Quaternary Science Reviews 72 (2013) 36–48

Contents lists available at SciVerse ScienceDirect

Quaternary Science Reviews

journal homepage: www.elsevier.com/locate/quascirev

Vegetation changes and human settlement of Easter Island during the last millennia: a multiproxy study of the Lake Raraku sediments

Núria Cañellas-Boltà [a,b,*], Valentí Rull [a,1], Alberto Sáez [b,2], Olga Margalef [c], Roberto Bao [d], Sergi Pla-Rabes [e,f], Maarten Blaauw [g], Blas Valero-Garcés [h], Santiago Giralt [c]

[a] Palynology and Paleoecology Lab, Botanic Institute of Barcelona (IBB-CSIC-ICUB), Passeig del Migdia s/n, E-08038 Barcelona, Spain
[b] Department of Stratigraphy, Paleontology and Marine Geosciences, Universitat de Barcelona, Marti Franques s/n, E-08028 Barcelona, Spain
[c] Institute of Earth Sciences Jaume Almera (ICTJA-CSIC), Lluís Solé Sabarís s/n, E-08028 Barcelona, Spain
[d] Faculty of Sciences, University of A Coruña, Campus da Zapateira s/n, 15071 A Coruña, Spain
[e] Biogeodynamics and Biodiversity Group, Center for Advanced Studies of Blanes (CEAB-CSIC), Cala St. Francesc 14, E-17300 Blanes, Spain
[f] Centre for Ecological Research and Forestry Applications (CREAF), Cerdanyola del Vallès, E-08193 Barcelona, Spain
[g] School of Geography, Archaeology and Palaeoecology (GAP), Queen's University Belfast, Belfast BT7 1NN, UK
[h] Pyrenean Institute of Ecology (IPE-CSIC), Apdo. 13034, E-50080 Zaragoza, Spain

ARTICLE INFO

Article history:
Received 2 February 2013
Accepted 8 April 2013
Available online 20 May 2013

Keywords:
Easter Island
Paleoecology
Late Holocene
Human settlement
Deforestation
Verbena litoralis

ABSTRACT

Earlier palynological studies of lake sediments from Easter Island suggest that the island underwent a recent and abrupt replacement of palm-dominated forests by grasslands, interpreted as a deforestation by indigenous people. However, the available evidence is inconclusive due to the existence of extended hiatuses and ambiguous chronological frameworks in most of the sedimentary sequences studied. This has given rise to an ongoing debate about the timing and causes of the assumed ecological degradation and cultural breakdown. Our multiproxy study of a core recovered from Lake Raraku highlights the vegetation dynamics and environmental shifts in the catchment and its surroundings during the late Holocene. The sequence contains shorter hiatuses than in previously recovered cores and provides a more continuous history of environmental changes. The results show a long, gradual and stepped landscape shift from palm-dominated forests to grasslands. This change started c. 450 BC and lasted about two thousand years. The presence of *Verbena litoralis*, a common weed, which is associated with human activities in the pollen record, the significant correlation between shifts in charcoal influx, and the dominant pollen types suggest human disturbance of the vegetation. Therefore, human settlement on the island occurred c. 450 BC, some 1500 years earlier than is assumed. Climate variability also exerted a major influence on environmental changes. Two sedimentary gaps in the record are interpreted as periods of droughts that could have prevented peat growth and favoured its erosion during the Medieval Climate Anomaly and the Little Ice Age, respectively. At c. AD 1200, the water table rose and the former Raraku mire turned into a shallow lake, suggesting higher precipitation/evaporation rates coeval with a cooler and wetter Pan-Pacific AD 1300 event. Pollen and diatom records show large vegetation changes due to human activities c. AD 1200. Other recent vegetation changes also due to human activities entail the introduction of taxa (e.g. *Psidium guajava*, *Eucalyptus* sp.) and the disappearance of indigenous plants such as *Sophora toromiro* during the two last centuries. Although the evidence is not conclusive, the American origin of *V. litoralis* re-opens the debate about the possible role of Amerindians in the human colonisation of Easter Island.

© 2013 Elsevier Ltd. All rights reserved.

1. Introduction

Easter Island is a tiny and remote island in the South Pacific Ocean (Fig. 1). The island has achieved global fame as the home of an ancient and complex society that erected megalithic statues, known as moai, and as an example of dramatic environmental degradation wrought by humans. This latter view is largely based on the palynological studies of lake sediments which have been

* Corresponding author. Department of Stratigraphy, Paleontology and Marine Geosciences, Universitat de Barcelona, Marti Franques s/n, E-08028 Barcelona, Spain. Tel.: +34 934034489, +34 932890611; fax: +34 93 4021340, +34 93 2890614.
E-mail address: nuriacatcb@gmail.com (N. Cañellas-Boltà).
[1] Tel.: +34 93 2890611; fax: +34 93 2890614.
[2] Tel.: +34 93 4034489; fax: +34 93 4021340.

