

Comments on the Saskatchewan Mineral Deposit Models with the Mafic-Ultramafic Intrusion-Hosted Magmatic Ni-Cu-(PGE) Model as an Example

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www.er.gov.sk.ca



**Ministry of
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Saskatchewan Mineral Deposit Models

- Saskatchewan Geological Survey has compiled synoptic descriptive mineral deposit models and posted them on the Energy and Resources website: www.er.gov.sk.ca/depositmodels.
- Models are oriented towards Saskatchewan mineral deposits and geology and many are specific to the province.
- Currently 42 models that include 24 metallic, 1 gem, 15 industrial, and 2 petroleum deposit types.

Saskatchewan Mineral Deposit Models

- Purpose is to document the key characteristics of each deposit type from the literature as an initial reference source.
- Primary intended audience is geoscience professionals, especially those in mineral exploration and government.
- Range from 1.5 to 4 pages, average about 2 pages. Text only at this time.
- Intent is to continue updates and perhaps add new models, where warranted by new information.

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GEOLOGY AND RESOURCES

Saskatchewan Mineral Deposit Models

Synoptic descriptive mineral deposit models for the metallic, industrial, and gem mineral deposit types which occur in Saskatchewan are presented. The purpose of the models is to document the key characteristics of each deposit type as an initial reference. They are not meant to be an exhaustive description of each deposit type. Selected references are included with the models as additional information sources. Although these models have undergone an internal and in some cases external review, they are still draft in nature and subject to revision in the future with new information.

If you have a comment or correction to make to any of the models please contact Murray Rogers, Geologist, Saskatchewan Geological Survey (e-mail: murray.rogers@gov.sk.ca); (Tel.: 306-787-1932).

Additional models will be added as they are completed.

Download or view the collection as one combined report or as individual deposit types by clicking on the links below.

RELATED DOCUMENTS

Saskatchewan Descriptive Mineral Deposit Models - Open File Report 2011-57
By M.C. Rogers

[Open File Report 2011-57.pdf](#) (9.8 MB)

Model Number A-1: Athabasca Basin Unconformity-associated Uranium \pm Polymetallic

[Model A-1_Athabasca Basin Unconformity-associated Uranium.pdf](#) (40.9 KB)

Model Number A-2: Beaverlodge-type Uranium \pm Polymetallic

[Model A-2_Beaverlodge-type Uranium.pdf](#) (23.4 KB)

Model Number A-3: Unconformity-associated Copper-Silver \pm Polymetallic

[Model A-3_Unconformity-associated Copper-Silver.pdf](#) (33 KB)

Saskatchewan Mineral Deposit Models

- This year all of the models were updated, edited and reorganized into logical groupings and reposted as individual PDF files on the website.
- They were also all compiled into a single document, with all of the models and four summary tables, that was published as Open File Report 2011-57 as a PDF file on the website. It occurs in two locations, with the individual model files, and with the Publications/Open File Reports at: www.er.gov.sk.ca/OF2011-57.



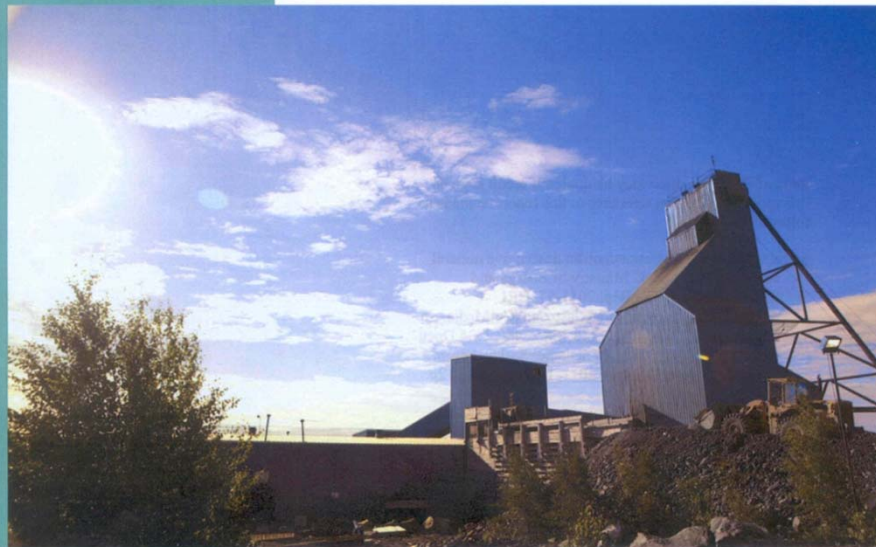
Saskatchewan
Ministry of
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Open File Report 2011-57

Saskatchewan Descriptive Mineral Deposit Models

M.C. Rogers

2011



Model Format

Mafic-Ultramafic Intrusion-Hosted Magmatic Ni-Cu-(PGE)

- **Model Number and Deposit Model Name**
- **Synonym(s)**
- **Concise Description**
- **Geological Environment**
 - **Host Rock Types**
 - **Rock Textures**
 - **Ages of Host Rocks and Mineralization**
 - **Depositional Environment**
 - **Tectonic Setting**
 - **Associated Deposit Types**

