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Recent Saltmarsh Changes and Sedimentation Rates in the Sado Estuary, Portugal

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ABSTRACT

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The tidal mudflats of the estuary of the Sado River are composed of silt and clay, with interspersed sandy units that may represent restricted paleo tidal channels or widespread fluvial flood deposits. The mineralogy of the clay is primarily montmorillonite, whereas the silt and sand grains are largely quartz.

Estuarine and lagoonal salt marshes cover 70%–100% of the upper mudflat, forming narrow platforms dissected by creeks and polygenetic salt pans. The lower mudflat is dissected by meandering and anastomosing tidal channels, and is characterized by numerous small marshy islands.

The spatial changes of the tidal flat features are dominated by the retreat of the upper mudflat surface, caused by notching of its margin, under the root layer, which results in the collapse and slippage seaward of peaty blocks of marsh. As a consequence of these undercutting processes, the upper tidal flat wetland margins are retreating at rates of 0.8–10.5 cm/yr. Where tidal pans on the upper surface are breached, the scarp becomes dissected quickly and the horizontal retreat of the scarp reaches 45.5 cm/yr. The maximum measured retreat of 76.7 cm/yr is caused by anthropogenic activity. In places, progradation of the saltmarsh edge is observed, reaching 1 m/yr.

The vertical sedimentary record is characterized by accretion rates that, during the last decade (1978–1989), reached 0.8–5.3 mm/yr on the upper mudflat (including the salt pans) and 106 mm/yr on the sandy levees. In several places a negative rate was observed, but not measured.

On the lower mudflat, silty sediments and shell hash accumulate near its inland margin, close to the scarp of the high marsh, whereas sand flats and sand levees accumulate along the margins of the estuarine channels. However, in several places present day thin deposits of sand overlay the inner margin of the low tidal mudflat as well as some portions of the high marsh surface. These sandy accumulations and the general retreat of the marsh scarp are related to the local sea level rise.

ADDITIONAL INDEX WORDS: *Estuarine sedimentation, coastal wetlands, geomorphology, sea-level rise.*

INTRODUCTION

The coastal wetlands of the Sado estuary, on the southwestern coast of Portugal (Figure 1), occupy 7,170 km². The wetlands are part of a National Natural Reserve whose surface has been decreasing because of progressive reclamation and development on its margins (MOREIRA and OLIVEIRA, 1988). The estuary is sheltered seaward by a northerly-extending sandy spit. It incorporates wide tidal flats and narrow salt marshes which are characterized by a dense Mediterranean-type halophytic vegetation (MOREIRA, 1987).

The climate is subtropical, with warm and dry summers of high evaporation rates causing desiccation of the mudflat clays and precipitation of salt crusts on the unvegetated saltmarsh surface and on the bottom of dry tidal salt-pans. During the winter rainfall is concentrated and accelerates the marsh erosional processes (MOREIRA-LOPES, 1979; MOREIRA, 1987).

Recognition of the hydrological regime is important to the understanding of the sedimentary processes on the estuarine wetlands (VERGER, 1968; RANWELL, 1972; CHAPMAN, 1974). The fluvial regime of the Sado is of a Mediterranean-type (AMBAR *et al.*, 1980), but at present the cool season floods are controlled by numerous small dams in the distributaries. Several times during the wet winters or during early spring, the controlled discharges from the dams cause an artificial flooding. This process is important to the modern day estuarine accretional processes because of the high turbidity of the released waters. The maximum concentration of suspended sediment in these discharges has reached 15.73 g/l in the turbid plume near Abul (Figure 1) in February 1979 (MOREIRA-LOPES, 1979). During the summer period, the fluvial discharge into the estuary is insignificant.

