SEDIMENT DISTRIBUTION AND CRUSTAL STRUCTURE OF THE SOUTHERN LABRADOR SEA

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Survey data from the USNS LYNCH cruise south of Kap Farvel, Greenland have delineated a new mid-ocean channel. This channel or canyon is apparently acting as a sediment conduit to transport terrigenous material from the West Reykjanes Basin south and west to the Northwest Atlantic Mid-Ocean Canyon. The triple junction point of the extinct Labrador Sea Ridge is found to be located at approximately 56° 50′ N, 41° 30′ W. The magnetic isochrons south of Kap Farvel are delineated for the first time.

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During the summer of 1971 the USNS LYNCH conducted a reconnaissance survey of selected parts of the Labrador Sea. Parameters measured were magnetics, bathymetry and seismic reflection. A proton precession magnetometer (Varian 4973 DR) was employed to measure the absolute values of the earth's magnetic field. Magnetic tapes were scaled at 100 gamma intervals and at all magnetic highs and lows. Soundings were obtained with a 3.5 kHz hull mounted transducer which also gave information on shallow subbottom sedimentary structures as penetration averaged about 15 m. Data was recorded on an EDO (333 PSR) recorder. The echo distances measured in units of 1/400 sec. travel time are probably accurate to at least 1 part in 3000. Seismic reflection data were collected with a 30,000 joule Teledyne sparker and hydrophone system. Data were recorded on two Raytheon PSR recorders, one on a 10 second sweep and the other at 4 seconds. The incoming signal was band pass filtered from 40 to 76 Hertz. With the exception of the leg between St. Johns, Newfoundland and Søndrestrøm Fjord, Greenland all navigation was by satellite with supplementary LORAN A and is accurate to within 0.18 nautical miles (0.37 km).

The Labrador Sea has been the subject of numerous papers in the last few years: Drake et al. (1963), Godby et al. (1966), Johnson et al. (1969), Vogt et al. (1970), Le Pichon et al. (1971), Johnson et al. (1971 a + b), and Laughton (1971). Based on the above works the genesis of the Labrador Sea is fairly well known as is summarized below:

1. Rifting commenced probably as early as late Jurassic (Johnson et al. 1969, Johnson & Vogt, 1972).
2. From slightly before anomaly 32 (76 mybp) to anomaly 24 (60 mybp) the Labrador Sea and North Atlantic are opening. Greenland is attached to the European Plate. Spreading rate is approximately 0.8 cm/yr.
3. From anomaly 24 (60 mybp) to anomaly 19 (47 mybp), a triple ridge junction existed in the North Atlantic with simultaneous opening of the Labrador Sea, Reykjanes Ridge and the North Atlantic. Spreading rates in the Labrador Sea were probably about 0.5 cm/yr.
4. From anomaly 19 (47 mybp) Labrador Sea spreading axis slowly becomes inactive and Greenland rejoins America's plate.

Seismic data from Le Pichon et al. (1971) revealing disturbed sedimentary layers over the median valley and occasional earthquakes suggest that some slight adjustments are still occurring.

Sediment distribution

In the survey region between 60 and 400 nautical miles (110–740 km) south of Greenland there are primarily three geomorphic features:

1. An outer ridge, comparable to the Blake-Bahama Outer Ridge, associated closely with the continental margin structure of Kap Farvel and the circulation patterns of the West Reykjanes Basin and Labrador Sea (Johnson & Schneider, 1969).
2. A mid-ocean channel and its flood plain found winding around southern Greenland, first deeply entrenched among ridge trends of an Eocene triple junction of crustal plates, and then widening onto a 75 nautical mile (135 km) wide flood plain and forming at least four braided channels.
3. An abyssal zone of current-formed, dune-like drifts between the mouth of the Labrador Sea and the western North Atlantic basin.

Eirik Ridge (Johnson & Schneider, 1969), dominates the sea floor from Greenland to within 50 nautical miles (90 km) north of the axis of Ran Ridge (ancient Labrador Sea spreading center) (Johnson & Vogt, 1972), see fig. 1. An arm of acoustically transparent sediment reaches from this

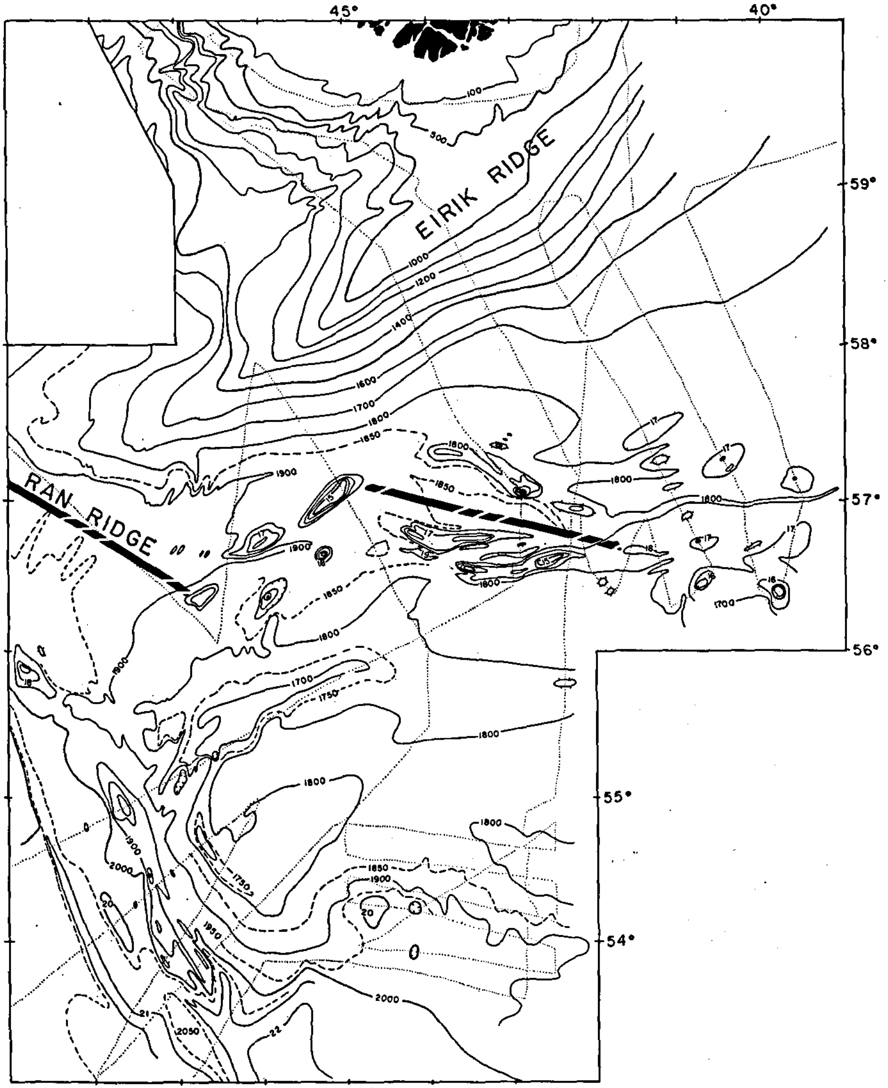

Fig. 1. Bathymetric sketch map of the southern Labrador Sea. Chart based on data presented by Johnson et al. (1971b), corrected and enlarged to include *Jean Charcot* data (Anonymous, 1971), *Glomar Challenger* (Laughton et al. 1972. and *Lynch,* 1971 data). Isobaths are in nominal echo-sounding units (1 fathom = 1/400 second). The axis of the extinct buried Ran Ridge is shown by a heavy broken line.

outer ridge almost to the axis of the NW-Atlantic Mid-Ocean Canyon and its associated flood plain near 57°N–49°W (plate 1 and fig. 2).