Model Format

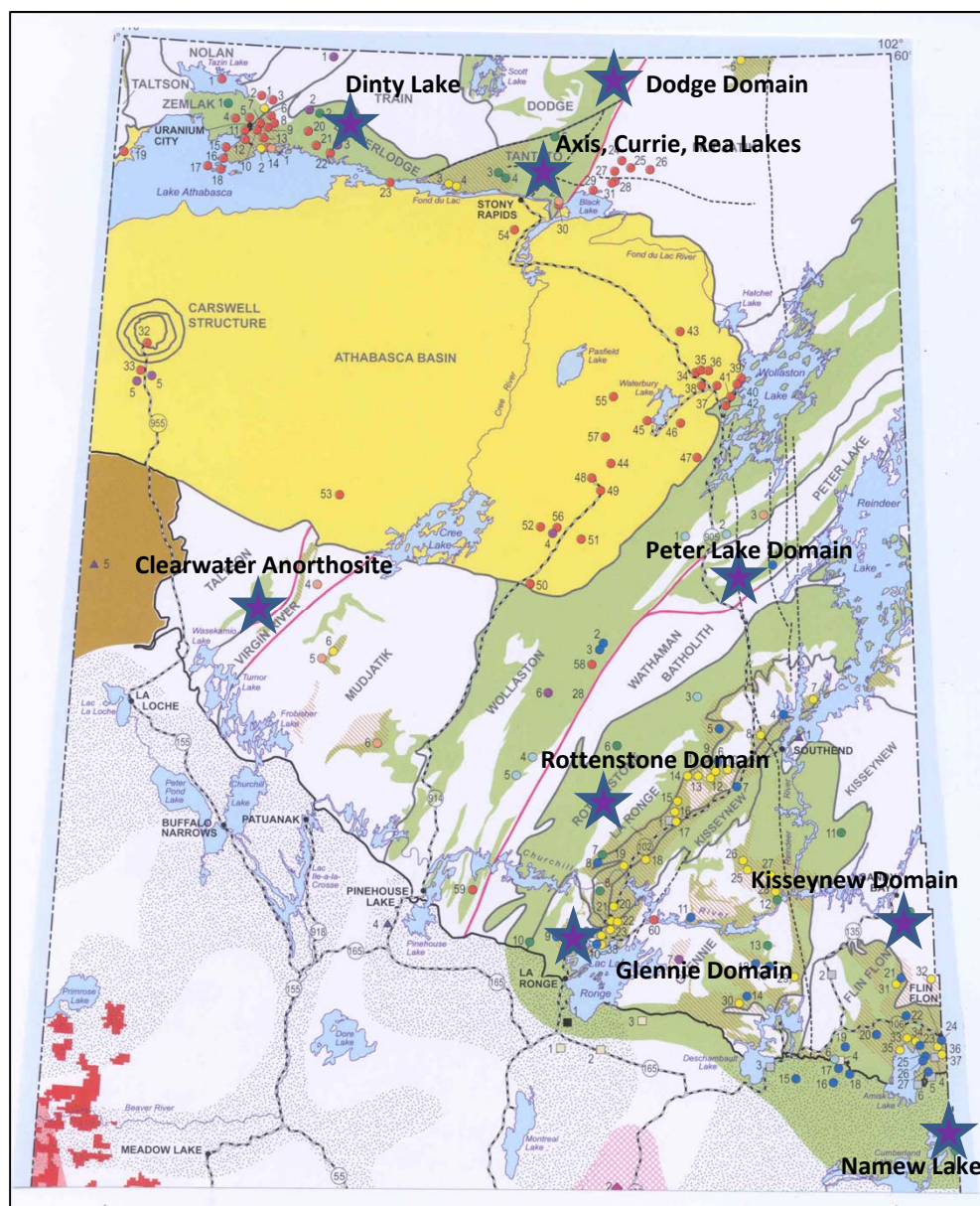
Mafic-Ultramafic Intrusion-Hosted Magmatic Ni-Cu-(PGE)

- **Concise Description:** Stratabound Ni, Cu \pm PGE \pm Co sulphide mineral accumulations, formed by magmatic processes, within mafic and/or ultramafic intrusive rocks. There are two general types: 1) sulphide-rich (PGE-poor) Ni-Cu dominant, disseminated to massive mineralization and 2) sulphide-poor (PGE-rich) platinum group element-dominant, disseminated mineralization with generally \leq 3% sulphides.

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Principal Ni-Cu-(PGE) and PGE Locations in Saskatchewan

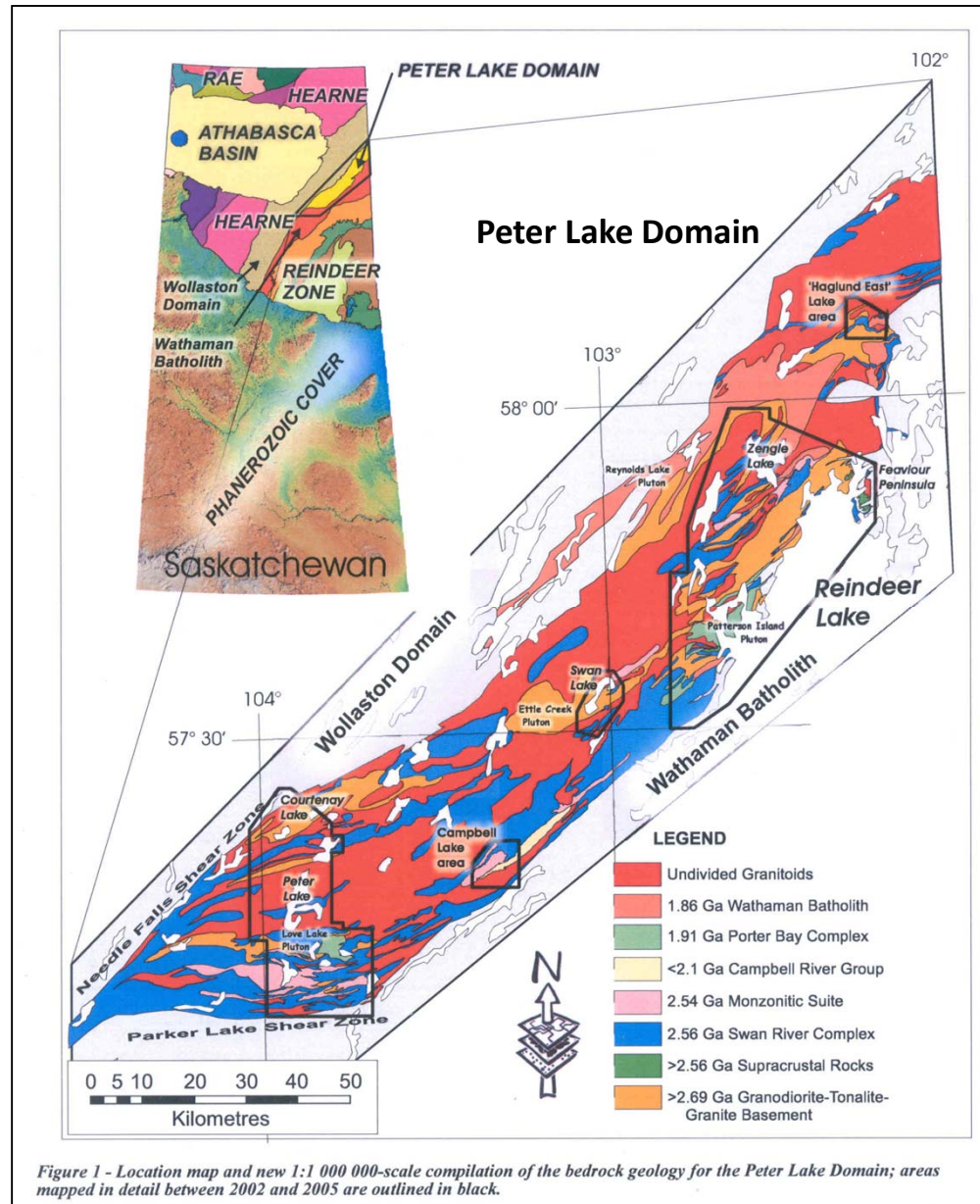


Figure 1 - Location map and new 1:1 000 000-scale compilation of the bedrock geology for the Peter Lake Domain; areas mapped in detail between 2002 and 2005 are outlined in black.

