

Natural gamma radiation in La Palma Island, Canary Islands, Spain

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Introduction

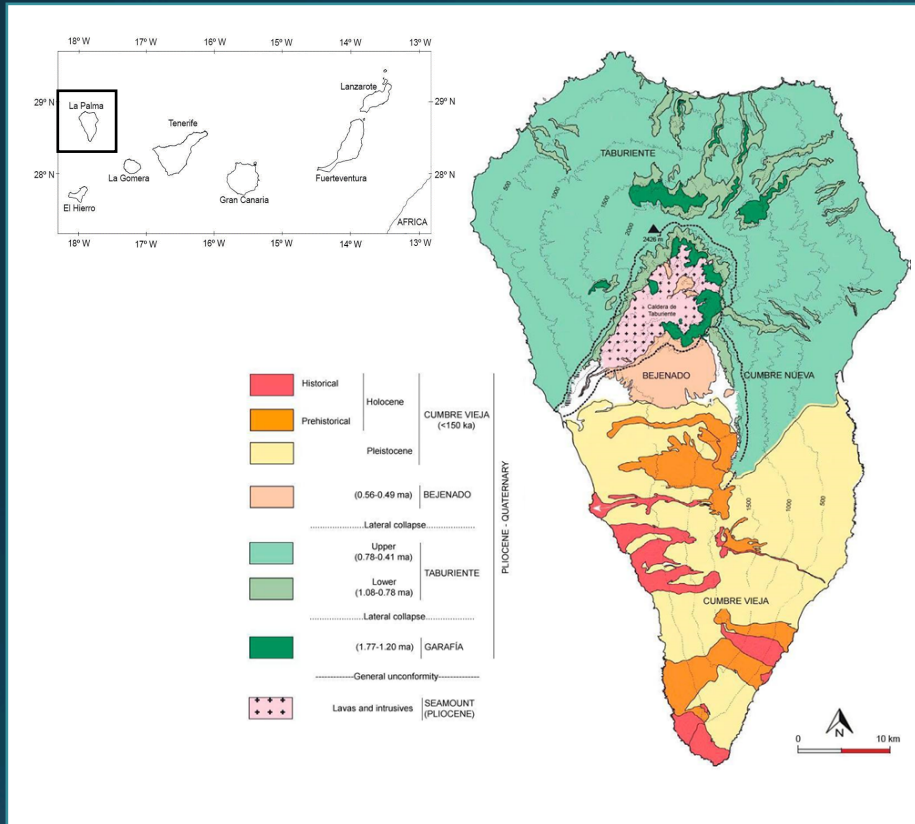


Figure 1. Simplified geological map of La Palma Island (modified after Carracedo and Troll, 2016).

Terrestrial gamma absorbed dose rates from soils of La Palma (Canary Islands) were measured and correlated with main geological features of the island (Fig 1) and with soil radiochemical composition (^{40}K , ^{226}Ra and ^{232}Th).

Materials and methods

- Natural gamma radiation measurements were carried out in 71 sites randomly selected on a predefined 3x3 km sampling grid covering the whole island in 2013.
- Total outdoor gamma radiation levels were measured at 1 m above the ground. Air gamma radiation was measured using a MINI 6-80 (Mini-Instruments) monitor equipped with an energy-compensated Geiger-Müller MC-71 probe and FH 40 GL 10 (ThermoFischer Scientific) dosimeter equipped with a proportional-gas detector.
- Cosmic radiation contribution was calculated for each sampling site and subtracted for each dose measurement.
- 25 soil samples were collected at a depth of 0-15 cm in uncultivated fields. Radiometric measurements for ^{40}K , ^{226}Ra and ^{232}Th radioisotopes were performed by low-level gamma spectrometry with coaxial-type germanium detectors (Canberra Industries Inc., USA).

