

ISM - WAGENINGEN
country: North America
subject: Metallogenic map
scale: 1:5,000,000
map ref.: A 11000 2.1
libr. ref.:

MINERAL DEPOSITS

NUCLEUS

METAL (MINERAL) CONTENT

The color and shape of the nucleus indicate the metal(s) or mineral content.

Code	Color	Symbol	Code A	Code B	Code C	Code D	Code E
1	Red	W	Sn	Be	NbTa	Li	
2	Orange	Fe	Ti	FeTi(V)	FeMn(Cu)	P	
3	Yellow	Cu	Mo	CuMo	CuZn(Ag)	CuAu	
4	Light Green	Au	AuCu	AuAg	AgPbZn(AuCu)	AgCo	
5	Green	Ce	Ni(Co)	Co/Pt	CuNi(Co)	Asbestos	
6	Dark Green	Ca	Na	K	Mg	B	
7	Blue	Pb	Zn	PbZn	PbZnAg(AuCu)		
8	Purple	Hg	Sb	F	Ba	Sr	
9	Brown	U	V	UV	Th	UTh	
10	Black	Mn	Al	Kyanite group	Pyrophyllite	Talc	
11	White	S	FeS	Rare earths	Diamond	Graphite	

MINERALOGIC NATURE OF THE DEPOSITS

Vertical — native metals or oxides
Vertical underline — sulfides, sulfates, arsenides, tellurides
Vertical, dotted underline — chlorides
Italics — sulfates and nitrates
Italics underline — carbonates and phosphates
Italics, dotted underline — halides
Coding for a few specific minerals:
w = wolframite; s = scheelite; l = lineite; r = rutile
c = columbite-tantalite; py = pyrochlore; b = borates; f = fluorite

REPRESENTATION OF DISTRICTS

Hatching in color of metal(s) or mineral contained; outline in color of geologic date of the deposit.

a. District of scattered deposits with symbol to represent cumulative importance and convey other information
b. District of scattered deposits without standard symbol
c. Outcrop of extensive stratabound deposit
d. For a few large evaporite basins, the positions of mines are shown by an X within the nucleus of the symbol
* = In penultimate position

EXPLANATION OF CODING

The numbers and letters assigned to colors, shapes, sizes, and positions of ticks are combined in a standard order to form an alphanumeric code that describes the deposit, thus:

NUCLEUS	RING
color shape ticks size	color shape* ticks
2 D 1-6 A	3 A 7

Example: Cornwall, Pa.
Tri-State District: 7C37A1094+
Benham, Ohio: 3C44A5A7

Other examples, closed up as they appear in the Listing:
Tri-State District: 7C37A1094+
Benham, Ohio: 3C44A5A7

Full codes are given in the Listing, if known, although the symbols may omit some or all the parameters except the nucleus or perimeter and hatching.

PRINCIPAL CONTRIBUTORS AND SOURCES OF INFORMATION

General
North American Geology Map Committee, 1965, Geologic map of North America. Washington, D.C., U.S. Geological Survey, 2 sheets, scale 1:5,000,000.
King, P. B., compiler, 1969, Tectonic map of North America. Washington, D.C., U.S. Geological Survey, 2 sheets, scale 1:5,000,000.
Case, J. E., and Holcombe, T. L., compilers, 1975, Preliminary geologic-tectonic map of the Caribbean region: U.S. Geological Survey Open-File Map 75-146, scale 1:2,500,000.

Canada
Geologic/tectonic background:
Douglas, R. J. W., editor, 1970, Geology and economic minerals of Canada (5th ed.). Canada Geological Survey Economic Geology Report 1-2, 4 (v. 1, text; v. 2, maps and charts). Includes Geologic map of Canada (Map 1250A) and Tectonic map of Canada (Map 1251A), scale 1:5,000,000.
Monger, J. W. H., and Hutchinson, W. W., compilers, 1971, Metamorphic map of the Canadian Cordillera. Canada Geological Survey Map 1322-A, scale 1:5,000,000 (complements Canada Geological Survey Paper 70-33).
Fraser, J. A., Heywood, W. W., and Mazurk, M. A., compilers, 1978, Metamorphic map of the Canadian Shield: Canada Geological Survey Map 1475A, scale 1:3,500,000 (complements Canada Geological Survey Paper 78-10).
Canada Geological Survey (1978), Tectonic assemblage map of the Canadian Cordillera. Open-File Report 572, 2 sheets, scale 1:2,000,000.
Reports and larger scale maps of the Geological Survey of Canada and Provincial government agencies, scientific journals.