(from Maxeiner, 2006)



Figure 14 - 'Taxitic'- textured gabbro of the Swan River Complex; dark, partly bladed minerals are hornblende; light coloured minerals are predominantly plagioclase (Station RM04-22-ST07, UTM 650259mE 6407312mN).

Taxitic-textured gabbro (Swan River Complex)



Figure 15 - Rhythmically layered gabbro intruded by pegmatitic gabbro and subsequent sulphide-bearing microgabbro; Swan River Complex (Station RM04-13-ST01, UTM 660128mE 6413076mN).

Rhythmically layered gabbro, pegmatitic gabbro, sulphide-bearing gabbro

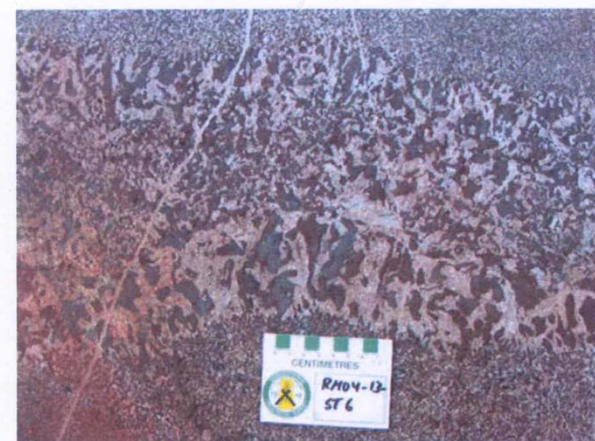


Figure 16 - Comb-texture in a pegmatitic gabbro dyke of the Swan River Complex (Station RM04-13-ST06, UTM 659362mE 6413793mN).

Comb-textured pegmatitic gabbro dyke (Swan River Complex)

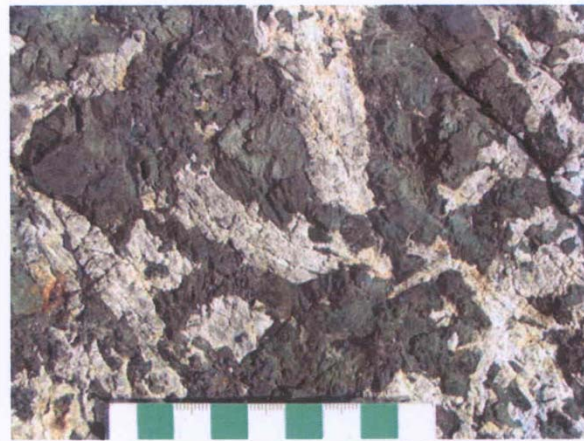


Figure 18 - Pegmatitic gabbro norite, undivided gabbro unit west of Fontaine Island (Station RM04-23-ST27, UTM 645224mE 6407805mN).

Pegmatitic gabbro norite

(from Maxeiner et al., 2004)



Figure 20 - Zebra layering in gabbro on a small island southwest of Feaviour Peninsula, Porter Bay Complex (Station RM04-31-ST24, UTM 661159mE 6411082mN).

Zebra layering in gabbro (Porter Bay Complex)

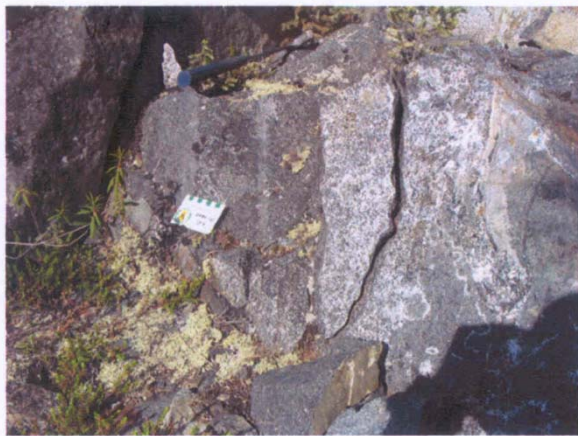


Figure 21 - Heterogeneous breccia with weakly layered gabbro autolith (left side of picture) in a varitextured leucogabbroic matrix (central part of photo); Station RM05-20-ST07 at UTM 620073 m E, 6381563 m N.

Heterogeneous breccia in a varitextured leucogabbro



Figure 19 - Cross-bedded igneous layering in gabbro of Porter Bay Complex from west of Fontaine Island (Station RM04-28-ST22, UTM 658506mE 6408291mN).

Cross-bedded layering in gabbro (Porter Bay Complex)



Figure 22 - Poikilitic phase of the Swan Lake gabbro (unit SGa); Station RM05-20-ST11 at UTM 619943 m E, 6381625 m N.

Poikilitic phase of Swan River gabbro

(from Maxeiner et al., 2004 and Maxeiner and Rayner, 2005)



Figure 25 - Zebra-layering in small gabbro intrusion southeast of Swan Lake; Station RM05-22-ST05 at UTM 6379020 m E, 6381953 m N.

