# Mt Peake Project

## Multi-element Lithogeochemical Assessment of drill hole data

*__DISCLAIMER__: The conclusions and recommendations expressed in this material represent the opinions of the author based on the data available. The opinions and recommendations provided from this information are in response to a request from the client and no liability is accepted for commercial decisions or actions resulting from them.*
*__DISCLOSURE__ : The author holds no shares directly or indirectly in TNG*

# summary

High Fe Tholeiitic Basalt similar to a MORB with little or No Ni prospectively and probably located in a rift setting

# Overview of magmatic sulfide deposits

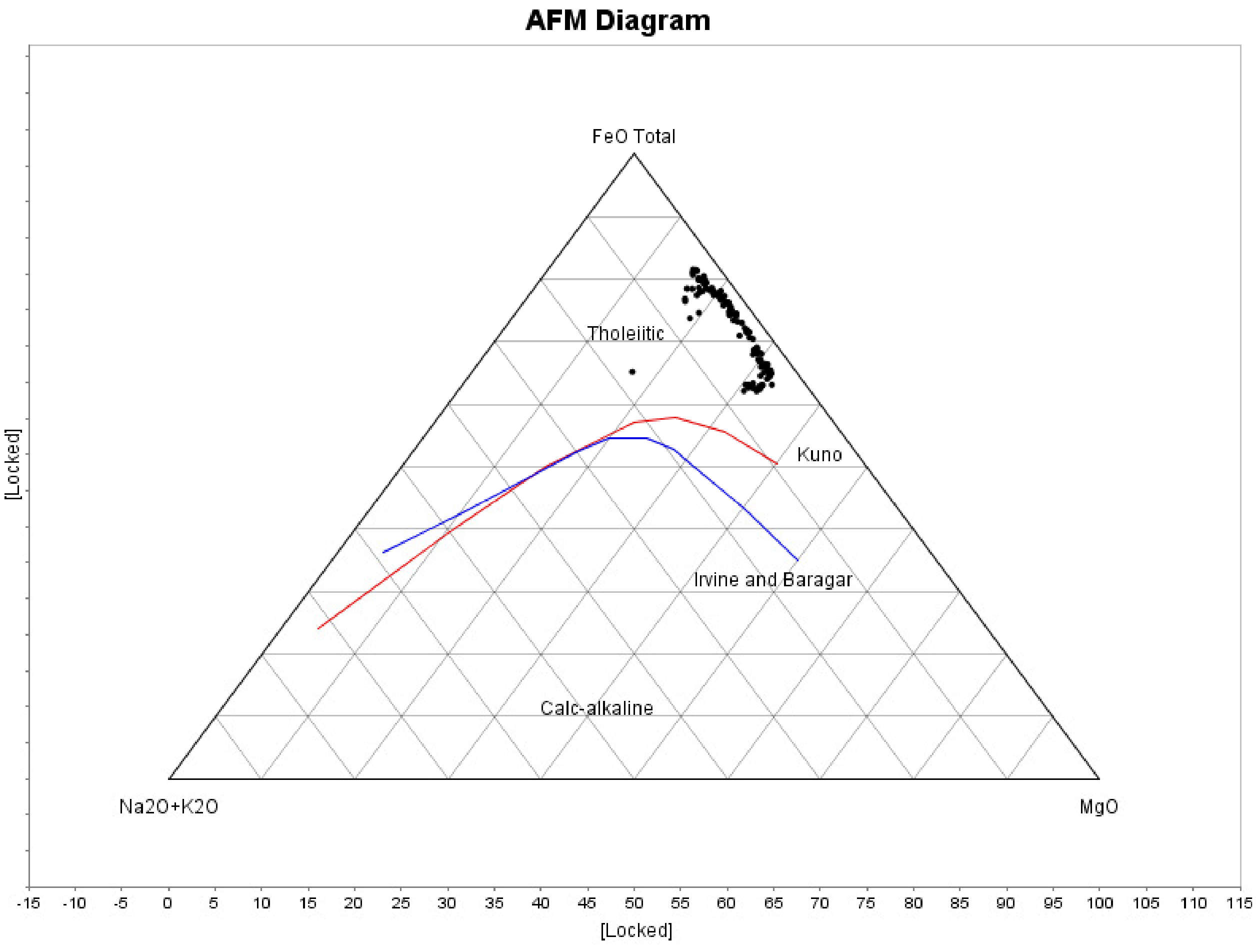
- Magmatic Ni sulfide systems include high-value ore deposits that are economically attractive exploration targets. In addition to nickel, many deposits contain significant concentrations of copper, cobalt, gold and the platinum group elements.
  - Examples include Kambalda, Noril'sk - Talnakh, Sudbury, Voisey's Bay, Jinchuan, Duluth Complex, Insizwa Complex, Pechenga, Raglan, Kabanga and Thompson.
- Economic mineralisation is generally localised within active flows and subvolcanic conduits. The associated initial melts range in composition from basalt to komatiite.
  - Details of the main deposits including grade/tonnage figures are included in **Table 1**.

# World Class Ni Deposits

| Deposit | Age | Resource Estimate | Main Host Rock Compositions |
|---|---|---|---|
| **Noril'sk** | Permo-Triassic | >555 Mt (prob ~1000 Mt) @ 2.7% Ni, 3.9% Cu, 3 ppm Pt, 12 ppm Pd (Lightfoot and Hawkesworth, 1997) | Gabbro, olivine gabbro, picritic gabbro, dolerite, picrite, troctolite, pyroxenite (+ vertical systematic chemical variations) |
| **Sudbury** | Proterozoic (1.85 Ga) | >1548 Mt @ 1.2% Ni, 1.0% Cu, 0.4 ppm Pt, 0.4 ppm Pd (Lightfoot et al. 1997). | Norite, gabbro, complex breccias, granophyre |
| **Voiseys Bay** | Proterozoic (1.3 Ga) | 136.7 Mt @ 1.59% Ni, + Cu, +Co credits (Naldrett and Li, 2000 ). | Troctolite |
| **Jinchuan** | Mid Proterozoic (1.5 Ga) | >500 Mt @ 1.2% Ni and 0.7% Cu (Barnes and Tang, 1999). | Dunite, Lherzolite and Olivine pyroxenite |
| **Duluth** | Mid Proterozoic (1.1 Ga) | Dunka Road – 1450 Mt @ 0.397% Cu, 0.094% Ni, 445 ppb Pd, 118 ppb Pt, and 61 ppb Au (Theriault et al., 1996). | Norite, troctolite, leucotroctolite, olivine gabbro |
| **Pechenga** | Early Proterozoic (2.0 Ga) | > 650 Mt @ 0.9% Ni and 0.3% Cu | Gabbro to wehrlite, ferropicrite |

# Mt Peake tectonic setting

- Geochemistry may provide some evidence of a “favourable” setting (e.g. intracontinental tholeiitic flood basalt rift setting), however in isolation the results may be ambiguous.
- Mt Peake - Tholeiitic



