



# Biostratigraphy of the Jurassic limestones of the CYAMAZ diving campaign

Morocco  
Mazagan  
CYAMAZ  
Jurassic  
Biostratigraphy

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## ABSTRACT

The micropaleontological content (calpionellids, foraminifera, algae) of the samples collected during the CYAMAZ campaign (1982) from the Jurassic platform of the Mazagan Plateau allows their attribution to upper Malm (but the lowermost Neocomian cannot be excluded completely). These samples are compared with the DSDP Leg 79 ones and those coming from numerous onshore outcrop sections. That comparison shows that CYAMAZ samples are very similar (if not identical) to those of the top of the Jurassic platform in site 545 and in Western High Atlas sections.

*Oceanol. Acta*, 1984. Submersible Cyana studies of the Mazagan Escarpment (Moroccan continental margin), CYAMAZ cruise 1982, 89-92.

## RÉSUMÉ

### Biostratigraphie des calcaires jurassiques de la campagne CYAMAZ

Le contenu micropaléontologique (calpionelles, foraminifères, algues) des échantillons recueillis lors de la campagne CYAMAZ (1982) sur la plate-forme jurassique constituant le plateau de Mazagan permet leur attribution au Malm supérieur (sans que l'on puisse exclure complètement le Néocomien basal). Ces échantillons sont comparés avec ceux du Leg 79 DSDP et avec ceux provenant de nombreuses coupes faites à terre. Cette comparaison montre que les échantillons CYAMAZ sont très comparables (sinon identiques) avec ceux du sommet de la plate-forme jurassique dans le site 545 et dans les coupes du Haut-Atlas occidental.

*Oceanol. Acta*, 1984. Études par le submersible Cyana de l'escarpement de Mazagan (marge continentale marocaine), campagne CYAMAZ 1982, 89-92.

## INTRODUCTION

One of the objectives of the CYAMAZ campaign was to obtain stratigraphical data directly from the exposed Mazagan Escarpment. Numerous samples collected *in situ* have been attributed to "upper Malm to lowermost Neocomian" according to their microfauna and/or microflora. The paleontological contents of these samples are described elsewhere (*cf. Jaffrezo et al.*, this volume). They can be assembled in four groups, three of which are based on the biostratigraphical data.

The "Jurassic" limestones of the CYAMAZ cruise will be compared, from a biostratigraphical point of view, with samples from DSDP Leg 79 and from onshore outcrops in the Western High Atlas.

## BIOSTRATIGRAPHY OF THE CYAMAZ SAMPLES ATTRIBUTED TO UPPER MALM (Fig.)

### Calpionellid-bearing limestones

The calpionellids of CYAMAZ 82, those of DSDP Leg 79, and those found in our High Atlas samples have been determined by J. Azema.

Five of the CYAMAZ samples contain calpionellids, good index fossils for the Tithonian/lower Neocomian interval. The facies of these calpionellid-bearing limestones is not the typical micrite with numerous calpionellids, but they are more or less recrystallised biomicrites with only a few poorly preserved calpionellids which are associated with benthic neritic organisms.



In the better occurrences (samples 85-4 and 87-3) the observed species (*Calpionella alpina*, *Tintinnopsella carpathica* and particularly *Crassicollaria parvula*) allow us to assign the calpionellid-bearing limestone to the Tithonian/Berriasian boundary.

In the other cases, solely *C. alpina*, or undetermined calpionellids were observed. In these cases, it is impossible to give a more accurate age than upper Tithonian to lower Berriasian.

#### Limestones with neritic microfossils

The most frequently observed foraminifera are: *Trocholina alpina*, *T. elongata*, *Pseudocyclammina lituus*, *Conicospirillina basiliensis*, *Protopenneroplis* sp., *Nautiloculina* sp., miliolids, etc. ;

The algae are: *Thaumatoporella parvovesiculifera*, *Baccinella/Lithocodium*, *Salpingoporella pygmaea*, *S. annulata*, *Clypeina jurassica* and *Teutloporella obsoleta*, oncoids.

These fossil associations are well known from the Western Mediterranean area from upper Malm to lower Neocomian (cf. J. P. Bassoullet, Fourcade, 1979; Jaffrezo, 1980). Particularly, *C. jurassica* is not younger than middle Berriasian and *T. obsoleta* is not quoted younger than Portlandian (cf. Bassoullet et al., 1978).

#### Limestones doubtfully dated as "late Jurassic"

Some of the CYAMAZ samples are tentatively attributed to the "late Jurassic", according to microfacies parameters and some foraminifera which are not distinctive in thin-sections (lenticulines, nautiloculines, etc.).

#### Breccias with Jurassic lithoclasts

Some samples of Cretaceous breccias contained reworked lithoclasts attributed to upper Malm/lowermost Neocomian: these clasts show the microfacies and microorganisms described before (see von Rad, this volume).

