

Depth of differentiation under Osorno volcano (Chile)

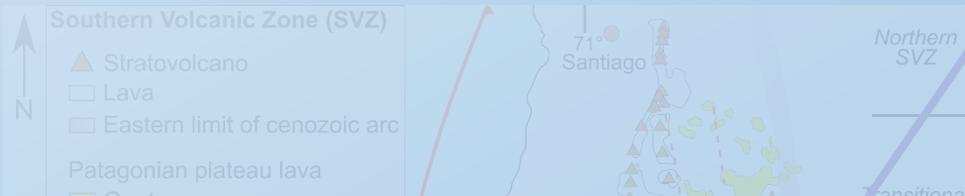
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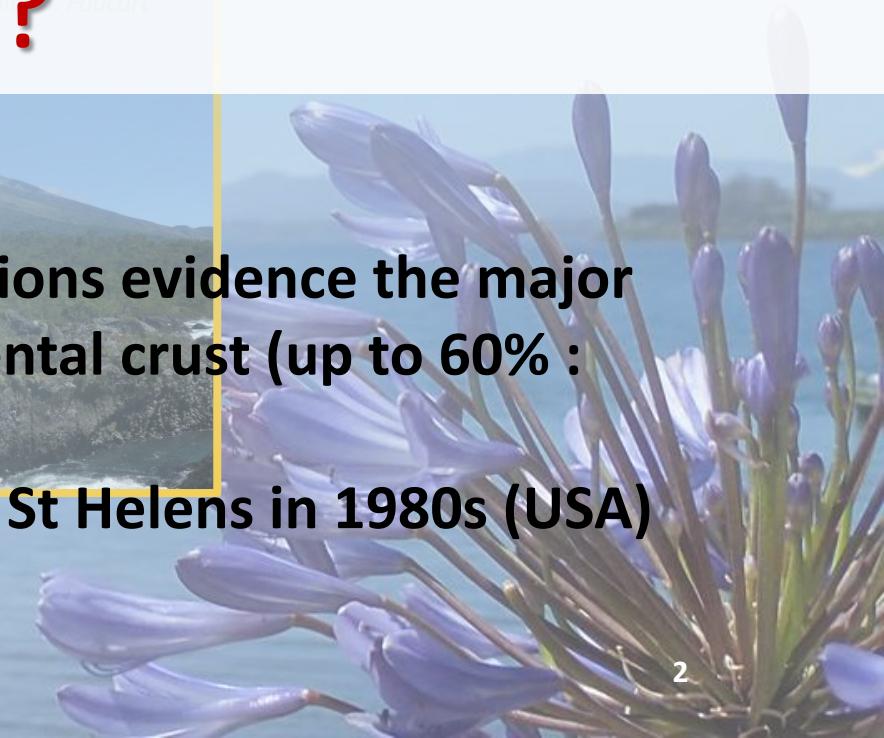
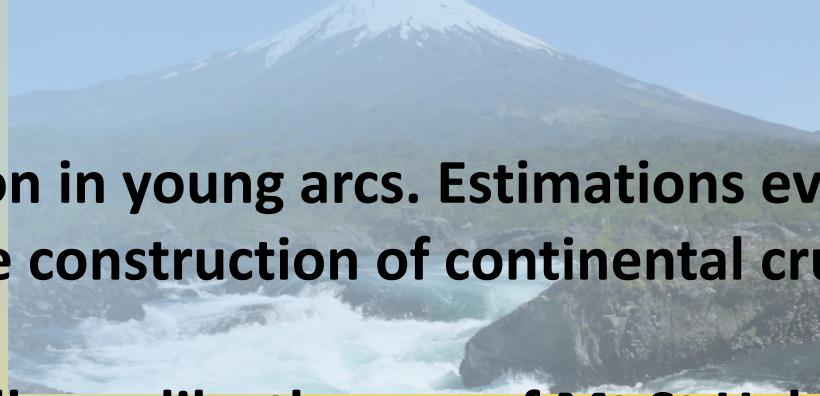




