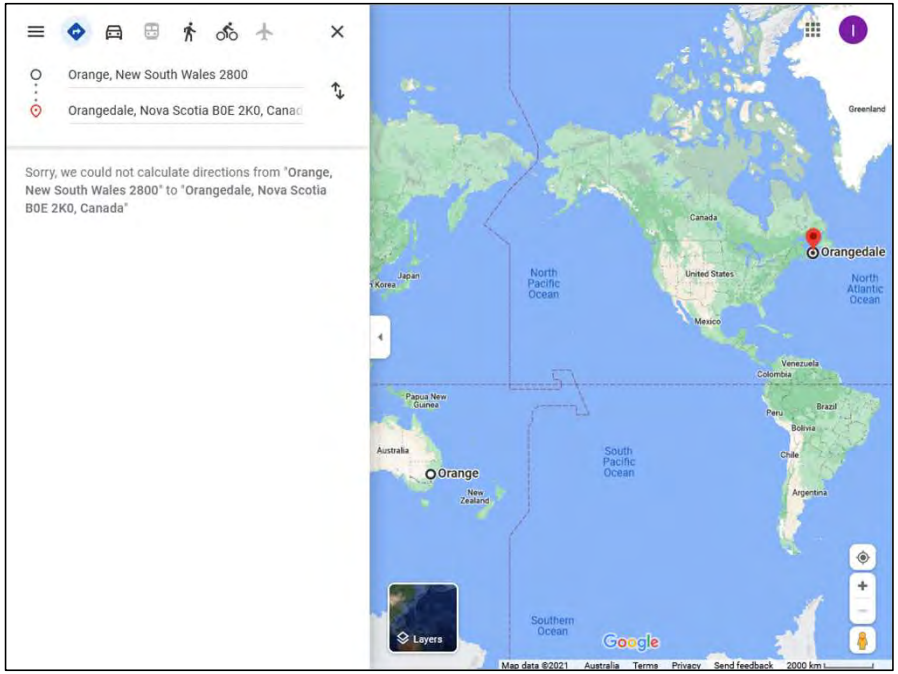
Orange to Orangedale



A Potash Odyssey

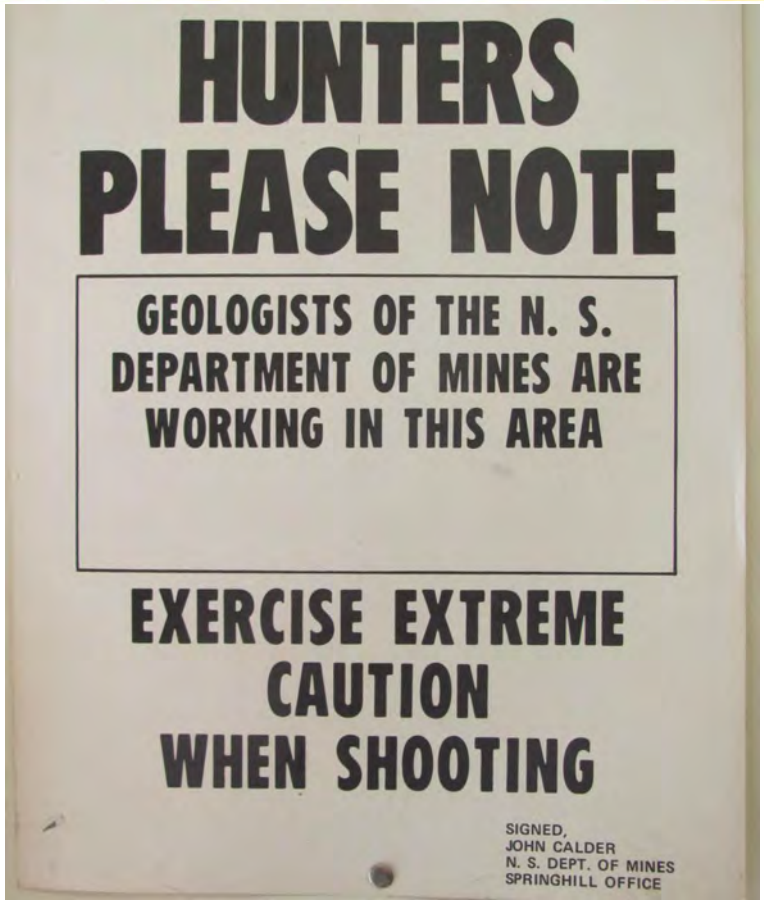
CWEDG

5th November 2021

Why bother?

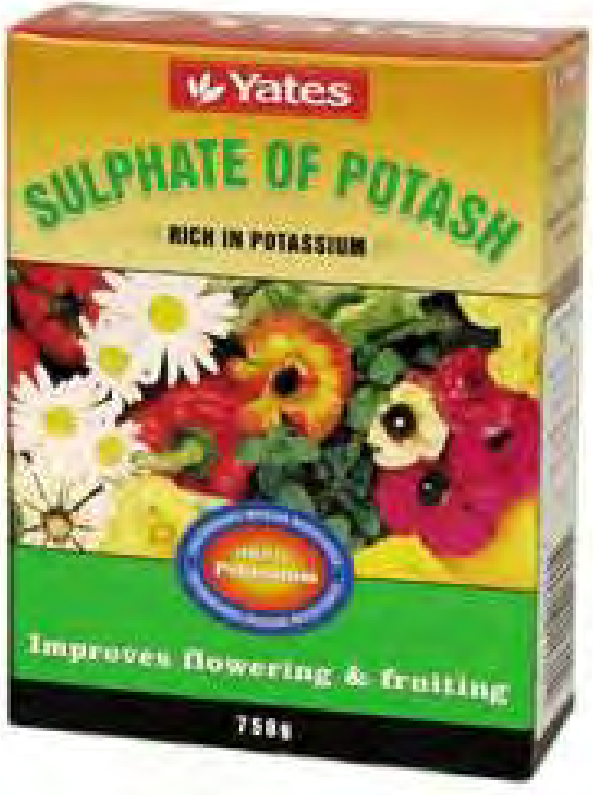
- What's Potash?
- Why Potash?
- Geology - setting & examples
- Where's Potash?
- Mining - conventional & solution

New Glasgow,
Nova Scotia



What's Potash?

- The mineral (K) is one of the three main macro nutrients required by plants, along with nitrogen (N) & phosphate (P)
- Potash helps
  - improve a plant's disease resistance
  - crop quality
  - increases yields
- Only potassium fertilizer source
  - No practical substitutes
- Comes from "ash" of "pot"
  - People burned wood, mixed ashes with water & evaporated solution in iron pots.
  - Remainder was potash - used primarily for soap and glass.
  - However, potash had a positive effect on plants & the importance of potassium began to be recognised



Why Potash?

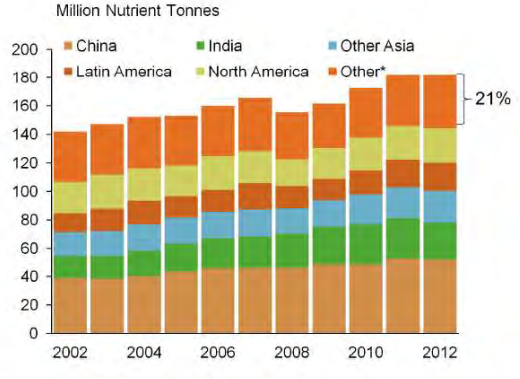
Nutrien®

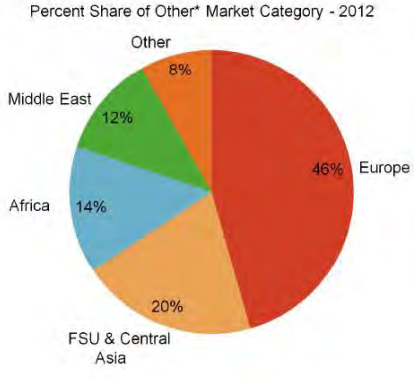
Fertilizer Prices

Nutrien produces and distributes approximately **27 million tonnes of potash, nitrogen and phosphate annually** which creates significant earnings leverage when fertilizer prices improve. Fertilizer prices have begun to recover from cyclical lows and are now above 3 year average levels, but below greenfield project economics. Underlying fundamentals for potash and nitrogen in particular, are strengthening, providing tremendous earnings growth potential.

World Fertilizer Consumption

More than 20 Percent of Consumption Outside of Asia, North and Latin America





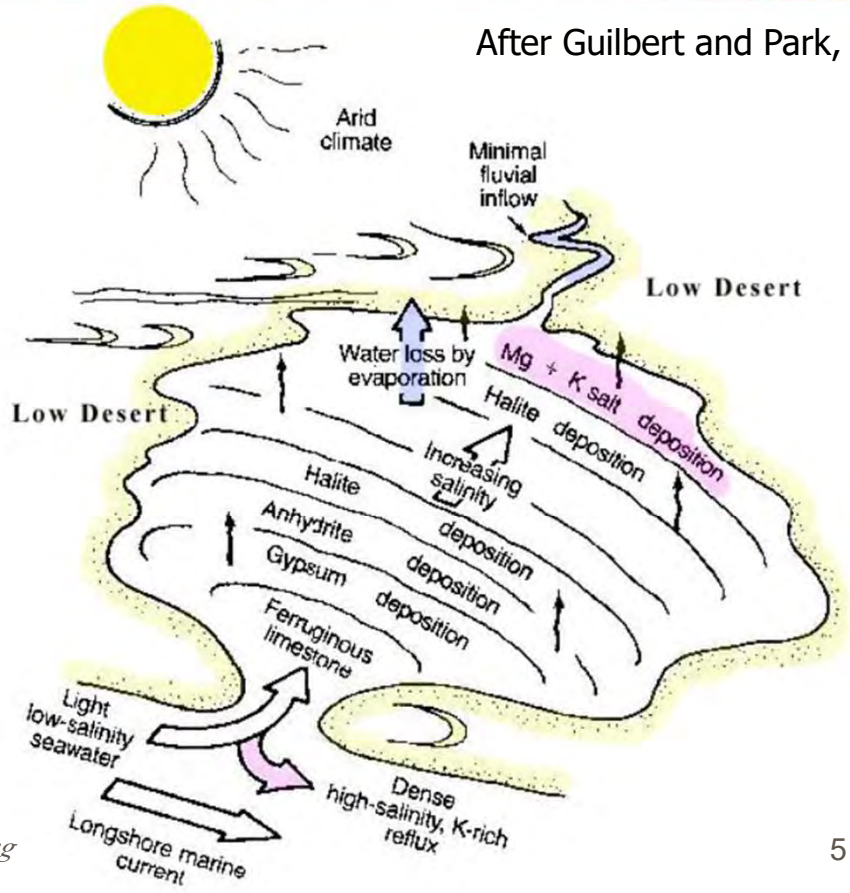
Based on a combination of calendar and fertilizer year data.
2012 refers to 2012 CY and 2012/13 FY.

