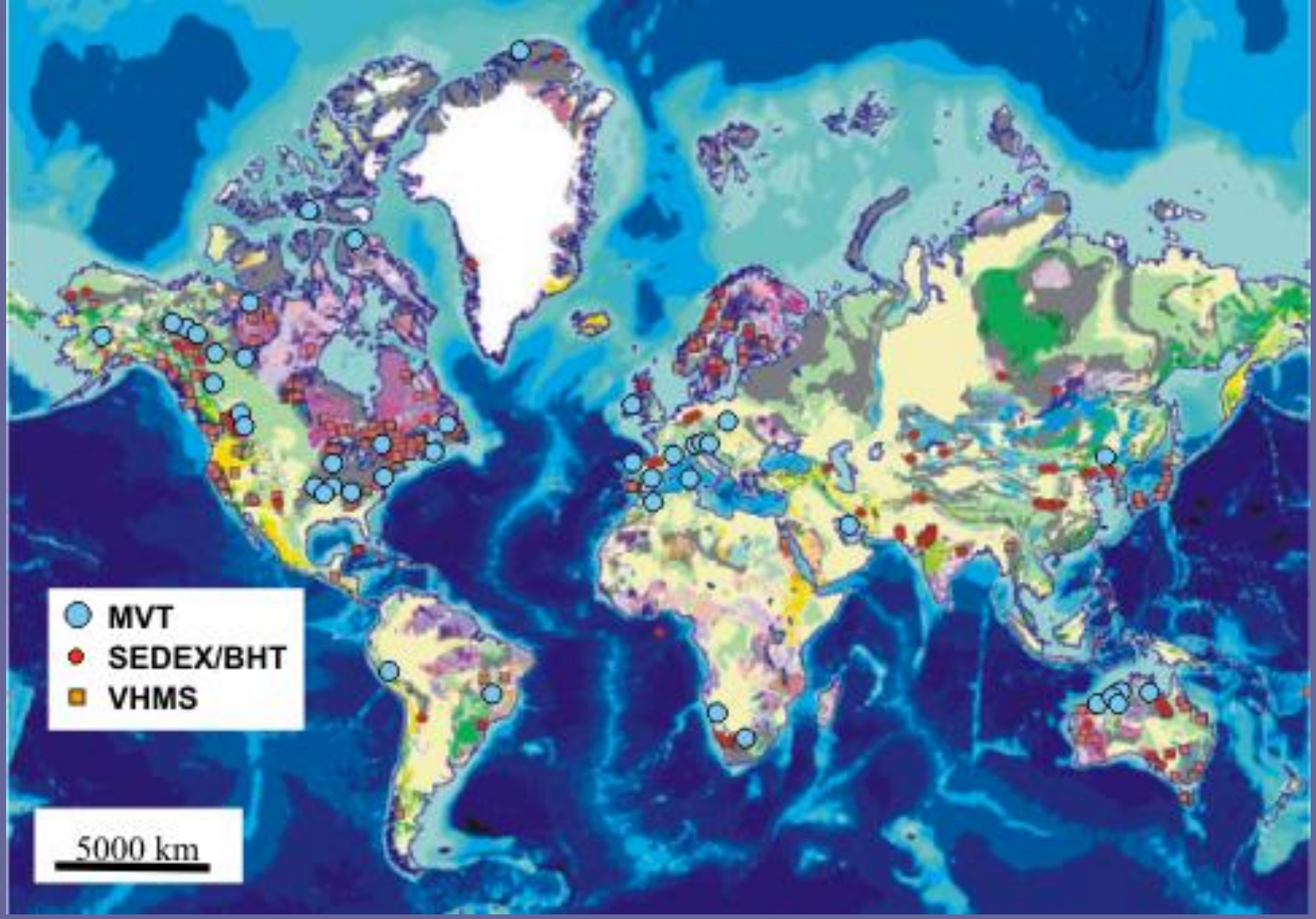
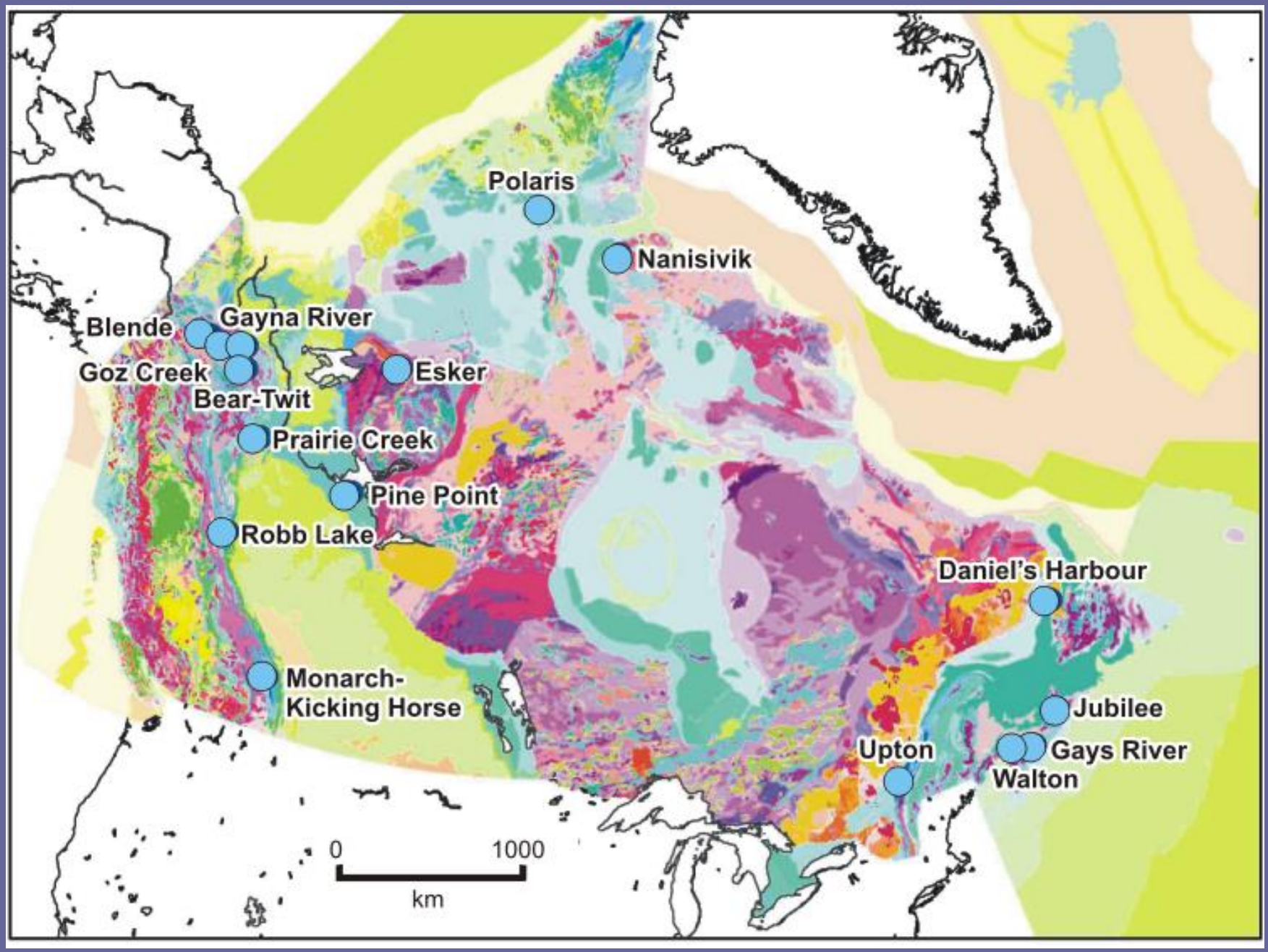