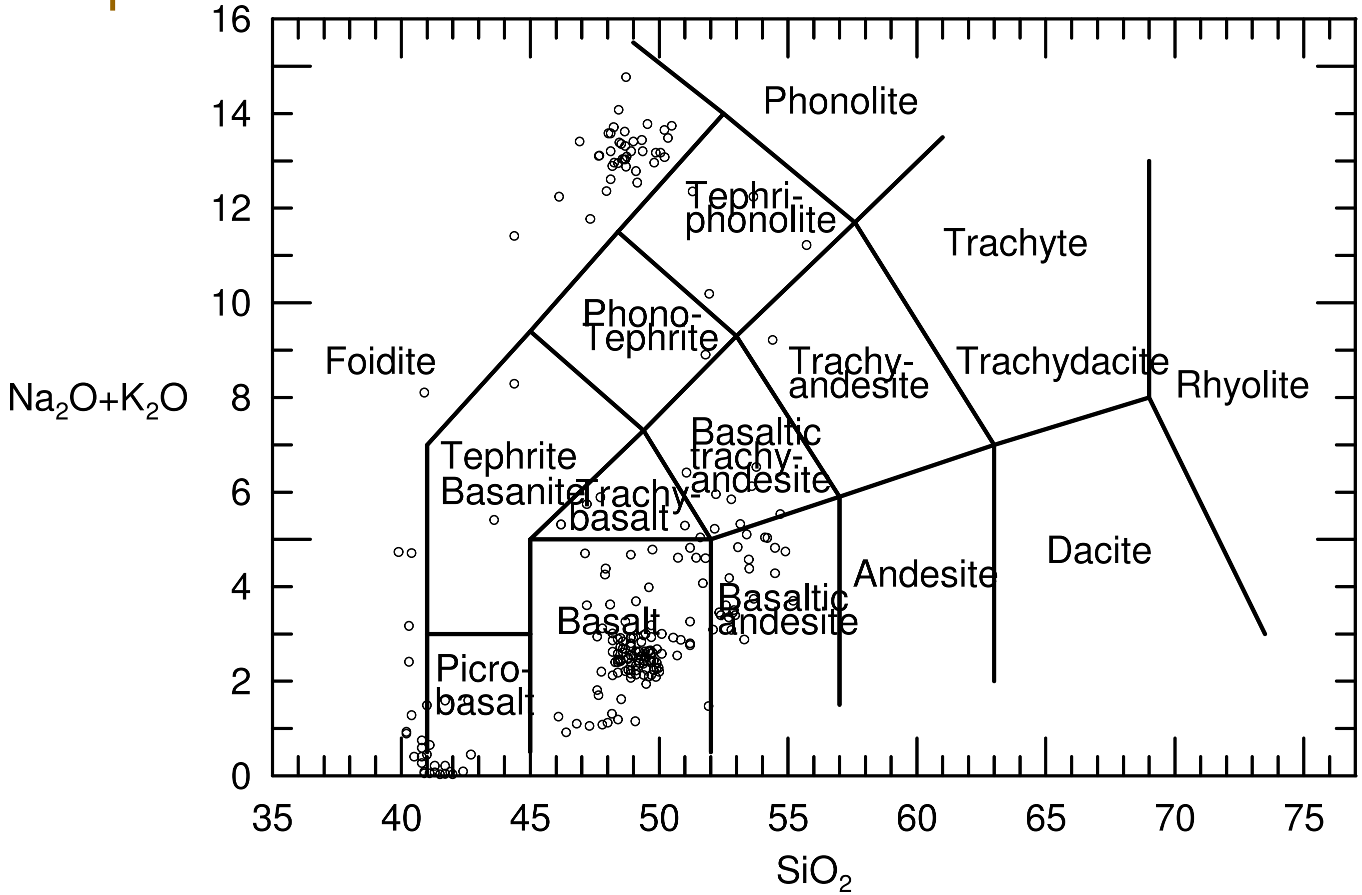
# Tectonic setting

- Magmatic Ni sulfide deposits can form in a range of tectonic settings (Naldrett, 1989, 1997). Most of the larger deposits have formed where mantle plume derived melts intersect large faults, continental rift zones or rifted continental margins (e.g. Lesher, 1997; Barnes et al., 1997).
- The interaction of a mantle plume with a rift or deep intracontinental fault zone allows rapid transport of the magma into the crust.  The rift setting may also provide sulfur-bearing country rocks, and if assimilated into the magma, this may help trigger sulfide saturation
- The use of whole rock geochemical data to determine tectonic setting is a controversial topic.
  - The work was pioneered by Pearce and Cann (1971; 1973), followed by a host of later workers including Floyd and Winchester (1975).
- Many of the published discrimination plots have overlapping fields and rarely produce unequivocal results with many limitations and results must be treated with caution.
- The elements commonly used as discriminants for tectonic setting are **Ti**, Zr, Y, Nb, Th, Hf, Ta, and **La**.
  - These elements are immobile under most conditions of hydrothermal alteration and up to moderate grades of metamorphism

# TAS (Total alkalie vs Silica)

- Simple & convenient starting point for the assessment of most common extrusive and equivalent intrusive igneous rocks

- The data shown in the diagram represent approximately 200 samples from the Siberian Flood Basalt Province.



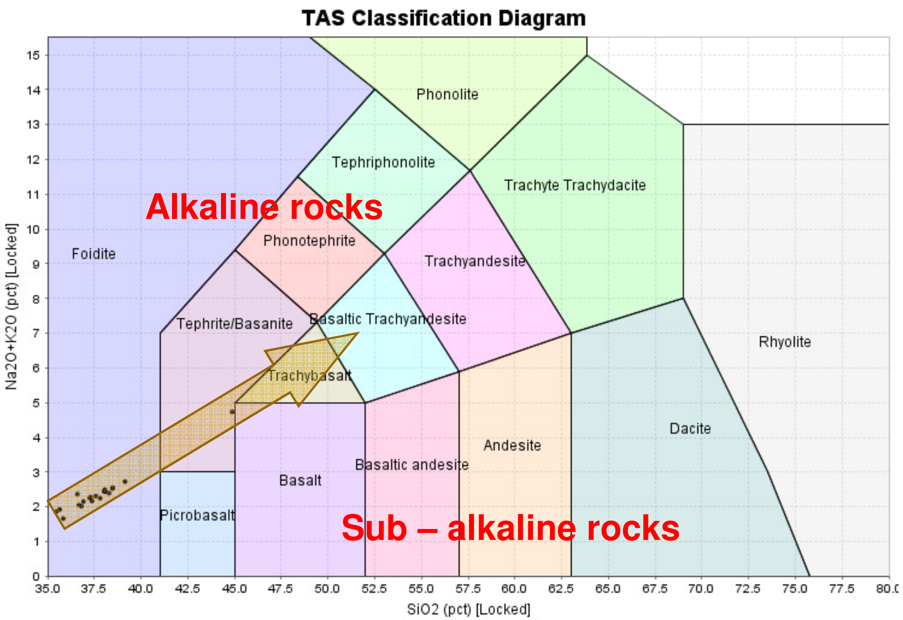
# TAS – Mt Peake

- In terms of data distribution,
  - movement up and near parallel to the Y – axis reflects decreasing degrees of partial melting.
  - movement diagonally across the diagram may reflect simple fractionation and or assimilation and concurrent fractional crystallisation.

