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Lateglacial-Holocene abrupt vegetation changes at Lago Trifoglietti in Calabria, Southern Italy: The setting of ecosystems in a refugial zone

Jacques-Louis de Beaulieu [a, *], Elisabetta Brugiapaglia [b], Sébastien Joannin [c], Frédéric Guiter [a], Giovanni Zanchetta [d], Sabine Wulf [e, f], Odile Peyron [c], Liliana Bernardo [g], Julien Didier [h], Agnès Stock [h], Damien Rius [h], Michel Magny [h]

[a] Aix Marseille Univ, CNRS, IRD, IMBE, UMR 7263 & 237, Aix-en-Provence, France
[b] Università degli Studi del Molise, Dipartimento di Agricoltura, Ambiente e Alimenti, Campobasso, Italy
[c] CNRS UMR 5554, ISEM, Université de Montpellier, Montpellier, France
[d] Dipartimento di Scienze della Terra, Università di Pisa, Italy
[e] Senckenberg Research Institute and Natural History Museum, BIK-F, TSP6 Evolution and Climate, Frankfurt/Main, Germany
[f] Institute of Earth Sciences, Heidelberg University, Germany
[g] Dipartimento DiBEST, Università della Calabria, Italy
[h] Laboratoire Chrono-Environnement UMR 6249 du CNRS, UFR des Sciences et Techniques, Besançon, France

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ABSTRACT

Retrospective science such as palaeoecology deeply depends on the preservation of archives in sensitive places. As an example, mountains of medium altitude from Mediterranean peninsulas have long been identified by biogeographers as refuges zones allowing the survival of European temperate taxa during the ice ages, but archives to validate this hypothesis are scarce, especially in Southern Italy. Here we present a new sequence from Lago Trifoglietti (1048 m a.s.l.) in the Calabrian Mountains, which covers the Late Glacial Interstadial (LGI, corresponding to the Bölling-Alleröd period in northern-central Europe) and the transition to the Holocene. The independent chronology based on seven radiocarbon dates is supported by the evidence of three tephra layers already identified in other regional sequences. During the LGI, besides the high diversity of non arboreal pollen grains, a great number of pollens of temperate forest trees are present or abundant (mostly deciduous oaks and fir). These assemblages suggest that the site was above but not far from the upper limit of diversified woodland stands. They confirm a local survival during the last glacial. The Younger Dryas is not marked by major changes, and oak percentages are even higher, suggesting a resilient expansion at lower altitude. Surprisingly the site remains above the timberline until an aridity crisis centered at 11,100 cal ^{14}C yr PB, which is correlated with the Preboreal Oscillation (PBO). This event is immediately followed by the local settlement of a dense fir and beech forest around the lake. A comparison with other Italian key sequences aims at explaining the climate forcing factors that governed this original vegetation dynamic. Further investigations using additional proxies are needed for a more robust climate reconstruction.

1. Introduction

The Lateglacial to Holocene transition constitutes a key period for the setting of temperate ecosystems, from which the present landscape is inherited. This is particularly true in the Mediterranean peninsulas whose role as refugial zones during the glacial times has been evidenced both by palaeoecological and phylogeographical studies (Hewitt, 2011). One can expect a two dimensional expansion (i.e. altitudinal and latitudinal) of temperate forest starting during the Lateglacial Interstadial (LGI) or quickly

* Corresponding author.
E-mail addresses: jacques-louis.debeaulieu@orange.fr (J.-L. Beaulieu), e.brugiapaglia@unimol.it (E. Brugiapaglia), sebastien.joannin@univ-montp2.fr (S. Joannin), frederic.guiter@imbe.fr (F. Guiter), zanchetta@dst.unipi.it (G. Zanchetta), Sabine.Wulf@geow.uni-heidelberg.de (S. Wulf), odile.peyron@univ-montp2.fr (O. Peyron), l.bernardo@unical.it (L. Bernardo), Julien.Didier@univ-fcomte.fr (J. Didier), agnes.stock@univ-fcomte.fr (A. Stock), Damien.Rius@univ-fcomte.fr (D. Rius), Michel.Magny@univ-fcomte.fr (M. Magny).

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following the postglacial warming, without significant lags due to migrations from more distant refuges. Nevertheless these dynamics cannot be fully understood without palaeo-data providing knowledge about the period corresponding to the setting of the Lateglacial warming. Unfortunately this period is poorly documented in Southern Italy, with the exception of the record obtained from the site of Lago Grande di Monticchio (Huntley et al., 1999; Allen et al., 2002) (Fig. 1). In Calabria a pollen study of the sediment infill of the Mountain lake of Trifoglietti constitutes a promising target to fill this gap. The study of a first coring from this site has recently provided a reconstruction of the local vegetation and hydrological changes since ca. 11,500 cal yr BP within a more extensive project focussing on the Central Mediterranean area (Joannin et al., 2012; Magny et al., 2013, Peyron et al., 2013). The sequence shows a phase characterized by open steppe vegetation apparently contemporaneous with the Preboreal Oscillation (PBO) based on three radiocarbon dates; this event is followed by the expansion of beech-fir woodland at ca. 11,000 ^{14}C cal yr BP. Such extremely arid event, never evidenced before, was rather difficult to understand without data for the preceding Lateglacial vegetation. A new coring campaign has been performed in autumn 2011, which allowed collecting a sequence beginning with the LGI and evidencing several tephra layers. The objectives of this study are fourfold as follow: 1/ to contribute in the description of the local environment history of Calabria during the Lateglacial, 2/ to establish the importance of this region as a possible refugium for temperate trees during the Lateglacial, 3/ to assess the regional impact of the Younger Dryas (YD) cold event, 4/ to test more robustly the regional significance and timing of the early Holocene, short-lived arid even (the 'Trifoglietti event'), as a possible correlative of the PBO.