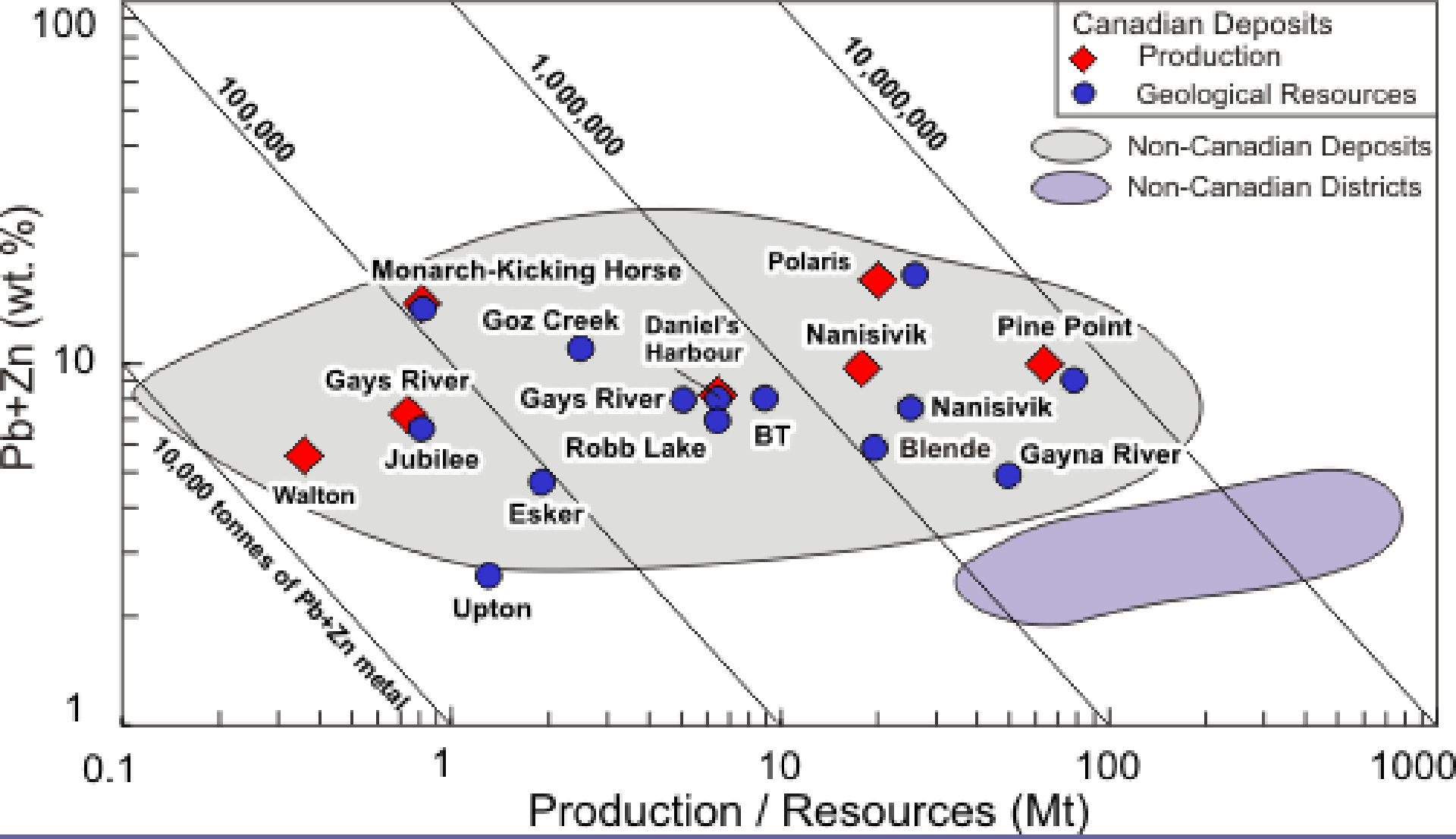
Mississippi Valley-type deposits (MVT)

