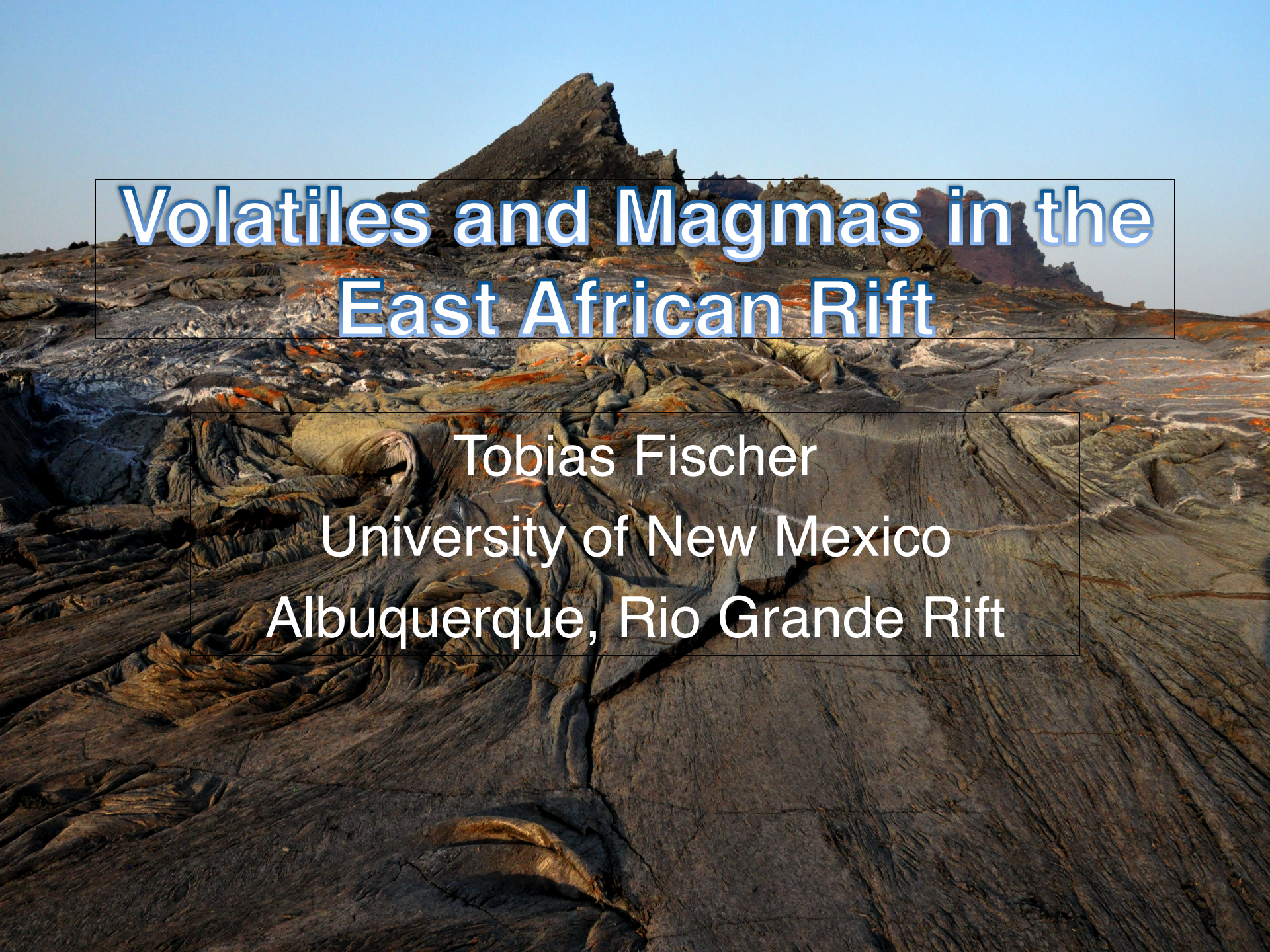


Volatiles and Magmas in the East African Rift

Tobias Fischer
University of New Mexico
Albuquerque, Rio Grande Rift

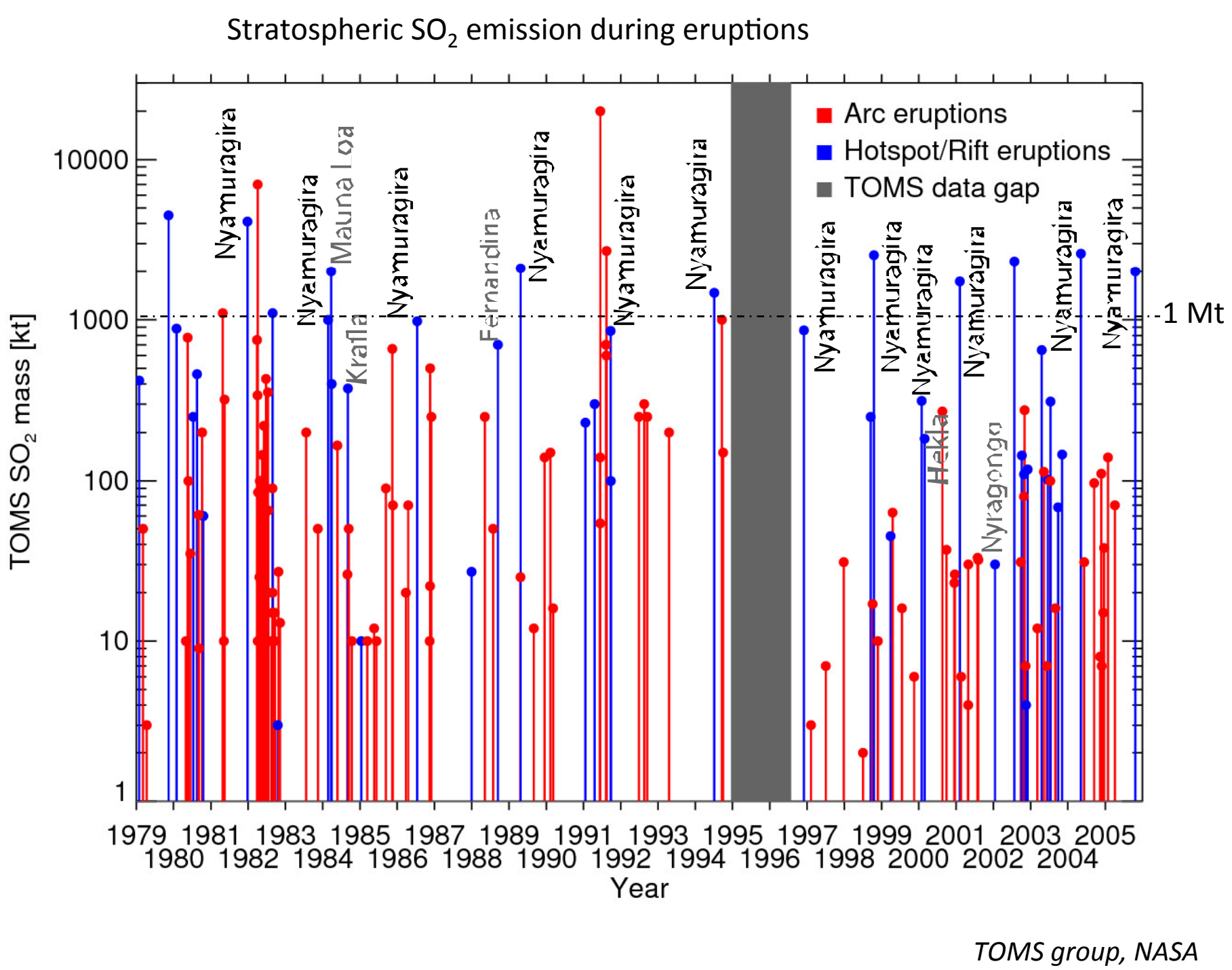
Volcanic emissions and magmatic volatiles are dominated by water, carbon dioxide and sulfur species. In (vol %):

H_2O	95	N_2	0.025
CO_2	1.6	Ar	0.00008
SO_2	1.3	He	0.00014
H_2S	0.4	H_2	0.77
HCl	0.7	O_2	<0.0005
HF	0.01	CH_4	0.00005
