

Magma chamber dynamics prior to the 1400 BP eruption of Rabaul, Papua New Guinea

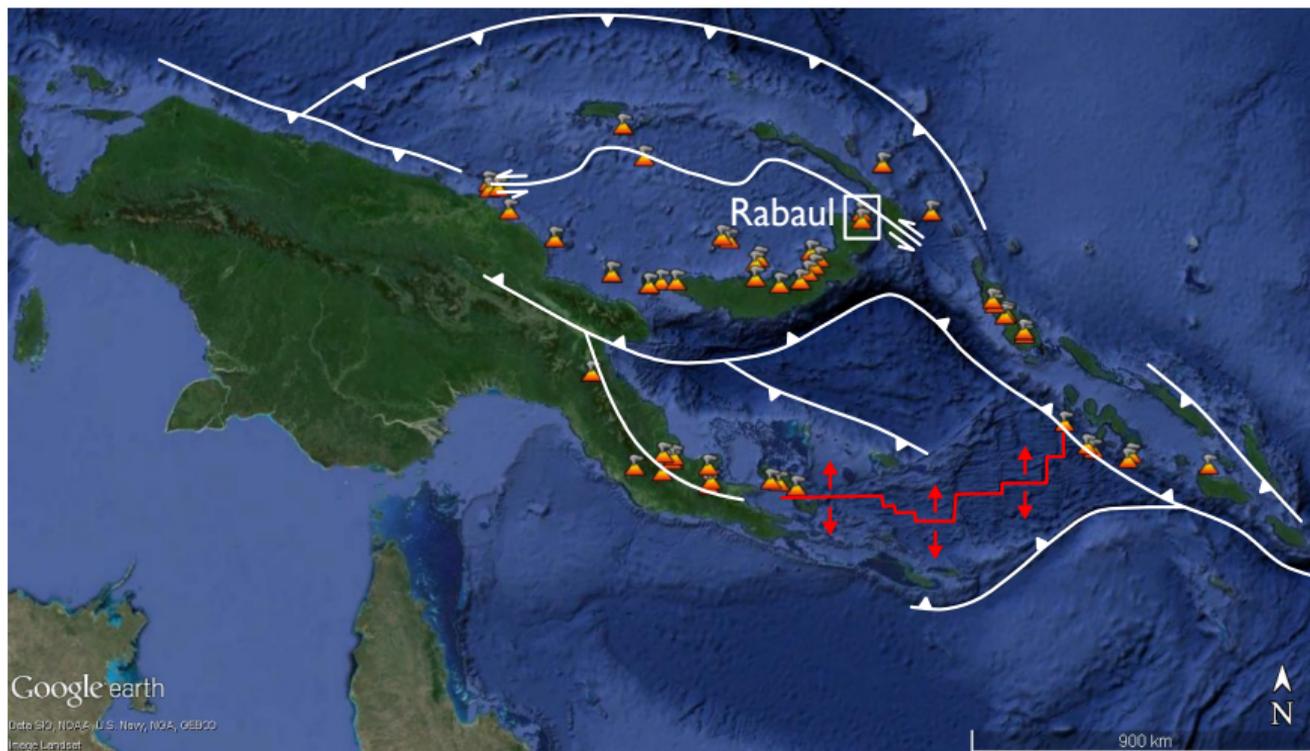
Gareth N. Fabbro, Caroline Bouvet de la Maisonneuve

Earth Observatory of Singapore, Nanyang Technological University, Singapore

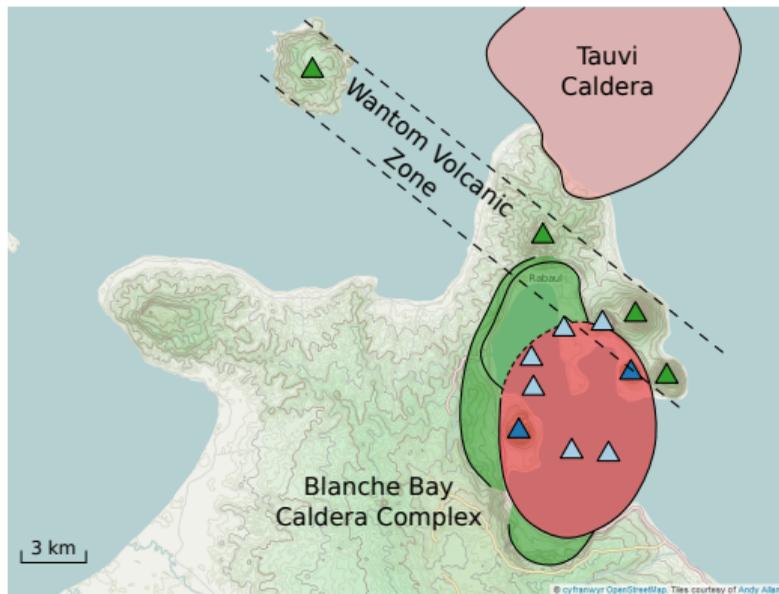
IUGG General Assembly, June 22–July 2, 2015



