MCC
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CENIZA Y LAVA

REVELACIONES CIENTÍFICAS JUNTO AL VOLCÁN

EXPOSICIÓN • 29 junio 2023 - 30 junio 2024 • Museo de la Ciencia y el Cosmos

ORGANIZAN:

IPNA CSIC
Instituto Español de Oceanografía
Instituto Geológico y Minero de España
CSIC Consejo Superior de Investigaciones Científicas

COLABORAN:

Gobierno de España
Ministerio de Ciencia e Innovación
FECYT

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EXHIBITION "CENIZA Y LAVA. REVELACIONES CIENTÍFICAS JUNTO AL VOLCÁN"

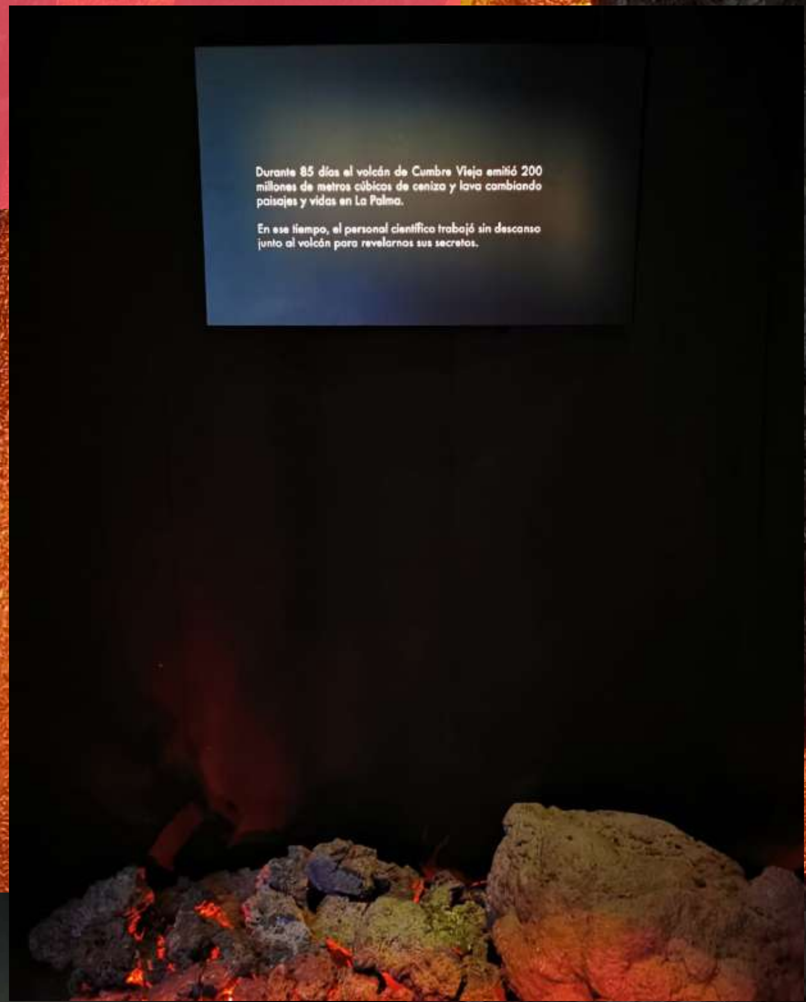
CENIZA Y LAVA

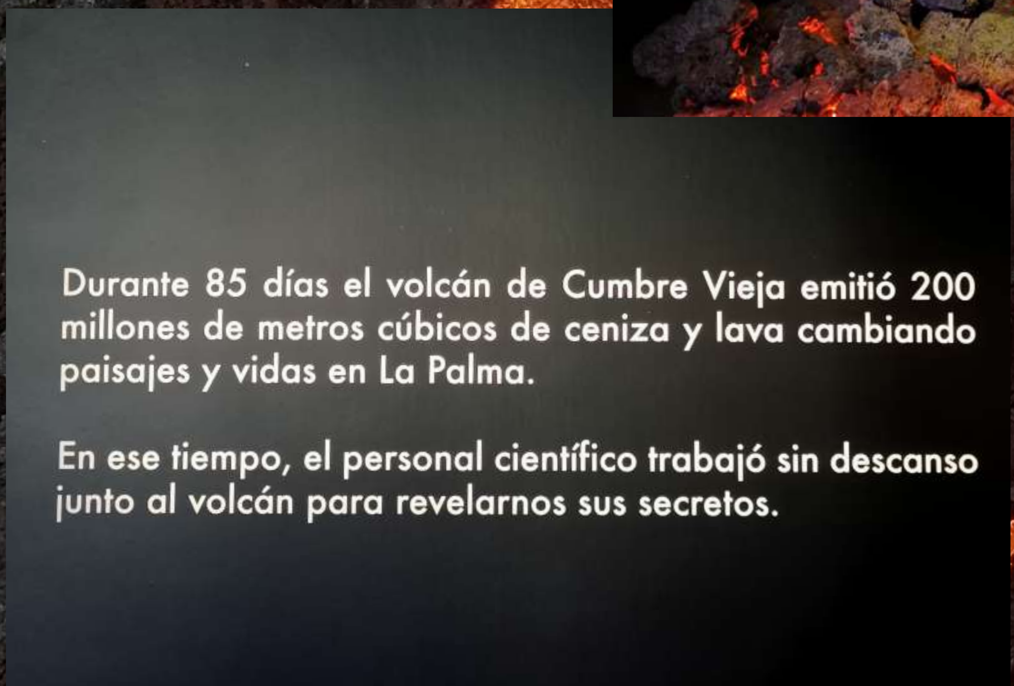
REVELACIONES CIENTÍFICAS JUNTO AL VOLCÁN