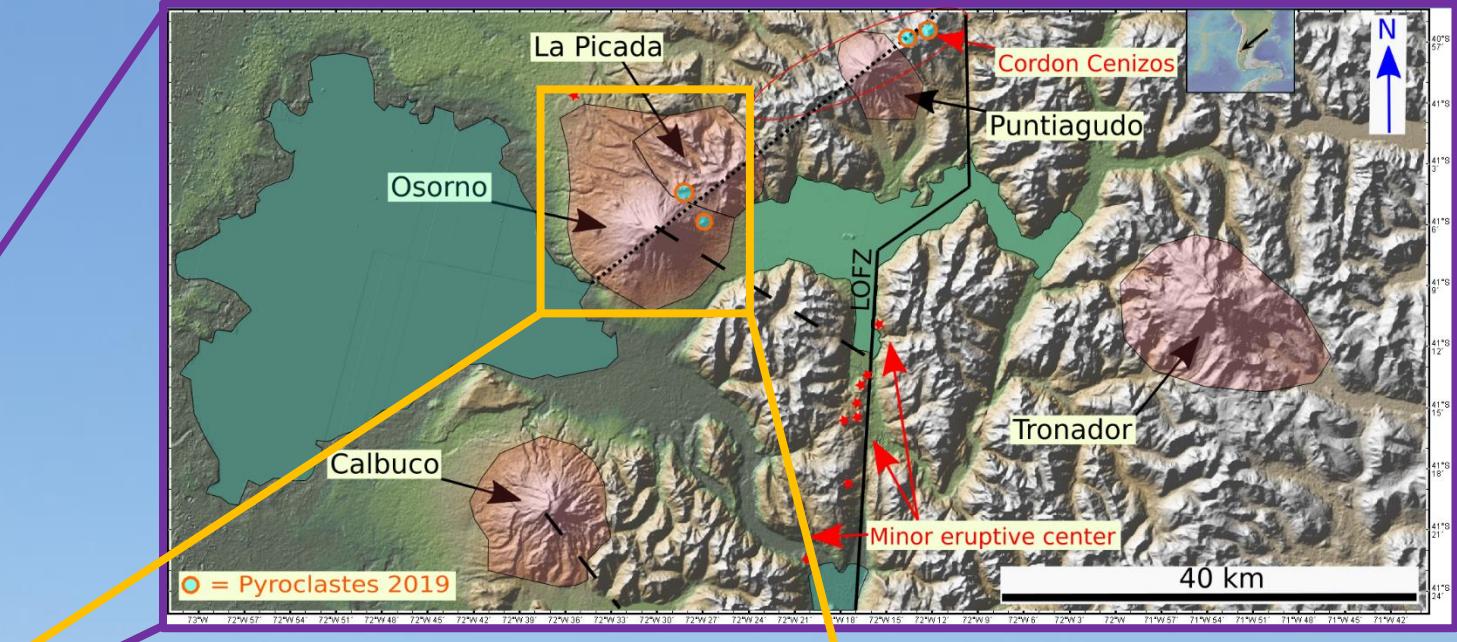
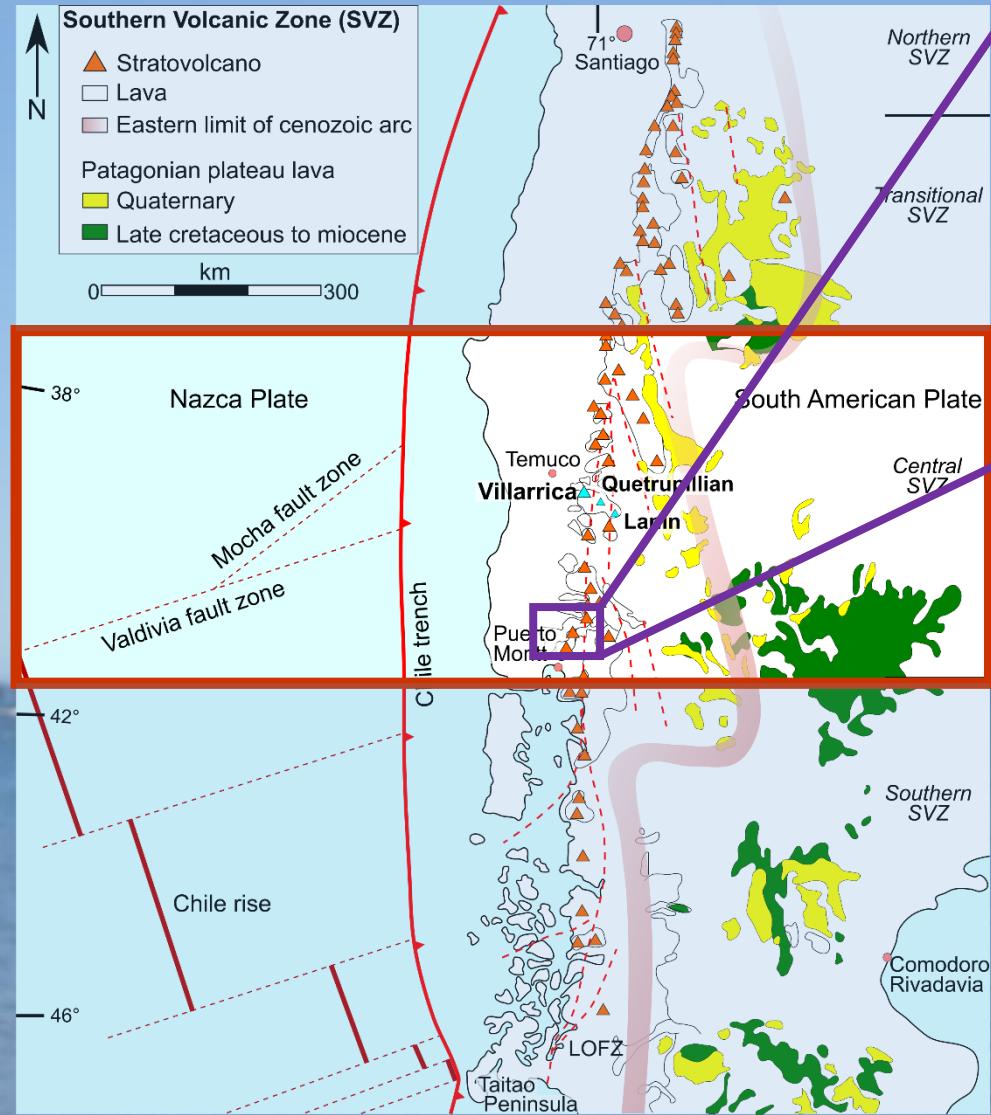
What is the depth of the magma chamber at Osorno volcano ?

It matters for :

- Understanding differentiation in young arcs. Estimations evidence the major role of arc magmatism in the construction of continental crust (up to 60% : Rudnick and Gao, 2003).
- Monitoring a major flank collapse like the one of Mt St Helens in 1980s (USA)



Introduction



Method

- Whole rock major elements: XRF
- Minerals major elements: microprobe

T°C and P (kbar) of last equilibration with mantle

Lee et al 2009

Assuming H₂O (1%)

Assuming P (0-5kbar) and H₂O (0-5%)

T°C:

Putirka 2008
Wan et al 2007
Coogan et al 2014
Harrison et Watson 1984

P (kbar):

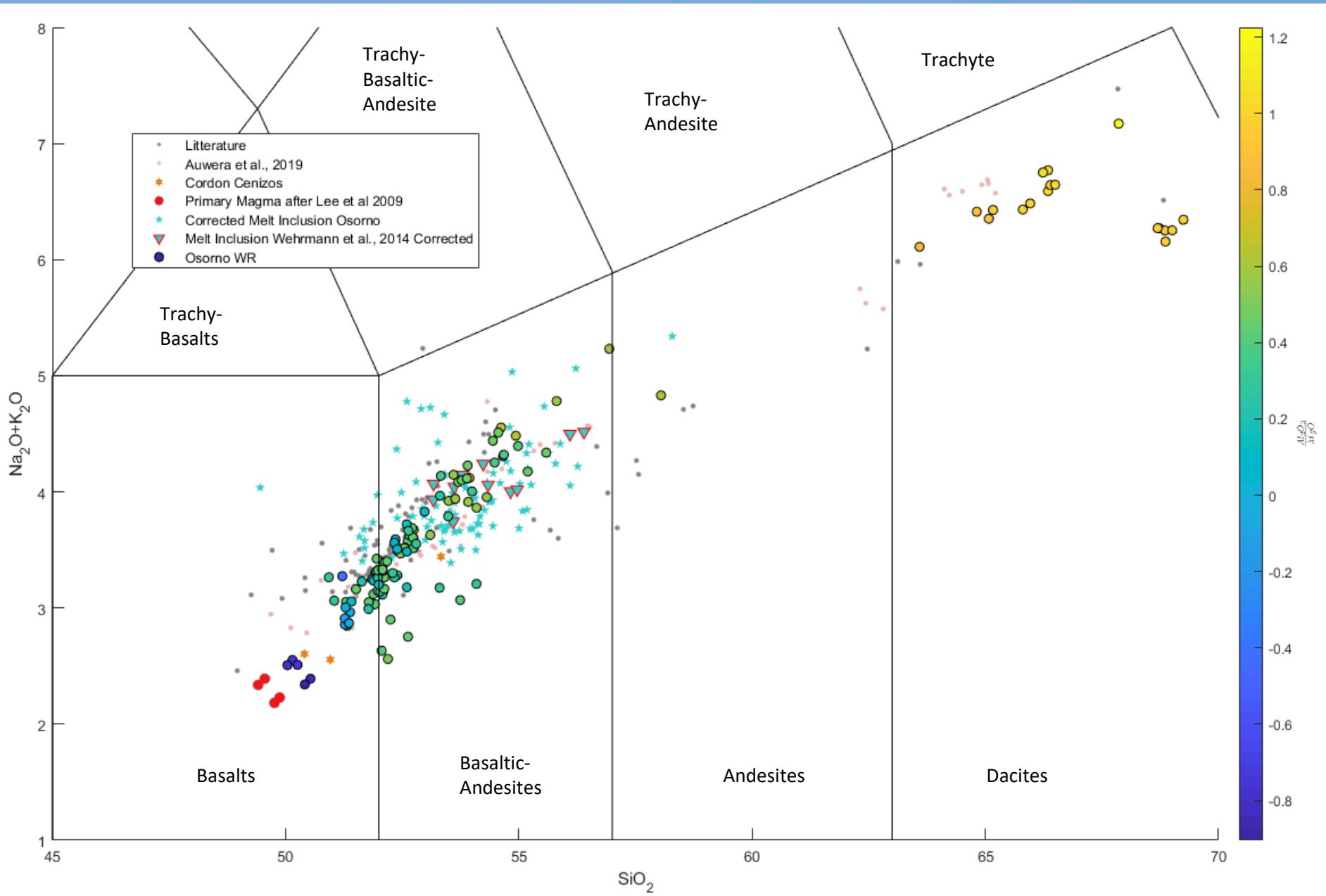
Putirka 2008
Neave et Putirka 2017

Assuming H₂O

Depth (km):

