EXPANDING EARTH DIAGRAMS

H.G.Owen

The DVD contains the reconstructions of global expansion published essentially in two works:-

Owen, H.G. 1983 *Atlas of continental displacement 200 million years to the Present.* Cambridge Earth Sciences Series. Cambridge University Press. i-x, 1-159, 76 maps.

These are the series of maps in which a strict spherical geometrical control of the break-up of Pangaea and subsequent continental displacement is afforded by the ocean-floor spreading data. The book was a test of the ocean-floor spreading data on a constant diameter Earth and that determined by the spherical geometry of the spreading data which indicated an Earth expanding from 80% of its current diameter to its modern size during the last 200 ma. In this DVD, the constant modern dimensions Earth reconstructions are omitted as being not only invalid but irrelevant. A comparison between the constant dimension Earth reconstructions and those indicating expansion can be checked in the publication cited above. A departure from the arrangement of maps in the Atlas is made here. In this DVD I have included all map reconstructions for each defined interval together. This rather than for each projection as in the Atlas where the object was to compare those showing the spherical geometric gaps of the constant modern Earth with those in which the strict ocean-floor spreading evidence was adhered to in the reconstructions.

The fit together of the pairs of identified anomalies remains the same and the size of the Earth that they indicate also remains the same. However the Stage dating of these fits needs revision to that of the International Commission for Stratigraphy (ICS) – International Chronostratigraphic Chart (2017) and this is done in the map descriptions given here. The question arises as to whether the difference in dating between the publication of the Atlas in 1983 and the ICS dating affects the validity of the reconstructions. In fact it does not statistically affect the reconstructions. It does provide, however, a better coincidence of the initial break-up of Pangaea with a Middle Jurassic commencement of ocean-floor spreading in the North Atlantic. This is coincident with a reconstruction which demands an 80% of modern diameter Earth at that time. In the reconstructions given here, the Map numbers used in the Atlas are given in parenthesis in the new numbering.

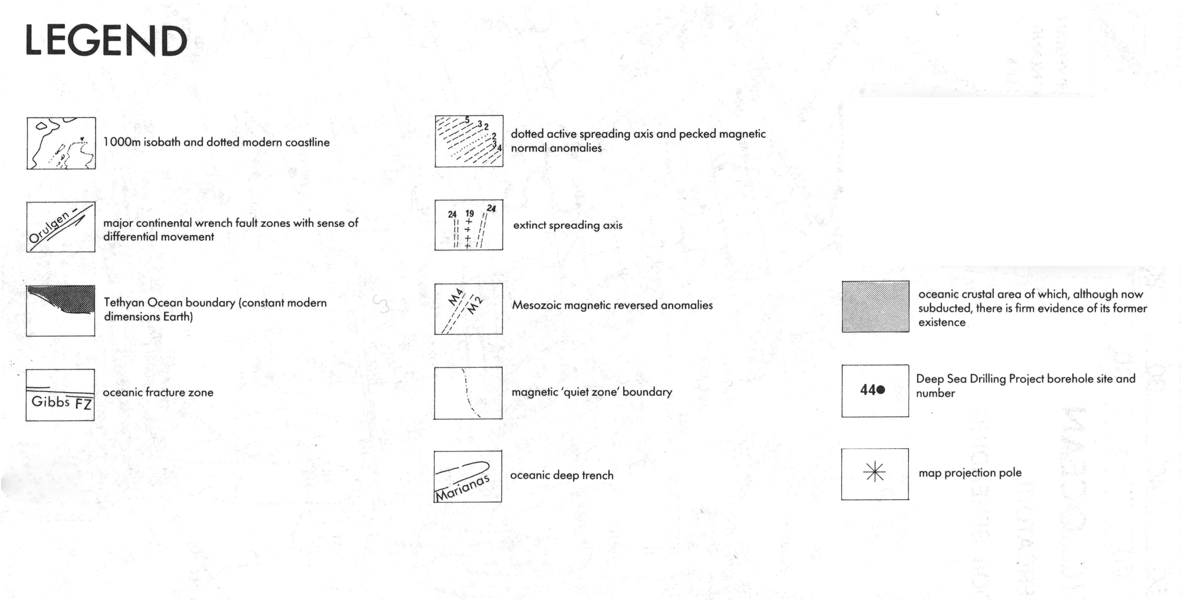
Owen, H.G 2012 Earth expansion - Some Mistakes, What Happened in the Palaeozoic and the Way Ahead. In Scalera G., Boschi, E., and Cwojdzinski, S Editors. The Earth Expansion Evidence – A challenge for Geology, Geophysics and Astronomy Erice, Sicily, 4-9 October 2012, 77-89

These are speculative in the sense that there is no ocean-floor spreading crust preserved giving a control on the spherical geometry of continental break-up. Also, that the post Palaeozoic sediment cover and tectonic deformation, obscure substantial areas of terrain. However, there are compelling sedimentary and faunal indications that these reconstructions might not be far off the mark. Secondly, it provides a kinematic reconstruction for the development of the Eo-Pacific oceanic crustal area detected by the spherical geometry of the Earth at the beginning of the break-up of Pangaea in the late Triassic – Early Jurassic. There is evidence that this pre-Jurassic crust was destroyed by subduction during the process of Mesozoic and Cenozoic ocean-floor spreading and continental displacement within the Pacific area.

Additional to these maps are others used in palaeogeographic and palaeobiogeographical reconstructions in various papers cited below with each diagram. The DVD terminates with a series of speculative diagrams on the possible structure of the inner Earth and the evidence for exponential Earth expansion which might mirror that currently observed in the Universe modified by the changes in gravitation due to our changing position within our Milky Way galaxy.

Projections and legend

All maps are projected using the Azimuthal equidistant projection using either the polar case or the oblique case. In the oblique case, the projection pole is stated on each map. For a description of the projection see the Atlas (1983).



Note that the shaded areas representing actual crustal area which has been subducted during the last 200 Ma, shows artefacts of the copying process and not significant discrete areas.

INDEX

1. Modern Earth (Maps 1-6) pages 8-15

2. Magnetic anomaly 9 , 29Ma Oligocene, Diameter 97% (Maps 7-12) pages 17-24

3. Magnetic anomaly 24, 53Ma Early Eocene, Diameter 94% (Maps 13-18) pages 26-33

4. Magnetic Quiet Zone, 90 Ma Turonian, Diameter 90% (Maps 19-24) pages 35-42

5. Magnetic anomaly M7, 129 Ma Aptian, Diameter 87% (Maps 25-30) pages 44-51

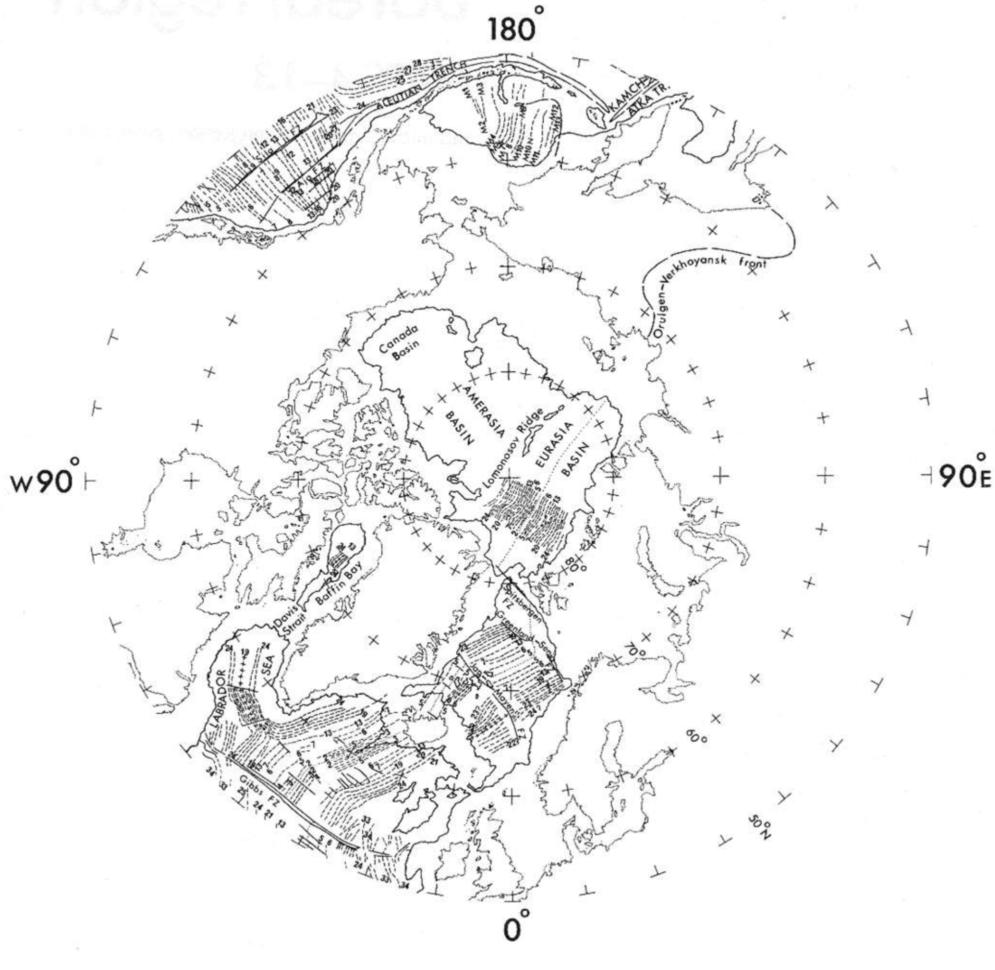
6. Magnetic anomaly M23, 158 Ma Tithonian, Diameter 84% (Maps 31-36) pages 53-60

7. Pangaea 180-200 Ma Early Jurassic, Diameter 80% (Maps 37-42) pages 62-69

8. Speculative Palaeozoic reconstructions pages 70-78

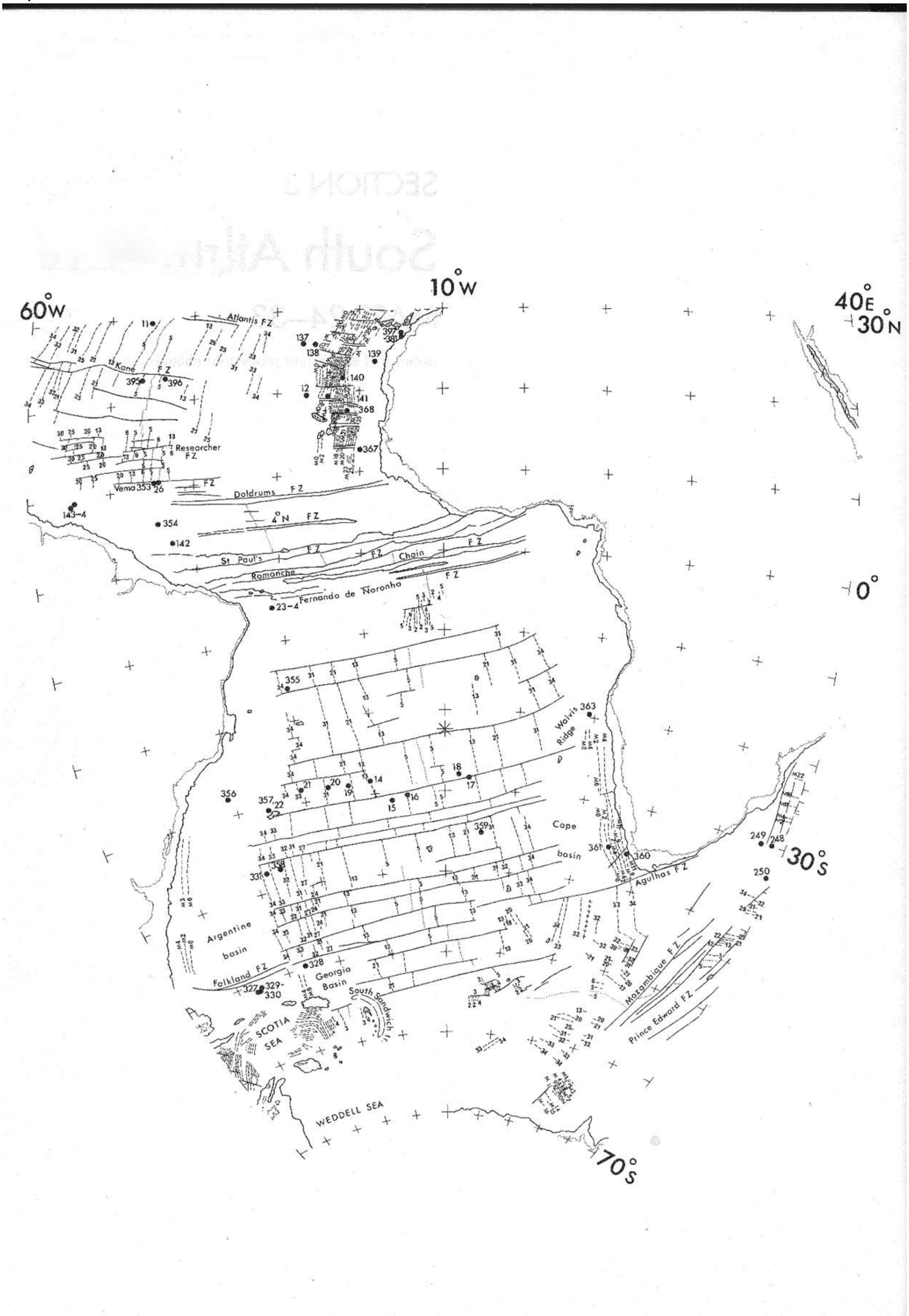
1. Modern Earth (Maps 1-6)

Map 1 Modern Earth. Boreal Region. Azimuthal equidistant Polar case S. to 50° N latitude (Atlas Map 4)



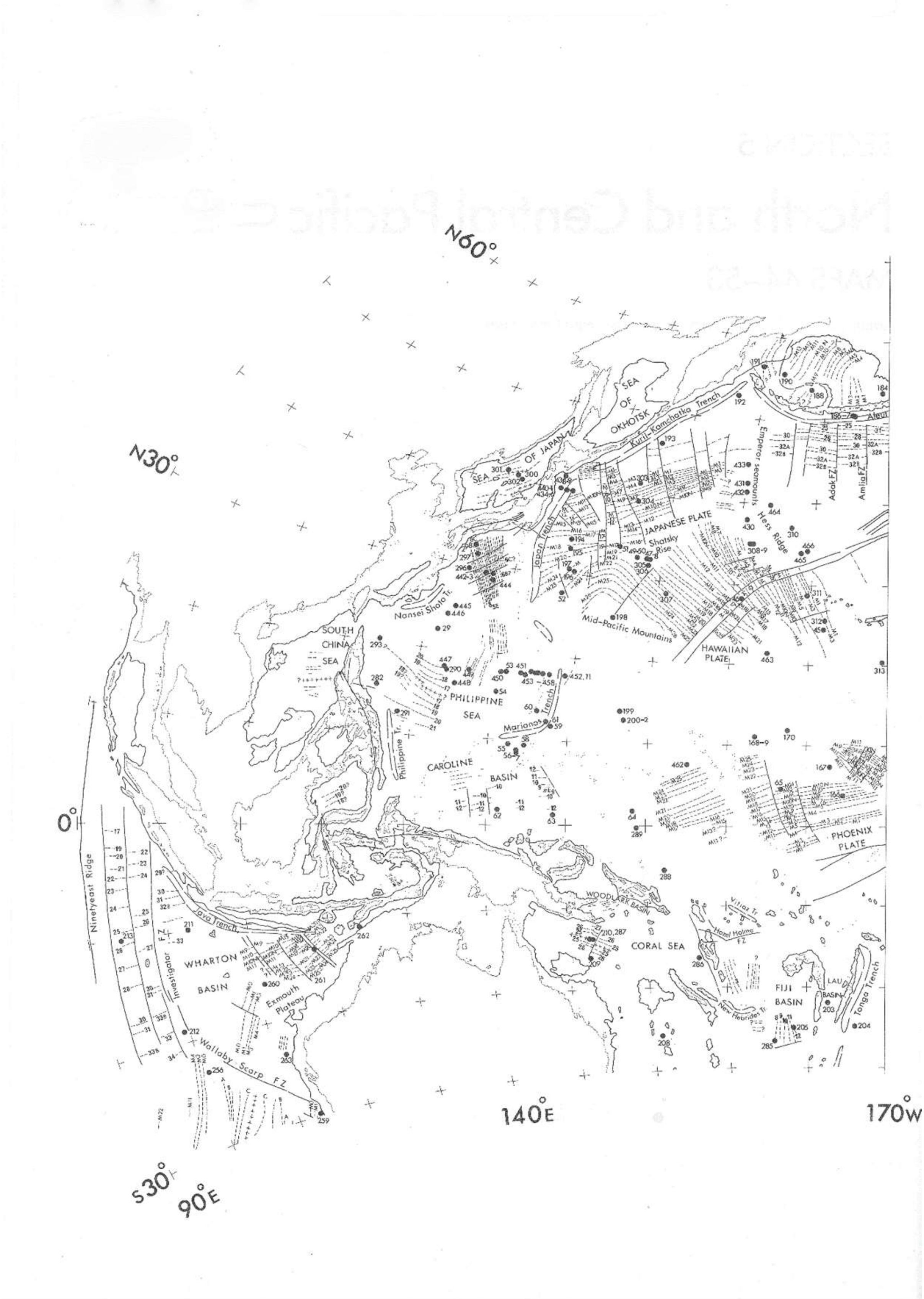
Map 2 Modern Earth, North Atlantic. Azimuthal equidistant. Pole 22° N, 30° W (Atlas Map 14)

Map 3 Modern Earth, South Atlantic. Azimuthal equidistant. Pole 22° S, 10° W (Atlas Map 24)



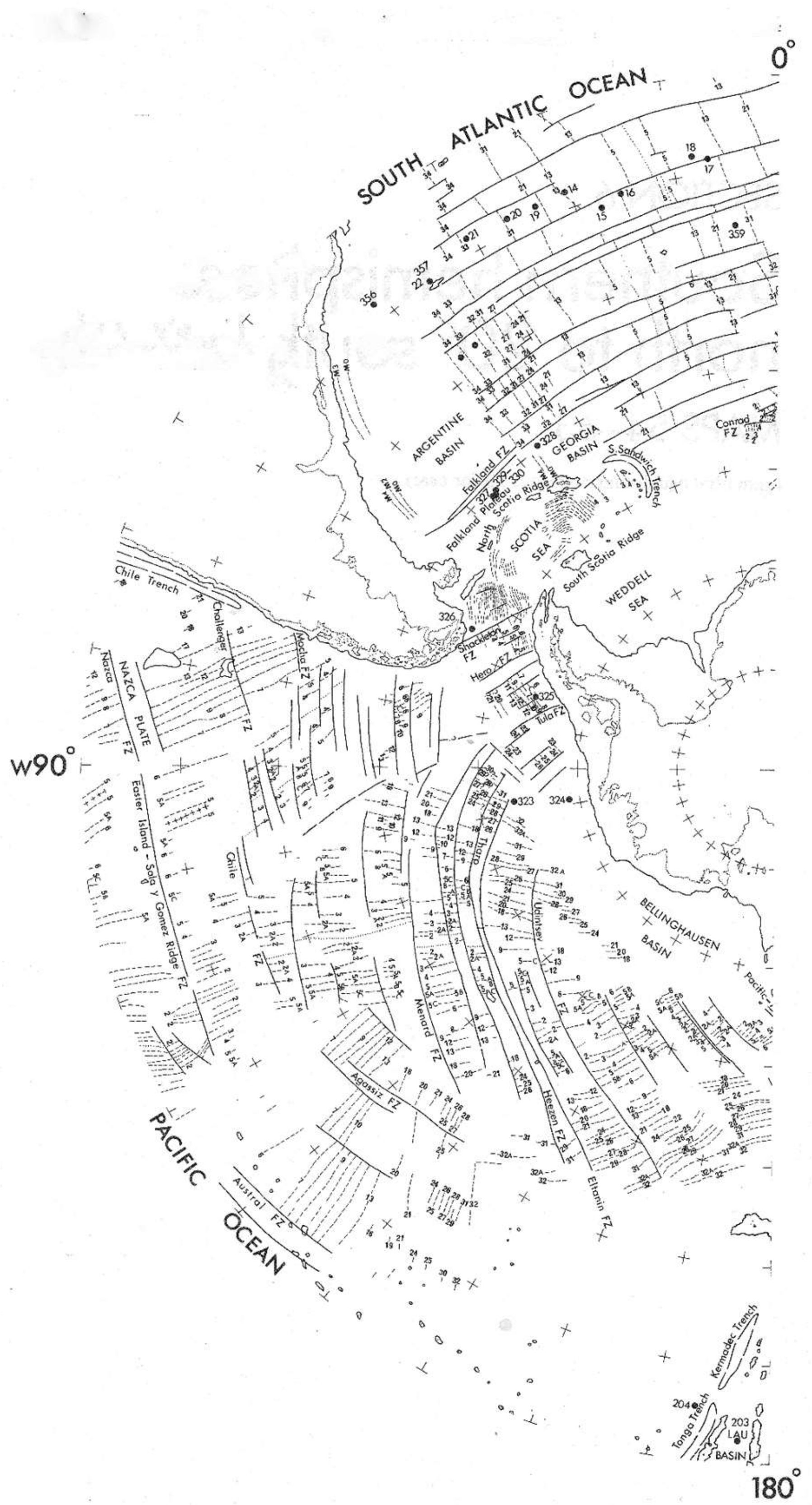
Map 4 Modern Earth, Indian Ocean. Azimuthal equidistant. Pole 22° S, 80° E (Atlas Map 34)

Map 5 LH Modern Earth, North and Central Pacific. Azimuthal equidistant. Pole 0°, 170° W (Atlas Map 44)

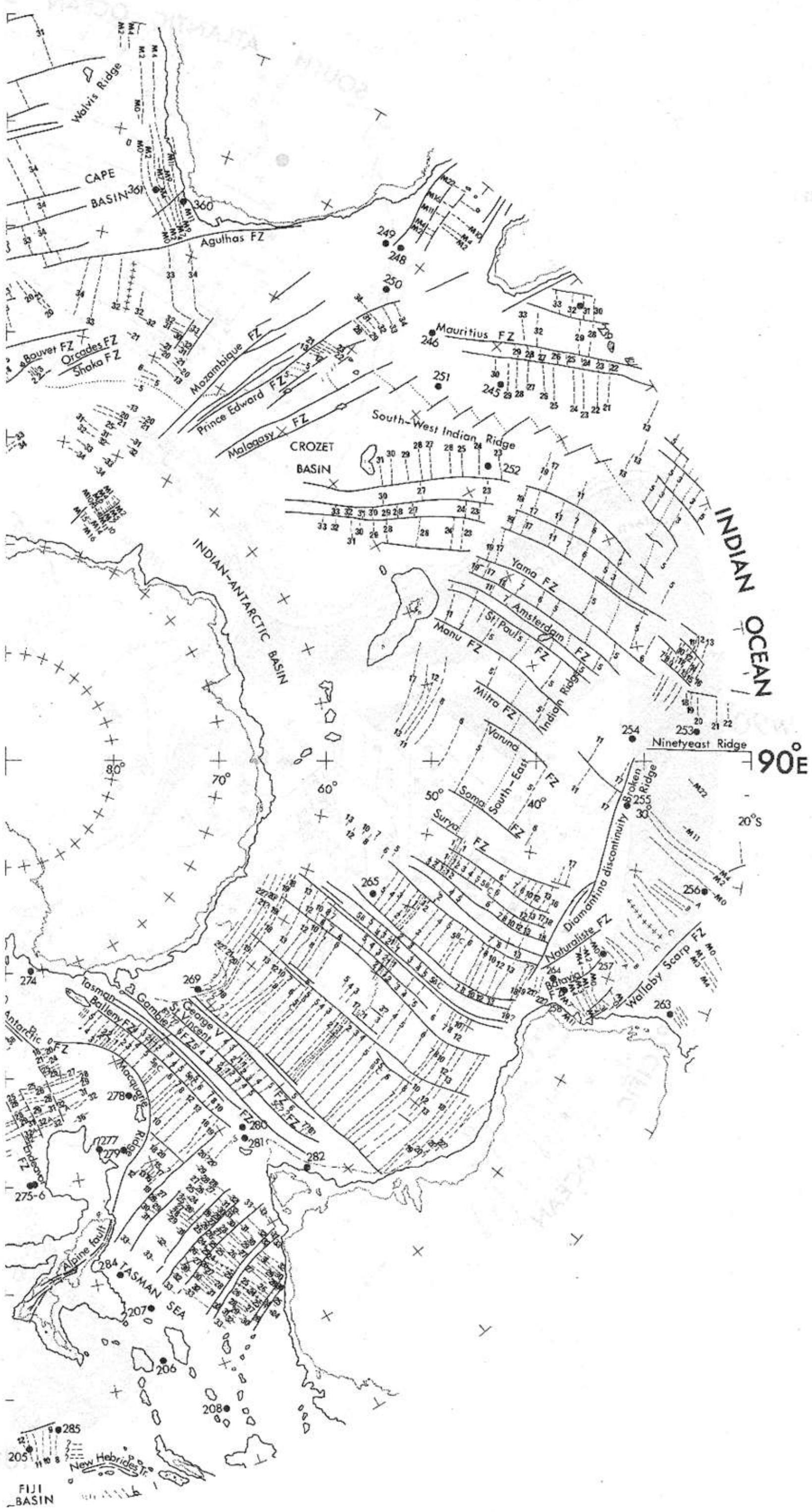


Map 5 RH Modern Earth, North and Central Pacific. Azimuthal equidistant. Pole 0°, 170° W (Atlas Map 44)

Map 6 LH Modern Earth, Southern Hemisphere. Azimuthal equidistant Polar Case S. to 20° S latitude (Atlas Map 54)

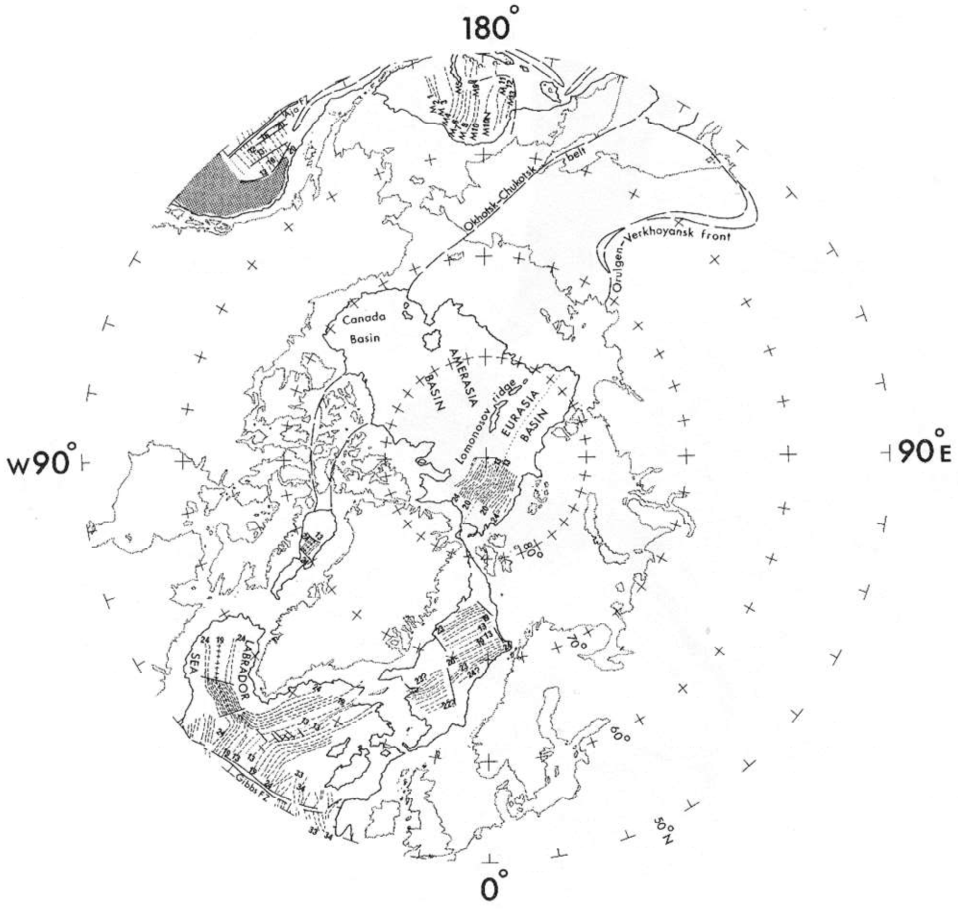


Map 6 RH Modern Earth, Southern Hemisphere. Azimuthal equidistant Polar Case S. to 20° S latitude (Atlas Map 54)



2. Magnetic anomaly 9, 29Ma Oligocene, Diameter 97% (Maps 7-12)

Map 7 Magnetic anomaly 9 , 29 Ma Oligocene, Diameter 97% Boreal Region. Azimuthal equidistant Polar case S. to 50° N latitude (Atlas Map 5)

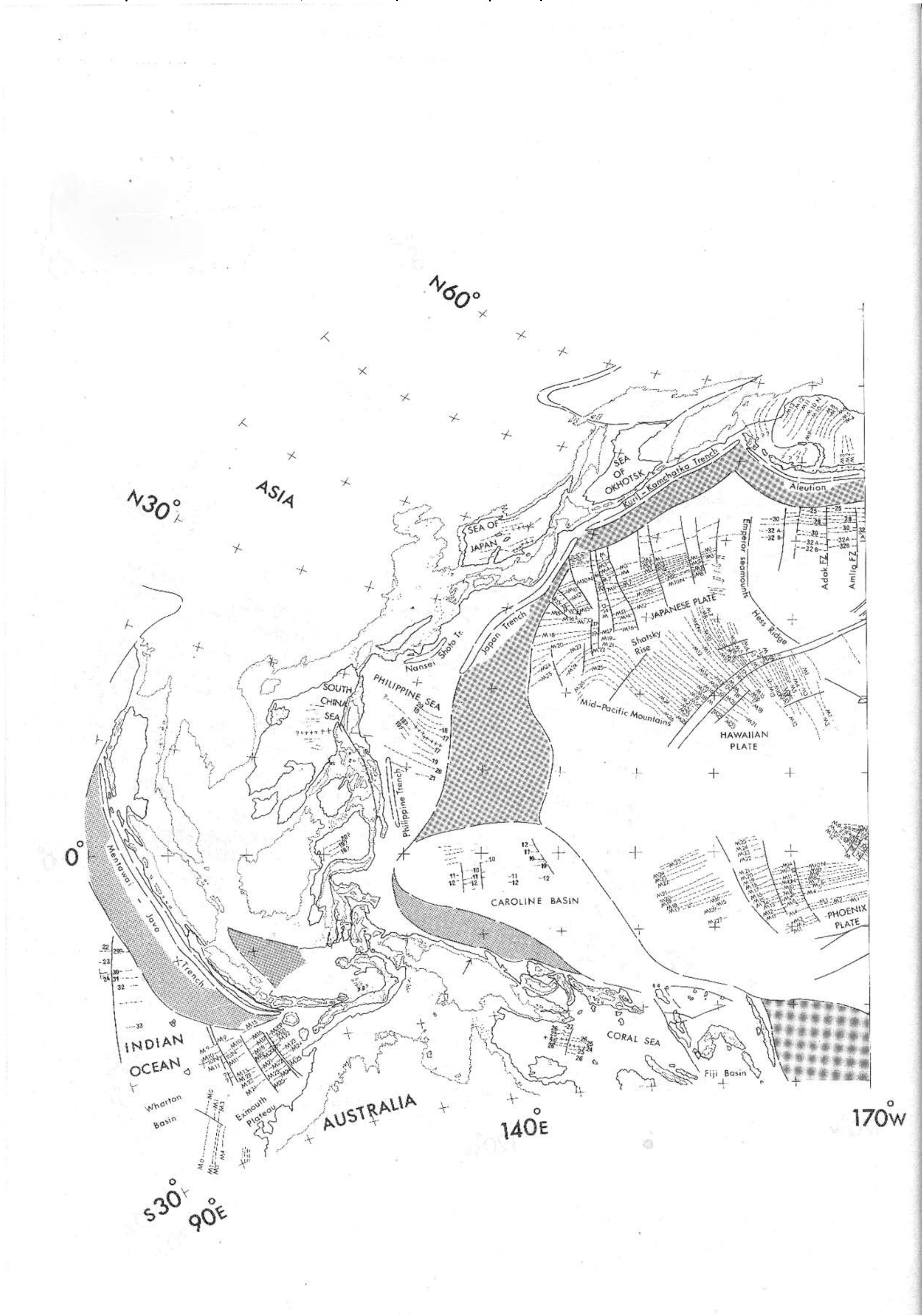


Map 8 Magnetic anomaly 9 , 29 Ma Oligocene, Diameter 97%North Atlantic. Azimuthal equidistant. Pole 22° N, 30° W (Atlas Map 15)