Source: Fertecon, IFA, PotashCorp

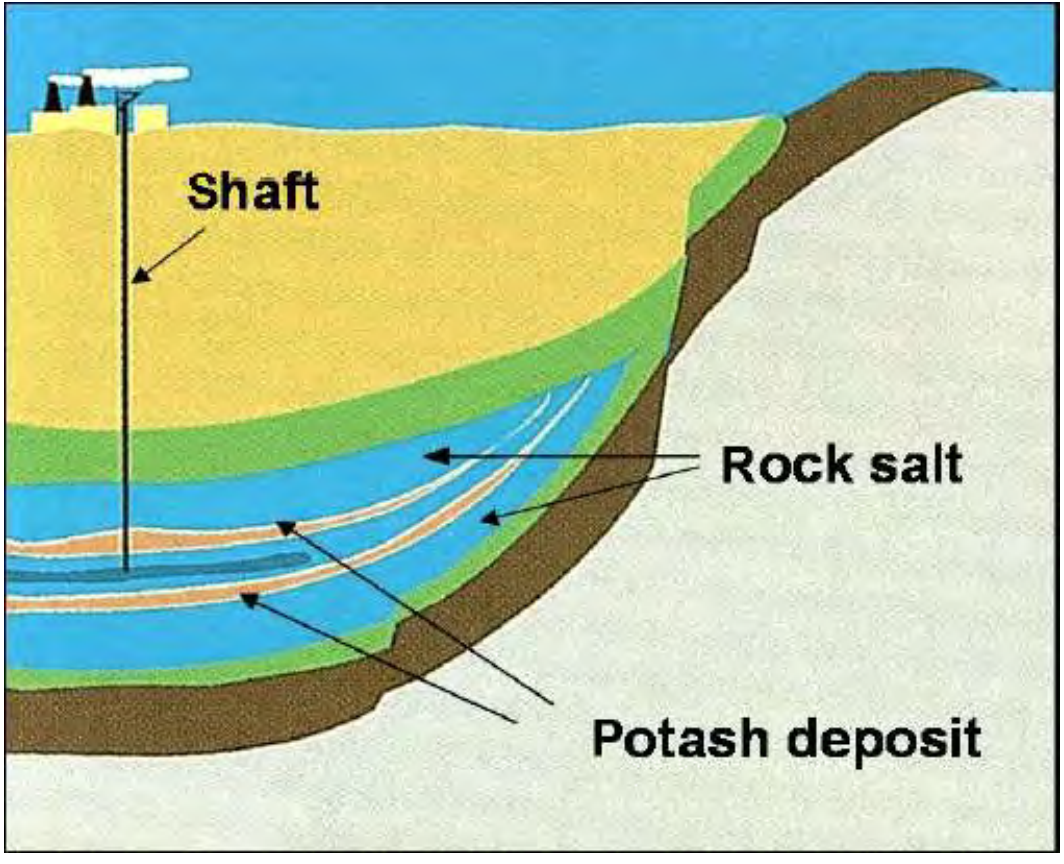
Geology

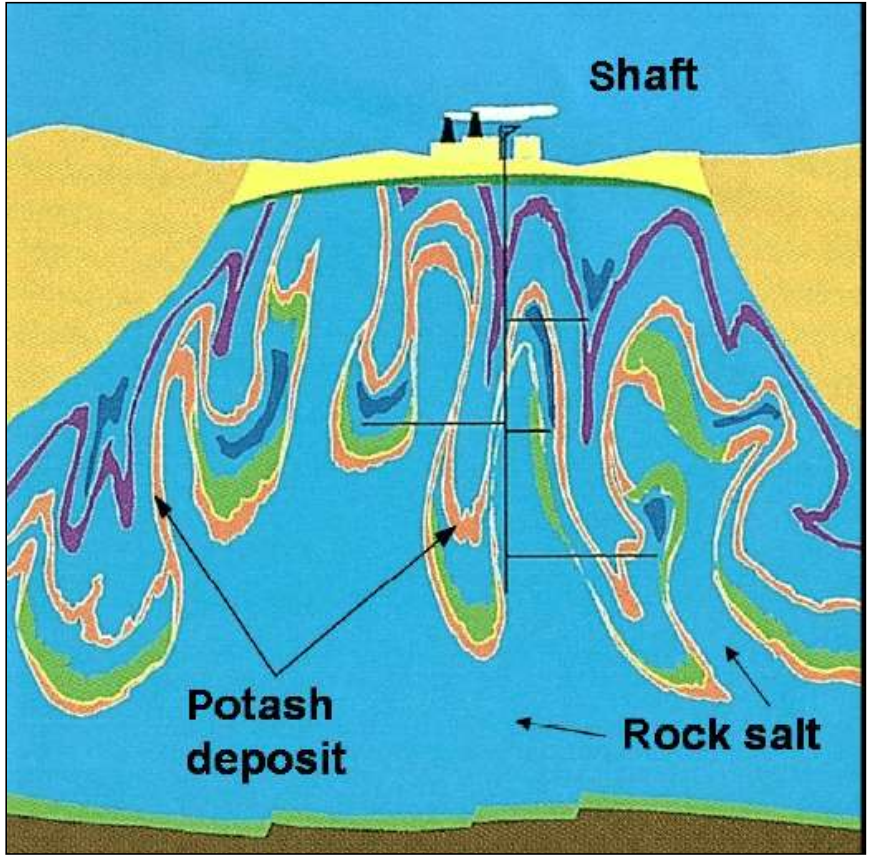
- Evaporite
- Barred basin – restricted infill
- Cycle – CO_3, SO_4, NaCl, Carnallite
  - dolomite, anhydrite, halite, sylvite
- Reflux – sea level
- Preservation – reduced shale (?cap)
- Stable tectonics – dissolution
- Deposits laterally continuous
  - +30km strike Carlsbad, NM

After Guilbert and Park, 1986



Zechstein Style





Zechstein Style

Where?


Pripyat, Belarus
Zechstein
Cis-Uralian
Elk Point
Maritimes
North Caspian
Catalonia
Bukhara
Paradox Basin
Michigan
Delaware
Khemiset
Dead Sea
Qaidan
Sicily
Laos / Thai
Danakil
Sergipe
Congo
Atacama
Neuquen
Current producing potash basin
Other known potash basins

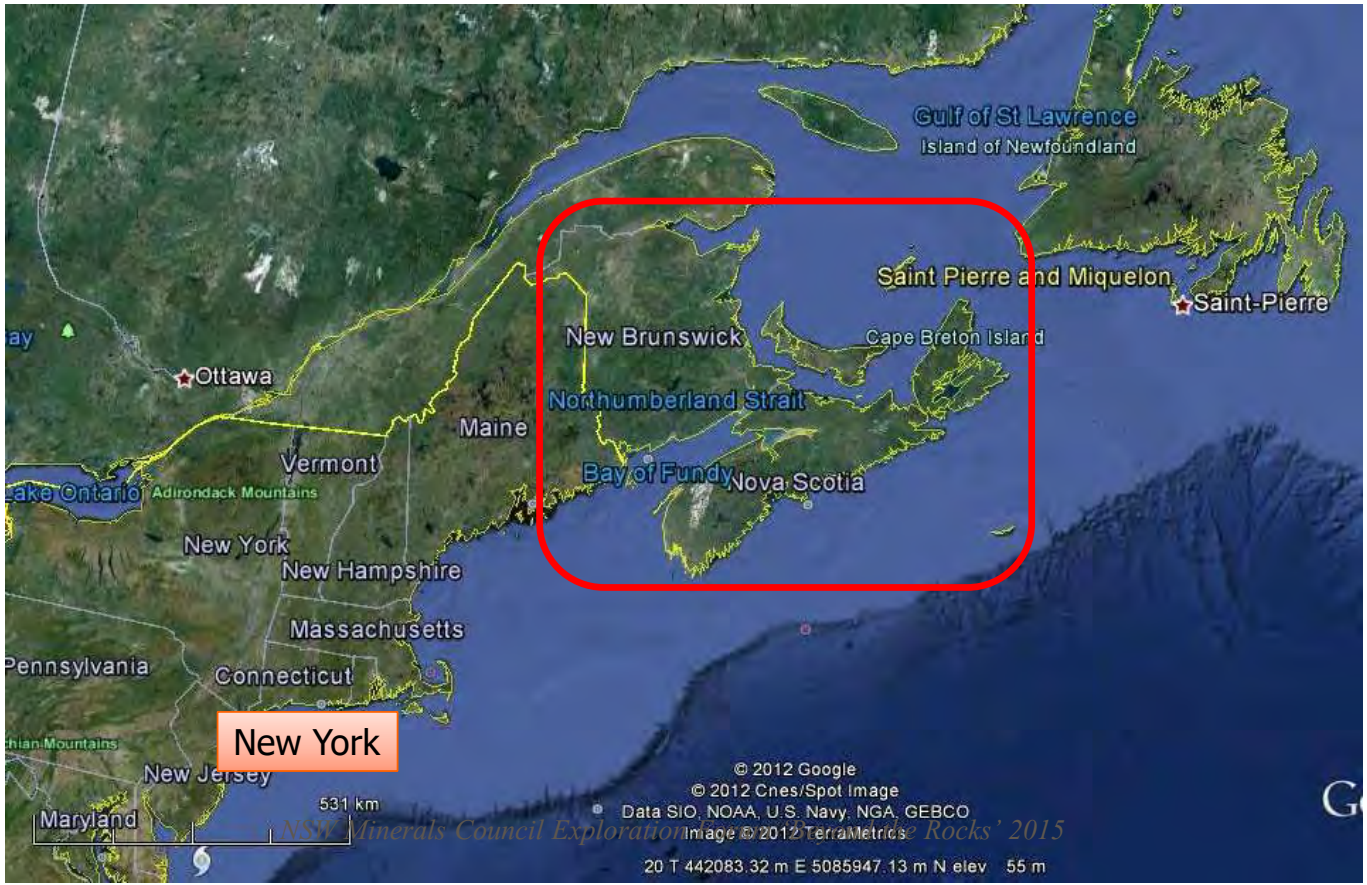
So where are we?