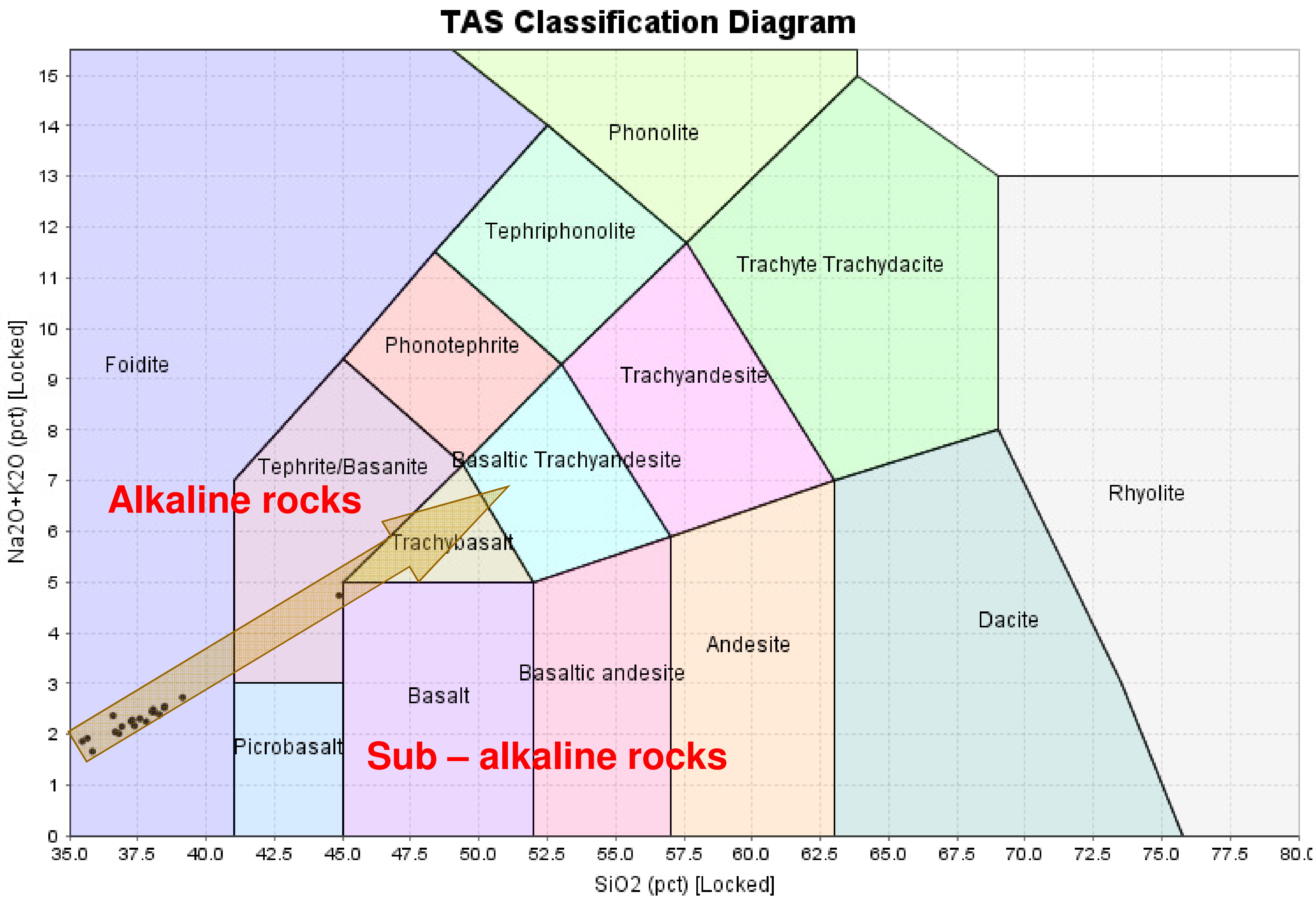
  - Sub – alkaline rocks plot in the regions labelled picrobasalt, basalt, basaltic – andesite and andesite.
  - Alkaline rocks plot in the regions labelled trachy – basalt and trachy – andesite, .

- **Mt Peake rocks are alkaline**

**NOTE** alkaline magmas are relatively cool and are low degree mantle melts. Low temperature melts of this type are likely to be characterised by moderate viscosity and are unable to assimilate significant volumes of crust.