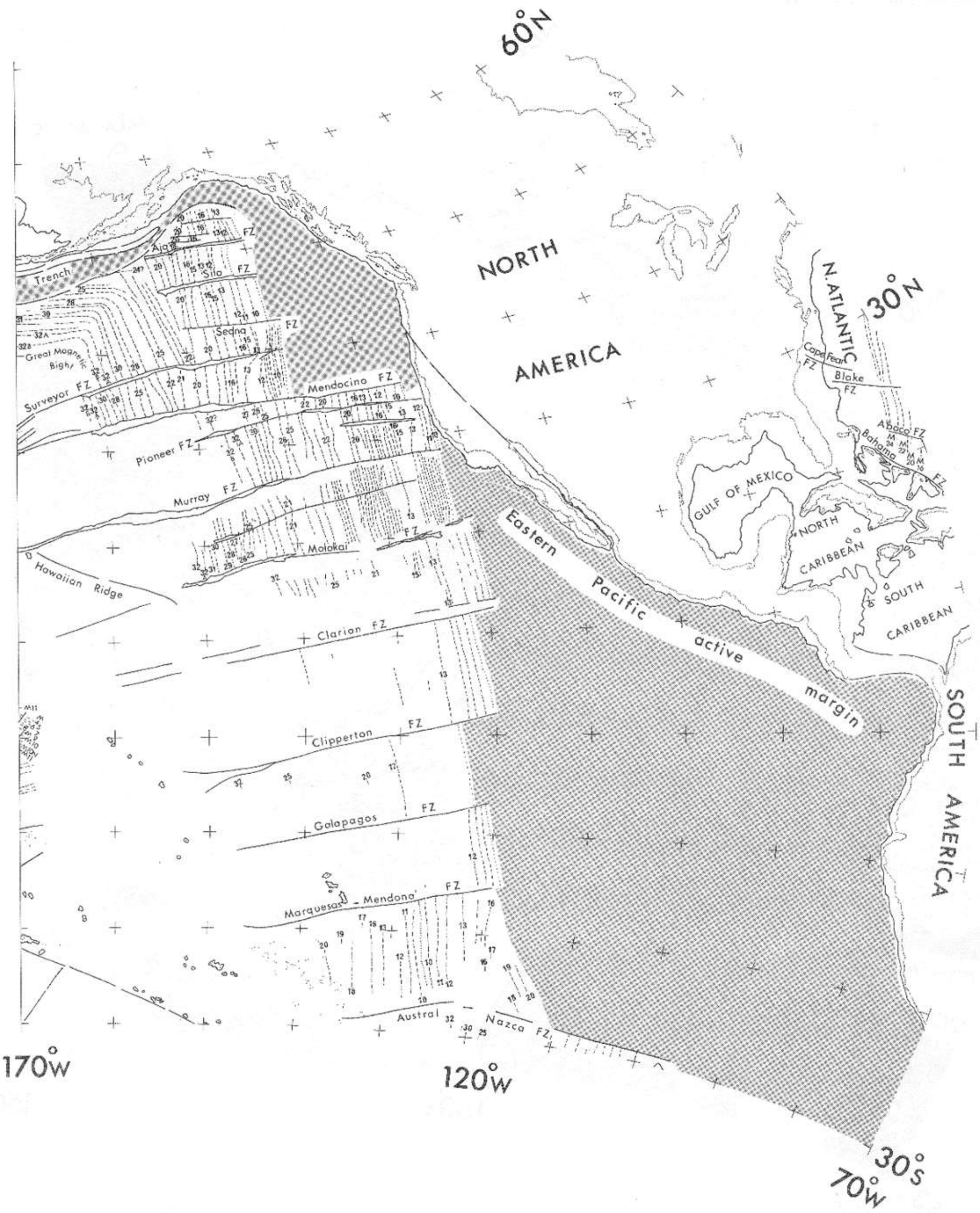
Map 9 Magnetic anomaly 9 , 29 Ma Oligocene, Diameter 97%South Atlantic. Azimuthal equidistant. Pole 22° S, 10° W (Atlas Map 25)

Map 10 Magnetic anomaly 9 , 29Ma Oligocene, Diameter 97%Indian Ocean. Azimuthal equidistant. Pole 22° S, 80° E (Atlas Map 35)

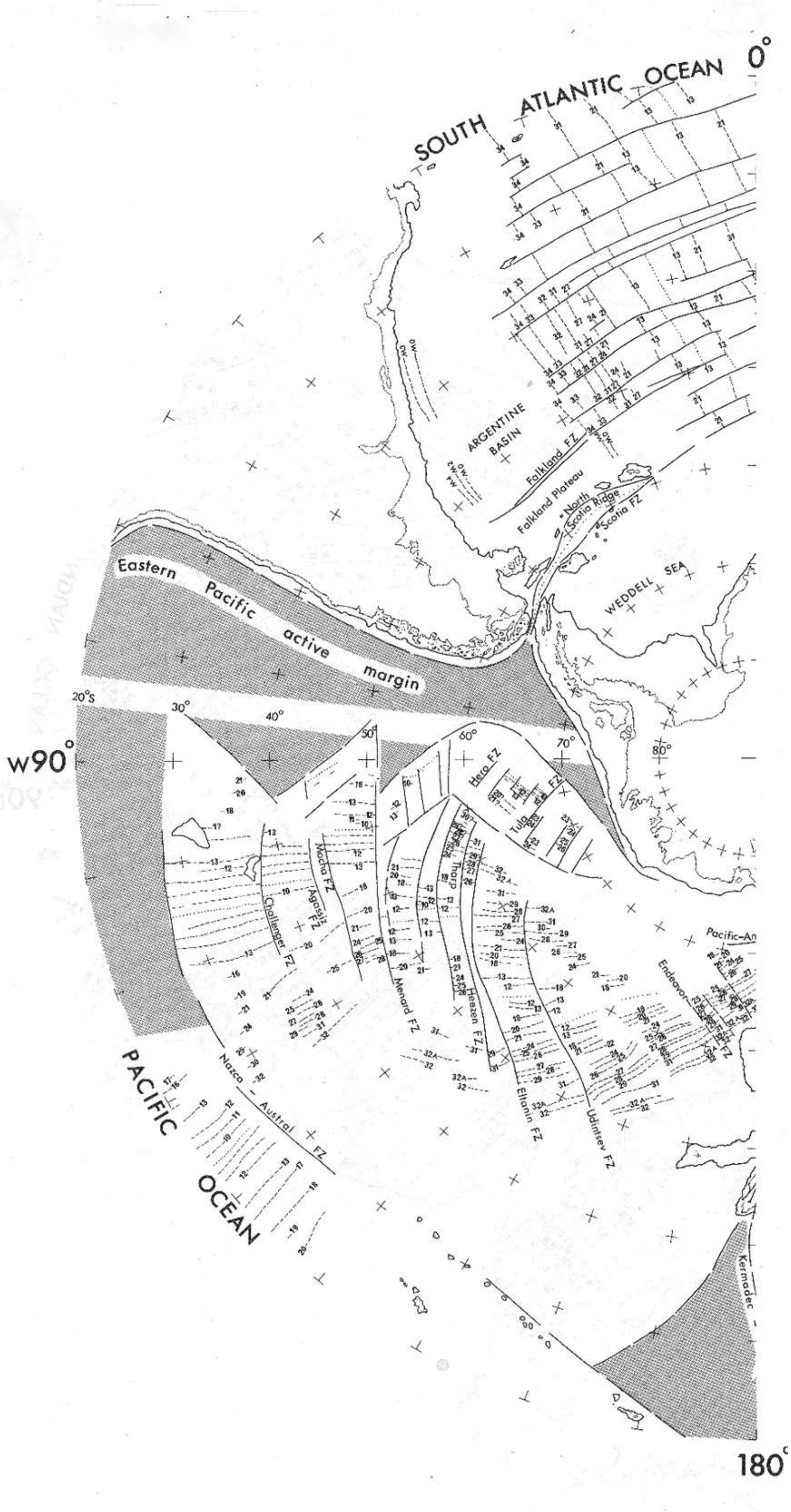
Map 11 LH Magnetic anomaly 9 , 29 Ma Oligocene, Diameter 97% North and Central Pacific.
Azimuthal equidistant. Pole 0°, 170° W (Atlas Map 45)



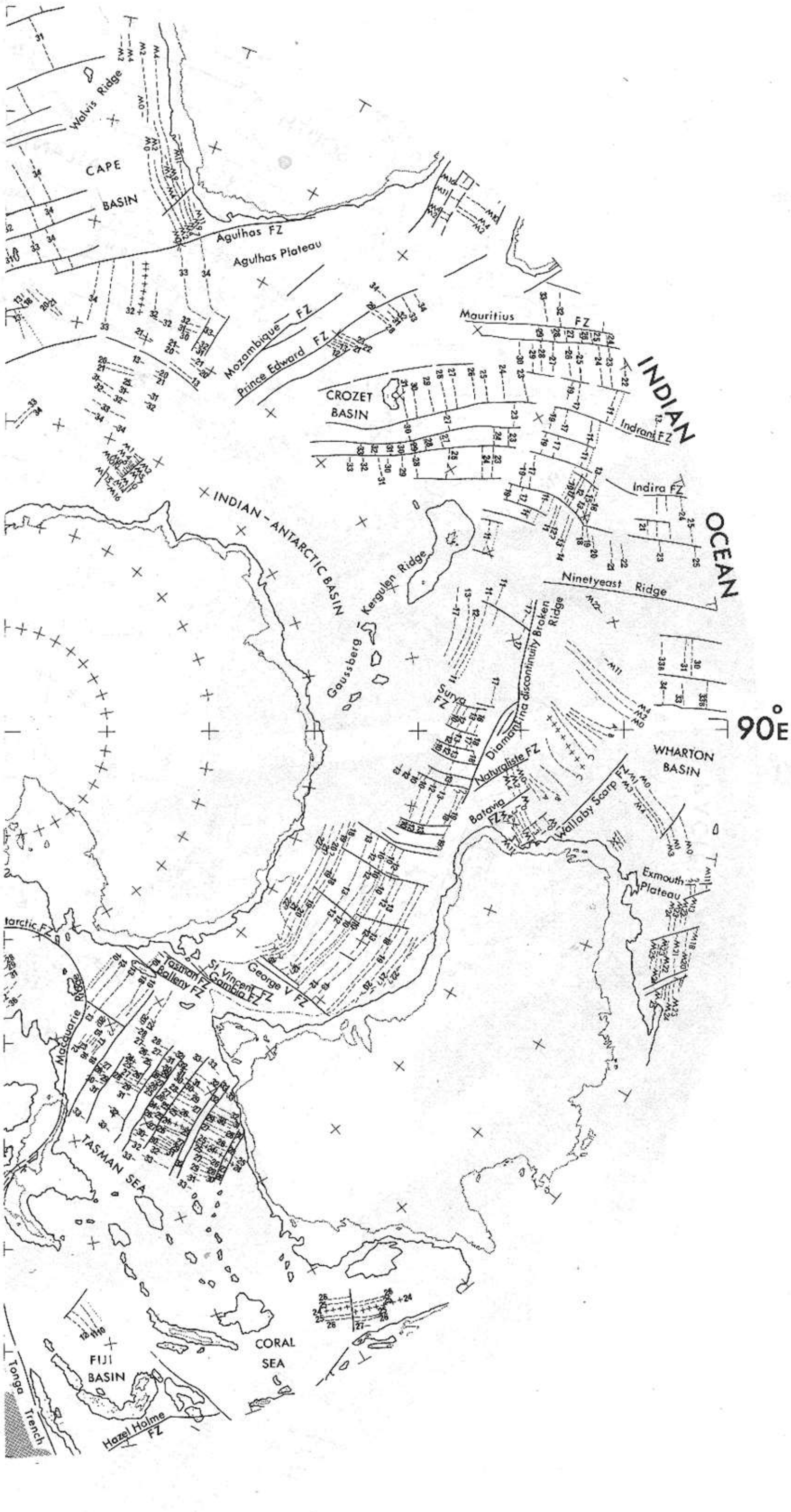
Map 11 RH Magnetic anomaly 9 , 29 Ma Oligocene, Diameter 97% North and Central Pacific.
Azimuthal equidistant. Pole 0°, 170° W (Atlas Map 45)



Map 12 LH Magnetic anomaly 9 , 29Ma Oligocene, Diameter 97% Southern Hemisphere.
Azimuthal equidistant Polar Case S. to 20° S latitude (Atlas Map 55)

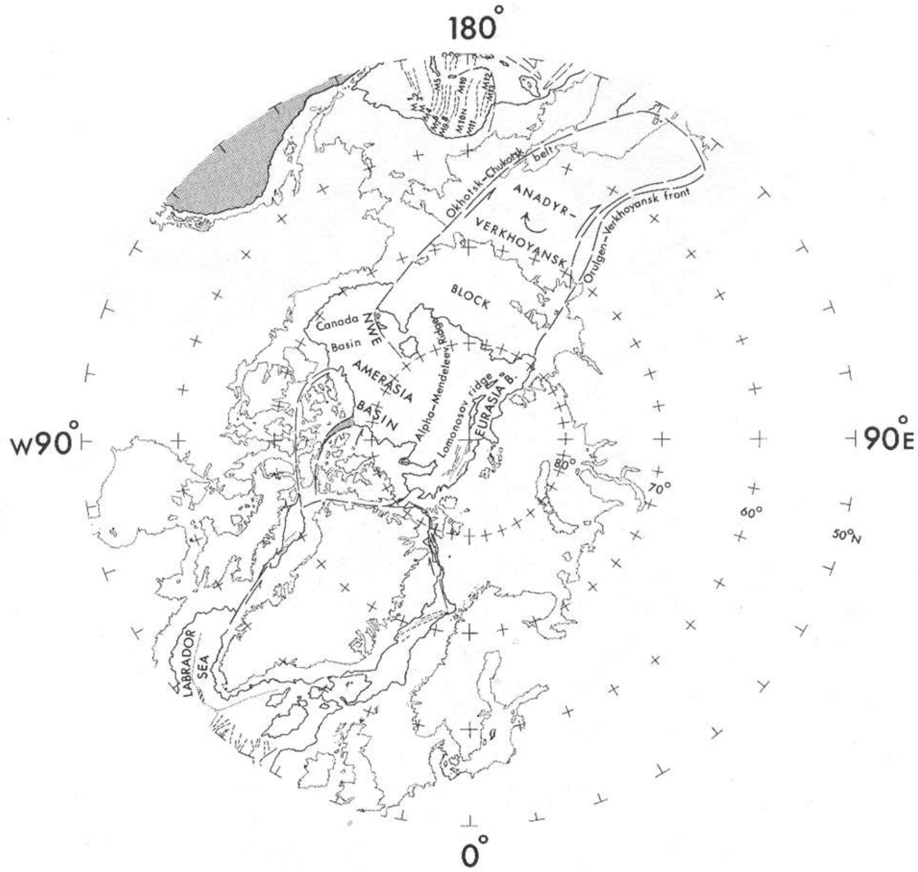


Map 12 RH Magnetic anomaly 9 , 29 Ma Oligocene, Diameter 97% Southern Hemisphere.
Azimuthal equidistant Polar Case S. to 20° S latitude (Atlas Map 55)

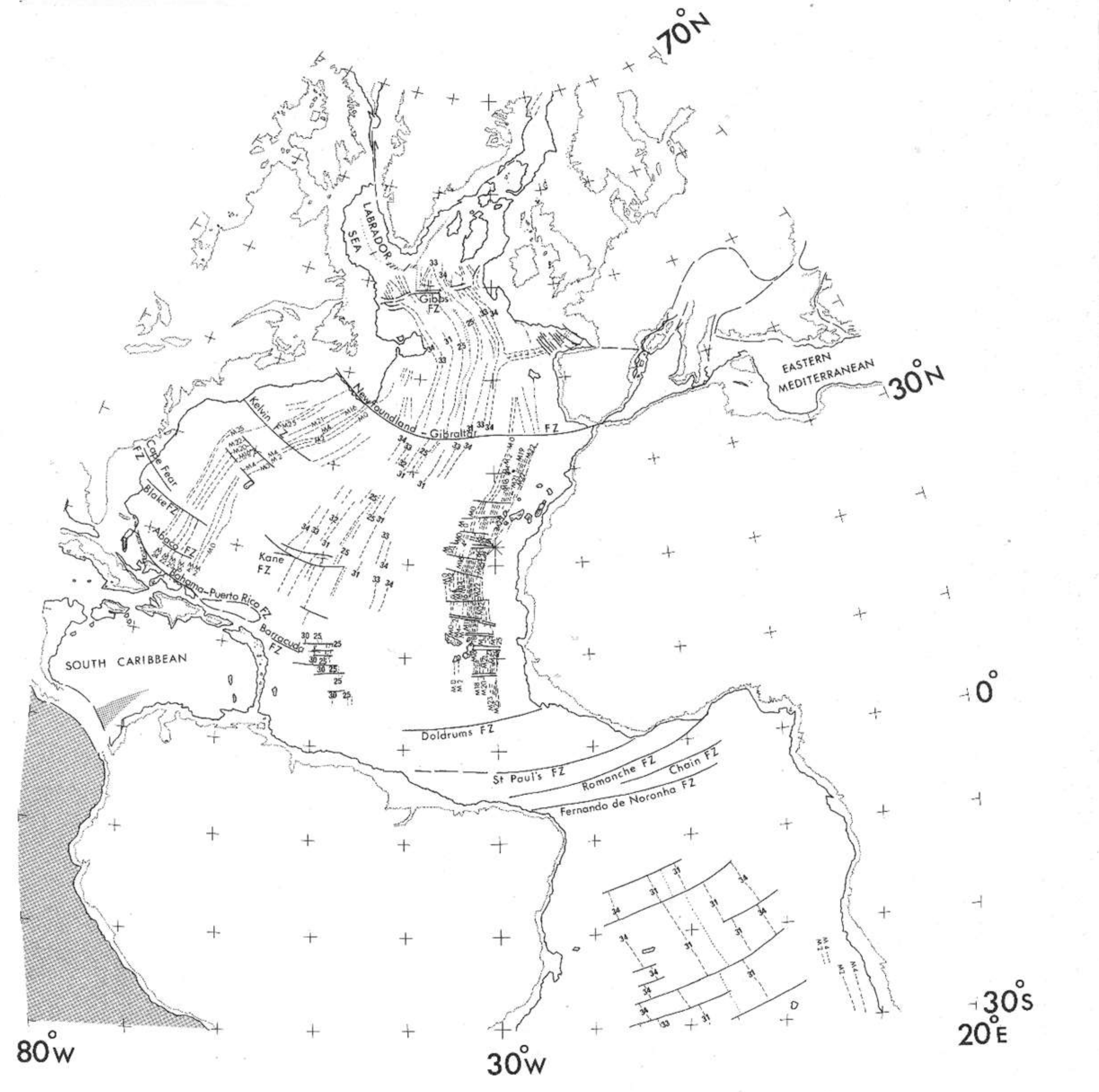


3. Magnetic anomaly 24, 53Ma Early Eocene, Diameter 94% (Maps 13-18)

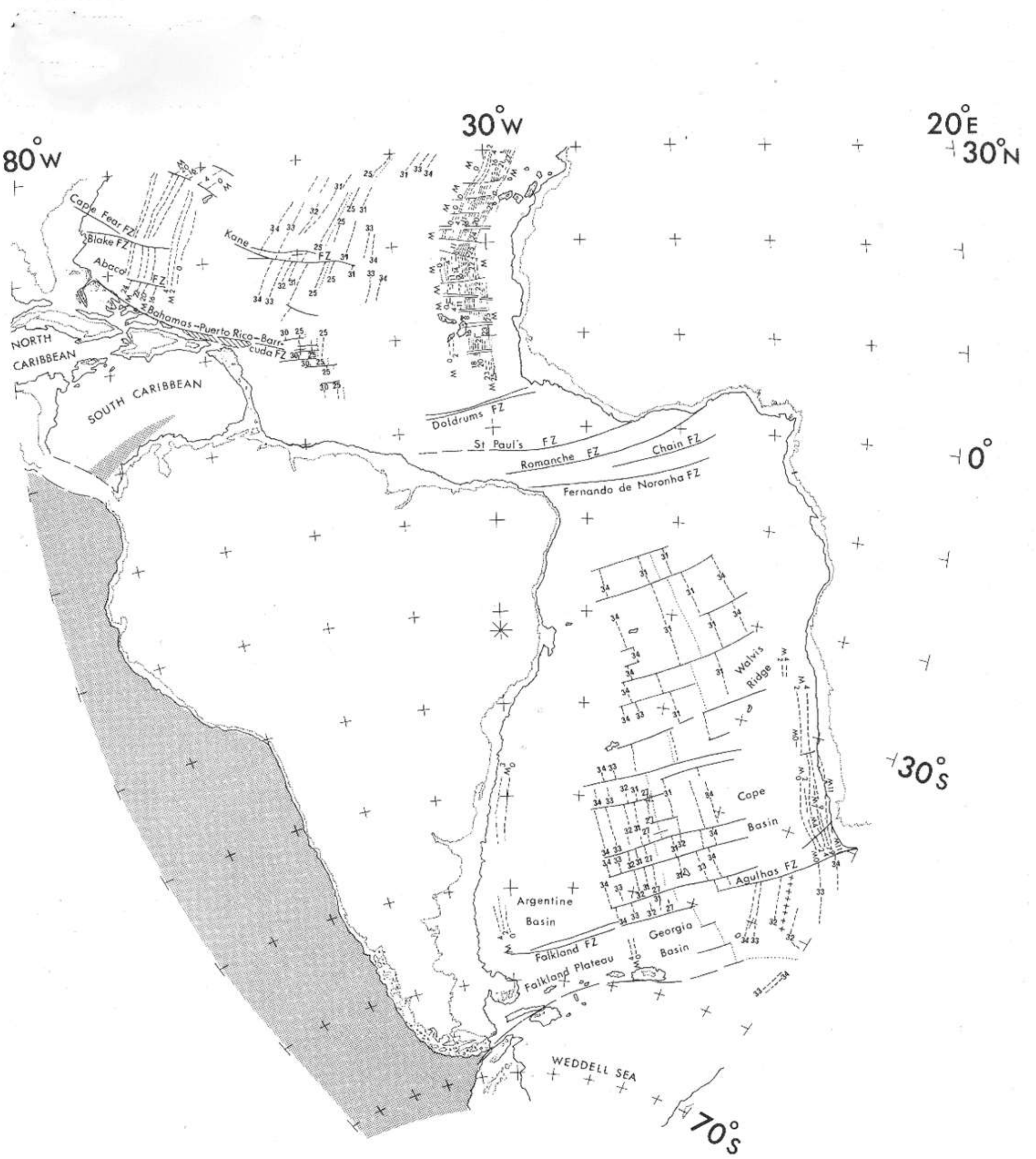
Map 13 Boreal Region. Magnetic anomaly 24, 53Ma Eocene-Palaeocene boundary, Diameter 94% Azimuthal equidistant Polar case S. to 50° N latitude (Atlas Map 7)



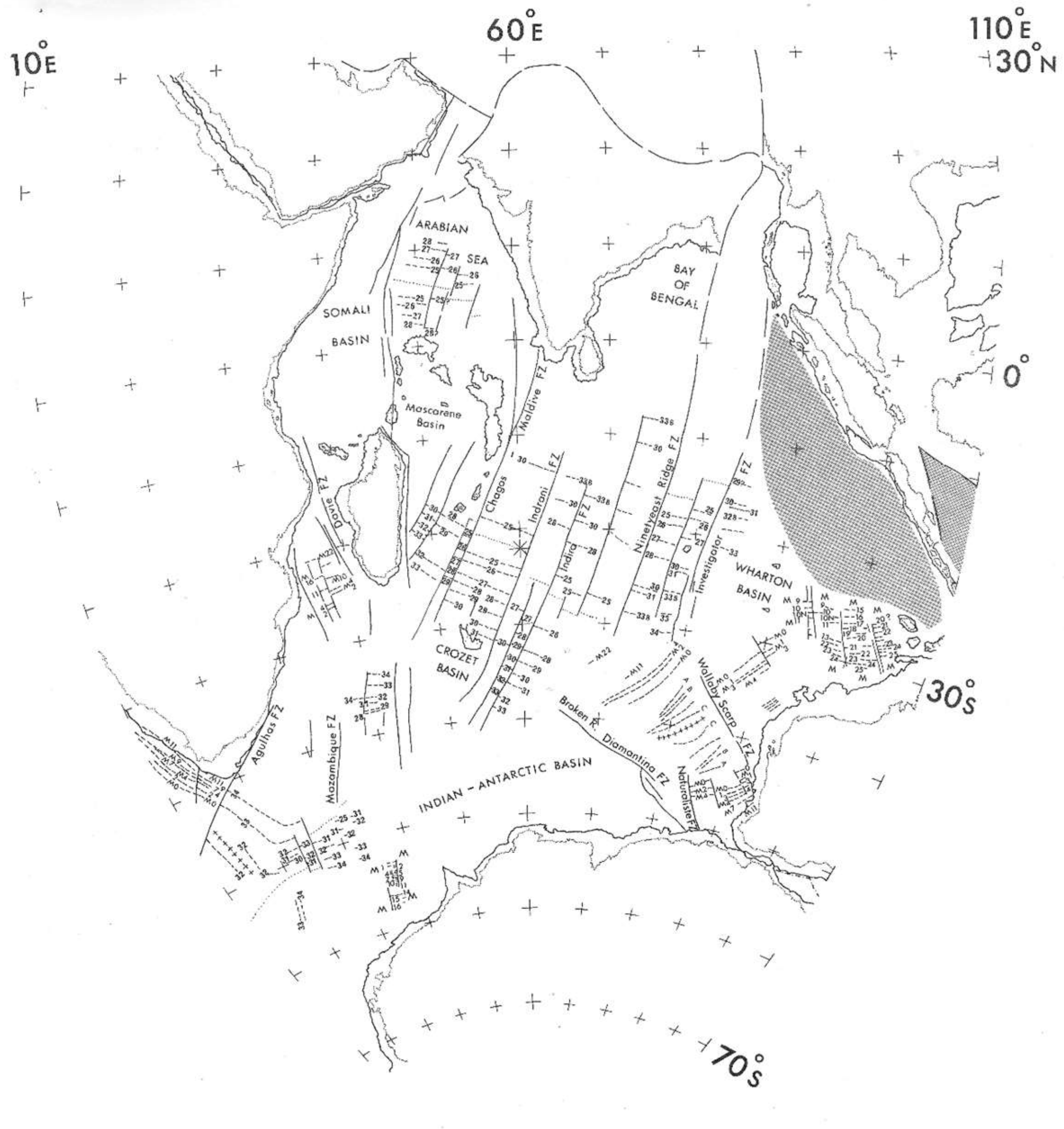
Map 14 Magnetic anomaly 24, 53 Ma Palaeocene-Eocene boundary. North Atlantic. Azimuthal equidistant. Pole 22° N, 30° W (Atlas Map 17)



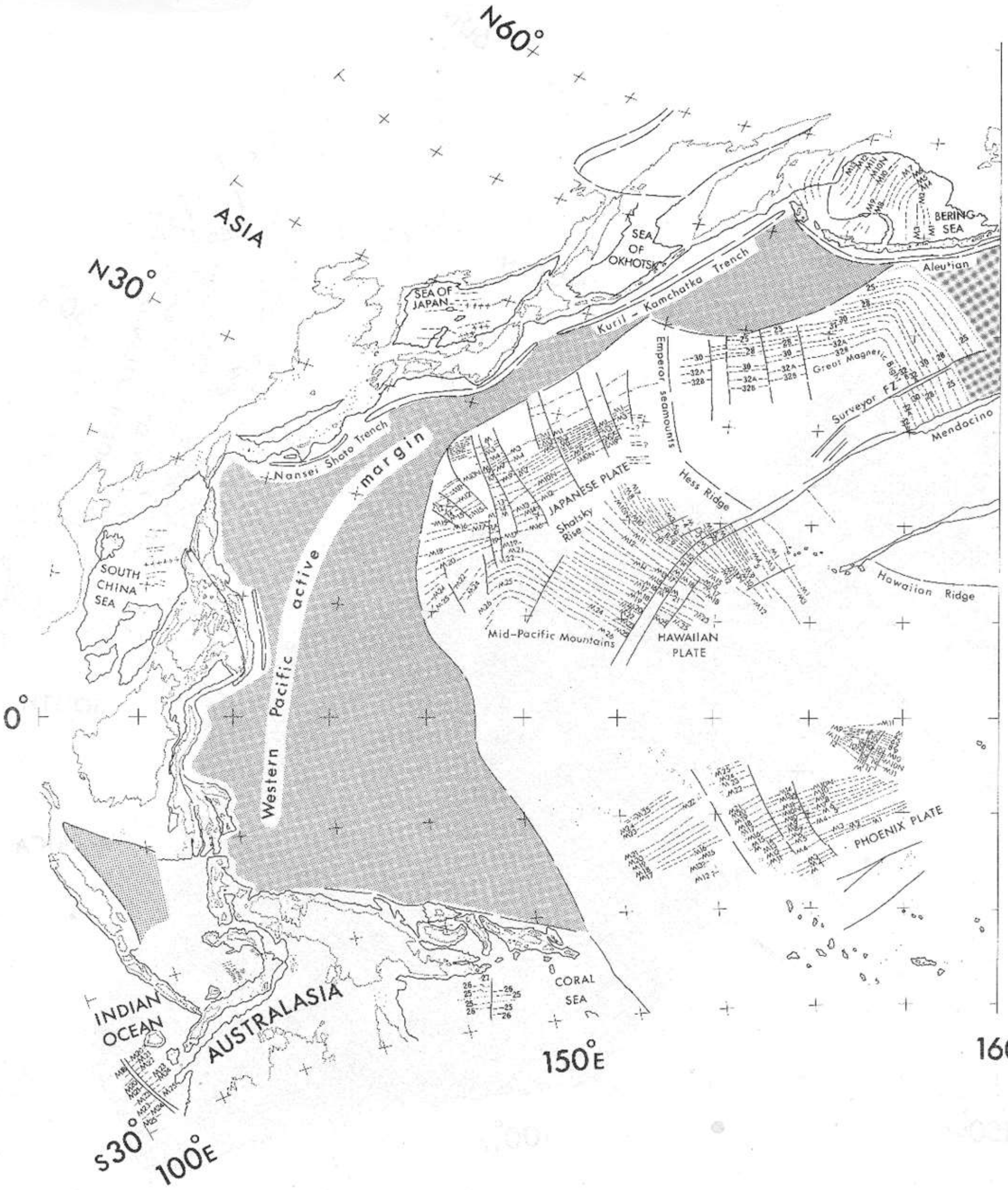
Map 15 Magnetic anomaly 24, 53 Ma Palaeocene-Eocene boundary. South Atlantic. Azimuthal equidistant. Pole 22° S, 30° W (Atlas Map 27)