Bonneville Salt Flats

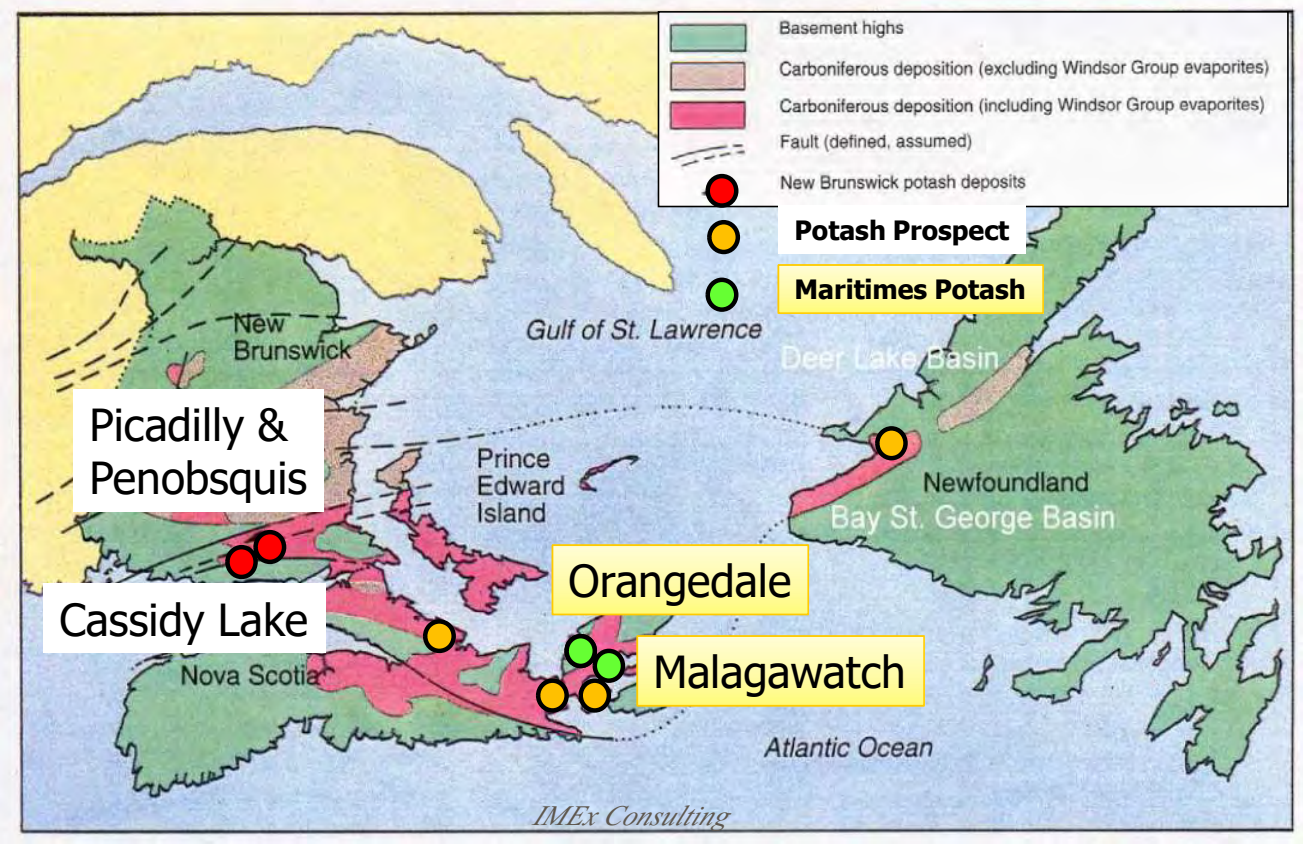
Great Salt Lake

Salt Lake City, Utah

The Maritimes



The Maritimes – New Brunswick



Why bother?

- New Brunswick
  - On open ground….Cassidy Lake
  - ~85-190Mt @ ~20% K2O (~7.3-16.4Moz Au)
- Nova Scotia
  - On open ground….Orangedale
  - ~30Mt @ ~20% K2O (~2.6Moz Au)
- ***The size of the prize!***

