The ¹⁴Canarias web application. An interactive radiocarbon database for the Canary Islands

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ABSTRACT

The dataset described in this work represents the first open-access compilation of uncalibrated radiocarbon dates for the archaeology of the Canary Islands (Spain). This collaborative ongoing dataset will be updated step by step with newly published radiocarbon dates. Finally, this database has a *Shiny* application hosted at the Universidad de la Laguna and is freely accessible.

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(1) OVERVIEW

CONTEXT

The Canary Islands were initially settled during the first centuries of the Common Era by Berber agropastoral populations from North Africa [1], thus representing the last and westernmost expansion of the Eurasian/Mediterranean farming package. These early inhabitants supposedly remained isolated in the archipelago until Europeans arrived in the 15th century CE; however, the debate on its isolation is far from over [2]. In this context, there is no doubt that radiocarbon dating is at the forefront of archaeological research. This is largely due to two interrelated phenomena. Firstly, the consolidation of Rick's dates as data proposal [3] is based on the premise that radiocarbon dating can be conceived as an indicator of palaeodemographic trends, including the influx of new populations. In other words, the subjacent idea of this approach is the following argument: any demographic increase implies the generation of more waste (archaeological sample to date) and, more dates denote more garbage and therefore more population. Admittedly, it is not without its debate [4–5]. Secondly, this type of analysis involves the use of large radiometric series [6] and the generation and publication of radiocarbon compilations is necessary. In this sense, except for the first syntheses [7, 8], the last decade has seen the publication of numerous works systematising radiocarbon information focused on Spanish prehistory [9, 10, 11], although the proposal of the people3k working group, which has published the first radiocarbon database on a global scale [12], also deserves special attention. However, while radiocarbon information from the Balearic Islands has been considered in different syntheses [8, 13], including IDEArq platform [9], the Canary Islands have been isolated from this phenomenon.[1]

For all these reasons, this dataset was conceived with the aim of filling this gap in radiometric information on Spanish archaeology. In this sense, the Canary Islands should be considered a historiographical reference in the application of the radiocarbon method, since the first radiometric dating associated with Spanish archaeology comes from an aboriginal mummy and from different archaeological wood items deposited in El Museo Canario, Las Palmas de Gran Canaria [16].

SPATIAL COVERAGE

The spatial coverage includes the Canary archipelago (Figure 1) which is constituted by the islands as follows: La Graciosa, Lanzarote, Fuerteventura, Gran Canaria, Tenerife, La Gomera, La Palma and El Hierro. This region is the farthest region where the Eurasian/Mediterranean farming package was expanded.

Coordinates of the analysed region in the *World Geodetic System 1984* (WGS84) are:

Northern boundary: +29.48
Southern boundary: +27.48

Figure 1 Geographical location of the Canarias Islands (Spain).

Eastern boundary: –13.32
Western boundary: –18.21

TEMPORAL COVERAGE

The temporal span covers the entire *Canario-Amazige* and the colonial transition (1st – 16th centuries CE). However, the database also provides some radiocarbon dates from a few centuries before the turn of the Era. Here, we use the ethnonym *Canario-Amazige sensu lato* as opposed to the pre-Hispanic and/or pre-European concepts. The reason is that it allows us to avoid conflicts concerning nomenclature, which have been extensively discussed in Onrubia and González [17].

(2) METHODS

The dataset has been built according to research and informative criteria, this implies that the cultural ascription assigned by archaeologists has not been modified. The dataset was developed and collected in the context of several grants funded by the Spanish *Agencia Estatal de Investigación – Ministerio de Ciencia* and by *Dirección General de Patrimonio Cultural del Gobierno de Canarias (Consejería de Educación, Universidades, Cultura y Deportes del Gobierno de Canarias)*.

STEPS

The search for radiocarbon data resources and its integration was based on gathering radiocarbon information from papers by scientific journals, monographs, and grey literature, it also integrates datasets of radiocarbon information published by the Cabildo de Gran Canaria (https://dataciones.grancanaria.com/). These data were collected manually and stored in the *Filemaker* database.

