



THE FEOS FORMATION IN THE CARBONERAS-NÍJAR BASIN: SEDIMENTOLOGICAL AND MICROPALAEONTOLOGICAL APPROACH OF THE POST-EVAPORITIC MESSINIAN DEPOSITS

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ABSTRACT

In this study, we present new sedimentological and micropaleontological data from the post-evaporitic deposits of the Feos Formation. We worked in two sections (Barranco de los Castellones and Gafares) of the central area of the Neogene basin of Níjar, SE Spain. This formation has traditionally been associated with “*Lago-Mare*” facies, deposited after the Messinian Salinity Crisis (MSC) and described in various locations around the Mediterranean. We described a new biofacies with abundant *Paratethys* ostracods in the deposits of the Feos Formation in the Barranco de los Castellones (BDC) section that we called *oxidized horizon* (oh). Additionally, we propose two different correlations between the two sections, BDC and Gafares (GAF). Although there are still unresolved issues, this work provides relevant information that should be included in future discussions when formulating hypotheses for the Mediterranean’s evolution after the MSC.

Keywords: Lago-Mare, Horizonte oxidativo, Ostrácodos, *Paratethys*, Post-evaporitas.

1. INTRODUCTION

The Messinian salinity crisis (MSC) of the Mediterranean (5.97-5.33 Ma) represents one of the biggest and fastest (approx. in 660 kyr) evaporitic events in the Earth’s history.

Ruggieri (1967) used the term “*Lago-Mare*” to characterize the transition from hypersaline evaporitic facies to fresh-brackish, which took place within the Mediterranean in the latest Messinian. The formation of the *Lago-Mare* facies and its connection among the Mediterranean basins is still uncon-

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cerned, as well as the water level. The *Lago-Mare* deposits in the Mediterranean basins did not happen in a single basin due to the high variability of the deposits (Stoica *et al.*, 2016). These authors argue that during the *Lago-Mare* phase, some ostracod Paratethyan species migrated and invaded the Mediterranean region. These suggest an intrabasinal exchange with high water levels during the last stage of the *Lago-Mare* episode.

The Neogene basins of the Cordillera Bética offer an extraordinary preservation of the late Neogene successions. In this basin, some paleofauna remains suggest the possibility of marine incursions during the end stage of the hypothesized isolated Mediterranean from the Atlantic (Aguirre & Sánchez-Almazo, 2004). The upper Messinian sediments in the Níjar Basin are represented by the Feos Formation (Fm.), characterized by a cyclic alternation of facies in the Upper Feos Member (Mb.) correlated with the “*Lago-Mare* episode”. This makes Feos Fm. ideal for reconstructing the depositional environments of the post-evaporitic units as well as understanding the *Lago-Mare* phases and their significance in the late Messinian events (Bassetti *et al.*, 2006).

1.1. Objectives

The main aim of this work was to study the sedimentology and micropaleontology of the Upper Feos Mb. in the central part of the Níjar basin to improve the current data.

2. MATERIALS AND METHODS

For this project, we carried out a study with fieldwork and laboratory work in the Feos Fm. to focus on the stratigraphic, sedimentological features, and micropaleontology content. Two locations have been selected: Barranco de los Castellones (BRC) and Gafares (GAF) Section; separated by 2km approximately.

2.1. Stratigraphy study

Detailed logs have been created to make sedimentological and paleoenvironmental correlations between the two sections. We focused on describing the Upper Feos Mb. We used the following classifications: for carbonate rocks the Dunham classification, 1962; and improved by Embry & Klovan, 1971; for siliciclastic rocks, we used Folk’s classification, 1980.

2.2. Micropaleontology analysis

A total of 6 samples were collected and analyzed under the microscope. In the samples where it was possible, 70 - 90 ostracods were hand pick and then identified taxonomically following the works of Stoica *et al.*, (2016) and Matoshko *et al.*, (2023) as well as to determine the palaeoecological preferences. The samples of the oxidized horizon were analyzed in depth and

compared with the species of the WL described by Aguirre & Sánchez-Almazo, 2004 and Bassetti *et al.*, 2006.

3. RESULTS

3.1. Sedimentary study

In the GAF section, we were able to distinguish both members (Upper and Lower Feos Mb.), separated by a Mg-rich black layer. In the BRC section, we were only able to distinguish the Upper Feos Mb.

3.2. Facies correlation

We focused our study on the correlation of the alternating white layers (WL), which have been described as the “*Lago-Mare*” facies. Here we propose two different stratigraphic correlations between the GAF and BRC sections based on the lateral continuity of the WL (*Figure 1*).

3.3. Micropaleontological data

In the BRC area, a cycle of oxidized horizons (*ob*) was described below the top three WL. The *ob* presents a high accumulation of articulated ostracods (*Figure 2*) that have not been described before and we identified taxonomically as Paratethys ostracods, highlighting *Cyprideis* genre.