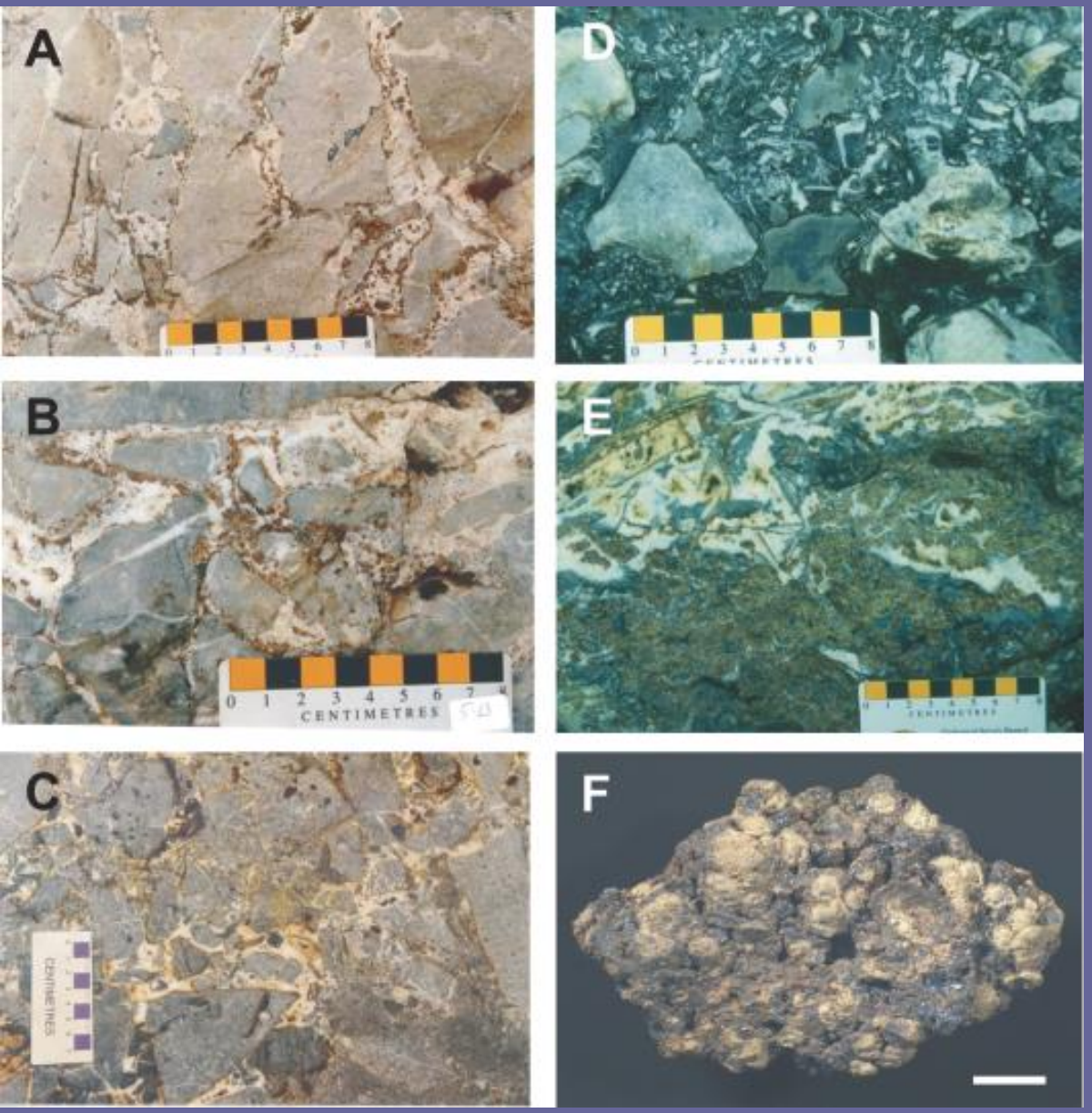
(includes the broad category of carbonate-hosted Pb-Zn deposits)