		CO	0.0008

C, N, S, H, O, noble gas isotopes

… and many trace elements (PGE, Na, K, Sr, Rb, B, Be…) at ppm, ppb levels


Erta Ale
SO_2 flux : ~ 100 tons/day
CO_2 flux: ~ 5000 tons/day
Sawyer et al., 2008
Fischer et al., unpubl. 2011



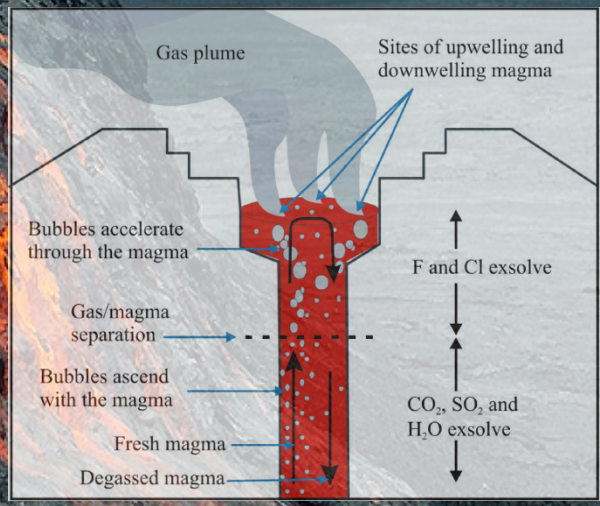
TOMS group, NASA

SO_2 , CO_2 emission during passive degassing

SO_2 flux ~3,000 t/day

CO_2 flux ~11,000 t/day

Sawyer et al., 2008



Mantle melting requires:

Unusually high mantle temperatures

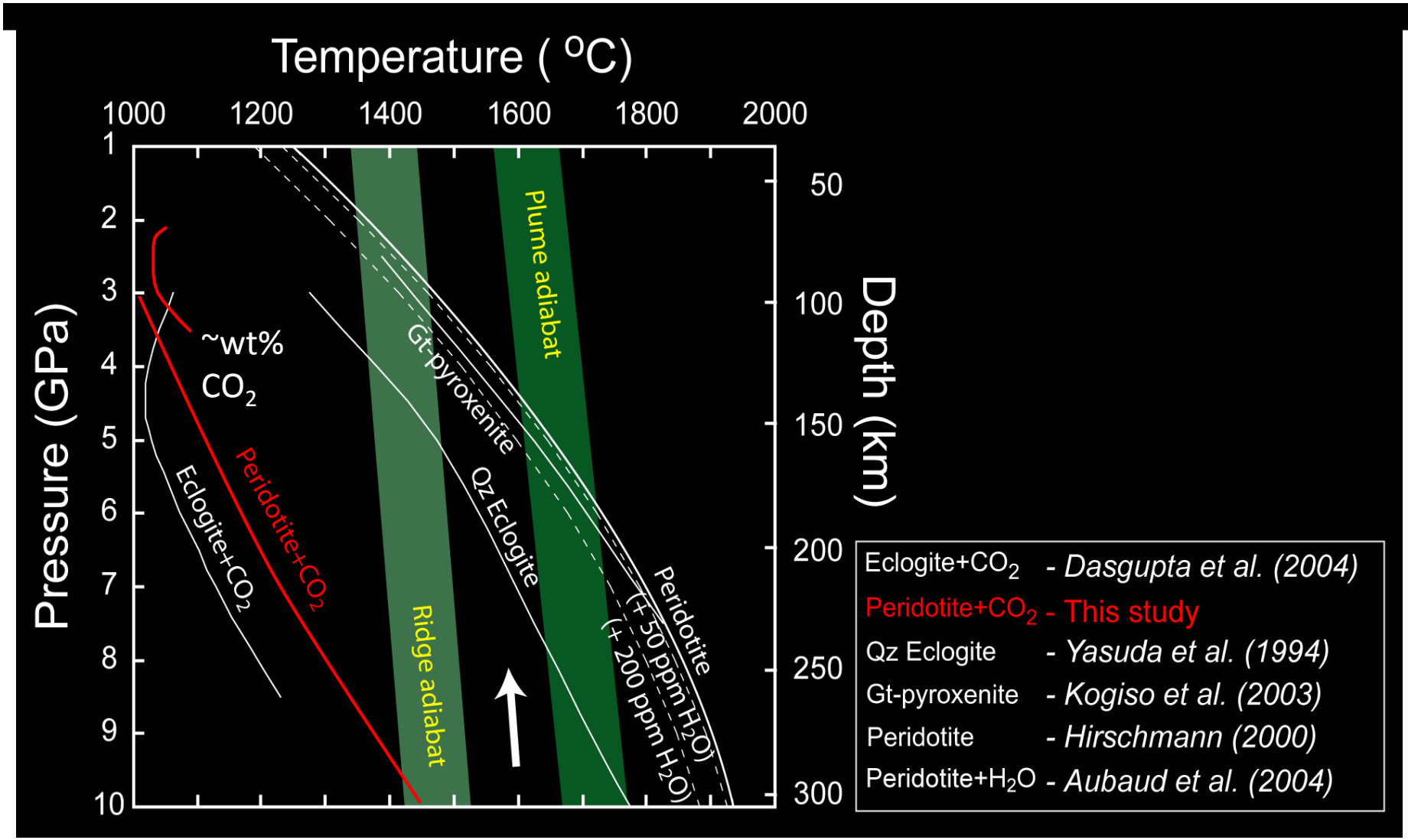
Fluids: H_2O and/or CO_2 lower melting temp

Decompression

Is there evidence for high volatile contents in EARS mantle?

What are volatile sources in EARS?