EXHIBITION ENTRY [ENTRADA EXPOSICIÓN]

For 85 days the Cumbre Vieja volcano emitted 200 million cubic metres of ash and lava, changing landscapes and lives on La Palma.

During this time, the scientific staff worked tirelessly at the volcano to reveal its secrets.





TIMELINE [LÍNEA DEL TIEMPO]

This is the graphic representation of a chronological sequence of events, processes or occurrences that have taken place regarding a given topic over a certain time period.

For instance, timelines can be usved to organise the different historical epochs of humanity: Prehistory, Ancient Times, Middle Ages, Modern Times and Contemporary Times.

HOW DOES IT WORK? [¿CÓMO FUNCIONA?]

Turn the pyramid module on your right up or down to see the different lines.

VGEOLOGICAL TIME SCALE [ESCALA TEMPORAL GEOLÓGICA]

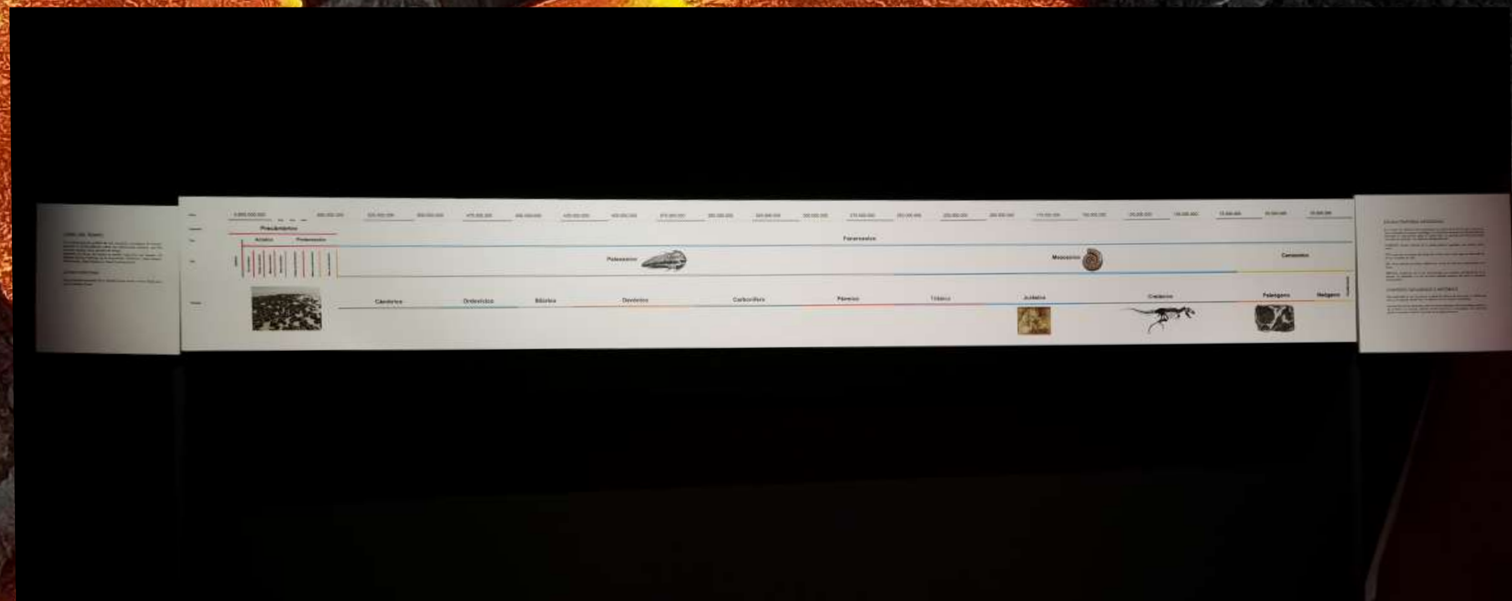
This a framework for representing the events of the history of life on Earth in chronological order. The divisions are based on the type of life that dominated each period according to the fossil record and on major physical disturbances that occurred on the planet. The established divisions are:

- **Superaeon**: informal division of the geological time scale grouping several aeons together.
- **Aeon**: Earth's longest span of time, fixed according to the development of complex life forms.
- **Era**: a long interval of time defined by the type of life that prevailed on Earth.
- **Period**: a subdivision of eras characterised by major disturbances on the planet. It is further subdivided into smaller units not shown here.