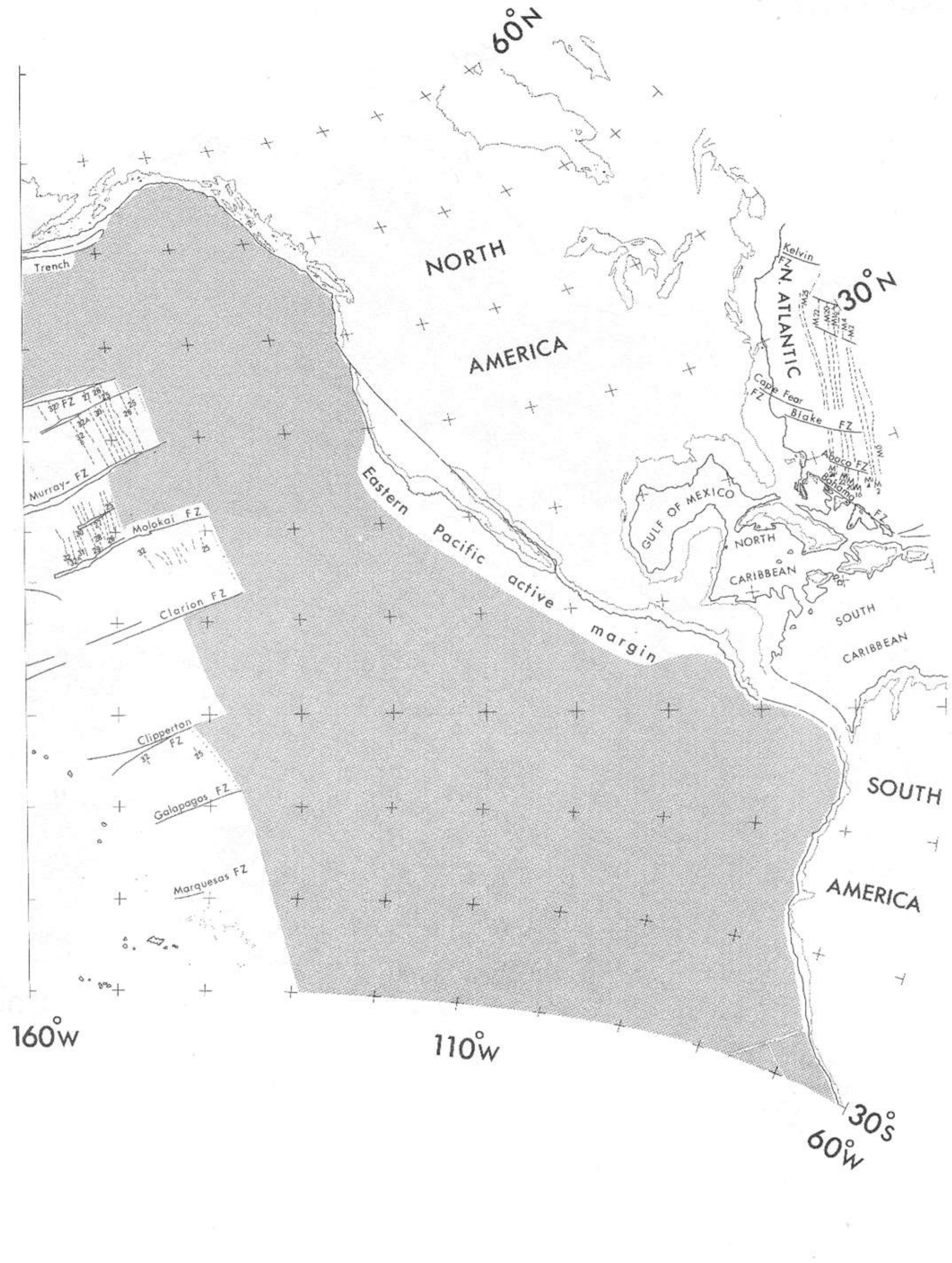
Map 16 Magnetic anomaly 24, 53 Ma Palaeocene-Eocene boundary. Indian Ocean. Azimuthal equidistant. Pole 22° S, 60° E (Atlas Map 37)



Map 17 LH Magnetic anomaly 24, 53 Ma Palaeocene-Eocene boundary.North and Central Pacific. Azimuthal equidistant. Pole 0°, 160° W (Atlas Map 47)

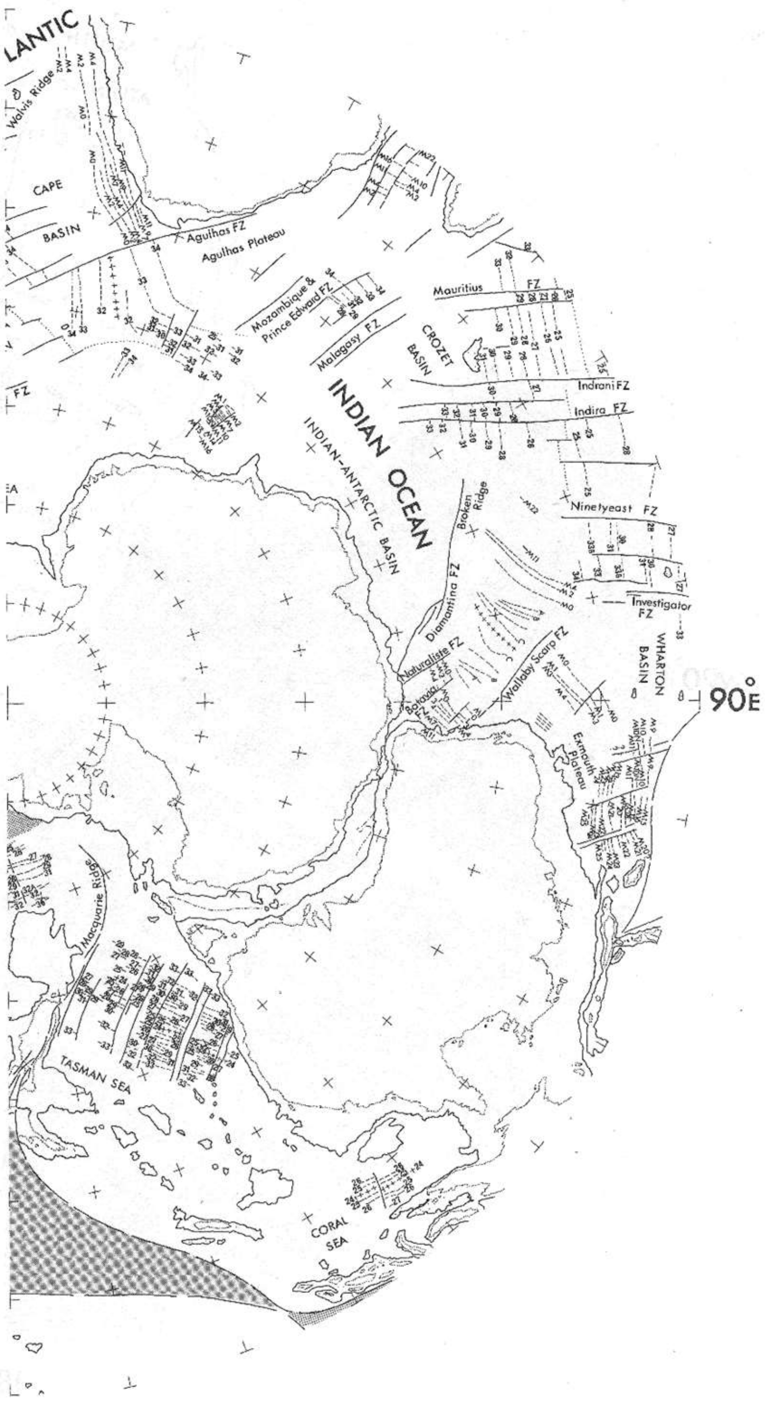


Map 17 RH Magnetic anomaly 24, 53 Ma Palaeocene-Eocene boundary. North and Central Pacific. Azimuthal equidistant. Pole 0°, 160° W (Atlas Map 47)



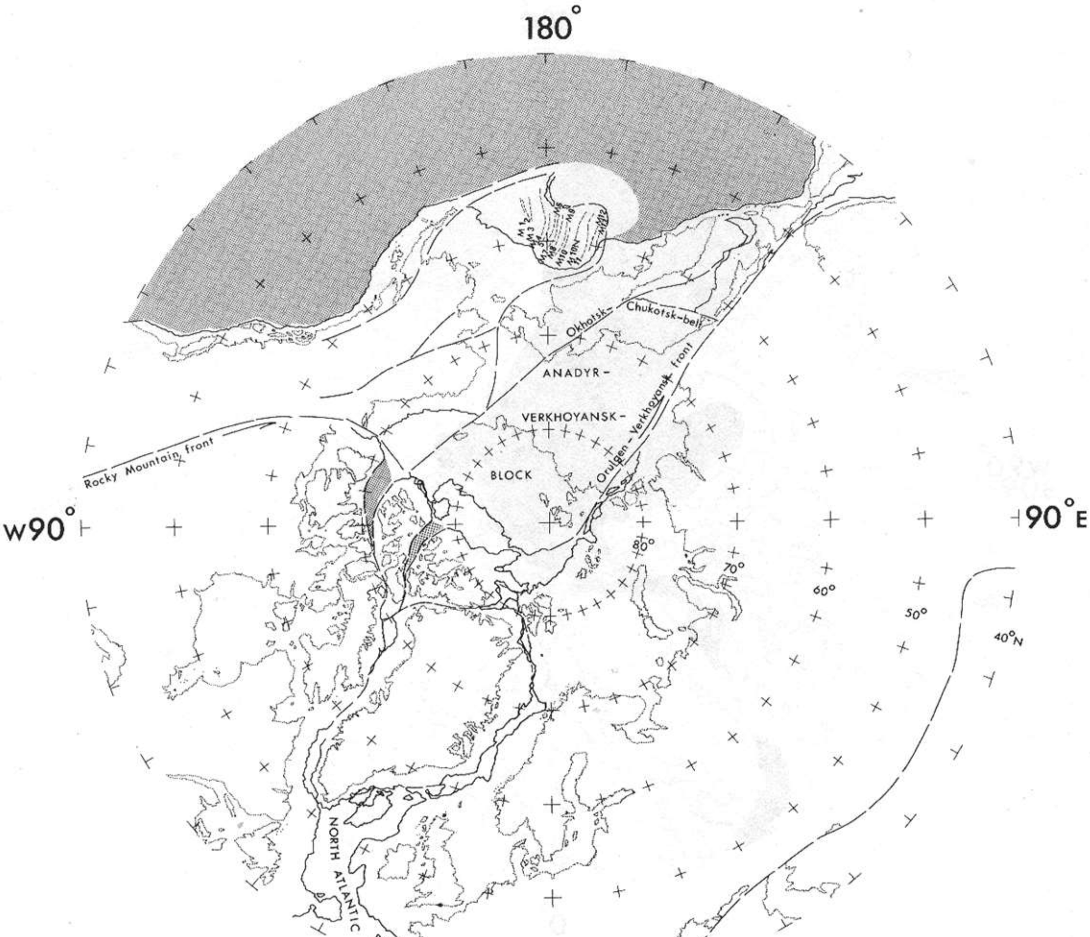
Map 18 LH Magnetic anomaly 24, 53 Ma Palaeocene-Eocene boundary. Southern Hemisphere. Azimuthal equidistant Polar Case S. to 20° S latitude (Atlas Map 57)

Map 18 RH Magnetic anomaly 24, 53 Ma Palaeocene-Eocene boundary. Southern Hemisphere. Azimuthal equidistant Polar Case S. to 20° S latitude (Atlas Map 57)

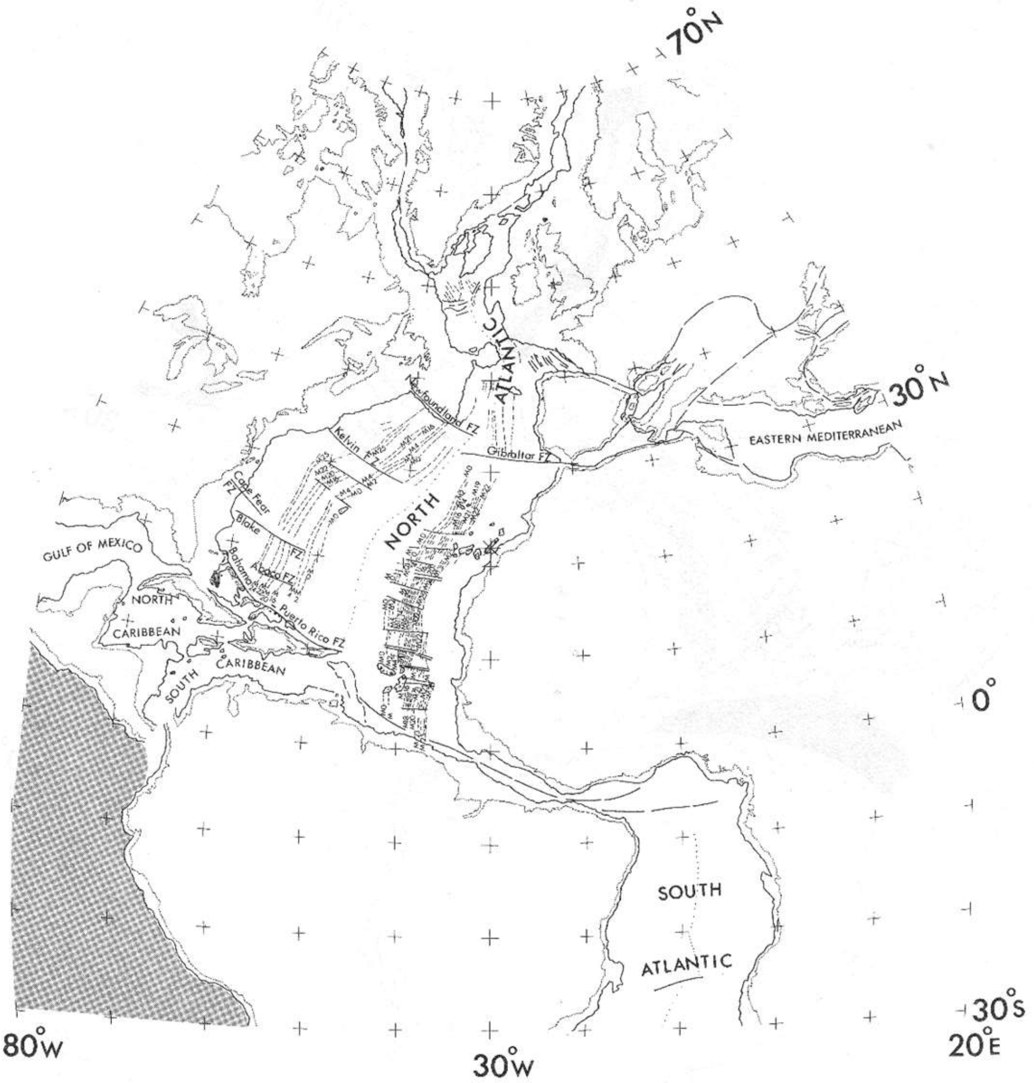


4. Magnetic Quiet Zone, 90 Ma Late Turonian, Diameter 90% (Maps 19-24)

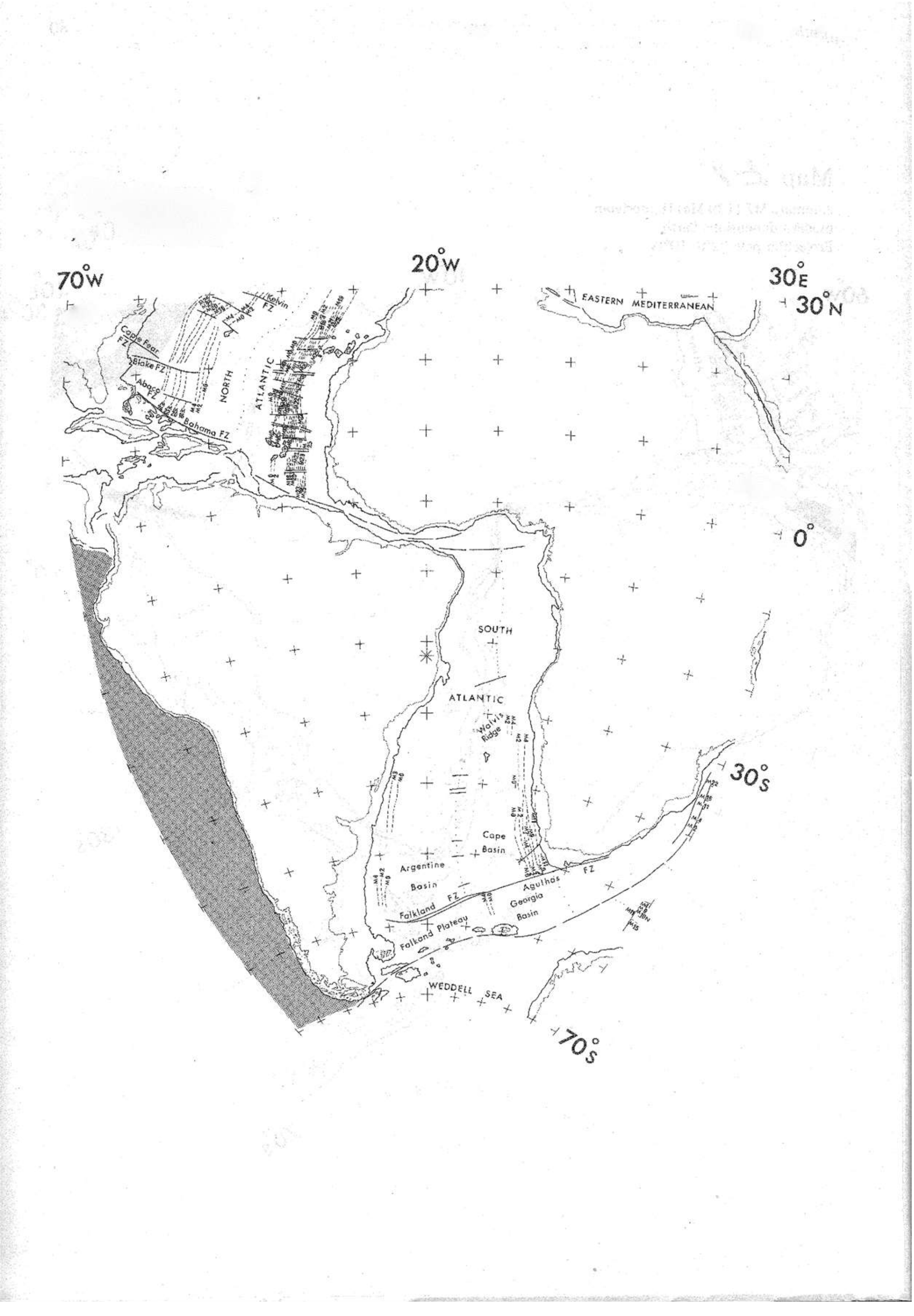
Map 19 Magnetic Quiet Zone, 90 Ma Late Turonian, Diameter 90%. Boreal Region.
Azimuthal equidistant Polar case S. to 40° N latitude (Atlas Map 8)



Map 20 Magnetic Quiet Zone, 90 Ma Late Turonian, Diameter 90%. North Atlantic. Azimuthal equidistant. Pole 22° N, 30° W (Atlas Map 18)

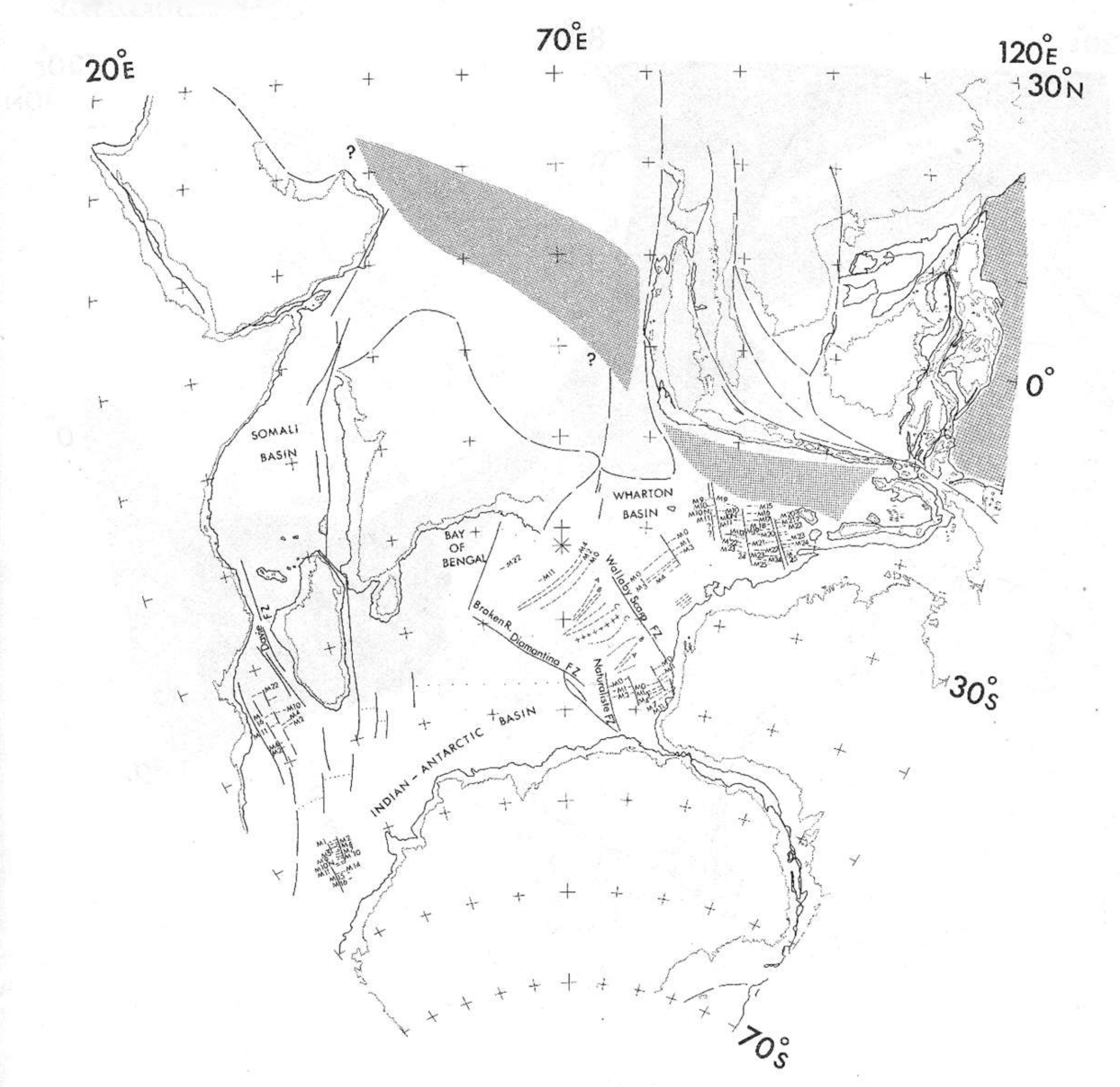


Map 21 Magnetic Quiet Zone, 90 Ma Late Turonian, Diameter 90%. South Atlantic. Azimuthal equidistant. Pole 22° S, 20° W (Atlas Map 28)

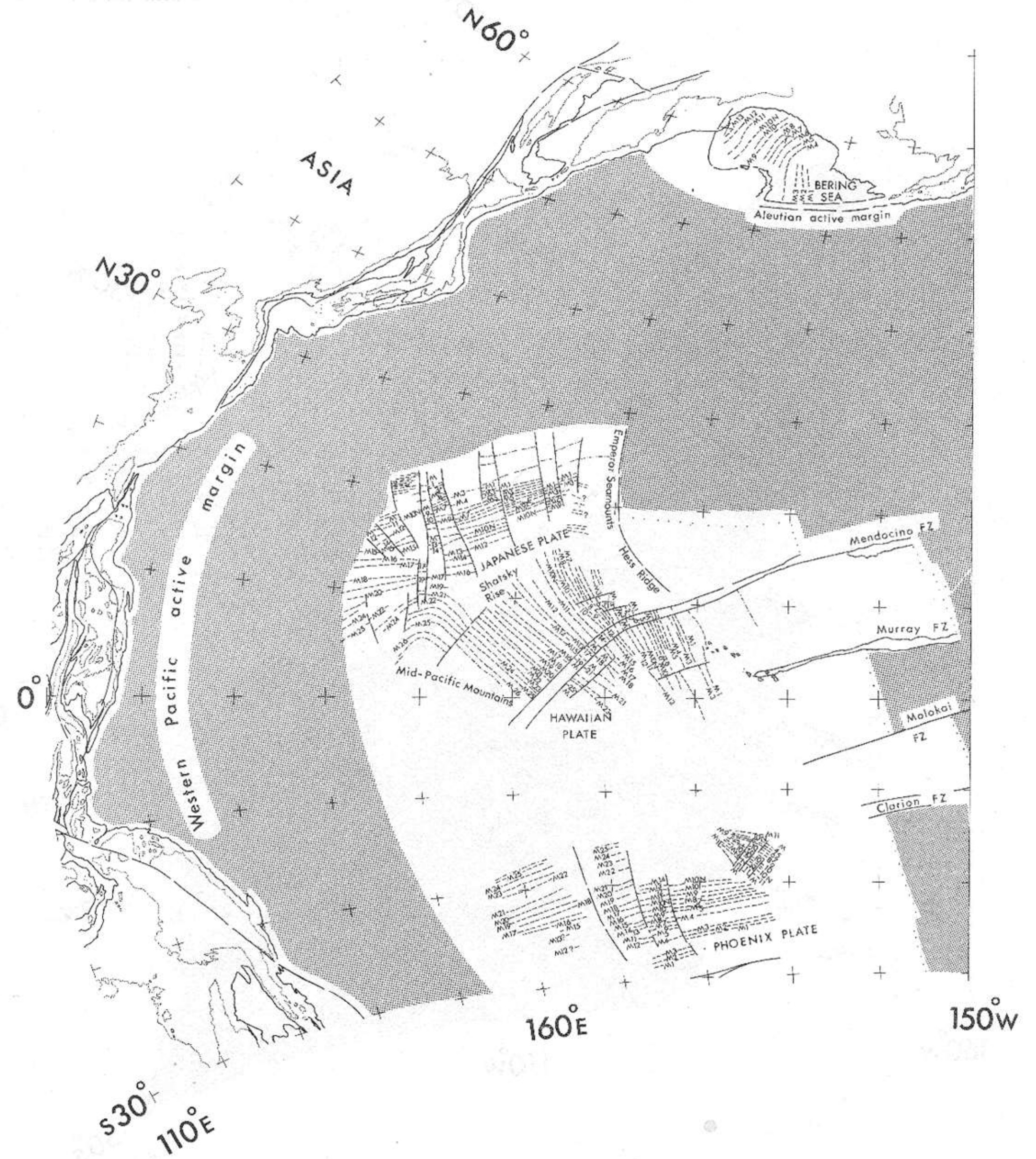


Map 22 Magnetic Quiet Zone, 90 Ma Late Turonian, Diameter 90%. Indian Ocean.

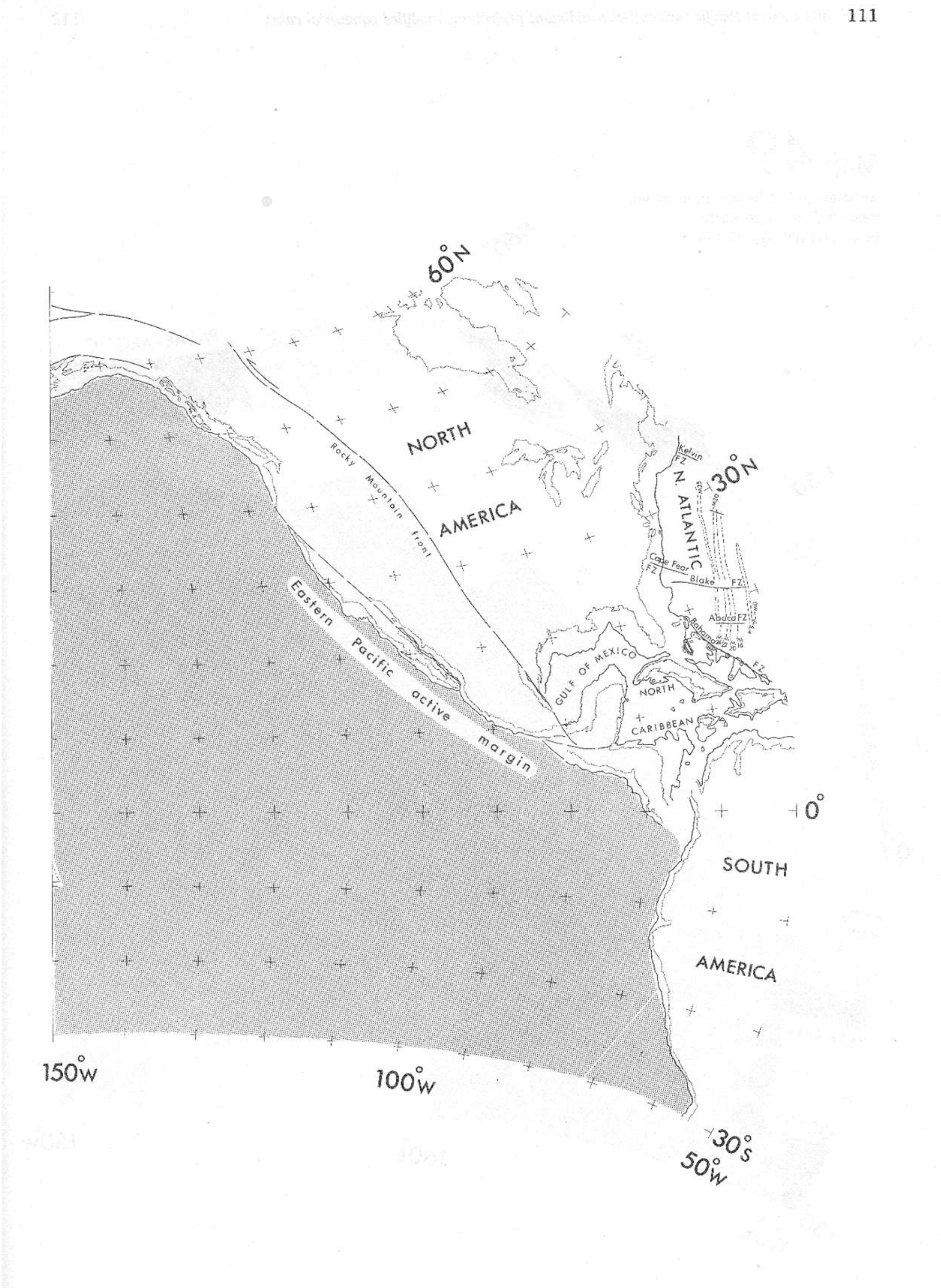
Azimuthal equidistant. Pole 22° S, 70° E (Atlas Map 38)



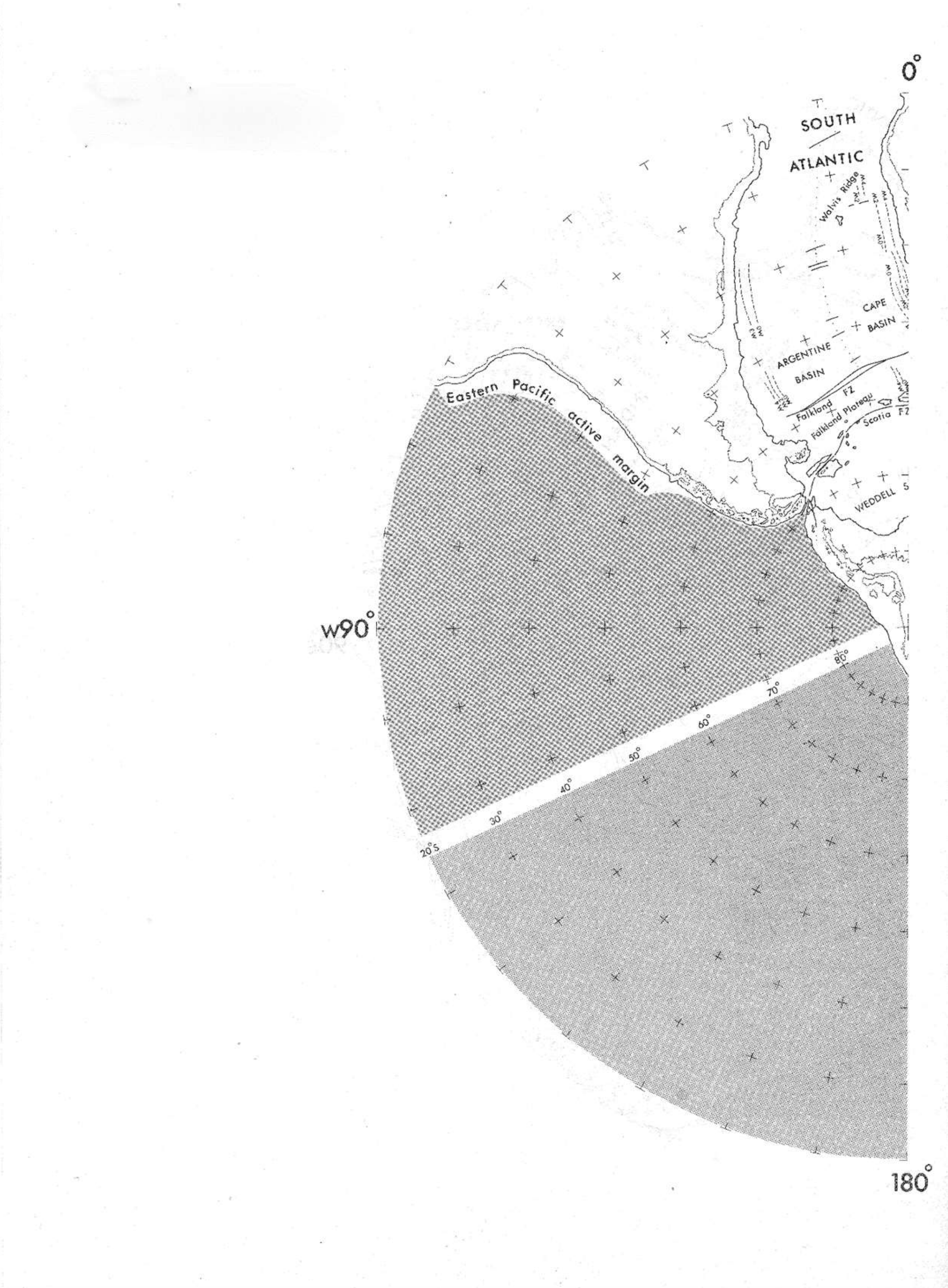
Map 23 LH Magnetic Quiet Zone, 90 Ma LateTuronian, Diameter 90%. North and Central Pacific. Azimuthal equidistant. Pole 0°, 150° W (Atlas Map 48)