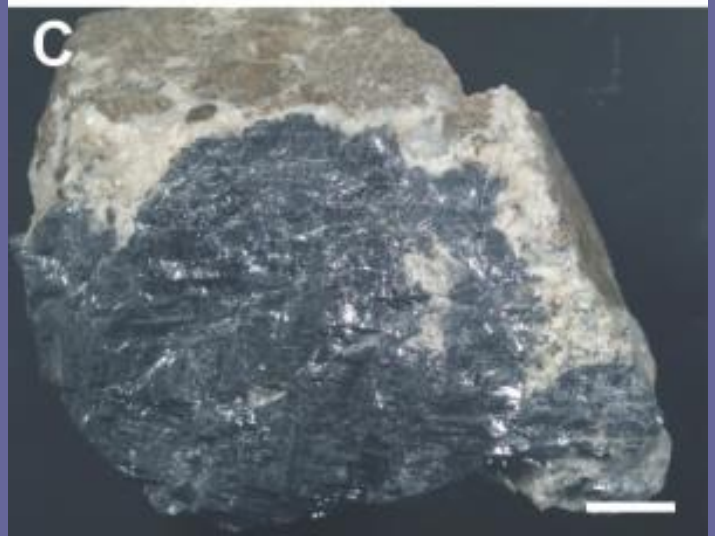
Distribution of Mississippi Valley-type deposits and districts worldwide. MVT = Mississippi Valley-type, SEDEX = sedimentary exhalative, BHT = Broken Hill-type, and VHMS = volcanic-hosted massive sulphides.


