June
2018

FIRE:
WP3 Petrogenesis & Geochemistry

João Mata

~~AL1: Volcanic structure~~

AL1: Petrology and Geochemistry of lavic materials

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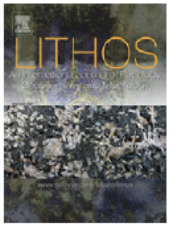
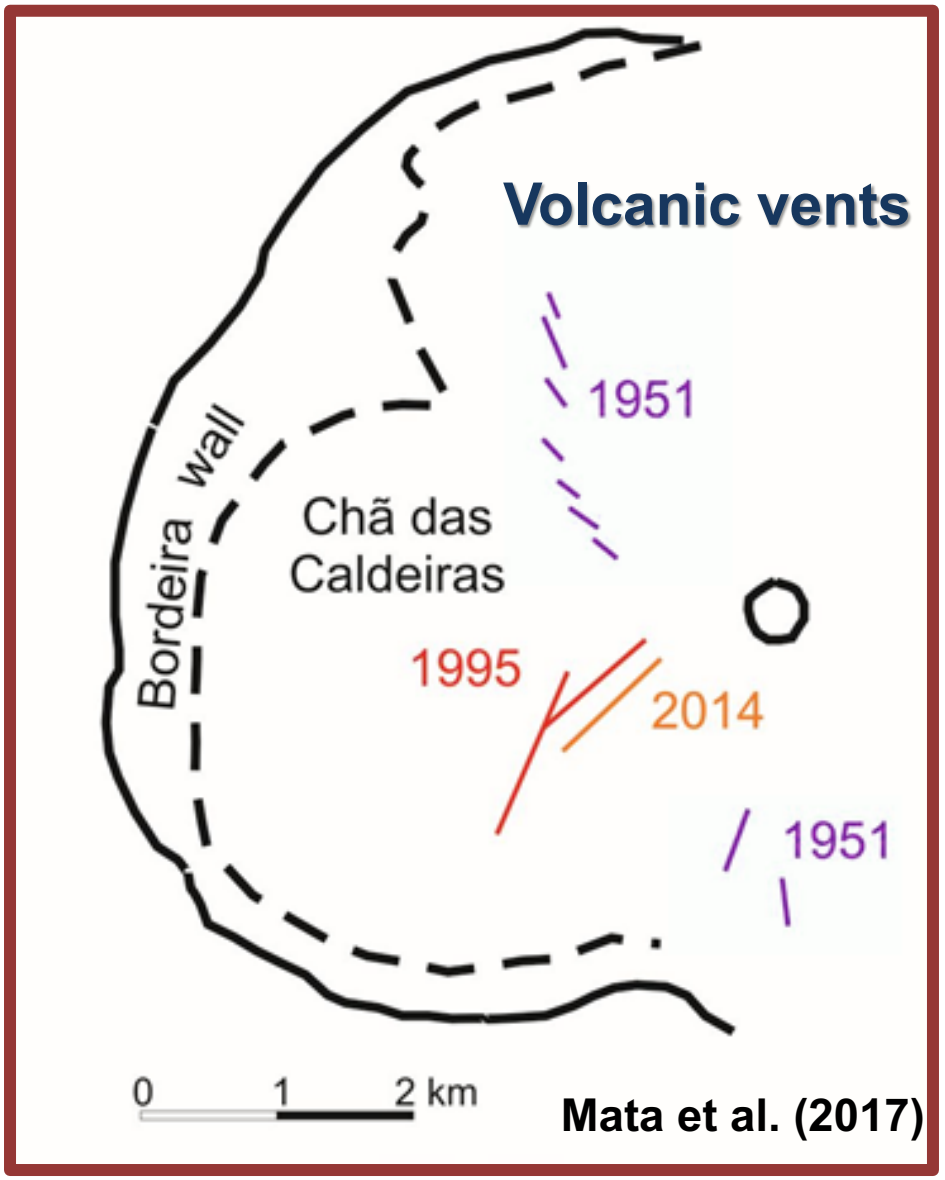


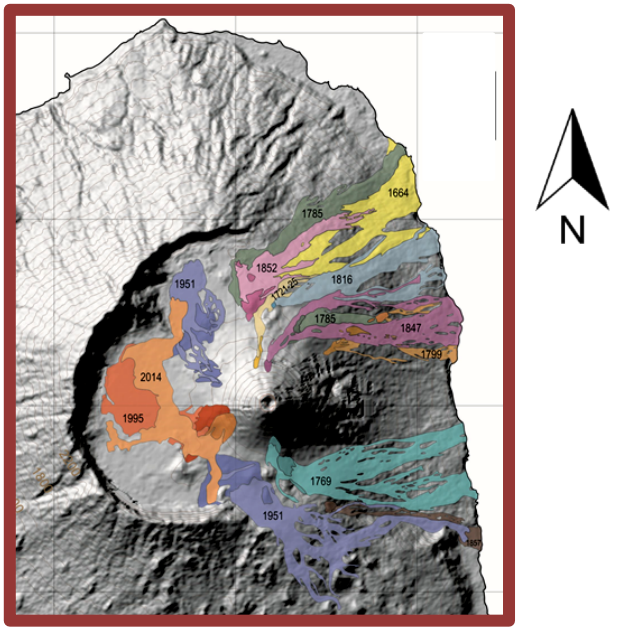
The 2014–15 eruption and the short-term geochemical evolution of the Fogo volcano (Cape Verde): Evidence for small-scale mantle heterogeneity

J. Mata [a,*], S. Martins [a], N. Mattielli [b], J. Madeira [a], B. Faria [c], R.S. Ramalho [a,d,e], P. Silva [a,f], M. Moreira [g], R. Caldeira [h], M. Moreira [a,f], J. Rodrigues [i], L. Martins [a]