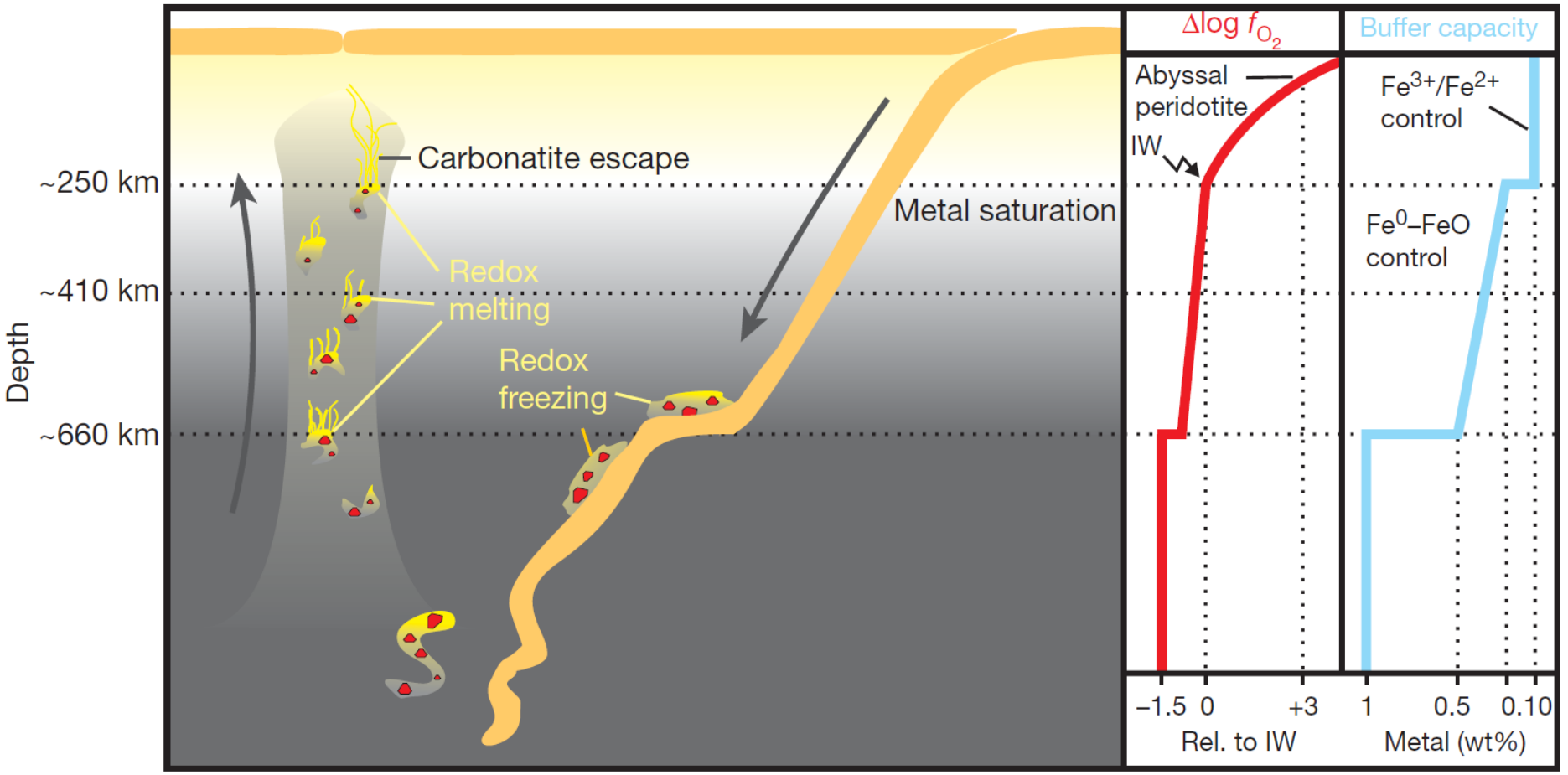
Water but also CO_2 enhances melting



Dasgupta & Hirschmann (2006) - Nature

From: Hirschman's MARGINS talk
WHOI 2006

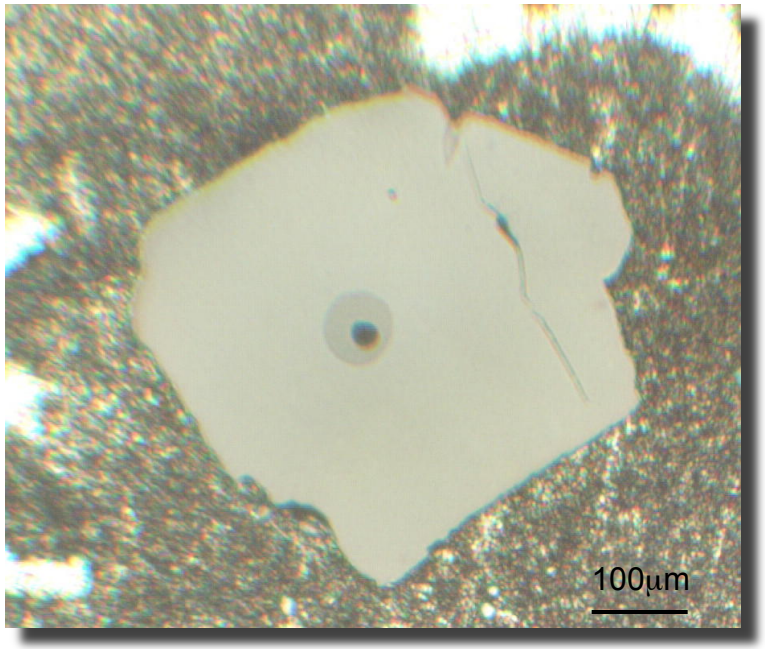
Subducted Carbon from oceanic crust and sediments



Rohrbach and Schmidt, nature 2011

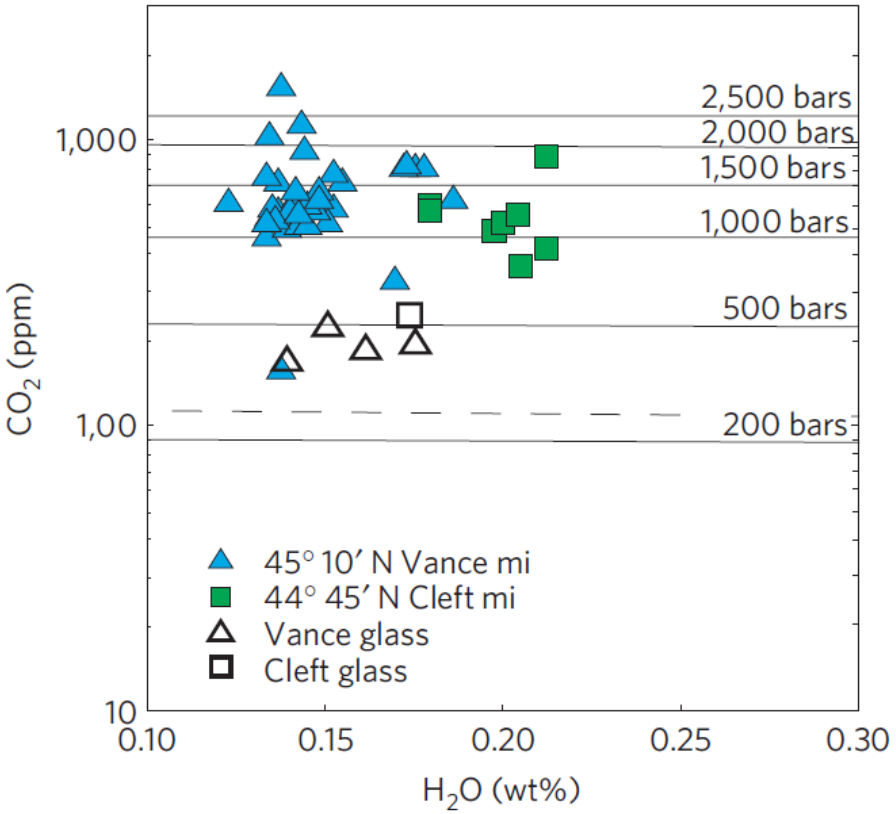
Melt inclusions: pre-eruptive melt volatile contents

