RARE-ELEMENT PEGMATITES

Introduction

Rare-element pegmatites are important hosts for Li, Cs, and Ta mineralization in Western Australia, with examples including the Greenbushes, Pilgangoora, and Wodgina deposits.

- This poster provides a mineral systems analysis for rare-element pegmatites
- Rare-element pegmatites are a new addition to the GSWA Mineral Systems Atlas

What are rare-element pegmatites?

- The simplest classification scheme divides granitic pegmatites into common pegmatites and rare-element pegmatites
- Rare-element pegmatites have anomalous contents of Be, Li, Ta, Sn, and Cs
- They are further divided into:
  - Lithium–Cesium–Tantalum (LCT) pegmatites
  - Niobium–Yttrium–Fluorine (NYF) pegmatites

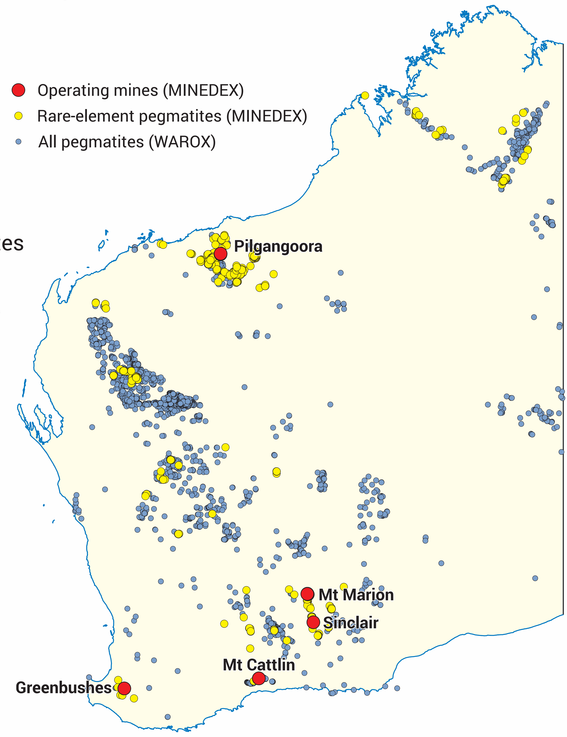

Figure 1. Pegmatites and operating mines

Pegmatites in Western Australia

- Pegmatite occurrences in the WAROX field observational database show their wide distribution and correspondence to greenstone belts (Fig. 1)
- Rare-element pegmatites represent <1% of all pegmatites

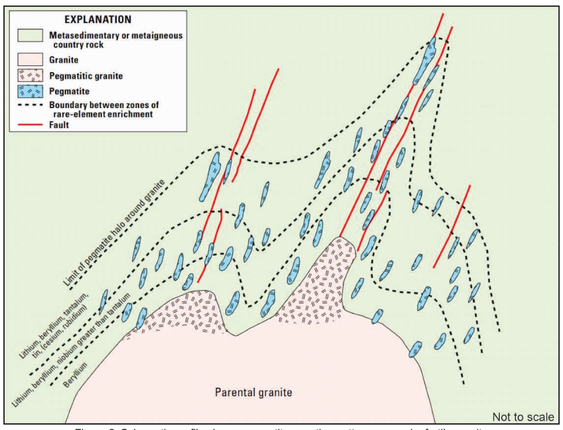

Figure 2. Schematic profile shows pegmatite zonation patterns around a fertile granite

Fertile granites (source)

- Fertile granitic magmas are a source of fluids and metals (Fig. 2)
- S-type granites that undergo extreme fractionation are enriched in Li, Cs, Ta, Rb, Sn, F, Be, Nb, Ga, Fe, Ti and REE (Fig. 3)
- Fertile granites are identified by the presence of fluorite, cordierite, tourmaline, garnet, white potassium feldspar and green muscovite

Magma pathways (structural architecture)

Pegmatites are opportunistic and use a variety of structural pathways, including faults, fractures, foliation or bedding planes in country rocks

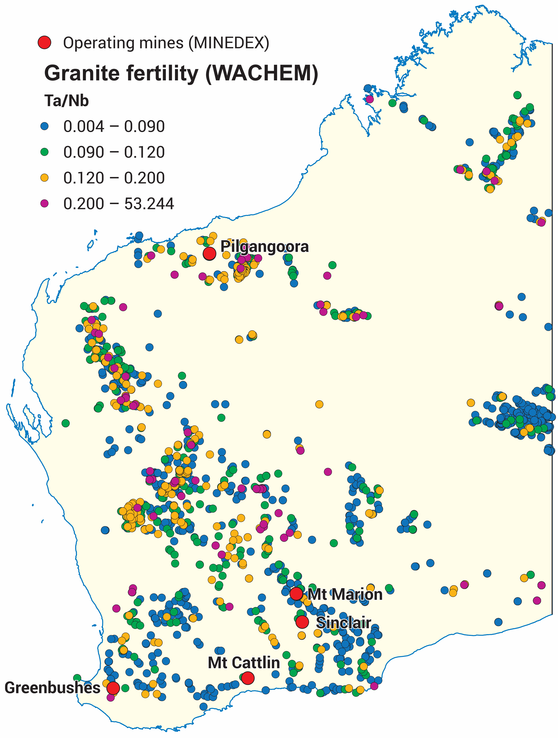

Figure 3. Fertile granites have a high fractionation index, identified by their high Ta/Nb ratios

Trapping conditions for mineralization

- Cooling and chemical diffusion of fractionating granitic melts result in rapid crystallization (over days to years)
- Pegmatites located within 10 km of fertile granites, and particularly roof zones, are more favourable sites (Fig. 2)

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