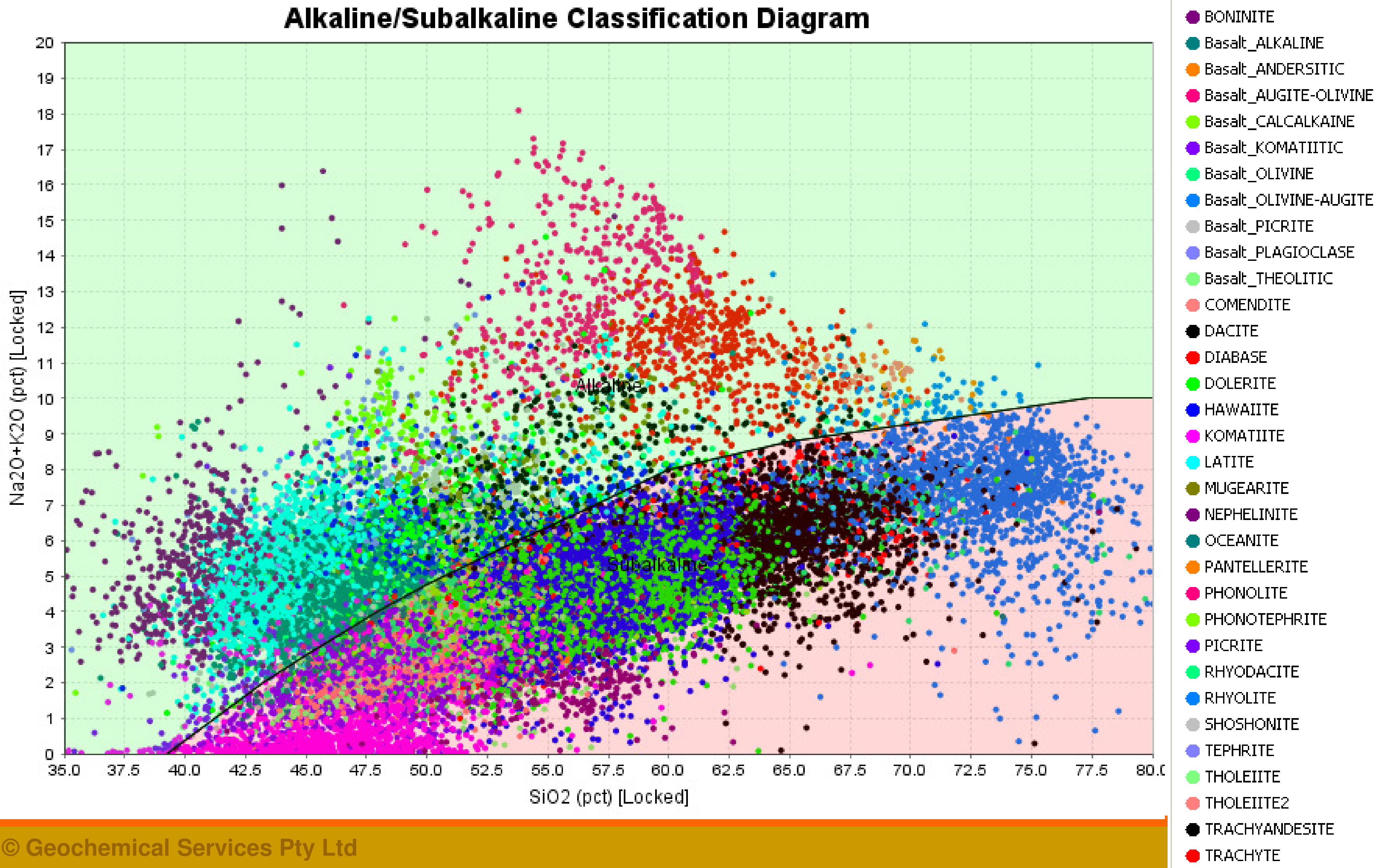


# TAS – Mt Peake

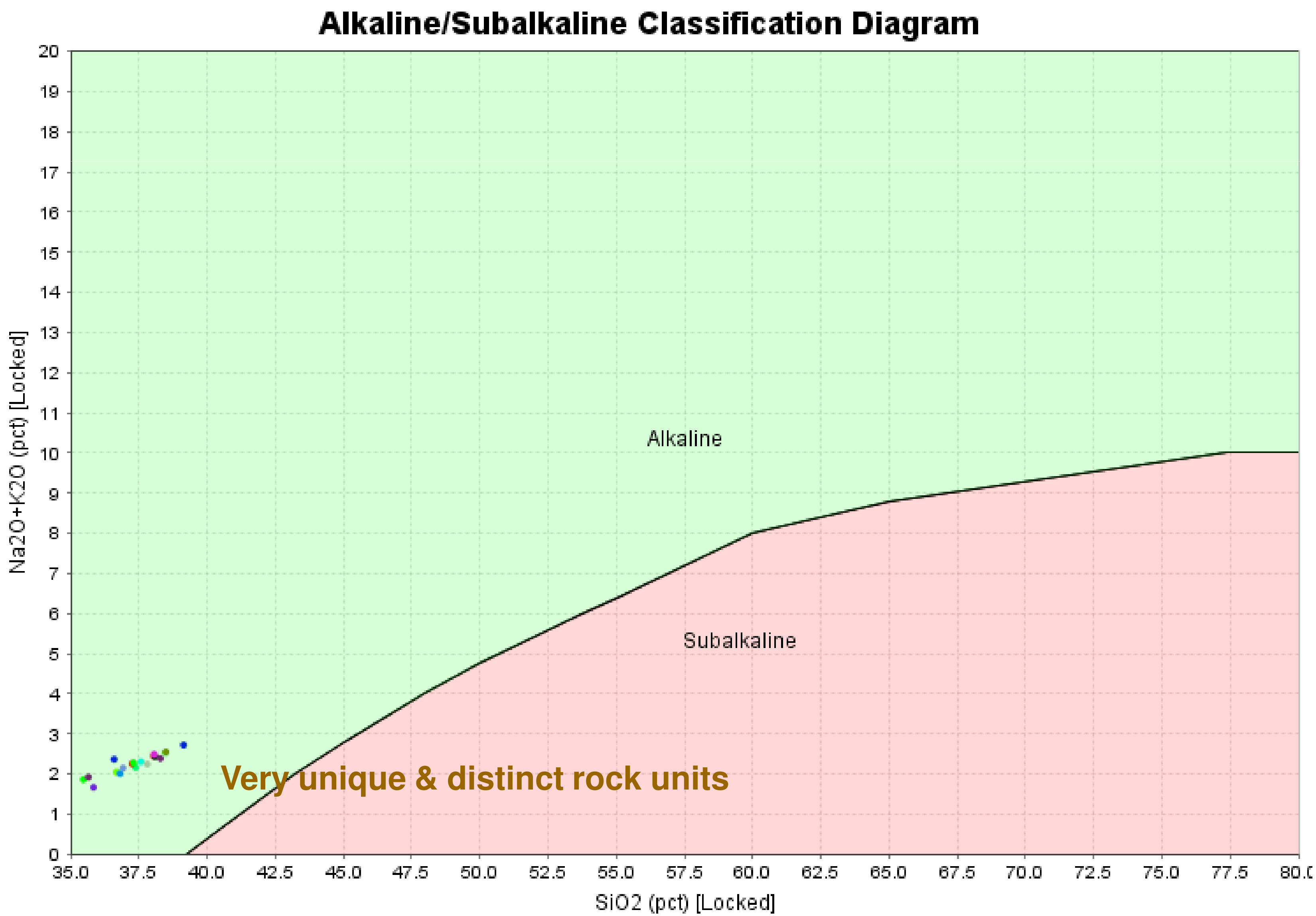



simple fractionation and or assimilation and concurrent fractional crystallisation

