What we know about historical eruptions in Canary Islands and what we can learn

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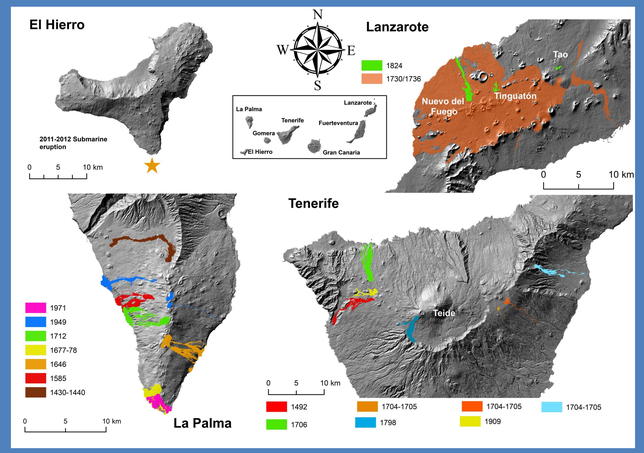
Canary Islands constitute an active volcanic archipelago located west of the coast of Morocco in the African plate. From the time immediately before the conquest of the islands, 16 volcanic eruptions have occurred (some of them with multiple eruptive vents) plus several seismic crisis, affecting the islands of Lanzarote, Tenerife, La Palma and El Hierro

Year	Name	Island	Date (Start/End)	Duration (in days)
1430/1440	Tacande or Mtña Quemada	La Palma	?	?
1492	Boca Cangrejo	Tenerife	August ?	?
1585	Tehuya	La Palma	19 May/10 August	84
1646	Martín or Tigalate	La Palma	2 Oct/ 21 Dec	82
1677/1678	San Antonio	La Palma	17 Nov/21 Jan	66
1704/1705	Sietefuentes	Tenerife	31 Dic/4-5 Jan	5
	Fasnia		5 Ene/ 16 Jan	12
	Arafo		2 Feb/27 March	54
1706	Garachico or Arenas Negras	Tenerife	5 May/13 Jun	40
1712	El Charco	La Palma	9 Oct/ 3 Dec	56
1730/ 1736	Timanfaya	Lanzarote	1 Sept 1730/16 April 1731	2055
1793	Seismic crisis	El Hierro	27 March/29 Jun 1793	95
1798	Narices del Teide or Chahorra	Tenerife	9 Jun/14-15 Sept	99
1824	Tao Nuevo del Fuego Tinguatón	Lanzarote	31 Jul/ 24 Oct	84
1909	Chinyero	Tenerife	18 Nov/27 Nov	10
1949	San Juan	La Palma	24 Jun/30 Jul	47
1971	Teneguía	La Palma	26 Oct/18 Nov	24
2011-2012	Mar de las Calmas (submarine eruption)	El Hierro	10 Oct 2011/5 March 2012	147



Historical volcanic eruptions in Canary Islands have traditionally been considered as quiet eruptions, mostly effusive and with scant explosions (VEI 1-2), attending to the general characteristics of this volcanism (fissure mafic eruptions, low VEI and typical Strombolian eruptive styles)

Of the 16 eruptions, at least 11 have shown behaviors with eruptive styles ranging from Hawaiian to Vulcanian, with short phases of water-magma contact, with calm water emissions or in the form of geysers, or even with phreatomagmatic explosions, forced extrusion of phonolitic pitons and block and ash deposits, and also with formation of PDCs by collapse of volcanic cones and lava flows

Block and ash in the 1585 eruption in La Palma

PDC in the 1971 eruption in La Palma formed by partial collapse of the volcanic cone

PDC in the 1949 eruption in La Palma formed during a phreatomagmatic phase

Nevertheless, eruptive dynamics vary significantly between some eruptions and others, between the different vents that make up each volcano and between phases of a single eruptive vent. The geological record of these eruptions shows abundant signs of moderate to high explosiveness with wide ash dispersion, not only on the island where the eruption takes place but also on the neighboring islands, PDCs, magma mingling, and bombs and blocks of considerable size outcropping on the islands.

