Tectonic Development of the Bismarck Sea Based on Gravity and Magnetic Modelling

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Summary

The Bismarck Sea is a small marginal sea situated north of the island of New Britain and its associated trench. The land areas which surround it on three sides are island arc structures which have been active episodically since the Middle Cretaceous but which were most active during the Tertiary. Magnetic and sediment distribution maps of the Sea have been compiled and the results of two-dimensional magnetic and gravity modelling along five north–south traverses are presented. The magnetic map shows that the general trend of the anomalies is east–west. Individual anomalies can be traced for more than 150 km, mainly in the eastern half of the Sea, but in the western half persistent anomalies are difficult to discern except along the coast of mainland New Guinea. The water depth in the Bismarck Sea is about 2000 m and Bouguer gravity values are of the order of +150 mGal. There is a substantial sediment-free area across the centre of the Sea, and sediment thickness increases towards land, reaching 2 km along the north New Guinea coast.

Magnetic models and sediment distribution indicate that in the eastern half of the Sea north–south extension is taking place, thus implying northwards movement of the North Bismarck Plate relative to the South Bismarck Plate. The extension is occurring at about 8 cm yr\(^{-1}\) and is single limbed, accretion taking place mainly to the south of the Bismarck Sea Seismic Zone. Earthquake focal-mechanism solutions from the eastern part of the seismic zone, which extends E–W across the Sea, indicate that the N–S movement is being accommodated along two north-west-trending segments of the zone, about a pole to the south-west of the Sea. This interpretation supports the concept of an extensional origin for marginal seas. In addition the mechanics of the process are shown to be (a) different from those at mid-ocean ridges, (b) probably episodic, and (c) possibly reactivated across established trends, thus effectively erasing magnetic lineaments. The western half of the Sea is more complex but some north–south extension has occurred at the seismic zone.

Introduction

In 1970 a marine geophysical survey of the Bismarck Sea (Fig. 1) was conducted.
Fig. 1. Bathymetric map of the Bismarck Sea and environs.
by the Australian Bureau of Mineral Resources, Geology and Geophysics (BMR) using the contract vessel M.V. Hamme (Compagnie Generale de Geophysique 1974). Magnetic, gravity, and seismic reflection recordings were made along predominantly north–south traverses with a spacing of between 40 and 50 km. These data, together with magnetic results collected in the area by BMR (Brooks 1971) and the Hawaiian Institute of Geophysics (Brown & Webb 1971), have been used in the present study.

The Bismarck Sea is situated north of the New Britain Trench, and its position relative to the trench suggests that it was formed in a similar way to other marginal seas. However, the tectonic environment of the Sea is complicated by the Bismarck Sea Seismic Zone (Denham 1969) and by the presence of mainland New Guinea along part of its southern margin. Packham & Falvey (1971), and others have suggested that marginal seas are formed by extension behind active trench–arc systems, but there are differing opinions as to the mechanism of the extension and no detailed model of the physical features to be expected in marginal seas has been put forward.

Several different interpretations of the current tectonic activity in the Sea have been published. Johnson & Molnar (1972) and Krause (1973) consider the Bismarck Sea Seismic Zone to represent the boundary between two small sub-plates and consider that motion along it is left-lateral strike-slip. Malahoff & Bracey (1974) suggested that the seismic zone was a spreading centre, and Connelly (1974) also suggested that extension was occurring in the sea but that it was not directly related to the seismic zone.

The paper presents a detailed magnetic contour map of the Bismarck Sea and the results of two-dimensional magnetic and gravity modelling along five north–south traverses. The general characteristics of the magnetic and gravity features of the crust are discussed in the light of possible extension within the Sea, and a possible relation between the seismic zone and crustal extension is examined.

**Land geological and geophysical background**

Regional geological mapping of the land areas surrounding the Bismarck Sea is approaching completion (Thompson 1952; French 1966; Hohnen 1970; Macnab 1970; Ryburn 1971; Johnson 1970; Johnson, Taylor & Davies 1972; Johnson & Smith 1974; Hutchinson 1975; Hutchinson & Norvik, in preparation), and a composite geological map of the New Guinea Region (BMR 1972) has been produced. The picture which emerges is one of episodic island arc activity which started in the Bewani–Torricelli region during the Late Cretaceous and had spread to the whole area by mid-Tertiary times. Volcanic activity continued intermittently to the present day and is now most prevalent along the Bismarck Volcanic Arc where some of it, but by no means all, is associated with well-defined Benioff zones. Faulting, much of it very recent, trends north-west in the Gazelle Peninsula and southern New Ireland, and west–north-west on the north coast of mainland New Guinea.

