IMaGe INTERACTIVE ATLASES ©

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ACKNOWLEDGMENT

The authors wish to thank John F. Kolars and John D. Nystuen of The University of Michigan for permission to reproduce the base maps of Tobler's Hyper-elliptical and of the azimuthal equidistant projections prepared for a set of their textbooks. Professor Nystuen's generosity in making specific comments about the content of this atlas is greatly appreciated.

William Nedella, and his classes of Earth Science students at Ypsilanti High School (Ypsilanti, Michigan), graciously provided us the opportunity to test these materials in the classroom. We are indebted to them for permitting us to explore this dimension for evaluation necessary to creating a useful product that is capable of responding to the demands of individual teachers.

Data displayed on base maps, and in lists, was compiled from a variety of atlases and textbooks enumerated in the list below. Certainly instructors and students, alike, would benefit from further reading in these, as well as in other sources mentioned in these.

Edward B. Espenshade and Joel L. Morrison, editors, Goode's World Atlas, Chicago: Rand McNally and Sons, various editions.

The Hammond World Atlas, Maplewood, N.J.: Hammond Incorporated, various editions.

Margaret S. Bishop et al., Focus on Earth Science, Columbus, Ohio: Charles E. Merrill, 1972.

Harm J. De Blij and Peter O. Muller, Geography: Regions and Concepts, New York: John Wiley, 1985.

John F. Kolars and John D. Nystuen, Geography: The Study of Location, Culture, and Environment, New York: McGraw-Hill, 1974. IMaGe reprint of part of the book, 1986.

Robert A. Muller, et al., Physical Geography Today: A Portrait of a Planet, Del Mar, California: CRM Books, 1974.

William L. Ramsey, et al., Modern Earth Science, New York: Holt, Rinehart and Winston, 1983.

Arthur N. Strahler and Alan H. Strahler, Elements of Physical Geography, New York: John Wiley, 1976.

The World Almanac and Book of Facts, 1985

SUGGESTIONS TO THE INSTRUCTOR ON THE USE OF THIS CUSTOMIZED IMaGe INTERACTIVE ATLAS

1. Students appear to master, more thoroughly, wide-spread distributions when they are actively involved in mapping these data, than when they are merely passively involved in looking at already-mapped data. The three sheets of coated plastic, hinged to sheets distributed evenly within the book, may be written on with pencil of any color to create as many as three overlays on any base map by suitable folding. The pencil marks erase easily from the plastic using any eraser that removes pencil from paper. The plastic is durable, has a life longer than does paper, and is recyclable from one class to the next. Should students write on the plastic with permanent ink markers, the ink may be removed using a compound containing acetone, such as finger-nail polish remover. Students should take care, when using overlays, to first, before entering any data on the overlay, record the registration marks from the underlying base map on each overlay to be used.

The base maps in the module entitled "Selected Map Projections" are included in all atlases. The back cover of the atlas is made of plastic coated with a chrome finish. Fingerprints may be removed from this reflective surface using a cloth moistened with a mild liquid soap and water mixture. Do not use any solution containing ammonia; regular cleaning of this material will enhance the appearance of the atlases (once or twice a year, or more often if necessary). A compound used specifically to clean this surface is also available from IMaGe; this may be useful for more thorough cleaning. Because the maps are bound together using a spiral binding, there is flexibility to shift the base maps (a small amount) to ensure an accurate fit to the plastic overlays.

2. The Instructor's Atlas contains all the material of the student Atlas, as well as a set of transparencies (enumerated on a list), in the pocket on the inside front cover. These are to be used on an overhead projector, in conjunction with the atlases, to promote interaction between student and instructor, and to demonstrate reasonable use of the materials in the Atlas.

3. All exercises are designed to take 50 minutes or less, so that when students in an early class take a minute to erase the plastic after they are done, the atlases may be used again in a later class. Therefore, instructors need to order only as many atlases as there are students in the largest Earth Science, or Geography, course. The only supplies needed in addition to the Atlas are colored pencils and erasers. We recommend that each student have access to three contrasting colors, such as red, green, and bright blue. This atlas may be used effectively by teams of students, working in groups of no more than three students, or it may be used individually. There are advantages to each approach; we suggest a mixture of uses.

4. MODULES CONTAINED IN THIS IMaGe ATLAS

SELECTED MAP PROJECTIONS

MODULE CONTENTS: One base map, Tobler's Hyper-elliptical
One base map, Azimuthal Equidistant

The student is introduced to selected map projections; one is an equal area projection, on which a unit square of area represents the same amount of area anywhere on the map, and the other is an azimuthal equidistant projection (centered near Paris, France), on which distances measured from the center are true. The reflective cover of the Atlas may be used to demonstrate how maps are distorted images of the earth. Experimentation is to be expected when students first encounter the reflective material. This can be turned to an advantage in showing maps as distortions; when a familiar three-dimensional object, such as a hand, is reflected, severe distortions occur. Try the following experiment.

1. Put the closed atlas on the table with the back cover facing you.
2. Pick up the atlas in your left hand by grabbing the atlas along the margin of the book opposite the spiral binding. Your left thumb should produce a slight indentation in the reflective material of the back cover.
3. Reflect your right palm in the atlas; hold it about three or four inches from the atlas cover. Slowly rotate your right hand and wiggle your fingers.
4. Move your right hand closer to your left thumb. Try bending the cover of the atlas a bit more while moving your right hand around, as suggested above.

Play with these steps to the extent where you can force your fingers to appear

1. much longer and thinner than they actually are;
2. to have twisted bones and joints;
3. to be separated from your hand.

These ideas show the difficulty of representing a three-dimensional object on a surface of different dimension. Next have students reflect their faces in the atlas cover. Point out to them that their heads are approximately spherical, so that the reflection they see in the atlas cover is a "map" of their heads. Make clear to them that even with the distortion, what they see is only about half of their head. Could bending the cover around the head reflect more than half? But then what sort of price would be paid in distorting their images beyond recognition? Now, you are ready to move them to a globe; have them try to create a reflected map of a large portion of the spherical globe--point out the distortions. Relate their difficulties to their previous experience with hand and head. Then show them the world maps of the earth in the atlas.

1. Talk about the obvious distortions in these maps, suggesting again the difficulties of projecting three dimensions into fewer.

2. Have them use the back of one atlas to reflect a map from another atlas. Have them bend the reflective surface slightly to produce new projections.

3. When the shiny surface is bent around a small globe, various distortions appear and suggest how the round earth might be projected into the flat plane.

All of this material can be covered in one class period.

WORLD PLACE NAMES: NATIONAL POLITICAL UNITS

MODULE CONTENTS: One list of place names.
One paper map of locational "hints."

ADDITIONAL CONTENT IN THE INSTRUCTOR'S ATLAS:
One transparency of locational "hints."
One transparency showing the solution to the exercise, for each continent.
Transparencies showing the list of place names.

ADDITIONAL REQUIREMENTS:
Students will need to use the plastic overlays; before beginning, make sure that each student has placed a sheet of plastic over the Tobler base map in the "Selected Map Projections" module, and has transferred the registration marks, to the plastic overlay. This exercise is best when done by students on an individual basis.

A list of place-names is provided, ordered within each continent by longitude from west to east. Students should use this list to locate political units on the base map in this module and should label them, on the plastic, using the number associated with each country. At the beginning of this exercise, instructors should project the list of place-names so that students have an easy time referring to the list. A map of locational "hints," showing the first letter of selected counties is provided to aid students who have difficulty using latitude and longitude to locate countries. We suggest that after about ten minutes, the instructor project the transparency showing the hints. Then return the place-name list to the overhead projector. Repeat this alternation, as needed. Students should be encouraged to ask for help, and to talk to each other about finding locations, although each should mark his or her own atlas to reinforce both country name and location.

A key, showing the solutions for each continent is provided on transparencies. We suggest doing this exercise one continent at a time. Depending on the level of the class, one continent per class period may be enough. At the end of the class period, solutions should be shown, on the overhead projector, for that period's work.

We suggest that you begin with North America, a continent that is likely to be more familiar to students than are the others. We suggest that South America be done next, followed by, in order of difficulty, Africa, Europe, Asia, and Oceania. Some of the islands listed do not appear on the map; students should be encouraged to label blank areas using latitude and longitude to position the appropriate number corresponding to the island. Take this opportunity to point out that maps of different scales will show different amounts of detail; compare this to the corresponding idea in photography. (The Maldive Islands, the Galapagos Islands, and various Pacific islands do not appear on Tobler's Hyper-elliptical projection).

This exercise will promote a good understanding of both relative and absolute position of the world's countries and continents. Many students may have to struggle to integrate the various skills required; however, once mastered, much of the material should stick.

THE GLOBAL DISTRIBUTION OF RAW MATERIAL PRODUCTION

MODULE CONTENTS: One list of raw material production
One paper map of locational "hints."

ADDITIONAL CONTENT IN THE INSTRUCTOR'S ATLAS:
One transparency of locational "hints."
Transparencies of the raw materials list.

ADDITIONAL REQUIREMENTS:
Have students unfold all three sheets of plastic; align them (using the registration marks) with Tobler's base map in the "Selected Map Projections" module. Each student, or group of students, should have pencils of three different, and contrasting, colors. Students may benefit from working in groups of no more than three.

A list of raw materials is enclosed in this module. Project the transparencies showing the list of raw materials. On the overlays, have students group natural associations of raw materials, using the symbols listed below the name of the raw material, to show relationships among various minerals. Students who have not first completed the World Place-Names Module will find this difficult; all will find it useful to have the "Hint" transparency from that exercise projected periodically during the course of this exercise. For example, Copper, Tin, and Bauxite, might be grouped putting the distribution of each of Cu, Sn, and Al, on a single overlay. Or, ferro-alloys Manganese, Nickel, Tungsten, Vanadium, Chrome Ore, Cobalt, Molybdenum, and Iron Ore might be grouped putting three raw materials on each of two overlays and two on the third.

PLATE TECTONICS

MODULE CONTENTS: Four paper base maps, Tobler's Hyper-elliptical. One shows the generalized ocean bottom topography, one shows the volcanic regions of continents, one shows earthquake epicenters, and one shows generalized plate boundaries.

ADDITIONAL CONTENT IN THE INSTRUCTOR'S ATLAS:
One transparency for each of the four base maps in the student atlas.

ADDITIONAL REQUIREMENTS:
Have students unfold all three sheets of plastic; align them (using the registration marks), with Tobler's base map. Each student, or group of students, should have pencils of three different, and contrasting, colors. Students may benefit from working in groups of no more than three.

Base maps are provided showing a) ridges and trenches on the ocean bottom; b) volcanic regions of continents; c) earthquake epicenters; d) generalized plate boundaries.

1. In Color #1, have students transfer the ridges and trenches shown on Map (a) to one sheet of plastic.
2. In Color #2, have them transfer sites of active volcanoes shown on Map (b) to a second sheet of plastic.
3. In Color #3, have them transfer earthquake epicenters to the third sheet of plastic.
4. Have them superimpose each sheet of plastic, singly, on Map (d) which shows the generalized boundaries of tectonic plates. Discuss the associations. Note that the volcanoes on Hawaii do not fit the pattern; perhaps there are cracks in the surface of the earth which let material escape. The instructor should also demonstrate this using the corresponding transparencies.
5. Have them superimpose pairs of plastic sheets on Map (d) and observe correspondences. Demonstrate this using transparencies, as well.
6. Have them superimpose all three plastic sheets on Map (d). Demonstrate this using transparencies, as well.
7. Have them superimpose all three plastic sheets on the appropriate base map in the "Selected Map Projections" module and comment on how well the composite traces out the plate boundaries shown in Map (d), using the transparency of Map (d) to permit visual comparisons.

Allow one class period to do the entire exercise; this may be done in groups or individually.

DIASTROPHISM

MODULE CONTENTS: Six maps of mountain ranges by continent
One map of physiographic provinces.
One list of mountain names ordered by height
One list of submerged features ordered by depth
One list of active volcanoes

ADDITIONAL CONTENT IN THE INSTRUCTOR'S ATLAS:
One transparency of each.

Project the lists in this module and have students locate selected mountains, volcanoes, and trenches on a base map of the world. Have them do it on base maps for each continent (on plastic overlays).

For a closer look at mountains and other topography, a base map showing the generalized boundaries of physiographic provinces of the United States and Canada is also enclosed. Overlays might be used to color the regions, or to work with them in some other way that will reinforce the pattern of the provinces in the mind of the student. Instructor's transparencies are included in the pocket.

Allow one class period to work with this material.

SOILS

MODULE CONTENTS: One base map showing the distribution of soil types for each of the continents--a total of six maps.

ADDITIONAL CONTENT IN THE INSTRUCTOR'S ATLAS:
One transparency of each map in the module.
One transparency of the legend for the maps.

Base maps showing the distribution of soil types for each continent serve as the foundation of this module. The plastic overlays might be used to advantage to superimpose a small number of elements on these complex patterns in order to focus attention on selected topics. For example, use an plastic sheet to superimpose material from the maps of mountains. This will give them a direct opportunity to see how well the category "Mountain and Mountain Valleys Soils" corresponds with the location of mountain belts. Instructor's transparencies are included. The legend should be projected, throughout any exercise which uses these maps.

Allow one class period for the entire exercise.

TABLE OF CONTENTS

TRANSPARENCIES LISTED BY MODULE

SELECTED MAP PROJECTIONS

Tobler's Hyper-elliptical projection--one transparency.
Azimuthal equidistant projection--one transparency.