Polaris
Nanisivik
Blende
Gayna River
Goz Creek
Bear-Twit
Esker
Prairie Creek
Pine Point
Robb Lake
Daniel's Harbour
Monarch-
Kicking Horse
Jubilee
Upton
Gays River
Walton
0
1000
km

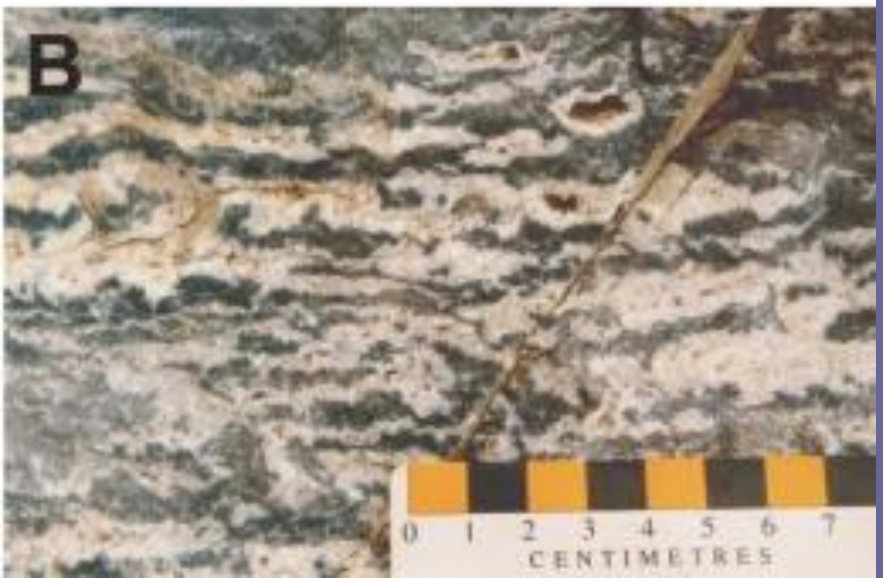

Canadian Deposits
Production
Geological Resources
Non-Canadian Deposits
Non-Canadian Districts
100,000
1,000,000
10,000,000
10,000 tonnes of Pb+Zn metal
Monarch-Kicking Horse
Polaris
Goz Creek
Daniel's Harbour
Nanisivik
Pine Point
Gays River
Gays River
Nanisivik
Jubilee
Robb Lake
BT
Blende
Gayna River
Walton
Esker
Upton
Pb+Zn (wt.%)
Production / Resources (Mt)
100
10
1
0.1
1
10
100
1000



