

Beach to Canyon Head Sedimentary Processes



João Duarte, Rui Taborda & Equipa *Beach to Canyon*

2^{as} Jornadas de Engenharia Hidrográfica
Lisboa 20,21 e 22 de Junho de 2012

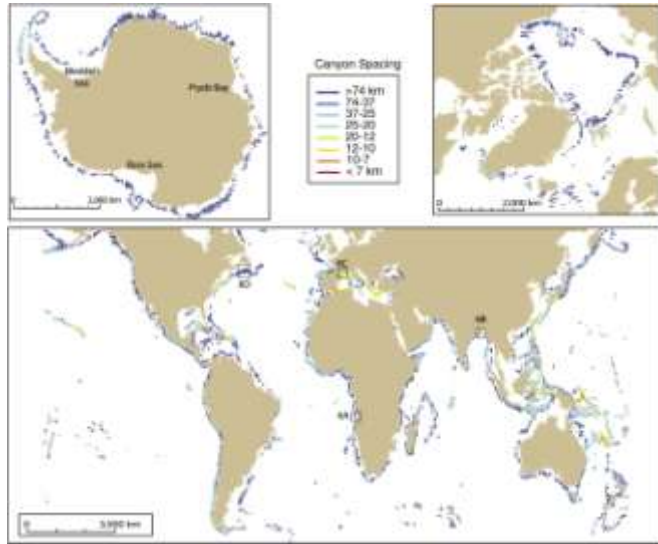


Beach to Canyon Head Sedimentary Processes

Portuguese Science Foundation (FCT)
PTDC/MAR/114674/2009

- Scientific Background
- Project Objectives
- Management and Tasks
- Activities

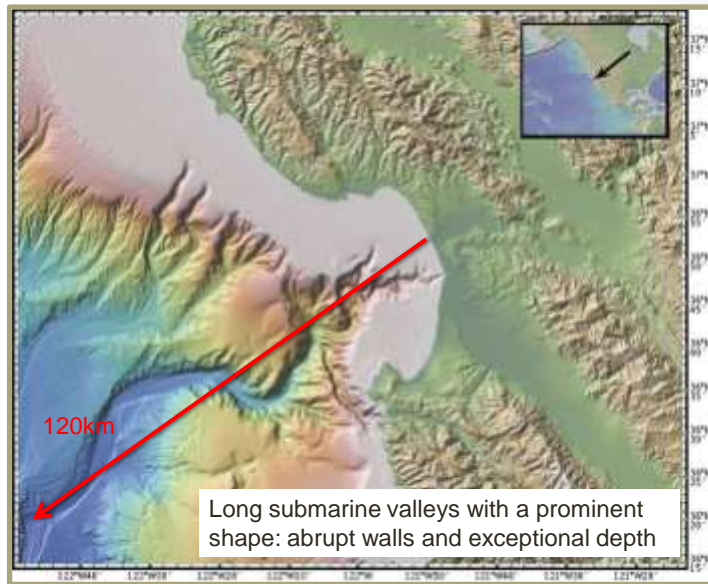
World submarine canyons



- Total mapped: 5849; based on ETOPO bathymetry (Harris & Whiteway, 2011)

2^{as} Jornadas de Engenharia Hidrográfica
Lisboa 20,21 e 22 de Junho de 2012

Submarine canyons with coastal signature

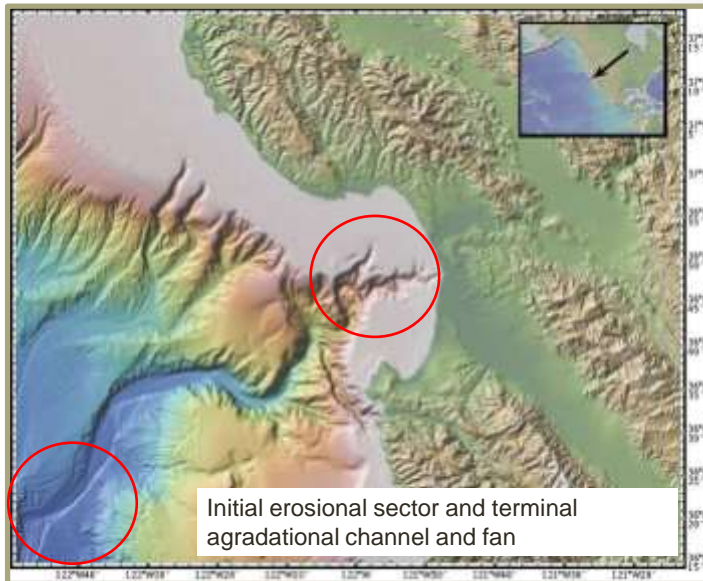


Long submarine valleys with a prominent shape: abrupt walls and exceptional depth