GEOLOGICAL AND HISTORICAL CONTEXT [CONTEXTO GEOLÓGICO E HISTÓRICO]

Subdivided into two: the first is from 30 million to 15 million years ago, and the second from that time to the present day.

It shows outstanding information on the geological history of the Canary archipelago, and of La Palma in particular, as well as historical and archaeological milestones of global importance that have been passed since the appearance of the human species.



CENIZA Y LAVA

REVELACIONES CIENTÍFICAS JUNTO AL VOLCÁN

FORWARD COMMAND POST [PUESTO DE MANDO AVANZADO]

The forward command post worked around the clock to monitor the volcano's activity and coordinate the operation mobilised by the eruption. In tents like this, there was incessant multidisciplinary activity. As if it were a brain, data collected in real time converged on this space, analysis of which was crucial for the authorities' decision-making.

The emergency teams also had technical and scientific support in carrying out their work and, as far as possible, attending the demands of the national and international media who had been attracted to the island by the eruption. Restricted access to the exclusion zone turned the scientific staff into regular reporters for the press, radio and television, a reach amplified by the social networks where the material they recorded with their mobile phones had enormous impact.

SCIENCE ON LAND [CIENCIA EN LA TIERRA]

The eruption on La Palma opened the door to hitherto unpublished research. One project was the possibility to follow, for the first time, how the effects of the eruption process on biodiversity developed in real time. Among other conclusions, the studies found that plants and animals benefitted from resilience linked to ecological and evolutionary trends in island environments. Examples of this are the adaptation of the Canary Islands pine tree to high temperatures, the strength of woody plants or the flexibility of vertebrate animals to changes in diet.

Another focus of study was to estimate the extent of damage caused by ash deposition on the island's crops. From the first days after the eruption, ash samples were continuously collected and analysed in selected areas close to the volcano. In addition to determining ash composition, the researchers sought answers to other questions: what would happen with the water leached through the ash after irrigation and rainfall, how it would affect the physical and chemical fertility of the soil, and what would be its impact on fruit ripe for harvesting and human consumption.

TEXT FOR MICROSCOPE SPECIMENS [MUESTRAS EN MICROSCOPIO]

[Lámina delgada de basanita]Thin basanite sections. The samples correspond to aa and pahoehoe lava flows from other eruptive times. They were collected with thermal gloves and cooled in a metal pan with water.

Basanite is a rock that has alternating zones with an aphanitic texture, where crystals are indistinguishable to the naked eye, and porphyritic, with larger crystals that are directly visible. It also has a considerable number of vesicles (gas bubble spaces) as a result of degassing, which can be up to 10 %.

The samples consist of a mineral association of clinopyroxene, magnetite and olivine. Amphibole is also present. These minerals are embedded in a glassy matrix with abundant microcrystals of plagioclase, ilmenite and olivine, some of which show frequent irregular fractures without alteration or small amounts of iddingsite, a material produced by the weathering of olivine. Amphiboles and clinopyroxenes form large crystals with straight edges, with clear zoning.

Collection date: 09/11/2021
Collection area: Playa de los Guirres (La Palma, Spain)
Collector: IEO-CSIC

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PROTECTIVE EQUIPMENT [EQUIPOS DE PROTECCIÓN]

The first steps to ensure the safety of the population near the eruption involved the demarcation of evacuation and exclusion zones. The many dangers inherent in an eruption such as on La Palma are diverse. High temperatures near lava flows require the use of appropriate protective equipment. Inhalation of volcanic gases can cause respiratory problems or even death, and some, such as hydrochloric (HCl) and sulphuric (H_2SO_4) acid gases, cause burns to the skin and mucous membranes on direct contact. There are also hazards posed by pyroclasts, such as the risk of impact from falling blocks and volcanic bombs, or lung and eye damage from exposure to ash. To all this we must add the direct destructive capacity of the lava flows, the possibility of acid rain, landslides caused by the accumulation of ash and lapilli or those caused by earthquakes accompanying the eruptive process.

