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The Origin and Evolution of REE Mineralisation in the NYF Pegmatites of the Strange Lake Pluton

By

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The Strange Lake Deposit a Potential HREE Producer

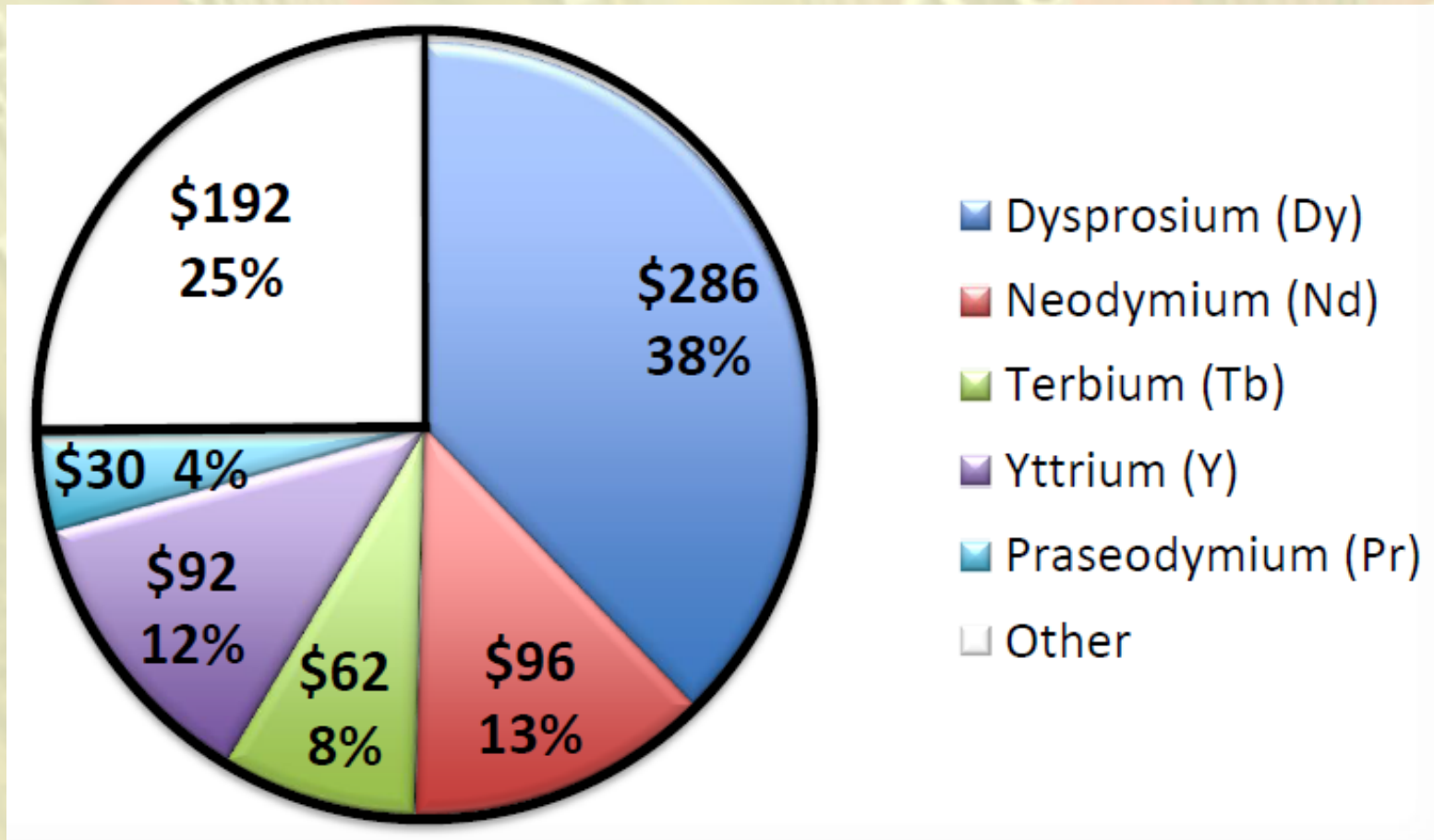
REE Reserves

www.questrareminerals.com

Domain	Tonnes (x1000t)	LREO	HREO + Y	TREO + Y	H:T Ratio
INDICATED					
Enriched Zone	20,020	0.72	0.72	1.44	50%
Granite	258,108	0.55	0.33	0.89	38%
Total	278,128	0.57	0.36	0.93	39%
INFERRED					
Granite	214,351	0.55	0.30	0.85	35%

Projected Annual Revenue from REE Production

\$758 million per year, dominantly from dysprosium



The View at Strange Lake



The Proterozoic Strange Lake Peralkaline Granite Pluton (1240 Ma)



Bedrock Geology



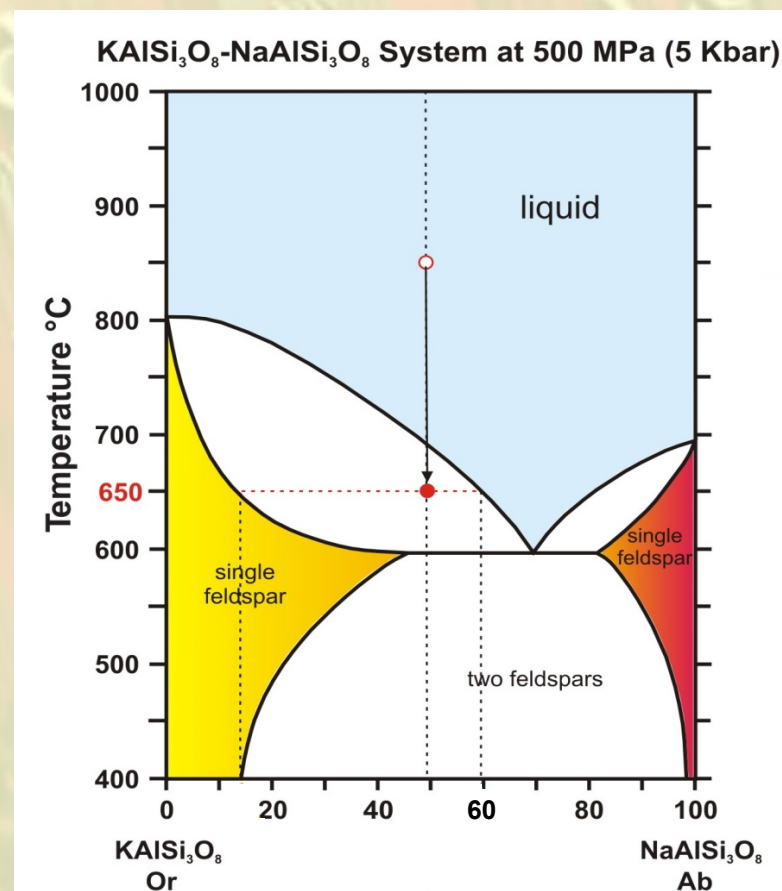
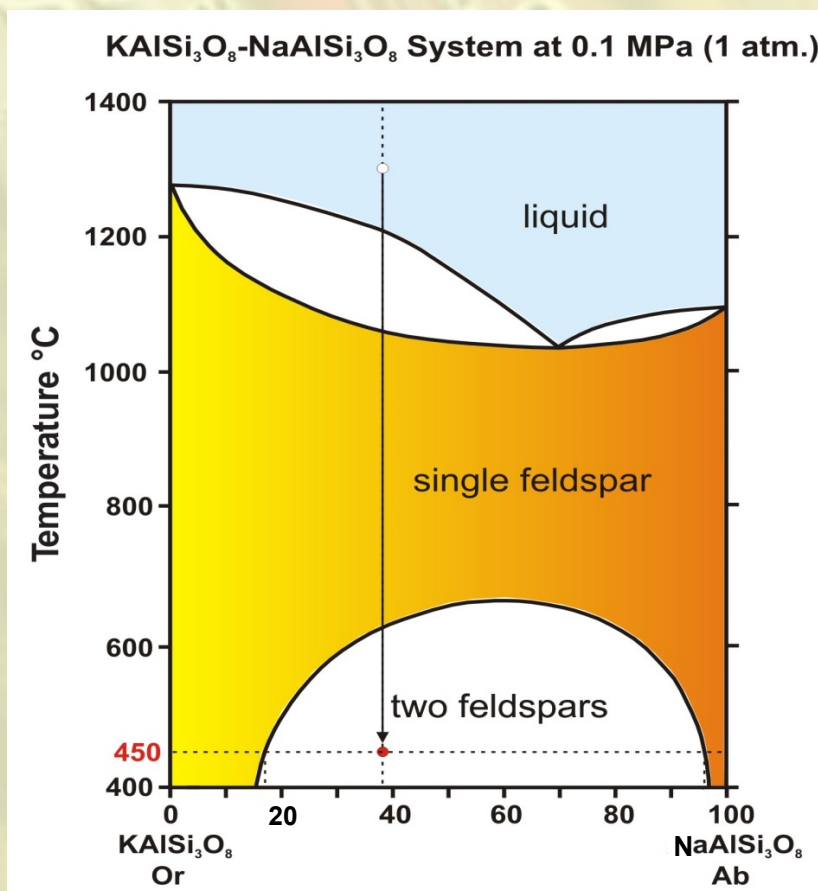
Quenched Hypersolvus Granite Cut by Subsolvus Granite



