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MODERN RADIOLARIAN GLOBAL DISTRIBUTIONS

by

GAIL LOMBARI and GARY BODEN

20 Knight Street, Coventry, RI 02816

and

University of Rhode Island, Kingston, RI 02881

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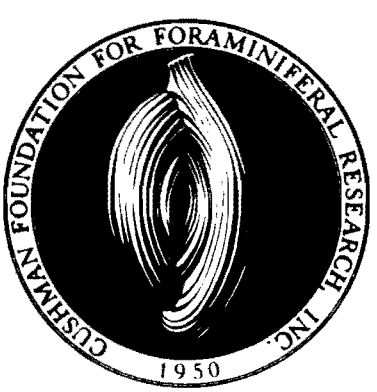

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ABSTRACT

Radiolarian census data have been tabulated from core top samples of the world oceans by CLIMAP project members. These census data produce coherent distribution patterns for each counted species group. The percent of the total population of 70 Recent radiolarian species groups from 621 samples are mapped and contoured. This provides a picture of individual species group frequency and biogeographic range.

INTRODUCTION

The CLIMAP project, a ten year interdisciplinary oceanographic study, has provided today's micropaleontologists with a wealth of data. It is now a widely accepted fact that ocean dwelling plankton follow the distribution of oceanic water masses, which help to control global climate. In comparing the distribution of modern planktonics with those of the past, climatic as well as biogeographic trends may be observed. This study is a survey of the radiolarian census data produced by CLIMAP project members, providing a data base for further investigations. Since radiolaria are found in most of the world's oceans, maps of their distributions are useful in interpreting changing oceanic parameters. The main purpose of this study is to produce a set of maps which can be used as a companion to the Guide To Modern Radiolaria by Nigrini and Moore, 1979.

DATA BASE

In any study which incorporates the work of several investigators, taxonomic considerations are most important. Only species groups which could be consistently recognized are used. The taxonomy strictly follows that of Nigrini and Moore (1979) which was used by CLIMAP project members as a standard reference. Table 1 lists the species which are mapped for this study. Some species could not be mapped for all oceans due to a lack of data or to non-agreement with the standard taxonomy.

Due to the large number of samples (621) used for this study, the contributions of data are listed in Table 2 and the sample locations are found in Table 3. All samples, except those from the Indian Ocean, were prepared according to the method of Moore (1973), and each investigator tabulated 400-600 known specimens in addition to the unknown forms. By dividing the count of each species group by the total number of knowns and unknowns, the percentage that each group contributes to the population can be determined. It is these percentages that are mapped and contoured. Indian Ocean specimens were examined from strewn slides and presence - absence data was recorded. No estimates of abundance or counts of total assemblages are available for the Indian Ocean samples. However, Nigrini (1967, 1968, 1970) and Johnson and Nigrini (1980, 1982) have shown that presence-absence data alone may be sufficient to delineate major water masses when species are discriminately chosen. Presence (P) and absence (A) ranges are recorded on the species' maps.

ACKNOWLEDGEMENTS

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TABLE 1

MAPPED SPECIES GROUPS
(Listed in the same order as they appear
in Nigrini and Moore, 1979)

Collosphaera tuberosa
Disolenia quadrata and zanguebarica
Acrosphaera flammabunda and lappacea
Acrosphaera murrayana
Acrosphaera spinosa
Siphonosphaera polysiphonia
Actinomma antarcticum
Actinomma arcadophorum and medianum
Actinomma haysi
Actinomma leptodermum
Anomalacantha dentata
Cenosphaera coronata
Cenosphaera cristata
Hexacontium entacanthum
Hexacontium laevigatum
Didymocyrtis tetrathalamus
Stylatractus spp.
Axoprunum stauraxonium
Spongurus cf. elliptica
Spongurus pylomaticus
Spongurus (?) sp.
Spongocore puella
Styptosphaera (?) spumacea
Heliodiscus asteriscus and echiniscus
Amphirophalum ypsilon
Euchitonia elegans and furcata
Dictyocorne profunda
Dictyocorne truncatum
Hymeniastrum euclidis
Spongaster tetras
Stylodictya validispina
Porodiscus sp.A
Porodiscus sp.B
Stylochlamydium asteriscus
Spongopyle osculosa
Hexapyle spp.
Tetrapyle octacantha and Octopyle stenozoa
Prunopyle antarctica
Larcopyle buetschlii
Larcospira quadrangula
Lithelius minor
Spirema melonia
Antarctissa antedenticulata
Antarctissa denticulata
Antarctissa strelkovi
Giraffospyris angulata
Liriospyris reticulata
Phormospyris stabilis antarctica
Carpocanistrum spp.
Dictyophimus crisiae and hirundo

TABLE 1 Continued

Pterocanium korotnevi
Pterocanium trilobum
Theocalyptra bicornis
Theocalyptra davisiana
Eucyrtidium acuminatum
Eucyrtidium hexagonatum
Anthocyrtidium ophirense
Anthocyrtidium zanguebaricum
Androcyclas gamphonycha
Lamprocyclas maritalis maritalis
Lamprocyclas maritalis polypora and ventricosa
Lamprocyrtis hannai
Lamprocyrtis nigriniae
Pterocorys minythorax
Pterocorys zancleus
Theocorythium trachelium
Botryostrobus aquilonaris
Botryostrobus auritus/australis grp.
Phormostichoartus corbula
Botryocyrtis scutum

TABLE 2

RADIOLARIAN CENSUS DATA

Ocean	Investigators	No. of Samples
Pacific	Moore (1978)	324
Indian	Johnson and Nigrini (1980 and 1982)	120
Antarctic	Hays (unpublished)	103
North Atlantic	Boden (unpublished)	17
South Atlantic	Morley (1977)	57

TABLE 3

LIST OF SAMPLE SITES
SURFACE SAMPLES

ANTARCTIC OCEAN

Site	Latitude	Longitude	Water Depth
RC8-37	41°19'S	33°13'E	4775 m
RC8-38	41 53	37 49	3784
RC8-39	42 53	114 26	4334
RC8-61	46 32	125 34	4254
RC8-63	51 05	129 58	3442
RC11-67	48 40	42 38 W	3150
RC11-69	48 54	41 00	5492
RC11-71	49 08	37 25	5537
RC11-73	49 04	29 14	5321
RC11-76	54 23	22 08	5229
RC11-77	53 03	16 27	4098
RC11-78	50 52	09 52	3115
RC11-80	46 45	00 03 E	3656
RC11-81	43 54	05 13	4704
RC11-82	43 29	05 43	4609
RC11-83	41 36	09 43	4718
RC11-117	36 29	69 33	4367
RC11-119	40 18	74 34	3709
RC11-120	43 31	79 52	3193
RC12-225	53 39	123 08 W	2964
RC12-265	40 54	26 51	4395
RC12-266	39 49	24 48	3939
RC12-267	38 41	25 47	4144
RC12-269	36 58	32 12	4360
RC12-289	47 54	23 42	4484
RC12-292	39 41	15 29	3541
RC12-293	36 53	13 09	3393
RC12-294	37 16	10 06	3308
RC12-299	34 05	01 00	4296
RC13-242	37 32	03 35	4266
RC13-243	36 54	01 20 E	4790
RC13-244	36 30	03 33	5222
RC13-252	45 05	09 09	4523
RC13-254	48 34	05 08	3636
RC13-255	50 35	02 54	3332
RC13-256	53 11	00 21 W	2525
RC13-259	53 53	04 56	2677
RC13-261	56 07	08 41	4221
RC13-263	53 48	08 13	3389
RC13-273	55 05	11 35 E	4967
RC13-275	50 43	13 26	1984
RC13-276	47 42	14 42	5015
RC13-278	42 04	16 44	4790
RC14-9	39 01	47 53	2692
RC15-91	49 55	15 34 W	3775
RC15-92	48 29	10 20	3378
RC15-93	46 06	13 14	2714
RC15-94	42 54	20 51	3762

Site	Latitude	Longitude	Water Depth
RC15-95	42°57'S	23°30'W	4264 m
RC15-96	42 53	23 55	4426
RC15-97	42 57	25 56	4583
RC15-98	42 56	29 47	4416
E11-1	54 54	114 42	3475
E11-2	56 04	115 06	3109
E11-3	56 54	115 14	4023
E11-4	57 50	115 13	4773
E14-5	57 01	160 06	4517
E14-6	58 03	160 09	4161
E15-6	59 58	101 19	4517
E15-12	58 41	108 48	4572
E15-13	58 56	110 32	4563
E36-14	58 06	150 14 E	3054
E35-7	49 58	128 04	3877
E39-13	45 01	125 59	4535
E39-29	55 06	126 04	4818
E45-63	53 26	114 15	3917
E45-64	52 29	114 05	3822
E45-69	48 51	114 37	3411
E45-71	48 02	114 29	3658
E45-74	47 33	114 26	3804
E45-83	42 35	114 26	4334
E48-20	39 11	89 23	3447
E48-27	38 33	79 54	3283
E49-6	51 00	109 50	3327
E49-7	53 02	110 03	3592
E49-9	56 58	110 05	4327
E49-10	59 01	110 08	4371
E49-17	48 17	90 15	3502
E49-18	46 03	90 09	3253
E49-19	43 53	90 06	3034
E49-23	47 08	95 05	3257
E49-24	47 59	95 03	3217
E49-25	49 23	94 50	3336
E49-33	57 46	100 03	4040
E49-35	54 23	100 02	3773
E49-37	51 42	100 03	3541
E50-11	55 57	104 57	3923
E50-17	63 00	120 03	4082
E53-13	53 47	145 53	2650
V12-53	40 54	20 23 W	3797
V14-65	41 04	07 47 E	4825
V15-133	56 37	53 55 W	4031
V16-65	45 00	45 46 E	1618
V18-166	34 59	27 07 W	4257
V22-106	46 08	10 54	3037
V22-108	43 11	03 15	4171
V24-202	34 21	59 13 E	5512
V27-192	36 34	16 53 W	3087
V27-201	34 46	03 25	4186
V29-104	50 02	16 34 E	4076
V29-105	48 05	17 41	4350
V29-83	41 32	30 57	5059
V29-87	49 06	27 23	5314
V29-88	47 51	26 54	5737

NORTH ATLANTIC OCEAN

Site	Latitude	Longitude	Water Depth
RC9-225	54°59'N	15°24'W	1020 m
V23-22	54 12	45 58	3669
V23-23	56 05	44 33	3292
V23-82	52 35	21 56	3974
V23-83	49 52	24 15	3871
V23-84	46 00	16 55	4513
V26-53	00 18	14 48	4323
V27-14	41 21	46 50	4453
V27-20	54 00	46 12	3510
V27-110	56 54	18 30	1264
V27-114	55 03	33 04	2532
V27-116	52 50	30 20	3202
V27-141	35 29	24 56	4506
V27-178	05 06	26 09	4327
V29-179	44 01	24 32	3331
V29-206	64 54	29 17	1624
V30-105	54 31	36 30	2758

SOUTH ATLANTIC OCEAN

RC8-18	24°04'S	15°17'W	3977
RC8-34	32 37	11 41 E	4521
RC11-26	28 35	30 04 W	2340
RC11-36	33 52	35 16	4222
RC11-65	47 02	43 41	5435
RC11-69	48 54	41 00	5492
RC11-78	50 52	09 52	3115
RC11-80	46 45	00 03	3656
RC12-241	43 28	57 40	3499
RC12-269	36 58	32 12	4360
RC12-274	32 34	46 52	3802
RC12-289	47 54	23 42	4484
RC12-294	37 16	10 06	3308
RC13-206	04 28	02 54 E	5194
RC13-218	10 38	09 33	4145
RC13-229	25 30	11 18	4190
RC13-239	32 56	07 26 W	4177
RC13-242	37 32	03 35	4266
RC13-252	45 04	09 09 E	4523
RC13-255	50 34	02 54	3332
RC13-256	53 11	00 21 W	2525
RC13-273	55 04	11 34 E	4967
RC13-275	50 43	13 26	1984
RC15-91	49 53	15 34 W	3775
RC15-166	00 43 N	40 30	3768
V16-34	17 02 S	16 13	3530
V17-152	03 09	19 23	5247
V18-166	34 59	27 07	4527
V-18-182	32 30	15 01 E	2941
V19-248	24 34	04 50	3321

Site	Latitude	Longitude	Water Depth
V9-23	05°53'S	21°02'W	5760 m
V12-78	04 23	00 11	4232
V15-166	02 46	34 17	3979
V19-267	13 23	02 13 E	5585
V20-203	28 39	12 19	3860
V22-140	17 28	05 11 W	4433
V22-168	14 38	07 34	4625
V22-170	08 46	14 17	4131
V22-175	05 01	15 39	2950
V22-178	03 18	16 26	3290
V22-180	00 32	17 16	4338
V22-182	33 37	02 21 E	3614
V24-228	34 55	07 48 W	4085
V24-230	34 13	11 59	3543
V26-55	11 36	15 34	3457
V26-63	23 58	37 57	3619
V26-99	01 28	32 43	4632
V27-181	00 04	25 30	3601
V27-191	33 03	18 43	3947
V27-206	31 22	01 41	4748
V27-217	27 49	01 32 E	4609
V27-231	03 28	07 26	4252
V27-232	00 14	07 32	2515
V27-238	06 28	03 43 W	4813
V27-240	02 03	05 00	5115
V30-33	02 58	31 14	4477
V31-128	02 53	26 23	5372
PACIFIC OCEAN			
AHF10626	32°51'N	119°33'W	1400 m
ANTP226G	18 35 S	176 45	2472
ANTP231G	17 09 N	175 54	2238
CM945	53 54	149 00 E	1070
CM946	54 38	151 15	460
DWBG-2	21 27	126 43 W	4370
E44-24	56 02 S	119 54 E	2405
E44-26	54 01	119 46	2325
E44-27	53 02	119 44	1917
E44-31	47 32	120 14	1956
E45-29	44 53	106 31	2088
E45-31	46 04	107 14	1818
E45-44	58 29	114 07	2428
E45-46	59 45	114 57	2415
E45-57	57 04	114 04	2436
E45-77	46 27	114 25	2081
E45-78	45 02	114 21	2203
E45-81	43 57	114 22	2327
E45-83	42 35	114 26	2370
E47-4	64 07	80 24	1967
E47-9	66 23	78 01	1330
E48-20	39 11	89 23	1885
E48-24	39 06	82 10	1887
E49-3	45 06	109 55	2289
E49-10	59 01	110 08	2352
E49-11	59 39	110 09	2391

Site	Latitude	Longitude	Water Depth
E49-17	48°17'	90°15'	1916 m
E49-18	46 03	90 19	1779
E49-21	42 11	94 53	1799
E49-25	49 23	94 50	1824
E49-32	58 22	98 28	2265
E49-38	50 51	100 05	1980
E49-39	50 04	100 13	1858
E49-14	48 15	100 03	1665
E49-46	44 04	100 01	1973
E49-48	42 27	100 02	1999
E49-50	40 37	99 55	2219
E50-6	48 02	105 15	1671
E50-9	52 01	105 01	1770
E50-15	60 04	109 59	2335
E50-16	61 03	114 49	1000
E54-11	57 47	81 01	4370
FANBG16	37 11 N	124 34 W	3850
FANHMS2G	30 17	118 14	2970
FAN511G	37 01	125 21	4350
HILO-2G	28 15	127 37	4560
HILO-3G	24 47	134 31	4700
HILO-5G	22 57	143 58	4850
:FGS-48G	38 35	127 45	4617
LFGS-50G	36 19	125 56	4599
LFGS-68G	36 33	124 06	3922
LSDH-68PG	11 19 S	158 03 E	3080
LSDH-76PG	6 40	163 13	3560
LSDH-102G	23 15 N	130 58 W	4850
LSDH-103G	27 29	125 49	4450
MEN-3G	33 58	122 34	4250
MEN-4G	34 02	125 15	4640
MEN-5G	36 04	125 04	4460
MEN-34G	32 32	117 31	1240
MFZ-1GC	33 36	131 43	5100
MFZ-2GC002	31 47	136 23 E	5100
MFZ-6PG012	28 36	155 18	2008
MSN-3G	20 01	135 12 W	5220
MSN-155G	15 09	137 06	4992
MSN-158G	29 07	122 57	4075
MUK-9G	53 15	156 57	4540
MUK1-1-1	51 15	145 40	4214
NOVA-A28	9 49 S	145 23 E	1774
NOVA-A29	10 27	145 25	1013
NOVA-A30	10 15	145 30	1161
NOVA-A31PG	12 17	145 50	3558
NOVA-A32PG	14 08	152 55	4582
NOVA-A36	21 41	67 23	2148
NOVA-A37	21 41	172 14	3125
NOVA-A40PG	23 00	164 58	3617
NOVA-A48	28 12	158 13	2220
NOVA-A50	28 08	158 19	2253
NOVA-A64G	27 37	168 59	3182
NOVA-H20	12 53	176 39	3063
NOVA-H34	12 34	175 19	2629

Site	Latitude	Longitude	Water Depth
NOVA-HV9GO	28°24'	159°15'	3403 m
NOVA-HV15G	28 10	171 12	3489
OPR-47615	31 34	153 33	3770
OPR-47620	33 30	165 02	3040
OPR-476184	33 09	159 27	3610
OPR-476223	33 32	166 32	2860
PAP 2G	23 35 N	119 53 W	4169
RC8-78	44 47 S	175 46	1756
RC8-79	46 19	172 51	4949
RC8-80	48 18	162 54	4997
RC8-81	47 57	159 03	5130
RC8-82	46 56	154 15	4308
RC8-83	45 58	149 45	4738
RC8-85	41 32	133 14	5022
RC8-87	39 28	125 30	4583
RC8-89	36 23	118 06	3900
RC8-93	29 22	105 14	3157
RC8-96	13 28	92 35	3853
RC9-86	23 33	72 29	4208
RC9-087	23 05	76 21	4508
RC9-106	44 13	179 33 E	931
RC9-107	44 13	179 34	902
RC9-108	45 46	177 22 W	4314
RC9-109	45 08	174 34	3351
RC9-110	42 52	172 01	1917
RC9-111	39 51	168 45	4777
RC9-113	36 43	167 03	4751
RC9-114	33 41	165 03	5453
RC9-115	31 23	163 43	5376
RC9-117	26 26	166 47	5634
RC9-118	24 31	168 45	5720
RC9-125	31 37	170 13 E	4125
RC9-131	45 59	156 54	4603
RC9-132	44 47	152 48	4709
RC9-134	44 05	143 47 W	4570
RC10-094	5 40 N	127 20	4356
RC10-106	4 16 S	146 28	4590
RC10-107	8 84	146 27	5127
RC10-108	12 56	148 19	4200
RC10-117	6 49	165 22	3523
RC10-131	14 32	157 58 E	2933
RC10-132	15 41	154 36	4502
RC10-134	13 17	153 07	4603
RC10-135	12 25	153 21	3902
RC10-136	10 22	154 32	3977
RC10-138	4 05	154 34	3563
RC10-139	3 02	156 26	1781
RC10-140	2 39	156 59	1679
RC10-141	1 08	156 18	1904
RC10-142	0 48	155 14	2294
RC10-143	0 20	153 59	3074
RC10-153	14 48 N	154 03	5460

Site	Latitude	Longitude	Water Depth
RC10-159	31°13'	162°19'	5894 m
RC10-160	32 39	159 50	4621
RC10-161	33 05	158 00	3587
RC10-167	33 24	150 23	6092
RC10-175	34 35	159 10	4014
RC10-178	37 48	172 20	5808
RC10-180	41 43	175 08	5663
RC10-181	44 05	176 50	5698
RC10-182	45 37	177 52	5561
RC10-184	49 31	179 04	4986
RC10-206	47 13	170 26 W	5479
RC10-217	50 57	146 05	4338
RC10-234	28 38	129 06	4281
RC10-235	25 50	129 25	4737
RC10-245	11 13	098 73	3680
RC10-249	7 19	087 03	3233
RC10-250	6 17	084 19	1734
RC11-166	43 46	171 14 E	5841
RC11-195	31 51	139 59 W	4934
RC11-198	21 31	139 60	5378
RC11-208	5 21	139 58	4720
RC11-209	3 39	140 04	4400
RC11-211	1 59	139 43	4319
RC11-230	8 48 S	110 48	3259
RC11-232	11 20	106 58	3762
RC11-234	13 19	100 57	3645
RC12-27	7 74 N	083 47	1683
RC12-29	9 44	088 02	3274
RC12-32	12 99	092 64	4034
RC12-87	2 29 S	163 96	5243
RC12-100	26 01	174 38	4171
RC12-101	26 01	174 37	4356
RC12-103	26 00	179 44 E	2401
RC12-104	26 04	176 42	4330
RC12-105	26 00	179 44	4404
RC12-106	26 01	174 01	4669
RC12-109	25 53	157 52	2930
RC12-110A	26 00	154 54	1942
RC12-114	24 46	170 26	3997
RC12-115	22 05	173 16	1875
RC12-116	19 28	175 06	3136
RC12-117	16 25	174 30	2734
RC12-118	12 59	174 01	3233
RC12-166	38 49 N	145 45	5243
RC12-205	8 28 S	171 31 W	4846
RC12-210	24 14	177 36	1529
RC12-213	31 31	170 45	5700
RC12-214	34 44	171 22	5760
RC12-215	35 28	167 54	4912
RC12-217	37 28	160 27	4942
RC12-218	39 30	157 42	4826
RC12-219	41 42	154 37	5004
RC12-220	43 42	151 17	5293
RC12-221	46 25	146 03	5024

Site	Latitude	Longitude	Water Depth
RC12-223	49°48'	138°10'	4572 m
RC12-224	51 73	133 41	4663
RC12-225	53 40	123 08	2964
RC12-227	55 14	111 56	3802
RC12-228	55 35	100 18	4402
RC12-230	55 03	88 57	4685
RC12-232	56 00	77 17	4296
RC12-401	40 49 N	148 08 E	5415
RC12-402	40 11	150 44	5332
RC12-410	32 23	161 19	5693
RC12-411	35 48	163 43	5550
RC12-412	40 41	166 59	5656
RC12-413	43 17	166 54	5015
RC12-415	41 17	164 09	4872
RC12-416	36 24	166 44	5319
RC12-417	38 06	170 01	3849
RC12-419	40 06	171 30	6179
RC12-425	57 27	170 27	1531
RC13-23	00 04	175 06 W	5218
RC13-35	08 28 S	178 01 E	4740
RC13-39	15 53	176 50 W	2116
RC13-40	17 24	176 41 E	2798
RC13-42	13 26	173 39 W	4729
RC13-43	12 15	171 41	4872
RC13-63	1 35 N	153 07	4420
RC13-68	7 20 S	152 16	4043
RC13-98	16 59	86 56	4437
RC13-99	16 31	84 34	4684
RC13-100	16 07	81 17	4570
RC13-105	6 58	86 01	4173
RC13-111	0 32	98 41	3252
RC13-117	0 19	106 54	3733
RC14-098	36 02 N	143 35 E	3871
RC14-099	36 58	147 56	5652
RC14-100	37 46	151 31	5892
RC14-103	44 02	152 56	5365'
RC14-104	40 19	154 40	5579
RC14-105	39 41	157 33	5630
RC14-106	45 50	155 42	4823
RC14-108	48 10	159 26	5446
RC14-109	47 39	163 27	5821
RC14-112	50 15	164 54	5532
RC14-114	51 38	161 55	5398
RC14-115	53 02	163 46	3757
RC14-125	60 44	175 44	2439
RC14-126	60 00	173 21	3085
RC14-141	57 21	164 26	3111
RC14-145	56 12	165 27	3704
RC14-148	54 27	177 44	2525
RC15-7	36 03	133 46 W	5209
RC15-30	23 30 S	141 09	4546
RC15-31	25 07	138 26	4212
RC15-32	26 47	135 24	4248
RC15-37	27 04	129 12	3860

Site	Latitude	Longitude	Water Depth
RC15-40	27°20'	127°51'	3720 m
RC15-55T	31 06	74 56	4294
RIS-3G	24 15 N	117 21	3935
RIS-5G	20 19	117 29	4015
RIS-125G	28 27	126 38	4550
RIS-127G	28 47	123 36	4300
S68-FFC1	16 00	157 90	5000
S68-PC4	9 07 S	173 50	5288
S68-PC8	7 14	159 29	2172
S68-PC16	1 36	158 46 E	2016
S68-PC22	4 20	172 04	3397
SCAN-5PG	41 03 N	130 04 W	3268
SCAN-8PG	28 12	140 01	4792
TRI-8PG	19 06	112 57	3463
TRI-11G	23 19	118 26	4025
TRI-12G	25 58	118 26	4180
TRI-14G	28 15	118 04	4112
TRI-10G	22 27	119 10	4121
V15-33TW	6 08 S	82 41	4040
V15-46TW	12 51	84 28	4385
V15-56TW	34 22	77 45	4137
V16-127	54 30	163 19	4471
V16-129	59 22	142 53	3651
V16-131	59 19	17 24	5029
V16-133	61 57	95 03	5062
V16-134	61 54	91 15	5138
V18-311	3 37	127 41	4559
V18-314	1 14	122 55	4495
V18-319	4 14 N	117 00	4160
V18-324	8 46	107 09	3517
V18-328	10 16	103 05	3239
V18-337	14 31	96 18	3891
V18-349	6 04	85 43	1818
V19-29	3 35 S	83 56	3157
V19-30	3 23	83 31	3091
V19-36	11 59	81 31	4731
V19-38	12 30	86 39	4276
V19-39	12 43	89 08	4173
V19-40	13 13	92 53	3693
V19-41	14 06	96 12	3248
V19-47	17 00	111 12	3422
V19-64	16 56	121 12	3570
V19-65	16 65	124 38	3867
V19-068	15 37	131 58	4199
V19-80	18 08	169 21	4839
V19-87	12 15	173 30	4621
V19-88	11 05	174 53	4497
V19-89	9 48	176 26	4212
V19-090	9 11	177 10	5358
V19-102	8 47 N	160 43 E	5017
V19-105	11 58	156 40	5810
V19-108	12 19	149 10	5879
V19-109	11 51	142 00	4294
V19-112	11 40	135 52	4773
V20-029	8 09	117 06 W	4116

Site	Latitude	Longitude	Water Depth
V20-47	14° 23'	145° 21'	4986 m
V20-48	14 26	145 21	4640
V20-057	17 21	153 52	5106
V20-64	23 21	155 52	4204
V20-66	28 00	151 10	5338
V20-68	30 58	146 48	5788
V20-74	41 04	132 22	3749
V20-85	44 54	143 37	3817
V20-88	40 11	151 39	5081
V20-095	33 53	164 47	5804
V20-119	47 57	168 47 E	2739
V20-120	47 24	167 45	6216
V20-121	46 58	164 16	5859
V20-122	46 34	161 41	5563
V20-123	46 15	157 55	4903
V20-124	45 50	154 30	5534
V20-126	42 09	155 52	5515
V20-127	40 17	156 55	5583
V20-128	38 47	157 24	5612
V20-129	37 41	156 35	5766
V20-131	36 20	151 00	5858
V20-136	32 55	142 32	6306
V20-137	29 51	137 58	3919
V20-138	28 52	135 33	4244
V20-146	5 55	135 31	4702
V21-029	0 57	89 21 W	712
V21-030	1 13 S	89 41	617
V21-034	5 22	93 22	3081
V21-036	8 18	96 14	3649
V21-040	5 31	106 46	3182
V21-042	4 20	112 22	4142
V21-044	6 10	116 59	4535
V21-45	7 13	119 90	4199
V21-48	9 51	126 37	3922
V21-54	18 58	137 36	4071
V21-55	21 07	138 49	4268
V21-56	23 47	140 26	4318
V21-57	25 36	142 23	4343
V21-65	23 58 N	176 51	5365
V21-67	24 58	176 16 E	5879
V21-70	27 05	166 04	5954
V21-071	27 54	162 31	5013
V21-073	29 28	154 36	5872
V21-074	29 51	150 50	6015
V21-075	30 04	147 41	6119
V21-080	34 02	138 23	4400
V21-083	27 54	140 03	3702
V21-90	23 57	144 23	5841
V21-097	23 41	136 05	4868
V21-099	23 32	132 14	4158
V21-101	23 29	131 01	5293
V21-115	19 52	132 08	5484
V21-126	13 00	127 03	5075

Site	Latitude	Longitude	Water Depth
V21-135	21°28'	130°03'	5929 m
V21-138	26 02	139 29	4418
V21-139	27 47	144 18	6009
V21-141	30 48	154 04	5821
V21-145	34 03	164 50	6088
V21-146	37 41	163 02	3968
V21-147	39 33	162 05	5256
V21-148	42 05	160 36	5477
V21-151	51 16	163 38	5055
V21-162	58 33	177 13 W	2318
V21-163	58 02	176 07	3270
V21-177	33 52	160 08	6022
V21-180	28 24	159 11	5676
V21-189	16 49	154 11	4947
V21-203	4 23	110 53	3928
V21-206	1 37	103 10	3334
V21-207	0 01	100 17	3352
V24-040	3 04	97 08	3204
V24-046	1 40	105 09	3574
V24-049	0 49	112 44	3878
V24-051	1 40	120 20	4409
V24-052	1 54	124 49	4702
V24-054	1 51	131 42	4479
V24-056	2 14	136 15	4341
V24-064	4 10	159 04	3933
V24-065	6 40	157 32	4726
V24-071	19 18	161 19	5092
V24-073	16 29	166 47	5234
V24-074	14 53	169 51	5669
V24-076	13 18	172 55	5680
V24-078	10 28	177 46	5312
V24-087	19 04	161 23 E	4879
V24-089	20 52	165 07	5544
V24-095	27 36	177 46	5287
V24-100	16 08	179 44	5330
V24-104	4 51	170 55	4501
V24-112	7 56	153 22	4964
V24-113	11 19	152 05	5861
V24-114	14 42	150 33	5993
V24-115	17 55	149 09	5544
V24-117	18 36	142 22	3706
V24-121	18 30	128 23	5431
V24-122	18 32	125 28	4870
V24-139	3 31	132 26	3350
V24-141	2 52	132 28	4383
V24-143	2 04	141 18	3191
V24-146	1 50	144 53	4526
V24-147	7 40	151 25	4918
V24-150	2 12 S	155 42	1849
V24-152	3 18	153 32	4422
V24-153	4 30	153 28	4103
V24-154	12 03	151 14	4235
V24-155	12 52	150 12	4559

Site	Latitude	Longitude	Water Depth
V24-156	13°49'	149° 04'	4519 m
V24-158	15 55	146 51	1754
V24-159	16 33	146 24	1403
V24-160	18 07	147 36	1007
V24-163	15 27	153 34	4656
V24-164	13 52	153 58	4526
V24-165	15 21	152 21	4063
V24-168	16 20	146 52	1785
V24-170	13 31	146 53	2243
V24-171	14 18	145 51	2714
V24-173	11 46	148 06	3360
V24-174	11 07	150 52	1004
V24-175	11 25	150 18	2618
V24-176	12 14	150 49	4422
V24-177	13 12	149 40	4535
V24-178	14 06	148 50	3997
V24-182	17 36	147 30	1053
V24-183	15 20	146 15	1099
V24-184	12 52	146 12	2992
V28-234	07 13	158 98	2719
WAH-8F2	0 03 N	147 98 W	4308
Y69-71M	0 06	86 29	2740
Y69-73M	1 27	86 56	2707
Y69-80M	1 01 S	91 51	3408
Y69-103P	0 05	82 26	2220
Y69-104M	2 18	81 31	3892
Y69-106M	2 59 N	86 33	2780
Y70-1-3P	45 00	136 05	4155
Y70-1-6	45 00	142 35	4583
Y70-2-34	54 01	154 47	4575
Y70-2-41	57 10	141 04	3384
Y70-4-56	53 01	141 41	3805
Y70-4-59	50 23	139 15	3774
Y70-5-62	50 30	132 42	3214
Y70-5-63	50 28	132 48	2896
Y70-5-64	49 26	132 46	2993
6609-19	43 43	128 41	3503
6705-2	46 43	126 03	2787
6705-6	46 25	126 24	2730
6808-8	46 42	131 01	2539
6910-2PG	41 16	127 01	2615
7-TOW72G	20 24 S	176 46	2730
7-TOW105	15 15	176 49	2163
Y70-5-67	48 17 N	132 53	3382
Y71-6-4P	14 37 S	79 07	4518
Y71-6-12	16 27	77 34	2734
Y71-6-14	17 40	75 47	4625
Y71-6-18MG2	16 56	74 21	7280
Y71-7-27	10 15	82 05	4569
Y71-7-28	11 01	85 01	4491
Y71-7-30	10 03	88 41	4237
Y71-7-32	10 45	93 06	3850
Y71-7-33	10 0	92 40	4098

Site	Latitude	Longitude	Water Depth
Y71-7-35	9° 57'	97° 56'	4010 m
Y71-7-36	10 08	102 51	4541
Y71-7-38	10 46	106 20	3691
Y71-8-70	8 42	82 13	4378
Y71-8-77	8 11	81 36	5121
Y71-9-84	5 00	85 57	4010
Y71-9-85	5 02	87 28	3858
Y71-9-86	5 05	90 47	3877
Y71-9-87	5 03	93 05	3858
Y71-9-88	5 00	99 27	3650
Y71-9-89	5 59	111 02	3990
Y71-9-91	5 57	114 52	3512
Y71-10-116	28 27 N	116 56	3447
ZAP-2G	17 52	109 31	3640
ZTS-39G	28 40	144 55	5048
ZTS-40G	30 12	143 17	5050
ZTS-41G	31 01	137 41	4613
ZTS-42G	31 10	135 57	4672
ZTS-44G	31 18	133 00	4569
6509-25A	43 35	129 12	3391

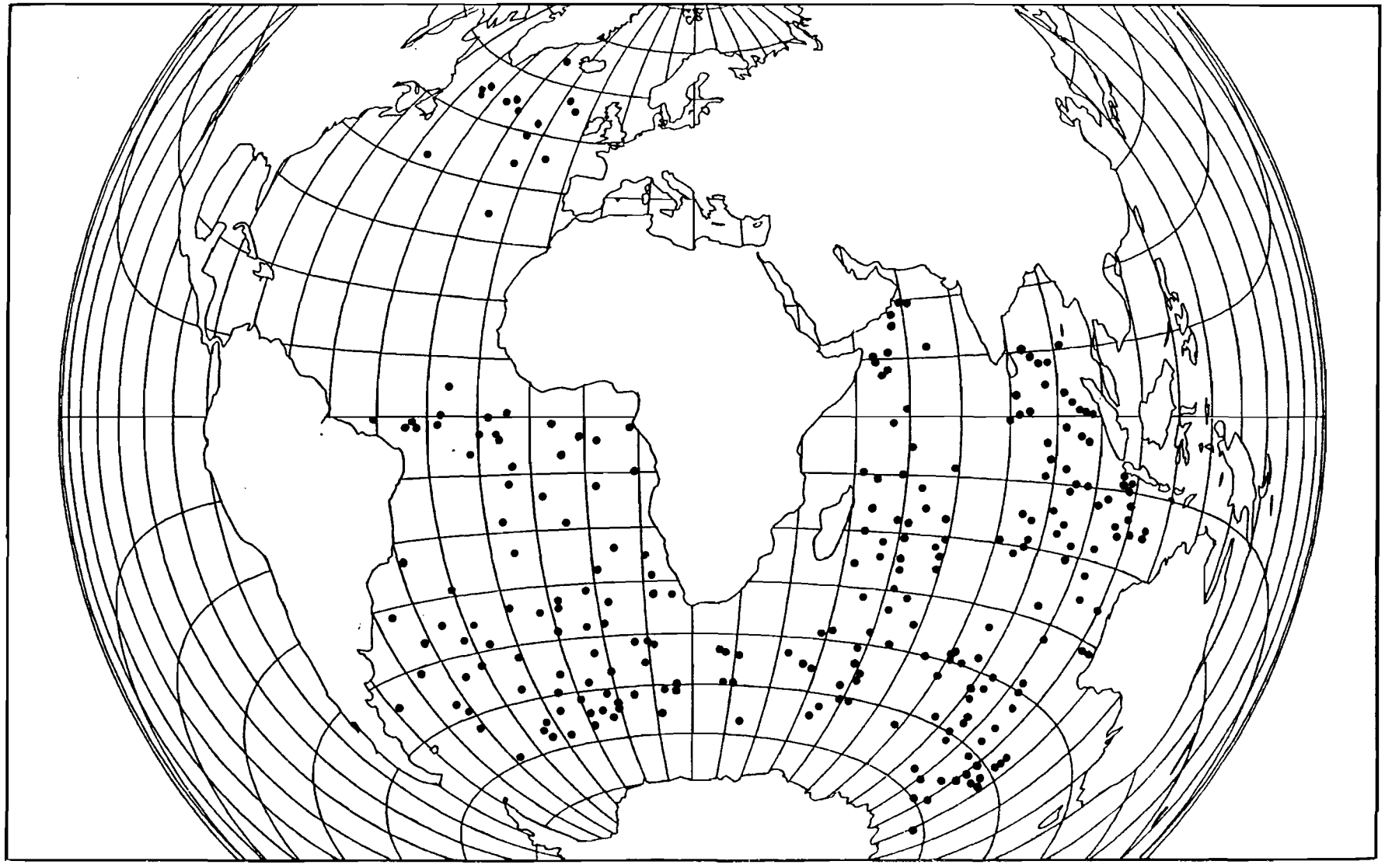
WESTERN INDIAN OCEAN

RC9-161TW	19° 34'N	59° 36'E	3332 m
AII15-596FF	18 56	61 23	3694
AII15-597FFA	17 26	57 11	1805
AII15-602FF	14 56	57 21	3357
RC9-160P	12 03	63 09	4268
V14-103P	11 26	56 14	4232
AII15-8PC	10 15	53 10	4173
AII15-14PG	9 02	53 40	4852
CHN100-26PG	7 48	56 12	4680
CHN100-29PG	6 53	43 41	5106
CHN100-40PG	1 37	59 40	5426
ANTP-150G	1 43 S	57 32	4456
LSD-H-12G	5 23	60 02	4100
DODO-173G	8 19	69 01	3977
AII93-11PC	9 28	52 10	4154
ANTP-142PG	10 17	58 58	2763
AII93-5PC	11 01	54 32	4599
DODO-121PG	12 16	62 50	3990
AII93-4PC	15 17	53 31	4641
DODO-163G	15 18	63 42	3301
DODO-157G	17 40	63 23	3196
CHN43-16PG	18 04	58 24	3869
DODO-117PG	18 21	62 04	3398
AII15-735HC	20 02	52 29	4936
V18-199P	20 31	61 55	3299
DODO 151G	21 14	62 26	3103
LSD-A-119G	22 02	57 33	4770
DODO-149V	22 28	68 03	3141
RC17-93P	23 41	69 41	2665
V29-53TW	24 16	61 54	4973
LSD-A-120G	24 30	57 29	4990

Site	Latitude	Longitude	Water Depth
RC17-91P	25°21'	69°29'	3444 m
RC14-17TW	25 49	52 16	5013
DODO-130G	26 56	61 49	4700
LSD-A-122G	29 54	61 53	4400
DODO-132PG	31 02	64 52	4805
AII15-766HC	32 00	55 07	4417
LSDA-125G	33 14	61 43	4800
RC11-116P	34 55	67 35	4548
RC14-13TW	37 23	59 19	5128
LSDA-126G	39 46	64 00	4980
RC11-104TW	40 55	57 39	4885
RC11-102TW	43 42	58 48	4709
RC11-100P	44 50	60 52	4742
RC11-99P	46 31	61 02	4449
RC17-62TW	47 35	57 52	4426
EASTERN INDIAN OCEAN			
TSDY-16PG	9°57'N	92°23'E	1262 m
CIRCE-39G	9 48	83 30	3644
CIRCE-41PG	8 00	85 39	3745
ANTIPO-159PG	7 25	86 11	3833
CIRCE-42G	6 55	89 02	3741
CIRCE-44G	4 11	88 35	4057
DODO-201G	2 59	91 41	4131
RC17-128TW	2 57	80 07	4366
ANTIPO-170PG	1 30	93 21	4326
RC17-132TW	0 52	84 33	4496
ERDC-34PG	0 38	96 15	4650
INDP-41PG	0 14	97 21	2649
INDP-39PG	0 14	97 20	2938
ANTIPO-155P	0 22 S	82 07	4643
RC17-130TW	0 56	80 09	4541
ERDC-27P	1 38	92 30	4335
DODO-226G	2 55	96 24	4743
DODO236G	4 04	98 37	4875
RC17-136TW	4 47	88 44	4201
V34-56P	6 29	89 05	2769
V34-46P	8 08	92 12	5273
ERDC-39PG	8 29	108 01	3525
MSN-37G	8 51	109 37	3300
RC14-31TW	9 02	88 34	3972
MSN-36G	9 23	109 17	1582
MSN-35G	10 27	109 46	6550
MSN-40G	10 30	98 59	5461
MSN-41G	10 31	94 58	5266
MSN-38G	11 18	103 33	5527
MSN-42G	11 33	94 41	5554
MSN-34G	11 39	109 33	4612
MSN-39G	12 22	101 26	4771
MSN-33G	13 20	109 36	4703
LSDA-143PG	13 53	90 48	5320
LSDH-53G	14 13	114 43	5660
LSDH-51G	14 52	107 16	5637

Site	Latitude	Longitude	Water Depth
DODO-56PG	15°31'	113°45'	5377 m
DODO-86PG	15 32	85 04	4755
DODO-58PG	15 42	110 37	5710
DODO-73PG	15 58	94 39	4740
DODO-59PG	16 11	108 21	5350
DODO-94G	16 17	86 11	5145
ANTIPO-173PG	16 51	93 50	5612
DODO-63PG	17 48	102 42	5948
DODO-71PG	18 30	96 11	5840
MSN-46G	18 41	86 44	4500
DODO-108PG	19 29	80 59	4960
DODO-103PG	20 15	86 11	5485
LSDA-140G	20 43	97 12	5690
DODO-104PG	20 47	85 29	4206
V34-43PC	22 17	103 40	2712
LSDA-139G	25 05	104 14	5215
RC11-145PC	25 29	110 01	3869
V16-95TW	28 01	95 11	4071
LSDA-136G	31 30	114 22	3860
LSDA-137G	31 45	113 65	4545
LSDH-33G	32 06	100 20	2455
V16-89PC	33 01	85 47	3416
RC11-123PC	37 59	86 39	3766
ELT48-26TC	38 44	80 43	3303
ELT45-21PC	38 59	103 43	4417
ELT48-24TC	39 06	82 10	4190
ELT48-22TC	39 05	85 25	3449
ELT49-20TC	40 05	94 55	3546
ELT45-24PC	40 09	104 11	4147
ELT49-21TC	42 11	94 53	3290
ELT45-27TC	43 18	105 33	3862
RC8-50P	44 46	92 25	3219
ELT50-5TC	46 07	105 02	3526
ELT49-23TC	47 08	95 05	3257
ELT50-6TC	48 02	105 15	3106
ELT54-1TC	48 07	86 11	3936
ELT49-25TC	49 23	94 50	3336
ELT29-26TC	51 22	95 05	3583

SAMPLE LOCALITIES



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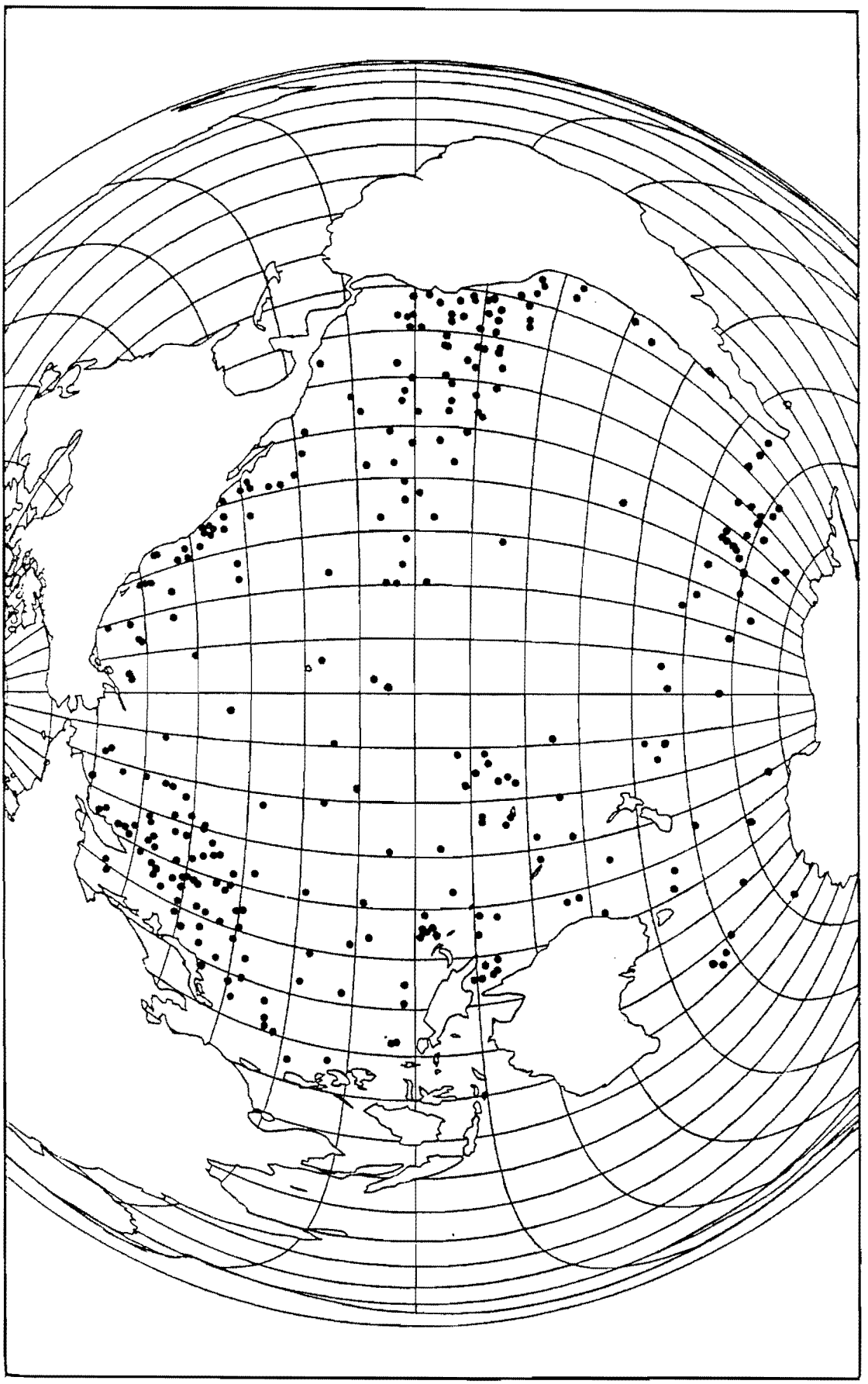
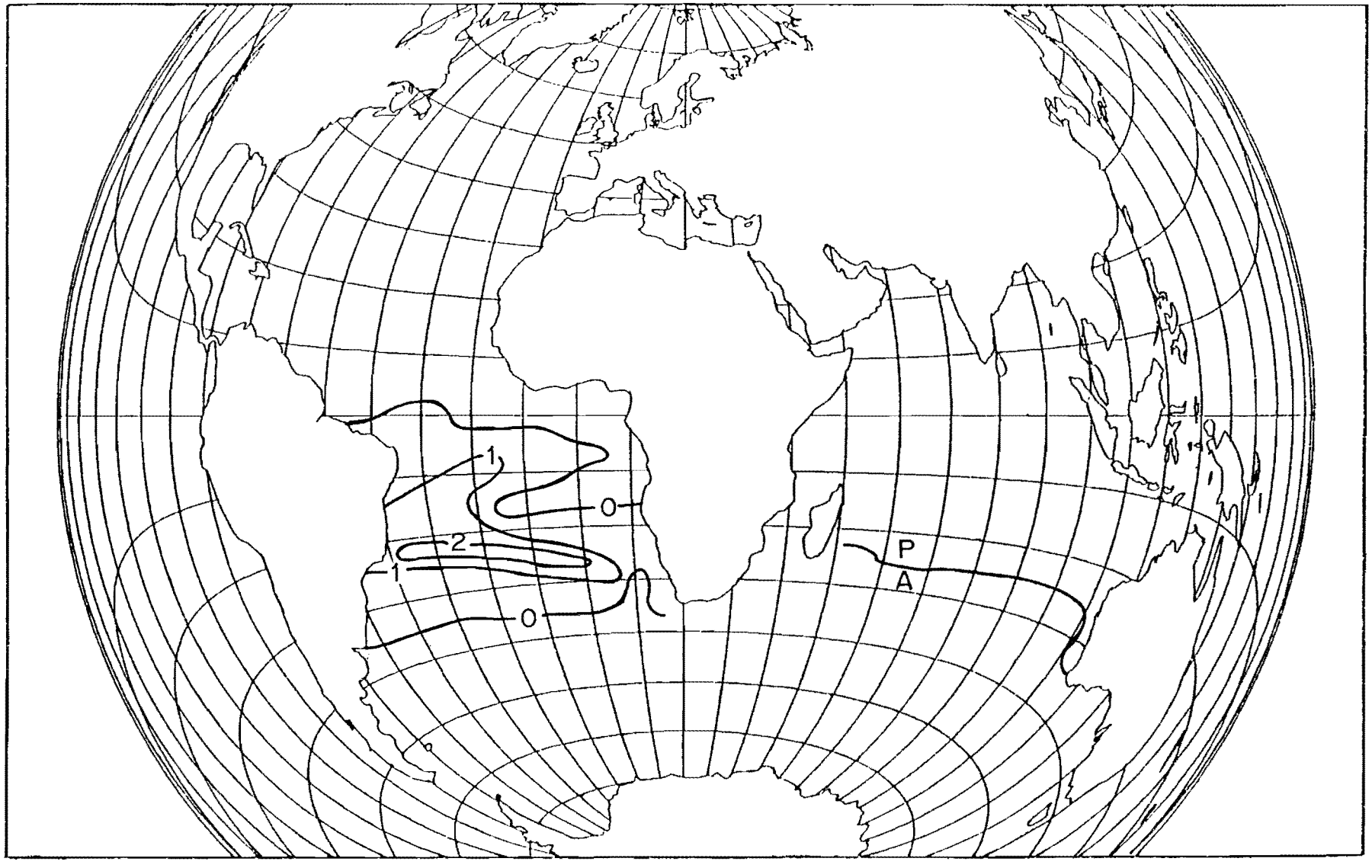
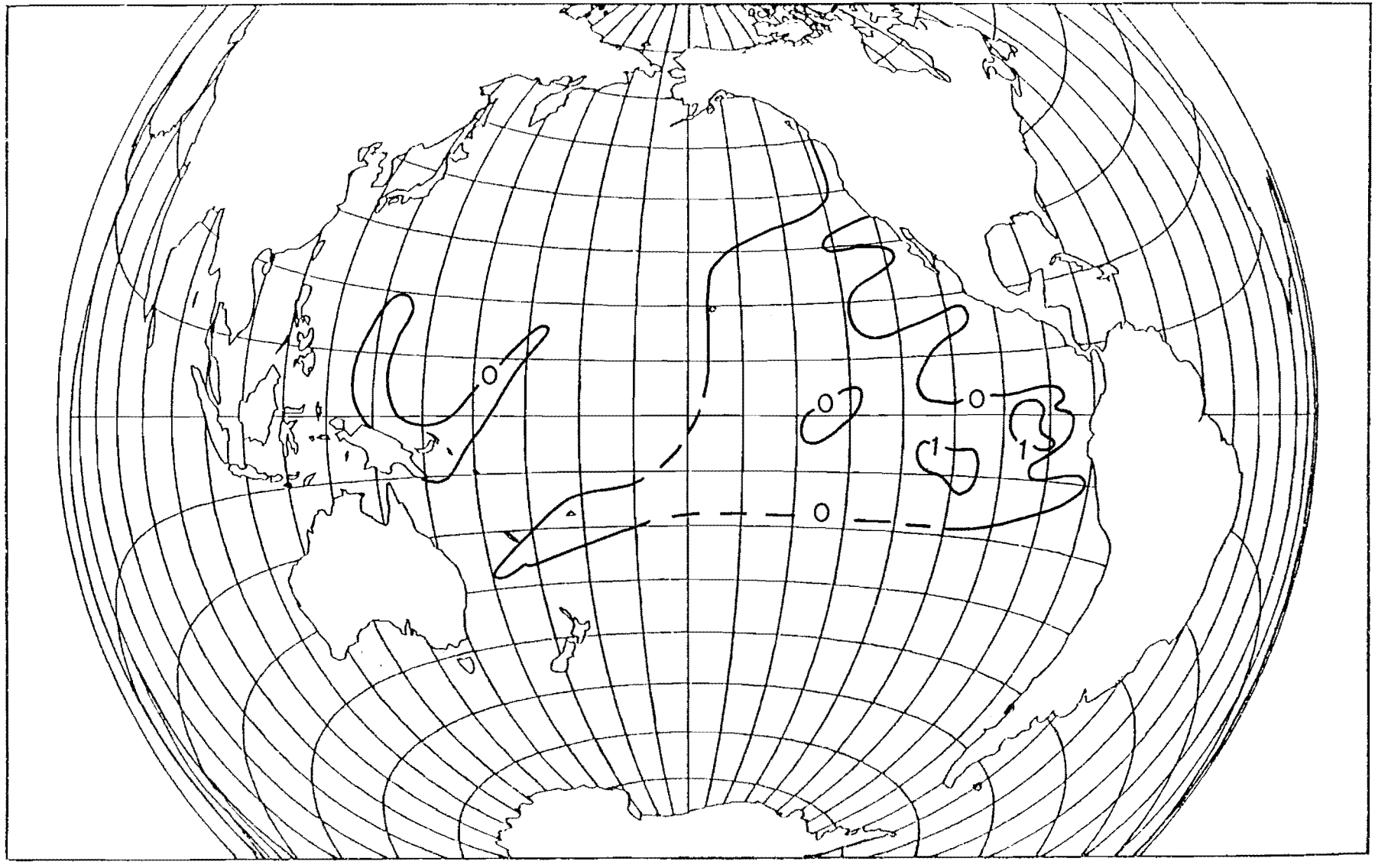
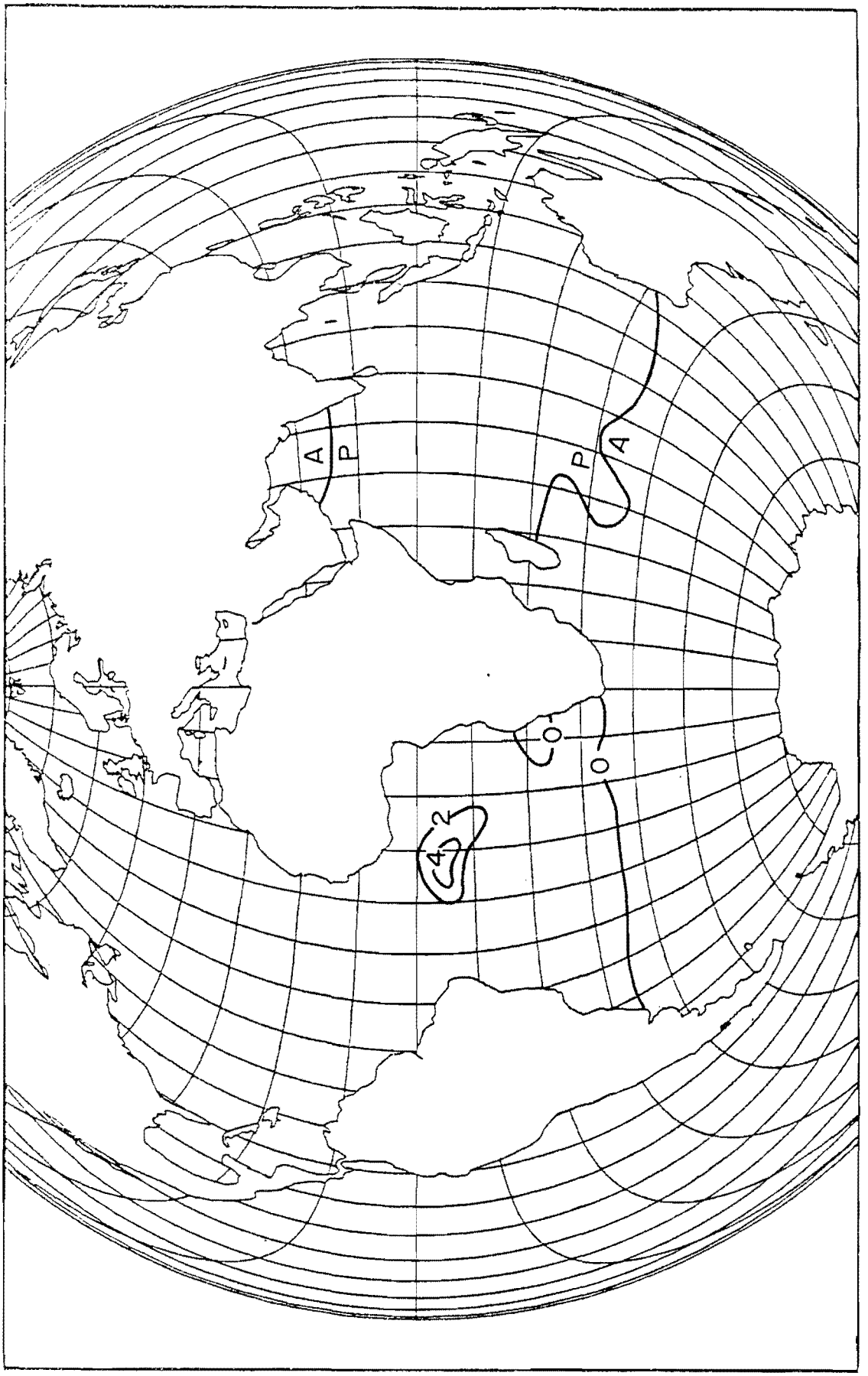