Fogo – as três últimas erupções: 1951; 1995; 2014

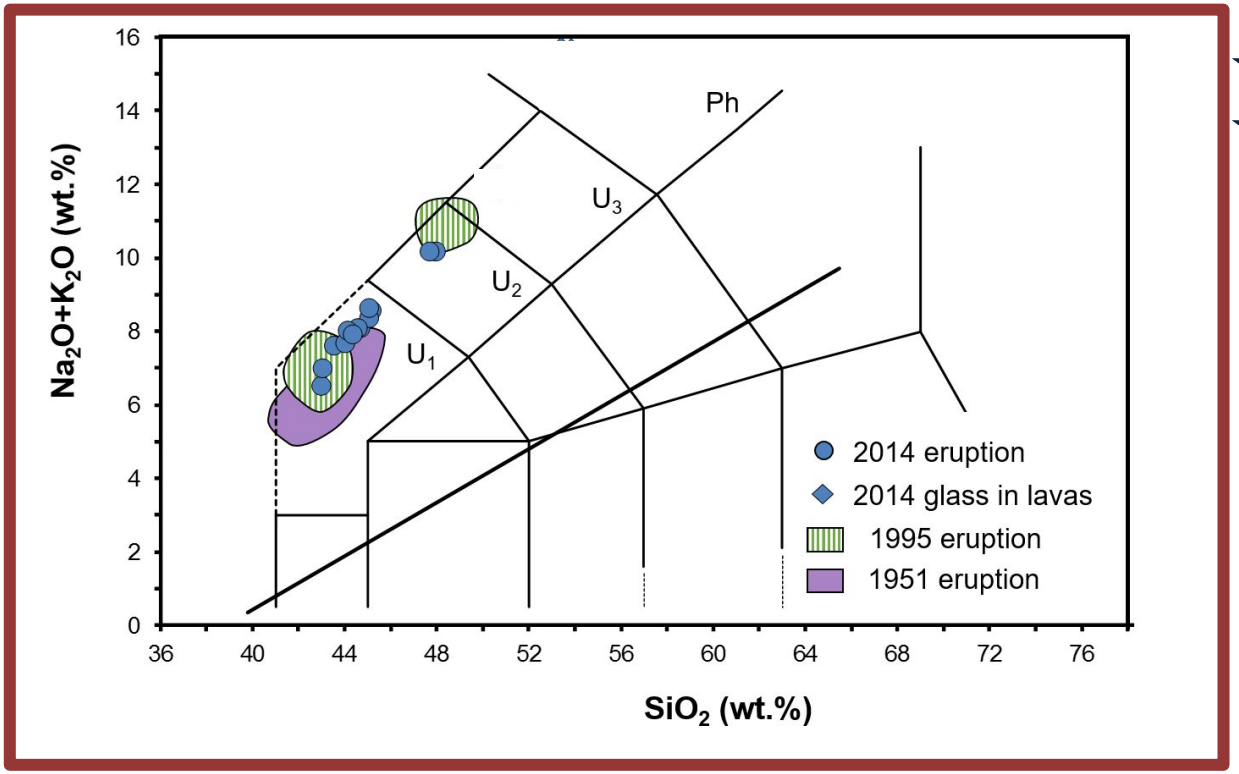
Intervalo de tempo: 63 anos
Almost coincident volcanic vents





Materiais extruídos: Tefritos (U_1)
Fonotefritos (U_2)

- $Na_2O + K_2O$ = 6.48 a 10.17 %
- Na_2O/K_20 = 1.35 a 1.36
- *ne* até 22.38 %
- *lc* até 0.93 %

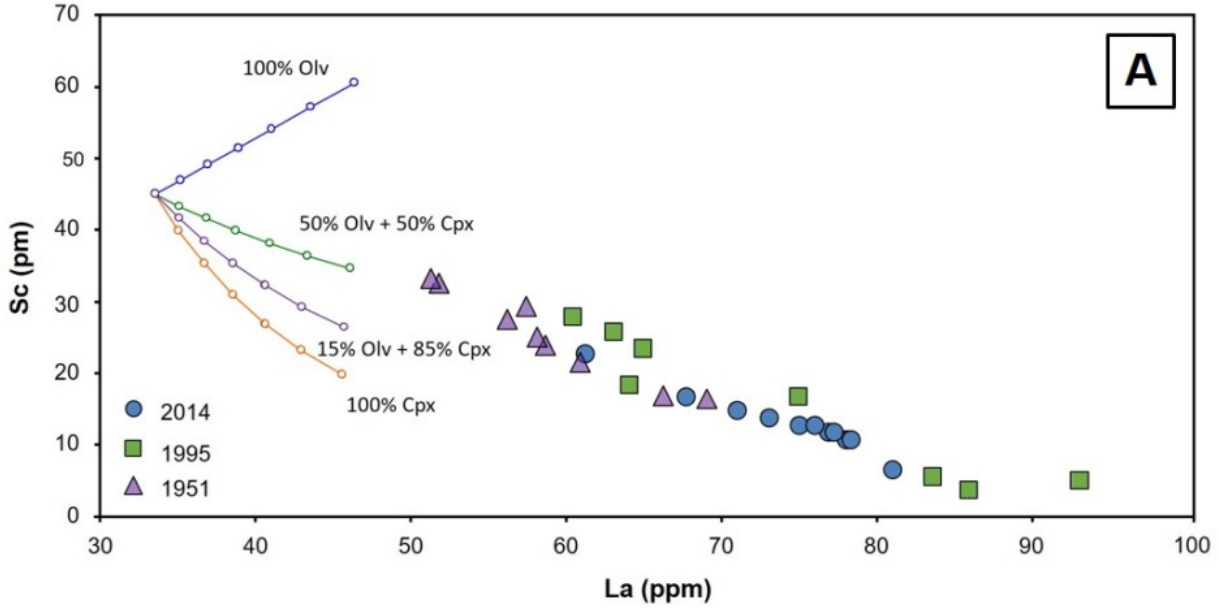


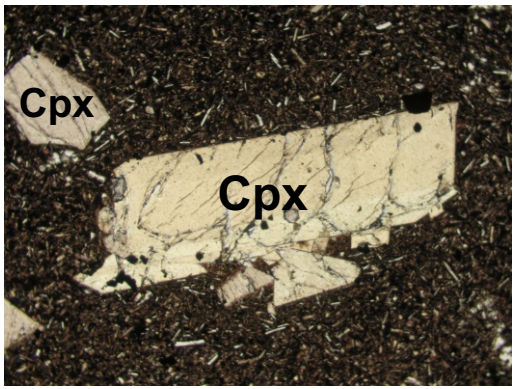
Mata et al. (2017) - Lithos

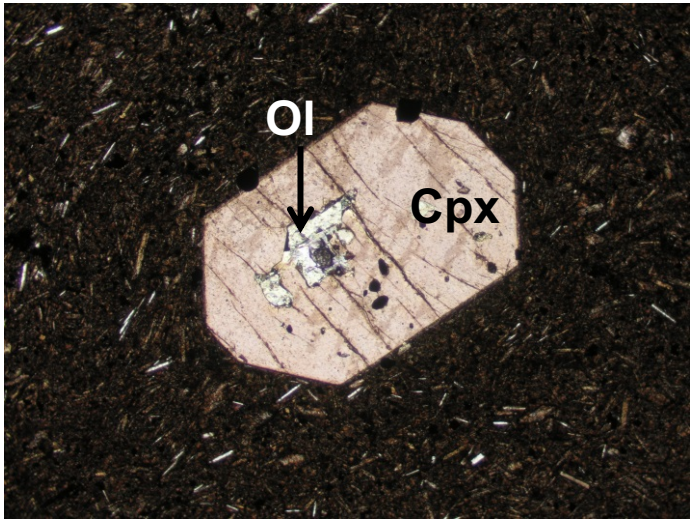
1951 and 1995: Doucelance et al. (2003); Escrig et al. (2005); Hildner et al. (2011)