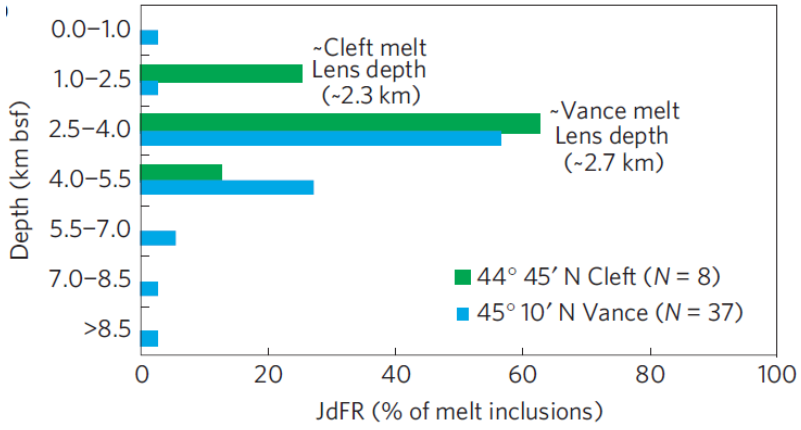
Allow for assessment of pre-eruptive melt volatile composition since they are assumed to be less susceptible to degassing and contamination than glasses