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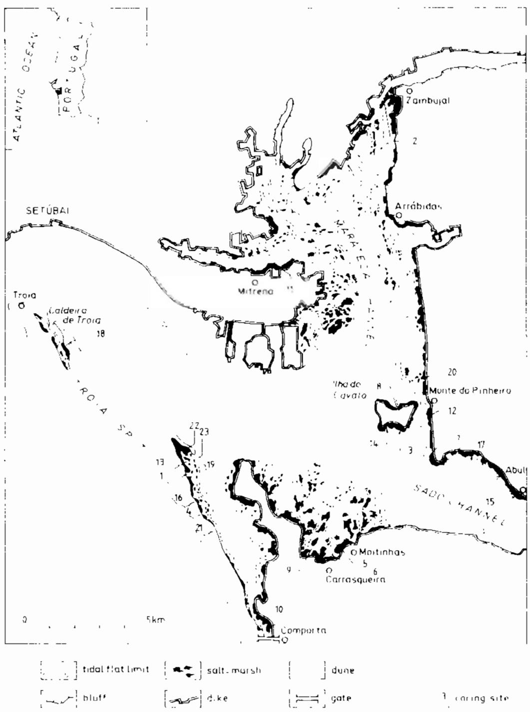

Figure 1. Location of the core sites on the intertidal platforms of the Sado estuary.

The tidal regime is semidiurnal and mesotidal. The tidal range at spring tide is 3.7 m at the entrance to the estuary (Troia) and 4 m at locations within the estuary (Comporta, Palma, Zambujal, and Mitrena). Wave heights in the estuary are usually less than 1.0 m. During the summer, maximum wave heights are associated with winds from the north, *Nortada*. In the winter, winds from the northwest are funneled through the Marateca estuarine channel and generate waves reaching 1.0 m. These waves produce considerable erosion of the dikes that are exposed to these greater fetches. Oceanic swell does not pass through the inlet into the estuary.

The objective of this study is to describe and analyze the sedimentation rates of the last decade on the intertidal platform and to relate the rates to the variety of natural and anthropogenic processes active in the area. The terminology applied to describe the estuarine and intertidal forms, the micro-forms, and the processes follows the definitions cited in CRONIN (1978), DAVIES (1978), MOREIRA (1984), KELLEY *et al.* (1988), and WOOD *et al.* (1989).

SURVEY METHODS

The linear horizontal retreat or progradation of the saltmarsh scarp was observed by surveying the distance from the scarp-line to fixed bench marks. In some cases, profile lines were run to include aspects of the vegetation dynamics. Vertical accretion rates on the high and low marsh surfaces were determined through a combination of surveying, using marker horizons of brick dust (STEERS, 1938; RICHARD, 1978), and stakes to identify specially-designated core sites in a range of wetland morphologies (Figure 1). Two cores were collected at each site and the results of the analyses represent the average of the two samples.

Brick dust was applied to sites after the first spring tide in September in each of three different years (1978, 1982, and 1983). Recovery of the brick dust layer in the entire study area was incomplete because several of the sampling sites were disturbed by fishermen, by cattle, and by other traffic through the marshes. Some of the other sites, although not apparently disturbed, did not retain a recognizable brick dust layer in their cores.

The inorganic component of the collected samples was determined by treating the samples with H_2O_2 and expressing the remaining sediment as a percentage of the total dry weight.

The major surficial geomorphological features and their distributions were identified on aerial photographs (1:25,000 and 1:15,000 scale) and on satellite imagery (Landsat MMS and TM), but the micro-geomorphological features and the processes at the micro-scale were measured, monitored, and analyzed in the field.

GENERAL GEOMORPHOLOGICAL AND SEDIMENTOLOGICAL CHARACTERISTICS OF THE STUDY AREA

The intertidal platforms and shoals of the Sado estuary develop between the elevations of −1.8 m and +2.0 m along the margins of the lagoon and the estuarine channels (Figure 1). Most of the wetland system has been modified by human action. The ecotone of the inland margin of the intertidal platform is against a constructed dike along 80% of its length. The only remaining natural ecotone of the inner margin of the intertidal platform is along the contact with the Troia spit and along short sectors of the bluffs at Arrábidas-Pinheiro and at Mitrena (Figure 1).

