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Middle-Upper Jurassic palynology of the Sagres region and the Carrapateira Outlier, southern Portugal

Borges, M. [(1) (2)]; Fernandes, P. [(1)]; Pereira, Z. [(2)] & Riding, J. B. [(3)]

(1) Universidade do Algarve, CIMA - Centro de Investigação Marinha e Ambiental, Campus de Gambelas, 8005-139 Faro. Portugal. marisa.borges@ineti.pt
(2) LNEG-LGM. Rua da Amieira, 4465-965 S. Mamede Infesta. Portugal.
(3) British Geological Survey. Kingsley Dunham Centre, Keyworth, Nottingham NG12 5GG. UK.

ABSTRACT

The palynology of the Middle-Upper Jurassic fill of the Sagres region (Algarve Basin) and the Carrapateira outlier, southern Portugal was investigated. Samples were collected from Mareta beach, Cilheta beach and the Carrapateira outlier. Dinoflagellate cysts are confined to the Upper Bajocian to Upper Callovian sedimentary rocks exposed at Mareta and Cilheta beaches and the Lower Kimmeridgian strata of the Carrapateira outlier. The palynostratigraphical study of the Jurassic successions has yielded new biostratigraphical data based on dinoflagellate cysts and miospores. The results confirm, and in some cases refine, the existing macrofaunal age determinations of these successions.

KEYWORDS: Portugal, Algarve Basin, Carrapateira outlier, Biostratigraphy, Dinoflagellate cysts, Jurassic.

1. Introduction

The Algarve Basin corresponds to the southernmost geological province of mainland Portugal. It has an E-W strike and is represented onshore from Cape São Vicente to the Guadiana River on the Portuguese-Spanish border (Fig. 1). More than 3000 m of essentially marine sediments accumulated during Mesozoic-Cenozoic times in the Algarve Basin (Mannupella, 1992).

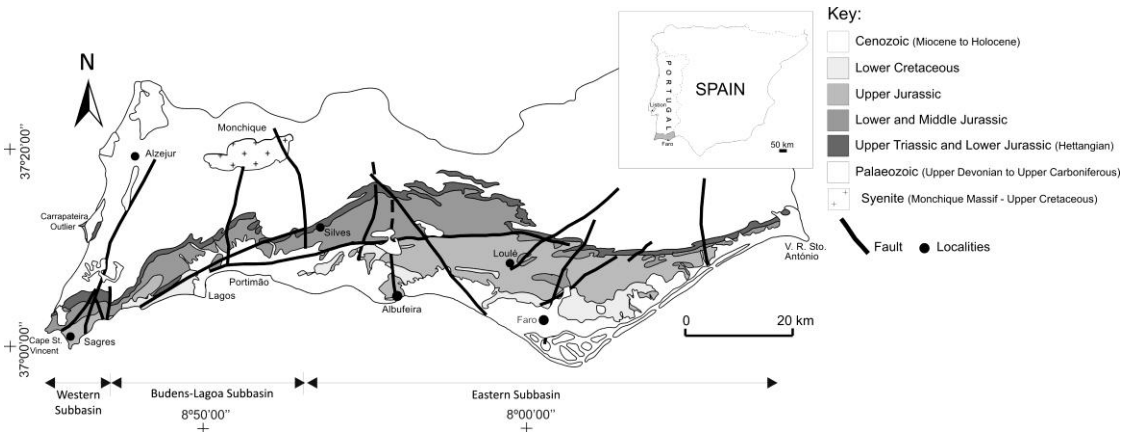

FIG.1 – The location and geology of the Algarve Basin and the Carrapateira outlier, illustrating the areas studied herein (adapted from Manuppella, 1992).

The Sagres Region is the reference area for the Mesozoic fill of the Western sub-basin where the Middle-Upper Jurassic strata outcrop in the cliffs between Mareta and Cilheta Beach.

The Mareta beach represent an important reference section for the Middle and Upper Jurassic of the Algarve Basin. A composite section is exposed, which is a 140 m thick succession of grey marls that grade into marly limestones, assigned to the late Bajocian to early Kimmeridgian. The coastal exposures at the Cilheta beach comprise 40 m thick succession of marly limestones, of the Callovian to Kimmeridgian interval (Rocha, 1976).

The Carrapateira outlier is located on the coast around 20 km north of the main Algarve Basin, west of Carrapateira village and consists of basic volcanics, dolomites, limestones, marls, and sandstones of Late Triassic to Late Jurassic age, that exhibit marked lithostratigraphical and macropalaeontological similarities with the succession in the Sagres Region. The most complete exposures are the coastal outcrops of Upper Jurassic carbonates which have been partially dolomitised. An Early Kimmeridgian age for this section has been invoked based on corals (Ramalho and Ribeiro, 1985).