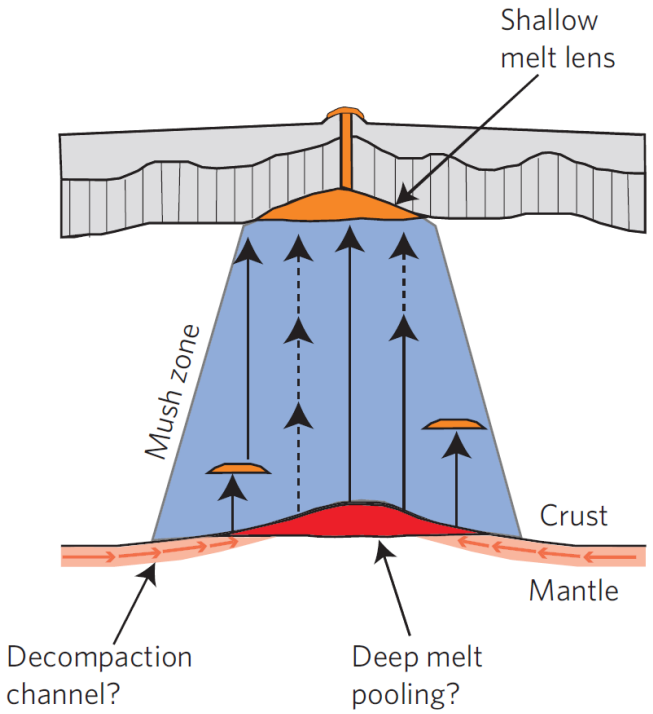


Photos: Alison Shaw

Melt Inclusion study of
Juan de Fuca Ridge

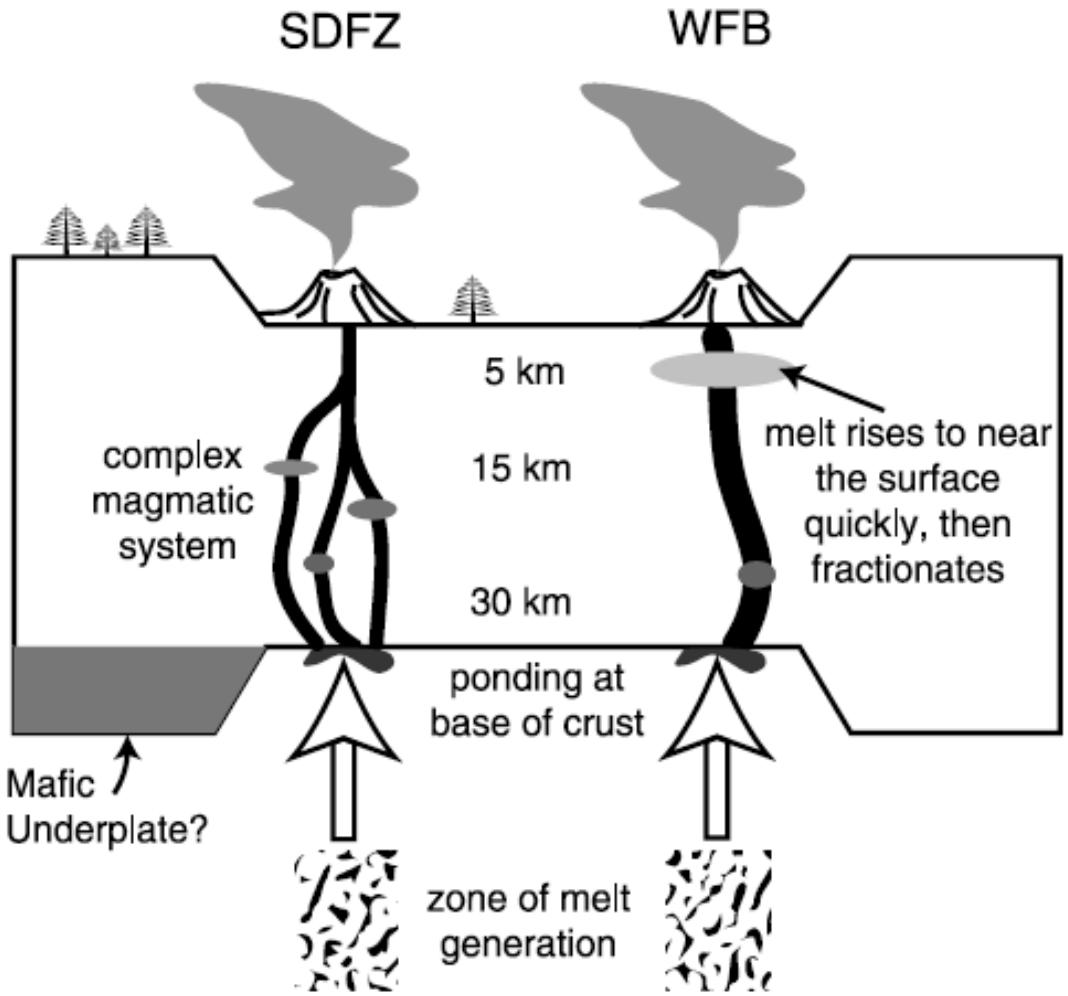




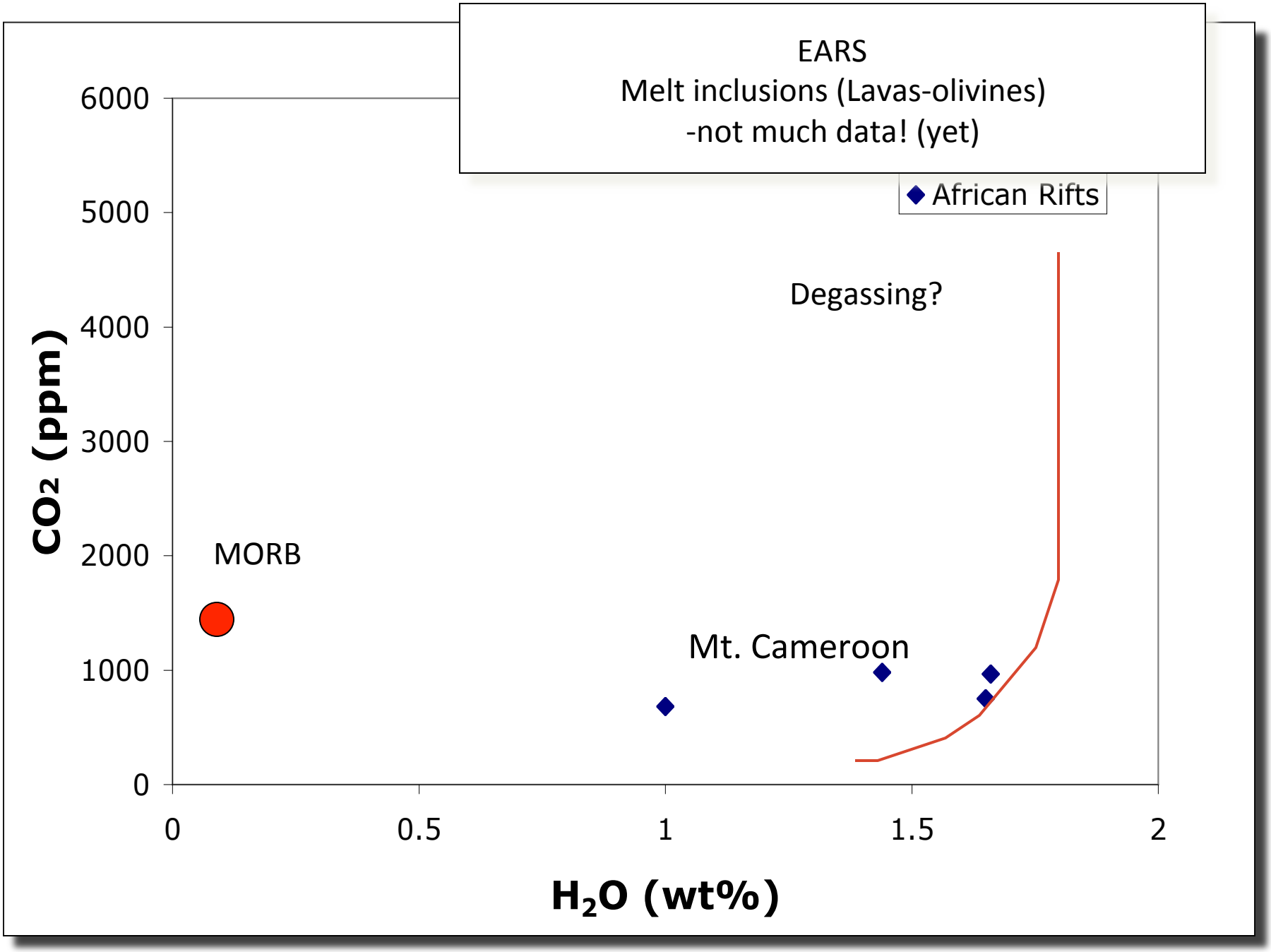