Dark inclusions in subsolvus granite represent quenched hypersolvus granite

Controls on Alkali Feldspar Solid Solution

Hypersolvus granite (perthite) evolved to subsolvus granite (K-feldspar, albite) because temperature dropped or more likely PH_2O increased.



The Fluorite Breccia



The Strange Lake Pegmatite Ores

Pegmatite border

Gittinsite
($\text{CaZrSi}_2\text{O}_7$)

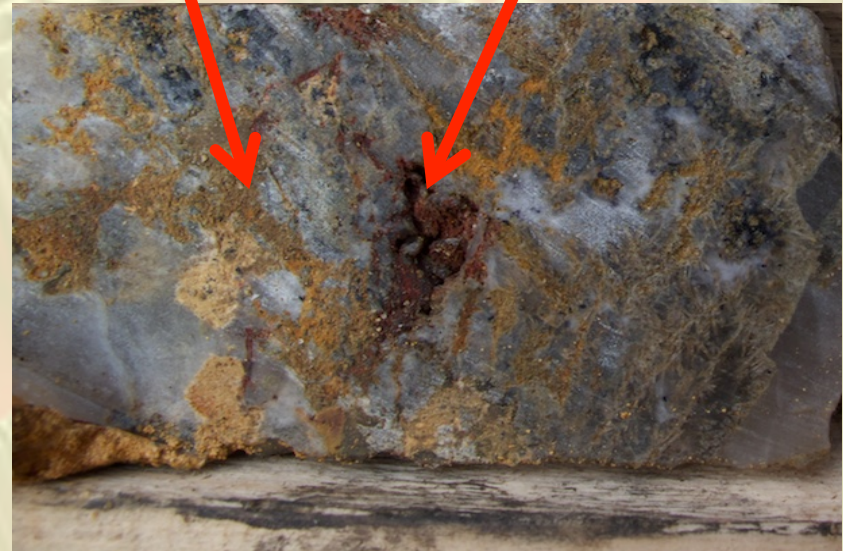
Titanite
(CaTiSiO_5)



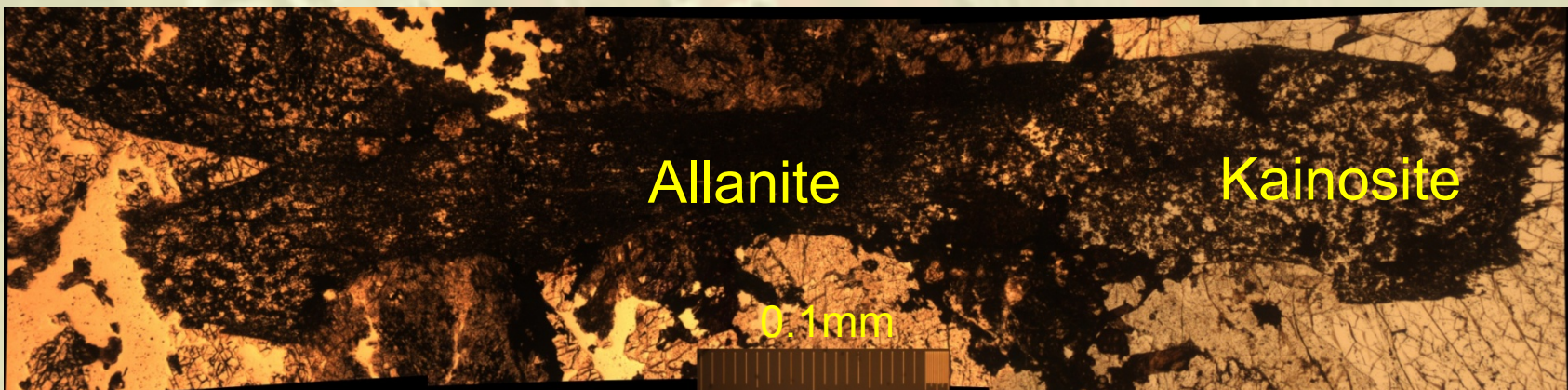
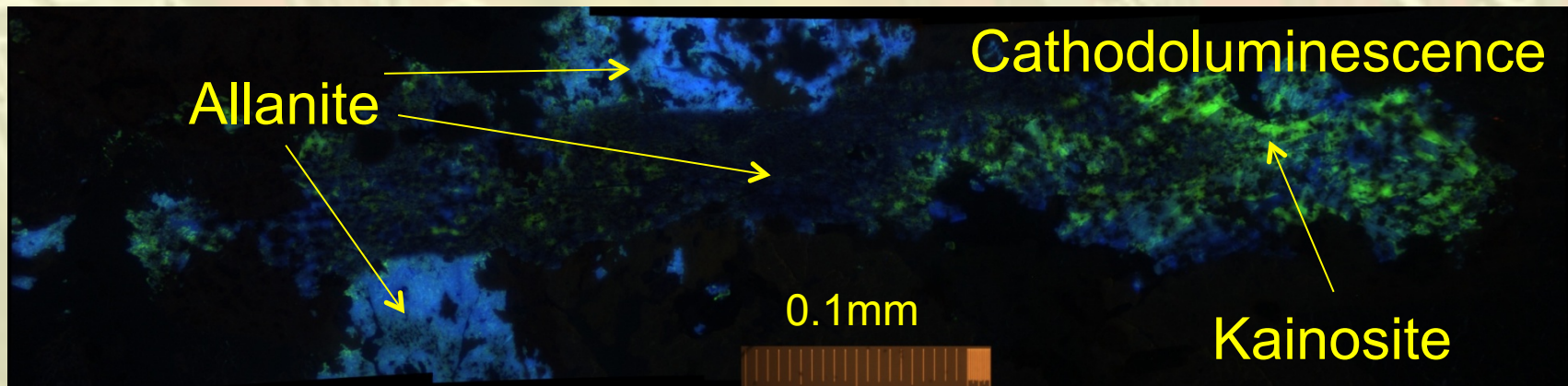
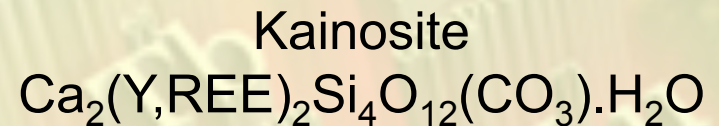
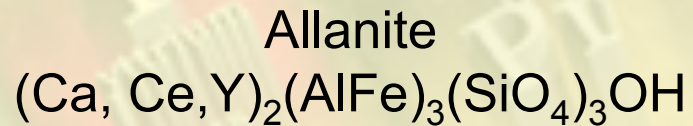
Pegmatite core

