Supplementary Information for

Satellite and Ground Remote Sensing Techniques to Trace The Hidden Growth of a Lava Flow Field: The 2014-15 Effusive Eruption at Fogo Volcano (Cape Verde)

Sonia Calvari[1*], Gaetana Ganci[1], Sónia Silva Victória[2], Pedro Hernandez[3,4], Nemesio Perez[3,4], Vera Alfama[2], José Barrancos[3], Jeremias Cabral[5], Nadir Cardoso[2], Samara Dionis[3], Paulo Fernandes[2], Gladys Melian[3], José Pereira[2], Hélio Semedo[5], Germán Padilla[3,4], Fátima Rodriguez[4]

[1]Istituto Nazionale di Geofisica e Vulcanologia, Osservatorio Etneo (INGV-OE), Catania, 95125, Italy, [2]Universidade de Cabo Verde (UNICV), Praia, Santiago, Cape Verde, [3]Instituto Tecnológico de Energias Renováveis de Tenerife (ITER), 38611 Granadilla de Abona, Tenerife, Spain, [4]Instituto Volcanológico de Canarias (INVOLCAN), 38400 Puerto de la Cruz, Tenerife, Spain, [5]National Protection Service of Cabo Verde, Praia, Santiago, Cape Verde

Contents of this file

Introduction

This supporting information provides Table S1, listing the main observations on the eruptive activity carried out during the eruption.

Date	Explosive activity	Effusive activity	Notes	Reference
23 Nov	Strombolian and lava fountains activity from 5 vents on the fissure, forming at 15.00 a 6 km high ash plume.	Two lava flows started at 10.00 directed S (Flow 1, 5-6 m thick) and NW (Flow 2).	A NE-SW eruptive fissure opened at 09.45.	Silva SV Report
24 Nov	Eruptive fissure propagated upslope with additional vents opened at 11.00 (6th) and 16.20 (7th).	2 lava flows ~ 2 km long and 4-5 m thick from 2 vents, spreading S (Flow 1) and NW (Flow 2). Flow 1 stagnated by dusk.		Silva SV Report Satellite images
25 Nov	Explosive activity decreased during the day, and two of the uppermost vents sealed; the eruptive column was 2 km high.	Flow 1 was 5 m thick and moving at 1 m h^{-1}. Flow 2 advancing N to Portela was ~3 m thick, split in two branches, and advanced at 9-10m^{-1} in the morning. In the afternoon Flow 2 was ~5 m thick and spreading at 16 m h^{-1}.	During the evening Flow 2 started covering the Fogo Natural Park building at ~3 km from vent.	Silva SV Report
26 Nov	The 6th vent along the fissure reactivated	Flow 2 was 6-7 m thick and moving at 2 m h^{-1}, increasing its	Flow 2 at Portela destroyed 15	Silva SV Report