2. General description of the site

2.1. Location

Lago Trifoglietti (39°33′N, 16°01′E; 1048 m a.s.l.) is located in Calabria (Southern Italy) (Fig. 1), near the town of Fagnano Castello in Cosenza province. The lake, overlooked by Monte Caloria

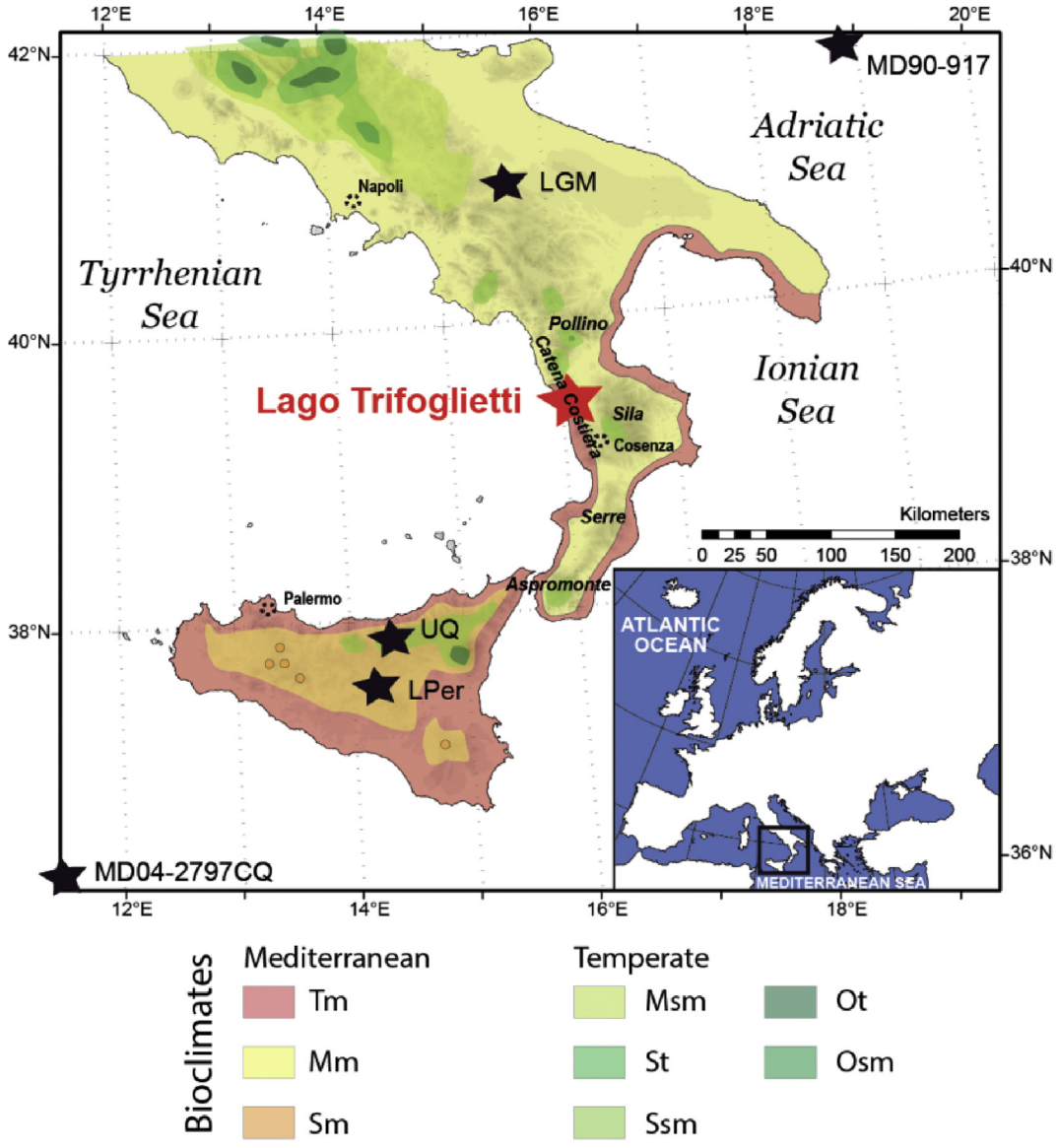

Fig. 1. Location of the study site and other sites considered in the text: Lago Grande di Monticchio (Allen et al., 2002), Urio Quattrocchi (Bisculm et al., 2012), Lago di Pergusa (Sadori and Narcisi, 2001), MD90-917 (Siani et al., 2012; Combourieu-Nebout et al., 2013), MD04-2797CQ (Desprat et al., 2013). Bioclimatic belts issued from Rivas Martinez's classification (1993), modified after Spampinato et al. (2010).