REE Minerals

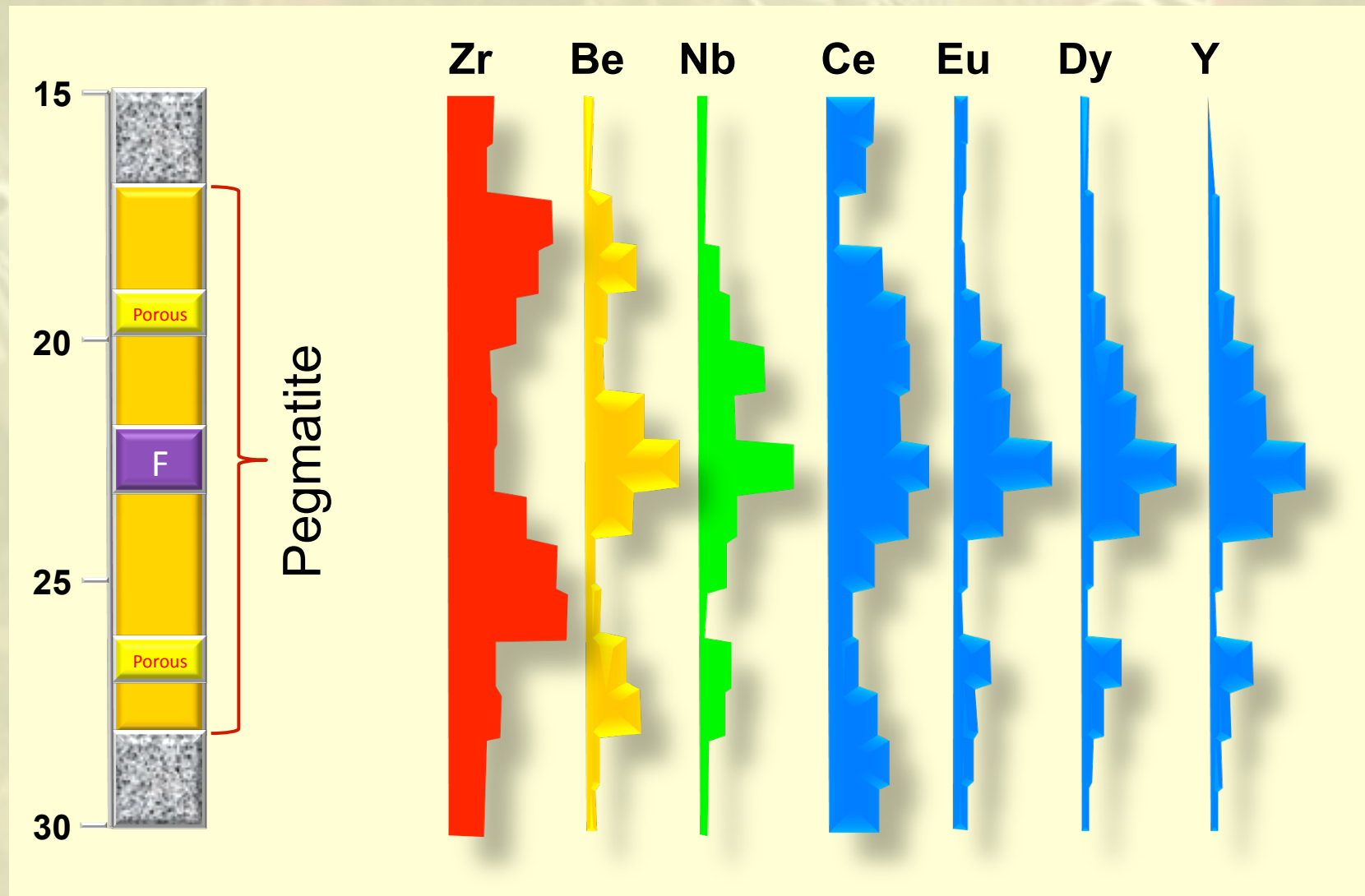
Fluorite



The Secondary Nature of the REE Mineralisation



Distribution of REE and Zr in Pegmatite

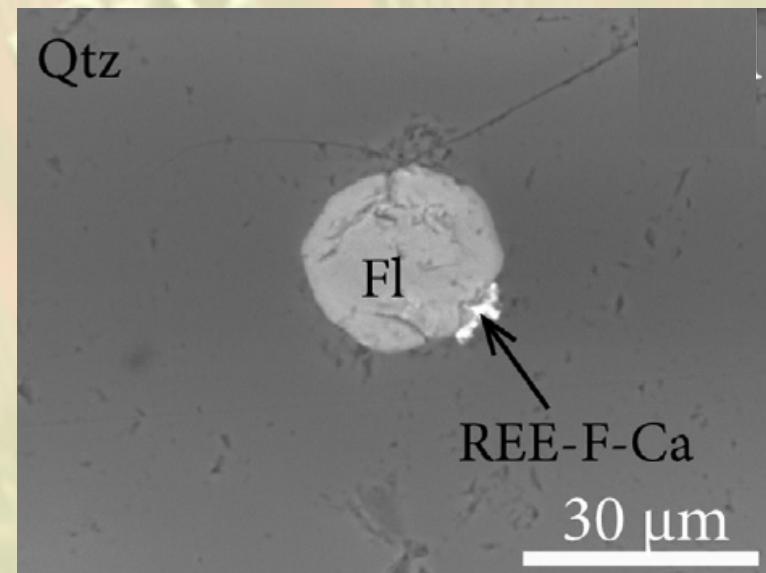
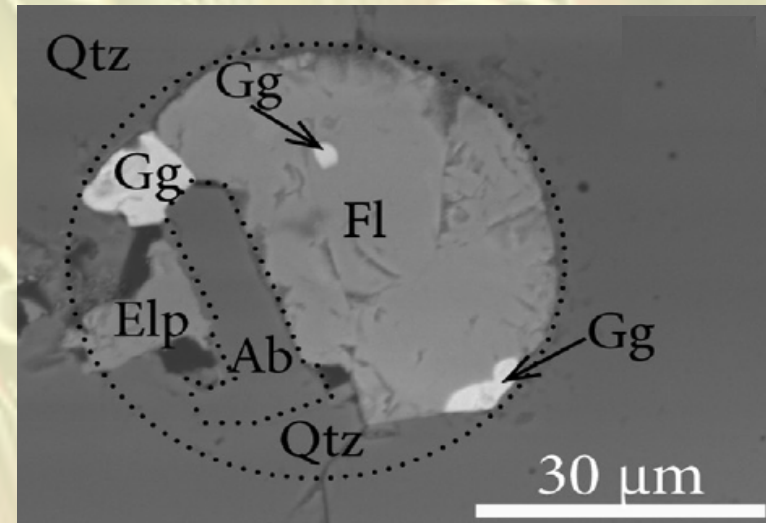
