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Usefulness of Rock-Eval pyrolysis, liquid chromatography, and GC/MS in the characterization of Ypresian Chaker organic matter, central-northern Tunisia

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Abstract

The present paper compares Rock-Eval pyrolysis (RE), liquid chromatography (L.C), and gas chromatography-mass spectrometry (GC–MS) data from a geochemical study of Jebel Chaker organic-rich facies, in central-northern Tunisia, in order to obtain independent parameters on organic matter source, composition, and thermal maturity.

This study shows a clear evidence of planktonic organic matter as indicated by the hydrogen index, n-alkanes distribution, predominance of saturated, and the high concentration of cholestane. The thermal maturity of Ypresian organic matter was estimated by T_{max}, abundance of hetero (N.S.O) compounds, and sterane geochemical parameters such as C_{29} αα 20S/(20S+20R) and C_{29} ββ (ββ+αα) maturity ratios..., to be of low thermal maturity (end of diagenesis–beginning of catagenesis). These data reveal a close concordance between RE, L.C., and GC/MS data, and show that these methods remain valuable and practical for geochemical characterization of sedimentary organic matter.

Keywords: Ypresian; Organic matter; Rock-Eval pyrolysis; GC–MS; Tunisia

1. Introduction

The organic geochemical characterization of sedimentary source rocks is typically based on various analytical techniques. Tow marked geochemical methods are Rock-Eval pyrolysis [1,2], and compound class given by liquid chromatography [3–5] are appropriate techniques for a good assessment of geochemical nature and characterization of source rocks sedimentary organic matter.

In addition, GC/MS analysis has been popular in the past few decades, mainly because of its usefulness in detecting complex polycyclic biomarkers to help the characterization of organic matter type, depositional conditions and to assess the maturity level etc. Such source and physico-chemical relationship features have made biomarkers invaluable to oil correlations. [6–10].

The main objective of this work is to attempt to understand the organic matter type, its depositional environment and thermal maturity by confrontation of RE pyrolysis, L.C., and GC–MS parameters at the Ypresian organic-rich carbonates of Jebel Chaker, which outcrop in western of Kairouan city, in central-northern Tunisia (Figs. 1 and 2). These facies belonging to the Metlaoui Group, which shows a wide range of facies from North to South [11], and have been intensively studied because of the commercial interest in phosphates and hydrocarbons.

2. Geological setting

The Ypresian Metlaoui Fm successions crop out 40 km to the West of Kairouan (central-northern Tunisia; Fig. 1), in the central and eastern parts of the Ypresian basin [11]. These successions show a wide facies variation from their northern to southern

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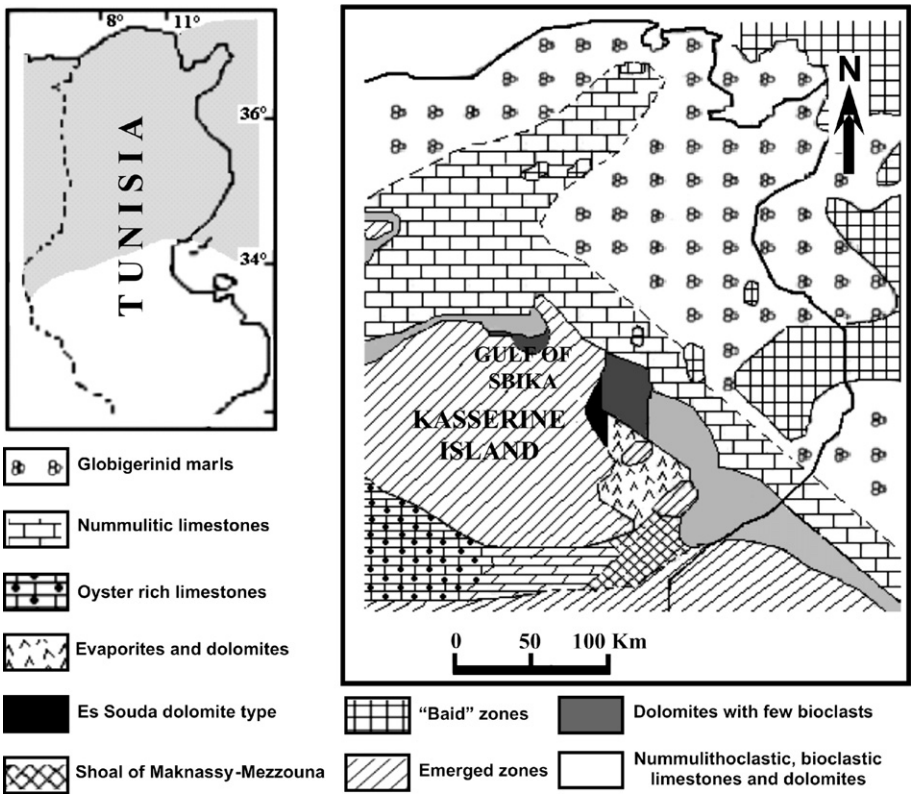