WORLD PLACE-NAMES: NATIONAL POLITICAL UNITS

Place-name list--two transparencies
Locational "hints"--one transparency
Solutions--six transparencies, one per continent

THE GLOBAL DISTRIBUTION OF RAW MATERIALS

Raw material production list--two transparencies

PLATE TECTONICS

Four transparencies, one of each map.

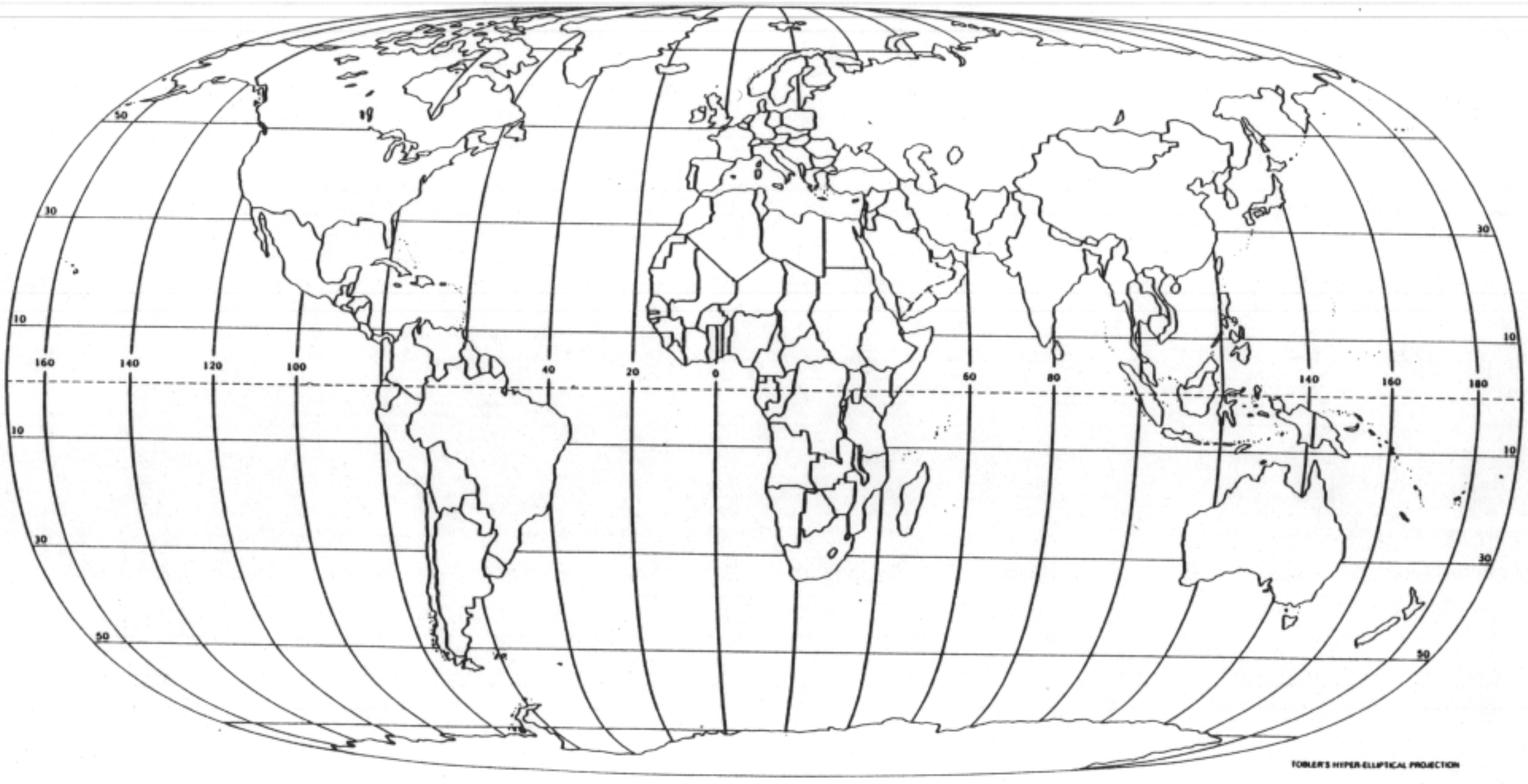
DIASTROPHISM

Transparencies of mountains on each of six continents
Transparencies of list of 145 principal mountains
arranged in decreasing order of height
Transparency of list of submerged features
Transparency of list of active volcanoes
Transparency of physiography of North America

MAJOR SOIL ZONES

Soil zones by continents--six transparencies.
Map legend--one transparency.

SELECTED MAP PROJECTIONS

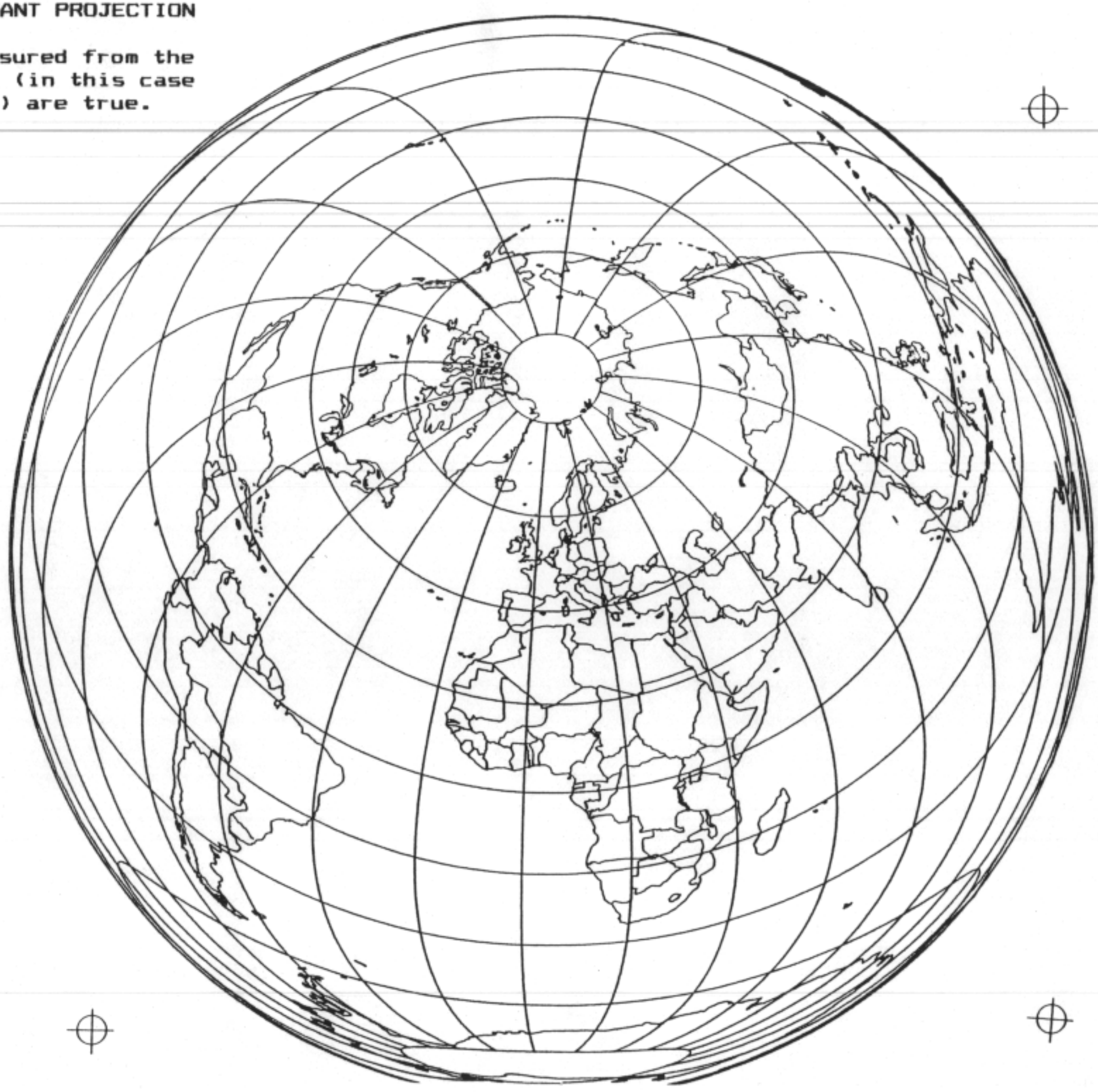


EQUAL AREA PROJECTION

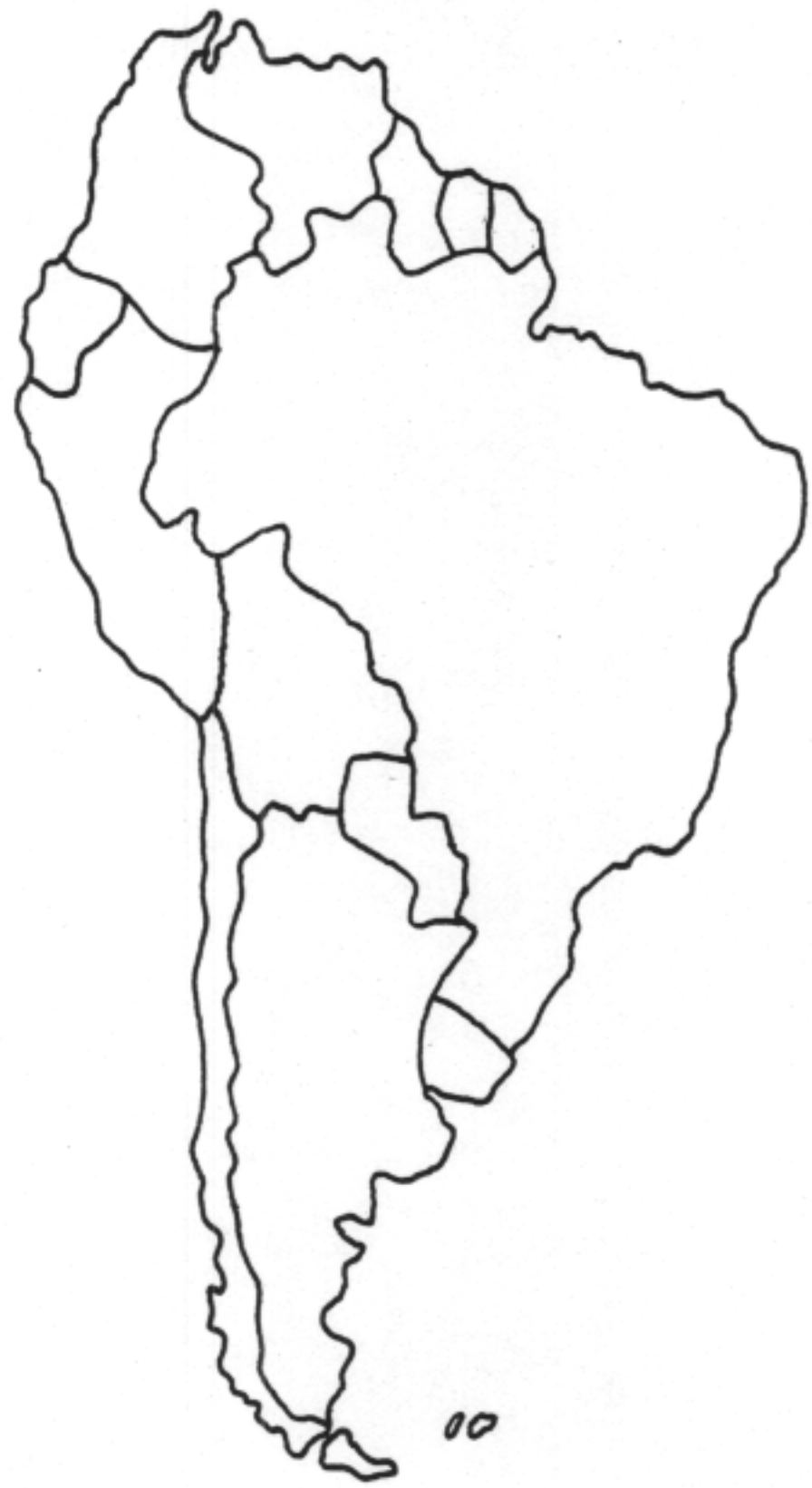
A square one-inch on a side represents the same amount of area anywhere on the map.

AZIMUTHAL EQUIDISTANT PROJECTION

Distances measured from the projection center (in this case near Paris, France) are true.



NORTH AMERICA



SOUTH AMERICA

EUROPE


ASIA

OCEANIA

WORLD PLACE-NAMES: NATIONAL POLITICAL UNITS

THE GLOBAL DISTRIBUTION OF RAW MATERIAL PRODUCTION

RAW MATERIAL PRODUCTION

The entries in each column account for most of the world's production of the given material (in most cases, well over 90%). The columns are arranged with the first entry producing the largest amount and the last entry the smallest amount.