Monterey Canyon - GeoMapApp

2^{as} Jornadas de Engenharia Hidrográfica
Lisboa 20,21 e 22 de Junho de 2012

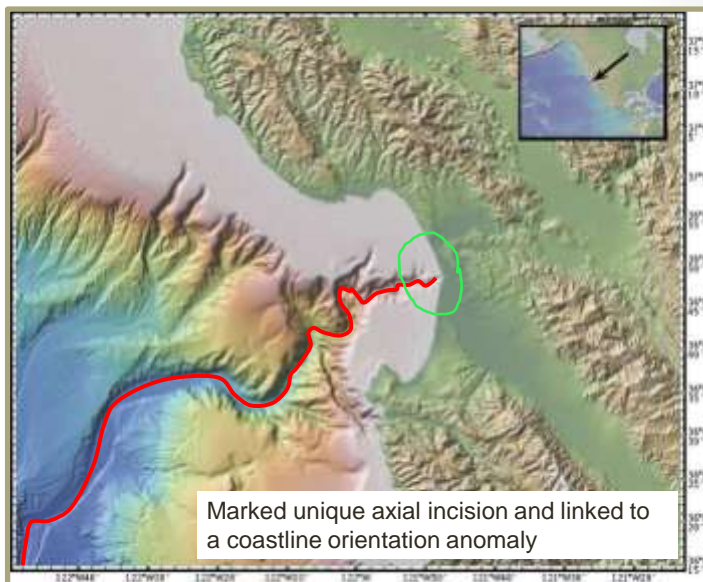
Submarine canyons with coastal signature



Monterey Canyon - GeoMapApp

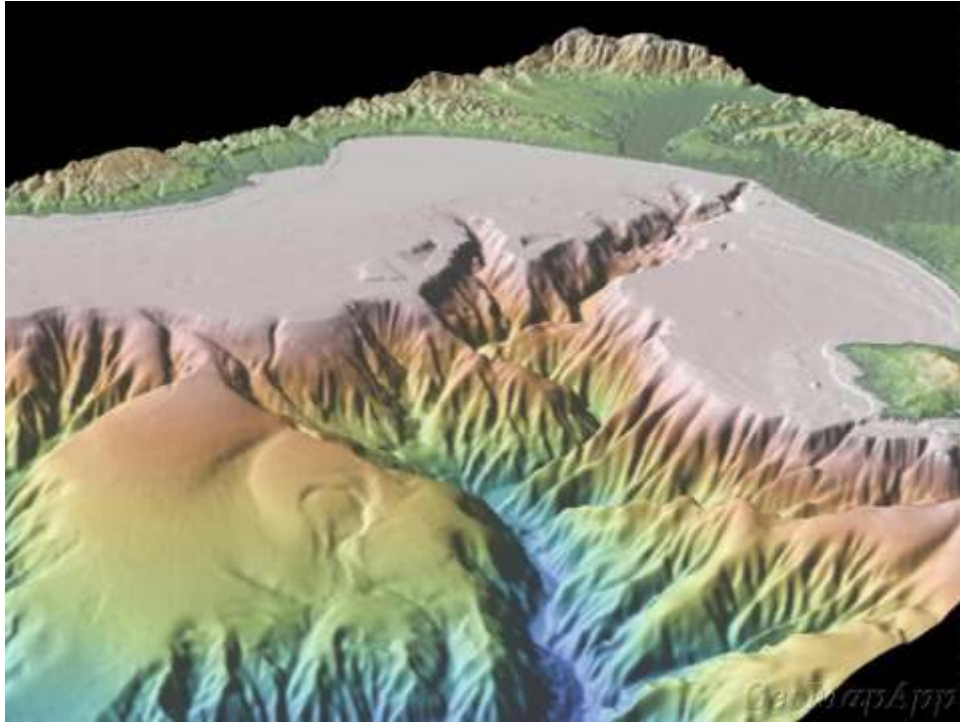
2^{as} Jornadas de Engenharia Hidrográfrica
Lisboa 20,21 e 22 de Junho de 2012