Two levels of intertidal platforms can be distinguished. The lower portion is usually an un-

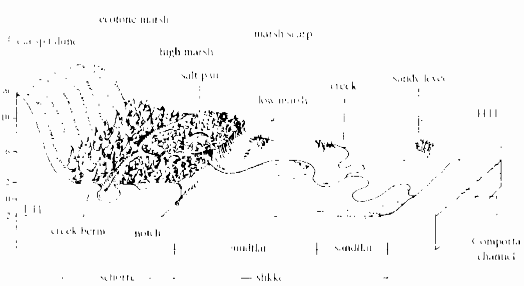

Figure 2. Schematic diagram of Sado estuary tidal platform morphology (Troia spit wetlands).

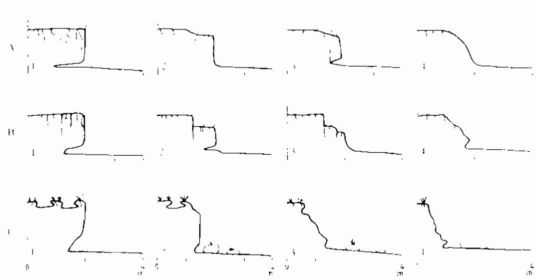

Figure 3. Retreating processes of the saltmarsh scarp: (A) Troia spit (Site 16), (B) Ilha do Cavalo (Site 3), and (C) Monte do Pinheiro (Site 7).

vegetated, low-tide platform, *slikke*, which is subjected to the tidal flows during every tidal cycle, whereas the higher portion is covered by a saltmarsh, forming a high-tide platform, *schorre*, which is usually inundated only during spring tides (Figure 2). The two portions of the platform are separated by a scarped rise of 0.5 m–2.0 m that constitutes a micro-cliff in the saltmarsh profile. It is the processes related to this micro-cliff or saltmarsh scarp, the rates of change, and the sedimentation in its vicinity that form the focus of this paper.

The low tidal flat component is wide and is comprised of sandy sediments adjacent to the creek channels (tidal sandflat) but of silty sediments away from the channels (tidal mudflat). Quartz is the dominant mineral making up the sand and silt particles, whereas most of the clay particles are montmorillonite (MOREIRA and LAPA, 1985). Within the tidal flats, sandy levees and spits are generated by tidal currents. These features are produced by the flood tides in the Comporta channel and by the ebb flows, augmented by fluvial discharge, in the Marateca and Sado channels. In several locations (Comporta, Carrasqueira, and Palma) small oyster reefs colonize the outer edges of the tidal flats and estuarine shoals, creating small, irregularly-shaped bioherms that trap organic detritus and fine sediment.

The high-tide platform is composed of compact silt and montmorillonitic clay accumulations and has two sectors. The inland sector is completely submerged only during the spring high tides, whereas the estuarineward sector is submerged during every ordinary high tide. The former sector is the high marsh portion of the platform and is colonized with semi-prostrate *Chenopodiaceae*, among which the dominant species are sea-purslane (*Halimione portulacoides*) and glassworts (*Arthrocnemum* ssp.). The lower and estuarineward marsh is dominated by horse grass (*Spartina maritima*) (MOREIRA, 1987). The high marsh is cut by meandering tidal channel networks which drain the upper surface and is pocked by salt pans (CHAPMAN, 1974; BEEFTINK, 1977).

RESULTS AND DISCUSSION

Horizontal Retreat of the Saltmarsh Scarp

In general, the saltmarsh scarp is present in all of the profiles measured in the Sado estuary. In most cases, the scarp is retreating inland, but in a few instances, the saltmarsh is extending estuarineward over the low tidal flat. The saltmarsh scarp retreat is due to several processes that depend on the vegetation cover and on the frequency of excavating fauna, as well as the sedimentological characteristics of the marsh.

