UNIVERSIDADE DO ALGARVE

FACULDADE DE CIÊNCIAS DO MAR E DO AMBIENTE

OVERWASH SEDIMENTARY DYNAMICS IN THE RIA FORMOSA BARRIER ISLANDS

(Tese para a obtenção do grau de doutor no ramo de Ciências do Mar,
especialidade de Geologia Marinha)

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TÍTULO DA TESE: Dinâmica Sedimentar de Galgamentos Oceânicos nas Ilhas Barreira da Ria Formosa

Resumo

O objectivo principal desta tese é o estudo da dinâmica sedimentar de galgamentos oceânicos. A área de estudo foi o sistema de ilhas barreira da Ria Formosa, e os principais aspectos abordados nesta tese foram: (a) transporte sedimentar induzido por galgamentos; (b) factores que governam a sedimentação de galgamento e o papel relativo dos galgamentos na dinâmica das ilhas barreira; (c) assinatura textural dos cortes de galgamento, e (d) classificação da dinâmica dos cortes de galgamento. Foi determinado o transporte sedimentar sob fluxos de galgamento confinados e não-confinados, incluindo variações morfológicas, remobilização e padrões de transporte. Os factores que governam a sedimentação de galgamento, incluindo condições de tempestade e de não-tempestade, bem como o papel relativo dos processos de galgamento, foram estabelecidos com base num estudo de médio-termo de uma barreira frequentemente galgada. A assinatura textural dos cortes de galgamento foi determinada e relacionada com os processes costeiros, num estudo comparativo com amostras de ambientes sedimentares adjacentes (duna, praia e barra de maré). A classificação da dinâmica de cortes de galgamento foi desenvolvida com base na interpretação de fotografia aérea. A classificação assenta na identificação dos mecanismos responsáveis pela formação e desaparecimento dos cortes, bem como na tendência evolutiva dos galgamentos.

Palavras-chave: galgamento; corte de galgamento; ilhas barreira; transporte sedimentar; classificação costeira; granulometria.

TITLE: Overwash Sedimentary Dynamics in the Ria Formosa Barrier Islands

Abstract

The main objective of this thesis is to study the overwash sedimentary dynamics. The study area was the Ria Formosa barrier island system, and the main issues addressed in this thesis were: (a) overwash sediment transport; (b) the factors governing overwash sedimentation, and the relative role of overwash in barrier island dynamics, (c) the washover textural signature, and (d) the classification of washover dynamics. Overwash sediment transport was determined for both confined and unconfined overwash flows, and include morphologic variations, mixing depth, and transport patterns. The factors governing overwash sedimentation, including storm and non-storm conditions and the relative role of overwash processes were established based on a medium-term study of a frequently overwashed barrier. The textural signature of washovers was determined in relation with the associated coastal processes in a comparative study with samples from the adjacent sedimentary environments (dune, beach, and tidal inlet). The classification of washover dynamics was developed based on the interpretation of a set of aerial photographs. The classification relays in the identification of the mechanisms responsible for the formation and disappearance of washovers, and on the overwash evolutionary trend.

Key-words: overwash; washover; barrier islands; sediment transport; coastal classification; grain-size.

Para o Miguel,
porque somos "nós",

Para a Mariana e o Pedro,
porque iluminam o mundo quando sorriem para "nós"

Para a Mãe Rosário, Pai João e Janeca
porque quando olho para mim vejo-nos a "nós"

Em memória da Avó Gerturdes,
por ter vivido para "nós"

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HOW THIS THESIS BECAME POSSIBLE:

I like mind challenges and I like to be outdoors. This probably explains why I found the overwash an interesting issue. Working under rough weather, around the clock sounded OK to me. However, when I realised that I needed to put my colleagues under these conditions, I knew that I probably had a lot of acknowledgments to make. Therefore, my first ackowlegments are for the people that made fieldwork for this thesis: Alexandre Braga, Ana Vila, André Pacheco, Brad Morris, Carla Garcia, Catarina Sá Pires, Francisco Plaza, Isabel

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It was a little crazy to set myself to do all this challenging work, but I was in my late 20's; it was much more surprising to me that my supervisors made a smile when we spoke about deploying our equipment on the beach during an overwash event. My second acknowledgements is then to my supervisors who encouraged and supported me.

Prof. Alveirinho Dias was the first person I met from the University of Algarve. We arrange a meeting in a coffee shop in front of the Museum of Natural History, in Lisboa, and he asked me a lot of questions about what were my expectations, what I would like to do after finishing my degree. When I started to work in his own office, at Gambelas, a few months later, his priority was to teach me "Team Work". I think he can be proud of that, maybe I even learned it a bit too well…

Prof. Óscar Ferreira was a "compagnon de route" of this work. He helped me since the idea first came into our heads until the painful reading of the entire manuscript. Óscar knew when to guide, to follow, and most of all to be by my side when I needed it. After 10 years of working with him, I can now look at a manuscript full of notes and arrows in different orientations, written with different coloured pens (except red!) and don't panic. He is more demanding with the people he appreciates. I still find it surprising how fast he finds my mistakes in computations.

My supervisors work at the University Campus of Gambelas, but I developed my own work in CIACOMAR, in Olhão, 15 km apart. The ones that mostly suffered with my bad temper were my colleagues in CIACOMAR. To them goes my profound appreciation for the companionship. Because I'm the dinosaur of CIACOMAR, I shared the space with many different persons, and just to mention the ones that immediately came to mind: Ana Vila, Isabel, Rita, André, Brad, Ricardo, Margarida, Célia, sr. Cunha, Tiago, Ramon, Carla,

Catarina, Amélia, Marcos,…CIACOMAR is that special place were Ramon walked with no shoes on, sr. Cunha tells his old adventures at IH, everybody enjoys Margarida's cakes, Tiago listens loudly to U2, André constantly walks around the place trying to find something, Isabel plays in the lab with pink tiny bugs, Rita stinks the place with smelly lagoon stuff, Ricardo played with a strange torpedo that made an annoying bip-bip, Paco couldn't look straight at his strange long sheets full of lines, and Amélia used to say people at CIACOMAR are "different". I wonder why…

Ana Vila-Concejo was one of my oldest and dearest colleagues from CIACOMAR. Because she worked in beach morphodynamics and tidal inlets, we had a lot of open-minded, long, and enjoyable discussions that helped me think and better sustain my conclusions. I must say that these discussions are one of the things I most miss since she left to Australia (that and the imitation of the fish "Nemo").

Brad Morris did most of the monitoring surveys, with the heavy GPS roving unit at his back. Meanwhile, I had 2 children and fieldwork continued, with Ana Vila and Brad taking charge of the fieldwork coordination and execution. I think this is one of the best demonstrations of team work at CIACOMAR. Because I'm a Portuguese person writing a thesis in English, of course I took advantage of having an Australian friend, and Brad was again the victim. For a physical oceanographer it must be painful to read a whole chapter about the size of sand grains!

To my family and friends, I will always be grateful: my brother's hilarious jokes, my mother's "cozido à portuguesa", my father holding the back of the bike, my husband's eyes, "mamã" as first word, the movies I see with Brotas when children are a sleep, the IST lunches with Ricardo, the fabulous stories of Gavinhos, the long phone calls with Zézita, the late lunches at Praia Verde with Betty and Chico, the barbarian invasions of my house in the summer, and so many other good moments.

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