

Paleozoic Basemaps

by
C.R. Scotese

Paleozoic Basemaps

Paleoceanographic Mapping Project Report #03-0984

by

Christopher R. Scotese

The Institute for Geophysics, The University of Texas
Austin, Texas

Introduction

This report briefly describes the set of Paleozoic reconstructions that were produced during the summer of 1984 while I was a visiting scientist at the British Petroleum Research Centre in Sunbury, England. These maps represent a revision of the Paleozoic basemaps that appeared in Scotese et al. (1979) and Scotese (1984). The following section describes the major differences between these maps and the previous reconstructions, and reviews the remaining problem areas. The rotation parameters used to produce the maps are listed in a separate appendix.

Late Precambrian.

The question as to whether or not there was a Late Precambrian Pangea remains unresolved. Considerable evidence suggests that between 800 and 600 million years ago (probably closer to 600), passive margins formed along the perimeter of North America, Northern Europe, Siberia, and southwestern South America. It is not clear, however, whether any of these margins can be matched to form a "Precambrian Pangea". The reconstruction of these continents shown on the Vendian (600 Ma) map is tentative, at best.

The role that Gondwana plays in this reassembly is particularly problematic because the timing of this proposed rifting coincides with the "Pan-African" event, which is thought to record the continental collisions that resulted in the formation of Gondwana.

The latitudinal positions of North America, Europe and Siberia shown in the Vendian reconstruction is based on earliest Cambrian paleomagnetic data from North America that places it on the Equator. This data may be too young. If I were to revise this map, I would position this group of continents 20 - 30 degrees further to the south. A more southerly position agrees with recent paleomagnetic results from Baja California, and is consistent with the dominantly clastic facies of Vendian rocks from these three continents. Significant amounts of Vendian carbonates occur only in Alaska and Arctic Canada. Carbonates appear to move southward during the Cambrian, suggesting a possible northward motion of North America during this interval.

Cambrian.

The positions of the continents shown on the Cambrian reconstructions are similar to the positions shown on the Late Cambrian map of Scotese et al. (1979), an exception being the location of the South China platform. Recent paleomagnetic evidence suggests that the South China platform occupied

equatorial latitudes, so we show it positioned adjacent to northwestern Australia.

Ordovician.

The most significant difference between 1979 Ordovician reconstruction and the new set of Ordovician maps is the position of Baltica. In the new set of maps, Baltica is further to the east and occupies more tropical latitudes. This is consistent with the appearance of a well developed carbonate platform on Baltica by the Late Ordovician and the increased similarity of faunas between Baltica and Laurentia by the end of the Period.

Silurian

The Silurian maps are nearly identical. In the more recent set of maps, the Iapetus Ocean is nearly closed; Avalon (and Britain) occupy a position adjacent to the eastern seaboard of North America.

Devonian

The Early Devonian map published in Scotese et al. (1979) has been completely revised. In the 1979 reconstruction a wide ocean is shown between North America and Gondwana; in the most recent set of maps this ocean is much narrower in the Early Devonian, and is eliminated by the Late Devonian.

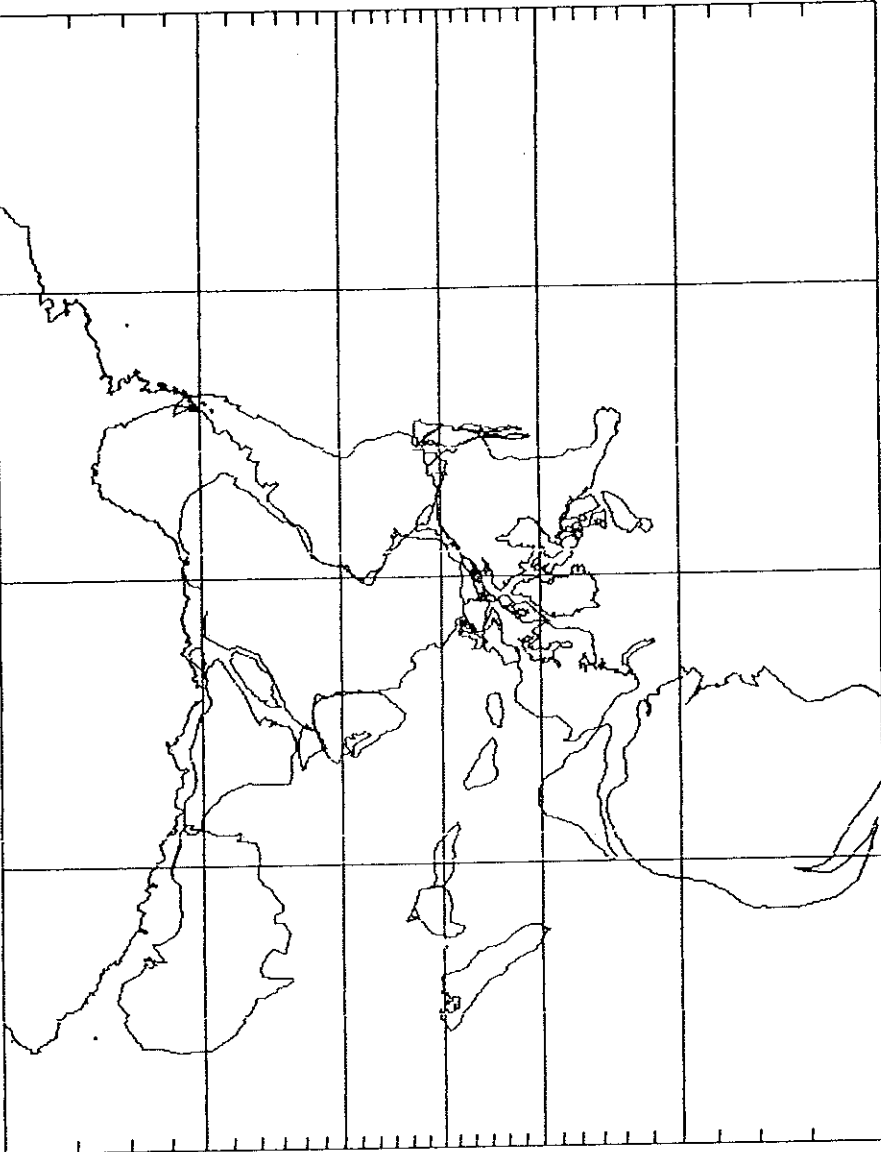
This change in the estimation of the width of this ocean is the result of several factors. 1). North America is now thought to have occupied a more southerly latitude based on new paleomagnetic determinations from the Canadian Arctic (Dankers, 1982), and the Catskill red beds (Van der Voo, personal comm.). 2) The poles that were used to orient North America in the 1979 reconstruction (Martin, 1975) have been rejected because they were derived from rocks that were remagnetized during the Late Paleozoic. The same is now thought to be true for the previous results from the Late Devonian Catskill red beds. 3). During the Early Devonian, coral reefs and a carbonate platform appeared along the northern margin of Gondwana suggesting that Gondwana may have entered warmer, more tropical waters (Heckel and Witzke, 1979). 4). Biogeographic affinities between Laurussia (North America and northern Europe) also indicate that the ocean separating these continents was relatively narrow.

The issue, however, is far from resolved; new paleomagnetic results from western Australia (Hurley et al., 1985) disagree with the biogeographic and paleoclimatic interpretations, and place the northern margin of Gondwana at 60 degrees south during the Middle-Late Devonian. At present I still believe that the weight of the evidence supports a subtropical (30 - 40? degrees) position for northwest Africa during the Late Devonian.

Though I believe that the Early Devonian reconstruction is accurate, I am not confident of the Late Devonian map. The Late Devonian map is based on poles from the Mauritanides (Gondwana) and from the Catskill red beds (North America) that were probably remagnetized during the Late Paleozoic. If I were to redo the Late Devonian reconstruction, I would move both of these continents 10-15 degrees further to the south. The Late Devonian reconstruction should look more like the Early Devonian map and less like the Late Carboniferous map.