New Brunswick

New Brunswick

New Brunswick

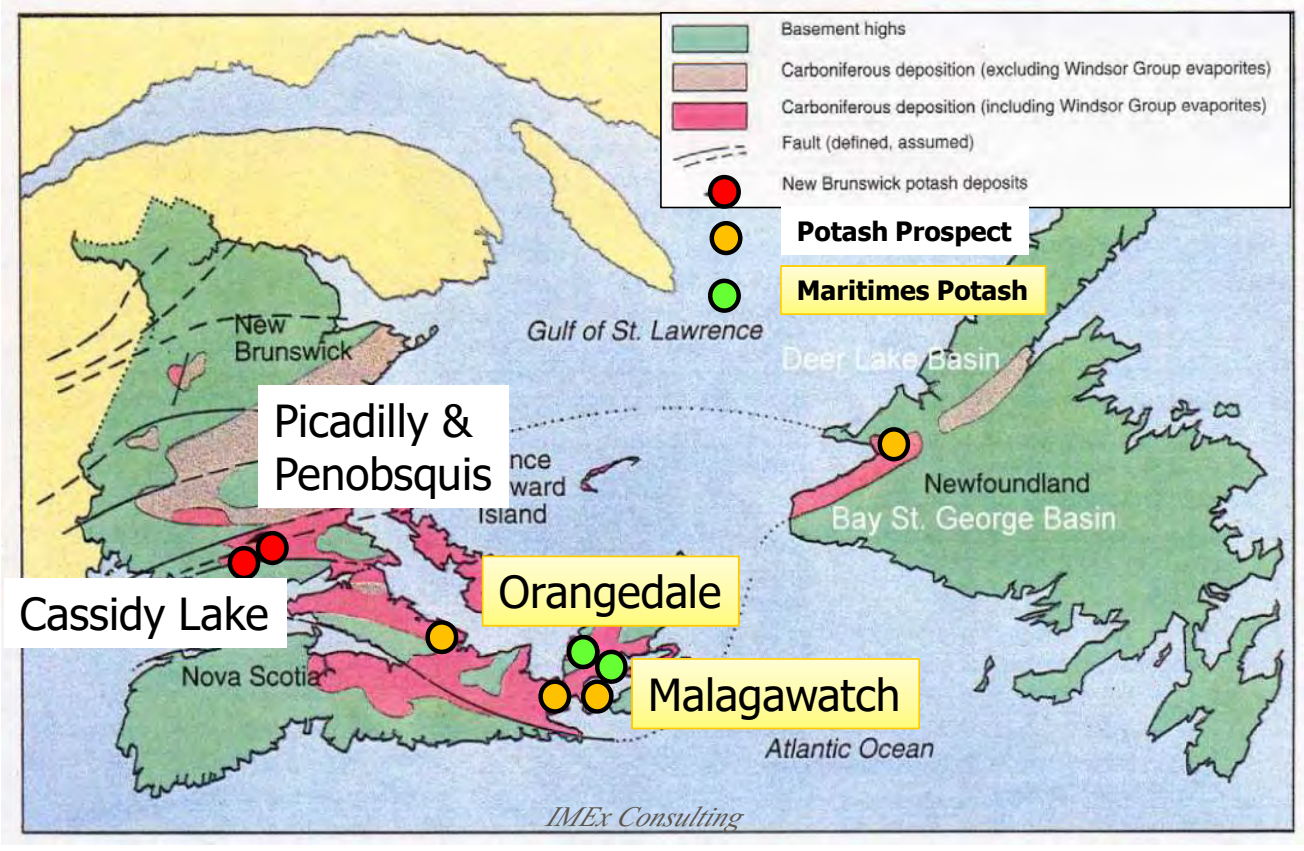
New Brunswick

New Brunswick

NB – Penobsquis & Piccadilly

New Brunswick – Cassidy Lake

The Maritimes – Nova Scotia



Halifax Nova Scotia

Halifax Nova Scotia

Halifax Nova Scotia

Halifax Nova Scotia

New Glasgow Nova Scotia

New Glasgow Nova Scotia

Nova Scotia

Orangedale

Orangedale

Malagawatch

Nova Scotia

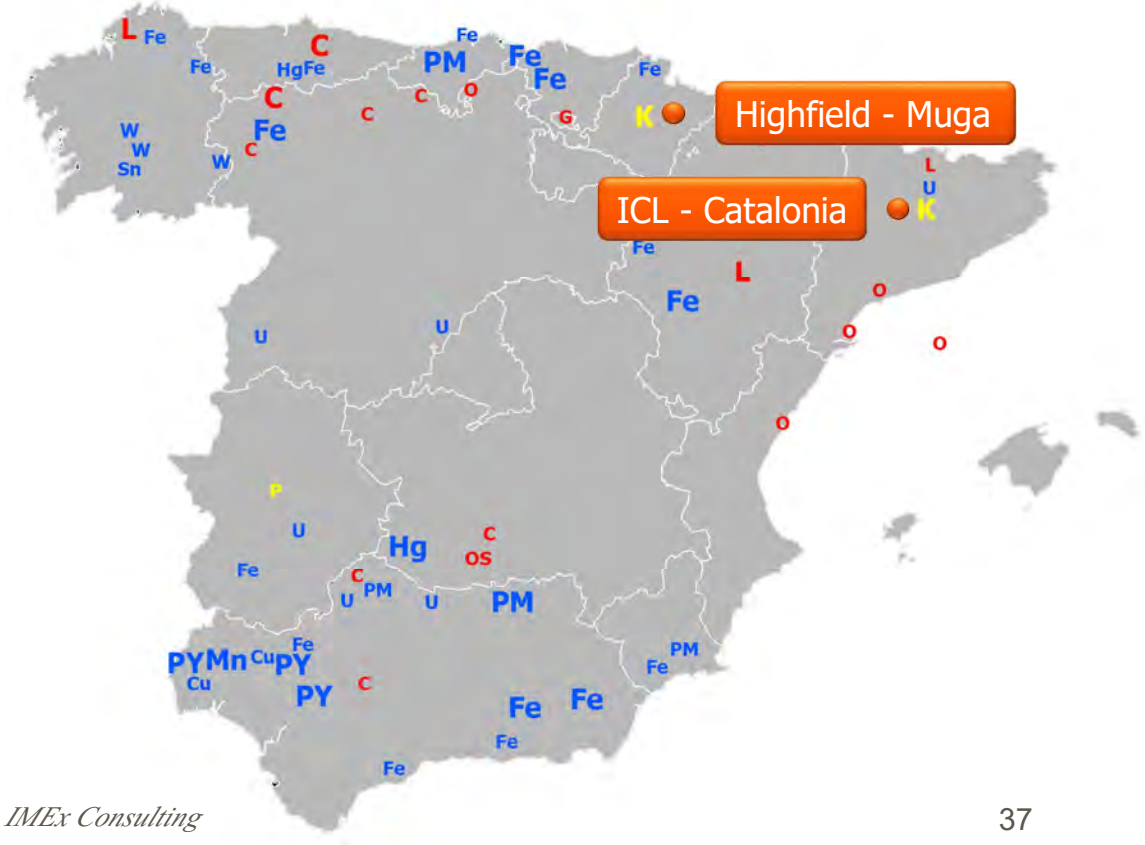

MAXIMUM
50
Elect
JOHN FRANK
TONEY
A BETTER FUTURE
for
TODAY'S FAMILIES
NDP
RE-ELECT
Keith
BAIN
VICTORIA - THE LAKES
PC
VICTORIA-THE LAKES
Pam
Eyking
Liberal

Sydney, Nova Scotia

Where?


Pripyat, Belarus
Zechstein
Cis-Uralian
Elk Point
Maritimes
North Caspian
Catalonia
Bukhara
Paradox Basin
Michigan
Delaware
Khemiset
Dead Sea
Qaidan
Lop
Sicily
Udon Thani
Danakil
Current producing potash basin
Other known potash basins
Sergipe
Congo
Atacama
Neuquen

Spain – Highfield Resources



Spain – Highfield Resources

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Where?


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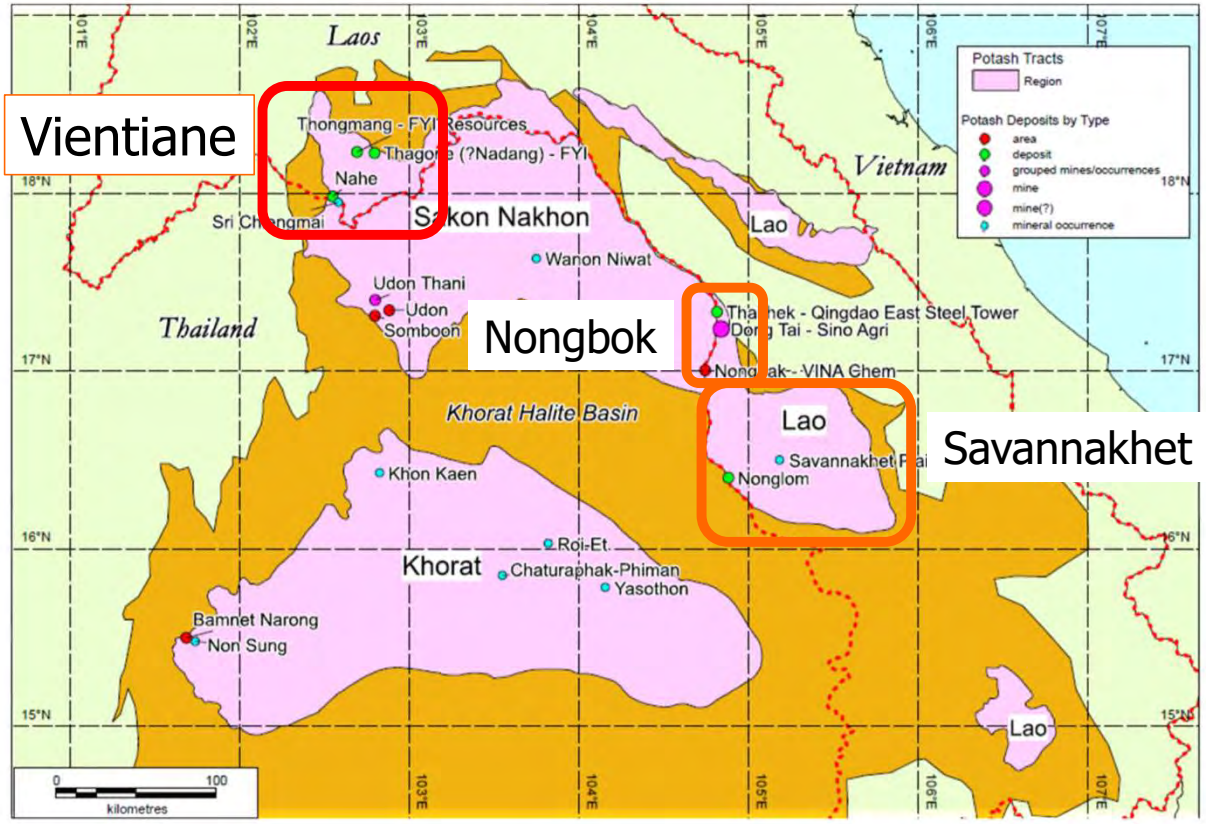
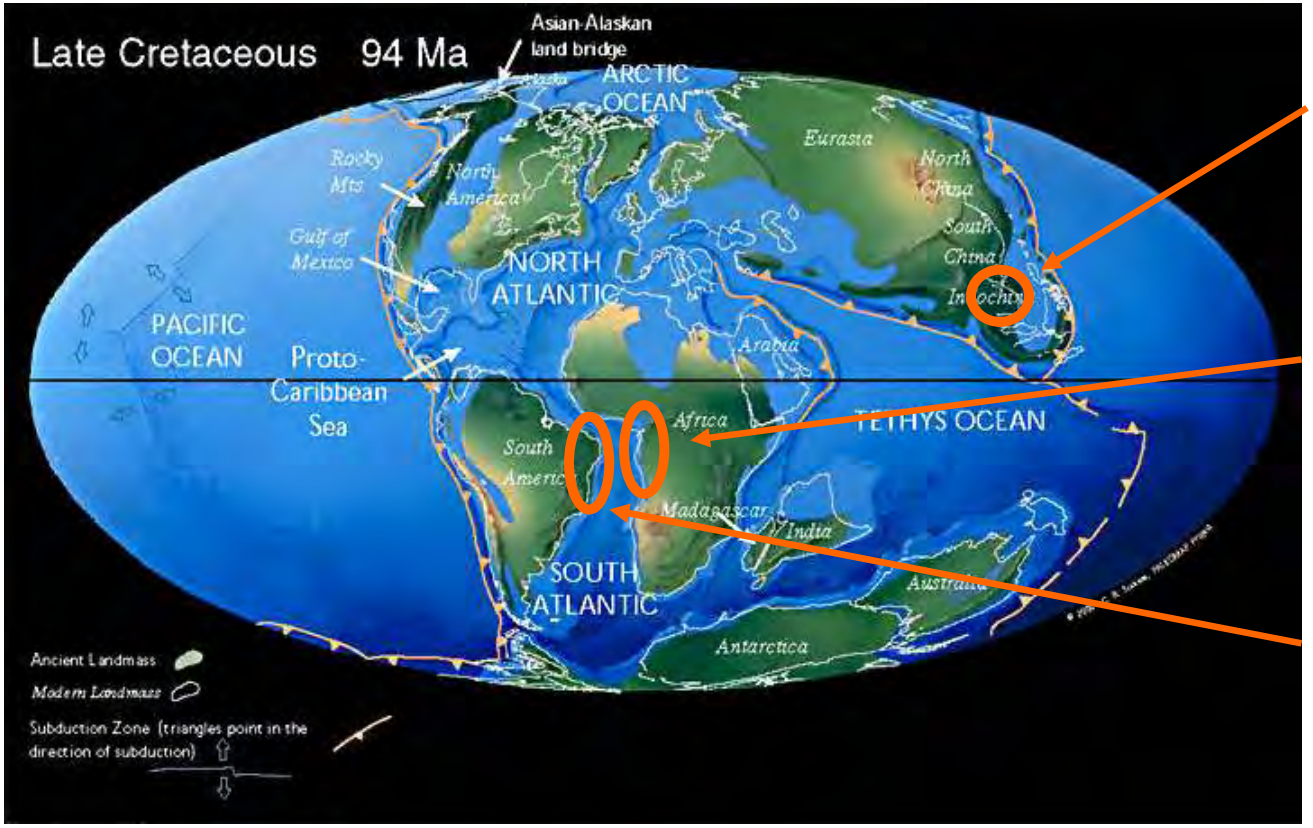
Thailand / Laos



Laos – Cretaceous Potash



Khorat (Thailand, Laos)