Tassara et Echaurren 2012

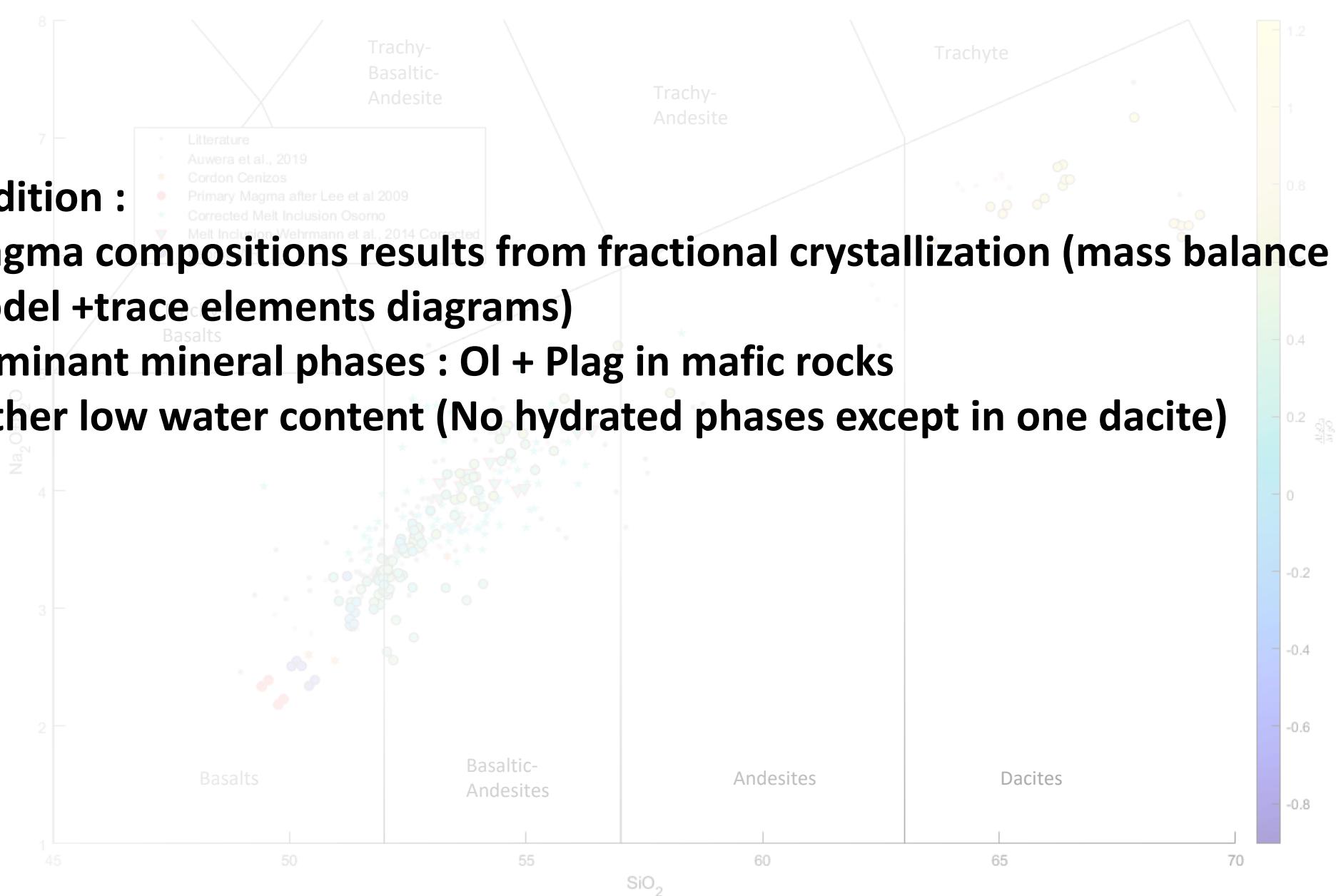
Results



Results

In addition :

- Magma compositions results from fractional crystallization (mass balance model +trace elements diagrams)
- Dominant mineral phases : OI + Plag in mafic rocks
- Rather low water content (No hydrated phases except in one dacite)