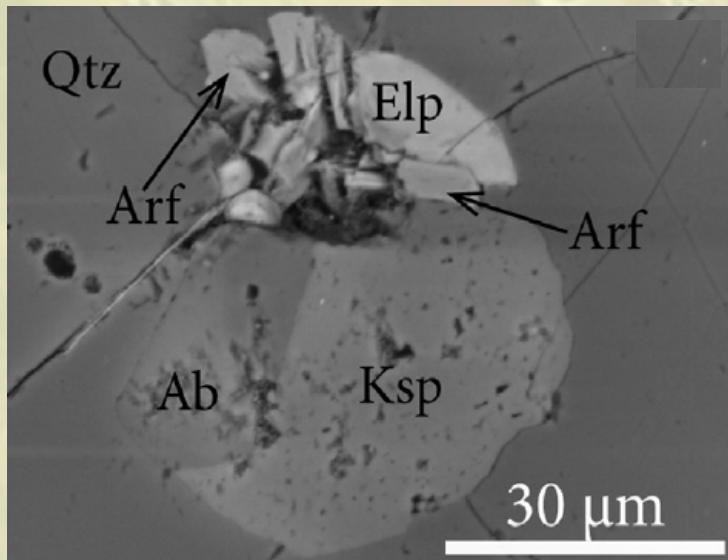


Melt Inclusions in Hypersolvus Granite

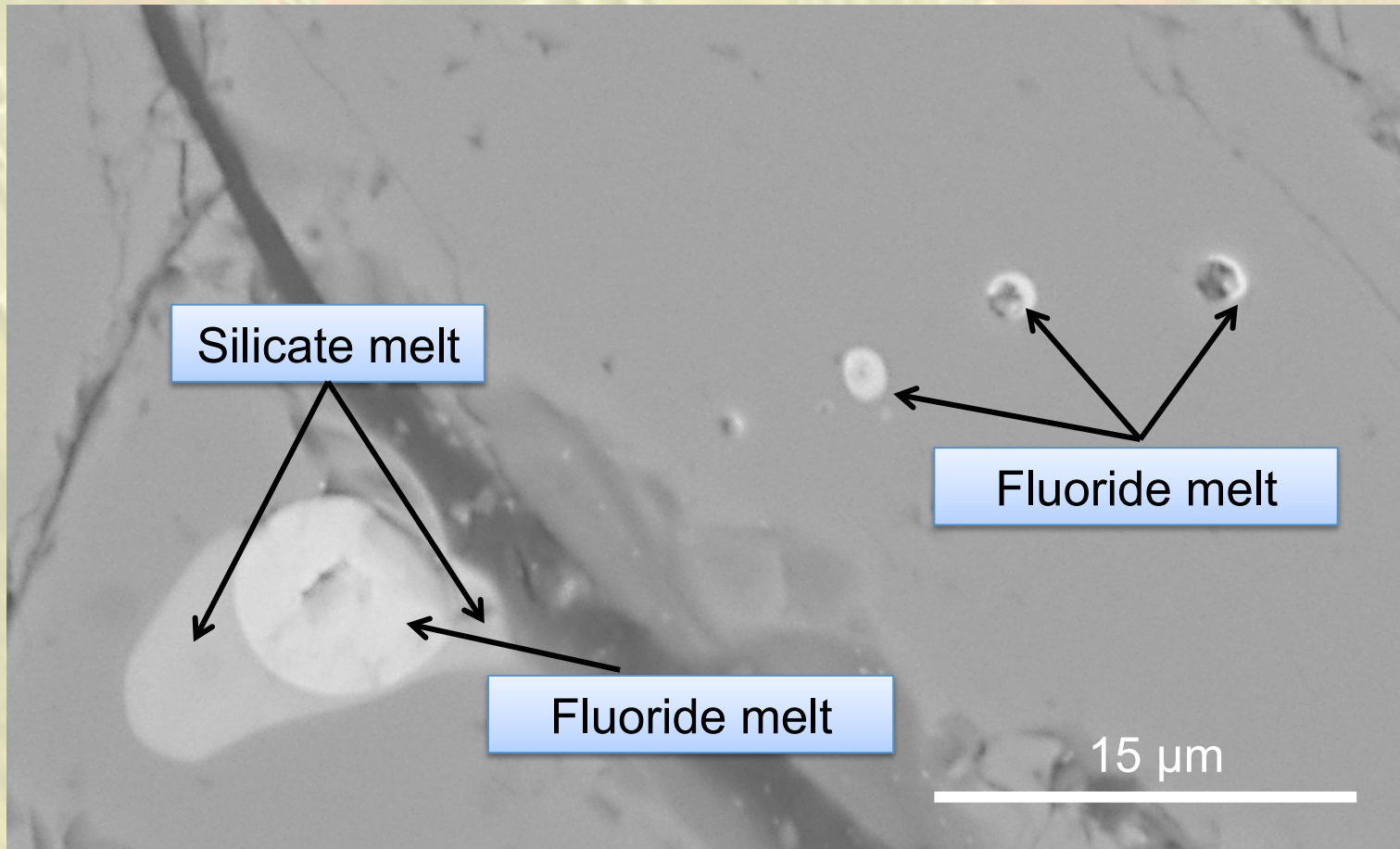
Melt Inclusions are evident by their spherical shape. They vary from being silicate-only, to fluorite-bearing to fluorite-only.