Cold Artic waters flow westward through the Mid-Atlantic Ridge via the Charlie Fracture Zone at 53°N, thence sweep northward along the western flank of the Reykjanes Ridge, mix and turn southward with additional Norwegian Sea water over-flowing through Denmark Strait. This flow parallels the Greenland continental slope, then south of Kap Farvel turns to the north, thereafter to form an anti-clockwise gyre in the Labrador Sea Basin (Johnson & Schneider, 1969, Heezen et al. 1966). As this strong current rounds Kap Farvel, it looses velocity and hence deposits its heavier suspended sedimentary fraction on the outer ridge (Eirik Ridge).

A cross-section of the south-facing slope (made by a course change at the ridge crest) in plate 1, profile 4, shows much of the genetic history of the ridge. In the tapered, intermediate depth sediment, 500 metres of disturbed hyperbolae represent a period when bottom currents created abyssal antidunes (Fox et al., 1968). It is not certain if this would require a higher or lower bottom current velocity than now exists as no measurements are available.

The bathymetric contours (fig. 1), clearly describe the outer ridge (Eirik Ridge) as being banked up against the higher Labrador Sea southern Greenland continental slope and rise. Sediment immediately northwest of the NE-SW trending ridge axis was found to be dammed behind the tapering crest. The south-facing slope is smooth and unbroken, and serves as the relief of "continental" slope and rise of Kap Farvel, Greenland.

The Imarssuak Mid-Ocean Channel (Imarssuak meaning great ocean, the Greenlandic name for the Atlantic Ocean) derives its coarse sediment fraction from canyons off the Denmark Strait, and SW Iceland banks (fig. 2). It must also receive sediment load in the form of sands and silts transported down the East Greenland continental rise through submarine canyon conduits by turbidity currents.

Pelagic foraminiferal sediments aggrade normally in the basin between East Greenland and the Reykjanes Ridge (plate 1, profile 1). But the excess load introduced from the continental margin, the once wave-swept Denmark Strait, and SW-Iceland banks, when combined with the force of Greenland Sea boluses of cold water, generates turbidite flows down the axis of greatest depth to the south, southwest in the West Reykjanes Basin.

Near 57°N–39°W the Imarssuak Mid-Ocean Channel abruptly turns west into the Eocene triple junction topography to follow the Ran Ridge trends heading WNW (Johnson & Vogt, 1972). Here among the ancient mountains of the now quiescent spreading ridge, the mid-ocean channel is entrenched deeply in otherwise deep ocean pelagic sediment (plate 1, profile 2 and 3). High reflectivity to both seismic and 3.5 kHz sound sources indicates the channel within the rough terrain of the triple junction. The channel clearly assists in delineating the transition between Reykjanes Ridge-spread and Ran Ridge-spread crust at its 57°N–39°W turning point (fig. 3).

Following the mid-ocean channel westward it is seen to meander to the north in a broad intermontane valley, until at 45°W it lies between the Eirik Ridge flank and an elongated peak at 57°N–45°W (see figs. 1, 2 and 3).

The peak at 57°N–45°W marks a fracture zone offset across the Ran Ridge structure (fig. 3) and the beginning of a wide flood plain with braided channels which show high reflectivity to 3.5 kHz and seismic sound sources. Still further west, soutwest-trending braided channels have isolated old levees and small hills where the main coarse fraction of the channel load must be deposited (plate 1, profile 4; fig. 2).

The four braided channels are most unobstructed as seen in plate 1, profile 5 (fig. 3, profile B; plate 2) and are essentially free of basement-controlled orientation, as is the Northwest Atlantic Mid-Ocean Canyon at this point (Ewing et al. 1953, Heezen et al. 1969). These various, only slightly leveed channels stream into the Northwest Atlantic Mid-Ocean Canyon predominantly near 56°N–49°W, although with more seismic reflection or 3.5 kHz sounding lines the Imarssuak Mid-Ocean Channel may be shown

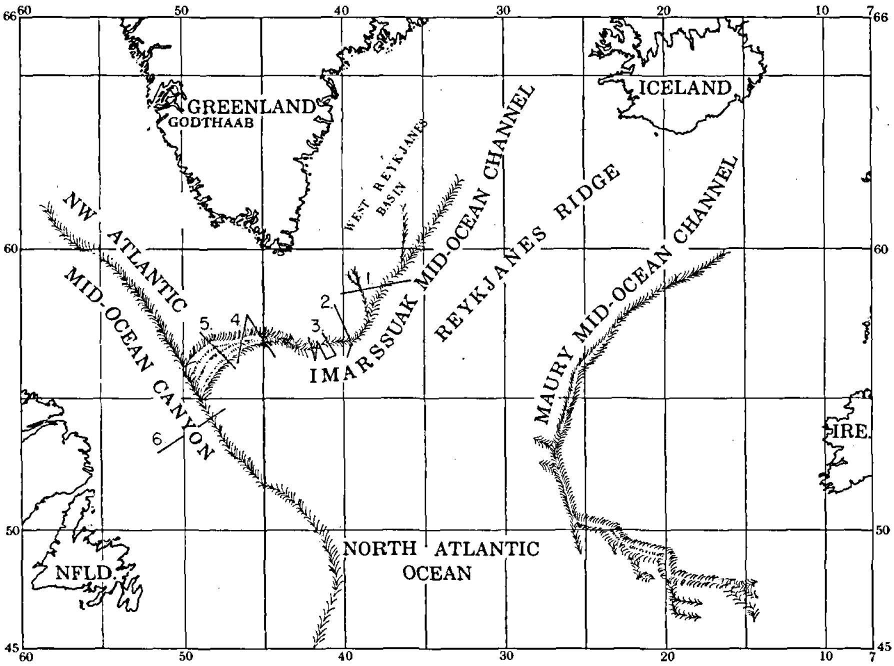

Fig. 2. Index for seismic reflection profiles illustrated in plate 1. Maury Mid-Ocean Channel is from Ruddiman (1973).

to juncture with the Northwest Atlantic Mid-Ocean Canyon further to the south if it crosses a local mid-Labrador Sea trending ridge at 56°N–48° to 49°W (Johnson et al. 1971b).

JOIDES hole 113 was drilled in the region of braided channels (Laughton et al. 1972). These authors noted that the reflectivity of the sea floor at site 113 was considerably higher than at site 112 due to the high terrigenous content of the upper sediments. They reported that most of the sediments have in common a considerable, sometimes dominant amount of volcanic minerals (glass, plagioclase, and their alteration products, chlorite and zeolite). At 400 metres a turbidite sand sequence was present. Preliminary estimates of sedimentary rates of deposition yielded 10 cm/1000 yrs for the Pleistocene and 35 cm/1000 yrs for the Upper Pliocene (Laughton et al. 1972). The JOIDES scientists further noted that the terrigenous material probably was derived from reworked East Greenland sandstones, metamorphic and igneous rocks.