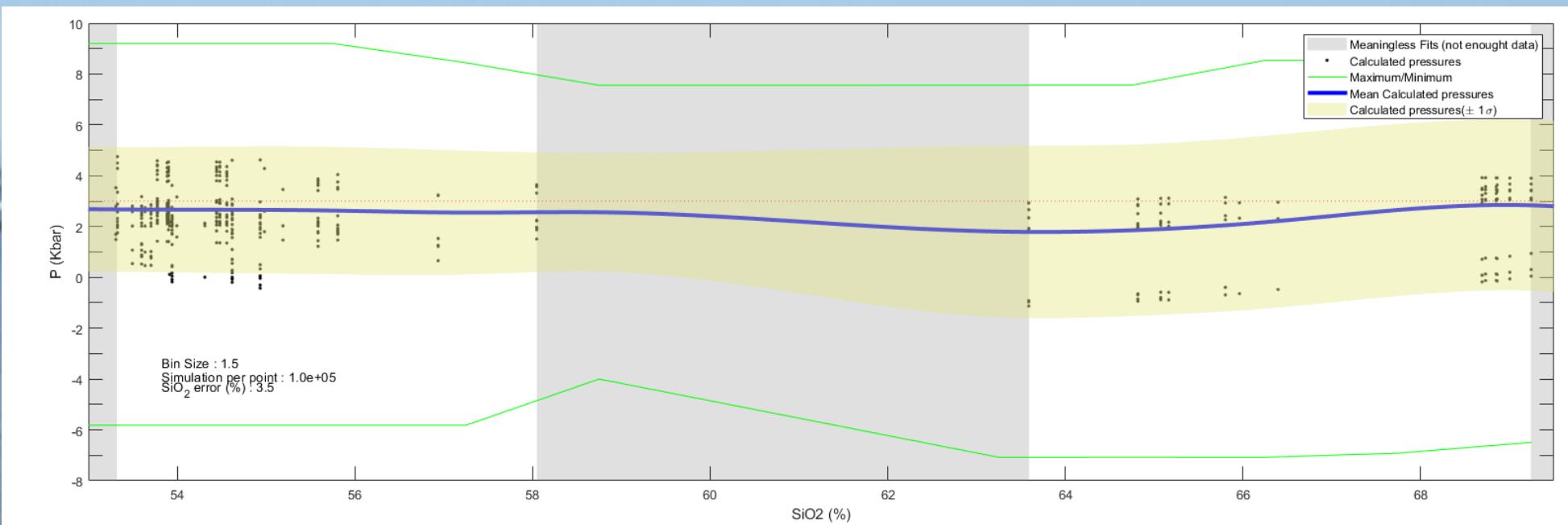
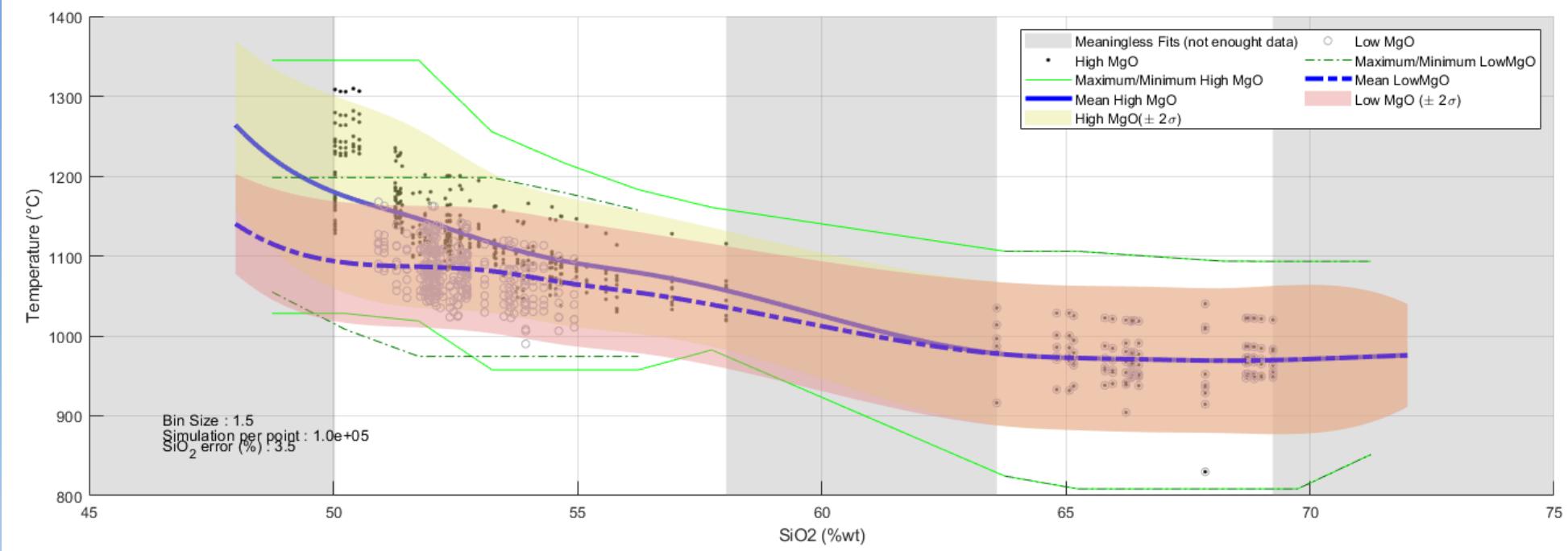


$$\frac{10^4}{T(\text{K})} = 7.53 - 0.14 \ln \left(\frac{X_{Jd}^{cpx} X_{\text{CaO}}^{liq} X_{Fm}^{liq}}{X_{DiHd}^{cpx} X_{Na}^{liq} X_{Al}^{liq}} \right) + 0.07 (\text{H}_2\text{O}^{liq}) - 14.9 (X_{\text{CaO}}^{liq} X_{\text{SiO}_2}^{liq}) \\ - 0.08 \ln (X_{\text{TiO}_2}^{liq}) - 3.62 (X_{\text{NaO}_{0.5}}^{liq} + X_{\text{KO}_{0.5}}^{liq}) - 1.1 (Mg\#^{liq}) \\ - 0.18 \ln (X_{EnFs}^{cpx}) - 0.027 P(\text{kbar}) \quad (33)$$

↑ Putirka (2008)

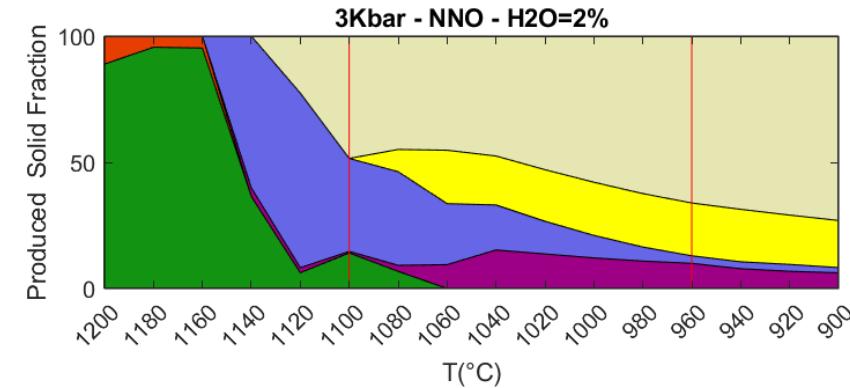
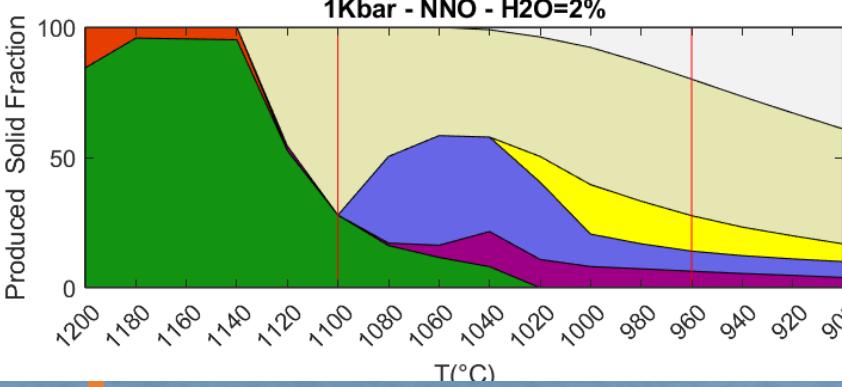
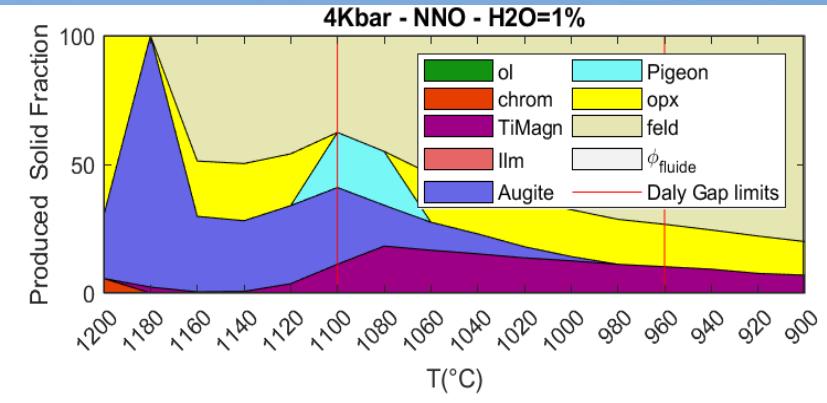
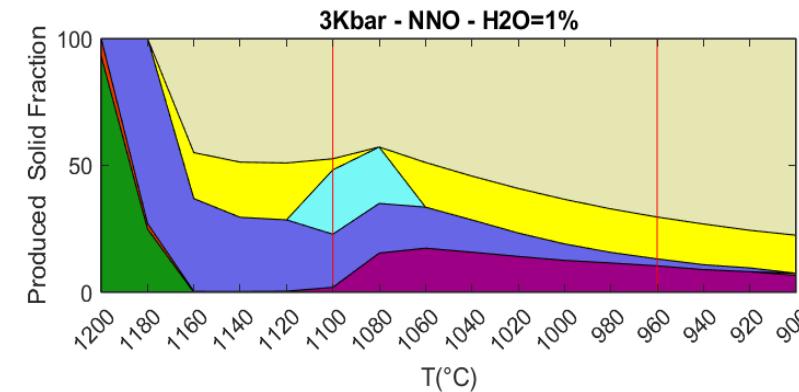
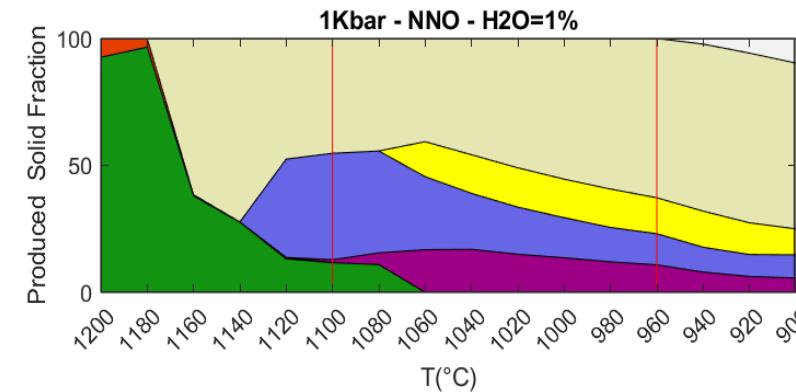