Carboniferous and Permian

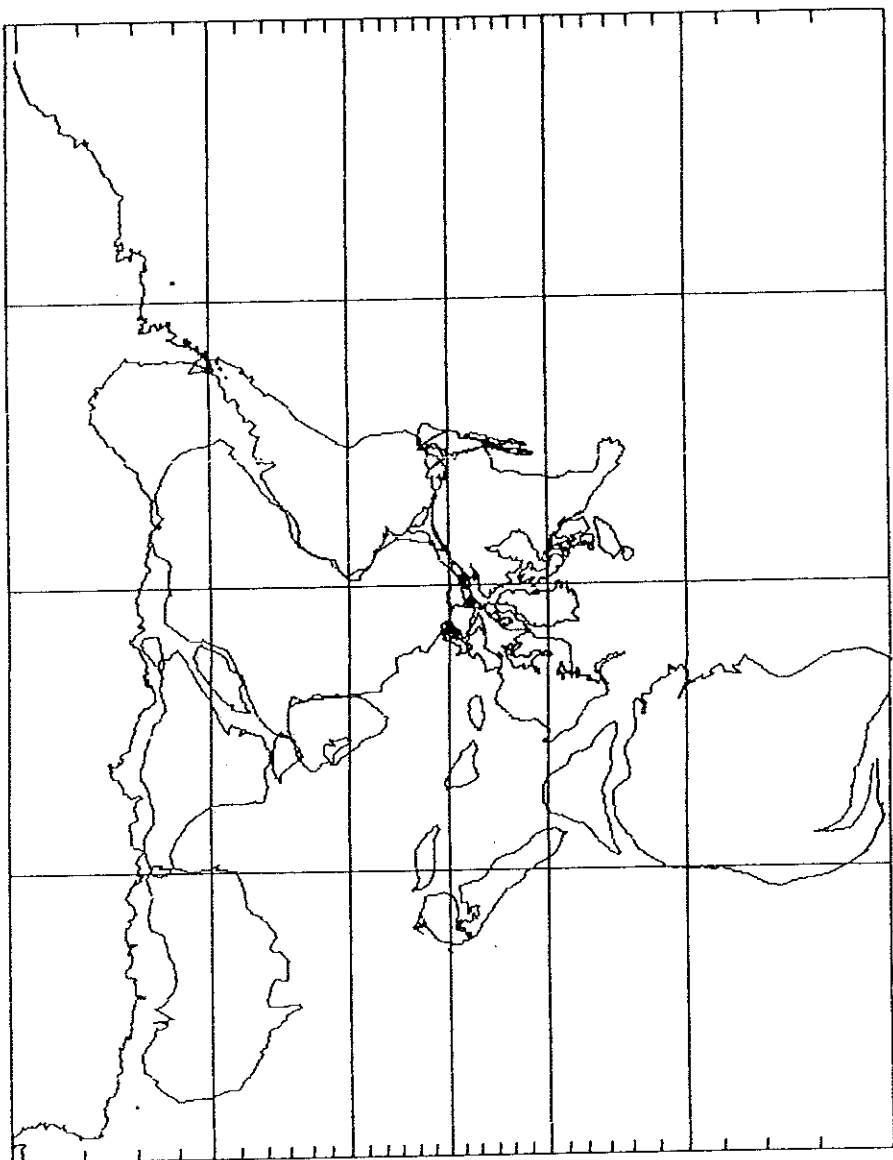
There are two major differences between the new set of Carboniferous maps, and those published in 1979. 1). The sinistral strike-slip movement subparallel to the Iapetus suture is no longer thought to have taken place during the Carboniferous. During the Carboniferous, strike-slip movement between these areas was largely dextral. Sinistral movement between Baltica and Laurentia is now thought to be syn-collisional, and was probably completed by the late Middle Devonian (see Progress Report #08). 2). Paleomagnetic and paleoclimatic data from the Chinese cratons (see Rowley et al., 1985) indicate that these areas occupied an equatorial position during the Late Paleozoic. It is interesting to note that they must have rifted away from the Gondwana sometime during the middle Paleozoic because unlike Australia, Southeast Asia, and Tibet, - China was not glaciated during the Late Paleozoic.