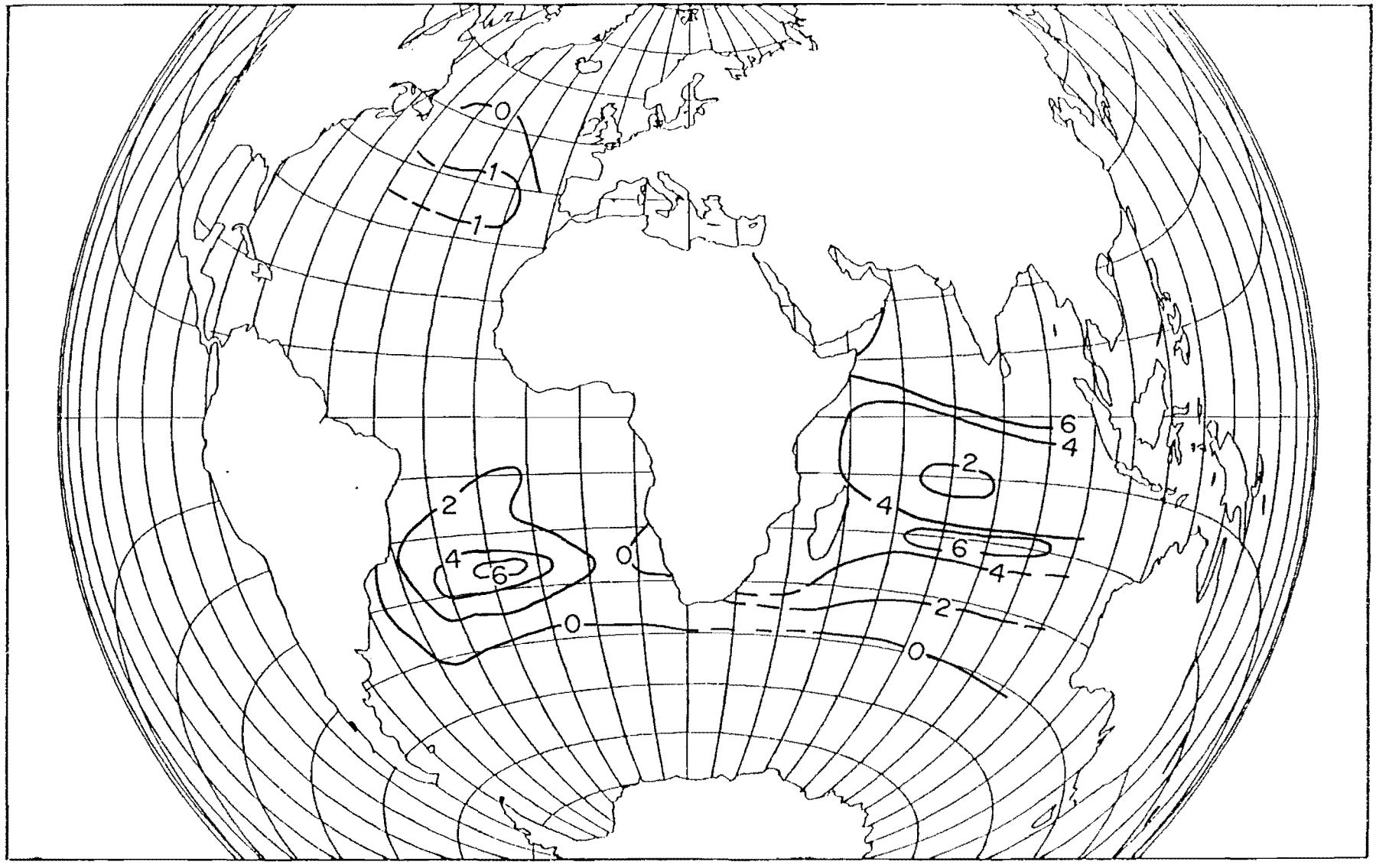
Collosphaera tuberosa



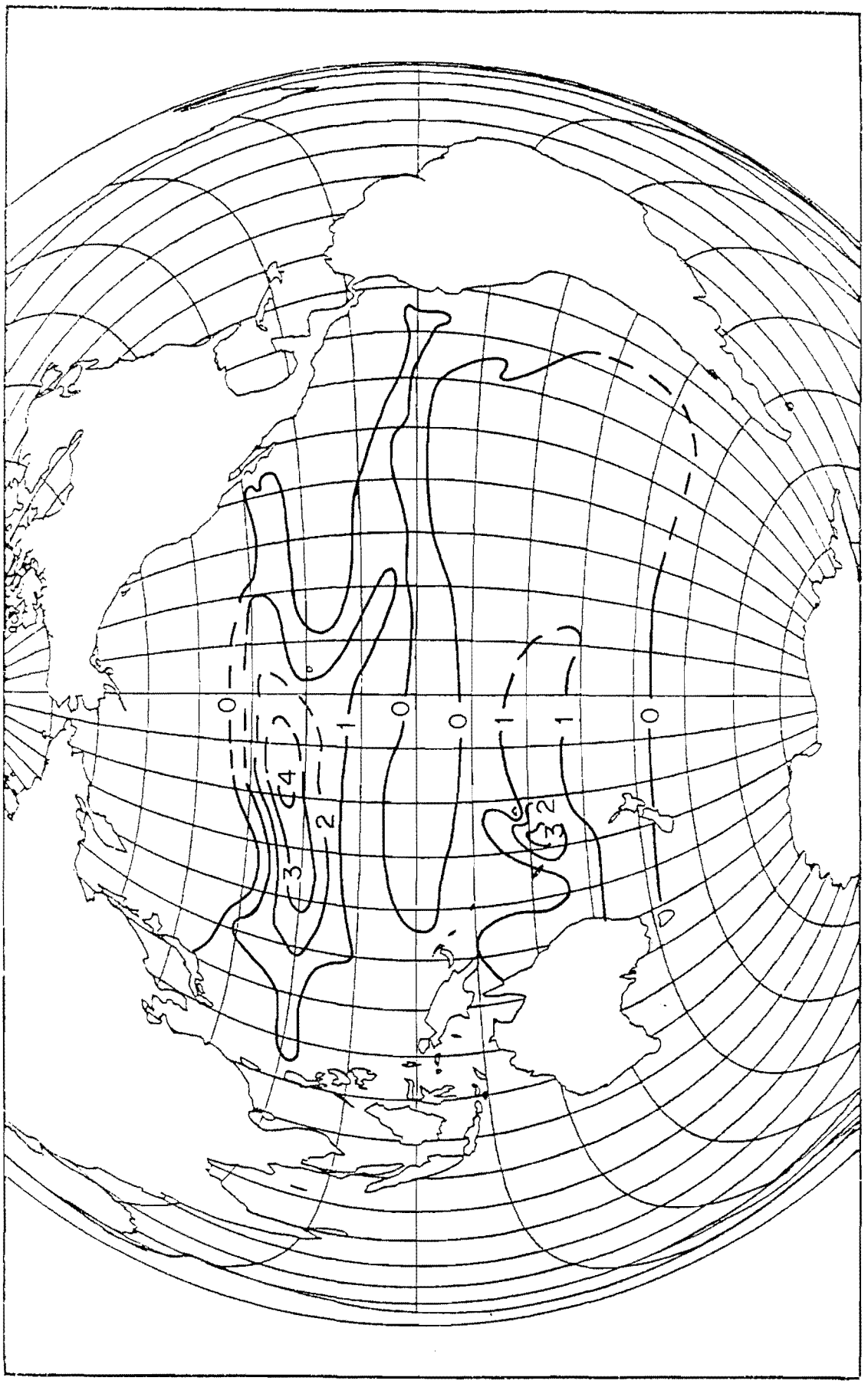
Collosphaera tuberosa



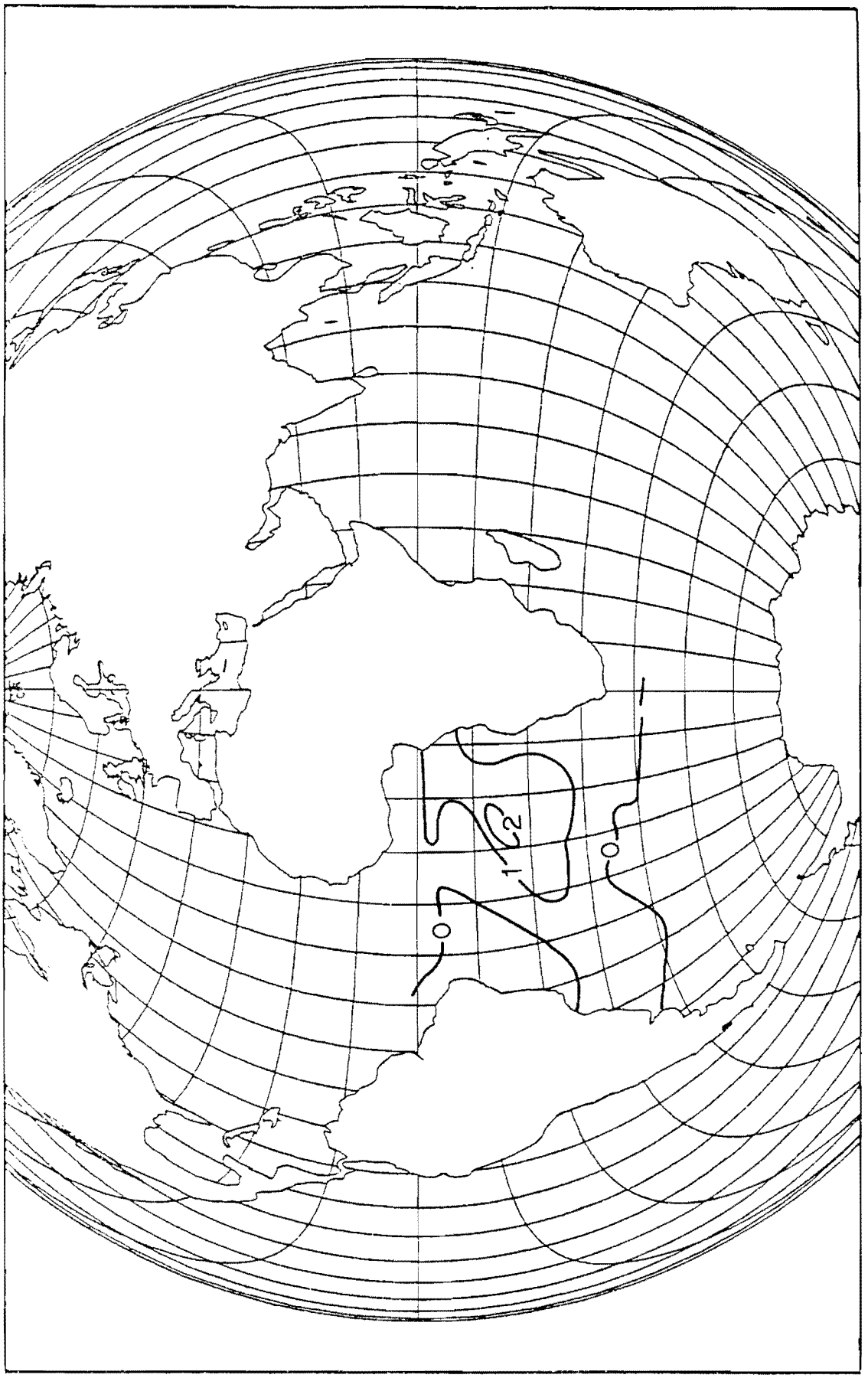
Disolenia quadrata and zanguebarica



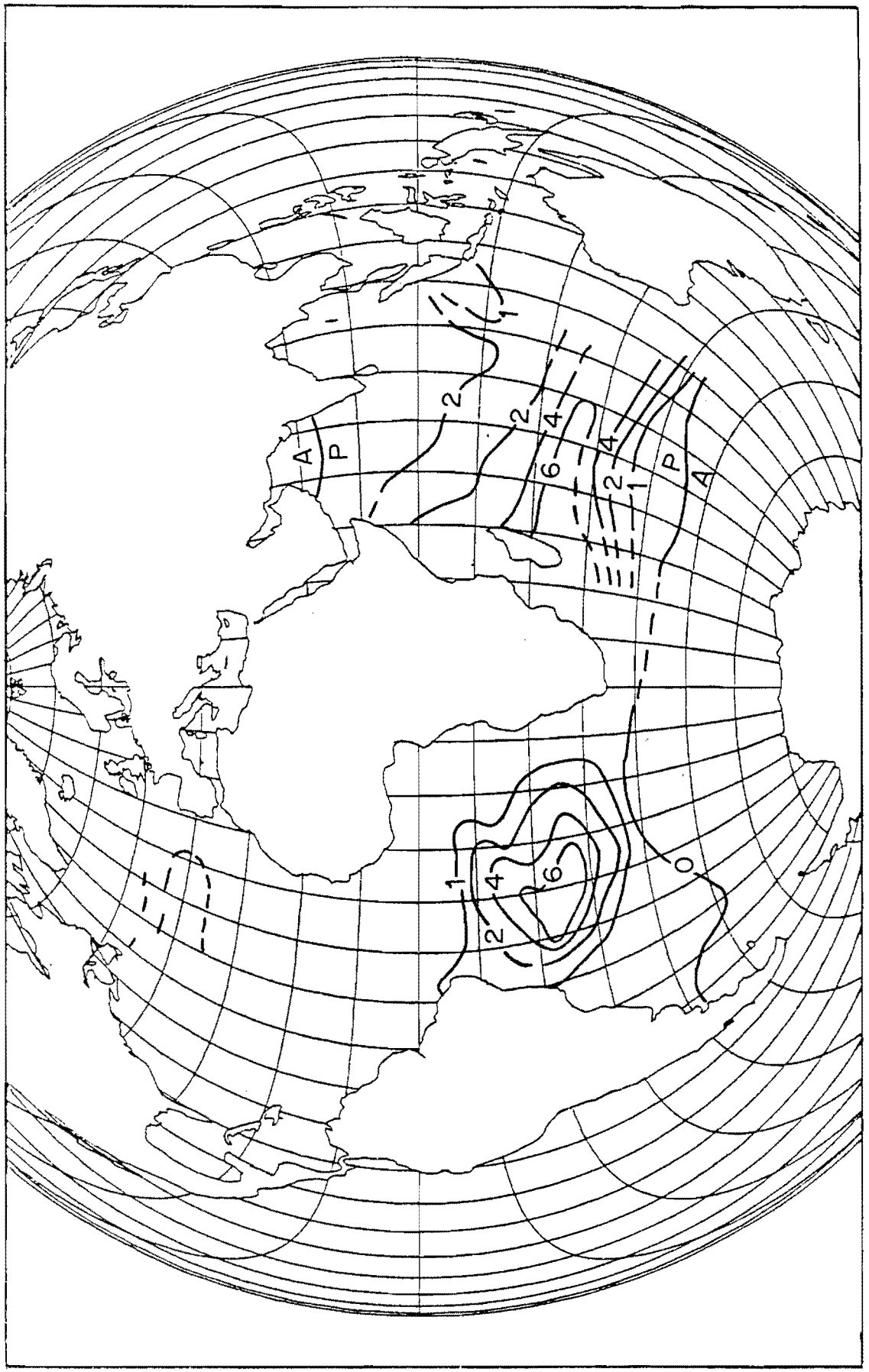
Acrosphaera flammabunda and lappacea



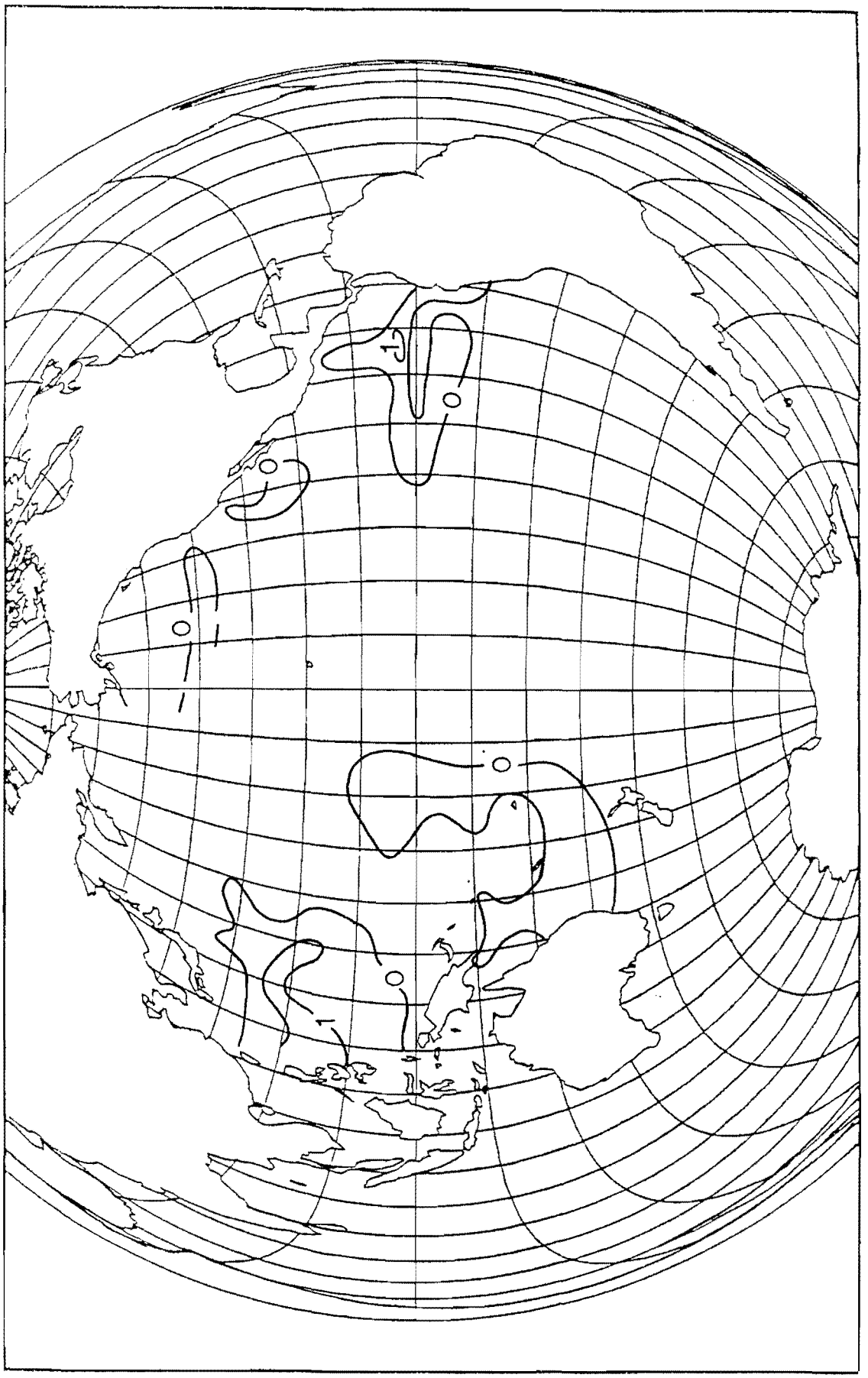
Acrosphaera lappacea



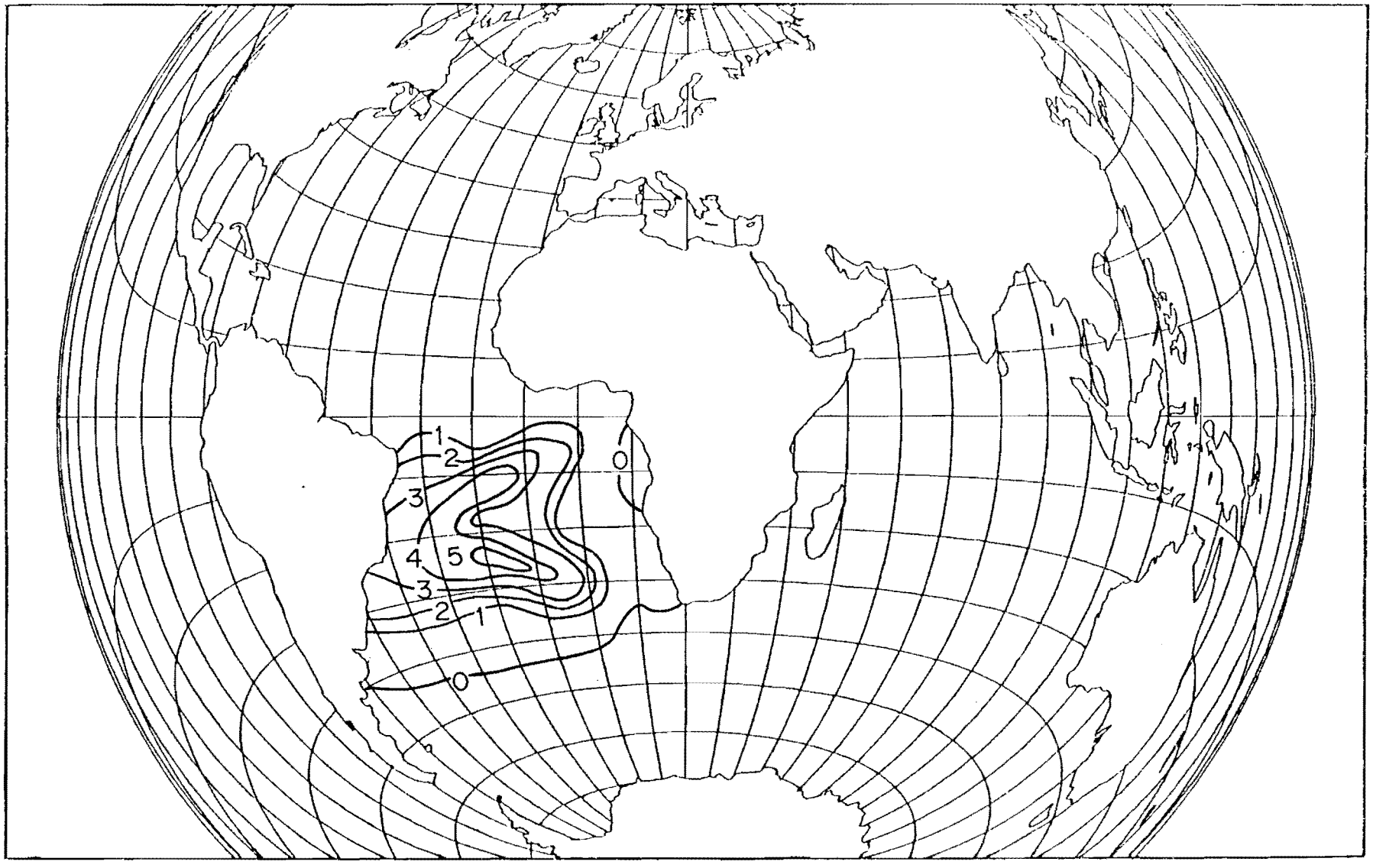
Acrosphaera murrayana



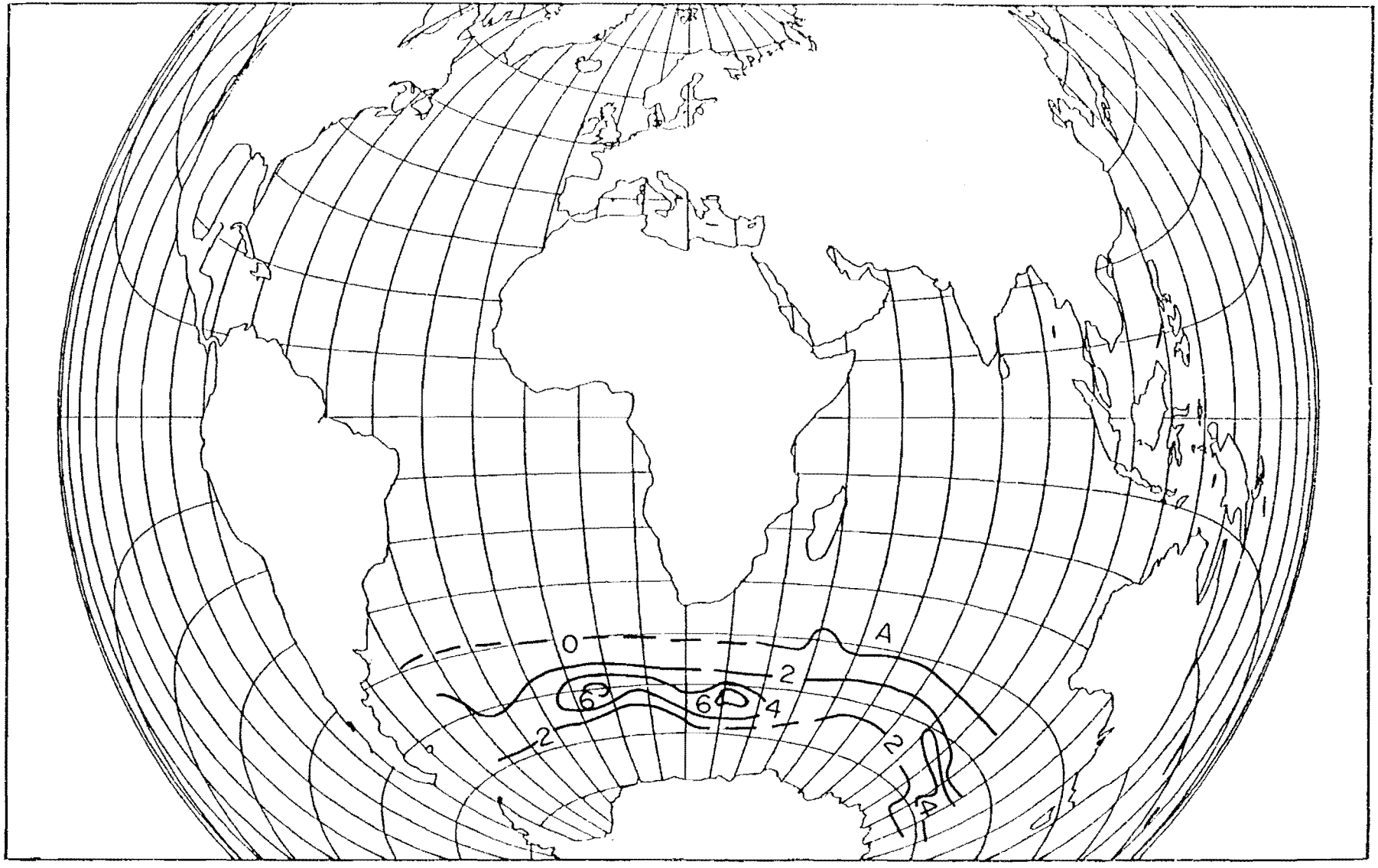
Acrosphaera spinosa



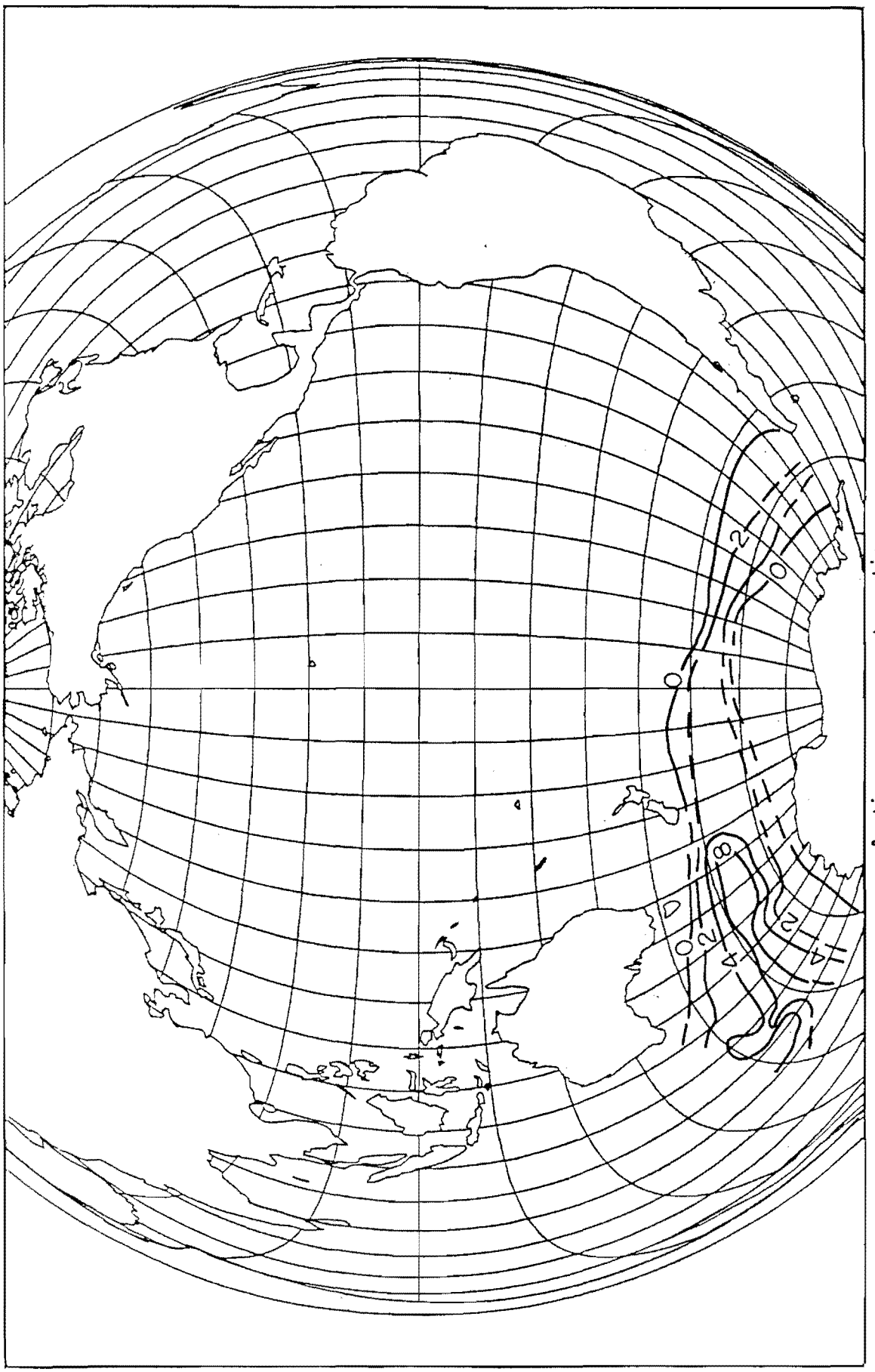
Acrosphaera spinosa

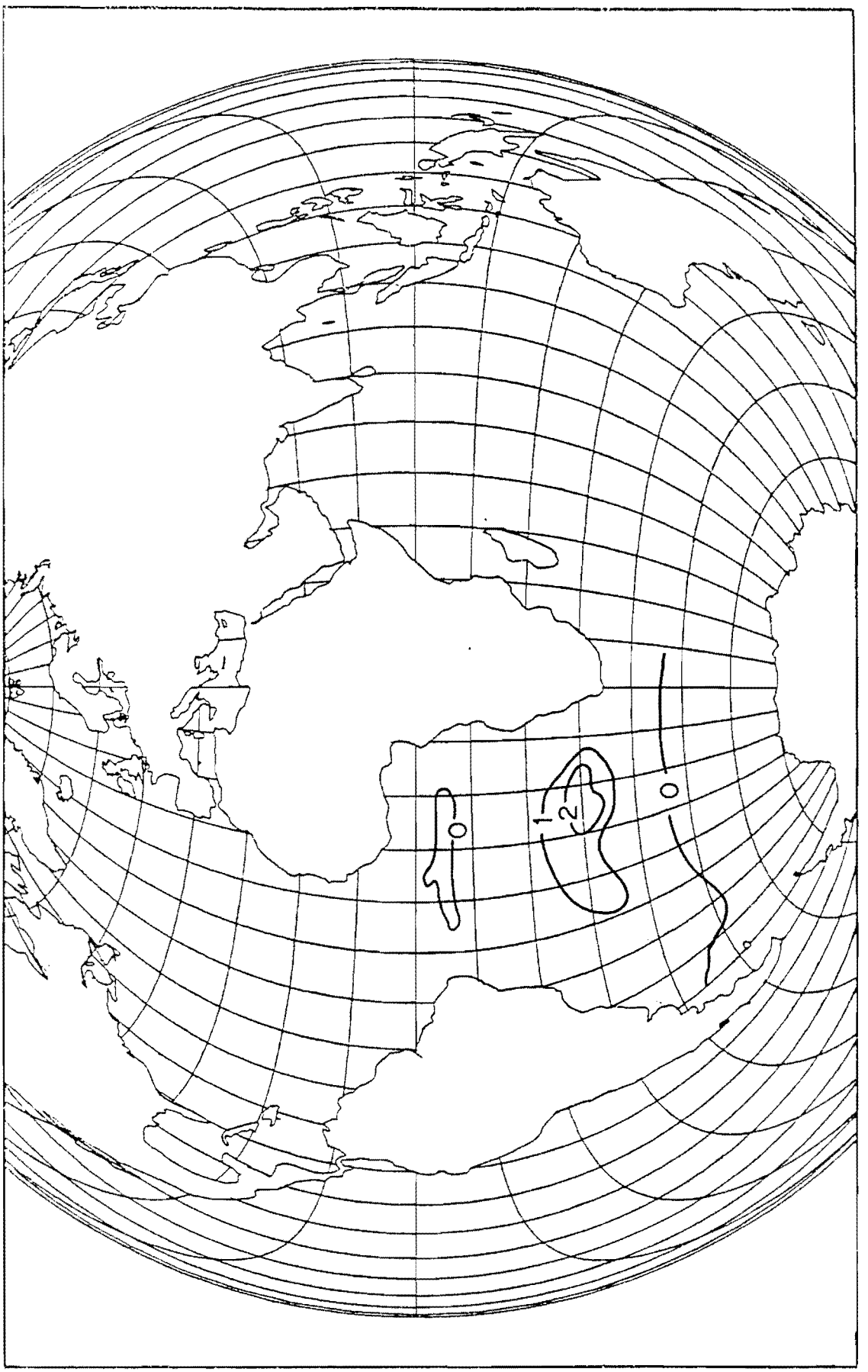


Siphonosphaera polysiphonia

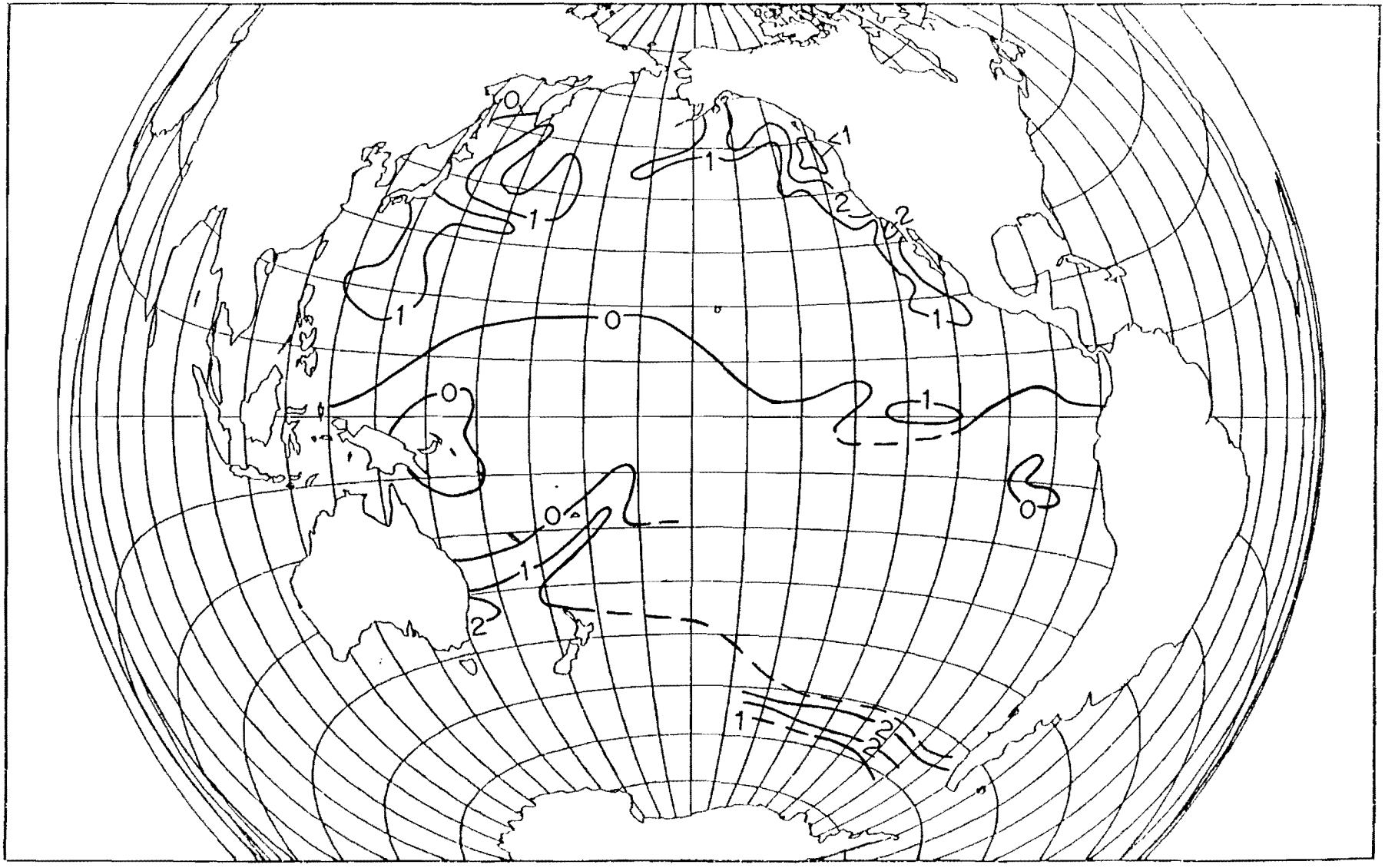


Actinomma antarcticum

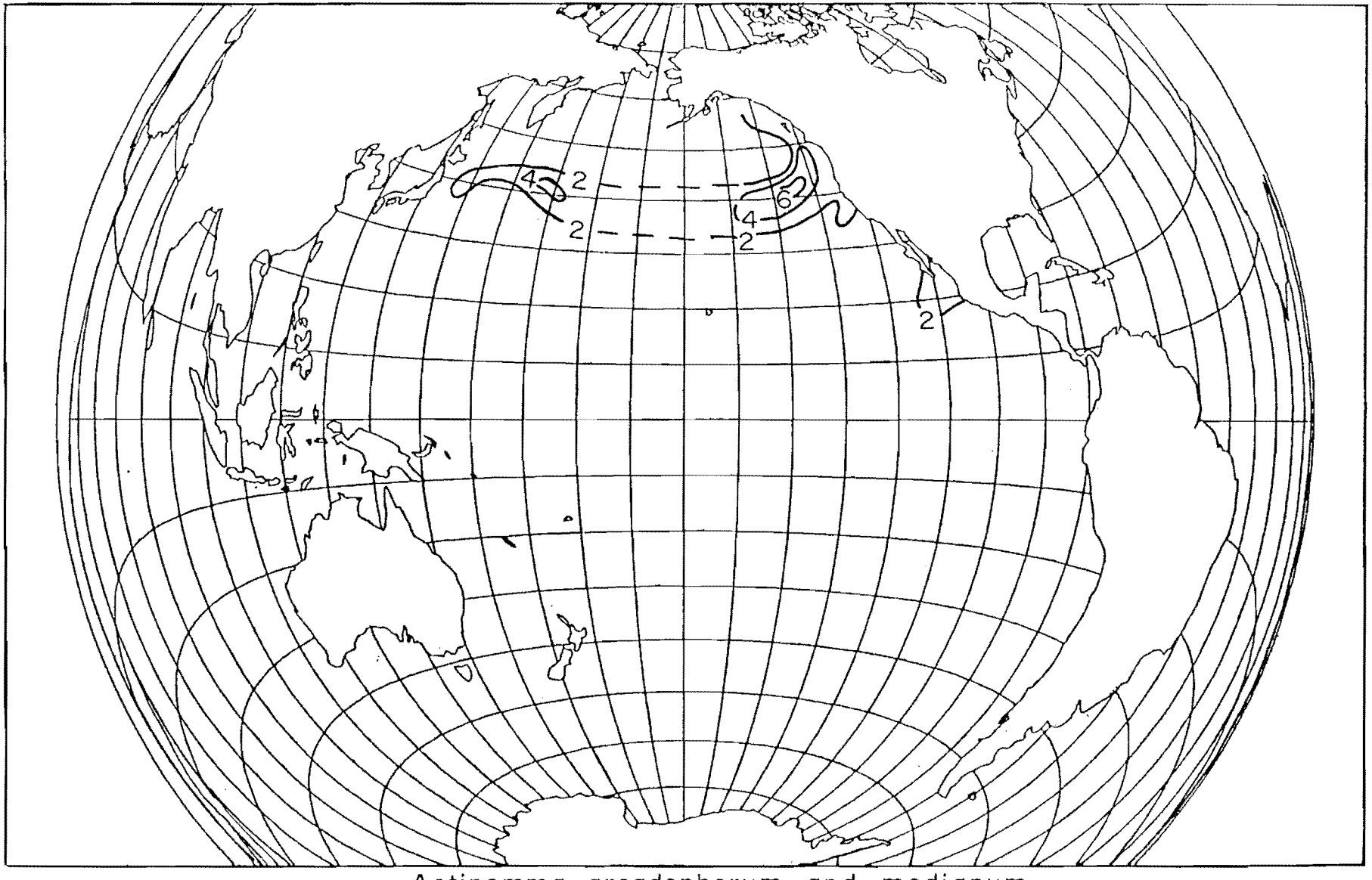

Actinomma antarcticum



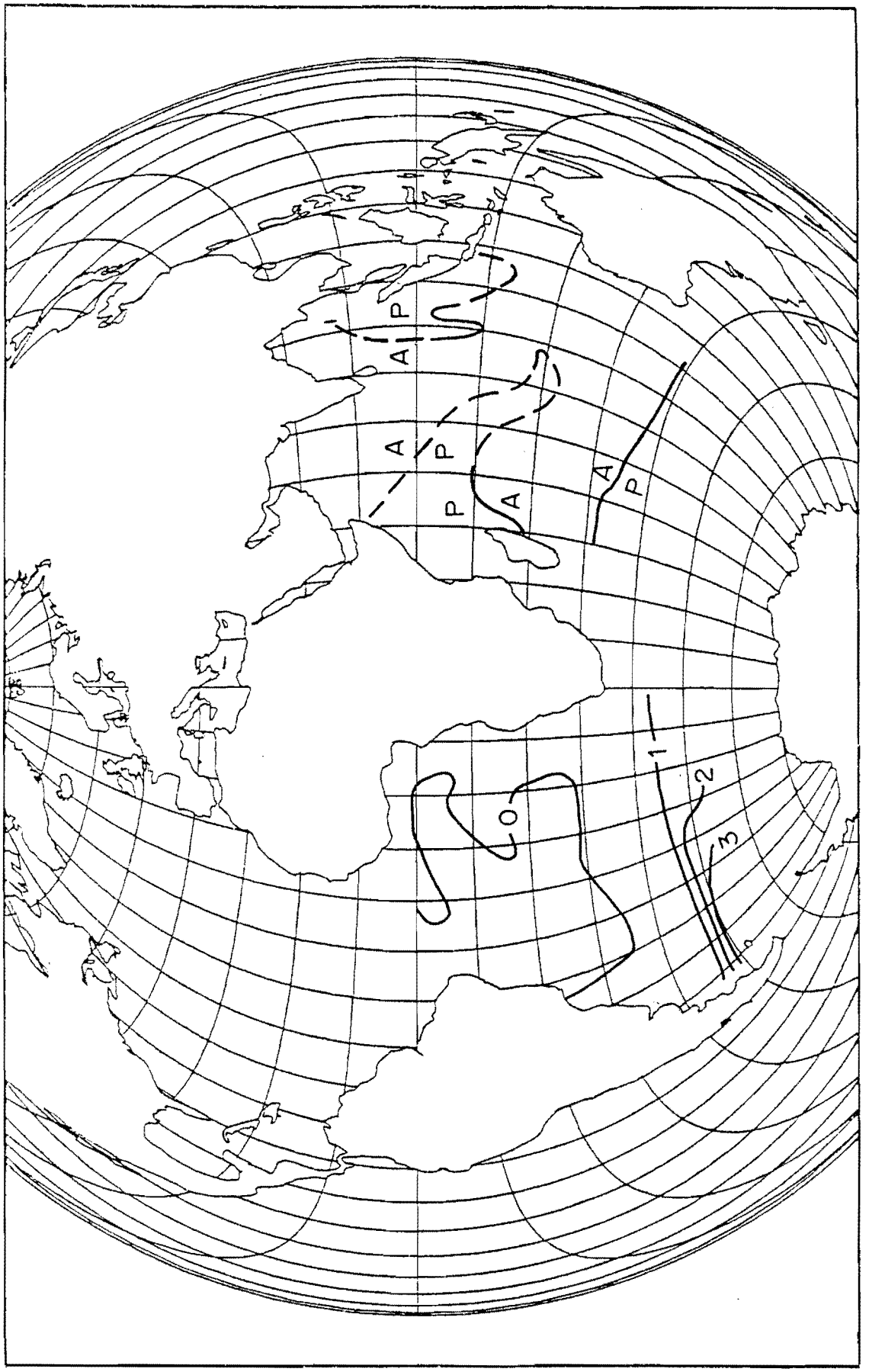
Actinomma haysi



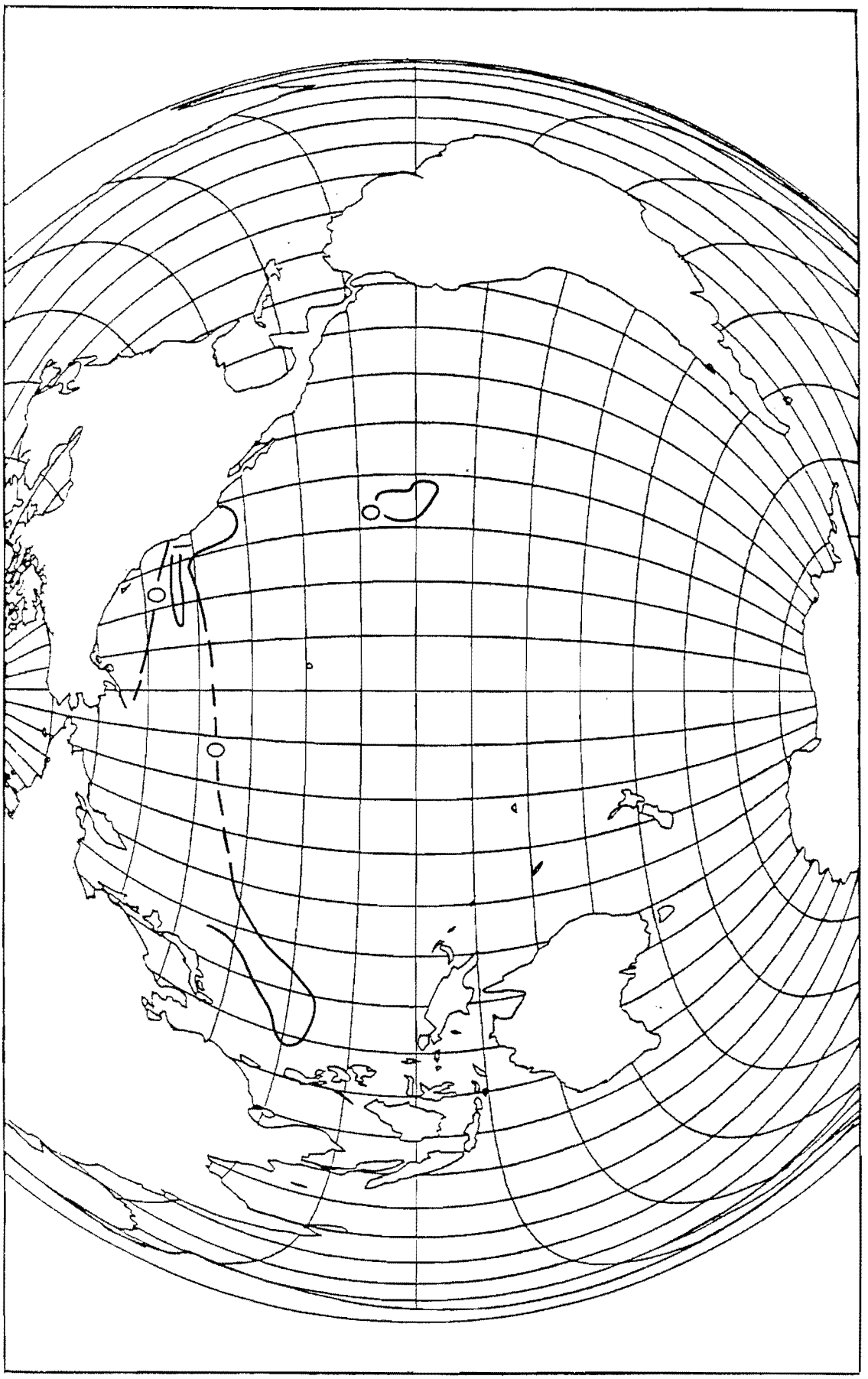