Submarine canyons with coastal signature

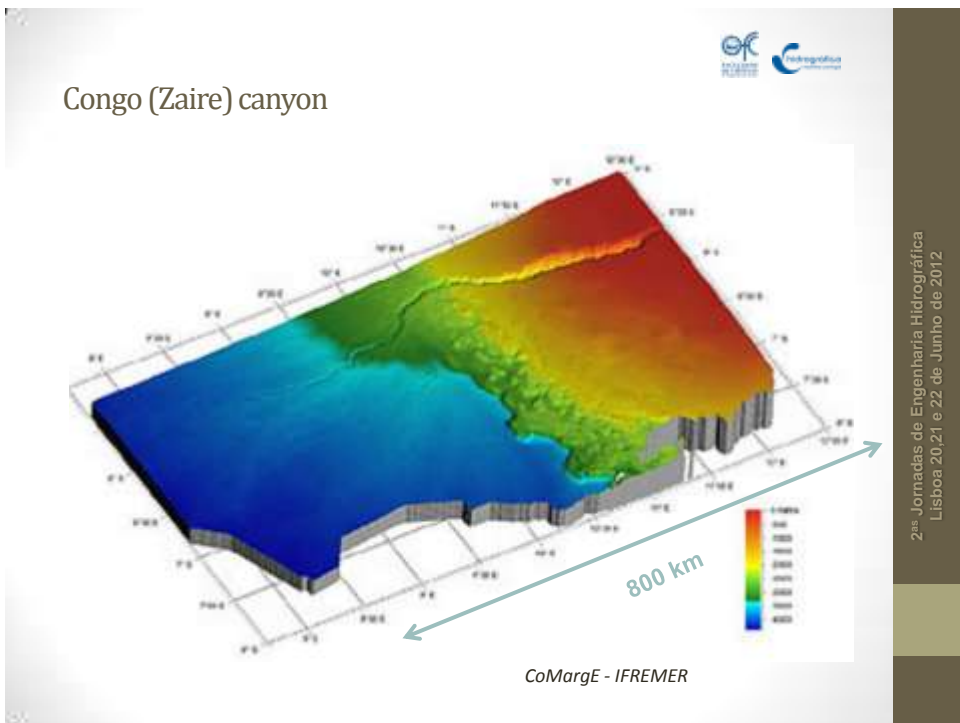


Monterey Canyon - GeoMapApp

2^{as} Jornadas de Engenharia Hidrográfrica
Lisboa 20,21 e 22 de Junho de 2012

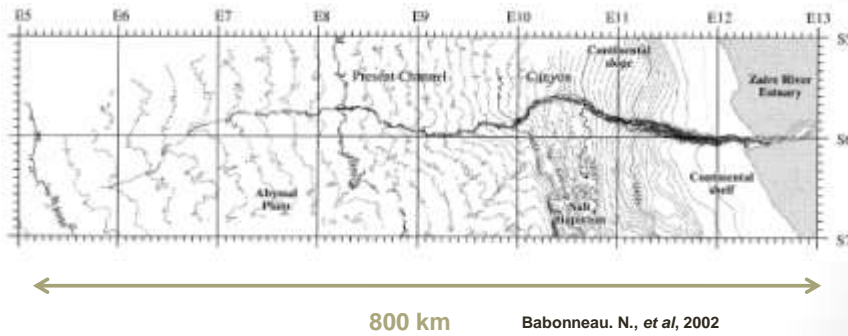


Congo (Zaire) canyon



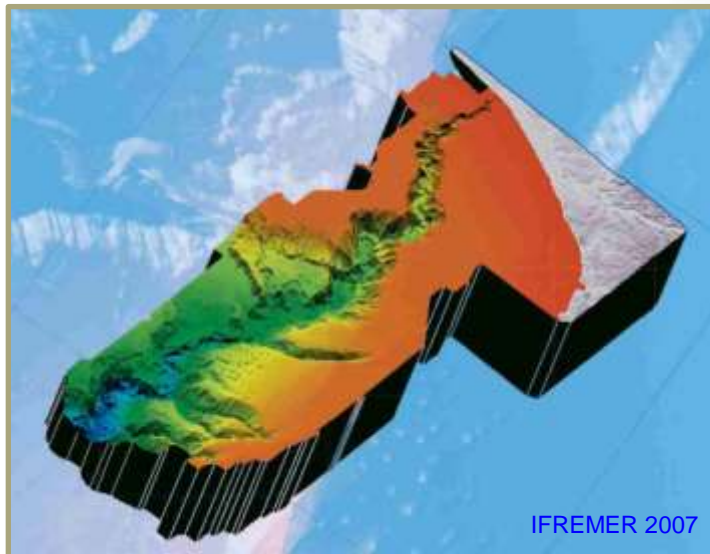
2^{as} Jornadas de Engenharia Hidrográfrica
Lisboa 20/21 e 22 de Junho de 2012