Wanless and Shaw, nature geosci, 2012

Similarities to EARS magma pathways



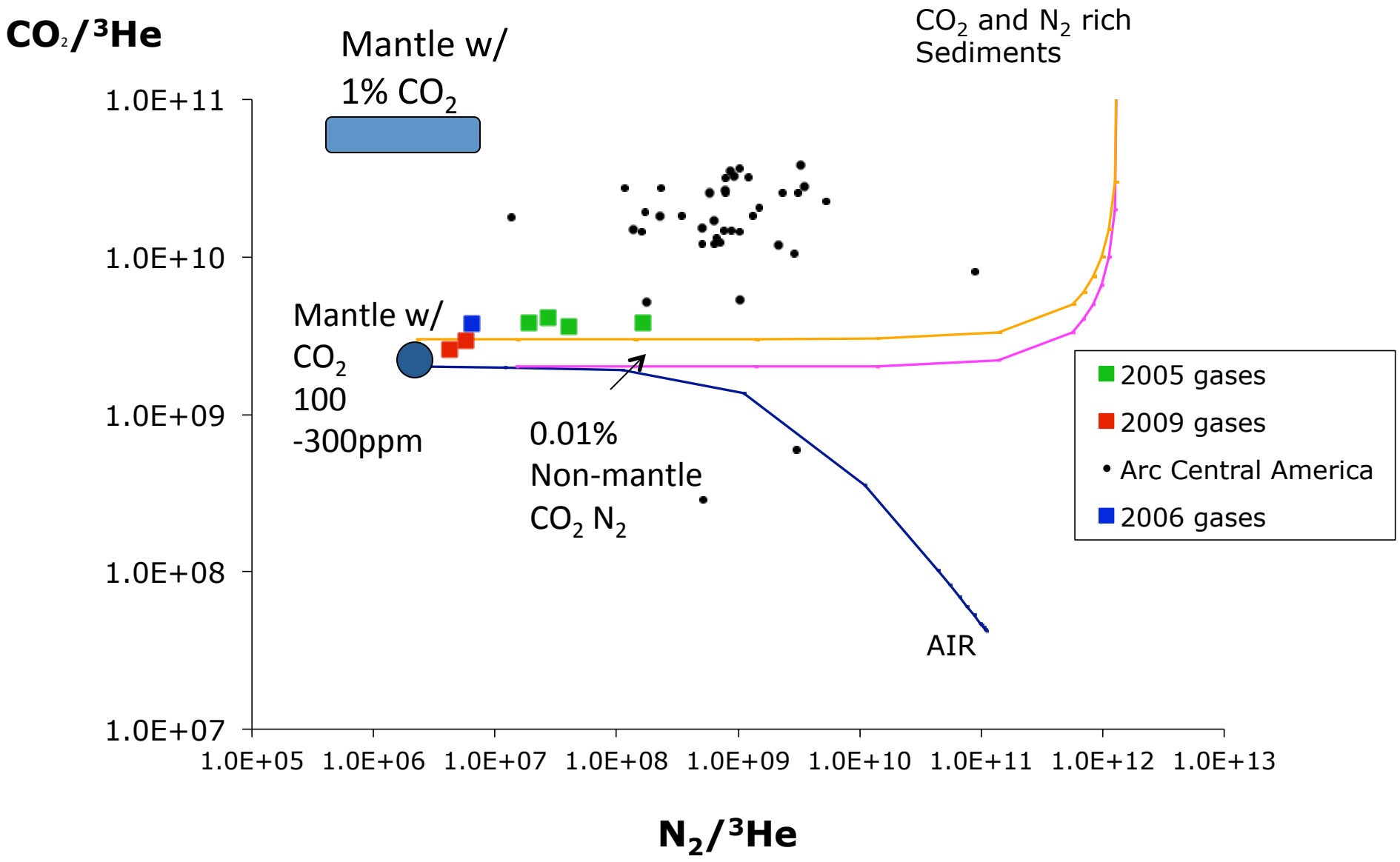
Rooney et al., 2007



Suh, 2008 *'MORB field' from Wallace, 2005* Georoc MI data-base (last update 2010)