Results



Discussion

P° (kbar)

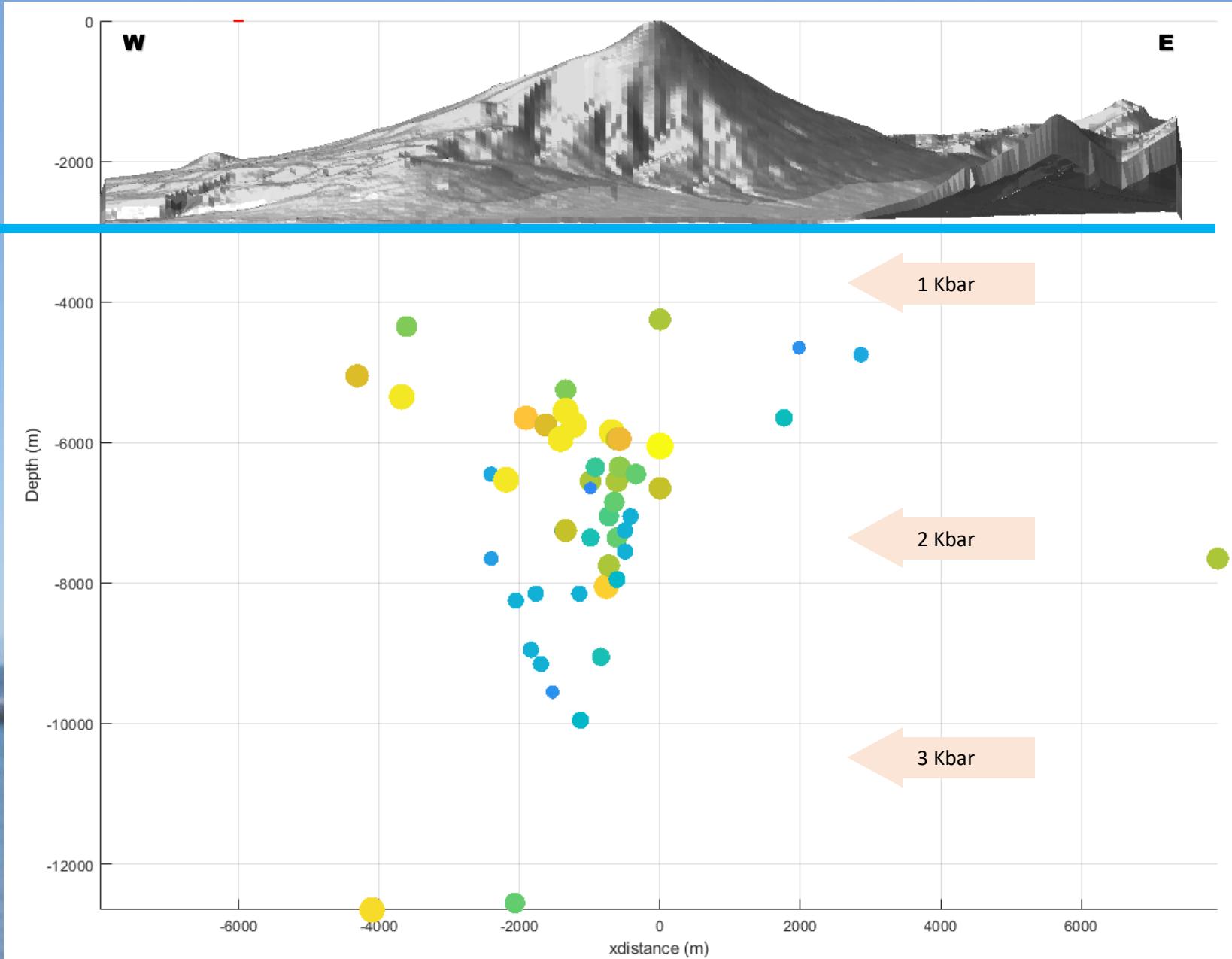


H₂O (%wt)