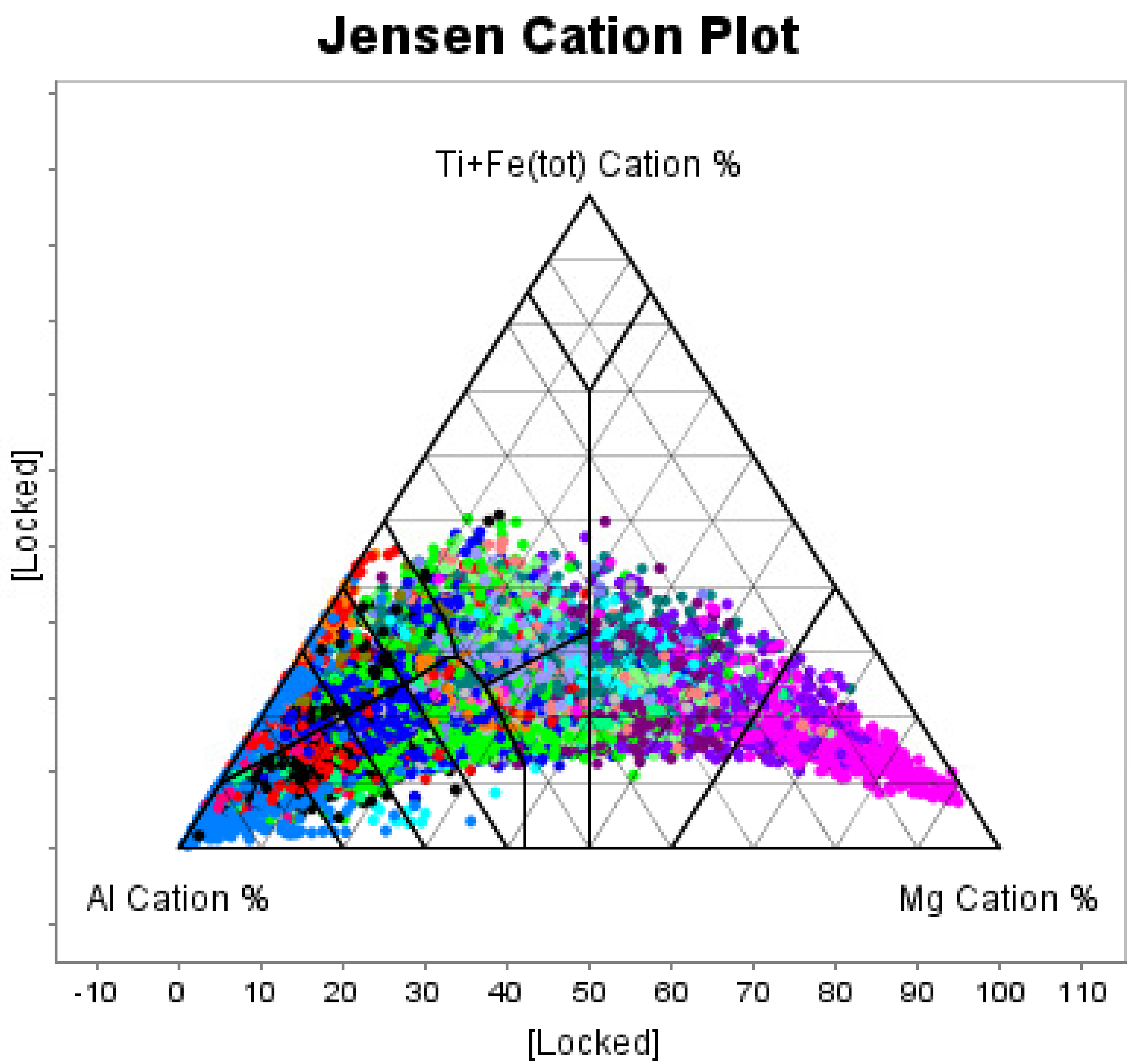
# Global trends of mafics



# Mt Peake (Alkaline)



# Global trends of mafic

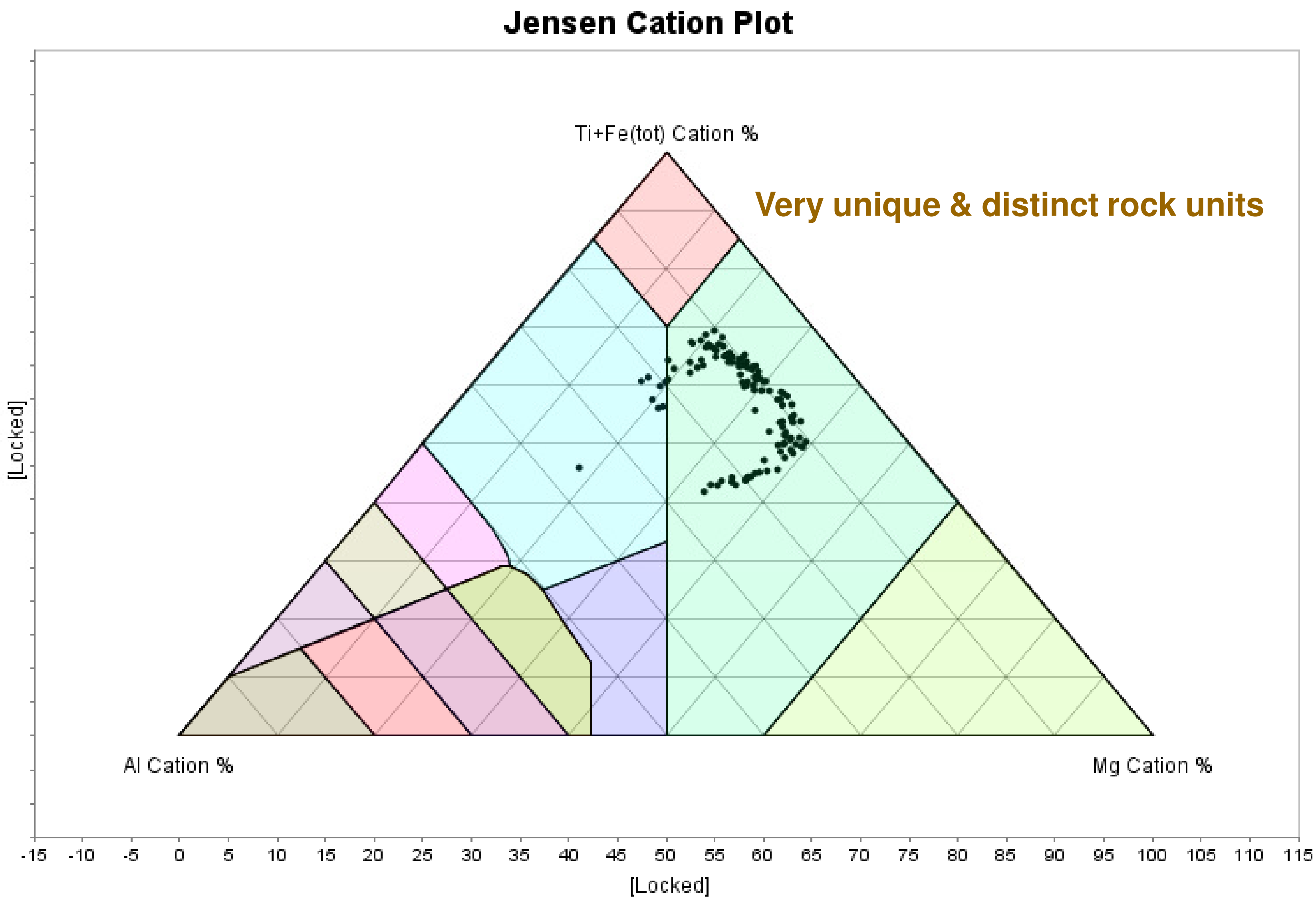




- Mafic – felsic rocks lie on a distinct and predictable trend as shown opposite

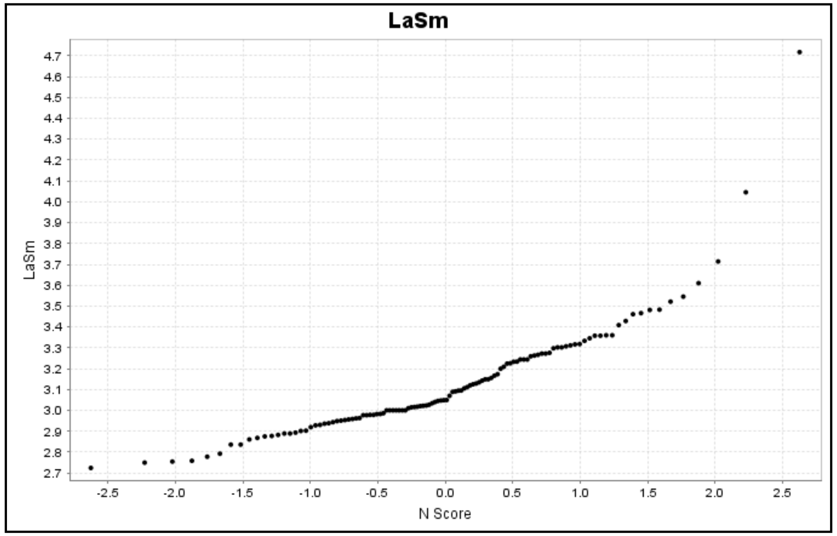
# Jensen – Mt Peak

Very unique & distinct rock units