Actinomma leptodermum



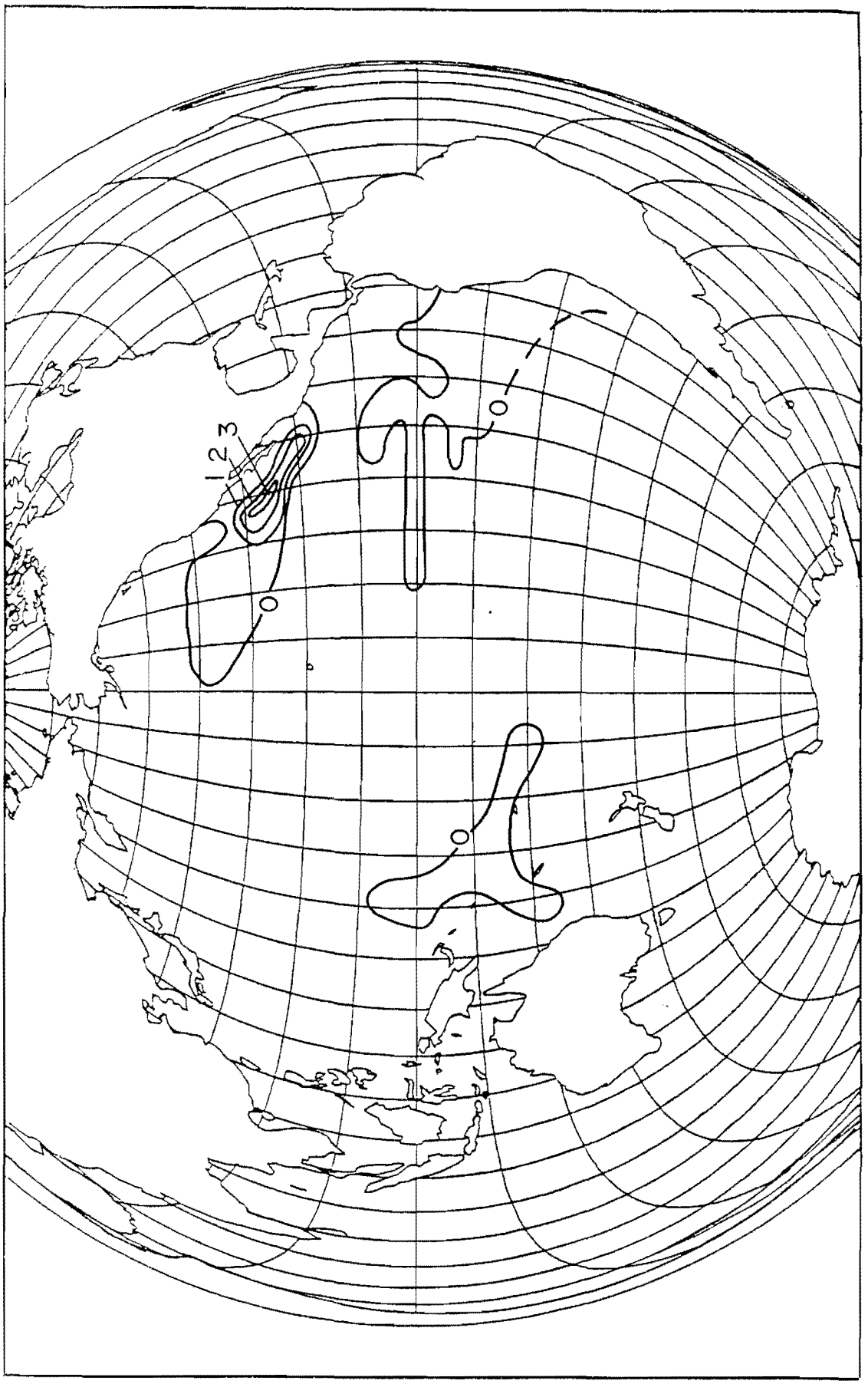
Actinomma arcadophorum and medianum



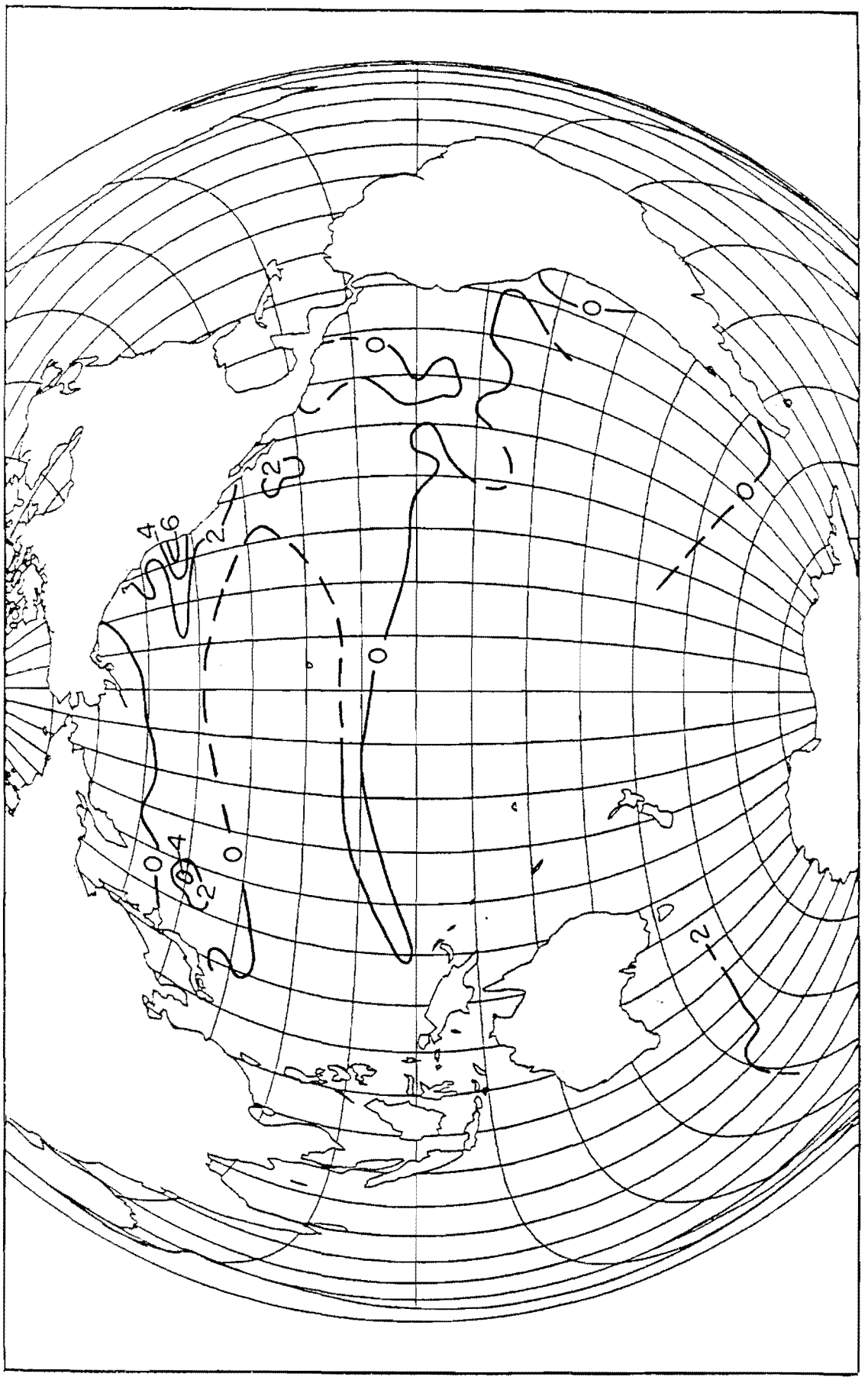
Actinomma medianum



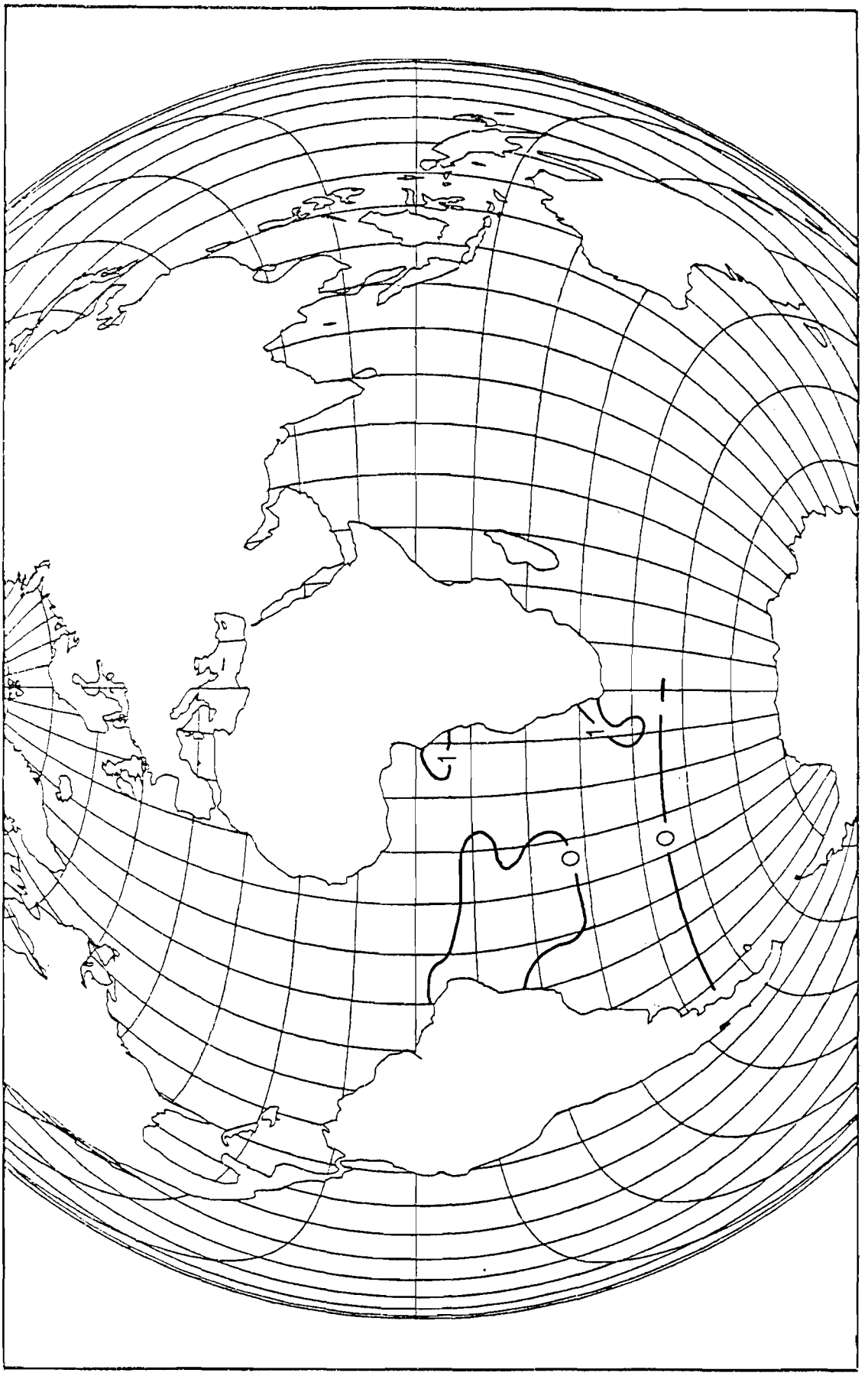
Anomalacantha dentata



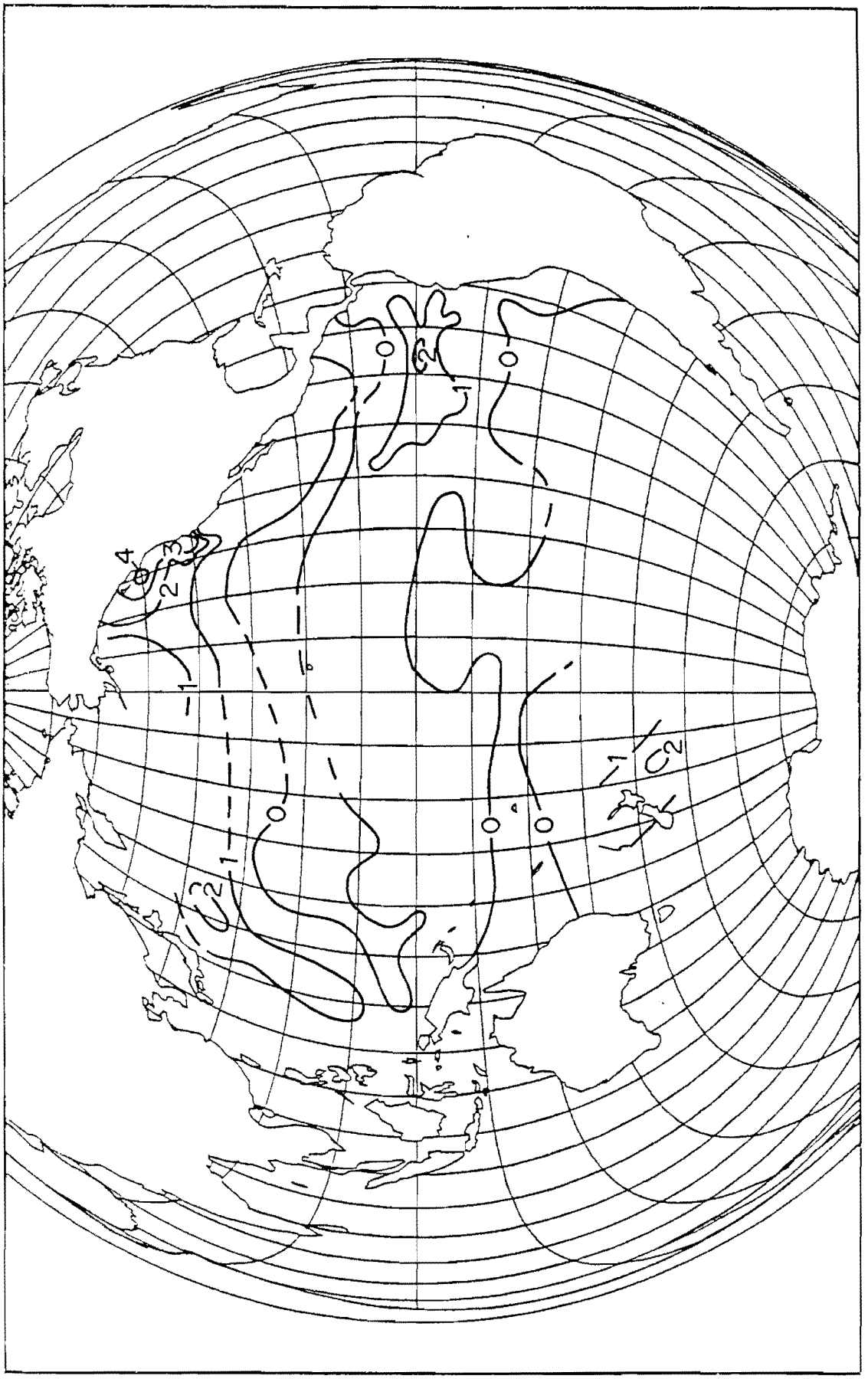
Cenosphaera coronata

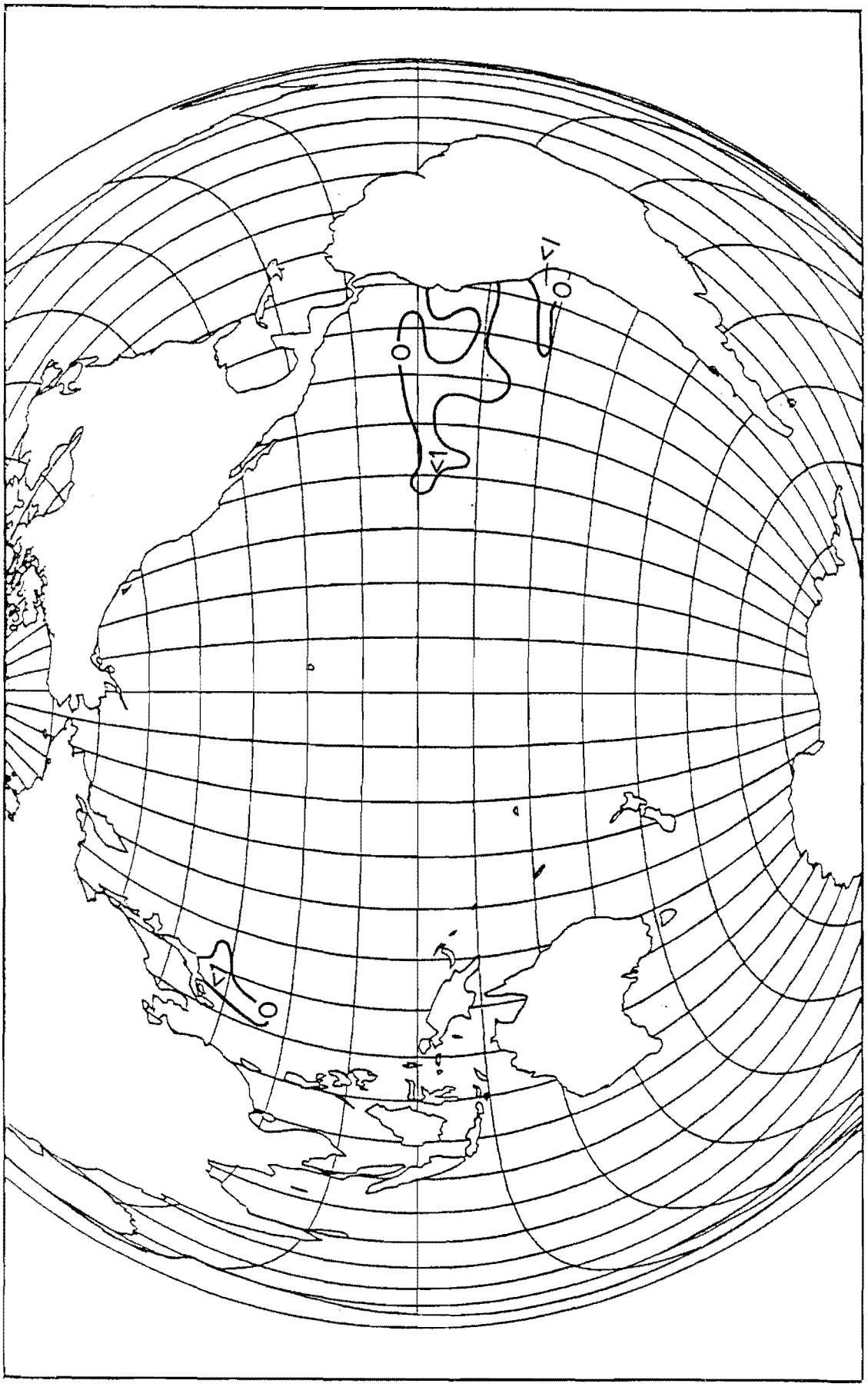


Cenosphaera cristata

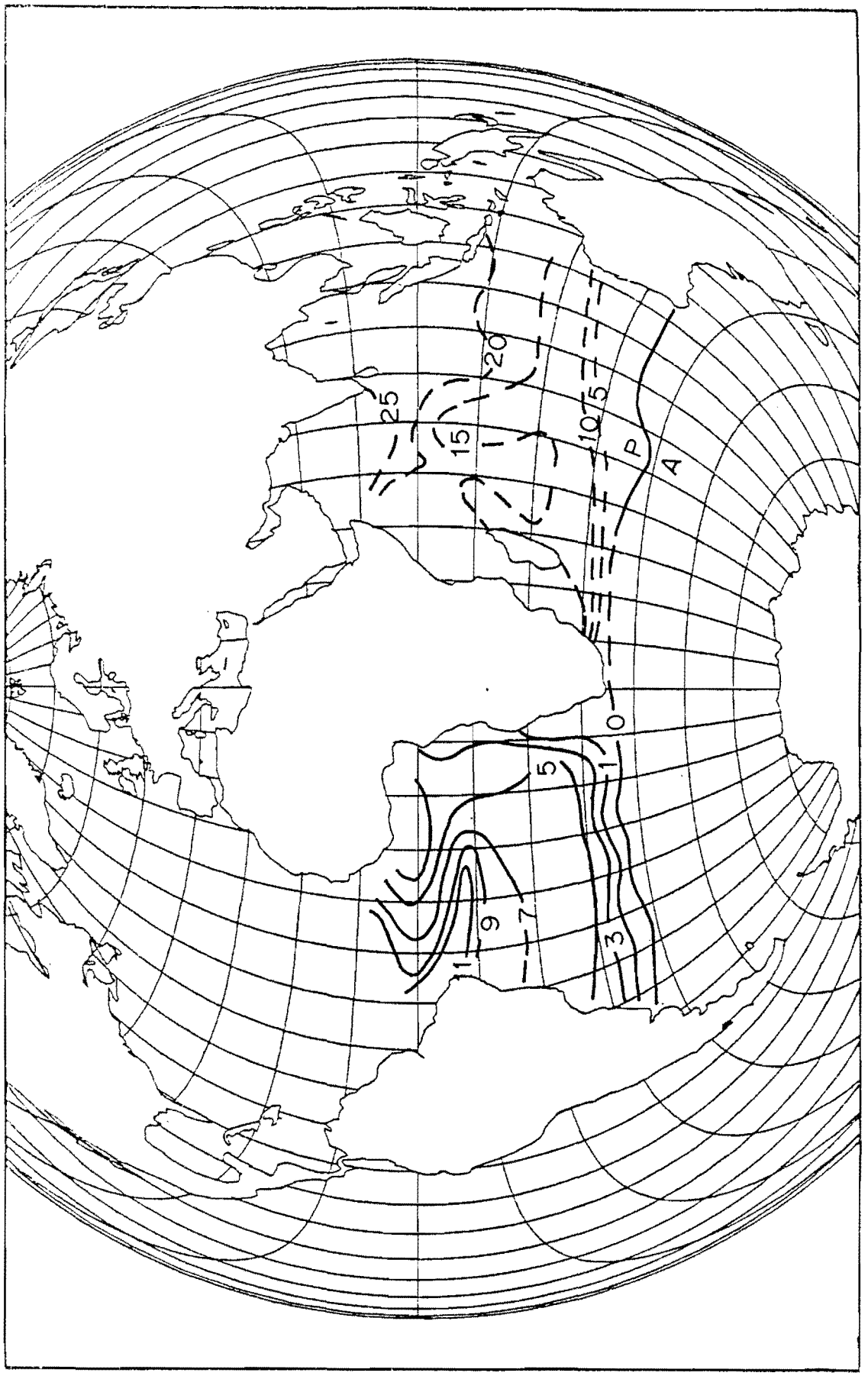


Hexacontium entacanthum

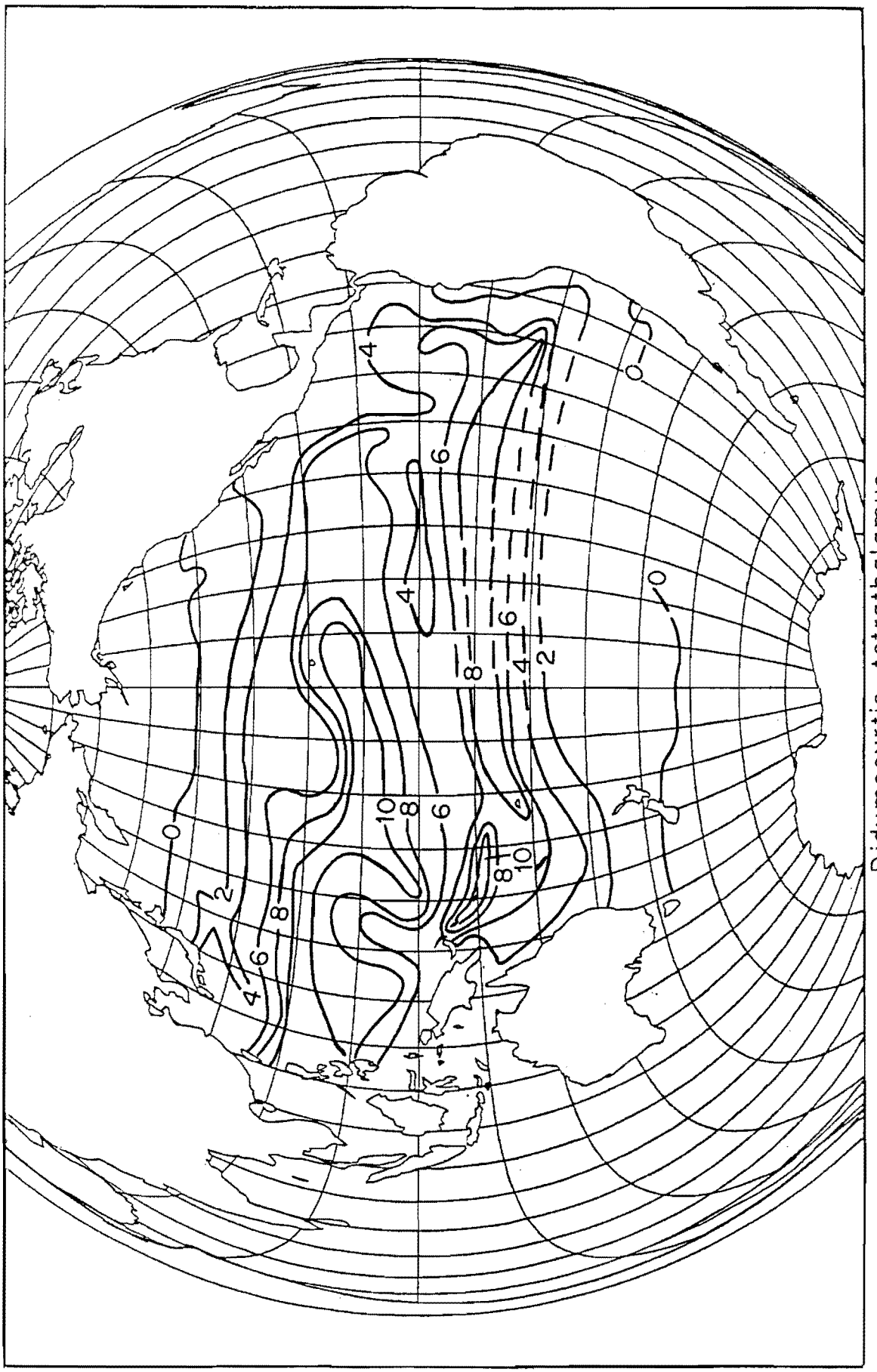

Hexacontium entacanthum

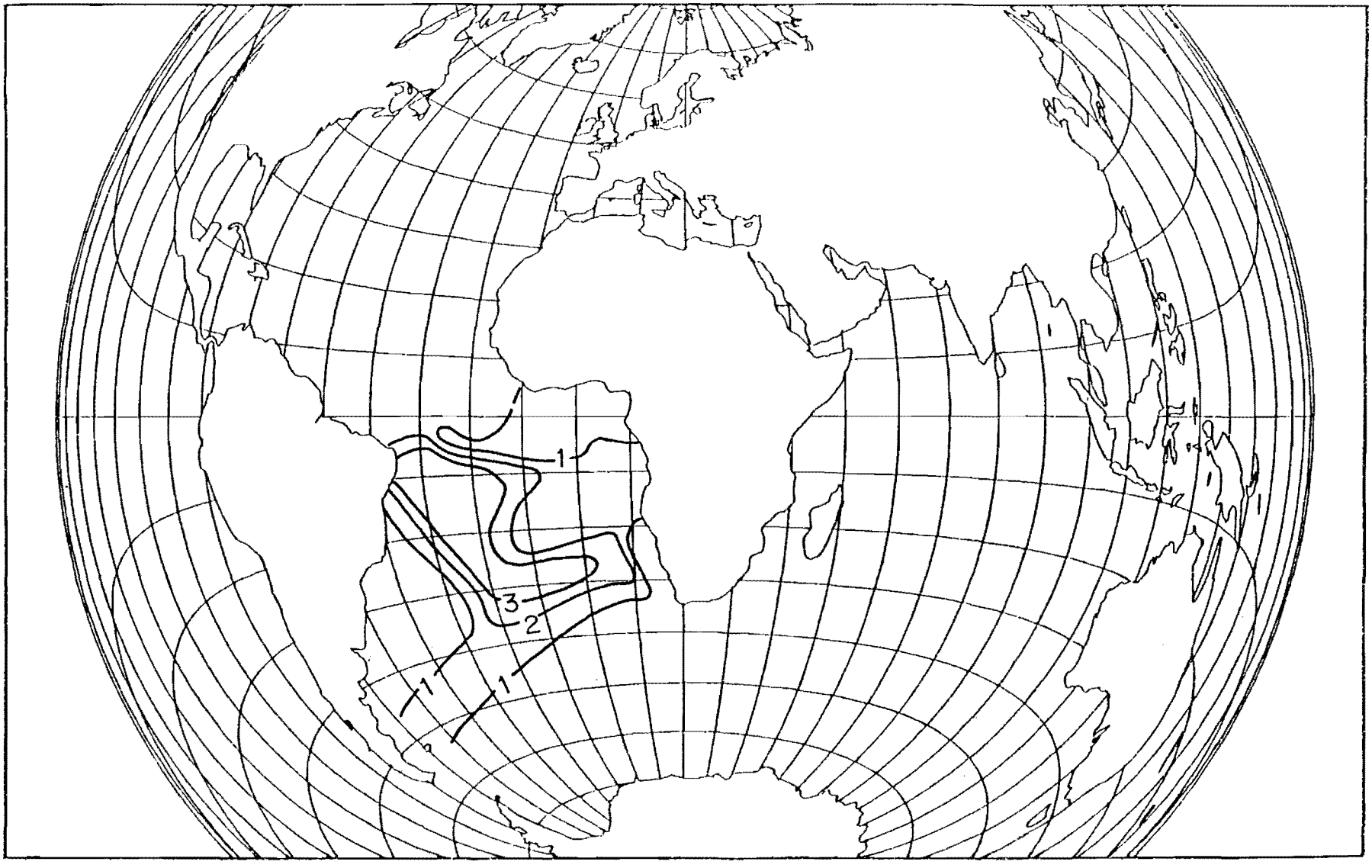


Hexacontium laevigatum

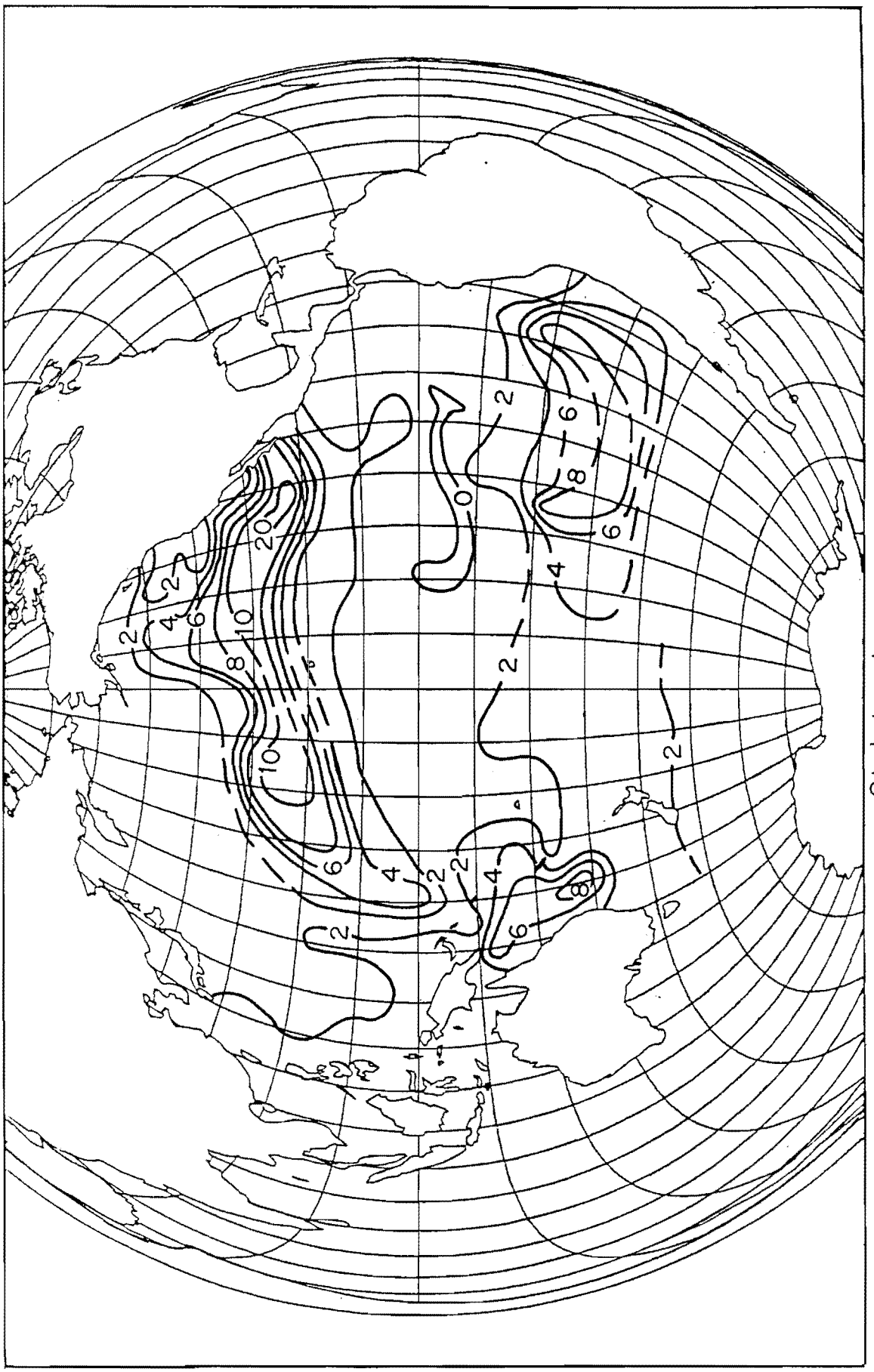


Didymocyrtis tetrathalamus

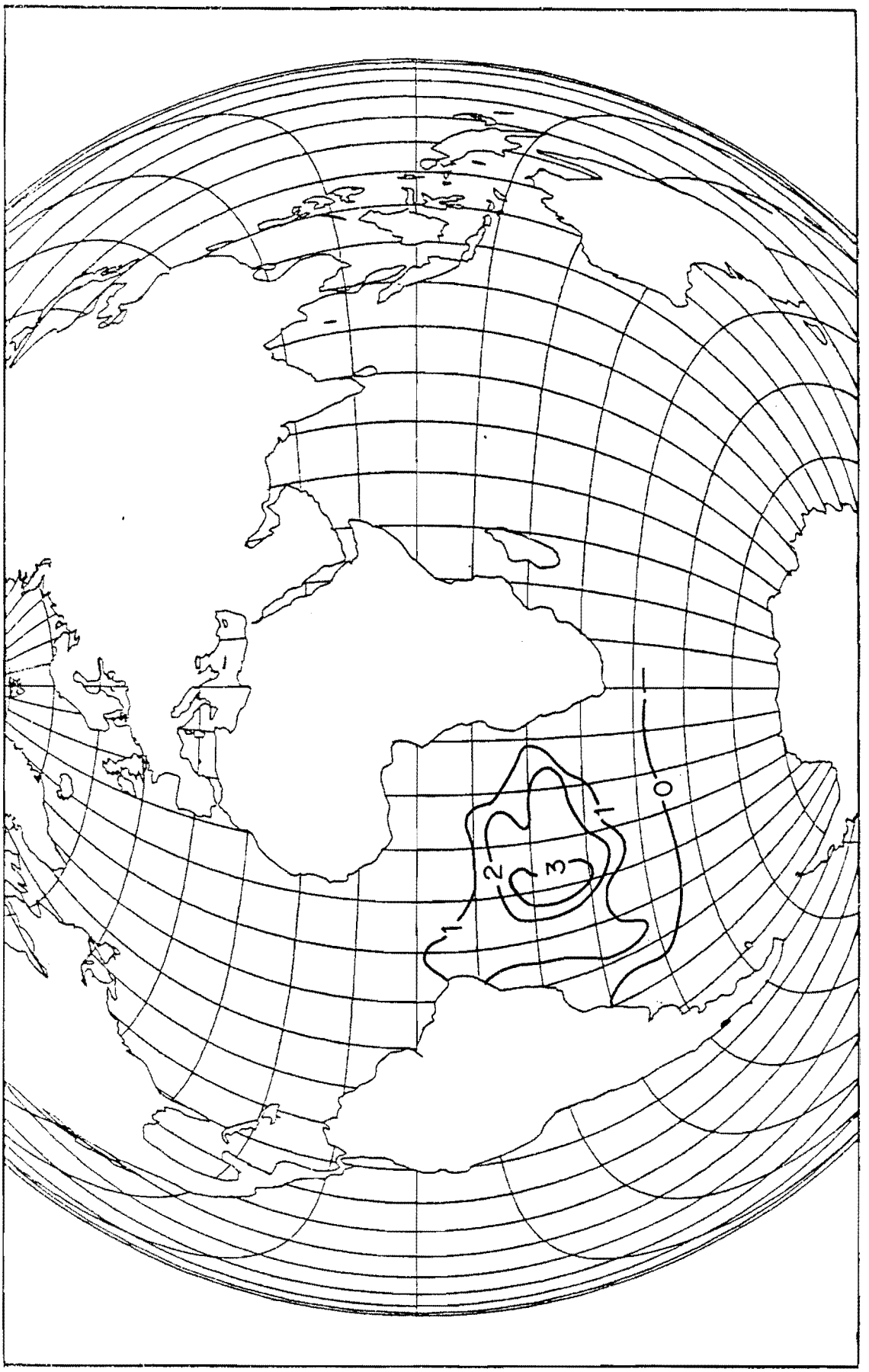

Didymocyrtis tetrathalamus



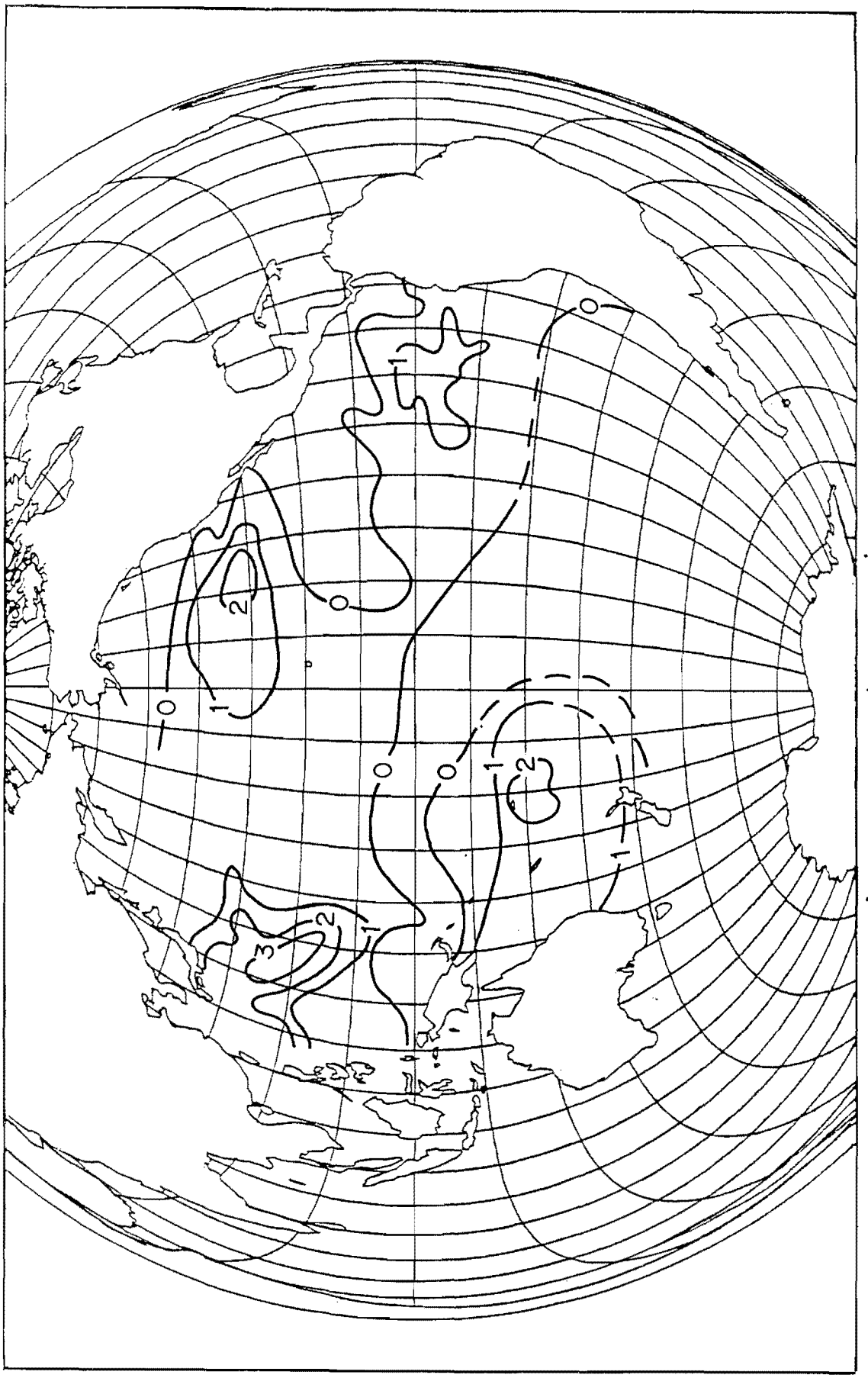
Stylatractus spp.

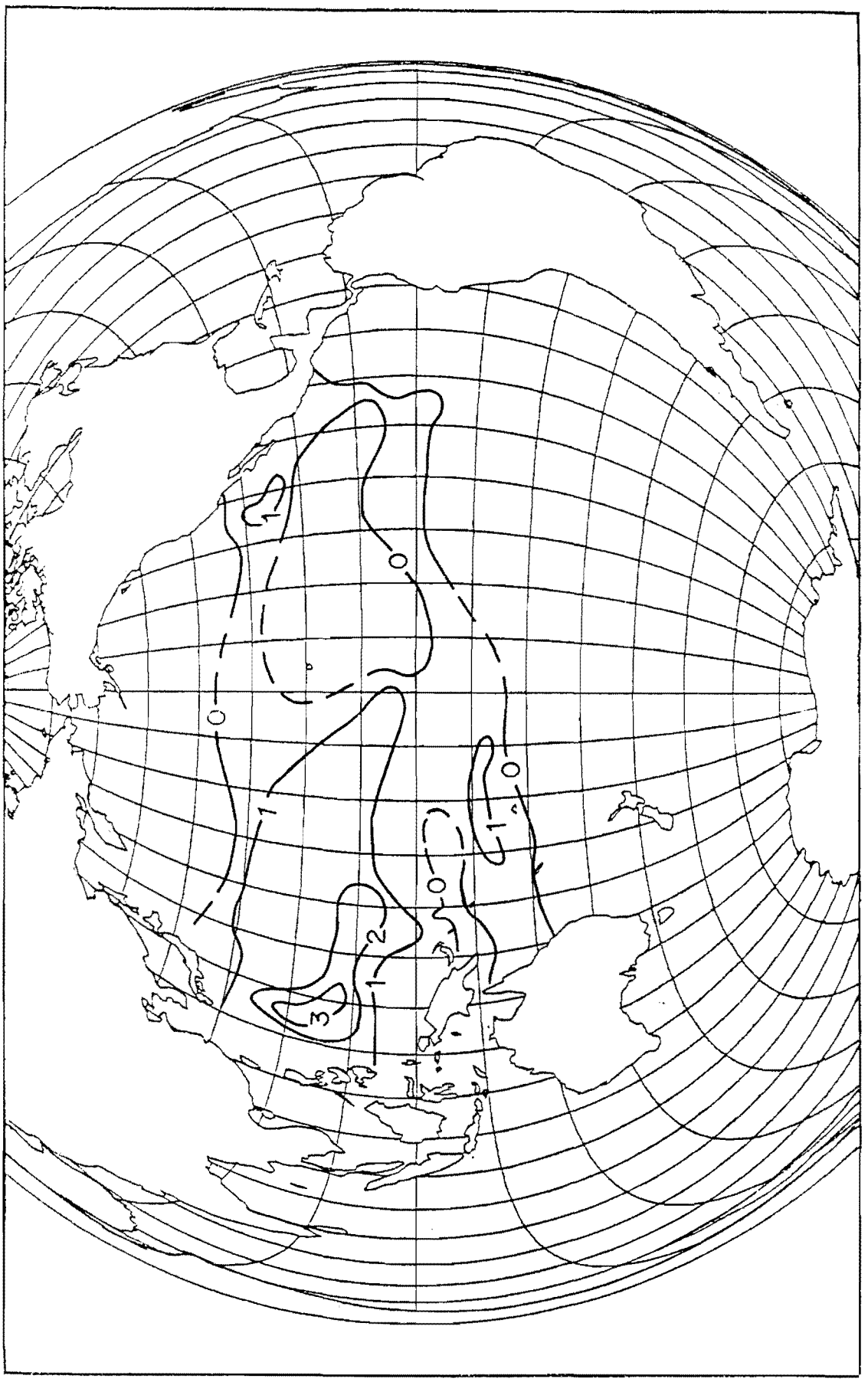


Stylatractus spp.