The palynology of the Jurassic fill of the Algarve Basin and the Carrapateira outlier, southern Portugal was investigated. Samples were collected from Mareta beach, Cilheta beach and the Carrapateira outlier. The present contribution is a initial account of the Upper Bajocian to Lower Kimmeridgian of the Sagres Region and in the Carrapateira outlier.

2. Methodology

Samples were collected from outcrops at Mareta beach, Cilheta Beach and Carrapateira outlier. They were prepared following standard palynological processing techniques involving mineral acid digestion with HCI and HF to remove the carbonates and the silicates, respectively (Wood et al., 1996). The organic residue was sieved using a 15 µm mesh sieve and mounted on microscope slides using Entellan® resin. The microscope slides were studied and light photomicrographs were taken, with an Olympus CX 41 optical microscope equipped with a SC 20 digital camera.

All organic residues and microscope slides are housed in the collections of the LGM/LNEG, S. Mamede Infesta, Portugal.

3. Palynology

The palynological study of the Mareta, Cilheta and Carrapateira successions has yielded new biostratigraphical data based on dinoflagellate cysts and miospores.

The organic residues are abundant and comprise well-preserved palynomorphs and phytoclasts. Pollen and spores are the dominant palynomorphs however, marine microplankton (i.e. acritarchs, dinoflagellate cysts, foraminiferal test linings) are also present in significant proportions. The miospores comprise bisaccate pollen, *Classopollis classoides, Callialasporites dampieri, Callialasporites turbatus, Callialasporites* spp., *Cyathidites* spp., *Ischyosporites variegatus, Leptolepidites* spp., *Perinopollenites elatoides, Sestrosporites pseudoalveolatus,* and *Todisporites* spp.

The dinoflagellate cysts, from the grey marls, present in the lower part of the Mareta succession are indicative of the Bathonian stage, mainly based on the occurrence of *Ctenidodinium* spp., *Ellipsoidictyum/Valensiella* group, *Korystocysta* spp. and *Valensiella ovulum* (Riding et al., 1985). The species *Impletosphaeridium varispinosum, Ctenidodinium cornigerum, Ctenidodinium sellwoodii, Gonyaulacysta jurassica* subsp. *adecta, Korystocysta gochtii* and *Meiourogonyaulax caytonensis*, present in the middle part of the succession, assigned to the Macrocephalus Zone (Rocha, 1976), are characteristic of the early Callovian.

The uppermost strata of this succession corresponds to the Cilheta outcrop and yielded *G. jurassica* subsp. *adecta, Korystocysta* spp., *M. caytonensis, Mendicodinium groenlandicum*, *Tubotuberella dangeardii* and *Wanaea acollaris* and are assigned to the Callovian Stage (Riding, 2005).

The dinoflagellate cyst associations from the Carrapateira outlier are indicative of an Early Kimmeridgian age due to the occurrence of species such as *Amphorula* sp *Gonyaulacysta jurassica* subsp. *jurassica*, *Histiophora ornate* and *Tubotuberella dangeardii* (Riding, 2005).

4. Conclusions

The biostratigraphical data based on dinoflagellate cysts confirm the previously existing macrofaunal age of these successions. The dinoflagellate cyst assemblages from the Upper Bajocian, Bathonian and Callovian of Mareta and Cilheta beaches and the Lower Kimmeridgian of the Carrapateira outlier proved to be consistently significantly less diverse than coeval assemblages from northwest Europe. The partially enclosed nature of this part of the Algarve Basin and the Carrapateira outlier seems to have prevented the free migration of dinoflagellates between southern Portugal and elsewhere in Europe. However, this conclusions are preliminary because more palynostratigraphical research in the Algarve Basin and Carrapateira outlier is currently still in progress.

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PLATE 1 – Selected dinoflagellate cysts from the Mareta beach section and Carrapateira outlier. The sample, slide and England Finder coordinates are provided.

1. *Gonyaulacysta jurassica* (Deflandre 1939) Norris & Sarjeant 1965 subsp. *adecta* Sarjeant 1982. Mareta Beach section, Sample M27; N47

2. *Gonyaulacysta jurassica* (Deflandre 1939) Norris and Sarjeant 1965 subsp. *jurassica* (autonym). Carrapateira outlier, Sample C47; R12/4