Volcanism at Rabaul is due to subduction at the New Britain Trench



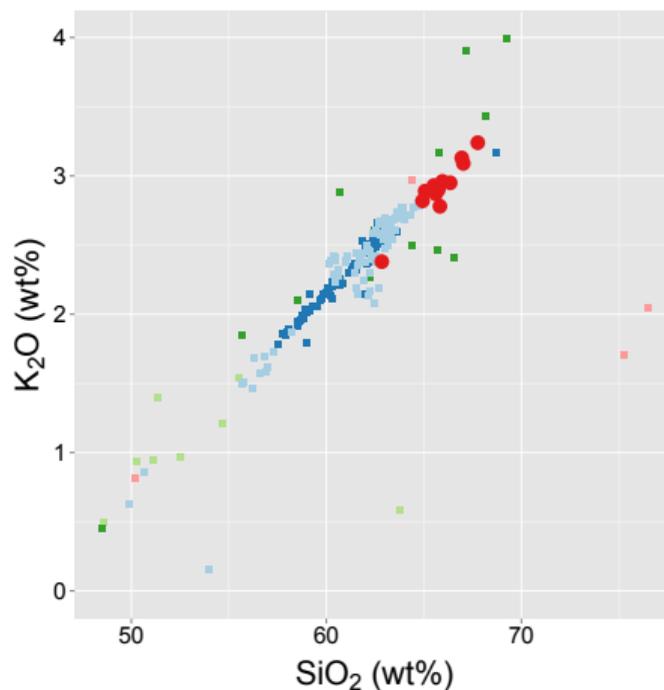
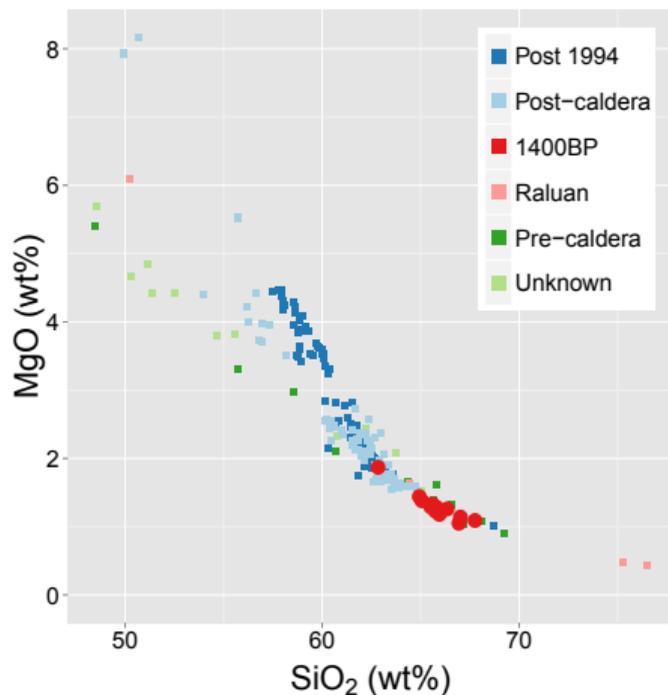
Volcanic history of Rabaul



- 1994– **Current phase of activity**
- ~750 **Oldest dated post-caldera rocks**
years BP
- 1,376 ± 34 “1400 BP” Ignimbrite**
years BP
- ~7,000 **Raluan Ignimbrite**
years BP
- 1,200–7ka **Pre-caldera**

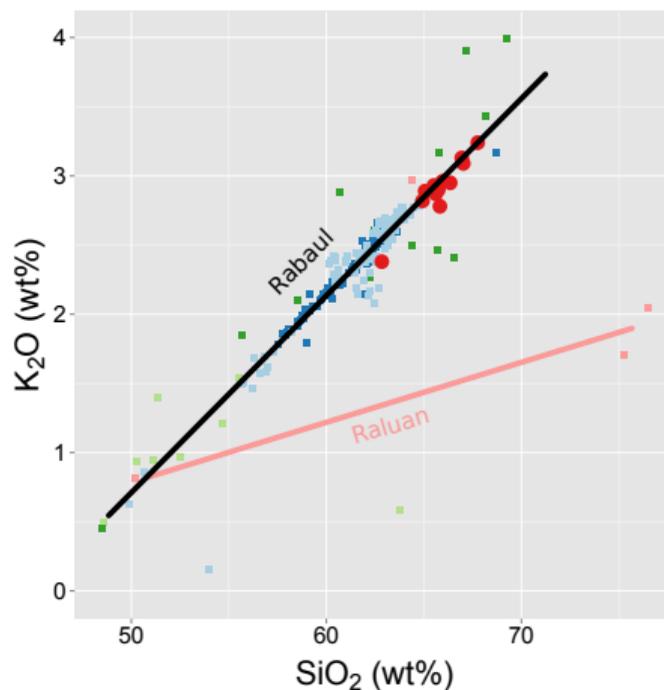
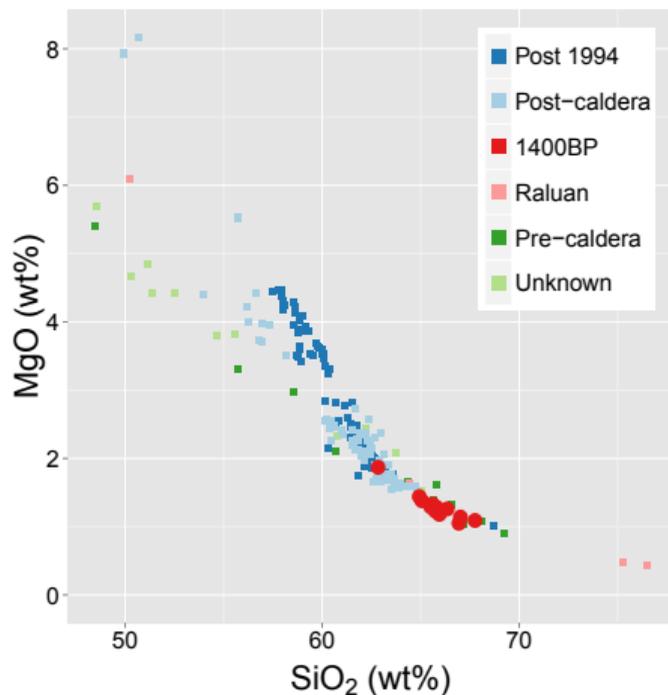
After Johnson et al. (2010)

