

Keys for sedimentation in the Balearic Islands continental margin: benthic carbonate production vs. particle fluxes

M. CANALS*, A.-M. CALAFAT*, J.-L. CASAMOR*, J. SERRA*, E. BALLESTEROS** and M. ZABALA***

*Departament de Geologia Dinàmica, Universitat de Barcelona, 08071 Barcelona (Spain)

**Centre d'Estudis Avançats de Blanes, 17300 Blanes (Spain)

***Departament d'Ecologia, Universitat de Barcelona, 08071 Barcelona (Spain)

The "warm temperate" Balearic Shelf, which has been studied in the frame of several Spanish and European projects (namely EURECOMARGE), can be considered as a counterpart of the terrigenous-dominated margin of the Gulf of Lions (BROOKFIELD, 1988; LA VIOLETTE, 1990).

The biogenic-dominated continental shelf sedimentation is controlled by extreme water transparency, hydrodynamism, nutrients and particulate organic matter (POM) concentrations, type of substrate and microtopography (CANALS et al., 1990). Carbonate production rates by benthic communities are explicated in Table 1. Calculations based on biomass estimations and turnover rates give a mean carbonate annual production of 0.7 metric tones per hectare (BALLESTEROS, 1984). This significant amount of biogenic particles continuously contributes to sediment formation.

Benthic com.	Water depth range (m)	Mean annual production rate, gCaCO ₃ m ⁻² y ⁻¹	Covered area		Total annual CaCO ₃ production		
			Ha	%	Tm	%	Tm/Ha
A	0.5-5	200	280	5	541	13	1.9
B	0-6	5	640	11	32	0.8	0.05
C	5-35	100	2,655	45	2,656	66	1
D	35->50	5	1,565	26	78	2	0.05
E	37-50	90	800	13	721	18	0.9
F	>45	125	Small patches		Too low		
G	>50	350	Small patches		Too low		
			5,940	100	4,028	100	

Table 1. Carbonate production by benthic communities in the Pollensa Shelf area (NE of Mallorca Is.). A: Photophilic algae; B: *C. prolifera*, *C. nodosa*; C: *P. oceanica*; D: sand com. w/ *Spatangus*; E: Algal crusts, *V. volubilis*; F: Coralligenous; G: Maëri.

The coarse particles (sand and gravel sizes) of biogenic production are transported by traction processes (mainly longshore currents and their helical components) as proved by the existence of modern sand wave fields to 50m of water depth (CANALS et al., 1990). As it was expected, suspended particulate matter (SPM) in the water column over the shelfbreak is very low, specially if compared with values obtained in the Gulf of Lions (Table 2).

Although they are two different concepts, and even though it may be considered an oversimplification, comparison between measured gross particle fluxes from the Gulf of Lions and biogenic production from Balearic Shelf, both expressed in g m⁻² y⁻¹, taking also into account the areas of the sediment-feeding zones (the river basins for the terrigenous input, and the productive zone over the shelf for the carbonate input), shows the main contrasting features between both depositional systems and eventually would allow an interesting discussion foreseen for the corresponding round table (Fig. 1).

	BALEARIC ISLANDS					GULF OF LIONS				
	N	M	SD	Max	Min	N	M	SD	Max	Min
SPM CONCENTRATION (mg/l)										
TOTAL SURFACE	44	0.23	0.157	0.8	0.04	24	0.86	0.504	2.3	0.23
BOTTOM	18	0.23	0.156	0.5	0.05	11	0.67	0.303	1.4	0.23
	26	0.22	0.157	0.8	0.04	13	1.02	0.590	2.3	0.36

Table 2. Suspended particulate matter concentrations (mg/l) in surficial (less than 50m depth) and near bottom (more than 50m depth) waters in the shelfbreak areas of the Balearic Is. and Central Gulf of Lions. Data from water samples obtained during 1986 to 1989 EURECOMARGE cruises. N: set of samples; M: mean values; SD: standard deviations; Max: maximal values; Min: minimal values.

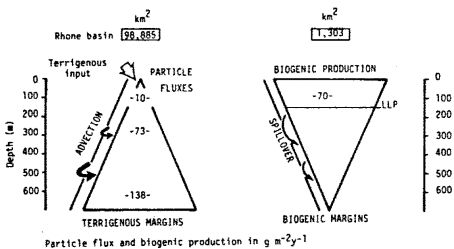


Fig. 1. Sketch showing the main contrasting features of particle fluxes vs. carbonate production in the Gulf of Lions and Balearic shelves. Gulf of Lions data are recalculated from MONACO et al (1987).

The production vs. transport/accumulation sediment regime dominating in the Balearic Islands continental margin during Pleistocene times has resulted in an important progradation of the outer shelf and upper slope, frequently associated with severe mass movement processes. The overall benthic carbonate production rate reaches its maximum during sea-level highstands when, according to the physiography of the margin, the greatest sea-floor area under the photic zone is available for benthic community growth (present shelfbreak is at 115m depth). Carbonate maceration from ALEXANDERSSON (1979) and hemipelagic settling of planktonic and aeolian particles are necessary processes to explain the muddy, calcareous nature of the sediments in the outermost margin. In the light of the available data, which show the absence of mid-water and bottom nepheloid layers, vertical particle fluxes are irrelevant as a sediment contributor factor in the Balearic carbonate environment.

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