Land geophysical work in the area includes seismic refraction studies in New Britain and southern New Ireland (Finlayson et al. 1972; Finlayson & Cull 1973a, b; Wiebenga 1973), reconnaissance gravity coverage of the whole of New Britain and New Ireland and parts of mainland New Guinea (Watts 1969; Harrison 1971), and aeromagnetic work along the north New Guinea coast (Young 1963; Continental Oil 1968; Australian Aquitaine 1967). The interpretations of the seismic refraction surveys, although varying in the details of structure under New Britain and New Ireland, all show depths to the Moho of the order of 18 km under the south-east part of the Bismarck Sea and velocities of 4·0 km s\(^{-1}\) and 6·8–6·9 km s\(^{-1}\) for oceanic layers 2 and 3 respectively. The structure under these islands is complex, but a general crustal thickness of about 35 km is indicated and a 6·1 km s\(^{-1}\) refractor is present.
FIG. 2. Diagrammatic representation of bottom topography and sediment distribution in the Bismarck Sea.
The transition from a crustal thickness of 18 km in the Bismarck Sea to 35 km under New Britain occurs in a gradual fashion along the north coast of the island with the wedging-in of a 6.1 km s\(^{-1}\) refractor. In contrast along the west coast of the Gazelle Peninsula the transition between the two crustal regimes is very rapid, suggesting the presence of a deepseated fault which may find surface expression in the Baining Fault.

**Marine geophysical data in the Bismarck Sea**

The bathymetry and sediment distribution of the Bismarck Sea have been described in detail by Connelly (1974), and are shown in diagrammetric form in Fig. 2. The water depth over most of the sea is about 2000 m. Topographic relief is generally moderate, but two rises—the Willaumez–Manus Rise south and west of Manus Island, and the New Hanover–Manus Rise between Manus Island and New Hanover—have water depths of only about 1000 m. There is a substantial east–west sediment-free area across the centre of the Sea, which in the east is 50–60 km wide and shows little topographic relief, whereas in the west it is narrower, rugged, and more in the nature of a chain of seamounts. Sediments generally thicken towards the margins of the sea, where their thickness reaches 2 km.

A total-intensity magnetic contour map of the Bismarck Sea constructed from values at 5-min intervals (about 1–1.5 km) along the traverses in shown in Fig. 4. The anomaly values plotted are relative to the International Geomagnetic Reference Field (Cain, Langel & Hendricks 1966), and synthetic diurnals based on the magnetograms from Port Moresby Geophysical Observatory were subtracted. The magnitude, inclination, and declination of the Earth's magnetic field in this region are about 40 000 nT, \(-22^\circ\), and \(6^\circ\)E respectively (Finlayson 1973).

The anomalies show a pronounced east–west trend and in the eastern part of the sea a pronounced positive anomaly with a broad associated negative can be traced for 150 km. In the centre of the sea a complex band of anomalies trends east–west but models of this zone in traverses 112, 106, 100, and 20 (Figs 6 and 7) do not show much similarity and the feature may not be as significant as it appears. However models fitting a low amplitude but persistent anomaly to the north of the Madang Basin show good correlation and this anomaly marks a significant tectonic feature. A change in the anomaly pattern is apparent south of New Hanover, where the broad negative centred on 3–5 °S and 150 °E has a number of shorter-wavelength anomalies superimposed upon it. This change coincides with the north-west-trending easterly segment of the seismic zone (Fig. 4). Another change in anomaly pattern, which is also marked by gravity and topographic features, is present across the New Hanover–Manus Rise (Fig. 4) and probably represents a further north-west-trending fault.

The Bouger gravity field over the Bismarck Sea varies smoothly between +150 mGal and +180 mGal and generally decreases towards land. The only departures from this pattern are two Bouger lows over the Willaumez–Manus Rise and the New Hanover–Manus Rise where the Bouger values decrease to +130 mGal and +100 mGal respectively.