Undercutting and Collapsing

The erosion and scarping of the high marsh is associated with the creation of a notch in the outer edge of the marsh surface. Tidal currents, especially those occurring during flood stages, sap and undercut the micro-cliff and eventually lead to the collapse or sliding (or both) of the top 30–50 cm section of the root-bound marsh surface. On the basis of observations throughout the Sado, the mechanisms for failure of the marsh margin are related to the dimensions of the notch. When the notch extends very far (60 to 130 cm) into the leading edge of a deep and densely-rooted high marsh and the notch is very thin (10 to 20 cm), the overlying material shifts forward by a relatively slow rotational movement and does not collapse completely. The result is a scarp with a convex profile (Figure 3A). In this situation, there is no abrupt cliff face and the scarpline is protected

Figure 4. Saltmarsh scarp retreat by rotational sliding and vegetation destruction in the southern side of Ilha do Cavalo.

and masked by vegetation (Table 1, Sites 1 and 2, Figure 4). However, the scarp is being undercut and is undergoing a progressive retreat. The Troia spit marsh is shifting in this manner (Table 1, Site 1). This appears to be the process of scarp migration in those locations where there is little interference by humans and where the scarp is laterally exposed to tidal currents (Figure 5).

Table 1. *Horizontal sedimentation rates of the saltmarsh scarp.*

Core Location Sites (Figure 1)	Monitoring Period	Mean Annual Horizontal Change	
		Retreat cm/year	Accretion cm/year
1	1978–1989	4.7	
1	1978–1983	1.2	
1	1983–1989	7.7	
2	1983–1989	0.8	
3	1978–1989	4.7	
3	1978–1983	2.7	
3	1983–1989	6.3	
4	1978–1989	5.0	
5	1978–1989	10.0	
6	1978–1989	31.8	
7	1978–1989	45.5	
8	1978–1989	72.7	
9	1978–1989	36.4	
9	1978–1983	64.0	
9	1983–1989	13.3	
10	1983–1989		37.5
11	1983–1989		83.3
12	1983–1989		100.0

In similar situations as described above, but where the clay has been subjected to drying, with surface cracks and holes excavated by animals, the retreat of the scarp takes place along a line of weakness. The edge is characterized by a small step or series of steps as thick as the root band (Figure 3B) and the process results in a progressive recession of the vegetation zones (Figure 5, Table 1, Sites 3 and 4). The entire process can be accelerated by anthropogenic destruction of the vegetation cover. Near the Carrasqueira fishing harbor, several islands of saltmarsh were almost completely destroyed because of the retreat processes combined with the use of the marsh surface for boat repairs (Table 1, Sites 5, 6, and 7; Figure 6).

Rotational Sliding and Peat Block Collapsing

Where there is no vegetation cover or where it is very scarce (<10%), where the desiccation cracks are deep and there is a high density of salt pans and holes, where the notch is not too deep (20 to 70 cm), and the flood tidal current is strong, there are two possible outcomes of edge failure depending on the lateral infiltration of water into

Figure 5. Saltmarsh scarp retreating by collapsing in the Troia marsh.

Figure 6. Horizontal and vertical retreat of the saltmarsh in Carrasqueira-Moitinhas, due to activity of fishermen.

Figure 7. Retreat of the saltmarsh scarp by gulleying followed by the collapse of blocks of peat, in the marsh of Monte do Pinheiro.

the marsh clay. One case occurs in the wet winter period during spring tides. At this time, the failure is by the rotational sliding of large blocks of the marsh edge. If salt pans are encountered during this type of retreat, the pans are rapidly dissected by the tidal exchanges (Figure 3C). This is the situation for the most rapid retreat of the saltmarsh scarp (Figure 7; Table 1, Site 7). This type

Figure 8. Advance of the *Spartina* marsh of Monte do Pinheiro over the low mudflat.

Figure 9. Organic and mineral detritus accumulated around the semi-prostrate stems of *Halimione portulacoides*.

is found most frequently in areas where the saltmarsh is very narrow and is pocked by numerous salt pans, and where the marsh scarp is exposed to very strong tidal currents.

Another instance occurs during the dry summer period when the clay sediments dry rapidly and are marked by deep desiccation cracks. At this time, spring tide elevations are accompanied by collapses of large blocks of peat. This process is especially prone to occur on the northward facing marsh scarps which are exposed to the greatest fetches across the estuary associated with either the *Nortada* of the summer, or to the winter storm waves coming from the northwest.

