

Hunga-Tonga-Hunga-Ha'apai Jan 15, 2022 eruption: Assembly of heterogeneous magma sources recorded in melt inclusions from plagioclase, clinopyroxene and orthopyroxene.

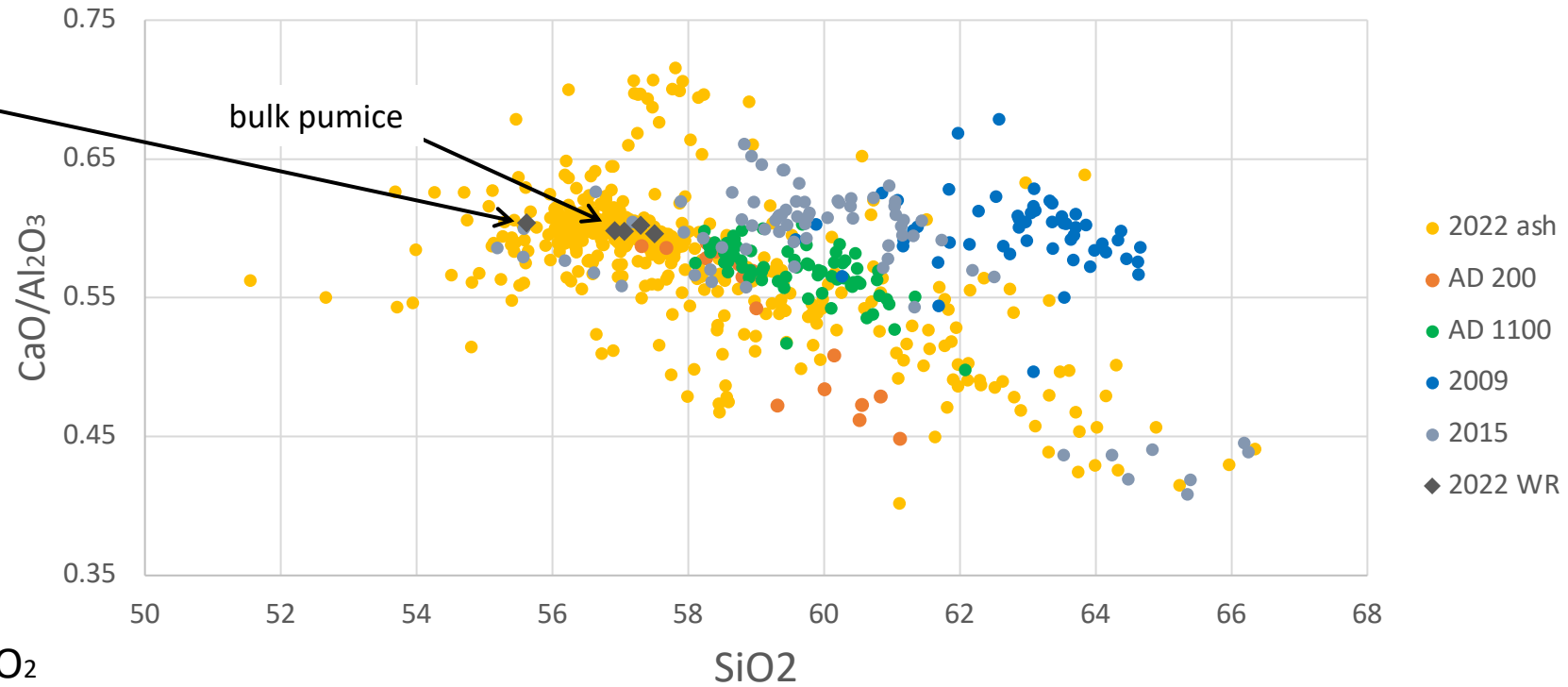
Ingrid Ukstins¹, Shane Cronin¹, David Adams¹, Jie Wu¹, Joali Paredes-Mariño¹,
Marco Brenna², Ian Smith¹, Isabelle Brooks-Clarke¹

1: School of Environment, University of Auckland, Auckland, New Zealand.

2: Department of Geology, University of Otago, Dunedin, New Zealand.