Mineral deposit data:
Published reports and maps of Canadian federal and provincial government agencies; publications of professional organizations; the mining press; unpublished data.
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Central America
Dengo, Gabriel, Levy, Enrique, Bohnenberger, Otto, and Caballero, Roberto, 1969, Mapa metalogenico de America Central—Metallogenic map of Central America. Guatemala, Instituto Centroamericano de Investigaciones y Tecnologia Industrial (ICATI), 2 sheets, scale 1:2,000,000.
Gabriel Dengo, Enrique Levy.

Cuba
Jubley, C. M., and others, 1963, Mapa de yacimientos minerales de Cuba (Havana) Instituto Cubano de Recursos Minerales, 4 sheets, scale 1:500,000.

Dominican Republic
Blesch, R. R., 1967, Mapa Geologica preliminar *** Republica Dominicana. Washington, D.C., Organization of American States, scale 1:250,000.

French Possessions in North America
Pierre Lafitte.

Greenland
Greenland Geological Survey, 1970, Tectonic/geological map of Greenland. Copenhagen, scale 1:2,500,000.
Nielsen, B. J., 1976, Economic minerals in Escher, Arthur, and Watt, Stuart, editors, Geology of Greenland: Greenland Geological Survey, p. 461-486.
K. Ellinggaard-Rasmussen, B. L. Nielsen, Arthur Escher.

Jamaica
Hughes, I. G., compiler, 1973, The mineral resources of Jamaica: Jamaica Geological Survey Department, Bulletin 8, 89 p.

Mexico
Lopez-Ramos, Ernesto, compiler, 1970, Carta geologica de la Republica Mexicana (4th ed.). Comite de la Carta Geologica de Mexico, scale 1:2,000,000.
Salas, G. P., 1975, Carta y provincias metalogenicas de la Republica Mexicana. Mexico Consejo de Recursos Minerales Publication 21 E, 242 p., maps (in pocket).
1976, Mapa metalogenico de la Republica Mexicana—Metallogenic chart of Mexico, 1975. Geological Society of America Map and Chart Series MC-13, scale 1:2,000,000.
G. P. Salas, Hugo Cortes G., Ariel Echavarran P.

Puerto Rico
Cox, D. P., and Briggs, R. P., 1973, Metallogenic map of Puerto Rico. U.S. Geological Survey Miscellaneous Geologic Investigations Map I-721, scale 1:240,000.

United States
King, P. B., and Belkman, H. M., compilers, 1974, Geologic map of the United States (exclusive of Alaska and Hawaii). Reston, Va., U.S. Geological Survey, 3 sheets, scale 1:2,500,000.
Belkman, H. M., compiler, 1978, Preliminary geologic map of Alaska. Reston, Va., U.S. Geological Survey, 2 sheets, scale 1:2,500,000.
Morgan, B. A., 1972, Metamorphic map of the Appalachians: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-724, scale 1:2,500,000.
Mineral Investigations Resource Maps (MR Series): U.S. Geological Survey, scale 1:3,168,000.
Mineral and Water Resources Reports prepared by the U.S. Geological Survey in collaboration with the Geological Surveys and Bureaus of Mines of the various states. Washington, D.C., U.S. Government Printing Office.
Resource reports and maps prepared by other organizations and individuals.
Numerous published and unpublished documents, data in the files of the U.S. Geological Survey, technical reports in journals, and personal communications.

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GEOLOGIC ENVIRONMENT

The geologic environment is shown by ticks on the nucleus. N-S and E-W positions indicate the depositional environment of the host rock; the 45° positions indicate the nature of intrusive rock believed to be related to the mineralization.

