Sequence stratigraphy of the Eocene-Miocene Mrayt Group, North-Western Rif (Morocco)

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Abstract

Detailed sequence stratigraphy of the Eocene-Miocene Mrayt Group in North-Western Rif (Morocco), allow identifying the nature and the sources of the sediment supplies, the sedimentary facies and the depositional environments as well as the factors that controlled the sedimentation. This work made it also possible to identify 16 facies sequences that have never been described before. facies sequences, indicate that the sedimentation occurs under a complex hydrodynamics strongly influenced by river discharge, tidal currents and wave's processes in an estuary, a tide dominated delta and waves and tide dominated nearshore. These depositional systems occur at the margin of the Maghrebian foredeep sedimentary basin under the interplay of climate, tectonic and eustacy.

Key words: Sédimentology, Tide dominated delta., Mrayt group, Rif, Morocco, Eocene - Miocene

1. Introduction

The Eocene-Miocene Mrayt Group is a 1730 m-thick sedimentary unit that belong to the Prerif domain and crop outs in Western North Rif along the Atlantic littoral between the cities of Asilah and Larache in North Morroco.

Detailed sequence stratigraphy carried out for the first time in the Sidi Mrayt group, allow recognizing a shallower sedimentary environments corresponding to tide dominated estuary, typical tide dominated delta system and a tides and waves dominated nearshore. The discrimination of the depositional system and controls which prevailed during Eocene –Miocene in this part of the perimediterranen alpine belt, is of great interest for identify the the type of sedimentary basin its tectonic setting and allogenic factors that controlled its evolution, and then can help in better understanding the geodynamic evolution of the Rif alpine belt.

2. Geological setting

The Mrayt Group (Fig.1B and Fig.1C) crops out in the Northwestern "external Zone" of the Rif North of the Jebha-Chrafat accident and it's overlapped to the East by the allochthonous Habt unit (Suter, 1980). The deposits of this group are structured in a succession of anticline and syncline folds trending S-N and separated by overthrust faults (Tejera de leon, 1993). The Mrayt Group consists of four formations whose age range from Upper Eocene to Middle Miocene based on foraminifera: Globigerines and Orbitolines (Suter and Fiechter, 1966; Suter, 1980 and 1986; Morley, 1992; Tejera de Leon, 1993; Abdelkhaliki, 1997).

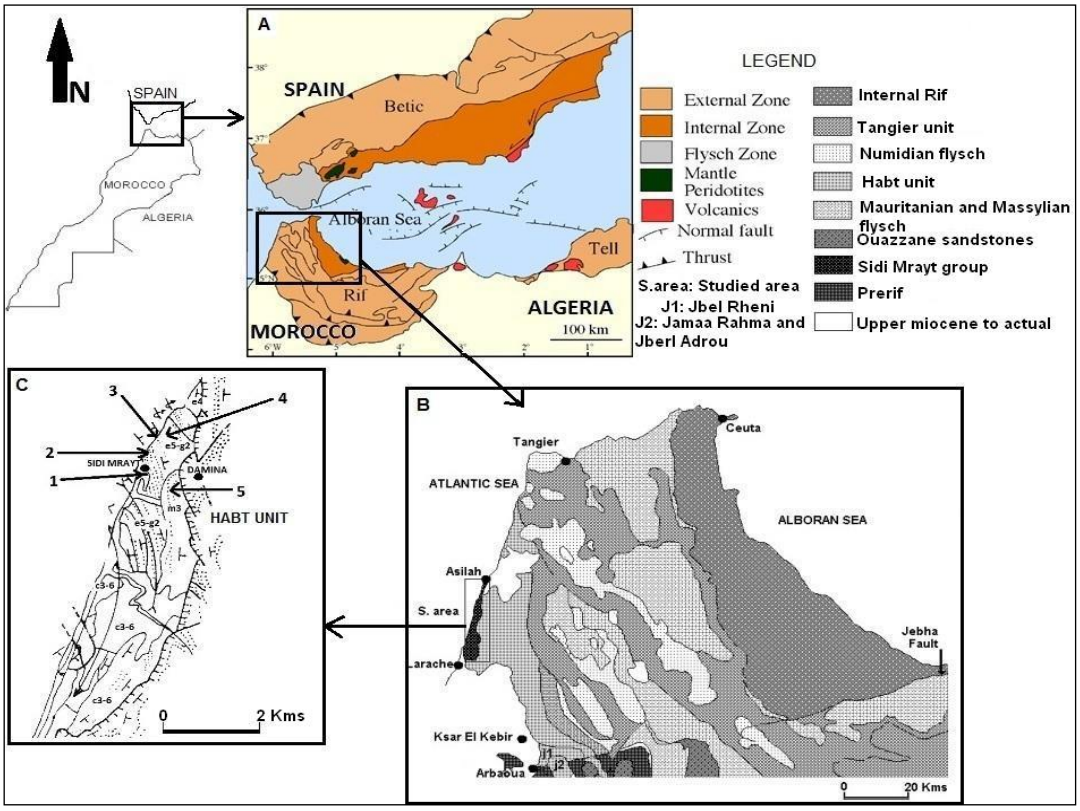

Fig.1. A. Geological map of the main geological domains in the Betic–Rif orogenic system (after Platt and Vissers, 1989). B. Location of the Mrayt Group, after Suter (1980). C. Location of the studied outcrops in the structural map of Suter (1980).