COPPER (Cu)
U.S.A.
Zambia
Chile
U.S.S.R.
Canada
Zaire
Peru
S. Africa
Japan
Philippines
Australia
Mexico
Portugal
Morocco
Norway
Sweden

TIN (Sn)
Malaysia
Bolivia
U.S.S.R.
Thailand
China
Indonesia
Nigeria
Australia
Zaire

BAUXITE (Al)
Jamaica
Australia
Surinam
Guyana
U.S.S.R.
France
Guinea
Yugoslavia
U.S.A.
Hungary
Dominican Republic
India
Malaysia
Indonesia

MANGANESE (Mn)
U.S.S.R.
S. Africa
Brazil
India
Gabon
China
Australia
Ghana

NICKEL (Ni)
Canada
U.S.S.R.
New Caledonia
Cuba
U.S.A.
Australia

COBALT (Co)
Zaire
Canada
Zambia
U.S.S.R.
Morocco
Cuba
Finland

VANADIUM (V)
U.S.A.
S. Africa
Finland
Norway
Namibia

CHROME ORE (Ch)
U.S.S.R.
S. Africa
Philippines
Turkey
Albania
Zimbabwe
India
Iran

TUNGSTEN (W)
China
U.S.S.R.
U.S.A.
N. Korea
S. Korea
Bolivia
Portugal
Australia
Canada
Brazil
Peru
Thailand
Japan

MOLYBDENUM (Mb)
U.S.A.
Chile
China
Canada
U.S.S.R.
Mexico
Peru
Norway
Corsica
S. Korea
Japan
Philippines

IRON ORE (Fe)
U.S.S.R.
U.S.A.
France
Canada
China
Australia
Sweden
Brazil
India
Liberia
Venezuela
Chile
Peru
Mauritania
S. Africa
N. Korea
Angola

LEAD (Pb)
U.S.S.R.
Australia
U.S.A.
Canada
Mexico
Peru
Yugoslavia
Bulgaria
Morocco
Sweden
Spain
N. Korea
Namibia
Japan
Ireland
W. Germany

ZINC (Zn)
Canada
U.S.S.R.
U.S.A.
Australia
Peru
Japan
Mexico
Poland
Italy
N. Korea
W. Germany
Zaire
China
Sweden
Yugoslavia
Bulgaria

PHOSPHATES (PO_4)	SULFUR (S)	POTASH (K_2O)	PYRITES (Py)	SYNTHETIC NITROGEN (N)
U.S.A.	U.S.A.	U.S.S.R.	U.S.S.R.	U.S.A.
U.S.S.R.	Canada	Canada	Japan	U.S.S.R.
Morocco	France	U.S.A.	Spain	Japan
Tunisia	Mexico	W. Germany	China	W. Germany
Nauru Is.	Poland	E. Germany	Italy	France
S. Africa	U.S.S.R.	France	Cyprus	Italy
		Spain	Finland	United Kingdom
			Norway	China
			S. Africa	Netherlands
			Sweden	Canada
			W. Germany	Poland
			Portugal	
			N. Korea	

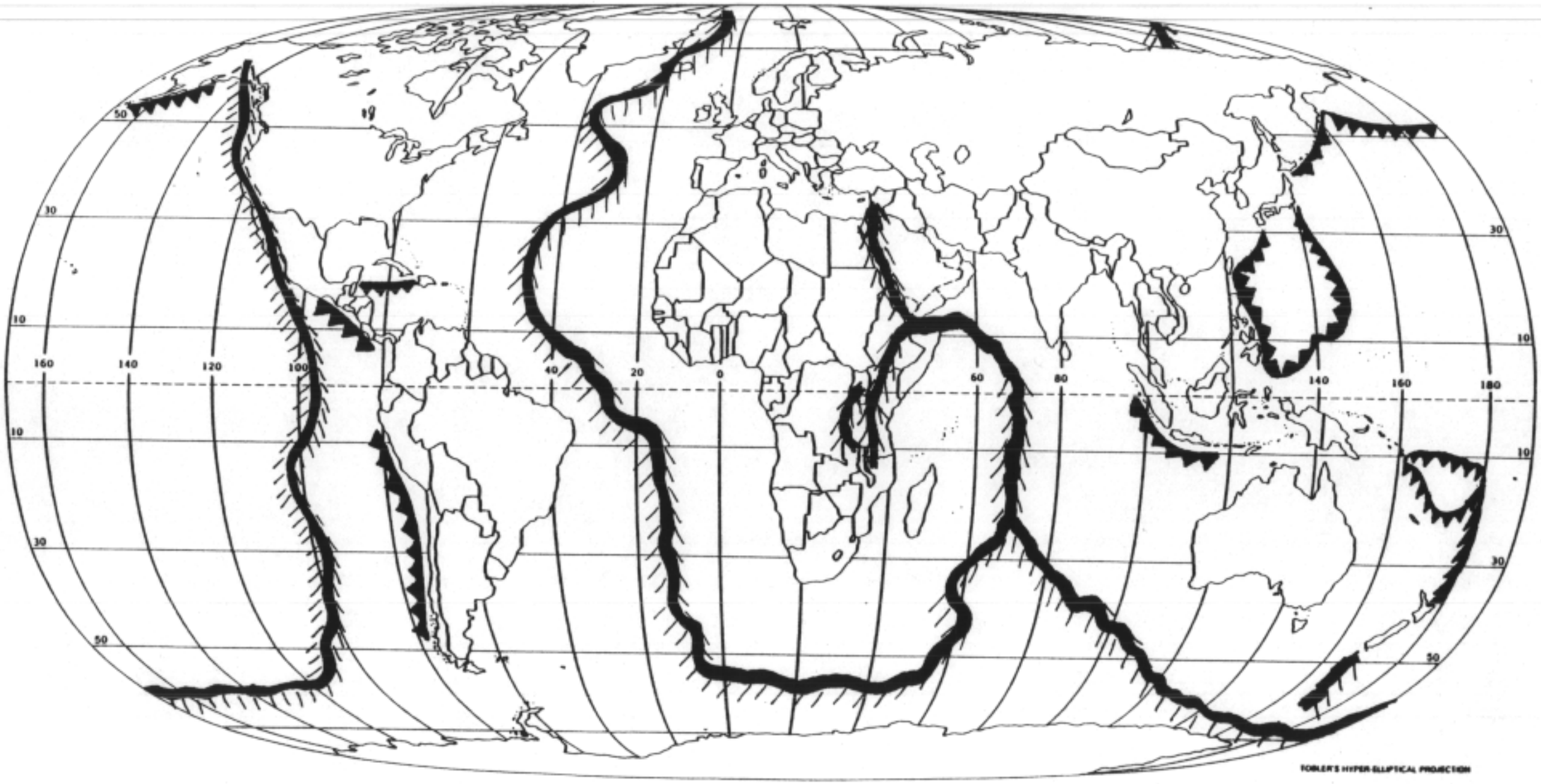
COAL (C)	PETROLEUM (Oil)	NATURAL GAS (Gas)
U.S.A.	U.S.A.	U.S.A.
U.S.S.R.	U.S.S.R.	U.S.S.R.
China	Saudi Arabia	Canada
United Kingdom	Iran	Netherlands
Poland	Venezuela	Venezuela
W. Germany	Kuwait	Iran
India	Libya	Romania
S. Africa	Nigeria	United Kingdom
Japan	Iraq	
France	Canada	
Czechoslovakia	Bahrain	
Australia	Indonesia	
N. Korea	Algeria	
S. Korea	Romania	
Netherlands	China	
Belgium	Mexico	
Spain	Argentina	
Canada	Colombia	
	Qatar	
	United Arab Emirates	