The mean annual values of retreat on the exposed saltmarshes were greatest on the northern side of Ilha do Cavalo and in the fishing harbor of Carrasqueira (Table 1, Sites 8 and 9), especially due to the anthropogenic activity.

Horizontal Progradation of the Low Marsh

In several sheltered sectors of the estuary, a positive sediment budget on the low tidal flat caused the *Spartina* marsh surface to prograde. Rates of buildout reached as high as 1.0 m/yr in Mitrena (Figure 9) and Monte do Pinheiro (Table 1, Sites 10, 11, and 12) due to a sandy accumulation on the mud flat (Figure 8). This phenomenon of migration of the sand tidal flat landward covering the low mud flat is found throughout the estuary. This transgressive characteristic may be a consequence of the recently-described sea-level rise along the Portuguese coast (TABORDA and DIAS, 1989), as well as a consequence of the subsidence of the Sado estuarine region.

Vertical Accretion Rates on the Saltmarsh Surface and on the Sandy Levees

The vertical accretion of sediment on the saltmarsh surface is not so spectacular as is the lateral erosion. The values of vertical change (Table 2) demonstrate that accretion is not regular nor homogeneous in either space or time. Local factors such as vegetation cover and floristic changes, the position of the core sites relative to the source of sediment supply (distance of tidal or fluvial transport) create differences in the quantities of accumulation and the composition of the sediments.

The suspended sediment load in the Sado estuary is derived from several sources. One very important source is the erosion of the tidal flats within the entire estuary. That is obviously a re-

Table 2. *Vertical sedimentation rates on the saltmarshes in the Sado Estuary.*

Core Location			Vertical Accretion	Composition of Sediments	
Site (Fig. 1)	Geomorphologic Environment	Monitoring Period	Annual Mean (mm/year)	(% min.)	(% org.)
13	creek berm	1978–1989	2.6	36.7	63.3
14	creek berm	1983–1989	1.7	39.5	60.5
15	tidal pan	1983–1989	4.8	38.2	61.8
16	tidal pan	1983–1989	5.3	0.3	99.7
16	high marsh	1978–1989	2.2	6.7	93.3
17	high marsh	1983–1989	3.1	33.8	66.2
18	high marsh	1983–1989	0.8	40.6	59.4
19	marsh berm	1978–1989	1.5	9.3	90.7
19	high marsh	1983–1989	1.7	11.2	88.8
19	low marsh	1983–1989	3.3	58.9	41.1
20	low marsh	1978–1989	0.7	7.6	92.4
21	low marsh	1978–1989	2.3	22.7	77.3
22	levee	1978–1989	106.0	98.9	1.1
23	levee	1983–1989	31.5	92.7	7.3

distribution of sediment and does not relate directly to a positive or negative sediment budget for the system. The fluvial drainage systems do contribute sediments to the estuary, especially during regulated discharges of the dams. Another important source is the drainage from the ricefields.

Accretion on the Saltmarsh Surface

On the high marsh surface, the sediments are almost entirely fine-grained organic detritus. The rates of accretion on the high marsh surface vary from 0.8 to 3.1 mm/yr (Table 2). The highest values are found along the sheltered tidal creek berms vegetated with *Halimione portulacoides* (Site 13) and in the high marsh concave depressions covered with *Halimione portulacoides* and *Arthrocnemum glaucum* (Site 17). These dominant semiprostrate species are very important in trapping the fine sediments (Figure 9).

In general, the accretion rates are slightly higher on the lower, vegetated portions of the marsh surface. This may relate to plant density as well as to the availability of sediment and the daily inundation. The rates of accretion in the *Spartina* marsh, whether on the higher or lower vegetated units, are related to the plant density and to the relative exposure of the sites. Site 19, for example, has the highest marshland accumulation rate. It is located to the lee of a sandy levee and is occupied by a dense vegetative cover comprised of 95% *Spartina maritima* and 5% *Suaeda maritima*.

The low rate of accumulation at Site 18, although in a low energy environment, seems to be related to the low plant density at the site, less than 50%, as well as a possible lack of sediment supply.

