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6. *Magnetic Survey of the Japan Sea (Part 1).*

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Abstract

A magnetic and bathymetric survey in the eastern part of the Japan Basin resulted in low amplitude and short wave length linear magnetic anomalies, trending in the northeast-southwest direction. These magnetic anomaly features may be the characteristic of the basin of the marginal sea.

Introduction

Recently, the results of geophysical investigations in the Japan Sea and the Okhotzk Sea have made it clear that these marginal seas, which are situated in the continental side of island arcs, have their own characteristic features different from those of typical oceans (Uyeda and Vacquier, 1968). These features have been explained in terms of descending mantle flow under island arcs (Uyeda and Sugimura, 1970; Hasebe et al., 1970).

Magnetic surveys have been carried out in the Japan Sea by Yasui and others at Maizuru Marine Meteorological Observatory on *R/V* Seifu-maru (Yasui et al., 1967), Matsuzaki and others at Hydrographic Office of Maritime Safety Agency on *R/V* Meiyo (Matsuzaki, 1966), and Tomoda and others at Ocean Research Institute of the University of Tokyo on mainly *R/V* Hakuho-maru (Tomoda and Nasu, 1971).

Analyses of these magnetic data (Yasui et al., 1967; Isezaki, 1970) established the following facts: In comparison with the typical magnetic lineations in the Pacific basin proper, the amplitude of the magnetic anomalies in the Japan Sea is smaller, and their wave length is shorter. As a result, the linearity of the anomalies is less obvious, compared with that in the Pacific. These results also mean that, in order to delineate the anomaly patterns in the Japan Sea, the ship's tracks

must be highly closely spaced. It is the authors' intension to make intensive surveys to fill all the magnetically blank areas in the Japan Sea. This is the report of the preliminary survey made in the Japan Basin area in May 1970.

Data

The survey was carried out by *R/V* Kofu-maru of Hakodate Marine Meteorological Observatory, in the eastern part of the Japan Basin which has a very flat bottom at about 3,600 m depth (Fig. 1). The total force magnetic data were taken every minute by a proton precession magnetometer. During this survey, no magnetic storm was reported by Aobayama Earthquake Observatory of Tohoku University, the land magnetic observatory nearest to the survey area. Ship's positions were fixed by Loran A.

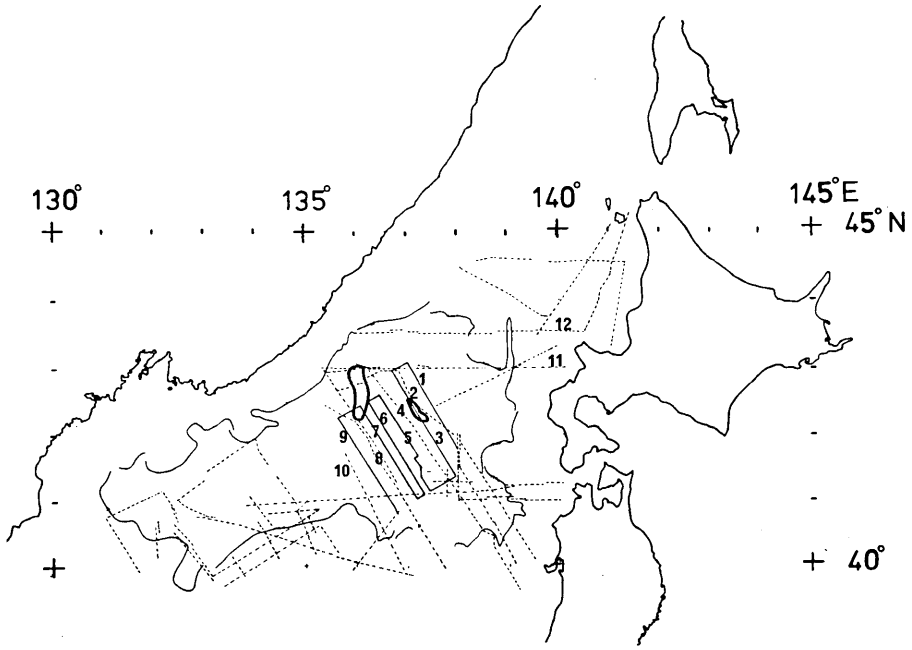

Fig. 1. Bathymetric boundaries of the floor of the Japan Basin (3100～3500 m). Broken lines are Seifu-maru tracks and solid lines (1, 3, 5, 6, 7, 9) are Kofu-maru tracks.

The total force distribution can be seen in Fig. 2. From these data, the anomaly in the total force was computed using the GSFC (12/66) model (Cain et al., 1967) as the reference field.