2022 eruption composition

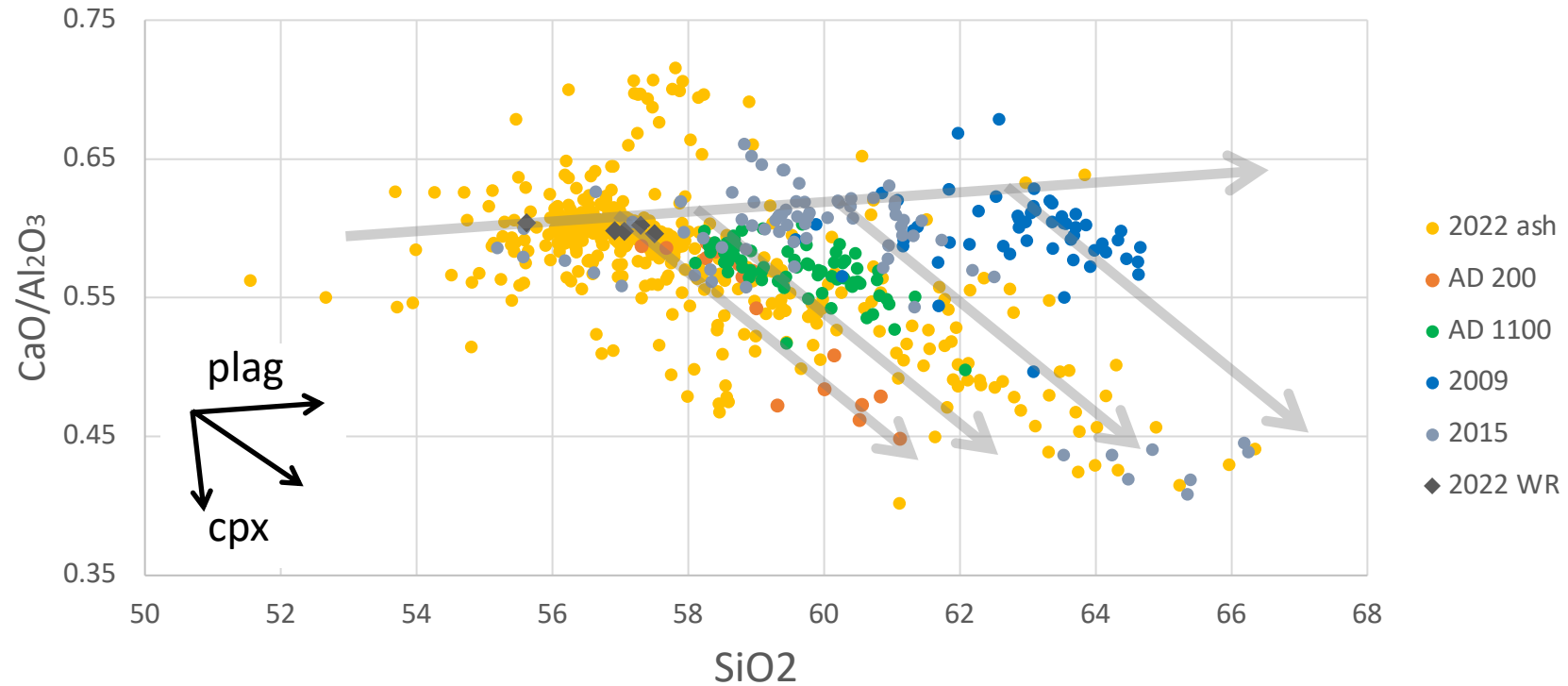
Sample	Pumice	Dark Pumice	Light Pumice	Massive Glass	Bulk
SiO ₂	56.9	57.5	57.1	57.3	55.6
TiO ₂	0.6	0.6	0.6	0.6	0.5
Al ₂ O ₃	15.3	15.0	15.3	15.0	14.9
FeO	13.8	13.5	13.7	13.5	13.5
MnO	0.2	0.2	0.2	0.2	0.2
MgO	3.9	3.7	4.0	3.9	4.0
CaO	9.2	8.9	9.1	9.0	9.0
Na ₂ O	2.0	2.0	2.1	1.9	2.8
K ₂ O	0.5	0.6	0.5	0.5	0.6
P ₂ O ₅	0.1	0.1	0.1	0.1	0.1
Alkalies	2.6	2.6	2.6	2.5	3.3



