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The Jan Mayen Ridge 1985 seismic survey. An initial planning proposal

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Greinargerð KG-84/05

ORKUSTOFNUN
National Energy Authority
Geothermal Division

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CONTENTS

1 INTRODUCTION

According to the agreement between Norway and Iceland regarding the boundaries of the economic zones between Iceland and the island of Jan Mayen, an area for shared exploitation was defined, bounded by latitudes 68.0° to 70.5°N and longitudes 6.5° to 10.5°W. The dimensions of this area are roughly 160 km in the E-W direction and 290 km N-S. A joint geophysical reconnaissance survey of the Jan Mayen Ridge was also stipulated, the emphasis being on the seismic reflection method. This survey will be organized and directed in cooperation between the national institutes of the Norwegian Petroleum Directorate (Oljedirektoratet) and the National Energy Authority (Orkustofnun) as representatives of Norway and Iceland respectively.

This report is an initial contribution of Orkustofnun towards planning of the Jan Mayen Ridge Seismic Survey, and is meant to be a basis for further discussion and coordination for forming the final plan for the survey. A short summary of present views on the geology of the Jan Mayen Ridge is given, especially some controversial and doubtfull aspects which future work could clarify. A more extensive recent review is e.g. given by Myhre et al. (in press). The accompanying charts are a compilation of important geological features of the region as obtained from various publications and read of seismic sections, and they are listed in Appendix 1. This is followed by guidelines which should direct the planning of the survey, and finally the proposed tracks are explained and presented on a map.

2 NOTES ON THE GEOLOGY OF THE J.M.R. AREA

It is generally accepted that the Jan Mayen block has been left in its present position by sea-floor spreading in the Norway Basin, starting just prior to the time of magnetic anomaly 24 and ending at about anomaly 7 times, followed by spreading on the Iceland plateau. Some overlap in time of these spreading episodes resulted in a fan shaped anomaly pattern in the Norway Basin, and a necessary complementary wedge in the western region, although the latter has not been definitely identified yet. Some different versions exist in the litterature. Talwani and Eldholm (1977) and Grönlie et al. (1979) assume that the initial opening of the Norway Basin took place in the strip next to the Faeroe-Shetland Escarpment, followed by a slight westward shift of the spreading axis just before anomaly 23. Thus they identify the oldest anomaly adjoining the eastern side of the Jan Mayen Ridge as anomaly 23. A different interpretation by Nunns (1980) proposes that only one spreading axis was active in the Norway Basin, and that anomaly 24 (24a and 24b) is found at both margins (see Chart 1). If the presumed oceanic crust between the eastern anomaly 24 and the F-S Escarpment has its "mirror image" to the west of western anomaly 24, much of J.M.R. could be oceanic. This problem does however not arise if the position of the initial rift lies some distance to the west of the F-S Escarpment as suggested by Smythe (1983). These questions do therefore relate to the study of the J.M.R.

Similarly, two basically different identification scemes exist for the magnetic anomalies on the eastern Iceland Plateau (e.g. Talwany and Eldholm (1977); Vogt, Johnson and Kristjánsson (1980)), but as the easternmost anomaly is in both cases of similar age and in similar position, this is not critical regarding the geology of the Jan Mayen Ridge itself.

2.1 Structural units and basement

The Jan Mayen Ridge Area consists of the Jan Mayen Ridge propper in the north and a southern rifted region, separated by the NNE-SSW trending Jan Mayen Trough. West of the Ridge, the Jan Mayen Basin extends westwards to an escarpment or basement ridge, called the Eastern Scarp of the Iceland Plateau. Within this basin a basement ridge, the so called "Middle Axis" which is presumably a part of the J.M.R. structural unit, pierces the smooth basaltic acoustic basement. The southern area is characterized by a complex of north-south trending ridges, which are faulted and tilted blocks. The JM-Trough is floored by flood basalts under relatively thin sediments, and another similar graben, which we can refer to as the southern graben, is found further to the south (Gairaud et al., 1978).

It is usefull to define the geological provinces of the Ridge as in fig. 2 (also reproduced on Chart 2), where yellow and red areas are presumed continental crust, and blue and purple are areas where the accoustic basement appears to be basaltic, but not typically oceanic. Outside these areas, the crust is oceanic as shown by the sea-floor spreading magnetic anomalies. In the presumed continental areas the basement horizon is named the "O-horizon" by Gairaud et al. (1978). It is usually considered to be an erosion unconformity, heavily faulted in places. The "purple" basalts on the eastern flank (hummocky in most places) are thought to be of early Tertiary age (Paleocene), originating at the time of initial rifting and spreading. The "blue" basalts cover the area west of the ridge and depressions in the rifts of the southern region. They are thought to be contemporary with the initiation of rifting west of the ridge, being flood basalts that covered low-lying areas after the Ridge was subjected to intensive faulting, and graben formation in the southern part.

It is not certain that the sub-division between blue and purple areas as shown in fig. 2 is valid. The basalts in the various rifts in the southern region could be formed at different times, corresponding to successive phases of rifting (Ólafsson, 1983). Basalts recovered in DSDP-hole 350 (in the purple area) were dated as about 41 My old, similar in age to the initiation of spreading between the JMR and Greenland according to Nunns (1981). The seismics reveal gaps in the flat lying "blue" basalts of Jan Mayen Trough, interpreted by Gairaud et al. (1978) as "windows" or areas where flood basalts are missing. These could also possibly be caused by faulting, a sort of a inner graben, indicating that some faulting postdated the lavas. In general, more information is needed about the extent of the basement basalts and their stratigraphic relations to the various sedimetary units and tectonically affected strata. The edges of the basaltic regions could provide the best locations for this study. Deeper horizons and faults below the blue-area basalts are also seen in the area between about 67.5-68.0°N and 8-9°W (e.g. in line 105), interpreted as the NW-SE trending transcurrent "JAG-fault" by Gairaud et al. The existence of this fault has not been confirmed by other workers, exept that Olafsson (1983) suggests a possible NE-SW trending rift. This area is complicated, and more seismic coverage is needed.