Map 23 RH Magnetic Quiet Zone, 90 Ma LateTuronian, Diameter 90%. North and Central Pacific. Azimuthal equidistant. Pole 0°, 150° W (Atlas Map 48



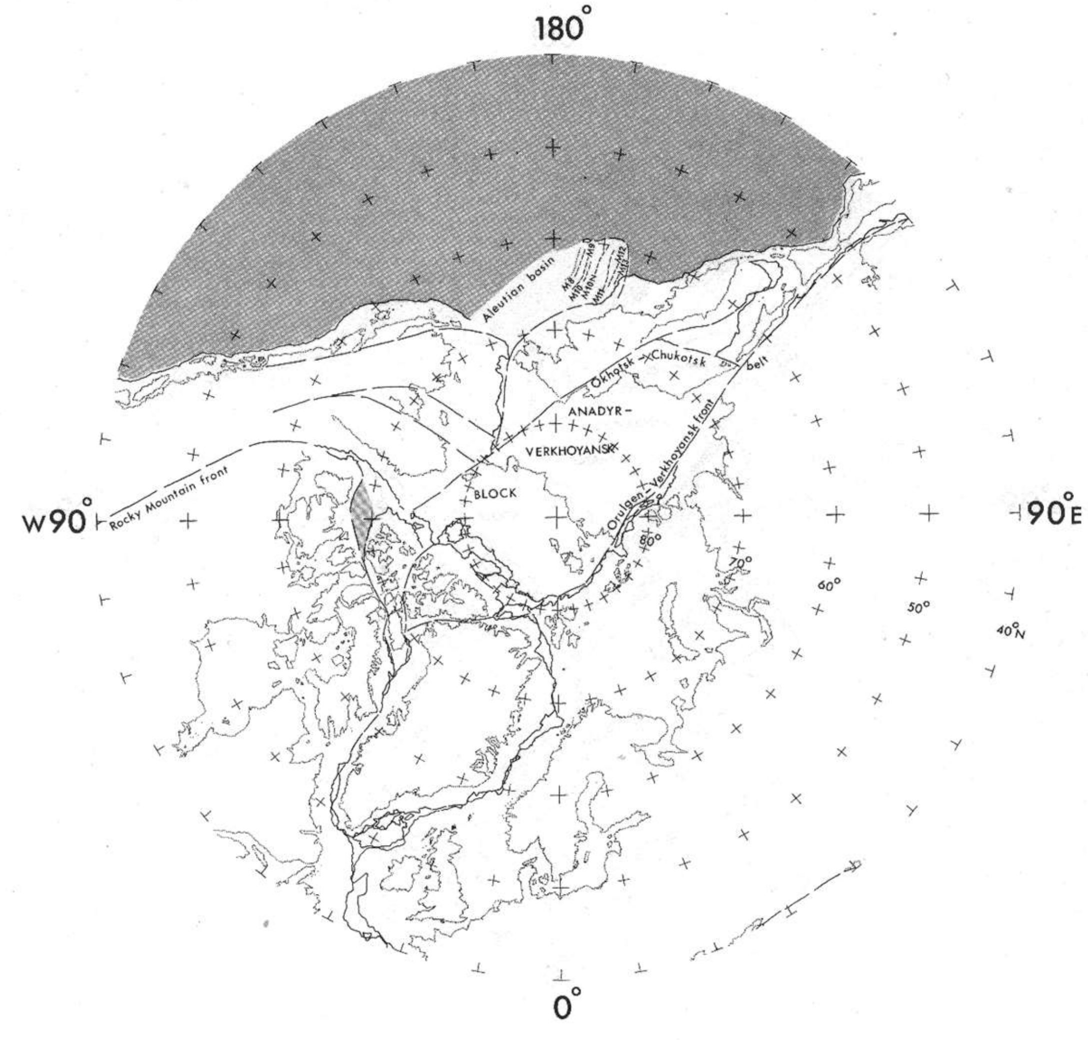
Map 24 LH Magnetic Quiet Zone, 90 Ma Late Turonian, Diameter 90%. Southern Hemisphere. Azimuthal equidistant Polar Case S. to 20° S latitude (Atlas Map 58)



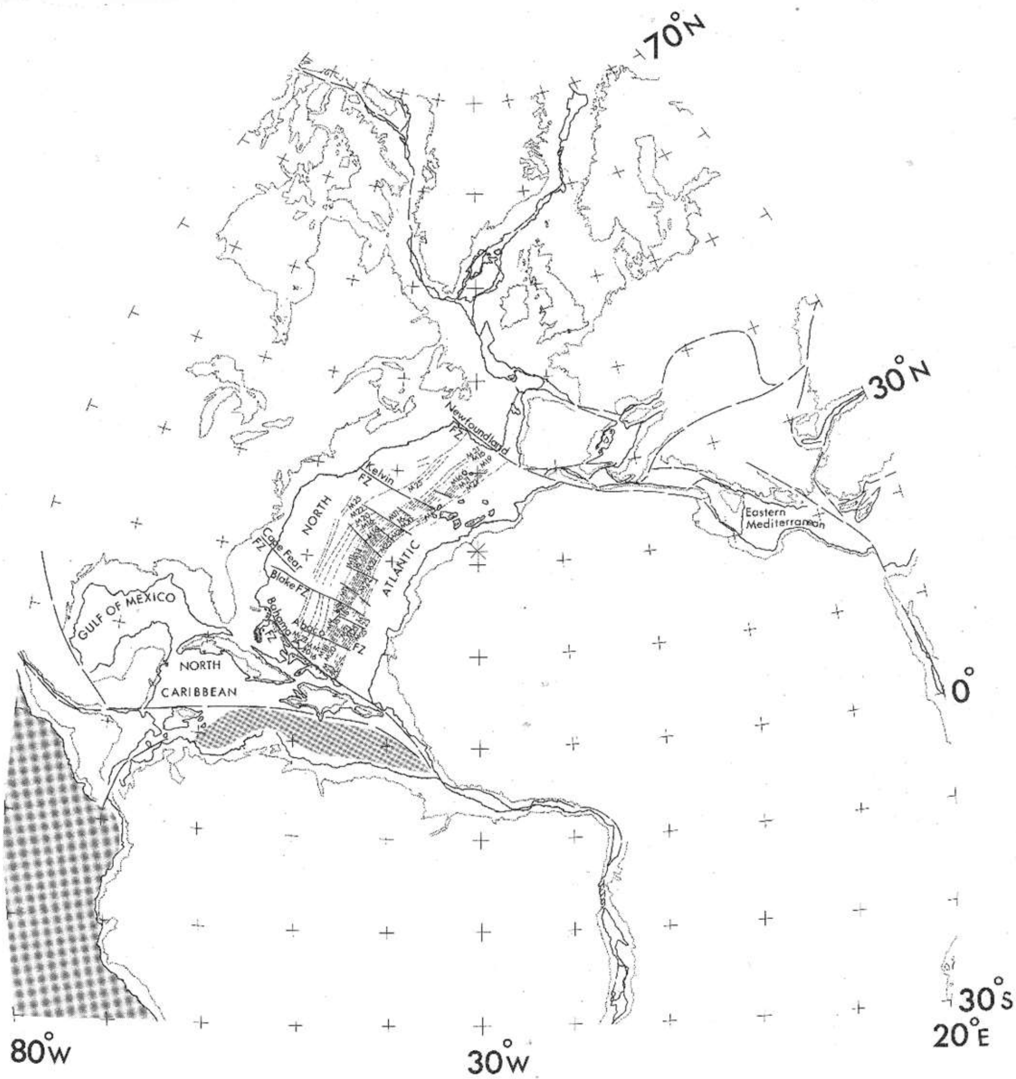
Map 24 RH Magnetic Quiet Zone, 90 Ma Late Turonian, Diameter 90%. Southern Hemisphere. Azimuthal equidistant Polar Case S. to 20° S latitude (Atlas Map 58)

5. Magnetic anomaly M7, 129 Ma Aptian, Diameter 87% (Maps 25-30)

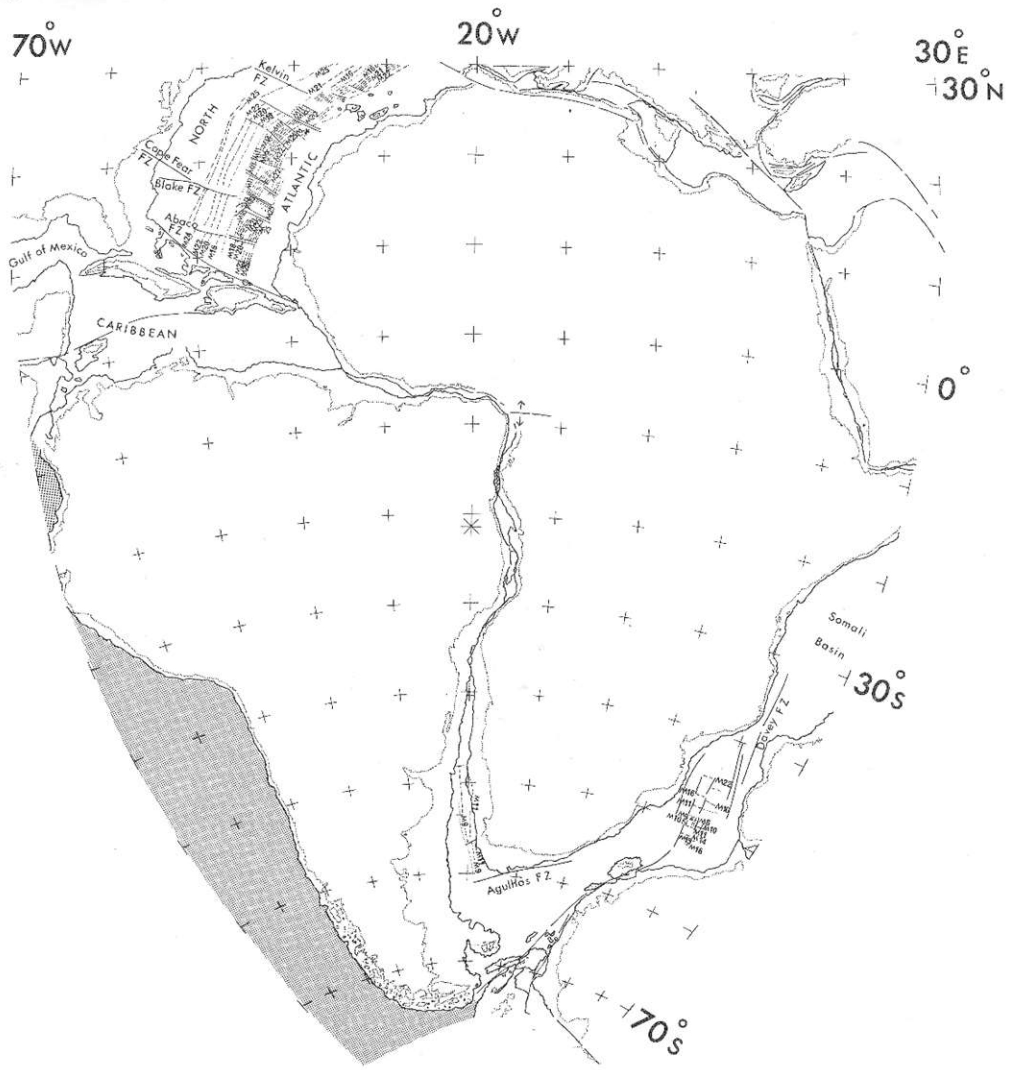
Map 25 Magnetic anomaly M7, 129 Ma Aptian, Diameter 87%. Boreal Region. Azimuthal equidistant Polar case S. to 40° N latitude (Atlas Map 10)



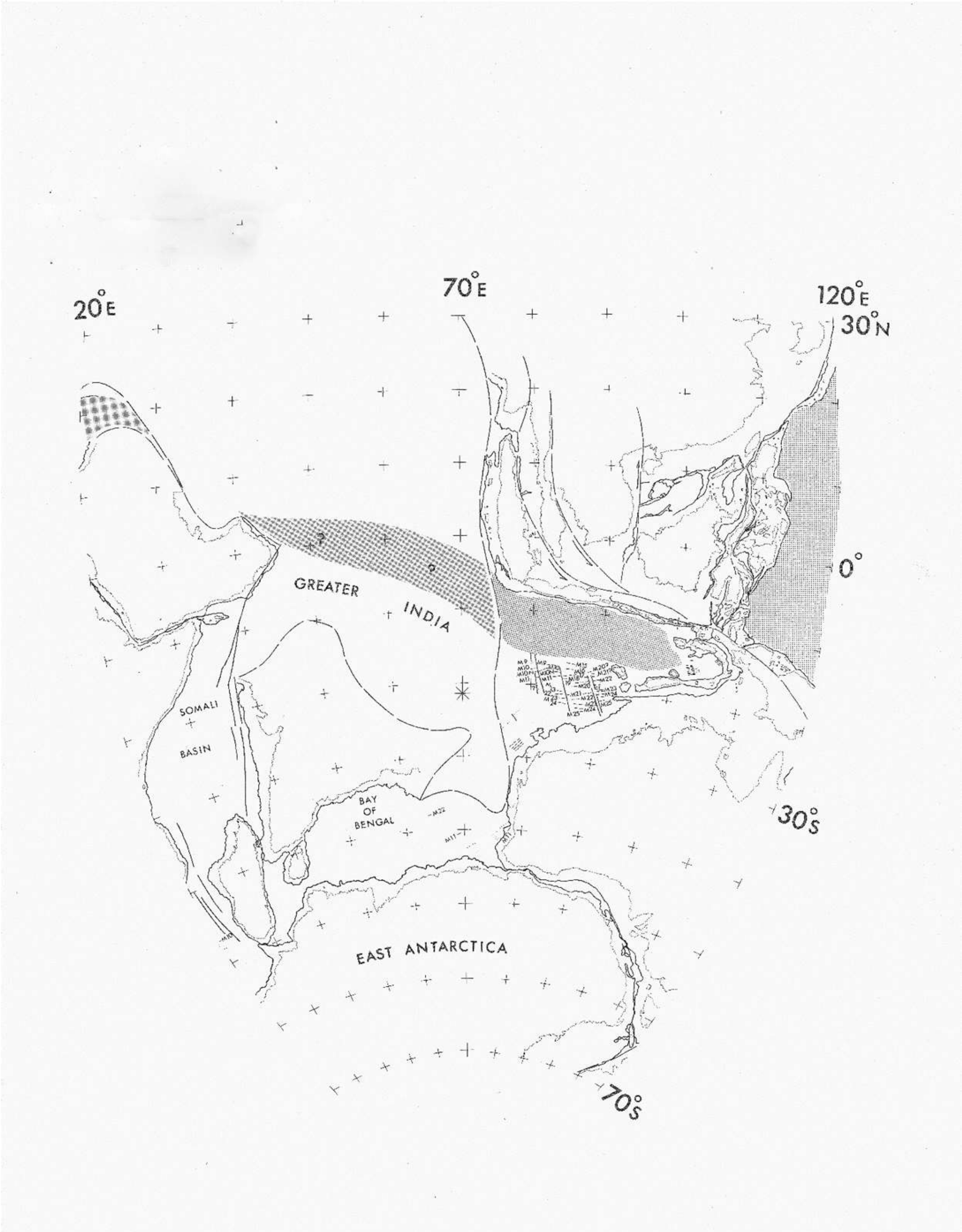
Map 26 Magnetic anomaly M7, 129 Ma Aptian, Diameter 87%. North Atlantic. Azimuthal equidistant. Pole 22° N, 30° W (Atlas Map 20)



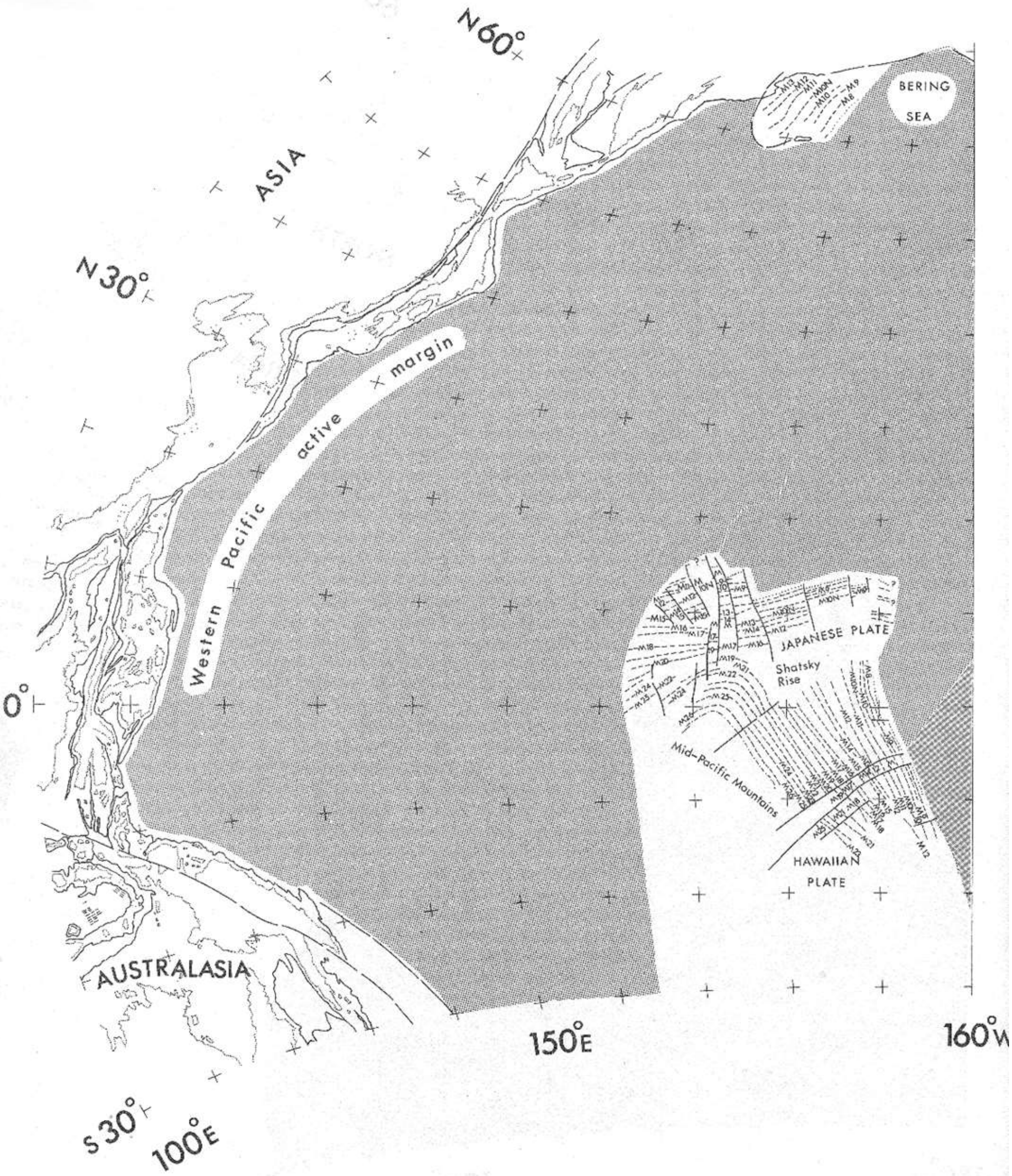
Map 27 Magnetic anomaly M7, 129 Ma Aptian, Diameter 87%. South Atlantic. Azimuthal equidistant. Pole 22° S, 20° W (Atlas Map 30)



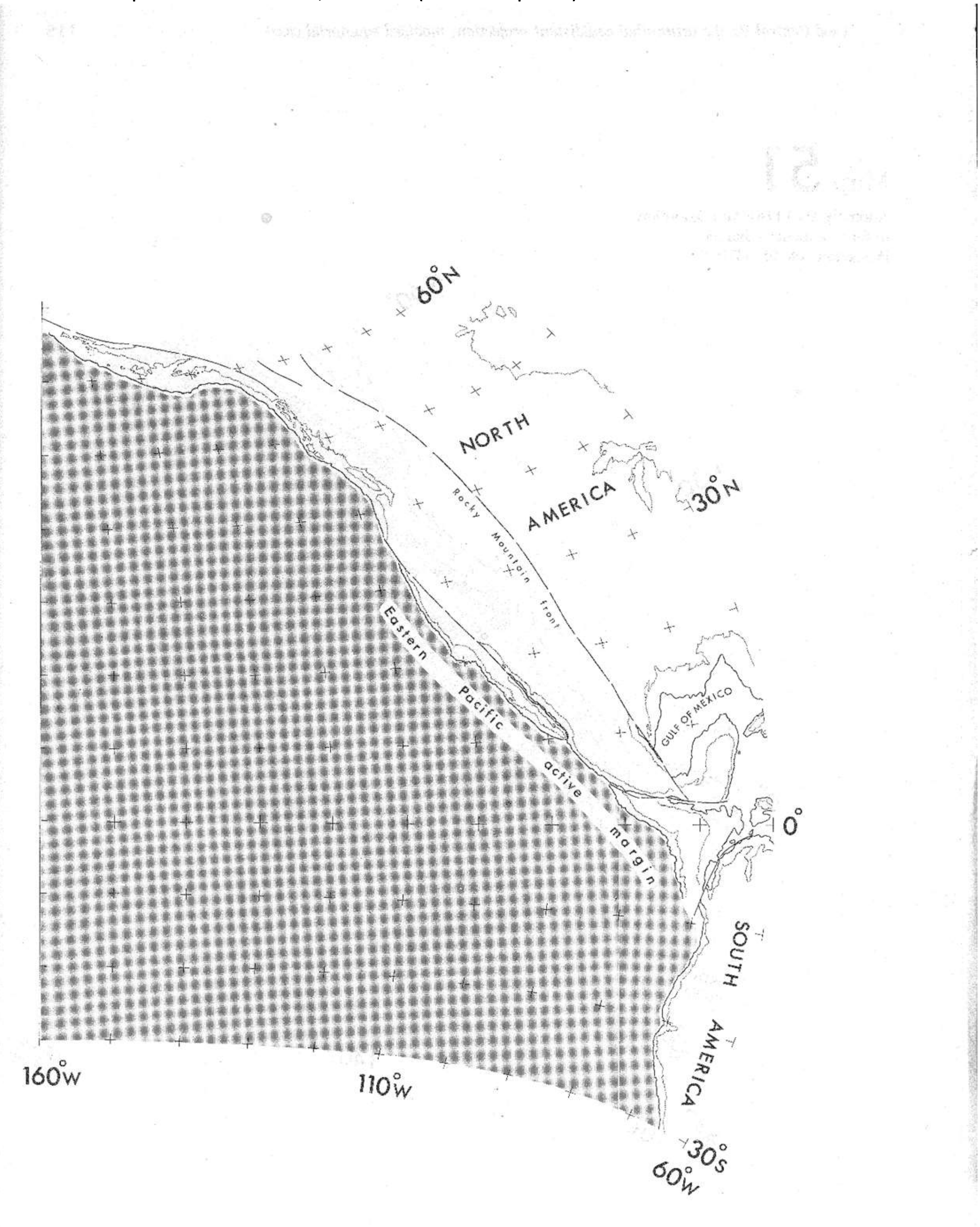
Map 28 Magnetic anomaly M7, 129 Ma Aptian, Diameter 87%. Indian Ocean. Azimuthal equidistant. Pole 22° S, 70° E (Atlas Map 40)



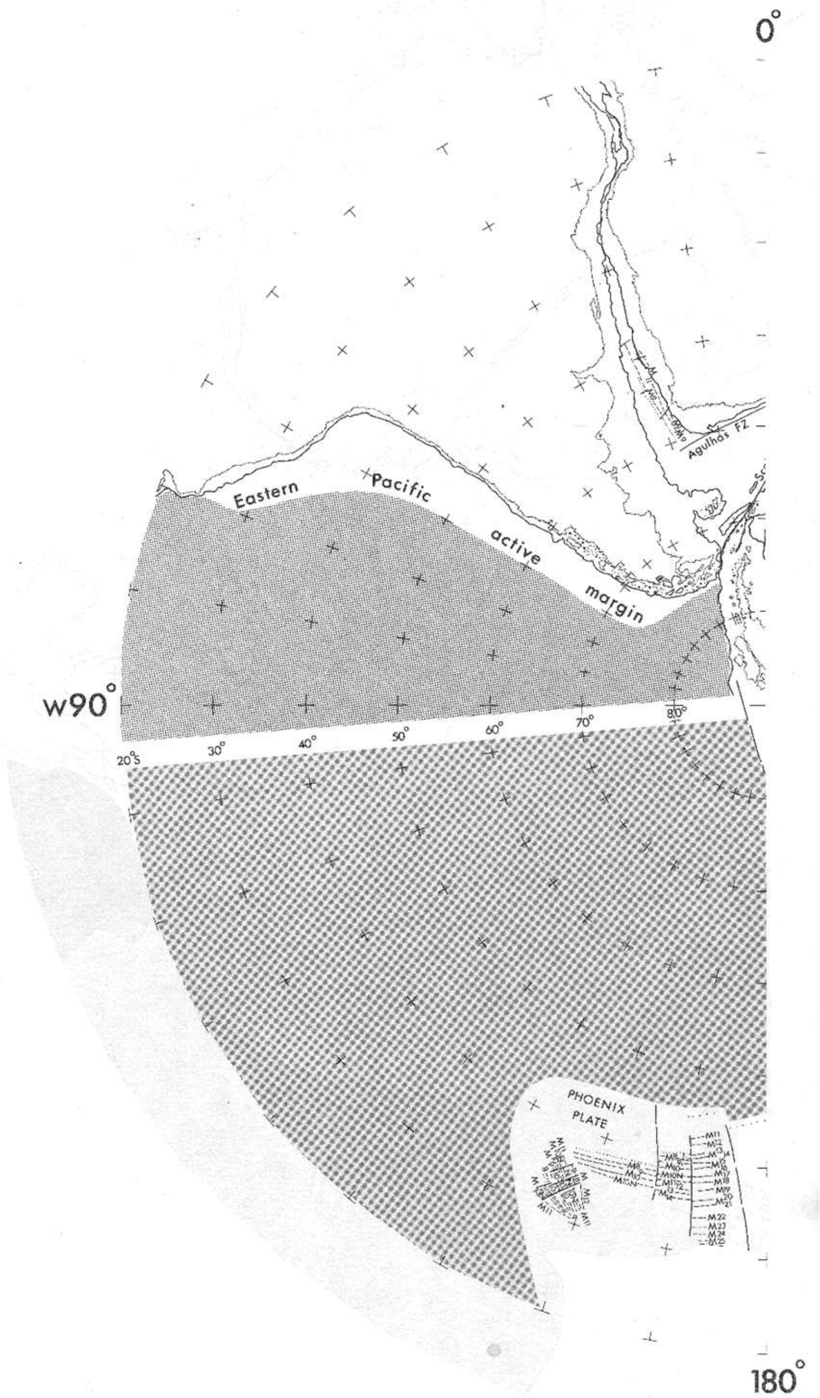
Map 29 LH Magnetic anomaly M7, 129 Ma Aptian, Diameter 87%. North and Central Pacific.
Azimuthal equidistant. Pole 0°, 160° W (Atlas Map 50)



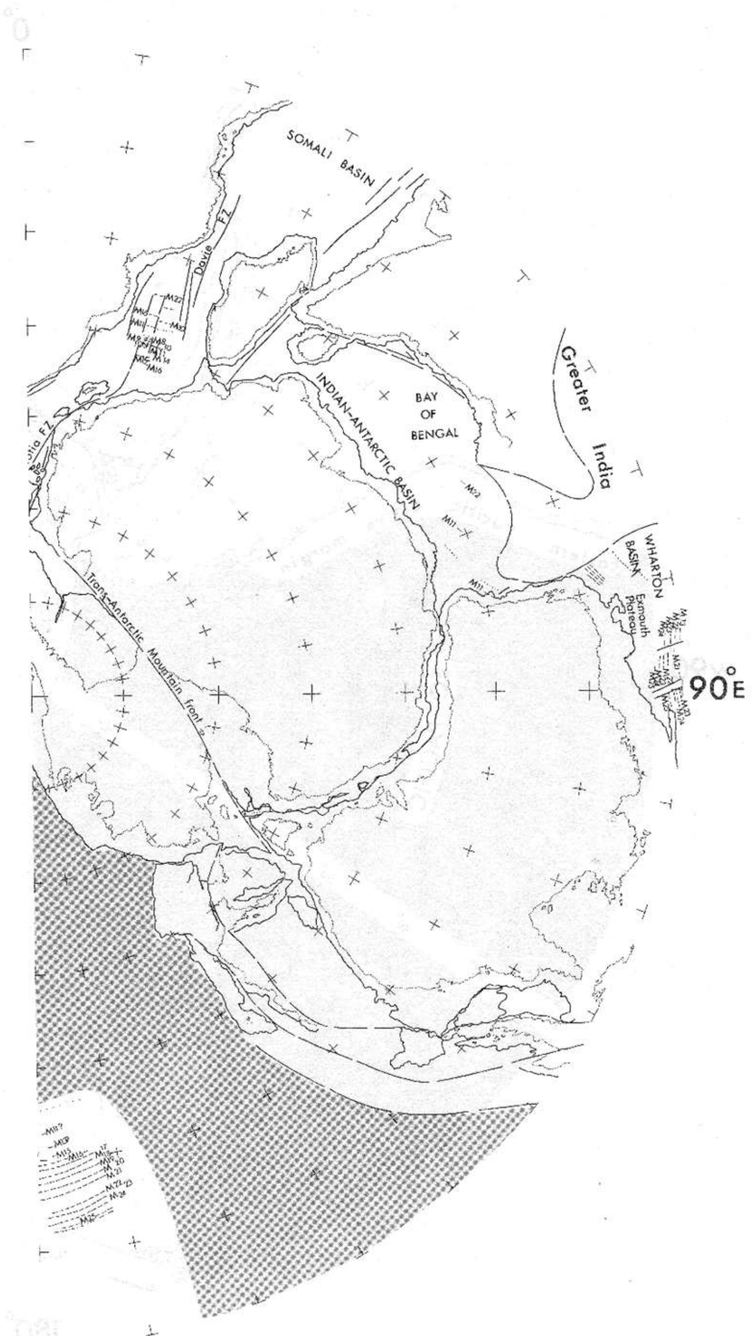
Map 29 RH Magnetic anomaly M7, 129 Ma Aptian, Diameter 87%. North and Central Pacific.
Azimuthal equidistant. Pole 0°, 160° W (Atlas Map 50)



Map 30 LH Magnetic anomaly M7, 129 Ma Aptian, Diameter 87%. Southern Hemisphere.
Azimuthal equidistant Polar Case S. to 20° S latitude (Atlas Map 60)