Gagarinite-(Y) $\text{NaCaY}(\text{F,Cl})_6$

Elpidite $\text{NaCaY}(\text{F,Cl})_6$



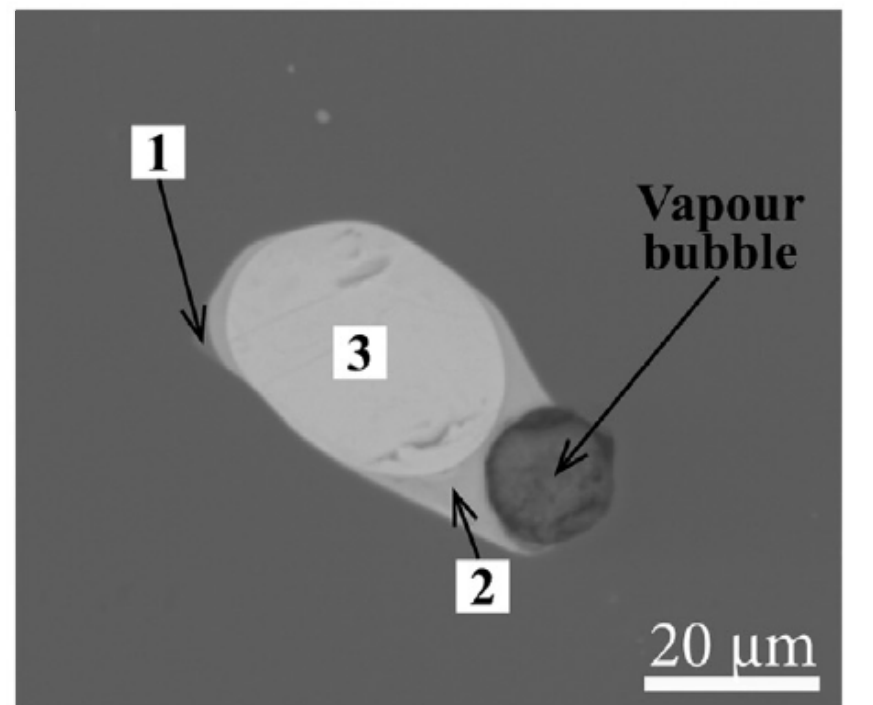
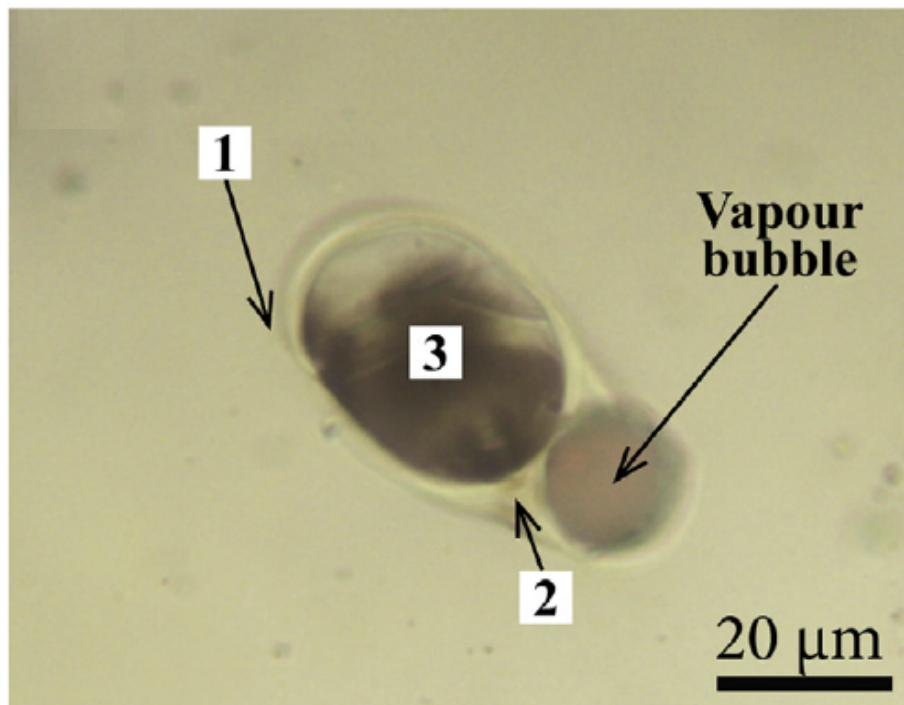
Melt Inclusions after Heating (to 900 °C) and Quenching



Fluoride-bearing Melt Inclusions after Heating and Quenching

Transmitted Light

SEM Image

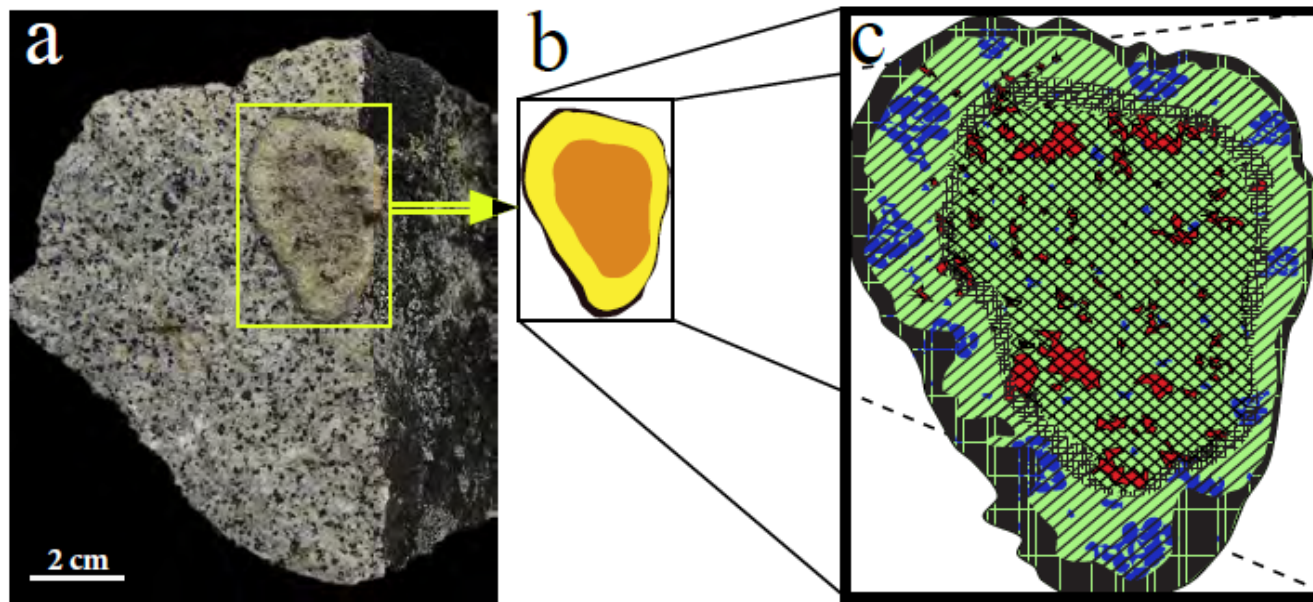


1 –Silicate melt
~3 wt.% Zr

2 –Ca-fluoride melt;
~10 wt.% REE

3 –REE-fluoride
melt; ~47 wt.% REE

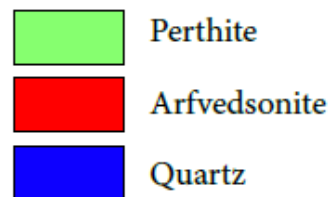
Macroscopic Fluoride Melt Inclusion in Hypersolvus Granite (25 wt% REE!)