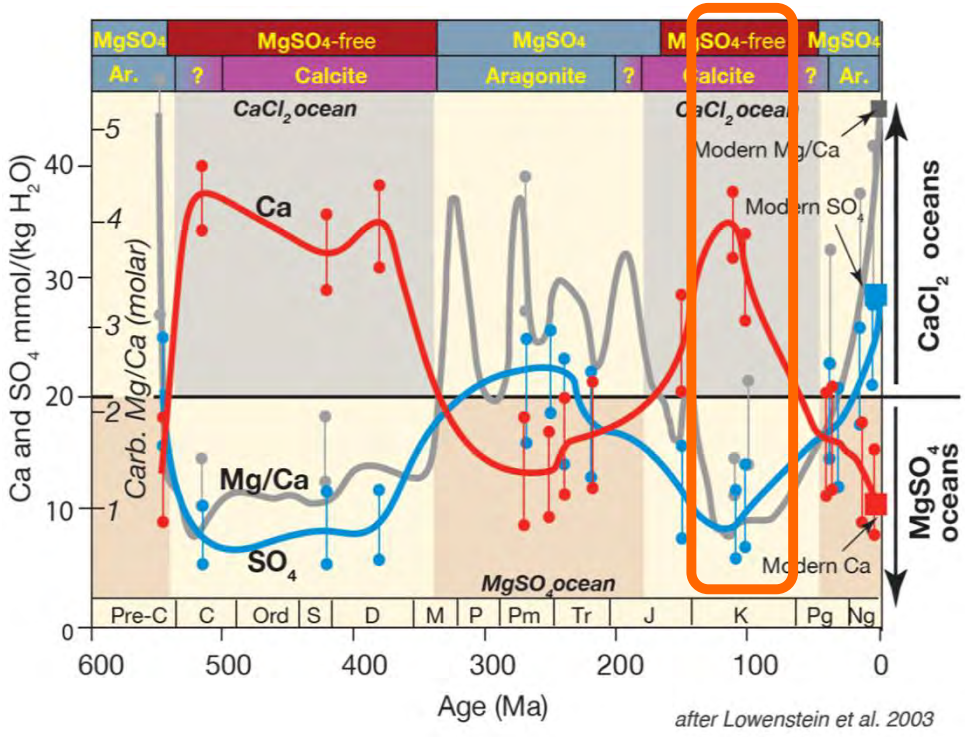
West Africa (Angola, ROC, Gabon)

Sergipe (Brazil)

after Scotese, 2002

Laos – Cretaceous Potash

- Ca oceans
- Low SO_4
- Low Mg/Ca
- Favours Tachyhydrite ($CaMg_2Cl_6.12H_2O$)

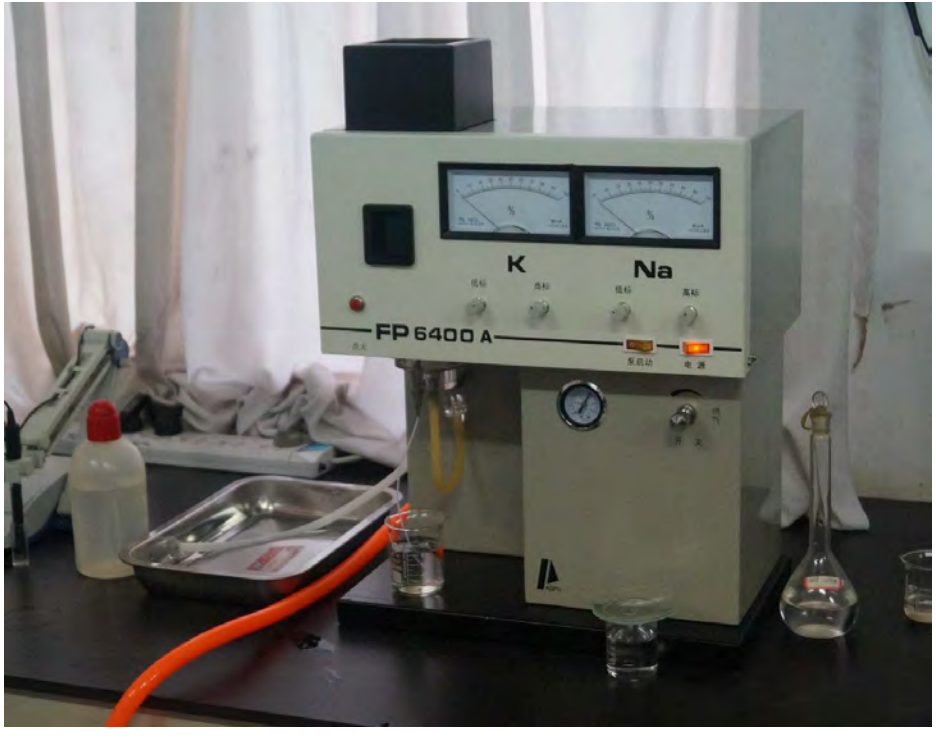


Laos

Laos – Friendship Bridge (1994)