The Northwest Atlantic Mid-Ocean Canyon is seen in the eastern portion of the seismic reflection profile 6, plate 1, and in the western portion of profiles A-D, plate 2. As noted by previous investigators, Johnson et al. (1969), Heezen et al. (1969), the western levee of the canyon is consistently higher than the east. Due to the Coriolis effect in the northern hemisphere a turbidity current will tilt with the upper surface on the right (the surface of a southward flowing current will dip eastward) (Menard, 1964, Bates, 1953). The higher western levee is therefore the result of sediment deposition from this inclined flow.

The profiles presented in plate 1 show that the floor of the Imarssuak Mid-Ocean Channel has no preferred dip probably because of its short east-west extension. In profile 2 the channel floor dips toward the north, while in profile 3 (NW end) the channel floor is flat and at the course change in profile 3 (marked by N) the channel floor strongly dips to the south. Coriolis force considerations would predict a northward dipping floor due to an erosional or non-depositional zone for a westward flowing channel in the northern hemisphere.

The Northwest Atlantic Mid-Ocean Canyon can be seen to have no relationship to basement structure varying in position from over structural lows (profile B) to over basement highs (profile C, plate 2). The canyon is most likely a Pleistocene structure draining the Hudson Strait channel created during periods of lower sea levels (Heezen et al. 1969). From these data it would appear that the canyon may be active at the present time south of its junction with its tributaries (57°N).

As noted by Laughton (1971) the southeastern Labrador Sea bottom morphology is a monotonous sequence of gently rolling topography which is interpreted to represent abyssal anti-dunes on the flanks of a large sediment

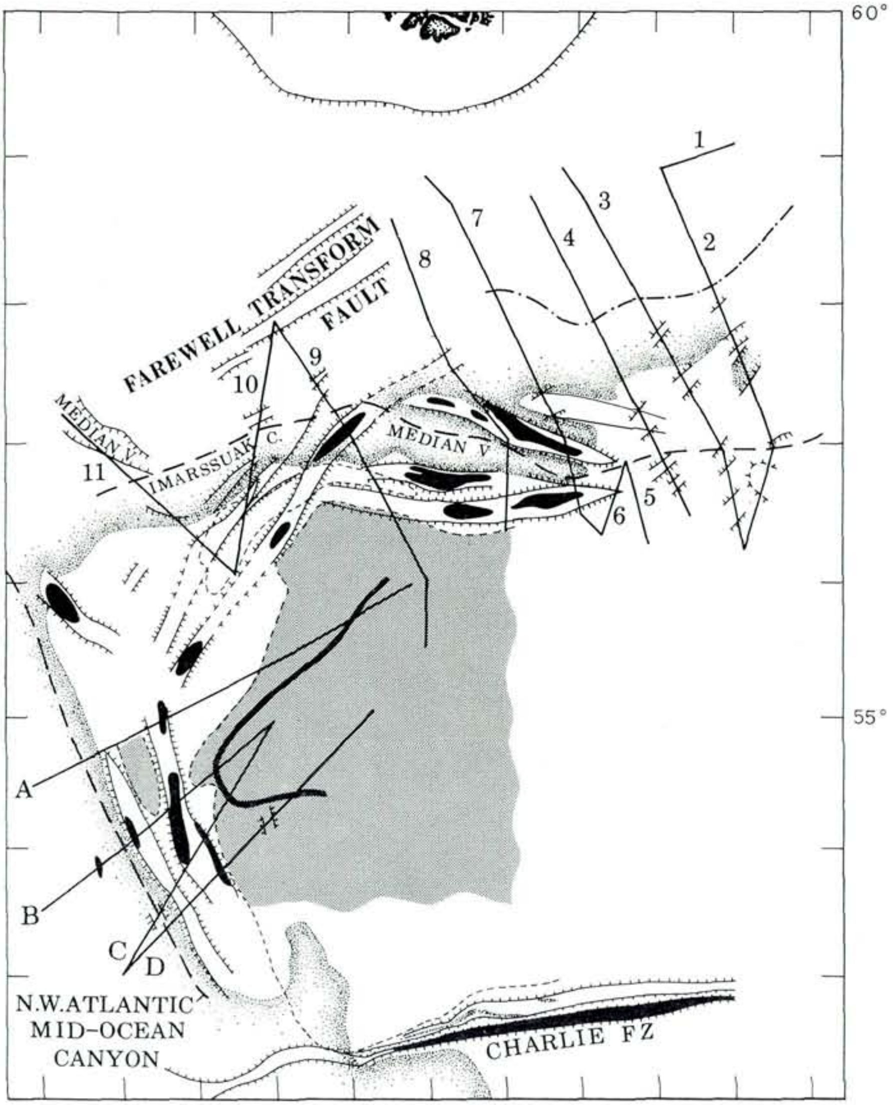

Fig. 3. Index of seismic reflection profiles in plate 2 and fig. 4. Wedging of basement trend, as the triple junction point is approached, is apparent as well as two major fracture zones. Stippling indicates extent of terrigenous sediments. Heavy stippling denotes sea floor dominated by dune topography (plate 2). Solid line is axis of the crest of the sediment drift. Dashed line indicates Northwest Atlantic Mid-Ocean Canyon and Imarssuak Mid-Ocean Channel system which is seen incised into the eastern median valley of Ran Ridge. Dash-dot line shows limit of smooth "basement" in northern part of the area. Black regions are basement outcrop. Modified from Laughton (1971).

drift (Johnson & Schneider, 1969). The individual dunes have an average amplitude of 20 fathoms (37 m) and a wavelength of approximately 3200 m (fig. 3, profiles A-D; plate 2; fig. 4, profile 9). The great pile of acoustically transparent sediments which forms this drift is believed to be sculptured by bottom waters flowing westward from the European Basin in an anti-clockwise gyre in this region (Laughton, 1971, Johnson & Schneider, 1969). Laughton et al. (1972) found the upper sedimentary column in JOIDES drill hole 112 to consist of terrigenous clays and silts, and glacial pebbles interbedded with a coccolith marl. The region of dune topography is restrained to the north and west by a series of topographic highs (plate 2). The wavy diffuse layer at approximately mid-point in depth in these profiles has been dated by Laughton et al. (1972) (JOIDES drill hole 112) as a lower Oligocene radiolaria/diatomaceous ooze. As noted by Laughton (1971) the ubiquity of the Oligocene reflector and its conformity with the overlying beds suggest the circulation in the southern Labrador Sea has remained constant since Mid-Tertiary despite a considerable widening of the Atlantic Ocean.