Cristalização fracionada

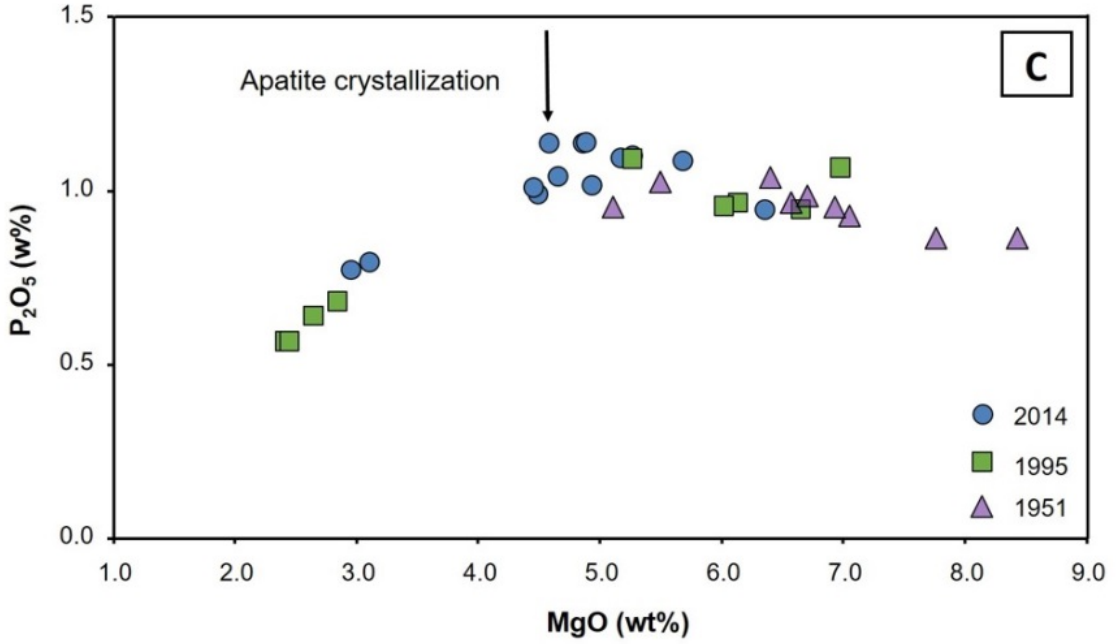
- **CLINOPIROXENA**
- **Apatite**
- **Titanomagnetite**