PLATE TECTONICS

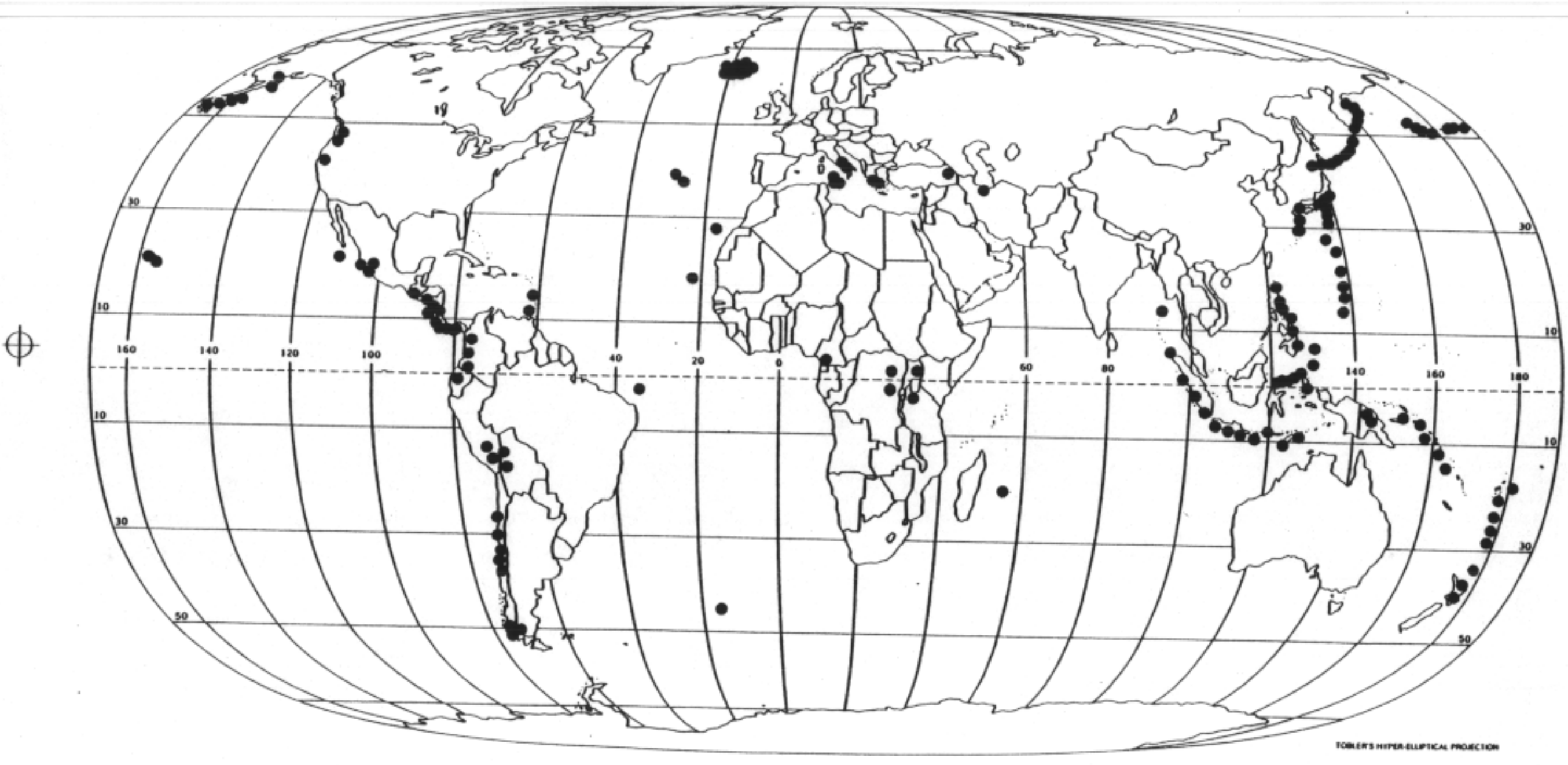
GENERALIZED OCEAN BOTTOM TOPOGRAPHY

Ridges

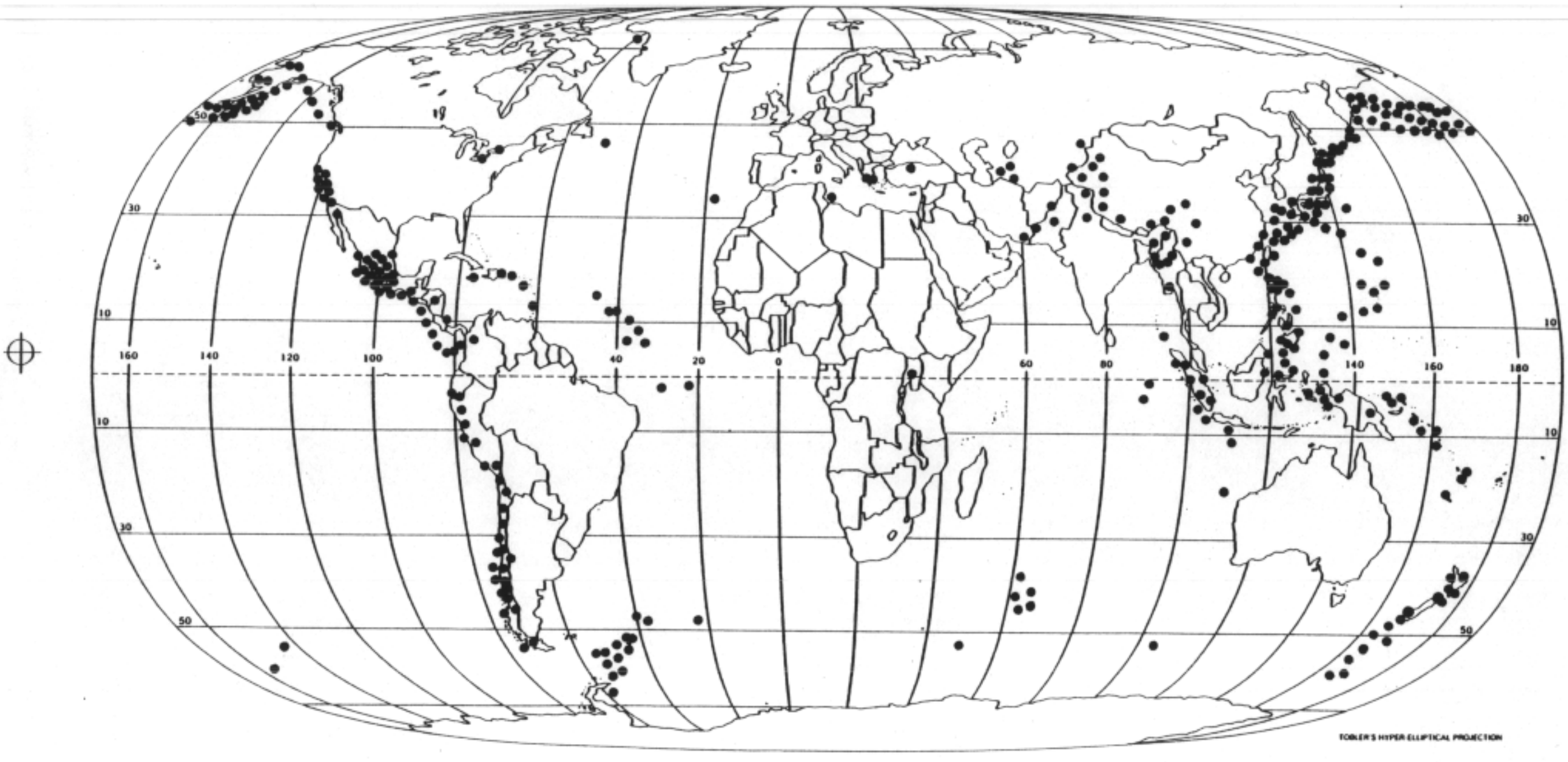
Trenches



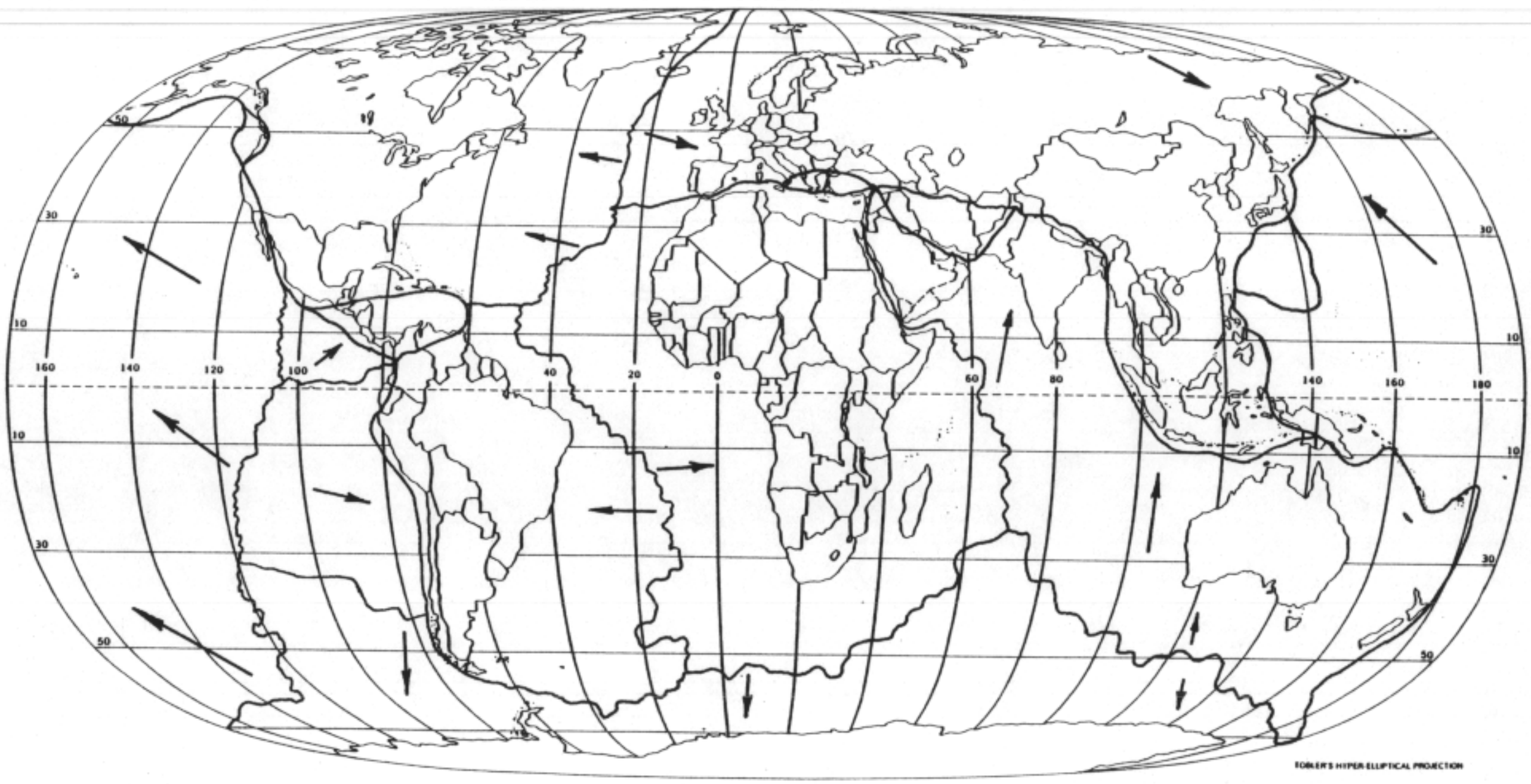
FOHLER'S HYPER-ELLIPTICAL PROJECTION



SITES OF ACTIVE VOLCANOES



EARTHQUAKE EPICENTERS



FOBLER'S HYPER-ELLIPTICAL PROJECTION

PLATE BOUNDARIES

DIASTROPHISM

NAME OF SUBMERGED FEATURE	BODY OF WATER	COORDINATES	DEPTH OF FEATURE (IN FEET)	AVERAGE DEPTH OF WATER
Mariana Trench	Pacific	11 20 N, 142 12 E	35,810	12,925
Tonga Trench	Pacific	23 16 S, 174 44 W	35,433	12,925
Philippine Trench	Pacific	10 38 N, 126 36 E	32,995	12,925
Kemadec Trench	Pacific	31 53 S, 177 21 W	32,963	12,925
Kuril Trench	Pacific	44 15 N, 150 34 E	31,988	12,925
Izu Trench	Pacific	31 05 N, 142 10 E	31,808	12,925
Bonin Trench	Pacific	24 30 N, 143 24 E	30,040	12,925
New Britain Trench	Pacific	06 19 S, 153 45 E	29,331	12,925
Yap Trench	Pacific	08 33 N, 138 02 E	27,976	12,925
Japan Trench	Pacific	36 08 N, 142 43 E	27,599	12,925
Peru-Chile Trench	Pacific	23 18 S, 71 14 W	26,457	12,925
Palau Trench	Pacific	07 52 N, 134 56 E	26,424	12,925
Aleutian Trench	Pacific	50 51 N, 177 11 E	25,194	12,925
New Hebrides Trench	Pacific	20 36 S, 168 37 E	24,836	12,925
North Ryukyu Trench	Pacific	24 00 N, 126 48 E	23,560	12,925
Mid. America Trench	Pacific	14 02 N, 93 39 W	21,857	12,925
Java Trench	Indian	10 19 S, 109 58 E	23,376	12,598
Ob' Trench	Indian	09 45 S, 67 18 E	22,553	12,598
Diamantina Trench	Indian	35 50 S, 105 14 E	21,660	12,598
Vema Trench	Indian	09 08 S, 67 15 E	21,004	12,598
Aguihas Basin	Indian	45 20 S, 26 50 E	20,325	12,598
Puerto Rico Trench	Atlantic	19 55 N, 65 27 W	28,232	11,730
So. Sandwich Trench	Atlantic	55 42 S, 25 56 E	27,313	11,730
Romanche Gap	Atlantic	00 13 S, 18 26 W	25,354	11,730
Cayman Trench	Atlantic	19 12 N, 80 00 W	24,721	11,730
Brazil Basin	Atlantic	09 10 S, 23 02 W	20,076	11,730
Ionian Basin	Mediterranean	36 32 N, 21 06 E	16,896	4,296
Eurasia Basin	Arctic	82 23 N, 19 31 E	17,881	3,407

VOLCANO NAME	COUNTRY	GENERAL LOCATION	RECENT ACTIVITY
Nyamuragira	Zaire	Africa	1984
Erebus	Ross Is.	Antarctica	1984
Sakurazima	Japan	Asia	1984
Arenal	Costa Rica	Cent. Amer.	1984
Etna	Italy	Europe	1984
Kilauea	Hawaii	Mid-Pacific	1984
Mauna Loa	Hawaii	Mid-Pacific	1984
Pavlof	Aleutian Is.	North Amer.	1984
Mt. St. Helens	Washington	North Amer.	1984
Langila	New Britain	Oceania	1984
White Is.	New Zealand	Oceania	1984
Manam	Papua New Guinea	Oceania	1984
Fournaise	Reunion Is.	Africa	1983
Niigata Yakoyama	Japan	Asia	1983
Bezymianny	U.S.S.R.	Asia	1983
Bulusan	Philippines	Asia	1983
Asama	Japan	Asia	1983
Santa Maria	Guatemala	Cent. Amer.	1983
Pacaya	Guatemala	Cent. Amer.	1983
Colima	Mexico	North Amer.	1983
El Chichon	Mexico	North Amer.	1983
Ulawun	New Britain	Oceania	1983
Villarica	Chile	South Amer.	1983
Cameroon	Cameroons	Africa	1982
Kirisima	Japan	Asia	1982
Ruapehu	New Zealand	Asia	1982
Suwanosezima	Japan	Asia	1982
Raung	Java	Asia	1982
Soputan	Indonesia	Asia	1982
Marapi	Sumatra	Asia	1982
Merapi	Java	Asia	1982
Galunggung	Java	Asia	1982
Concepcion	Nicaragua	Cent. Amer.	1982
Poas	Costa Rica	Cent. Amer.	1982
Momotombo	Nicaragua	Cent. Amer.	1982
Telica	Nicaragua	Cent. Amer.	1982
Gareloi	Aleutian Is.	North Amer.	1982
Lopevi	New Hebrides	Oceania	1982
Guagua Pichincha	Ecuador	South Amer.	1982
Aso	Japan	Asia	1981
Gamkonora	Indonesia	Asia	1981
Semeru	Java	Asia	1981
San Cristobal	Nicaragua	Cent. Amer.	1981
Krafla	Iceland	Mid-Atl. Ridge	1981
Hekla	Iceland	Mid-Atl. Ridge	1981
Shishaldin	Aleutian Is	North Amer.	1981
Karkar	Papua New Guinea	Oceania	1981
On-Take	Japan	Asia	1980
Fuego	Guatemala	Cent. Amer.	1980
Akutan	Aleutian Is.	North Amer.	1980
Makushin	Aleutian Is.	North Amer.	1980
Tupungatito	Chile	South Amer.	1980
Soufriere	St. Vincent	Caribbean	1979

Ambrym	New Hebrides	Oceania	1979
Llaima	Chile	South Amer	1979
Usu	Japan	Asia	1978
Mayon	Philippines	Asia	1978
Azuma	Japan	Asia	1978
Iliamna	Alaska	North Amer.	1978
Nyirangongo	Zaire	Africa	1977
Karthala	Comoro Is.	Africa	1977
O-Sima	Japan	Asia	1977
Nasu	Japan	Asia	1977
Taal	Philippines	Asia	1977
Seguam	Alaska	North Amer.	1977
Purace	Colombia	South Amer.	1977
Karymskaya	U.S.S.R.	Asia	1976
Siau	Indonesia	Asia	1976
Sarycheva	Kuril Is. USSR	Asia	1976
San Miguel	El Salvador	Cent. Amer	1976
Augustine	Alaska	North Amer.	1976
Sangay	Ecuador	South Amer.	1976
Stromboli	Italy	Europe	1975
Leirhnukur	Iceland	Mid-Atl. Ridge	1975
Ngauruhoe	New Zealand	Oceania	1975
Cotopaxi	Ecuador	South Amer.	1975
Chokai	Japan	Asia	1974
Klyuchevskaya	U.S.S.R.	Asia	1974
Great Sitkin	Aleutian Is.	North Amer.	1974
Erta-Ale	Ethiopa	Africa	1973
Tiatia	Kuril Is. USSR	Asia	1973
Hudson	Chile	South Amer.	1973
Alaid	Kuril Is. USSR	Asia	1972
Acatenango	Guatemala	Cent. Amer.	1972
Dukono	Indonesia	Asia	1971
Deception Island	South Shetland Is.	Antarctica	1970
Lokon-Empung	Celebes	Asia	1970
Akita Komaga take	Japan	Asia	1970
Beerenberg	Jan Mayen Is. (Nor)	Mid-Atl. Ridge	1970
Alcedo	Galapagos Is.	South Amer.	1970
Amburombu	Indonesia	Asia	1969
Kiska	Aleutian Is.	North Amer.	1969
Lewotobi Laki-Laki	Indonesia	Asia	1968
Batur	Bali	Asia	1968
Kerintji	Sumatra	Asia	1968
Keli Mutu	Indonesia	Asia	1968
Awu	Indonesia	Asia	1968
Rincon de la Vieja	Costa Rica	Cent. Amer.	1968
Lascar	Chile	South Amer.	1968
Kelud	Java	Asia	1967
Siamet	Java	Asia	1967
Tangkuban Prahu	Java	Asia	1967
Irazu	Costa Rica	Cent. Amer.	1967
Surtsey	Iceland	Mid-Atl. Ridge	1967
Rindjani	Indonesia	Asia	1966
Me-akan	Japan	Asia	1966
Sangeang Api	Indonesia	Asia	1966
Izaico	El Salvador	Cent. Amer.	1966
Redoubt	Alaska	North Amer.	1966

