

# Paleoenvironmental conditions during the Aptian-early Albian in the Essaouira-Agadir Basin, western Morocco

## Walid Hassanein

Cairo University, Faculty of Science, Geology Department, Giza, Egypt; walidgkassab@yahoo.com

## Fabienne Giraud

Université Grenoble-Alpes, ISTERre, UMR 5275, IRD, BP 53, 38041 Grenoble cedex 9, France; fabienne.giraud-guillot@univ-grenoble-alpes.fr

## Etienne Jaillard

Université Grenoble-Alpes, ISTERre, UMR 5275, IRD, BP 53, 38041 Grenoble cedex 9, France; etienne.jaillard@univ-grenoble-alpes.fr

## Emmanuel Robert

Université de Lyon, Université Claude Bernard Lyon 1, ENS de Lyon, CNRS, UMR 5276 LGL-TPE, F-69622 Villeurbanne, France; emmanuel.robert@univ-lyon1.fr

## Mohamed Aly

Cairo University, Faculty of Science, Geology Department, Giza, Egypt; mf\_alaly@yahoo.com

## Mohamed Hammed

Cairo University, Faculty of Science, Geology Department, Giza, Egypt; salehhammed@gmail.com

## Moussa Masrour

Université Ibn Zohr, Faculté des Sciences, Département de Géologie, B.P. 8106, Cité Dakhla, Agadir, Maroc; moussamasrour5@gmail.com

The aim of this study was to reconstruct the paleoenvironmental evolution of the Essaouira-Agadir Basin (EAB) during the Aptian-Albian and propose a functioning model for sedimentation in its mixed carbonate/clastic ramp.

Nine sections were studied to define the sedimentary facies, and 189 samples were collected and analyzed for calcareous nannofossils and 218 samples for geochemistry (calcium carbonate content and stable isotopes) from six sections.

The facies and depositional environments of the Aptian-early Albian successions were identified on the basis of their lithology, sedimentary structures, fossil content, and microfacies. It was possible to identify: (1) four types of key surfaces that are related to subaerial or submarine erosion, (2) four sedimentary carbonated facies in the Aptian that correspond to outer to inner ramp depositional environments, and (3) four early Albian sedimentary facies, which are represented by sandstones and

shales that correspond to a deep-marine outer ramp-basin depositional setting. There is a deepening upward trend that is related to sea-level rise during the early Albian.

During the Aptian, the EAB carbonate ramp was characterized by high carbonate production within a large photic zone, low terrigenous influx due to the shallow depth of the basin, warm sea-surface conditions, and a slow rise in sea level. During the early Albian, there was an increase in both the accommodation space and siliciclastic input in the EAB. Dysoxic sediments were observed, carbonate production decreased, a rapid rise in sea level occurred, and upwelling currents were present. Enhanced nutrient input into the basin, which can be related to both increasing siliciclastic influx and upwelling, led to an increase in nannofossil primary productivity. A decrease in sea surface temperature, which is suggested by a higher abundance of cold taxa and the migration of cosmopolitan biota from the Boreal realm, was also recognized.