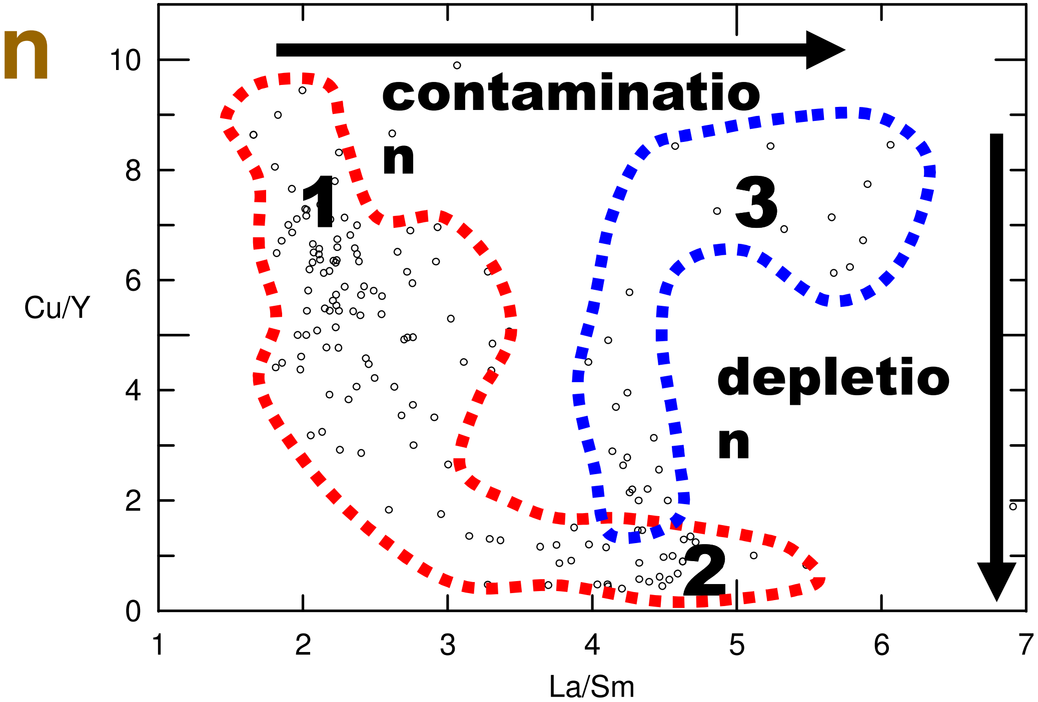


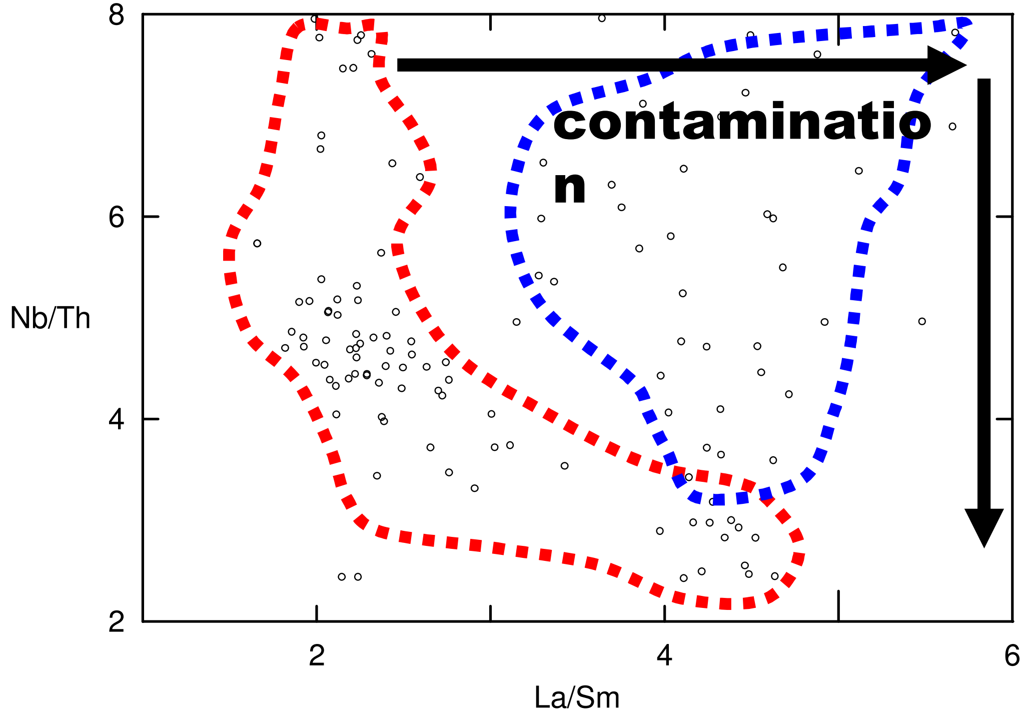
# Crustal contamination

- A number of research studies on magmatic Ni deposits indicate crustal contamination has occurred and is a critical process that contributes to the formation of Ni sulfide mineralisation