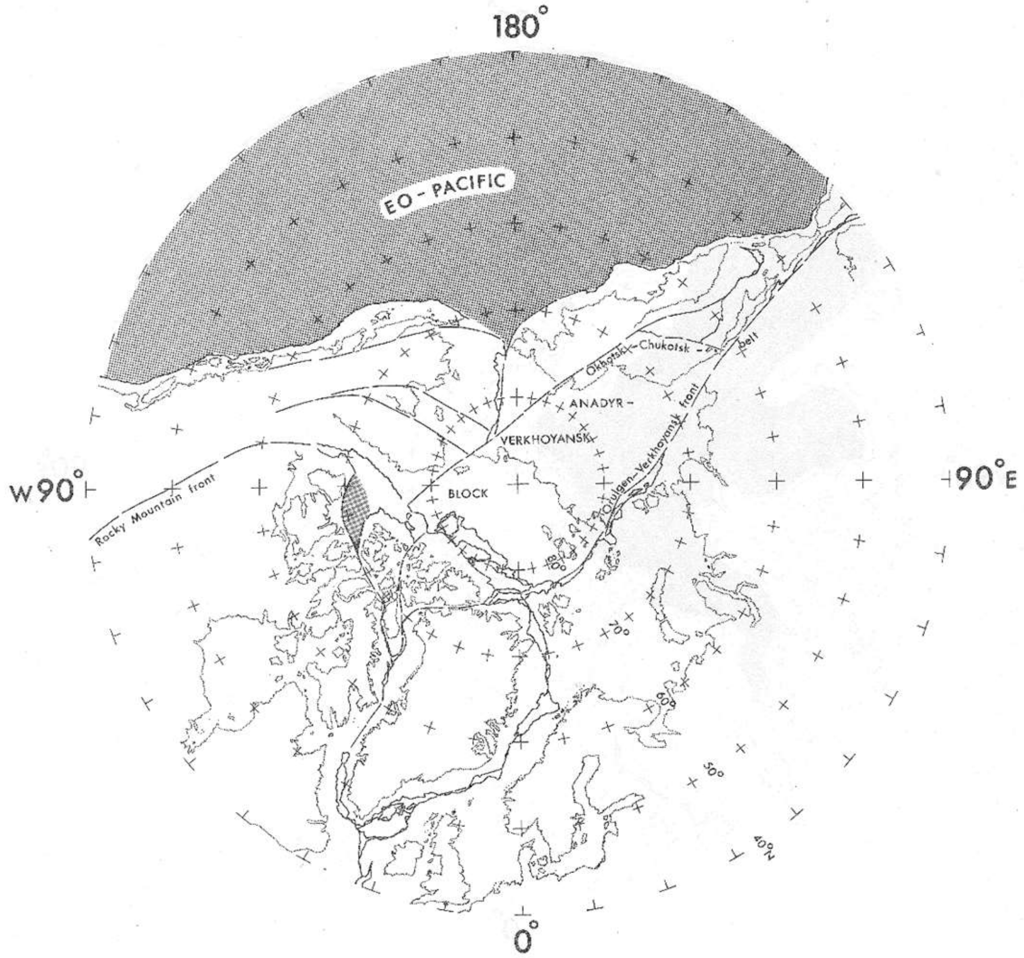


Map 30 RH Magnetic anomaly M7, 129 Ma Aptian, Diameter 87%. Southern Hemisphere.
Azimuthal equidistant Polar Case S. to 20° S latitude (Atlas Map 60

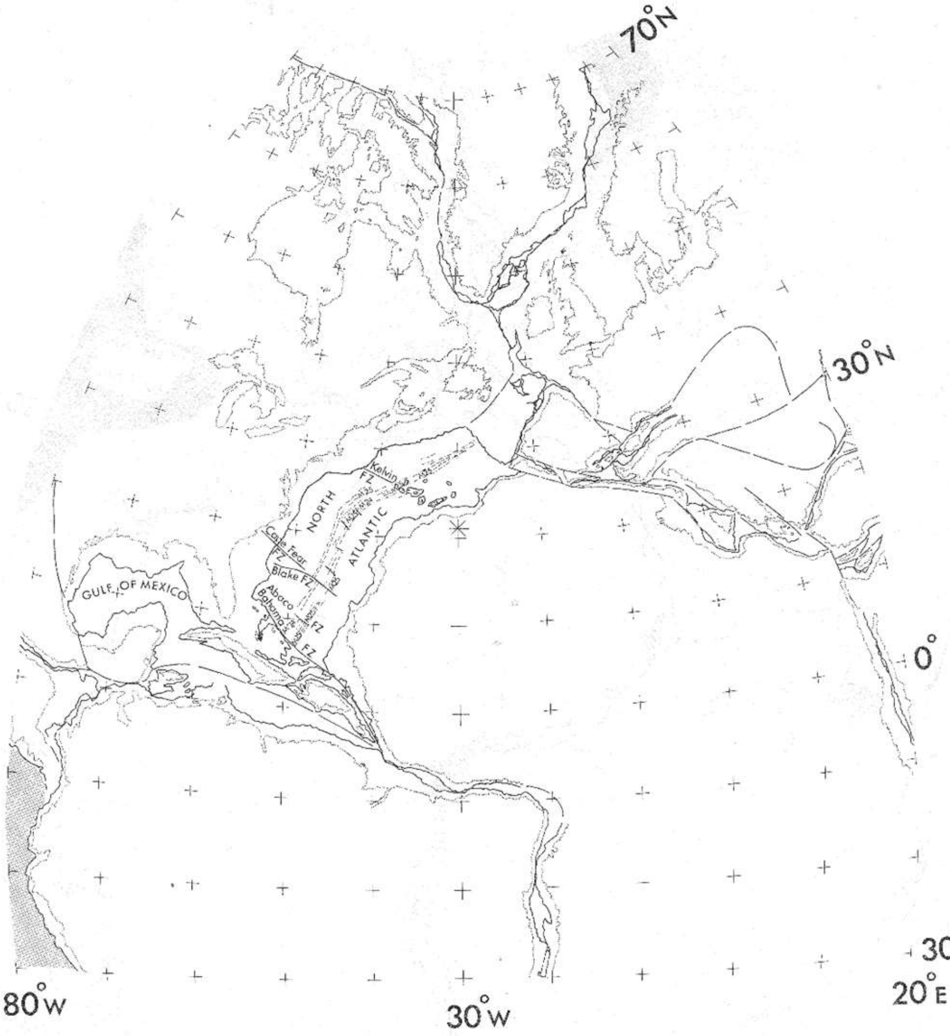


6. Magnetic anomaly M23, 158 Ma Oxfordian, Diameter 84% (Maps 31-36)

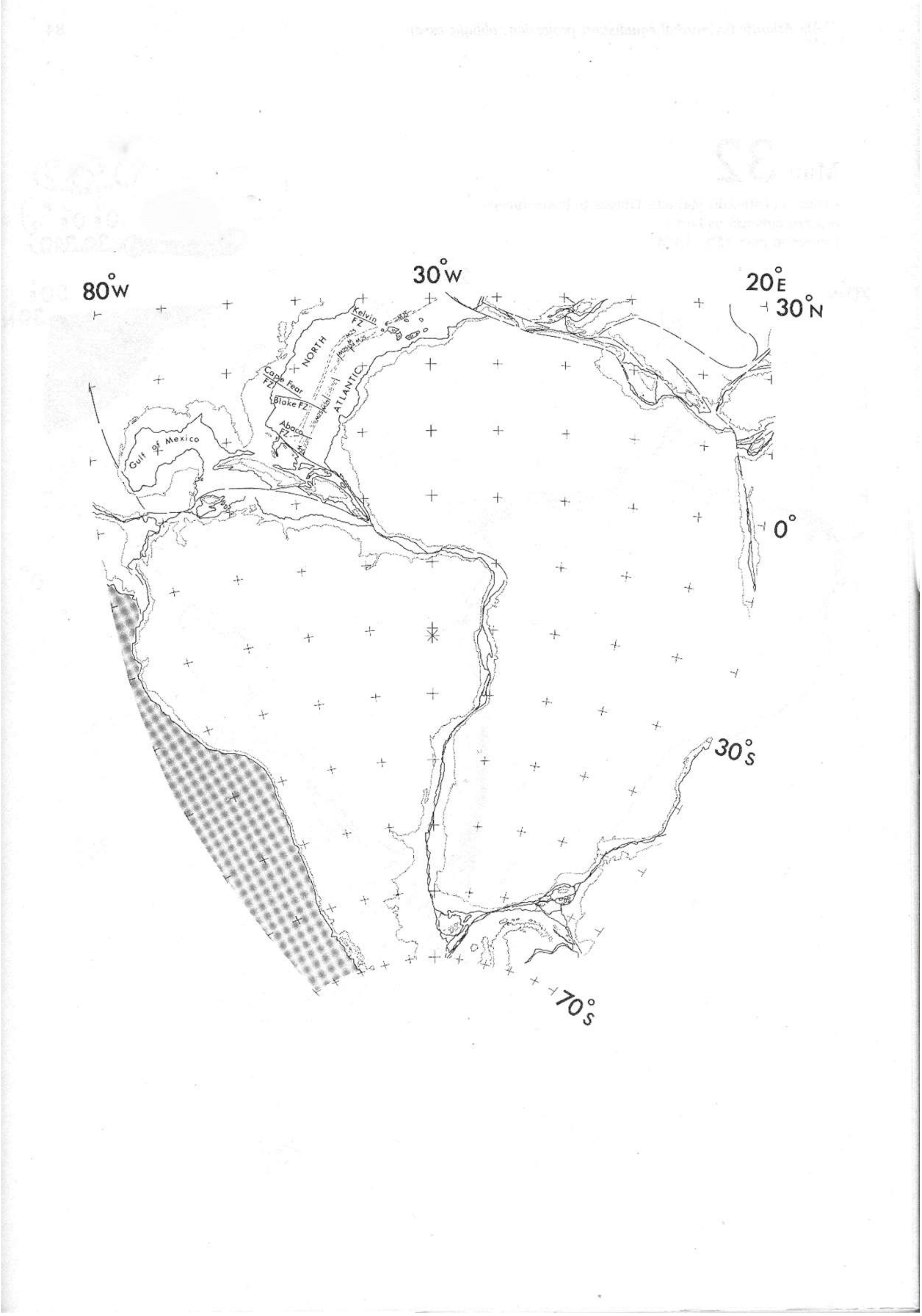
Map 31 Magnetic anomaly M23, 158 Ma Tithonian, Diameter 84%. Boreal Region. Azimuthal equidistant Polar case S. to 40° N latitude (Atlas Map 11)



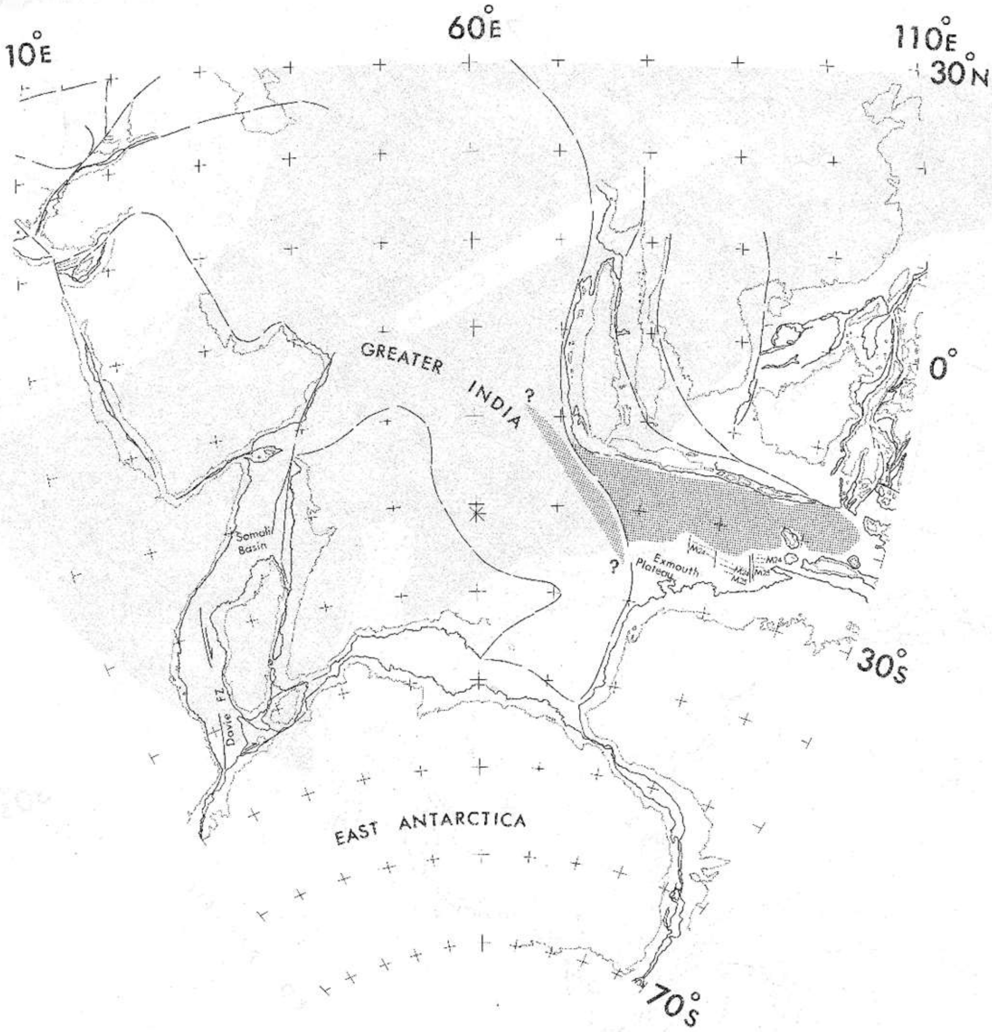
Map 32 Magnetic anomaly M23, 158 Ma Tithonian, Diameter 84%. North Atlantic. Azimuthal equidistant. Pole 22° N, 30° W (Atlas Map 21)



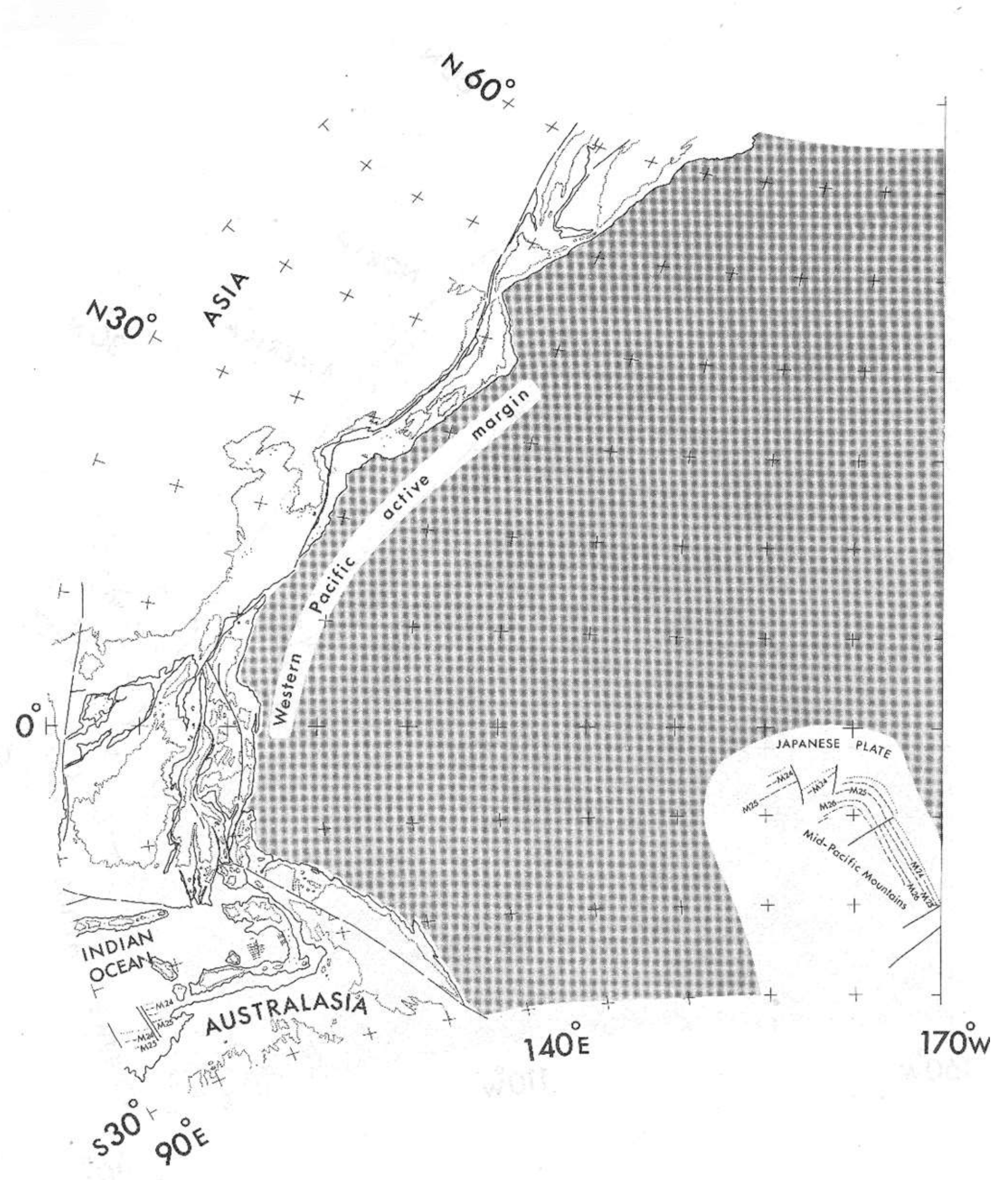
Map 33 Magnetic anomaly M23, 158 Ma Tithonian, Diameter 84%. South Atlantic. Azimuthal equidistant. Pole 22° S, 30° W (Atlas Map 31)



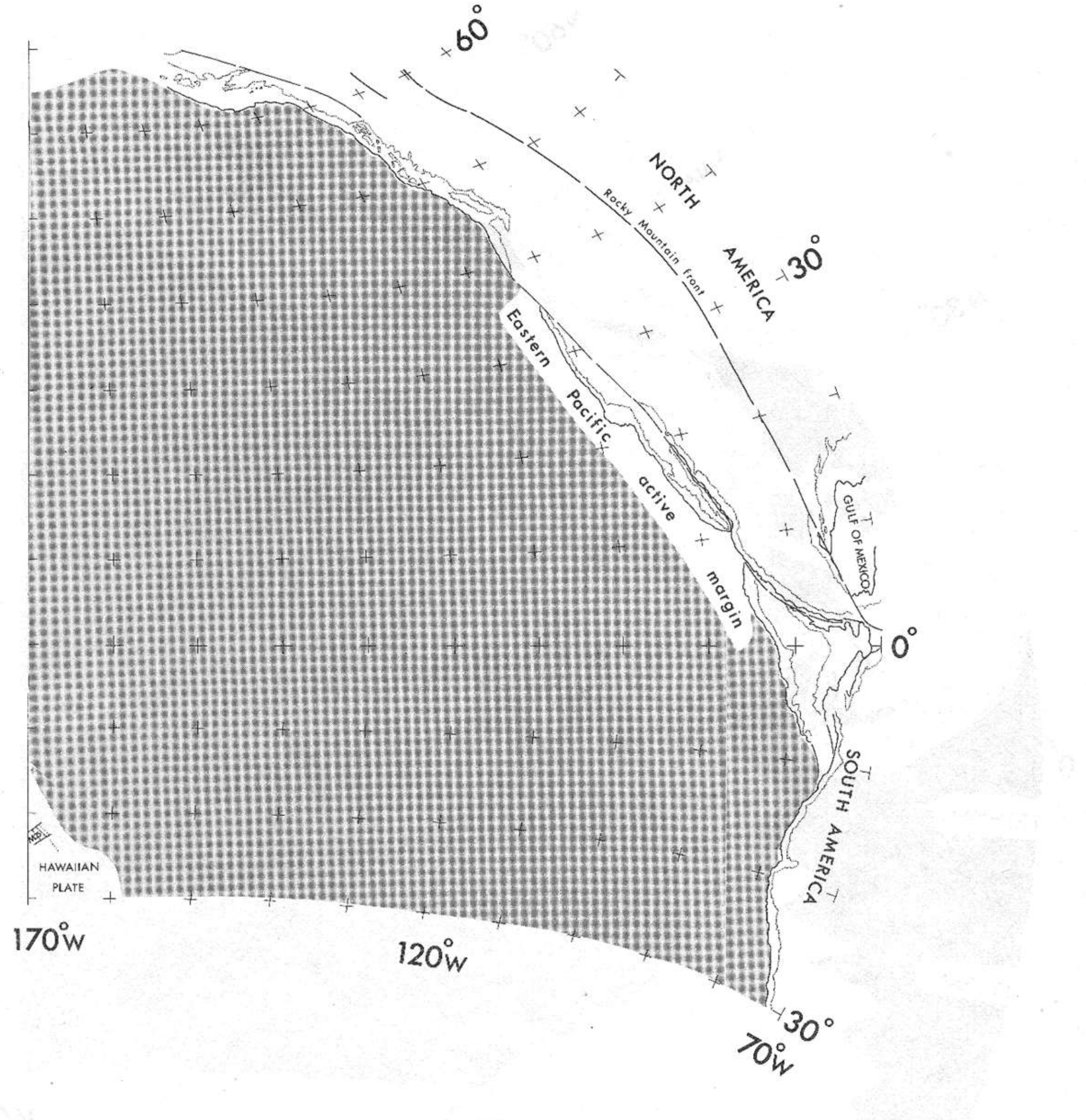
Map 34 Magnetic anomaly M23, 158 Ma Tithonian, Diameter 84%. Indian Ocean. Azimuthal equidistant. Pole 22° S, 60° E (Atlas Map 41)



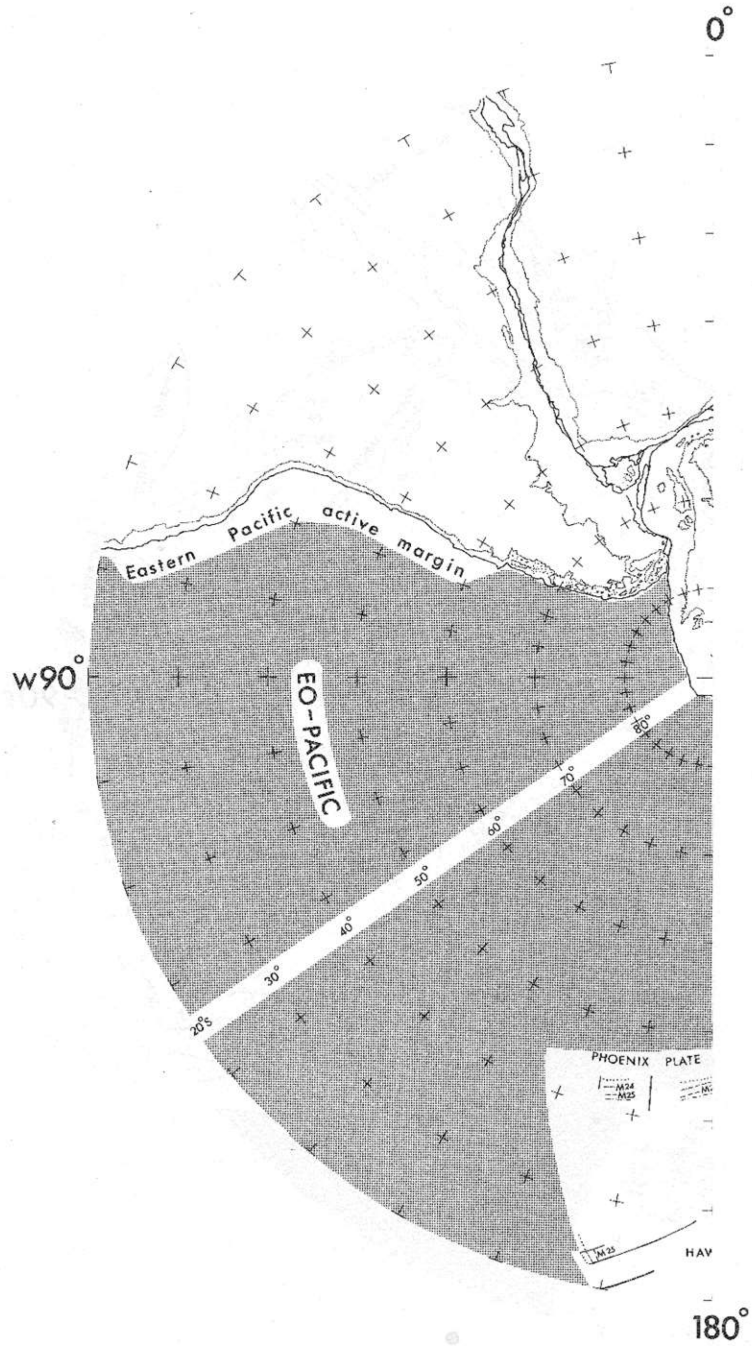
Map 35 LH Magnetic anomaly M23, 158 Ma Tithonian, Diameter 84%. North and Central Pacific. Azimuthal equidistant. Pole 0°, 170° W (Atlas Map 51)



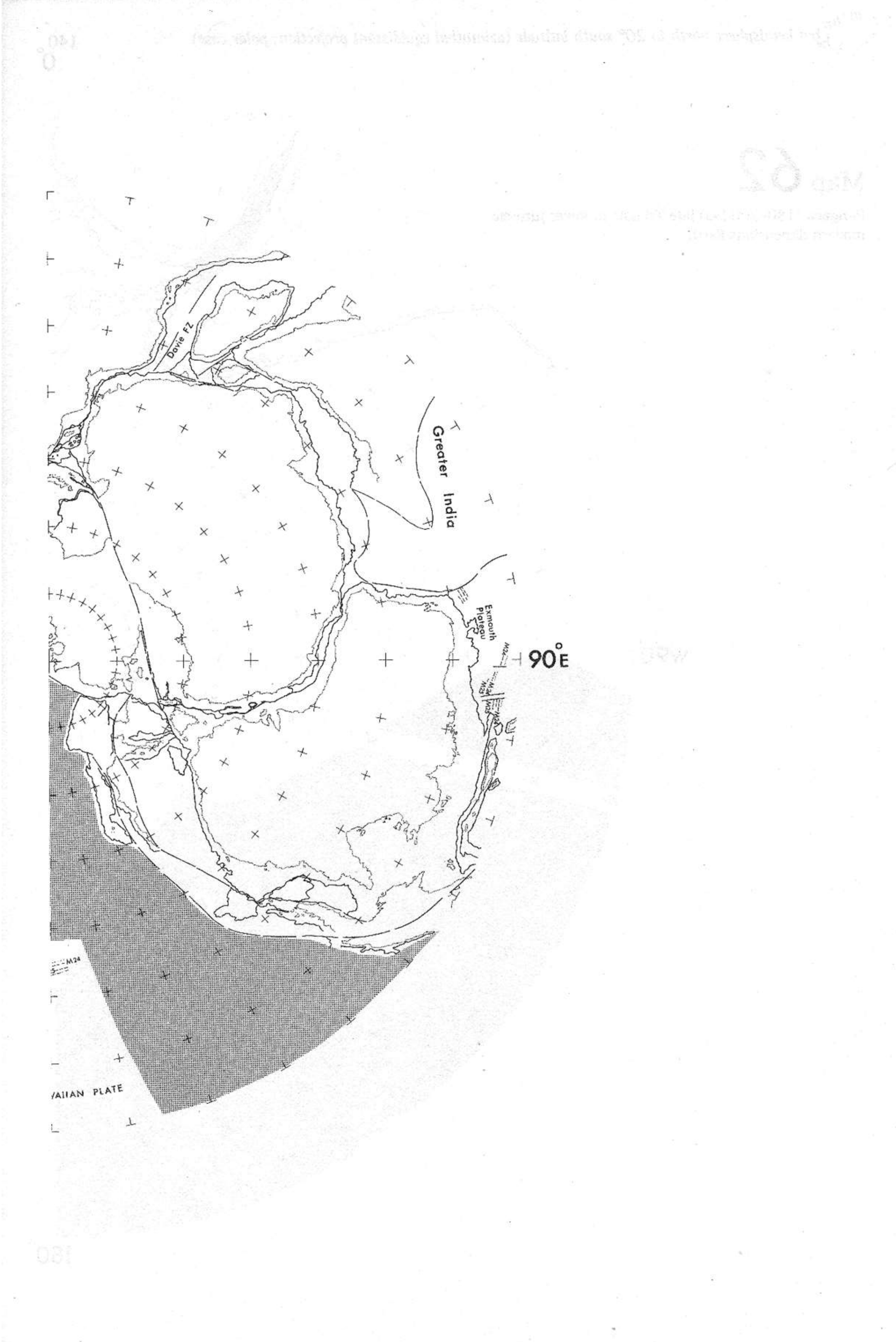
Map 35 RH Magnetic anomaly M23, 158 Ma Tithonian, Diameter 84%. North and Central Pacific. Azimuthal equidistant. Pole 0°, 170° W (Atlas Map 51)



Map 36 LH Magnetic anomaly M23, 158 Ma Tithonian, Diameter 84%. Southern Hemisphere. Azimuthal equidistant Polar Case S. to 20° S latitude (Atlas Map 61)

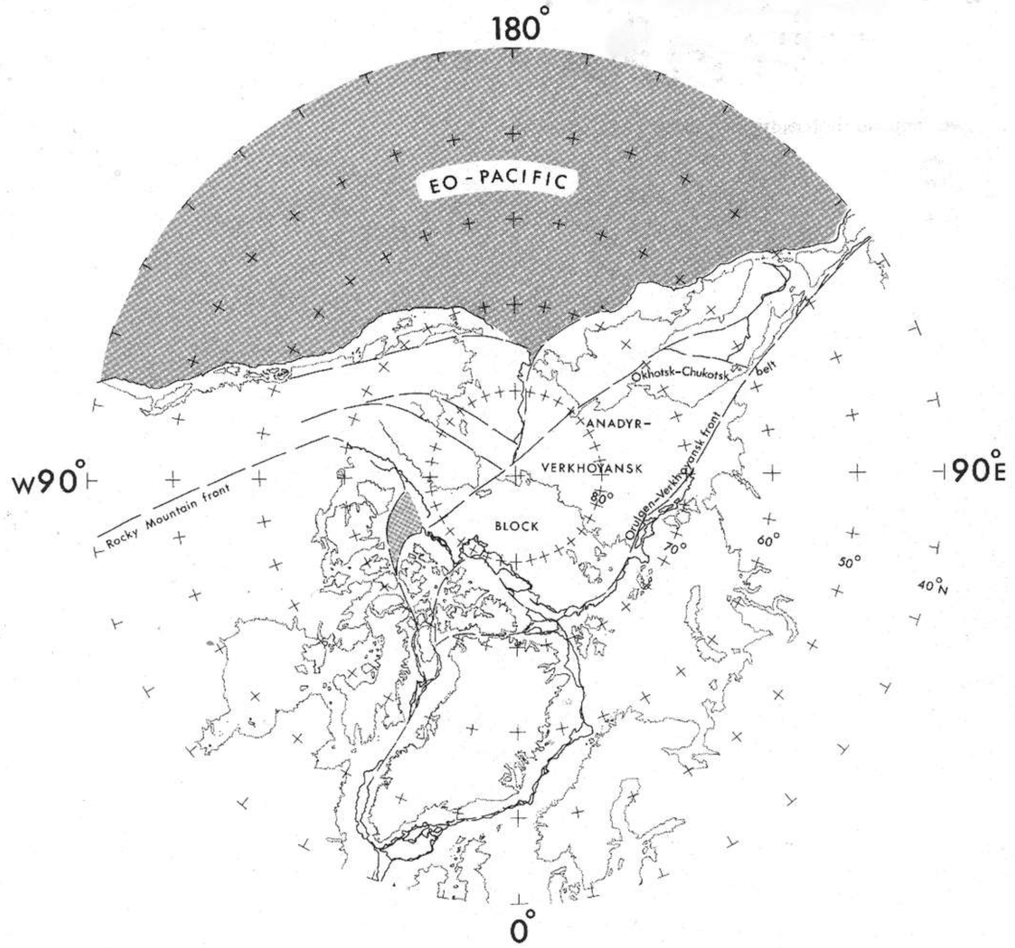


Map 36 RH Magnetic anomaly M23, 158 Ma Tithonian, Diameter 84%. Southern Hemisphere. Azimuthal equidistant Polar Case S. to 20° S latitude (Atlas Map 61)