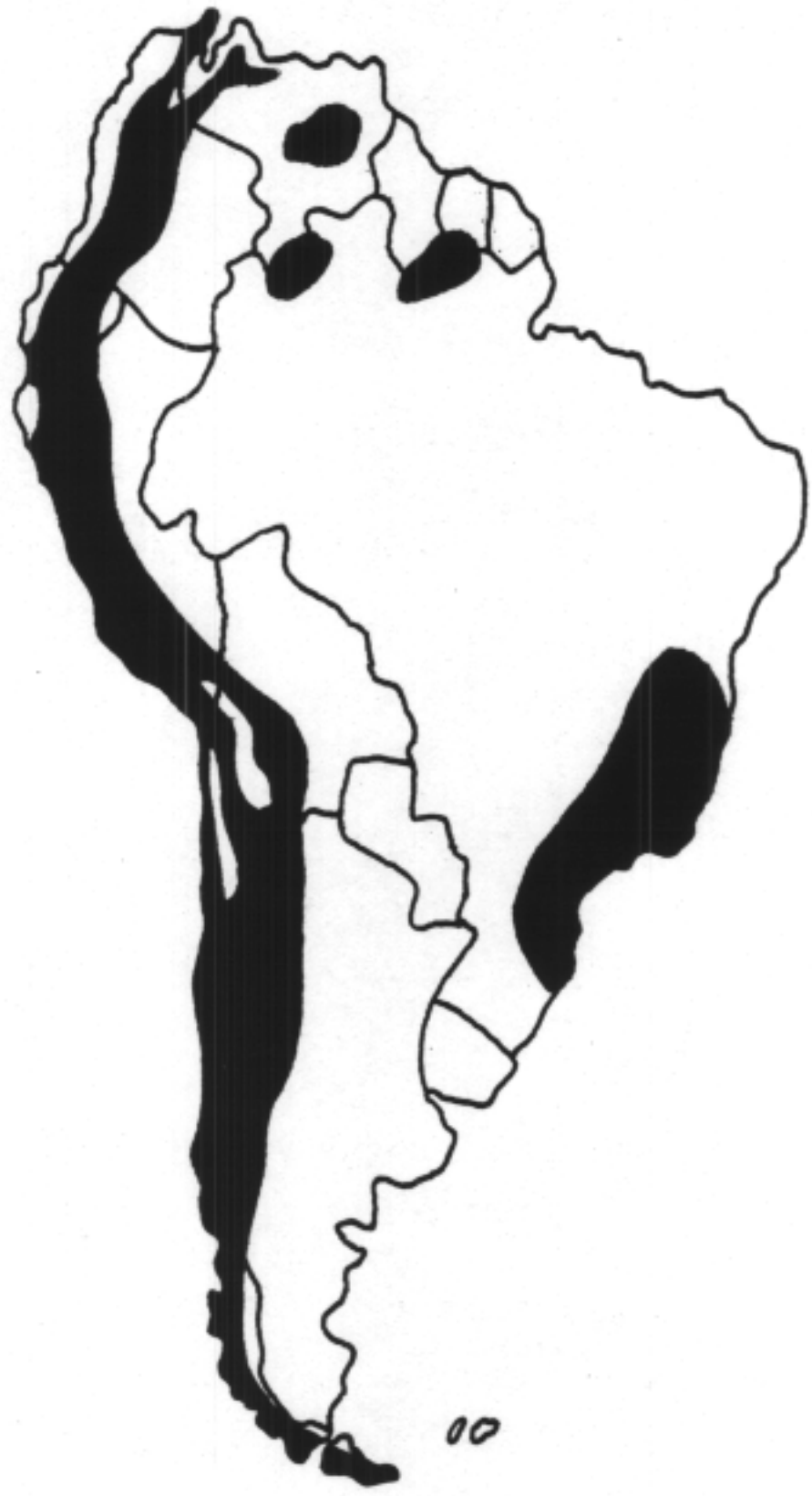
Agung	Bali	Asia	1964
Shiveluch	U.S.S.R.	Asia	1964
Pogromni	Alaska	North Amer.	1964
Yake Dake	Japan	Asia	1963
Temate	Indonesia	Asia	1963
Trident	Alaska	North Amer.	1963
Big Ben	Heard Is.	Antarctica	1960

	MOUNTAIN NAME	COUNTRY NAME	HEIGHT (FEET)	LATITUDE N. OR S.	LONGITUDE E. OR W.	MT'N.RANGE OR ISLAND
1.	Everest	Nepal-China	29,028	28 00 N	86 57 E	Himalaya
2.	Godwin Austen	Pakistan	28,250	36 06 N	76 38 E	Karakoram
3.	Kanchenjunga	Nepal-India	28,208	27 30 N	88 18 E	Himalayas
4.	Makalu	China-Nepal	27,824	*	*	Himalayas
5.	Dhaulagiri	Nepal	26,810	28 42 N	83 31 E	Himalaya
6.	Nanga Parbat	Pakistan	26,660	35 20 N	74 35 E	Karakoram
7.	Annapurna	Nepal	26,504	*	*	Himalayas
8.	Gasherbrum	Pakistan	26,470	*	*	Hindu Kush
9.	Gosainthan	China	26,291	*	*	
10.	Nanda Devi	India	25,645	30 30 N	80 25 E	Himalayas
11.	Rakaposhi	Pakistan	25,550	*	*	
12.	Kamet	India	25,447	35 50 N	79 42 E	Karakoram
13.	Namcha Barwa	China	25,443	*	*	
14.	Gurla Mandhata	China	25,354	*	*	
15.	Ulugh Muztagh	China	25,338	*	*	
16.	Tirich Mir	Pakistan	25,230	36 50 N	71 48 E	Hindu Kush
17.	Minya Knoka	China	24,900	29 16 N	101 46 E	Kun Lun Shan
18.	Kommunizma	U.S.S.R.	24,590	39 46 N	71 23 E	Pamirs
19.	Pobeda	China	24,406	*	*	
20.	Muztagh Ata	China	24,388	38 N	75 E	Astin Tagh
21.	Lenin Park	U.S.S.R.	23,406	*	*	
22.	Khan Tengri	U.S.S.R.	22,940	42 10 N	80 20 E	Tien Shan
23.	Aconcagua	Argentina	22,831	32 38 S	71 00 W	Andes
24.	Ojos del Salado	Chile	22,572	*	*	Andes
25.	Tupungato	Chile	22,310	*	*	Andes
26.	Pissis	Argentina	22,241	*	*	Andes
27.	Mercedario	Argentina	22,211	31 58 S	70 07 W	Andes
28.	Huascaran	Peru	22,205	09 05 S	77 50 W	Andes
29.	Llullaillaco	Chile	22,146	24 50 S	68 30 W	Andes
30.	Kailas	Tibet-China	22,031	*	*	
31.	Yerupaja	Peru	21,765	*	*	Andes
32.	Incahuasi	Chile	21,719	*	*	Andes
33.	Sajama	Bolivia	21,391	18 13 S	68 53 W	Andes
34.	Illimani	Bolivia	21,151	*	*	Andes
35.	Chimborazo	Ecuador	20,561	01 35 S	78 45 W	Andes
36.	McKinley	U.S.A., AK	20,320	63 00 N	151 02 W	Alaska
37.	Antofalla	Argentina	20,013	26 00 S	67 52 W	Andes
38.	Logan	Canada	19,850	60 54 N	140 33 W	Rockies
39.	Dos Conos	Argentina	19,357	*	*	Andes
40.	Cotopaxi	Ecuador	19,347	00 40 S	78 26 W	Andes
41.	Kilimanjaro	Tanzania	19,340	03 09 S	37 19 E	
42.	Tocopuri	Bolivia	19,137	*	*	Andes
43.	Misti	Peru	19,098	*	*	Andes
44.	Cristobal Colon	Colombia	19,029	11 00 N	74 00 W	Andes
45.	Cayambe	Ecuador	18,996	00 03 N	79 09 W	Andes
46.	Damavand	Iran	18,934	36 05 N	52 05 E	Elburz
47.	Huila	Colombia	18,865	02 59 N	76 01 W	Andes
48.	Antizana	Ecuador	18,714	*	*	Andes

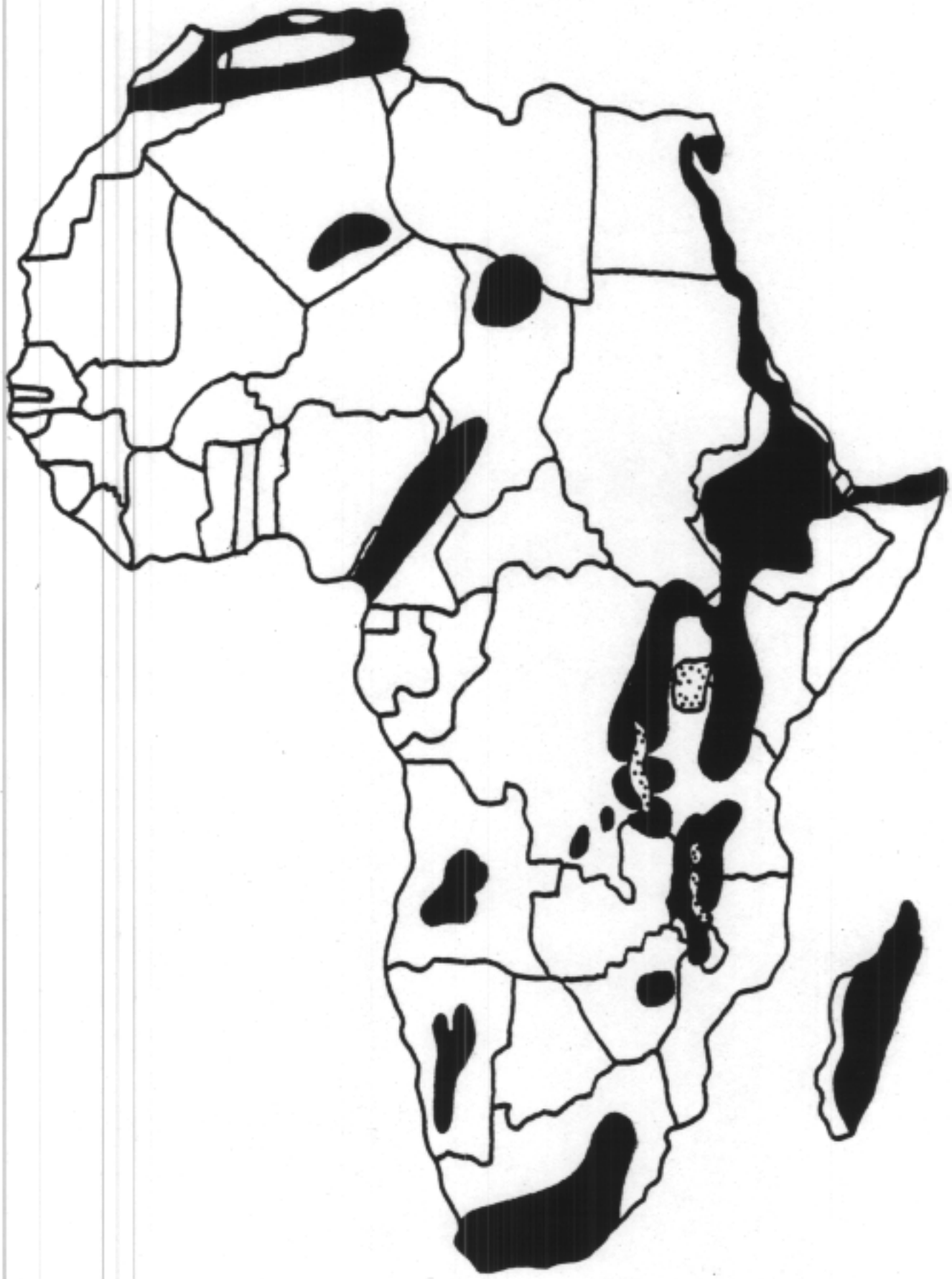
49.	Citlaltepetl	Mexico	18,701	19	04	N	97	14	W	Sierra Madre Or.
50.	Azufre	Chile	18,701	26	10	S	69	00	W	Andes
51.	El'brus	U.S.S.R.	18,481	43	20	N	42	25	E	Caucasus
52.	St. Elias	Canada	18,008	60	25	N	141	00	W	Rockies
53.	Popocatepetl	Mexico	17,887	19	01	N	98	38	W	Sierra Madre Oc.
54.	Altar	Ecuador	17,451		*			*		Andes
55.	Foraker	U.S.A. AK	17,395	62	40	N	152	40	W	Alaska
56.	Ixtacihuatl	Mexico	17,343		*			*		
57.	Sangay	Ecuador	17,159		*			*		Andes
58.	Dykh-Tau	U.S.S.R.	17,070		*			*		Caucasus
59.	Kenya	Kenya	17,058	00	10	S	37	20	E	
60.	Ararat	Turkey	16,946	39	50	N	44	20	E	
61.	Vinson Massif	Antarctica	16,864	77	40	S	87	00	W	
62.	Margherita	Zaire-Uganda	16,763	00	22	N	29	51	E	
63.	Kazbek	U.S.S.R.	16,558	42	45	N	44	30	E	Caucasus
64.	Shkhara	U.S.S.R.	16,549		*			*		
65.	Djaja	Indonesia	16,500		*			*		Peg. Maoke
66.	Bona	U.S.A., AK	16,421		*			*		
67.	Bolivar	Venezuela	16,411	08	44	N	70	54	W	
68.	Sanford	U.S.A., AK	16,237		*			*		
69.	Blanc	France	15,771	45	50	N	06	53	E	Alps
70.	Klyuchev-skaya	U.S.S.R.	15,584	56	13	N	160	00	E	Kamchatka
71.	Trikora Puntjak	Indonesia	15,518	04	15	S	138	45	E	Peg. Maoke
72.	Rosa, Monte	Italy	15,200	45	56	N	07	51	E	Alps
73.	Ras Dashen	Ethiopia	15,158	12	49	N	38	14	E	Ahmar
74.	Meru	Tanzania	14,978	03	15	S	36	43	E	
75.	Karisimbi	Zaire-Rwanda	14,787		*			*		
76.	Belukha	U.S.S.R.	14,783	49	47	N	86	23	E	Altai
77.	Weisshorn	Switzerland	14,780		*			*		Alps
78.	Matterhorn	Switzerland	14,685	47	57	N	07	36	E	Alps
79.	Whitney	U.S.A. CA	14,494	36	34	N	118	18	W	Sierra Nevada
80.	Elbert	U.S.A., CO	14,431	39	05	N	106	25	W	Rockies
81.	Rainier	U.S.A. WA	14,410	46	52	N	122	56	W	Cascades
82.	Blanca	U.S.A., CO	14,317	37	36	N	105	22	W	Rockies
83.	Markham	Antarctica	14,272	82	59	S	159	30	E	
84.	Elgon	Kenya	14,178	01	00	N	34	25	E	
85.	Shasta	U.S.A. CA	14,162	41	35	N	122	12	W	Sierra Nevada
86.	Pikes Peak	U.S.A., CO	14,110	38	49	N	105	03	W	Rockies
87.	Finster-aarhorn	Switzerland	14,022		*			*		Alps
88.	Wrangell	U.S.A., AK	14,005	61	58	N	143	50	W	Alaska
89.	Colima	Mexico	13,993	19	30	N	103	38	W	Sierra Madre Oc.
90.	Mauna Kea	U.S.A., HA	13,796	19	52	N	155	30	W	
91.	Mauna Loa	U.S.A., HA	13,680	19	28	N	155	38	W	
92.	Jungfrau	Switzerland	13,668	46	30	N	07	59	E	Alps
93.	Toubkal	Morocco	13,661	31	15	N	07	46	W	Atlas
94.	Kinabalu	Malaysia	13,455	05	45	N	115	26	E	Sabah
95.	Victoria	New Guinea	13,363	09	35	S	147	45	E	Owen Stanley
96.	Cameroun	Cent Afr Rep	13,353	04	12	N	09	11	E	
97.	Gran Paradiso	Italy	13,323		*			*		Alps
98.	Waddington	Canada	13,260	51	23	N	121	15	W	Rockies
99.	Hsinkao	Taiwan	13,113	23	38	N	121	05	E	

