

GEOMORPHOLOGICAL EVIDENCE OF DROWNED MARINE SHELVES: A REVIEW OF THE OFFSHORE DATA FOR LA GOMERA ISLAND (CANARY ISLANDS)

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Bathymetric investigations of the Canary archipelago offshore area have shown that several of the islands present an insular shelf sculptured in the submarine volcano flanks. This geomorphological feature has also been identified in other oceanic islands around the world, such as the Hawaiian archipelago, and related with subsidence. The non-active and highly eroded island of La Gomera (>20–4 Ma) is semi-circular in outline with an east-west diameter of 24 km, a north-south length of 20 km and an area of 378 km². The island's maximum elevation of 1487 m above sea level (asl) is reached in its centre at Alto de Garajonay whereas the base of the volcanic apron is located at an approximate depth of 2000 m below sea level (bsl) (Figure 1).

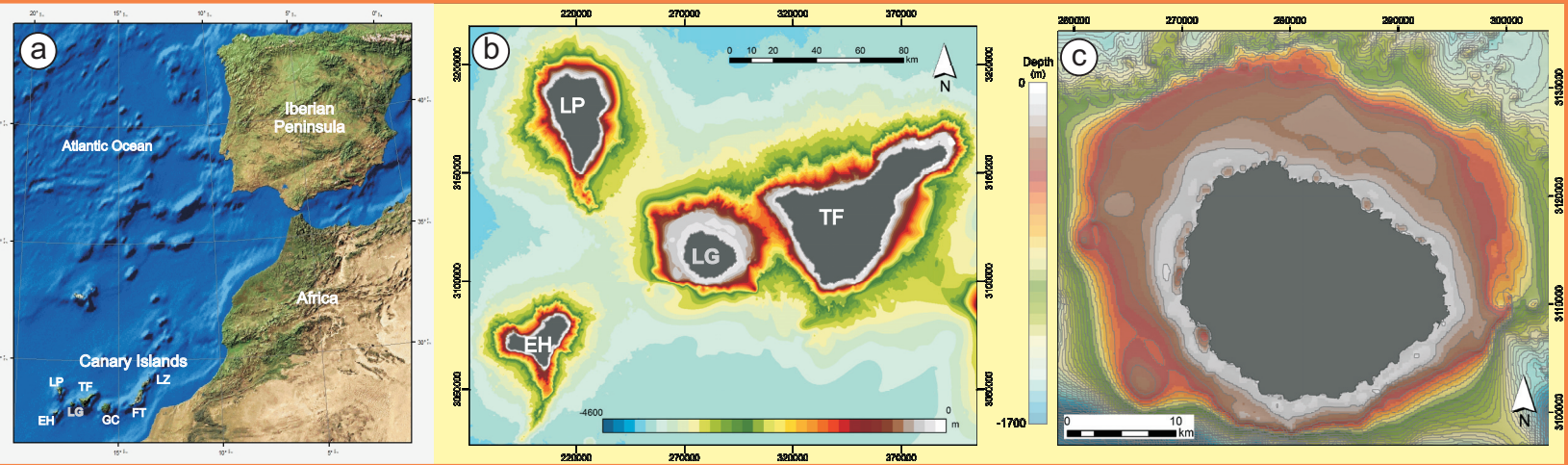


Figure 1. a) Location of the Canarian Archipelago (LZ_ Lanzarote, FT_ Fuerteventura, GC_ Gran Canaria, TF_ Tenerife, LG_ La Gomera, LP_ La Palma, EH_ El Hierro); b) Bathymetry of the Western Canaries (Tenerife, La Gomera, La Palma and El Hierro; 50 m grid); and c) Bathymetric map of the proximal area to La Gomera Island (50 m grid; contour interval is 50 m).

The non-active and highly eroded island of La Gomera (>20–4 Ma) does not present a unique shelf but various wide subhorizontal surfaces (slope < 0.5°) that define a staircase morphology observed in the submarine DEM between 30 and 200 m below the present sea-level (Figure 2.a). All of them constitute a regional smooth surface that previous authors have interpreted as only one surface related with turbidity current deposition and erosion as well as hemipelagic processes or the result of marine abrasion (Acosta *et al.* 2003; Llanes *et al.* 2009). That closer to the island ("I" in Figures 2b and 2c) forms an almost continuous ring along the current coast at 30 m bsl with an average width of 350 m. It is better developed on the northwestern area where it presents more than 1.5 km width. Seaward, a shelf break with slopes ranging from 1–2° in the north and east, and 2–5° in the south and west reaches 100 m bsl ("II" in Figures 2b and 2c). At that depth, a wider shelf is observed from the west to the northeast of the island. This second morphology width varies from 3 to 4 km and although in its northwestern area is not completely continuous it is 37 km long. Its shelf break leads to the volcanic apron except in the southwest, northwest and eastern areas where another two shelves (ca. 1 km wide each; ("III" and "IV" in Figures 2b and c) can be described at 170 and 200 m bsl. The upper one appears isolated in the northwest and northeast areas whereas the deepest one is located in the north, northeast and southwest. Once the insular slope appears it presents gradients of 5–20° (Figure 2c).