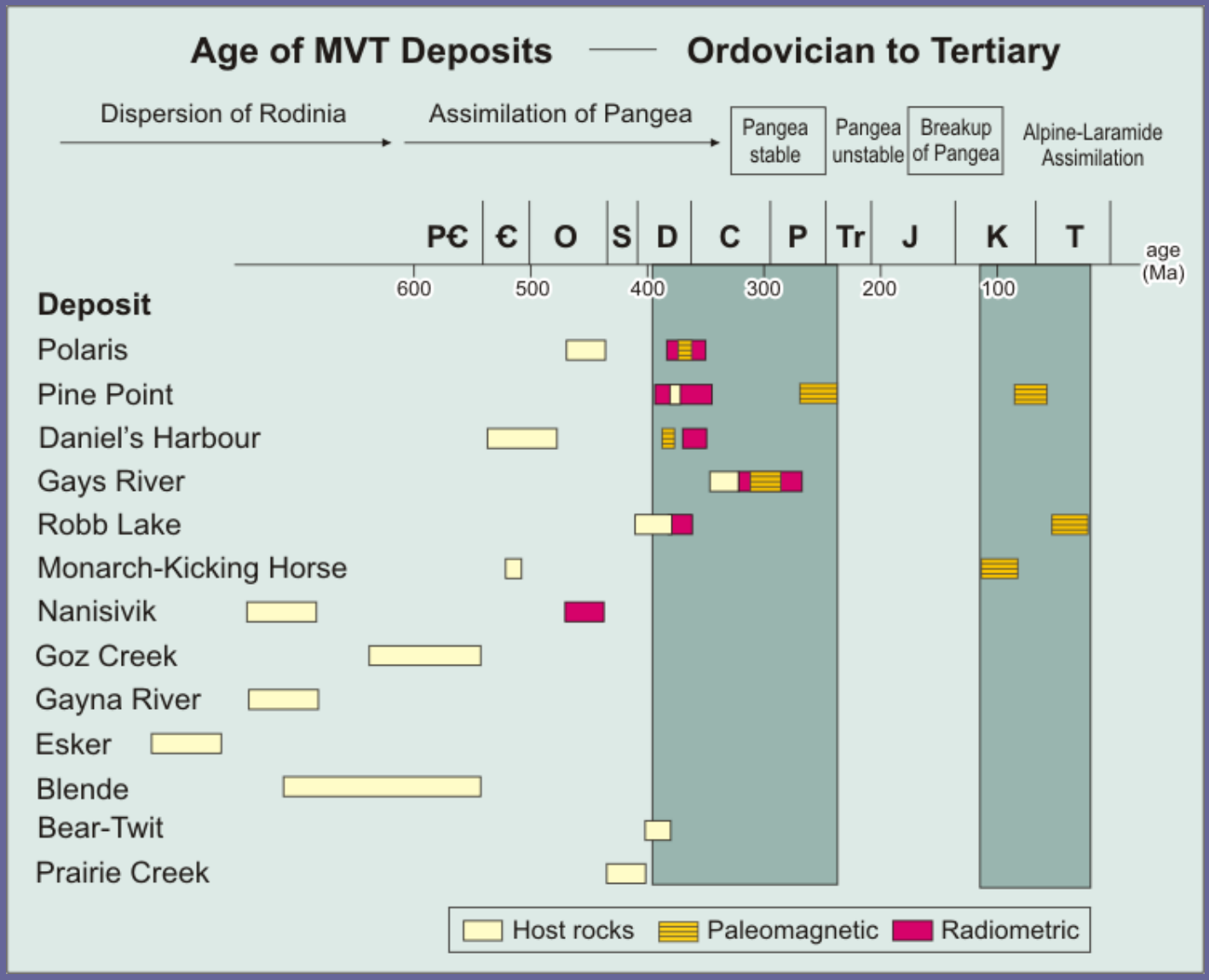
A. Crackle breccia with disseminated sphalerite crystals in white dolomite cement, Robb Lake, BC. B. Mosaic breccia with sphalerite crystals in white dolomite cement, Robb Lake, BC. C. Rubble breccia consisting of variably altered dolostone fragments and shale fragments in white dolomite cement. Note the dolostone fragments with zebra texture, Robb Lake, BC. D. Rock-matrix breccia with dolostone, shale, and white sparry dolomite fragments in dark grey fragmental matrix, Robb Lake, BC. E. Aggregates of sphalerite crystals and white sparry dolomite along small fractures, Pine Point, NWT. F. Aggregates of colloform sphalerite and skeletal galena completely replacing the carbonate, Polaris, Nunavut; scale bar is 1 cm.