Zebra-layering in Swan River gabbro

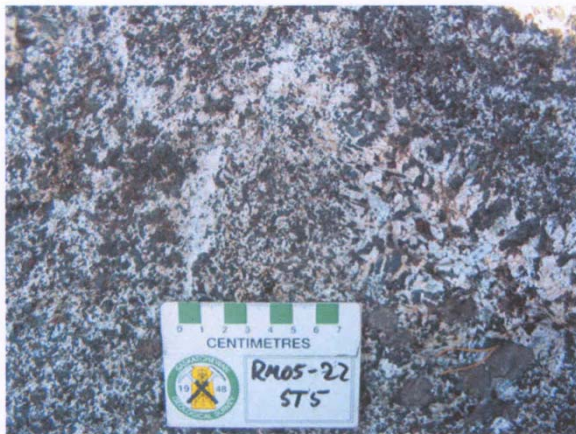


Figure 24 - Varitextured gabbro in small gabbro intrusion southeast of Swan Lake; Station RM05-22-ST05 at UTM 6379020 m E, 6381953 m N.

Varitextured Swan River gabbro

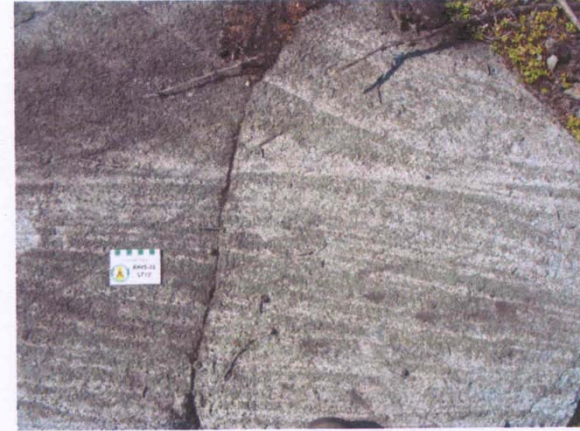


Figure 26 - Cross-bedded gabbro in small gabbro intrusion southeast of Swan Lake; Station RM05-22-ST15 at UTM 619090 m E, 6378741 m N.

Cross-bedded layering in Swan River gabbro

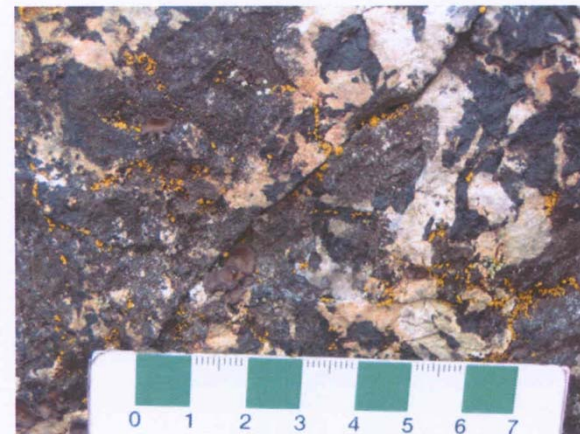


Figure 30 - Pegmatitic gabbro at Haglund East Lake PGE-occurrence; Station RM05-30-ST04 at UTM 661868 m E, 6444899 m N.

Pegmatitic gabbro at Haglund East PGE occurrence

(from Maxeiner and Rayner, 2005)

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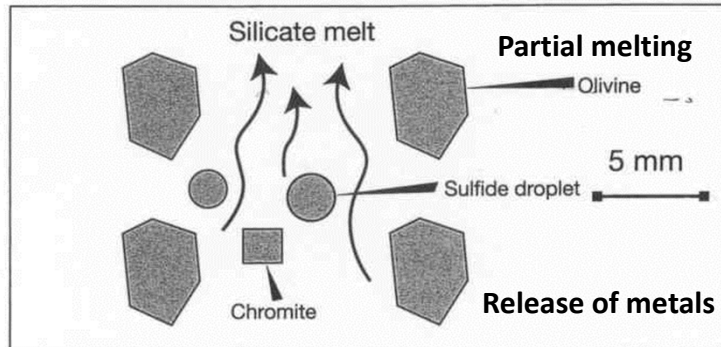
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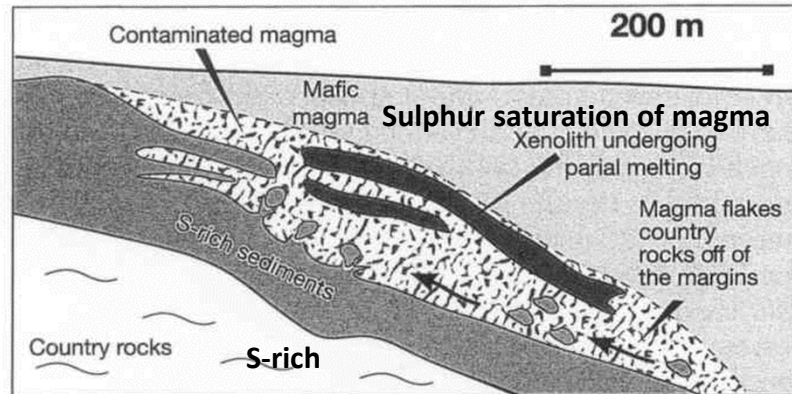
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General Genetic Model for Ni-Cu-(PGE) Formation

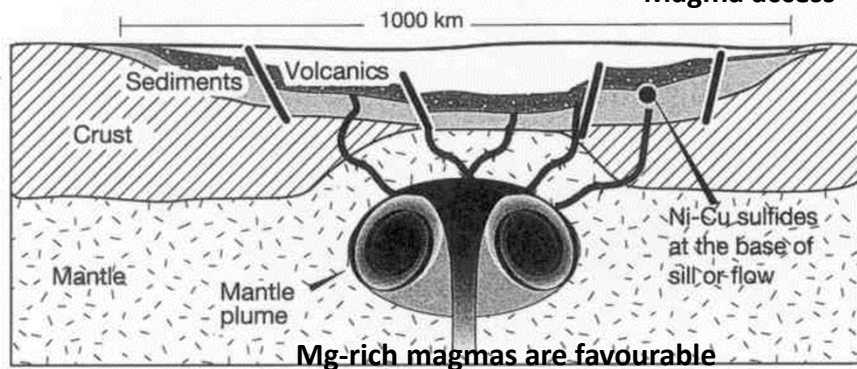
- a) Partial melting of mantle, high degree of partial melting needed to release Ni from olivine