DEPOSITIONAL ENVIRONMENT

CODE	DEPOSITIONAL ENVIRONMENT
1	○ Predominantly sedimentary rocks of miogeosynclinal type
5	○ Predominantly volcanic and related sedimentary rocks of eugeosynclinal type
1-5	○ Thick metamorphosed sequence, original character not specified
3-7	○ Platform cover rocks, including coastal plains
3	○ Cover rocks in successor basins and/or essentially unconsolidated materials unconformable on platform sediments
7	○ Essentially undeformed continental volcanic rocks
1-7	○ Sequence of intermediate and felsic volcanic rocks with terrestrial and marine sedimentary rocks
3-5	○ Volcano-sedimentary sequence of old Precambrian age—tectonic environment uncertain

INTRUSIVE IGNEOUS ENVIRONMENT—In or associated with:

2	○ Alkaline rocks
4	○ Felsic rocks—granite to quartz diorite
6	○ Gabbroic rocks, including diabase
8	○ Ultramafic rocks
4-6	○ Diorite
6-8	○ Anorthosite
2-8	○ Alkali-mafic rocks

SIZE OF DEPOSIT

Deposit size, in terms of metric tons of metal or mineral contained unless otherwise specified in the table, is indicated by the size of the nucleus.

Nucleus Size Code	Large A	Medium B	Small C
Aluminum (bauxite)	100,000,000	50,000	1,000,000
Antimony	50,000	50,000	5,000
Asbestos	10,000,000	100,000	
Bartite (BaSO ₄)	5,000,000	50,000	
Beryllium (BeO)	1,000	10	
Boron (B ₂ O ₃)	10,000,000	100,000	
Chromium (Cr ₂ O ₃)	1,000,000	10,000	
Cobalt	20,000	1,000	
Copper	1,000,000	50,000	
Diamond	10	1	
Fluorite (CaF ₂)	5,000,000	50,000	
Gold	500	25	
Ginghite	1,000,000	10,000	
Gypsum-anhydrite	100,000,000	5,000,000	
Iron (ore)	100,000,000	5,000,000	
Kyanite group (Al ₂ SiO ₅)	1,000,000	50,000	
Lead	1,000,000	50,000	
Lithium (Li ₂ O)	100,000	10,000	
Magnesium (MgCO ₃)	10,000,000	100,000	
Manganese (tons of 40% Mn)	10,000,000	100,000	
Mercury (flask)	500,000	10,000	
Molybdenum	500,000	5,000	
Nickel	500,000	25,000	
Niobium-Tantalum (Nb ₂ O ₅)	100,000	1,000	
Phosphate (P ₂ O ₅)	200,000,000	200,000	
Platinum group	500	25	
Potassium (K ₂ O)	10,000,000	100,000	
Pyrite (FeS ₂)	20,000,000	200,000	
Pyrophyllite	10,000,000	1,000,000	
Rare earths (RE ₂ O ₃)	1,000,000	1,000	
Silver	10,000	500	
Sodium (salt)	10,000,000	1,000,000	
Strontium (salt)	1,000,000	10,000	
Sulfur	10,000,000	100,000	
Talc	10,000,000	1,000,000	
Thorium	10,000	1,000	
Tin	100,000	5,000	
Titanium (TiO ₂)	10,000,000	1,000,000	
Tungsten	10,000	500	
Uranium	10,000	100	
Vanadium	10,000	500	
Zinc	1,000,000	50,000	

RING

The geologic class of the deposit is shown by the color of a ring around the nucleus, or, for districts, by a colored line, solid or dashed. Rings are omitted in crowded areas, or to suggest less important deposits.

CLASS

1	○ Pegmatite deposits
2	○ Chemical sediments other than evaporites
3	○ Skarn or greisen deposits
4	○ Placer deposits
5	○ Stockworks, pipes, and deposits of irregular or indefinite shape, other than skarn or greisen
6	○ Evaporite deposits
7	○ Veins and shear zones
8	○ More or less concordant deposits in intrusive igneous rocks
9	○ Laterite deposits
10	○ More or less strata-bound*, mainly disseminated deposits other than known placers
11	○ More or less strata-bound* massive deposits