Various ore textures from Polaris, Nunavut; scale bar is 1 cm. A. Sphalerite and skeletal galena are replacing the carbonate clasts. B. Crystalline sphalerite in solution collapse breccia. C. Massive galena and sparry dolomite in pseudobrecciated carbonate host rock.



A. Hydrothermal dolomite in bedding-parallel bands forming zebra texture (wall of pit N-42, Pine Point mine site, NWT).
B. Close-up of selective replacement of bedding-parallel bands by coarse-crystalline dolomite (Robb Lake, BC).


Age of MVT Deposits — Ordovician to Tertiary
Dispersion of Rodinia
Assimilation of Pangea
Pangea stable
Pangea unstable
Breakup of Pangea
Alpine-Laramide Assimilation
P€
€
O
S
D
C
P
Tr
J
K
T
age (Ma)
600
500
400
300
200
100
Deposit
Polaris
Pine Point
Daniel's Harbour
Gays River
Robb Lake
Monarch-Kicking Horse
Nanisivik
Goz Creek
Gayna River
Esker
Blende
Bear-Twit
Prairie Creek
Host rocks
Paleomagnetic
Radiometric

Characteristics of Mississippi Valley-type Deposits (strict sense) (after Brown, 1970)

1. Primarily hosted in carbonates, originally limestone or dolomite, but now usually dolomite. Minor impregnations in sandstone.

2. Dominant ore minerals are galena and sphalerite, usually with predominant sphalerite. Iron sulfides are copious but often marginal to ore.

3. Lead is anomalous J-type enriched in radiogenic ^{206}Pb, ^{207}Pb and ^{208}Pb. Much inter- and intra-deposit variation.

4. Low in precious metals, but high in the trace elements Cu, Cd, Ge, Ga, Co, Ni and Hg. Copper is usually present and sometimes in economic amounts. Accessory minerals, e.g. greenockite β-CdS and siegenite $(Co,Ni)_3S_4$, may have byproduct value.

5. Barite important in some deposits, but virtually absent in others. Some have fluorite.

6. Sphalerite is usually low in iron, but is frequently banded.

7. Coarse crystallinity is characteristics.

8. Rocks are unmetamorphosed and deposits are unmodified except by weathering.

9. Ores occur preferentially in certain horizons and are stratabound if not stratiform.

10. Igneous activity is minor or lacking most districts and has no relationship to ore.

11. All geological evidence indicates low-temperature origin. Fluid inclusion temperatures of 100º to 150ºC and salinities five to ten times those of seawater.

Several subtypes of Mississippi Valley-type have been defined including the Appalachian subtype, the Irish subtype and the Alpine subtype. The Appalachian subtype is described below.

Characteristics of the Appalachian subtype of Mississippi Valley-type deposits
(after Hoagland, 1976)

1) shallow marine carbonate

2) dolomite-limestone transition (may be diagenetic rather than alteration dolomite)

3) open-space filling predominant

4) predominantly dolomite gangue

5) iron in sphalerite <1%

6) pyrite + marcasite <5%

7) barite + fluorite <0.5%

8) galena rare or absent

9) karst phenomena important

10) deposited from brine solutions

11) deposition between 80ºC - 180ºC

12) slightly anomalous lead