Apatite and Zircon Geochemistry in a granitic melt under disequilibrium conditions

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Motivation and objective

- To quantify the disequilibrium textures in experimentally synthesised apatite

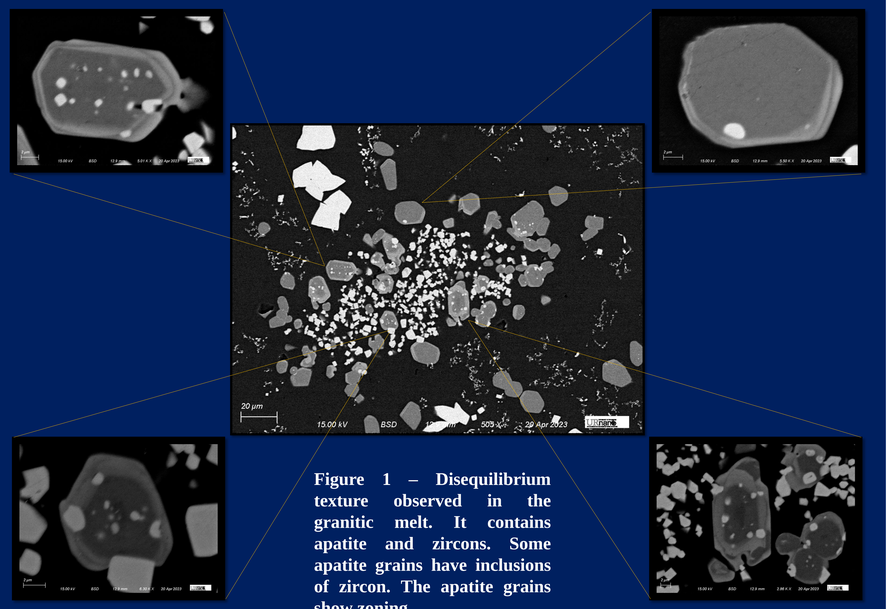
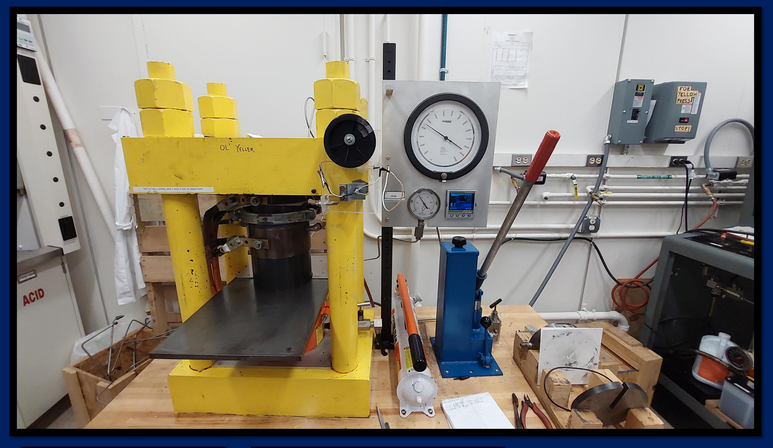


Figure 1 – Disequilibrium texture observed in the granitic melt. It contains apatite and zircons. Some apatite grains have inclusions of zircon. The apatite grains show zoning.

Sample Preparation and Methodology

- Boyd and London piston cylinder
- Uncoated epoxy mount
- Gold coated epoxy mount (Sputter Coating)
- Backscattered electrons (BSE)
- Secondary electrons (SE2)
- Energy Dispersive Spectroscopy (EDS)

Figure 2.1 – Piston cylinder



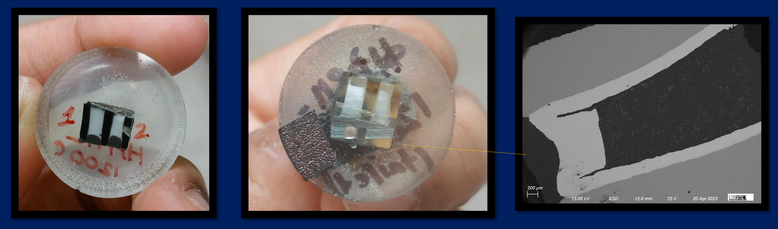
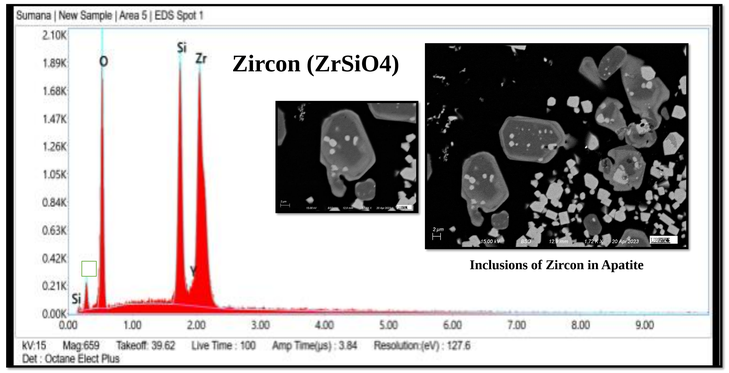