LP

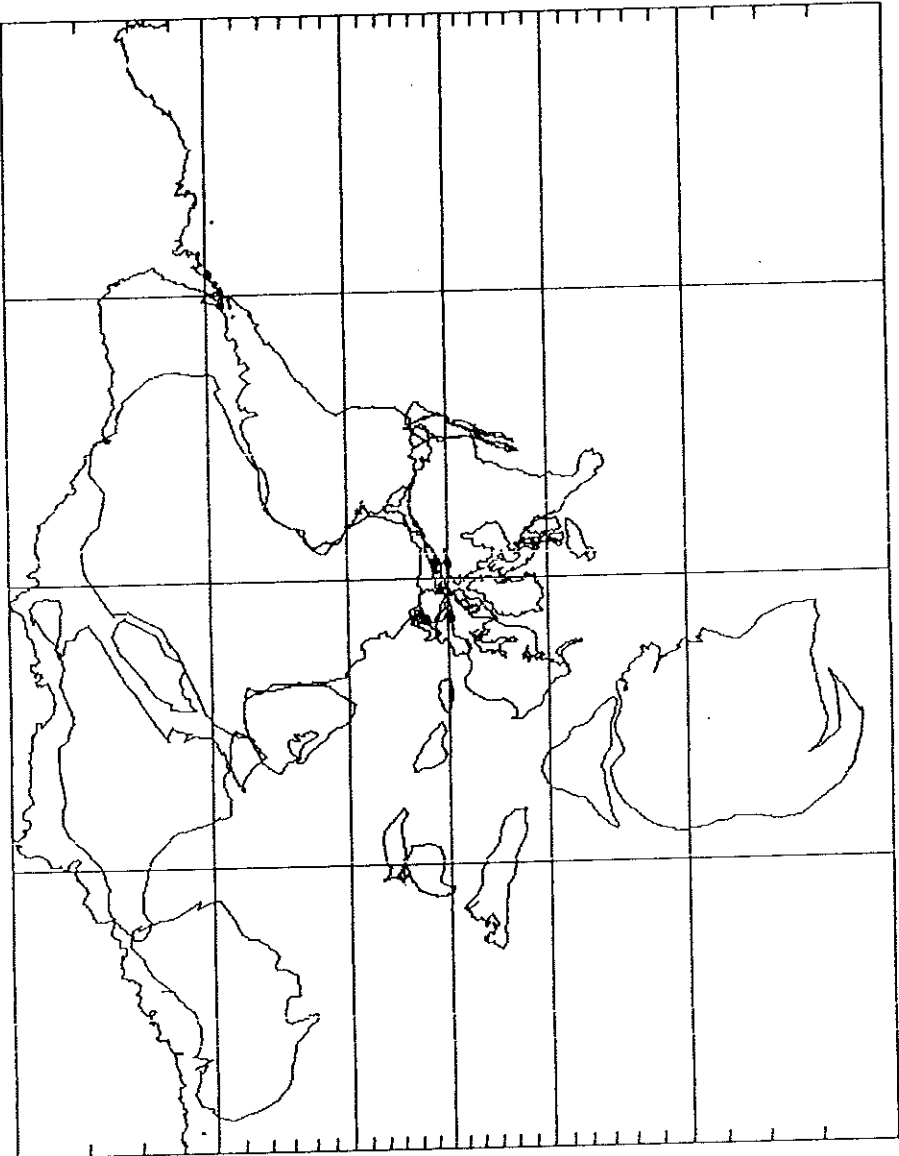
258

EP



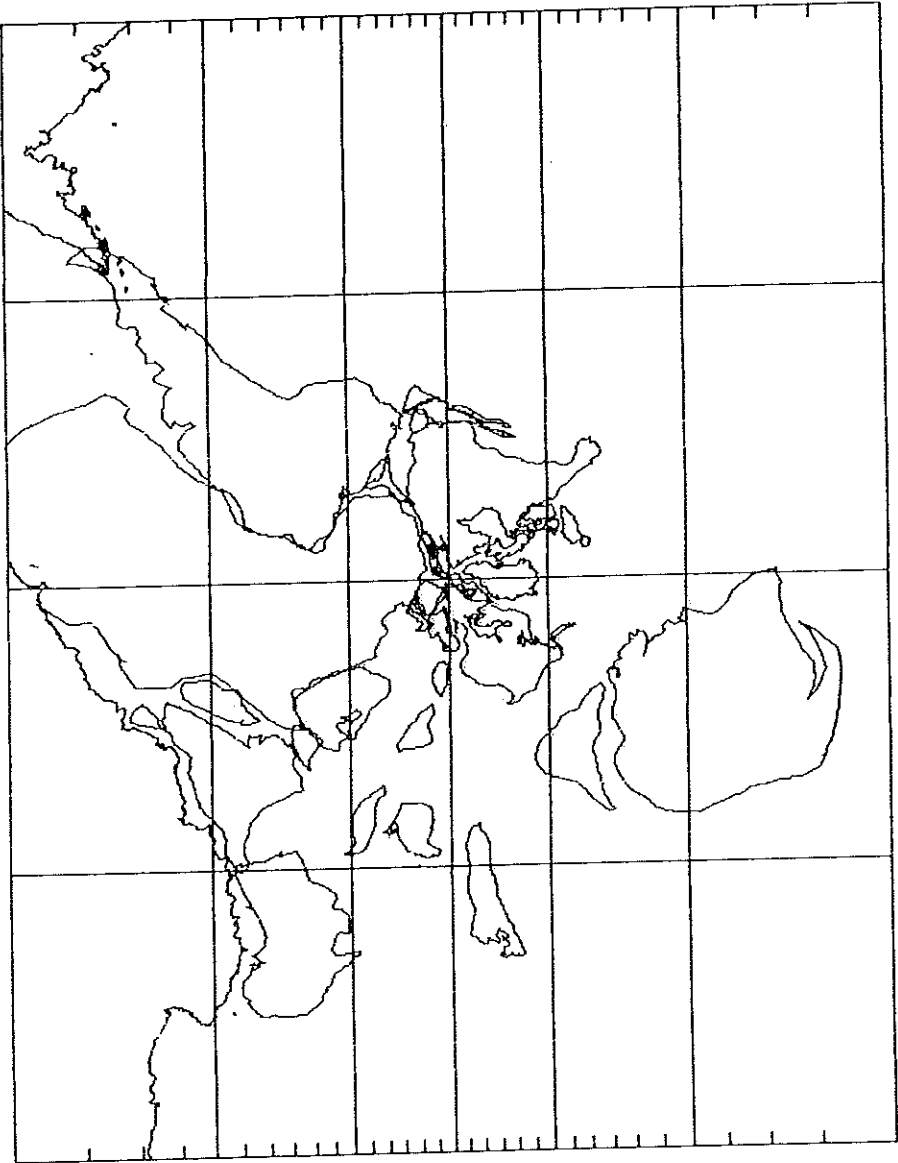
268

LC



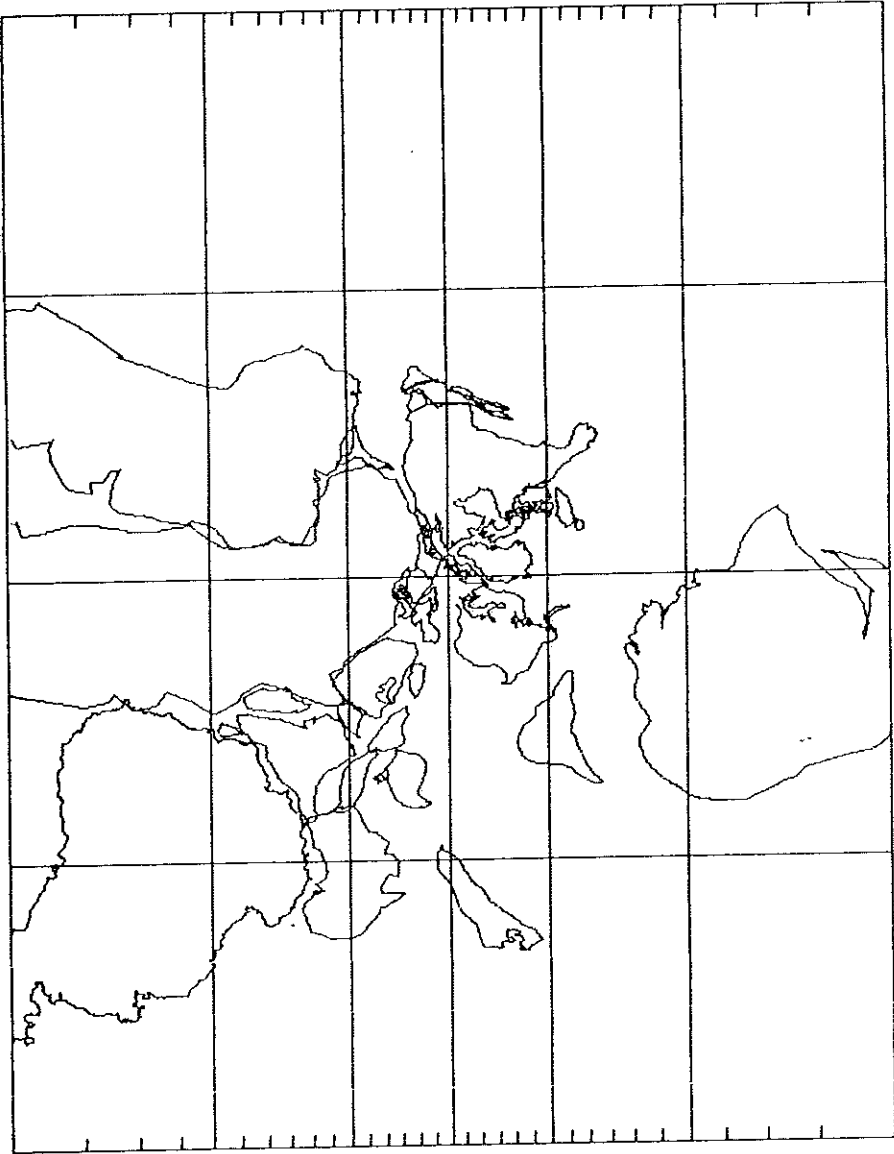
295

MC



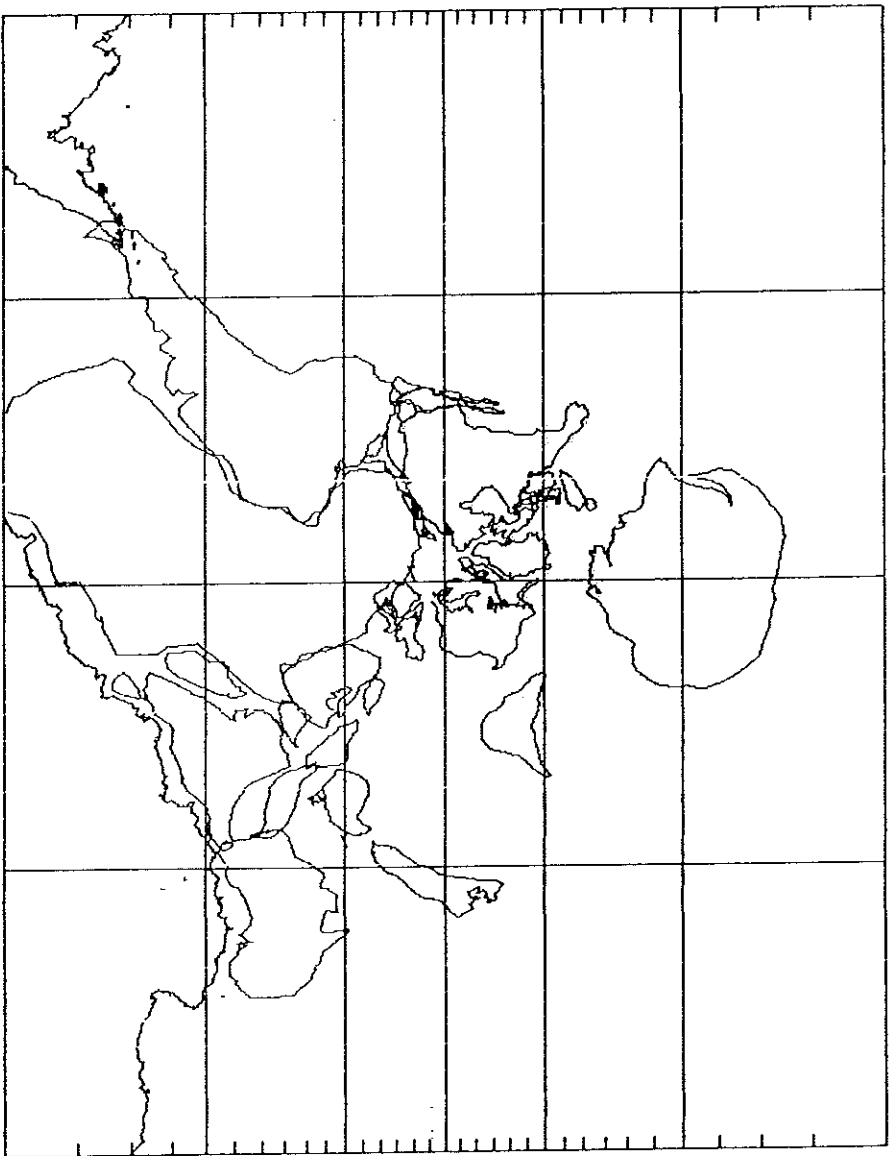
323

EC



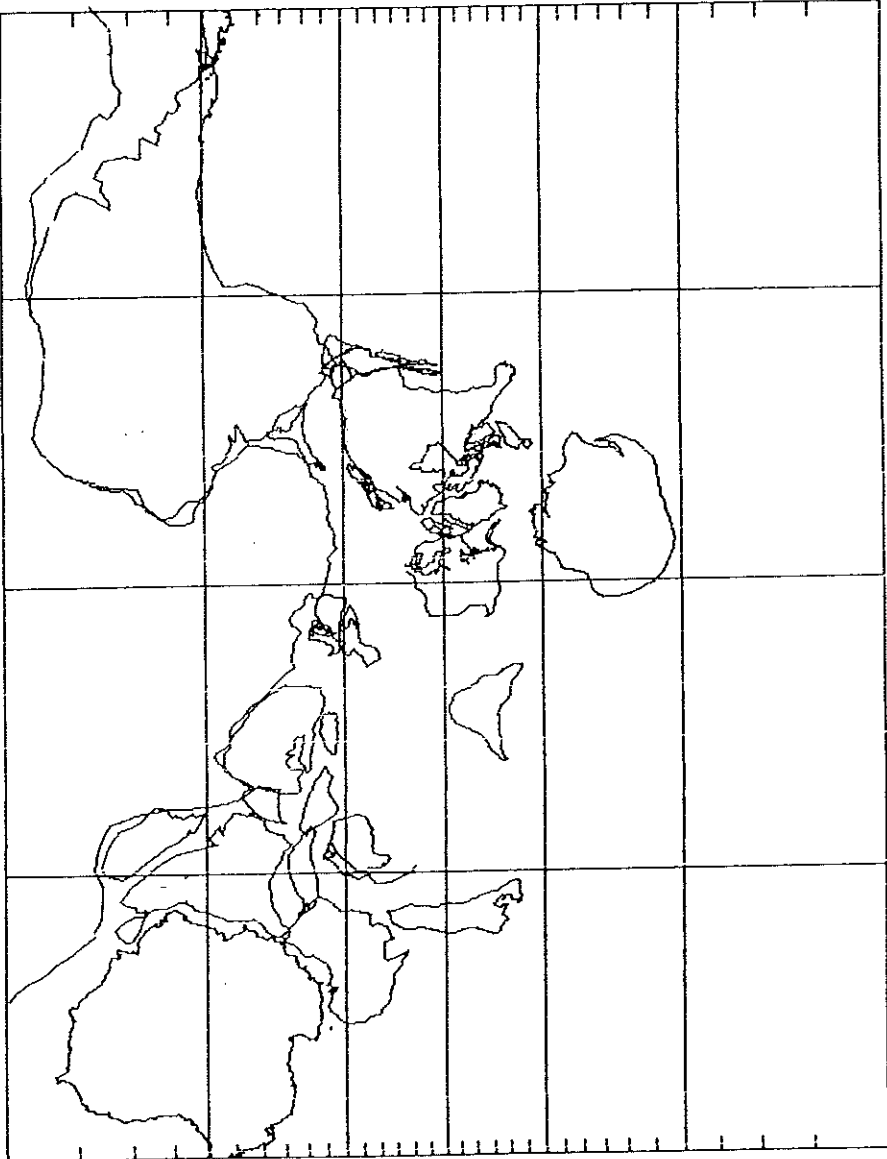
352

LD

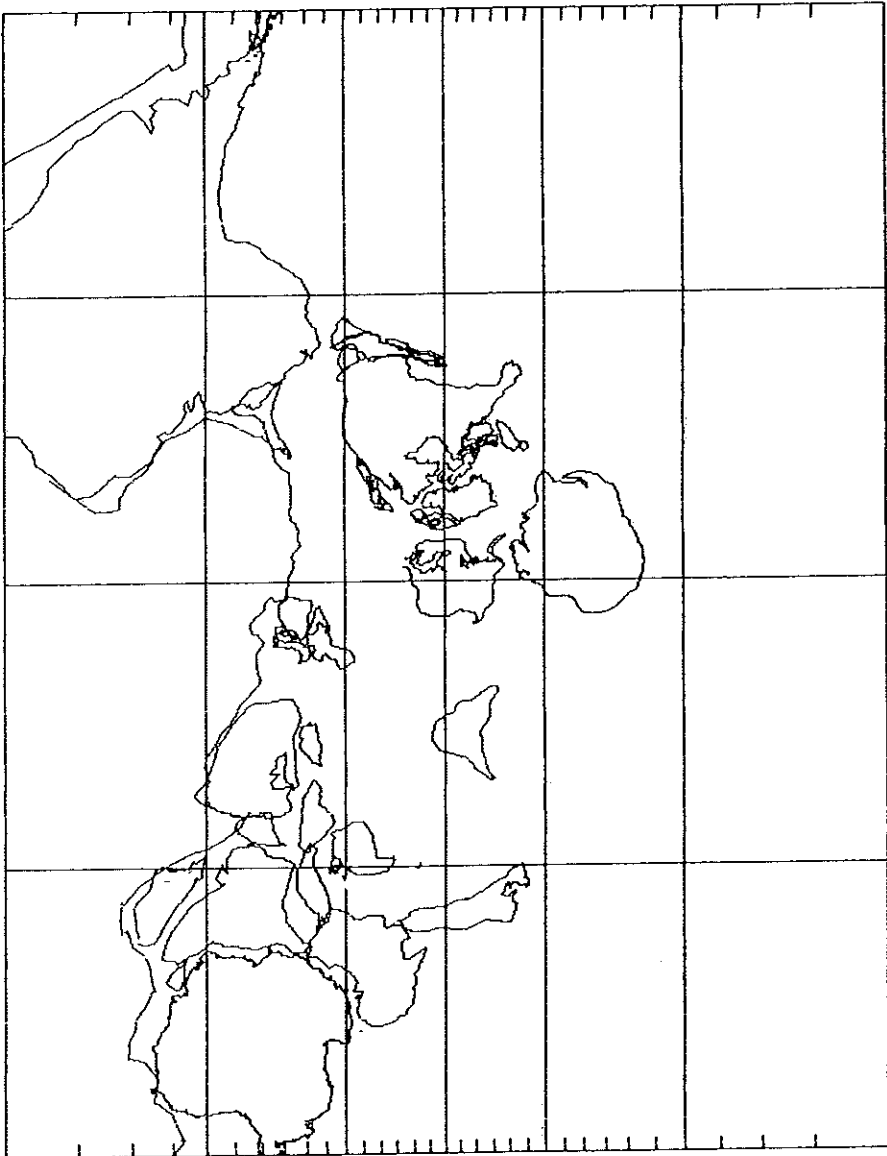


367

ED



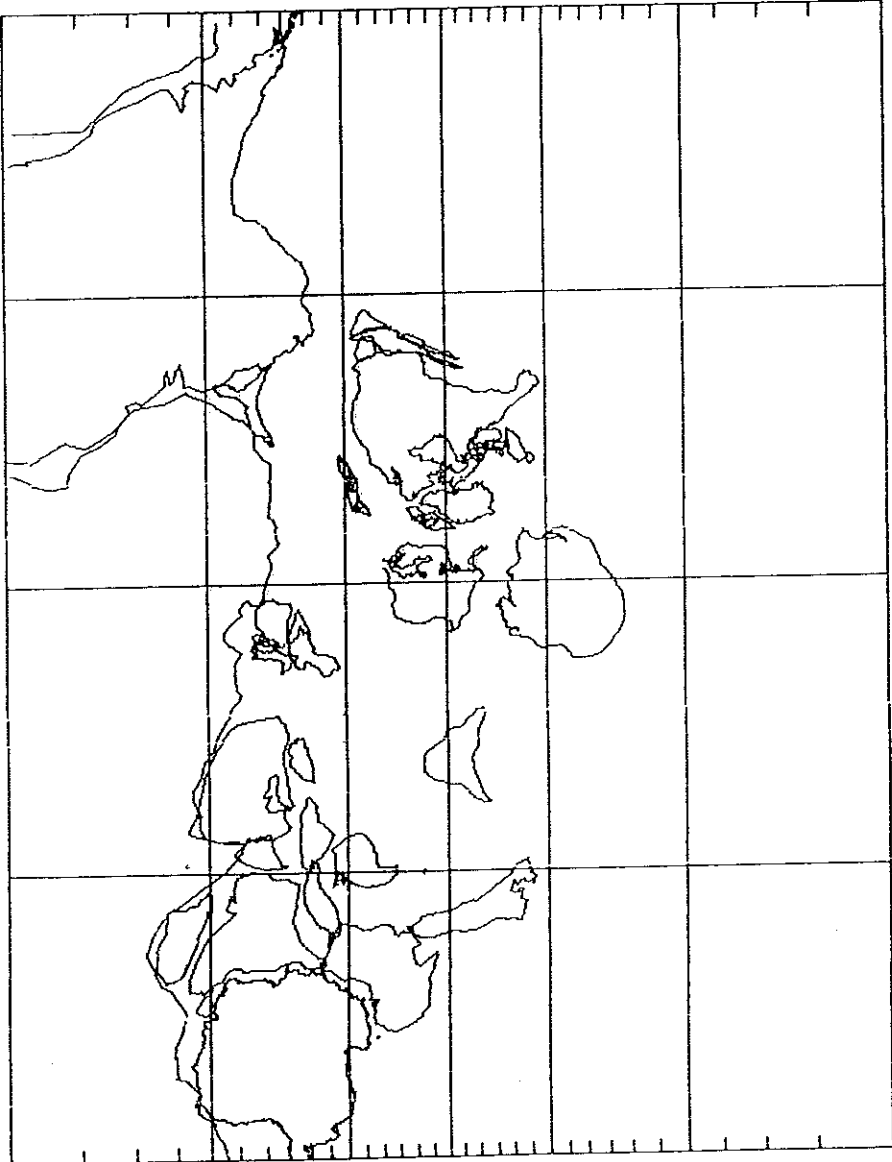
394



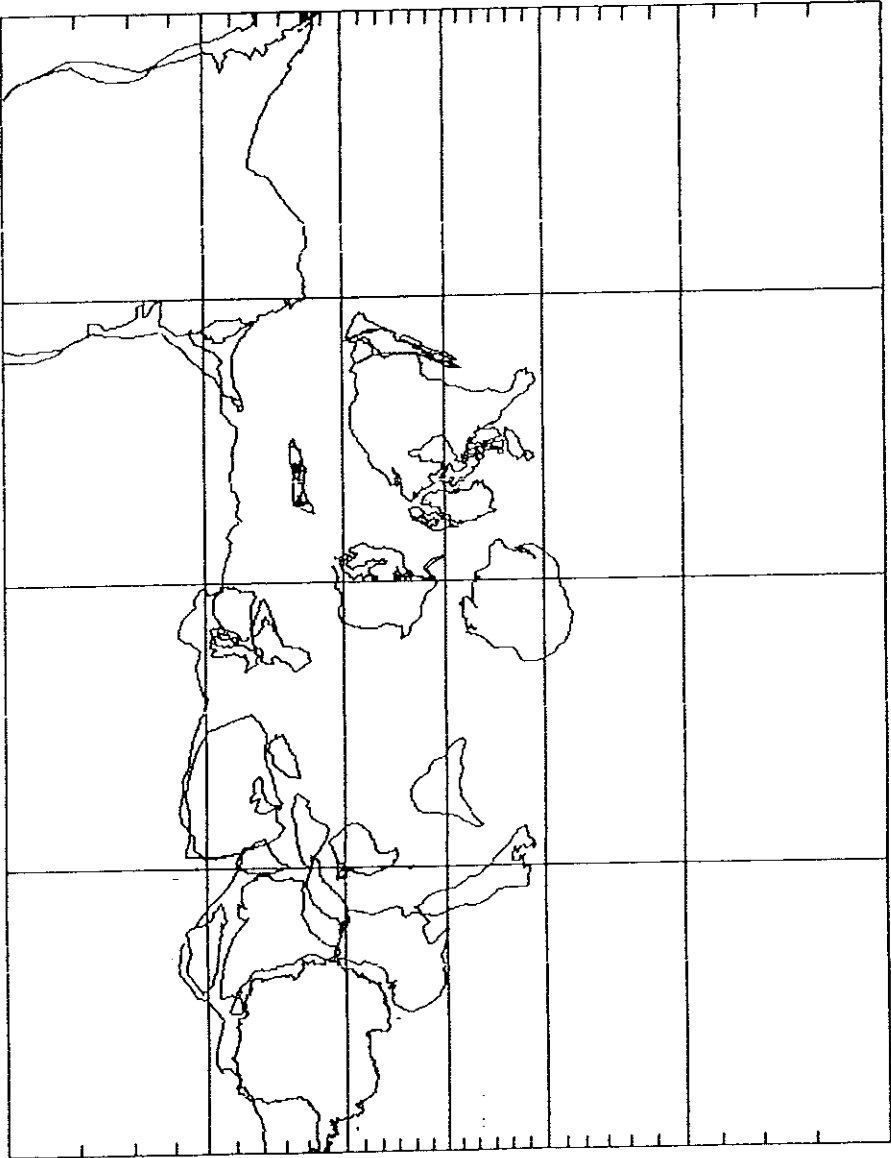
LS

414

ES



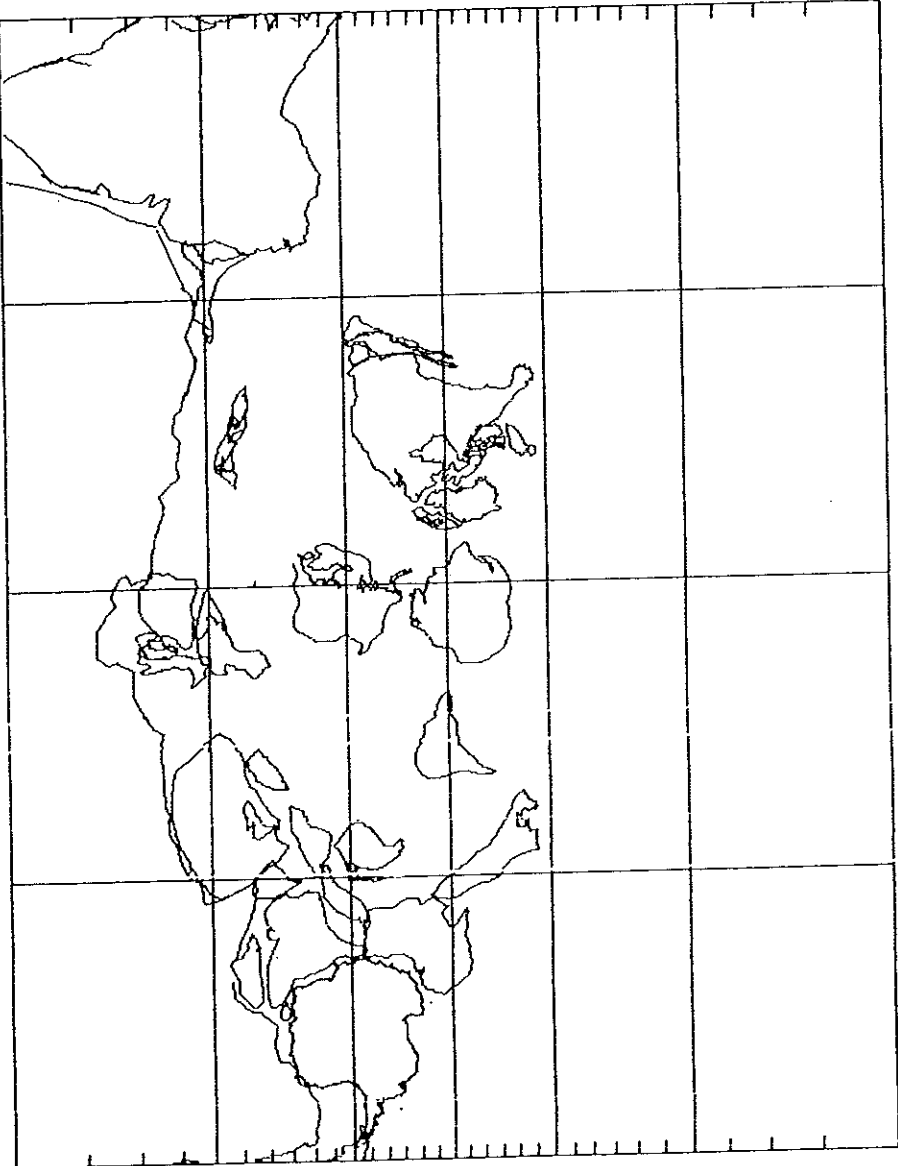
428



LO

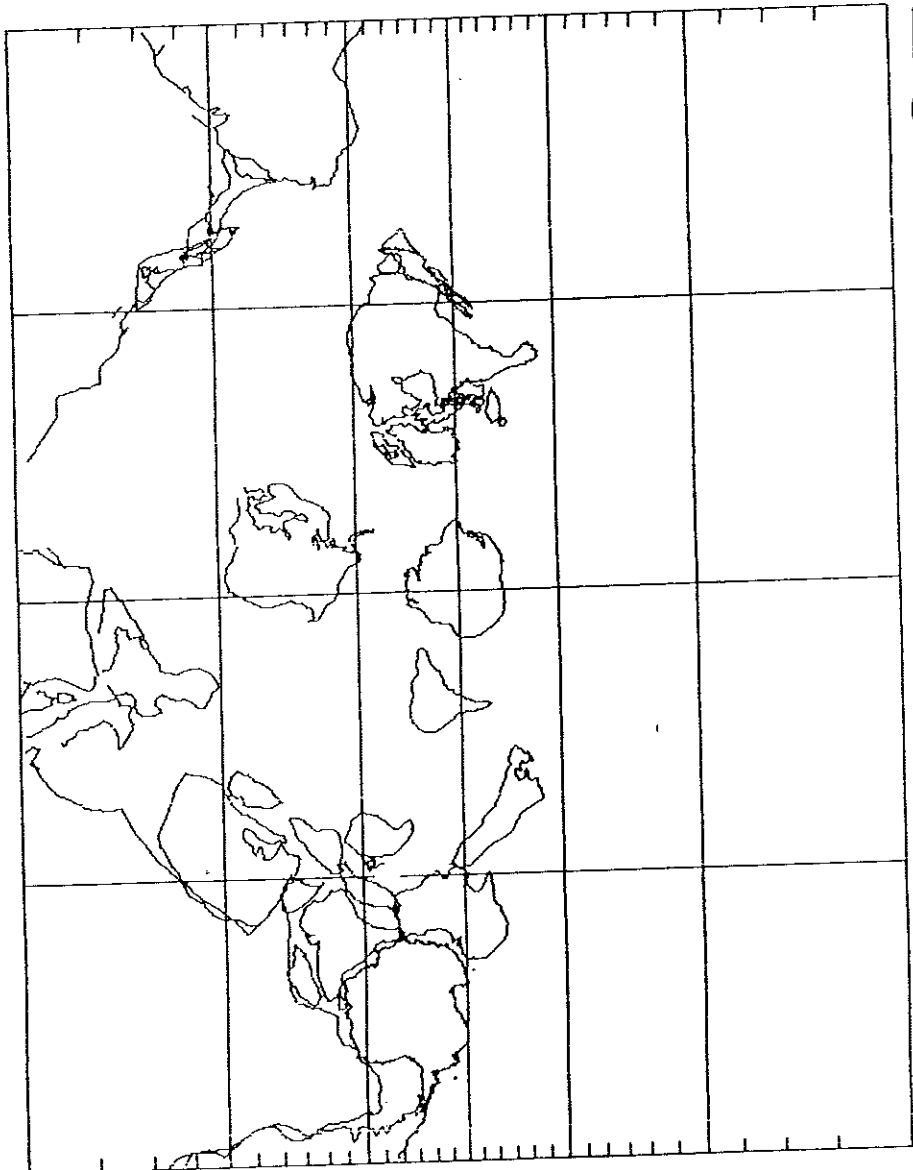
443

M-L O

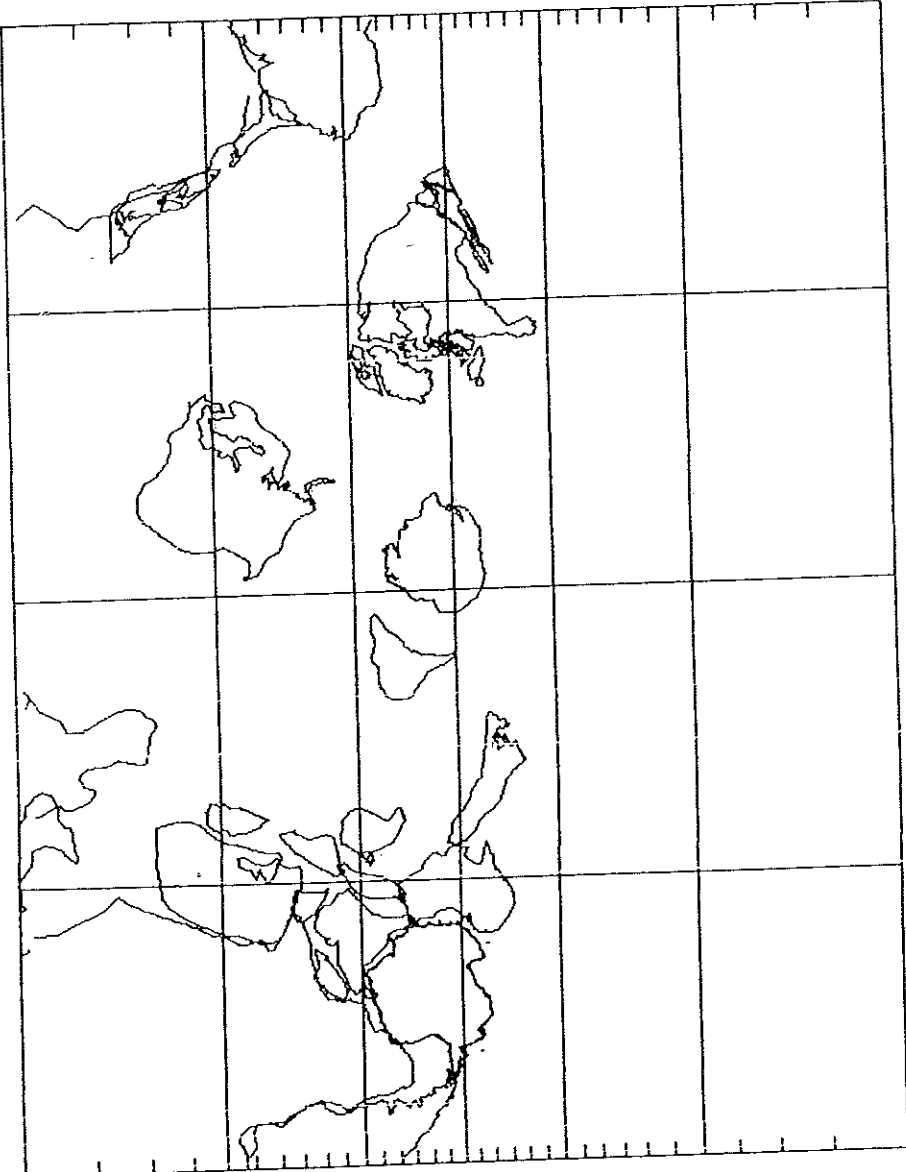


458

EO



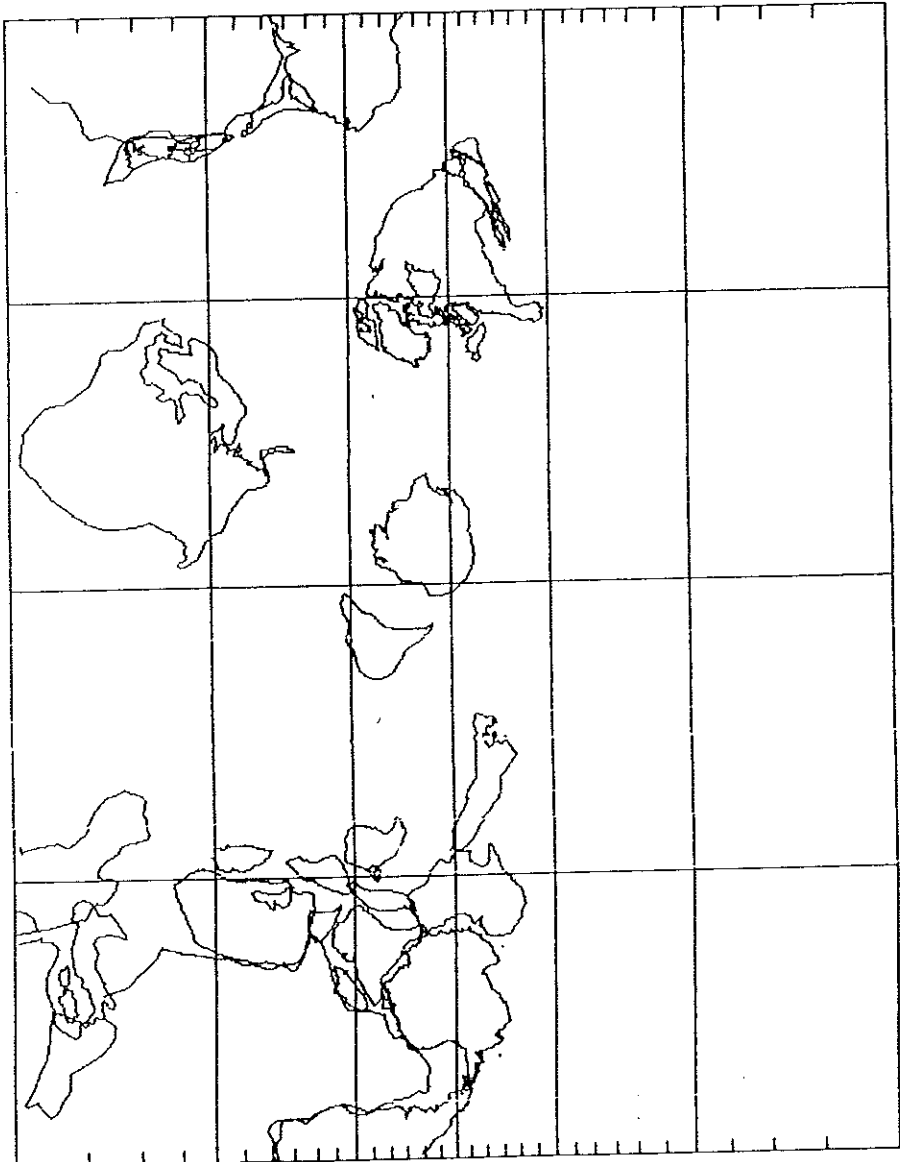
483



E-O

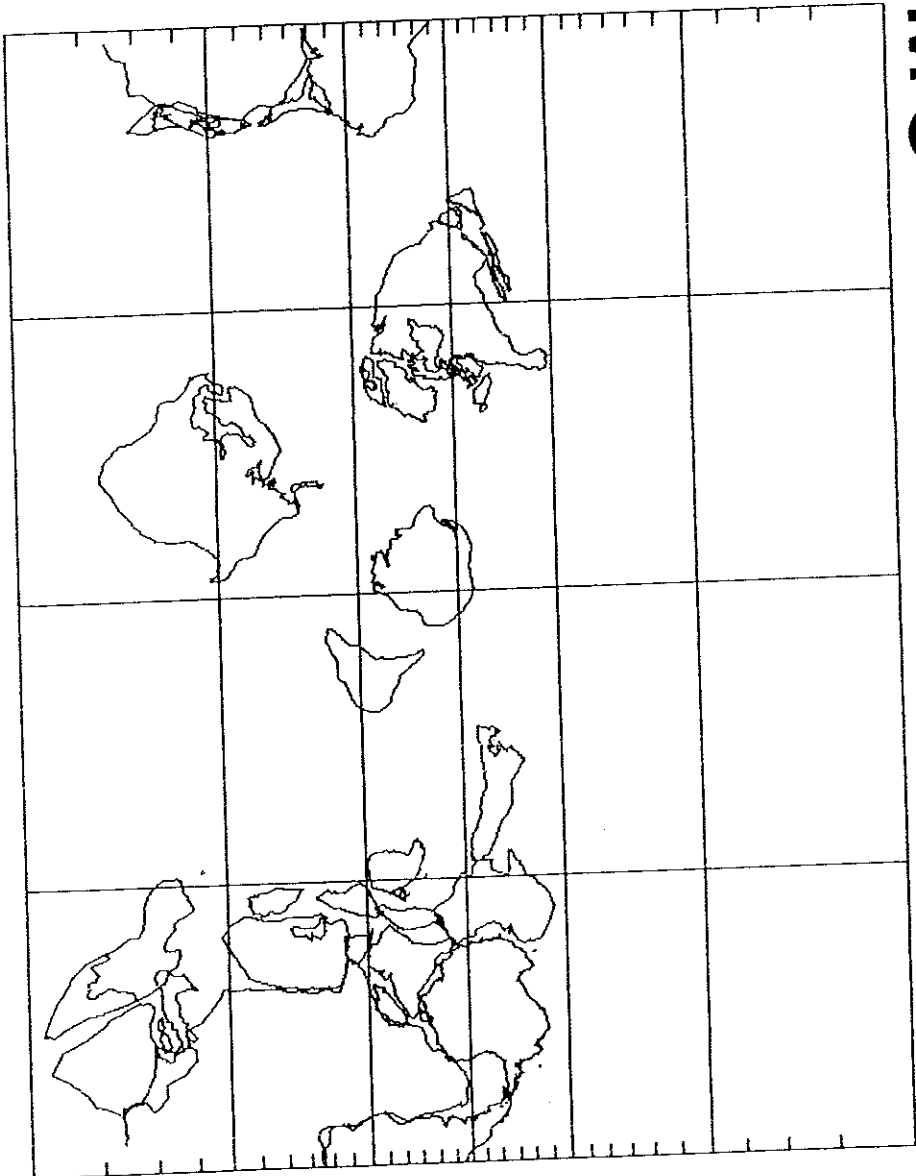
505

LE



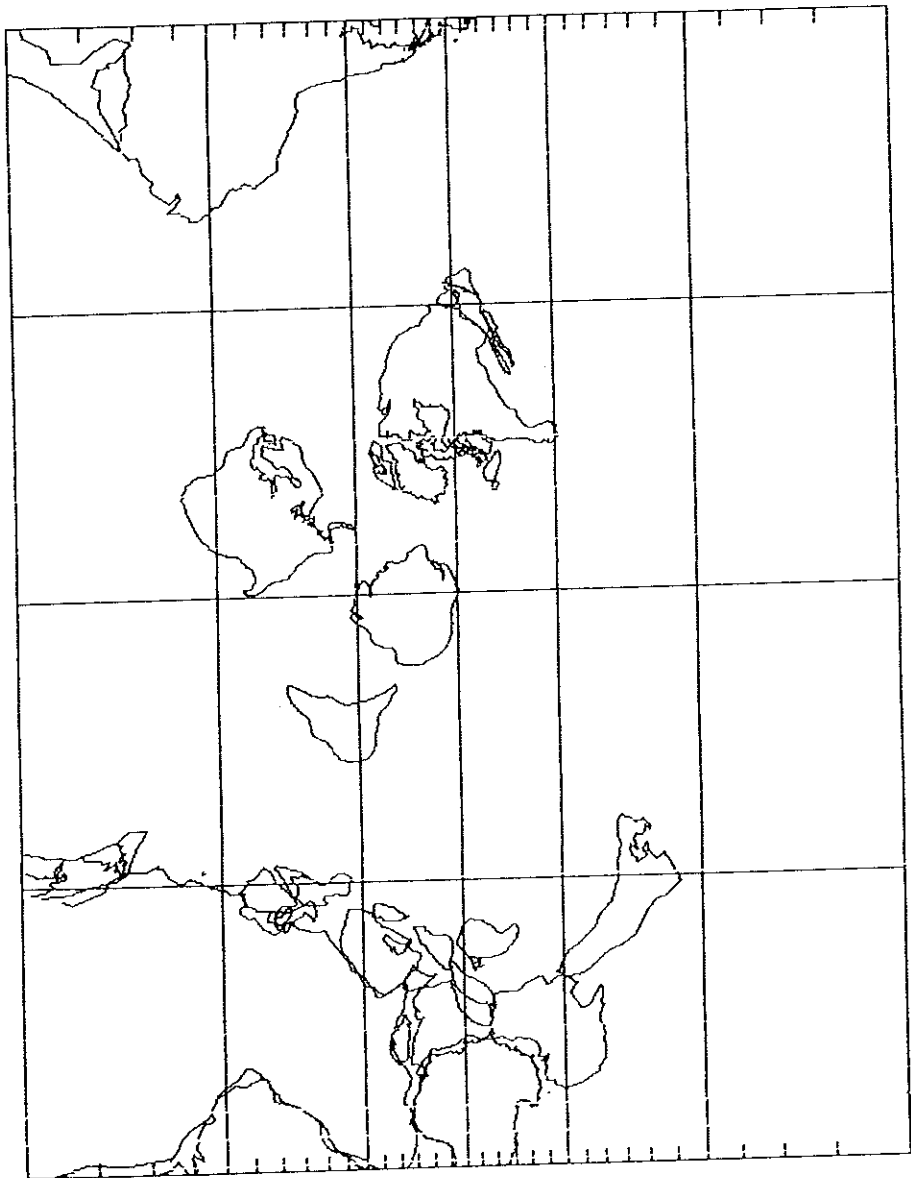
525

ME

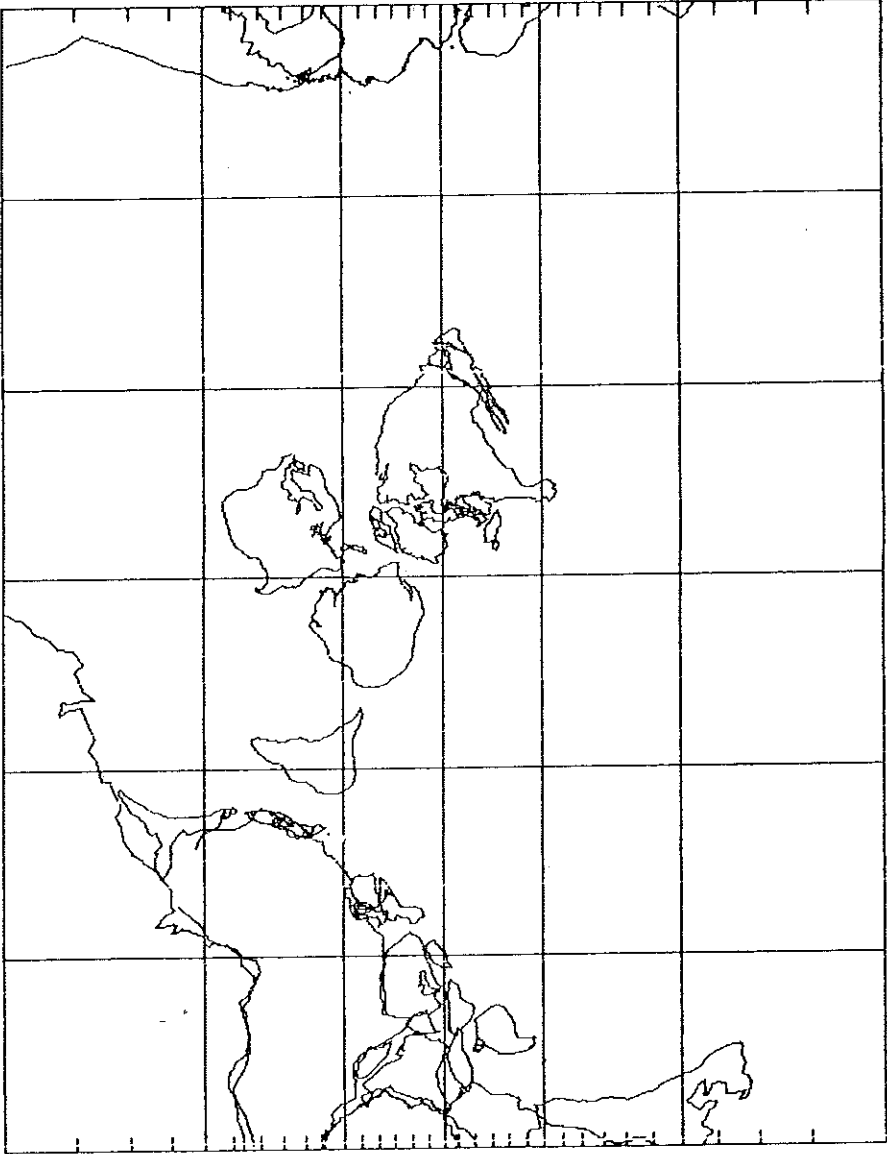


540

EE



570



V

009

PALEO.DAT

701	258.0	0.00	152.10	50.10	000	!FILE NAME: PALEO11.DAT
701	280.0	0.00	147.40	59.40	000	!LAST MODIFIED: 12/17/85