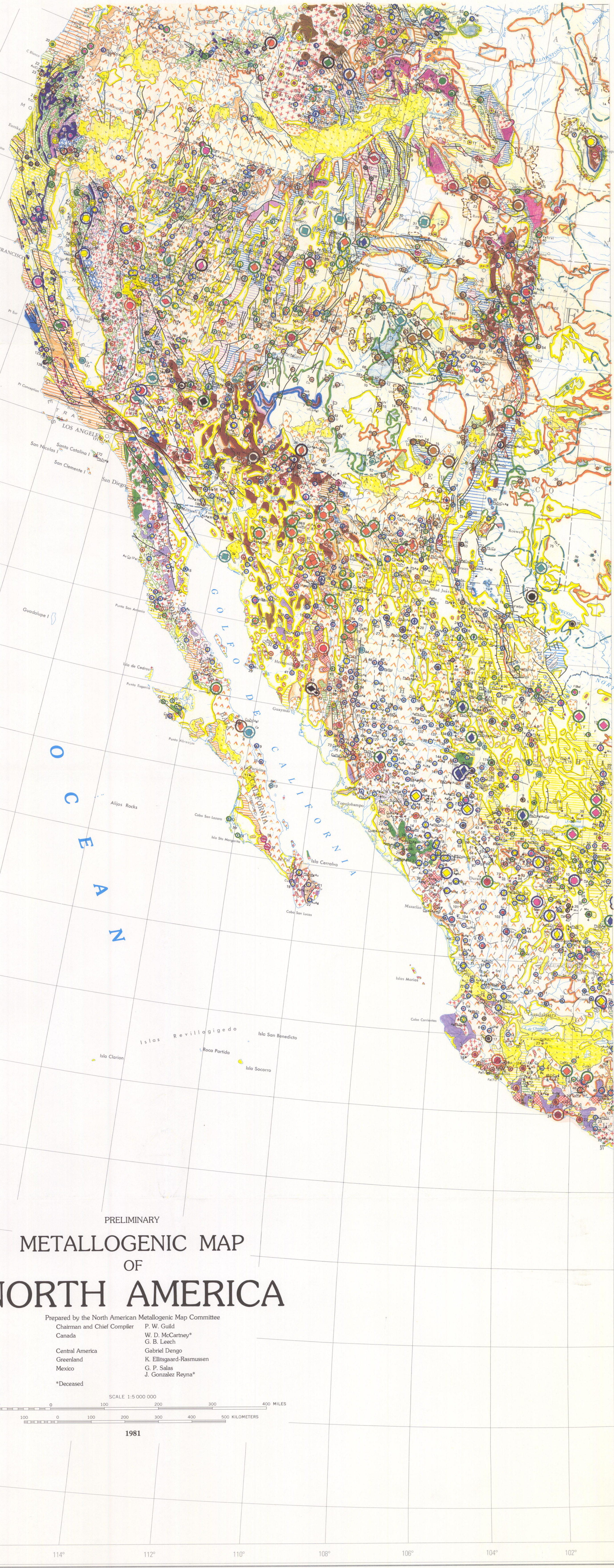
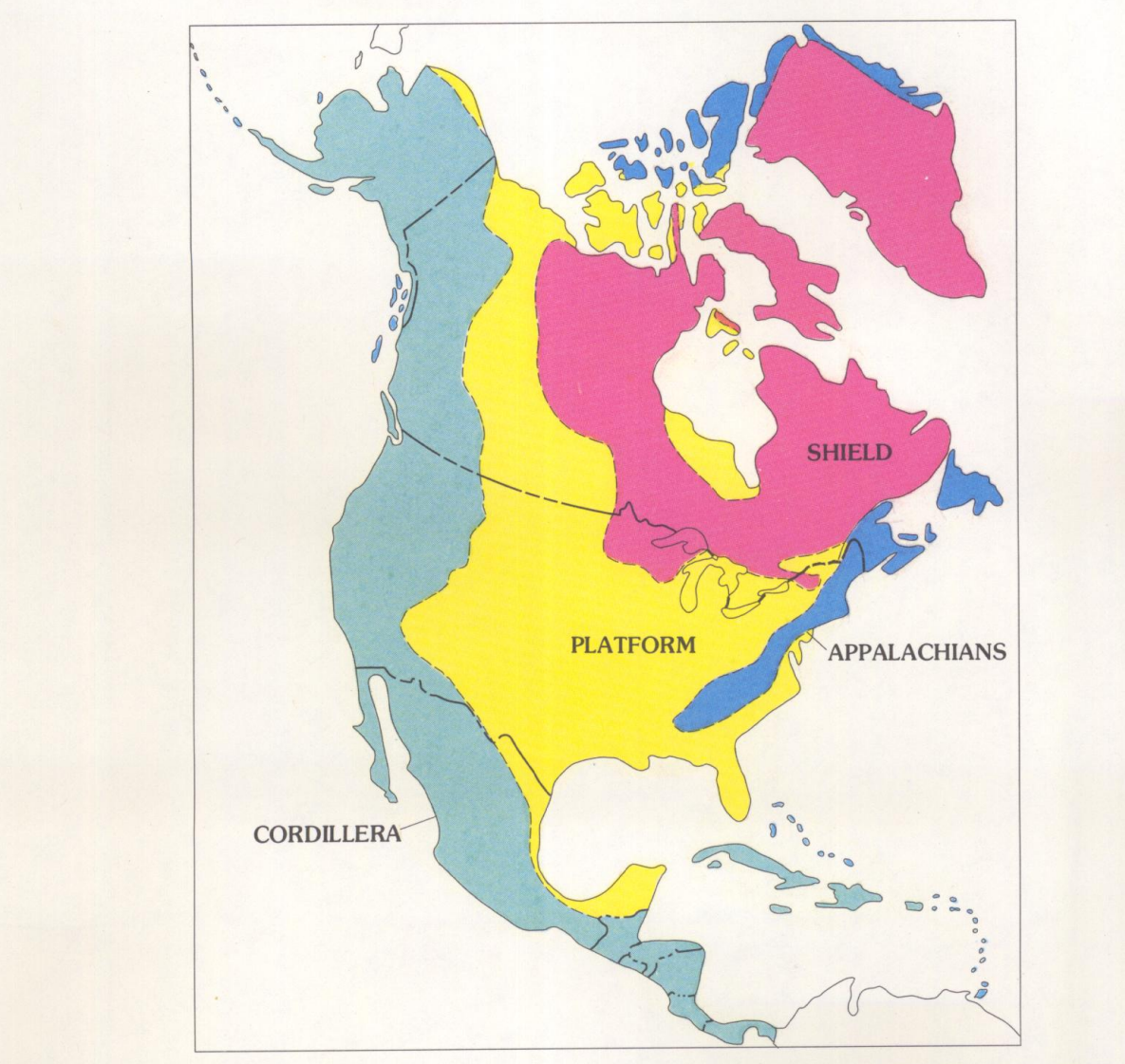
*Within (bound to) certain stratigraphic units but not necessarily stratiform