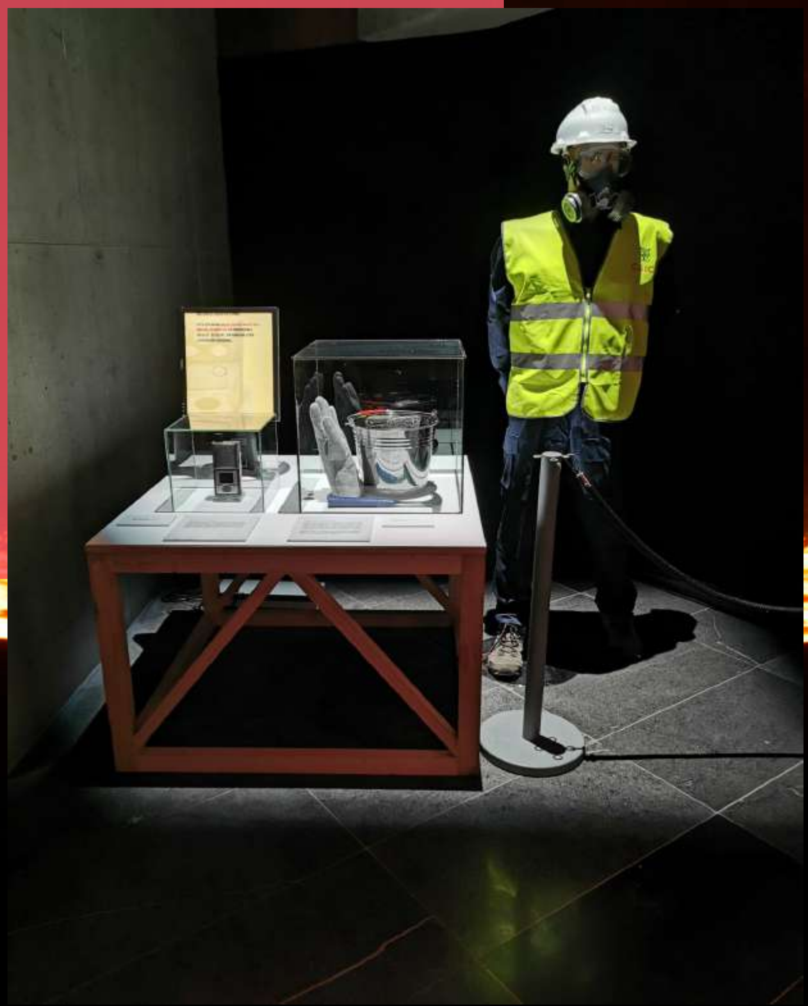
The personal protective equipment to which the pandemic had accustomed us was again the norm during the eruption but with variations adapted to the new situation: helmet, goggles, masks with specific gas filters and protective footwear and high-visibility clothing. Additionally, in the case of sample collection, chemical and thermal protective suits and gloves became essential.

The emergency teams also had technical and scientific support in carrying out their work and, as far as possible, attending the demands of the national and international media who had been attracted to the island by the eruption. Restricted access to the exclusion zone turned the scientific staff into regular reporters for the press, radio and television, a reach amplified by the social networks where the material they recorded with their mobile phones had enormous impact.

INVISIBLE ENEMIES [ENEMIGOS INVISIBLES]

Personnel involved in the monitoring and study of a volcanic process need real-time readings of the concentrations of the gases most usually emitted. CSIC staff used personal gas detectors equipped with sensors for O_2, SO_2, H_2S (hydrogen sulphide), HCl (hydrochloric acid gas) and CO (carbon monoxide). These detectors were set to trigger opto-acoustic alarms when the daily and short exposure ambient limit values were reached, being defined for times of 8 hours and 15 minutes, respectively. Furthermore, staff paid regular attention to the detector display because when the concentration exceeded 10% of the limit values, they had to replace their FFP2 or FFP3 masks with gas masks.

Industrial Scientific IBRID MX6 Detector on loan from GEALIA



SCIENCE AT SEA [CIENCIA EN EL MAR]

During the eruption, the Spanish Institute of Oceanography (IEO-CSIC) carried out two multidisciplinary oceanographic expeditions. The first, in September, with the vessel Ramón Margalef, and in October with the Ángeles Alvariño, to study the marine environment in the area before and during the arrival of lava flows at the ocean shore.

The team responsible for the geological surveys used echo sounders, a high-resolution mapping tool to identify depth and structures associated with changes in seafloor morphology. These were mapped daily to assess the advance and growth of the lava deltas.

Oceanographic studies were performed to detect variations in water properties, such as temperature, salinity, pH, dissolved oxygen or inorganic nutrients, among other parameters. An oceanographic rosette was used for this purpose, equipped with various sensors and bottles for collecting water samples at various depths.

These samples also permitted microbiological studies to quantify the impact on phytoplankton communities and other marine microorganisms of the massive influx of lava, cinders and ash into the sea.

OCEANOGRAPHIC ROSETTE [ROSETA OCEANOGRÁFICA]

For water sampling, a rosette of oceanographic bottles was used to obtain samples at different depths, and also to measure some parameters continuously with various sensors. Analysis of these samples can identify physico-chemical anomalies in the water or changes in the planktonic communities due to lava flow, ash or underwater thermal emissions.

An unmanned underwater vehicle or ROV was also used, the Liropus 2000. The use of this ROV made it possible to capture high-definition images of the underwater lava flow and to take rock and near-bottom water samples for analysis of chemical and biological parameters

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PILLOW LAVA
[LAVA ALMOHADILLADA]

This rock is generated in underwater seabeds, where its characteristic appearance is due to the contraction of very hot lava due to rapid cooling on coming into contact with seawater. Its surface is formed by a series of overlapping rounded cushion-like bulges, hence its name.

AA LAVA [LAVA AA]
Rough-surfaced wash, with irregularly shaped blocks and sharp sides. Its surface cools quickly, which causes the wash to crack and break easily.

MODEL OF THE SUBMARINE PISCES VI
[MAQUETA DEL SUBMARINO PICES VI]

In February 2023, during the Vulcana III campaign, the largest lava delta formed during the eruption was subject to an exhaustive geological and biological study. On that occasion, the Tenerife-based manned submarine Pisces VI was used for the first time in Spain. It can go down to a depth of 2180 m; indeed it is one of only five autonomous research submarines in the world capable of exceeding the 2,000-metre barrier. Its dimensions of 5.5 m long and 3.5 m high allow it to hold up to three people with eight hours' autonomy.