		speed to 4 m h^{-1} by 19.00.	houses, water tanks and animal pens	
27 Nov	Along the fissure 2 cinder cones formed, with craters ~100 m and 20 m in diameter, respectively.	Opening of Vent 1 at the base of the eruptive fissure, drainage of the lava pond. Flow 1 is inactive, Flow 2 is moving N at ~1-2 m h^{-1}. Overflows above Flow 1.	A total of 14 water tanks plus several animal pens destroyed	Silva SV Report ITER/INVOLCAN thermal images
28 Nov	2 explosive vents, the vent upslope is no longer active. Powerful explosions, with eruptive column 800 m high.	3 overflows from the cone rim (1 of these covering the previously inactive lava flow field) and 2 active lava flows.		Silva SV Report ITER/INVOLCAN thermal images
29 Nov	2 explosive vents within the cone, with wider crater; Strombolian activity and fire fountains apparently lower, with the upslope vent emitting little ash	Wider lava flow field; cinder cone breached and eroded. 3 active lava flows, two of which towards Portela. Flow 2 deeper within a channel with high levees; tumulus above Vent 1; Flow 1 wider and spreading laterally with 2 branches.	Very slow Flow 2 front at Portela.	Silva SV Report ITER/INVOLCAN thermal images ITER/INVOLCAN webcam
30 Nov	Weak explosions from 2 vents feeding a bent ash plume (weak plume); lower magma level within the cone. Degassing from skylights along the upper tube.	Lava channel from Vent 1 is sealed, and several skylights open along it, suggesting a fast growth of the upper lava tube.	Lower magma level within the cinder cones	Silva SV Report ITER/INVOLCAN thermal images ITER/INVOLCAN webcam
1 Dec	Strombolian explosions from 4 vents along the eruptive fissure, with 3 gas plumes (Fig. 4A). Explosive activity decreasing with time.	The upper part of the lava tube is sealed, with several degassing skylights along it (Fig. 4A). At ~03.40 an overflow from Vent 1 covered the upper tube.	Decreased explosive activity from the 4 upper vents along the fissure was followed by a surge of lava from Vent 1 at ~03.40.	ITER/INVOLCAN webcam
3 Dec	No explosive activity	A well-established lava channel at the base of the cone		Silva SV Report ITER/INVOLCAN thermal images ITER/INVOLCAN webcam
4 Dec	No explosive activity	A well-established lava tube from the base of the eruptive fissure. Lava dropping at a lower level, possibly thermally eroding the base or falling within a lower level channelled flow-tube.	Flow surface velocity 3 m min^{-1}, (channel ~10 m wide, ~2-3 m deep estimated from video = 1.5 m^3 s^{-1})	Silva SV Report ITER/INVOLCAN webcam video TV
4 Dec	No explosive activity	Lava flow within the tube, high fluidity, high T		Silva SV Report ITER/INVOLCAN thermal images
7 Dec	No explosive activity	Some TM images showing a wide and fast spreading flow front		Silva SV Report ITER/INVOLCAN thermal images
8 Dec	Photos display degassing from the summit vents and ash clouds (collapses within the vent?).	View from Mt. Beco shows a well-fed lava flow flowing within a lava channel. Lava flow front at Portela is apparently several 100s wide, very fluid and hot (up to 820 °C), and spreading very fast as a sheet-like flow.		Silva SV Report ITER/INVOLCAN thermal images
9	Satellite image displays a	The lava flow field is apparently		Satellite image and

Dec	thick ash plume from the upper fissure vent spreading North (collapses within the vent?).	stationary.		map from Copernicus (EC)
11 Dec	Only degassing from the fissure.	Lava channel up to Portela, proximal channel very deep (eroding base? estimated ~ 1 m below levees). Flow fronts at Portela still spreading. At least 3 lava channels at Portela visible from a video https://www.youtube.com/watch?v=douRas96Vuo published on 7 Dec 2014. Lava boulders along proximal channel testify channel/cone erosion.	280 people evacuated	Silva SV Report www.fogonews.com TV video
12 Dec	Only degassing from the upper fissure (2 vents), with occasional ash puffs.	Lava flow within proximal channel very fast, well-fed, and eroding margins but with no gas bubbles on the surface, then falling within the lava tube and spreading along a wide (20m?) proximal channel with a winding path along the Cha das Caldeiras up to Portela. Skylight visible above the first proximal channel. Lava flow surface higher in level when compared to images of the previous day (~ at the levees). Lava flow front spreading at Portela and covering houses and trees with estimated thickness of 6-8 m (top of the houses). Widening flow field in the proximal E portion of Flow 2.		Silva SV Report www.fogonews.com TV video Satellite image and map from Copernicus (EC)
16 Dec		Widening lava flow field in the proximal (expansion of Flow 3 to West) and distal portion (Flow 2 expanding North).	Flow 3 starts its expansion westwards	Ali Image (Fig. 2c)
18 Dec	Slow but dense degassing from the upper fissure (3 vents).	Lava flow to Portela still on-going, but much slower than before.		Silva SV Report www.fogonews.com TV video
23 Dec		Significant lengthening of Flow 3 towards W and up to the cliff of the valley, then turning N along it.		Satellite image and map from Copernicus (EC)
26 Dec		Significant widening of Flow 3 front at the cliff of the valley, then turning N and S along it.		OLI TIR image
28 Dec		Flow 2 and Flow 3 widening.		Satellite image and map from Copernicus (EC)
29 Dec		Small thermal anomalies at the vent and front of Flow 3, and stronger thermal anomaly at the main vent along the eruptive fissure.		ALI TIR image
11		Small thermal anomaly along		OLI TIR image

Jan 2015		Flow 3, and stronger thermal anomaly at the main vent along the eruptive fissure.		
12 Jan	White ash emission from the top of the fissure.	Small widening of the lava flow field, especially at the flow front of Flow 2 and Flow 3.		Satellite image and map from Copernicus (EC)
8 Feb	End of eruption.	Small widening of the lava flow field, especially at the flow front of Flow 2 and Flow 3.		Satellite image and map from Copernicus (EC)

Table S1. List of main eruptive events occurring during the 2014-15 Fogo eruption.