Crustal structure

South of Kap Farvel the basic crustal structure has been delineated by Laughton (1971) and Le Pichon et al. (1971). The ancient Labrador Sea spreading center, Ran Ridge (Johnson & Vogt, 1972) can be seen in plate 2 and fig. 3 to be a typical "slow" spreading mid-oceanic ridge. A central rift is present flanked by basement highs. The axial valley 15–20 nautical miles (27 to 36 km) wide is morphologically similar to the rift valley of the present Mid-Oceanic Ridge (Heezen et al. 1959). The rift valley and flanking rift mountains are evident in profiles 7 and 8 (fig. 4). Approximately 1 kilometre of sediment fill is present in the median valley whereas the flanking rift mountains are sediment-free and tower about 800 metres above the adjacent floor. At its eastern extremity Ran Ridge narrows to an apex at 56° 50′N, 41° 30′W. The point of this fan-shaped pattern is the triple ridge junction with the Mid-Atlantic Ridge, indicating that simultaneous spreading was occurring on both ridges. This topographic pattern is identical to that reported by Deffeyes et al. (1971) at the Pacific triple junction formed by the Galapagos Ridge and the East Pacific Rise. Proceeding westward along the axis two prominent transform faults are present, one at 57°N 45°W and the Farewell Transform Fault (Vogt et al. 1973, Laughton, 1971, Le Pichon et al. 1971), see fig. 3. The fault scarps, as is the case for most fracture zones in the Atlantic, are marked by prominent basement highs (fig. 4, profile 9, northern end). The outer portions of the fracture zones change strike from NE-SW to ENE-WSW. Le Pichon et al. (1971)

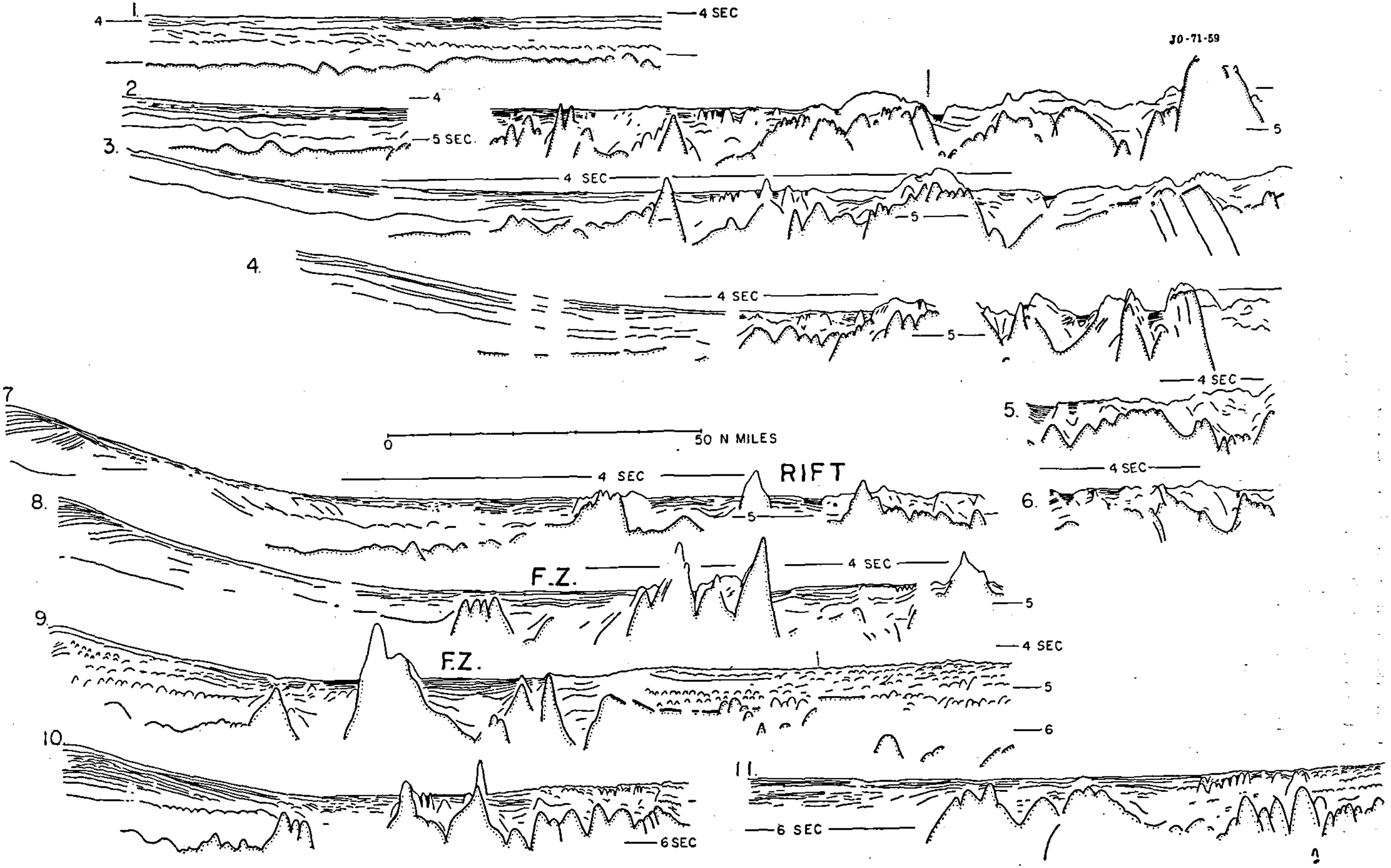

Fig. 4. Eleven seismic profiles south of Kap Farvel. Profile tracks are indicated in fig. 3. Median relic rift of the Labrador Sea (Ran Ridge) triple junction is labeled as well as a prominent fracture zone centered on 56° 30′ N, 45° 50′ W (fig. 3). One second of travel time equals approximately 1 kilometre. Acoustic basement is denoted by stippled pattern. 50 nautical miles equals about 90 km.

noted the change in strike and relate it to a change 60 mybp of orientation of the spreading axis of the Mid-Labrador Sea (Ran Ridge) spreading axis (plate 2).

Profile 10 (fig. 4) reveals unusually smooth basement beneath the overlying sediments as also do the northern portions of profiles 2, 3, 4 and 7.