QUALITY CONTROL AND CONSTRAINTS

The quality control has consisted of compiling all published archaeological dates and going back to the original bibliographical source whenever possible. Also, if a ^{14}C has contradictory information in several references, the original publication prevails if there is no evidence to the contrary. Likewise, the database has a specific file *14CanariasHIG.csv* corresponding to the quality of the radiocarbon data according to the recently designed radiocarbon hygiene proposal for the Canary Islands [18].

Some dates have the reference *out* which means that those dates do not meet some of the current acceptance standards (Carbon-Nitrogen correlation and/or laboratory consistency). We also include some dates that were published without any lab code, giving them an artificial lab code (e.g., n.d-1) followed by a sequential number. Five dates were published without uncalibrated

information and another without uncalibrated error. In these cases, we have decided to include them in our database, but not in the app.

The geographical information has been added by comparing the cartography published (location map) in the literature with the satellite image (Google Earth). The coordinates are in decimal degrees following the World Geodetic System (WGS84) ellipsoid 4326. However, in the case of La Gomera, the geographical information has been provided by the administration (Juan Carlos Hernández Marrero, director of the Archaeological Museum of La Gomera).

(3) DATASET DESCRIPTION

OBJECT NAME

As indicated above (subsection steps) the database has been designed in *FileMaker*. However, it is presented as individual CSV (comma-separated value) format files except for the bibliographic file which is in *BibTeX* format.

RADIOCARBON DATASET ("14CANARIASDATA.CSV")

This file contains the essential information about each radiocarbon date. Each record has a unique identified (*Id_date*), the reference to the archaeological site number (*Id_site*), its conventional radiocarbon date (BP) and the uncertainty (SD), radiocarbon code (e.g., Beta-12345) isotopic signatures such as ∂^{13}C and ^{15}N, the dating method and its quantity, the material and its species, the archaeological context is indicated if it is known. Finally, the database has a field (*Id_BibTeX*) to refer to the identification code of the bibliography stored in *14CanariasREF.bib*.

ARCHAEOLOGICAL SITES ("14CANARIASSITE.CSV")

This table refers to the basic information associated with the site and its geographical location. This includes the site number identifier (*Id_site*), the type of site (e.g., cave, open air, and so on), the island where the site is located and the administrative province. Finally, the coordinates (latitude, longitude) are in decimal degrees.

HYGIENE INFORMATION ("14CANARIASHIG.CSV")

In this table, radiocarbon dates are identified according to the radiometric hygiene protocol [18]. Each record has its *Id_date*, the radiocarbon laboratory code (*IdMuestra*), and the value of feasibility (*Rango fiabilidad*). It falls between 1 to 7, with those dates identified as 1 being the most reliable.

REFERENCES ("14CANARIASREF.BIB")

Bibliographical references of each radiocarbon dates are stored in the file *14CanariasREF.bib* that is a BibTeX file format.

DATA TYPE

Secondary data.

FORMAT NAMES AND VERSIONS

CSV, Western Europe (ISO-8859-15/EURO)
BibTeX

CREATION DATES

Radiocarbon dates information created from January 2021 to January 2023. During the revision of this work some radiocarbon dates have been added. Thus, all the radiocarbon dates of the Canary Islands up to 21 March of 2023 have been compiled. In this sense, we have new unpublished dates that, once published by their authors, will be added to the database.

DATASET CREATORS

All authors have been involved in the compilation and revision of the radiocarbon information. The corresponding author has harmonised the tables and developed the shiny application.

LANGUAGE

Spanish

LICENSE

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REPOSITORY LOCATION

The database can be downloaded at the open repository ZENODO developed under the European *OpenAIRE* program (https://doi.org/10.5281/zenodo.7621889).

WEB APP LOCATION

The ¹⁴Canarias dataset is also related to the web app (Figure 2) hosted by Universidad de La Laguna (http://holoceno.iaas.ull.es/14Canarias_ULL/). Details about how it works are available in its presentation tab. The app's citation corresponds to this paper. If the user in the section *Summed Probability distribution* (SPD) at site scale gets the message "*An error has occurred. Check your logs or contact the app author for clarification.*", it is correct. The reason for this is that the selected site only has dates from the Gakushuin laboratory (GaK) and, due to its problems [18, 19], this function does not consider them.