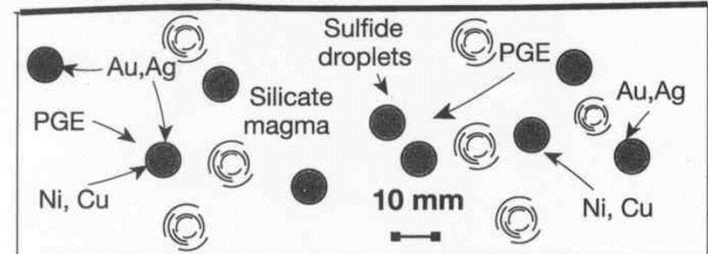
- c) Contamination of the magma brings about sulfide saturation



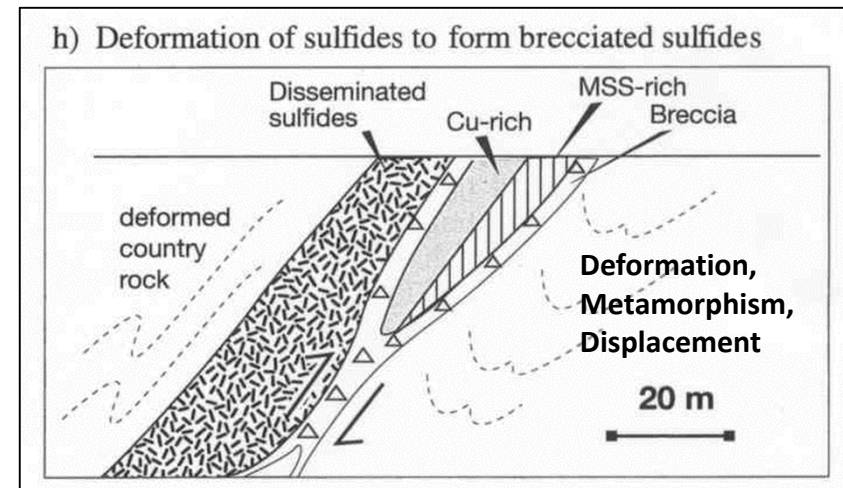
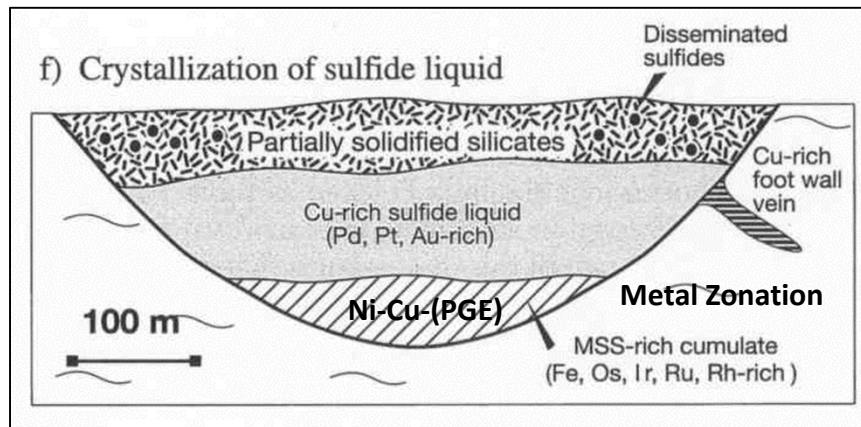
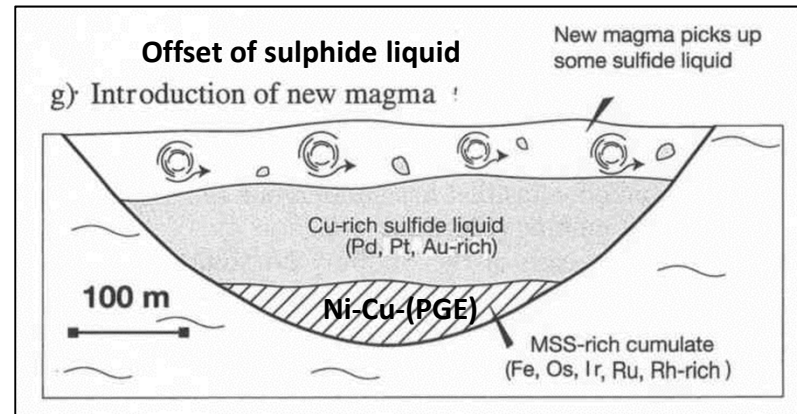
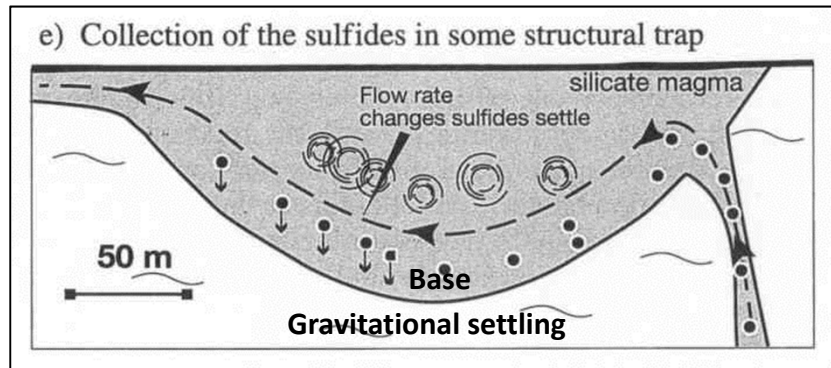
- b) Transport of magma into the crust



- d) Collection of the metals by sulfide liquid
Vigorous convection raises silicate to sulfide liquid ratio resulting in Ni and PGE rich ores



(from Barnes and Lightfoot, 2005)



(from Barnes and Lightfoot, 2005)

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 - **Mineralogy**
 - **Textures and Styles of Mineralization**
 - **Alteration**
 - **Geological Ore Controls**
 - **Geochemical Signature**
 - **Geophysical Signature**
- **Examples**
- **Selected Bibliography**