701	303.0	0.00	142.60	66.10	000	!COPYRIGHT 1985
701	357.0	-14.00	106.00	50.00	000	!PALEOCEANOGRAPHIC MAPPING PROJECT
701	380.0	-14.90	125.70	56.90	000	
701	415.0	-2.70	108.50	78.30	000	!BP MODEL, SCOTESE (1984)
701	438.0	-1.00	106.30	88.00	000	!GONDWANA APW
701	535.0	-7.00	87.00	131.00	000	
701	559.0	-2.00	89.00	144.00	000	
701	600.0	43.20	110.00	111.20	000	
101	245.0	62.20	-15.90	78.80	701	!M. KELLY, PERS. COMM. (1979)
101	258.0	57.00	-20.80	88.90	701	!M. KELLY, PERS. COMM. (1979)
101	303.0	57.00	-20.80	88.90	701	!A2 - FIT, SCOTESE ET AL (1979)
101	303.0	45.37	64.00	74.18	000	!N. AMERICAN APW
101	357.0	38.50	59.90	68.90	000	!BP MODEL, SCOTESE (1984)
101	380.0	46.10	55.49	67.17	000	
101	415.0	29.90	30.50	76.60	000	
101	438.0	24.80	42.80	71.50	000	
101	480.0	26.40	39.70	71.40	000	
101	547.0	-24.30	48.70	97.20	000	
101	600.0	12.00	76.00	80.00	000	
302	245.0	88.40	27.70	-38.10	101	!BAL-NAM FIT