GEOLOGIC AGE OF THE MINERALIZATION

By ticks on the ring: code numbers shown by "clock," which has different meaning in various regions (see the inset map). Upper and lower age limits, and range that:

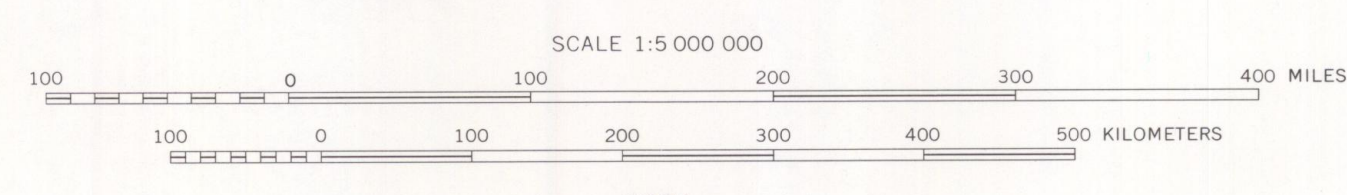
○ or younger:	code 3+
○ or older:	code 7-
□ from — to —:	code 4-6

SHIELD	APPALACHIANS
1. Archaean	1. Precambrian 1 (to > 1000 Ma)
2. Proterozoic 1 (Archean)	2. Precambrian 2
3. Proterozoic 2 (Paleoarchean)	3. Cambrian-Ordovician
4. Proterozoic 3 (Neoproterozoic)	4. Sturrian-Middle Devonian
5. Proterozoic 4 (Proterozoic)	5. Late Devonian-Mississippian
6. Paleozoic	6. Pennsylvanian-Permian
7. Mesozoic	7. Mesozoic
8. Post-Mesozoic	8. Post-Mesozoic



PRELIMINARY METALLOGENIC MAP OF NORTH AMERICA

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