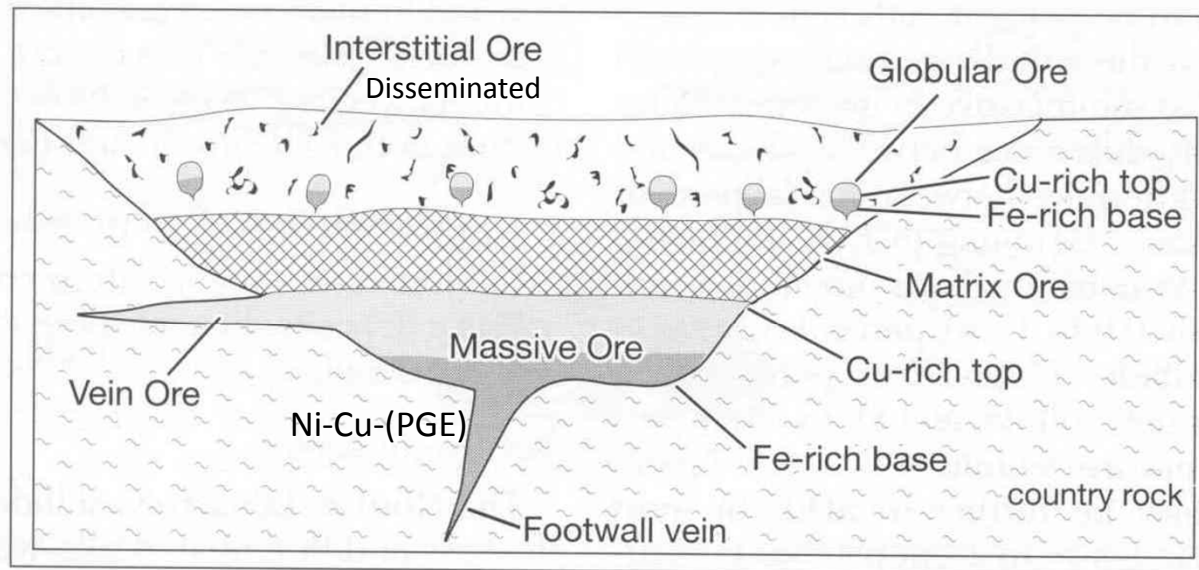


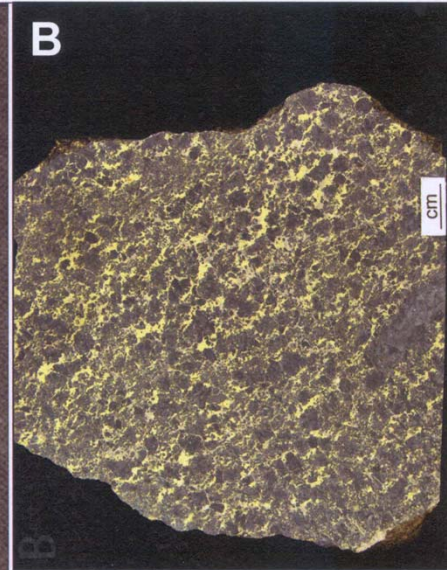
FIG. 5. Idealized sketch of the relationship between massive, matrix, disseminated, and vein sulfides (modified after Barnes et al., 1997b).

(from Barnes and Lightfoot, 2005)