1400 BP magma plots along Rabaul trend



1400 BP: Our data; all other eruptions: Heming and Carmichael (1973), Wood et al. (1995), Patia (2004), Cunningham et al. (2009)

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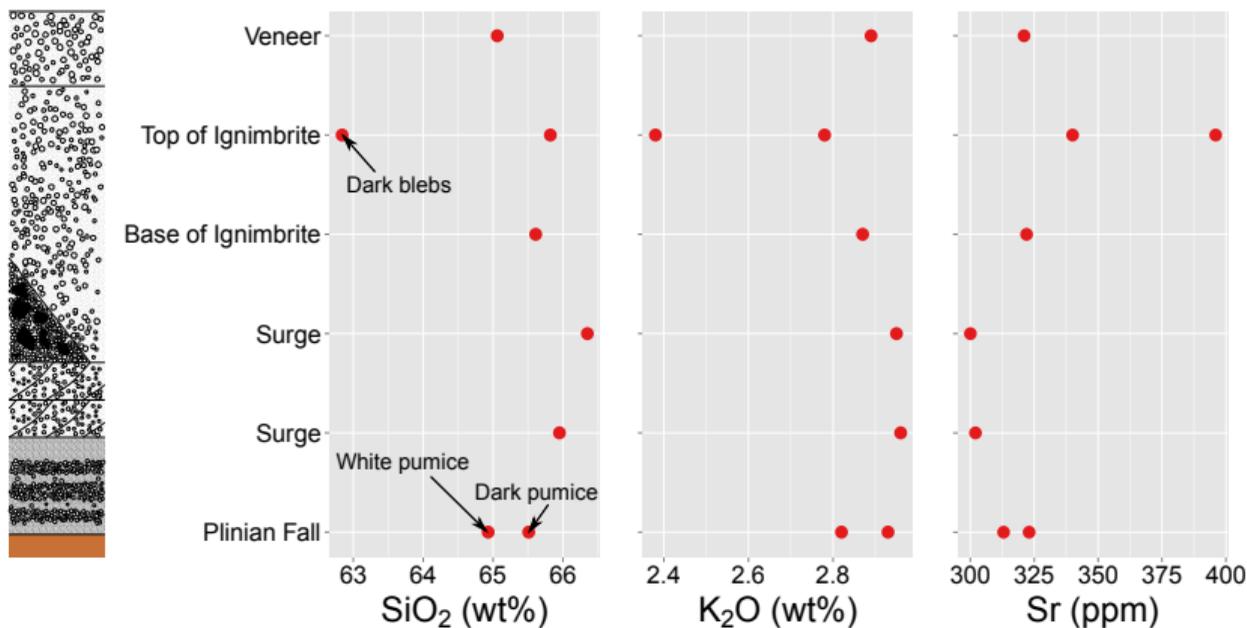