4. CONCLUSIONS

We state that the Upper Feos Mb. presents a high lithological variability laterally and vertically. Which on the one hand complicates the paleo-sedimentological interpretations but, on the other hand, provides great information about the evolution of the system on a local and regional scale. Furthermore, we attempt two correlations between the WL assuming that they are laterally continuous without a clear preference due to the need of more data (*Figure 1*).

The new ostracod fauna composition found *in situ* in the *ob* of the BRC is the same present in the WL (Paratethys ostracods). *Cyprideis* can tolerate a wide salinity range (0.5 – 100 ppt), but the presence of oligohaline species such as *Typhlocypris* (*Figure 2*) and charophytes suggests a freshwater environment. We suggest that GAF and BRC did not have a great connection due to the lack of the *ob* in the GAF section.

There are still open questions that should be answered to improve the MSC and Lago-Mare topic: 1) Are the WL deposited in a local lacustrine environment or do they represent the *Lago-Mare* marine excursions into the Níjar basin? 2) How does the new micropaleontological data from the *ob* (IL) affect and/or change the hypothesis proposed in previous publications? Nevertheless, this project provides new and important data that is going to have an important role in future investigation of the post-evaporitic deposits in the Níjar basin.

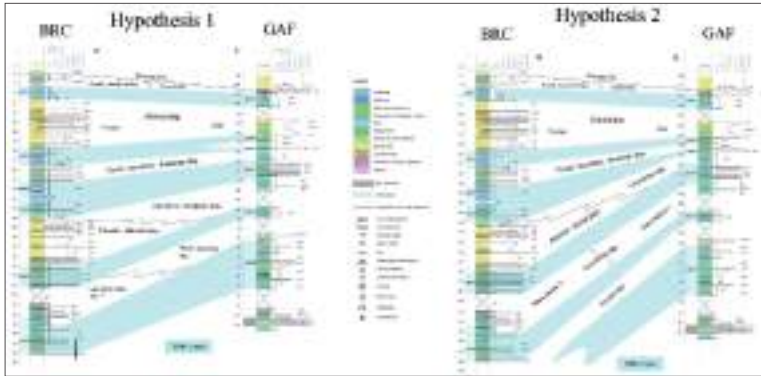


Figure 1: Stratigraphic correlation hypothesis based on the WE alternation of the Upper Feos Mb. between the Barranco de los Castellones (BRC) and the Gafares (GAF) sections.

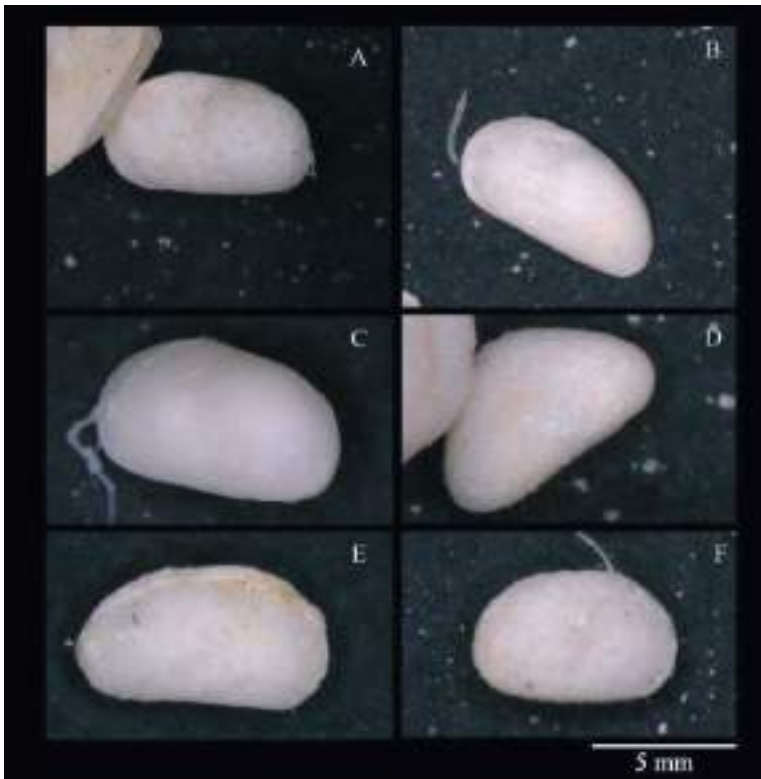


Figure 2: The different ostracod species found in the oxidized horizons of Barranco de los Castellones (BRC). A: *Cyprideis* sp.1; B: *Cyprideis* sp.2; C: *Cyprideis* ex. gr. *torosa*; D: *Typhlocypris* sp.; E: *Cyprideis* male F: *Cyprideis* female.

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