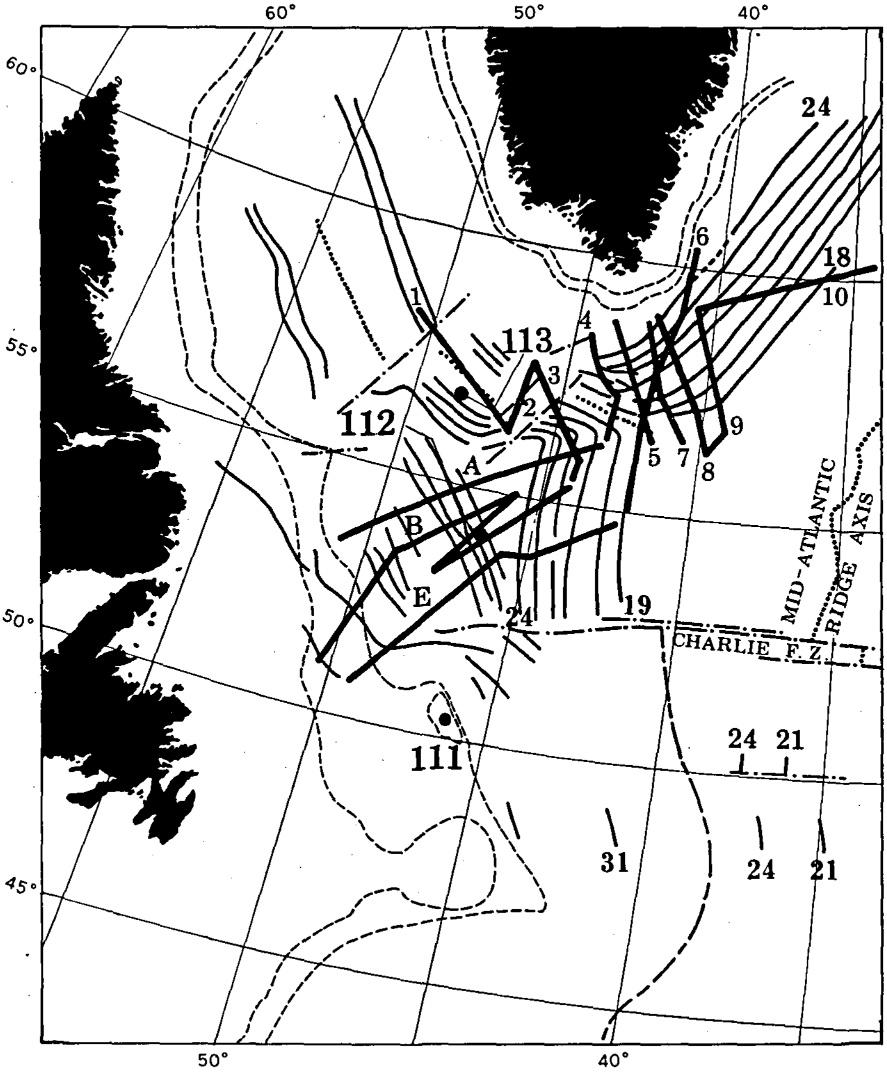

Fig. 5. Index for figs. 6 and 7. Based on *Lynch* magnetic data anomalies 19–24 are traced southward from Kap Farvel into the Labrador Sea triple junction. *Joides* drill holes 111, 112, and 113 (Laughton et al. 1972) are noted. Base chart is from Laughton (1971) with additions of *Lynch* magnetic data.

Smooth basement is normally associated with "fast" Pacific type mid-ocean ridges. Laughton (1971) calculated a spreading rate of 1.3 cm/yr for anomalies 18–24 south and east of the Labrador Sea. This relatively smooth basement has been noted in sea floor of the same age in the northeastern Atlantic (Ruddiman, 1973). The smooth basement in profiles 2, 3, 4 and 7 as contrasted to profile 1 is more likely an opaque sedimentary horizon rather than true basaltic crust at the base of the sedimentary column.

As is evident north of 57° (fig. 5) the sequence of north-south striking magnetic anomalies (19–24) swings ENE to form a magnetic bight, and thence change strike to the north to trend NE-SW as a complement to anomalies 19–24 in the northeastern Atlantic, Godby et al. (1966), Avery & Vogt (1973), Avery et al. (1969). The rough crustal structure of seismic profiles 2–4 (fig. 4) is presumed to parallel the easterly strike of the bight (fig. 5), however, the line spacing is too great to trace basement highs with any confidence. The crustal topography is rougher than that north of the magnetic bight in the eastern Atlantic (Ruddiman, 1973) which is very similar to that of profile 1, (fig. 4). The roughness in profiles 2 and 3 as contrasted to profile 1 implies a slower spreading rate with coincident rougher topography. The spreading rate in the region of the bight is under 1 cm/yr at about 0.95 cm/yr, (fig. 5). Vogt et al. (1969) suggest that rough topography is generated by ridges below which heat and/or basalt input is insufficient to prevent freezing of ultrabasics below the axis. The consequence is that the ultrabasics are discontinuously injected with resultant faulting. In contrast smooth topography is created when the heat and/or basalt input is great enough to allow steady-state intrusion of ultrabasics (Vogt et al. 1969).

The spreading rate of 1.3 cm/yr for anomalies 19–24, which to the north and south of the bight is producing "smooth" basement, is rather slow. Vogt (1971) has suggested that additional heat was added by a greater discharge of the Icelandic "mantle plume" 60 million years ago, thereby producing a basement crust similar to that created by the fast spreading Pacific Mid-Oceanic Ridge.

Laughton's proposed spreading axis

Plate 2 illustrates four seismic reflection profiles which were obtained over a NW-SE striking belt of prominent basement highs (see fig. 3 for profile tracks). Laughton (1971) proposed that these represent the crustal expression of an early pre-60 mybp spreading axis. That these structures are perpendicular to the fracture zone trends, determined by Le Pichon et al. (1971) for the initial spreading episode of the Labrador Sea, further influenced his thoughts. Laughton's conclusions were based on rather short lines taken during the JOIDES drilling expedition in the Labrador Sea preparatory to hole 112. One of the objectives of the LYNCH cruise was to examine this area in greater detail.

The magnetic profiles obtained concurrently with the seismic reflection data would seem to support the pre-60 my axis hypothesis. Profiles A and B (fig. 6) show a complete sequence of anomalies from 20 (49 mybp) to 26 (64 mybp). Thence a 200 km wide band of unidentified anomalies bordered on the western end by anomaly 31 (72 mybp). The axis shifted to the Ran Ridge spreading center by the time of anomaly 24 (60 mybp). The wedging out of anomalies 25–26 to the southeast (fig. 6) creates a fan-shaped pattern for the old spreading axis anomalies which is a complement to that south of Rockall Bank reported by Avery & Vogt (1973).

Anomaly 24 (60 mybp) is marked in the eastern Atlantic by a prominent crustal scarp separating relatively shallow acoustic basement from basement about 2 kilometres deeper, (Vogt et al. 1973). By comparing plate 2 and figs. 5 and 6 it is seen that the 60 mybp isochron (anomaly 24) generally coincides with a basement high. The peculiar flat opaque reflector is atypical of the normally rugged basement. A very similar reflector was reported by Vogt et al. (1973) to be present in the western Atlantic along the older 135 mybp Bermuda discontinuity. In this instance it was attributed to indurated Eocene cherts, or basalt flows emplaced during the early to Mid-Cenozoic activity of the Bermuda volcano. JOIDES hole 112 bottomed in basalt without encountering chert so we can fairly safely state the smooth reflector is basaltic in composition. However, the hole was made on a small topographic high and not directly on the smooth opaque layer. Vogt (1971) has hypothesized that basement scarps and major elevations along prominent North Atlantic discontinuities have been formed by an abrupt increase in mantle plume flow. The initial active period 65–55 mybp was perhaps responsible for splitting the plate separating Greenland and Europe (Vogt, 1971). As noted earlier the basement is smoothish in this region as compared to the crustal topography in the bight of the Labrador Sea where spreading rates were under 1 cm/yr as contrasted to this region associated with anomalies 19–32 where spreading rates are slightly in excess of 1 cm/yr.