0277-3791/$ – see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.quascirev.2013.04.004

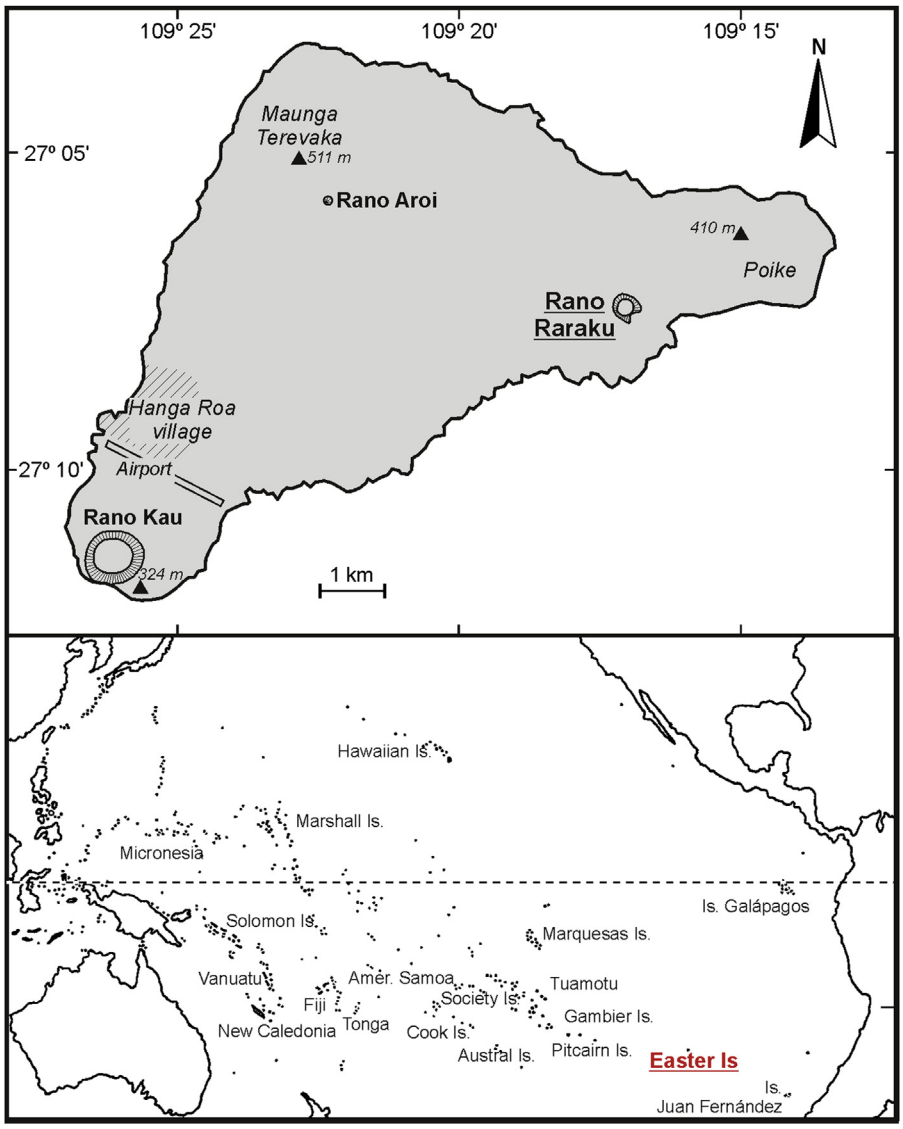

Fig. 1. Map of Easter Island. Above: map of Easter Island showing the location of the three permanent water resources on the island (Rano Raraku and Rano Kau crater lakes and Rano Aroi fen). Below: the location of the island in the SE Pacific Ocean (map modified from Elix and McCarthy, 2008).

interpreted as palm-dominated forests that were recently and suddenly replaced by grasslands. This apparently abrupt landscape change has been attributed to deforestation by the indigenous population (Flenley and King, 1984; Flenley et al., 1991; Flenley and Bahn, 2003; Diamond, 2005; Mann et al., 2008; Mieth and Bork, 2010). As a consequence, Easter Island has traditionally been regarded as an illustrative example of how humans can destroy their own habitat and cause a societal breakdown (Flenley and Bahn, 2003; Diamond, 2005), and it is often used as a model for the possible consequences of the over-exploitation of natural resources. Nevertheless, the environmental history of the island is poorly understood, and controversies about the timing and causes of the assumed deforestation, its consequences, and the role of humans are still ongoing (Mann et al., 2008; Rull et al., 2010).

According to the prevailing view of the history of Easter Island, a small group of Polynesian settlers reached the island from the west, most likely from the Marquesas, Tuamotu, Gambier or Austral Islands (Stefan, 2001; Flenley and Bahn, 2003) around AD 800–1000 (Martinsson-Wallin and Crockford, 2002; Vargas et al., 2006) (Fig. 1). As the islanders grew in number, the need for open spaces for agriculture and dwellings as well as the demand for firewood and timber would have increased rapidly. This would have led to rapid deforestation and soil degradation, thereby initiating a positive feedback of catastrophic consequences. According to this view, before the arrival of Europeans in the 18th century, the inhabitants had completely deforested the island, which would have led to wars, famine and, finally, to cultural collapse (Flenley et al., 1991; Flenley and Bahn, 2003; Diamond, 2005).

Nevertheless this proposed sequence of historical events is not shared by all scholars. The settlement date is controversial and different chronologies ranging from AD 100 to AD 1200–1290 have been suggested (e.g. Heyerdahl and Ferdon, 1961; Hunt and Lipo, 2006; Butler and Flenley, 2010; Wilmshurst et al., 2011). Moreover, dating uncertainties have complicated the assignment of the precise age of the alleged deforestation, and its causal relationship with human activities has not been wholly accepted. Other additional or alternative causes for the vegetation clearance, such as climatic changes (McCall, 1993; Hunter-Anderson, 1998; Nunn, 2000) or the action of introduced fruit-eating rats preventing palm regeneration (Hunt, 2007; Hunt and Lipo, 2009) have also

Download English Version:

https://daneshyari.com/en/article/6446642

Download Persian Version:

https://daneshyari.com/article/6446642

Daneshyari.com