The ashes of the Timanfaya eruption affected almost the whole island of Lanzarote and a great part of Fuerteventura

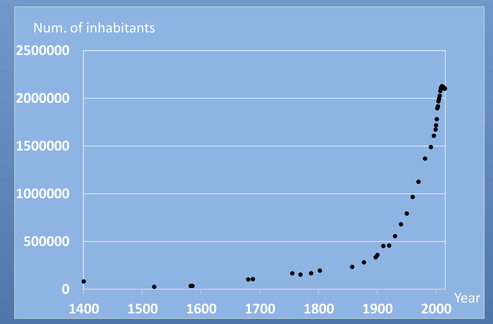
Date	Island	Observations
1430-40?	La Palma	?
1492	Tenerife	?
1585	La Palma	Forced extrusion of phonolitic pitons. Block and ash. Magma mingling
1646	La Palma	Pyroclastic fall-out in Tenerife. Roar in Lanzarote
1677-1678	La Palma	Violent Strombolian explosions. Phreatomagmatic volcanism
1704-1705	Tenerife	Violent Strombolian explosions
1706	Tenerife	Pyroclastic flows due to lava flows collapse
1712	La Palma	Without documentary information. Phreatomagmatic deposits
1730-1736	Lanzarote	Violent explosions
1798	Tenerife	Phreatic explosion. Explosive breccia
1824	Lanzarote	Quietly water emission and in form of geysers
1909	Tenerife	Violent Strombolian explosions
1949	La Palma	Phreatomagmatic explosions. Pyroclastics flows with a column height of 5 km. Lahars
1971	La Palma	Lava flows collapse. Pyroclastic flows

Eruption	Dead and injured	Causes of deaths and injuries	Number of evacuated	Main damage
1585	Several affected 5 (methodology from Simkin et al. 2001 and Whitman 2005)	Intoxication from gases associated with ash fall		1, 5, 9
1646	0	-----	No data	1, 2, 3, 4, 5, 7, 9
1677/78	4 dead	1 Intoxication from gases 3 unknown	+ 80	1, 2, 3, 4, 7, 9
1704/1705	16 dead	Seismicity associated to the eruption	280	1, 7, 8, 9, 10
1706	0	-----	2880	1, 2, 3, 4, 6, 7, 8, 9, 10
1712	0	-----	8	1,7
1730/1736	1 dead	Unidentified cause	2500	1, 2, 3, 4, 6, 7, 8, 9, 10
1793	0	-----	-----	7
1798	0	-----	-----	No damage, developed in uninhabited areas
1824	0	-----	?	7, 10
1909	1 dead	Accident during a visit to the volcano	1514	1
1949	1 missing 1 injured 3 affected	----- Gases Post-eruptive lahars	1000	1, 2, 4, 5, 7, 8, 10
1971	2 dead	Intoxication from gases	1500	1
2011/2012	1 affected	Intoxication from gases	370	No damage
Total :	35 victims (24 dead, 10 injured, 1 missing)		10132	

Damage

1. Destruction of crop fields; 2. Destruction of hydraulic infrastructures; 3. Grass areas; 4. Livestock; 5. Forest fires; 6. Urban fires; 7. Destruction of houses; 8. Disappearance of complete urban centers; 9. Destruction of infrastructures: commercial ports, churches, hermitages, hot springs; 10. Road infrastructures.

The results of this research studying and examining the historical chronicles shows that, contrary to what is generally believed, historical eruptions in Canary Islands did cause several impacts, sometimes very serious, both on the population (dead, injured or missing, displaced and evacuated), and on the economy (damage to crops, livestock, buildings, roads and several infrastructures). The historical documents also highlight that there was indeed some kind of crisis management, both from the political and scientific authorities in most of the eruptions.



Taking into account the increase in population in Canary Islands in the two last centuries, should and eruption like these occur nowadays in Canary Islands the damage and population affected would be much higher: the 1730-36 eruption in Lanzarote would affect ~75000 people today; the 1909 eruption in Tenerife would affect ~10700 people, and the 1949 eruption in La Palma, would affect ~2600 people.

CONCLUSIONS

The hazards of these eruptions are linked to the changes produced on the surficial geological features of the opening area of the eruptive vents, in the hydrogeological characteristics, as well as in the topography in which the volcanic materials are emplaced.

The seismicity, followed by the emission of gases, have produced the majority of deaths during volcanic events in the Canary Islands, which suggests that the secondary volcanic hazards will be more problematic for management crisis in the near future.

From all these we can conclude that no social interpretation has been made about the legacy of historical eruptions in Canary Islands nor about the impact they had. We should implement this knowledge in the prevention and emergency plans made by the authorities to improve the management of future eruptions, even more considering the population increase in the Canary Islands from ca. 360000 inhabitants in 1900 up to ca. 2.13 millions in 2018, plus some millions of tourists (15.5 in 2018).