**CEED: Conceiving Earth Evolution and Dynamics**

**Field trip**

**Time:** Thursday October 19. Bus from Hotel LAGUNA NIVARIA, Plaza del Adelantado, 11 at 09.00 o’clock, ending no later at 17.00 o’clock at the same place.

**General**

![Map of the Canary Islands](image.png)

*Fig. 1. The Canary Islands. The continent-ocean boundary is located east of the islands Fuerteventura and Lanzarote.*

The Canary Islands (Fig. 1) are “ocean islands”, which represent volcanism on ocean floor away from plate boundaries. The best known example is Hawaii. The Canary Islands consist of seven major islands. Tenerife is the largest, and has the highest mountain in Spain, the Pico del Teide volcano (3717 m high).

Tenerife consists of the following main parts (Fig. 2): (a) the old domains (8.5-3.3 Ma) in the northeast (Anaga), the west (Teno), and south (Roque del Conde); (b) the young volcano Las Cañadas Edifice (1.9-0.17 Ma), and (c) the Dorsal Ridge (ca. 1.9-0.17 Ma) that links the Anaga Massif to the Las Cañadas
Edifice. However, with respect to periods of formation of the different parts of the island, we have to remember that large parts of the island are below sea level. This means that volcanism must have started well before 8.5 Ma.

The old domains (a) are believed to represent three separate islands that were connected through the formation of the Cañadas Edifice (d) and the Dorsal Ridge (e). The age differences between the old and young domains probably represent a period of volcanic quiescence, after which the foci of the volcanism shifted. The Cañadas Caldera formed about 170,000 years ago, and there has been volcanic activity in Pico del Teide and the Dorsal Ridge until recent times, the last eruption was in 1909.

![Map of Tenerife showing domains with volcanic activity in different periods.](image)

**Stop 1. The Dorsal Ridge**

We start by driving southwest along the Dorsal ridge that links the Anaga Massif to the Cañadas Edifice (Fig. 3).

Our first stop is at Mirador de Tarta, a view point along the Dorsal Ridge (Stop 1; Fig. 4) where we see the Cañadas Edifice, the rim of the Cañadas Caldera and the peak of Pico del Teide from a distance. The summit of Teide is at 3717 meters above sea level. If we add about 4000 meters from sea level to the seafloor outside of the Canary Islands, we get a volcano that is rated as the world’s third largest, ranking after two in the Island of Hawaii! Furthermore, if we continue the inclination of the outer flanks of the volcano to an imaginary, pre-historic summit (Fig. 4) we see that before the formation of the caldera the Cañadas volcano must have been significantly taller than it is today. Notice also lavas running down the flanks of the Cañadas volcano.

We also look to the north, into the Orotava valley. This valley has been formed by immense landslides. Mapping of the seafloor outside the coast shows
where the material has settled on the seafloor. Huge landslides make major incisions into the flanks of ocean islands and contribute to shape the coastline and landscape. Notice that the Orotava Valley has a lot of vegetation. The winds come from the north and give off rain on the northern side of Tenerife. The southeastern coast is very dry, and most favoured by the tourists.

![Map of Tenerife showing stops we will visit during the field trip.](image)

**Fig. 3.** Map of Tenerife showing stops we will visit during the field trip.
Stop 2. Bathroom facilities

Fig. 4. Pico del Teide seen from Stop 1, the youngest cone in the central volcano.

Fig. 5. Pico del Teide and the Las Cañadas Caldera seen from the air. The caldera is best developed to the south (left.) Lava flows from Pico del Teide and the older, and slightly smaller volcano, Pico Viejo have buried the northwestern (right) part of the caldera wall.

Stop 3. Las Cañadas Caldera and Montaña Blanca
We are now inside the Las Cañadas Caldera (elevation ca. 2300 m). The caldera measures 17 km in its longest direction and is one of the world’s largest calderas (Fig. 5)! In the caldera wall we see numerous lava flows that make up the youngest (outermost) part of the Las Cañadas Edifice.
Fig. 6. Different colours on extrusive material reflect different chemical compositions. Here we see small cones formed by extrusions of pinkish silicic ash in the Montaña Blanca, overflown by somewhat younger black basaltic lava rich in magnesium and iron.

On the caldera floor and on the flanks of the Teide volcano we see lots of small lava cones, such as Montaña Blanca. The relative age of lava flows may be distinguish by different degrees of vegetation. The colors of lavas and other extrusive rocks give information on chemistry (Fig. 6). We will walk a short distance up towards Montaña Blanca to get a better view of the caldera floor and of different types of lava. Those who wish may take a longer trip.