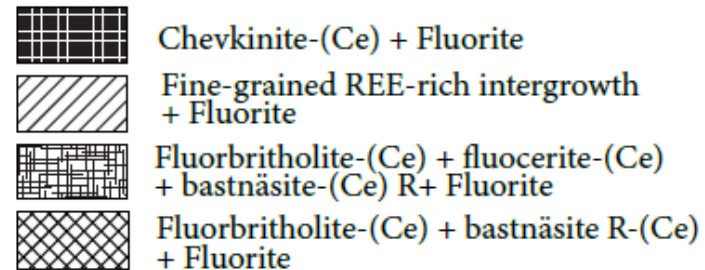
Visible zoning:



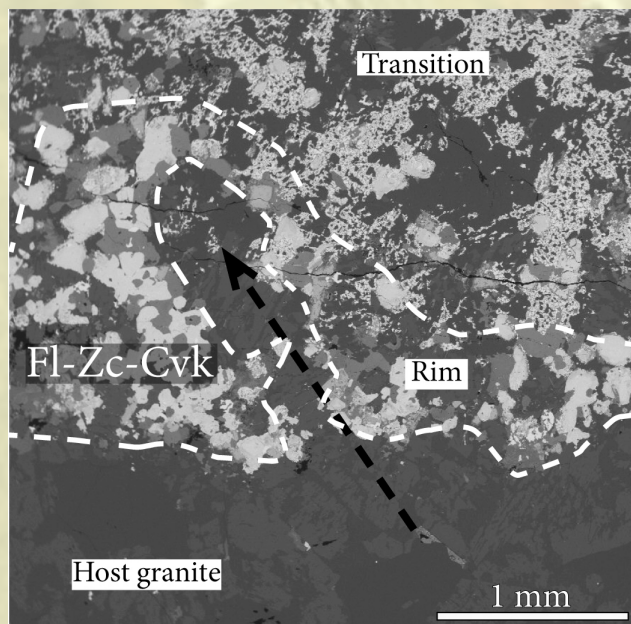
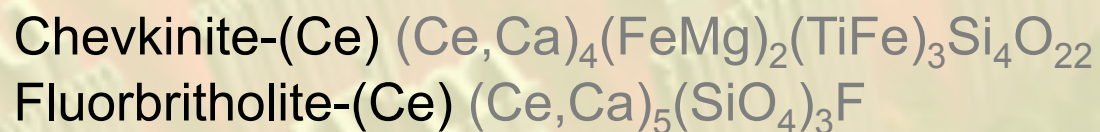
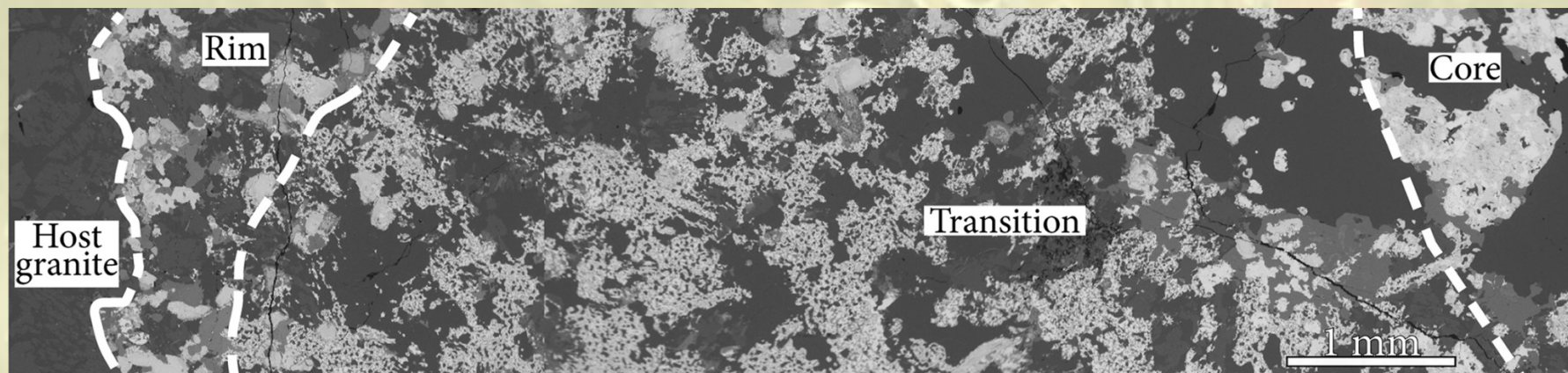
Silicate minerals:



REE-mineral assemblages:

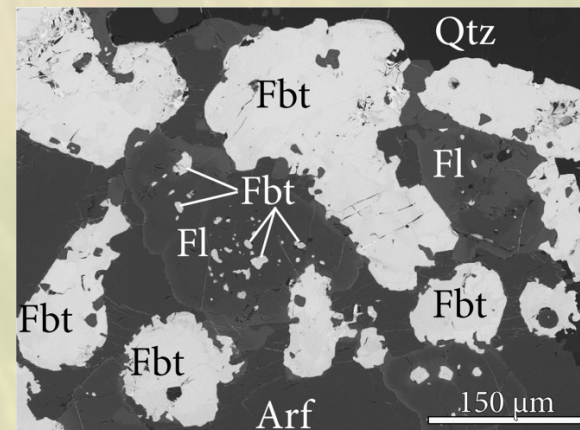
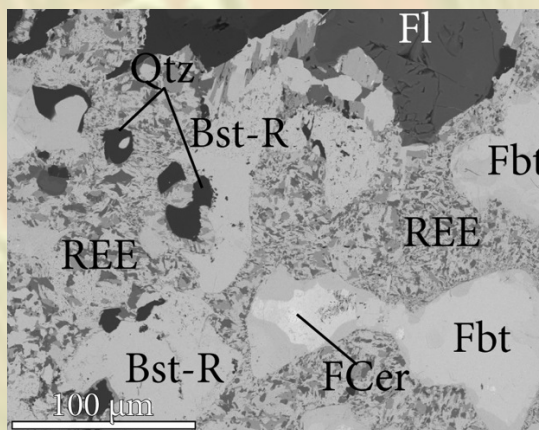