Laos

Laos



Laos

Laos

Laos - Dong Tai – Sino Agri

Laos - Dong Tai – Sino Agri

Laos - Dong Tai – Sino Agri

Laos – Tha Ngon - Sino-Hydro

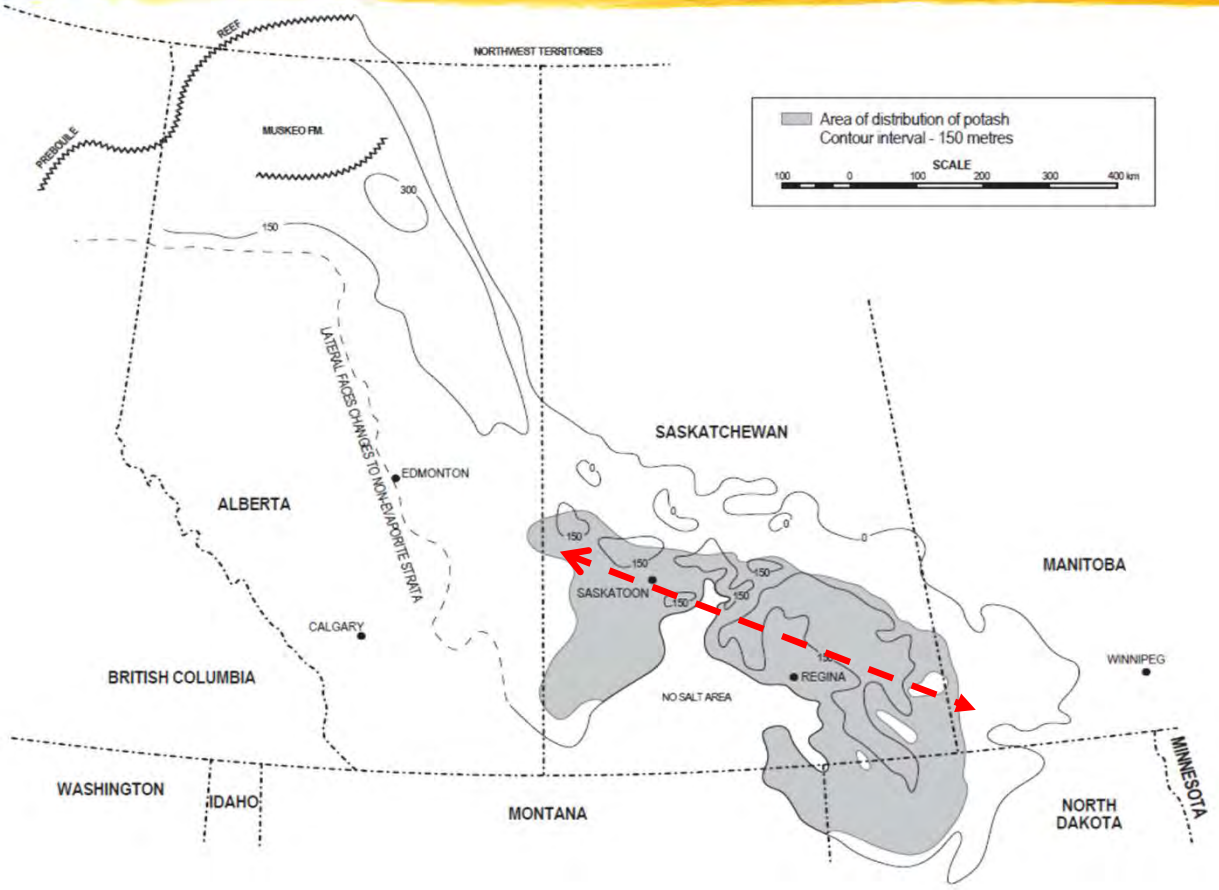
Laos – Tha Ngon - Sino-Hydro

Laos – Vientiane

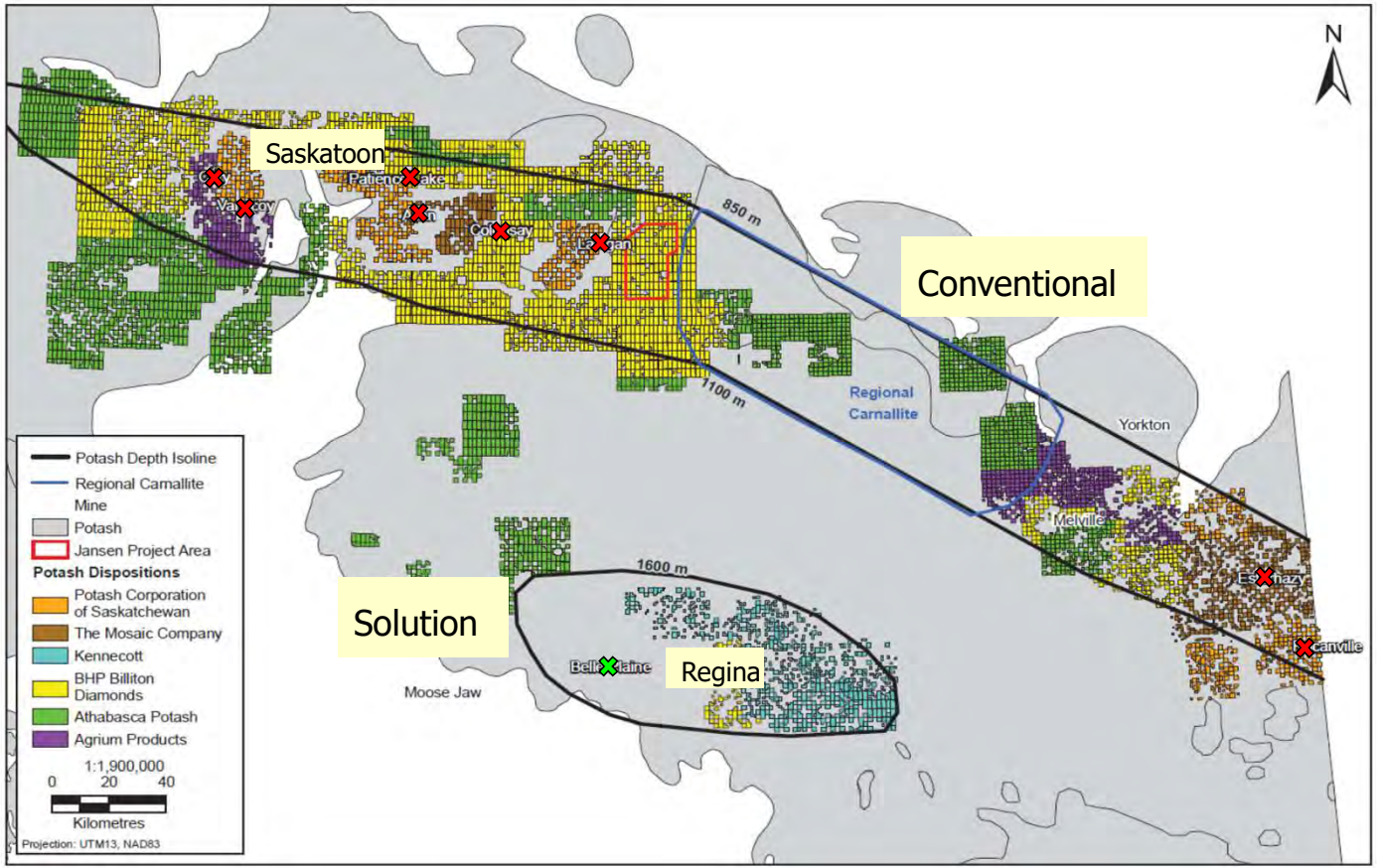
Laos – Vientiane

Elk Point Basin, Canada

Elk Point Basin – Potash Distribution



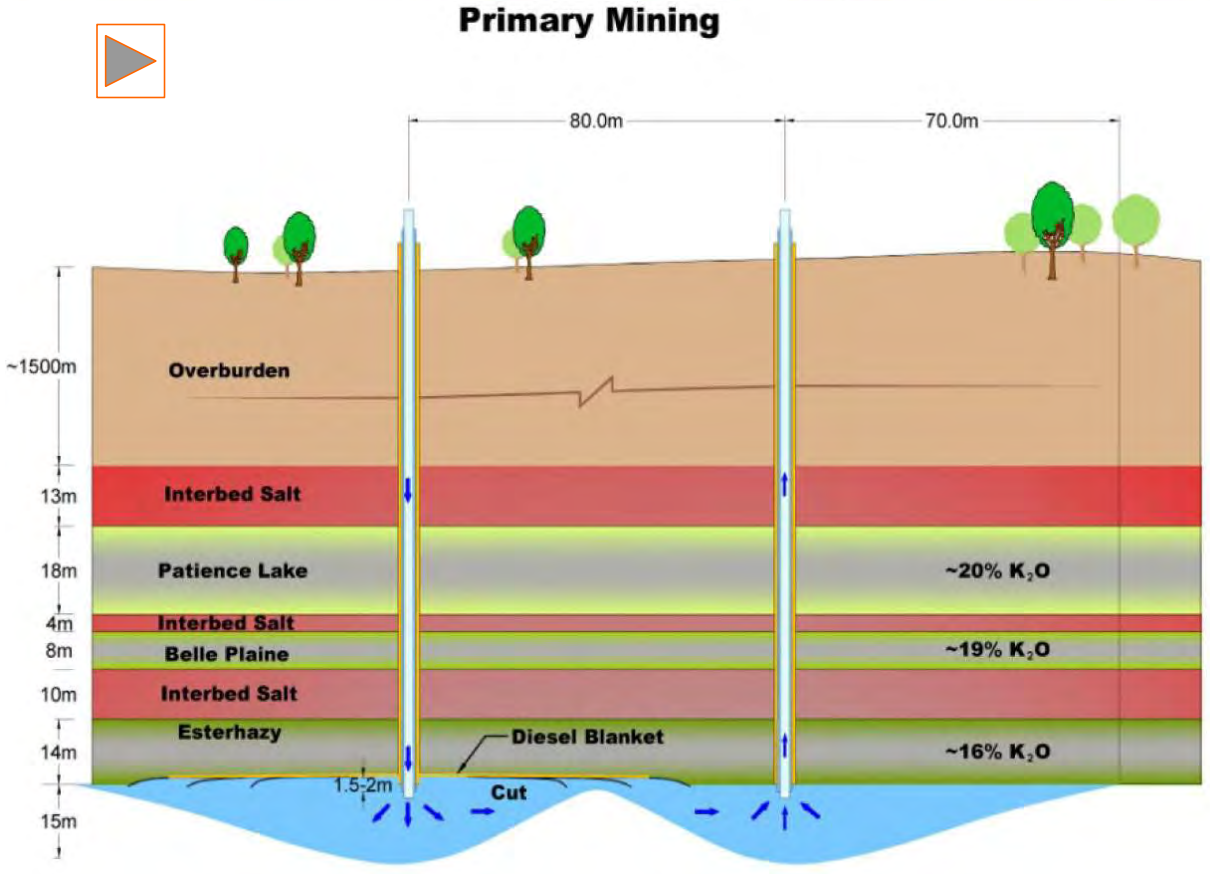
Southern Saskatchewan Potash Mines & Depth to Potash



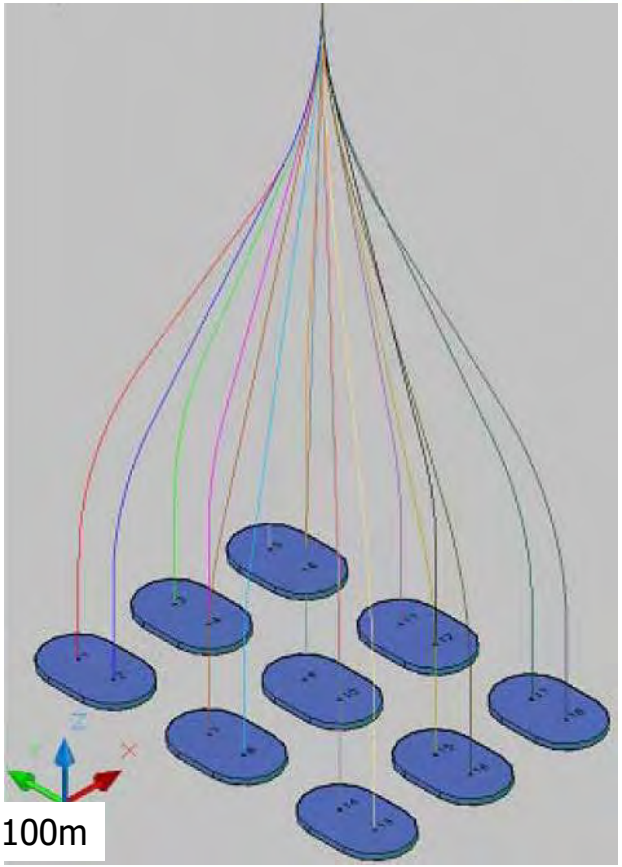
Solution Mining

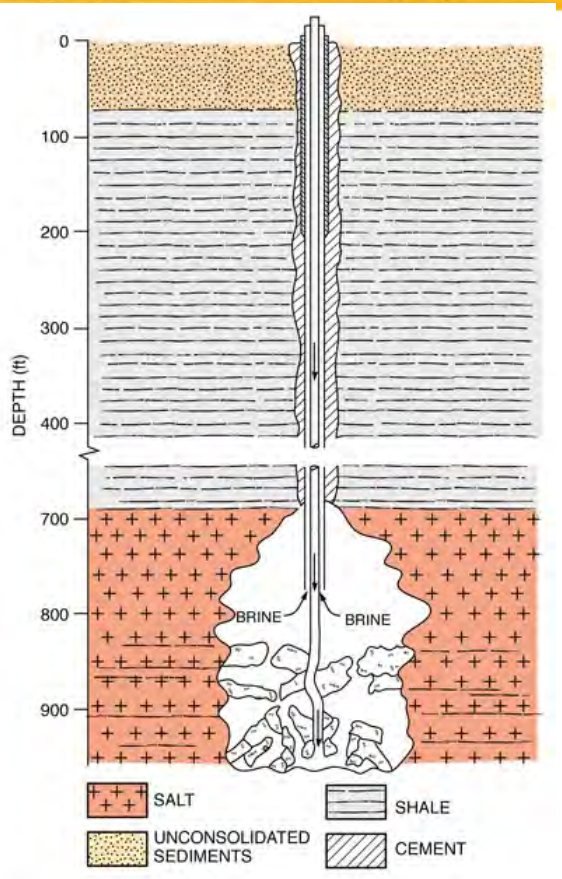
- Steam or Hot water injected
- Salt saturate inc. Potash recovery
- Single well (concentric casing)
- 150-1500m deep (Barradeel, NL : 2800m)
- One well - 100,000 tonnes
- Major cost
  - Evaporation Ponds
    - plastic liner
  - Drying Kilns - Canada
- Production
  - Sol : 4.5Mt, Belle Plaine, SK (Mosaic)
  - Con : 3.0Mt, Colonsay, SK (Mosaic)