302	357.0	88.40	27.70	-38.10	101	!BULLARD ET AL (1965)
302	410.0	81.45	-69.30	-50.10	101	!BAL-NAM FIT, SCOTESE & MCKERROW (1986)
302	410.0	-0.90	63.63	63.75	000	!BALTICA APW, BP MODEL, SCOTESE (1984)
302	430.0	-0.70	63.30	71.60	000	
302	455.0	-5.00	74.20	88.40	000	
302	480.0	-7.00	81.20	97.40	000	
302	535.0	-19.00	77.00	128.00	000	
302	547.0	-19.00	76.30	138.70	000	
302	600.0	-19.70	100.90	111.30	000	
309	245.0	88.40	27.70	-38.10	101	
309	245.0	0.00	0.00	0.00	302	!USPTZ-BAL
309	600.0	0.00	0.00	0.00	302	!TEMPORARILY KEPT FIXED TO BALTICA
310	245.0	0.00	0.00	0.00	302	!CSPTZ-BAL
310	600.0	0.00	0.00	0.00	302	!TEMPORARILY KEPT FIXED TO BALTICA
311	245.0	0.00	0.00	0.00	302	!BAR-BAL
311	600.0	0.00	0.00	0.00	302	!TEMPORARILY KEPT FIXED TO BALTICA
401	245.0	40.16	84.62	46.31	000	
401	303.0	20.12	83.55	52.12	000	!SIBERIAN APW
401	321.0	36.10	78.30	62.30	000	!BP MODEL, SCOTESE (1984)