Below reflector O on the eastern slopes of the Ridge, deeper reflectors are seen in the area from about 69.0° to 69.7°N. Chart 4 shows those segments of the seismic lines where indications of these reflectors are seen, according to Garde (1978), Gairaud et al. (1978) and our own interpretations. The reflectors appear to have an eastward dip, but they are not clear nor coherent exept on the N-S trending line J-1-79, where a continuous reflector can be traced over long distances and is seen at depths up to 1.5 s t.w.t. below reflector O. The limits of these strata in depth and areal extent are badly defined by existing data, and should be investigated further.

The nature of reflector O is open to speculation. It is often thought to represent an Paleocene erosional unconformity, formed at the initiation of spreading in the Norway Basin, undelain by continental crust (crystaline rocks and/or Mesozoic or Paeleozoic sediments). It has furthermore been suggested that the horizon is the Kimmerian (late Jurasic) unconformity known on the Norway margin. In this case the sediments above could also be pre-Tertiary. Another possibility is that reflector 0 is underlain by anomalous oceanic crust formed sub-aerially before anomaly 24 times, at the earliest stage of spreading. Seaward dipping reflectors are considered characteristic of such formations (Mutter et al., 1982). Even if the Ridge is continental in character, it could possibly be covered by the continuation of the East-Greenland plateau basalts.

2.2 Sediments

An attempt to construct a isopach map for total sediment thickness is shown on Chart 3. The eastern slope of the northern JMR is underlain by sediments of thickness corresponding to up to 3 s t.w.t., deposited on top of the smooth and relatively transparent accoustic basement (horizon 0). The thickness of the sediments and their sub-units in this area should be easily mappable. Under the flat top of the Ridge, and especially the heavily faulted western slopes, basement and internal reflectors are in most places indistinct and difficult to trace. Perhaps more data processing, such as migration, could make some improvement. In the southern region of faulted and tilted blocks, sediments of considerable thickness are also seen. The basaltic basement is typically covered by 0.6 to 1.0 s t.w.t. of sediments, but it seems likely that the basalts have in their turn covered older sedimentary sequences. The thick sediments that can been seen, are in the so-called "window" regions, which escaped from beeing covered by basalts, probably because of their elevation.

A major upper unconformity ("horizon A" according to Gairaud et al.) has been associated with erosion due to uplift concurrent with the sepparation of JMR from Greenland. Another possible interpretation is that it was caused by the global Mid- Oligocene fall in sea-level. This horizon is a flat erosional surface cutting the eastward dipping strata under the crestal region of the ridge, but under the slopes and low-lying regions it is more conformal. Narvestad and Jörgensen (1979) have divided the post-A sediments into three sub-units. Unit IA is uppermost, including the 200 to 400 m thick horizontal ridge-top strata above horizon A. Units IB and IC are found below IA on the eastern flank, and show onlap against the erosional unconformity. These strata must have been deposited while the top of the ridge was still being actively eroded. The sequence below horizon A has also been divided into three units. This stratigraphic scheme needs to be checked, and mapped in more detail in the various physiographic regions of the Jan Mayen Ridge.

Drilling on the top of the ridge near the western slopes indicate an Upper- to Middle-Oligocene age (about 30 My) of the unconformity (Talwani and Udintsev, 1976). Below the unconformity are primarily massive terrigenous sandy mudstones from early Oligocene to late Eocene. Above the upper unconformity is a unit of middle Miocene to late/middle Oligocene in age. It consists of sandy mud and biogenic siliceous oozes. The connection between horizon-A and the sedimentary formations above, as seen in the different ridge and slopes regions, is not always clear and should be investigated with care.

If seismics are to give any information about the age of reflector 0 and the overlying sediments, sedimentary stratigraphy on the ridge must be established, and connected with available borhole sections and dated oceanic crust. Presently, such relationships are poorly known, as faulting in the area of the boreholes makes it difficult to establish stratigraphic connection with the more regular eastern slope section. More effort must be put into solving these problems, perhaps more seismic lines and better processing are both needed. Relative stratigraphic relationships between various strata in the Jan Mayen Ridge Area and dated oceanic basement can also put some constraints on possible age. Mapping of basement and sub-0 reflectors, and comparision with sonobuoy results and gravity and magnetic modelling, could give some idea of the nature of the basement rocks.

3 AN INITIAL PLAN FOR THE 1985 SURVEY

At this stage of planning it is more appropriate to concentrate on defining the general outlines of the survey, than produce an exact plan of survey tracks. The aims and extent of the survey, and the relevant controlling geological factors, are outlined below. When such guidelines are established and agreed on, a final track chart can be plotted. The track chart presented here indicates basically the desired attitudes and density of tracks, and the area to be investigated.

3.1 Planning guidelines

The following points are used as guidelines for positioning of the tracks of the planned 1985 seismic survey:

(1) The principal area of investigation is the box 68.0-70.5°N and 6.5-10.5°W, where the bulk of the effort should be placed. However,

there is no reason to cover the box evenly with tracks if it is not required by geological reasons. Similarly, some lines could be placed outside the box, if this is expected to produce relevant information on the geology of the area. We propose that the areas of presumed continental crust and where post-O sediments are thickest (yellow,red and shaded areas in fig. 2) should have priority. This includes the area immediately south of 68°N, but there the track density could be lower. The main tasks should be to investigate the stratigraphy of the thick post-O sediments, the tectonic structure and nature of the accoustic basement (whether "continental" or basaltic) and any deeper formations detected.

