

Geophysical Monitoring of the Reawakening Volcanism in Cape Verde Islands

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Ilha do Sal, July 2022

Geological settings



- 10 islands archipelago of volcanic origin
- Several seamounts
- Magmatism due to a hotspot

Fogo



- After a lateral collapse (c.a. 73 ky), frequent and intense volcanism filled the collapse scar
- Since 1500 AD occurred about 28 eruptions

Frequency dynamic



Is the time interval being divided by 2 since 1951?

Mapping time (year of the eruptions) into an order space and "build" the surface of section

 $\tau(y,\Delta t) \rightarrow (n,\Delta t)$

 $\sigma(n,\Delta t) \rightarrow \cup \{(n,\Delta t) \cap \pi\}$

(π : Poincaré's surface of section)

Poincaré's surface of section



 $\exists n_1, n_2, \delta, \qquad \forall \varepsilon \quad |n_1 - n_2| < \varepsilon \Rightarrow |\sigma(n_1) - \sigma(n_2)| > \delta$

Chaotic dynamic?

=> Eruptions are to be expected any time

Geophysical Monitoring Network



Brava



Smallest inhabited island (62.5 km²)

Dome shaped with steep coastal slopes and cut by erosional valleys

Summit plateau, formed by the infilling with pyroclastic rocks of a wide central caldera

Phonolite lava domes

Carbonatites lava

Phreatomagmatic craters are widespread in the summit plateau

Phreatomagmatic explosion craters identified during fieldwork Other fresh craters evident from topography Morphologically distinct phonolite domes Mafic and hybrid scoria vents **Carbonatite vents** Note: map incomplete and provisional 2 km Contour interval 200 r

Older submarine volcanic and intrusive sequences are found at 300 m asl => the island is experiencing uplift

The most recent eruptive activity of Brava is Holocene age and is at least partly phreatomagmatic (hydrovolcanic) in character

Brava Monitoring Network



Six broadband seismic station (CMG-3ESPCD)

Seismic rate and cumulative number of events



Just after the M4 (located on the submarine slopes), seismic swarms became more frequent

20160802



Hypocentral distribution vs time



Despite of some regions were more active in certain time periods, there were no clear clues of time migration of the hypocenters





b-value



b-value calculated using maximum likelihood method, using at least 200 "near" events with no overlapping, and a Mc=1

Exotic volcanic seismic events (a)

Long-period event



Harmonic volcanic tremor



Hydrothermal seismic event



Seismic swarm near Sal, January 2018



Buracona





Santo Antão



- Three overlapping volcanic center
- Dominated by very explosive volcanic activity
- Eruptive activity younger than 0.1 Ma

Several modern and ancient volcanic rift zones



Santo Antão hot springs



• Some springs present CO2 concentration levels up to 100 mg/l

Santo Antão seismic stations



Only four (CMG-3ESPCD) seismic stations for 784 km²





Seismic swarm, August 2018



Plot start time 20180812T1503Z

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Plot start time 201808T1539Z



Epicentral distribuion





17°00'N