Magnetic anomalies

Magnetic data from the LYNCH cruise has made it possible to extend magnetic anomalies 19–24 southward from the aeromagnetic survey of Godby et al. (1966) around the southern tip of Greenland to join the same sequence east of Labrador (Avery et al. 1969, Laughton, 1971). The LYNCH data has been combined with these data to create fig. 5 and the anomaly profiles are presented in fig. 7. At the apex of the triple junction

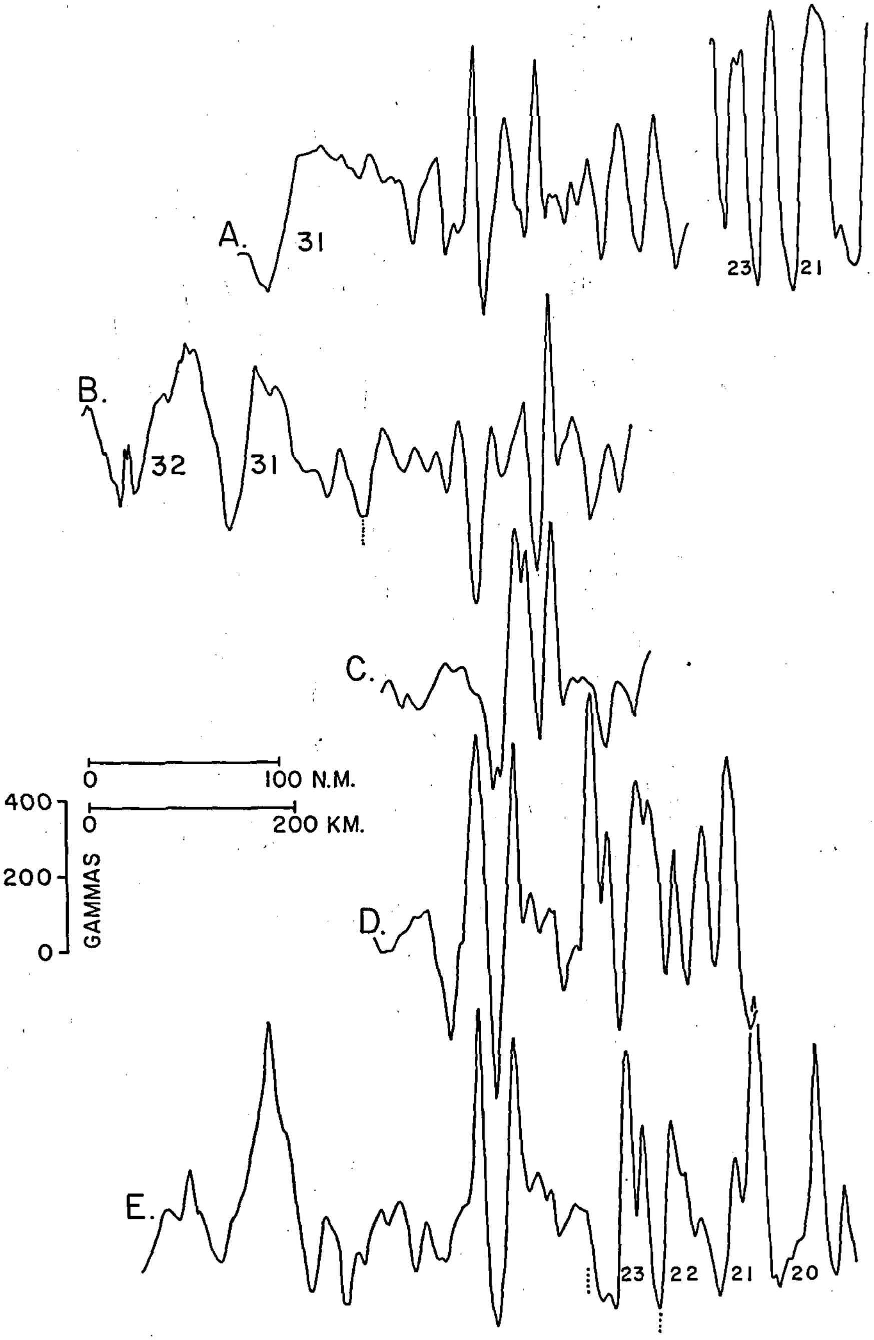

Fig. 6. Residual magnetic profiles across the proposed initial spreading axis in the Labrador Sea (Laughton, 1971). Anomaly 32 is dated at 77 mybp (Heirtzler et al. 1968). Profiles are indexed in fig. 5.

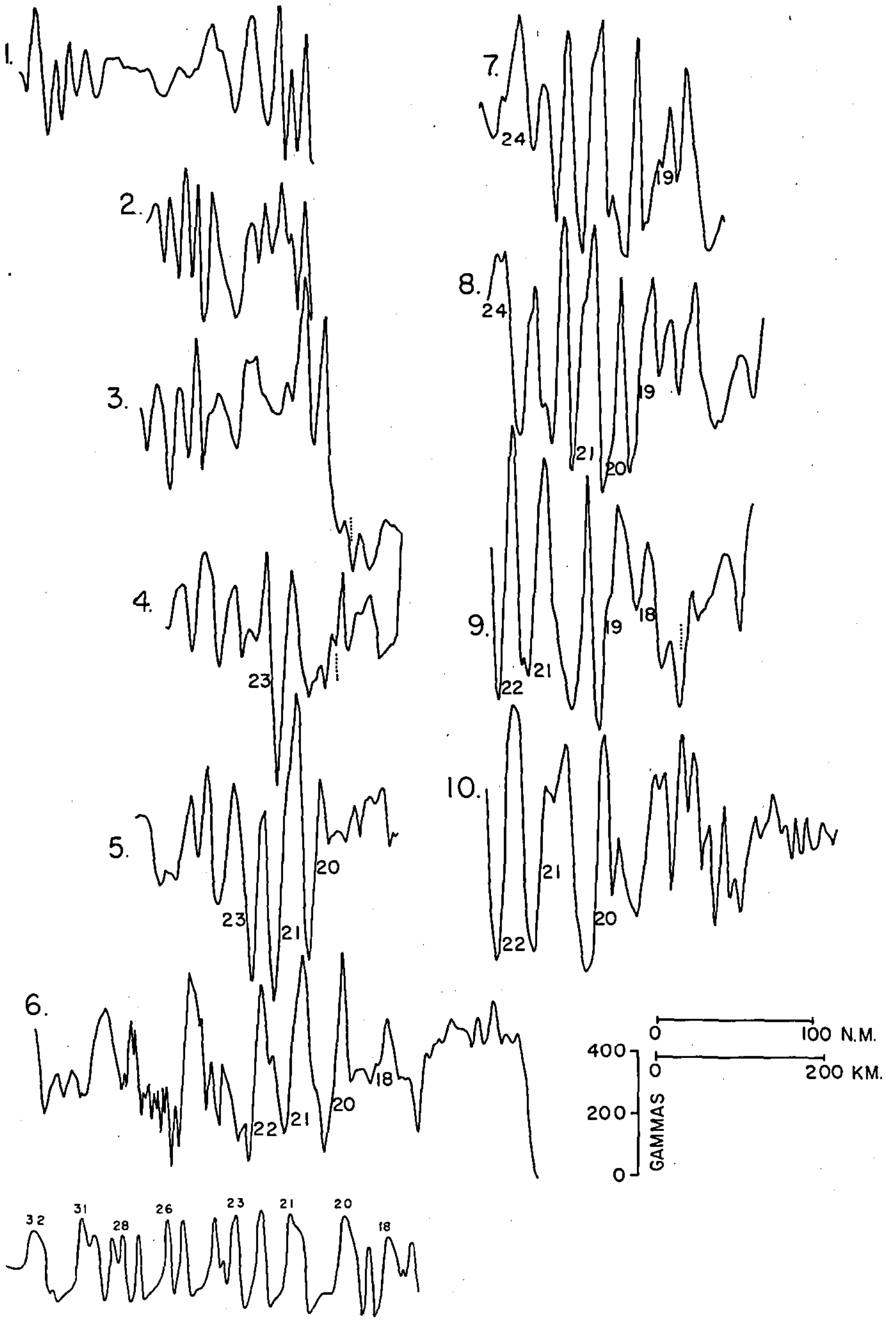

Fig. 7. Residual magnetic anomalies south of Kap Farvel. Profiles are indexed in fig. 5. Lower profile is a model calculated at a spreading rate of 0.98 cm/yr.