Solution Mining

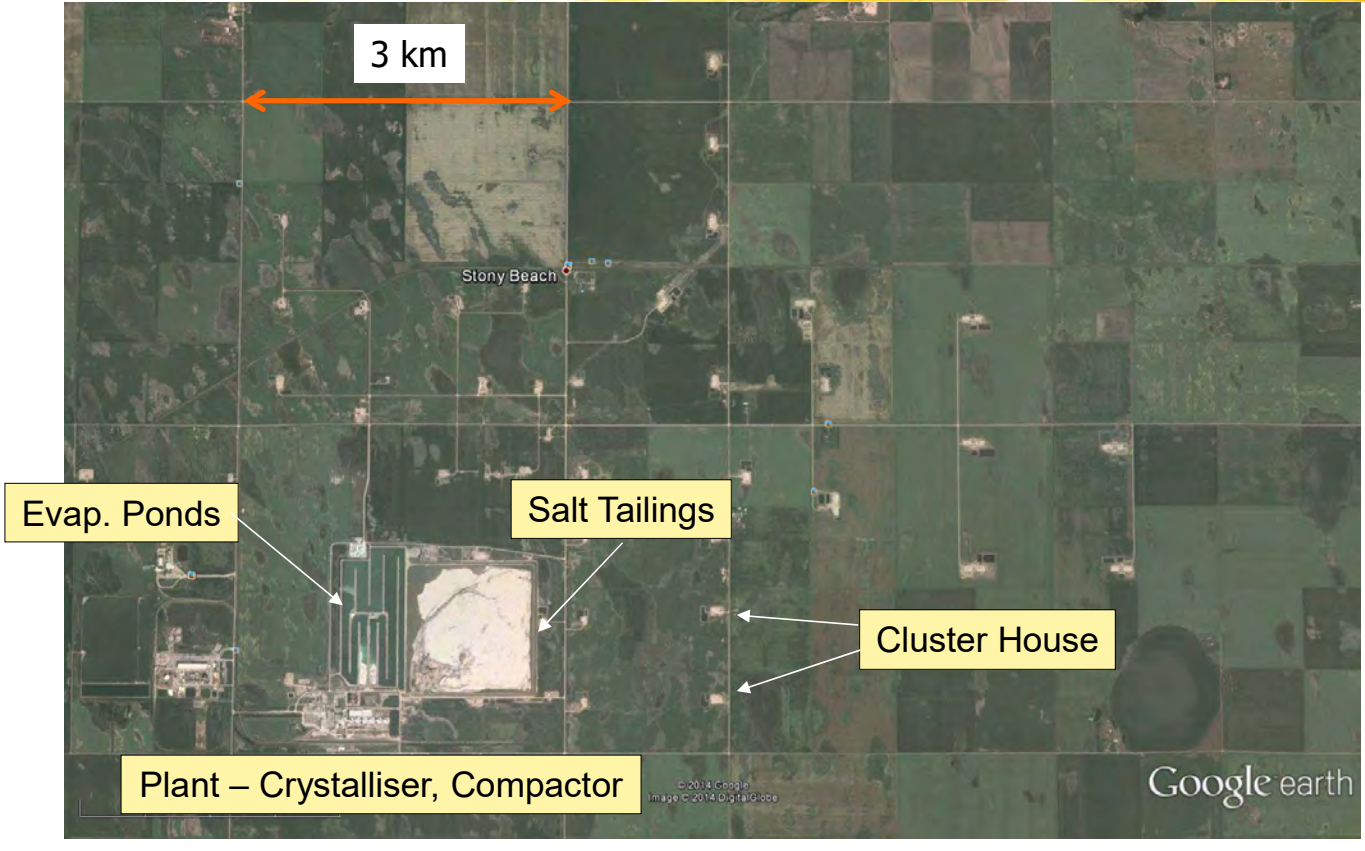


Solution Mining





Belle Plain - Mosaic

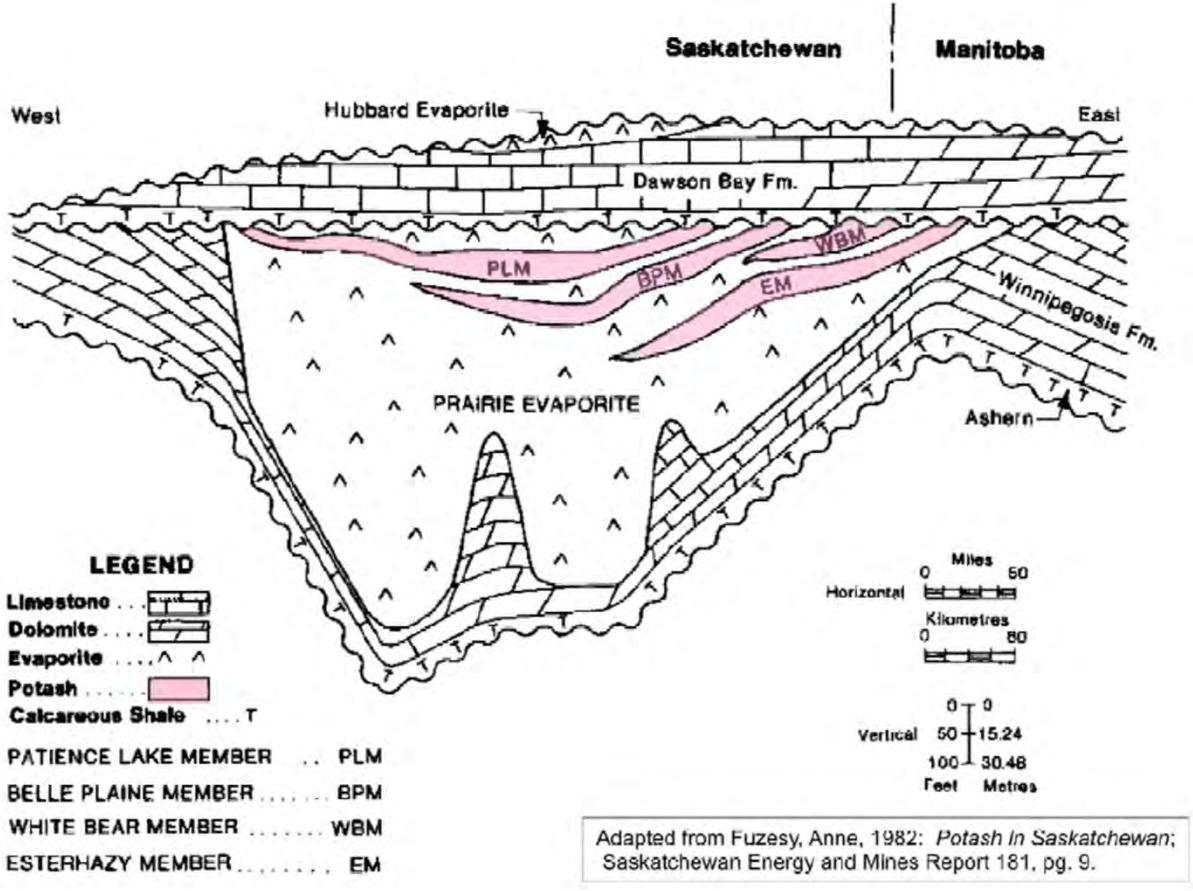


Belle Plain Potash

Belle Plain Potash

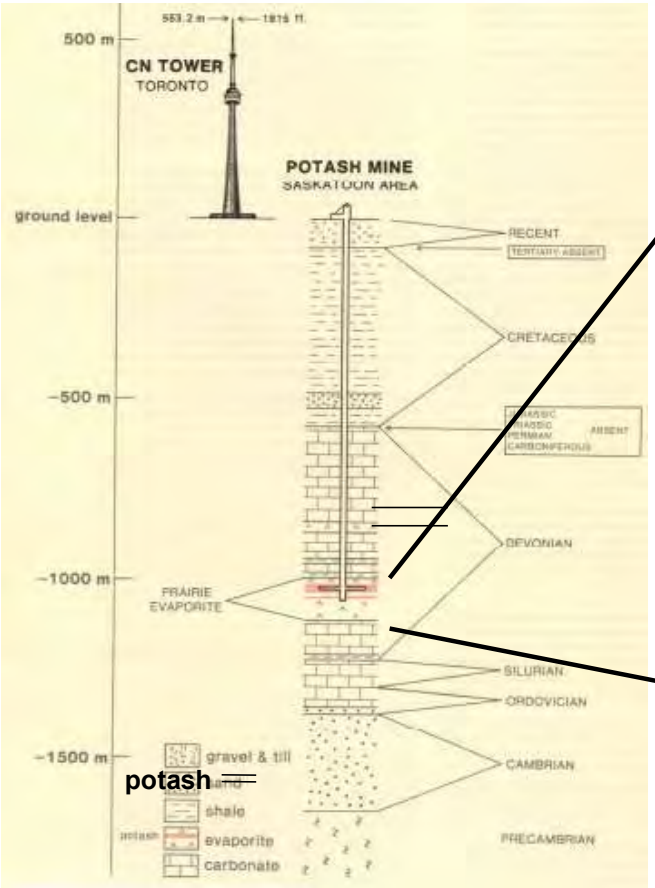
Elk Point Basin

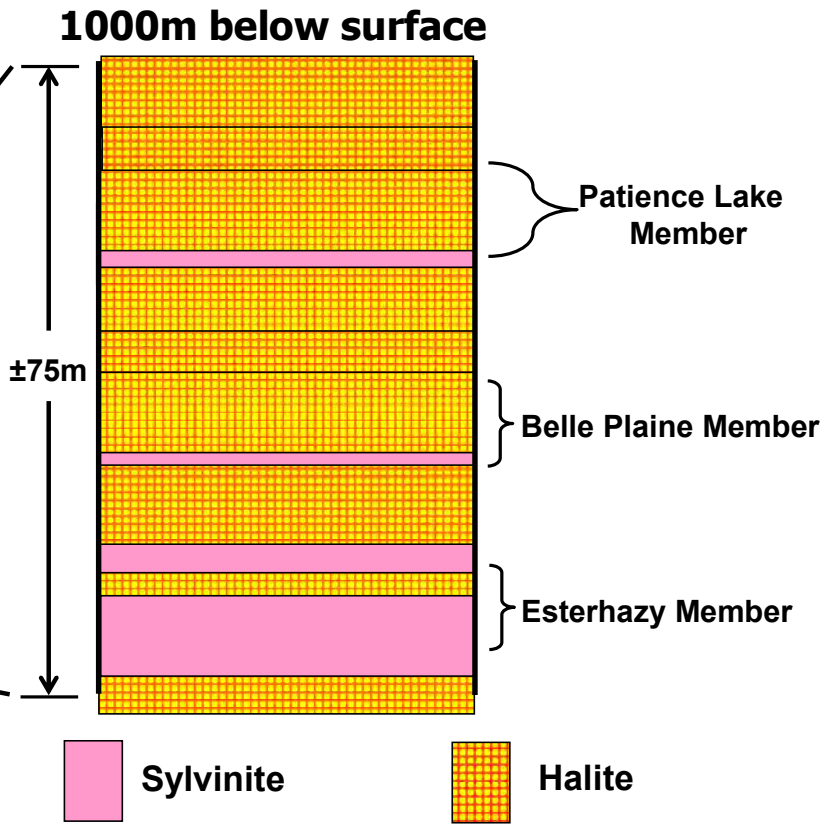
- Geology
  - Winnipegosis - dolomite
  - Mid Dev – Prairie Evaporite
    - Lower Ha-An
    - Three main potash bearing units
      - PLM, BPM, EM (max +30m)
  - Second Red Bed
    - Shales – dolomitic; R G A



Adapted from Fuzesy, Anne, 1982: *Potash in Saskatchewan*; Saskatchewan Energy and Mines Report 181, pg. 9.