The greatest rates of accretion during the study period were in the salt pans (Table 2, Sites 15 and 16). The sediment was almost totally organic at Troia (Site 16) and with a thin layer of sand at Abul (Site 15). This fine sand layer is also evident across the surface of the retreating marsh of the Sado and the Marateca channels.

Accretion on the Sandy Levees

The largest accretion values were measured in the sandy accumulations on the channel levees (Table 2, Sites 22 and 23) and in the salt pans (Table 2, Sites 15 and 16). However, these sites are receiving sediments from different sources and thus have different characteristics. The sediments contributing to the levees in the vicinity of the Troia spit (Figure 10) are of fine sand that is derived from tidal current erosion of the inner margin of the spit. Also, the fine sand that is accumulating in the salt pans of the marsh adjacent to the Troia spit is likewise derived from the spit. It was transported by mass movement, eolian processes, and by the surface water flow associated with springs emanating at the landward base of the Troia dunes.

The sand accumulations on the levees of the Carrasqueira, Marateca, and Ilha do Cavalo marshes are derived from sandstones located in the drainage basin of the Sado estuary and are part of the fluvial load coming into the estuary.

CONCLUSION

Although there is a great variation within the observations and measurements of the erosion and accretion rates in the Sado estuary, there are some general conclusions that may be drawn from the data sets.

The mean horizontal retreat of the saltmarsh scarp for the 1978–1989 and 1983–1989 periods of 17 cm/yr gives evidence of a general loss of the salt-marsh area over this period. Much of this loss can be attributed to the human activity in the area, causing erosion directly or contributing to an increased rate of erosion. In addition, it is likely that the eustatic rise of sea level is an important

Figure 10. Sandy accretion on marginal levees of the Comporta channel; several geomorphological characteristics of the Troia spit wetlands can be observed.

contributor. The upward shifting of the sedimentary units, primarily the sandy accretion on the tidal mudflat, demonstrates a transgressive situation attributable to a rising water level.

Significantly, the accumulation rate of 1.9 mm/yr on the marsh surface is sufficient to keep pace with the sea-level rise estimated for the Portuguese coast.

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LITERATURE CITED

AMBAR, I.; FIUZA, A.; SOUSA, M.F., and LOURENÇO, L., 1980. General circulation in the lower Sado River estuary under drought conditions. NATO Seminar on *Problemas Actuais da Oceanografia Portuguesa*, scientific paper. Lisbon: 13p.

CHAPMAN, V.J., 1974. *Salt Marshes and Salt Deserts of the World*. London: Leonald Hill Books, 392p.

CRONIN, L.E. (ed.), 1978. *Estuarine Research, II—Geology and Engineering*. New York: Academic, 389p.

DAVIS, R.A. (ed.), 1978. *Coastal Sedimentary Environments*. Berlin: Springer-Verlag, 420p.

MOREIRA-LOPES, M.E.S.A., 1979. *O Estuário do Sado, Paisagem e Dinâmica*. Lisbon: Centro de Estudos Geográficos, 89p.

MOREIRA, M.E.S.A., 1984. *Glossário de Termos Usados em Geomorfologia Litoral*. Lisbon: Centro de Estudos Geográficos, 167p.

MOREIRA, M.E.S.A., 1987. Estudo fitogeográfico do ecossistema de sapal do Estuário do Sado. *Finisterra, Revista Portuguesa de Geografia*, 22(44), 247–303.

MOREIRA, M.E.S.A. and OLIVEIRA, E.M., 1988. Estuário do Sado: Identificação de unidades fisiográficas a partir de imagens LANDSAT. *Informação Técnica de Detecção Remota*, ITDR 3, 47p.

MOREIRA, M.E.S.A. and LAPA, A., 1985. Nota preliminar sobre o estudo dos sedimentos argilosos das plataformas de maré do Estuário do Sado. University of Coimbra, unpublished report.