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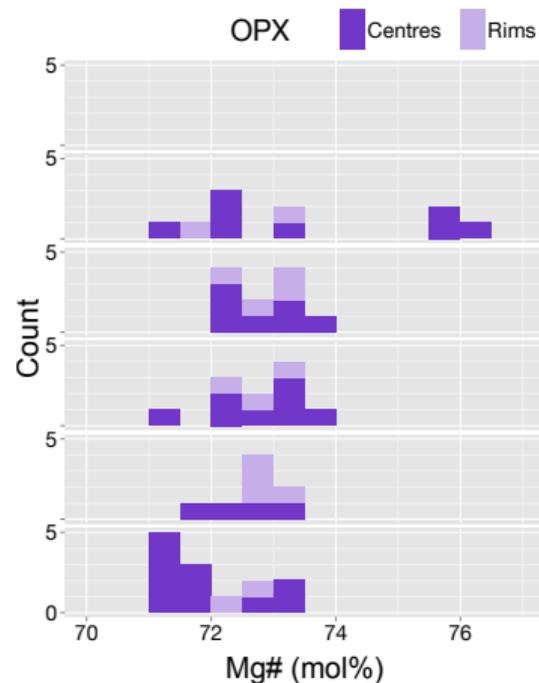
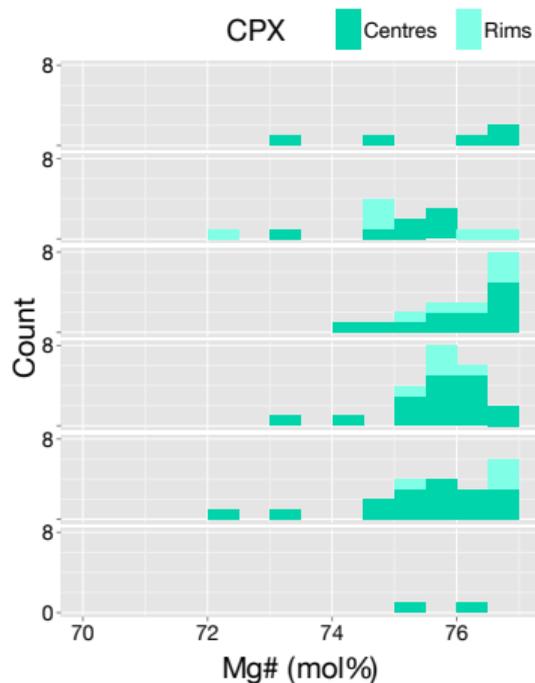
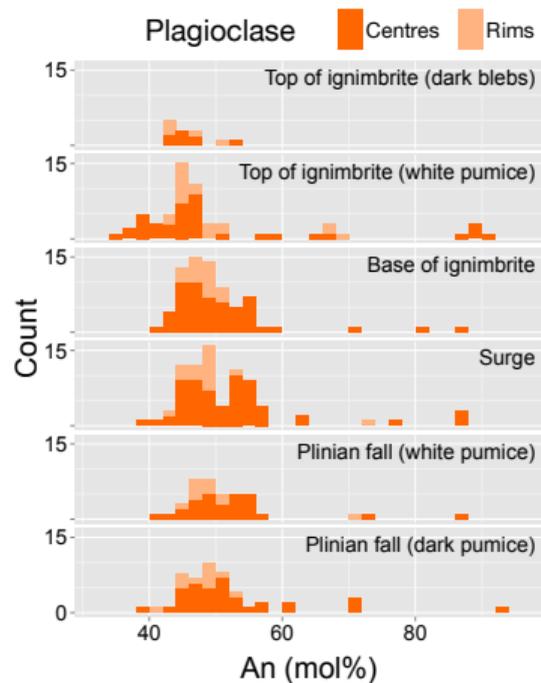
The 1400 BP magma appears homogeneous

There are dark, less-evolved blebs at top of the ignimbrite

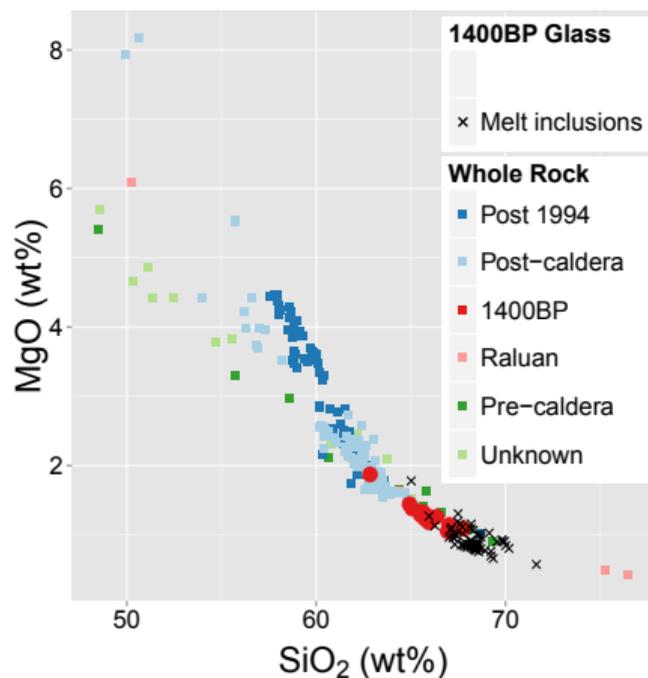
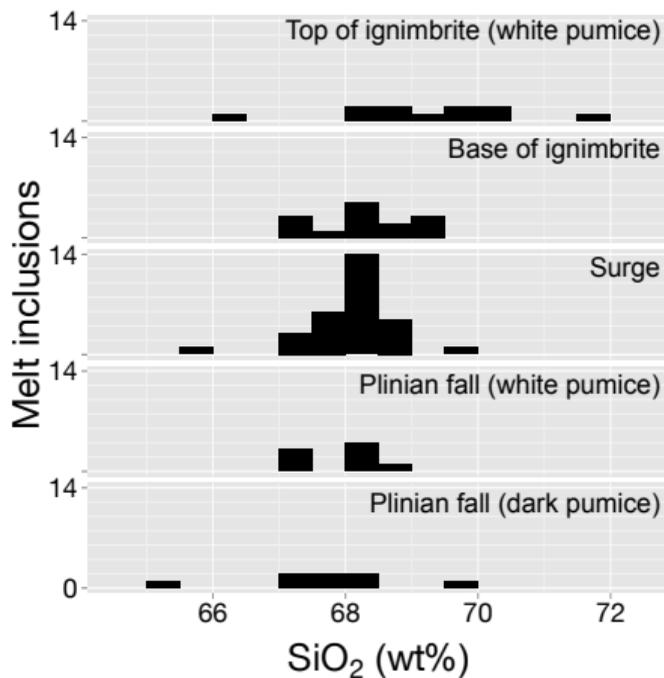
A recharge magma injected into base of chamber shortly before eruption?