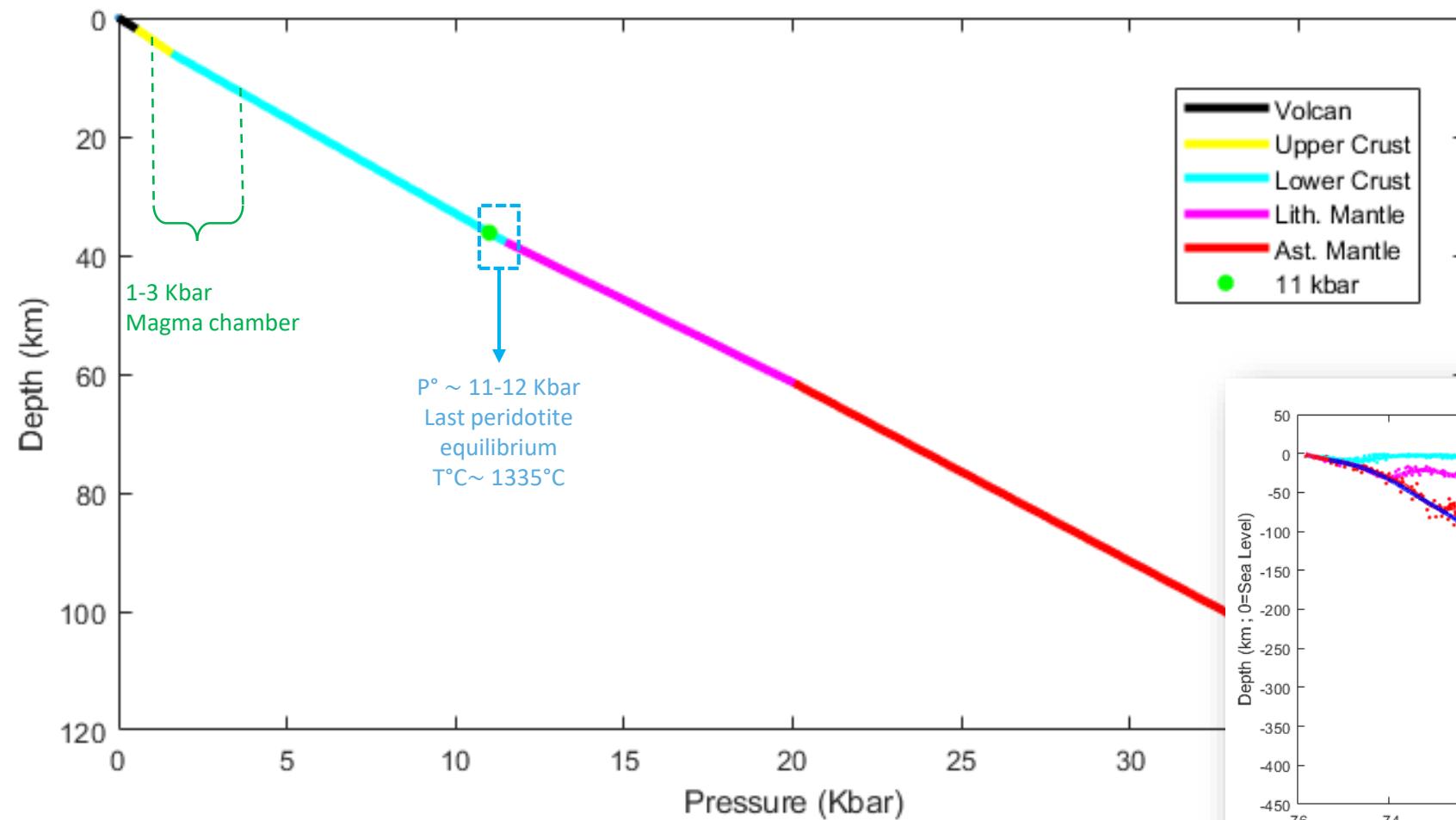


Discussion

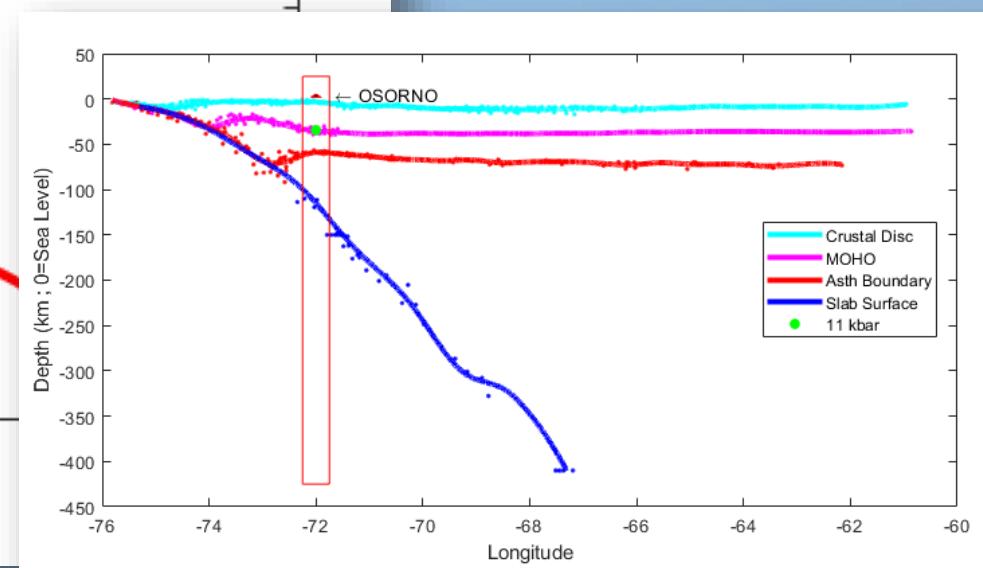
↓ Seismic data from SERNAGEOMIN surveillance (Chile)