the magnetic anomalies form a bight which is a direct complement of the bight formed in the eastern Atlantic by the same anomalies (Avery et al. 1969, Avery & Vogt, 1973). It is not clear if anomaly 18 (46 mybp) is present in the center of the Labrador Sea as a spreading anomaly, however anomaly 19 (47 mybp) is present (Laughton, 1971). The slow spreading rates of the Labrador Sea makes anomaly identification difficult. For example profiles 2 and 3 (figure 7) certainly show some anomalies between 20 and 24. However, exact identification is difficult as compared to profiles 7–10 (fig. 7) just east of the Labrador Sea spreading center. Identification of central Labrador Sea anomalies 20–24 have been published by Le Pichon et al. (1971), Avery et al. (1969) and Johnson et al. (1971b). These anomalies flank a magnetically quiet central portion of the Labrador Sea. Vogt et al. (1970) suggest this quiet zone was formed by the very slow spreading of the Labrador Sea after 47 mybp.

Fig. 8 shows a close similarity between magnetic profiles across the possible extinct rift in the central Norwegian Sea and Labrador Sea and suggests that both ridges, Aegir and Ran, (Johnson & Vogt, 1972) became extinct

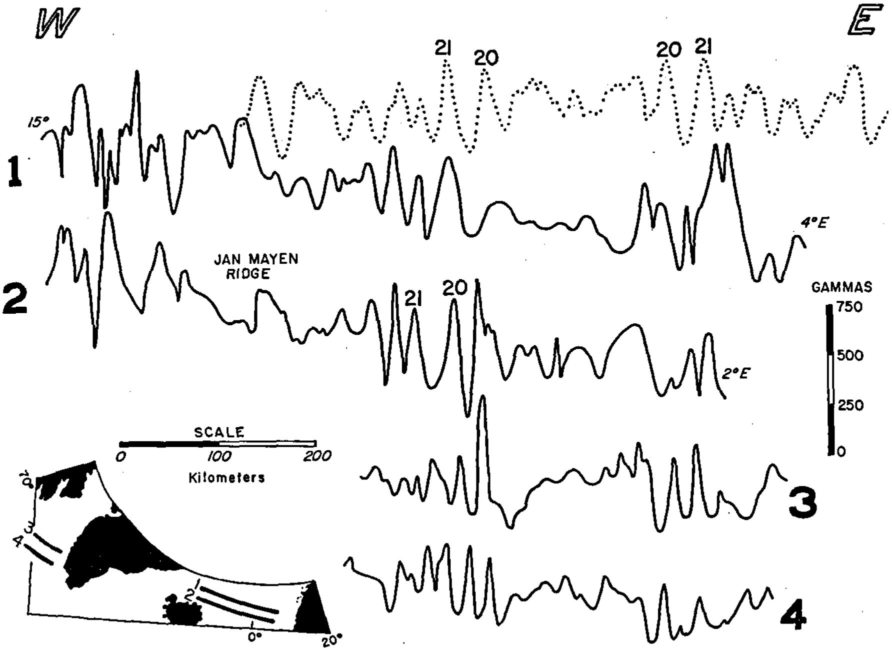

Fig. 8. Residual magnetic profiles across the Norwegian Sea and Labrador Sea, illustrating their general similarity. The two upper profiles cross the Norwegian Basin (from Avery et al. 1968). The two lower profiles cross the Labrador Basin (from Godby et al. 1966). Dotted line is a model calculated for a spreading rate of 0.63 cm/yr. Anomaly 20 is dated at about 49 mybp (Heirtzler et al. 1968).

at the same time. The central "quiet" zones of both areas are believed to represent the dying phase of the central rifts, but the model profile, which assumes abrupt stoppage, implies that the low amplitudes of the magnetic anomalies are probably also related to the increased frequency of polarity reversals after 42 mybp (anomaly 16), (Heirtzler et al. 1968). The central quiet zone is very similar to that reported by Malahoff & Handschumacher (1972) for a relic spreading centre in the Pacific south of the Murray Fracture Zone. This axis commenced activity about 38 million years ago and like its northern Atlantic counterpoint became extinct about 27 mybp.

Conclusions

Data from the LYNCH cruise south of Kap Farvel allow us to draw certain conclusions:

1. Imarssuak Mid-Ocean Channel is an important conduit for transportation of terrigenous sediment westward from the West Reykjanes Basin to the Northwest Atlantic Mid-Ocean Canyon.
2. From the Oligocene to present the sedimentation pattern in the southern Labrador Sea has been dominated by bottom currents. These Arctic waters have constructed Eirik Ridge south of Kap Farvel and the extensive dune topography in the southern Labrador Sea.
3. Laughton's (1971) proposal of a pre-60 my spreading center in the Labrador Sea is supported by both magnetic and crustal data.
4. The present Ran Ridge triple junction apex is located at 56° 50′N, 41° 30′W. Sea floor spreading on Ran Ridge ended approximately 30 mybp.
5. Fracture zones in the southern Labrador Sea change strike in response to a change in sea floor spreading orientation in the Labrador Sea.
6. The magnetic anomalies south of Kap Farvel form a bight which is a direct complement to that reported in the eastern Atlantic.

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Dansk sammendrag

USNS "Lynch" expeditionens målinger i farvandet syd for Kap Farvel har bl. a. vist tilstedeværelsen af en ny midt-ocean kanal (Imarssuak Kanalen), som transporterer terrigene sedimenter mod vest fra Reykjanes Bassinet til den midt-oceaniske canyon i det nordvestlige Atlanterhav. Fra Oligocæn til nutiden er sedimentationsmønsteret i det sydlige Labrador Hav blevet domineret af bundstrømme. De arktiske vandmasser har formet Eirik Ryggen syd for Kap Farvel, samt den udbredte klittopografi i det sydlige Labrador Hav. Knudepunktet (triple point junction) mellem den nu uddøde

Labrador Hav Højderyg og spredningsaksen langs den Midt-atlantiske Højderyg er blevet lokaliseret omtrentligt på positionen 56° 50′ N, 41° 30′ W. Labrador Højderyggen menes at have været aktiv som spredningsakse i tidsrummet 60–30 mill. år før nutiden. De magnetiske isochroner syd for Kap Farvel er angivne for første gang.

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Plate 1

Six four second seismic reflection profiles across Imarssuak Mid-Ocean Channel south of Kap Farvel. One second of travel time equals approximately 1 kilometre. Note the high reflectivity of the canyon floor.