Another option is to concentrate all effort on relatively small areas where prospecting potential is thought to be greatest. Considering the present state of knowledge and the nature of the proposed survey, we think that such an approach could lead to less information returns on the fundamental questions relating to the geology of the area.

(2) We assume that the total length of survey lines will be at least 3000 km, and not more than 5000 km, although we are not certain about these figures. The plan should then ideally cover all important areas with a 3000 km survey, but be flexible enough so up to 2000 km can be added profitably and without leaving some areas too sparsely or disproportionally densely covered.

(3) The plan should take into account the existing multi-channel seismic data in the area, so unnecessary overlapping can be avoided. The existing quantity is comparable with the planned survey, and will therefore be important and indispensable for interpretation. This implies that all existing data in the area should be collected and compiled, and if neccessary re-processed. We propose that the data from BGR and Oljedirektoratet can be considered to be of sufficient quality to be rated equal to the 1985 survey tracks. The data from CNEXO, University of Bergen and LDGO will be considered as additional material, and will influence the positioning of the new tracks to a lesser degree.

(4) The main orientation of the tracks should be perpendicular to the suspected structural trend of the area. We propose that E-W orientation is appropriate for the northern part of the area, taking into consideration the structural trend and the position of existing tracks. If the existing E-W lines are included, a fairly regular grid with line intervals of some 10 to 15 km will be obtained. The other existing seismic lines, especially the N-S lines, can be regarded as tie lines. In the southern part of the area the structural trend seems to be approximately 25 degr. east of north, making a survey line

orientation of about 115 degrees preferable. In this area we will in fact try to include existing lines such that coverage will be as uniform as possible. The location of the existing lines will there fore dictate the location of the additional programme.

(5) Some north-south trending tie-lines should be included. These serve best in places where horizons can be reliably traced, so stratigraphic relations between the E-W trending lines can be established. Such conditions are mainly found on the eastern flank of the Ridge where the sediments are thickest and most regular. The sedimentary sequence of the central and western side of the ridge is heavily faulted in places, and reflections from basement and intra-sedimentary reflectors are often indistinct, but tie-lines in this area could serve to indicate correct ties between structural entities. Similar arguments apply to the southern rifted region. It is questionable whether much effort should be spent on the relatively thin and monotonous sediments overlying the western and some of the southern basaltic basement regions.

(6) In case the previous tasks described above do not require all the available ship time, additional lines must be planned, perhaps up to 2000 km long. This could include more N-S tie-lines, and lengthening of selected traverses of the ridge in order to obtain connections with adjacent areas. Special local surveys could be placed in areas of special interests, where sediments are exceptionally thick or tectonic structure complicated, e.g. in the vicinity of boreholes. It could also be profitable to place additional lines on the east flank of the Ridge, approximately between latitudes 69.0° and 69.7°N, where the clearest indications of sub-"O" reflectors have been found.

(7) Sonobuoys should be deployed at selected sites, especially where layering seems to be parallel or the track lies along the tectonic strike. Gravity and magnetics should be recorded continuously. Other geophysical measurements are not suitable for this cruise, but methods such as heat-flow measurements and deep penetration seismics are of interest in investigating the Jan Mayen Ridge microcontinent.

3.2 A plan for seismic survey tracks

The planned seismic lines are shown on Chart 5, superimposed on the track chart of the previous surveys. The primary or priority lines are indicated by the letter A, and are orientated in a E-W direction north of latitude about 68.8°N. In the southern region a direction of about 115-120° has been chosen, as this is approximately perpendicular to the structural trend, and fits in with some of the existing Cepan tracks.

The survey lines are so positioned that they cover areas of continental crust and relatively thick sedimentary cover, but less emphasis is laid on the monotonous areas where the basement is obviously basaltic and "opaque", and sediments are thin. The traverses span the Ridge from the oceanic crust or basaltic basement of the Norway Basin, westwards to the younger basalts forming the basement of the J.M. Basin. The "Middle Axis" of the J.M. Basin receives some attention. The survey extends south to include the main basement ridges and rifts of the southern area, towards DSDP-hole 350. Two N-S trending tie-lines along the length of the Ridge are planned, at about 8.4°W and 7.7°W, the latter extending south throughout the survey area.

The lines are straight lines on the Transverse Mercator projection, and should approximately represent great circles, but lines of constant heading (straight lines on a Mercator projection) could also be used without any significant visible difference.

As indicated above, the extent or length of individual lines is governed by local geological conditions. In the final sailing plan this might have to be modified for practical reasons. The average line interval in the northern region is about 12 km when the existing regular E-W trending lines are included. Corresponding interval in the southern region is about 16 km. Total length of the traverses as they now stand is some 2310 km. When the two tie-lines are included, the line length totals 2990 km.

Additional seismic lines, "B-lines", are shown on Chart 5 as broken lines. They are meant to provide more detailed information, or to cover marginal areas, if time allows. They are organized in relatively small units, as listed below:

Four E-W lines in the vicinity of borehole 349, also intended to investigate the sub-"O" reflectors. Length is 210 km.

Two E-W lines in the vicinity of boreholes 346 and 347. Length is 80 km.