Disseminated



Matrix textured



Massive

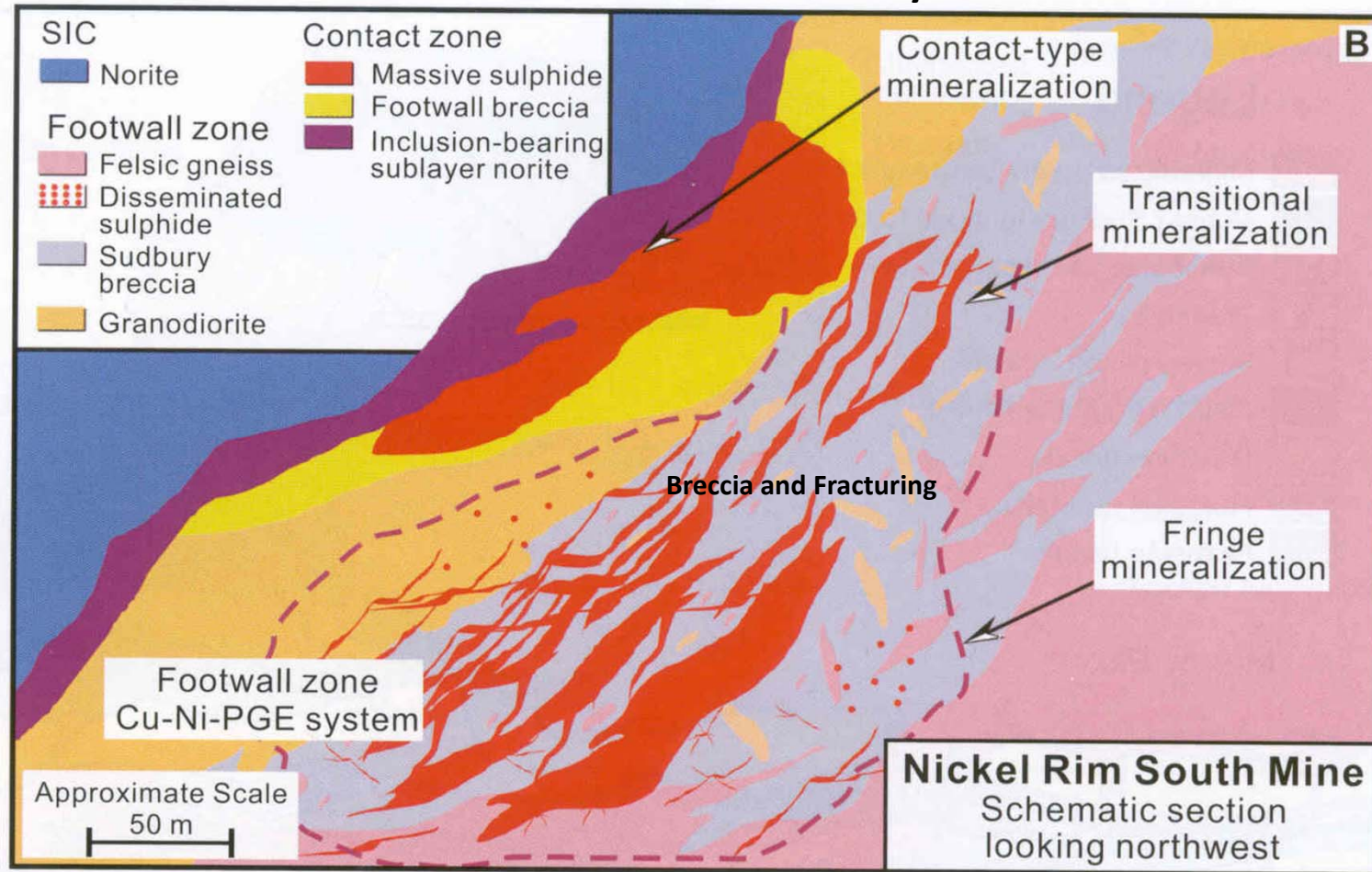


Breccia

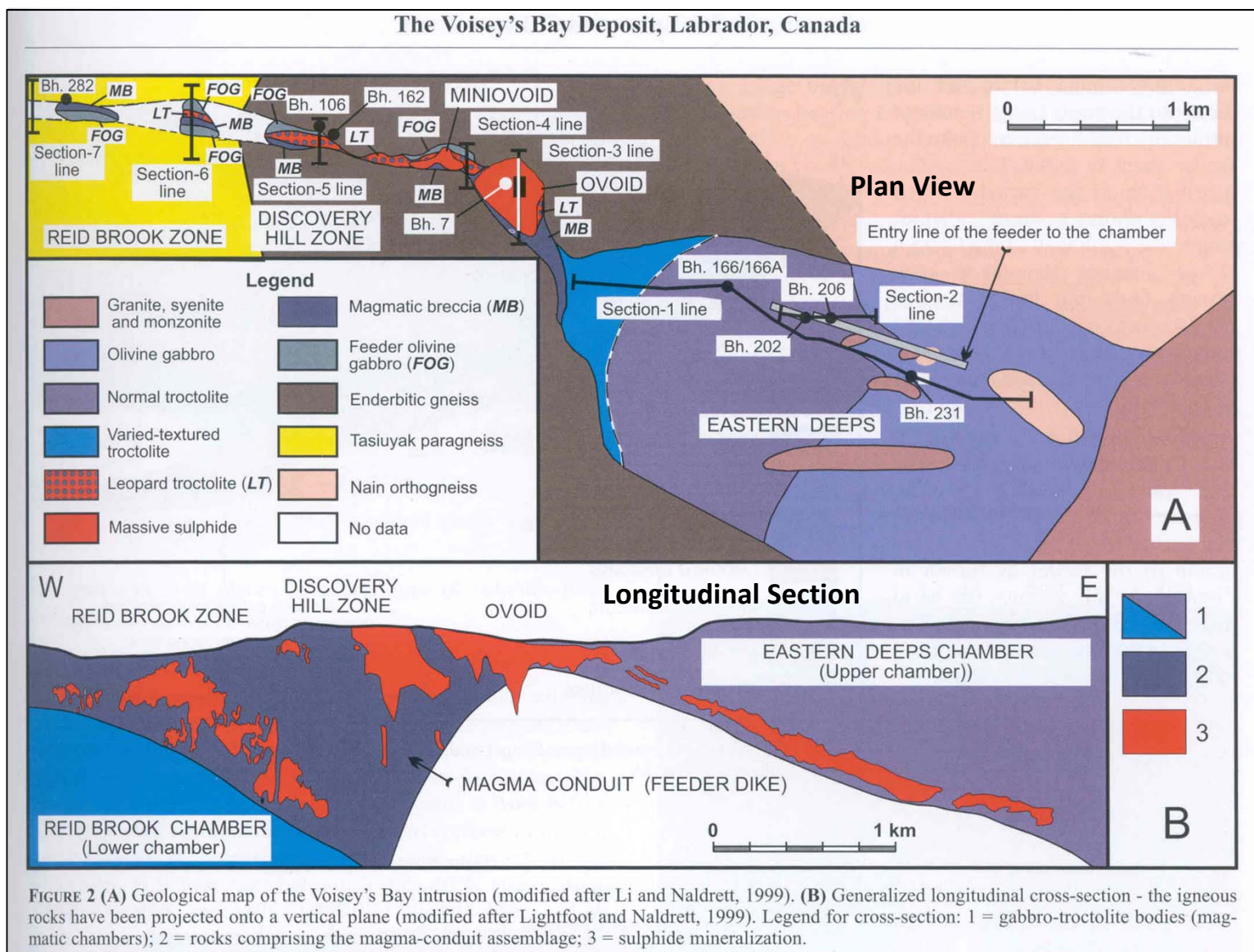


(A) disseminated; (B) matrix textured; (C) massive; (D) breccia
(from Eckstrand and Hulbert, 2007)

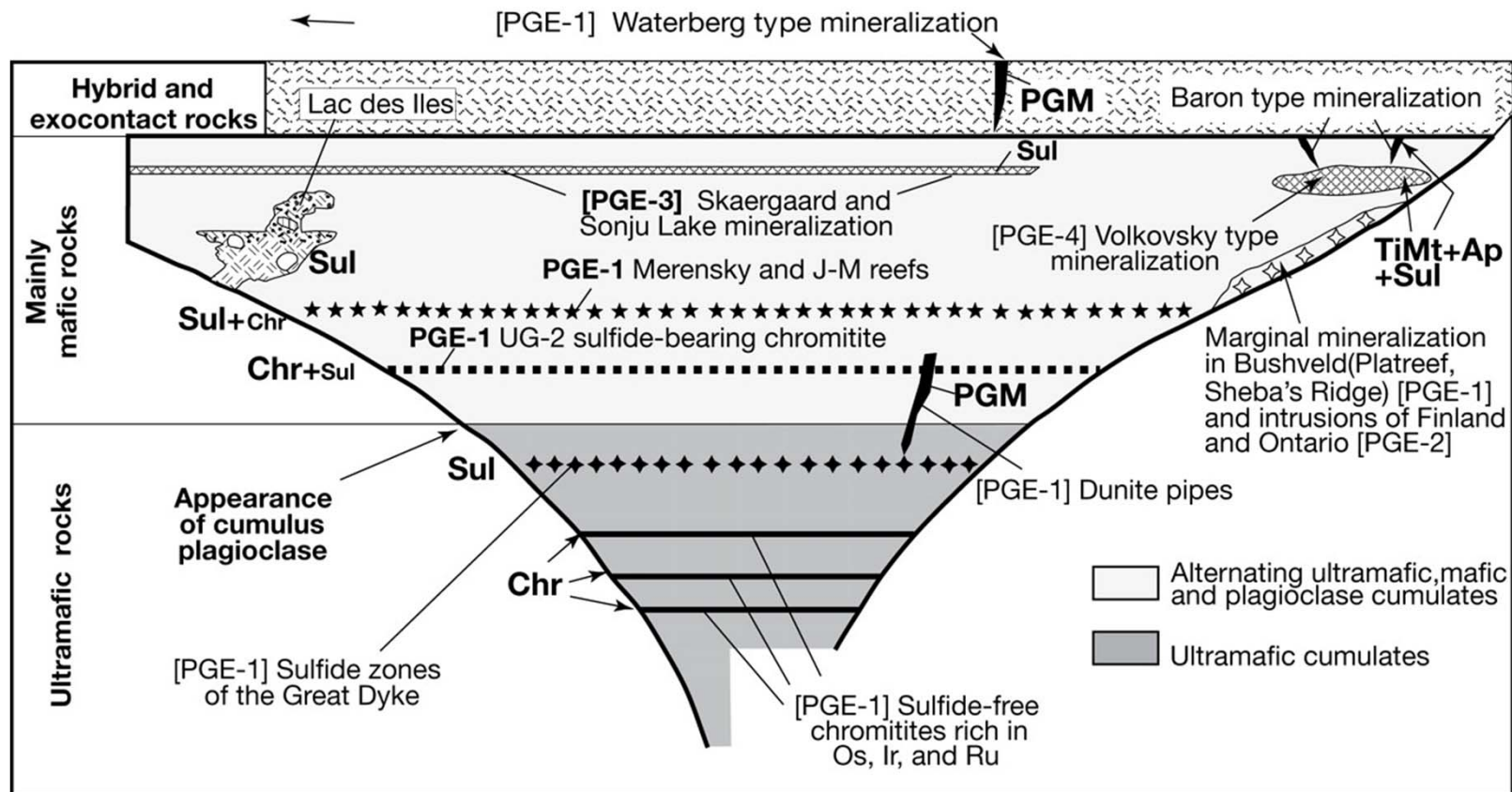
Nickel Rim South Mine – Sudbury District