401	357.0	38.20	68.80	61.00	000	
401	380.0	31.40	56.37	69.56	000	
401	410.0	23.80	45.80	83.50	000	
401	430.0	31.10	49.70	101.50	000	
401	438.0	35.60	55.90	114.30	000	
401	480.0	15.20	64.00	118.50	000	
401	547.0	8.30	52.00	127.90	000	
401	600.0	3.00	75.00	134.00	000	
402	245.0	40.16	84.62	46.31	000	
402	303.0	20.12	83.55	52.12	000	!KAZAKHSTAN APW
402	321.0	36.10	78.30	62.30	000	!BP MODEL, SCOTESE (1984)
402	380.0	15.64	99.63	49.85	000	
402	410.0	-14.91	103.35	48.74	000	!EARLY PZ INFERRED FROM CLIMATE DATA
402	455.0	14.90	108.00	73.30	000	!ZIEGLER ET AL (1977)
402	547.0	-0.60	64.50	125.60	000	
402	600.0	5.50	72.10	162.00	000	
602	245.0	-26.70	-109.40	77.90	000	
602	276.0	0.00	162.00	36.00	000	!S. CHINA APW
602	303.0	-20.90	165.60	40.90	000	!BP MODEL, SCOTESE (1984)
602	357.0	-46.40	171.90	60.50	000	
602	357.0	-49.90	-105.00	56.00	701	!SCH-GON, LIN ET AL (1983)
602	600.0	-49.90	-105.00	56.00	701	!SCH-GON, LIN ET AL (1983)
