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# Repetitive changes in Early Pliocene vegetation revealed by high-resolution pollen analysis: revised cyclostratigraphy of southwestern Romania

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## Abstract

A high-resolution pollen analysis has been carried out on the Lupoia section (SW Romania) in order to check whether the repetitive clay–lignite alternations correspond to cyclic changes in climate. Increases in altitudinal tree pollen content appear to have been caused by drops in temperature, while developments of thermophilous elements correspond to rises in temperature, still under humid conditions. Such repeated changes in vegetation, on the whole consistent with the clay–lignite alternations, have been forced by cycles in eccentricity. On the basis of a comparison between the Lupoia pollen record and (1) European climatostratigraphy (based on reference pollen diagrams documenting global changes), and (2) global climatic curves (eccentricity,  $\delta^{18}\text{O}$ ), the age of the section has been reconsidered. The Lupoia section (i.e. from lignite IV to lignite XIII) starts just before the C3n.3n Chron and probably ends just before the C3n.1n Chron. The section represents a time span of about 600 kyr, i.e. from about 4.90 Ma to about 4.30 Ma. © 2001 Elsevier Science B.V. All rights reserved.

*Keywords:* pollen analysis; vegetation; cyclostratigraphy; Pliocene; Romania

## 1. Introduction

During the last decades, palynological efforts have been made to obtain a good knowledge of the European and Mediterranean Pliocene vegetation and climate (Zagwijn, 1960; Menke, 1975; Diniz, 1984; Suc, 1984a; Zheng and Cravatte, 1986; Drivaliari, 1993; Bertini, 1994). Today, reconstructions of vegetation and climate are coherent for North-European to Mediterranean lati-

tudes during the whole Pliocene, more especially the Early Pliocene (i.e. the Zanclean stage from 5.32 to 3.6 Ma) (Suc and Zagwijn, 1983; Suc et al., 1995). In addition, a climate transfer function, based on pollen records, has been introduced, which underlines subtropical temperatures in southwestern Europe during the Early Pliocene (for example, 16.5°C as mean annual temperature in the Nice area) (Fauquette et al., 1999a).

Early Pliocene pollen data show consistent vegetation changes in Europe from north (Zagwijn, 1960; Menke, 1975) to south (Suc, 1984a; Bertini, 1994; Zheng and Cravatte, 1986), as well as from west (Diniz, 1984) to east (Drivaliari et al., 1999),

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