SCIENCE IN THE AIR [CIENCIA EN EL AIRE]

The scientific monitoring of the eruption had an unexpected ally: the drone. Although there are no specific models designed for volcanoes, there are geologists who fly them and who are able to make a scientific reading of their images even during the recording. They literally became the eyes of the research staff, capable of flying to less than 100 m from the volcanic cone and barely 35 m from lava flows, practically entering the mouth of the crater. In addition to avoiding endangering people's lives, their use provided images and data of crucial interest for science and for emergency management decisions.

Another aspect of the air that was studied in detail was its quality. From this point of view, the case of La Palma is also unique, because never before had information on air quality during an eruption been collected in such detail. Chemical analysis of the samples showed that the composition of respirable particles (smaller than 10 microns diameter), consisted of tephra or magma debris, dust from the Sahara on days when such haze arrived, soot from diesel vehicles and fires, organic carbon of varied origin and salts deriving from volcanic acids.

DRONES IN THE SERVICE OF SCIENCE
[DRONES AL SERVICIO DE LA CIENCIA]

Two types of drones were used to monitor the volcano: conventional camera drones and thermal drones. The latter were especially useful not only for flying at night, but also during the day, because the infrared and thermal cameras revealed the state of the crater and the lava flows, to know if they were still active or starting to cool...

IGME and GES personnel used industrial drones that withstood high temperatures better than expected. These ranged from over 1000 °C at the cone to 500 °C flying over the lava flows. Another factor that hampered operating the drones was the ash in the environment, which mainly affected their stabilisers, but the main cause of the loss of devices in the lava flows was the intensity of the wind.

Strong winds forced the larger of the drones on display here to make an emergency landing on unstable, rocky terrain, causing the propellers and landing legs to break. The smaller drone shows parts that melted as it flew at low altitude over the lava flows and crater.

DRONE MODELS
DJI Matrice 210 v2 Drone plus radio control
DJI Mavic Enterprise Dual Drone plus radio control and Sky monitor

MONITORING AIR QUALITY [VIGILANDO LA CALIDAD DEL AIRE]

The crises of poor air quality during the volcanic eruption on La Palma required intensive field work and real-time data analysis. A CSIC team provided scientific support and advice for air quality monitoring at the Canary Islands Government stations.

The CSIC team carried out respirable aerosol concentration measurements in different parts of La Palma, which consisted of:

- Mobile measurements of PM_{10} and $PM_{2.5}$ along numerous transects, or cuts, through El Paso, Los Llanos and Tazacorte. PM stands for *particulate matter*, and the subscript numbers indicate whether the diameter is less t han or equal to 10 or 2.5 microns, respectively.
- Continuous measurements of fine and ultrafine particles and black carbon or soot in Los Llanos.
- Chemical analysis of respirable PM_{10} in El Paso and Los Llanos.

The information obtained was shared daily with the Canary Islands Government and PEVOLCA, in order to take decisions aimed at protecting the health of the population. General recommendations included the use of FFP2 masks, goggles, long-sleeved clothing and avoidance of outdoor physical activity. In the most adverse scenarios, confinement of local residents was advised.

The tool shown here was used in the mobile measurements, when transects were made between Tazacorte and El Paso to identify the areas where air quality was better or worse.

RESPIRABLE PARTICLES [PARTÍCULAS RESPIRABLES]

Here you can see replicas of the PM_{10} samples of respirable particles taken daily in El Paso and Los Llanos during the eruption. Most of them are black and grey, identifiable as volcanic aerosols consisting of micrometric fragments of magma enriched in sulphur, chlorine, fluorine and elements not normally present in ambient air, such as thallium, bismuth, molybdenum, lead, cadmium and nickel. The orange and ochre-coloured particles were collected during days with Saharan dust haze.

The original samples were digested with strong acids during the treatment process and chemical analysis.

COMPOSITION OF RESPIRABLE PARTICULATE MATTER
[COMPOSICIÓN DE LAS PARTÍCULAS RESPIRABLES]

This graph shows the chemical composition of respirable PM_{10} particles taken in El Paso and Los Llanos during different periods. The coloured bars show the contribution of each source of respirable particles: haze, microparticles of tephra or volcanic magma, volcanic sulphate and carbon (soot, charcoal) from fires.

Air quality was good when concentrations of respirable particulate matter PM_{10} were below 20 micrograms per cubic metre (μg/m^3), reasonably good between 21 and 40, fair between 40 and 50, highly unfavourable between 101 and 150 and extremely unfavourable when above 151 μg/m^3. During the eruption, most of the respirable particles consisted of ash, tephra or volcanic magma.