PUBLICATION DATE

The publication date in the repository of the dataset is 09/02/2023. However, a new updated version was upload in 21/03/2023. The ¹⁴Canarias app in its first tab also refers to its latest modification.

(4) REUSE POTENTIAL

Regarding the archaeology of the Canary Islands, our 14Canarias database is the first compilation of its type in the region. Using standardised criteria will allow it to be reused both for research/scholar purposes and for management by the regional administration (Cabildos and the regional government). Finally, the nature of **this**
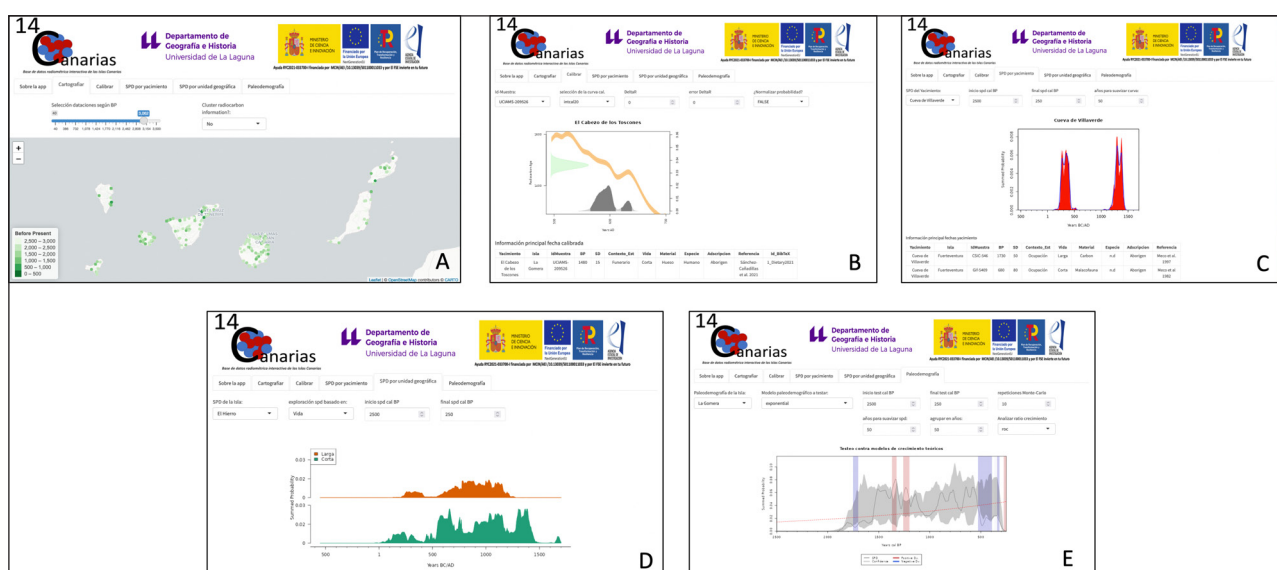

Figure 2 Main tabs of the app. **A:** Geographical distribution of the radiocarbon dates. **B:** Calibration tab. **C:** Tab to build a Summed Probability Distribution using the site as criterion. **D:** Example of Summed Probability Distribution at island scale using sample type as a comparative element. **E:** Illustration the *dates as date* at insular scale. Details on the elaboration can be found in the presentation tab of the database and the methodological issues in references [4] & [5].

work is collaborative, and any colleague can contact spardogo@ull.edu.es to report errors and/or introduce new dates published.

NOTE

1 The Canary Islands are only referenced in the first synthesis coordinated by M. Almagro in which Professor Martín de Guzmán compiles the radiocarbon information of the archipelago [14] following his previous contribution published in volume 33 of *Trabajos de Prehistoria* [15].

COMPETING INTERESTS

The authors have no competing interests to declare.

AUTHOR CONTRIBUTIONS

Salvador Pardo-Gordó – Conceptualisation, writing-reviewing the manuscript and funding acquisition.

Paloma Vidal-Matutano – Writing-reviewing the manuscript and funding acquisition.
María del Cristo González-Marrero – Writing-reviewing the manuscript and funding acquisition.
María Esther Chávez-Álvarez – Writing-reviewing the manuscript and funding acquisition.

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