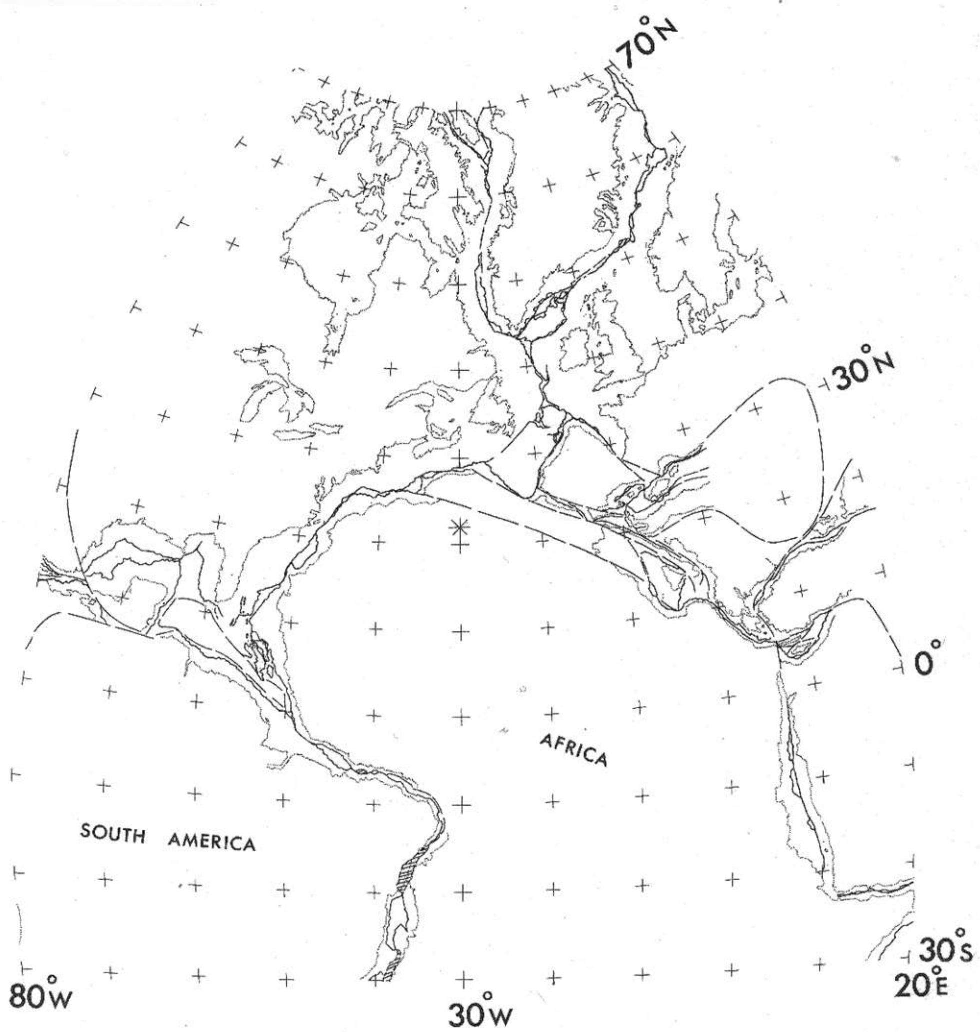


7. Pangaea 180-200 Ma Early Jurassic, Diameter 80% (Maps 37-42)

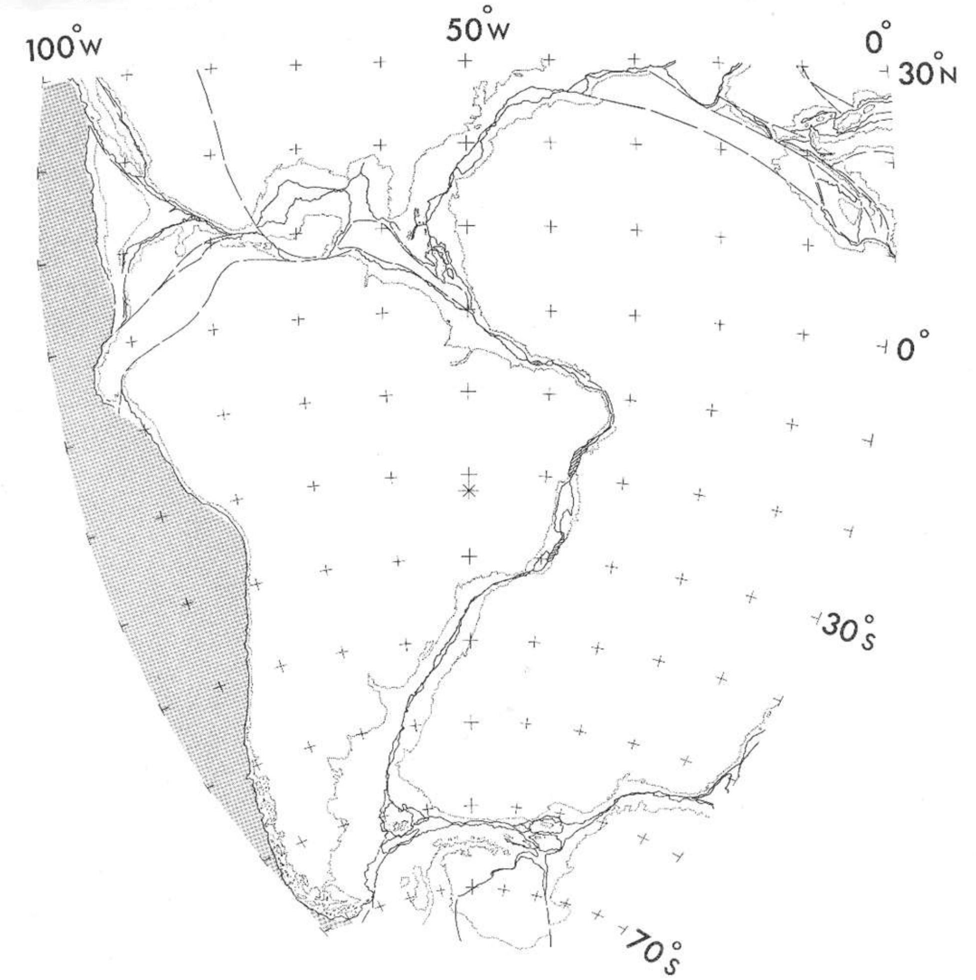
Map 37 Pangaea 180-200 Ma Early Jurassic, Diameter 80%. Boreal Region. Azimuthal equidistant Polar case S. to 40° N latitude (Atlas Map 13)



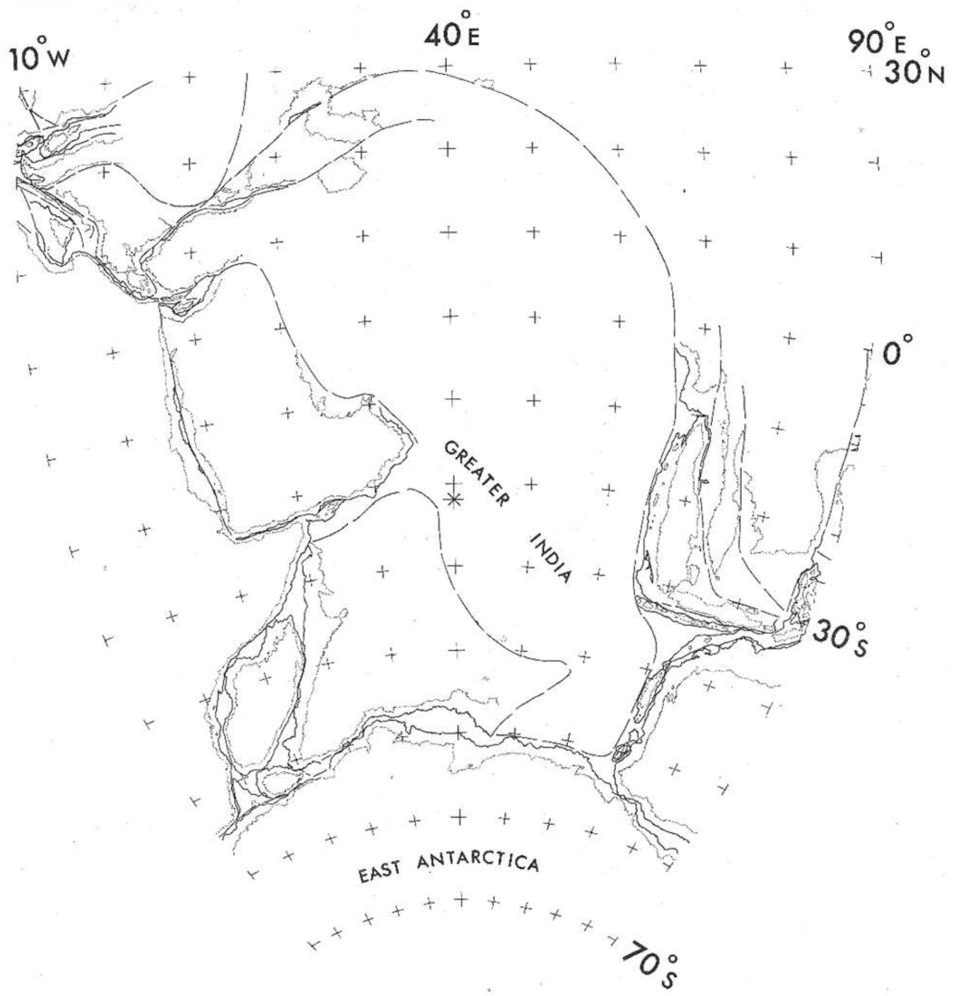
Map 38 Pangaea 180-200 Ma Early Jurassic, Diameter 80%. North Atlantic. Azimuthal equidistant. Pole 22° N, 30° W (Atlas Map 23)



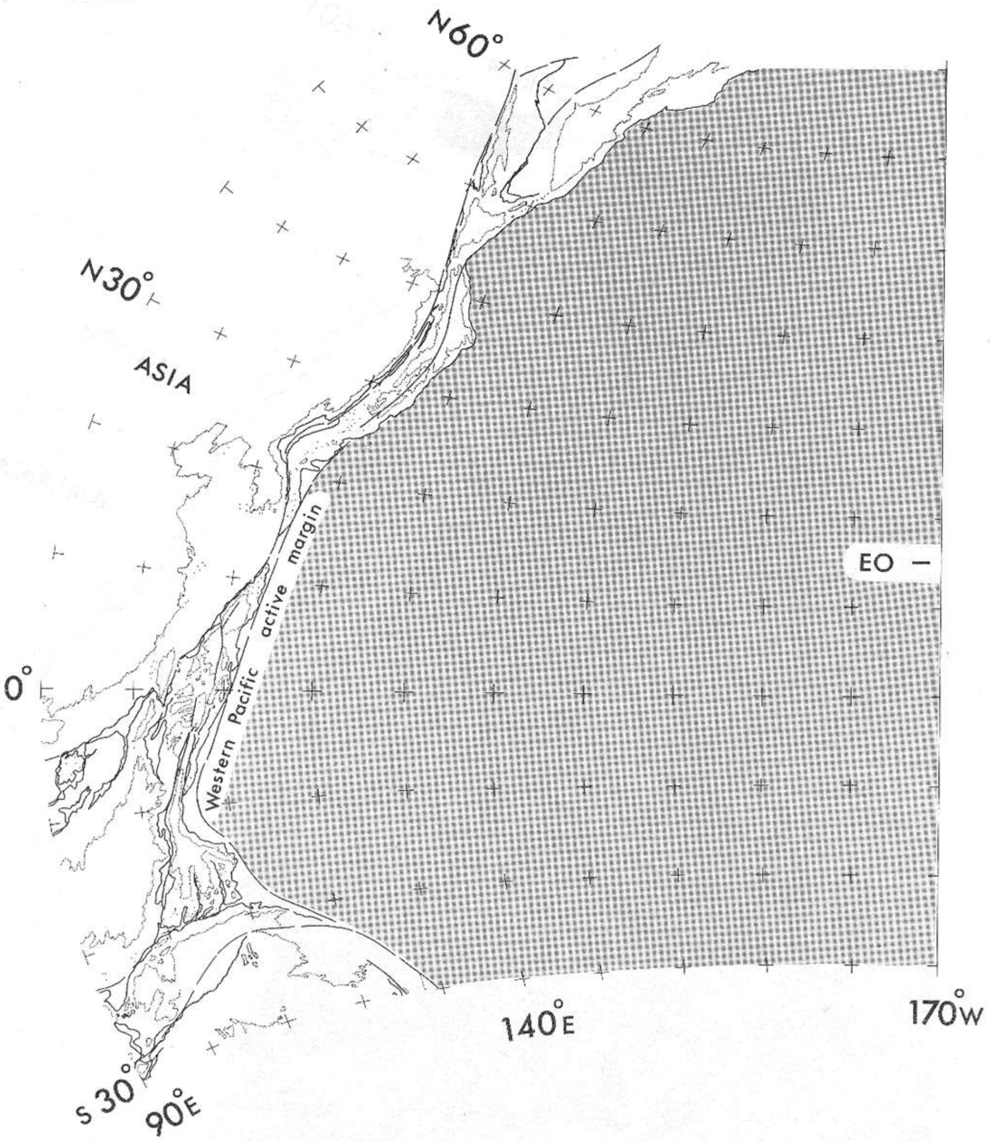
Map 39 Pangaea 180-200 Ma Early Jurassic, Diameter 80%. South Atlantic. Azimuthal equidistant. Pole 22° S, 50° W (Atlas Map 33)



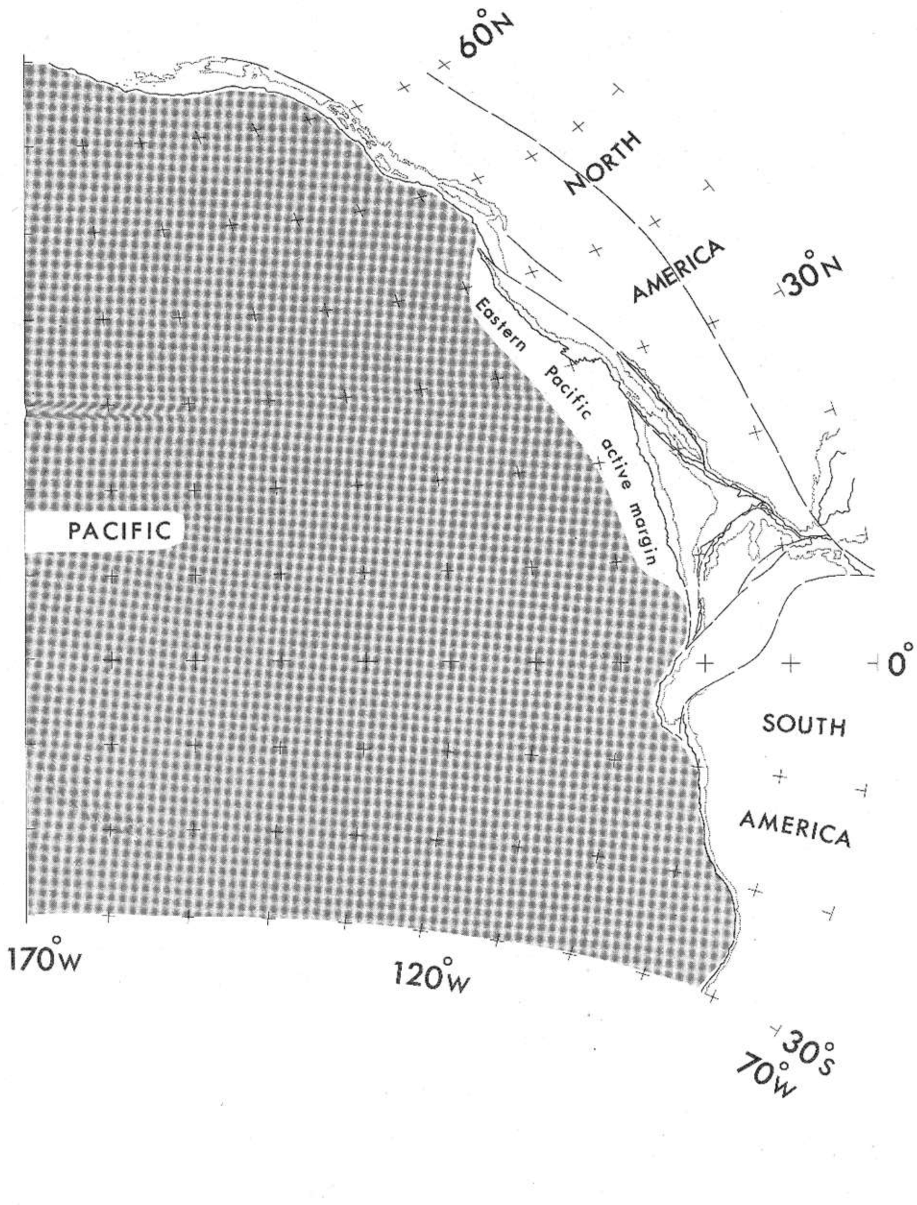
Map 40 Pangaea 180-200 Ma Early Jurassic, Diameter 80%. Indian Ocean. Azimuthal equidistant. Pole 22° S, 40° E (Atlas Map 43)



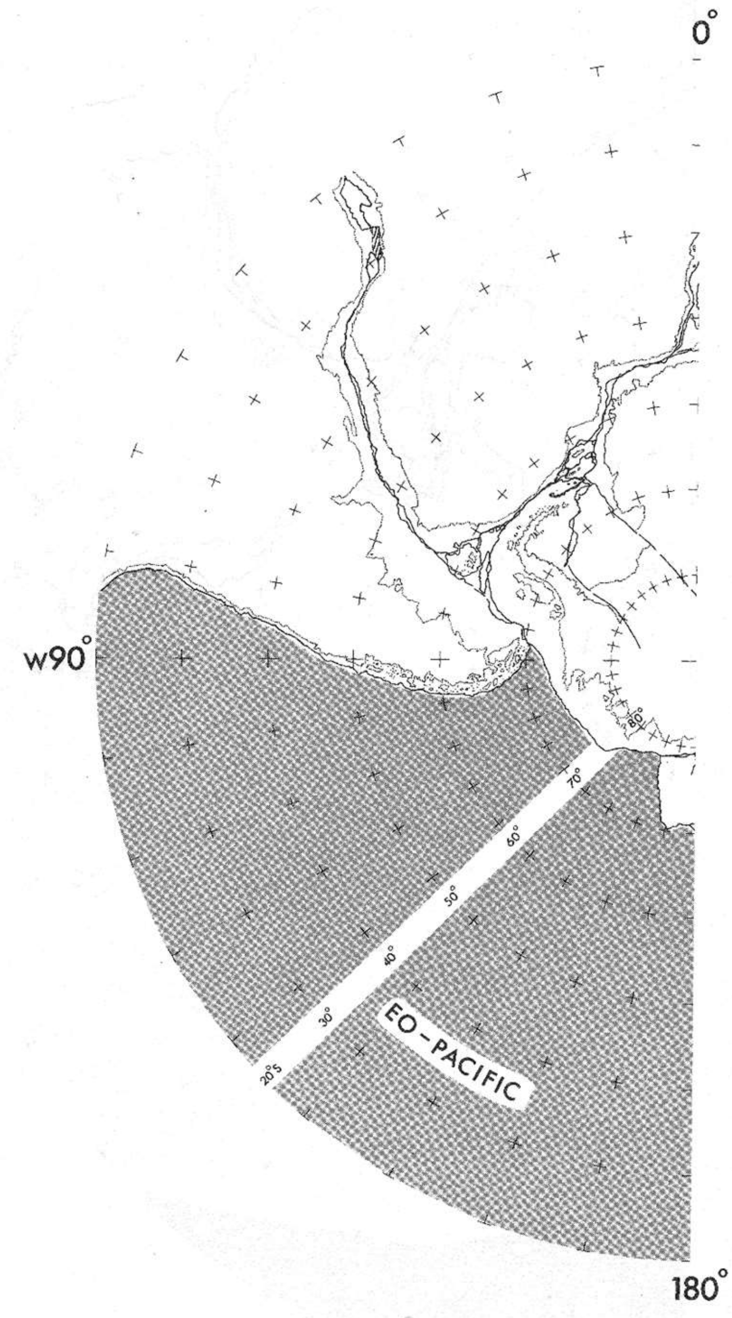
Map 41 LH Pangaea 180-200 Ma Early Jurassic, Diameter 80%. North and Central Pacific.
Azimuthal equidistant. Pole 0°, 170° W (Atlas Map 53)



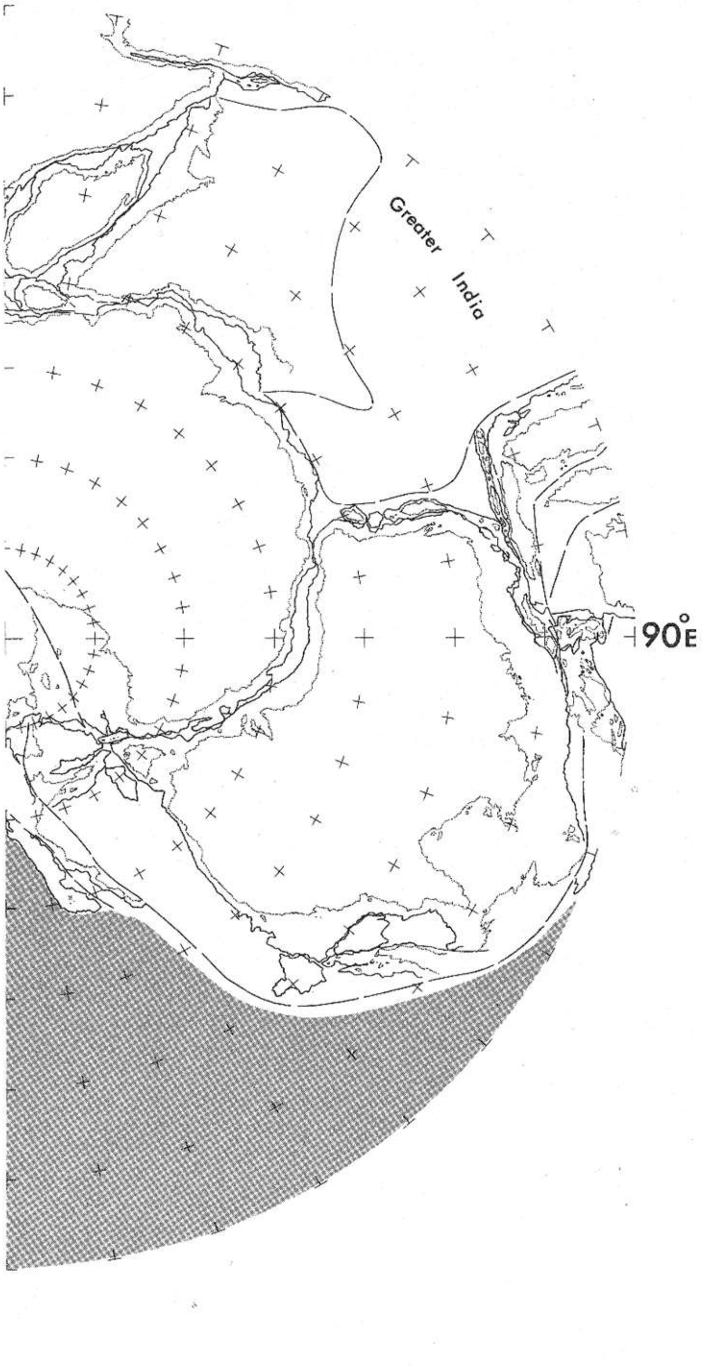
Map 41 RH Pangaea 180-200 Ma Early Jurassic, Diameter 80%. North and Central Pacific.
Azimuthal equidistant. Pole 0°, 170° W (Atlas Map 53)



Map 42 LH Pangaea 180-200 Ma Early Jurassic, Diameter 80%. Southern Hemisphere. Azimuthal equidistant Polar Case S. to 20° S latitude (Atlas Map 63)



Map 42 RH Pangaea 180-200 Ma Early Jurassic, Diameter 80%. Southern Hemisphere.
Azimuthal equidistant Polar Case S. to 20° S latitude (Atlas Map 63)



8. Speculative pre Pangaea reconstructions pages

All figures numbered as in - Owen, H.G 2012 Earth expansion - Some Mistakes, What Happened in the Palaeozoic and the Way Ahead. In Scalera G., Boschi, E., and Cwojdzinski, S Editors. The Earth Expansion Evidence – A challenge for Geology, Geophysics and Astronomy Erice, Sicily, 4-9 October 2012, 77-89

All projections employ the Azimuthal Equidistant projection extended to the whole hemisphere. The common 0° and 180° degree meridians used in these maps relate to that of the Pangaea reconstructions of the Atlas (Owen 1983) and see Maps 37-42 above and are used only to show the relative motions of the continental crustal and tensional areas. They do not indicate the Earth's spin axis, magnetic axis or climatic belt criteria. Therefore the terms "Southern" and "Northern" are arbitrary and do not reflect true geographic orientation. For continental (sialic) crustal regions, the modern configuration of borders and coasts are used merely as a guide to position.

Note. The artefact of the copying process has rendered all of the reconstruction drawings to the same size. Use, therefore, the figure description and the scales on Fig. 3 and 6

Figure 3A. Northern Hemisphere reconstruction assuming an Earth of approximately 75% of modern mean diameter (260Ma Late Permian). The Eo-Pacific oceanic crust shown shaded in this Late Permian reconstruction is approximately half that of the area of the Late Triassic – Early Jurassic reconstruction of Owen (1983) and is further proportionally reduced in the Mid Carboniferous reconstruction Figure 4A.

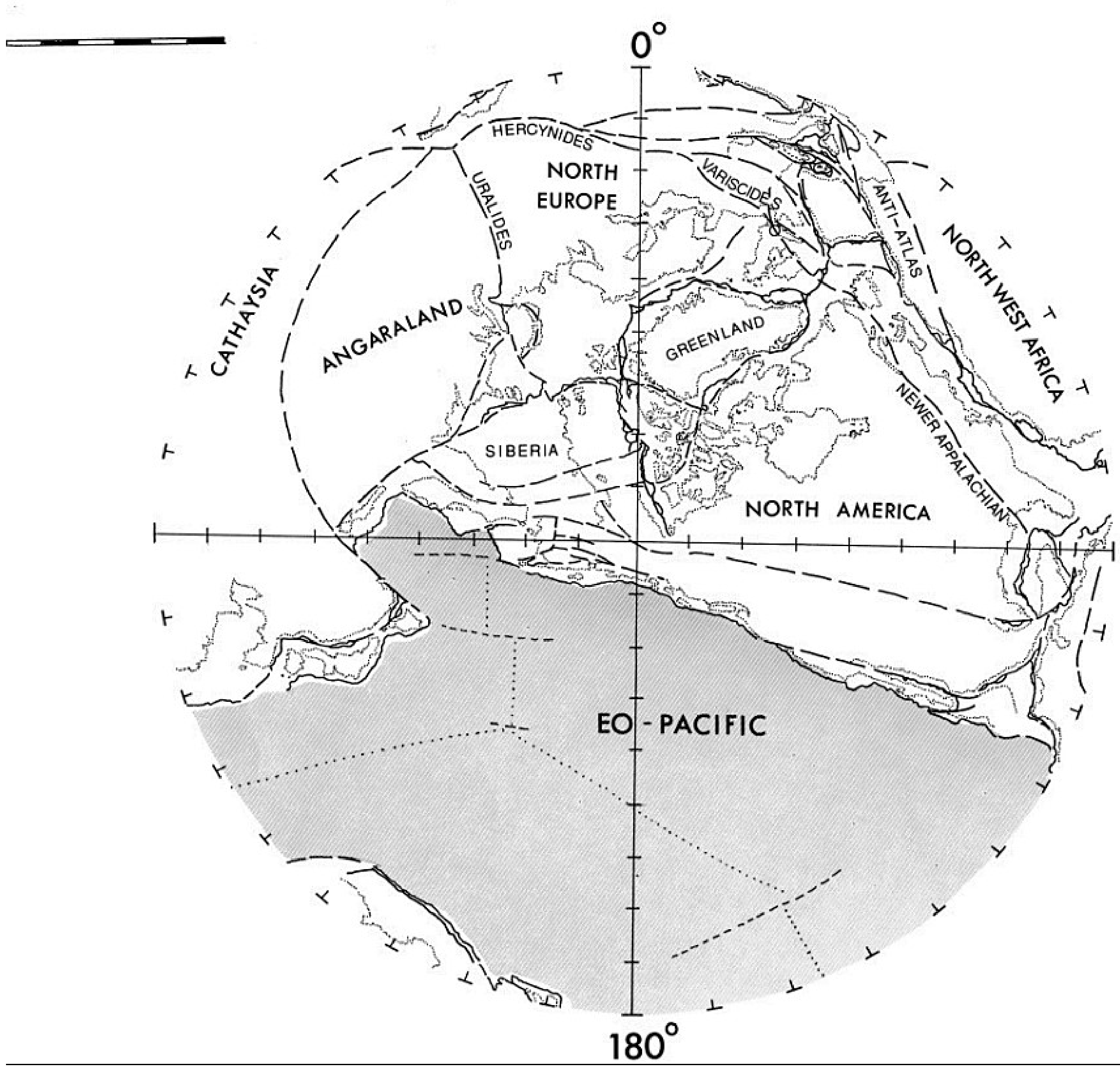


Figure 3B. **Southern Hemisphere reconstruction assuming an Earth of approximately 75% of modern mean diameter (Late Permian 260 Ma). Extension of the Eo-Pacific oceanic crust shown shaded**.

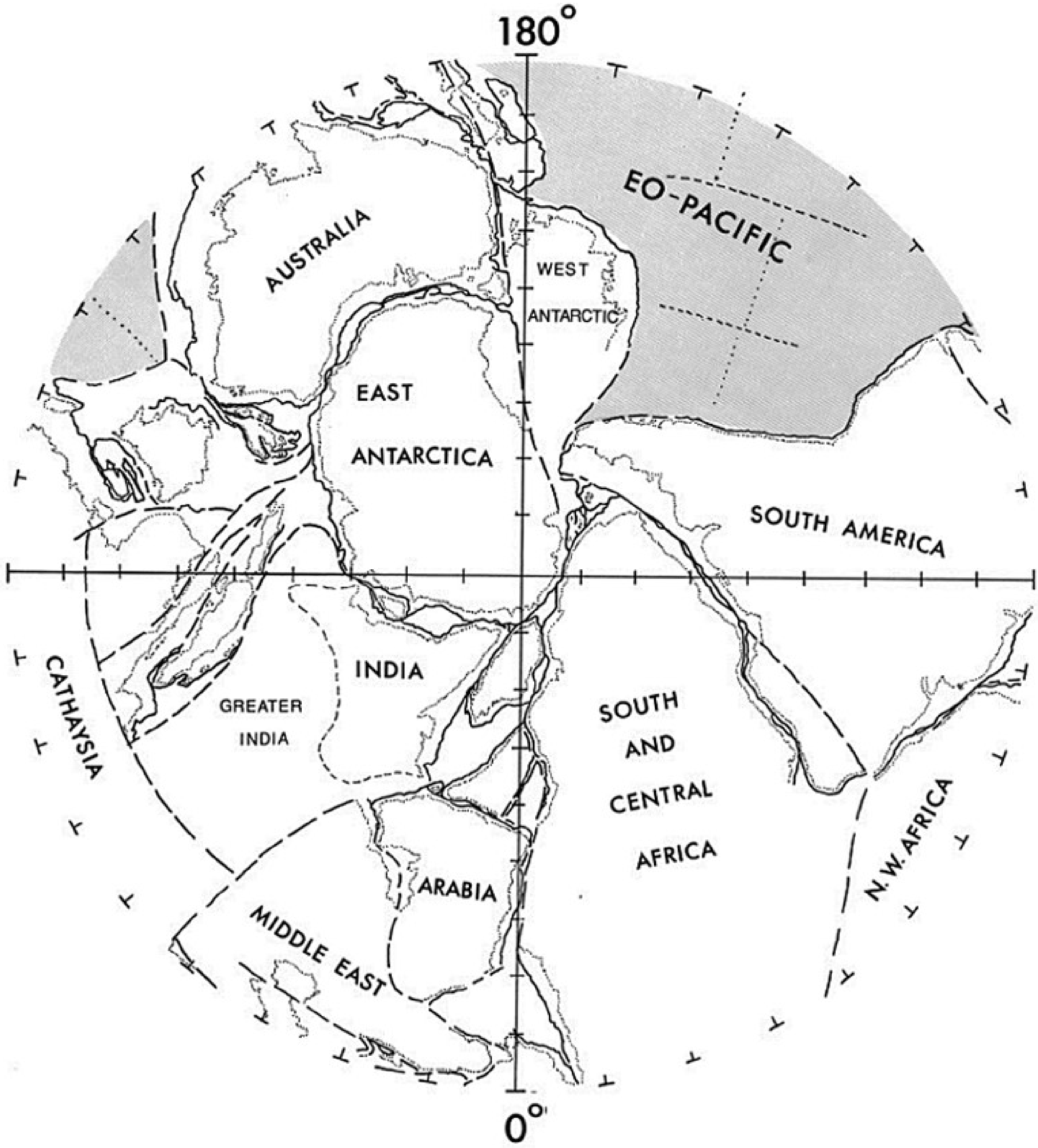


Figure 4A. Northern Hemisphere reconstruction assuming an Earth of approximately 70% of modern mean diameter (Mid Carboniferous 325Ma). Showing an earlier stage of Eo-Pacific oceanic crustal growth shown shaded with the relative movement of Australia southward.