100. Albert Edward	New Guinea	13,100	08 25 S	147 25 E	Owen Stanley
101. Erciyas	Turkey	12,848	38 30 N	35 36 E	Pontic
102. Borah	U.S.A., ID	12,662	44 12 N	113 47 W	Rockies
103. Kerintji	Indonesia	12,467	01 45 S	101 18 E	Peg. Barisan
104. Fuji San	Japan	12,388	35 23 N	138 44 E	
105. Cook	New Zealand	12,349	43 27 S	170 13 E	Southern Alps
106. Erebus	Antarctica	12,280	*	*	
107. Rindjani	Indonesia	12,225	08 39 S	116 22 E	Lombok
108. Gunnbjorns	Greenland	12,139	*	*	
109. Semeru	Indonesia	12,060	08 06 S	112 55 E	Java
110. Thabana Ntlenyana	Lesotho	11,425	29 28 S	29 17 E	Drakensberg
111. Chiriqui	Panama	11,410	08 48 N	82 37 W	
112. Hood	U.S.A., OR	11,235	45 20 N	121 43 W	Cascades
113. Koussi	Chad	11,204	*	*	Tibesti
114. Injasuti	S. Africa	11,182	*	*	
115. Leuser	Indonesia	11,178	03 36 N	97 17 E	Sumatra
116. Etna	Italy	11,122	37 48 N	15 00 E	
117. Sources	Lesotho	10,822	28 47 S	29 04 E	Drakensberg
118. Lassen	U.S.A. CA	10,457	40 30 N	121 32 W	Sierra Nevada
119. Midi d'Ossau (Pic du)	France	10,322	42 51 N	00 25 W	Pyrenees
120. Sa'uda	Lebanon	10,131	*	*	
121. Neiges, Piton des	Reunion	10,069	21 06 S	55 36 E	
122. Sham	Oman	9,902	23 01 N	57 45 E	Al Akhdar
123. Apo	Philippines	9,692	06 56 N	125 05 E	Mindanao
124. Pulog	Philippines	9,612	16 38 N	120 53E	Cordil. Central
125. Musala	Bulgaria	9,592	42 05 N	23 24 E	Balkans
126. Olimbos	Cyprus	9,550	34 56 N	32 52 E	
127. Bandeira	Brazil	9,482	20 27 S	40 47 W	Braz. Highlands
128. Maromokotro	Madagascar	9,436	14 00 S	49 11 E	
129. Pico	Cape Verde	9,281	15 48 N	26 02 W	
130. Paricutin	Mexico	9,213	19 27 N	102 14 W	Sierra Madre Oc.
131. Ruapehu	New Zealand	9,175	39 15 S	175 37 E	Northern Island
132. Korab	Albania	9,026	41 45 N	20 00 E	
133. Balbi	Solomon Is.	9,000	07 00 S	148 00 E	
134. Loz	Saudi Arabia	8,461	*	*	Al Hijaz Asir
135. Negoi	Romania	8,344	45 33 N	24 38 E	Transylv. Alps
136. Kwanmo	Korea	8,337	*	*	
137. Piduru-talagala	Sri Lanka	8,281	12 27 N	80 45 E	
138. Glitter-tinden	Norway	8,104	61 39 N	08 12 E	
139. Orohena	Tahiti	7,352	17 30 S	149 30 W	
140. Kosciusko	Australia	7,316	36 26 S	148 20 E	Great Dividing
141. Hvannadal-shnukur	Iceland	6,952	64 09 N	16 46 W	
142. Mitchell	U.S.A. NC	6,684	35 47 N	82 15 W	Appalachians
143. Pelee	Martinique	4,800	14 49 N	61 10 W	
144. Hekla	Iceland	4,747	63 53 N	19 37 W	
145. Vesuvius	Italy	3,842	40 35 N	14 26 E	

NORTH AMERICA

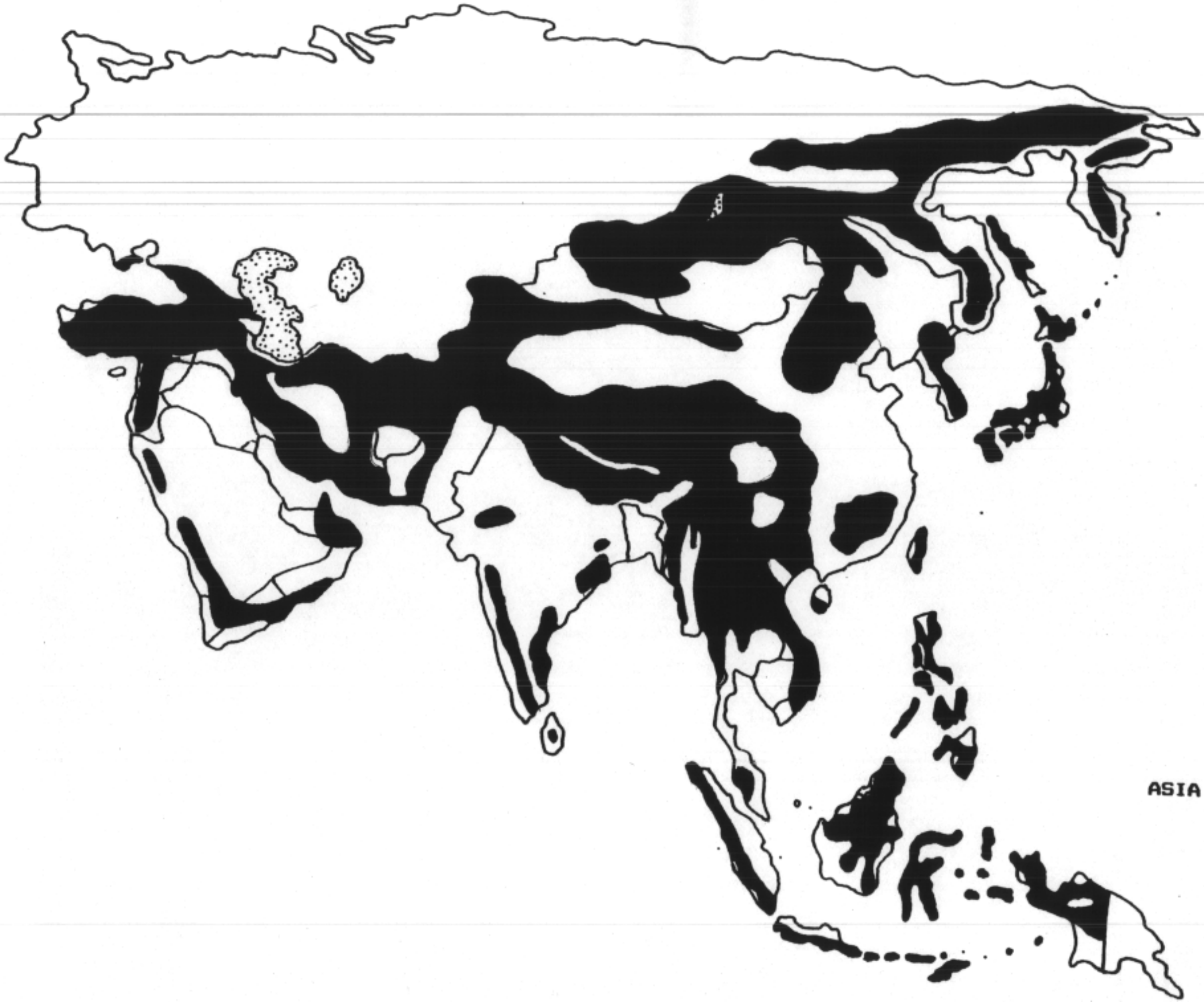


SOUTH AMERICA

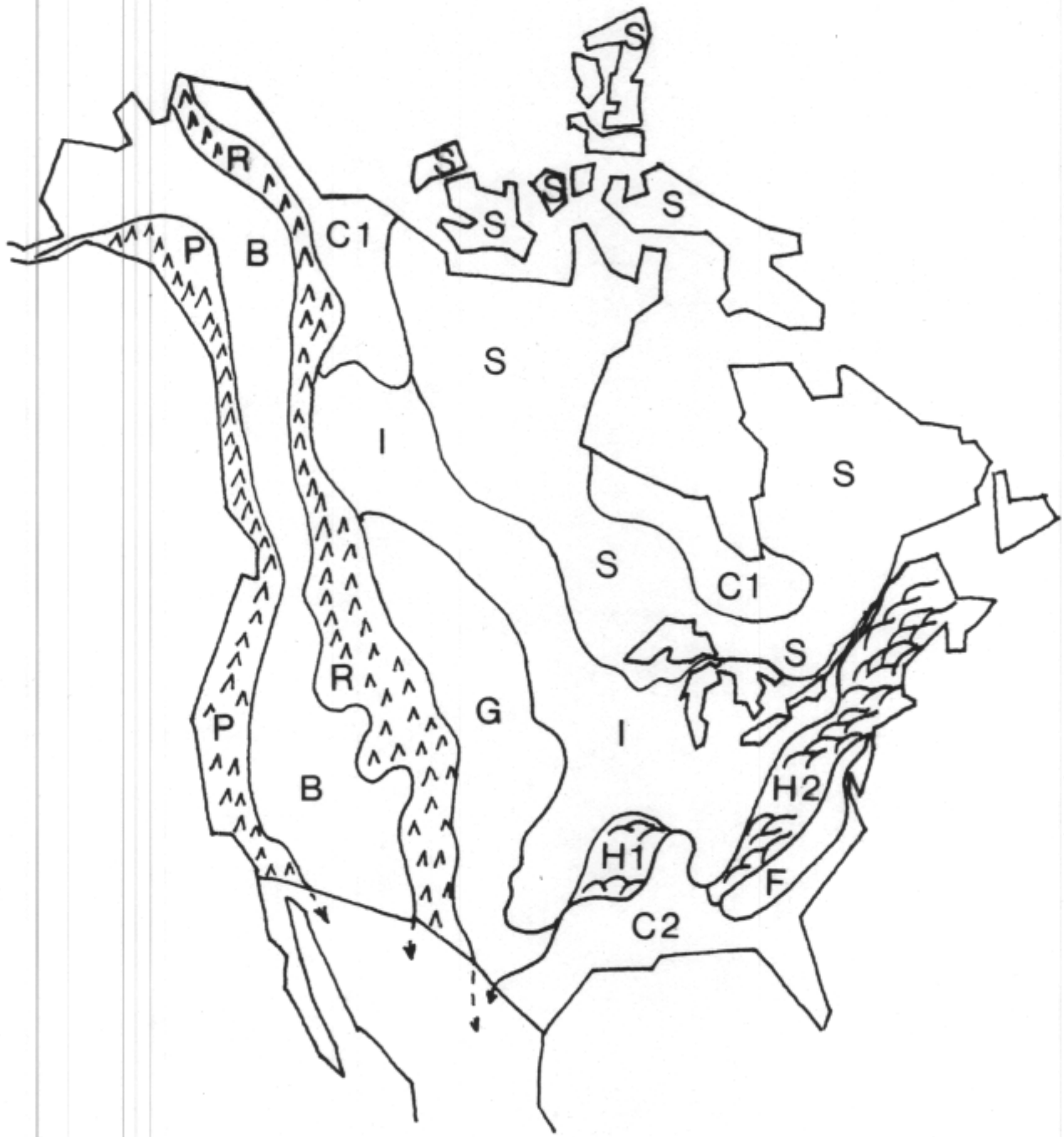


AFRICA

EUROPE


ASIA

OCEANIA



GENERALIZED PHYSIOGRAPHY--UNITED STATES AND CANADA

P: Pacific Mountains
B: Intermontane Basins
R: Rocky Mountains
G: Great Plains
I: Interior Plains
S: Canadian Shield