Fig. 1. Paleogeographic map of Tunisia showing the distribution of Ypresian facies (modified from Zaïr et al. [29]).

outcrops and coeval with the main phosphatic facies (Chouabine Formation) that crop out extensively in western Tunisia [12].

In the eastern part of the Ypresian basin, outcrops of the Jebel Chaker limestone [13] are bounded by the Pelagian Platform to the East, by the Jebel Ousselat to the West, and the Jebel Es-Sfeïa to the South (Fig. 2).

West of Kairouan, it exhibits a carbonate megasequence, which is bounded by Palaeocene clays (El Haria Formation) at

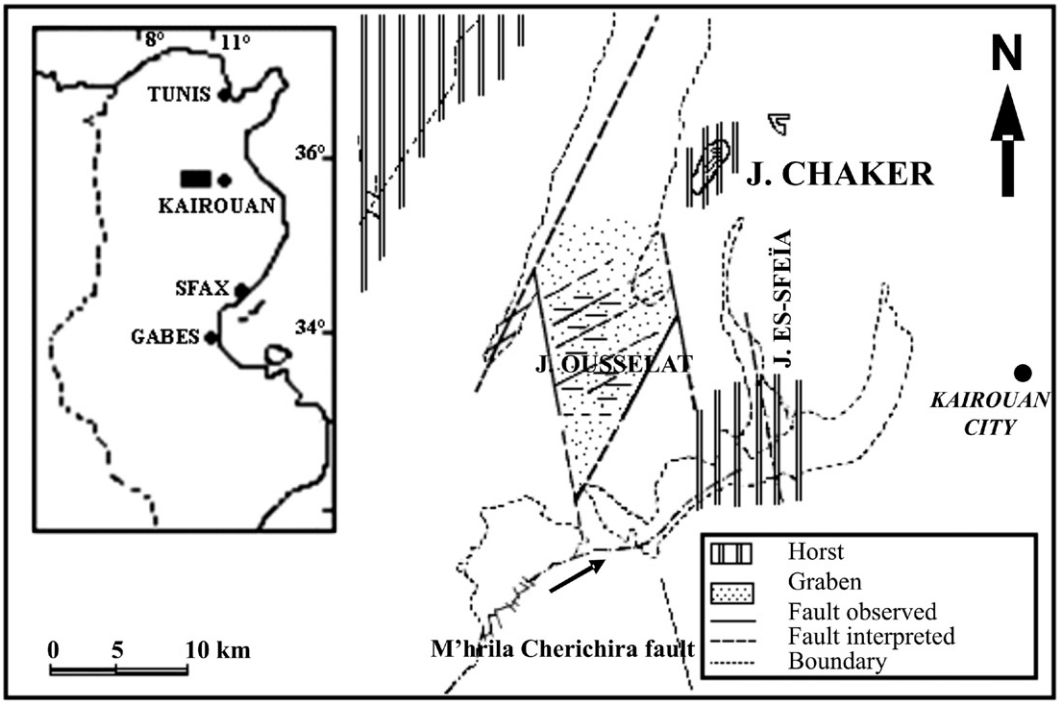

Fig. 2. Location and morphostructural setting of Jebel Chaker (modified from Rigane et al. [14]).