Macroscopic Fluoride Melt Inclusion



Transition zone

Core

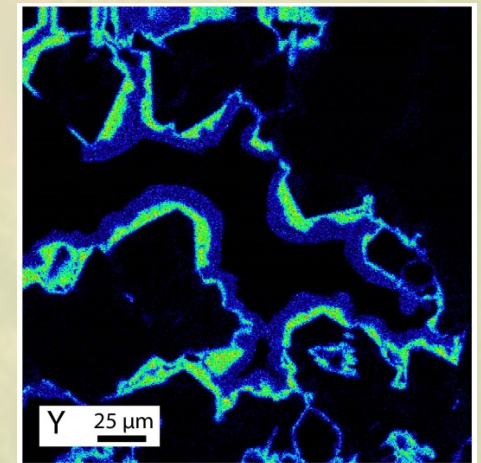
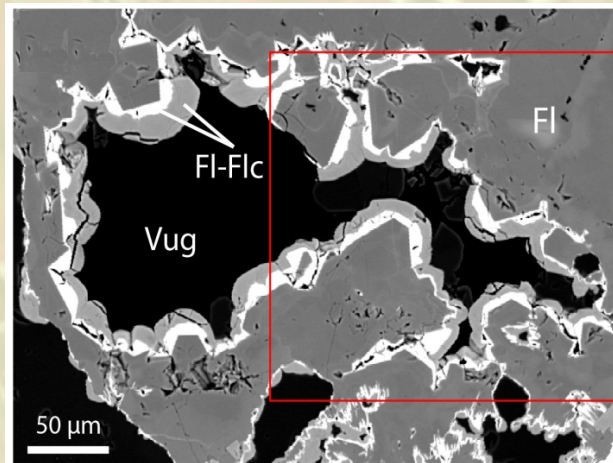
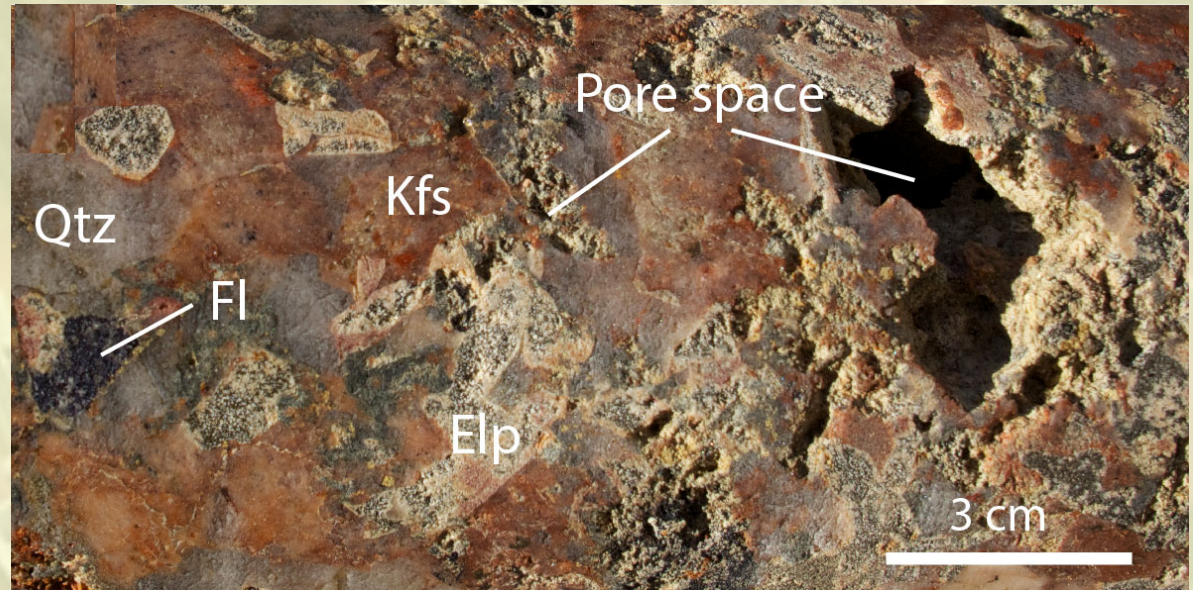


Acidic Alteration and REE Mobilisation

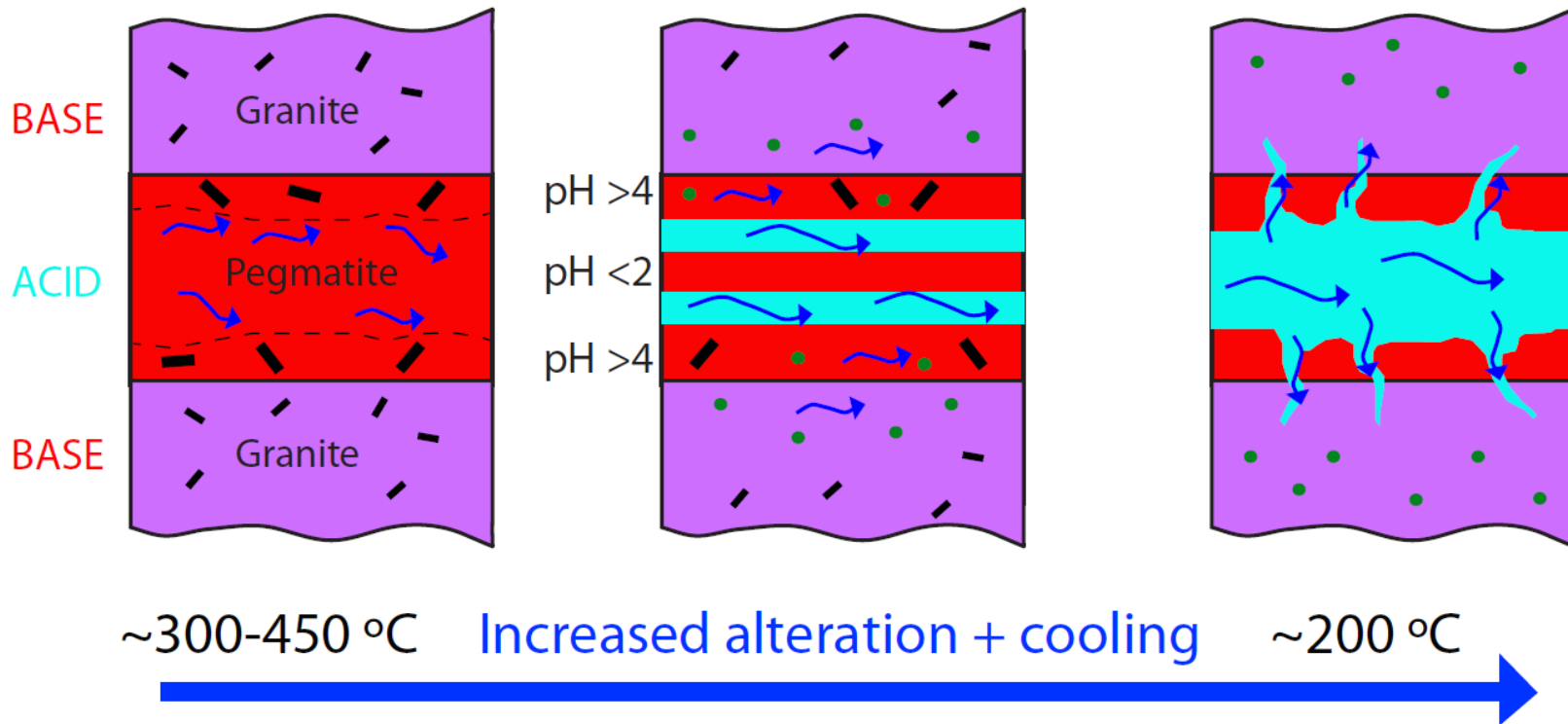
Autometasomatism lead to acidic alteration by HCl-HF-bearing fluids that destroyed the primary mineralogy, creating porosity