- Bulk WR composition 55.6 – 57.3 wt% SiO₂
- Componentry: pumice (light, dark), massive glass, crystals (10%: plagioclase, orthopyroxene, clinopyroxene and rare olivine), lithics.
- Tephra glass composition by EPMA ranges from 51.5 – 66 wt% SiO₂
- Average glass comp = 57.9 wt% SiO₂ (n= >500)

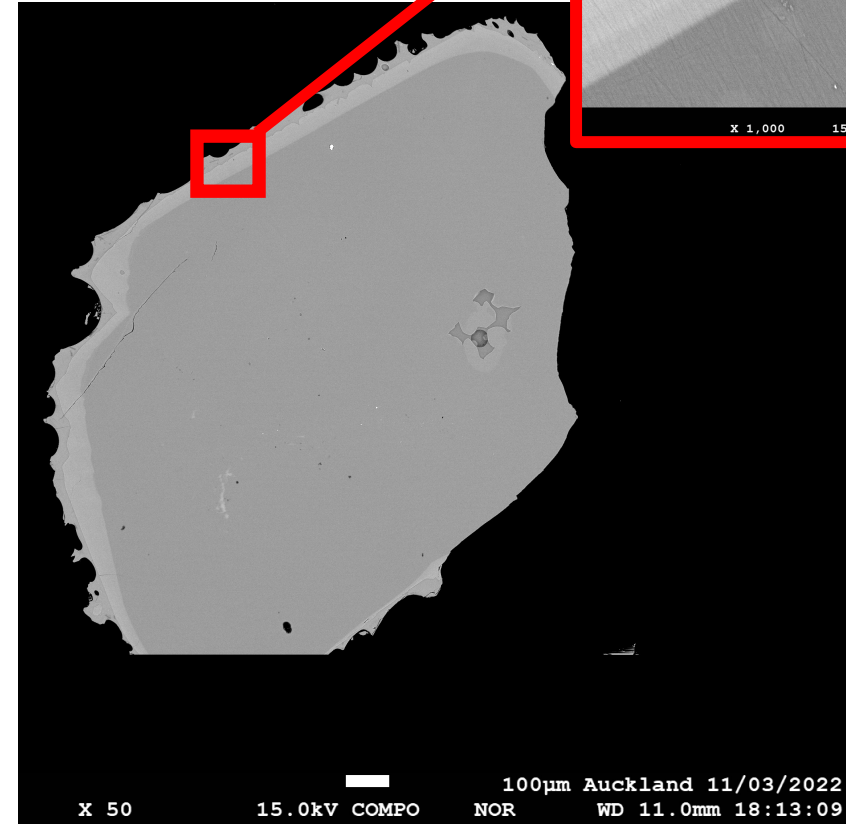
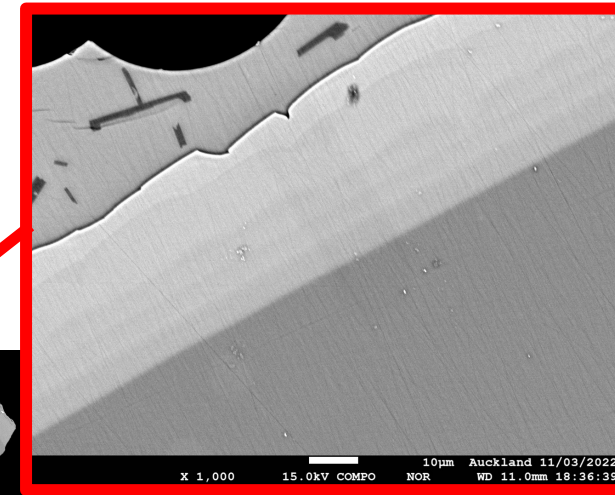
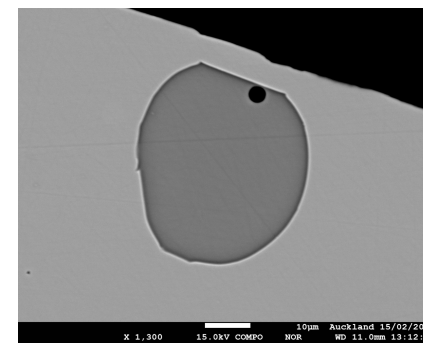
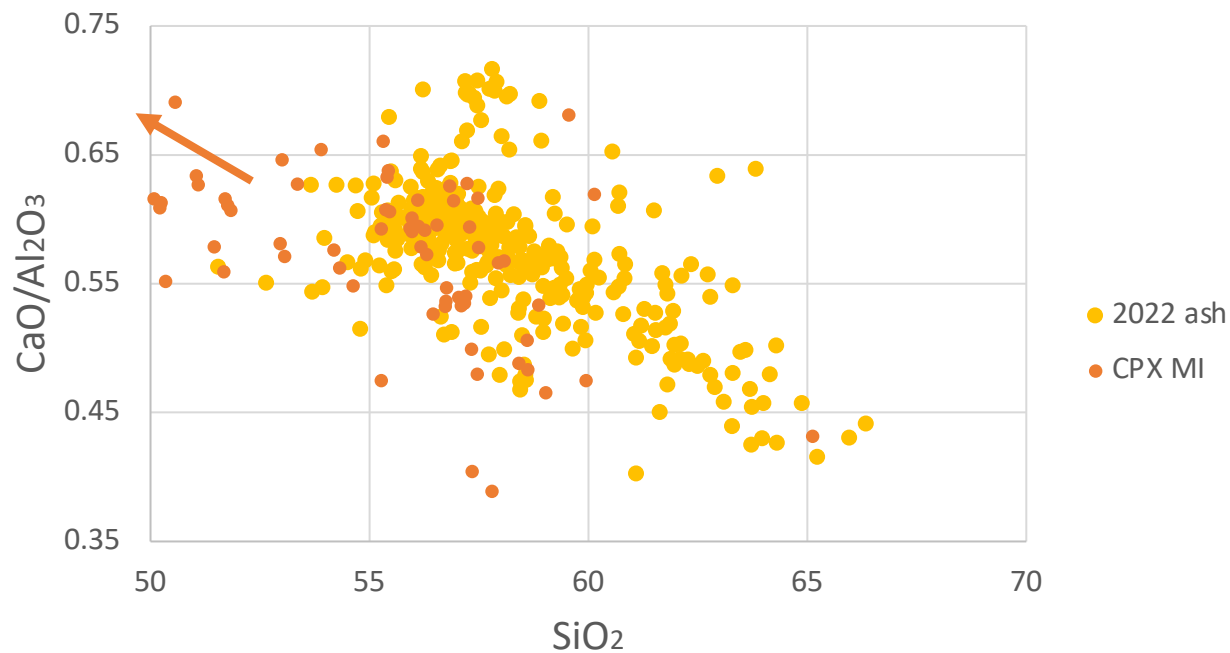
2022 eruption composition

