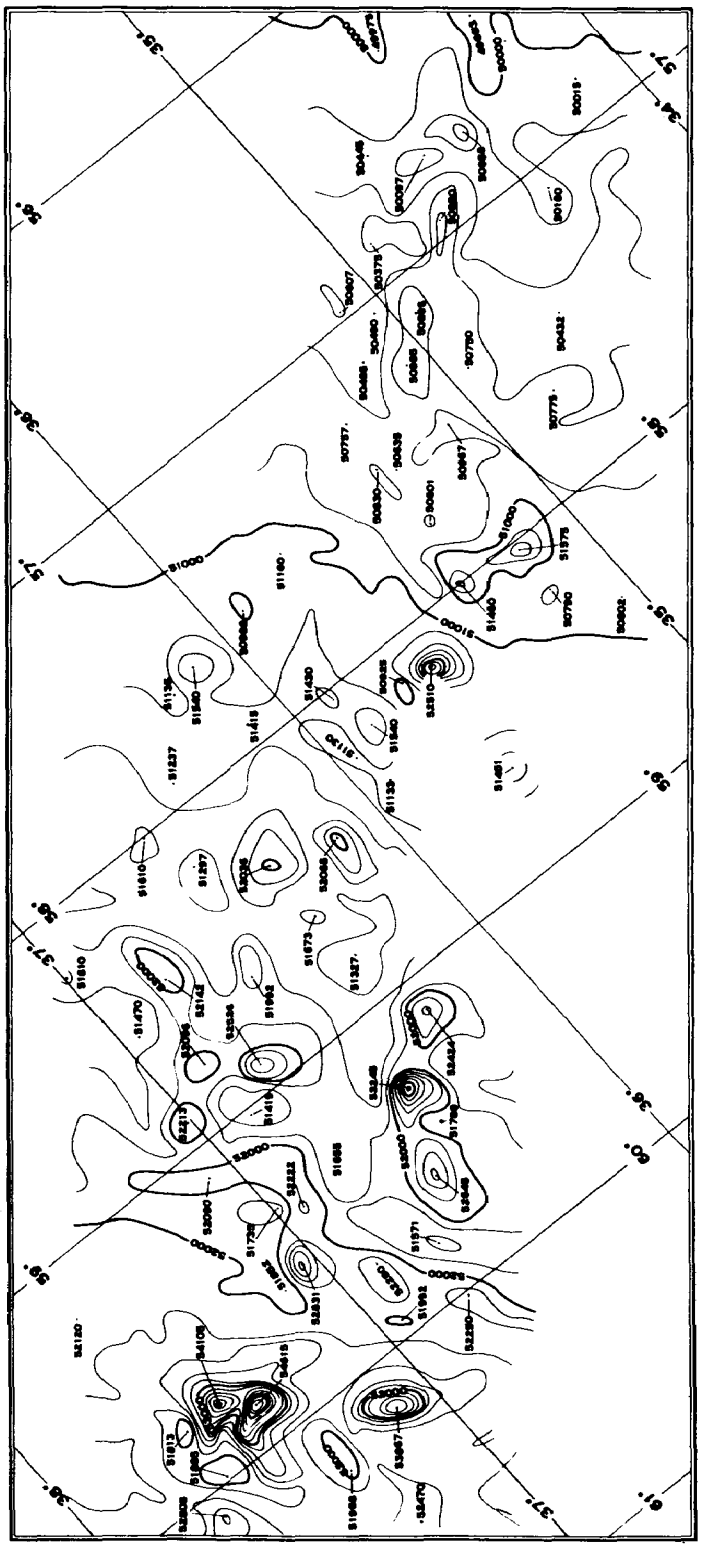

FIG. 5. — Total Magnetic Intensity
Contour Chart New England Seamount Chain, Area Two.
Contour interval : 200 gammas.

extremely difficult because of strong surface currents. Celestial observations were used as a check when weather conditions were favorable.

Instrumentation

All sounding data were obtained on the Precision Depth Recorder, Mark XI, used in conjunction with the AN/UQN-1C sounding set. The standard hull-mounted transducer was operated at 12 kc with an effective beam width of 60 degrees.

Total magnetic intensity measurements were made with a Model V-4914 Varian proton precession airborne magnetometer, adapted for use as a marine survey instrument. The sensor or *fish* was towed approximately 500 feet astern of the ship to minimize the effect of the ship's magnetic field. For the first time, the Oceanographic Office used a toroidal coil within an epoxy casting for the towed body. The hydro-carbon proton sample sealed within the coil was kerosene.

Details on the operation of this proton magnetometer can be obtained by writing Varian Associates (see Bibliography).

Seamount Magnetization Studies

Using data from this survey the magnetic polarization constants for Kelvin Seamount have been computed (VAN VOORHIS, 1963) using the method of VACQUIER (1962). The results of these computations indicate that Kelvin Seamount is highly magnetized and has a large component of remanent magnetization. The direction of total magnetization of the seamount was found to have an azimuth considerably east of, and an inclination shallower, than the present earth's field.

Paleomagnetic pole positions for Kelvin Seamount have been calculated using the computed direction of magnetization (VACQUIER, 1963). These calculations locate the North Magnetic Pole at the time of the seamount's formation at 73° North and 43° East in the Barentsz Sea. This position is not unusual, based on paleomagnetic studies of other rocks (DOELL, 1961).

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