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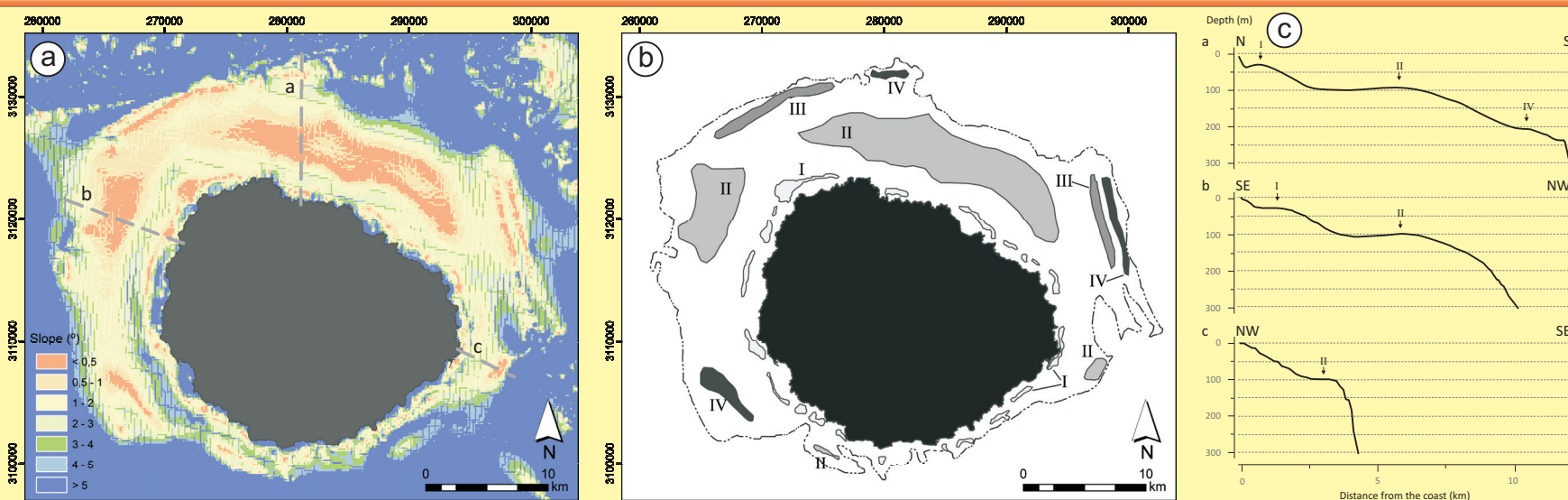


Figure 2. a) Slope map La Gomera derived from the 50 m elevation grid (see Figure 1); b) Morphological interpretation of La Gomera insular shelf. Dashed line is the limit of the previously identified abrasion platform. Platform I located at -30 m bsl; platform II located at -100 m bsl; platform III at -170 m bsl; and platform IV at -200 m bsl; and c) Profiles perpendicular to the insular coast where arrows point out the identified shelf (see Figure 2a for location).

The depth and morphological features of these submarine terraces suggest the present insular shelf is the result of both the active marine erosion during the Quaternary glacio-eustatic oscillations and the continuum subsidence of the oceanic lithosphere due to the volcanic load. Seismic profiles have proved that this flexure is a function not only of the island's loading history but also of that of its neighbours. Even though some uplift has been previously suggested as a result of large landslides removing load from the islands (ca. 9 Ma, Tazo and San Marcos) several recent geomorphological features may suggest this subsidence process is still acting. For example, the fact that no morpho-sedimentary record of sea-level highstand have been described in the littoral of the island or the occurrence of hanging valleys that denote a strong retreat of the cliffs that only can be explain for the action by a continue drowning of the littoral that enhance the erosive processes of waves. In this scenario, the described terrace I that surrounds the island at 30 m bsl may correspond to the Last Interglacial MIS 5e sea-level highstand. This marine stage has been recorded in other Canarian islands by means of morphosedimentary complex located near the present sea-level that indicate subsidence rates of ca. 0.07 mm/y for Fuerteventura and Tenerife (Zazo *et al.* 2002; 2003) whereas in La Palma point towards an uplift of approximately 0.015 mm/y (Zazo *et al.* 2003). In contrast with these data, the estimated subsidence rate for La Gomera during the last 120 ka will be in the order of 0.25 mm/y what indicates a higher subsidence than that of the islands around (Figure 3). The description of several insular drowned shelves around La Gomera represents the first evidence of a remarkable subsidence process during the Quaternary in this island that has already been described in other archipelagos such as Hawaii.

Figure 3. Correlation between Late Quaternary sea-level fluctuation and main identified drowned shelves for La Gomera Island and simplified evolution model for the vertical movements of these morphologies. Both platforms were probably subaerially exposed during the last 50 ka. ▼