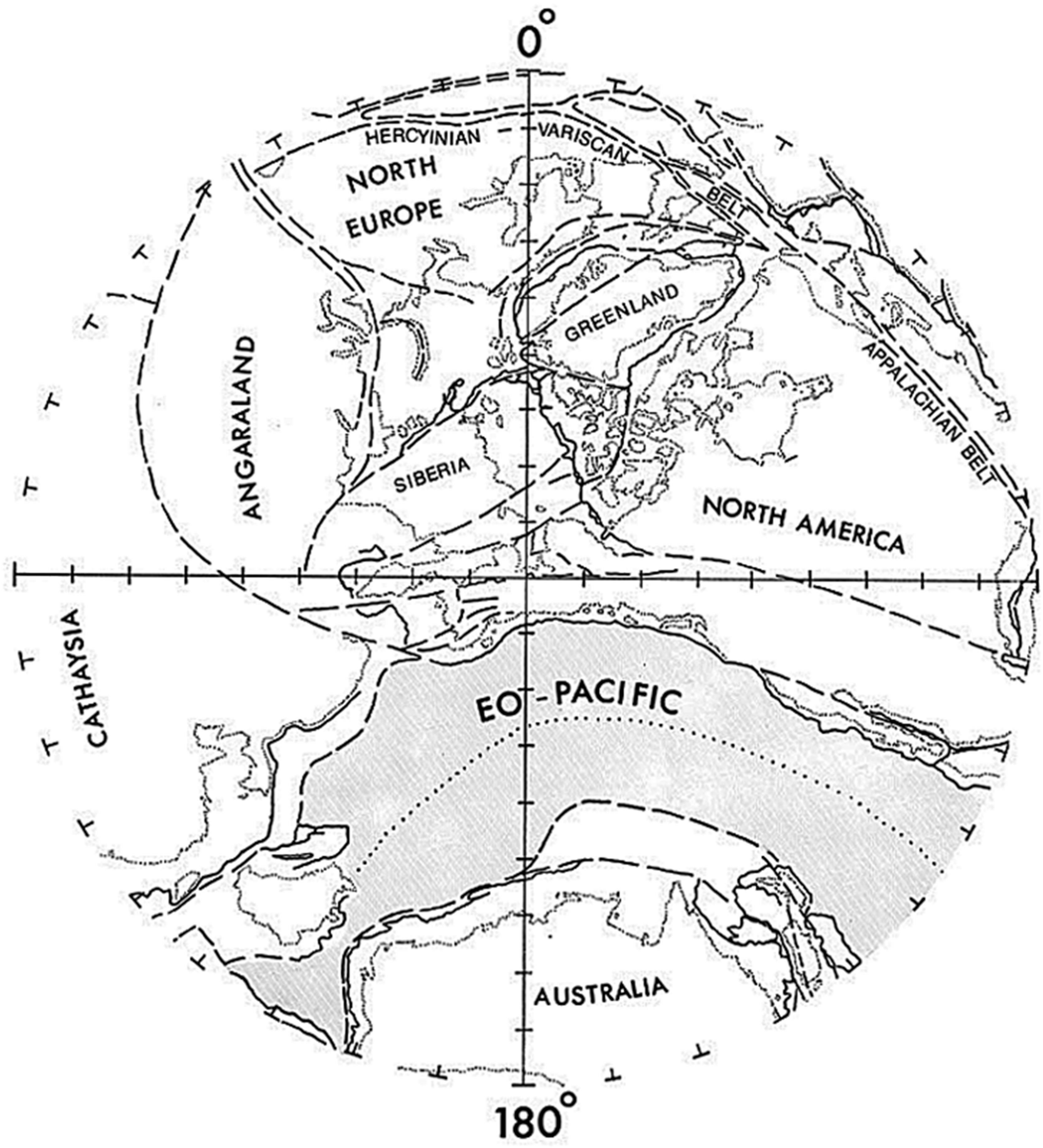


Figure 4B. Southern Hemisphere reconstruction assuming an Earth of approximately 70% of modern mean diameter (Mid Carboniferous 325 Ma). Eo-Pacific oceanic crust shown shaded

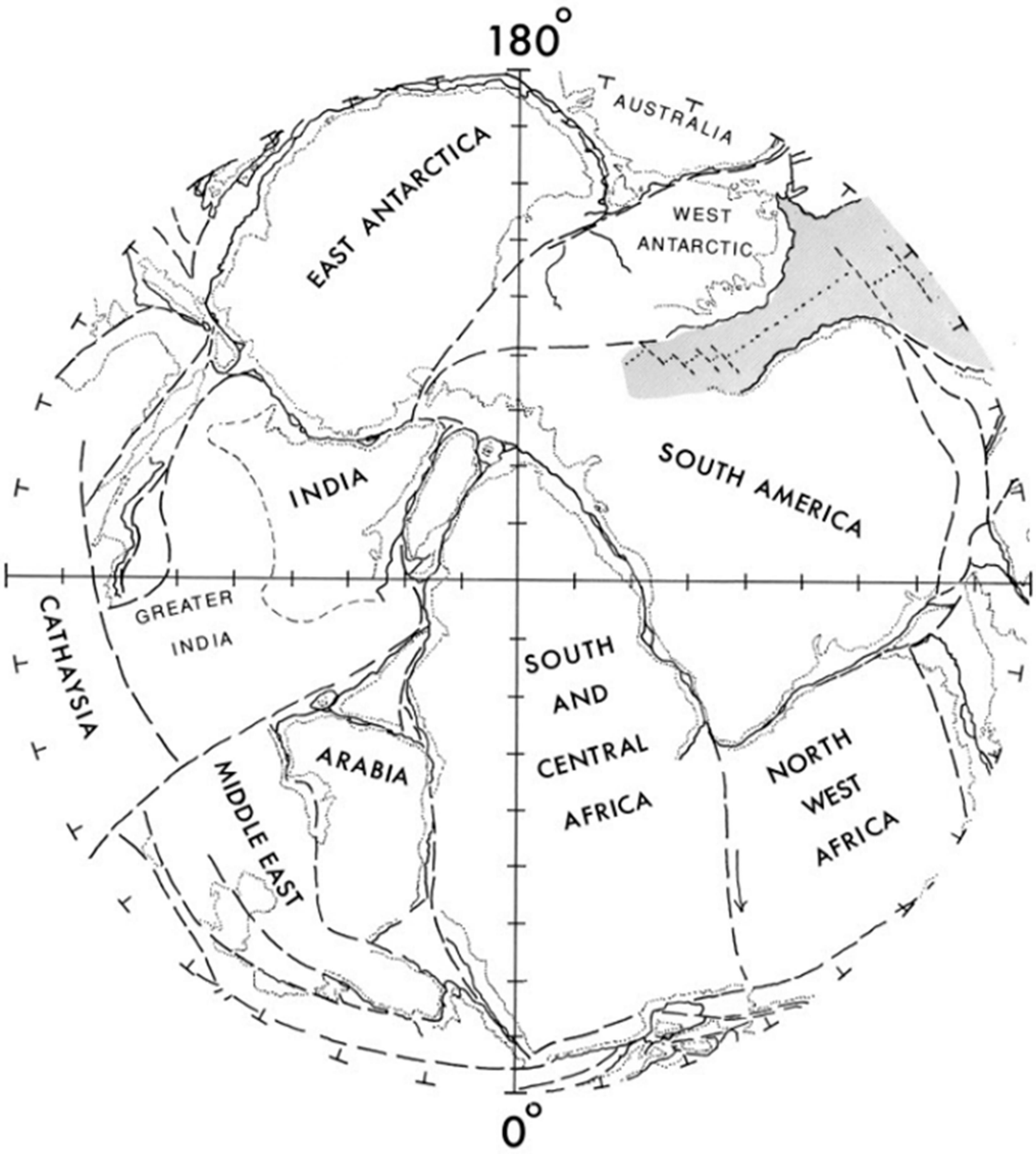


Figure 5A. **Northern Hemisphere reconstruction assuming an Earth of approximately 65% of modern mean diameter (Mid Devonian 400 Ma). The area of the tensional Caledonian suture shown shaded. The sketch map shows Australia in close contact with Cathaysia to the left and North America to the right.**

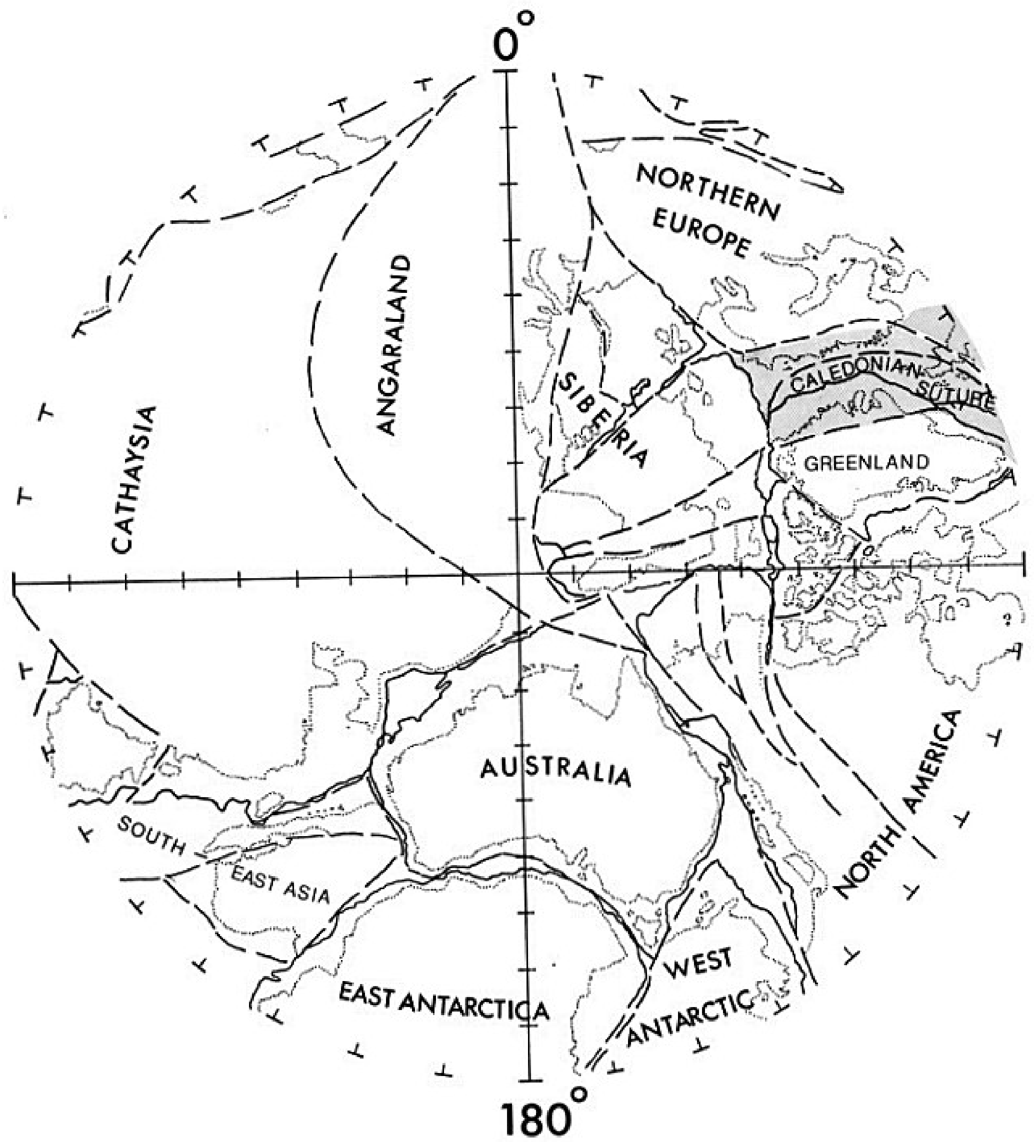


Figure 5B. Southern Hemisphere reconstruction assuming an Earth of approximately 65% of modern mean diameter (Mid Devonian 400 Ma). Area of the tensional Iapetus – Caledonian suture – presumed of oceanic crust is shown shaded.

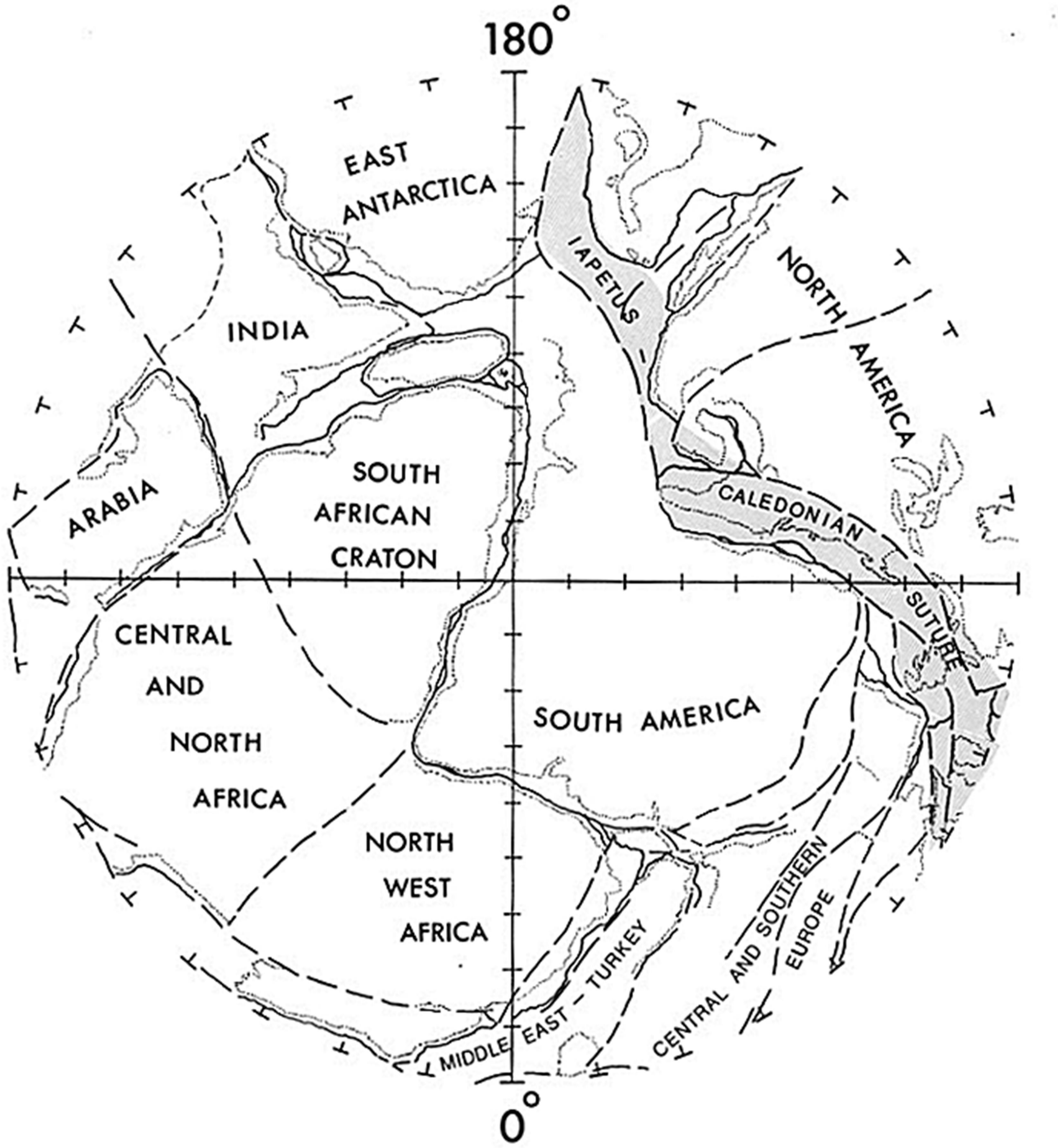


Figure 6A. Northern Hemisphere reconstruction assuming an Earth of approximately 60% of modern mean diameter (Late Cambrian – Early Ordovician 485Ma).

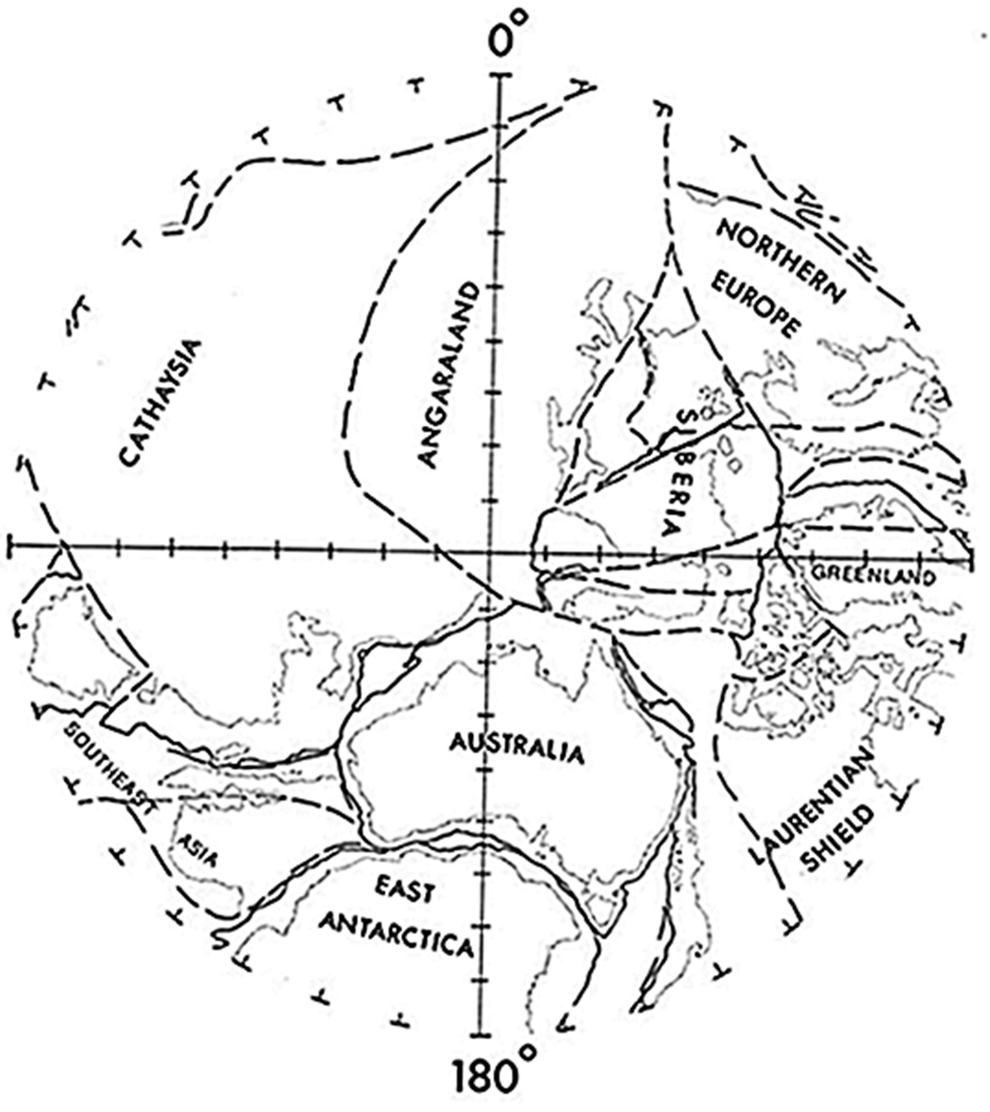


Figure 6B. **Southern Hemisphere reconstruction assuming an Earth of approximately 60% of modern mean diameter (Late Cambrian – Early Ordovician 485Ma)**.

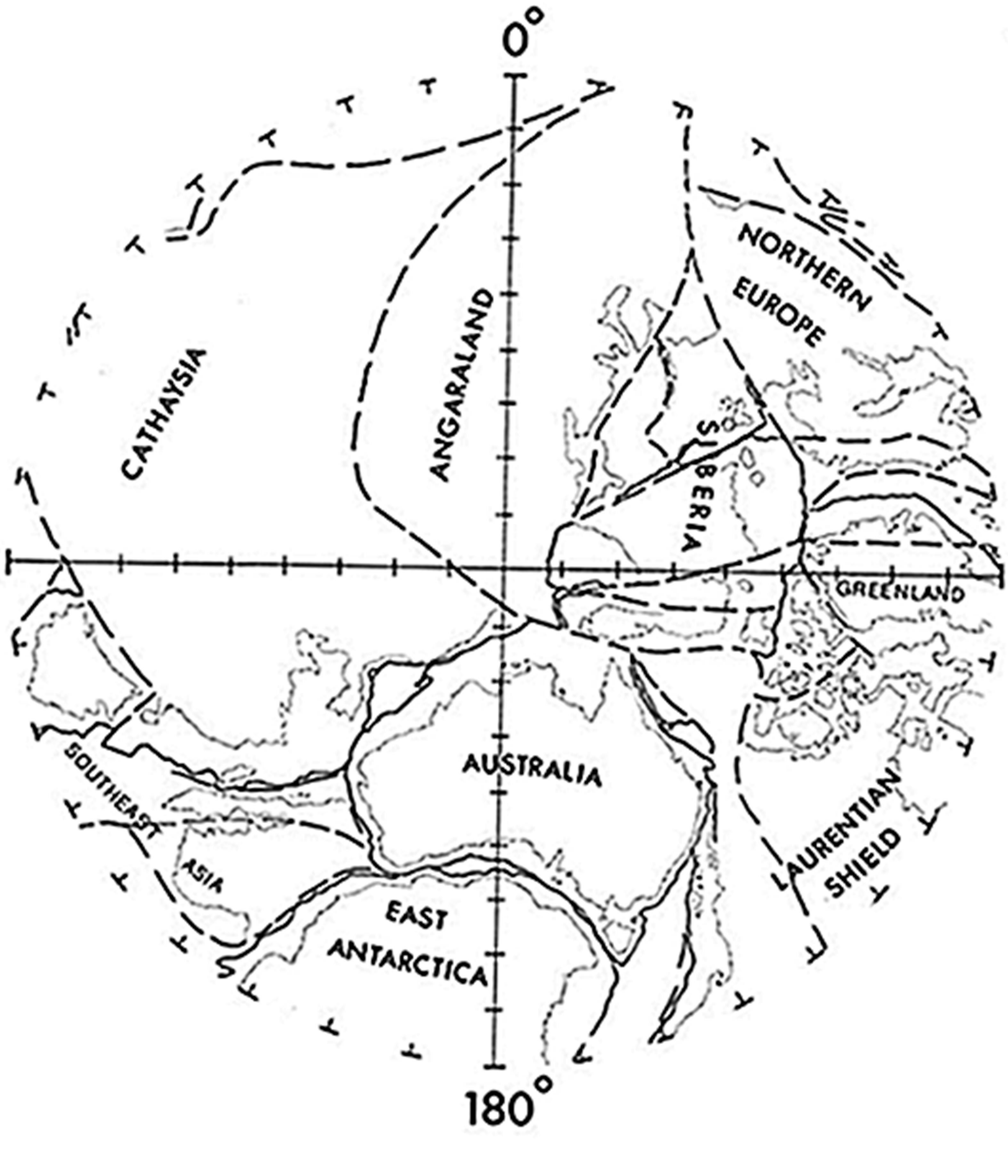


Figure 1. Schematic diagram of the rotational inter-relationships of the modern Earth's atmosphere and terrestrial spin with that of the crustal displacements due to the similar but much slower rotational motion of the Asthenosphere, tempered by the effect of ocean-floor spreading in both the passive-margined (tensional) and active-margined (subducted) oceans

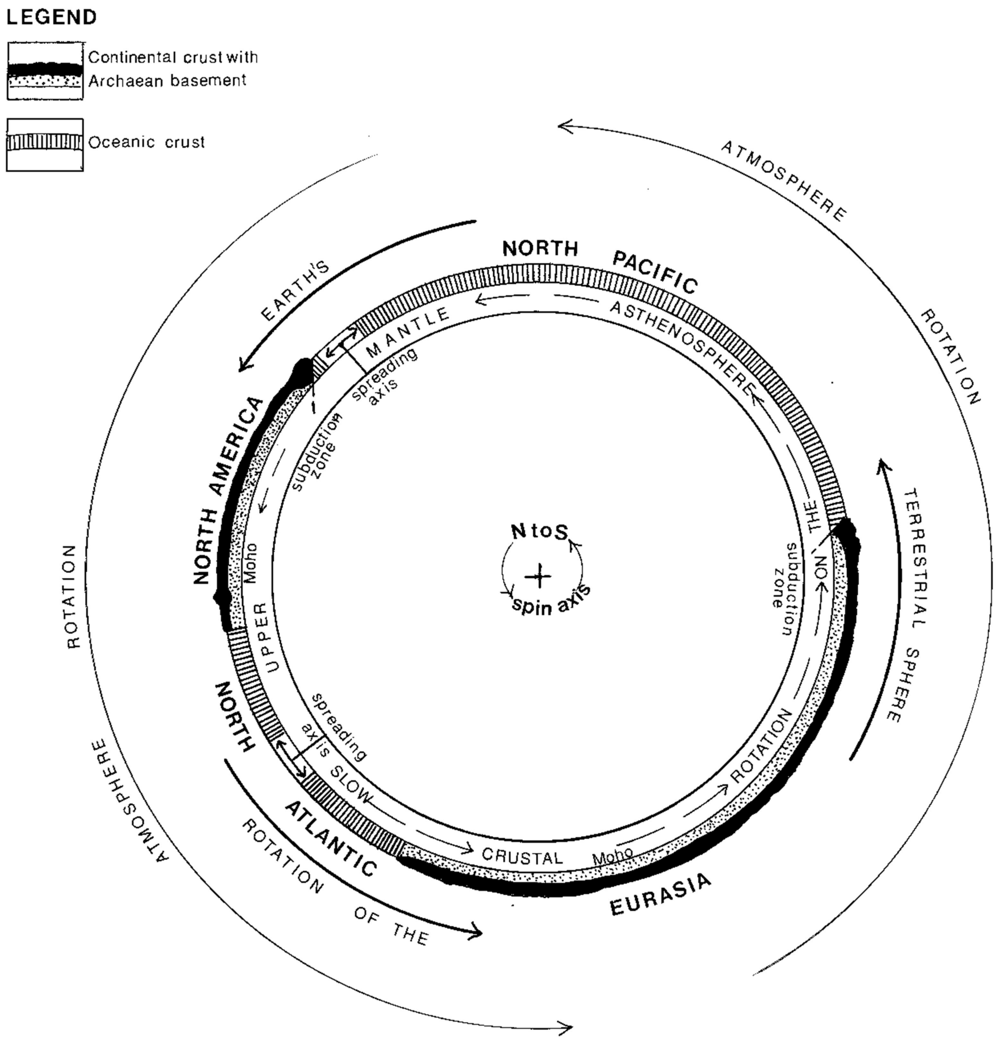
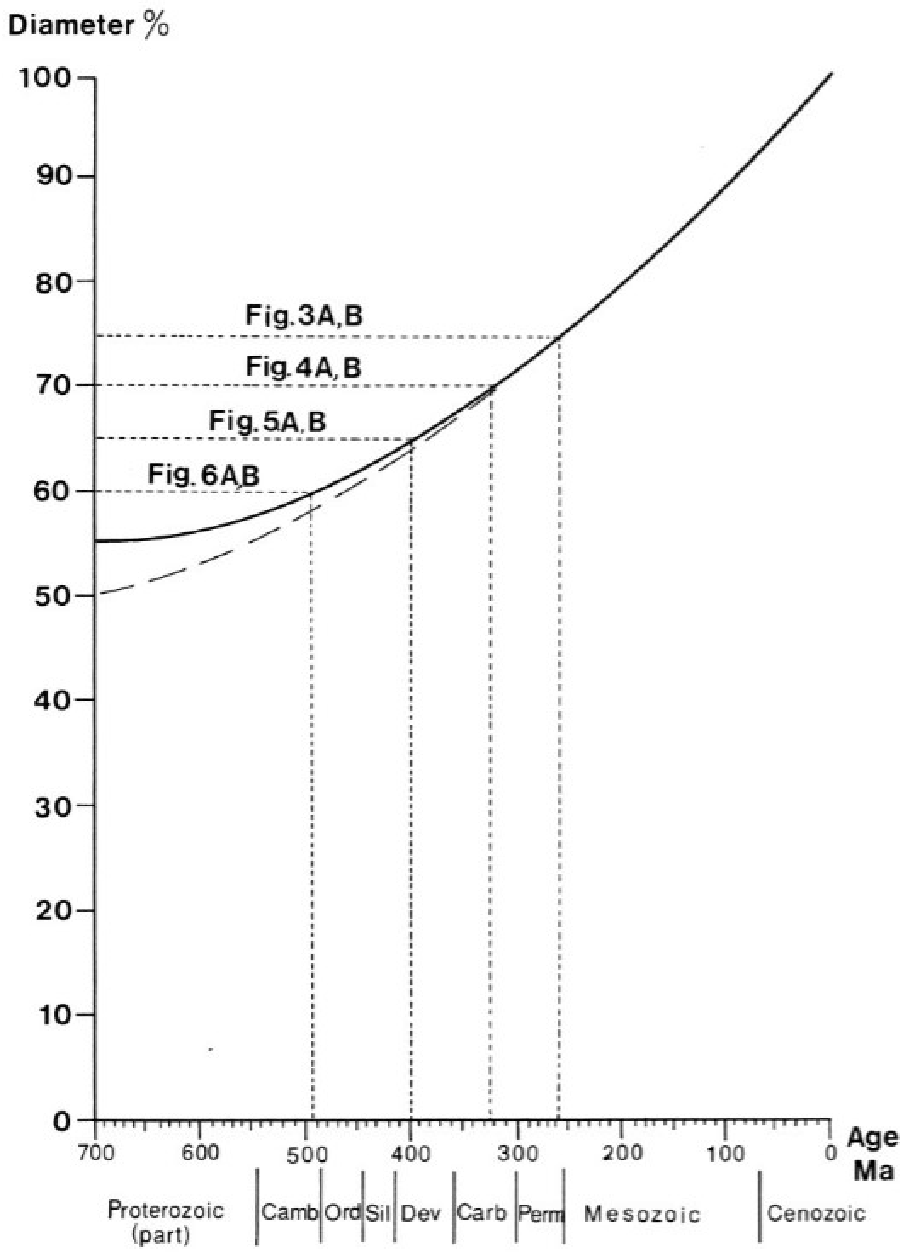


Figure 2. Theoretical exponential curve of Earth expansion since the Proterozoic with the dating of Figures 3-6. The bold pecked line represents the theoretical exponential curve in the lower Palaeozoic; the continuous line representing the area of sialic crust thought to have existed during this interval.