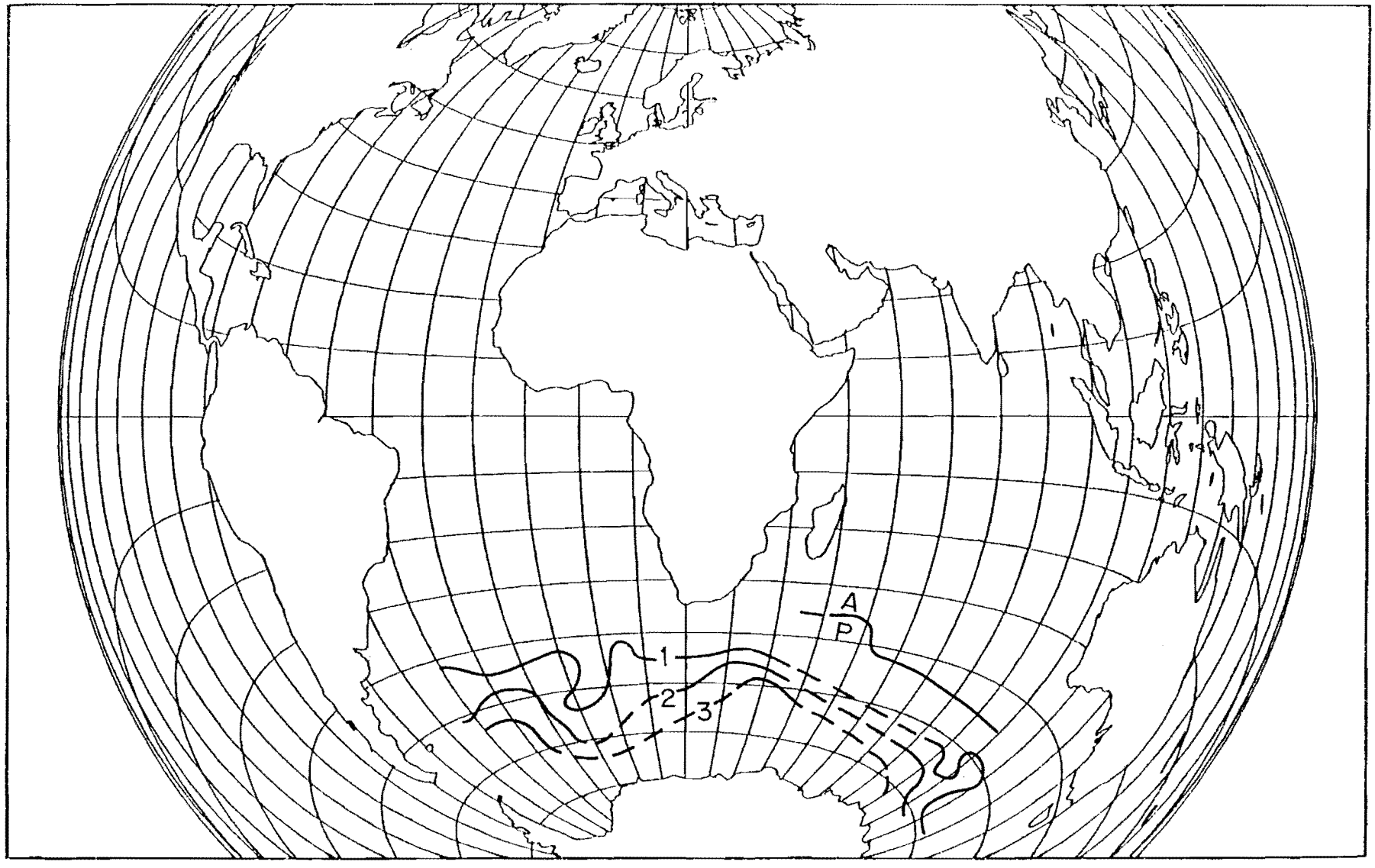


Axoprunum stauraxonium

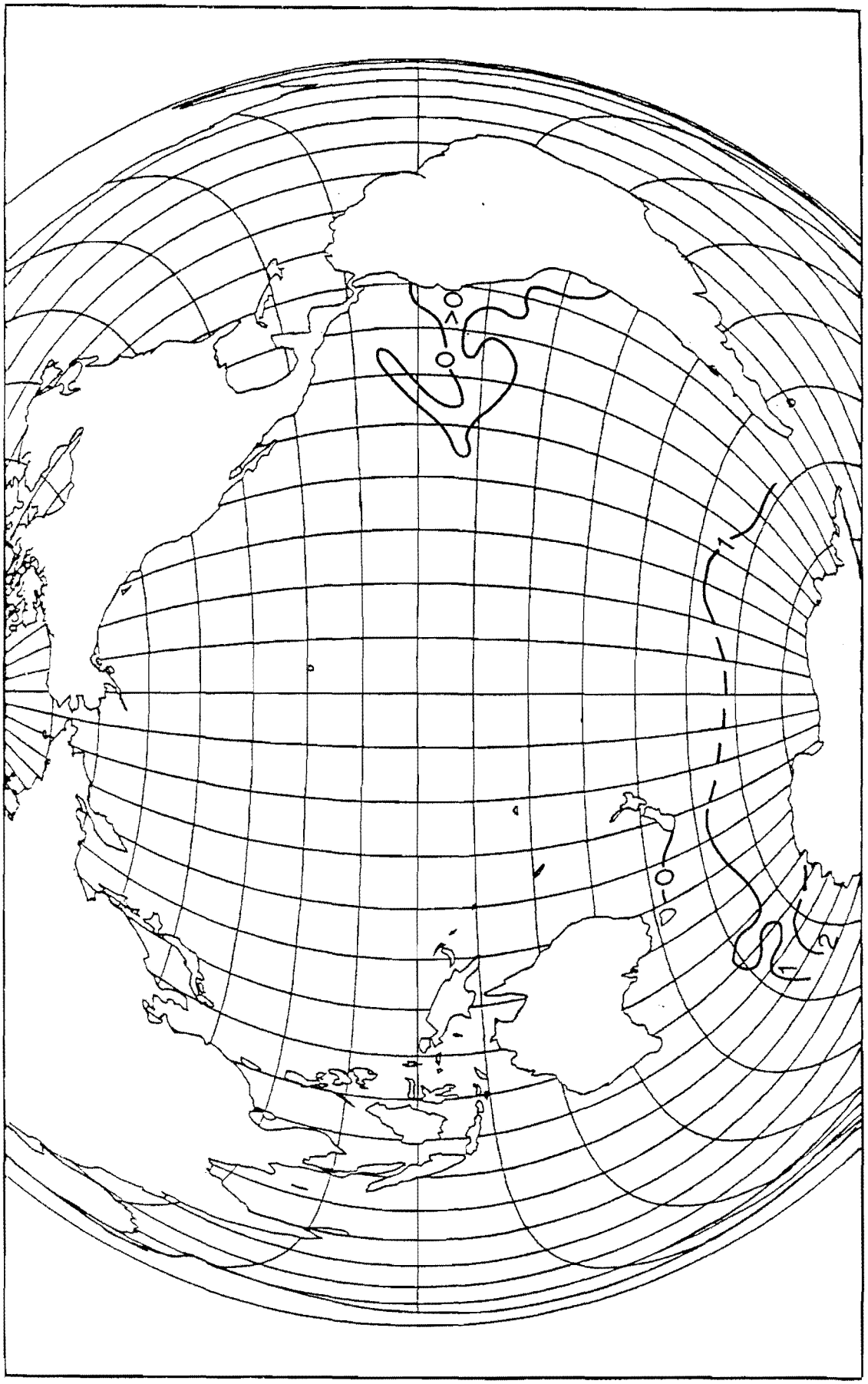

Axoprunum stauraxonium



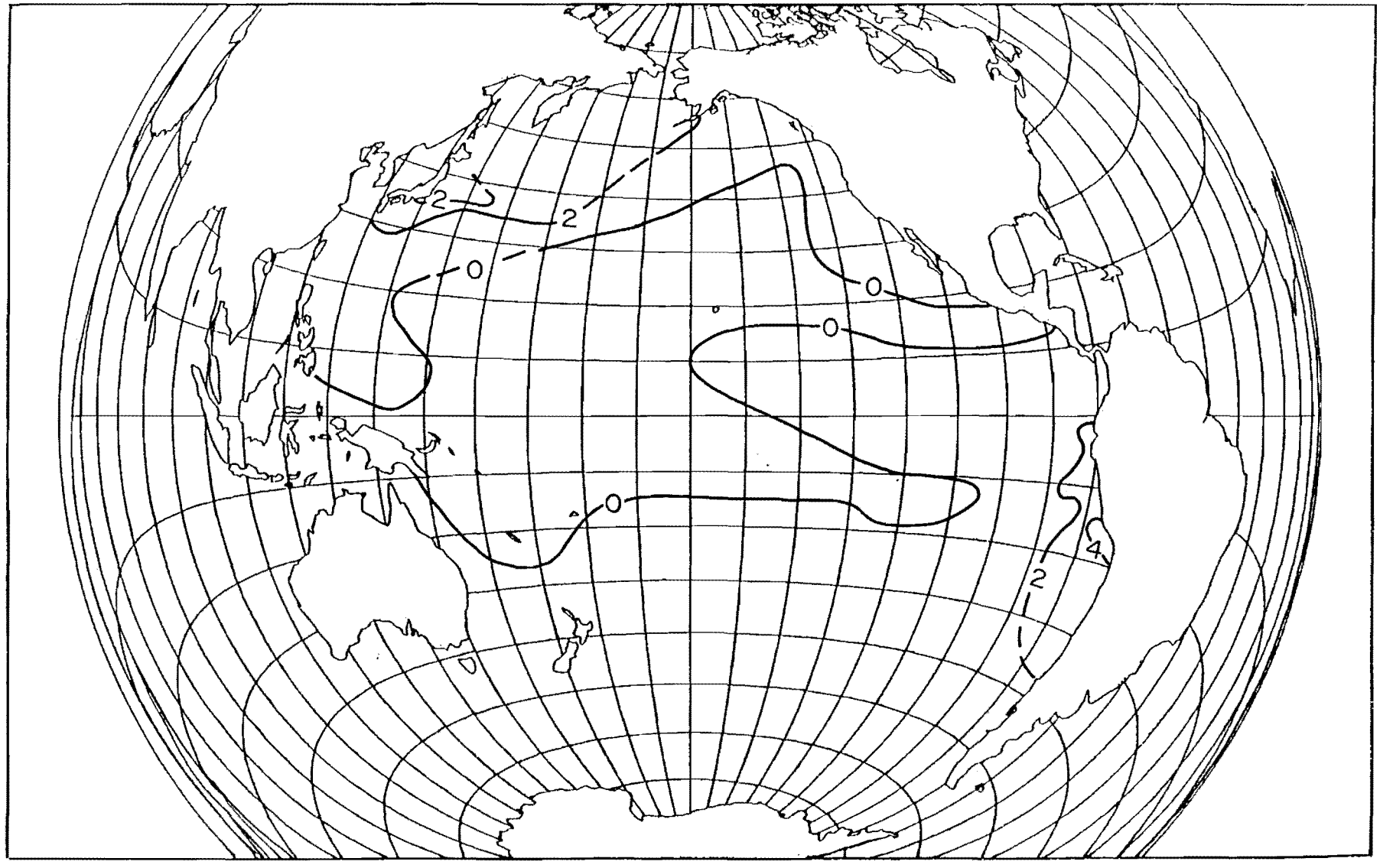
Spongurus cf. elliptica



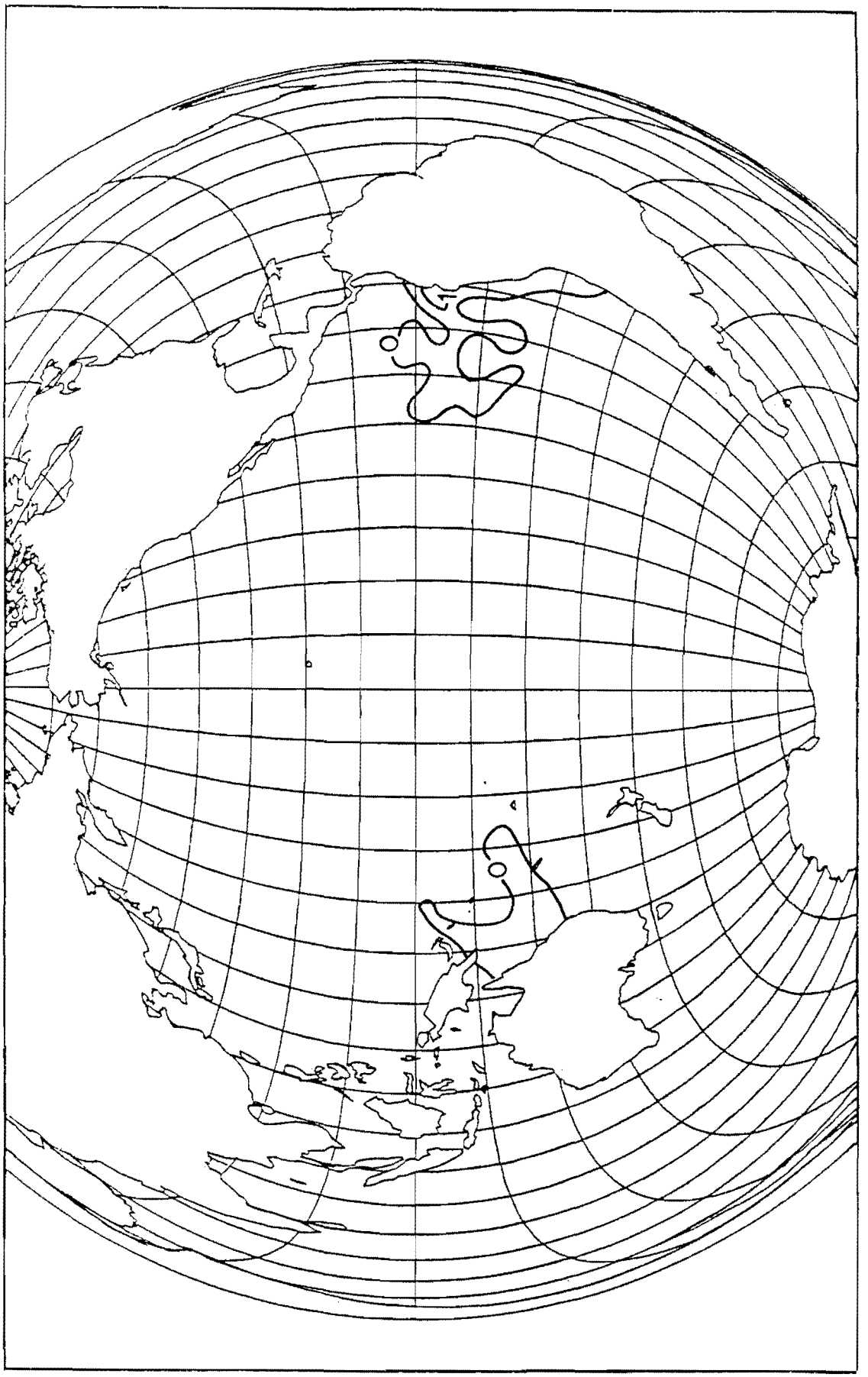
Spongurus pylomaticus



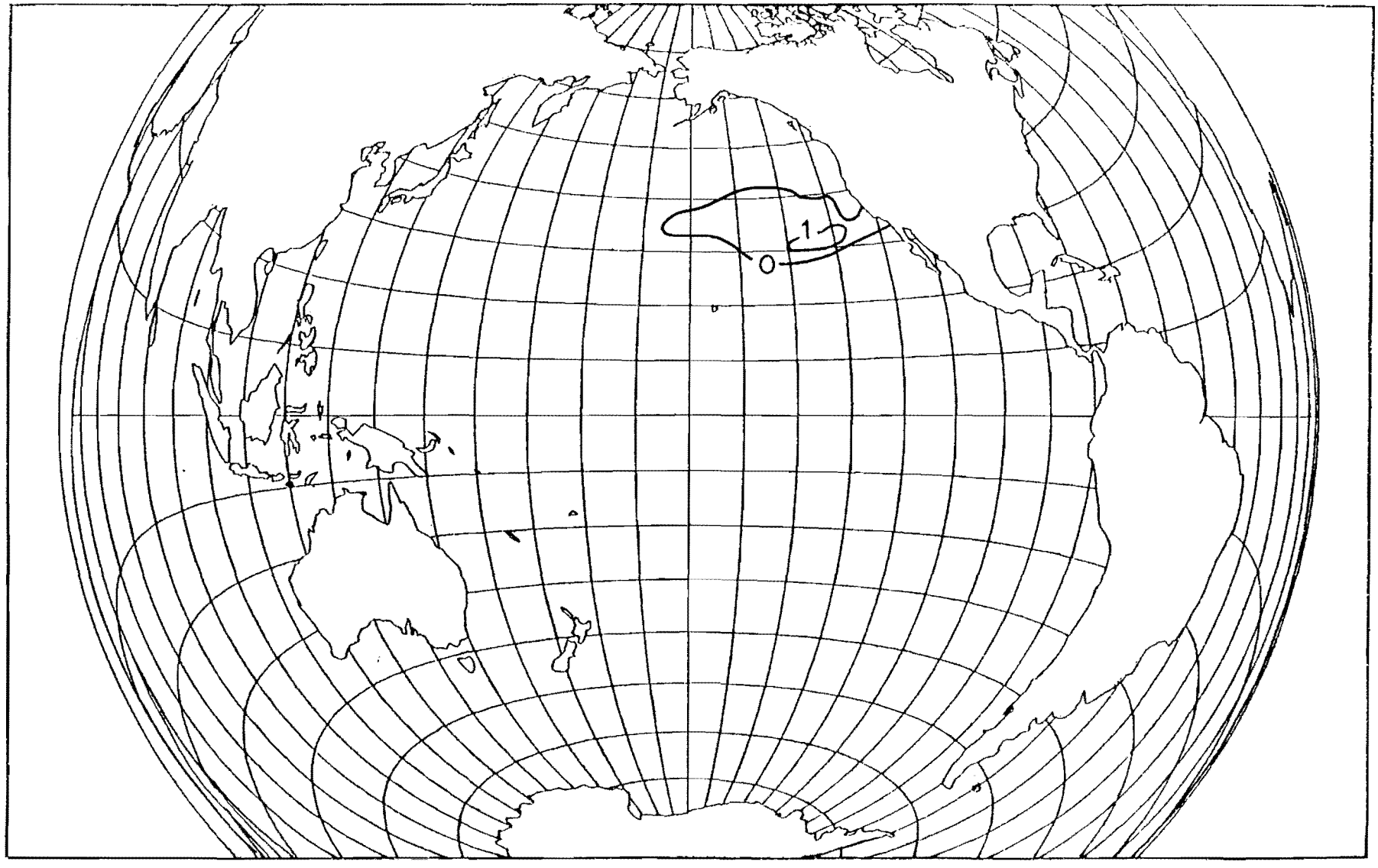
Spongurus pylomaticus



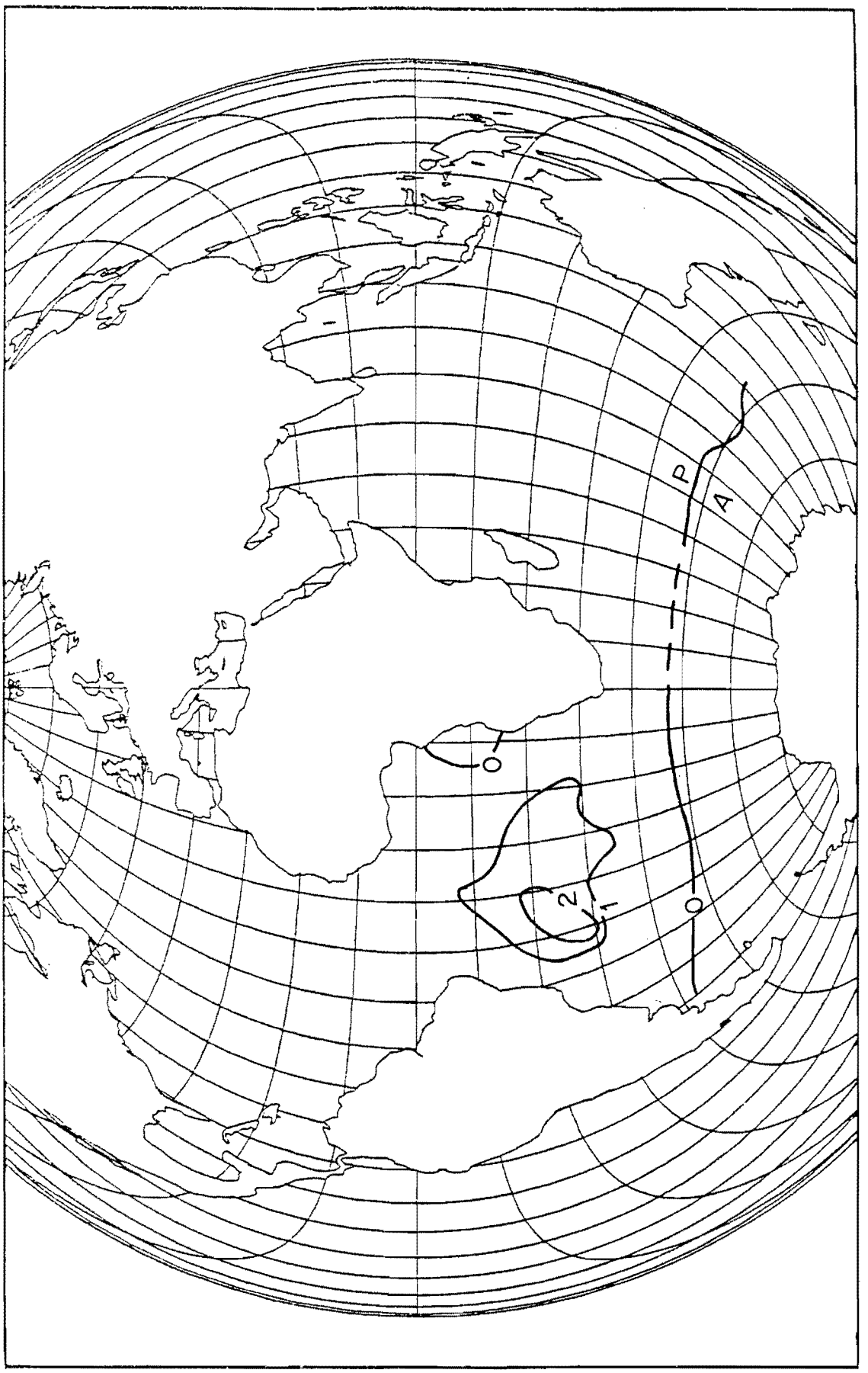
Spongurus (?) sp.