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CENTRAL TABLE

PYROCLAST FORMATION [FORMACIÓN DE PIROCLASTOS]

Eruptions in the Canary Islands are not normally very explosive, mainly strombolian, which involves a pyroclastic cone near the eruptive mouths and lava flows. The morphology of these lava flows varies from more fluid, pahoehoe, to more viscous, aa or *malpais*. Pyroclasts are formed by fragmentation of magma due to the rapid or explosive expansion of bubbles formed by gases separating out from the magma during their ascent to the surface. Pressure inside the gas bubbles builds up and eventually ruptures, breaking up the magmatic liquid film surrounding them. This explosion generates fragments known as pyroclasts, classified according to their size as ash (smaller than 2 mm), lapilli (between 2 and 64 mm) and bombs or blocks (larger than 64 mm).

During the La Palma eruption, the vents emitted some 200 million cubic metres of material and the lava flows covered 1,219 hectares of ground after travelling more than 6.5 km from the main cone to the sea. This table displays a tiny representative fraction of the materials ejected during the 85 days of eruptive activity.

PYROCLAST COLUMN [COLUMNA DE PIROCLASTOS]

This column is a valuable testimony of the evolution of the eruption process. It shows changing intervals of material, reflecting the different phases and pulses of volcanic activity. vThus, at the base of the column, which corresponds to the first weeks of the process, coarser fragments were deposited. Later layers of fine ash alternate with coarser pyroclast layers, depending on the type of material thrown up by the volcano through time.

Analysis of the data provided by monitoring with geophones, sensors that record seismic and seismo-acoustic waves, enables correlating geophysical data with the chronology of the pyroclast deposits in parallel, as shown in the column.

[Ceniza] Ash. Product consisting of pulverised rock grains smaller than 2 mm in size. It can remain suspended in the atmosphere for a considerable time and can be deposited at great distances from the emission source.
Collection date: 14/11/2021
Collection area: Tajuya (La Palma, Spain)
Collector: MUNA

[Lapilli] Lapilli. Small magma fragments between 2 and 64 mm in diameter.
Collection date: 14/11/2021
Collection area: Tajuya (La Palma, Spain)
Collector: MUNA

[Sal contaminada] Contaminated salt. Although not a direct product of the eruption, it is a consequence of aerial ash dispersal to the coastal salt-pans (*salinas*) located in Fuencaliente, making it impossible to use the salt extracted from sea-water.
Collection date: 14/11/2021
Collection area: Salinas de Fuencaliente (La Palma, Spain)
Collector: MUNA

LAVA MOULDS AROUND PINE TREES [MOLDES DE LAVA ALREDEDOR DE PINOS]

[Molde de rama] Branch mould. Figure in relief generated by the contact of lava that rolled around a low reaching Canary pine branch, causing the organic matter to burn and the mould to remain. The lava flow reached the branch due to the height that the accumulated ash had already reached.

[Molde de tronco] Log mould. In this case, the lava surrounded the trunk of a pine tree, which was trapped inside the lava. The gradual carbonisation of the trunk left a hollow, as if it were a mould.

CARTOUCHE FOR EACH SAMPLE

[Colada cordada] Corded lava flow. When the surface of the lava cools and deforms plastically without breaking, it adopts wave or rope forms like those shown. The grey fragment was transported over the surface of the lava flow as it advanced.
Collection date: 22/10/2021
Collection area: Camino de la Cruz Chica (La Palma, Spain)
Weight: 1.6 kg
Collector: IPNA-CSIC

[Lava aa o malpaís] Aa lava or malpais. Rough-surfaced lava, with irregularly shaped blocks and sharp sides. The surface cools quickly, which causes it to crack and break easily.
Collection date: 10/11/2021
Collection area: La Laguna, Los Llanos de Aridane (La Palma, Spain)
Weight: 0.3 kg
Collector: Museum of Nature and Archaeology (MUNA).

[Xenopumita] Xenopumite. Rock resulting from the interaction of a magma of basic (alkaline) composition that melts, incorporates and coats sediments in its ascent from the ocean floor. These materials are richer in silica and lighter due to their large number of vesicles, which allows them to float on water for a considerable time.

These are rocks unstable at magmatic temperatures (800 - 1000 °C), witnessing the rapid ascent of magma to the surface, allowing a clear differentiation between the white molten inner materials and the dark outer ones, which are the magma that carries them.
Collection date: 04/10/2021
Collection area: El Paraíso (La Palma, Spain)
Weight: 1 kg
Collector: IPNA-CSIC and University of La Laguna (ULL)

[Basalto alterado] Altered basalt. Samples of lava fragments covered with patinas of iron oxides and hydroxides deriving from hydrothermal processes.
Collection date: 06/03/2022
Collection area: Inside the 2021 crater of Cumbre Vieja (La Palma, Spain)
Weight: 0.1 kg
Collector: IEO-CSIC

[Bombas volcánicas] Volcanic bombs. Compact fragments of magma ejected during a volcanic eruption with an average diameter greater than 64 mm. Bombs are ejected in a plastic state and often take on a rounded or fusiform (spindle) shape because they complete their consolidation by rotating during their trajectory through the air.