9. Palaeogeographic Maps

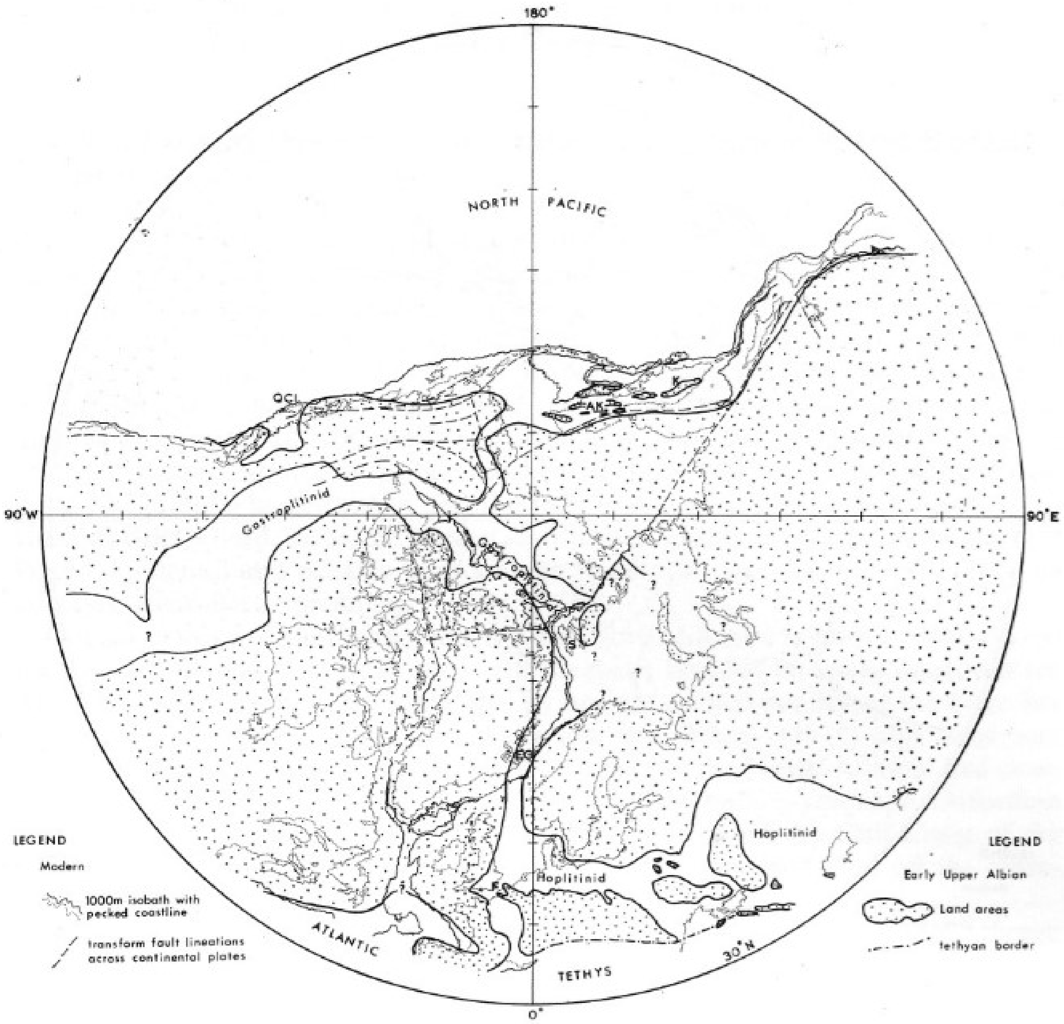
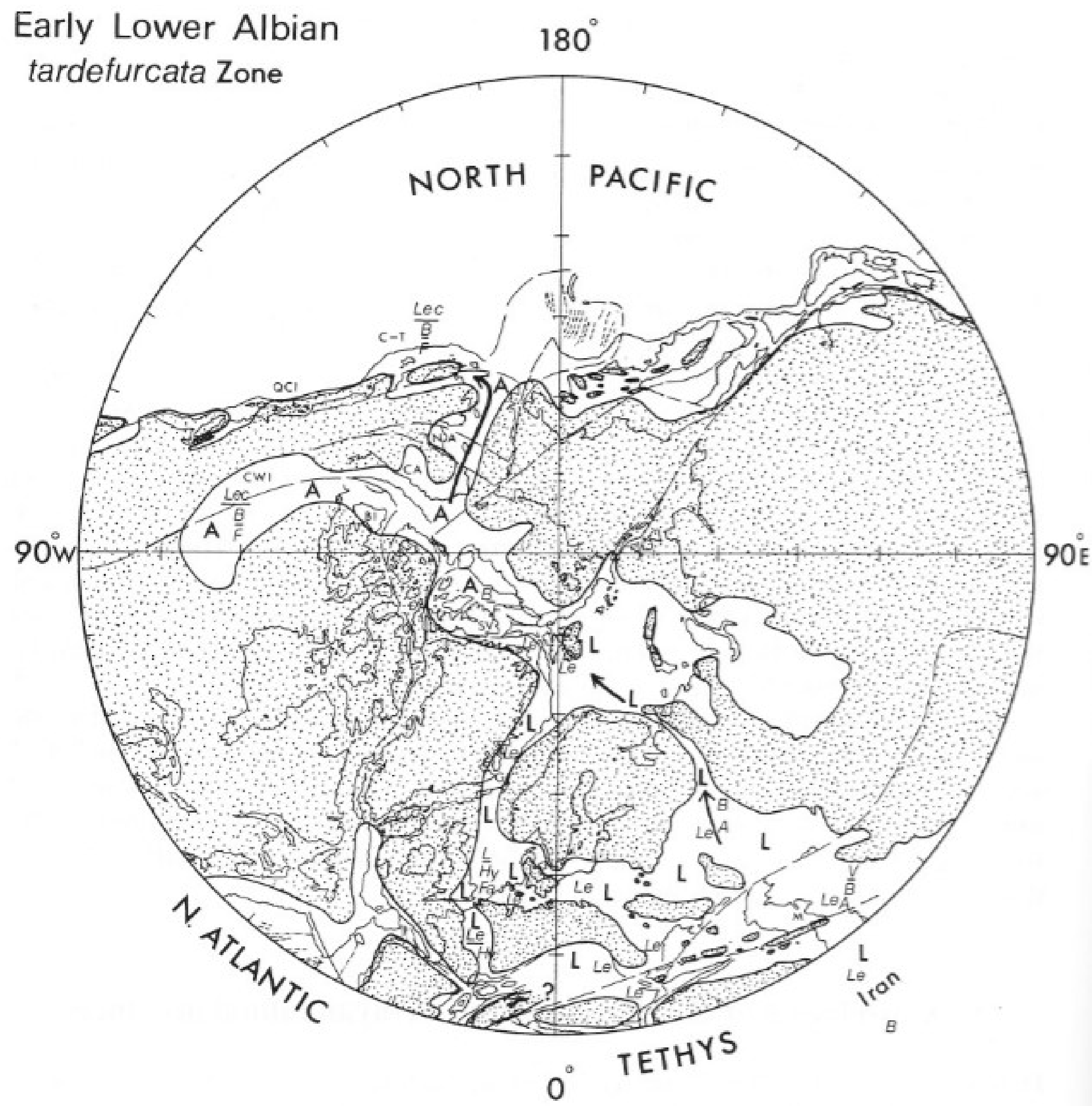


Fig. 3. Reconstruction of the Boreal Region and adjacent areas produced by rotating North America, Greenland, Europe and Asia in accordance with the ocean-floor spreading data from the Atlantic and Pacific Oceans, together with the partial elimination of movements along major transcurrent faults. Projection is standard Zenithal Equidistant of a portion of a globe with a diameter approximately 88% of that of the modern mean diameter. Sources of palaeogeographical information are as in Figure 2. The positions of principal pre-Albian and post-Albian to present-day transcurrent fault lineations are taken essentially from King *et al.* (1969) and Atlasov *et al.* (1969). Locality symbols are as in Figure 1: QCI = Queen Charlotte Islands.

Owen, H.H. 1973 Ammonite faunal provinces in the Middle and Upper Albian and their palaeogeographical significance. *Geological Journal. Special Issue* **5,** 145-154.



Text Fig. 1. Palaeogeographic map of the Boreal Region in the *Leymeriella tardefurcata* Zone to illustrate known areas of marine sedimentation (unstippled areas), likely migration routes from the Tethys to the North Pacific (arrowed), ammonite faunal provinces (L = leymeriellinid, A = Arctic), significant ammonites with bars representing subzonal boundaries (*Lec* = *Leconteites*, *B* = *Bellidiscus/ Subarcthoplites*, *F* = *Freboldiceras* of possible *schrammeni* Subzone age, *Le* = *Leymeriella*, *Hy* = *Hypacanthoplites* in Anglo-Paris Basin, *Fa* = *Farnhamia*, *V* = *Vnigriceras*, *A* = *Arcthoplites* shown in the European province only; it is ubiquitous in the Arctic province), and certain key sequences (QCI = Queen Charlotte Islands, C-T = Chitina Valley & Talkeetna Mountains, NA = North Alaska, CA = Central Alaska, CWI = Canadian Western Interior, BI = Banks Island, SV = Sverdrup Basin, P = Peary Land, S = Spitzbergen, G = East Greenland, M = Mangyschlak). Azimuthal Equidistant projection, for source of base map see text.

Owen, H.G 1988 Correlation of Ammonite Faunal Provinces in the Lower Albian (mid - Cretaceous). *in* WIEDMANN, J. & KULLMAN, J. (Editors). *Cephalopods - Present and Past.* pp. 477-489. Schweizerbart'sche Verlag.

Owen, H. G. 1996 Boreal and Tethyan late Aptian to late Albian ammonite zonation and Palaeobiogeography. *Mitteilungen aus dem Geologisch-Paläontologischen Institut der Universität Hamburg.* **77,** 461-481

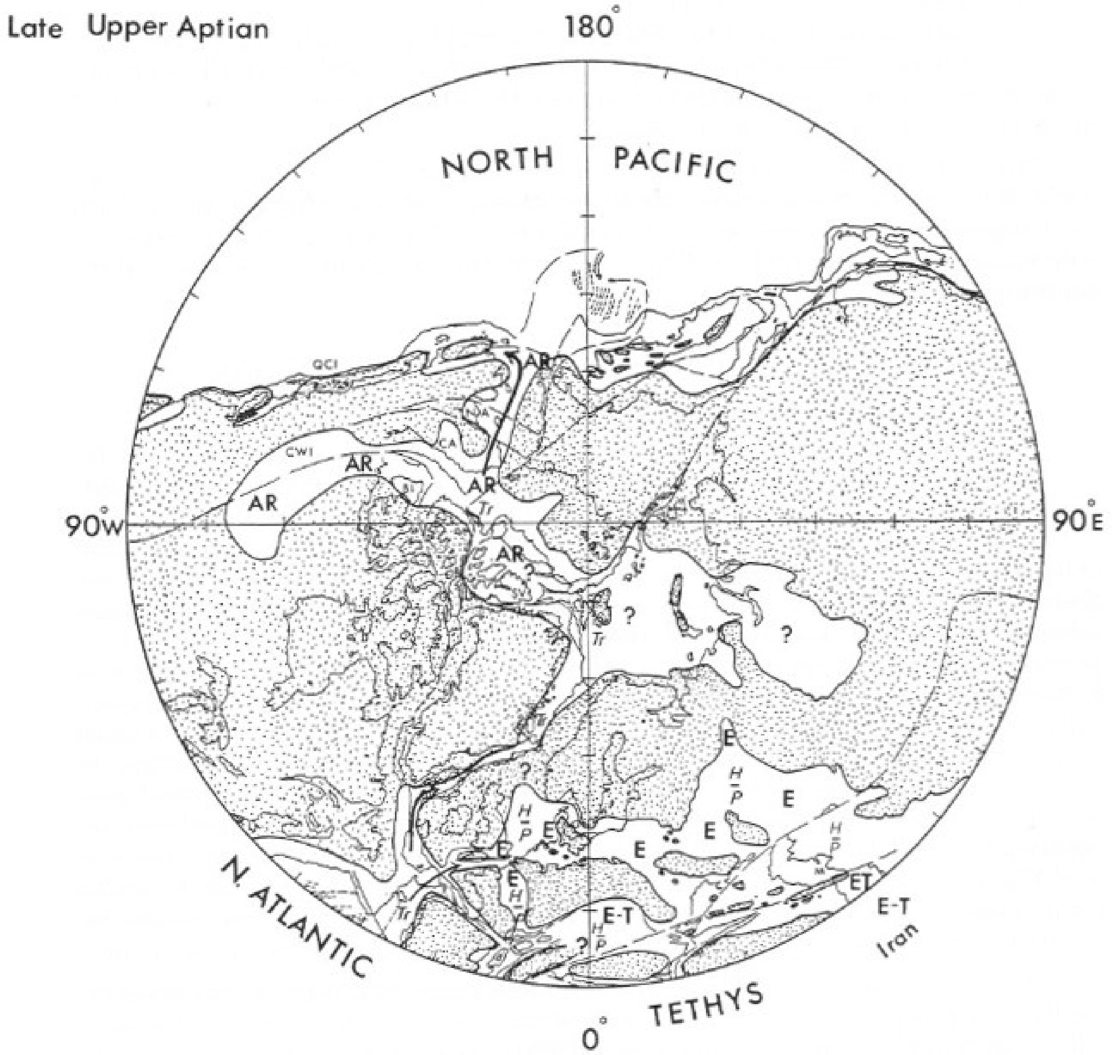


Fig. 1: Tentative palaeogeographic map of the Boreal Region in the late Aptian *Parahoplites nutfieldiensis* Subzone [*Cheloniceras (Epicheloniceras) martinioides* Zone] to the end of the *Hypacanthoplites jacobi* Subzone to illustrate areas of marine sedimentation (unstippled areas), likely dispersal routes (arrowed) and faunal realms. AR = Arctic shelf seas with connection to the Pacific, and the Atlantic via Greenland; E = European shelf seas; E-T = seas with a mixed ammonite fauna of shelf and deep open water aspect. P = generalised distribution of *Parahoplites* in the *nutfieldiensis* Subzone, H = generalised distribution of *Nolaniceras* and *Hypacanthoplites* in the *jacobi* Zone. Tr = dispersal of *Lytoceras* and *Tropaeum* into the European and Arctic shelf seas from the North Atlantic extension of the Tethyan faunal province. Bars separating faunal symbols represent zonal/subzonal boundaries.
Modern localities in Text-Figs 1–5: QCI Queen Charlotte Islands, C-T = Chitina Valley & Talkeetna Mountains, NA = North Alaska, CA = Central Alaska, CWI = Canadian Western Interior, BI = Banks Island, SV = Sverdrup Basin, P = Peary Land, S = Spitzbergen, G = East Greenland, M = Mangyschlak. Azimuthal equidistant projection; for source of base map see text.

Owen, H. G. 1996 Boreal and Tethyan late Aptian to late Albian ammonite zonation and Palaeobiogeography. *Mitteilungen aus dem Geologisch-Paläontologischen Institut der Universität Hamburg.* **77,** 461-481

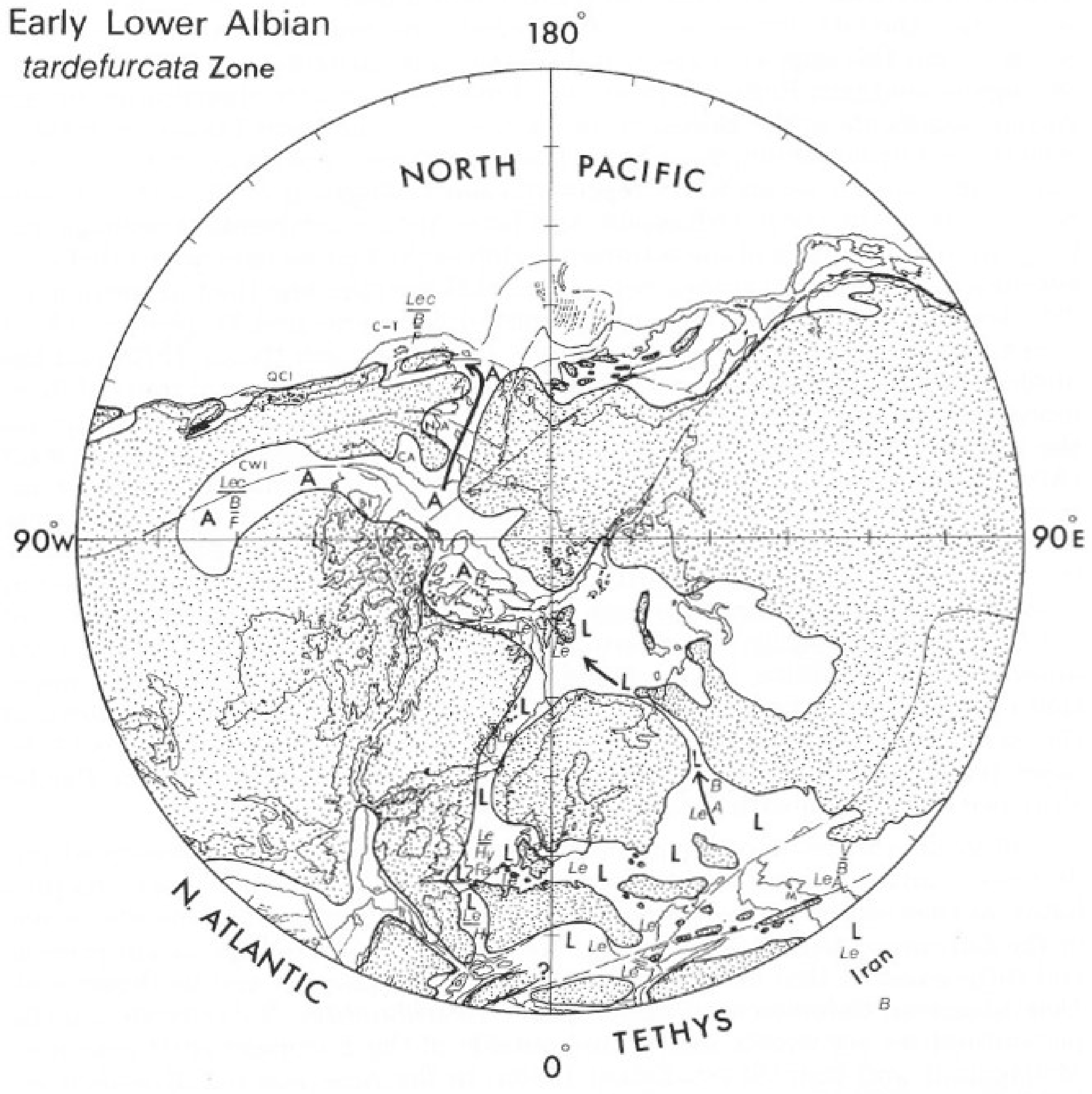


Fig. 2: Palaeogeographic map of the Boreal Region in the *Leymeriella tardefurcata* Zone (early Lower Albian) to illustrate areas of marine sedimentation (unstippled areas), likely dispersion routes across Europe from the Tethys to the North Pacific (arrowed) and ammonite faunal provinces (L = leymeriellinid, A = Arctic). Significant ammonite occurrences are shown with bars representing subzonal boundaries *(Lec = Leconteites, B = Bellidiscus/Subarcthoplites, F = Freboldiceras* of possible *schrammeni* Subzone age, *Le = Leymeriella, Hy = Hypacanthoplites* of lower and middle *tardefurcata* Zone age in the Anglo-Paris Basin, *Fa = Farnhamia, V = Vnigriceras, A = Arcthoplites* in the European province only; it is ubiquitous in the Arctic province). Locality symbols and map projection as in the explanation to Text Fig. 1.

Owen, H. G. 1996 Boreal and Tethyan late Aptian to late Albian ammonite zonation and Palaeobiogeography. *Mitteilungen aus dem Geologisch-Paläontologischen Institut der Universität Hamburg.* **77,** 461-481

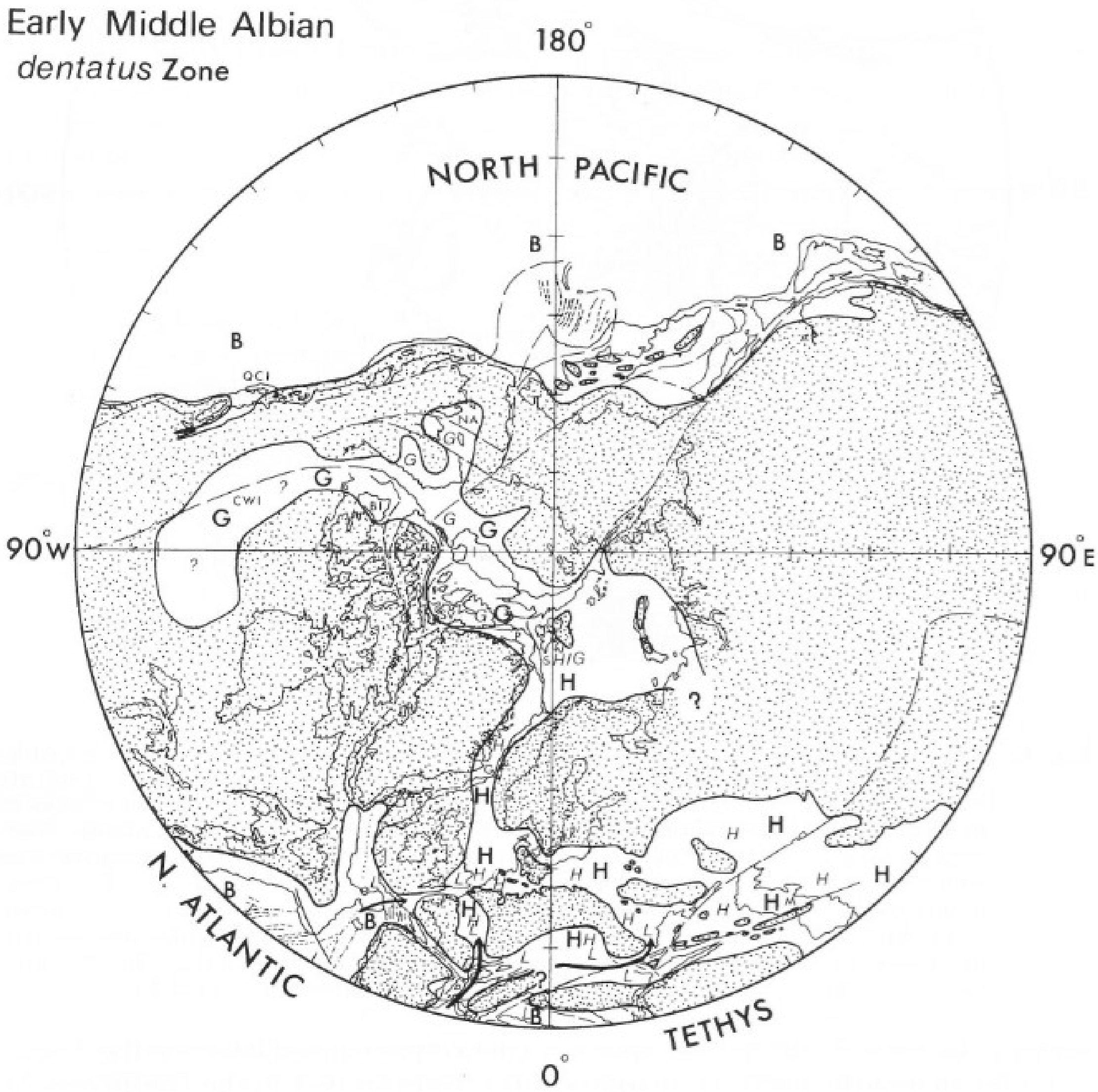


Fig. 3: Palaeogeographic map of the Boreal Region in the *Hoplites dentatus* Zone (early Middle Albian) to illustrate areas of marine sedimentation (unstippled areas), ammonite faunal provinces (H = Hoplitinid, the European shelf seas, B = Brancoceratinid, the Tethyan, Gondwanan and Pacific regions, and G = Gastroplitid, the Arctic – North American shelf seas) and faunal dispersal routes indicated by arrows. Dispersal of Tethyan elements into north west Europe was probably via the developing North Atlantic as well as the southern region of France. The region of East Greenland and Spitzbergen has a mixed fauna of European endemic hoplitinids and Arctic region endemic gastroplitids. Significant ammonite occurrences are shown *L = Lyelliceras, Brancoceras* and *Oxytropidoceras* fauna, *H = Hoplites, G = Grycia.* Locality symbols and map projection as in the explanation to Text Fig. 1.

Owen, H. G. 1996 Boreal and Tethyan late Aptian to late Albian ammonite zonation and Palaeobiogeography. *Mitteilungen aus dem Geologisch-Paläontologischen Institut der Universität Hamburg.* **77,** 461-481

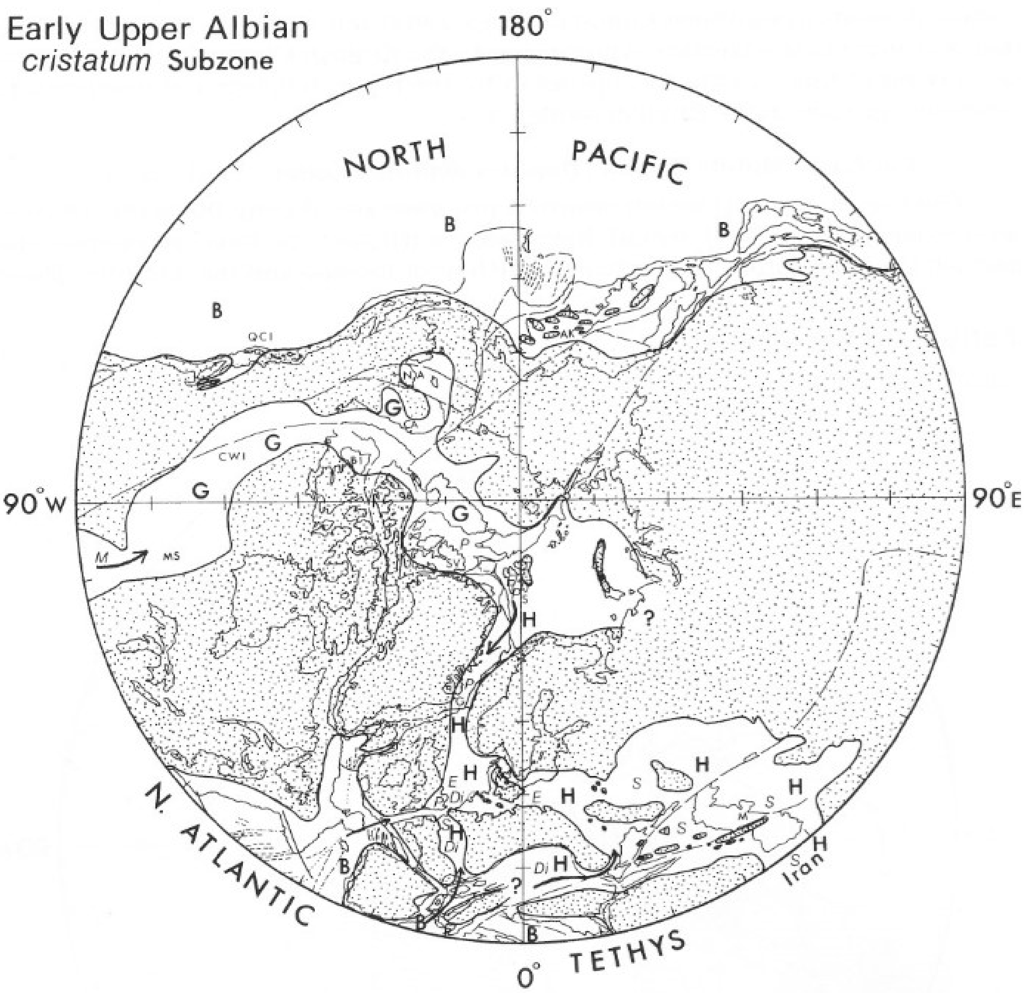


Fig. 4: Palaeogeographic map of the Boreal Region in the *Dipoloceras cristatum* Subzone (earliest Upper Albian), a period of widespread rift-faulting, to illustrate areas of marine sedimentation (unstippled areas), ammonite faunal provinces as in Text Fig. 3. Dispersal of Arctic and Tethyan elements via the Greenland – Norwegian strait and from the Tethyan region via the growing North Atlantic and southern Europe into the European shelf seas is indicated by arrows. *P* = *Pseudogastroplites*, *E* = *Euhoplites, Dimorphoplites, Anahoplites fauna*, *S* = *Semenovites, Epihoplites fauna*, and *Di* = *Dipoloceras*. Mixing of *Euhoplites* and gastroplitids occur in the region extending from South East England to Spitzbergen. Locality symbols and map projection as in the explanation to Text Fig. 1.

Owen, H. G. 1996 Boreal and Tethyan late Aptian to late Albian ammonite zonation and Palaeobiogeography. *Mitteilungen aus dem Geologisch-Paläontologischen Institut der Universität Hamburg.* **77,** 461-481

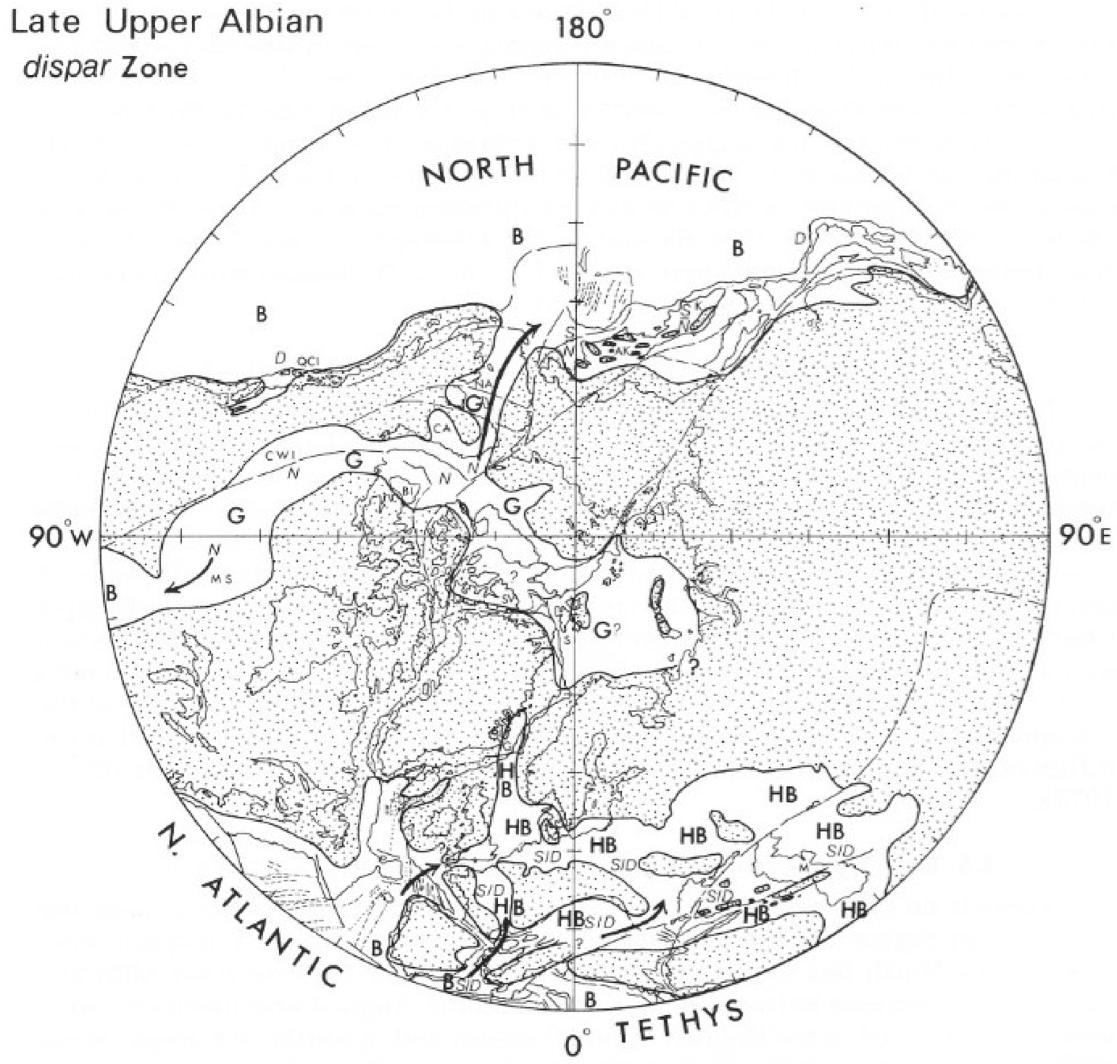


Fig. 5: Palaeogeographic map of the Boreal Region in the *Stoliczkaia dispar* Zone (latest Upper Albian) to illustrate areas of marine sedimentation (unstippled areas), ammonite faunal provinces as in Text Fig 3 with HB indicating the mixture of the hoplitinid faunas endemic to Europe and the coexisting more cosmopolitan Mortoniceratinae and Stolickzkainae characteristic of Upper Albian time. Although isolated from Europe, the Arctic regions were connected via the Maury Sea (MS) to the North American interior, and to the North Pacific. *S/D* = *Stoliczkaia – Durnovarites association, D* = *Durnovarites* occurrences in the Pacific realm, *N* = *Neogastroplites* fauna. Locality symbols and map projection as in the explanation to Text Fig. 1.