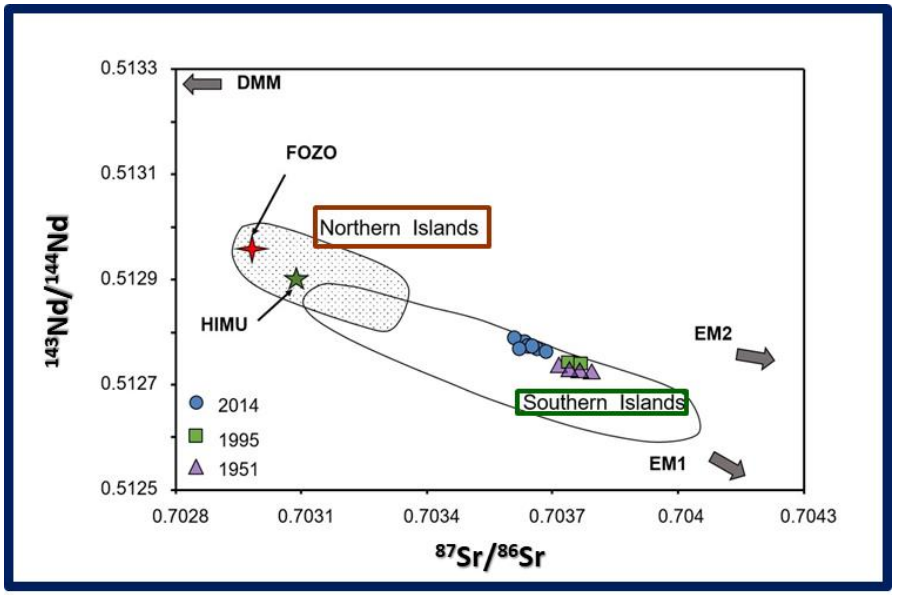


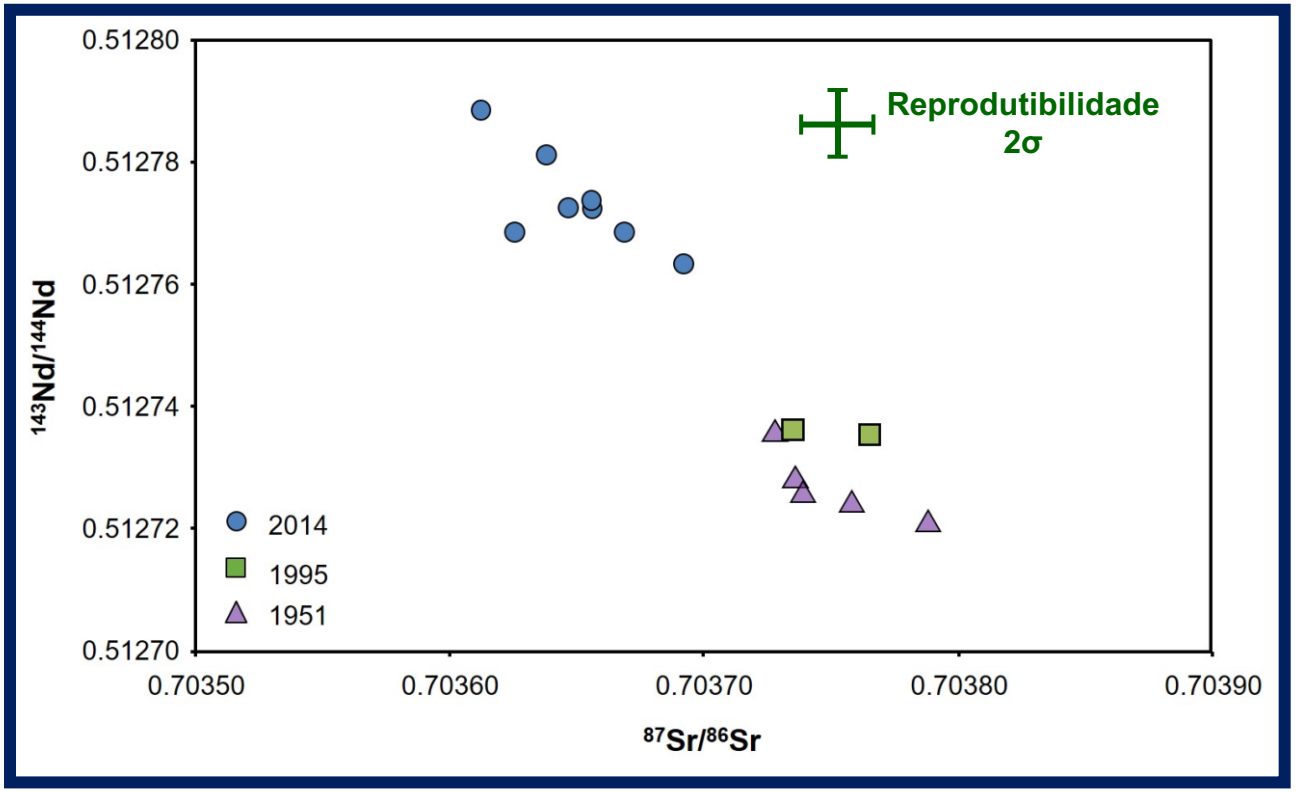


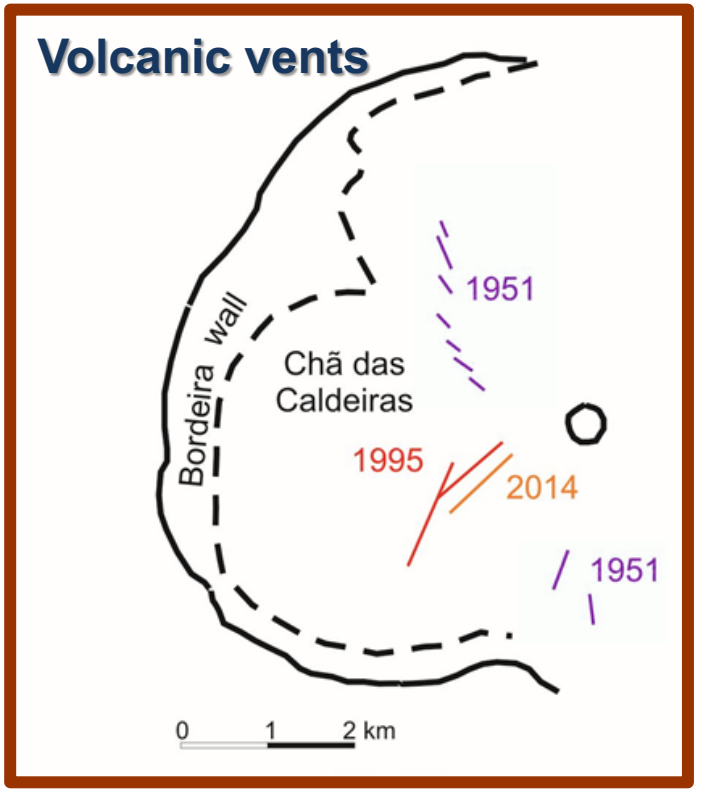
- **Olivine**



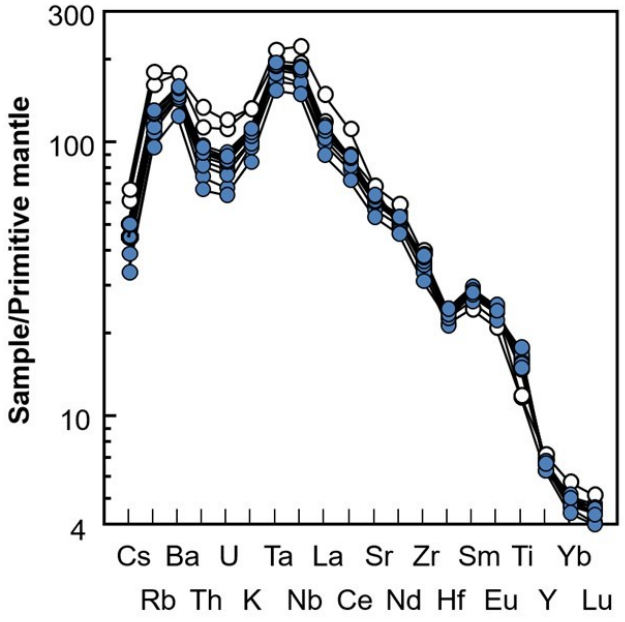
Heterogeneidade sub-Fogo







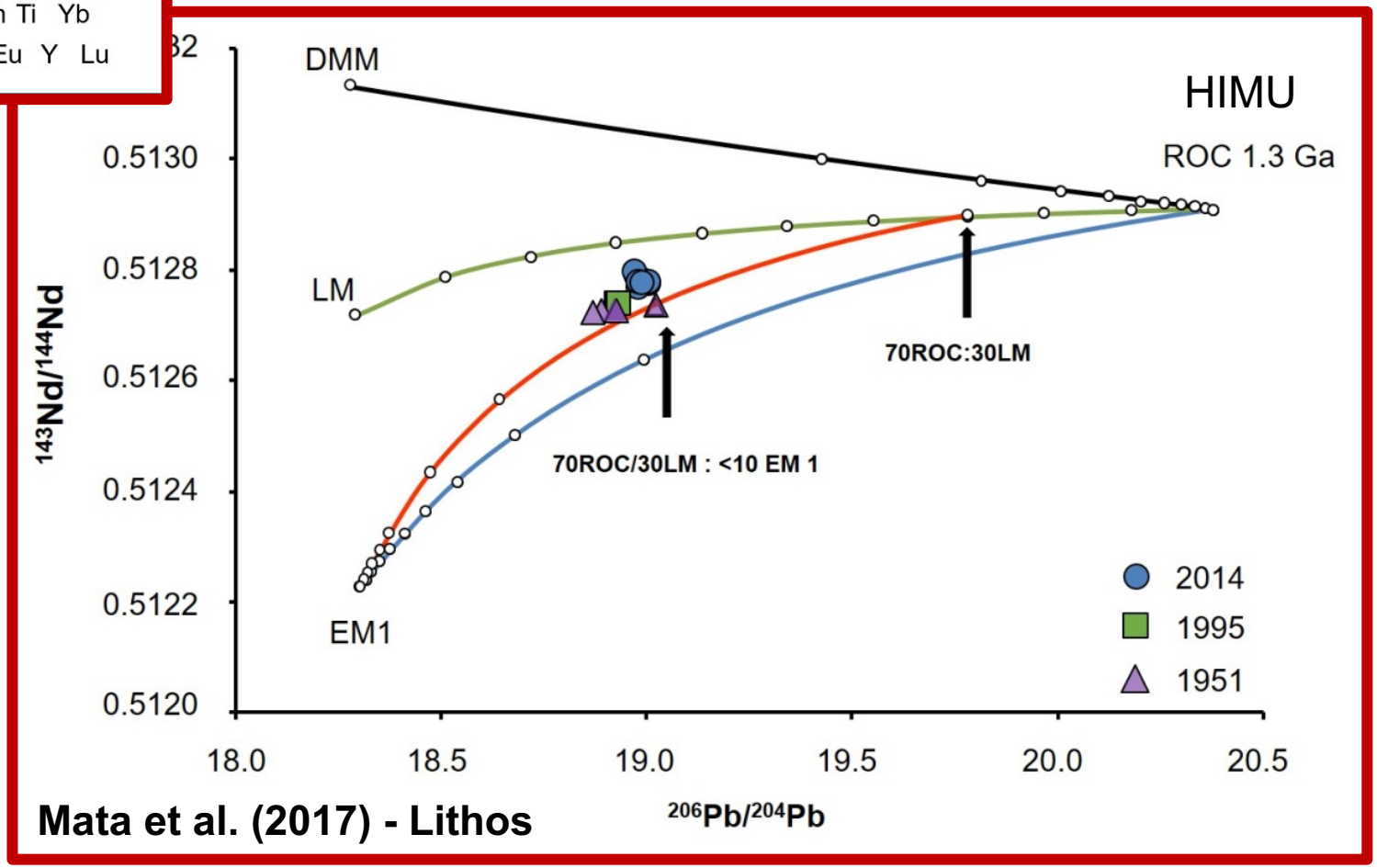
Composição Mantélica no Fogo



HIMU + EM1 + Manto inferior

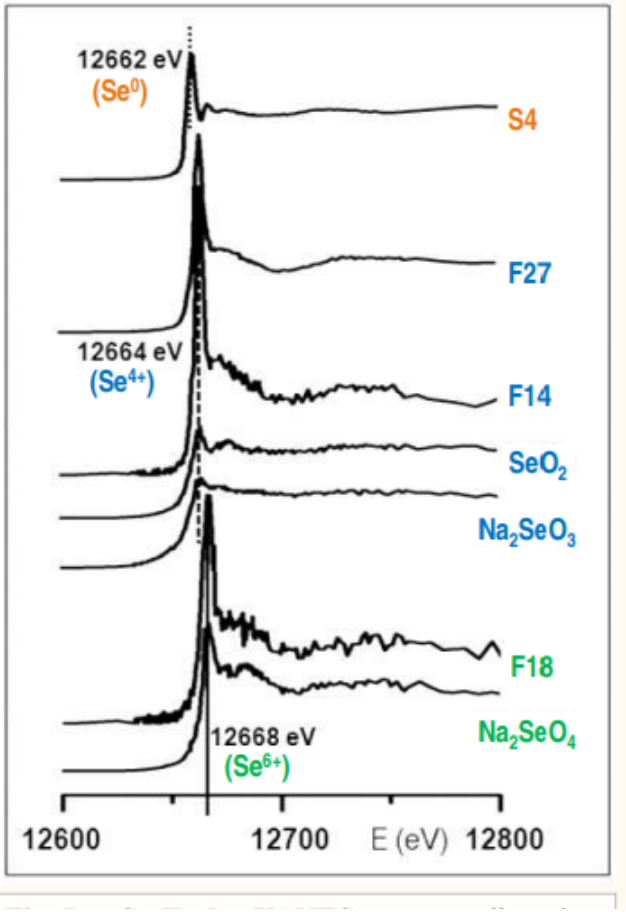
HIMU: Crosta oceânica reciclada há cerca de 1.3 Ga

EM 1: Manto litosférico sub-continental delaminado durante a abertura do Atlântico (≈ 200 Ma)



Mata et al. (2017) - Lithos

Estudo de incrustações geradas por fumarolas



The main phases identified were:
sulphur (α-S)
anhydrite (CaSO4)
bassanite (CaSO4 .1/2H2O)
gypsum (CaSO4 .2H2O)
halite (NaCl),
thenardite (Na2SO4)