[Bomba 1.] Bomb 1. The sample on the left was emitted during the last eruptive phase. It is covered with salts derived from the reaction with volcanic gases.
Collection date: 15/12/2021
Collection area: Las Manchas, between the road to San Nicolás and the Cabeza de Vaca road (La Palma, Spain).
Weight: 7.1 kg
Collector: IPNA-CSIC

[Bomba 2.] Bomb 2. The sample in the centre has a cracked outer crust known as a bread crust. These cracks develop when the outer surface of a partially molten magma fragment cools and subsequently cracks as the hotter interior continues to expand.
Collection date: 04/03/2022
Collection area: vicinity of the 2021 Cumbre Vieja crater (La Palma, Spain)
Weight: 9.4 kg
Collector: IEO-CSIC

The sample on the right has a reddish hue due to a higher content of iron oxides and hydroxides.
Collection date: 05/03/2022
Collection area: near the Duraznero crater (La Palma, Spain).
Weight: 8.5 kg
Collector: IEO-CSIC

[Bomba 3.] Bomb 3. The sample on the right has a reddish hue due to a higher content of iron oxides and hydroxides.
Date of collection: 05/03/2022
Collection area: vicinity of the crater of the volcano Duraznero (La Palma, Spain)
Weight: 8.5 kg
Collector: IEO-CSIC

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FACE WALL

(INTRODUCTORY TEXT)

This wall introduces you to the scientific staff from the CSIC and other institutions whose contributions have made the *'Ceniza y Llava'* (Ash and Lava) exhibition possible.

The science of the La Palma volcano has many more faces and names, from the CSIC and other organisations. Our appreciation goes to all those who carried out (and continue) research on the eruption.

Notably, the environmental workers of the Cabildo de La Palma (Island Council) and to all the volunteers who helped in and facilitated the work under very difficult conditions.

VERÓNICA PÉREZ MÉNDEZ

DOCTOR IN BIOLOGICAL SCIENCES - University of Malaga (UMA)

Institute of Natural Products and Agrobiology (IPNA-CSIC)

I took data and samples for the documentation and study of the effects of the volcanic eruption on the different crops on the island, mainly in places close to the eruptive cone and lava fields, delimited as an exclusion zone. In addition, as a member of the La Palma Technical Unit, I provided fieldwork support to researchers from other disciplines who were in the area during the eruption.

THOMAS BOULESTEIX

DOCTOR IN EARTH SCIENCES - Université Paris-Saclay

Institute of Natural Products and Agrobiology (IPNA-CSIC)

I supported the CSIC members on the scientific committee of the PEVOLCA (Special Plan for Civil Protection and Volcanic Emergencies of the Autonomous Community of the Canary Islands) in documenting the eruption and in studying the products emitted (lava, pyroclasts, gases...), its evolution and spatial distribution.

SERGIO RODRIGUEZ

DOCTOR IN PHYSICS - Universitat Politècnica de Catalunya (UPC)

Institute of Natural Products and Agrobiology (IPNA-CSIC)

I am a specialist in Atmospheric Sciences, especially in the study of aerosols and desert dust, and their impact on air quality, biogeochemical processes and climate. During the eruption, I was focused on volcanic aerosols, for which I carried out a major deployment of scientific instrumentation that allowed me to obtain a record of the chemical composition, size distribution and concentrations of respirable and ultrafine particles. These data were also used to manage the air quality crises caused by the eruption.

PABLO J. GONZÁLEZ

DOCTOR IN EARTH PHYSICS - Complutense University of Madrid (UCM)

Institute of Natural Products and Agrobiology (IPNA-CSIC)

I am a volcanic geophysicist, I interpret deformation measurements such as elevation changes to better understand what is going on inside a volcano. During the eruption, our priority was to record as much geophysical and volcano-tectonic data as possible. We also advised the emergency managers. These data allow us to develop and test the limits of new numerical physics models that have predictive capabilities. Such models allow us to predict when there will be more explosive phases or when an ongoing eruption will end, to name a few of their applications.

MARÍA MERCEDES HERNÁNDEZ GONZÁLEZ

DOCTOR IN BIOLOGICAL SCIENCES - University of La Laguna (ULL)

Institute of Natural Products and Agrobiology (IPNA-CSIC)

I study the fertility of agricultural and horticultural soils on farms located at different altitudes and distances from the volcano. I also investigate the effect over time of ash deposited on banana, avocado and ornamental crops such as proteas, as well as the consequences on their nutrition, growth and production.

JESSICA LÓPEZ DARIAS

DOCTOR IN CHEMICAL SCIENCES - University of La Laguna (ULL)

Institute of Natural Products and Agrobiology (IPNA-CSIC) and University of La Laguna (ULL)

I was there during the La Palma eruption with the Atmosphere, Aerosols and Climate Group of the IPNA-CSIC. We carried out important work on air quality monitoring in the Aridane Valley, taking daily samples and making continuous measurements of PM10 and ultrafine particles. The data collected were used for decision-making by the PEVOLCA scientific committee. At present, several lines of scientific work are being developed, based on the samples and data obtained on La Palma.