- Mt Peake – unable to assess due to lack  Y & Nb/Th data

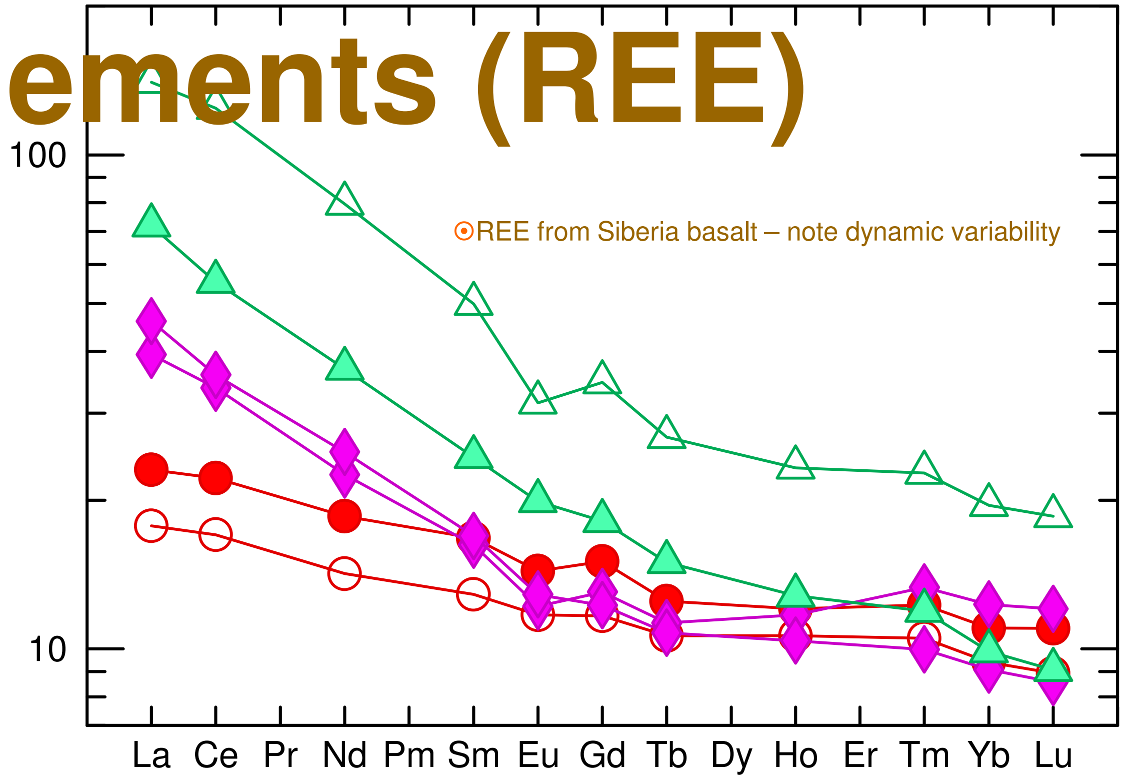


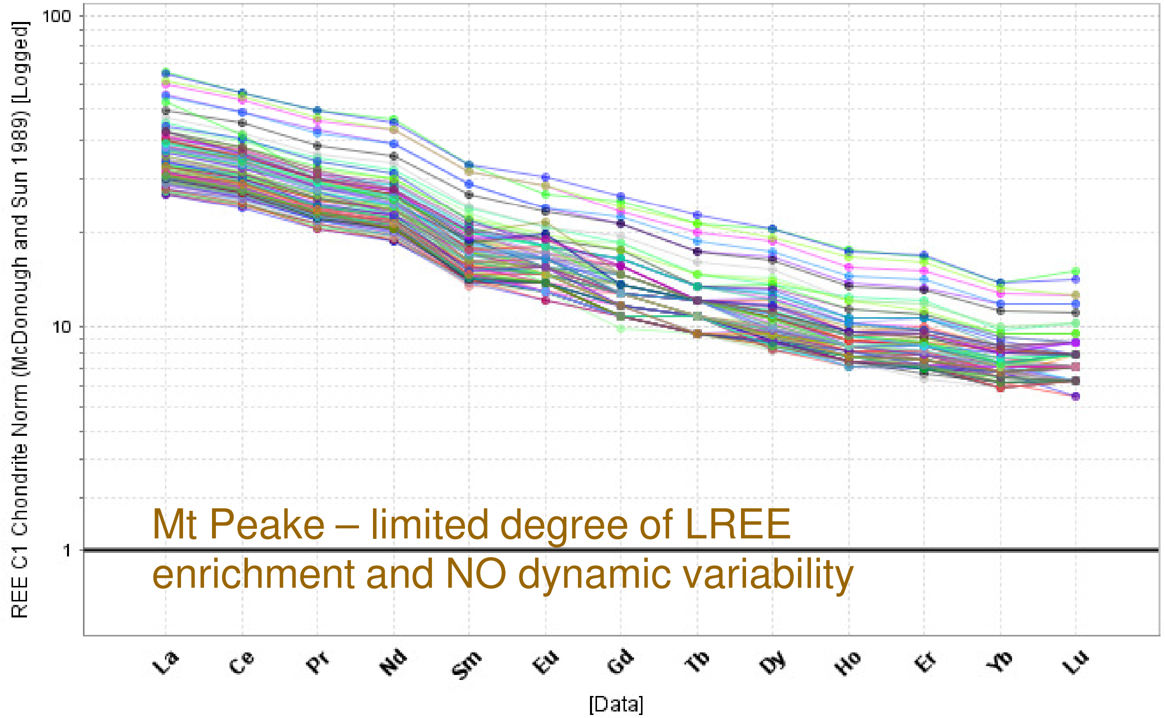



# Rare Earth Elements (REE)

- REE behave as a coherent group during mantle melting and crystal fractionation.
- LREE – source of melt
  - Typically crustal rocks are <u>highly enriched</u> LREE,
  - Primitive melts derived from the ‘depleted mantle’ are depleted in the LREE.
  - These differences in relative enrichment may be expressed by the La/Sm ratio e.g.
    - upper crust ~ 7
    - primitive melts ~ 1.
    - Mt Peake ~ 3