ralstonite (NaxMgxAl2-x(F,OH)6 .yH2O).

XIV CGPLP
Congresso de Geoquímica dos Países de Língua Portuguesa
XIX Semana de Geoquímica

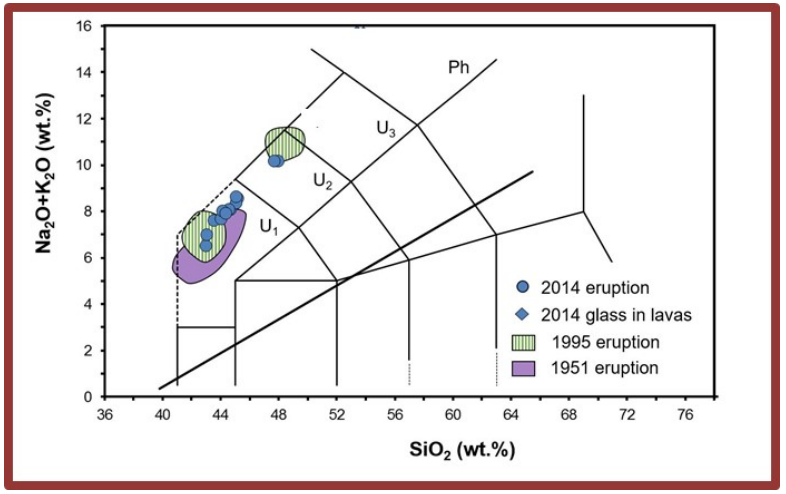
Selenium Retained by Minerals from Volcanic Fumaroles at Fogo Island (Cape Verde)

Selénio Retido por Minerais das Fumarolas Vulcânicas na Ilha do Fogo (Cabo Verde)

Silva, T. P.[1*], de Oliveira, D.[1], Veiga, J. P.[2], Ávila, P.[3], Candeias, C.[4], Salas-Colera, E.[5], Caldeira, R.[6]

AL2: Eruption dynamics

A erupção dos Fonotefritos precedeu a dos Tefritos



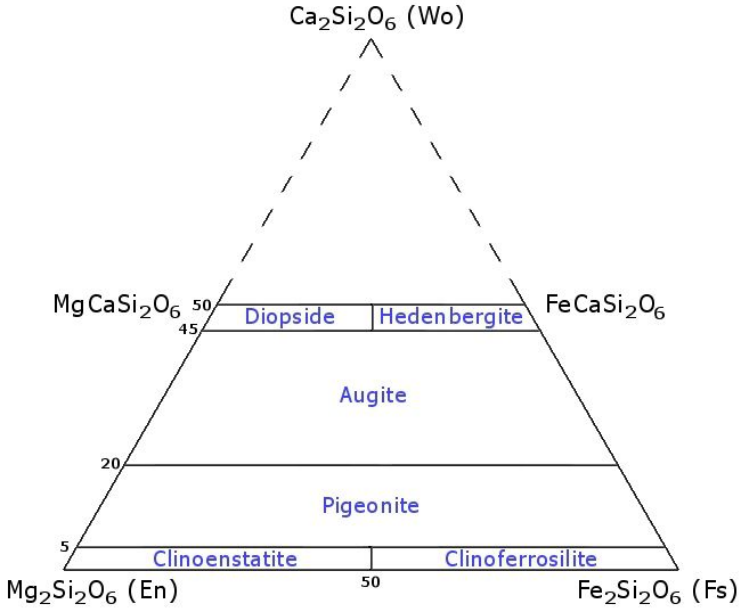
Fonotefritos:

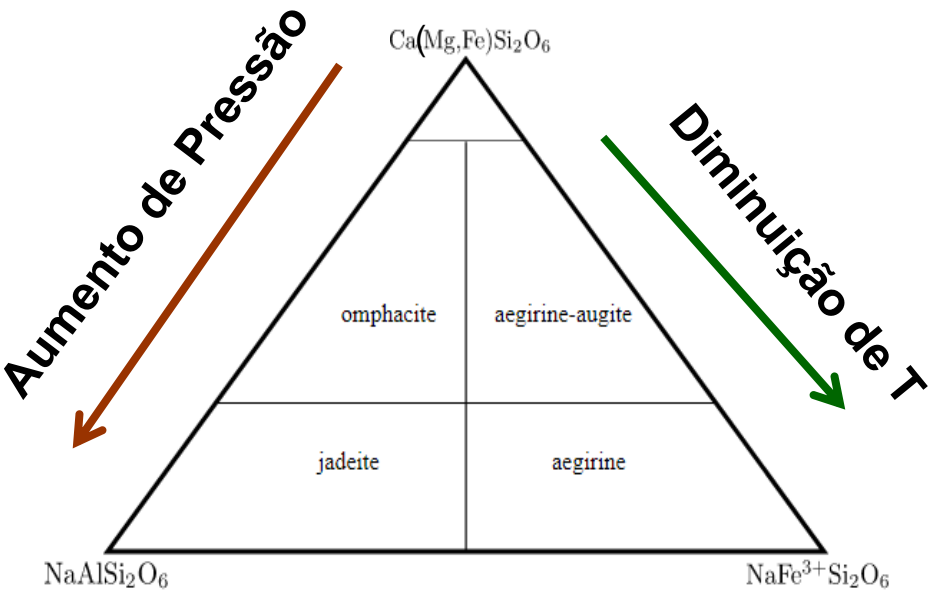
log η = 3.08 Pa.s a 1000 ºC

Viscosidades com 1% H_2O

Tefritos:

log η = 0.43 Pa.s a 1200ºC





Volume da célula unitária:

Hedenbergite: 450.72 Å^3
Diópsido: 438.58 Å^3
Jadeíte: 401.85 Å^3

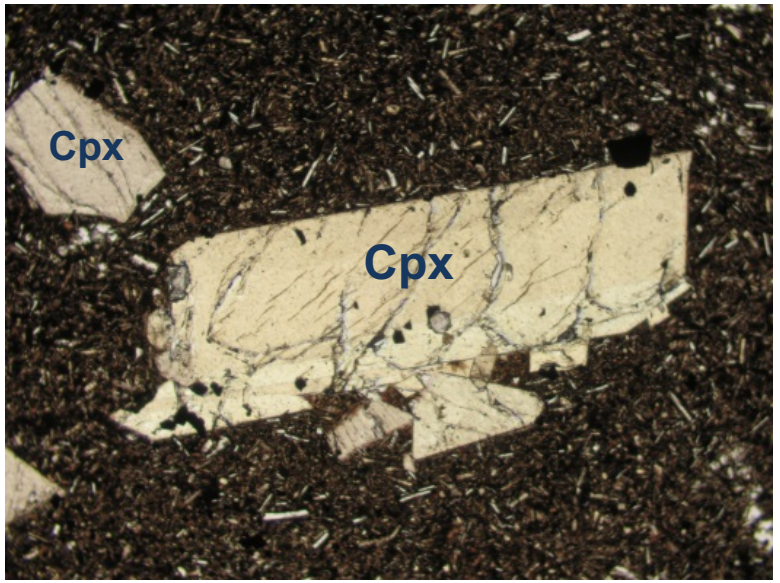
Putirka et al. (2003)

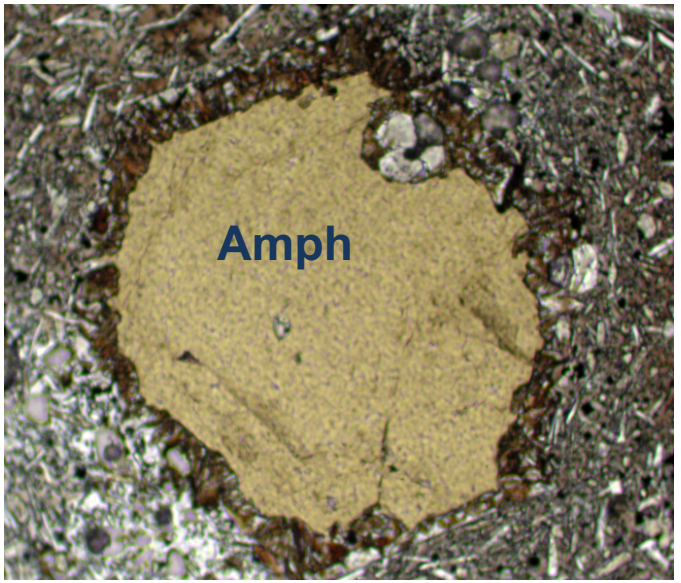
$$P(\text{kbar}) = -88.3 + 2.82\times10^{-3}T(\text{K})\ln\left[\frac{[\text{Jd}^{\text{cpx}}]}{\left[\text{Na}^{\text{liq}}\text{Al}^{\text{liq}}\left(\text{Si}^{\text{liq}}\right)^2\right]}\right] + 2.19\times10^{-2}T(K) - 25.1\ln[\text{Ca}^{\text{liq}}\text{Si}^{\text{liq}}]$$

$$+7.03[\text{Mg}'^{\text{liq}}] + 12.4\ln[\text{Ca}^{\text{liq}}]$$

Geotermobarometria

Fenocristais de Clinopiroxena e Anfíbola





Clinopiroxena

Anfíbola

Putirka et al. (2003)

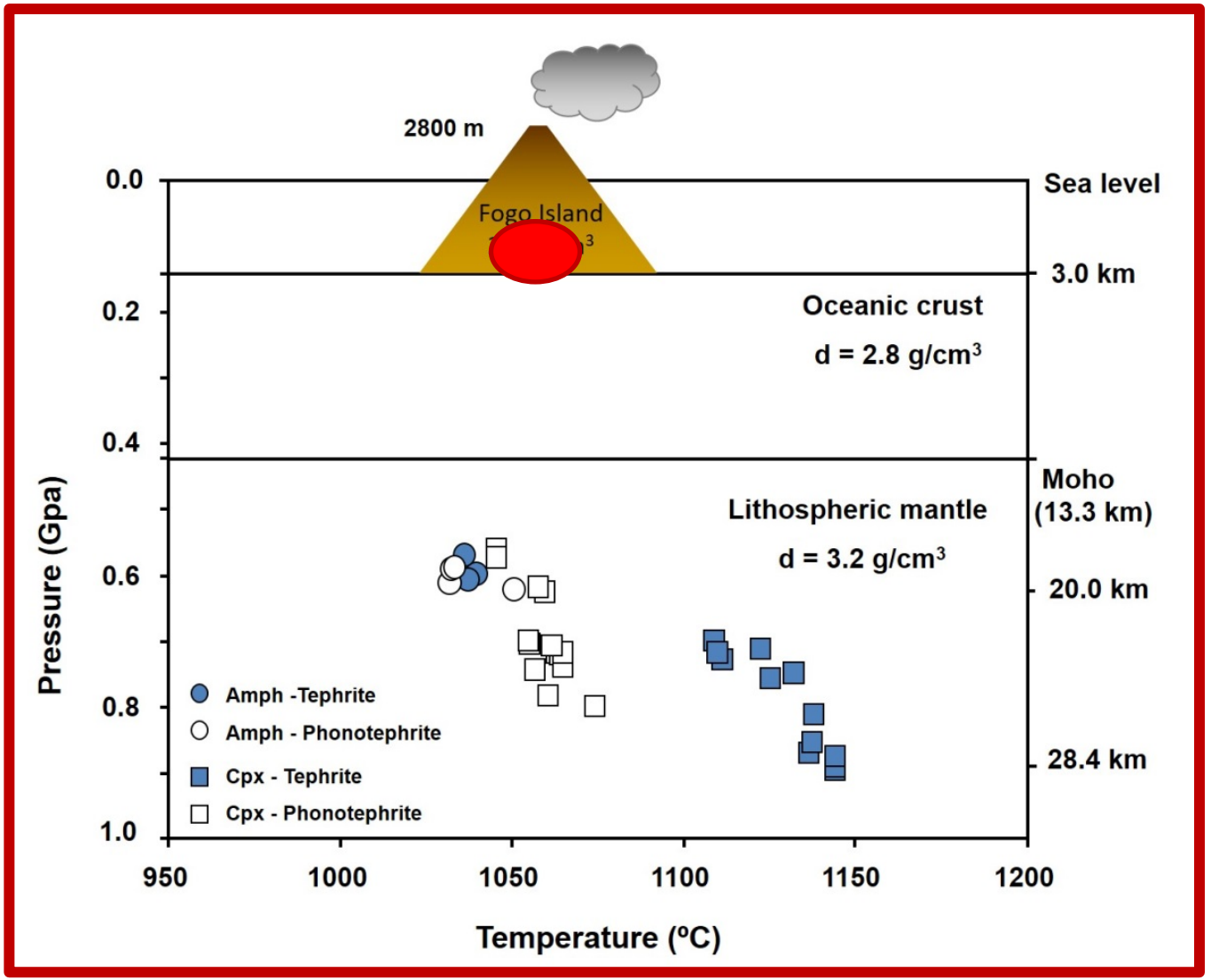
Erros: ±1.7 kbar; ±33ºC

Ridolfi and Renzulli (2012)