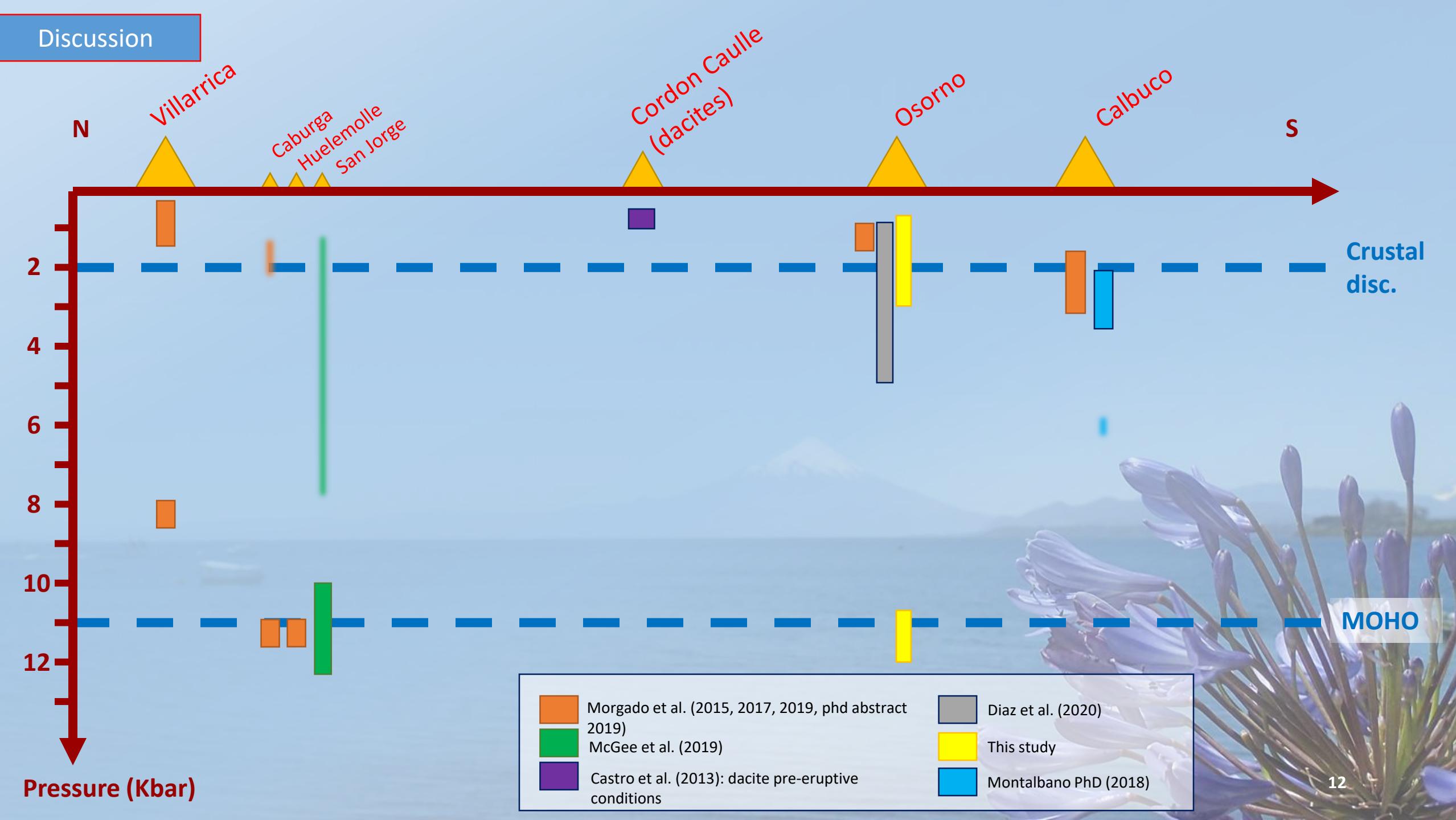
Discussion



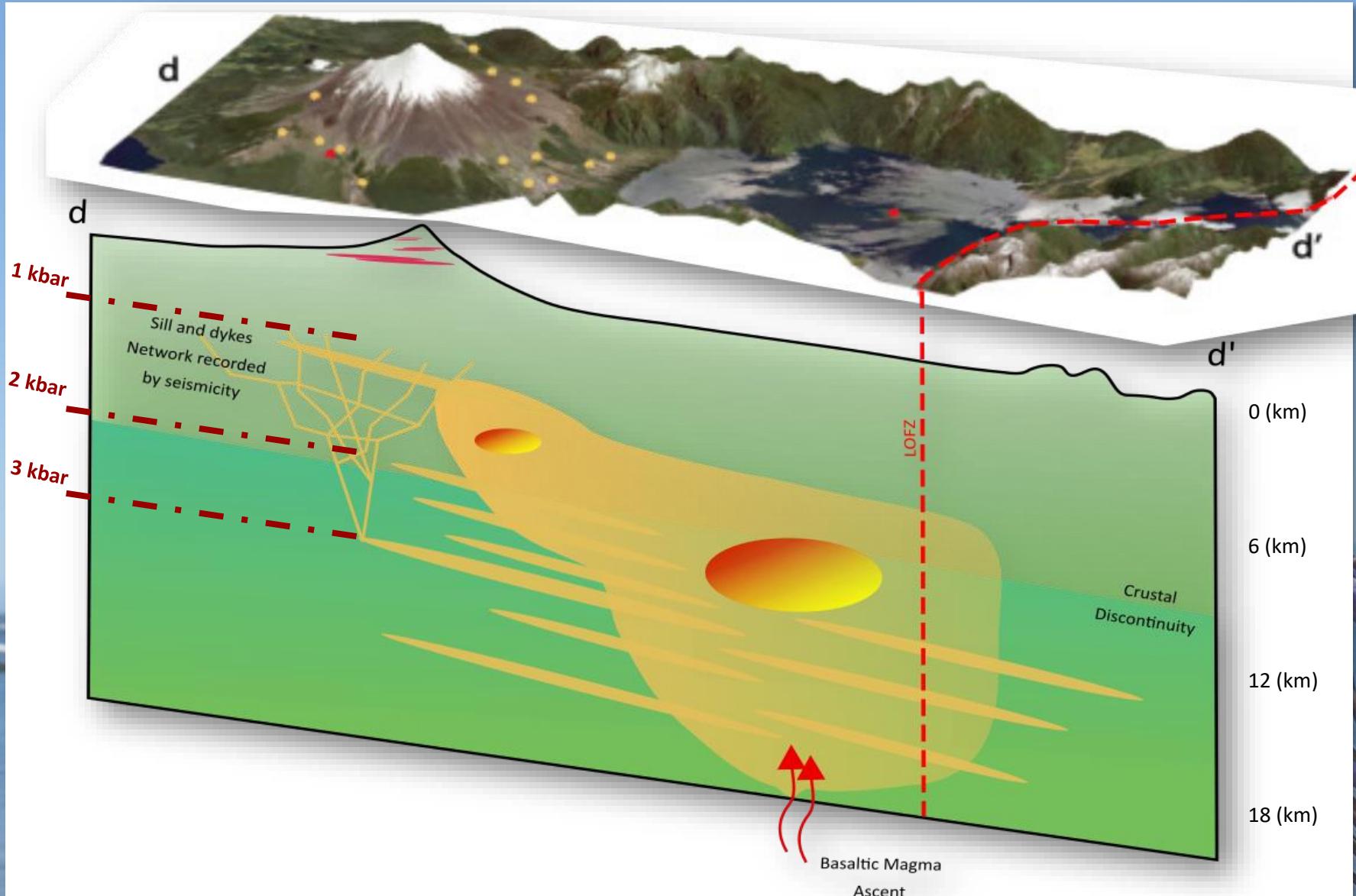
Using crustal model of Tassara and Echaurren (2012) ↴↓



