Chapter 8
High Resolution Cyclostratigraphy During the Last Two Millennia Based on the Clayey Fraction Within the Mhabeul Wetland (Southeastern Tunisia)

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ABSTRACT

High-resolution proxy-based paleoenvironmental records derived from wetlands provide important insights into climate changes over centennial to millennial timescales. This work aims to study the climatic cyclicity of the clayey fraction along a 78 cm core from the saline system of Mhabeul, located in Southeastern Tunisia. Based on the age model of Essefi et al., the core covers the last two millennia (»2100 yr). A high-resolution sampling of 2mm was carried out to obtain 380 samples evenly distributed along the core. In terms of analyses, the cumulative curve of the grain size distribution carried out by Fritsch laser apparatus percentages of the Clayey fraction underwent the spectral analysis. Based on the spectral analysis, millennial cycles of » 2500 yr, and 1000 yr are related to solar forcing. Solar irradiation is most likely responsible for the cyclic characteristics at 500 yr (600 yr) frequency.

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INTRODUCTION

Depending upon the culture, wetlands have been named differently (Essefi, 2009). But ambiguity and confusion are still common features in many languages. In the Arabic-speaking world, the word sebkha includes inland and coastal saline systems; its variant spellings such as salina, salare, salada, salar give approximately the same meaning. In many Spanish-speaking cultures, the word playa dominates in use. On the other hand, it is noticed that the English register proposes varieties of names to distinguish between these geological features. In spite of the ever present use of regional terms, several attempts for classification have been made to resolve confusion. To name but a few, playa, playa lake, lake playa, recharge playa, discharge playa, salt lake, pan, clay pan, saline lake, alkali flat, salt plain, dry lake, and salt flat are varieties of terminology frequently encountered in the literatures of the English-speaking cultures. These names could be given to a saline environment according to its geological features and the discipline of the study. A useful terminology of these saline environments was given by Rosen (1994). In this chapter, the words sebkha, endorheic basin and saline system are interchangeably used to indicate the the studied wetland of Mhabeul.

In order to predict the future climatic tendency, past climatic global changes and cyclicity should be inferred based on the sedimentary record of some depressions (e.g., oceans, seas) and wetlands (e.g., lakes and sebkhas). Due to their geographical locations, Mediterranean areas are considered as the most influenced region to past as well as future climate changes (IPCC, 2014, Jaouadi et al., 2016), associated with many factors such as polar ice retreat, anthropogenic warming and increased greenhouse gases concentrations (Giorgi, 2006; Fletcher and Zielhofer, 2013). The ecosystems of the Mediterranean region are particularly vulnerable to hydrological changes and strong demographic pressure (Lionello et al., 2006; IPCC, 2014; Jaouadi et al., 2016). In this vein, south-eastern Tunisia is currently suffering from increasing human pressure resulting in obvious pollution and arid climatic conditions, which reflect the degradation of its natural environment and the increasing desertification (Jaouadi et al., 2016; Essefi, 2021). The millennial and centennial scale variability of the Holocene climate in Tunisia (Essefi, 2021) is poorly understood, due to the lack of high-resolution records, especially of temperature.

The Holocene is an interglacial period that follows the last glacial of the Pleistocene. It is considered as a warm and stable interval, but now it is known to be characterized by pervasive climatic oscillations and abrupt climatic events (Mayewski et al., 2004, Wanner et al., 2008, Fletcher and Zielhofer, 2013), related to the Holocene cyclostratigraphy. Contrary to ancient cyclostratigraphy, which is controlled by the Milankovitch theory, the Holocene cyclostratigraphy is controlled by astronomical and oceanographic mechanisms. In fact, the millennial and decadal

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