Erros: P = ± 11.5%; T= ± 23.5ºC

Desidratação dos cristais de anfíbola:

P < 100 – 150 Mpa (e.g. Rutherford, 2008; Browne and Gardner, 2006)

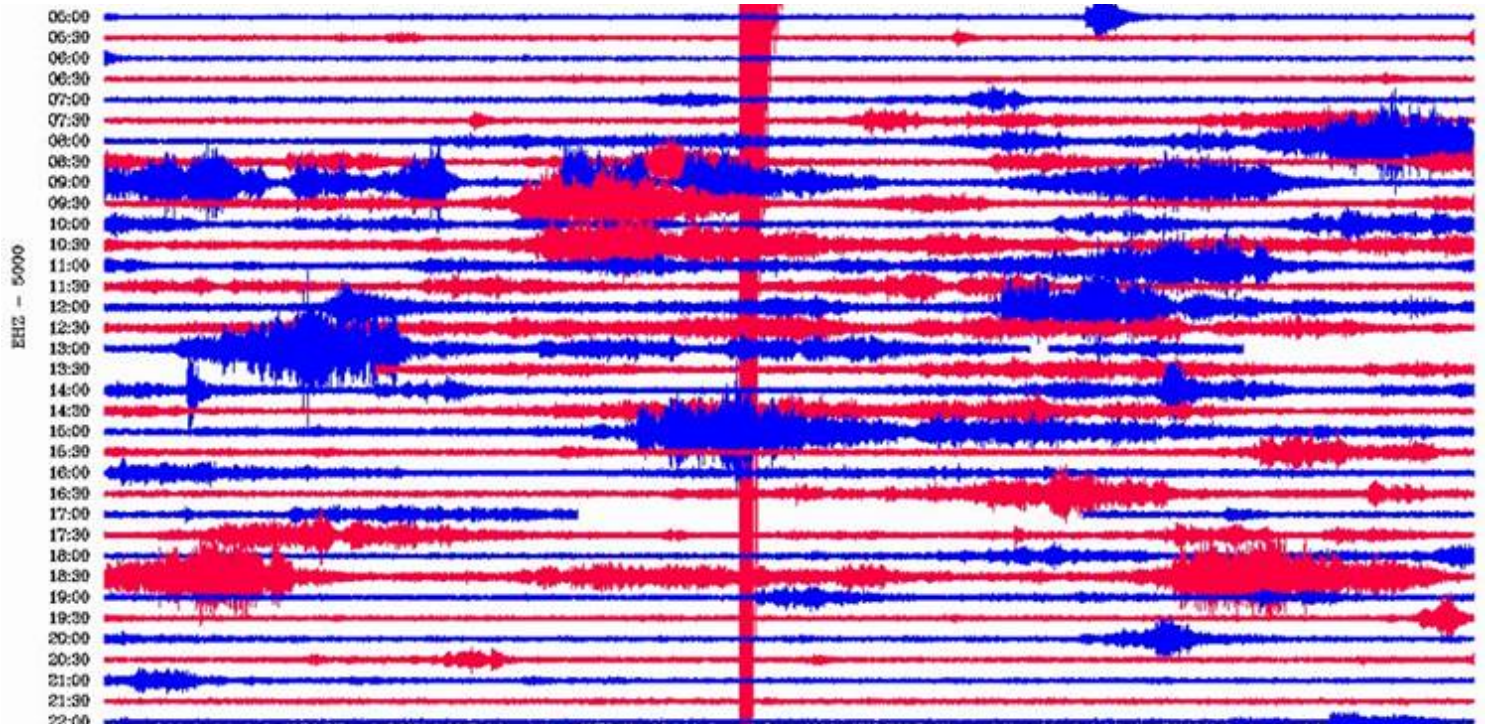

2800 m
Fogo Island
0.0
0.2
0.4
0.6
0.8
1.0
Pressure (Gpa)
Sea level
3.0 km
Oceanic crust
d = 2.8 g/cm3
Moho
(13.3 km)
Lithospheric mantle
d = 3.2 g/cm3
20.0 km
28.4 km
Amph -Tephrite
Amph - Phonotephrite
Cpx - Tephrite
Cpx - Phonotephrite
950
1000
1050
1100
1150
1200
Temperature (ºC)

Monitorização sísmica –
Instituto Nacional de Meteorologia e Geofísica (Cabo Verde)

4 de Outubro – detectada sismicidade tectono-vulcânica

17 de Outubro – Protecção Civil avisada da possibilidade de erupção

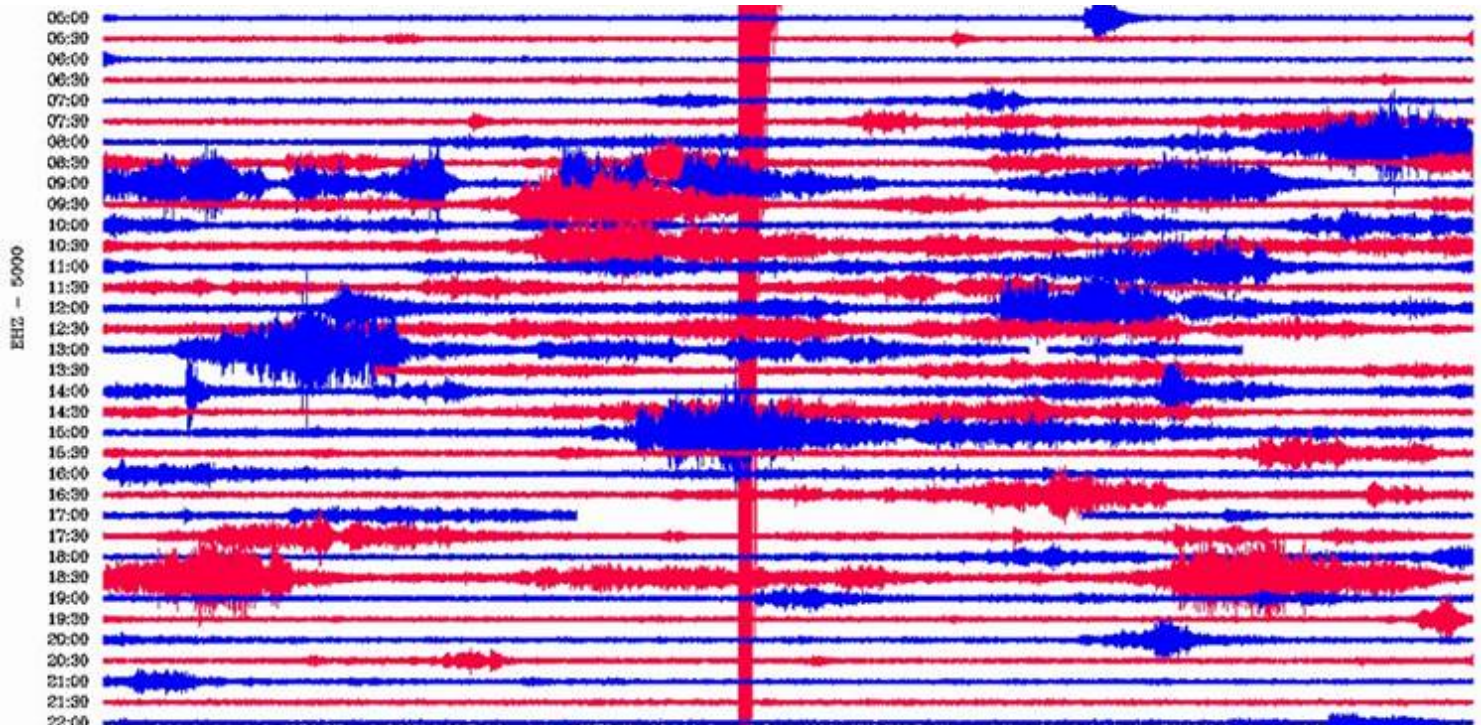
22 de Novembro – alerta de erupção iminente