- Plagioclase fractionation towards more evolved older eruptions
- Recent small eruptions most evolved (2009, 2014-2015)¹
- Older, larger eruptions less evolved (AD 1100, AD 200)¹
- Plag + cpx fractionation within individual eruptions



Clinopyroxene MI

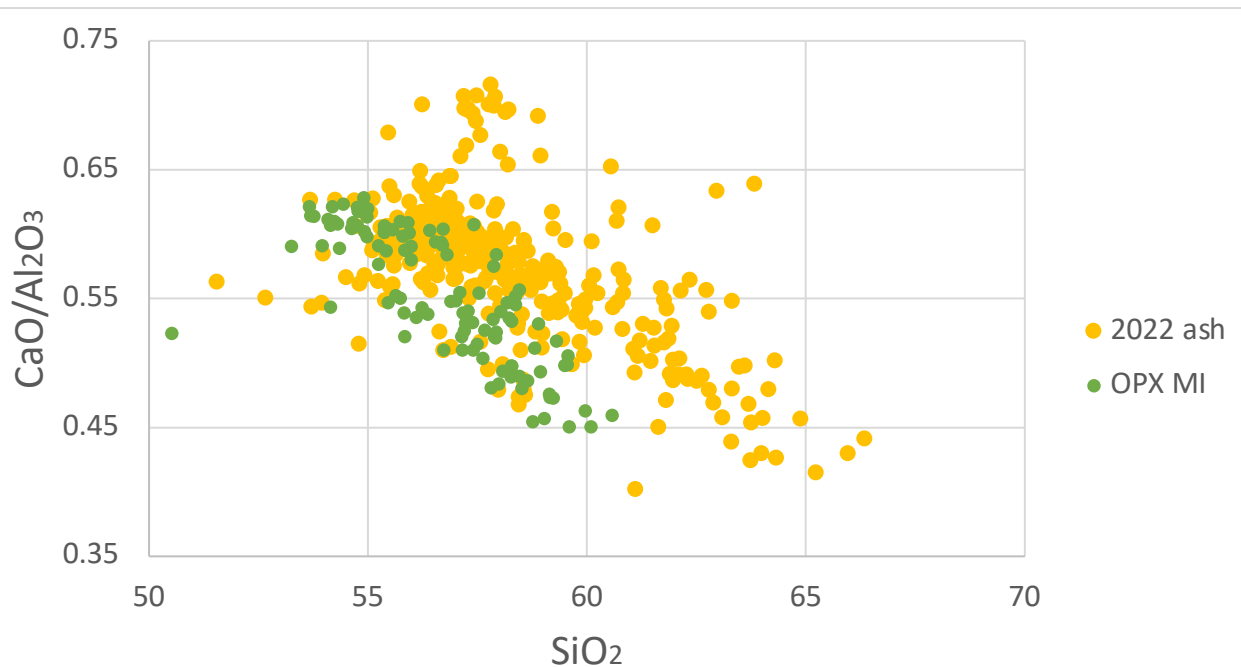
- Mg# average = 76.2, max 88.5 & min 27.5 (n=500)
- MI range from 49-65 wt% SiO₂



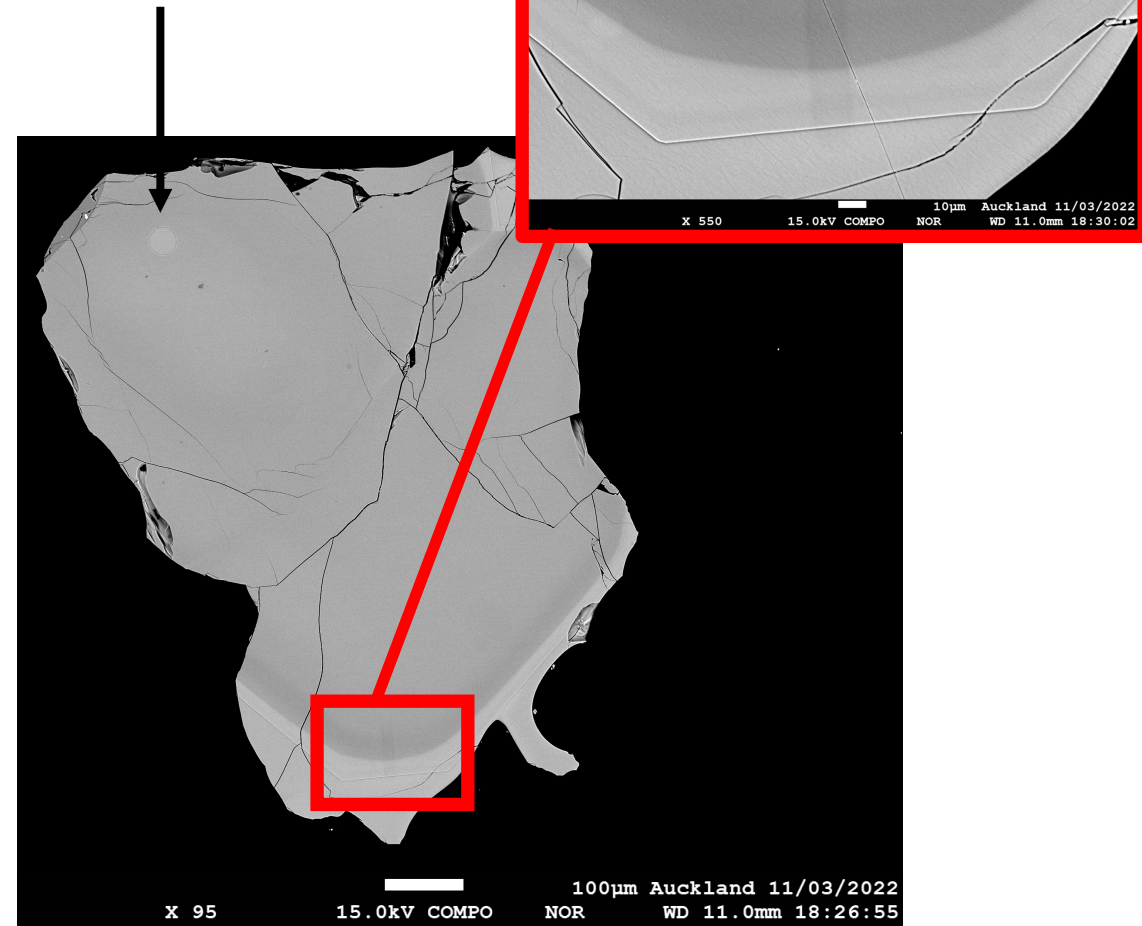
HT14_px60: Mg# 74.4-88.5; Wo_{38.9-43.2} En_{41.1-50.3} Fs_{6.5-20}