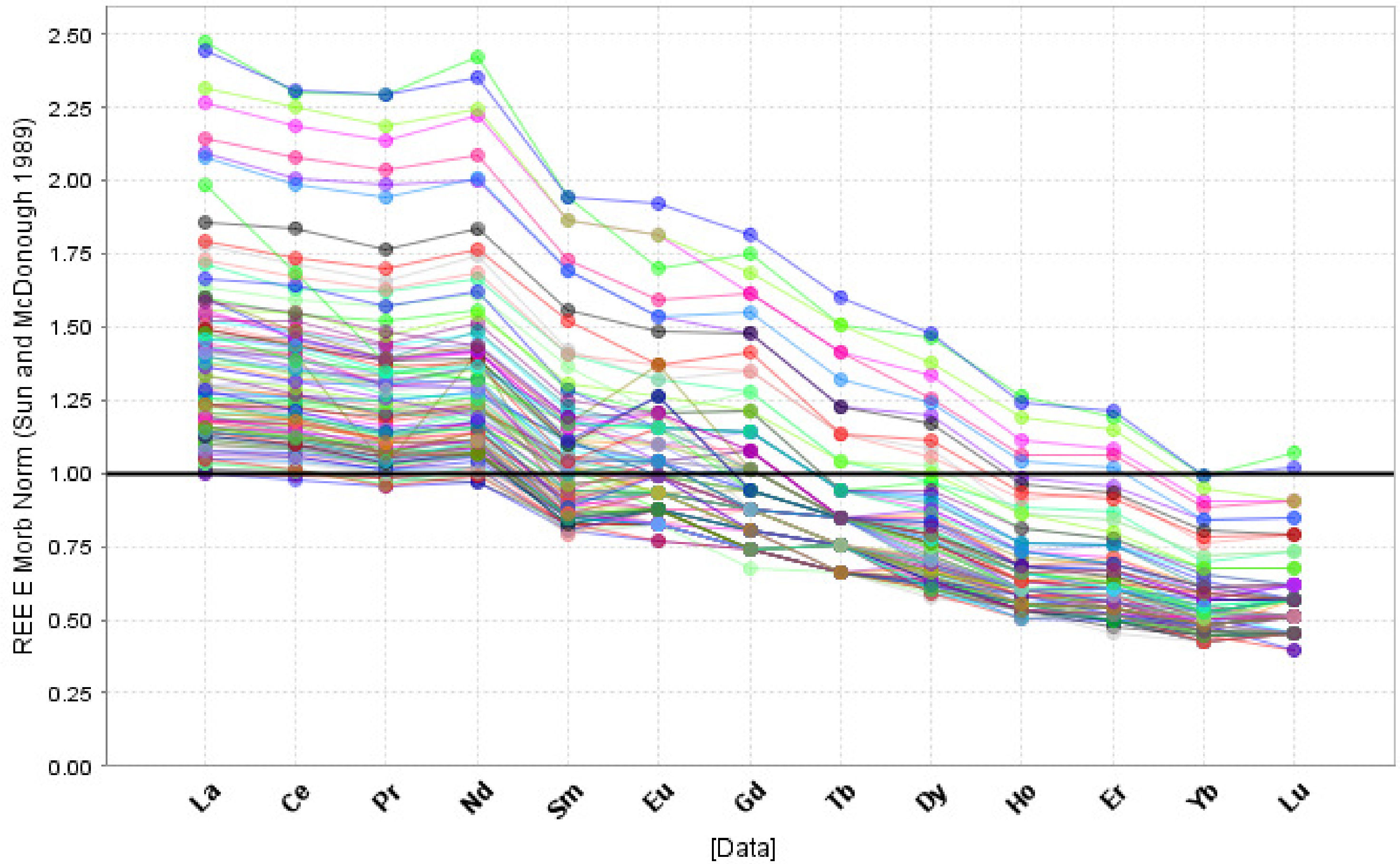
Rock/Chondrites Nickel Diagrams. REE. Evensen et al 1978



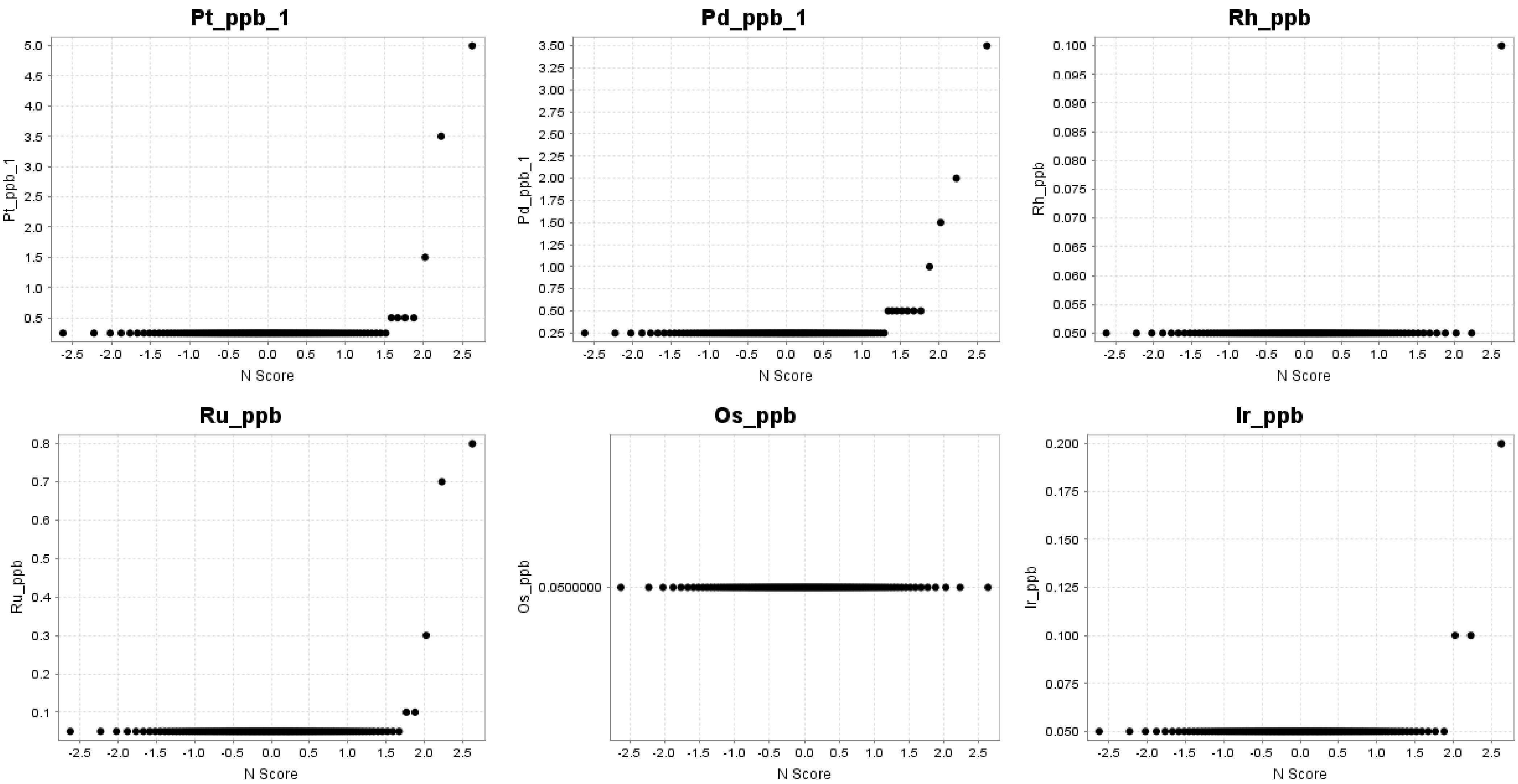
# Mt Peake REE's

- Mt Peak REE's have a MORB signature



# Mt Peake - PGEs

- At or below dl



# Mt Peake - summary

- The Mt Peake data made available for assessment shows NO indication of Ni fertility or prospectively for Ni sulphide mineralisation.
  - The lithologies are alkaline in nature (cool)
  - The lithologies have a very distinct geochemical signature are probably not related to any tectonic setting favorable for Ni$
  - The REE show NO variation (i.e. very uniform lithology)

  - High Fe Tholeiitic Basalt similar to a MORB
    - Probably located in a rift setting