The distribution of earthquake epicentres in the Bismarck Sea and surrounding areas has been well documented by Denham (1969, 1975) and Connelly (1974), and focal-mechanism studies of the region have been made by Ripper (1970, 1975, 1976), Johnson & Molnar (1972), and Curtis (1973). Fig. 3 shows earthquake epicentres which have been located using 10 or more seismograph stations together with all published focal mechanisms in the Bismarck Sea (up to 1975). A well-defined Benioff zone dips north under New Britain. This zone is most prominent east of the Willaumez Peninsula, where earthquakes occur down to depths of 500 km. West of the Willaumez Peninsula no earthquakes at depths greater than 300 km have been recorded. Beneath
Fig. 3. Earthquake epicentres (1958–1974) and focal mechanism solutions in the Bismarck Sea.
Fig. 4. Total force magnetic contour map of the Bismarck Sea.
northern mainland New Guinea the zone becomes diffuse, and earthquakes occur randomly over a wide area to depths of 300 km.

The Bismarck Sea Seismic Zone extends east–west from the St Georges Channel to the north coast of mainland New Guinea. It is made up of four linear segments, three of which are in the eastern part of the Sea and give that part of the zone a much more disturbed appearance. Focal-mechanism solutions along the zone indicate left-lateral strike-slip movement, but except at the western end, all these solutions are from earthquakes on north-west-trending segments, and their focal planes are parallel to the strike of the segments (see Fig. 3).

**Method of profile interpretation (magnetic and gravity)**

Detailed modelling of the magnetic and free-air gravity profiles was undertaken using two-dimensional models, of infinite extent perpendicular to the traverse and of any required cross-section. The theoretical anomaly profile was calculated using a computer program based on formula derived by Vallabh Sharma (1966).

The top of the initial magnetic model was taken as the acoustic basement picked from seismic reflection records and the bottom as 5 km below sea level, which in this region is the base of oceanic layer 2 (Finlayson & Cull 1973a). This body was also incorporated in the initial gravity model. The magnetic susceptibility was taken as $4\pi \times 10^{-4}$ SI units, the magnitude of the remanent vector as $4$ Am$^{-1}$, and the inclination of the remanent vector as $-22^\circ$ or $+158^\circ$. The initial interpretation was directed towards matching the observed profile and calculated profiles by inserting a series of normally and reversely-magnetized bodies with vertical interfaces. However, in many areas a reasonable match could not be obtained by this technique, so many different models such as sloping interfaces, non-magnetic gaps, dipping slabs, and faults were eventually used to match the observed and computed profiles. These models should not be interpreted as exact geological structures. The sloping boundaries may in fact represent gradual transitions between reversely and normally magnetized material, and the non-magnetic gaps may be merely areas with much lower values of remanent magnetism.

For the gravity interpretation, densities adopted were: sediments $2.2$ tm$^{-3}$; oceanic layer two, $2.6$ tm$^{-3}$; oceanic layer three, $2.85$ tm$^{-3}$; and sub-Moho material, $3.33$ tm$^{-3}$. The standard crust used consisted of a $2.85$ tm$^{-3}$ layer to a depth of 32 km and a sub-Moho density of $3.33$ tm$^{-3}$, the same as that adopted by Finlayson & Cull (1973a) for the New Britain region. The initial model consisted of the sedimentary layer, the oceanic layer 2 described above, and an oceanic layer 3 to a depth of 18 km. This basic model fits the free-air gravity over much of the area, most of the relief in the gravity profile being accounted for by sea bottom topography. Where the fit was poor, alteration of the thickness of the various layers and the introduction of an intermediate layer of density $2.72$ tm$^{-3}$ under the Madang Basin enabled a satisfactory fit to be obtained. However, except in the south-east corner of the Sea no seismic control was available on these models. Thinning of oceanic layer 2 as revealed by gravity modelling was included in the magnetic model and generally improved the fit between the observed and calculated magnetic profiles. On the other hand in some places (for example where Traverse 106 crosses onto the New Hanover–Manus Rise) the gravity and magnetic models did not agree.