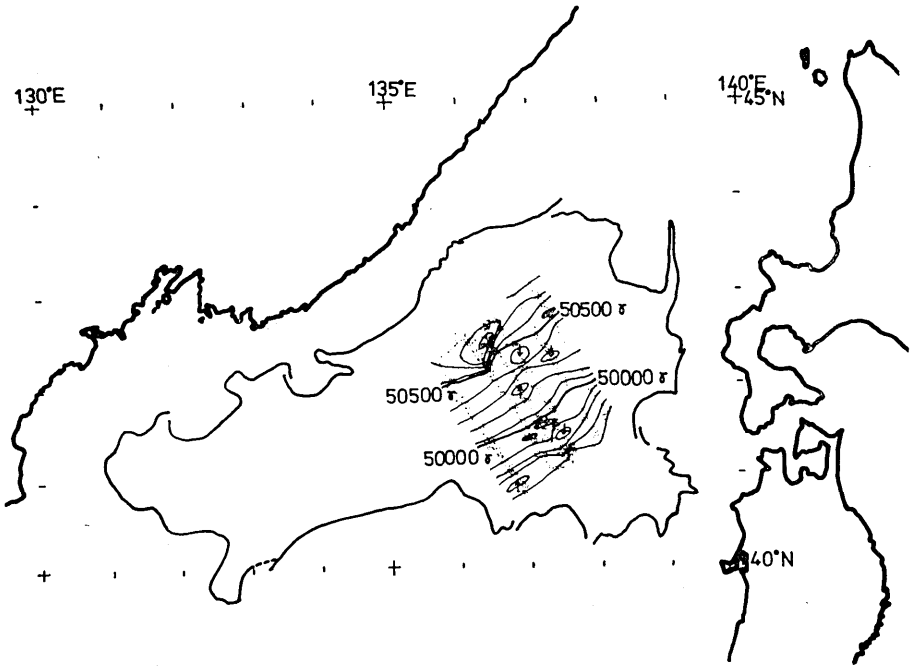

Fig. 2. The contours of the total force. Contour interval is 100 γ.

Features of magnetic anomalies

The total force magnetic anomalies shown in Fig. 3 are the values obtained through shifting the anomaly values, which are the differences between observations and GSFC (12/66) values, by about −200 gammas. On the other hand, the magnetic data of the same area taken by Yasui and others on *R/V* Seifu-maru in 1965 show almost the same anomaly features through shifting the anomaly values by about −100 gammas (Fig. 3). GSFC (12/66) model gives less than −10 gammas for 5 years as the secular change in the area concerned. But the above observation seems to show that the true secular change in the main field may be about −20 gammas/year in the Japan Basin. This value may appear too great but it is the same magnitude as the secular change observed on the land nearby; i.e. −20∼−25 gammas/year for the last two years at Aobayama Earthquake Observatory of Tohoku University (Yukutake, 1970, private communication). It would be important to improve the secular change terms of the reference field when we draw the contour lines of magnetic anomalies.

The peak to peak amplitude of the observed magnetic anomalies is less than 200 gammas except in the area of Bogorov Seamount and other bathymetric uplifts. This amplitude is significantly small com-