Orthopyroxene MI

- Mg# average = 74.2, max 82.7 & min 58.2 (n=300)
- MI range from 50.5-60.6 wt% SiO₂



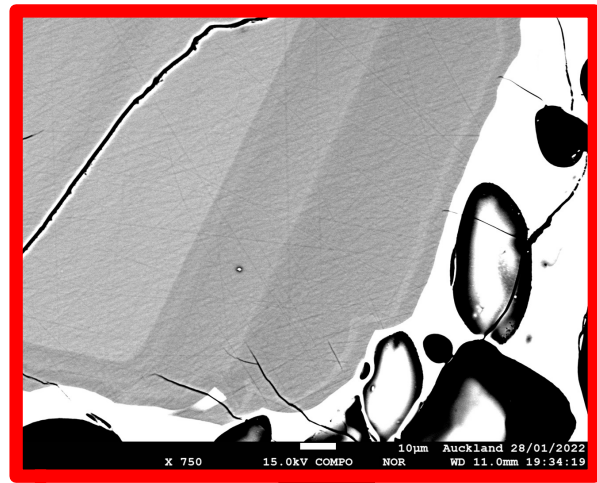
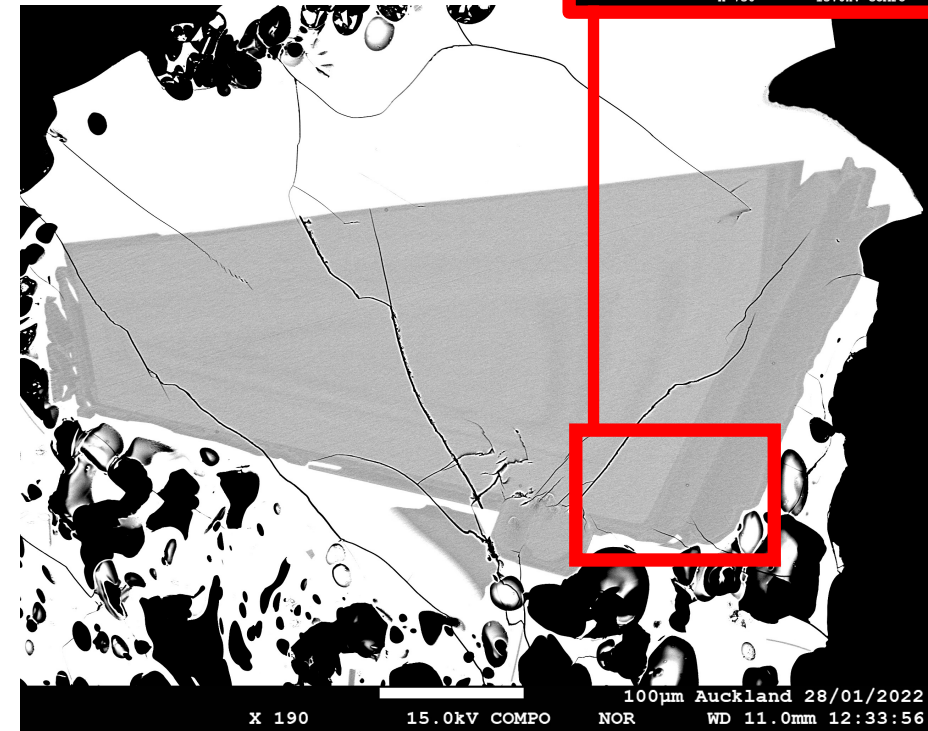
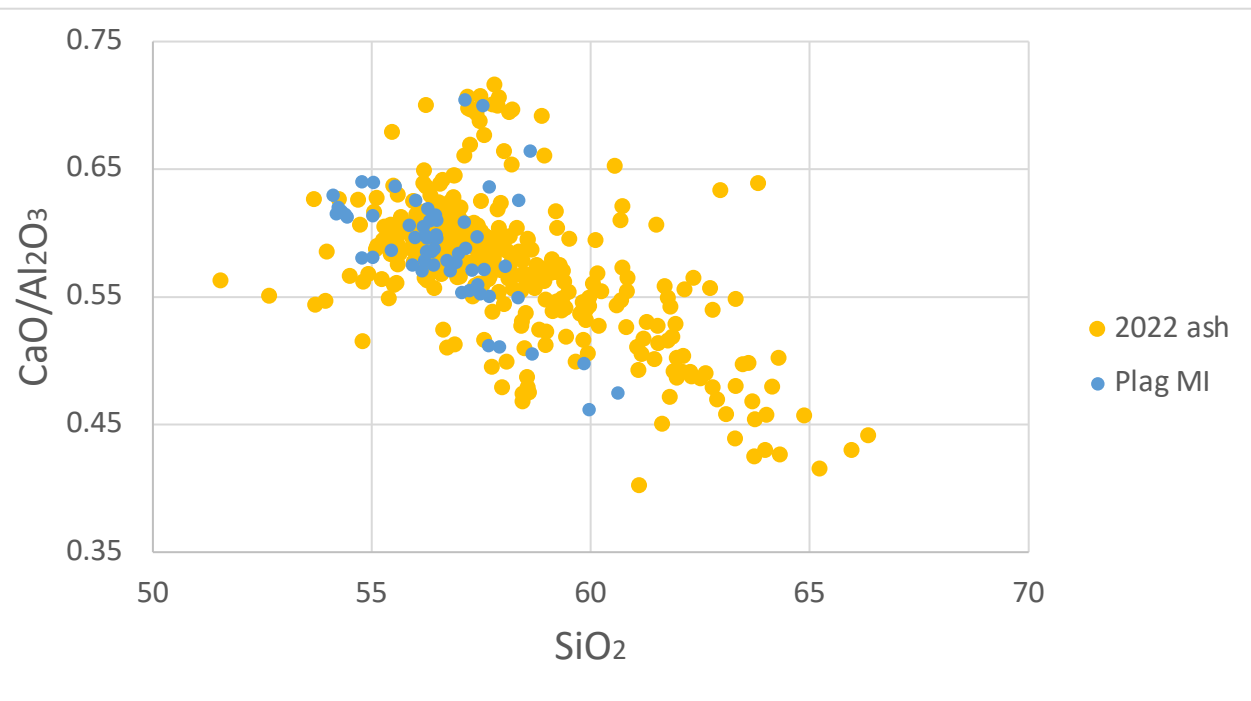
melt inclusion



HT14_px68: Mg# 73.9-80.6; Wo_{3.6-4.2} En_{70.8-77.6} Fs_{18.7-25}

Plagioclase MI

- An average = 85.7, max 95.1 & min 73.6 (n=450)
- MI range from 54-60.6 wt% SiO₂



Conclusions

- Clinopyroxene MI span the full range of Hunga volcanic compositions and extend to more mafic compositions.
- Orthopyroxene and Plagioclase MI mainly overlap 2022 groundmass glass.
- MgO vs. SiO₂ - Plag slightly higher and OPX slightly lower compared to GM glass.
- CPX MI reflect sourcing from more primitive magmas.
- OPX MI resemble more evolved previous eruptions.
- Plag MI span full range of observed GM compositions.
- *Plus:* Mineral zoning shows no evidence of magma recharge immediately preceding eruption.