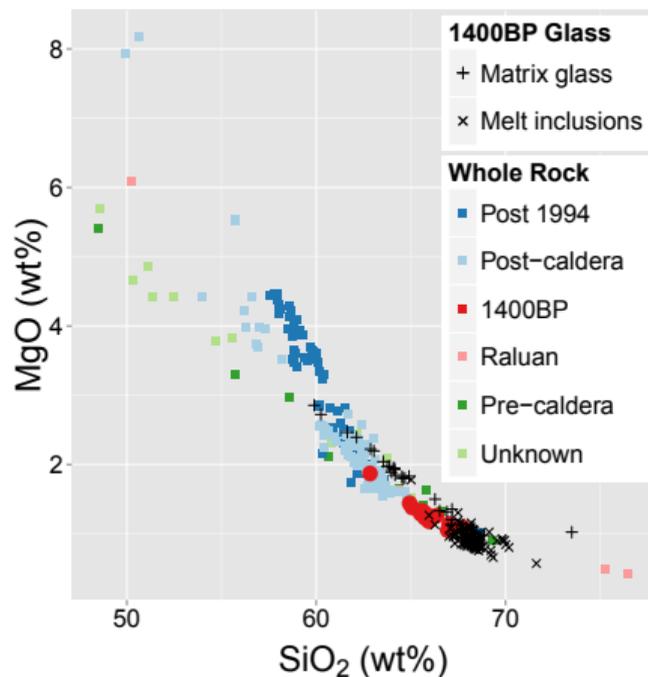
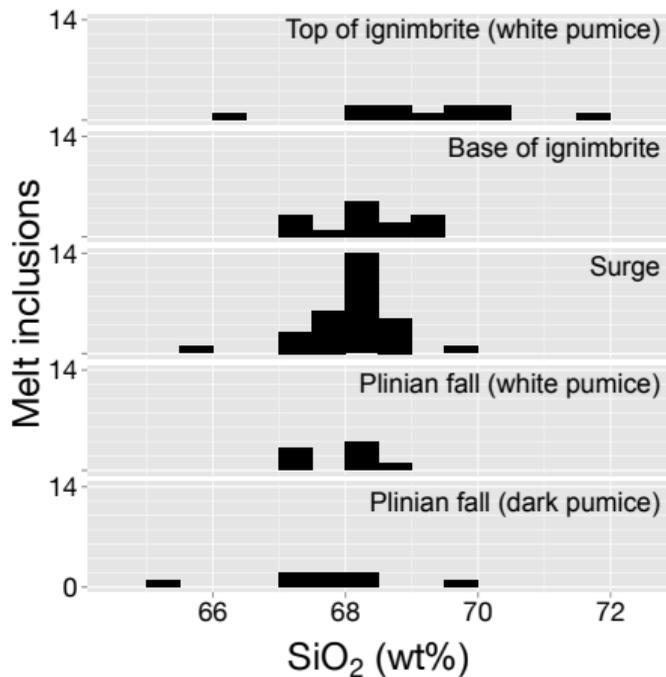
No sign of recharge in mineral chemistry



Only one population of melt inclusions...