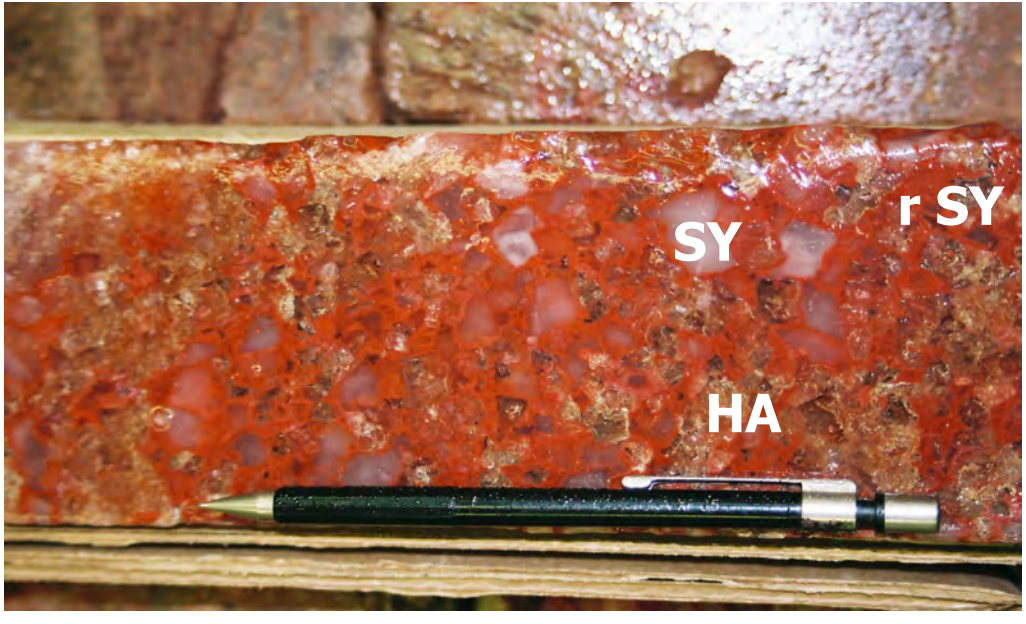
Prairie Evaporite

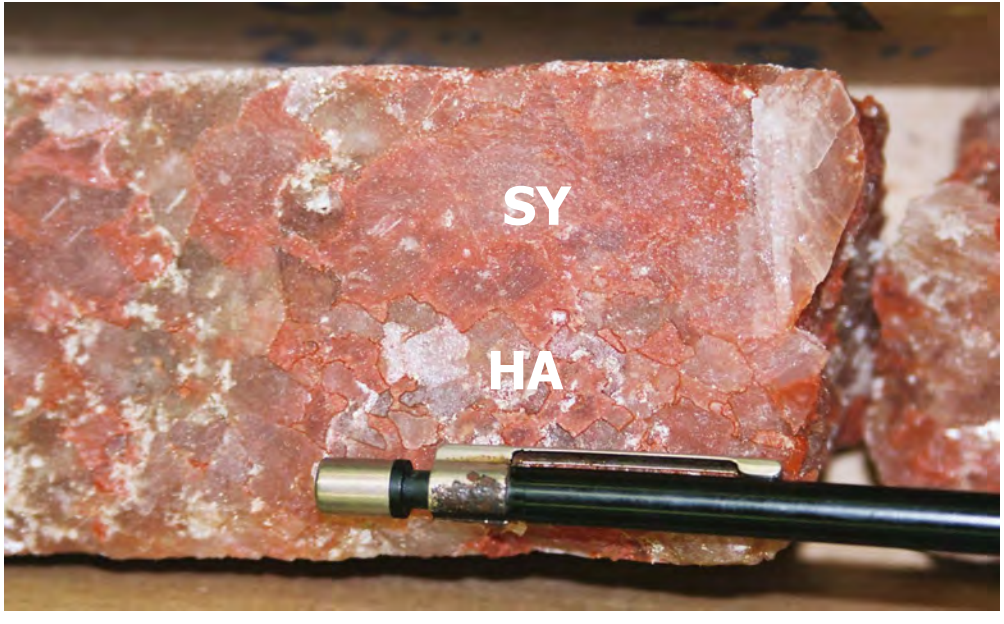




Regina, Saskatchewan

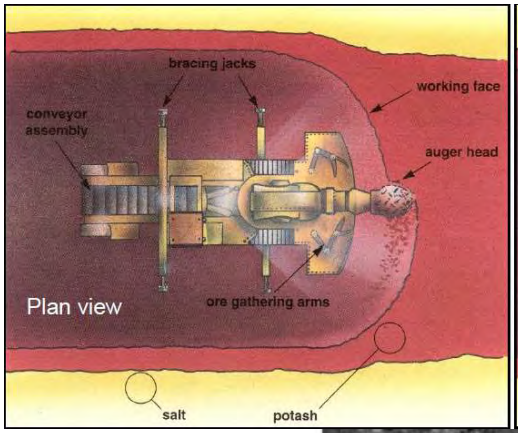
PLM & BPM - Lanigan

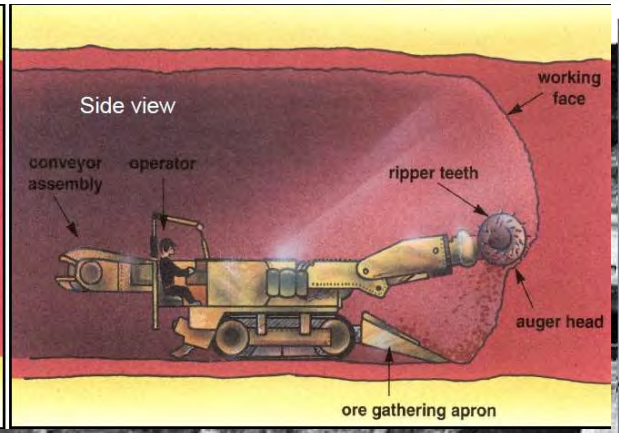


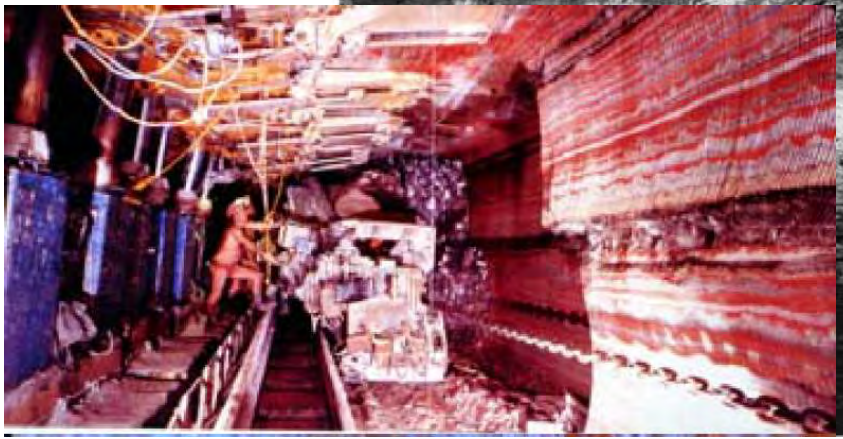


Anhydrite marker - ↓BPM

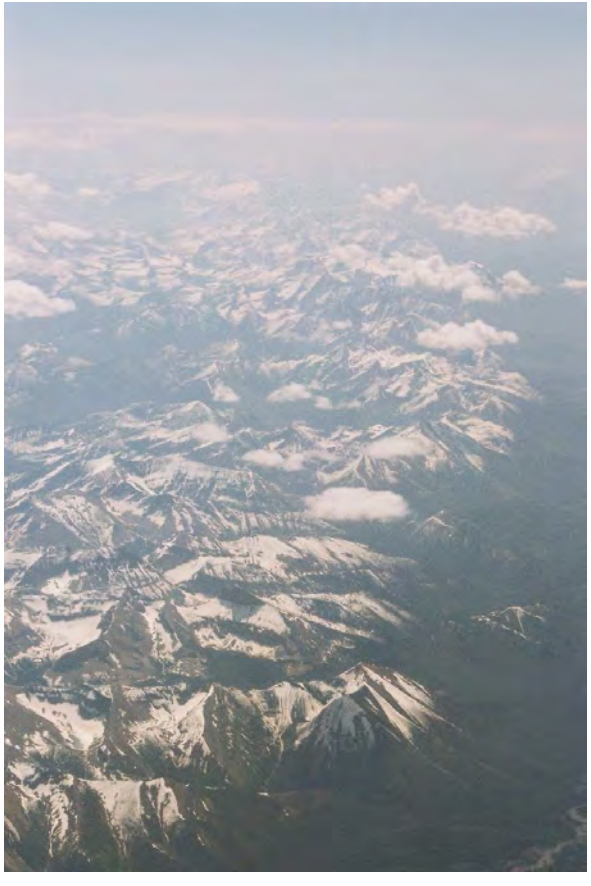
Conventional Mining







Adieu Canada



Sampling

IMEx Consulting
692 followers
1mo •

Is it time to move on from minus 80 mesh?

IMEx Consulting
692 followers
2w •

Orientation Sampling – a waste of time & money?