A fairly large program of some 510 km to investigate the area roughly bounded by 67.0-67.7°N and 8-10°W. This is aimed at investigating thick sediments in the graben just west of 9°W, the area around DSDP-hole 350, and the possible transverse fault to the north. This program can be trimmed down depending on priorities.

A N-S tie-line near 7°W. Length is 170 km.

Two N-S tie-line on the western flank of the Ridge. Length is 310 km.

An E-W line just south of Jan Mayen Island. Length is 100 km.

A traverse (210 km long) just south of latitude 67°N, and another similar further south (south of the area shown on Chart 5). Total length is 240 km.

A lengthening of two E-W lines (A-lines) in order to get long geophysical traverses across the northern Ridge (not shown on chart). Length is 200 km.

The B-lines listed above are combined 1820 km long, which brings the total planned survey up to about 4800 km, close to the maximum we assume attainable. These various tasks can be given a flexible priority order and included prior to or during the execution of the project, as circumstances allow.

REFERENCES

Eldholm, O., Myhre, A.M., and Sundvor, E., 1981: The Jan Mayen Ridge: present status. Polar Res.

Eldholm, O., and Sundvor, E., 1980: The continental margins of the Norwegian-Greenland Sea: resent results and outstanding problems. Phil. Trans. R. Soc. Lond., A 294, 77-86.

Eldholm, O., and Windisch, C.C:, 1974: Sediment distribution in the Norwegian-Greenland Sea. Geol. Soc. Am. Bull., 85, 1661-1676.

Gairaud, H., Jacquart, G., Aubertin, F., and Beuzart, P., 1978: The Jan Mayen Ridge; synthesis of geological knowledge and new data. Oceanologica Acta, 1, 335-358.

Garde, S.S., 1978: Zur geologischen Entwicklung des Jan Mayen Rückens nach geophysikalischen daten. Unpublished dissertion, University of Clausthal, 74p.

Grönlie, G., Chapman, M., and Talwani, M., 1979: Jan Mayen Ridge and Iceland Plateau: origin and evolution. Norsk Polarinstitutt, Skr. 170, 25-47.

Grönlie, G. and Talwani, M., 1978: Geophysical Atlas of the Norwegian-Greenland Sea. Vema Research Series 4, Lamont-Doherty Geological Observatory, Palisades, N.Y.

Hinz, K. and Schlüter, H.U., 1979: The North Atlantic - results of geophysical investigations by the Federal Institutt for Geosciences and Natural Resources on North Atlantic continental margins. Erdoel-Erdgas-Zeitschrift, 94, 271-280.

Mutter, J.C., Talwani, M. and Stoffa, P.L., 1982: Origin of seaward-dipping reflectors in oceanic crust off the Norwegian margin by "subaerial sea-floor spreading". Geology, 10, 353-357.

Myhre, A.M., Eldholm, O. and Sundvor, E., in press(?): The Jan Mayen Ridge: present status. Polar Res.

Narvestad, T. and Jörgensen, F., 1979: Aeromagnetic investigations on the Jan Mayen Ridge: Norw. Petrol. Soc., NSS/9, 12 p.

Nunns, A.G., 1981: Marine geophysical investigations in the Norwegian-Greenland Sea between latitude of 62°N and 74°N. Ph. D. dissert., Durham, England, Univ. Durham, 185 p.

Nunns, A.G., 1983: Plate tectonic evolution of the Greenland-Scotland Ridge and surrounding regions. In: Bott et al. (ed.): Structure and Development of the Greenland-Scotland Ridge, 11-30, Plenum Press, New York, 1983.

Ólafsson, I., 1983: The Jan Mayen Ridge and surrounding areas - a marine geophysical study. Unpublished Cand. Real. thesis, University of Bergen, 127 p.

Smythe, D.K., 1983: Faeroe-Shetland Escarpment and continental margin north of the Faeroes. In: Bott et al. (ed.): Structure and Development of the Greenland-Scotland Ridge, 109-120, Plenum Press, New York, 1983.

Sundvor, E., Gidskehaug, A., Myhre, A.M. and Eldholm, O., 1979: Marine geophysical survey on the northern Jan Mayen Ridge. Seismol. Obs. Univ. Bergen, Sci. rept. no 6, 17 p.

Talwani, M. and Eldholm, O., 1977: Evolution of the Norwegian-Greenland Sea. Geol. Soc. Am. Bull., 88, 969-999.

Talwani, M., Udintsev, G. and Shirshov, P.R., 1976: Tectonic synthesis. In: Initial reports of the Deep Sea Drilling Project. Vol. 38, 1213-1242.

Talwani, M. and others 1980: The area between Jan Mayen and eastern Iceland; a geological report. Prepared at a workshop held at Lamont-Doherty Geological Observatory, Palisades, New York, USA, December 8 to 10, 1980.