601	245.0	0.00	-93.60	51.00	000	!NCH/REF
601	276.0	-33.60	-108.40	56.00	000	
601	303.0	-27.10	-142.90	30.00	000	
601	357.0	21.70	139.60	51.50	000	
601	380.0	9.82	128.74	75.30	000	
601	415.0	22.50	117.30	108.00	000	
601	415.0	26.90	165.40	48.30	701	!NCH-GON, LIN ET AL (1983)
601	600.0	26.90	165.40	48.30	701	!LIN ET AL (1983)
102	245.0	70.30	-93.80	-17.90	101	!GRN-NAM FIT
102	600.0	70.30	-93.80	-17.90	101	!SCLATER ET AL (1977)
103	245.0	70.11	-128.16	-78.00	101	!NSL-NAM
103	600.0	70.11	-128.16	-78.00	101	!BOUCHER (1978)
104	245.0	-48.60	94.10	26.00	101	!MEX-NAM FIT
104	600.0	-48.60	94.10	26.00	101	!ZIEGLER, SCOTESE, & BARRETT (1983)
105	245.0	37.90	-91.30	7.37	104	!BAJ-MEX FIT
105	600.0	37.90	-91.30	7.37	104	!MODIFIED SCOTESE ET AL (1979)
205	245.0	-29.60	87.10	32.90	104	!YUC-MEX
205	600.0	-29.60	87.10	32.90	104	!YUC-MEX
204	245.0	-39.70	87.90	31.10	104	!HON-MEX FIT