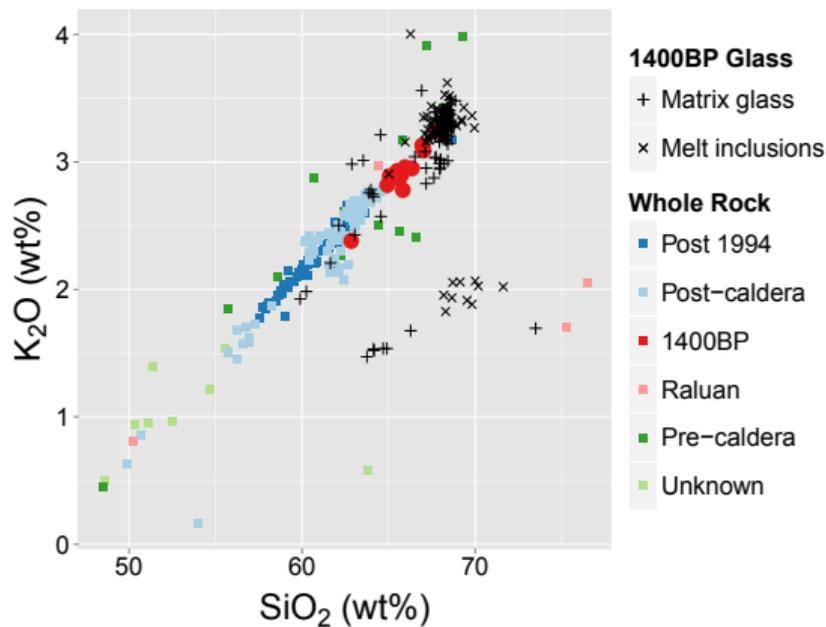


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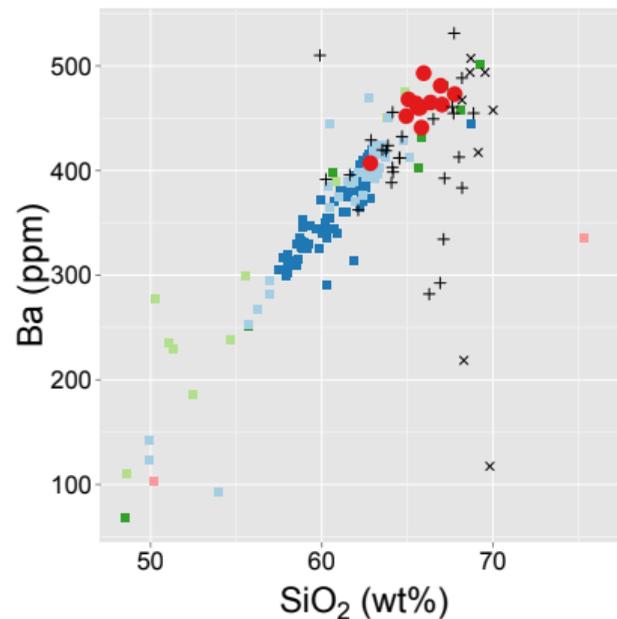
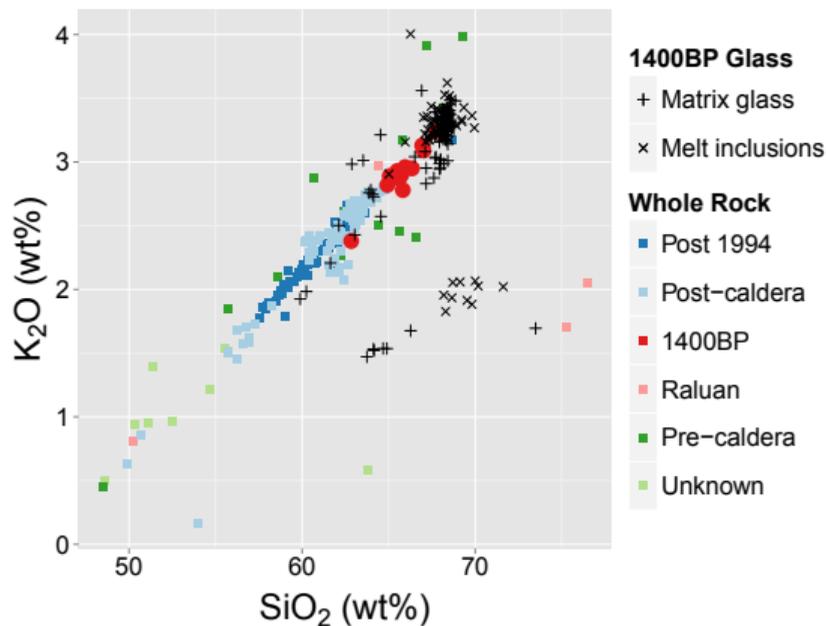


... but matrix glass shows greater spread—mixing

Interaction with remnant Raluan magma?