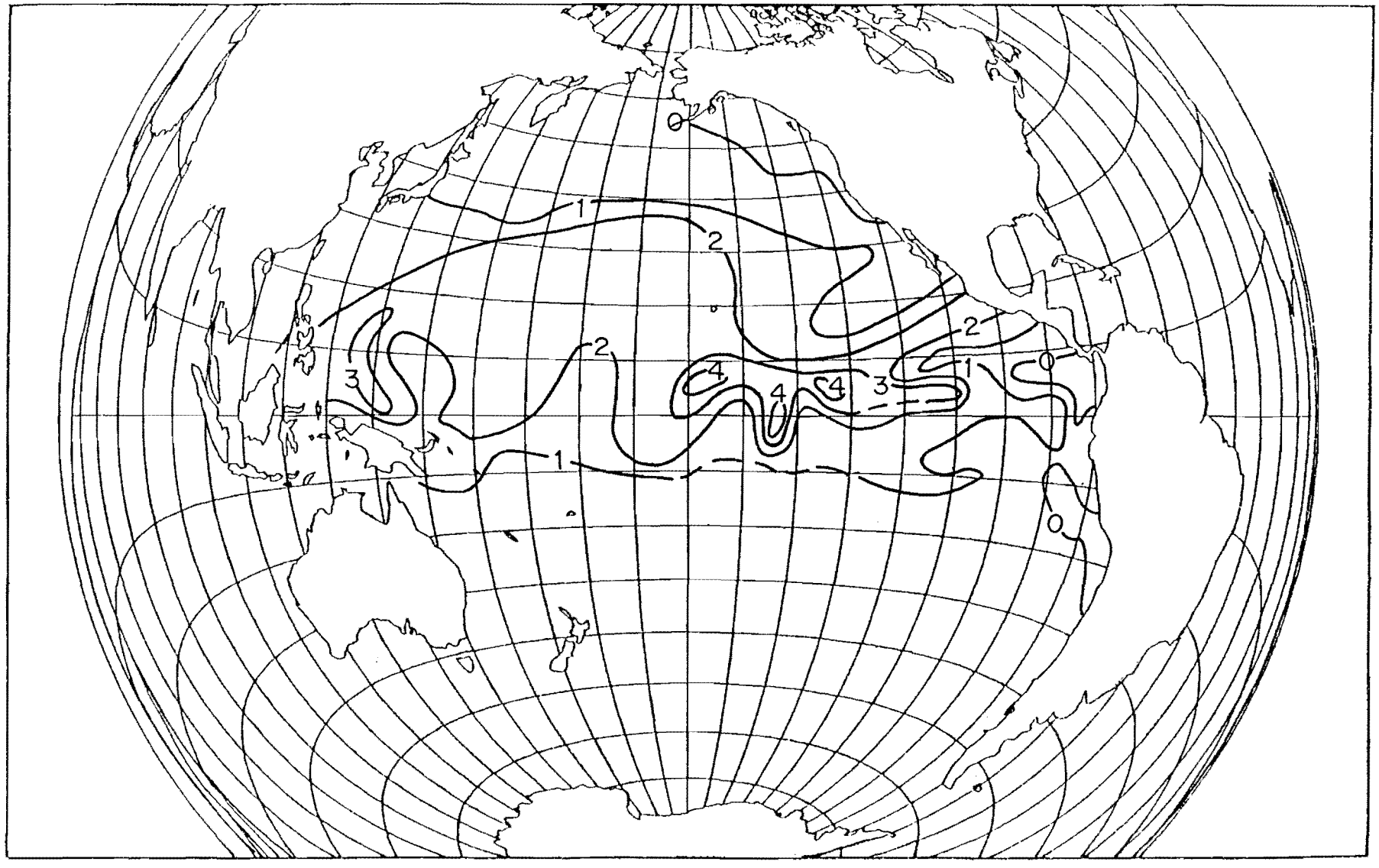
Spongocore puella



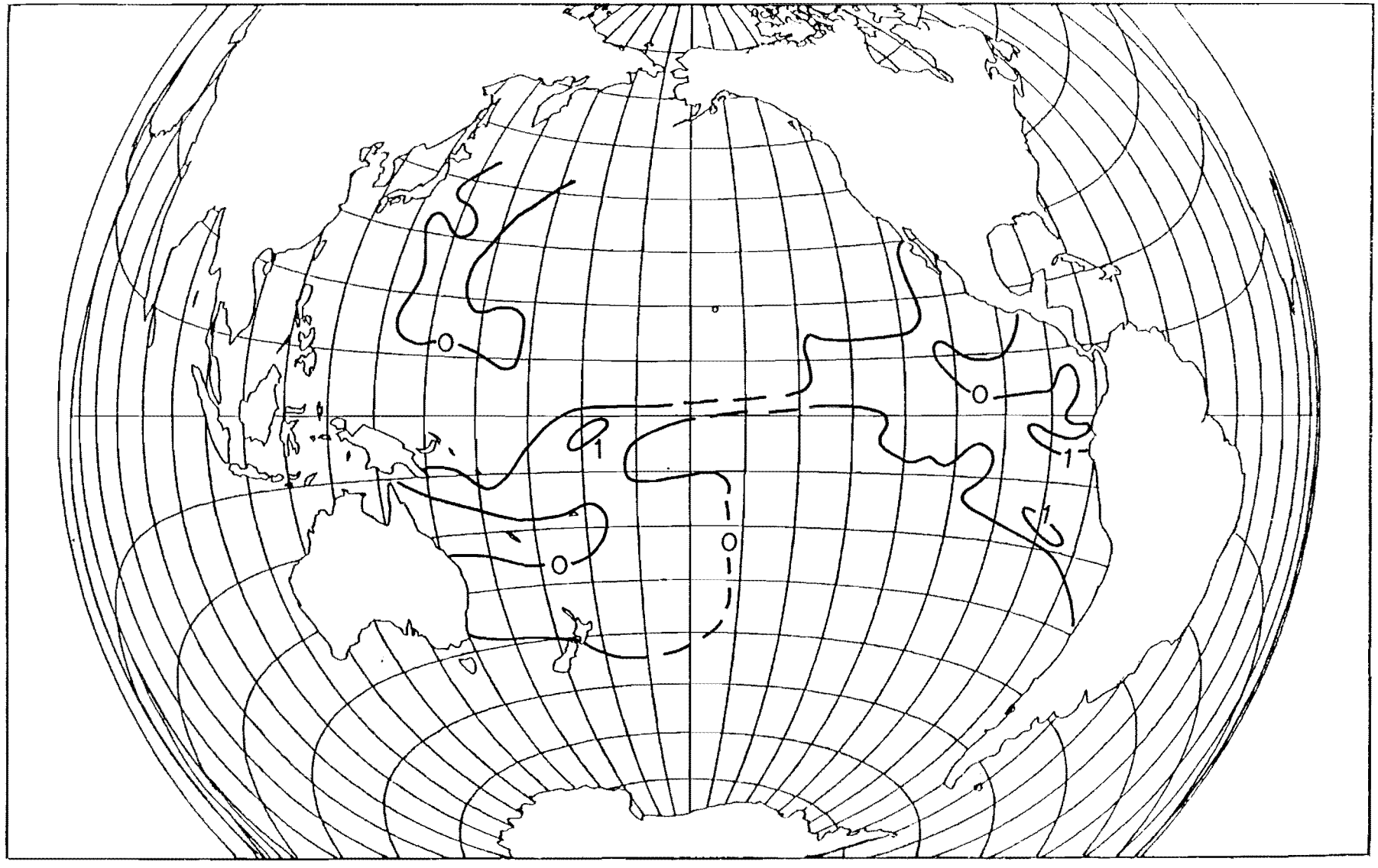
Styptosphaera (?) spumacea



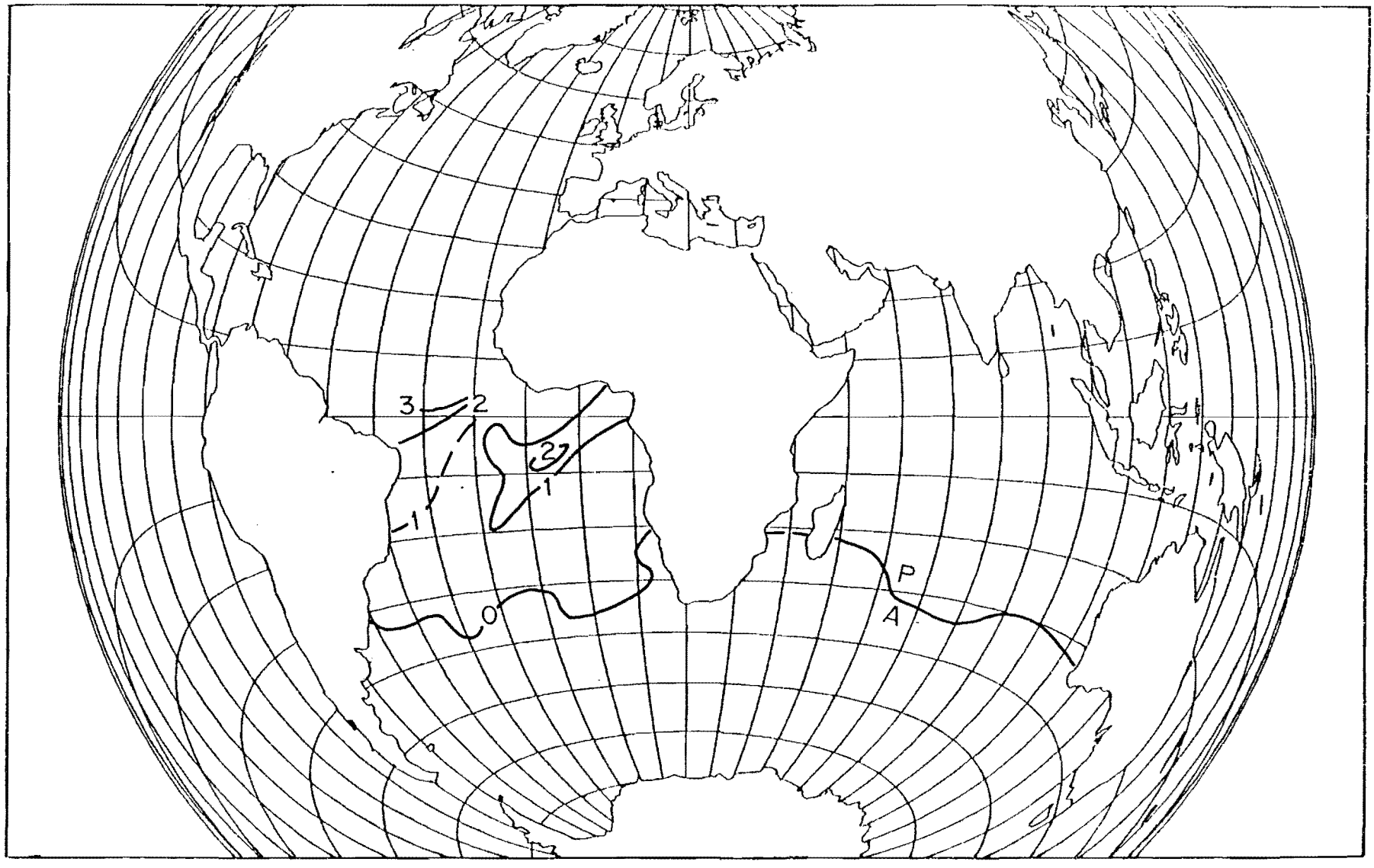
Heliodiscus asteriscus and echiniscus



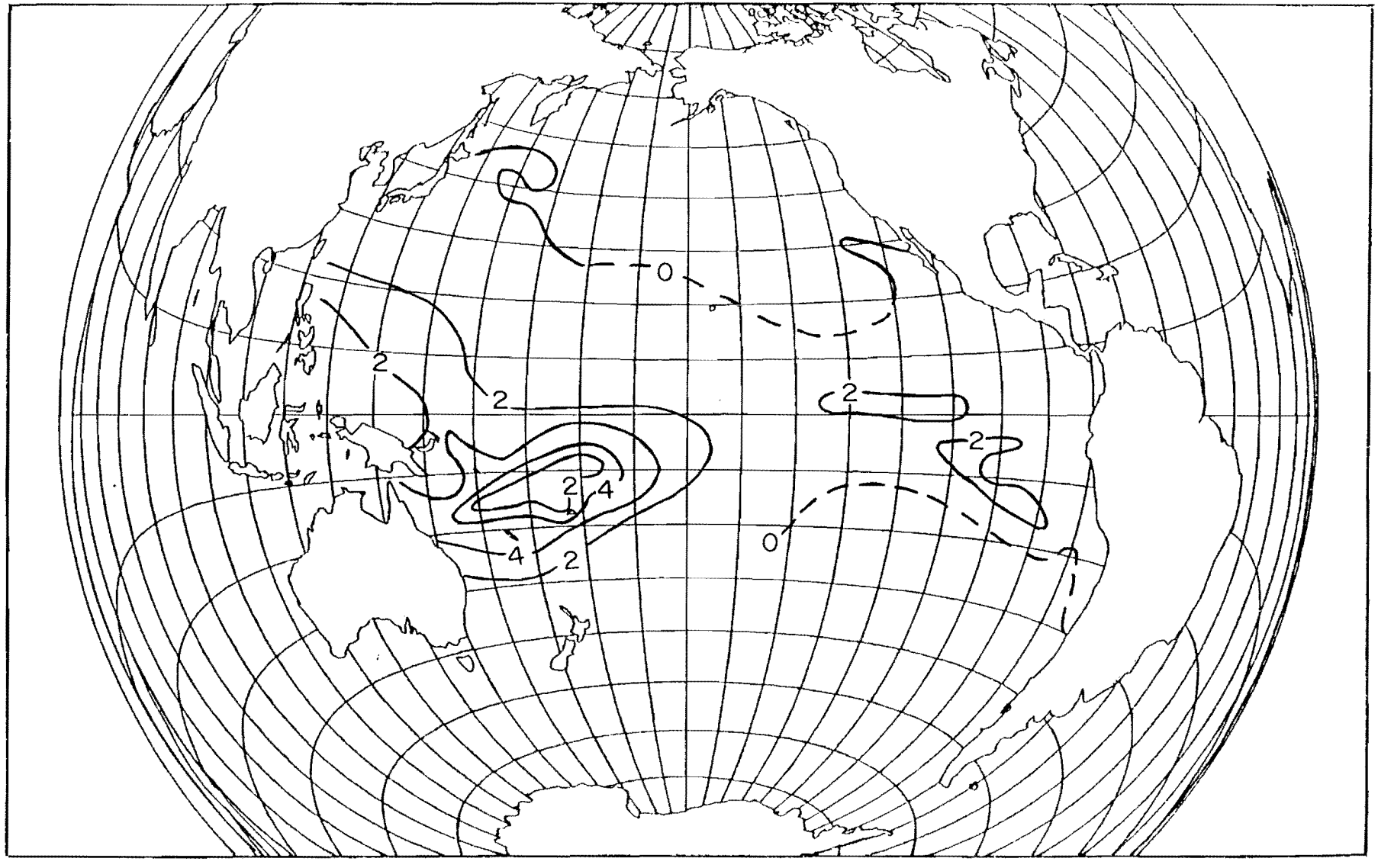
Heliodiscus asteriscus and echiniscus



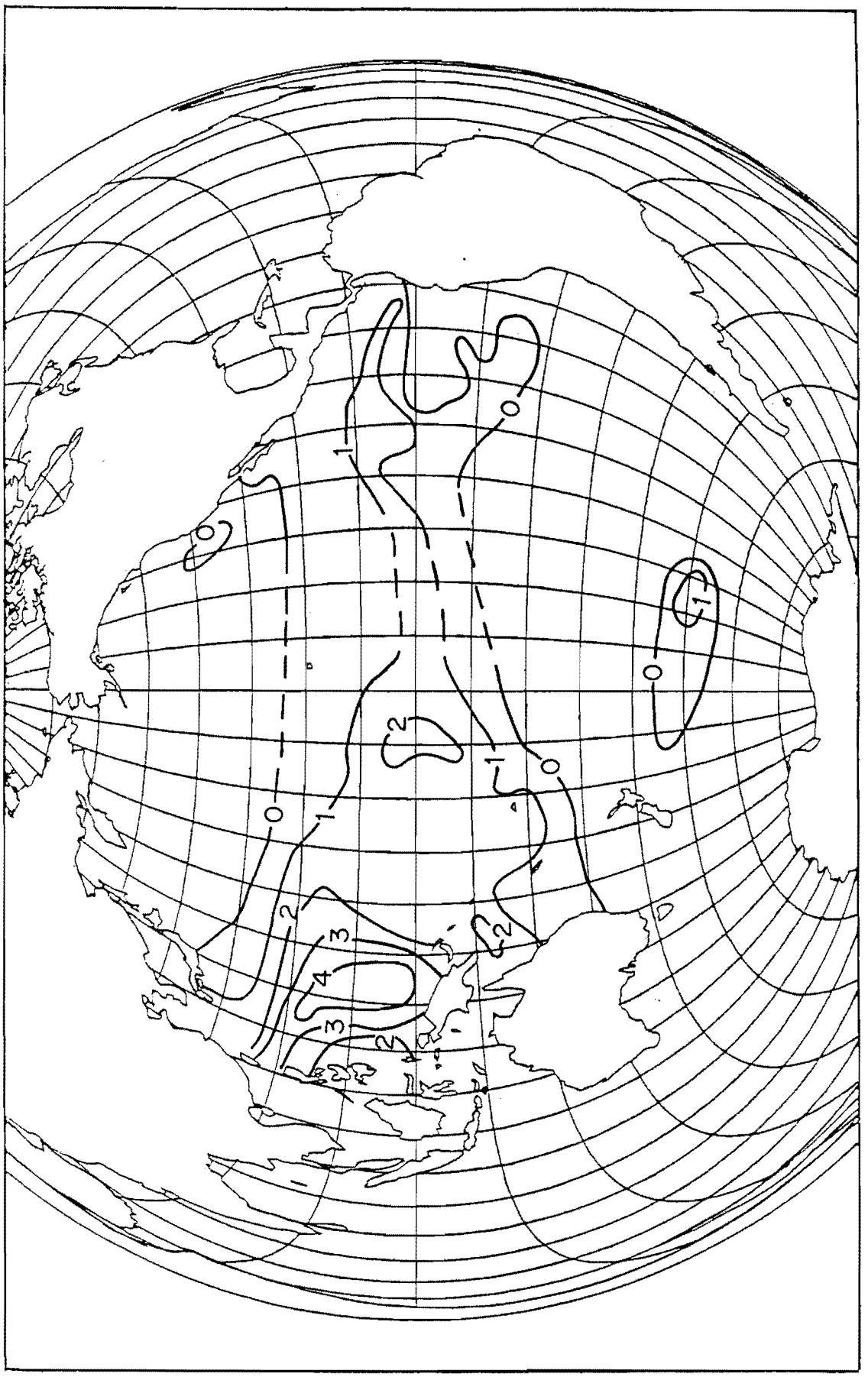
Amphiropalum ypsilon

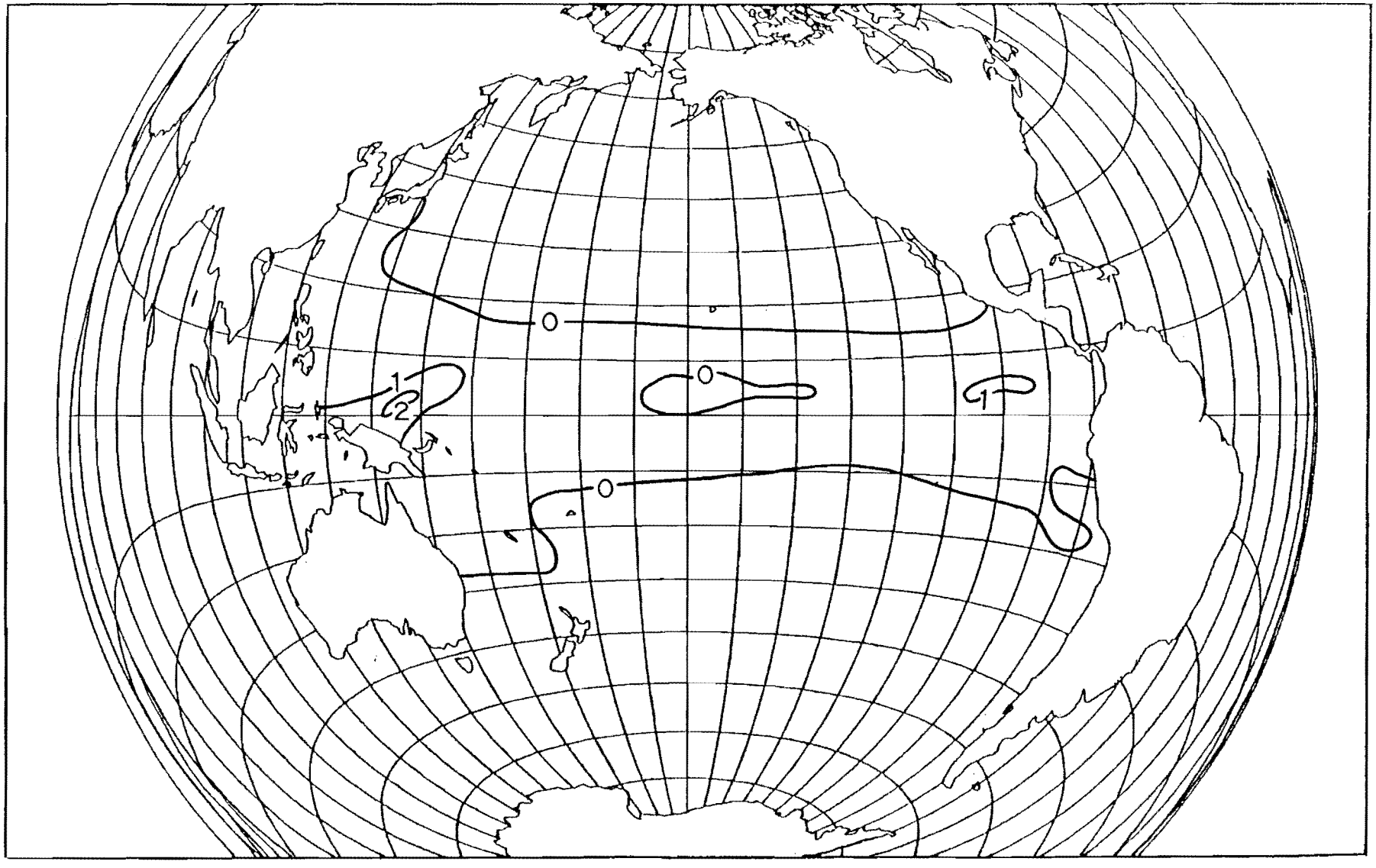


Euchitonia elegans and furcata

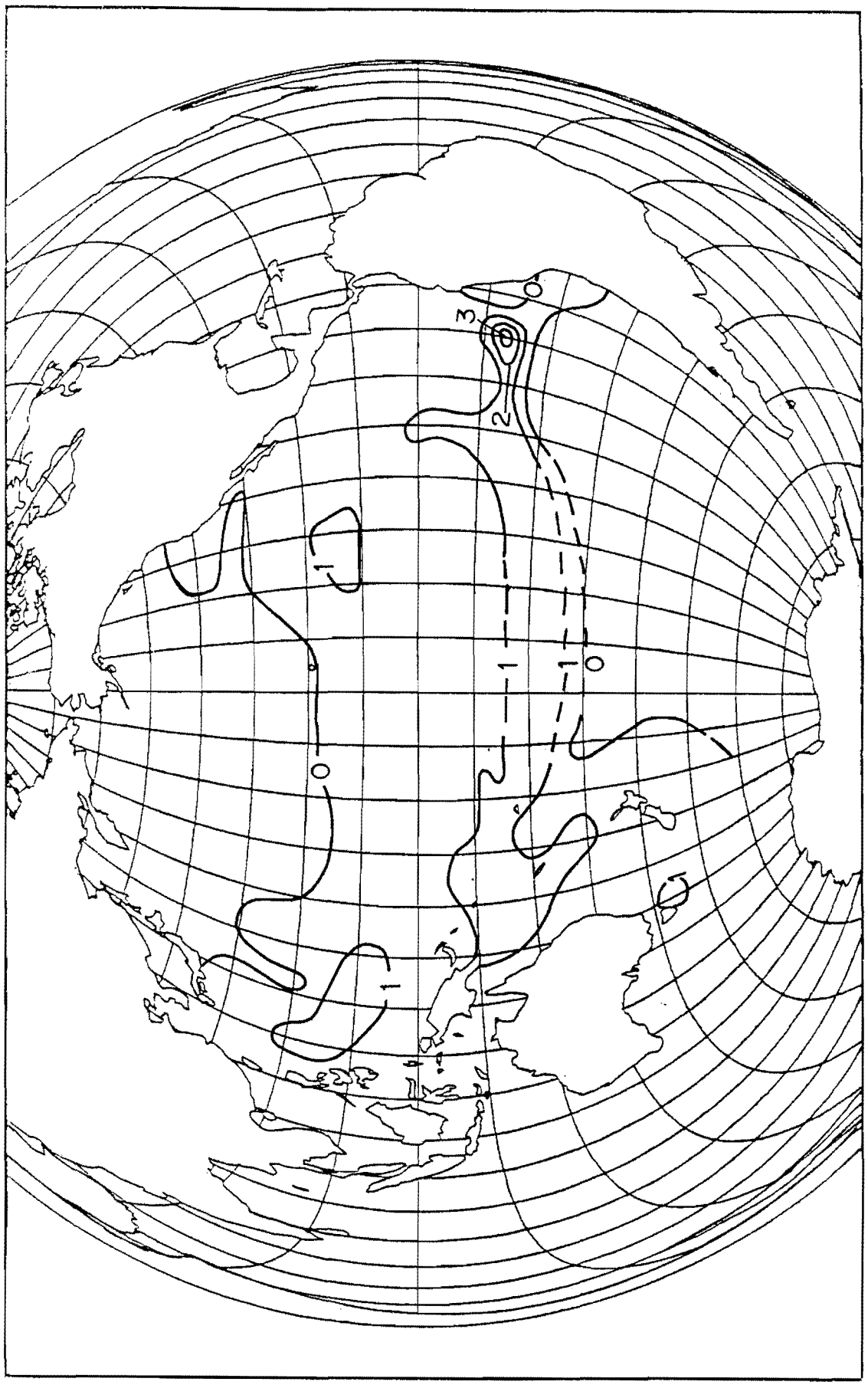


Euchitonia elegans and furcata

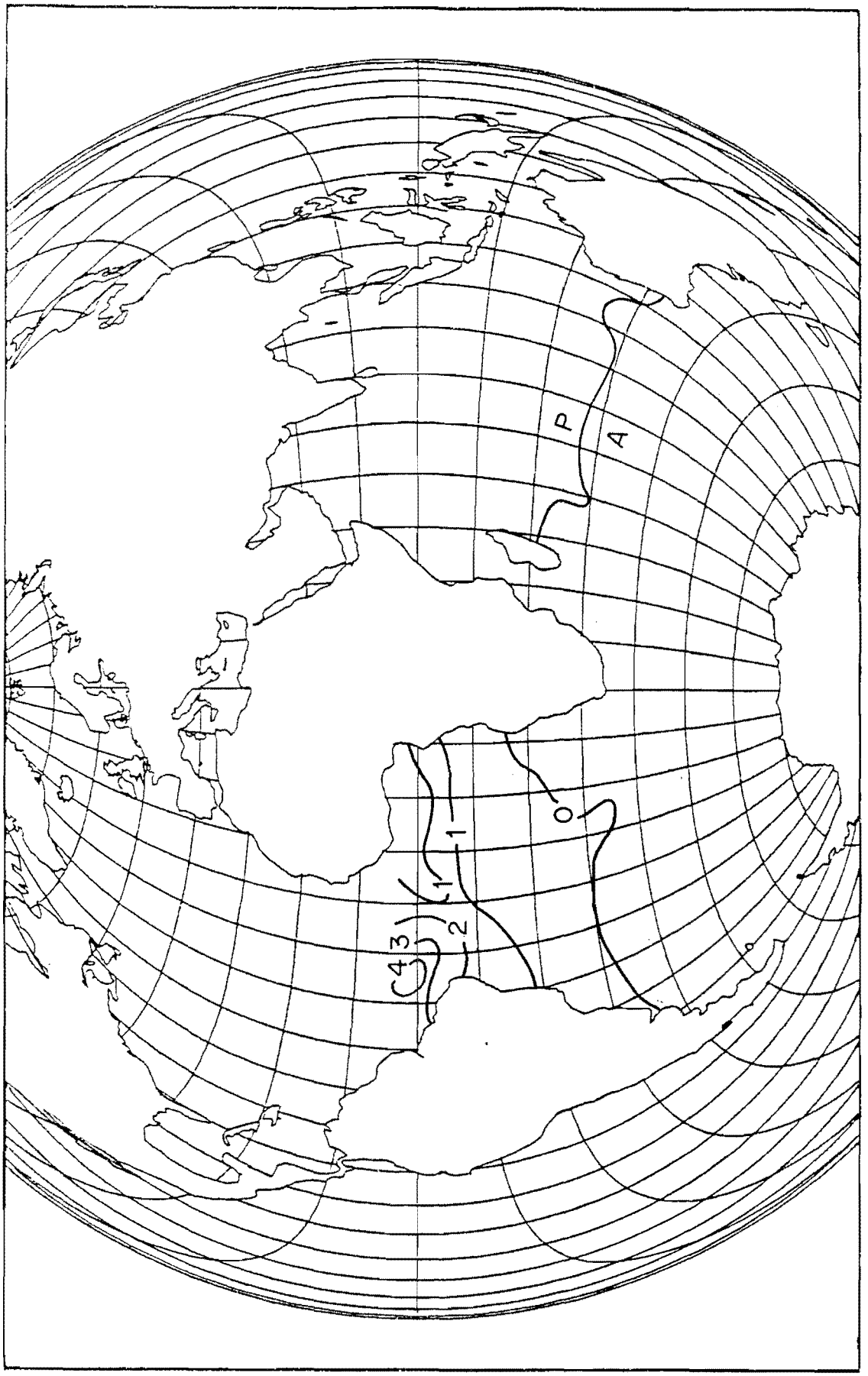

Dictyocorne profunda



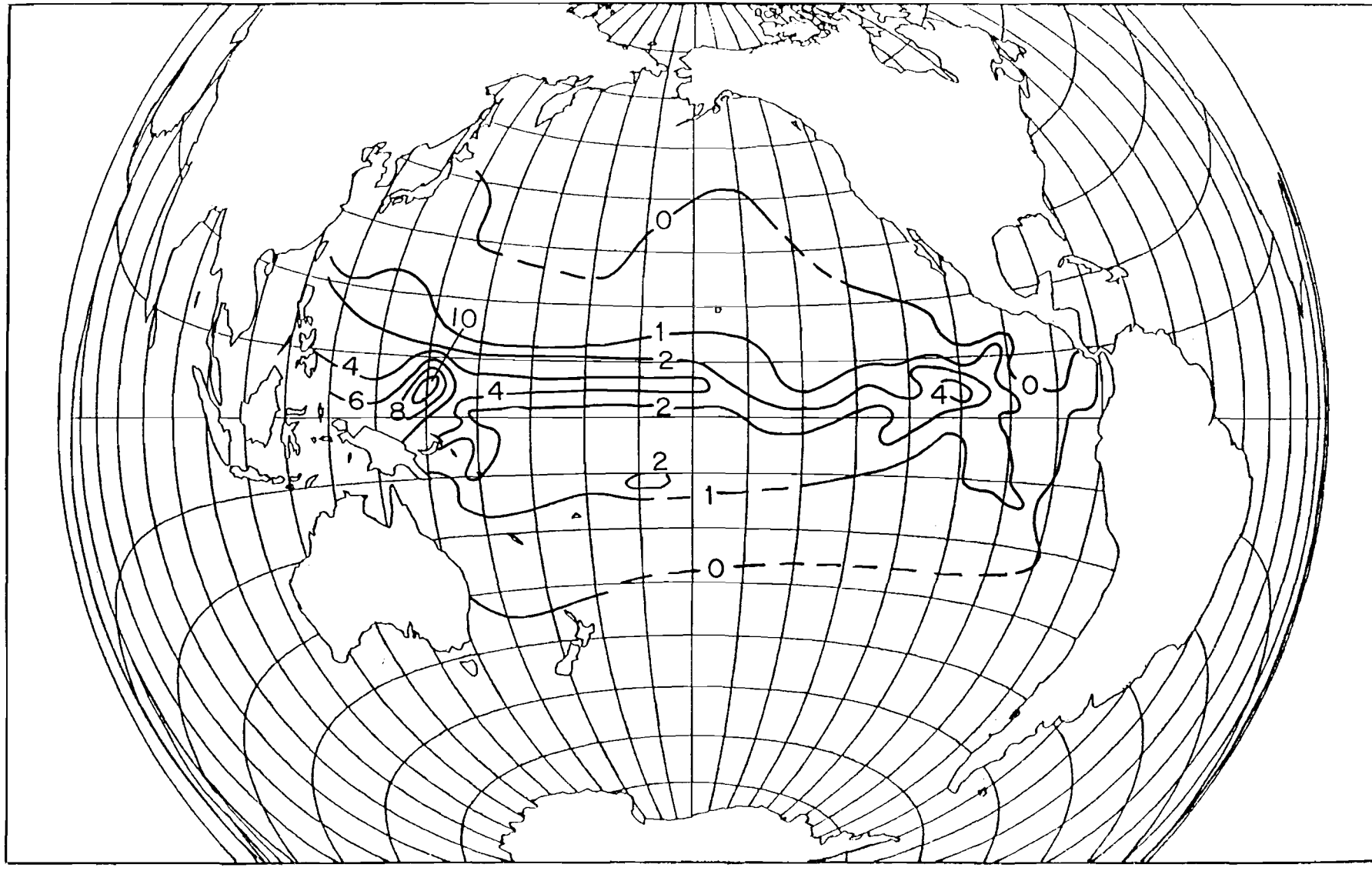
Dictyocorne truncatum



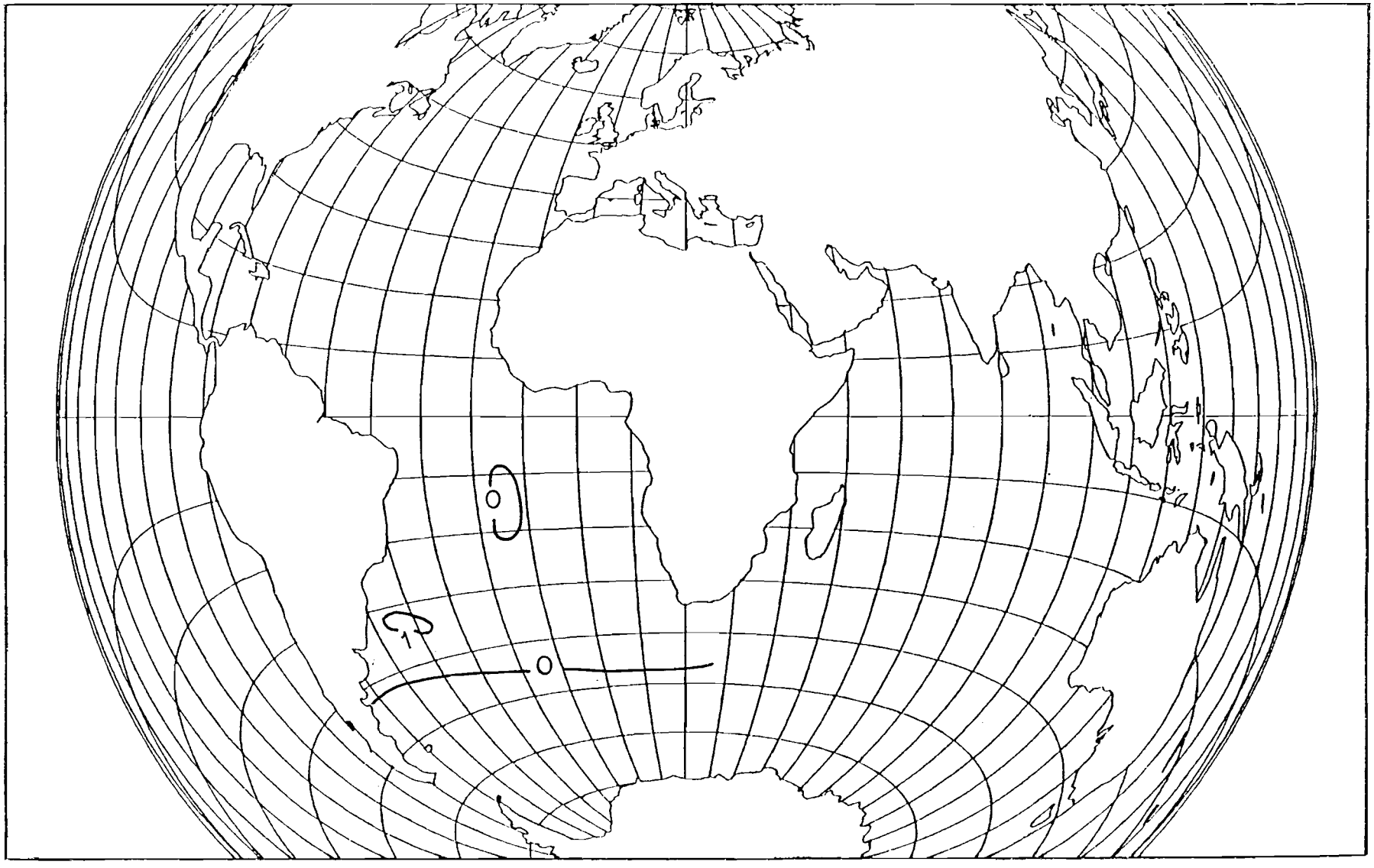
Hymeniastrum euclidis



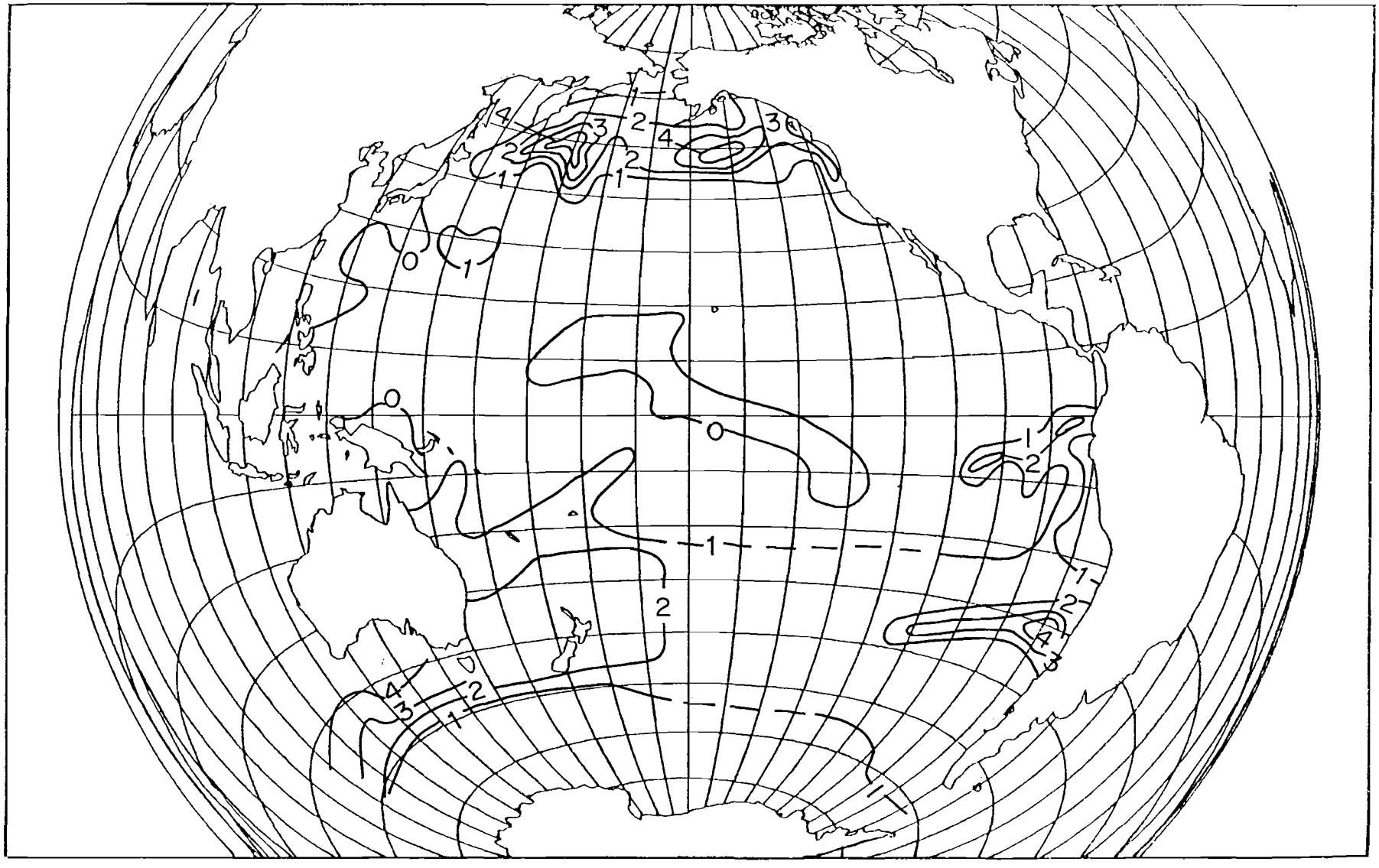
Spongaster tetras



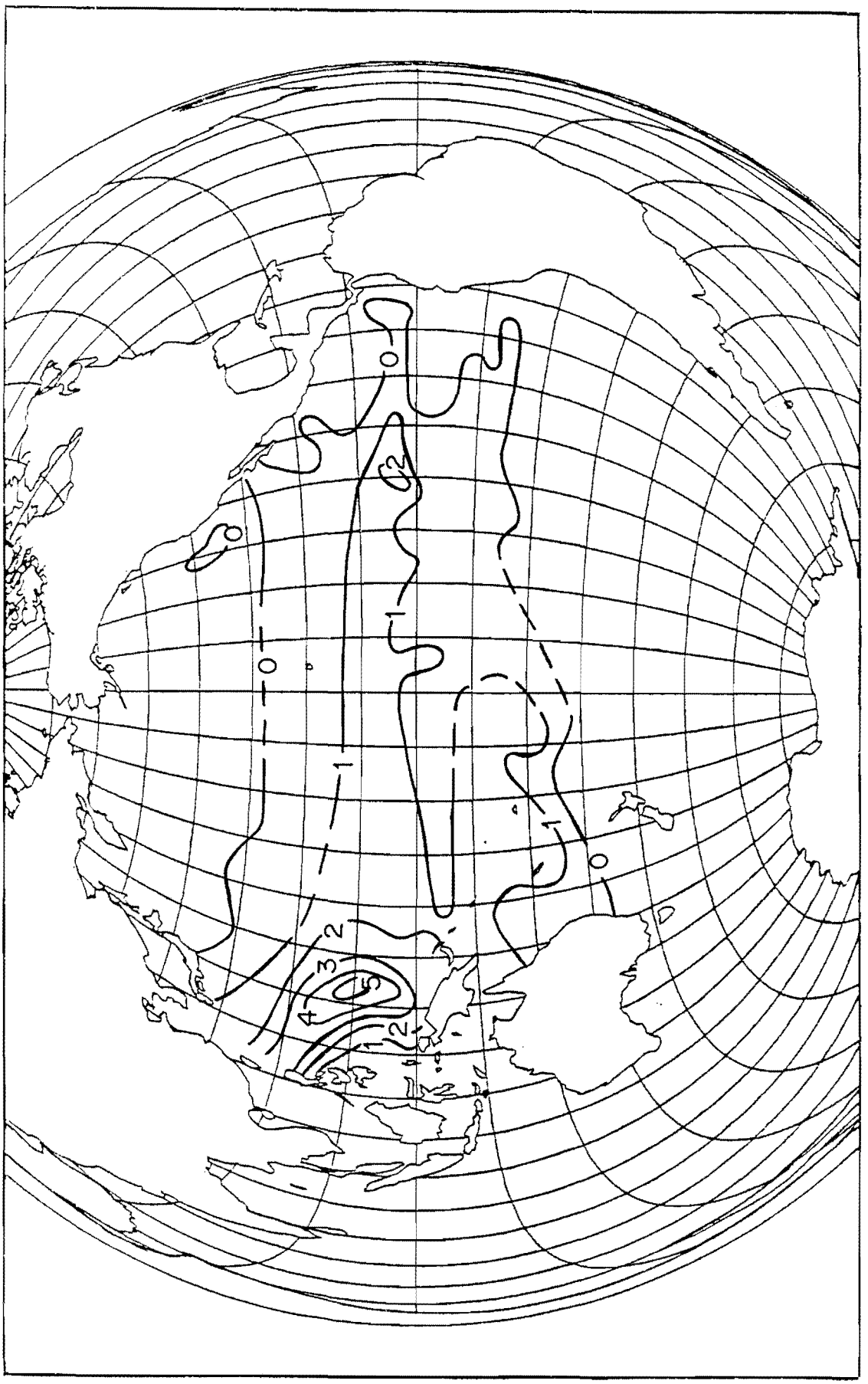
Spongaster tetras



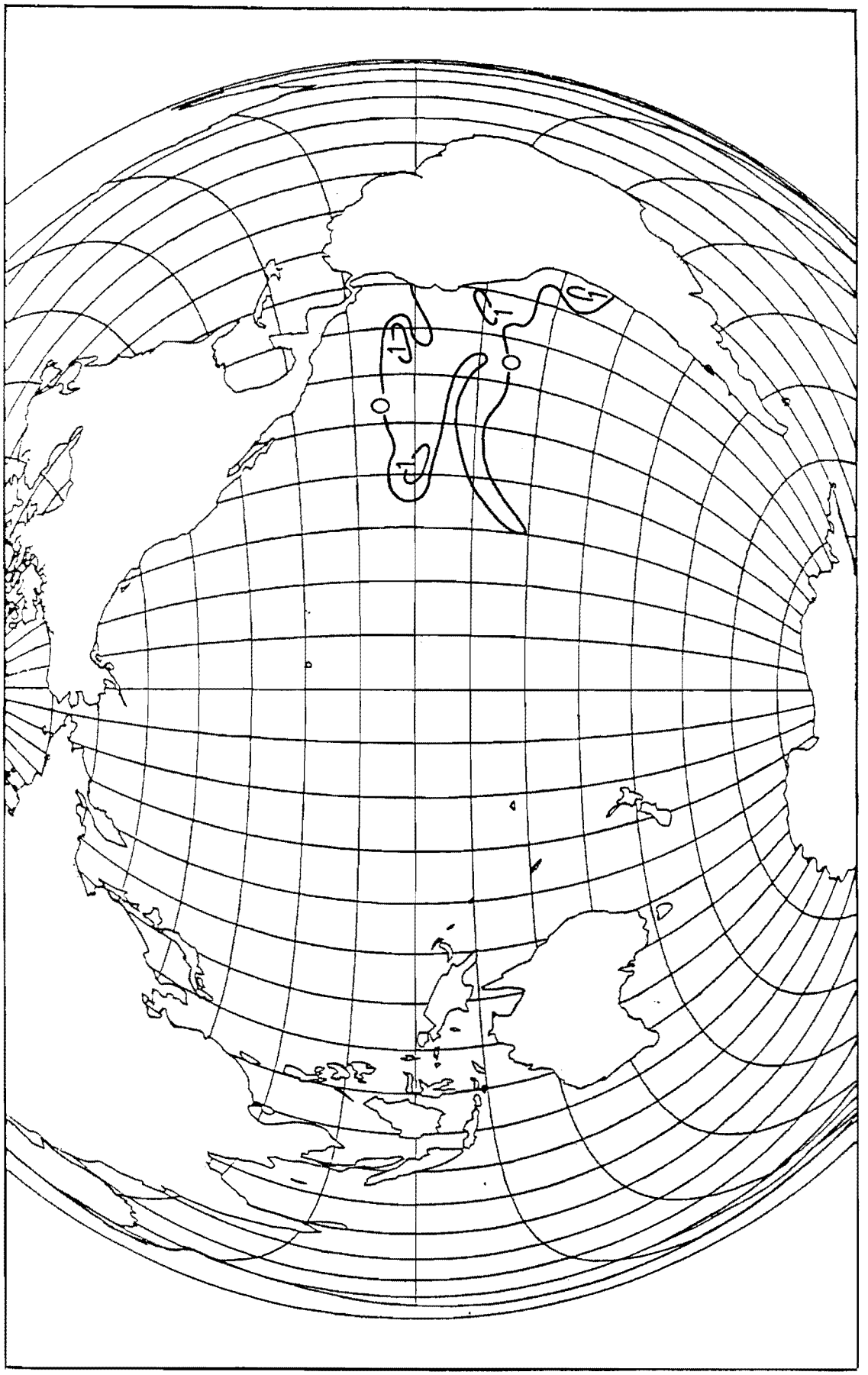
Stylodictya validispina



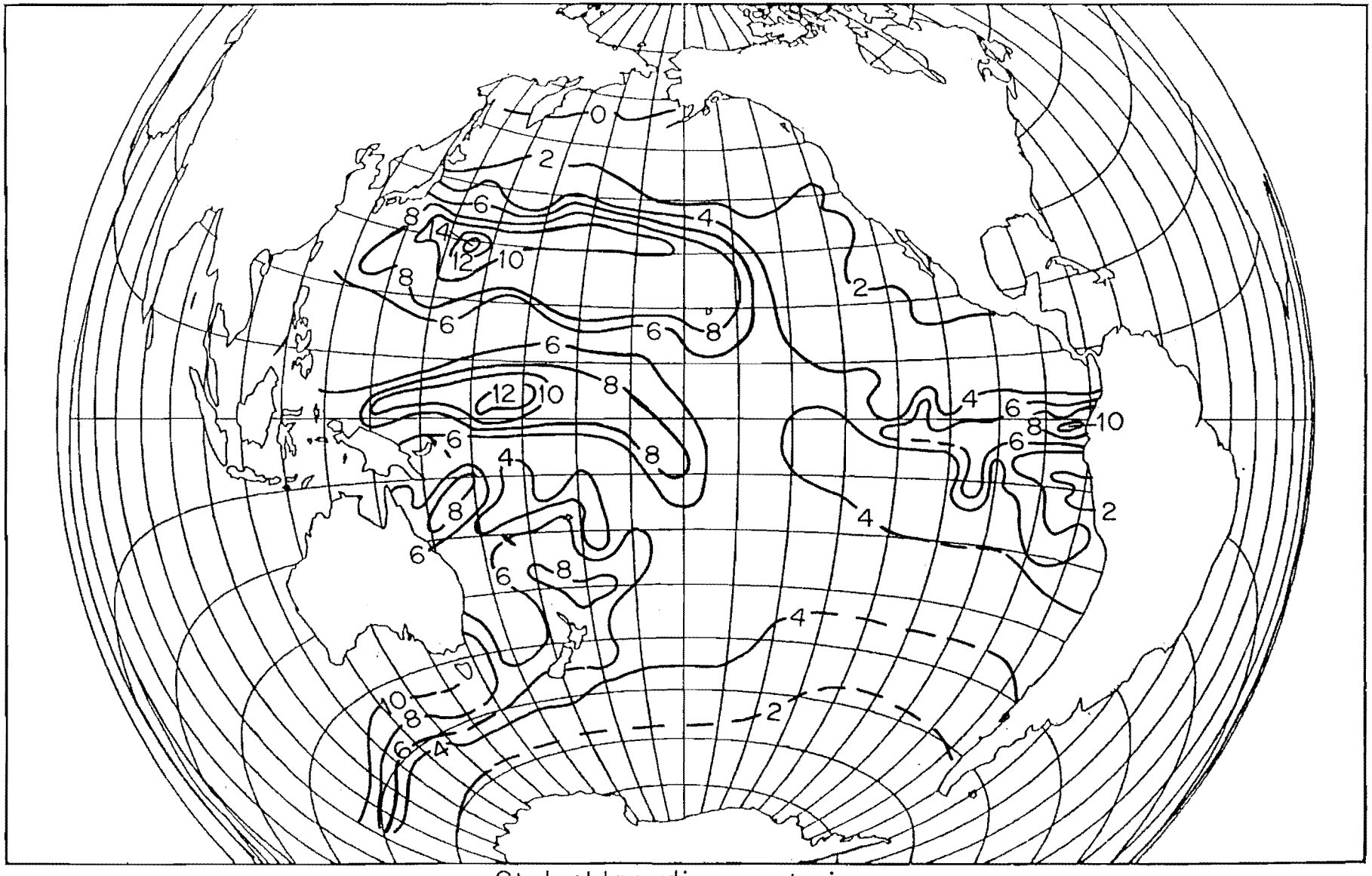
Stylodictya validispina



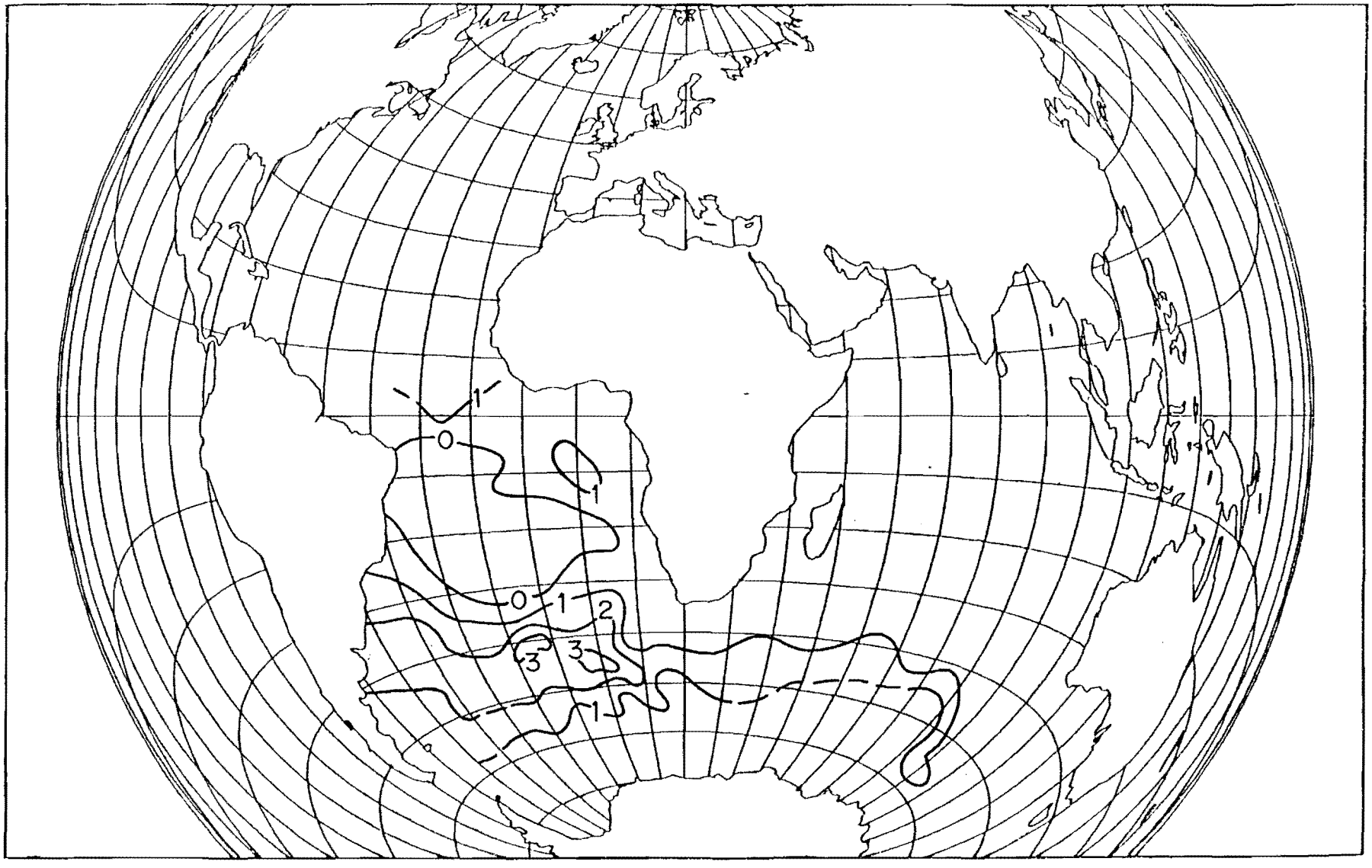
Porodiscus sp. A



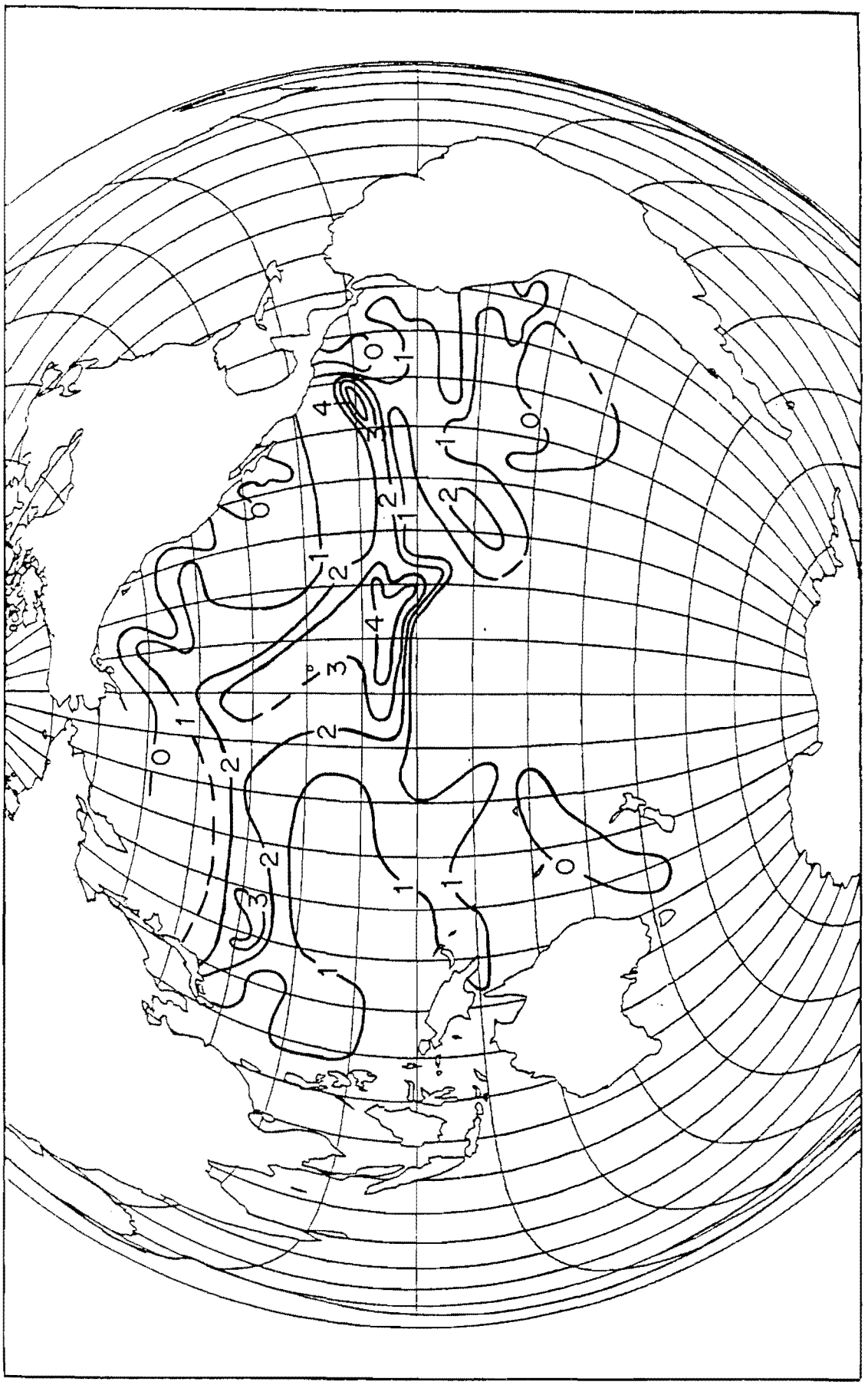
Porodiscus sp. B



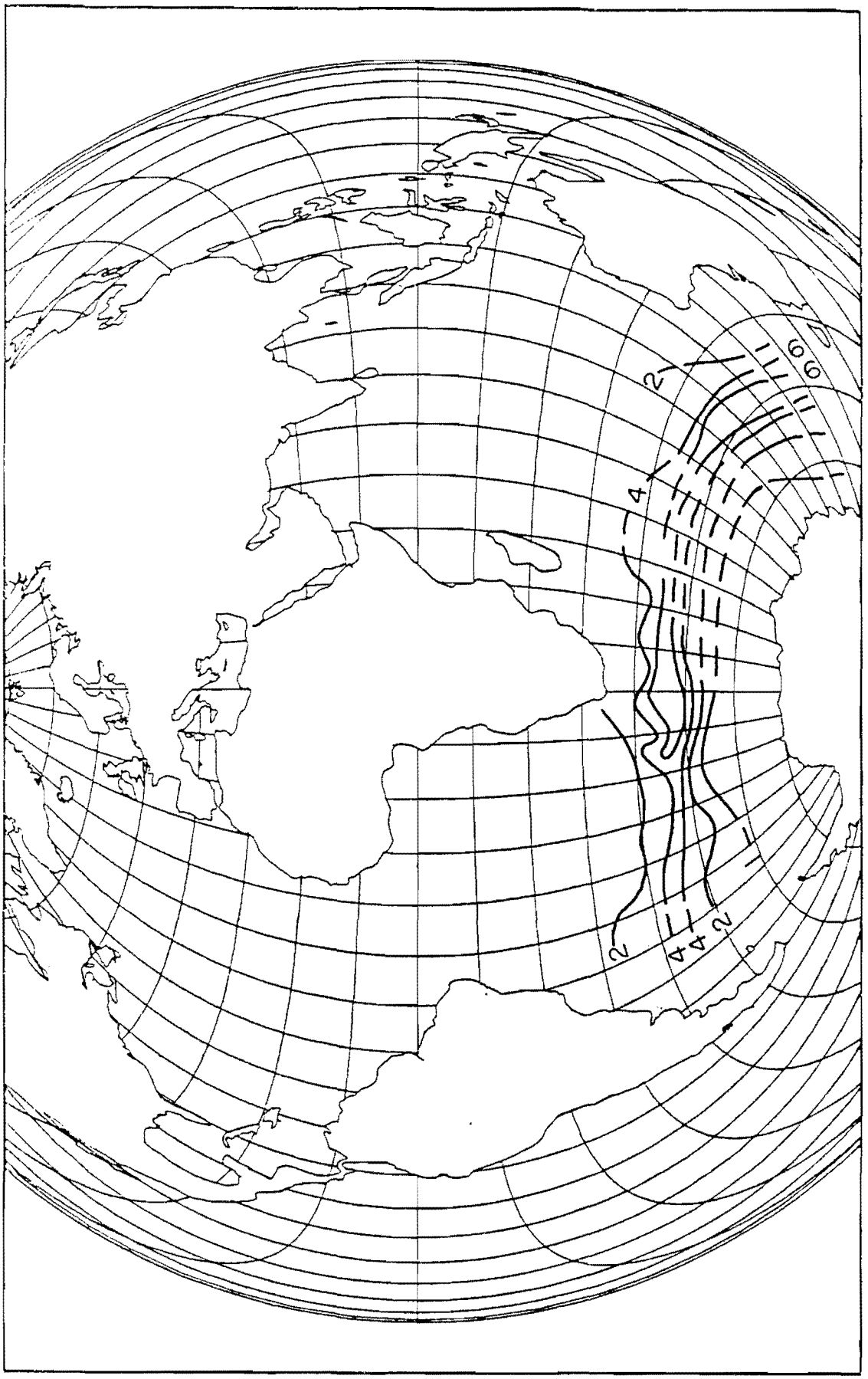
Stylochlamydium asteriscus



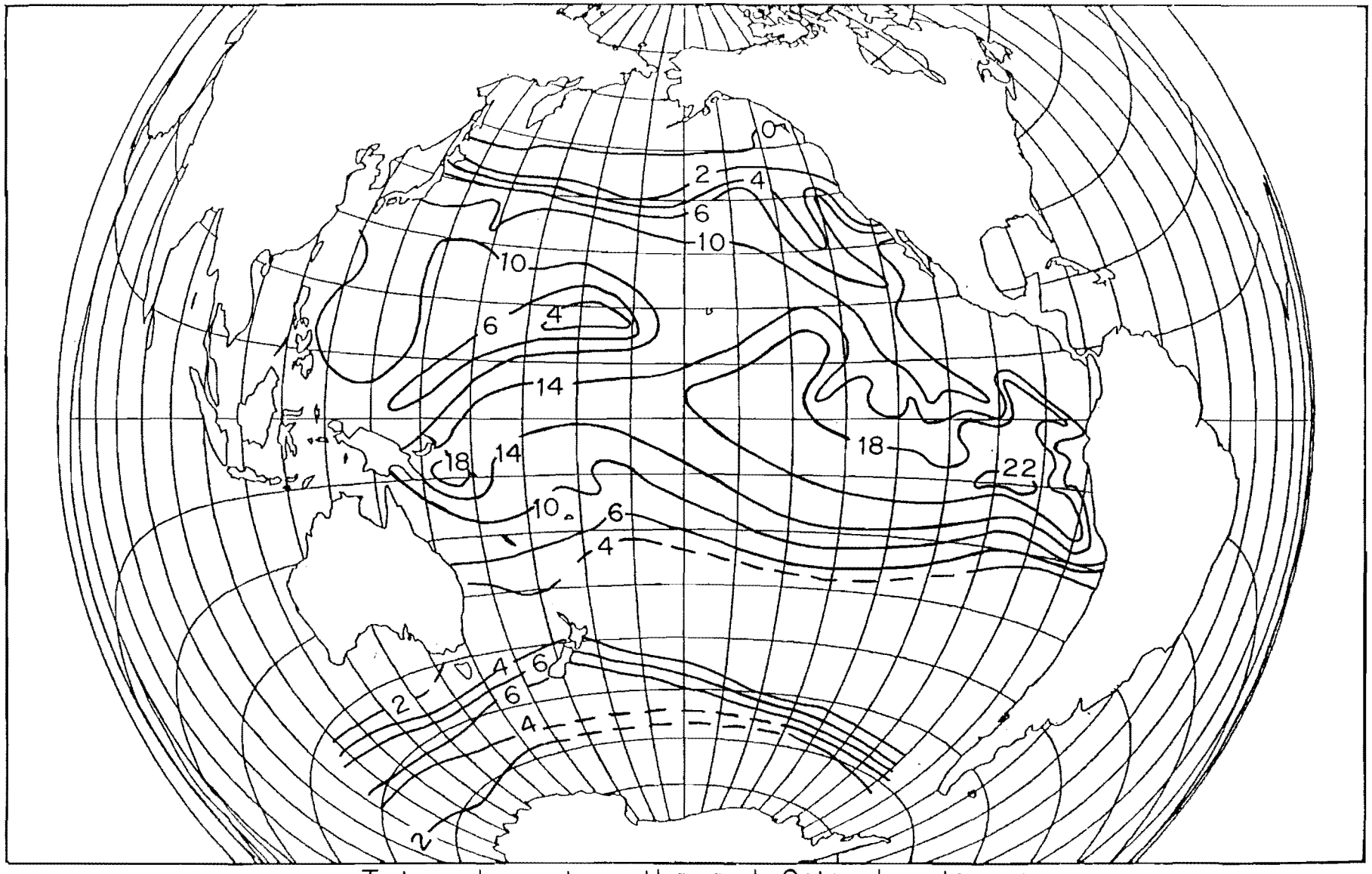
Spongopyle osculosa



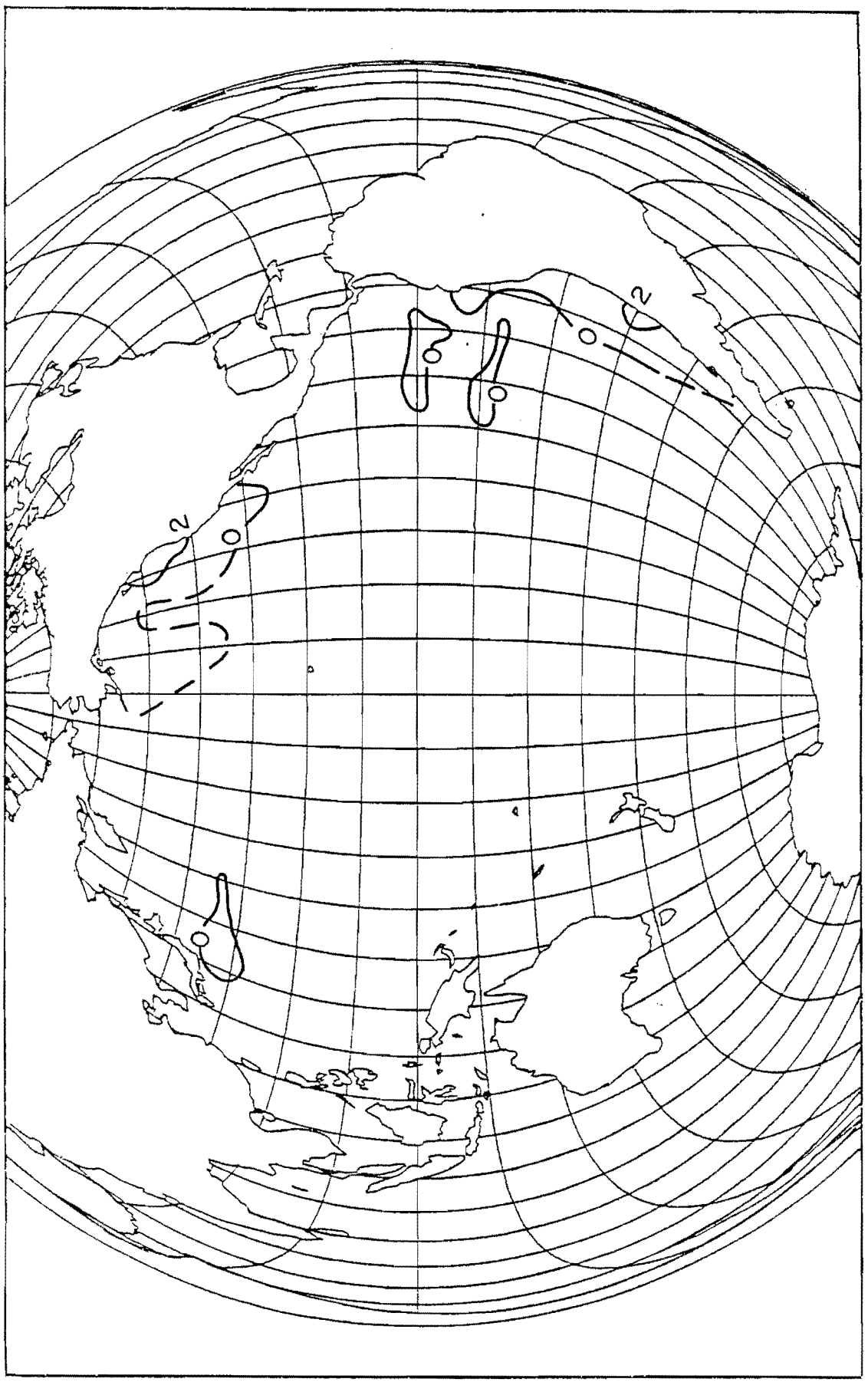
Hexapyle spp.



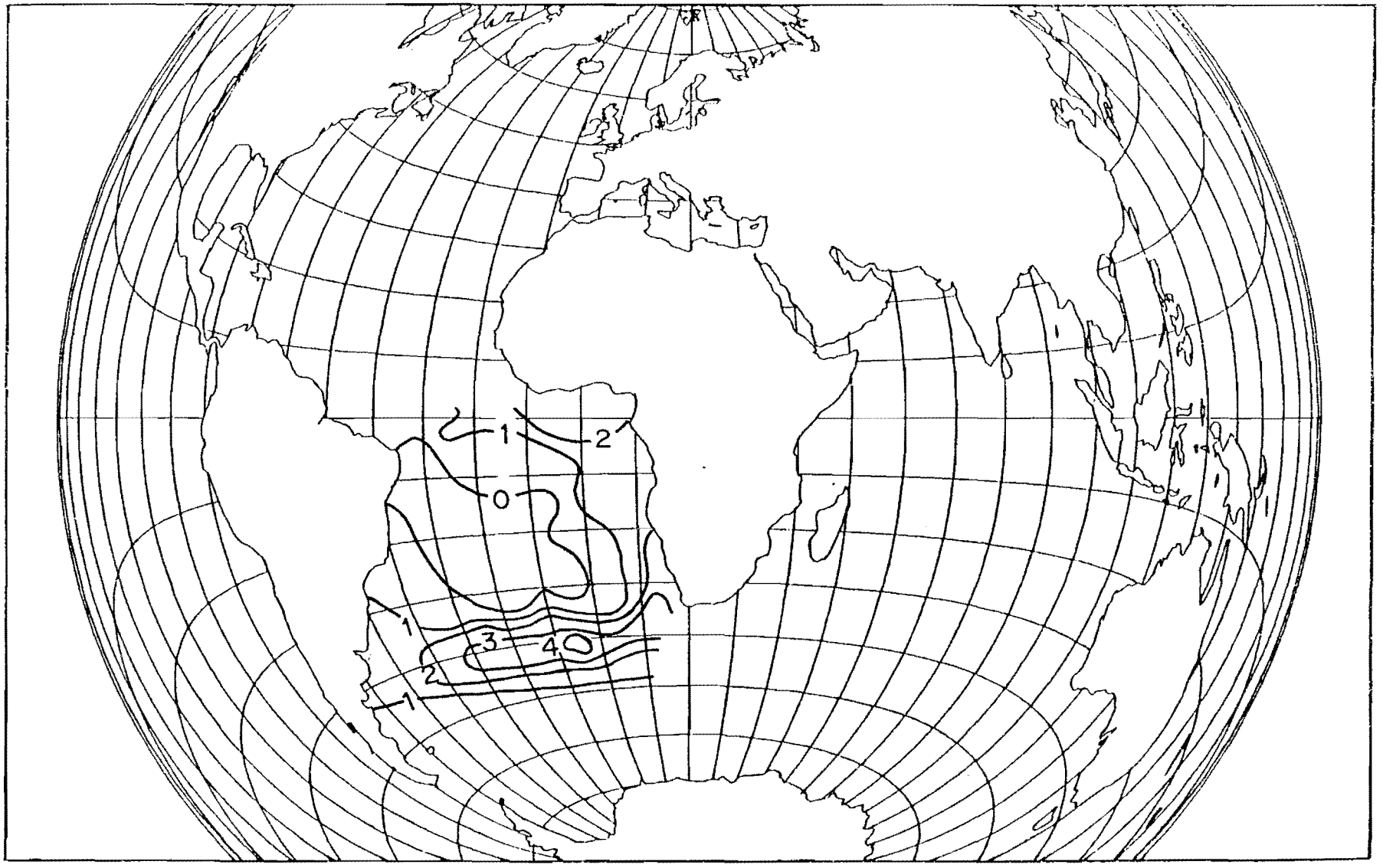
Tetrapyle octacantha



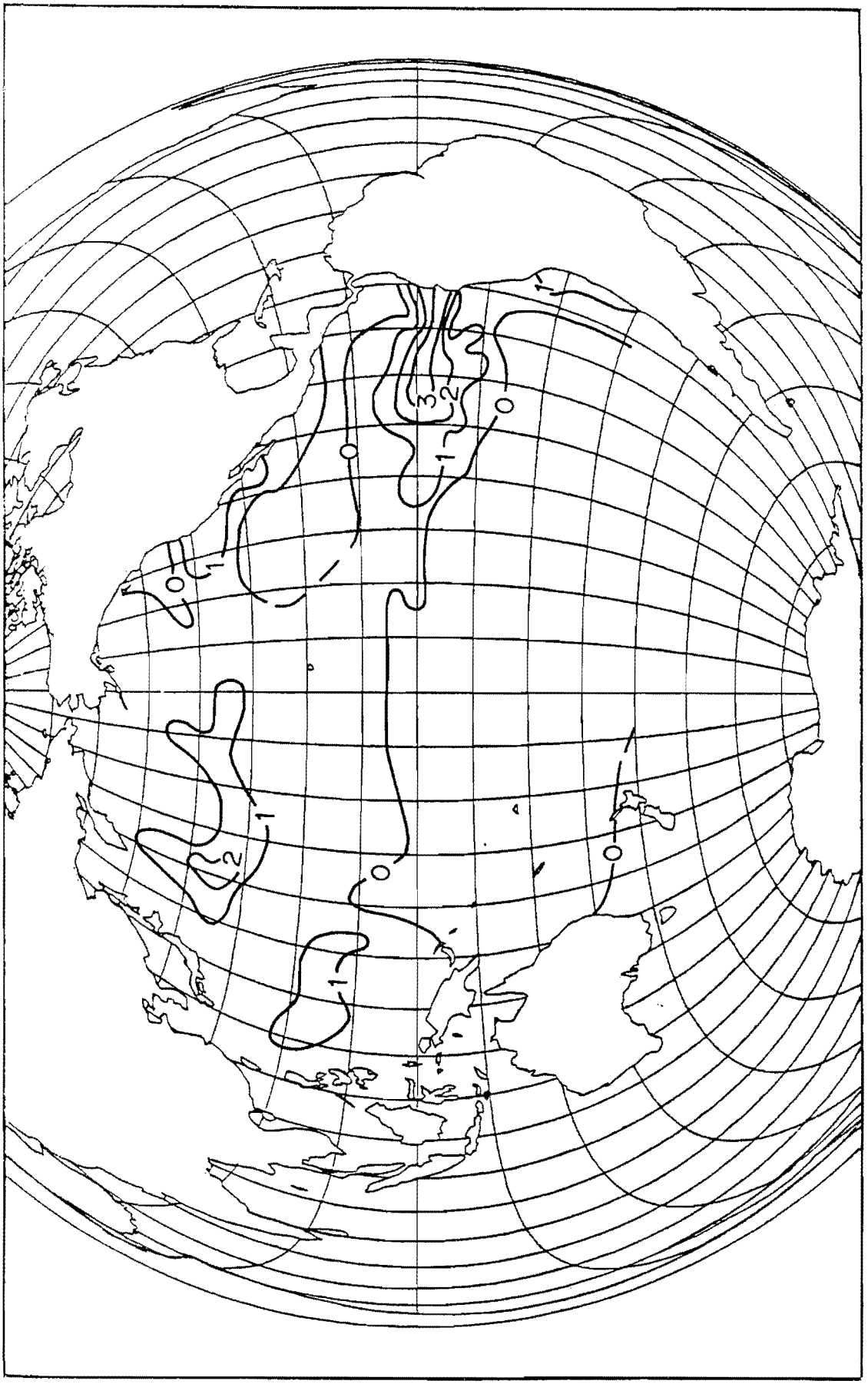
Tetrapyle octacantha and Octopyle stenozoa