Figure 2.2 – Epoxy mount before gold sputter coating, epoxy mount after gold sputter coating, the sample under investigation



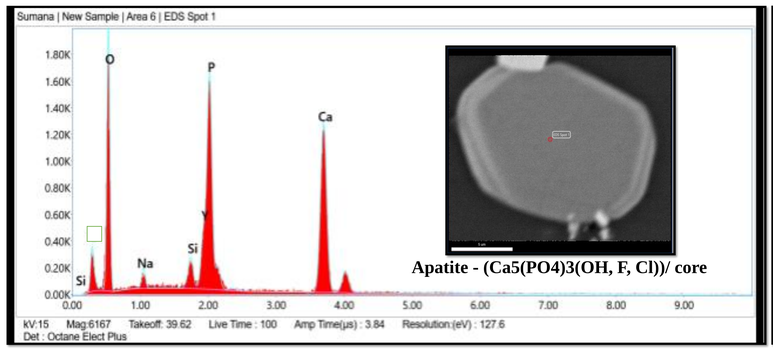
Inclusions of Zircon in Apatite

Findings

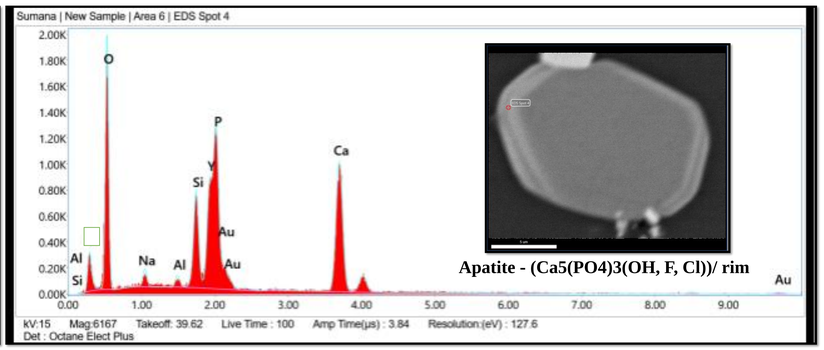
- **Elemental zoning increases from core to rim in apatite.**
- **Elemental distribution caused due to changes in temperature**
- **The above phenomenon is caused by the partition coefficient, where the partition coefficient of an element may increase with increasing temperature**
- **The thermodynamic increase in temperature is caused due to instrument failure.**

$$\ln K_{eq} = -\frac{\Delta H^{o}}{RT} + \frac{\Delta S^{o}}{R}$$

X-ray spectra of the major components of interest



Apatite - (Ca5(PO4)3(OH, F, Cl))/ core



Apatite - (Ca5(PO4)3(OH, F, Cl))/ rim

Element	Weight %	Atomic %
O K	42.29	57.83
Na K	1.73	1.64
Si K	1.49	1.16
P K	13.12	9.27
Ca K	26.72	14.59
Y L	7.10	1.75

Element	Weight %	Atomic %
O K	39.83	57.33
Na K	1.43	1.43
Al K	0.61	0.52
Si K	4.94	4.05
P K	8.46	6.29
Ca K	20.89	12.00
Y L	13.34	3.45
Au M	2.90	0.34

Elemental maps

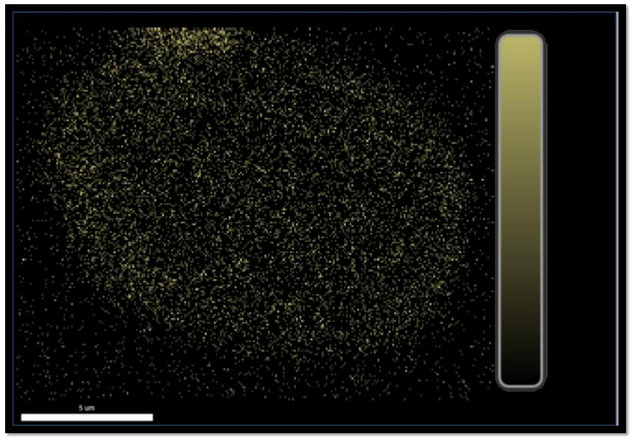


Figure 3.1 – Elemental map of Yttrium (Y)

Figure 3.2 – Elemental map of Aluminum (Al)