H1: Ozark-Ouachita Highlands
H2: Appalachian Highlands
F: Piedmont
C1: Arctic Coastal Plain
C2: Atlantic Coastal Plain

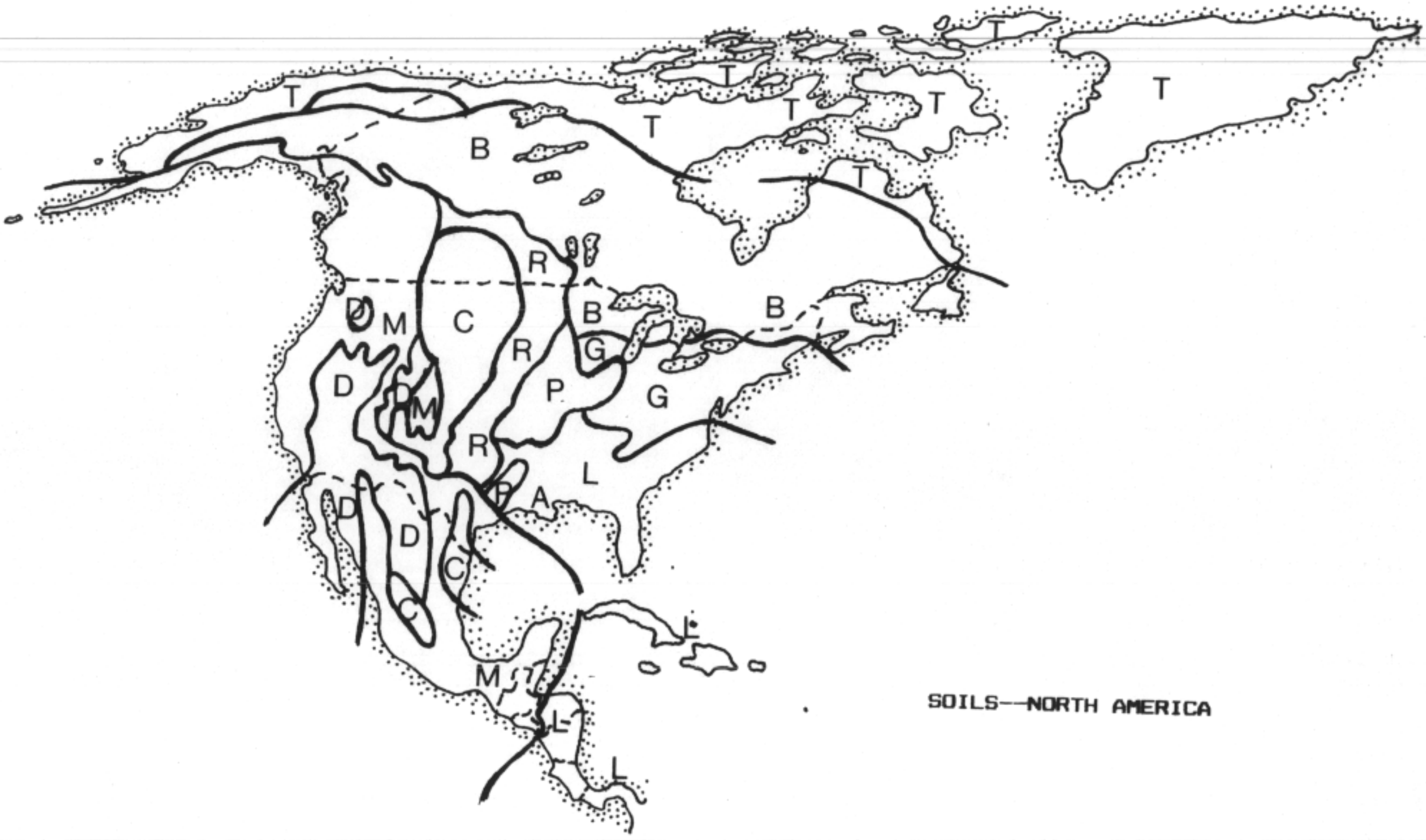
MAJOR SOIL ZONES

MAJOR SOIL ZONES

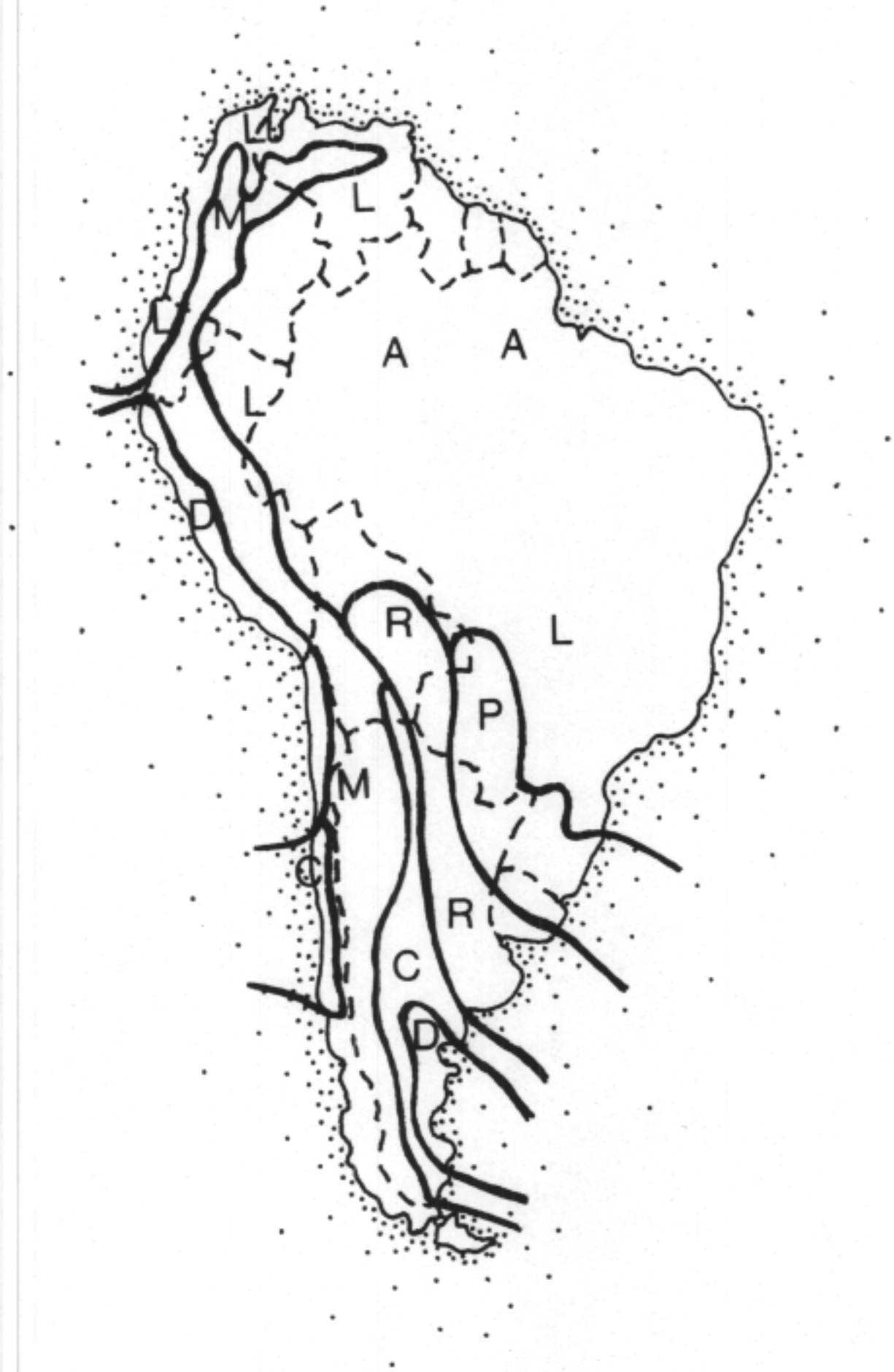
The maps that follow show the major soil zones of the world on Tobler's Hyper-elliptical projection. Each sheet shows one continent. The scale of these enlargements is all the same, so that areal comparisons are valid. Boundaries of countries are formed from a single strand of dashed line. Water (in the ocean as well as in inland lakes) is indicated by layered dotted lines. The legend for each of these maps is given below.

MAJOR SOIL ZONES

T: Tundra
P: Podzols (with much Bog)
G: Gray-brown Podzols
L: Laterites
C: Chestnut and Brown
D: Sierozem and Desert
P: Prairie and Degraded Chernozems
R: Chernozem and Reddish Chestnut
M: Mountain and Mountain Valley soils
A: Alluvial soil (appears in conjunction with river valleys within various of the zones designated above).

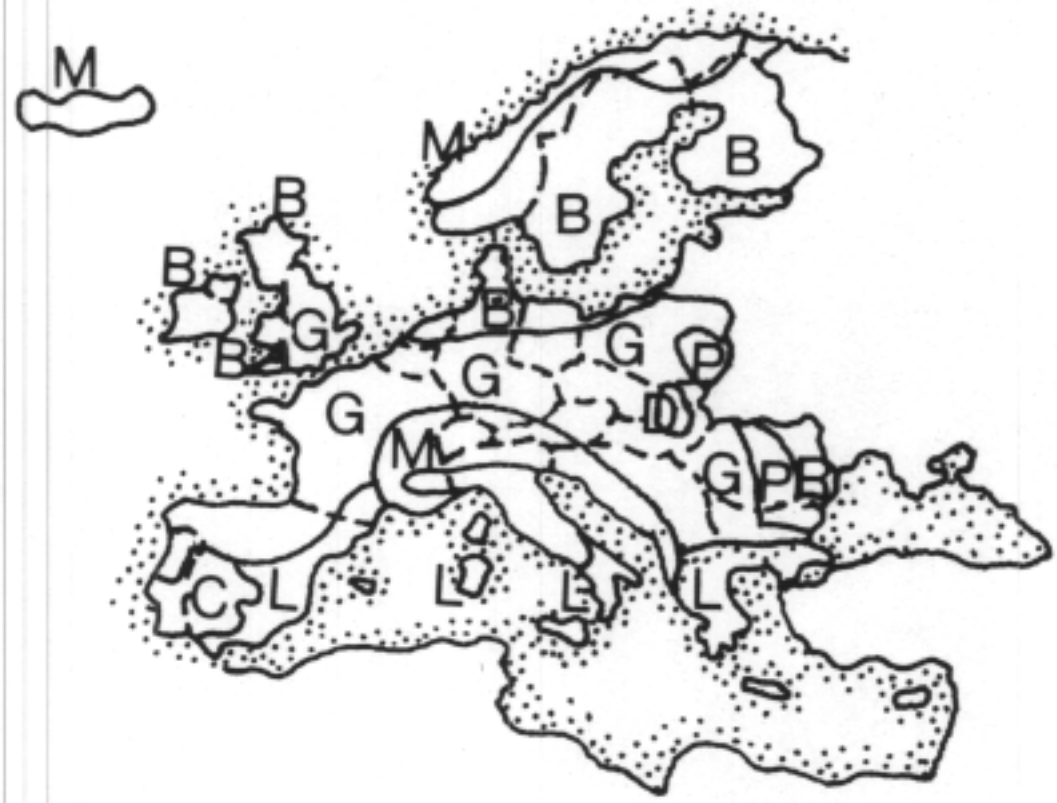


SOILS—NORTH AMERICA

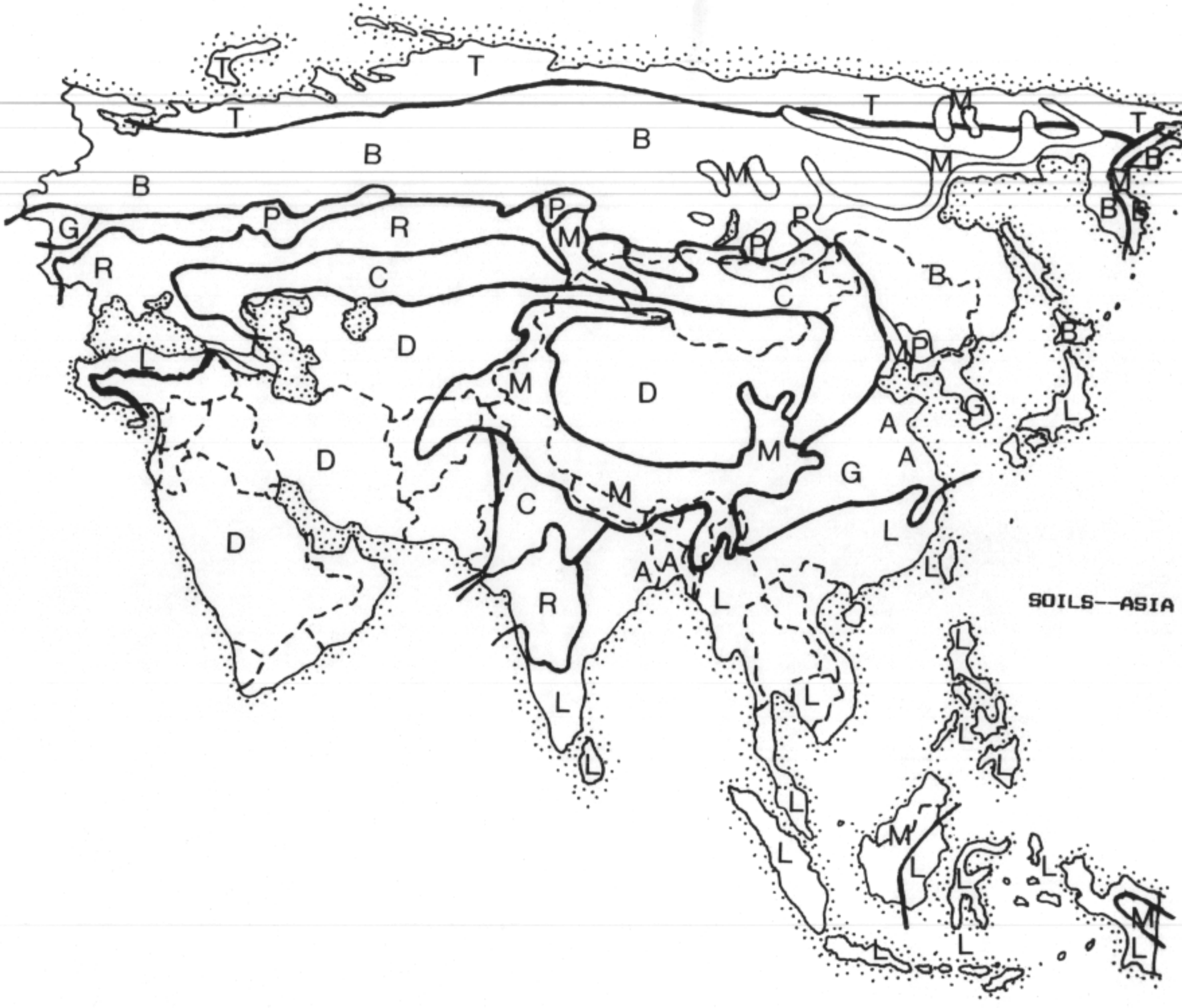


SOILS--SOUTH AMERICA

SOILS--AFRICA



SOILS--EUROPE


SOILS--ASIA

SOILS--OCEANIA

THE EARTH'S MAJOR POLITICAL UNITS--AS OF 1985.