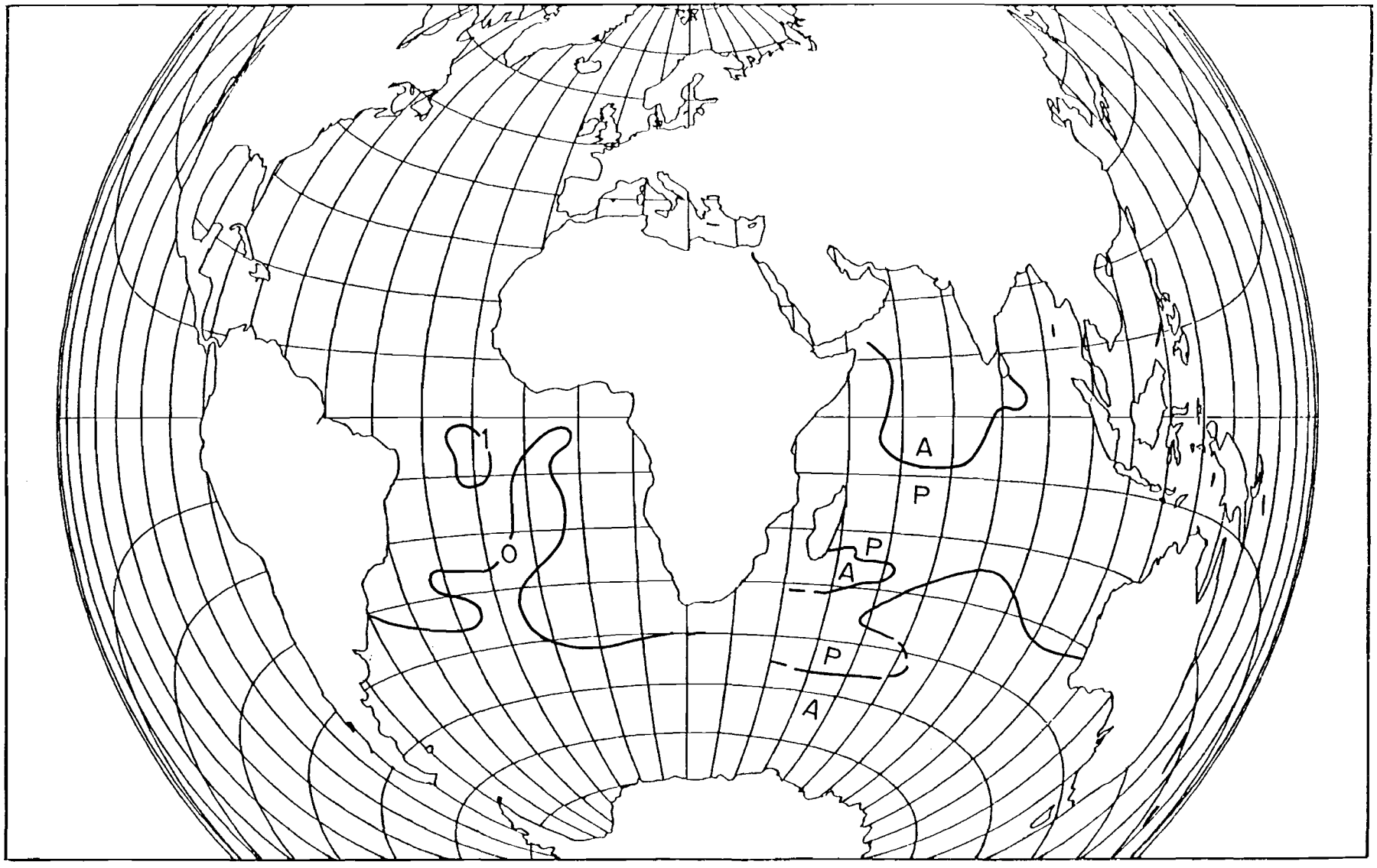
Prunopyle antarctica



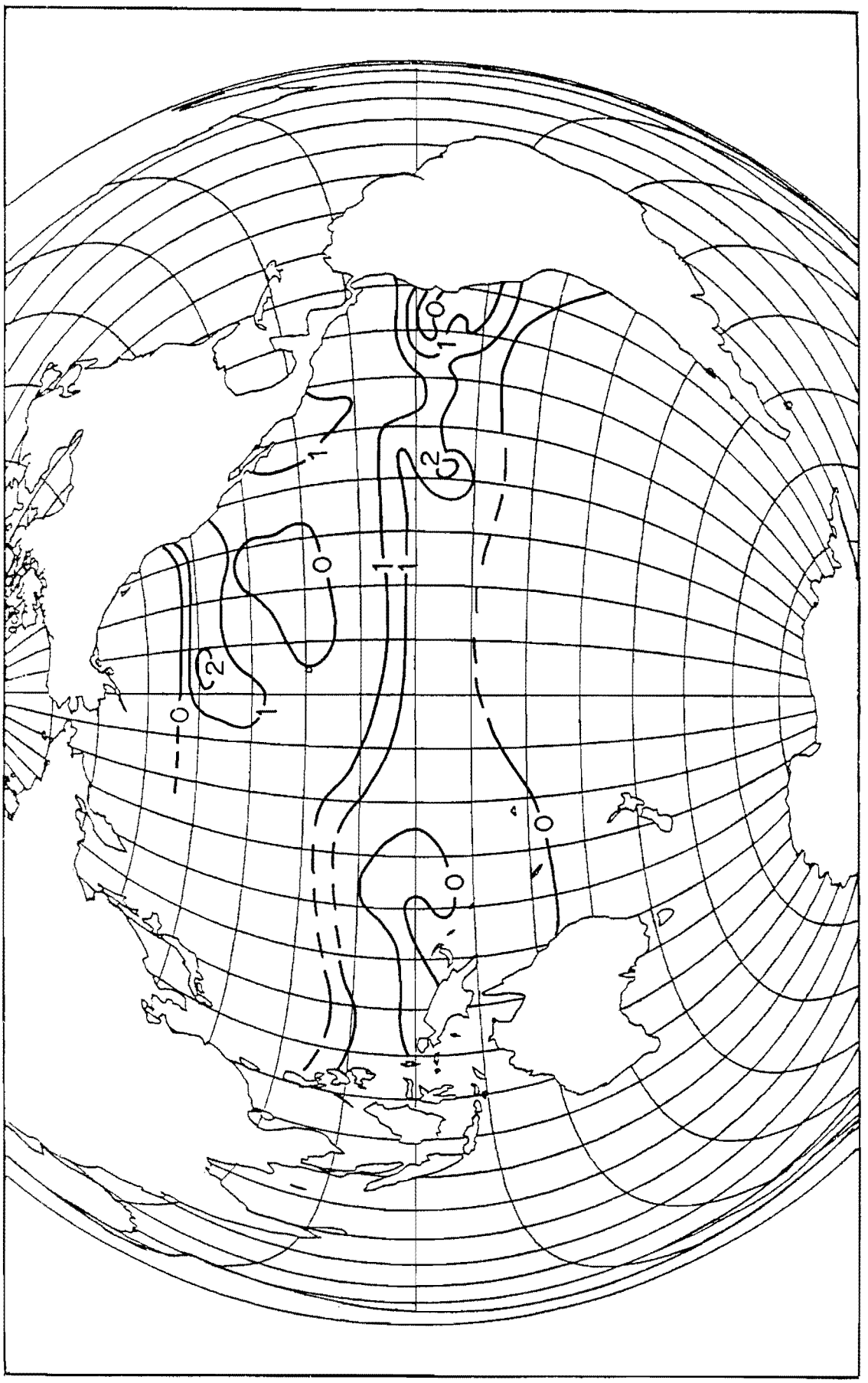
Larcopyle buetschlii



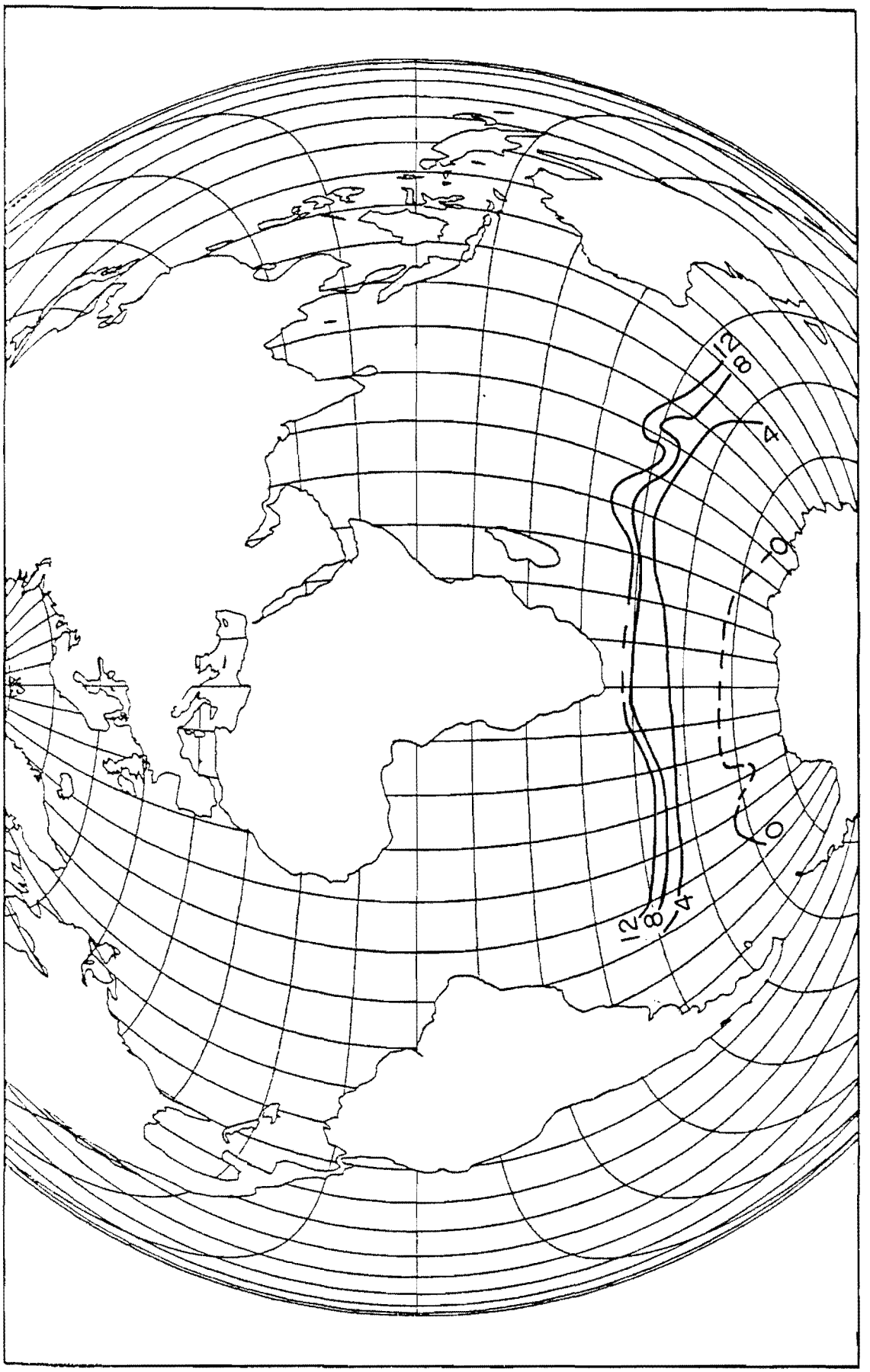
Larcopyle buetschlii



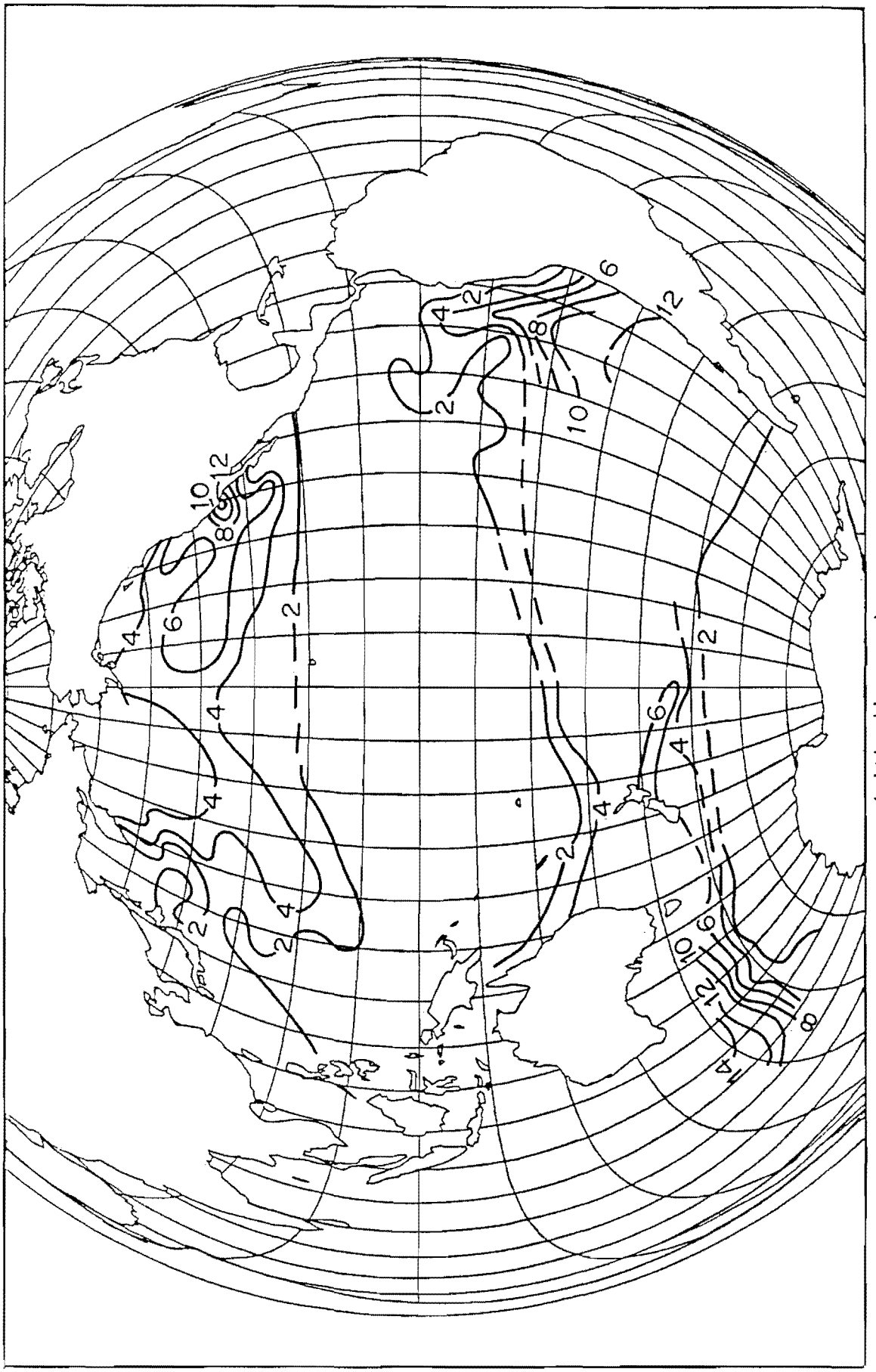
Larcospira quadrangula

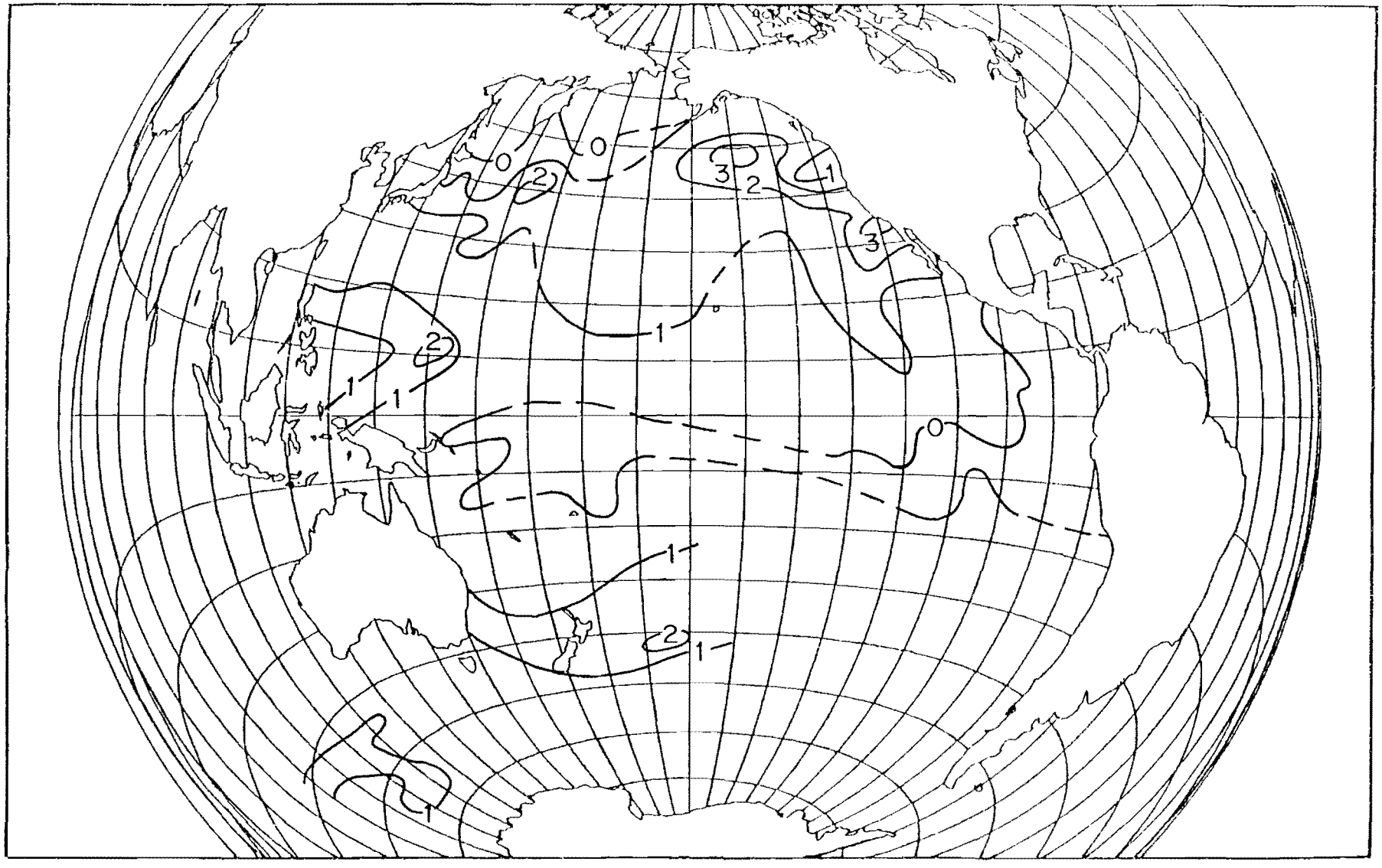


Larcospira quadrangula

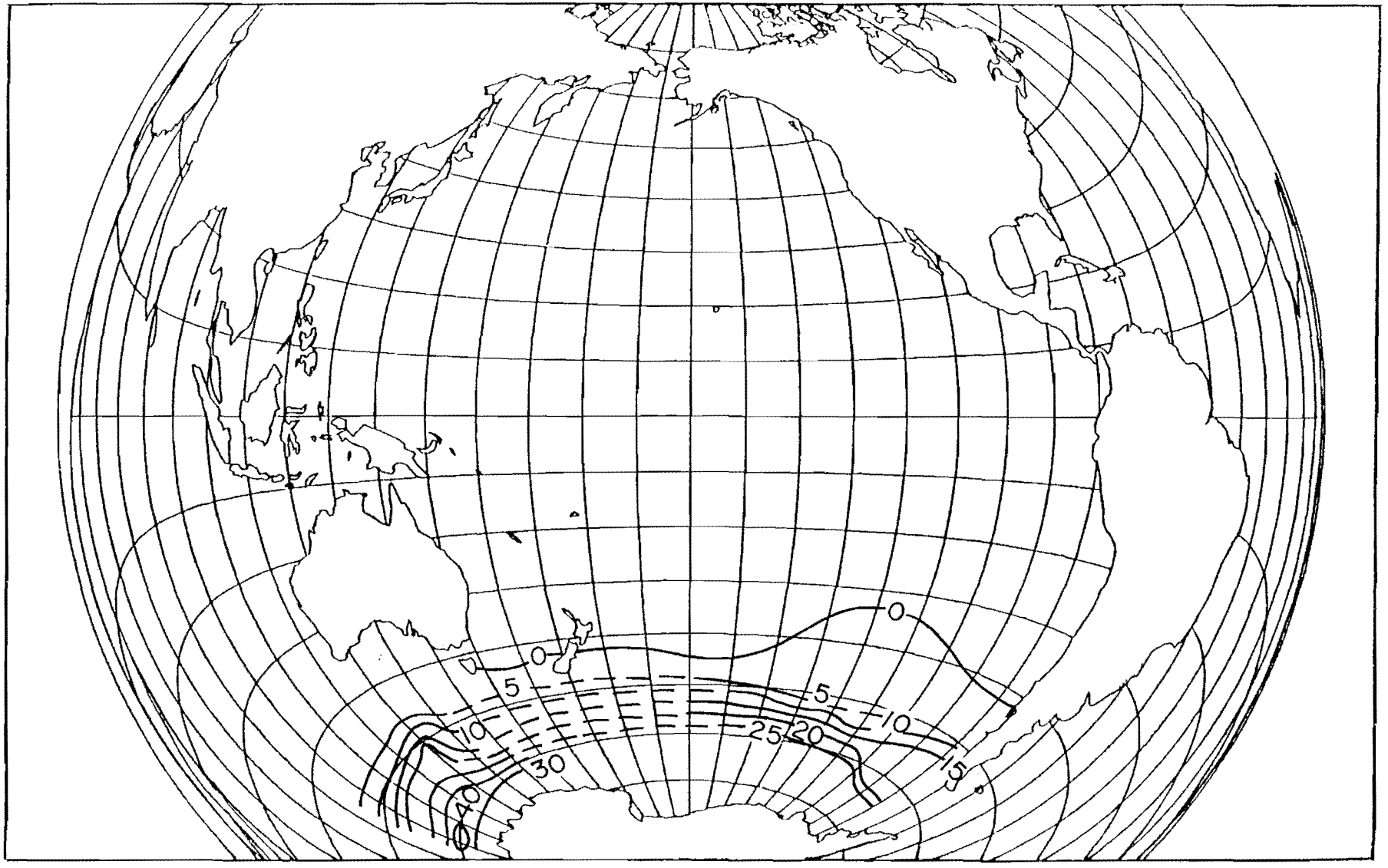


Lithelius minor

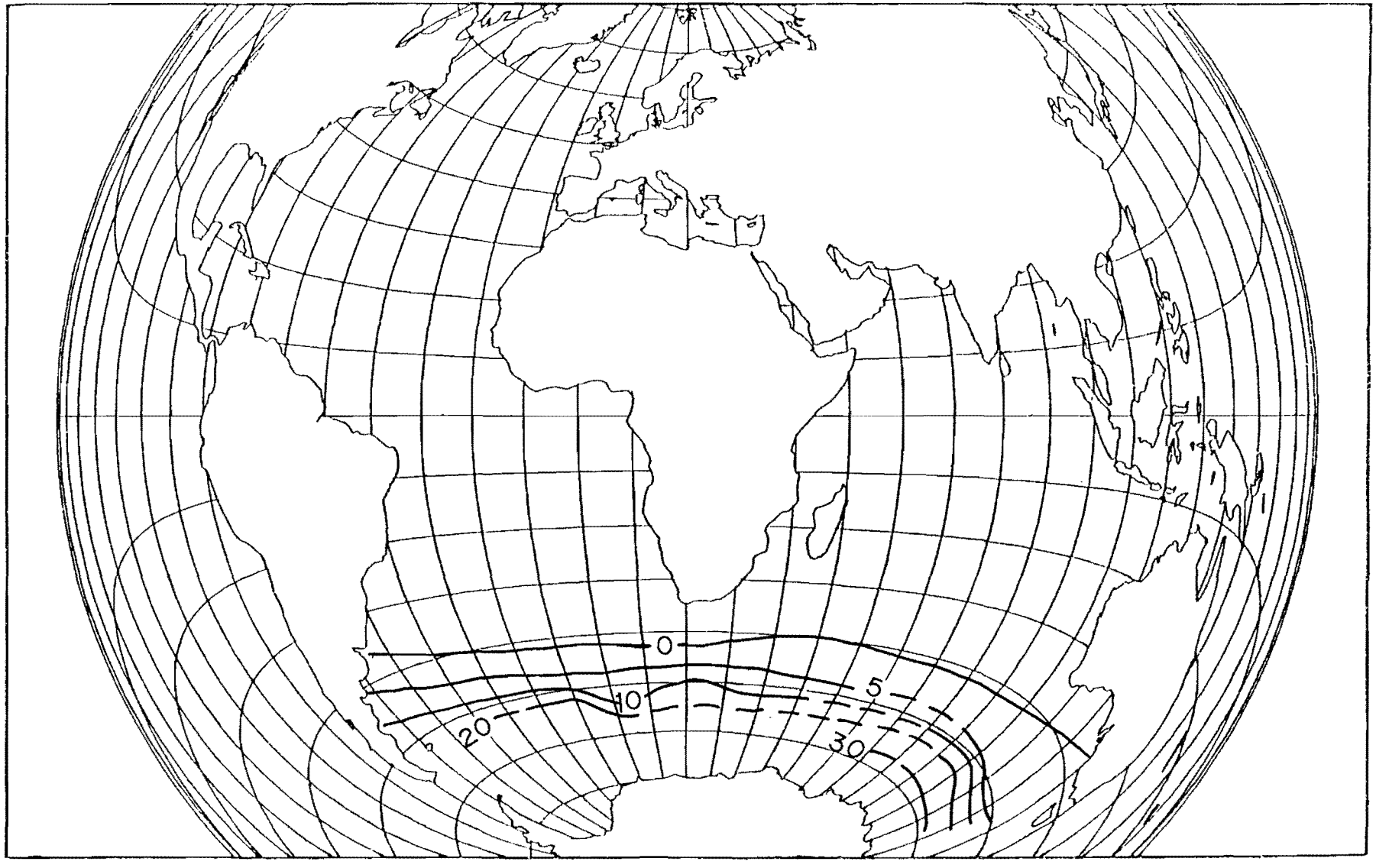

Lithelius minor



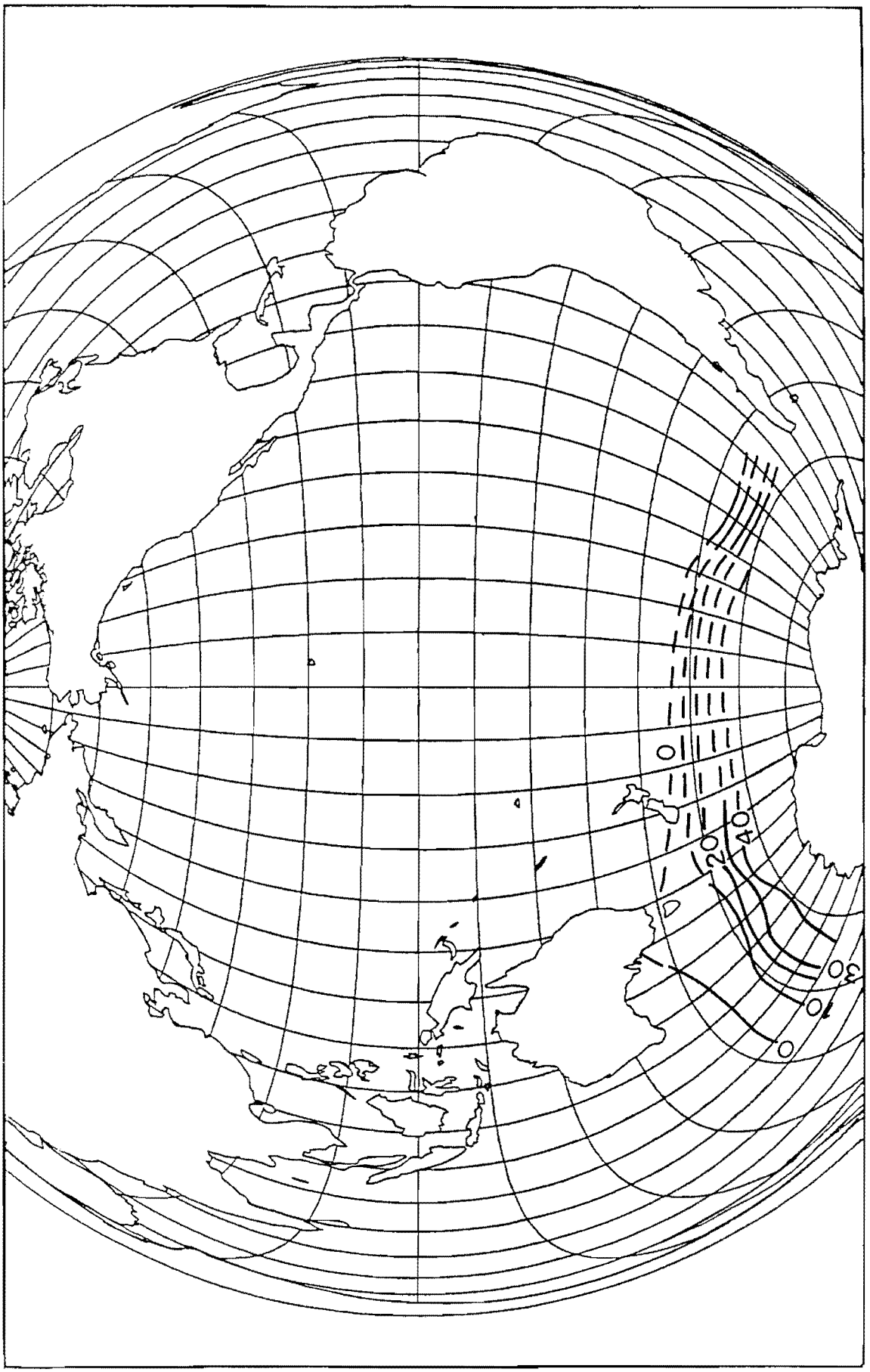
Spirema melonia



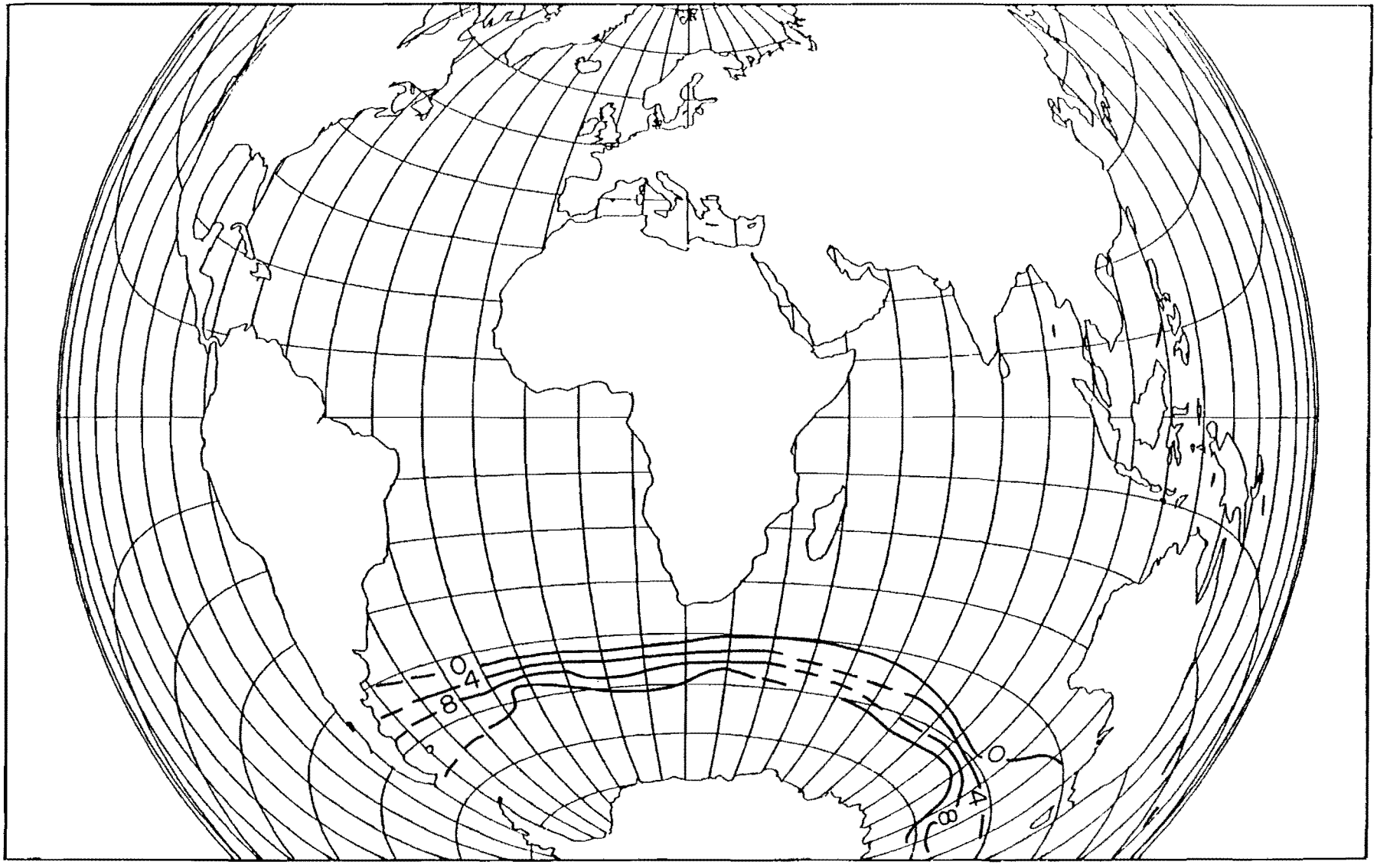
Antarctissa antedenticulata



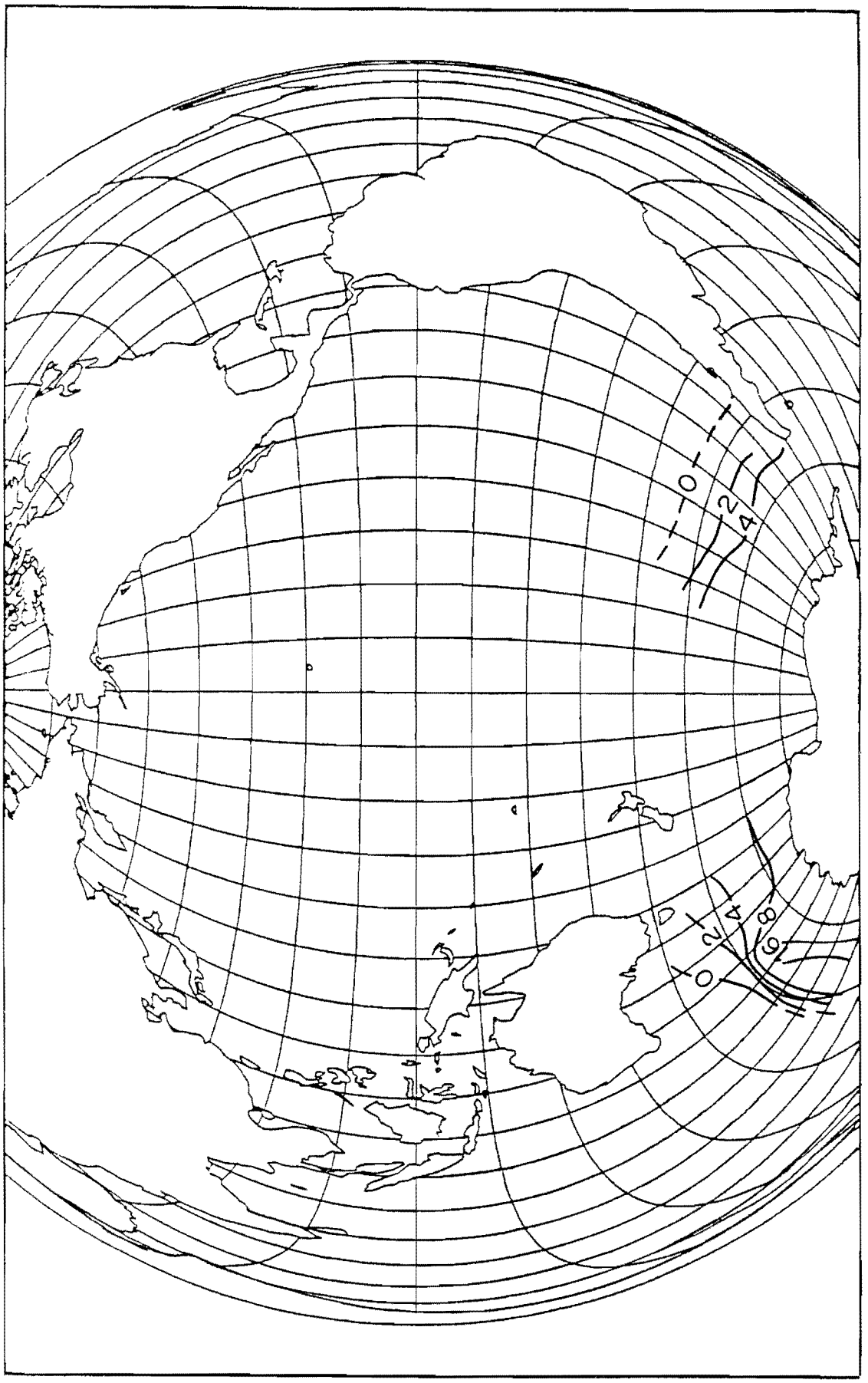
Antarctissa denticulata



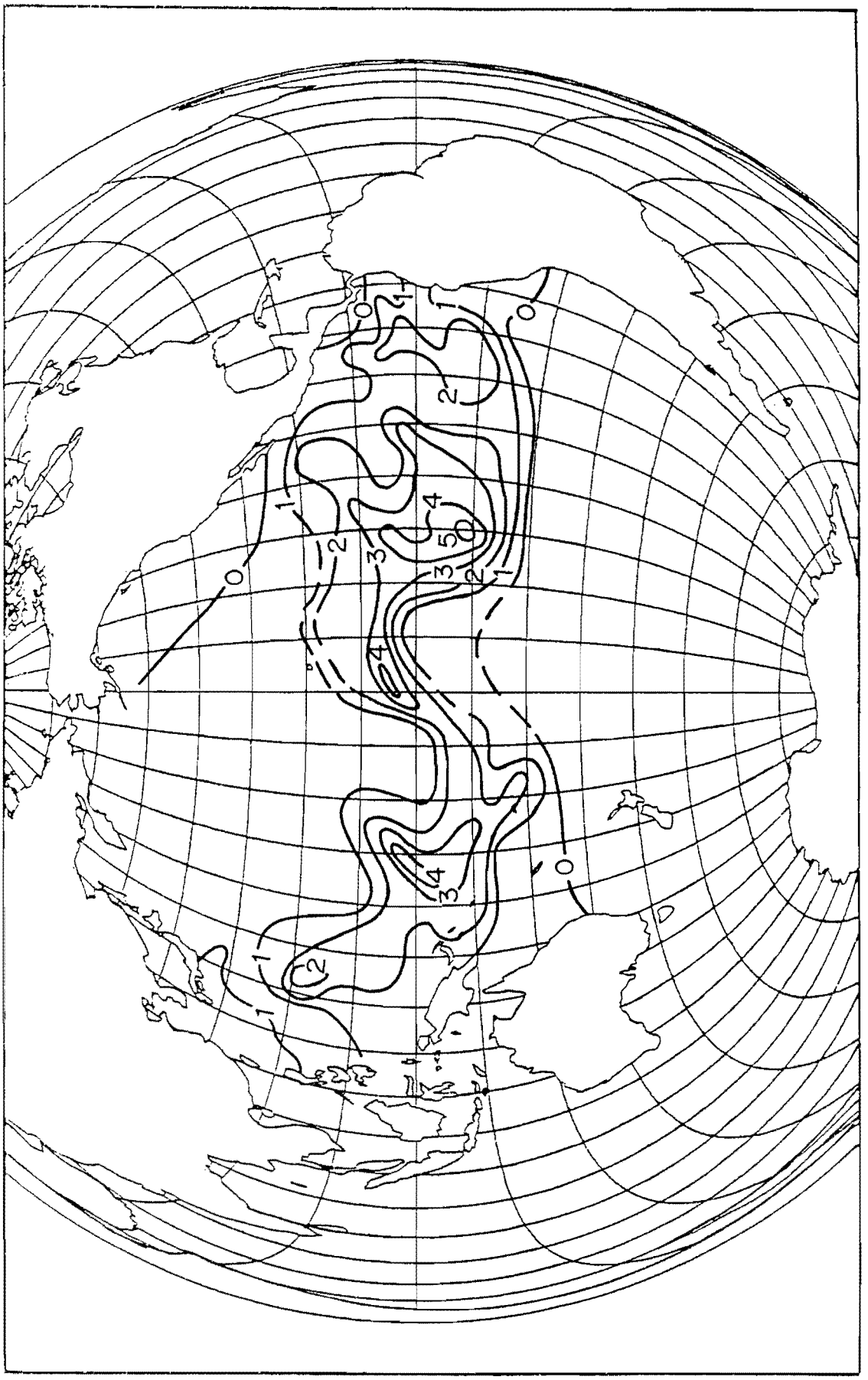
Antarctissa denticulata



Antarctissa strelkovi



Antarctissa strelkovi



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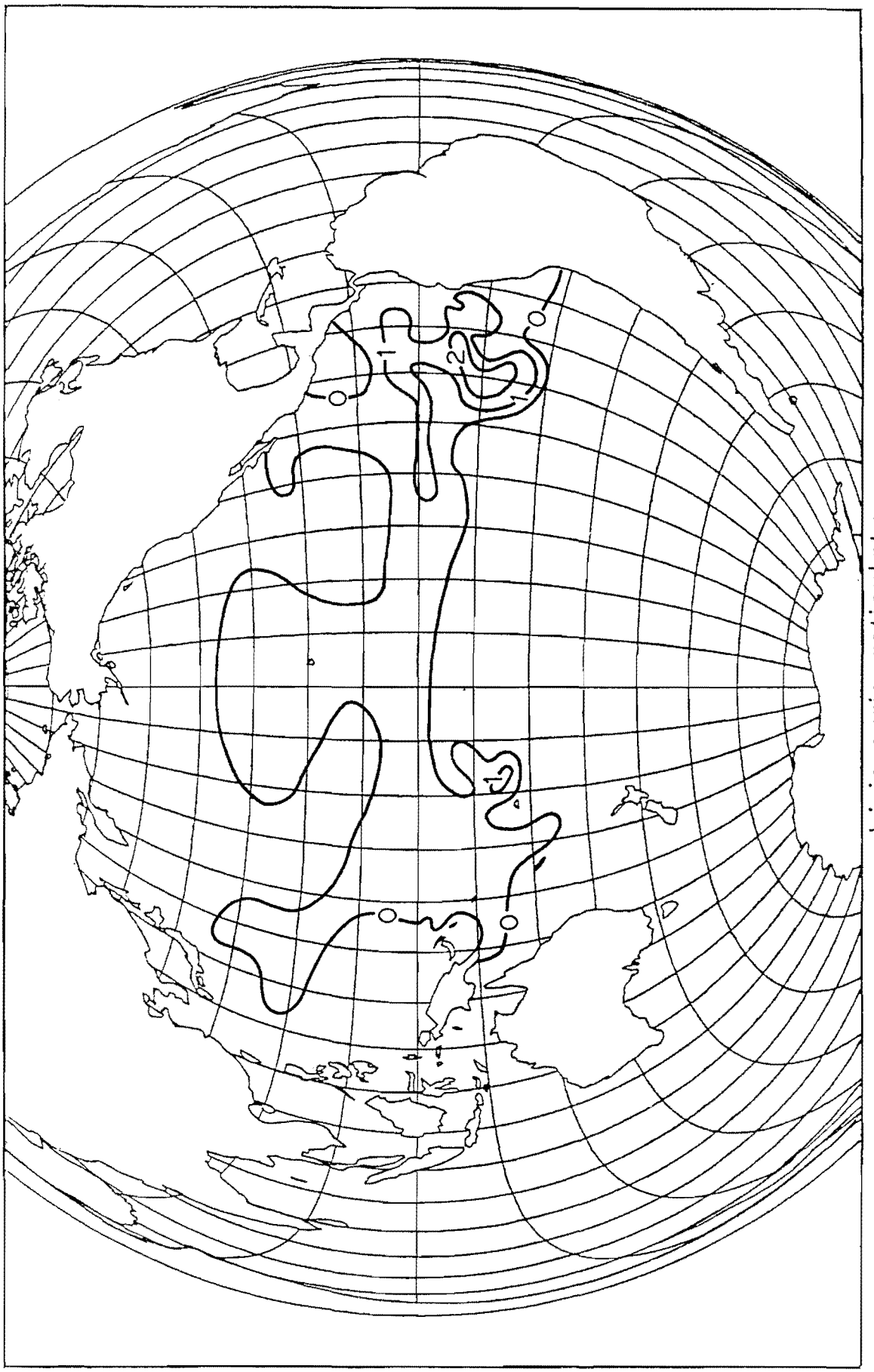
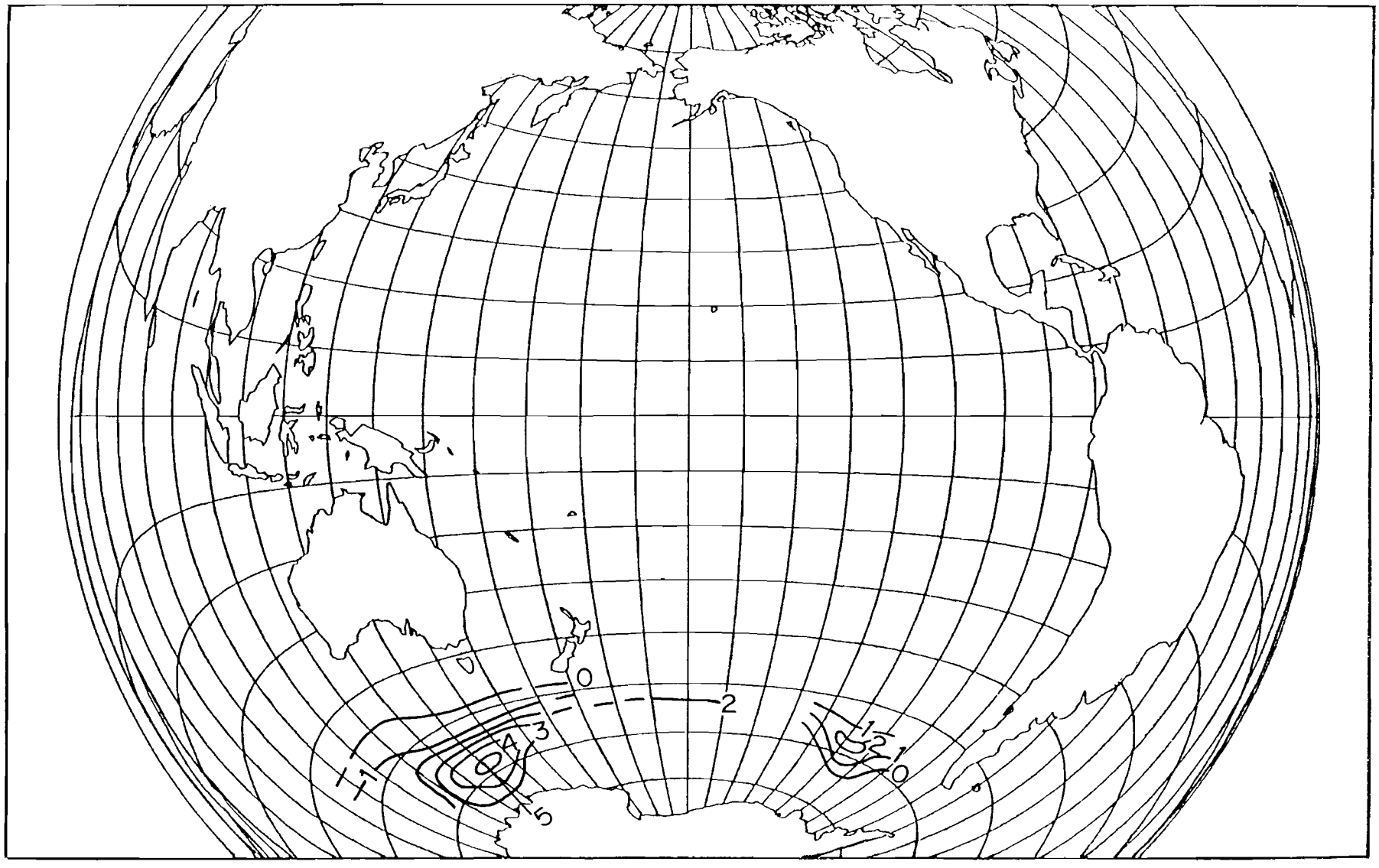