**Detailed description of interpreted traverses**

Five north–south traverses were subjected to detailed magnetic and gravity modelling. Fig. 5 is a map showing the locations of the interpreted profiles and distinguishes basement areas that are predominantly normally magnetized, predominantly reversely magnetized, or of mixed polarity.
FIG. 5. Main tectonic features of the Bismarck Sea and distribution of areas of normally magnetized and reversely-magnetized basement.
FIG. 6. Magnetic and gravity models along Traverses 112 and 106. The normally-magnetized, reversely-magnetized and non-magnetic bodies together make up oceanic layer 2. The sharp boundaries between the bodies are a function of the modelling technique and some of them, especially the sloping ones, probably represent gradual changes.
Fig. 7. Magnetic and gravity models along Traverses 100 and 20 (for legend see Fig. 6).
Traverse 112 (Fig. 6)

This traverse lies in the eastern half of the sea and extends from the Willaumez Peninsula to the island of New Hanover. Normally magnetized material with a central, apparently non-magnetic plug coincides with the seismic zone and sediment-free area and apart from a normally magnetized seamount the remainder of the traverse appears to be reversely magnetized. The presence of extensive areas of reversely magnetized basement along this traverse is postulated because of the excellent fit produced by the simple topographic models.

Gravity modelling shows very little variation in either the thickness of layer 2 or the depth to the Moho. The seismic zone has no gravity expression and the only variations from the standard model are a thickening of the crust under New Ireland and a slight thinning of the crust near the Willaumez Peninsula.

Traverse 106 (Fig. 6)

This traverse is 70 km west of Traverse 112 and extends from south of the Vitu Islands to the New Hanover-Manus Rise. The pattern of magnetic bodies found on Traverse 112 also applies to the central part of this traverse. The normally magnetized body at 155 km probably represents the short normal epoch which started 0.89 MyBP. As on Traverse 112, the gravity measurements do not indicate the presence of any variations in the depth to the base of oceanic layer 2 or depth to the Moho across the central seismic zone. The seaward extensions of the Vitu Islands appear to be composed of normally-magnetized material extruded through the overlying reversely-magnetized material. They are expressed in the gravity profile only by their topographic effects and not by any deep-seated low-density material as might be expected if a magma chamber were present.

The southern boundary of the New Hanover-Manus Rise is distinct on both magnetic and gravity profiles and is interpreted as a major fault. Gravity modelling shows a basement ridge along the boundary and an increase in the depth to the base of oceanic layer 2 and to the Moho. Magnetically the boundary is represented by a transition from reversely-magnetized basement south of the Rise to normally-magnetized basement under the Rise; but the basement ridge apparent on the seismic reflection records and the gravity model could not be made to fit any magnetic model, so it is shown as being non-magnetic in Fig. 6. The magnetic anomalies over the Rise show subdued relief, in sharp contrast to the Sea itself, and this area does not appear to be oceanic in nature, nor has it been subjected to appreciable recent volcanic activity.

Traverse 100 (Fig. 7)

Traverse 100 extends from the western tip of New Britain across the Willaumez-Manus Rise to the New Hanover-Manus Rise. The central normally magnetized body is replaced on this traverse by an area of mixed polarity, which produces an area of intense anomalies south of Manus Island and is bounded on the northern side by a major fault. An extensive area of predominantly reversely-magnetized basement to the south may have been uplifted by diapiric action to form the Willaumez-Manus Rise. Magnetic models in this region show possible upfaulting of the basement, and gravity modelling shows increases in the depth to the base of the crustal layers, an effect which may be of thermal origin.

The models of the New Hanover-Manus Rise are similar to those from Traverse 106 except that the basement ridge is represented in the magnetic models as well as the gravity models, suggesting the possibility of volcanism being associated with it.

Traverse 20 (Fig. 7)

Traverse 20 extends from the north coast of New Guinea to Manus Island. The largely reversely-magnetized basement forming the Willaumez-Manus Rise and the
mixed-polarity zone which causes the intense anomalies south of Manus Island are present on this traverse, but the northern boundary fault is not traversed. To the south the traverse crosses the Madang Basin, an area which has thicker continental-type crust and a very subdued magnetic anomaly pattern.

The boundary between the Basin and the Bismarck Sea to the north is composed of two small basement ridges and is marked by gravity, magnetic, and sedimentary features. Gravity modelling shows a marked thinning of oceanic layer 2 with material of 2.85 $\text{tm}^{-3}$ density coming to within 2 km of the sea-floor. Magnetic models also reflect this thinning and show a gradual transition from normally-magnetized basement in the Madang Basin to reversely-magnetized basement to the north. Sediments are gently folded between the basement ridges, in contrast to the sediments to the north and south. The exact nature of this boundary is obscure; it appears to be a compressional feature, which is not of recent origin as the topmost sediments are flat-lying.