This list is ordered from West to East by longitude within continents; when units have the same longitude, they are ordered from North to South by latitude. Values for latitude and longitude to represent the position of an entire country are for an interior point and are rounded to the nearest degree.

EUROPE

1.	Iceland	(65N, 20W)
2.	Ireland	(53N, 13W)
3.	Portugal	(35N, 08W)
4.	Northern Ireland	(55N, 07W)
5.	Scotland	(57N, 05W)
6.	Spain	(40N, 04W)
7.	Wales	(52N, 03W)
8.	England	(51N, 02W)
9.	France	(47N, 01E)
10.	Belgium	(51N, 03E)
11.	Netherlands	(53N, 04E)
12.	Switzerland	(47N, 08E)
13.	Denmark	(56N, 09E)
14.	West Germany	(52N, 09E)
15.	Norway	(64N, 11E)
16.	Italy	(44N, 11E)
17.	Austria	(47N, 12E)
18.	East Germany	(54N, 13E)
19.	Sweden	(60N, 14E)
20.	Czechoslovakia	(49N, 16E)
21.	Poland	(53N, 17E)
22.	Yugoslavia	(45N, 17E)
23.	Hungary	(47N, 18E)
24.	Albania	(42N, 20E)
25.	Greece	(30N, 22E)
26.	Romania	(46N, 23E)
27.	Bulgaria	(42N, 24E)
28.	Finland	(36N, 26E)

ASIA

1.	Cyprus	(35N, 31E)
2.	Turkey	(39N, 32E)
3.	Lebanon	(34N, 34E)
4.	Israel	(33N, 34E)
5.	Syria	(35N, 37E)
6.	Jordan	(30N, 38E)
7.	Iraq	(32N, 42E)
8.	Yemen (S'ana)	(16N, 45E)
9.	Saudi Arabia	(23N, 46E)
10.	Yemen (Aden)	(15N, 47E)
11.	Kuwait	(29N, 49E)
12.	Bahrain	(26N, 51E)
13.	Iran	(31N, 53E)
14.	Qatar	(25N, 53E)
15.	United Arab Emirates	(24N, 54E)
16.	Oman	(20N, 58E)
17.	Afghanistan	(33N, 63E)
18.	Soviet Union	(61N, 64E)
19.	Pakistan	(28N, 67E)
20.	Maldive Islands	(04N, 71E)
21.	India	(23N, 77E)
22.	Sri Lanka	(09N, 82E)
23.	Nepal	(29N, 83E)
24.	Bangladesh	(24N, 90E)
25.	Bhutan	(27N, 91E)
26.	China	(37N, 93E)
27.	Burma	(21N, 95E)
28.	Mongolia	(46N, 100E)
29.	Thailand	(16N, 101E)
30.	Malaysia	(04N, 101E)
31.	Laos	(20N, 102E)
32.	Kampuchea	(12N, 104E)
33.	Singapore	(01N, 104E)
34.	Vietnam	(18N, 107E)
35.	Macau	(22N, 113E)
36.	Brunei	(05N, 114E)
37.	Hong Kong	(22N, 115E)
38.	Indonesia	(05S, 119E)
39.	Philippines	(14N, 125E)
40.	Korea	(39N, 130E)
41.	Japan	(36N, 133E)

AFRICA

1.	Gambia	(14N, 20W)
2.	Guinea-Bissau	(12N, 20W)
3.	Senegal	(15N, 15W)
4.	Mauritania	(20N, 13W)
5.	Guinea	(11N, 12W)
6.	Sierra Leone	(09N, 12W)
7.	Liberia	(06N, 10W)
8.	Morocco	(32N, 07W)
9.	Ivory Coast	(08N, 06W)
10.	Ghana	(08N, 02W)
11.	Mali	(16N, 000)
12.	Togo	(08N, 01E)
13.	Benin	(08N, 02E)
14.	Upper Volta	(12N, 03E)
15.	Algeria	(35N, 04E)

AFRICA, CONTINUED

16. Nigeria (09N, 06E)
17. Equatorial Guinea (02N, 07E)
18. Niger (18N, 08E)
19. Tunisia (35N, 10E)
20. Cameroon (06N, 11E)
21. Gabon (00O, 11E)
22. Congo (03S, 14E)
23. Libya (28N, 15E)
24. Angola (14S, 16E)
25. Namibia (19S, 16E)
26. Chad (18N, 19E)
27. Central Afr. Rep. (08N, 21E)
28. Zaire (01S, 22E)
29. Botswana (22S, 23E)
30. Zambia (14S, 24E)
31. South Africa (28S, 25E)
32. Egypt (27N, 27E)
33. Sudan (14N, 28E)
34. Zimbabwe (18S, 29E)
35. Rwanda (02S, 30E)
36. Burundi (03S, 30E)
37. Uganda (02N, 32E)
38. Tanzania (07S, 34E)
39. Malawi (11S, 34E)
40. Mozambique (20S, 34E)
41. Kenya (01N, 37E)
42. Ethiopia (08N, 38E)
43. Djibouti (12N, 43E)
44. Comoro Is. (13S, 43E)
45. Madagascar (18S, 43E)
46. Somali Republic (03N, 45E)
47. Seychelles (05S, 55E)
48. Reunion (21S, 56E)
49. Mauritius (20S, 58E)

OCEANIA AND PACIFIC ISLANDS

1. Palau Island (07N, 134E)
2. Australia (25S, 135E)
3. Papua New Guinea (07S, 142E)
4. Caroline Islands (09N, 143E)
5. Mariana Islands (17N, 145E)
6. Solomon Islands (07S, 148E)
7. Marshall Islands (10N, 165E)
8. New Caledonia (21S, 165E)
9. Wake Island (19N, 167E)
10. Nauru Island (00O, 167E)
11. New Hebrides (16S, 169E)
12. New Zealand (39S, 170E)
13. Gilbert & Ellice (01S, 173E)
14. Fiji (19S, 175E)
15. Wallis & Futuna (13S, 176E)
16. Midway Island (28N, 179W)

OCEANIA, CONTINUED

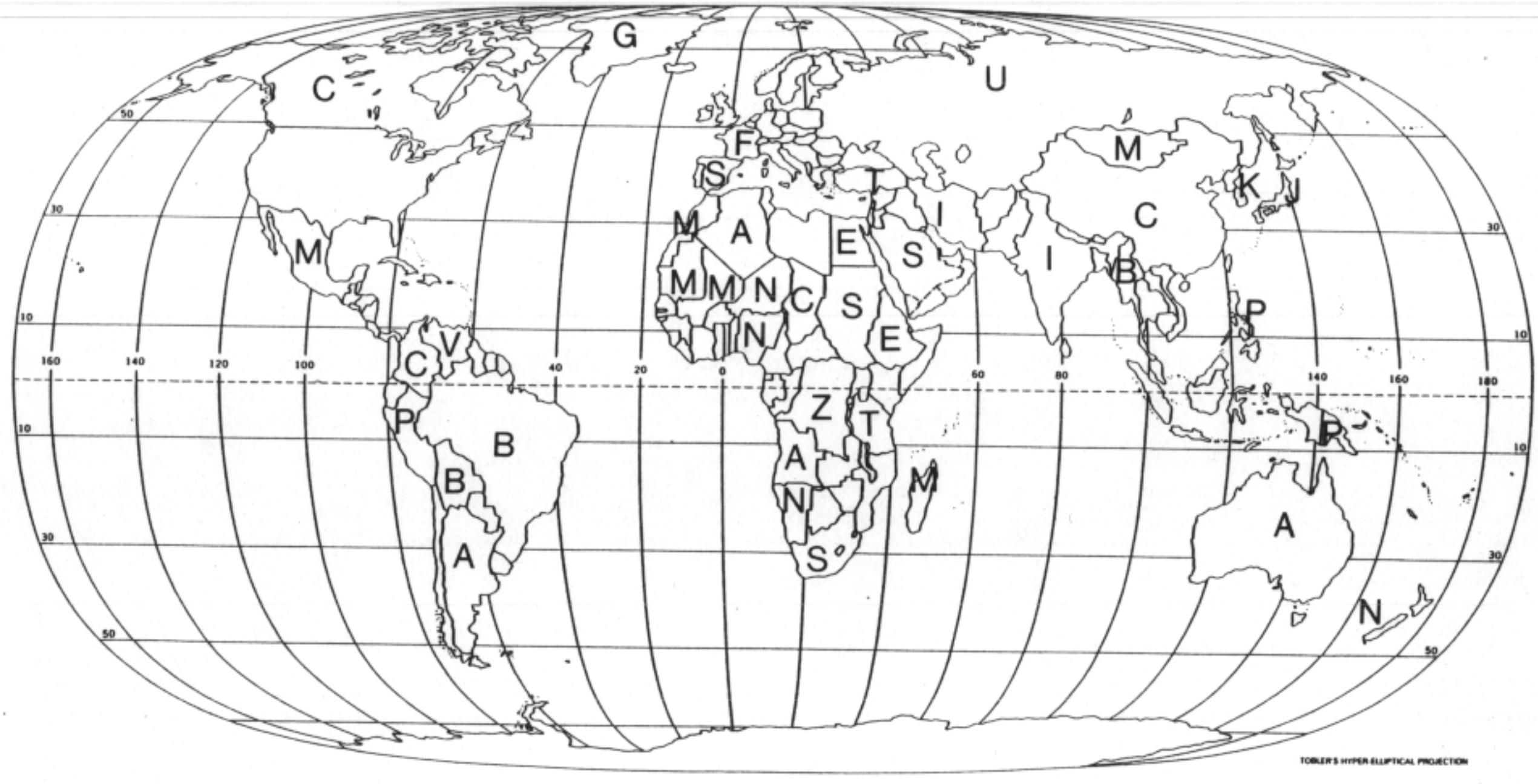
17. Tokelau Is. (08S, 176W)
18. Tonga (19S, 175W)
19. Niue (20S, 167W)
20. Line Islands (00O, 160W)
21. Cook Islands (19S, 158W)
22. French Polynesia (20S, 150W)
23. Pitcairn Islands (24S, 130W)

NORTH AMERICA

1. Hawaiian Islands (22N, 158W)
2. United States (38N, 110W)
3. Canada (50N, 100W)
4. Mexico (24N, 104W)
5. Guatemala (15N, 90W)
6. Belize (17N, 89W)
7. El Salvador (14N, 89W)
8. Honduras (14N, 88W)
9. Nicaragua (13N, 86W)
10. Costa Rica (10N, 84W)
11. Panama (09N, 81W)
12. Canal Zone (09N, 80W)
13. Cuba (22N, 79W)
14. Jamaica (18N, 78W)
15. Bahamas (26N, 76W)
16. Haiti (19N, 72W)
17. Dominican Republic (19N, 71W)
18. Neth'land Antilles (12N, 70W)
19. Puerto Rico (18N, 67W)
20. Bermuda Islands (32N, 66W)
21. Leeward Islands (17N, 63W)
22. Windward Islands (13N, 62W)
23. Barbados (13N, 59W)
24. Greenland (74N, 40W)

SOUTH AMERICA

1. Easter Island (27S, 109W)
2. Galapagos Islands (00O, 88W)
3. Ecuador (00O, 78W)
4. Peru (10S, 75W)
5. Colombia (03N, 72W)
6. Chile (35S, 72W)
7. Argentina (35S, 67W)
8. Venezuela (08N, 65W)
9. Bolivia (17S, 64W)
10. Falkland Islands (51S, 61W)
11. Guyana (08N, 59W)
12. Paraguay (24S, 57W)
13. Surinam (04N, 56W)
14. Uruguay (33S, 56W)
15. French Guiana (04N, 53W)
16. Brazil (09S, 53W)


TOBLER'S HYPER ELLIPTICAL PROJECTION