**Lunch stop: Parador National**
We eat our lunch bags outside the Parador National.

**Stop 4. Los Roques de Garcia (depending on available time)**
The Las Cañadas caldera formed by at least two large explosions that blew the top off the Cañadas volcano about 170,000 years ago (Figs 5, 7, 8). Los Roches de Garcia represents the boundary between the two parts of the caldera floor. We take a walk to look closer at these rocks. Among other features we will see greenish domains how gasses rising from the magma chamber below the caldera have altered the minerals in the rocks from the original ones formed from the host magma at high temperatures, to new minerals stable in the presence of H$_2$O, CO$_2$, SO$_2$, H$_2$S, etc. at low temperatures.
Stop 5. Los Gigantes (depending on available time)

We drive from the youngest part of Tenerife towards one of the old complexes, the Teno Massif (Fig. 2). The landscape is quite different. The young areas are dominated by volcanic features, the large Cañadas volcano with mildly outwards sloping surface with lots of satellite cones and lava flows. In the old complexes, in contrast, the topography is completely dominated by erosion. Here erosion has cut deep valleys and canyons into the endless sequence of mildly inclining lava flows that formed the massif (Fig. 9). The road that leads inside the massif is very narrow and zigzags up and down steep cliffs. It is therefore impossible for the bus to enter this area. We will therefore look at the southernmost termination of the Teno Massif at Los Gigantes (Fig. 10).
At Los Gigantes (Fig. 10) we see the lava flows that built the massif as bands across the cliff, and we also see nearly vertical dykes that cut through the lava sequence. These dykes have acted as feeder channels to younger lava flows higher in the lava sequence. We see clearly that this island is built by volcanic activity.
The existence of the Canary Islands was possibly known in ancient times. Plato spoke of Atlantis, a continent that had sunk beneath the ocean floor in a great cataclysm that left only the peaks of its highest mountains above the water. The islands gained an almost mythic reputation, passed down from one classical writer to the next, as a Garden of Eden. The name "Canarias" was mentioned by Plutarque and Plinius the Elder in year 77 AD. Around 120 AD, Marinus of Tyre wrote that the habitable world was bounded on the west by “the Fortunate Islands”. Claudius Ptolemy (AD 90 - 168), following Marinus, established “the Fortunate Islands” as the western edge of the known world in his Geographia. This was the most famous classical map of the world, unsurpassed for almost 1500 years.

Carbon dating has placed the earliest settlement in the Canary Islands at around 200 BC, although earlier settlement is possible.

The Canary Islands were then forgotten by the Europeans until the 13th century, when they were “rediscovered” by European navigators.

In 1402, Jean de Béthencourt, from Normandy, occupied the islands of Lanzarote, Fuerteventura, Gomera and Hierro, on behalf of King Henri III Spain but Tenerife, La Palma and Gran Canaria resisted occupation. Grand Canaria was then conquered and the population christianed. On the 31st of May 1494 the Spaniards walked blindly into a ravine in the Anaga Mssif and there they met disaster. Guanches attacked them from the slopes. Using stones and spears against the Spanish blunderbusses and canons, and they fought naked while the conquerors wore armour and shields. In spite of their overwhelming advantage, the Spaniards suffered a terrible defeat. Four out of five Spanish soldiers were killed.

After a totally failed attempt to conquer Tenerife Spanish troops came back in 1495. At that time they met the Guanches on open fields at the place where the University of La Laguna now stands. A terrible battle took place and the Guanches were decimated. After a kind of plague that was fatal to the Guanches, but did not affect the Spaniards, the Guanches were completelt sudued.
The Spaniards described the locals on Tenerife, the Guanches, as a "highly beautiful white race, tall, muscular, and with a great many blondes amongst their numbers". Guanche was the name by which the natives of Tenerife called themselves. Guan Chenech meant "Man from Chenech", or “Man from Tenerife”. With the passage of time, the term Guanche became identified with all the native peoples of the Canaries. It would seem that the natives of La Palma, seeing the snow-covered peak of Pico del Teide on the horizon, called that island Ten-er-efez, "White Mountain" (from Ten, teno, dun, duna= mountain, and er-efez= white). The Guanches relied on limited farming, herding, hunting and gathering, and the majority of them lived in caves.

Suggestions for the origins of the Guanches have ranged from Celtic immigrants from mainland Spain or Portugal, to Norse invaders, supplying a possible explanation for the blonde hair and blue eyes. Berber immigrants from nearby Saharan Africa almost certainly inhabited some of the eastern islands, and place names bear a striking resemblance to Berber tribal languages. Occasionally blue eyes and fair hair crop up among the Berbers as well. Thus the origin of the Guanches is thus still an open to question.