**Traverse 38 (Fig. 8)**

Traverse 38 extends from Madang and spans the entire Willaumez–Manus Rise west of Manus Island. The single mixed-polarity zone found on Traverses 100 and 20 is here represented by two mixed zones, one coinciding with the seismic zone and one forming the northern boundary of the Willaumez–Manus Rise. These two zones coalesce on Traverses 20 and 100 and give rise to the area of intense anomalies south of Manus Island. The Madang Basin and its northern boundary show the same features found on Traverse 20, and the diapiric nature of the Willaumez–Manus Rise is again evidenced by thinning and upfaulting of the magnetic layer and thickening of all the crustal layers.

The mixed-polarity zone coinciding with the seismic zone is a complex feature and has both tensional and compressional aspects. The sediment-free normally-magnetized basement indicates recent volcanism and presumable tension. However, gravity modelling shows material of 2.85 $\text{tm}^{-3}$ density within 2 km of the sea bottom just north of this area, and this must be a compressional feature. Previous modelling
by Connelly (1974) showed a non-magnetic plug coinciding with the seismic zone in this area, but this interpretation has been rejected as it led to models of the southern part of the traverse which differed from those on the southern parts of Traverses 20 and 100.

To the north of the Willaumez–Manus Rise crustal thickness decreases abruptly, as does the apparent thickness of the magnetic layer assuming there is no change in the magnitude of the remanent vector. These features may represent a transition to normal oceanic crust, particularly as a sequence of reversed and normal bodies similar to those found in oceanic areas is present, although the anomalies cannot be traced to adjacent traverses. Attempts were made to date this sequence using the magnetic polarity time scale of Heirtzler et al. (1968) but only seven reversals are present and are insufficient to give a reliable age.

Discussion and conclusions

Connelly (1974) defined two tectonic provinces in the Bismarck Sea, one to the east of a line joining Manus Island and the Willaumez Peninsula and one to the west of it. The basis of the division is the age of tectonic activity, which is Quaternary in the east but mainly older although of indeterminate age in the west.

Models along Traverses 112 and 106 (Figs 6 and 7) show normally magnetized material coinciding with the sediment-free area, and assuming it was all generated during the current polarity epoch, a spreading rate of the order of 4 cm yr\(^{-1}\) is indicated. The proximity of New Hanover to the northern boundary of this material indicates that most of the spreading must have occurred to the south, giving an equivalent single limb spreading of 8 cm yr\(^{-1}\). The site of spreading is assumed to be the non-magnetic plug at the centre of the normally-magnetized material.

The maximum possible period over which this rate of extension could have been maintained is about 2·5 My in which interval the entire present-day width of the Bismarck Sea would have been generated at 8 cm yr\(^{-1}\). Magnetic models show most of the region to the south composed of reversely magnetized material, and so the current episode of spreading might have continued for the whole of the Matuyama epoch; however, the thickness of sediments, up to 1 km, found in the southern part of this area is most unlikely to have accumulated during the last 2 My and this rules out spreading having continued for this period of time. Sea-floor produced by the current episode of spreading is likely to be marked by thin sediments, and these occur only to a distance of about 120 km south of the site of spreading, thus putting the onset of spreading at about 1·5 MyBP. Evidence from the geochemistry of the Bismarck Volcanic Arc (Johnson & Blake 1972) and from earthquakes (Denham 1975) suggests that the eastern half of the New Britain Arc is far more active than the western half, and this evidence supports the idea of rapid spreading occurring in the east but not in the west.

The relation between the Bismarck Sea Seismic Zone and the spreading is obscure, and the hypotheses that they are related phenomena and that they are two completely separate processes both lead to problems. Connelly (1974) suggested that they were unrelated phenomena and that the non-magnetic blocks at the centre of the Seismic Zone represent a zone of fractured rock produced by strike-slip movement along the lineament. However the two north-west-trending segments of the zone bound the area of extension, and in the eastern half of the Sea the focal-mechanism solutions, all of which are on these segments, show alignment of one of their nodal planes parallel to the segments. This evidence suggests that the spreading is being accommodated along these segments and that the seismic lineament and the spreading are related. This hypothesis, however, requires that in the Bismarck Sea spreading has associated with it fairly intense earthquake activity and basement with very low values of remanent
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intensity. Neither of these features is found at conventional mid-ocean spreading centres, which are largely aseismic and show very high values of remanent intensity.