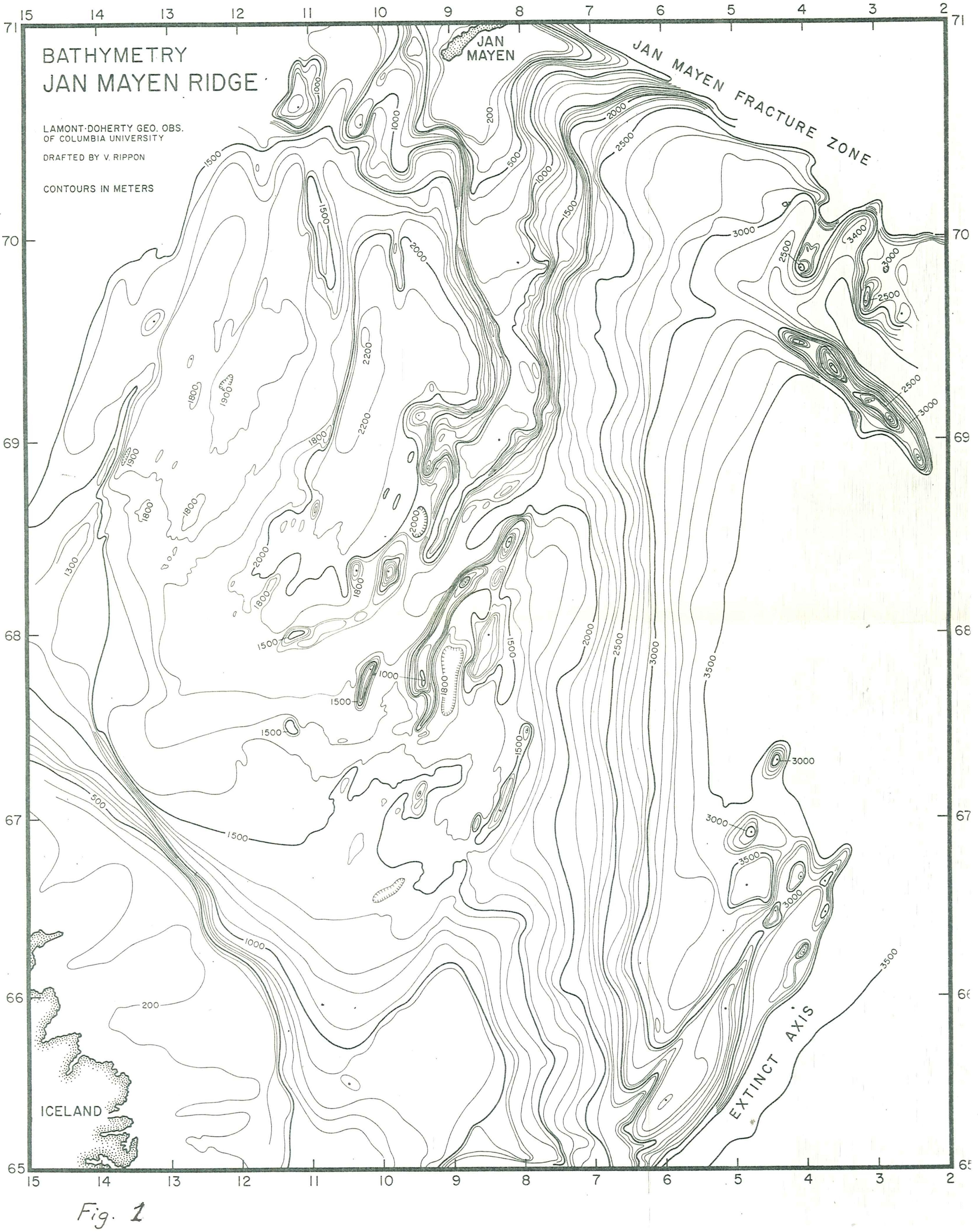
Vogt, P.R., Johnson, G.L. and Kristjánsson, L., 1980: Morphology and magnetic anomalies north of Iceland. J. Geophys., 47, 67-80.

FIGURE CAPTIONS

Fig. 1. A map from L-DGO of bathymetric contours of the Jan Mayen Ridge Area (Talwani et al., 1980). Contour interval is 100 m. Compiled for the workshop held December 1980 at L-DGO, in preparation for the Norway/Iceland agreement on the Jan Mayen Ridge area.

Fig. 2. Major geologic provinces of the JMRA (Talwani et al., 1980). Shown are boundaries between geological provinces, multi-channel seismic tracks, areas of sediment thickness greater than 2.5 km, and bathymetry as in fig. 1.

Fig. 3. A structural map of the Jan Mayen Ridge Area, from Ólafsson (1983). Magnetic anomaly identification on eastern Iceland Plateau is unique to this publication.