3. Methodology

The Mrayt Group has been logged bed by bed in five successions totaling 1730 m-thick, belonging to the Damina and the Sidi Mrayt beach localities (Fig.1C): MG1- Damina succession, MG2- Marabout succession, MG3- Sidi Mrayt beach succession, MG4- Merja succession, and MG5- Merja ravine succession.

The approach used the techniques of sequence stratigraphy. The reconstruction of the depositional systems is based on the sedimentary facies analysis, sedimentary facies associations and sequences identification,

4. Results :Facies sequences and control of the depositional environments

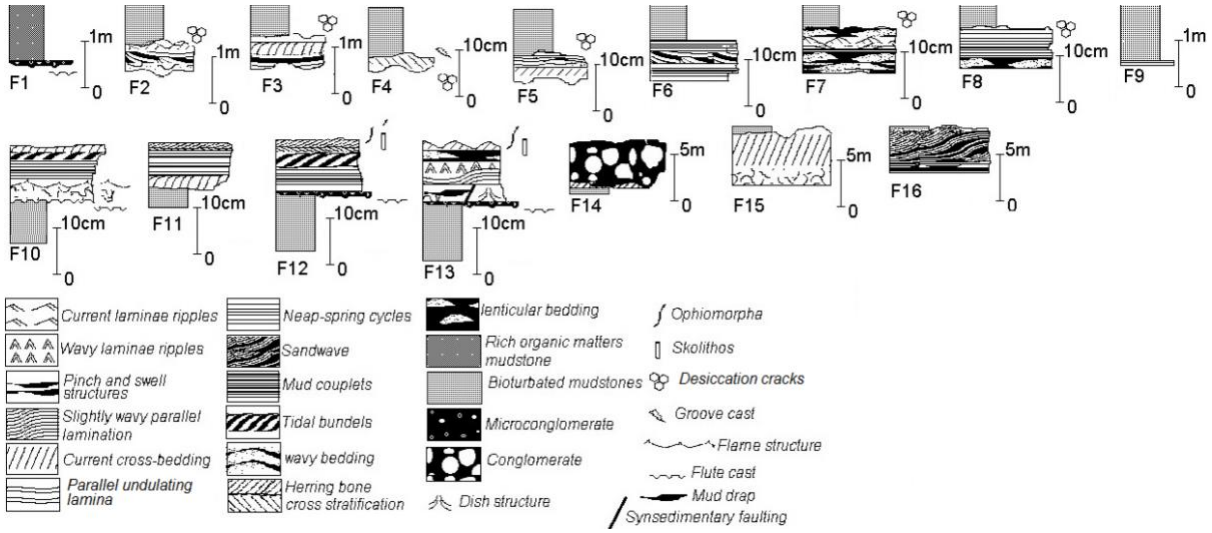

Fig. 2. The facies sequences of the Sidi Mrayt group.

The facies sequences (F1 to F 16) correspond to the basic repetitive stratigraphic units controlled mainly by physical processes. These stratigraphic units are stacked in genetic sequences as defined by Homewood et al (1992). The genetic sequences are in turn stacked in system tracts bounded by erosive boundaries. The high-stand system tracts HST consist of beach ridges sequence, estuarian sequence, lower delta plain sequence, and tides and waves dominated nearshore sequence. The low stand system tracts 'LST' correspond to the delta platform sequence, the prodelta sequence, and the shoreface. The system tracts identified are grouped into three depositional sequences: SII1, SII2, and SII3 (Fig. 5) bounded by major uncomformities, indicated by lithological, petrographic and bathymetric changes:

The sequence SII1 of 450m thick, extending from the base of the succession to the middle part of the « Lower sandstone-pelitic formation » of Lower Oligocene age, is made of stacked highstand system tracts HST, recording the passage from a tidal flat into a distributary channel fill estuary. The sequence SII2 of 840 m thick, extending from the upper part of the « Lower sandstone-pelitic formation » to the « Upper sandstone-pelitic formation » (Middle Oligocene), is composed of stacked lowstand system tracts and highstand system tracts, indicating the passage from a prodelta into a delta front, which in turn pass into the mouth area with channel and then to the lower delta plain. The sequence SII3 of 440m thick, ranging from the middle part of the « Upper sandstones-pelitic formation » to the top of « Si Moussa formation » (Upper Oligocene to Middle Miocene)

consists of stacked lowstand system tracts, and highstand system tracts, indicating the passage from a shoreface into a beach ridges.