REE mobilised, replacing earlier minerals and filling vugs

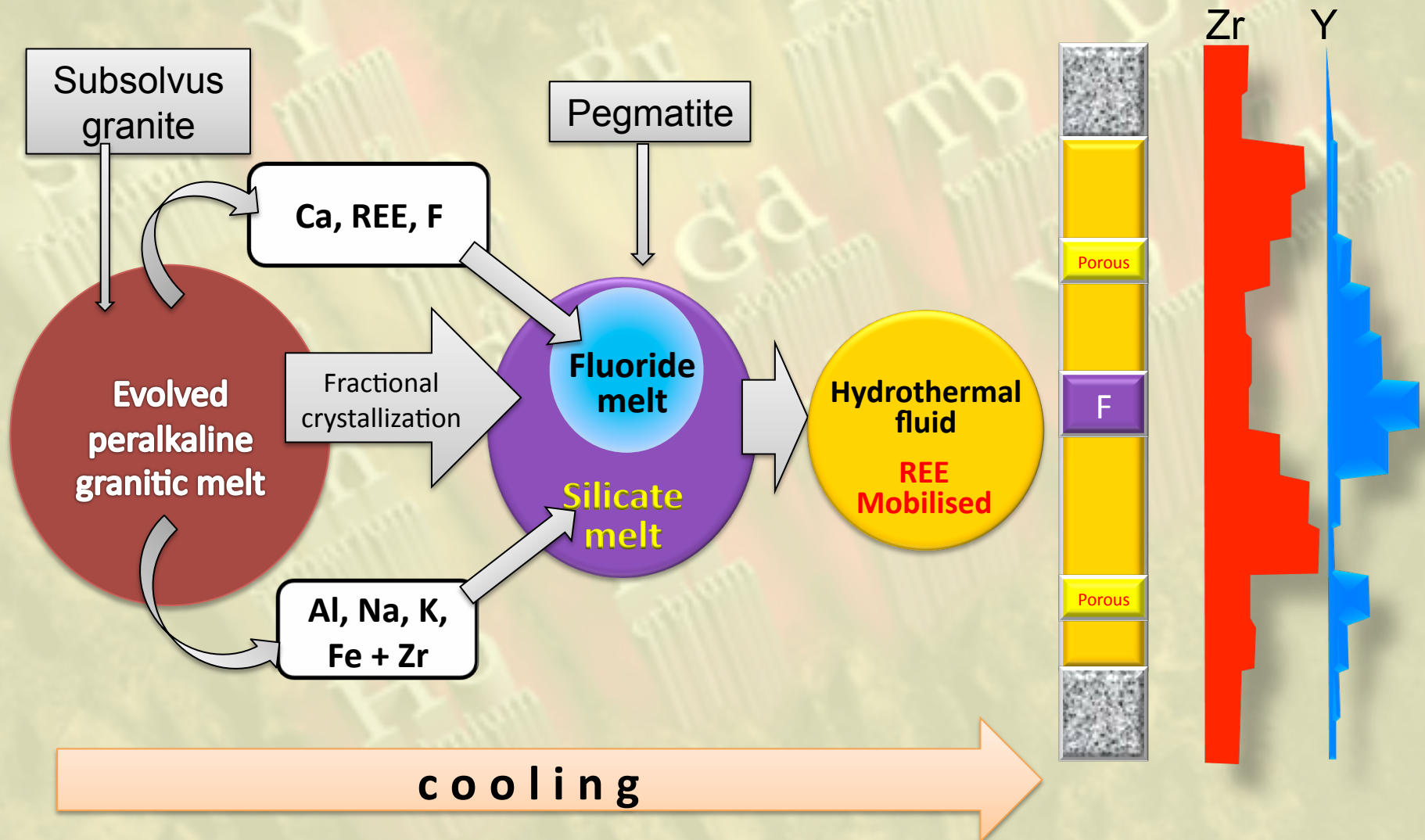
Flc - fluocerite (REEF_3)

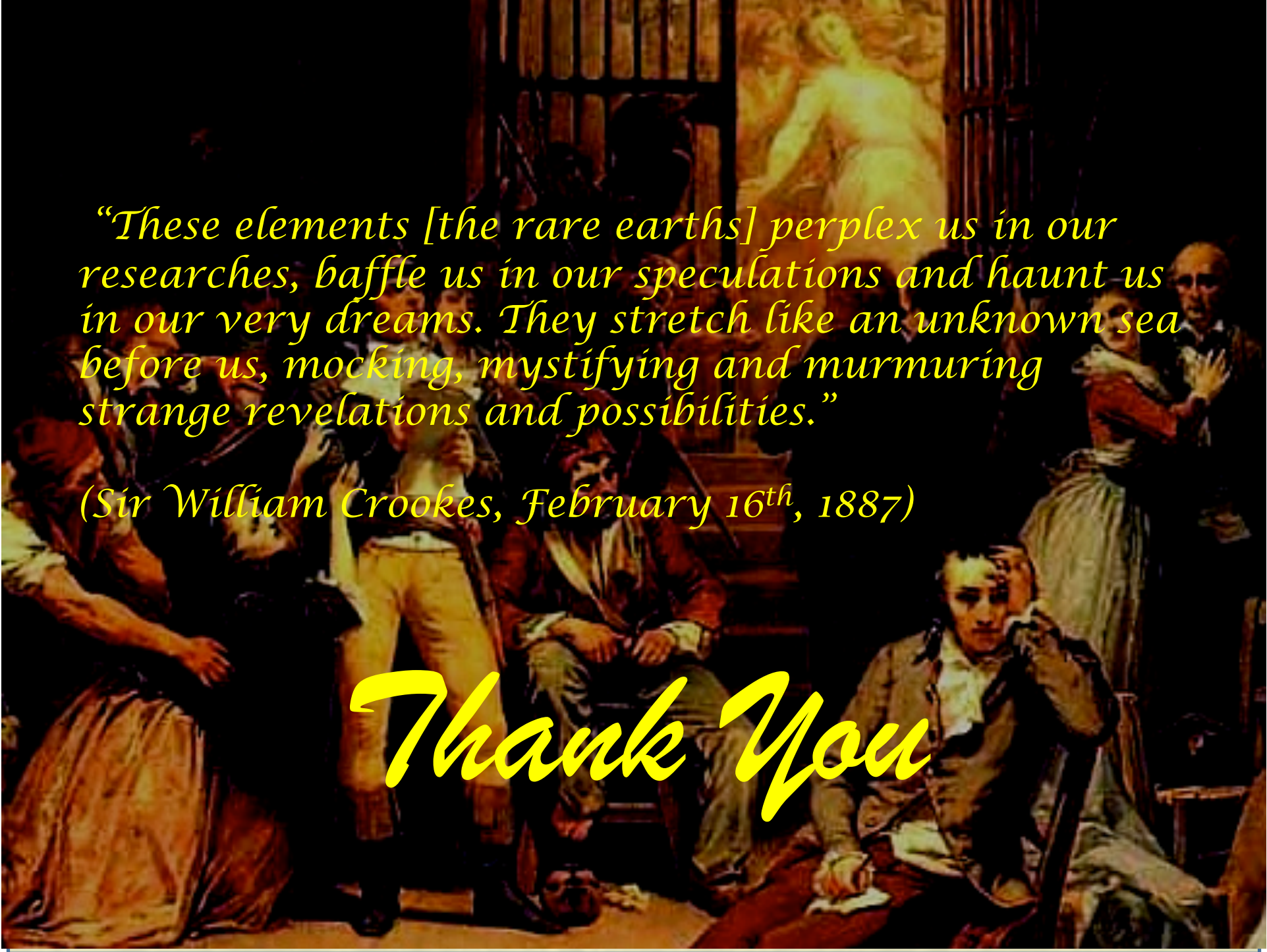


The Pegmatites Stewed in their own Juices



Model of REE Accumulation





“These elements [the rare earths] perplex us in our researches, baffle us in our speculations and haunt us in our very dreams. They stretch like an unknown sea before us, mocking, mystifying and murmuring strange revelations and possibilities.”

(Sir William Crookes, February 16th, 1887)

Thank You