RANWELL, D.S., 1972. *Ecology of Salt Marshes and Sand Dunes*. London: Chapman and Hall, [illegible]

RICHARD, G.A., 1978. Seasonal and envi ations in sediment accretion in a Long Island salt marsh. *Estuaries*, 1, 29–35.

STEERS, J.A., 1938. The rate of sedimentation on salt marshes on Scolt Head Island, Norfolk. *Geological Magazine*, 75, 26–39.

TABORDA, R. and DIAS, J.M.A., 1989. Tide-gauge data in deducing sea level rise and crustal movements rate: The Portuguese case. *IGU-CCE Annual Regional Symposium Guide Book*. Lisbon: 130p.

VERGER, F., 1968. *Marais et Wadden du Littoral Francais, Etude de Géomorphologie.* Bordeaux: Biscaye Frères Imprimeurs, 541p.

WOOD, M.E.; KELLEY, J.T., and BELKNAP, D.F., 1989. Patterns of sediment accumulation in the tidal marshes of Maine. *Estuaries,* 12(4), 237–246.

□ RESUMO □

Este artigo refere a dinâmica actual da plataforma de maré alta, no estuário do Sado, durante o período de 1978–1989. O balanço da sedimentação nesta plataforma caracterizou-se por um recuo generalizado da sua escarpa, de 0.7 a 10.5 cm/ano, devido a processos de deslizamento e de desmoronamento da parte superior da escarpa posteriores ao subescavamento de uma sapa basal, abaixo do nível das raízes do sapal.

Quando a taxa de cobertura da vegetação do sapal é baixa, a densidade de tocas de animais escavadores e elevada, e as poças de maré são abertas pelo recuo da escarpa ou dos canais de maré, o ravinamemto da escarpa é o processo dominante, desprendendo-se blocos de vasa compacta aglutinada pelas raízes das plantas do sapal. O valor de 45.5 cm/ano foi o máximo atingido, por este processo de recuo. Porém, os valores máximos do recuo da escarpa do sapal, de 76.7 cm/ano, foram ocasionados pela intervenção antrópica. Em sectores abrigados do estuário verifica-se o avanço do sapal sobre a plataforma de maré baixa, tendo-se registado o valor máximo de 1 m/ano.

Durante o mesmo período a acumulação de materiais sobre a superfície da plataforma do sapal, apesar de não ser uniforme, atingiu valores médios anuais de 0.8 e 5.3 mm/ano, enquanto nos bancos arenosos das margens dos principais esteiros, este valor atinqiu 106 mm/ano. Sobre os lodaçais e também sobre alguns sectores do sapal, observou-se a acumulação de uma estreita camada de areia. Este fenómeno e o recuo generalisado da escarpa da sapal atestam uma recente elevação local do nível do mar.

□ RÉSUMÉ □

Cet article présente la dynamique sédimentaire actuelle de la plate-forme du schorre de l'estuaire du Sado, pendant la période 1978–1989. Le bilan sédimentaire de cette plate-forme est caractérisé par le recul de la micro-falaise du schorre, de 0,7 à 10,5 cm/an, à cause du glissement de la corniche de la microfalaise, aprés sapement basal.

Quand la végetation n'est pas très dense et que la densité des animaux fouisseurs est grande, quand les mares du schorre sont ouvertes par l'érosion, le processus le plus éfficace est le ravinement suivi d'un èboulement de bloules de vase (recul moyen de 45,4 cm/an). La valeur maximale du recul de cette micro-falaise (76,7 cm/an), résulte l'aménagement des marges des étiers.

Dans les secteurs les plus abrités de l'estuaire, on vérifie des phénomènes d'accrétion, à cause de la progression de la végetation du schorre sur la slikke sablo-vaseuse. L'accrétion verticale qui a été observée n'est pas regulière; des valeurs moyennes de 0,8 à 5 mm/an sont observées sur la surface du schorre et de 31,5 à 106 cm/an sur les leveés sableuses. Presque partout, l'ensablement des slikkes vaseuses et de quelques secteurs du schorre est un phénoméne actuel. Ce fait associé au recul généralisé du schorre résulte de l'activité humaine et de l'élevation locale du niveau de la mer.