Liriospyris reticulata

Phormospyris stabilis antartica



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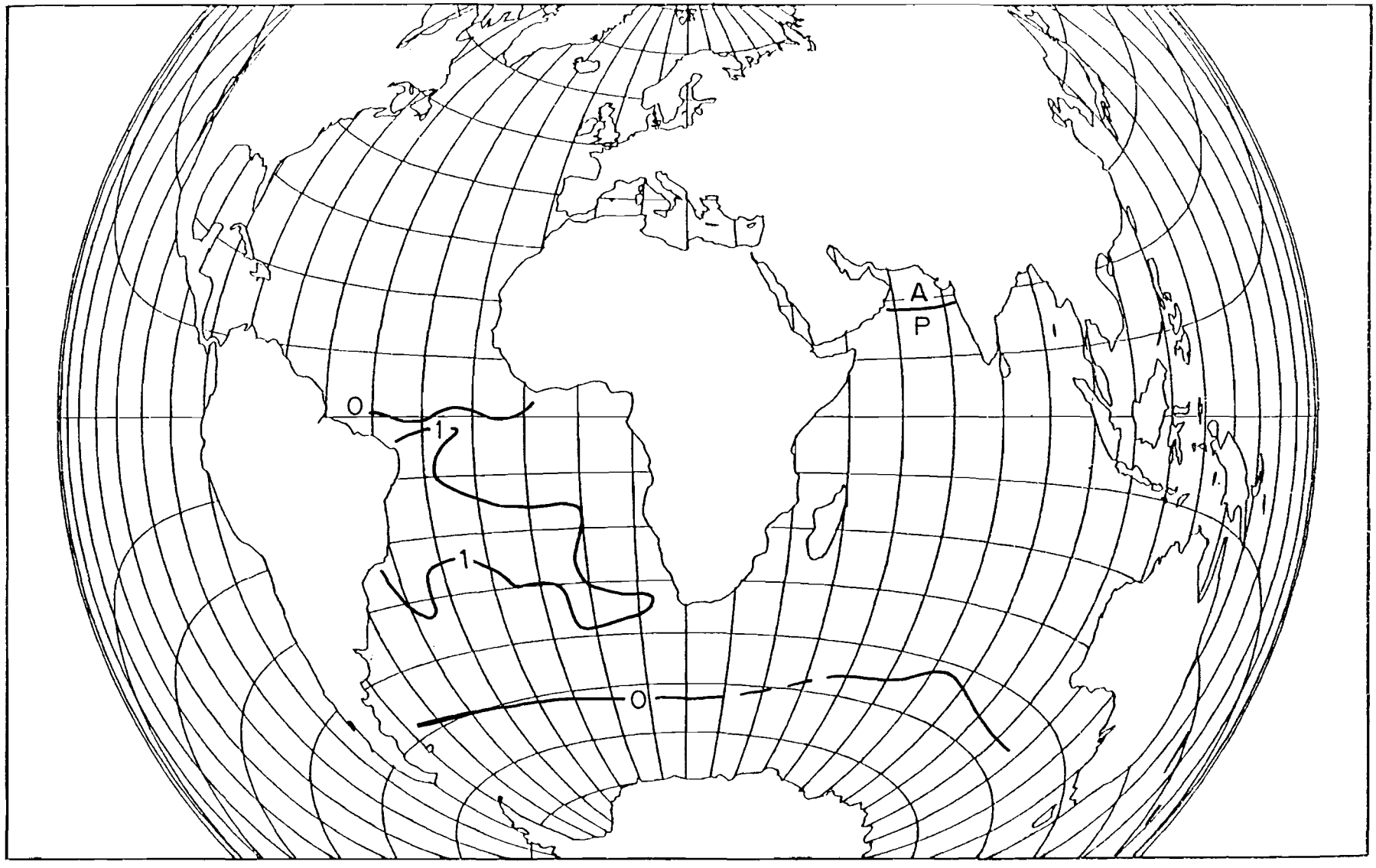
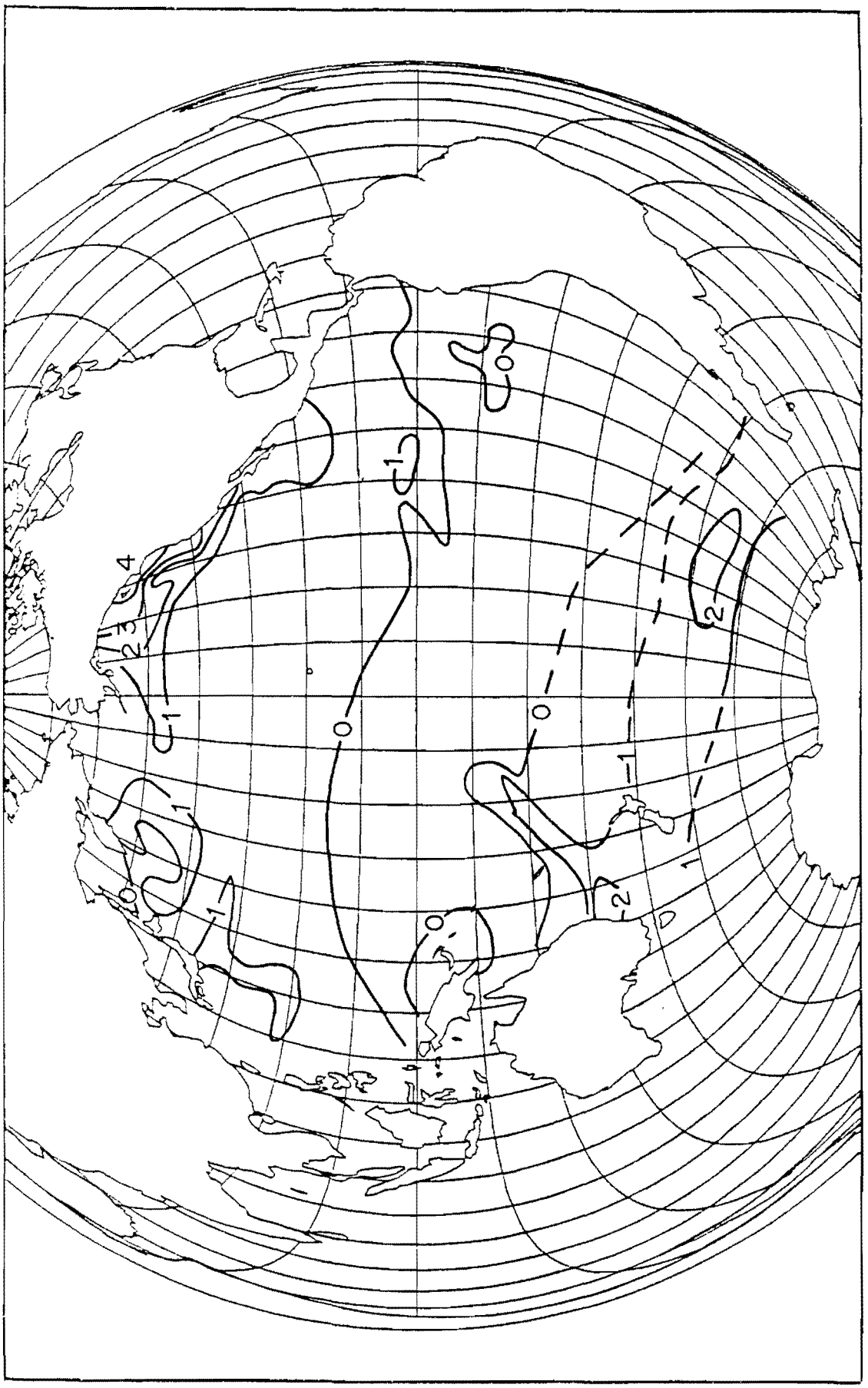
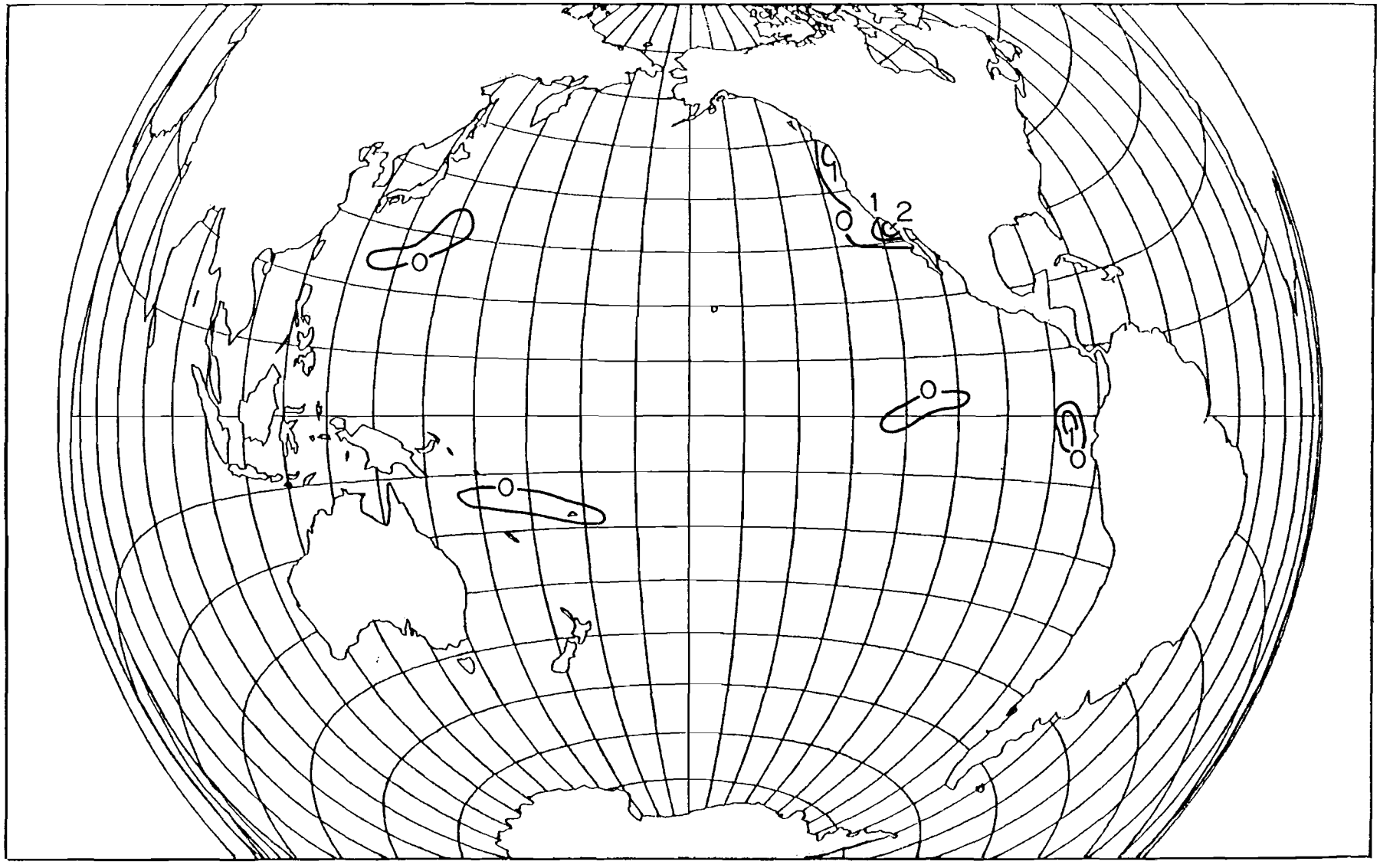


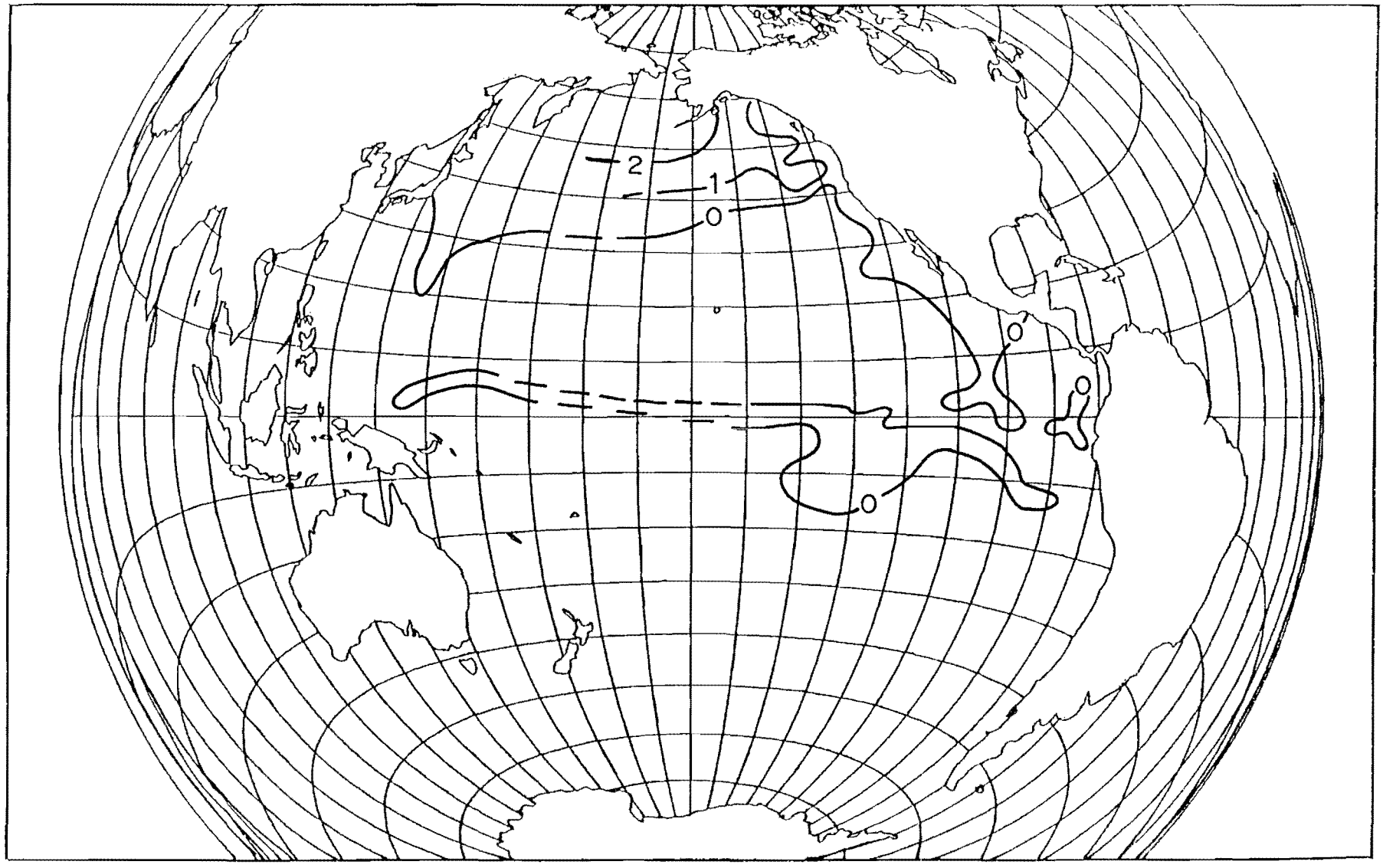
Carpocanistrum spp.



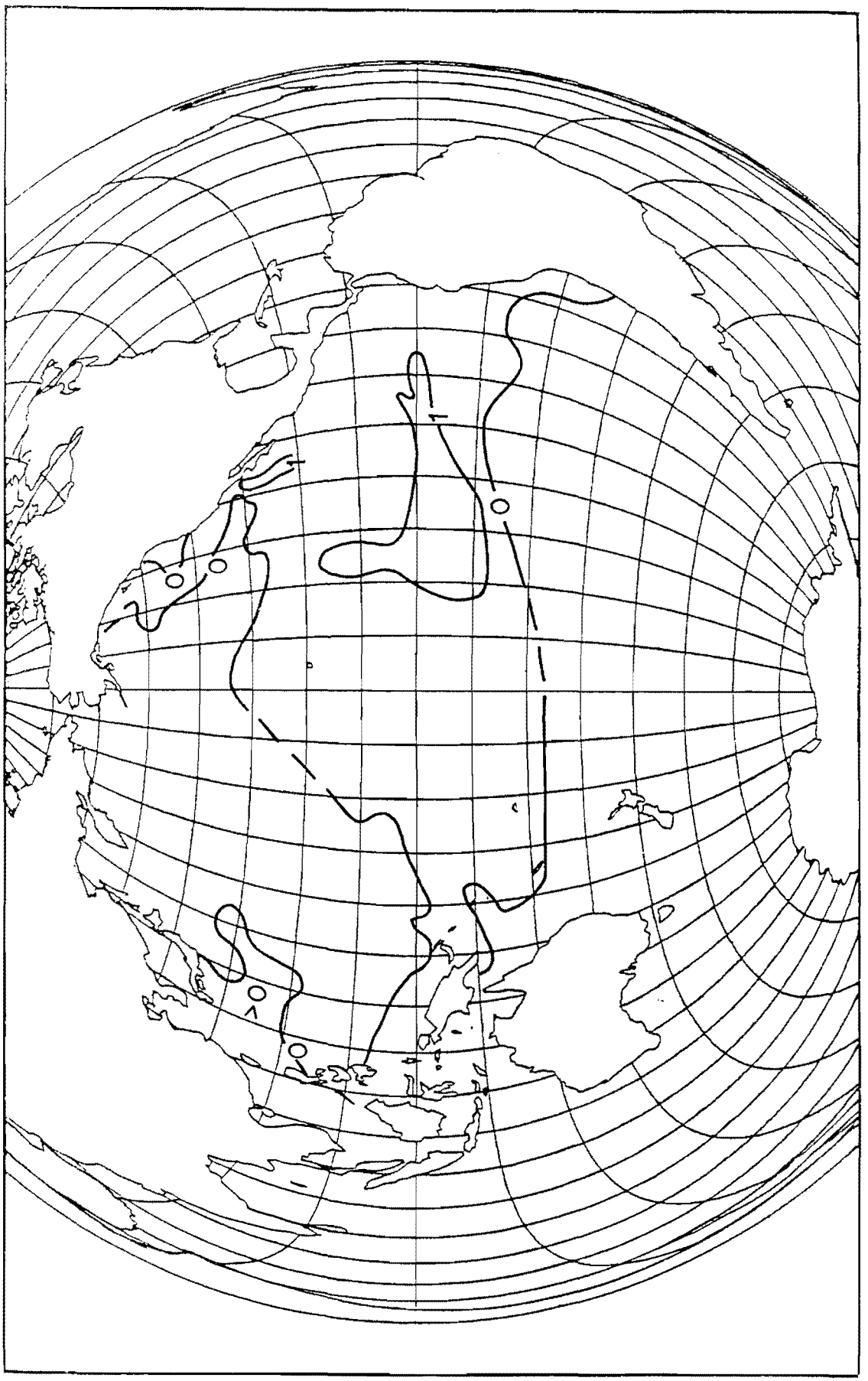
Carpocanistrum spp.



Dictyophimus crisiae and hirundo



Pterocanium korotnevi



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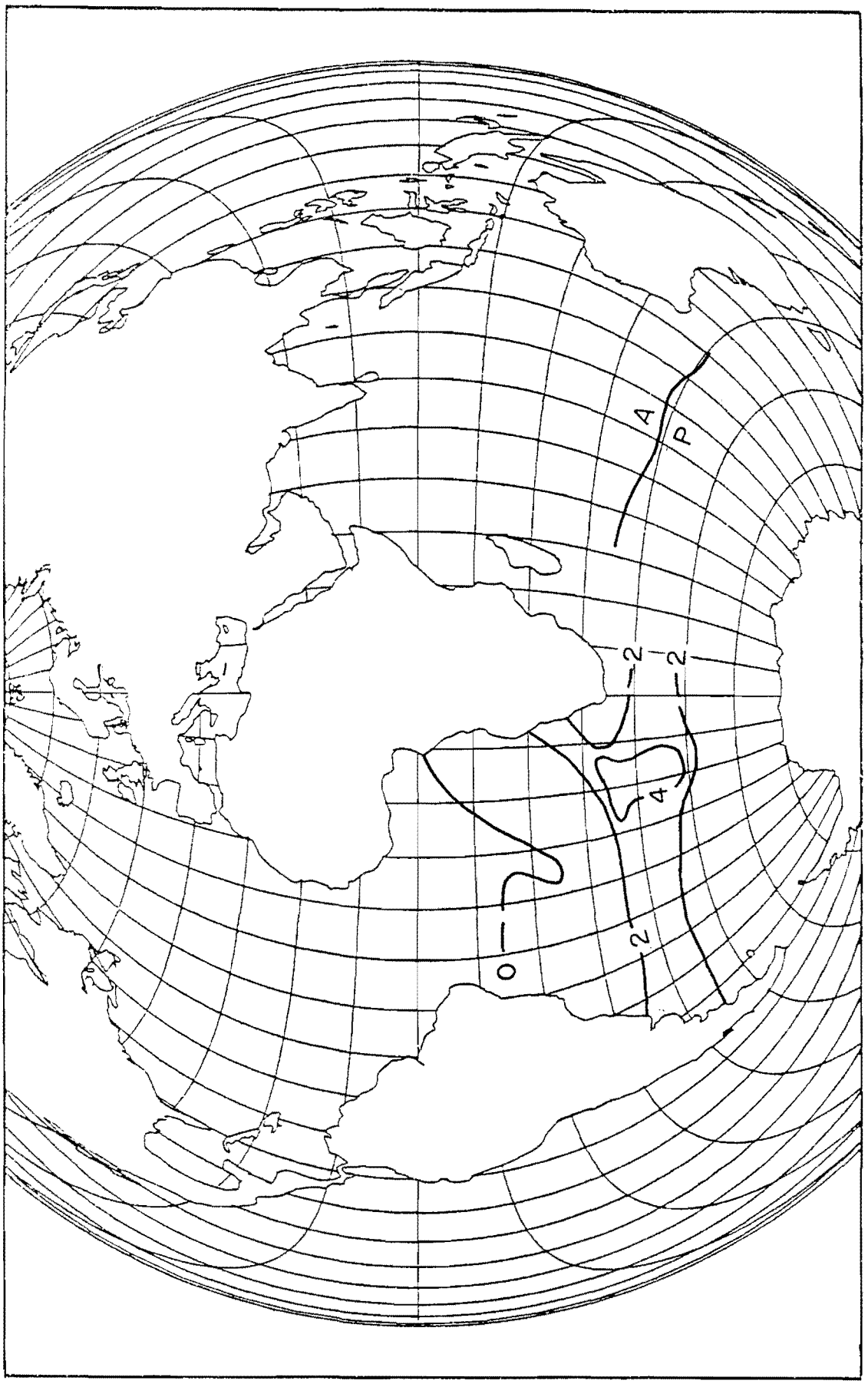
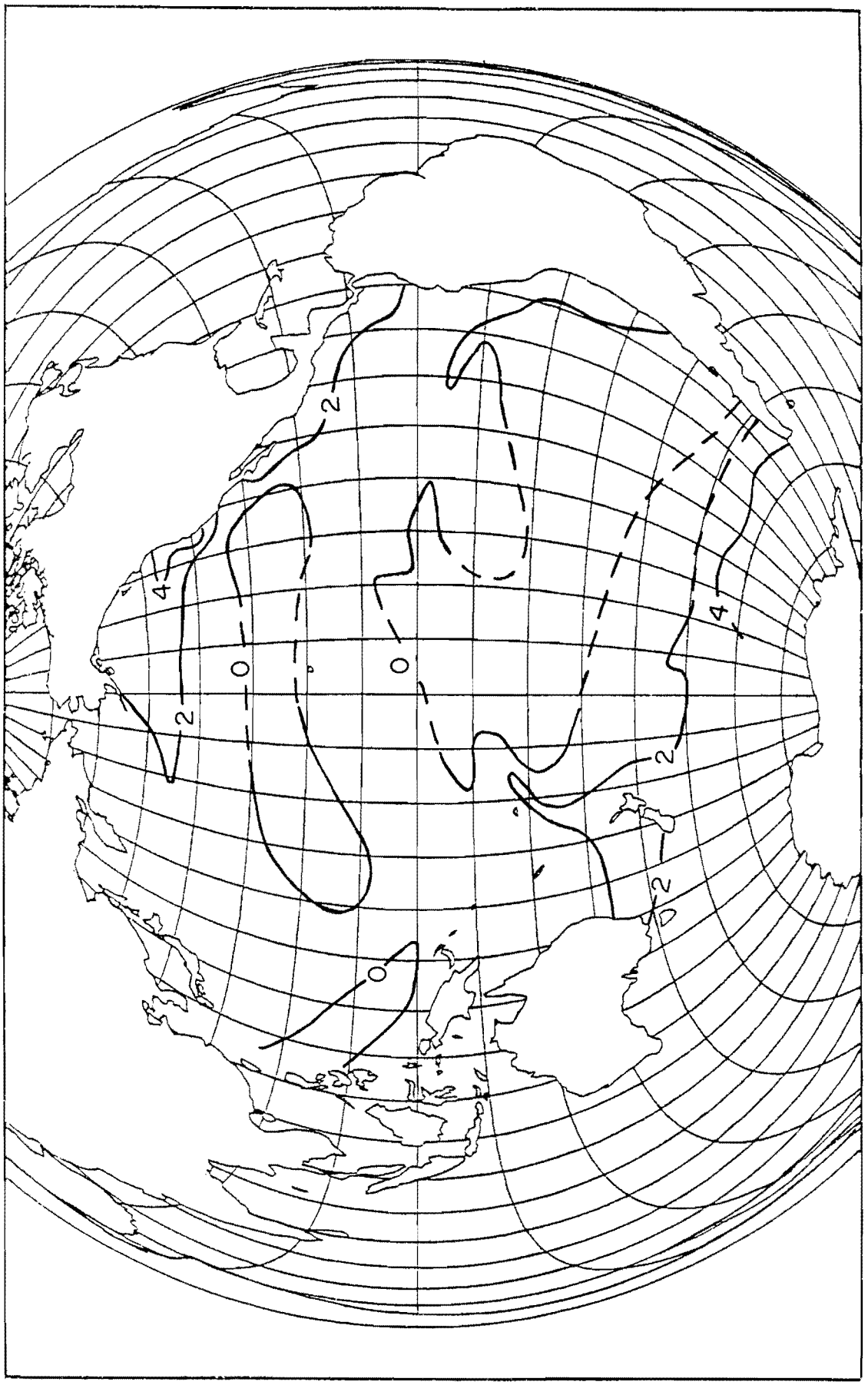


Theocalyptra bicornis



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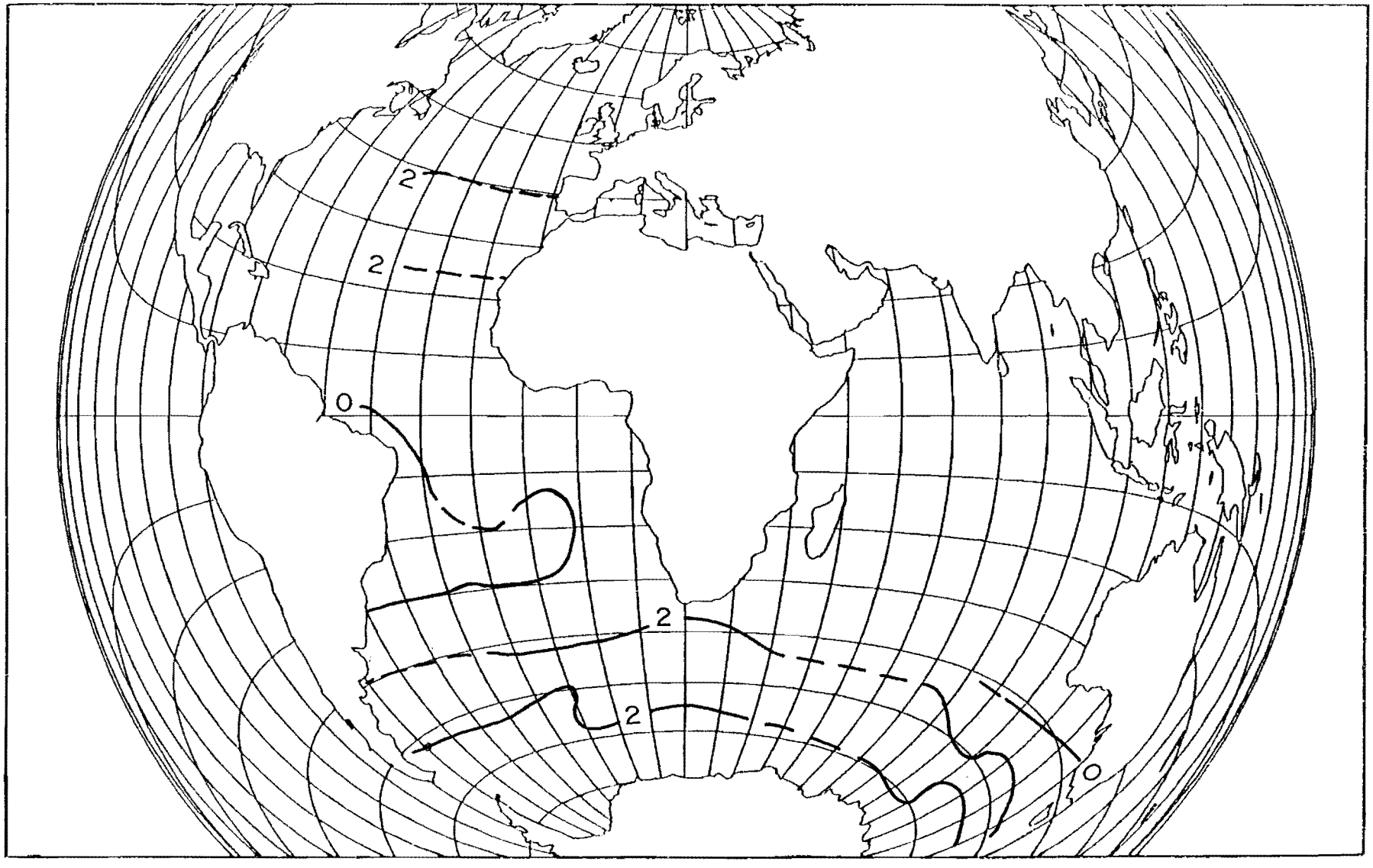

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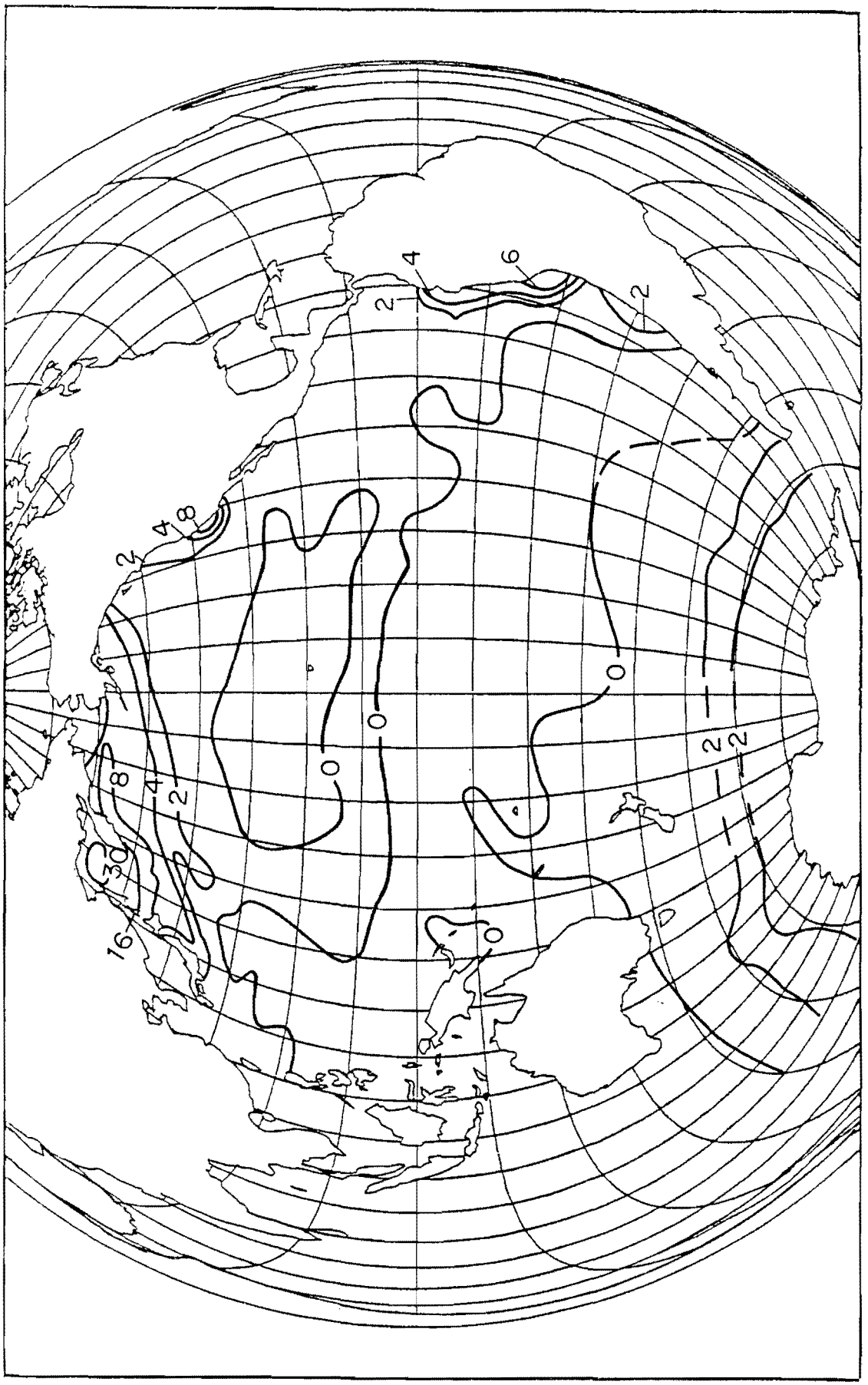
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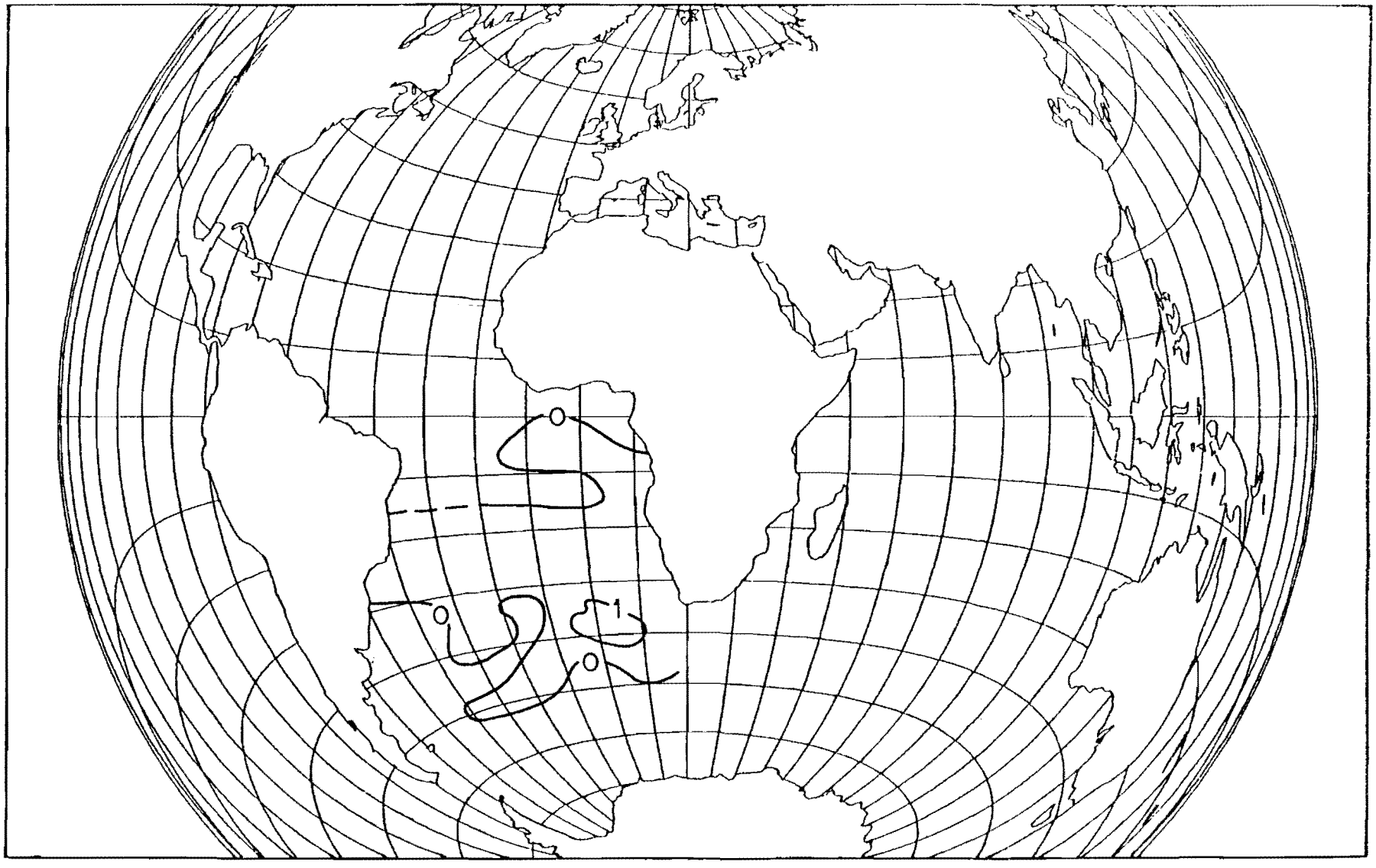
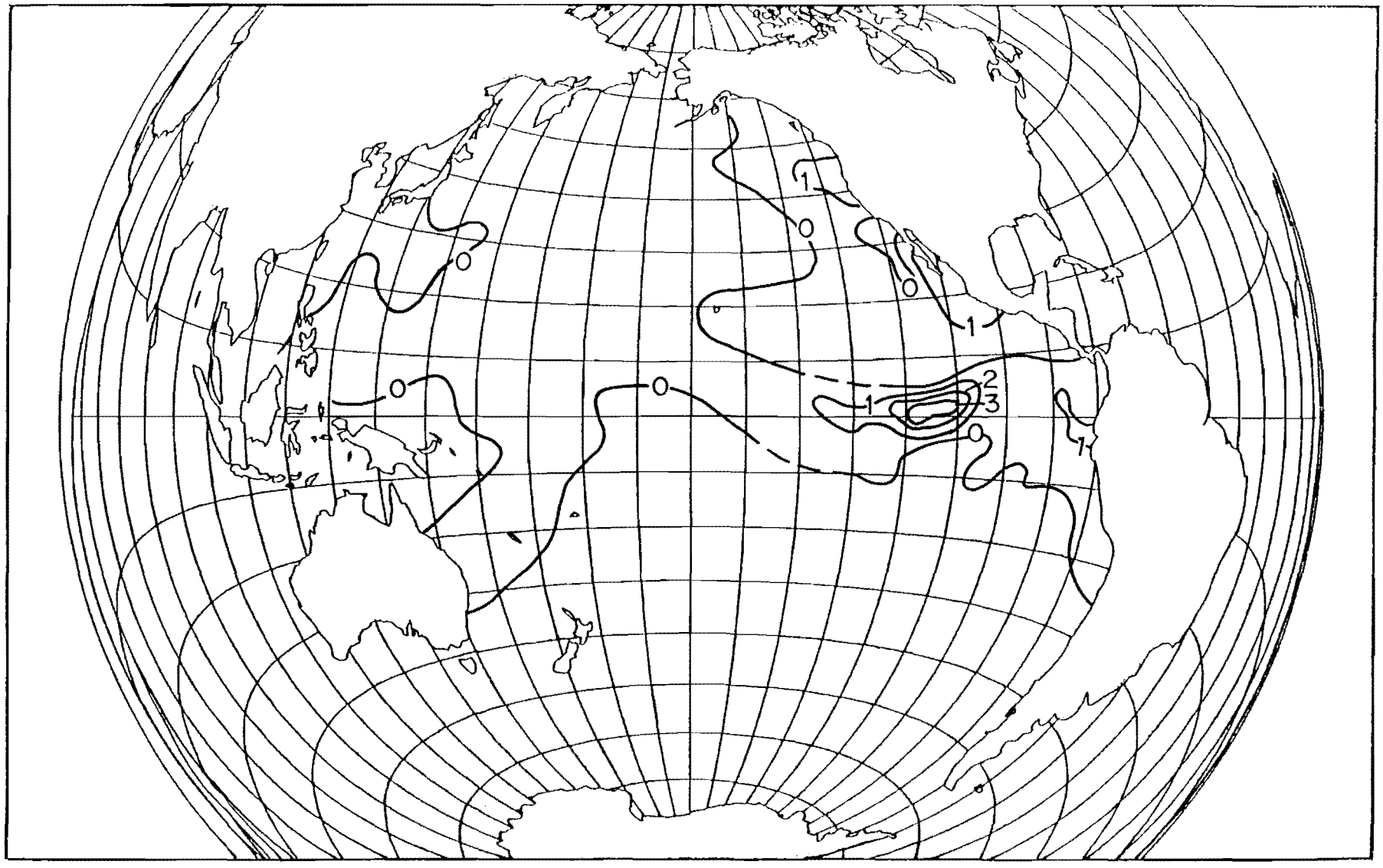


Eucyrtidium acuminatum



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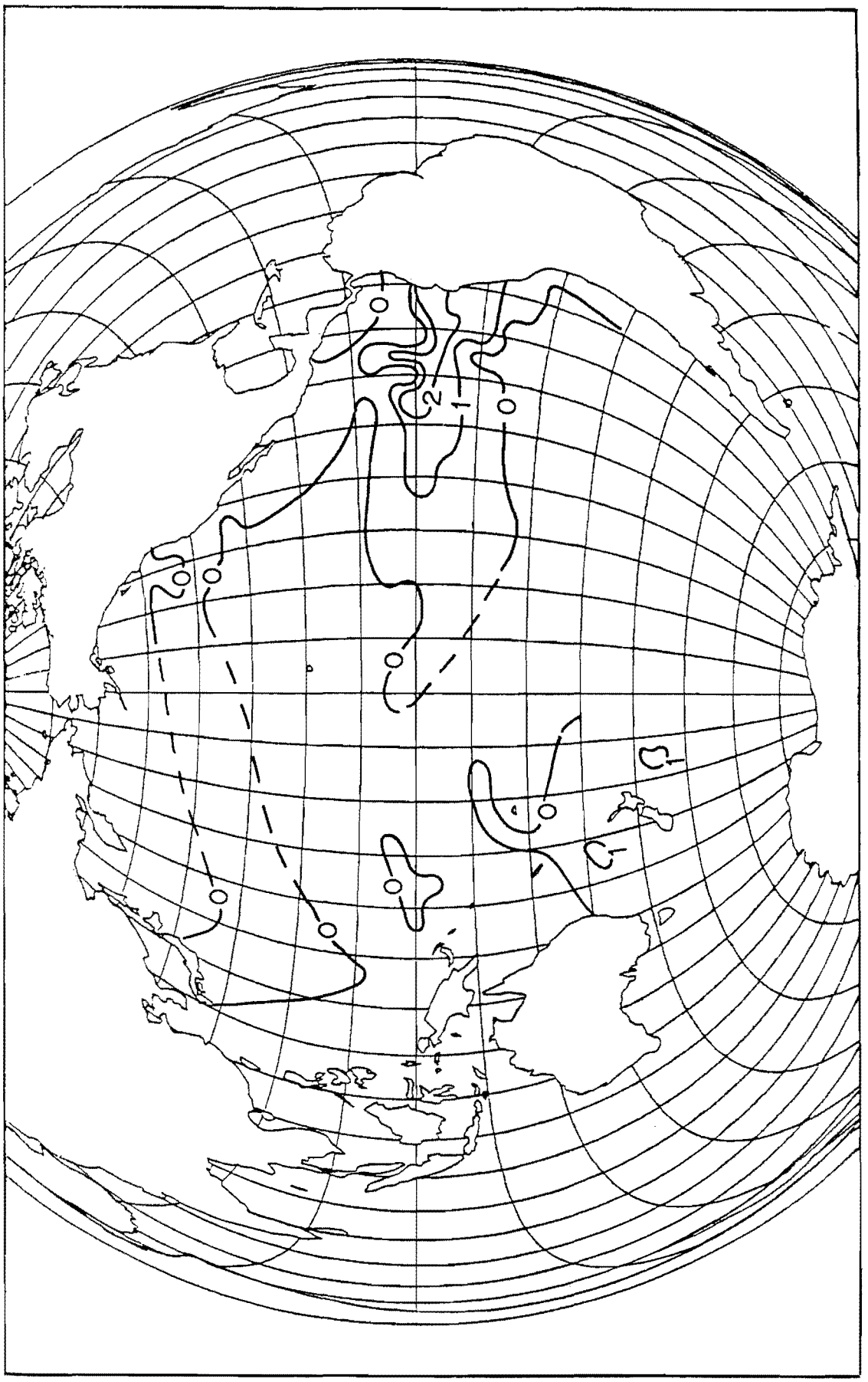
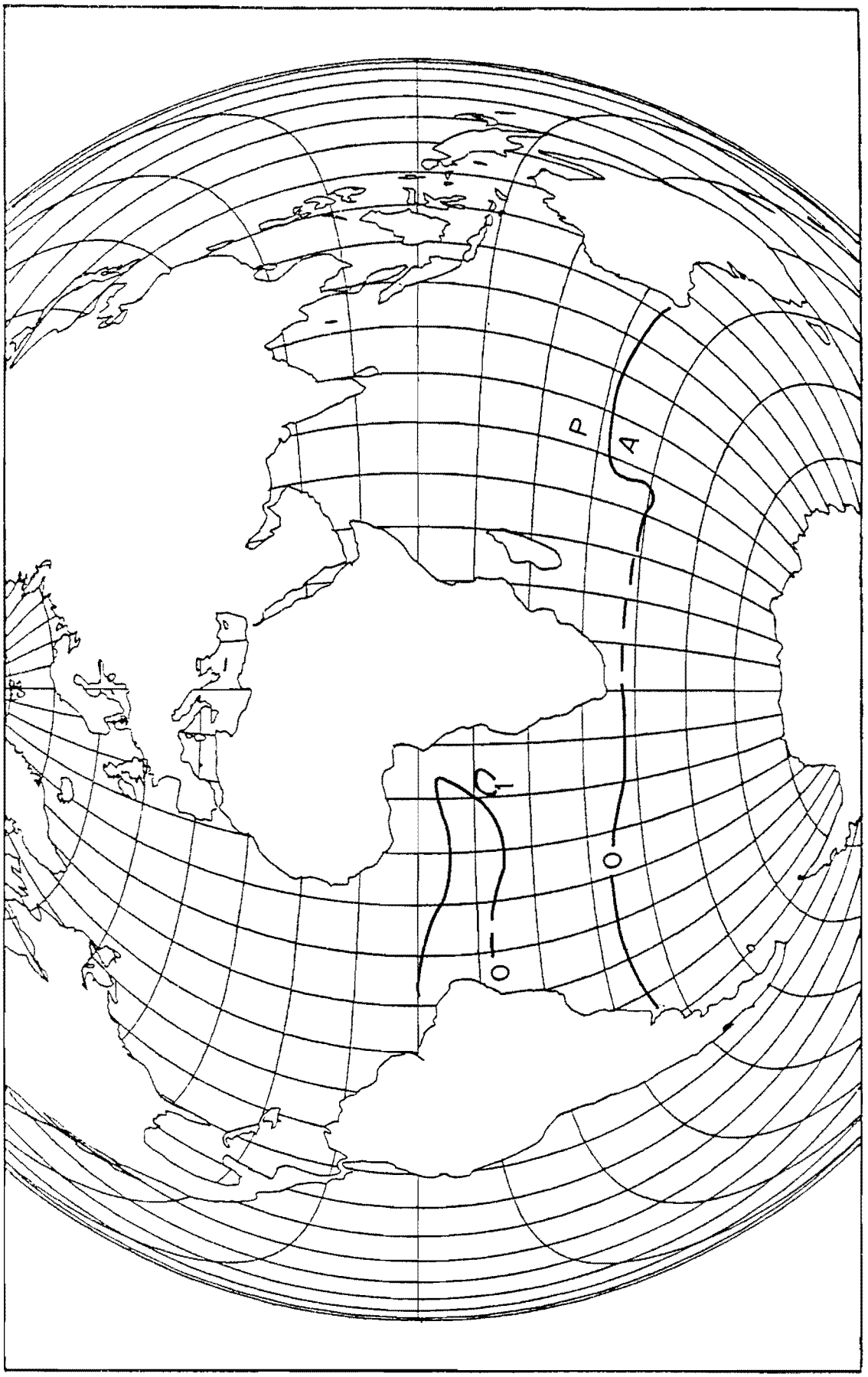
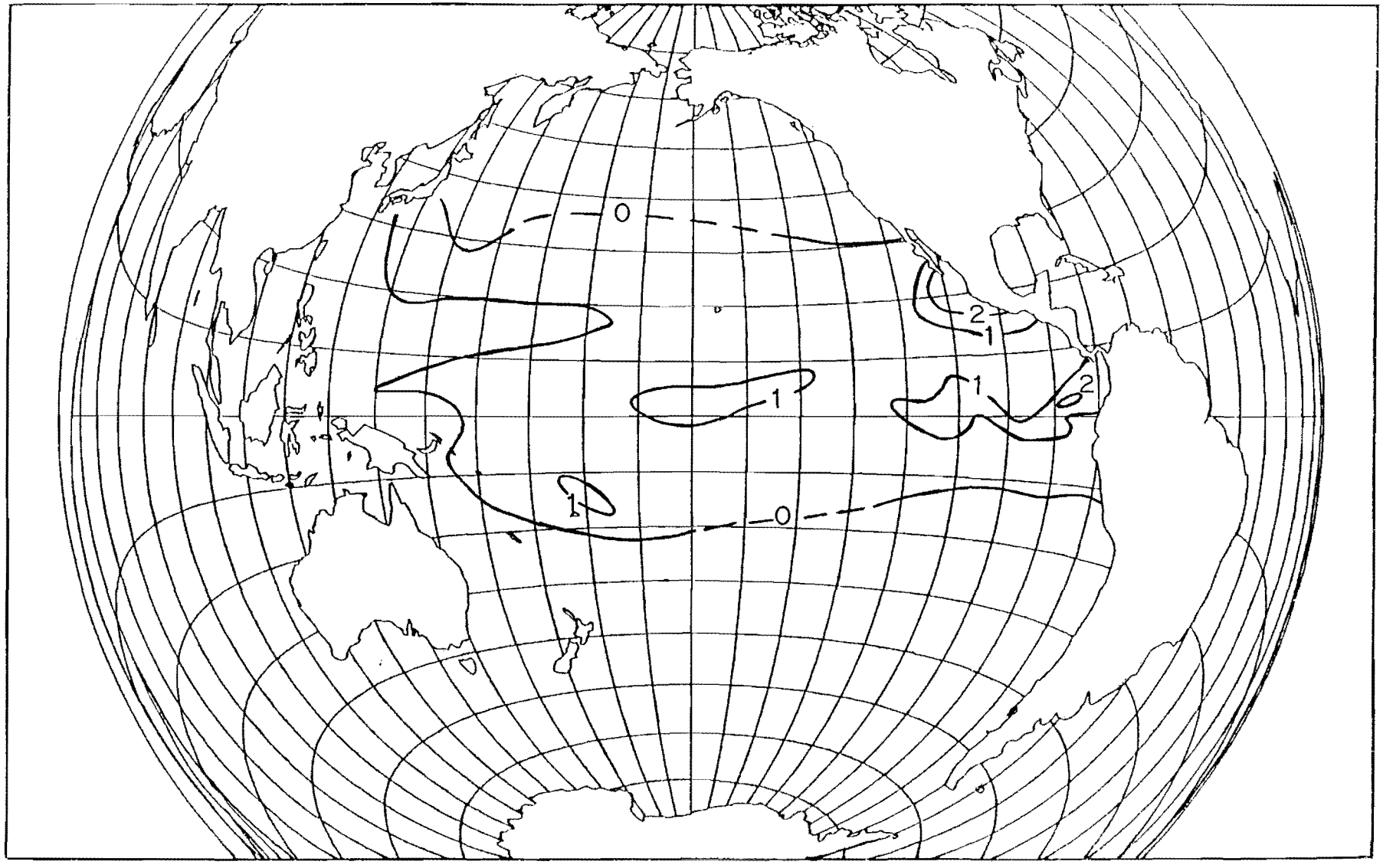