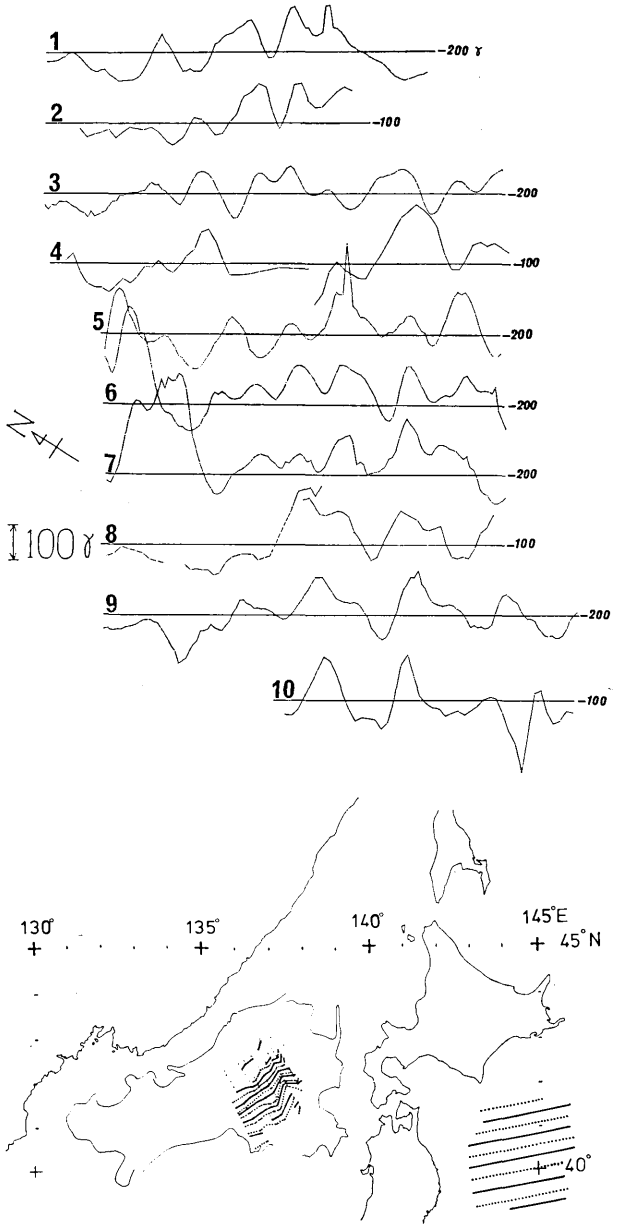

Fig. 3. Upper diagram: Magnetic anomaly profiles. The track number is referred to in Fig. 1. Lower diagram: Magnetic lineations in the Japan Basin and in the Pacific off the Sanriku and Hokkaido coasts. Solid lines are positive anomalies and dotted lines are negative anomalies.

pared with the peak to peak amplitude in the northwest Pacific where it is some 500 gammas. The wave length of the magnetic anomalies is 10 to 20 miles and this is also small compared with that in the north-

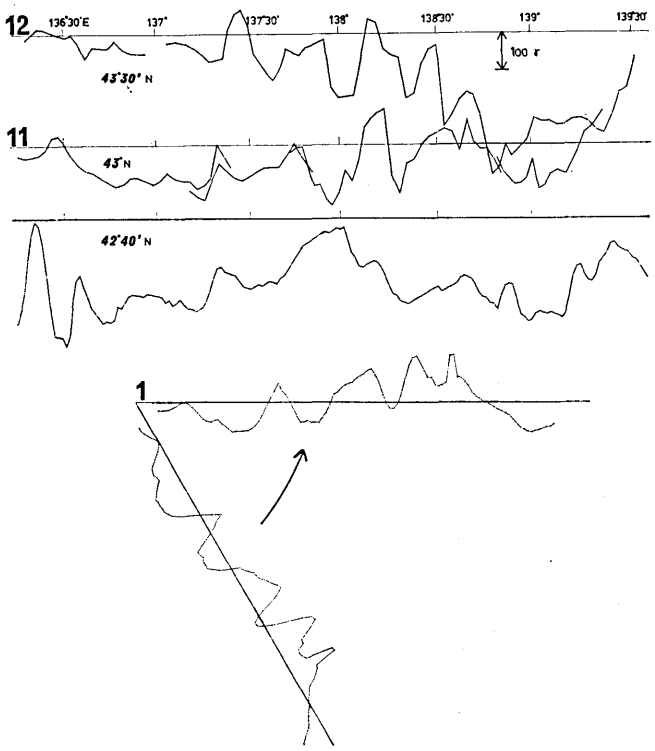

Fig. 4. The northward change of magnetic lineations. The track number is referred to in Fig. 1. The profile along 42°40'N was obtained by Hakuho-maru of the University of Tokyo in 1970. The profile of track 1 is rotated to the east-west direction for comparison with other profiles.

west Pacific off Japan where it is typically about 40 miles.

The magnetic lineations are obvious and parallel to the axis of the basin. It may be worth noticing that the strike of lineations in the western part of the survey area is parallel to that of lineations in the northwest Pacific off Japan and the strike appears to change northward in the eastern part of the survey area in a fashion more or less parallel with the trend of the Japan arc. The northward change of the strike of the magnetic lineations is shown in Fig. 4. There is, however, some uncertainty in this inference due to the sparse track lines.

The lineations parallel to the Japan arc seem to present two alternative interpretations, i.e. the plate of the Japan Sea has been generated holding the parallelism to the present shape of the Japan arc or it had been developed holding a straight strike and then bent afterwards by the bending of the northern part of the Japan islands (Kawai et al., 1961). Even if we accept Vine-Matthews hypothesis (Vine and Matthews, 1963) and try to apply it to the magnetic anomalies in the Japan Sea, it appears impossible to identify the positions of possible

source generating the floor of the Japan Sea, because of lack of symmetry in the magnetic anomaly profiles. There is, moreover, no reason to assume the existence of a single spreading center in the Japan Sea.

A more extensive survey is being planned in the wider area of the Japan Sea, so that we may be able to find solutions to the problems mentioned above.

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6. 日本海に於ける地磁気観測 (その 1)

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1970 年 5 月，函館海洋気象台の観測船高風丸によつて，日本海盆東部の地磁気観測を行つた．

太平洋側の典型的な地磁気異常に較べて，振幅も波長も半分以下であつた．また，地磁気異常の lineation は，日本海盆では，ほぼ三陸沖のそれと同じ方向で，海盆の軸とも平行に東北東—西南西に走つているが，海盆の北側の端に近付くと，北に向いて行くように見える．

地磁気異常の振幅や波長が太平洋側のそれらと顕著に異なること，及び地磁気異常の lineation の方向等は，日本海の成因や日本島弧の成因に密接に関係があると思われるが，まだまだデータの密度が不十分である．今年の秋には，日本海全域に亘る密な地磁気観測が予定されている．