(from Ames and Farrow, 2007; modified from McLean et al., 2005)



(from Naldrett and Li, 2007)



PGE Styles of Occurrence

(from Naldrett, 2004)



Bushveld Complex – Merensky Reef, underground

(from web.uct.ac.za)



High-grade PGE ore, Merensky Reef, Bushveld Complex

(from johnbetts_fine minerals)

Model Format

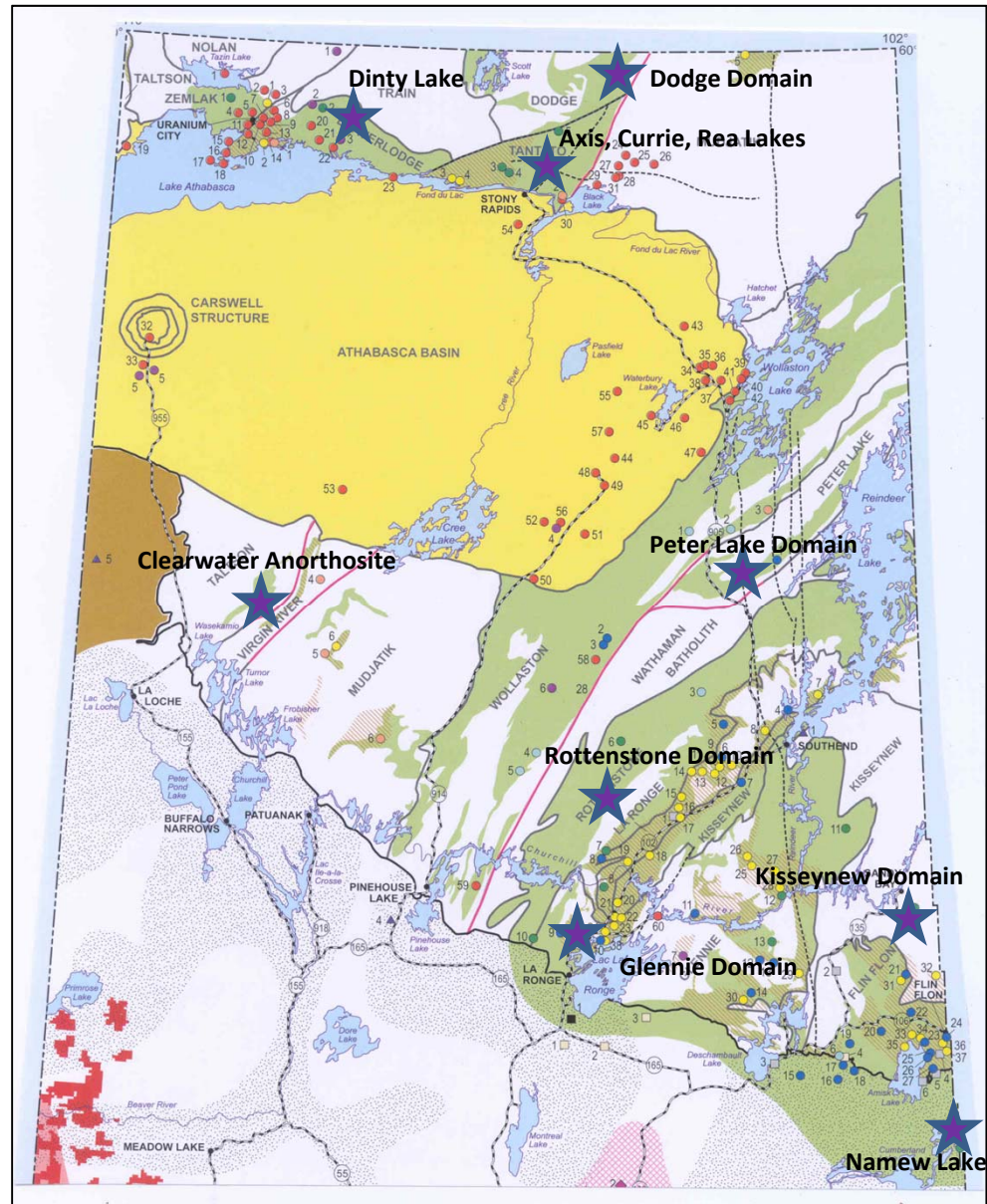
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Principal Ni-Cu-(PGE) and PGE Locations in Saskatchewan

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Thank You

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