Eucyrtidium hexagonatum

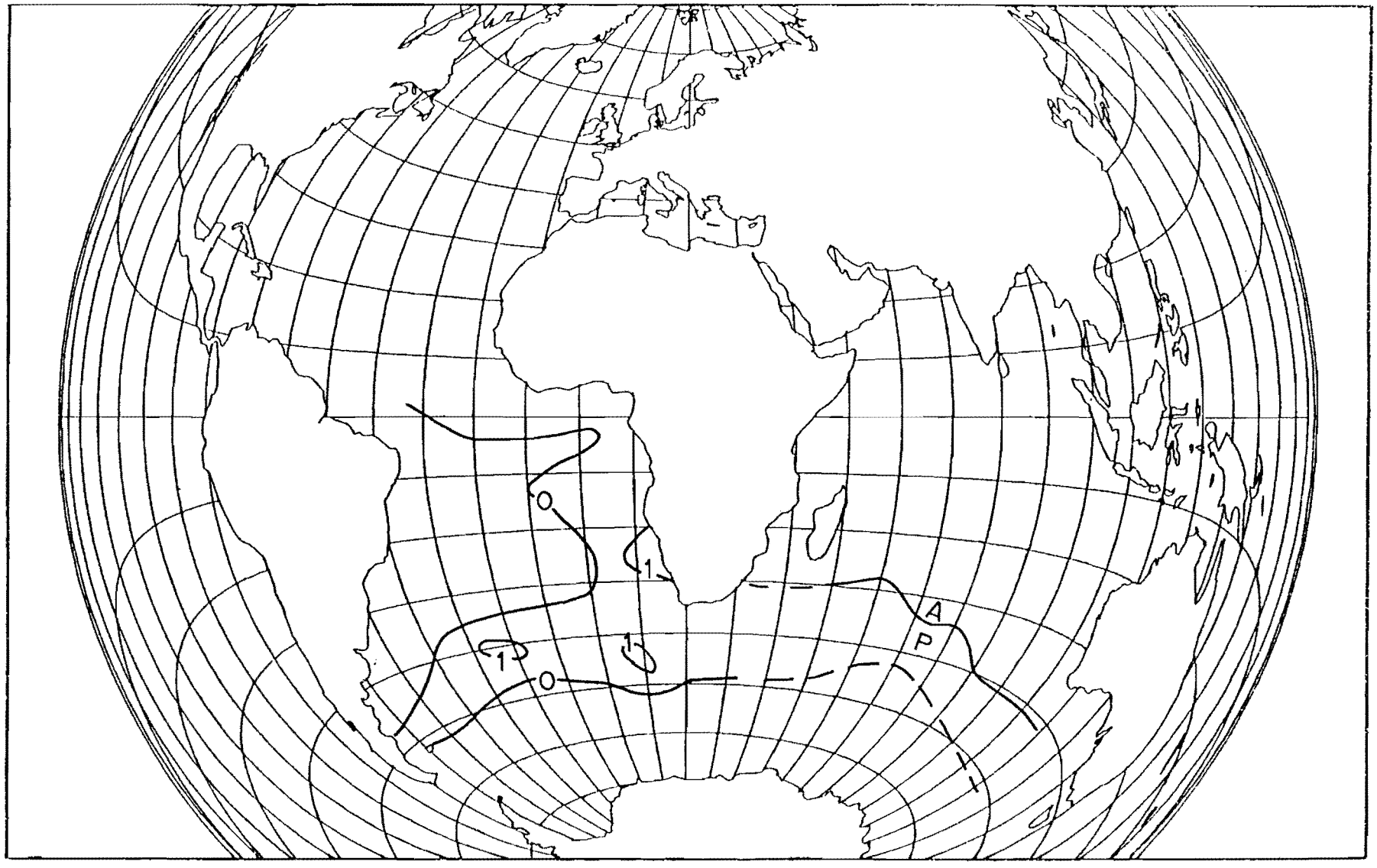


Anthocyrtidium ophirense

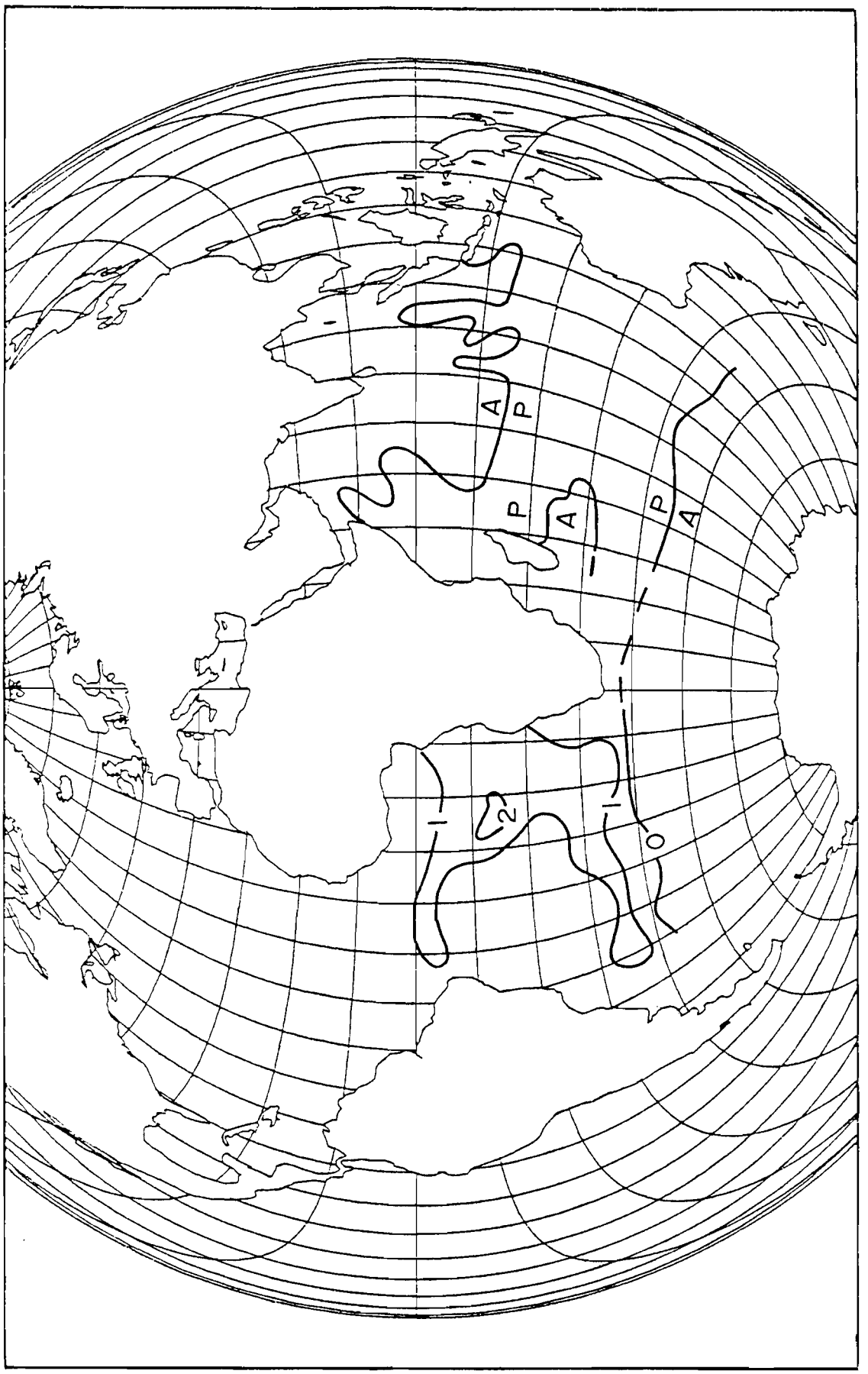


Anthocyrtidium ophirense

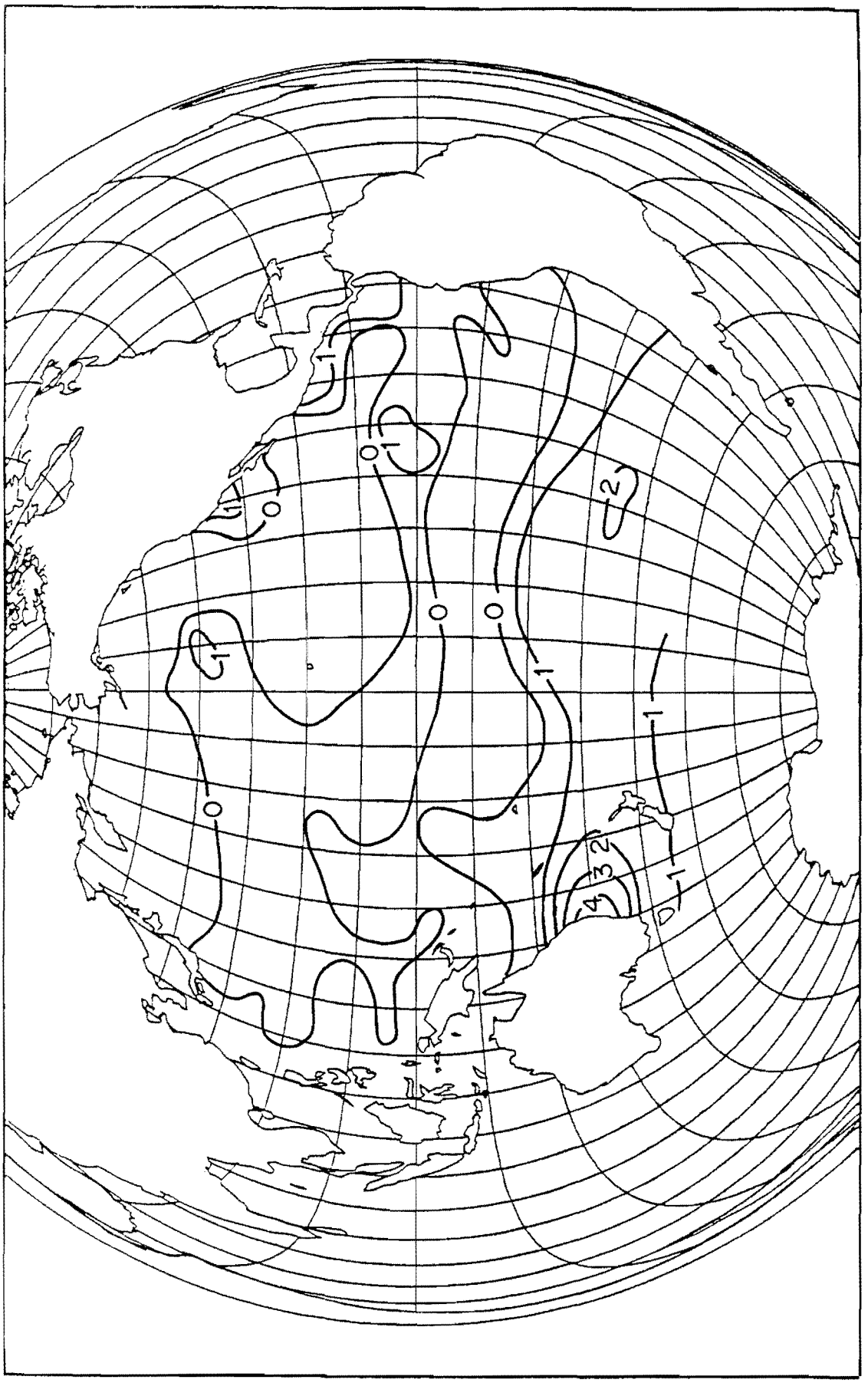
Anthocyrtidium zanguebaricum



Androcyclas gamphonycha



Lamprocyclas maritalis maritalis



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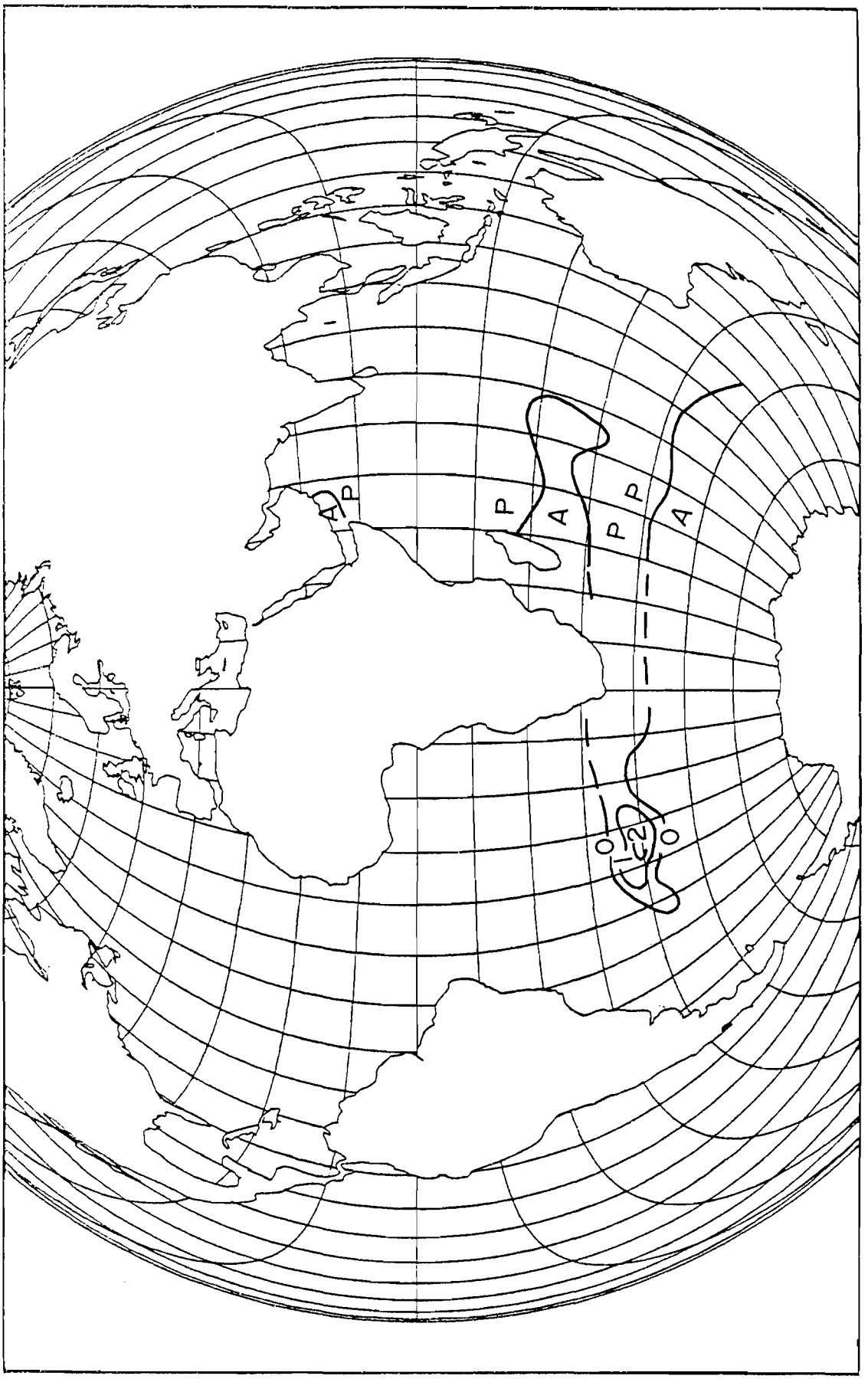
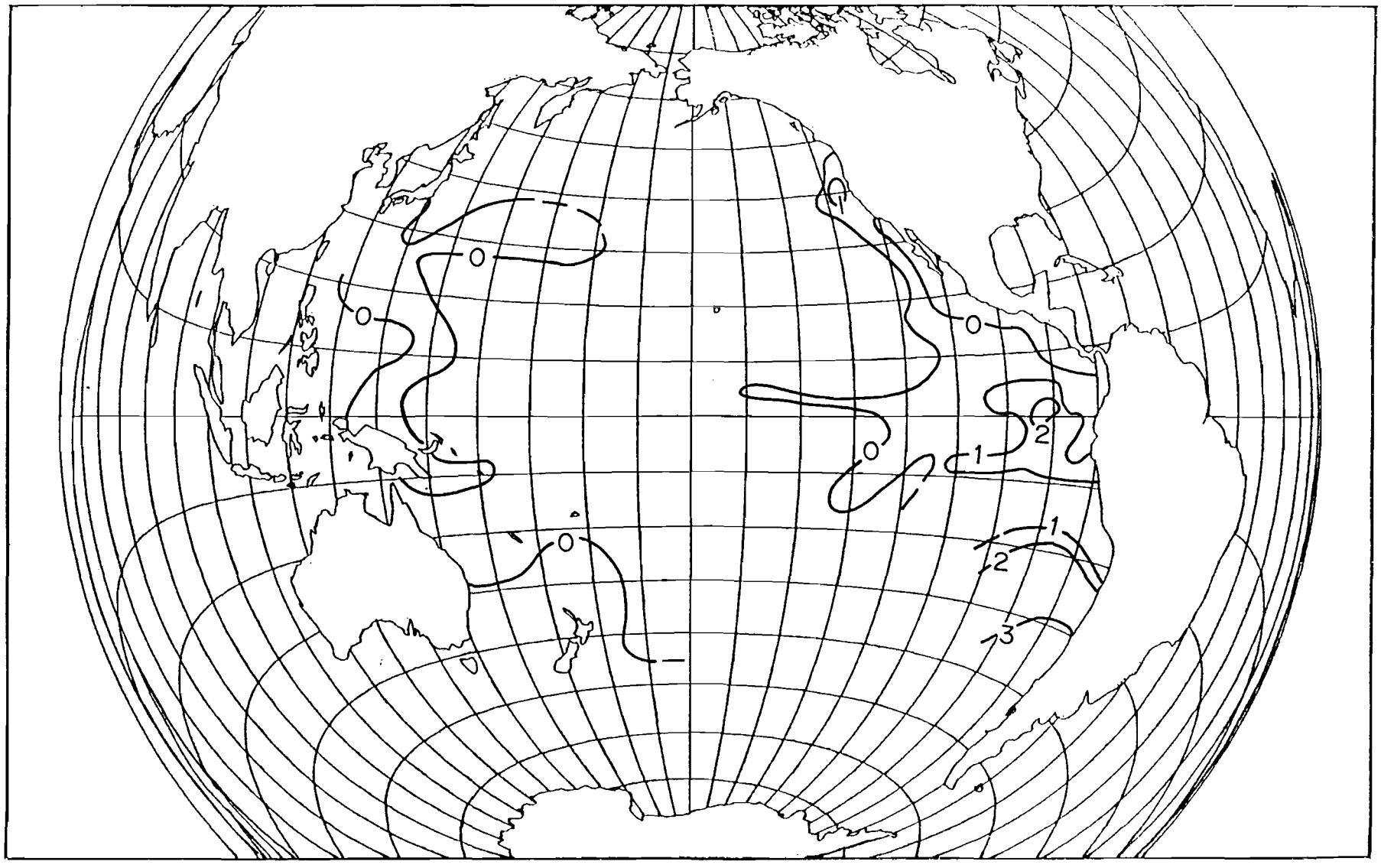
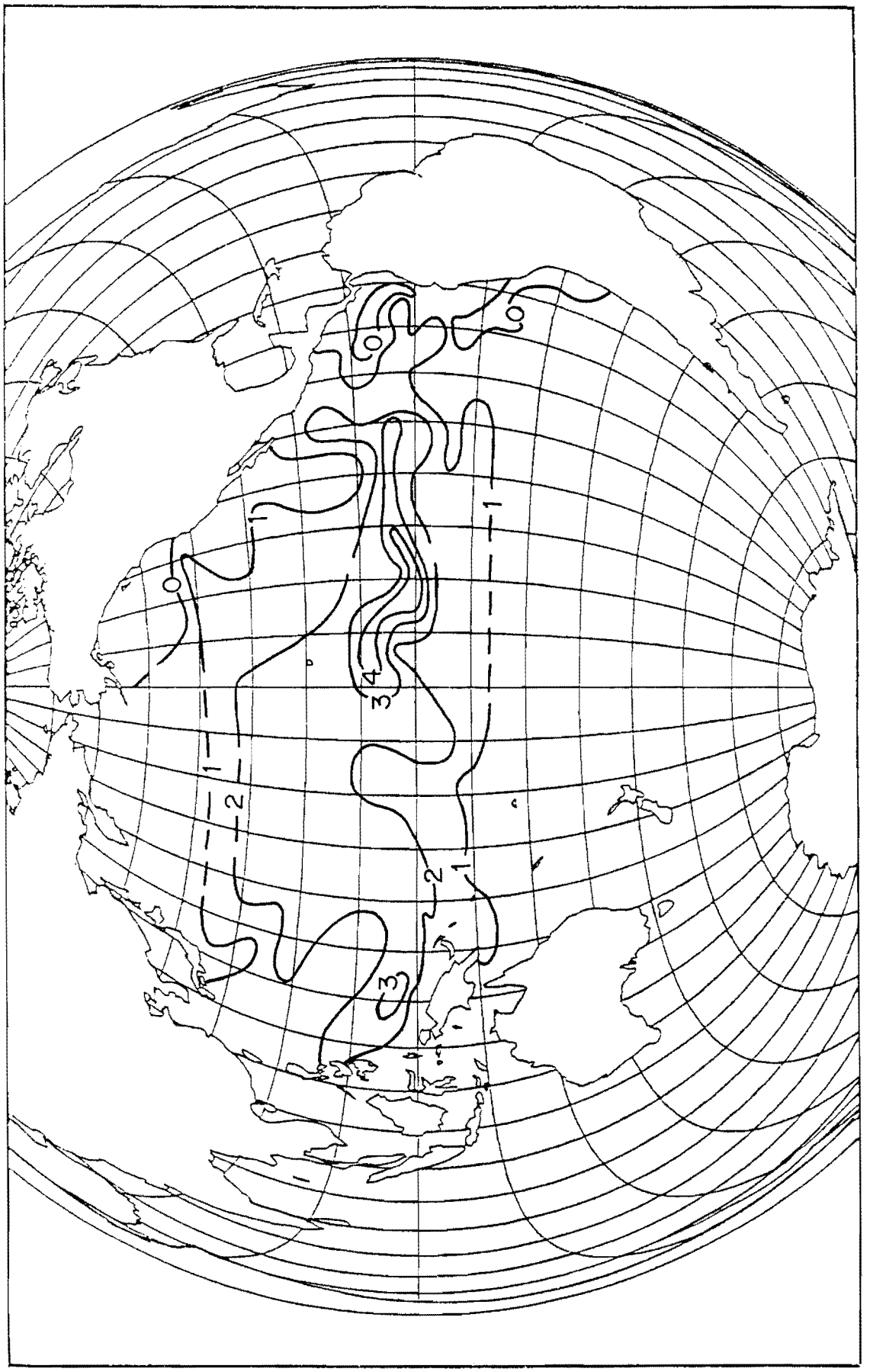


Lamprocyclas maritalis polypora

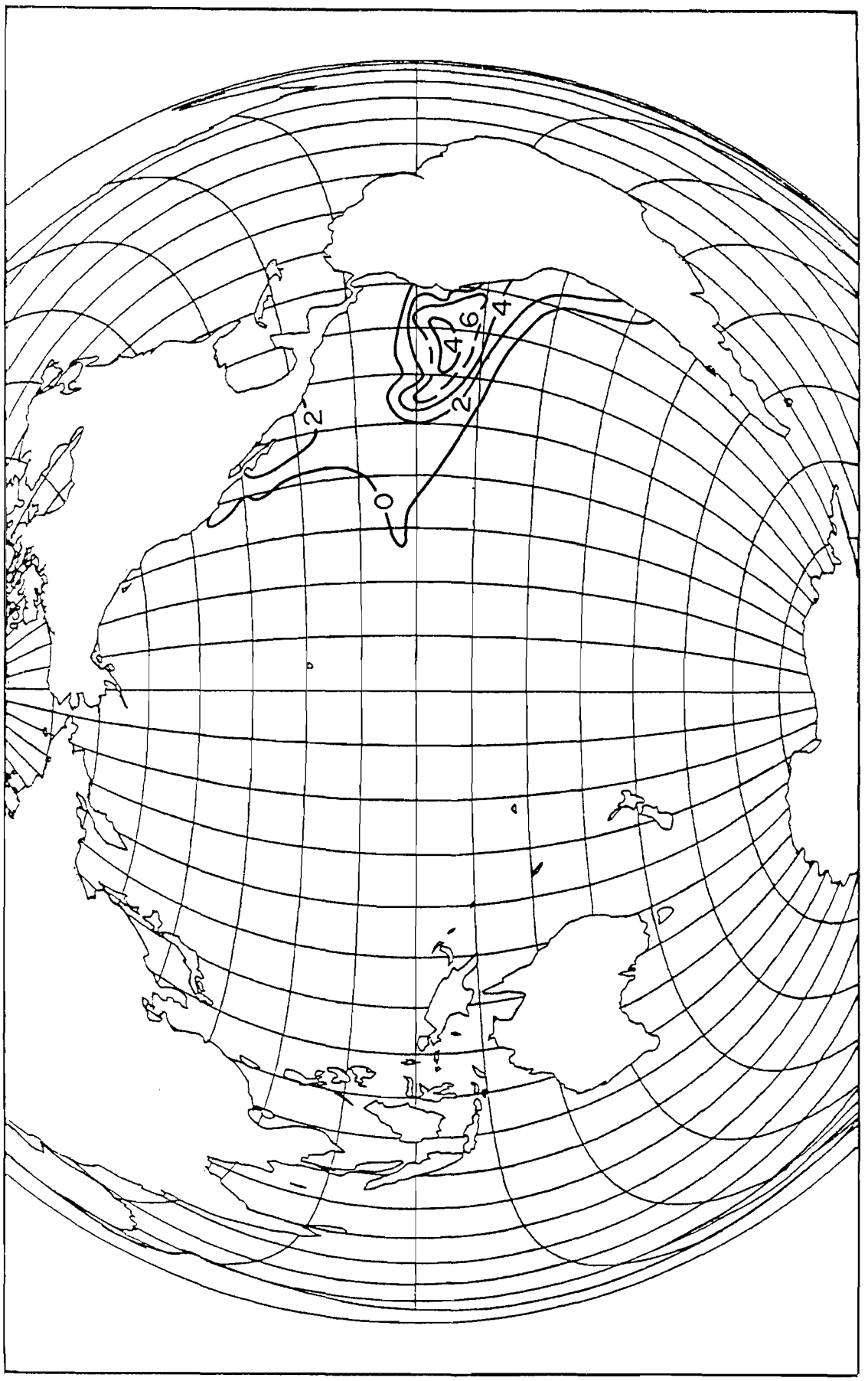


Lamprocyclas maritalis polypora and ventricosa

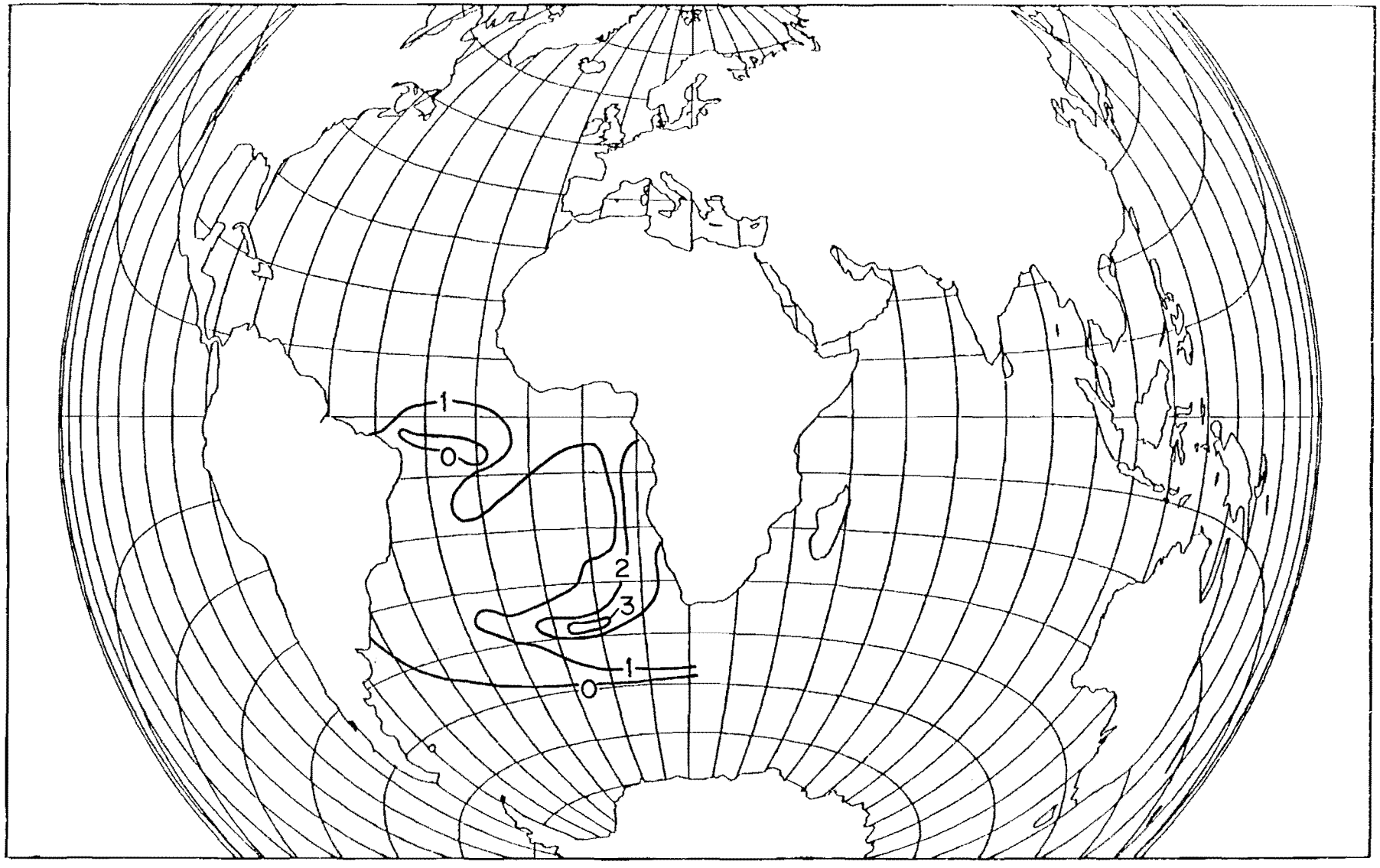


Lamprocyrtis hannai

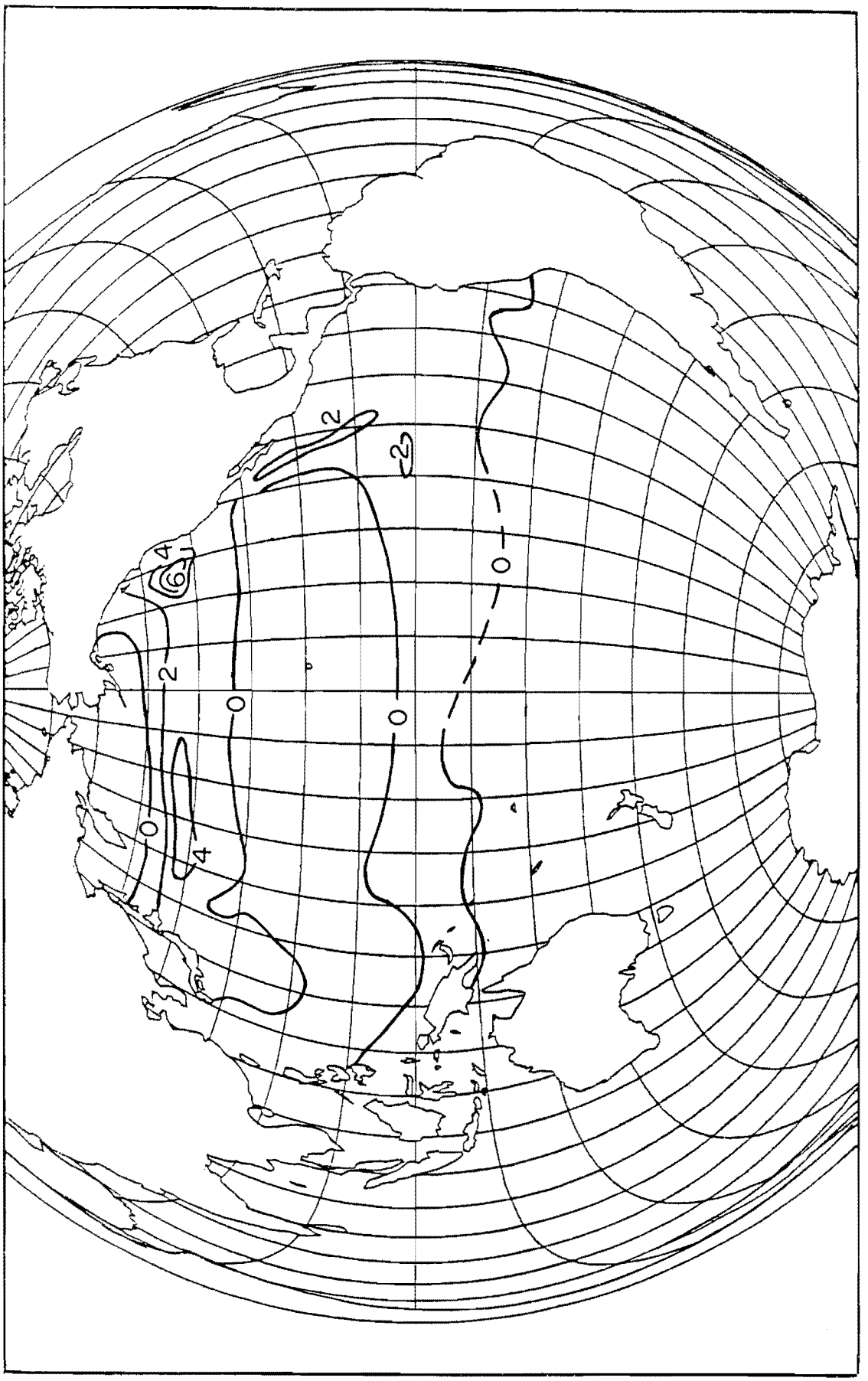
Lamprocyrtis nigriniae

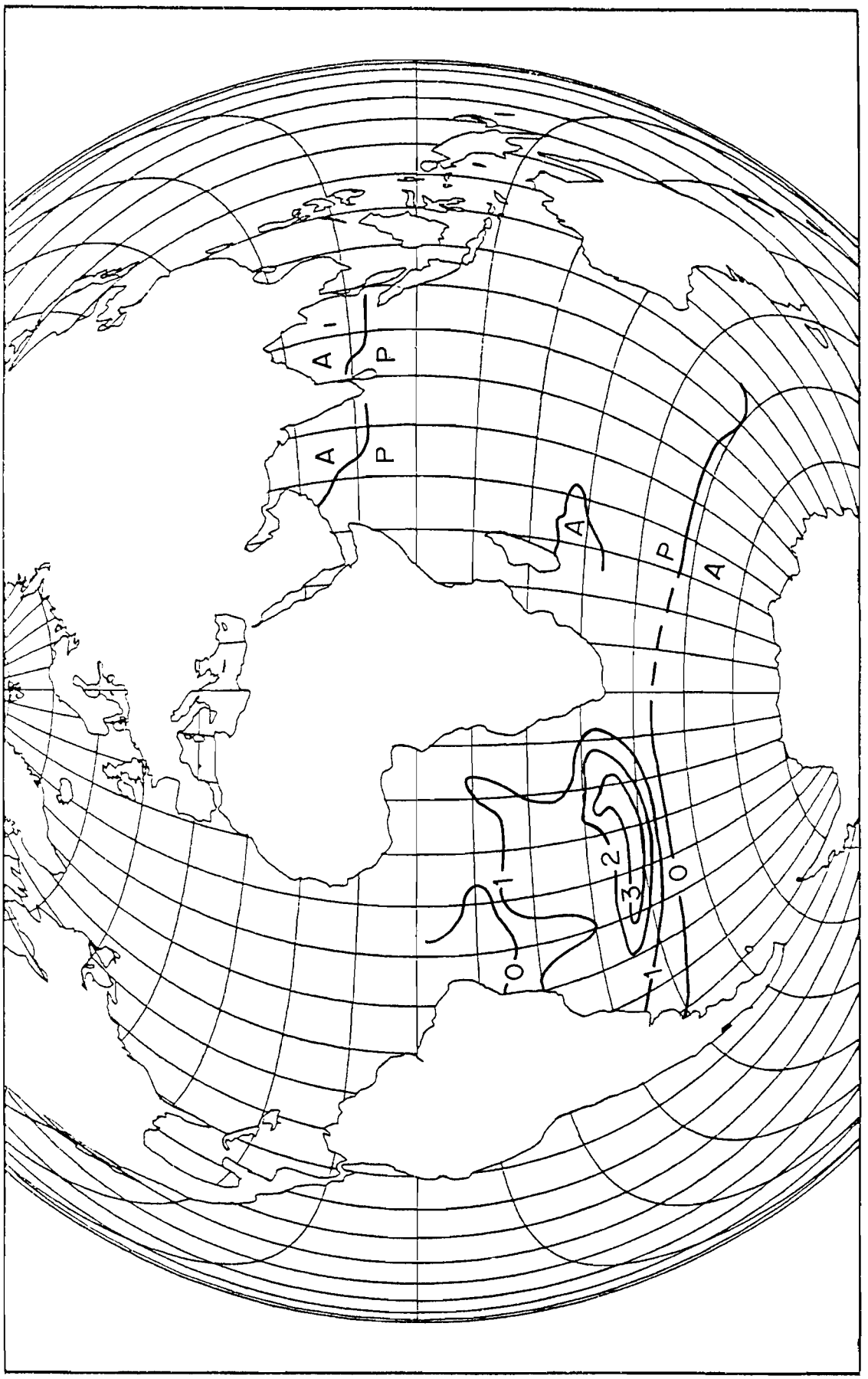


Pterocorys minythorax

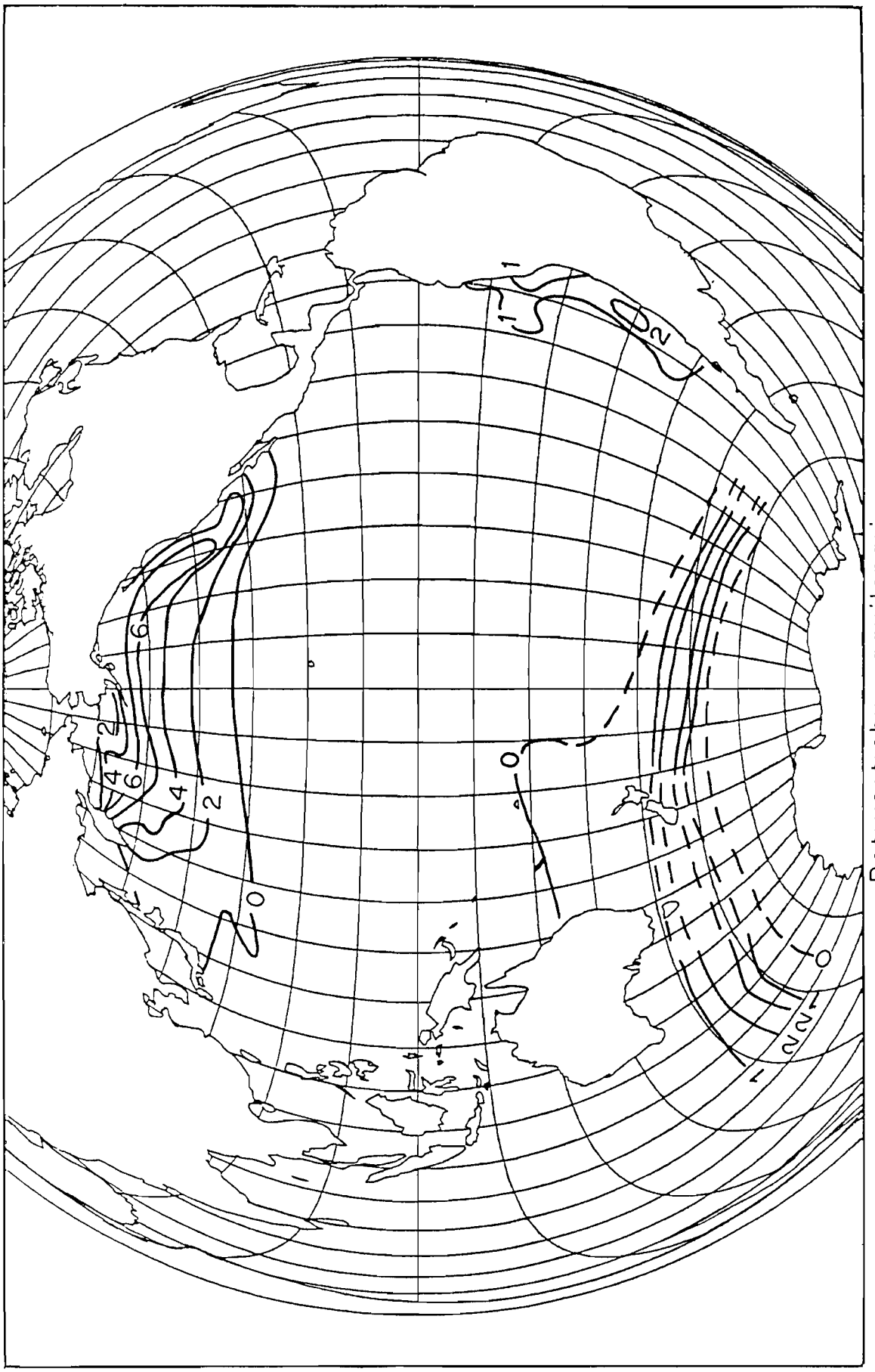


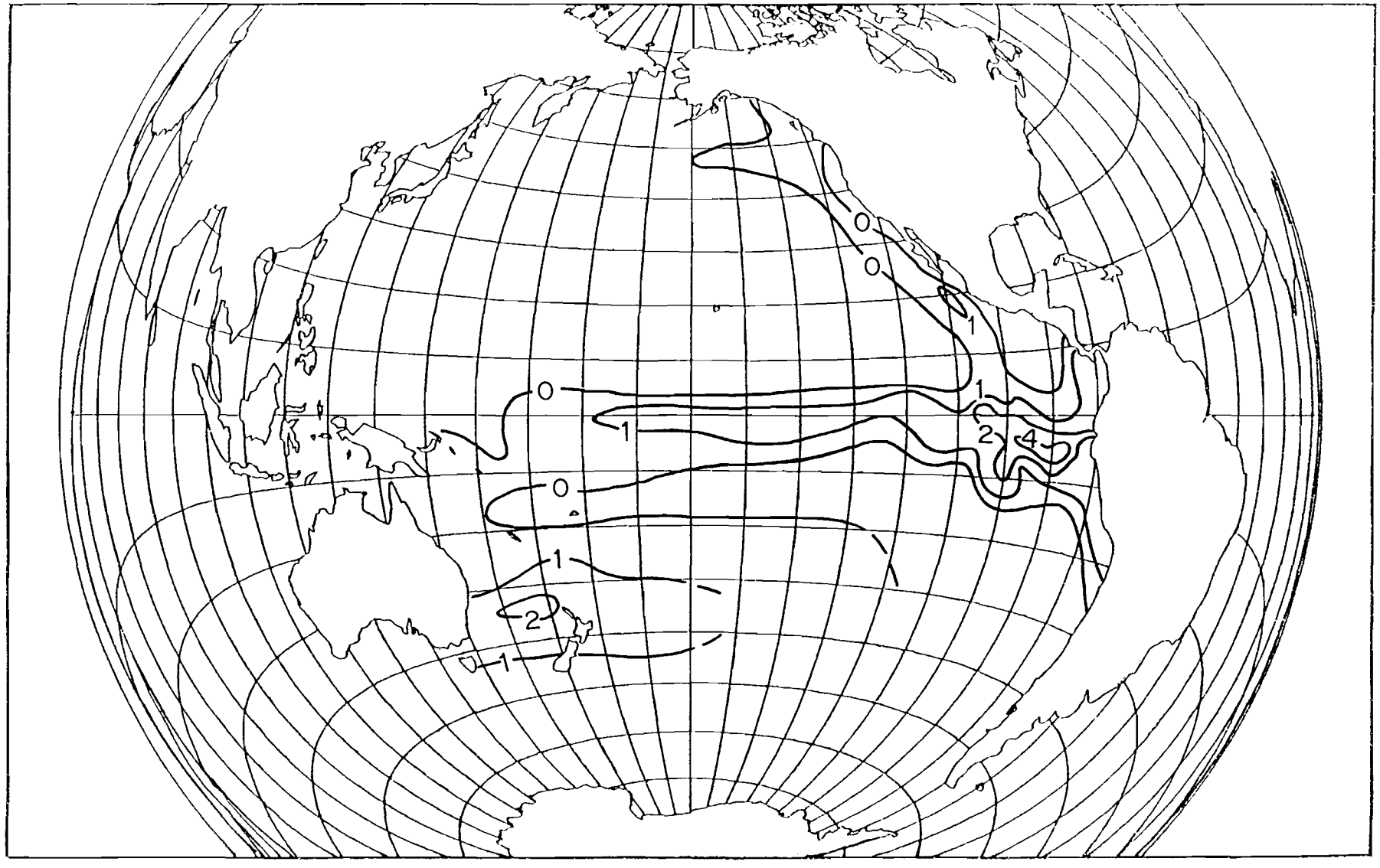
Pterocorys zancleus


Pterocorys zancleus

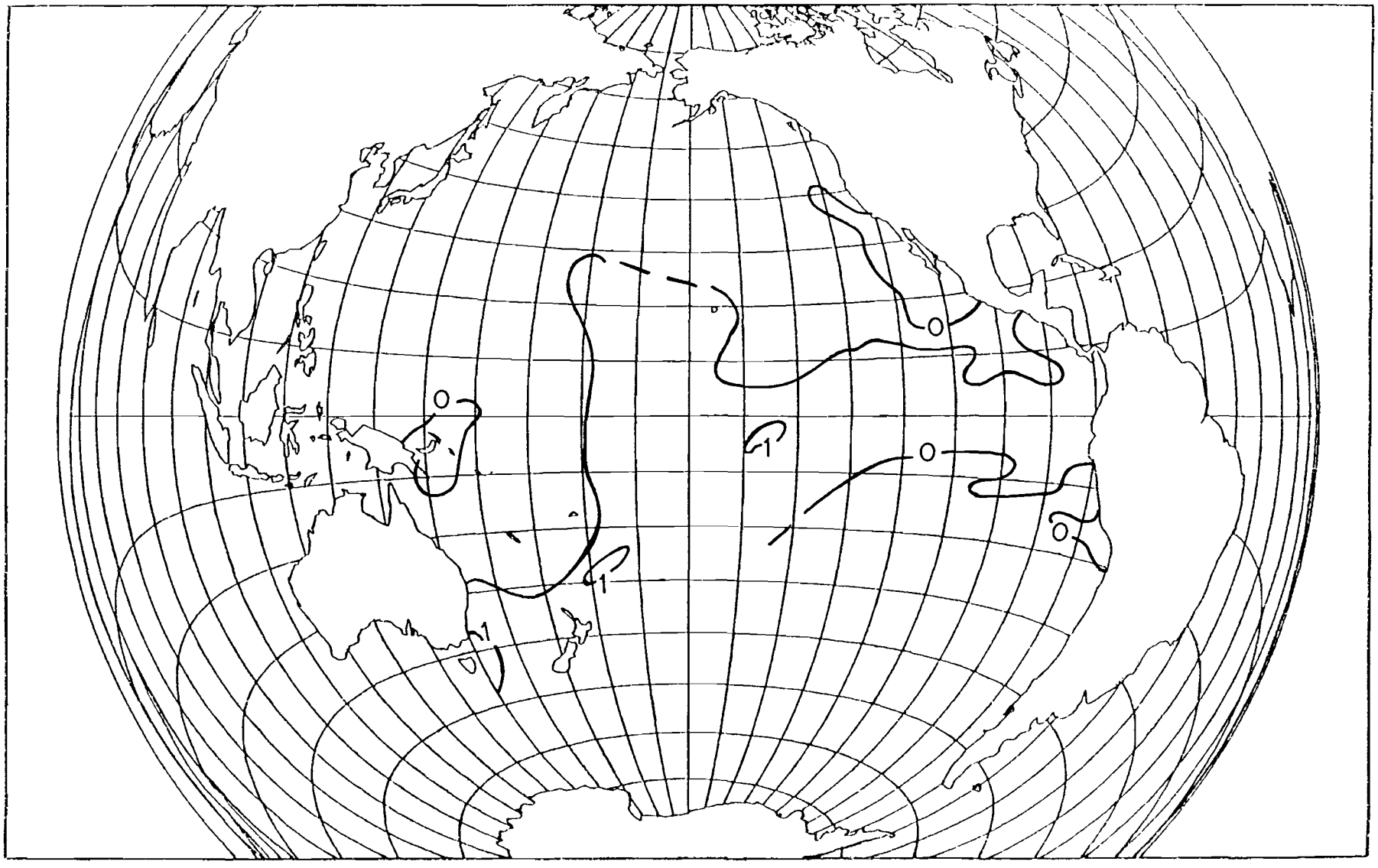


Theocorythium trachelium

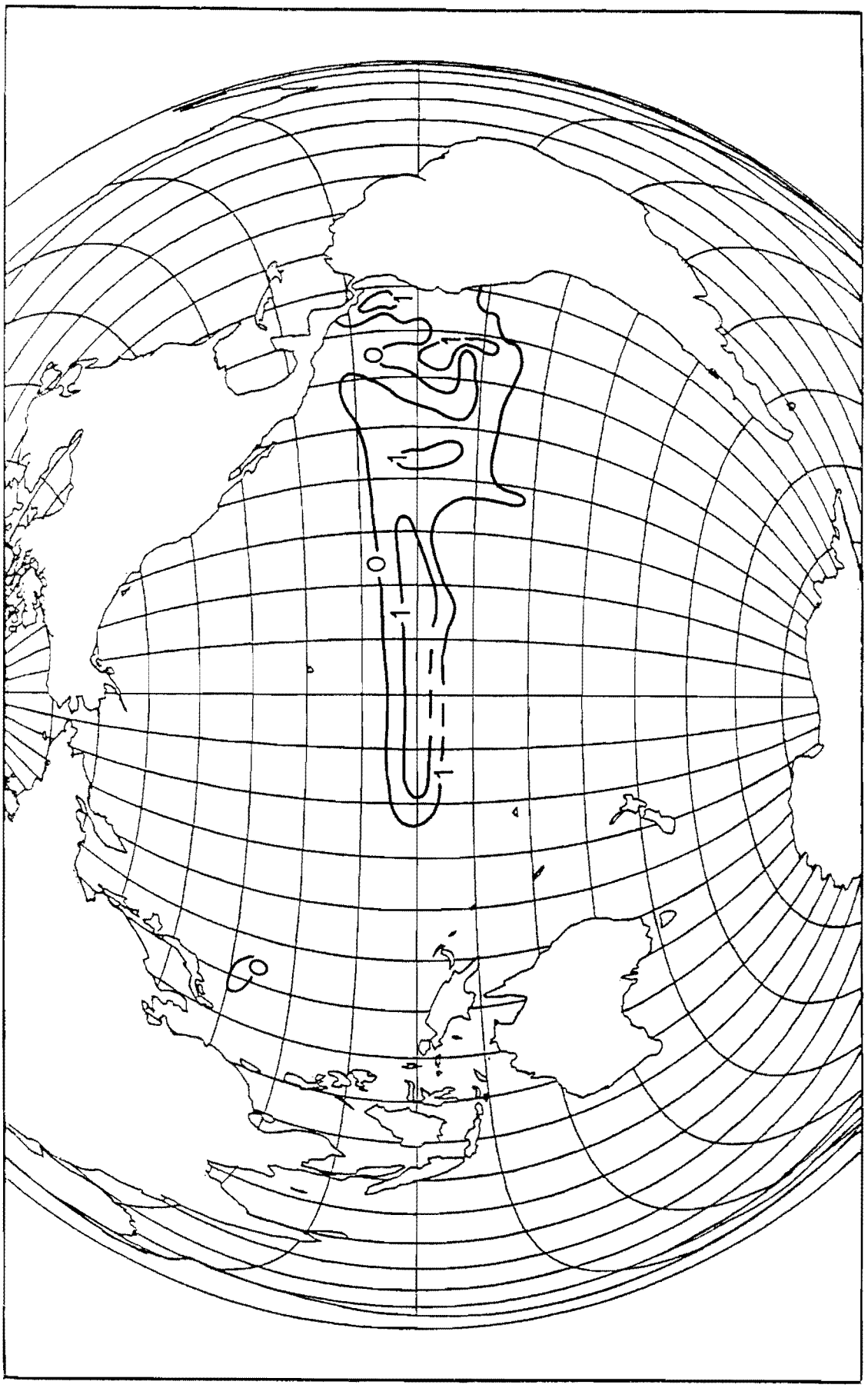

Botryostrobus aquilonaris



Botryostrobus auritus/australis grp.



Phormostichoartus corbula


Botryocyrtis scutum

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