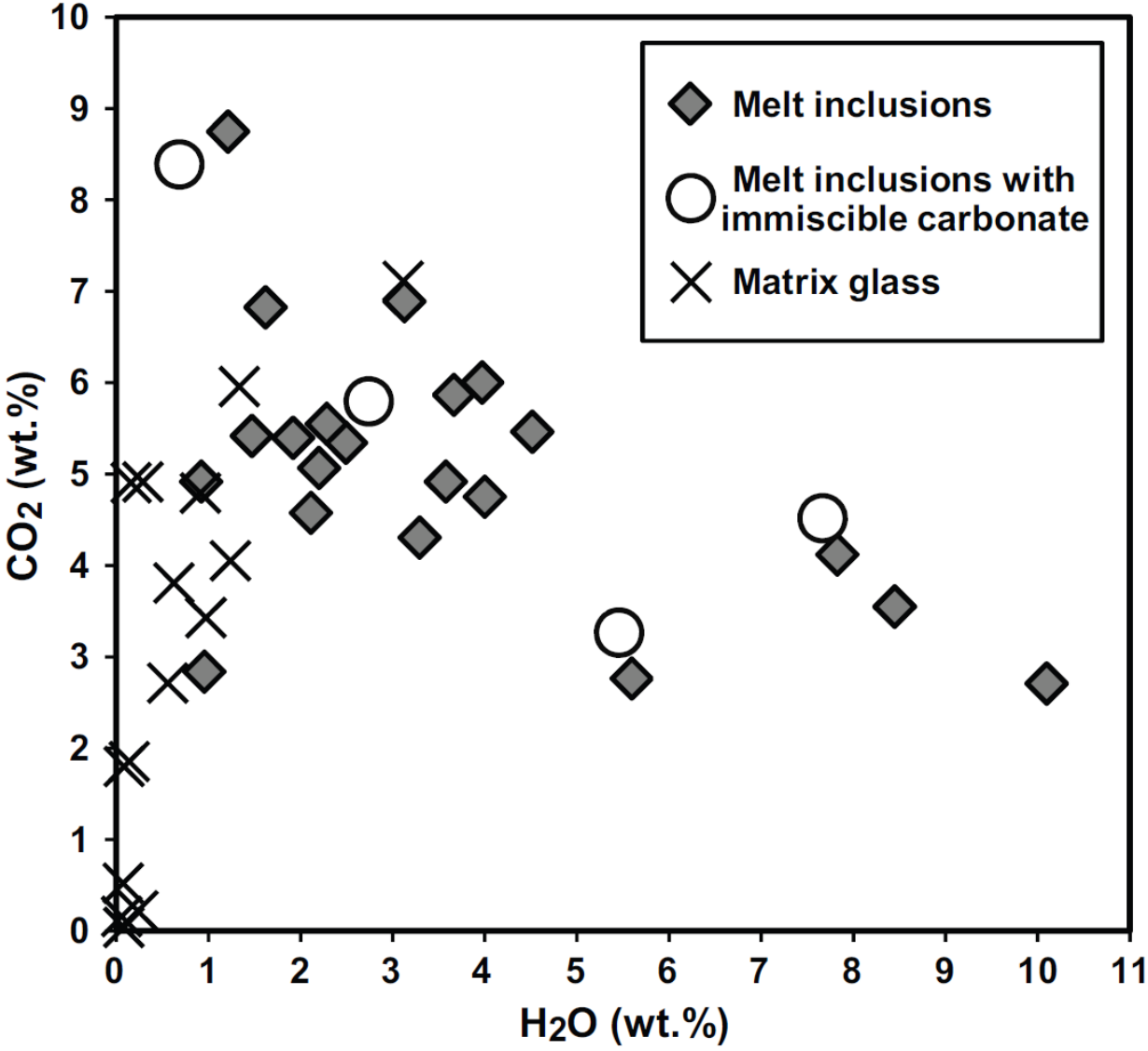
Lengai Gas sampling: fumarole temperatures 98°C to 160°C

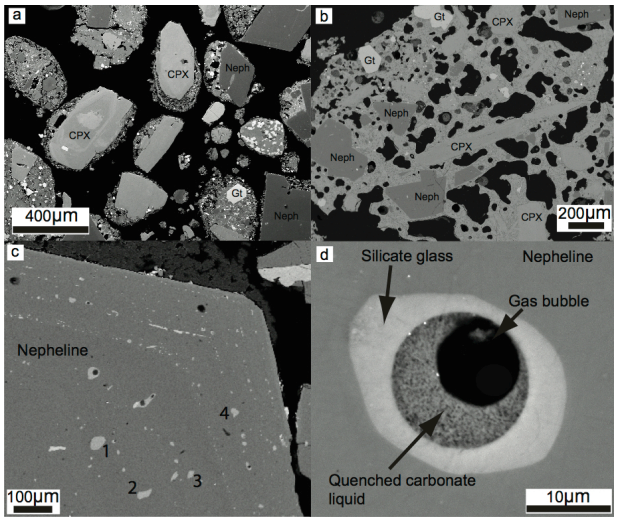
CO_2 (and Nitrogen) in Gas Emissions (Lengai and Rungwe)



Fischer et al. 2009

Lengai silicate melt inclusions in nepheline from explosive eruptions 2007-2009





de Moor et al. EPSL in revision

Conclusions

- Volatiles can be sensitive geochemical tracers
- We can use a variety of sampling techniques (fluids, phenocrysts, melt inclusions) to capture volatiles.
- Presence of carbonatite does not alone imply high source CO_2
- MUCH MORE WORK NEEDED ….