BATHYMETRY
JAN MAYEN RIDGE
LAMONT-DOHERTY GEO. OBS.
OF COLUMBIA UNIVERSITY
DRAFTED BY V. RIPPON
CONTOURS IN METERS
JAN MAYEN
JAN MAYEN FRACTURE ZONE
EXTINCT AXIS
ICELAND
15
14
13
12
11
10
9
8
7
6
5
4
3
2
71
70
69
68
67
66
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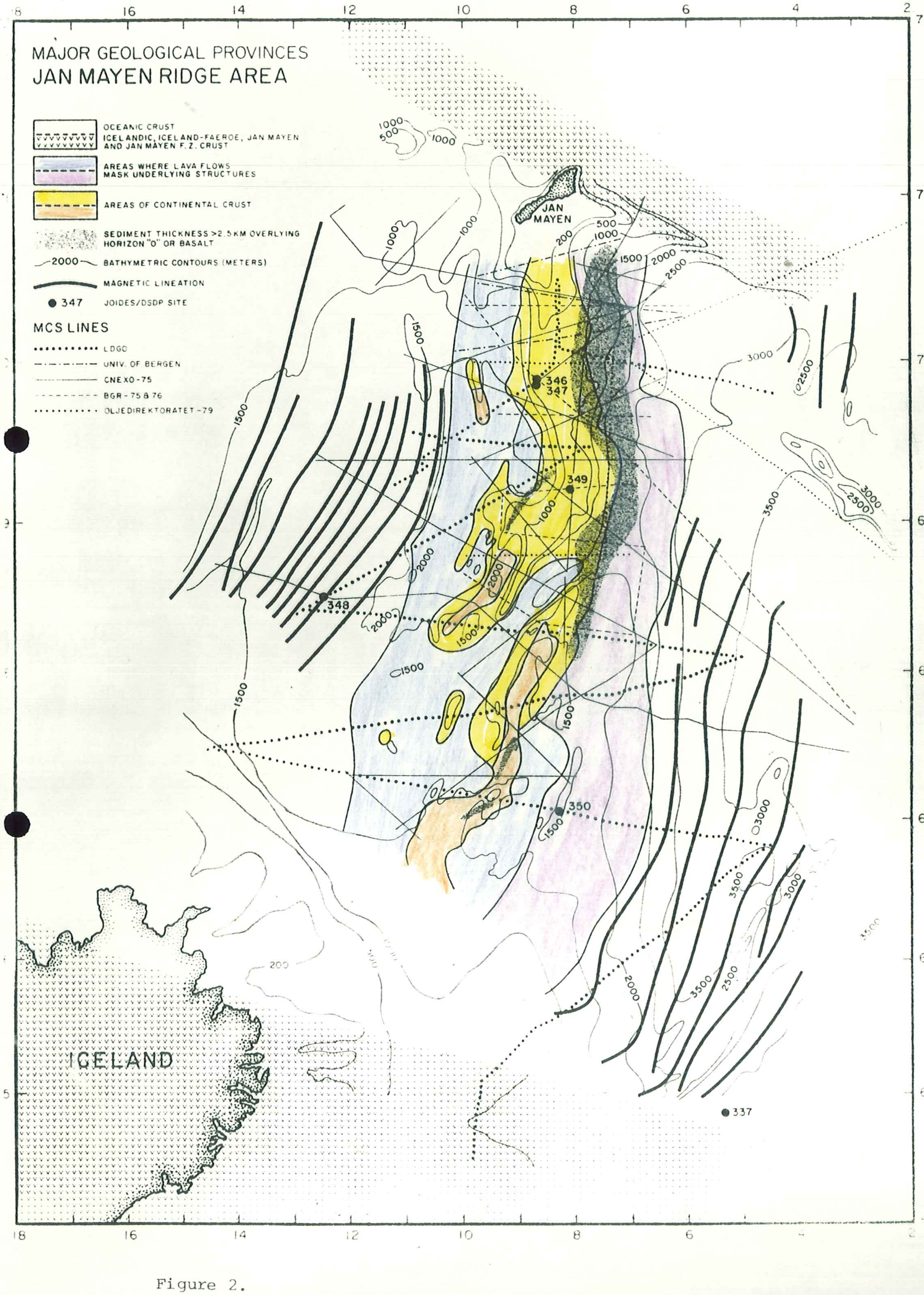
200
500
1000
1300
1500
1800
1900
2000
2200
2500
3000
3400
3500

Fig. 1


MAJOR GEOLOGICAL PROVINCES
JAN MAYEN RIDGE AREA
OCEANIC CRUST
ICELANDIC, ICELAND-FAEROE, JAN MAYEN AND JAN MAYEN F.Z. CRUST
AREAS WHERE LAVA FLOWS MASK UNDERLYING STRUCTURES
AREAS OF CONTINENTAL CRUST
SEDIMENT THICKNESS >2.5 KM OVERLYING HORIZON "O" OR BASALT
2000 BATHYMETRIC CONTOURS (METERS)
MAGNETIC LINEATION
● 347 JOIDES/DSDP SITE
MCS LINES
LDGO
UNIV. OF BERGEN
CNEXO-75
BGR-75 & 76
OLJEDIREKTORATET-79
JAN MAYEN
ICELAND
346
347
348
349
350
337
18
16
14
12
10
8
6
4
2
72
71
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65

Figure 2.