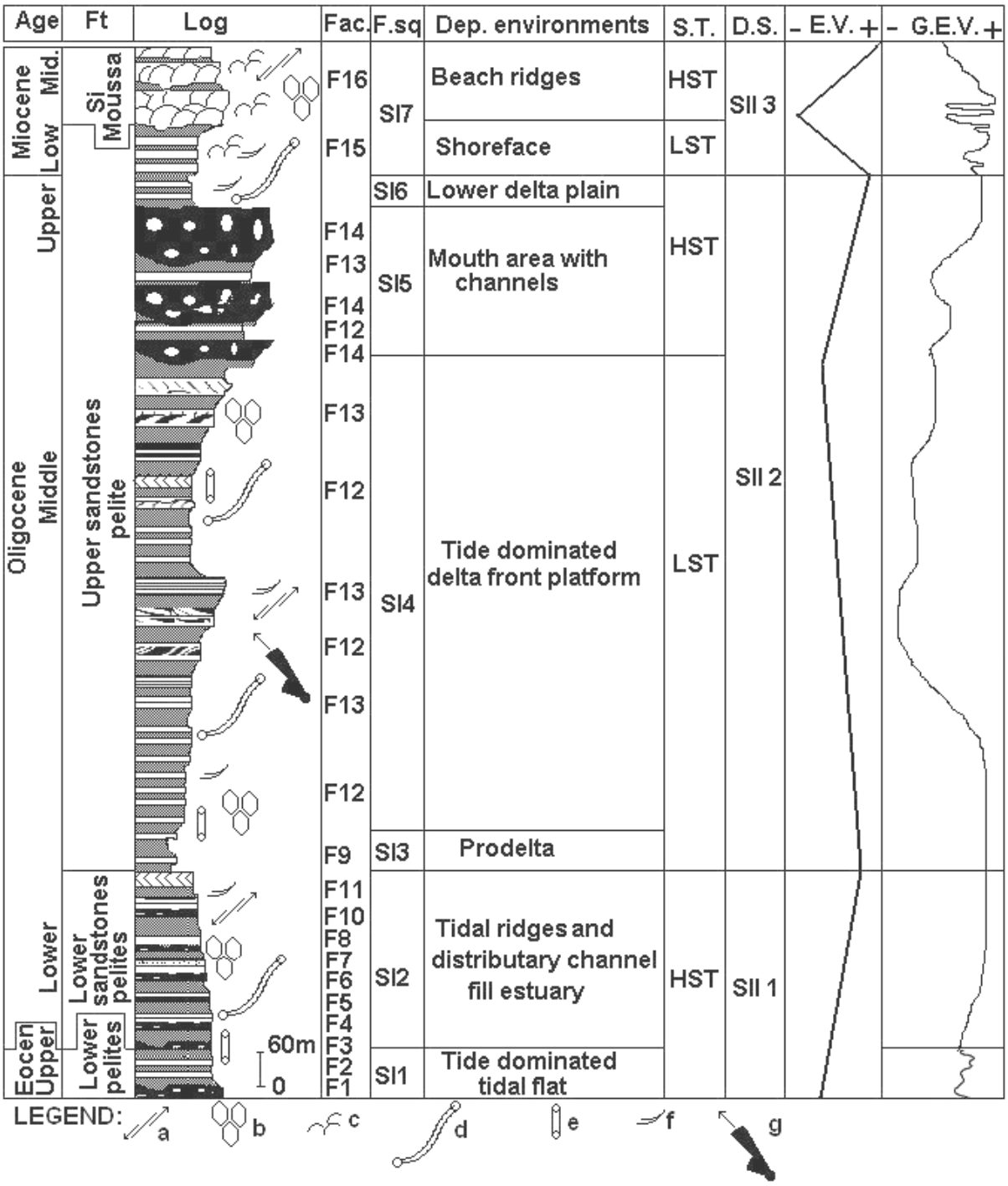

Fig. 3. Depositional sequences of Sidi Mrayt Group. a- Synsedimentary faults; b- desiccation crack; c- ball and pillow; d- ophiomorpha ichnofacies; e- skolithos ichnofacies; f- convolute bedding; g- palaeocurrent measurement (main direction SSE to NNE, n=48). Ft: formation; Fac: facies; F.sq.: facies sequences; Dep. Environments: environments deposits ; ST : system tracks ;

D.S. : depositional sequences ; E.V : eustatic variation of the Sidi Mrayt basin ; GEV: global eustatic variations fter Haq et al. (1987).

Discussion

Three depositional sequences: SII1, SII2, and SII3 bounded by major uncomformities were identified they developed under the interplay of climate, tectonic and eustacy. The relative sea level evolution shows concordance with the global eustatic sea level curve (Haq et al., 1987) from Upper Eocene to middle Oligocene. But during the upper Oligocene and Miocene, the tectonic control is higher than average eustatic variations and then, the pattern of sea level fluctuations is different from the global eustatic curve (Haq et al., 1987).

In addition to the discrimination of the nature and source of the sediment and the depositional environment and their control , the results obtained in this work are important for more than one reason: 1) this work is a contribution for a better knowledge of the regional geology since the rif belt is a branch of the peri- Mediterranean alpine chain , 2) although mixed siliciclastic /carbonate sediments are very developed in the geological record, their petrofacies are not well encoded, 3) Despite advances in tide dominated sedimentary environments, ancient tide dominated deltas are not widely recognized and their facies sequences are poorly documented and 4) delta may contain significant volumes of hydrocarbon.

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