### COMPARISON WITH ONSHORE OUTCROPS

#### Outcrops in the El Jadida area

In the El Jadida area, between the Atlantic Ocean and the Paleozoic of the Meseta, there are large outcrops attributed to upper Jurassic (cf. Geological Map of Morocco, Mazagan and Marrakech sheets, 1/500 000<sup>e</sup>). But, since the rocks are gypsiferous and dolomitized, they did not give us any figures for their biostratigraphical dating. Only in one section (W of Tleta d'Ighoud) the base of sediment cover overlying the Paleozoic rocks of the Jebilet is dated as upper Dogger since *Pseudocyclammina maynci* and *Praekurnubia crusei* are present (Medina, Jaffrezo, in press).

#### The Western High Atlas outcrops

In this area, numerous sections were investigated. Lower Cretaceous sandy marls overlie platform limestones attributed to upper Jurassic (possibly including lower Berriasian).

At their top there is a thin calpionellid level. The microfacies of these calpionellid-bearing limestones is very similar to the CYAMAZ samples (see paragraph "Calpionellid-bearing limestones"). But the species observed in the High Atlas, when determinable, are not very meaningful (*Calpionella alpina* and *Tintinnopsella carpathica*).

This calpionellid level is located at the top of the "Timsiline limestones" (to use the name given by Société Chérifienne des Pétroles, 1966). The "Timsiline limestones" are characterized also by the presence of *Salpingoporella annulata*, *Actinoporella podolica*, *Clypeina jurassica*, *Trocholina alpina*, *T. elongata*, *Pseudocyclammina lituus*, *Conicospirillina basiliensis* and *Anchispirocyclus lusitanica*.

The paleontological content of these limestones is similar, if not identical, to that of the CYAMAZ samples, except for *A. lusitanica* which is absent in the CYAMAZ samples.

In the Western High Atlas, the calpionellid level is always at the top of the "Timsiline limestones"; the numerous normal faults seen during the CYAMAZ dives can explain the fact that we did not observe this sequence at the Mazagan Escarpment.

Below the "Timsiline limestones" of the Western High Atlas, there are dolomitic and calcareous formations dated as Kimmeridgian with *Alveosepta jaccardi* and *Favreina* sp. These facies and microorganisms were not found in the CYAMAZ samples.

### COMPARISON WITH THE DSDP LEG 79 SITES

Upper Jurassic has been drilled in three of the four DSDP Leg 79 Sites (cf. Hinz et al., 1982).

#### Site 544

Ammonites and oncoid-bearing limestones (Oxfordian) are directly overlain by Miocene sediments.

#### Site 547

Below Valanginian marls, the "Jurassic" limestones begin with a thin calpionellid level; calpionellids are associated with *Aptychus* and *Globochaete*. The quoted species (*Remaniella ferasini*, *Tintinnopsella carpathica*, *Crassicollaria parvula* and *Cr. intermedia*) permit the attribution of this level to the lower Berriasian (for the top) and to upper Tithonian lower Berriasian boundary (for the base; cf. Azema, Jaffrezo, 1984).

The calpionellid level overlies limestones with cyanophycean algae, ammonites and *Aptychus*. This last type of facies was observed in site 544 but neither in the CYAMAZ samples nor in the Western High Atlas 1 outcrops.

#### Site 545

(drilled at the foot of the Mazagan Escarpment).

Under lower Cretaceous marls, the Jurassic series begins with dolomitic limestones where dasycladacean algae (*Salpingoporella pygmaea*, *Lagenoporella sardi-*

*niensis*) are associated with trocholines, pseudocyclammines, and *Protopenneroplis* sp. These dolomitic limestones are very similar to those sampled during CYAMAZ (see paragraph "Limestones with neritic microfossils"). Below these limestones were drilled dolomitic limestones with abundant quartz but a very poor microfauna.

In site 545, calpionellid-bearing clasts (dated as the lower part of upper Tithonian) were found in Miocene-Pliocene breccias.

## CONCLUSIONS

- 1) According to the microorganisms quoted from the CYAMAZ "Jurassic" samples of the Mazagan Escarpment the outcrops must be attributed to upper Malm (although lowermost Neocomian cannot be excluded completely).
- 2) These "upper Malm" limestones are very similar

to those found in onshore outcrops, not to those found in the El Jadida area, but to those observed further to the south, in the Western High Atlas, and only at the top of the Jurassic limestones of this area ("Timsiline limestones").

3) The facies and the microorganisms observed in the CYAMAZ samples are similar (if not identical):

— to those observed in site 545, in the uppermost part of the "Jurassic" limestones; but in site 545 these limestones are overlain by a 500 m thick sediment cover; while the Escarpment limestones are mostly outcropping;

— and to the Jurassic clasts in the Miocene-Pliocene breccias of site 545.

4) The facies and microorganisms of CYAMAZ samples are, however, different from those of sites 544 (Oxfordian?) and of site 547, which are characterized by a calpionellid level at the top. They are also different from the limestones underlying the "Timsiline limestones" in the Western High Atlas.

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