Results and discussion

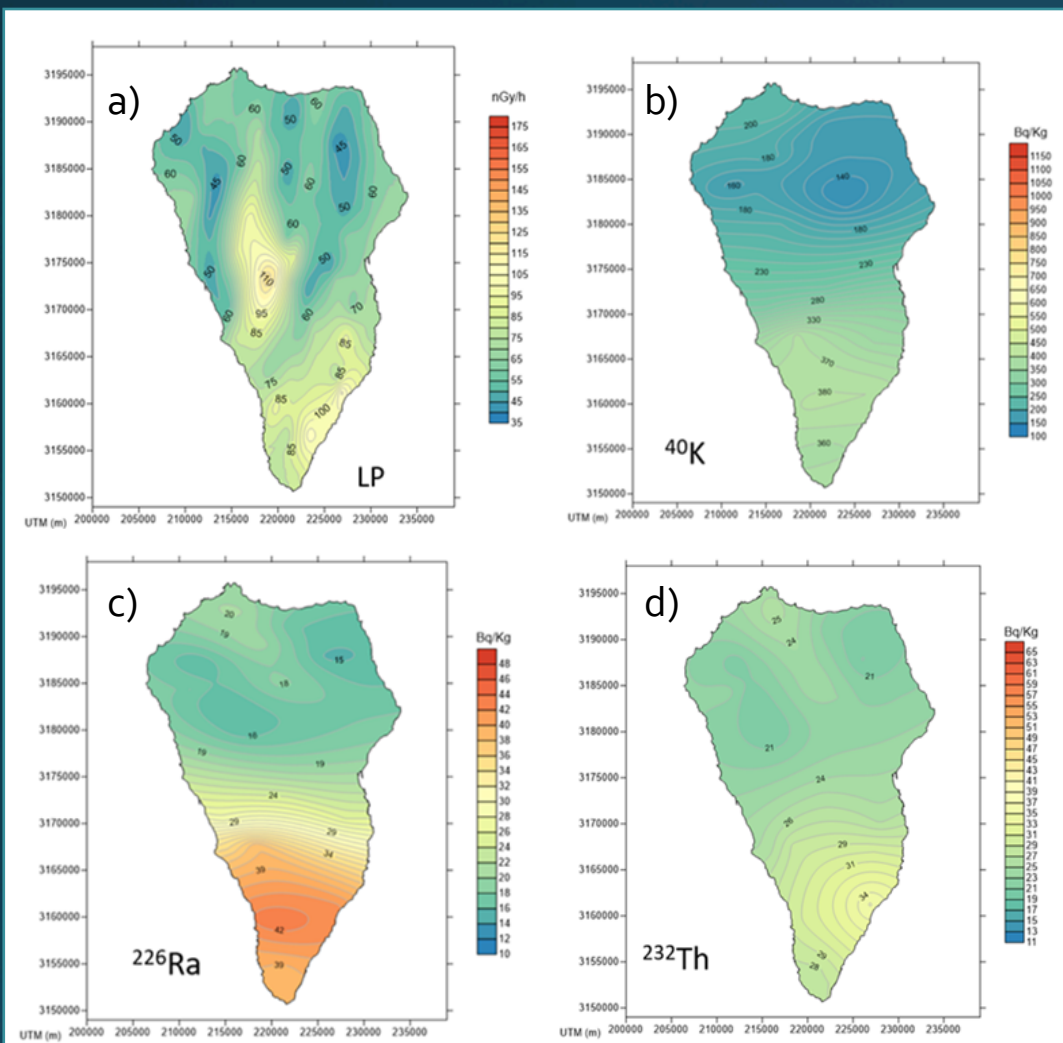


Figure 2. Terrestrial gamma absorbed dose rate map (a) and spatial distribution of ^{40}K , ^{226}Ra and ^{232}Th activity concentrations in soils of La Palma Island (b, c and d respectively)

The geometric mean of outdoor gamma absorbed dose rate at La Palma was 102.7 nGy h^{-1} , almost twice the reported value (55 nGy h^{-1}) for the surveyed countries in the UNSCEAR report (1988) and higher than most of other Spanish regions (Suárez et al, 2000)

Lower absorbed dose rates ($45 - 70 \text{ nGy h}^{-1}$) and lower ^{40}K , ^{226}Ra and ^{232}Th activity values ($<200 \text{ Bq kg}^{-1}$, $<20 \text{ Bq kg}^{-1}$ and $<25 \text{ Bq kg}^{-1}$ respectively) were observed in the oldest northern Taburiente and Garafía basaltic shields. Two anomalies were found ($80 - 110 \text{ nGy h}^{-1}$) at the Bejenado stratovolcano and at the southeastern zone of the Cumbre Vieja ridge (Fig 2a), both related to phonotrephritic and phonolitic rocks of the upper Bejenado sequence and at Cumbre Vieja edifice. At this edifice, higher ^{40}K , ^{226}Ra and ^{232}Th activity concentrations ($300-500 \text{ Bq kg}^{-1}$, $20-45 \text{ Bq kg}^{-1}$ and $25-35 \text{ Bq kg}^{-1}$ respectively) were measured (Figs. 2 b, c and d respectively).

References:

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