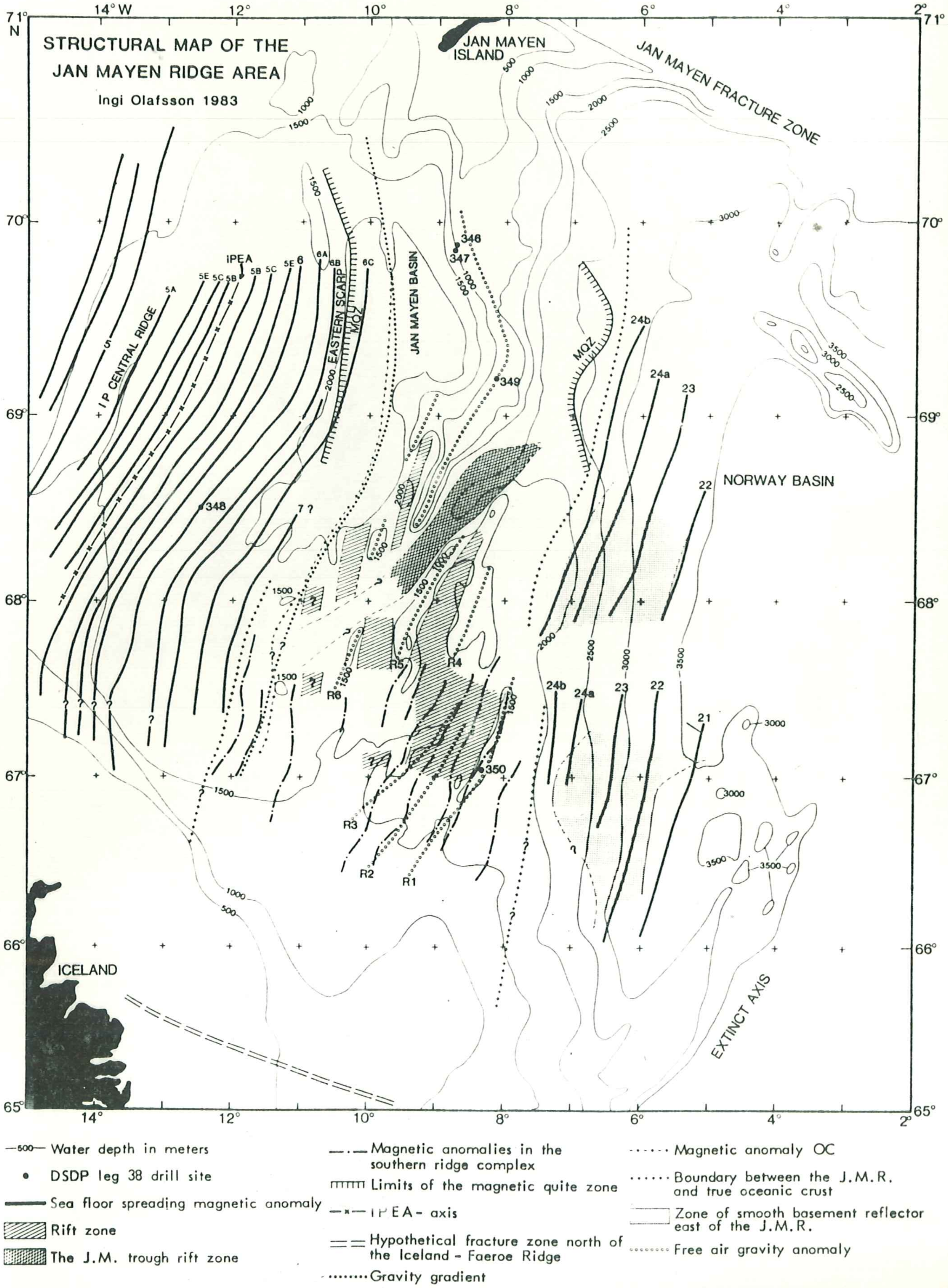
STRUCTURAL MAP OF THE JAN MAYEN RIDGE AREA
Ingi Olafsson 1983
14° W
12°
10°
8°
6°
4°
2°
71° N
70°
69°
68°
67°
66°
65°
JAN MAYEN ISLAND
JAN MAYEN FRACTURE ZONE
JAN MAYEN BASIN
EASTERN SCARP
MQZ
IPEA
I P CENTRAL RIDGE
NORWAY BASIN
EXTINCT AXIS
ICELAND
346
347
348
349
350
5
5A
5B
5C
5E
6
6A
6B
6C
7
24b
24a
23
22
21
R1
R2
R3
R4
R5
R6
500
1000
1500
2000
2500
3000
3500
Water depth in meters
DSDP leg 38 drill site
Sea floor spreading magnetic anomaly
Rift zone
The J.M. trough rift zone
Magnetic anomalies in the southern ridge complex
Limits of the magnetic quite zone
IPEA- axis
Hypothetical fracture zone north of the Iceland - Faeroe Ridge
Gravity gradient
Magnetic anomaly OC
Boundary between the J.M.R. and true oceanic crust
Zone of smooth basement reflector east of the J.M.R.
Free air gravity anomaly

Figure 3.

Appendix 1. LIST OF ACCOMPANYING CHARTS.

The loose charts accompanying this report can be used as overlays with the seismic track chart of Oljedirektoratet (Arkiv:1690, dato: mars 1980, TM International Spheroid, central meridian 9 degr. W , Malestokk 1:500000). A short description of the five charts follows.

Chart 1 is a compilation of some important features shown on maps from the following publications:
(a) Bathymetry digitized from L-DGO map. Contours are at intervals of 500 meters (Talwani at al., 1980; see reduced original map in fig. 1 of this report).
(b) Grönlie, Chapman and Talwani (1979). Contents: boundaries of Jan Mayen microcontinent, limits of magnetic quiet zone (fig 9). Linear magnetic anomalies in Norway Basin (fig. 11). This interpretation is essentially similar to that of Talwani and Eldholm (1977).
(c) Nunns (1981). Contents: boundaries of J.M.R. microcontinent (similar to those of Gairaud et al. 1978), linear anomaly strips and transform faults in Norway Basin. (d) Vogt, Johnson and Kristjánsson (1980). Contents: linear magnetic anomalies on Iceland Plateau (fig 2).

Chart 2 shows some features of the geological map compiled for the workshop held December 1980 at L-DGO, in preparation for the Norway/Iceland agreement on the Jan Mayen Ridge area (Talwani et al., 1980). A reduced copy of the original map is also included in this report in fig. 2. Shown are boundaries between geological provinces, L-DGO multi-channel seismic tracks (approximate location), areas of sediment thickness greater than 2.5 km, and bathymetry as in Chart 1.

Chart 3 is a rough map of sediment thickness, or rather two-way travel time, above accoustic basement (basaltic or reflector 0). Some tectonic features are also shown, such as limits of basaltic basement and apparent faults as detected on individual seismic sections. It is only a preliminary working sketch and all available data have not been considered in detail. The map is based on seismic sections from Oljedirektoratet, the Cepan cruise sections and publications (Gairaud et al., 1978), and a rough sediment thickness map from Garde (1978), based on the BGR-survey.

Chart 4 shows the area on the eastern flank of the J.M.R. where the strongest indications of reflective horizons are found below horizon 0. It is based on seismic section from Oljedirektoratet and the Cepan survey, and Garde (1978). These horizons are rather vague exept in line J-1-79, where a continuous reflector can apparantly be traced over long distances in the north-south direction. Maximum thickness below "0" is 1.5 s near shot point 1500, and possibly even deeper horizons are indicated in that region.