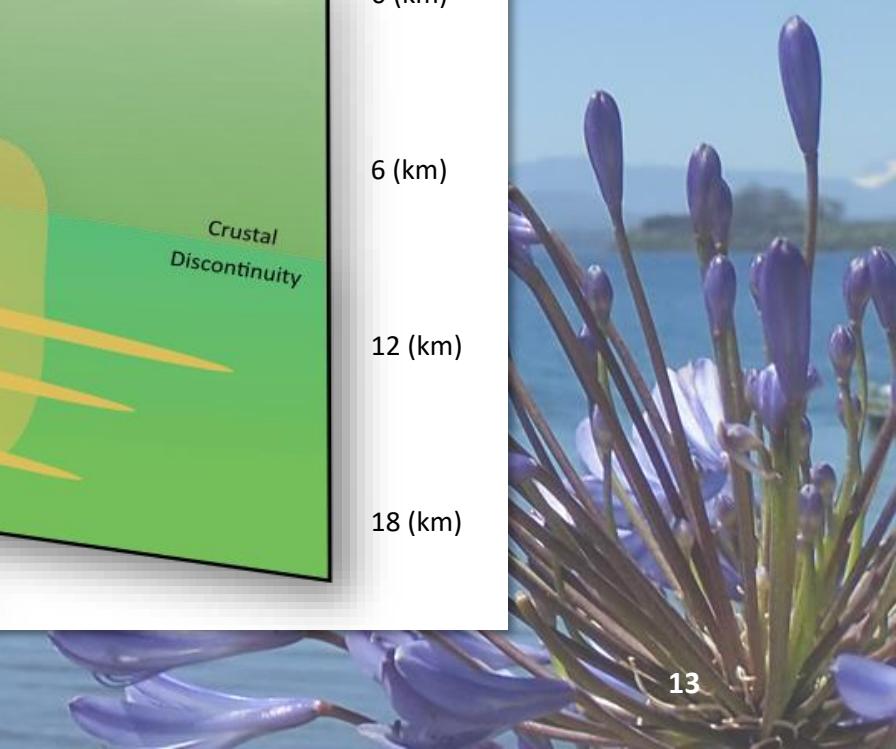
Discussion



Conclusion



Diaz et al. (2020) modified ↑

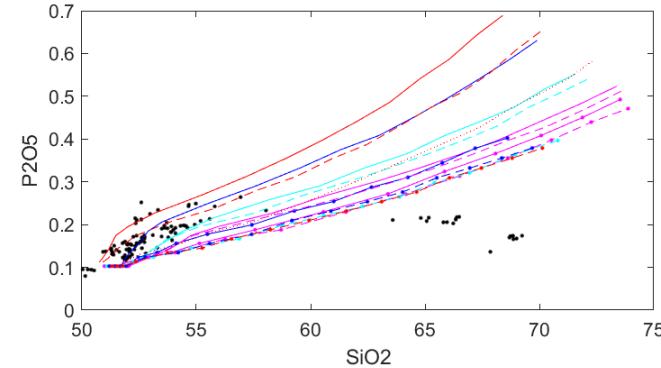
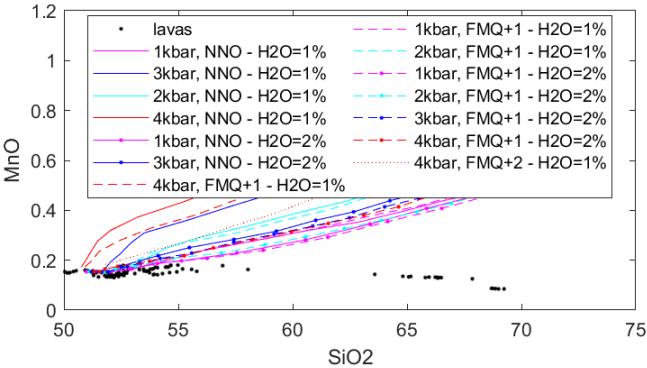
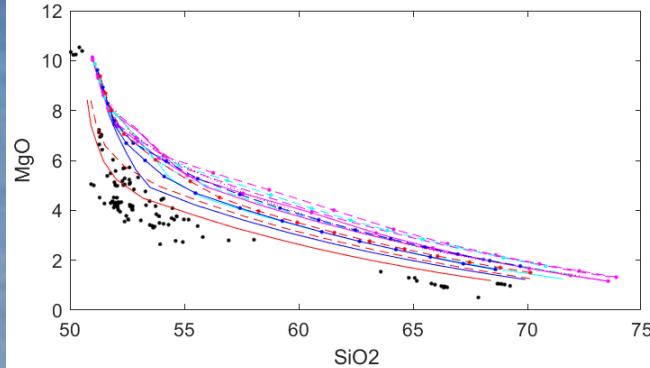
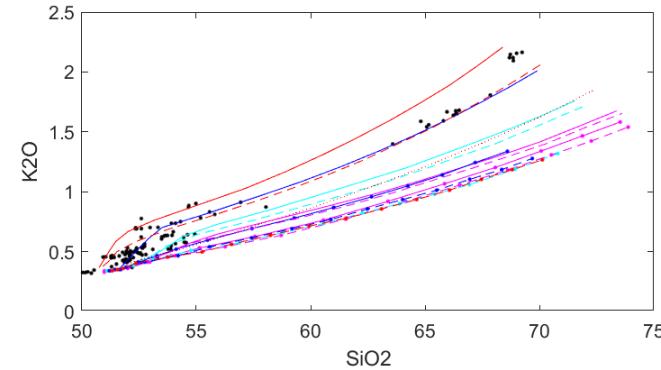
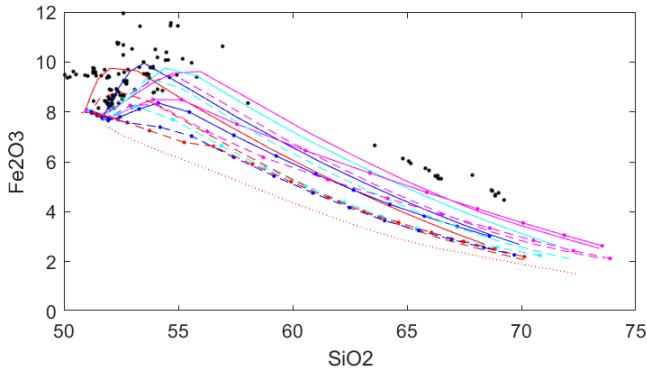
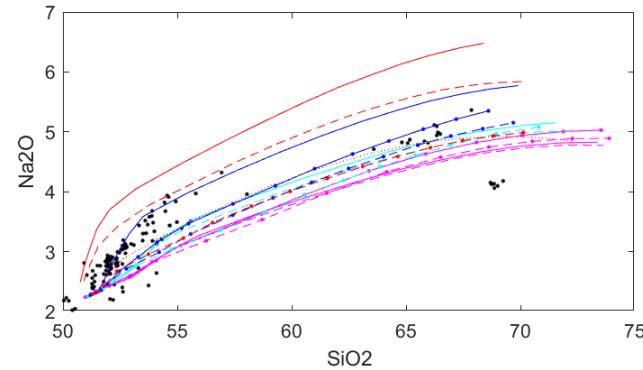
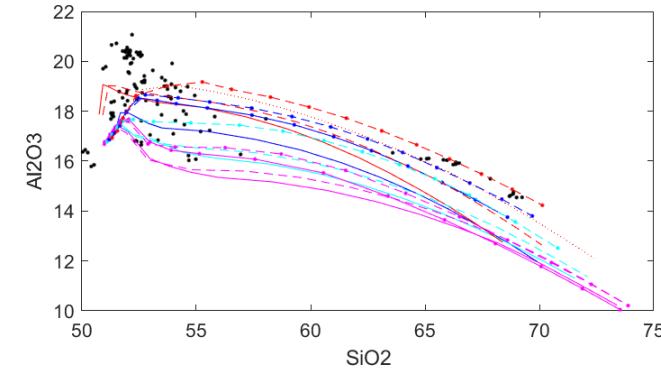
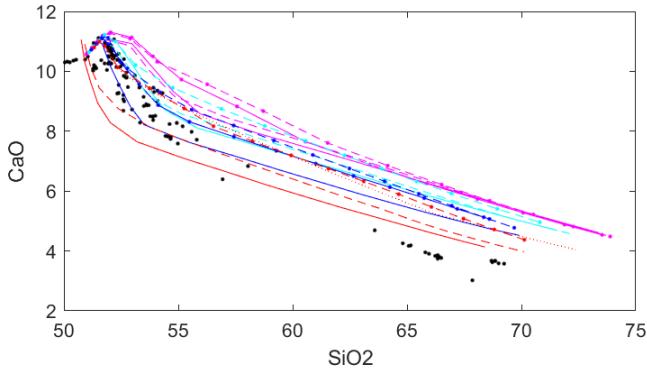
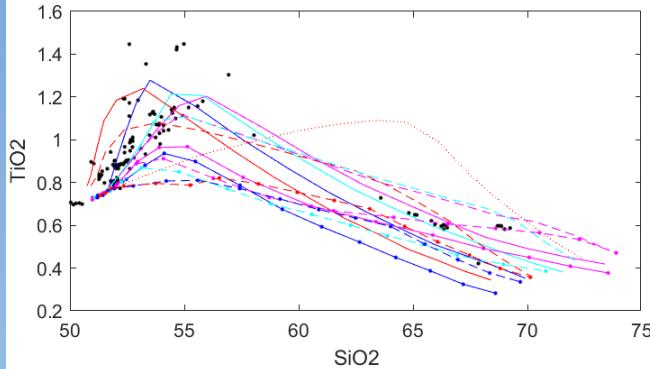


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Discussion



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