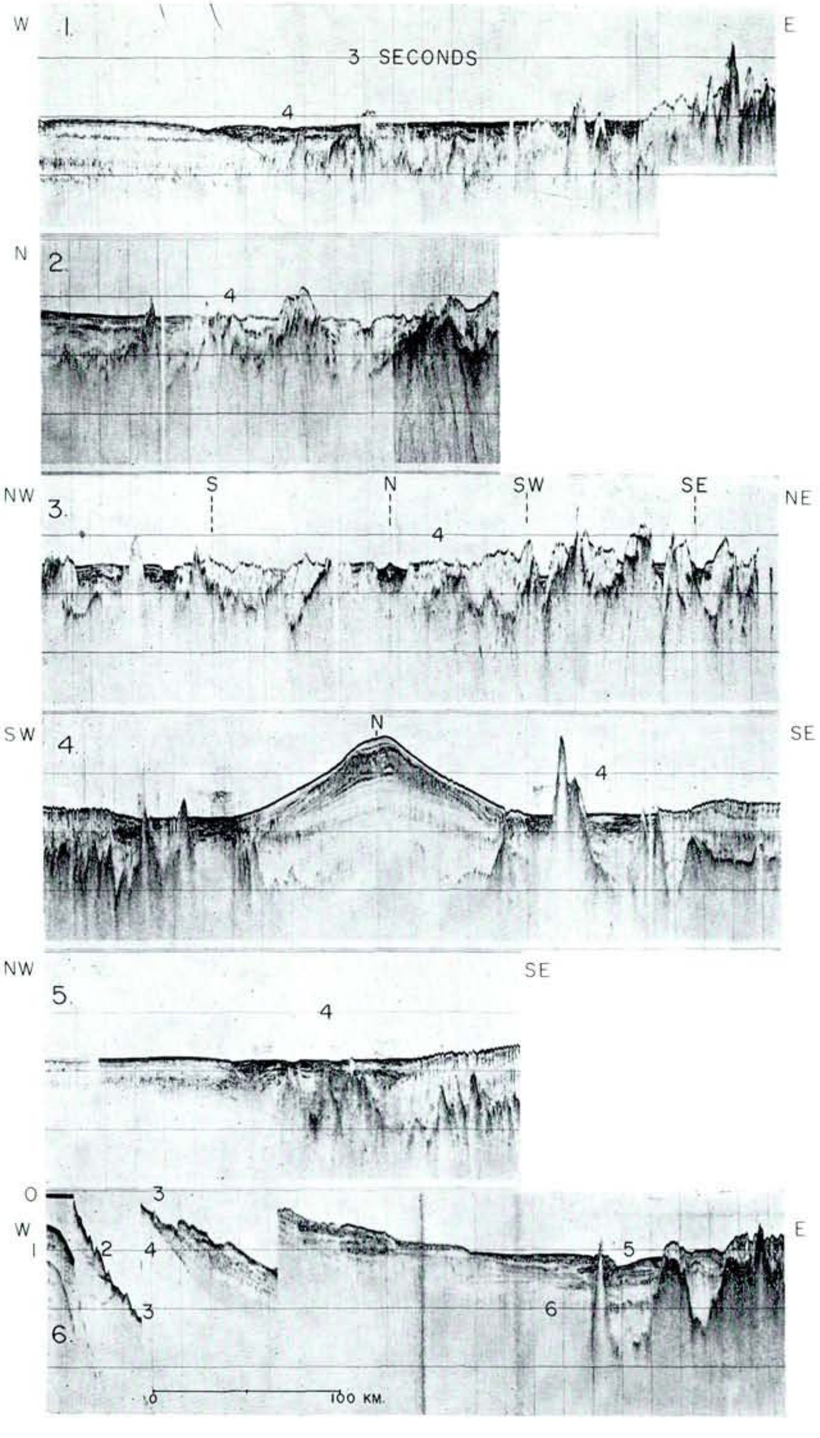
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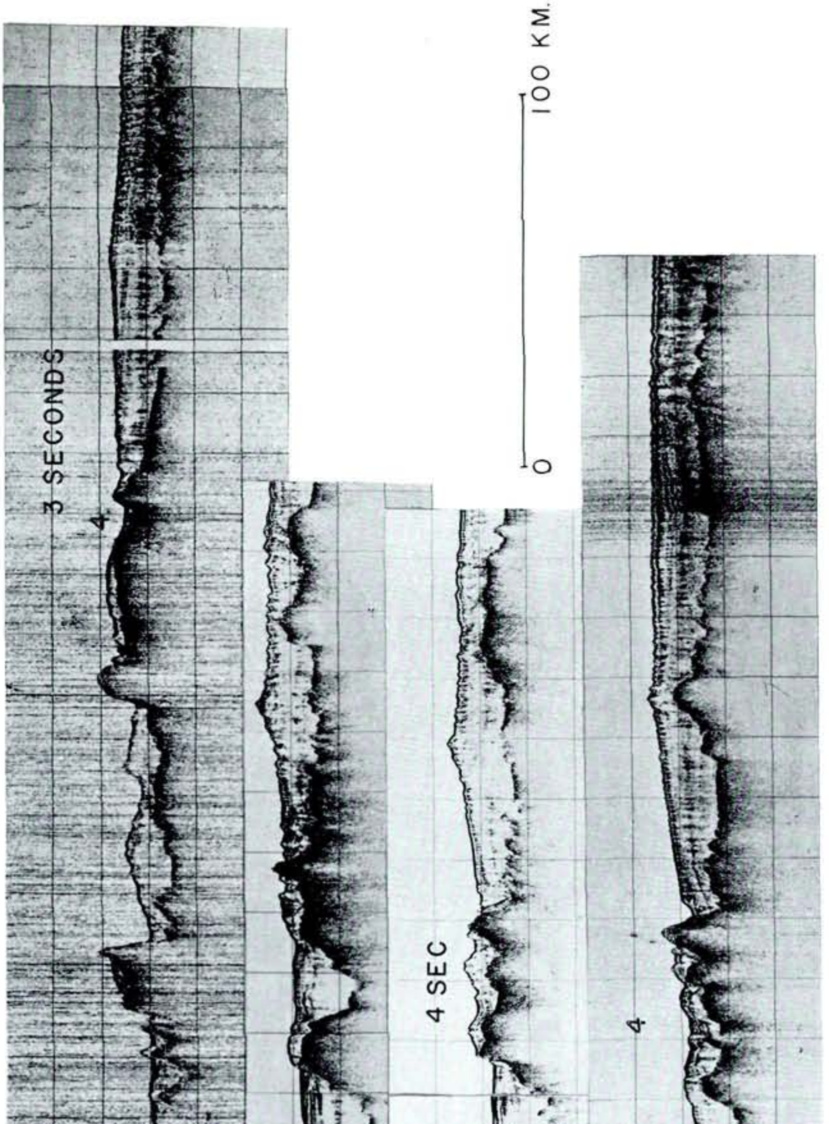
Plate 2

Four seismic reflection profiles across the region of Laughton's proposed early Labrador Sea spreading axis. The Northwest Atlantic Mid-Ocean Canyon is the prominent canyon on the western portion of all profiles. One second of travel time equals approximately 1 kilometre. Indexed on fig. 3.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