204	600.0	-39.70	87.90	31.10	104	!SCOTESE ET AL (1979)
106	245.0	0.00	0.00	0.00	101	!ARC-NAM
106	600.0	0.00	0.00	0.00	101	!KEPT FIXED TO N. AMERICA
201	245.0	45.50	-32.20	58.20	701	!SAM-AFR FIT, SCOTESE & LAWVER (1986)
201	600.0	45.50	-32.20	58.20	701	!SIMILAR TO RABINOWITZ & LABREQUE (1979)
702	245.0	-3.41	-81.70	19.73	701	!MAD-AFR FIT
702	600.0	-3.41	-81.70	19.73	701	!SCOTESE & LAWVER (1986)
501	245.0	-4.44	16.74	-92.77	802	!IND-ANT
501	600.0	-4.44	16.74	-92.77	802	!SCOTESE AND LAWVER (1986)
503	245.0	26.50	21.50	-7.60	701	!ARB-AFR
503	600.0	26.50	21.50	-7.60	701	!NORTON & SCLATER (1979)
801	245.0	-1.58	39.02	-31.29	802	!AUS-ANT FIT
801	600.0	-1.58	39.02	-31.29	802	!SCOTESE AND LAWVER (1986)
506	0.0	0.00	0.00	0.00	501	!AF6-IND
506	0.0	0.00	0.00	0.00	501	!AF6-IND
802	245.0	-7.78	-31.42	58.01	701	!ANT-AFR
802	600.0	-7.78	-31.42	58.01	701	!SCOTESE & LAWVER (1986)
803	245.0	73.87	108.59	-41.79	802	!WAP-ANT
803	600.0	73.87	108.59	-41.79	802	!SCOTESE & LAWVER (1986)
804	245.0	62.27	21.84	13.27	802	!MBL-ANT FIT
804	600.0	62.27	21.84	13.27	802	!SCOTESE & LAWVER (1986)
805	245.0	72.64	100.37	-37.44	802	!ELL-ANT
805	600.0	72.64	100.37	-37.44	802	!SCOTESE & LAWVER (1986)
806	245.0	43.00	-68.20	40.60	802	!NNZ-ANT
806	600.0	43.00	-68.20	40.60	802	!SCOTESE & LAWVER (1986)
807	245.0	64.40	-38.80	74.05	802	!SNZ-ANT
807	600.0	64.40	-38.80	74.05	802	!SCOTESE & LAWVER (1986)
504	245.0	-42.60	-151.40	30.00	302	!TRK-BAL
504	310.0	-42.60	-151.40	40.00	302	!TRK-BAL
504	345.0	-42.60	-151.40	54.97	302	!BP MODEL, SCOTESE (1984)TRK-BAL
504	600.0	2.02	36.90	-24.60	503	!TRK-ARB
504	600.0	2.02	36.90	-24.60	503	!BP MOUDEL, SCOTESE (1984)
505	245.0	0.00	0.00	0.00	504	!IRN-TRK
505	600.0	0.00	0.00	0.00	504	!IRAN FIXED TO TURKEY
606	245.0	8.00	23.00	64.00	501	!TIR-IND
606	310.0	4.00	26.00	53.00	501	!SCOTESE (1977)
606	345.0	-43.50	8.00	0.00	501	!TIR-IND
606	600.0	-43.50	8.00	0.00	501	!TIR-IND
108	245.0	88.40	27.70	38.10	302	!AVA-BAL
108	357.0	88.40	27.70	38.10	302	!AVA-BAL
108	410.0	74.10	-35.12	54.19	302	!AVA-BAL
108	455.0	88.40	27.70	38.10	302	!AVA-BAL
108	510.0	59.53	57.30	46.84	302	!BP MODEL, SCOTESE (1984), AVA-BAL
108	510.0	63.07	-5.60	73.70	701	!AVA-AFR
108	600.0	63.70	-5.60	73.70	701	!BP MODEL, SCOTESE (1984), AVA-AFR
109	245.0	57.00	-20.80	88.90	701	!PIED-AFR
109	600.0	57.00	-20.80	88.90	701	!BP MODEL, SCOTESE (1984), PIED-AFR
303	245.0	88.40	27.70	-38.10	101	!NHL-NAM
303	600.0	88.40	27.70	-38.10	101	!BP MODEL, SCOTESE (1984), NHL-NAM
312	245.0	0.00	0.00	0.00	303	!GRM-NHL
312	600.0	0.00	0.00	0.00	303	!TEMPORARILY KEPT FIXED TO N. HIGHLANDS
313	245.0	0.00	0.00	0.00	303	!MDV-NHL
313	600.0	0.00	0.00	0.00	303	!TEMPORARILY KEPT FIXED TO N. HIGHLANDS
314	245.0	0.00	0.00	0.00	303	!SUP-NHL
314	600.0	0.00	0.00	0.00	303	!TEMPORARILY KEPT FIXED TO N. HIGHLANDS
304	245.0	50.00	3.30	-27.00	305	!SPN-CEUR
304	600.0	50.00	3.30	-27.00	305	!SIRUET (1970)
305	245.0	0.00	0.00	0.00	315	!CEUR-ENG
305	303.0	0.00	0.00	0.00	315	!BP MODEL, SCOTESE (1984), CEUR-ENG
305	303.0	40.20	-2.90	59.40	701	!CEUR-AFR
305	357.0	64.31	147.26	20.60	701	!BP MODEL, SCOTESE (1984), CEUR-AFR
305	600.0	64.31	147.26	20.60	701	!CEUR-AFR
306	245.0	-50.85	178.46	26.17	304	!CSD-SPN
306	600.0	-50.85	178.46	26.17	304	!SCOTESE ET AL (1979)
307	245.0	-45.67	-173.30	67.12	304	!ITL-SPN FIT
307	600.0	-45.67	-173.30	67.12	304	!ZIEGLER, SCOTESE & BARRETT (1983)
315	245.0	0.00	0.00	0.00	302	!ENG-BAL
315	455.0	0.00	0.00	0.00	302	!BASED ON COCKS & FORTEY (1982)
315	455.0	88.40	27.70	-38.10	108	!ENG-AVA
315	600.0	88.40	27.70	-38.10	108	!BULLARD ET AL (1965)
502	245.0	-13.67	31.11	-107.14	802	!CEY/IND
502	600.0	-13.67	31.11	-107.14	802	!SCOTESE AND LAWVER (1986)
809	245.0	72.55	97.64	-39.73	802	!WHT/ANT
809	600.0	72.55	97.64	-39.73	802	!SCOTESE AND LAWVER (1986)
808	245.0	0.00	0.00	0.00	804	!THR/MBL
808	600.0	0.00	0.00	0.00	804	!SCOTESE AND LAWVER (1986)
813	245.0	63.72	-33.05	80.77	802	!CHR/ANT
813	600.0	63.72	-33.05	80.77	802	!SCOTESE AND LAWVER (1986)