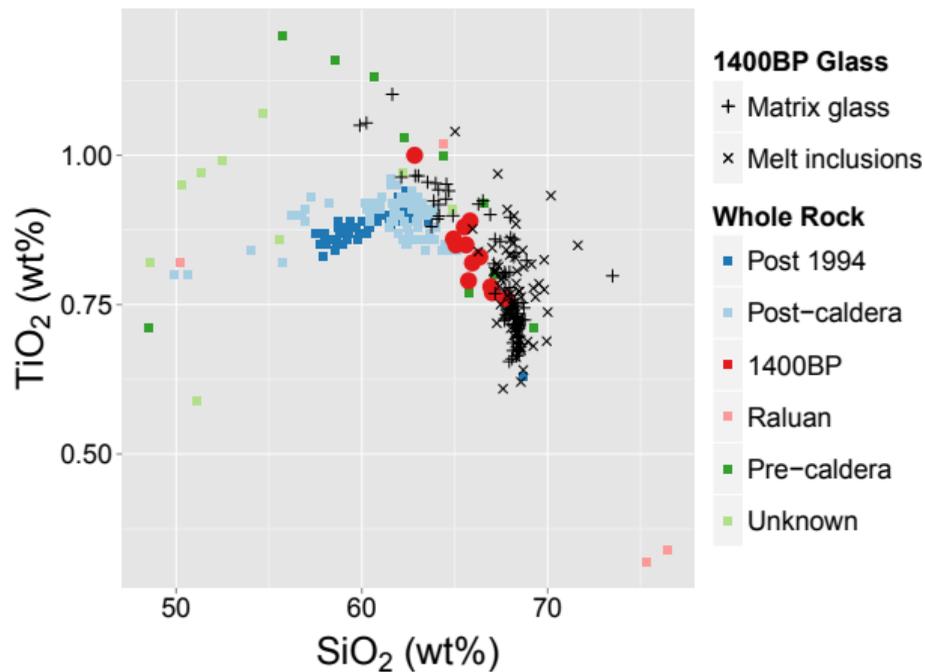


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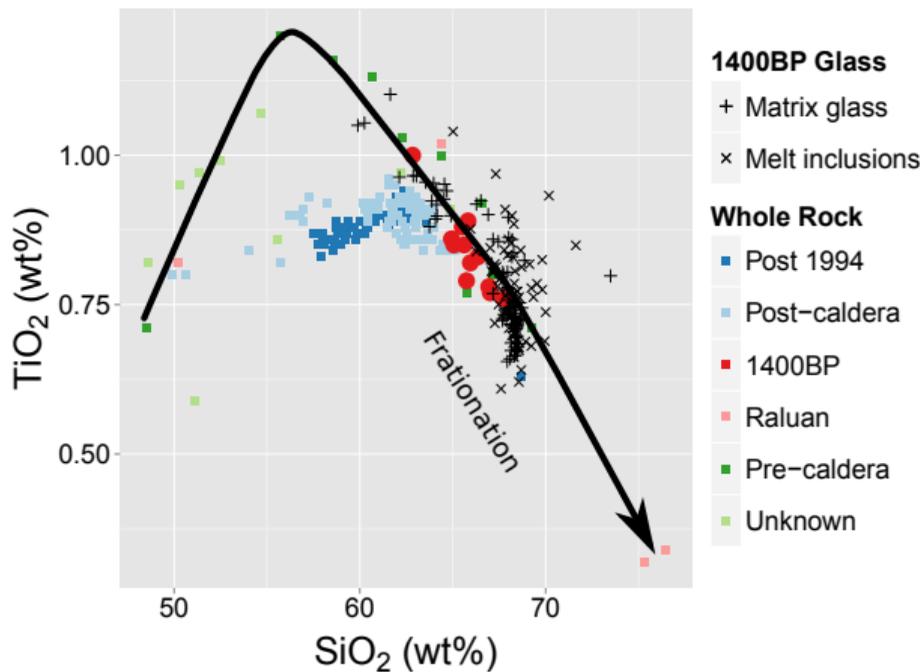


No! Matrix glasses have high incompatible trace element concentrations (Ba, Zr, Hf, Rb, La)

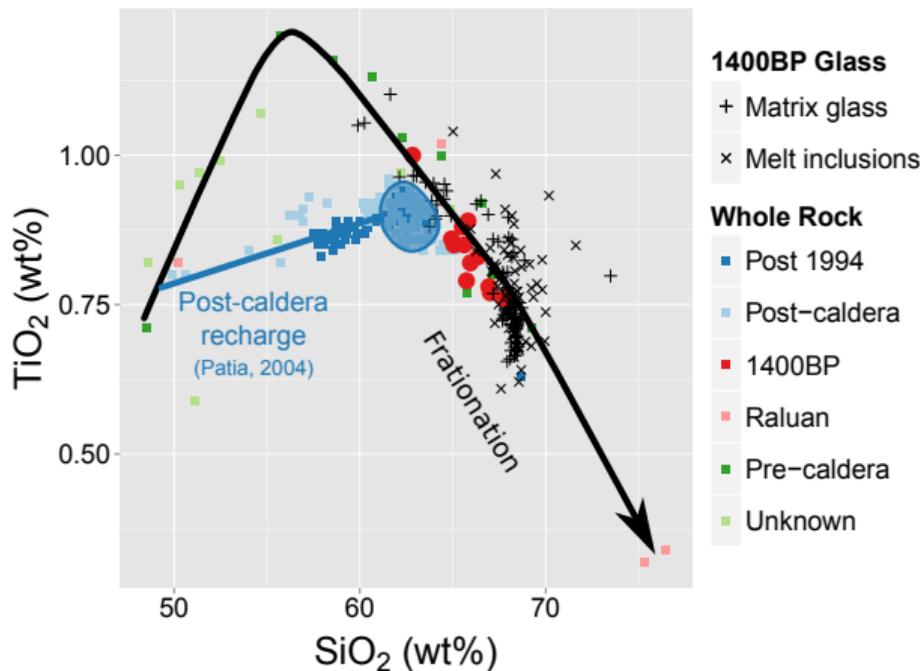
Composition of the recharge magma for the 1400 BP and post-caldera magmas



