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CONCEPTS AND METHODOLOGY TO QUANTITATIVELY RECONSTRUCT CLIMATE FROM POLLEN DATA

ABSTRACT: VALLÉ F., FURLANETTO G., MAGGI V., PINI R. & RAVAZZI C., *Concepts and methodology to quantitatively reconstruct climate from pollen data.* (IT ISSN 0391-9838, 2019).

Pollen data are widely used as *proxies* to reconstruct past vegetation and climate changes. During the last decades numerical techniques have been developed to quantitatively estimate climate parameters from fossil pollen assemblages. This contribution introduces first the concepts and methodologies based on modern calibration sets to obtain past climate reconstructions. Then, focusing on high-elevation environments, the use of elevational transects as a tool for the evaluation of pollen-climate models and a temperature reconstruction obtained from an alpine fossil site are presented. (IT ISSN 0391-9838, 2019).

KEY WORDS: Pollen data, Climate, Calibration sets, Models, Transfer functions, Reconstruction.

RIASSUNTO: VALLÉ F., FURLANETTO G., MAGGI V., PINI R. & RAVAZZI C., *Concetti e metodologia per ricostruire quantitativamente il clima da dati pollinici.* (IT ISSN 0391-9838, 2019).

I dati pollinici sono generalmente utilizzati come *proxies* per ricostruire i cambiamenti del paesaggio vegetale e del clima. Negli ultimi decenni sono state sviluppate diverse tecniche numeriche per stimare parametri climatici a partire da associazioni polliniche fossili. Questo contributo introduce dapprima i concetti e le metodologie basate su moderni datasets di calibrazione al fine di ottenere ricostruzioni climatiche del passato. Successivamente, focalizzando sugli ambienti di alta quota, vengono presentati l'utilizzo di transetti altitudinali come strumento per valutare i modelli polline-clima, e le ricostruzioni di temperatura ottenute da siti alpini fossili.

TERMINI CHIAVE: Dati pollinici, Clima, Datasets di calibrazione, Modelli, Funzioni di trasferimento, Ricostruzione.

INTRODUCTION

Climate triggers plant distribution and vegetation dynamics, due to the sensitivity of plants to air temperature, moisture ranges and soil microclimatic conditions. The widespread fossilization potential of pollen and spores (palynomorphs) in continental and oceanic sediments and the possibility of identifying them with high taxonomic resolution, promote the use of statistical methods in palynology to reconstruct past and present climate conditions. Fossil pollen records obtained from lakes, peat bogs, mires and ocean sediments are used since the early 20th century as a tool to reconstruct vegetation and environments of the past and their reaction to climate change and human pressure (e.g. Birks & Berglund, 2018).

From the qualitative description (i.e. "colder", "warmer", "wetter", "temperate") of past Quaternary climates inferred from microfossil assemblages, a step further towards quantitative reconstruction of environmental and climate parameters has been done during the last 50 years. Different procedures were developed to quantitatively estimate past temperature, precipitation, bioclimatic indexes, chemical and trophic state of water bodies from stratigraphical microfossil assemblages (chironomids: Eggermont & Heiri, 2011; chrysophytes: Kamenik & Schmidt, 2005; cladocera: Brodersen & *alii*, 1998; diatoms: Birks & *alii*, 1990) including pollen data (e.g. Birks 1995, Birks, 2003, Seppä & *alii*, 2004 and reference therein, Brewer & *alii*, 2007, Kamenik & *alii*, 2009, Juggins & Birks, 2012). Thus, quantitative reconstructions from biological proxies using the so-called "transfer functions" have revolutionised palaeolimnology (Juggins, 2013).

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