Chart 5 is a tentative plan for the seismic tracks of the 1985 cruise. Priority tracks (A-lines) are shown with continuous lines, but secondary tracks (B-lines) with broken lines. Previous multi-channel seismic lines are also shown.

Appendix 2. JAN MAYEN RIDGE DATA AT ORKUSTOFNUN

A considerable part of existing seismic reflection data from the Jan Mayen Ridge Area is now (June 1984) available at Orkustofnun. The extent and format of the seismic sections for the various cruises in our collection are listed below, including corresponding maps. The most serious defect of the collection is the absence of multi-channel seismic reflection data from the BGR 1975-`76, Bergen University 1978 and L-DGO (Conrad) 1978 cruises. Aeromagnetic maps from Oljedirektoratet are also stored. Details of other data are not given here, but a compilation of digital geophysical data is presently in progress at Orkustofnun.

3.3 Cepan 1 cruise (1975), seismic survey.

Obtained from Oljedirektoratet 14.10.1983. Processed sections are "1/2 scale" paper copies (horizontal scale 1:50000, vertical scale 5cm/s , 20 SP/km). Paper copies of 1/8 scale combined processed and unprocessed data of complete survey lines are also included, and similar data in 1/4 scale were received 04.08.81 from Institut de Francais du Petrole. Shot point loc. map, scale 1:2000000 ("Mer de Norwege, Plan de position CEPAN 1). These data are also referred to as the CNEXO-data. References: Gairaud et al., 1978.

Line	SP-	seismic sections of scale		
no.	range	1/8	1/4	1/2 (processed segments)
101	1-8168		x	1600-2773,3700-4600,5200-5700, 6300-7100
102	1-1968		x	2175-2625
102B	1-2622		x	200-1090
103	1-964			1-750
103B	1-1604			1-800
104	1-2419			1100-2300
105	1-11000		x	1-750,1400-3810,5000-6388, 6401-6890,7500-8197
106	1-8755		x	250-1152,8000,8745
107	1-2084	x	x	
108	1-6147	x	x	3556-6146
109	1-3983	x		1-750
110	1-3954	x		1050-3299
111	1-5163	x		700-2201

112	1-5581	x		2650-4550
113	1-4890	x	x	1650-1969,2157-2449
114	1-2945	x		951-2944
115	1-3494	x		1-1499
116	1-674			
117	1-148			
118	1-2095	x		
119	1-1059			
120	1-274			
121	1-570			
122	1-6555	x		1500-4279,4280-6554
123	1-2073	x		1-1649
124	1-2850	x		573-999,1001-2503
125	1-1993	x		1-1992
126	1-1180			
127	1-2201			1-599,(1-599),1-2200
128	1-856			1-859
129	1-5887	x		250-3002

3.4 Oljedirektoratet, 1979 seismic survey.

Obtained from Oljedirektoratet 10.06.83, unpublished data. Paper copies of processed seismic sections, both 1/1 and 1/2 scale exept only 1/2 scale copy for NH-3-79. Line NH-1-79 (in Norway Basin) was not included.

line no.	SP-range	
J-1-79	1-3202	(two 1/2 scale copies)
J-2-79	1-2328	(two 1/2 scale copies)
J-4-79	1-1136	
J-4A-79	1-1249	
J-6-79	1-2124	
J-8-79	1-2152	
NH-2-79	2-7165	
NH-3-79	1-6865	(1/2 scale copy is missing)

Sonobuoy recordings of 1979 survey:

line no.	SP-range of section
J-1-79	2056-2775
J-2-79	726-1264
J-2-79	1571-2328
J-4(4A)-79	930-1136(1-558)

J-4A-79	715-1249
J-6-79	321-1030
J-6-79	1090-1780
J-8-79	776-1490
(In Norway Basin:)	
NH-1-79	540-1119
NH-1-79	1788-2371
NH-1-79	5094-5550
NH-1-79	8149-9000
NH-3-79	14756-15560

Maps:
Shot point location map of scale 1:500,000 (transparent and paper copies) including location of the Cepan 1979, BGR 1975-76 and Bergen 1978 surveys.
Three contour maps of free-air and Bouguer gravity anomalies, and magnetic total intensity. Scale is 1:250,000 .

3.5 Oljedirektoratet, 1976 aeromagnetic survey

Maps (some 33 sheets):
Interpretation maps, scale 1:250,000.
Residual field intensity contour maps, scale 1:250,000 and 1:100,000.

Two reports from contractor (C.G.G.): Short field operation report, and interpretation report.

References: Narvestad and Jörgensen, 1979.

3.6 Other surveys

Seismic sections from three multi-channel seismic surveys in the area are presently not available at Orkustofnun. These are:

BGR (Bundesanstalt fur Geowissenshaften und Rohstoffe, Hannover) project: "Geoscience Studies in the North Atlantic", 1975 and 1976 cruises. References: Hinz and Schluter, 1978; Garde, 1978.

University of Bergen 1978 survey. References: Sundvor et al., 1979.

Lamont-Doherty Geological Observatory, Conrad 1978 (C2114) cruise. Ingi Ólafsson (1983) displays line drawings of some of the seismic lines.

L-DGO (Vema cruises), U.S. Navy and Deutsche Hydrografische Institut have conducted a number of surveys in the Jan Mayen Ridge Area. These data are various combinations of single-channel seismic profiling, seismic refraction, gravity, magnetics and bathymetry. Compilation of these data is in progress.