JANA ALONSO LORENZO

DOCTOR IN MOLECULAR BIOLOGY - Universidad Autónoma de Madrid (UAM)

Institute of Natural Products and Agrobiology (IPNA-CSIC)

I have studied the impact of ash on banana crop physiology by analysing primary and secondary metabolite profiles. To do so, we applied state-of-the-art mass spectrometry and optical and scanning microscopy techniques.

NIEVES SÁNCHEZ

DOCTOR IN GEOLOGICAL SCIENCES - Universidad Complutense de Madrid (UCM)

Spanish Geological and Mining Institute (IGME-CSIC)

In addition to being the acting head of the IGME-CSIC Territorial Unit in the Canary Islands, I am their representative on the PEVOLCA scientific committee and on the advisory committee of the La Palma Territorial Emergency Plan for Civil Protection (PEINPAL) coordinated by the island's Cabildo Insular (Island Council). During the eruption I advised the Spanish authorities on the volcanic process, a task I continue to carry out today as the emergency sequels continue.

JUANA VEGAS

DOCTOR IN GEOLOGICAL SCIENCES - Universidad Complutense de Madrid (UCM)

Spanish Geological and Mining Institute (IGME-CSIC)

I am a field scientist at the Emergency Geological Response Unit (URGE) and a specialist in geological heritage and volcanism. I am also involved in science communication and outreach.

INÉS GALINDO

DOCTOR IN GEOLOGICAL SCIENCES - Universitat de Barcelona (UB)

Geological and Mining Institute of Spain (IGME-CSIC)

I have been a senior scientist and head of the IGME-CSIC Territorial Unit in the Canary Islands since 2006, also representing IGME on the scientific committee of PEVOLCA since 2011. I am part of the Emergency Geological Response Unit (URGE). During the eruption of La Palma I was coordinator of the IGME-CSIC group. I am a specialist in geological studies on oceanic volcanic islands with extensive experience in the case of the Canary Islands. My main research lines are focused on geological hazards and geological heritage in volcanic terrain.

JESÚS MARÍA ARRIETA LÓPEZ DE URALDE

DOCTOR OF BIOLOGICAL SCIENCES - University of Groningen

Spanish Institute of Oceanography (IEO-CSIC)

I studied the effect of pyroclastic and other volcanic material deposition on planktonic micro-organisms.

JOSÉ ANTONIO LOZANO RODRÍGUEZ

DOCTOR IN PETROLOGY AND GEOCHEMISTRY - University of Granada (UGR)

Spanish Institute of Oceanography (IEO-CSIC)

I was in charge of studying all the geological changes caused by the lava flows and the formation of the lava deltas. These studies were part of the VULCANA (Vulcanología Canaria Submarina) project, led and funded by the IEO-CSIC with the support of the oceanographic vessels Ramón Margalef and Ángeles Alvariño, as well as the Liropus 2000 remotely operated vehicle (ROV) for taking images and geological samples.

EUGENIO FRAILE NUEZ

DOCTOR IN MARINE SCIENCES - University of Las Palmas de Gran Canaria (ULPGC)

Spanish Institute of Oceanography (IEO-CSIC)

I am the Principal Investigator of the marine studies performed during the eruption of the volcano on Cumbre Vieja. I have led studies of the variations in physico-chemical, biological and geological anomalies in the entire water column, as well as evaluating the effect and recovery of the marine ecosystem in the area. I was campaign leader on board the oceanographic vessels Ramón Margalef and Ángeles Alvariño of the IEO-CSIC with the use of the ROV Liropus 2000 and the submarine PISCES VI.

JOAQUÍN QUIRÓS PRIEGO

CHEMICAL ENGINEER - University of Seville (US)

Occupational Risk Prevention Area of the CSIC

I travelled to La Palma because the deployment of CSIC researchers in the field required real-time occupational risk prevention advice to help in decision-making and ensure the highest degree of safety for the institution's staff. I also provided as much advice as possible to other entities involved in the operation.

FÉLIX MANUEL MEDINA

DOCTOR IN BIOLOGICAL SCIENCES - University of La Laguna (ULL)

Biodiversity Unit of the Department of Environment of the La Palma Island Council

I was part of the team led by the IPNA-CSIC responsible for monitoring the biodiversity affected by the La Palma volcano, both in the area of the crater and the lava flows. To this end, we carried out sampling of vegetation, as well as vertebrate and invertebrate fauna. This work was carried out simultaneously with the eruptive process under extreme environmental conditions. Subsequently, once the eruption was over, this monitoring has continued in the affected areas in order to study its sequels.

MARIA JOSÉ JURADO

DOCTOR IN GEOLOGICAL SCIENCES - Universitat de Barcelona (UB)

Geosciences Barcelona (GEO3BCN-CSIC)

I installed a three-component geophone device in an area close to the volcano for continuous seismoacoustic monitoring of the eruption, in collaboration with the Instituto Geográfico Nacional (IGN). The sensors were located outside the Caños de Fuego Visitor Centre in Las Manchas. With this innovative system, a continuous recording was obtained in a frequency range of up to 120 Hz, complementing the data collected with conventional seismic networks and stations. I designed and managed the continuous recording until the end of the eruption. I am currently working on a research project analysing the data collected.