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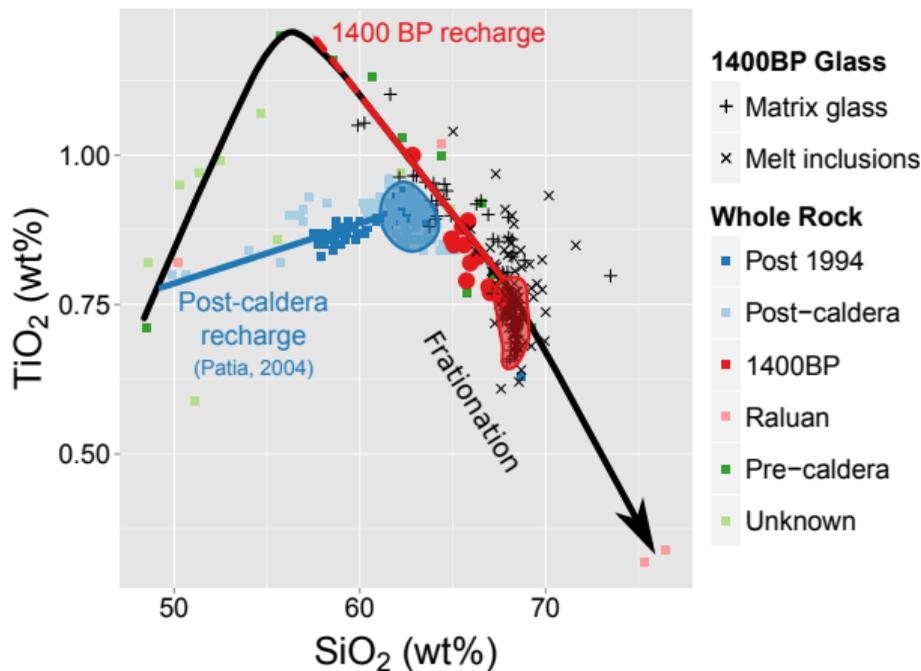


Composition of the recharge magma for the 1400 BP and post-caldera magmas



Post-caldera recharge has
~50 wt% SiO₂

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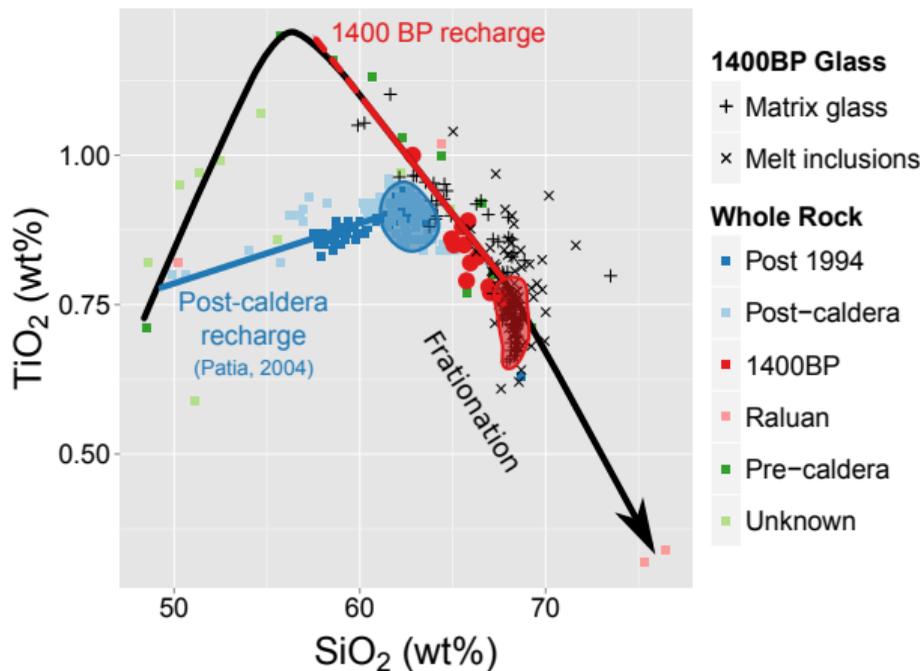
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1400 BP recharge magma has

~57–60 wt% SiO_2

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Possible interpretations:

1. More evolved recharge magma causes a more evolved magma reservoir to form
2. The presence of a more evolved magma reservoir prevents basaltic recharge from entering the shallow system

Conclusions

1. The 1400 BP eruption did not remobilise Raluan magma
2. The 1400 BP magma chamber was recharged with a more evolved magma to that which is currently being input into the plumbing system
3. This implies the plumbing system changed after the 1400 BP eruption

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Thank you!

Questions? Email: gfabbro@ntu.edu.sg