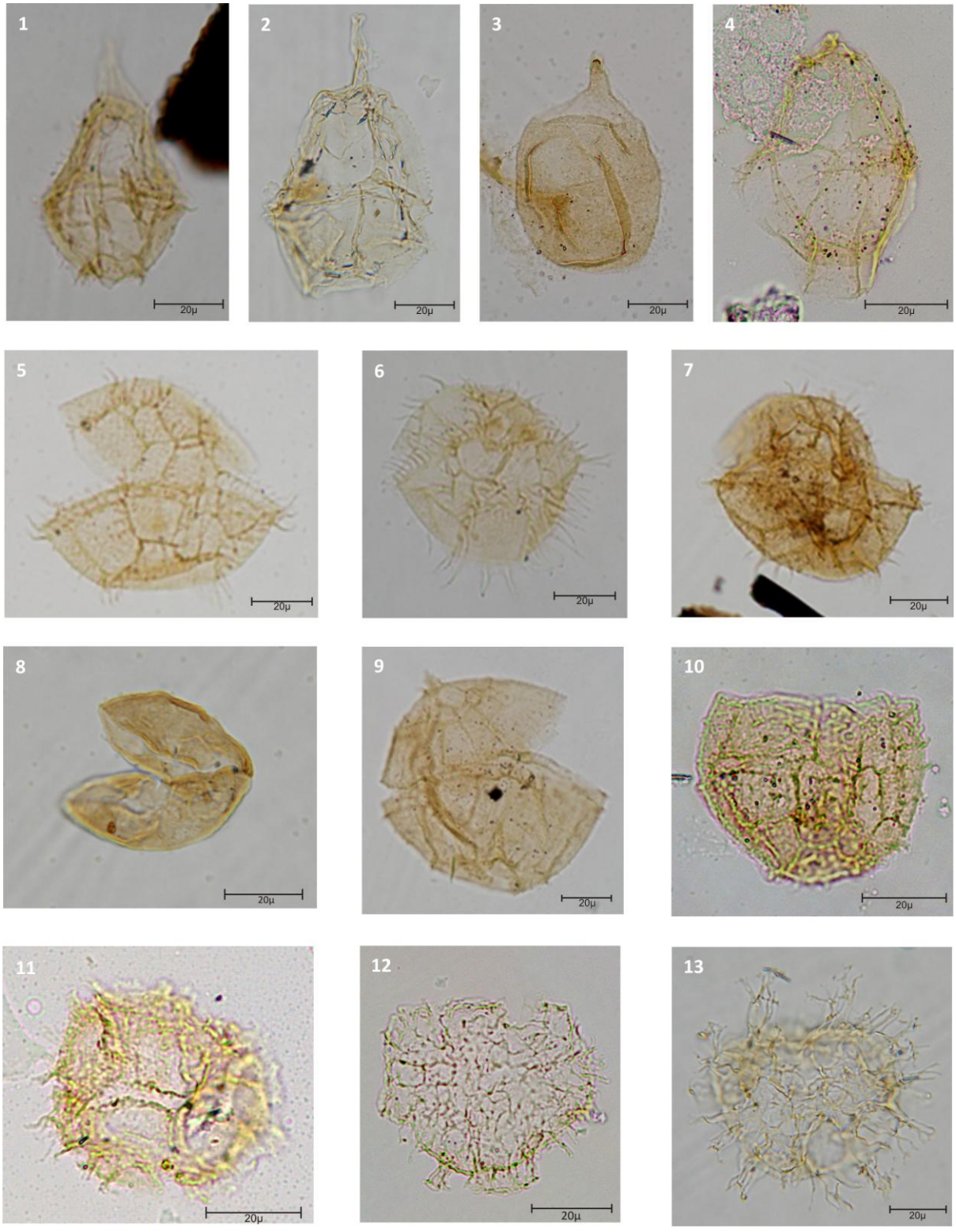
3. *Pareodinia ceratophora* Deflandre 1947. Mareta Beach section, Sample M28; L38-2

4. *Tubotuberella dangeardii* (Sarjeant 1968) Stover & Evitt 1978. Mareta Beach section, Sample M45; P18

5. *Ctenidodinium sellwoodii* (Sarjeant 1975) Stover & Evitt 1978. Mareta Beach section, Sample M2; W53

6. *Ctenidodinium cornigerum* (Valensi 1947) Jan du Chêne et al. 1985. Mareta Beach section, Sample M25; N3
7. *Ctenidodinium* spp. Carrapateira outlier, Sample C12; G34/4
8. *Mendicodinium groenlandicum* (Pocock & Sarjeant 1972) Davey 1979. Mareta Beach section, Sample M27; Q30/1
9. *Korystocysta gochtii* (Sarjeant 1976) Woollam 1983. Mareta Beach section, Sample M28; M63
10. *Meiourogonyaulax caytonensis* (Sarjeant 1959) Sarjeant 1969. Mareta Beach section, Sample M3; O18/3
11. *Histiophora ornata* Klement 1960. Carrapateira outlier, Sample C35; R36
12. *Ellipsoidictyum/Valensiella* group. Mareta Beach section, Sample M4; M12/3
13. *Systematophora areolata* Klement 1960. Carrapateira outlier, Sample C4; U36V30/2

PLATE 1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