Le Pichon (1968) established that strike-slip motion between the Indian and Pacific Plates could be expected along that part of their boundary which extends from Tonga to Irian Jaya. However, he stressed that this was only a gross interpretation, which took no account of the numerous small subplates in this region. In the New Guinea Region Johnson & Molnar (1972) and Krause (1973) have identified this strike-slip motion as occurring along the Bismarck Sea Seismic Zone, but the detailed results given here seem to rule this out and in fact Johnson & Molnar’s focal-mechanism solutions emphasize the north-west direction of motion which is occurring in the eastern half. In my opinion the strike-slip motion in this area is being taken up in a north-westerly direction with a north-west movement of the North Bismarck Plate relative to the South Bismarck Plate. This must be accompanied by underthrusting of both plates under the New Guinea mainland and possibly underthrusting of the Pacific Plate along the outer Melanesian Trench.

A relative pole of rotation for the two Bismarck plates would lie somewhere in the New Guinea mainland and would account for the progressive decrease in the amount of extension along the western part of the seismic lineament. The east–west strike-slip focal mechanisms at the western end of the lineament would also be expected on this construction, as strike-slip movement may occur along plate boundaries as the relative pole of rotation is approached; an example of this effect is found along the southern part of the Macquarie Ridge (Johnson & Molnar 1972).

Comparison of the site of spreading with those at mid-ocean ridges reveals some striking differences: (1) Gravity modelling shows no evidence of low-density material under the spreading axis such as is found at mid-ocean ridges. (2) There is no topographic ridge associated with the spreading centre. (3) Magnetic modelling indicates that magnetic material may possibly be evenly distributed through oceanic layer 2, rather than in the top 500 m, although the magnetic parameters are not sufficiently well known for this to be stated with any certainty. (4) The values of remanent magnetism are low, whereas those found at conventional spreading centres are high. (5) There is extensive seismicity at the site of spreading as well as on the associated transform faults, which is not observed at conventional spreading centres. The first two of these features indicate that the environment at the site of spreading may be tensional as opposed to the diapiric regime which is found at mid-ocean ridges and which produces the distinctive topographic rise and its associated rift valley and normal faulting. A tensional environment would be consistent with the lack of any topographic feature across the site of spreading, and emplacement of magnetic material could take place throughout oceanic layer 2. The non-magnetic block may possibly be caused by substantial amounts of material above the Curie point, although this would conflict with the gravity evidence.

The easternmost segment of the Seismic Zone forms part of a larger fracture which extends from west of New Hanover to the Gazelle Peninsula. It is represented by an offset in the New Hanover–Manus Rise, and in the Gazelle Peninsula by the Baining Fault, which was found by Finlayson & Cull (1973a) to be associated with an abrupt change in crustal thickness. This shear zone possibly extends across to the south-west coast of New Ireland, and it has been suggested (Hohnen 1970; Tilbury 1975) that New Ireland was formed by left-lateral shearing in a north-west direction. Shearing of this type would explain the marked contrast between the thick sediments on the New Hanover–Manus Rise and their absence in the adjacent Manus Basin.

The western half of the Sea presents a far more complex problem. The detailed sequence of tectonic events cannot be resolved, but the dominant trends in this area prior to the establishment of the Bismarck Sea Seismic Zone appear to have been parallel to the New Guinea mainland. The two major tectonic features—the Willaumez–Manus Rise and the Madang Basin—both conform to this trend, but
Tilbury has suggested the existence of north-east-trending sea-floor spreading magnetic anomalies in this area and these if present must represent an earlier tectonic regime. No estimate of the age of this area could be made from the present study, but it is obviously most likely to have been formed some time in the Tertiary. Some possible sea-floor spreading magnetic anomalies are present north of the Willaumez-Manus Rise on Traverse 38 but there are too few reversals to allow satisfactory dating. Tilbury (1975) has on the basis of poorly-defined magnetic lineaments mentioned above assigned an age of Oligocene to this area, but I do not consider this date reliable.

Current tectonic activity as manifested by the Seismic Zone and its associated chain of seamounts cuts across the north-west trend of the area. This indicates that marginal seas may be reactivated along trends different from the established trend, and if this process occurs to any great extent it would effectively obliterate magnetic lineaments thus accounting for the general lack of these features in marginal seas.

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References