Monte Lentisco, Fogo

AL3: Strategies for risk mitigation

4 de Outubro – detectada sismicidade tectono-vulcânica



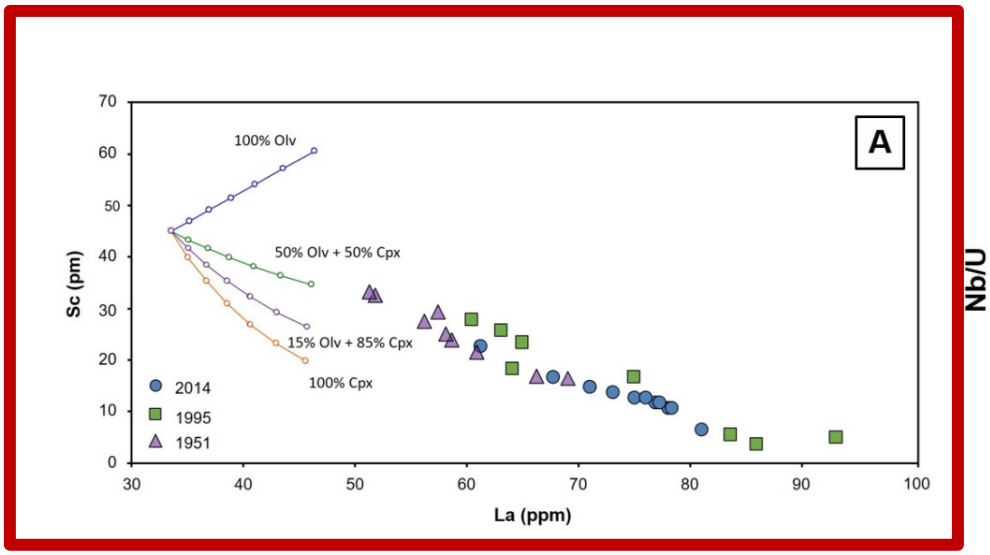
Monte Lentisco, Fogo

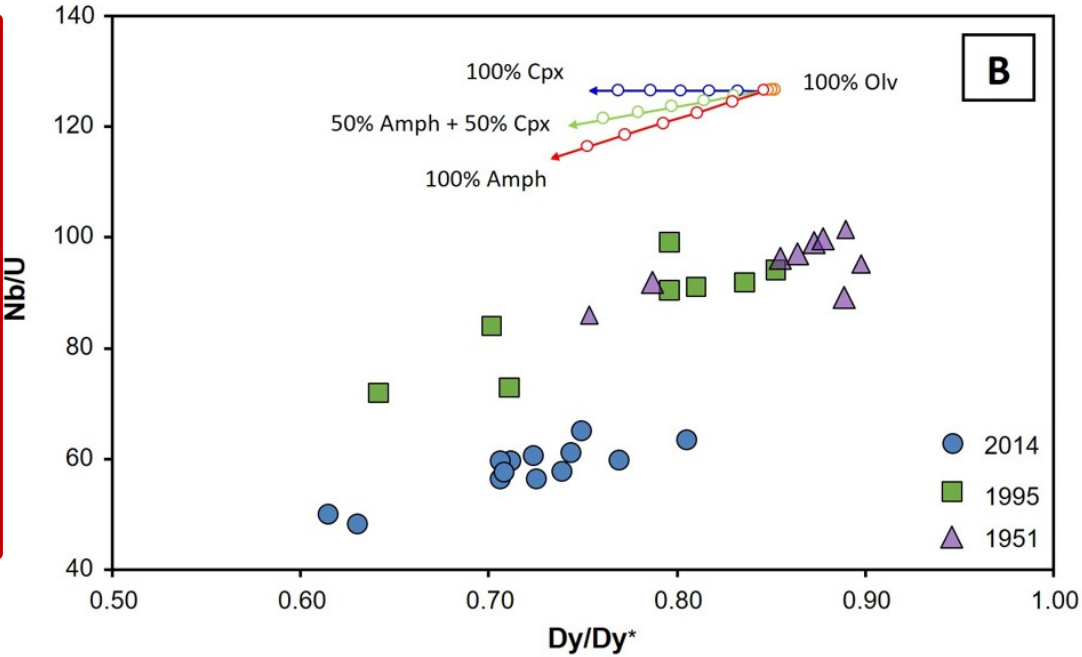
Challenges/issues encountered/anticipated

- **Diferença relativamente às lavas de 1995 e 1951**
- **Câmaras magmáticas localizadas no manto**
- **Valores de Nb/U muito elevados nas lavas de 1995 e 1951**
- **Publicar rápido… pois a concorrência é muita**

Plans for coming months

- Trabalhar petrológica e geoquimicamente as lavas pós-5 de janeiro 2015
- Estudar os xenólitos gabróicos ocorrentes nas lavas
- Perceber as causas das diferenças na razão Nb/U





- Continuar o estudo das incrustações através de novas análises no Sincrotão
- Perceber o "triggering mechanism" da erupção ??????????????

Perspectivas petrológicas sobre o mecanismo desencadeante da erupção de 2014-15 do vulcão do Fogo (Arquipélago de Cabo Verde)

João Mata & Sofia Martins

Ciências ULisboa | Geologia

INSTITUTO DOM LUIZ

Dissemination

Number of papers:

- **in prep. : 2**
- **submitted: 1**
- **published: 1**

Number of communications (national and international):

- **planned (2018): 3**
- **done: 2 orais + 1 poster**

Number of outreach: 2 (done)

Other