Congo (Zaire) canyon



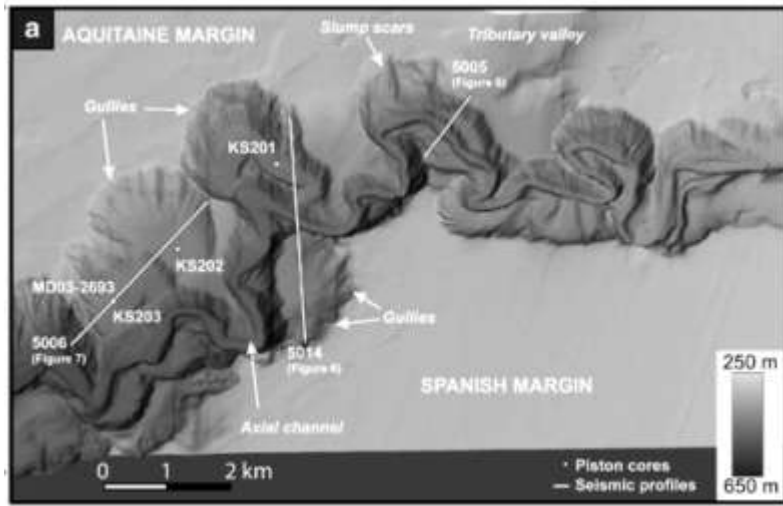
2^{as} Jornadas de Engenharia Hidrográfrica
Lisboa 20,21 e 22 de Junho de 2012

Capbreton canyon



2^{as} Jornadas de Engenharia Hidrográfrica
Lisboa 20,21 e 22 de Junho de 2012

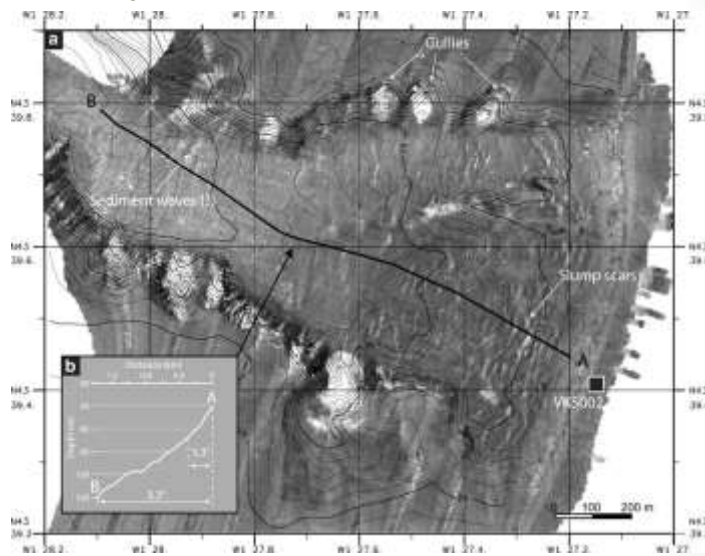
Capbreton canyon



Gaudin, M., et al, 2006

2^{as} Jornadas de Engenharia Hidrográfica
Lisboa 20.21 e 22 de Junho de 2012

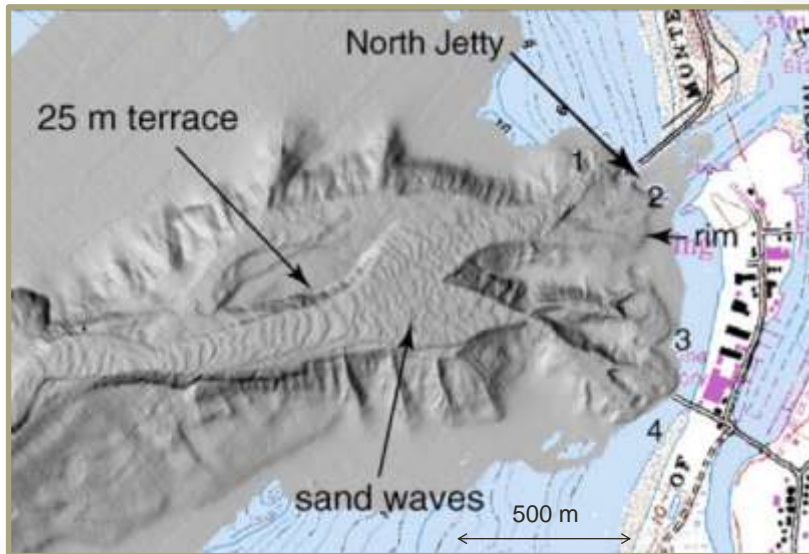
Capbreton canyon head



Gaudin, M., et al, 2006

2^{as} Jornadas de Engenharia Hidrográfica
Lisboa 20.21 e 22 de Junho de 2012

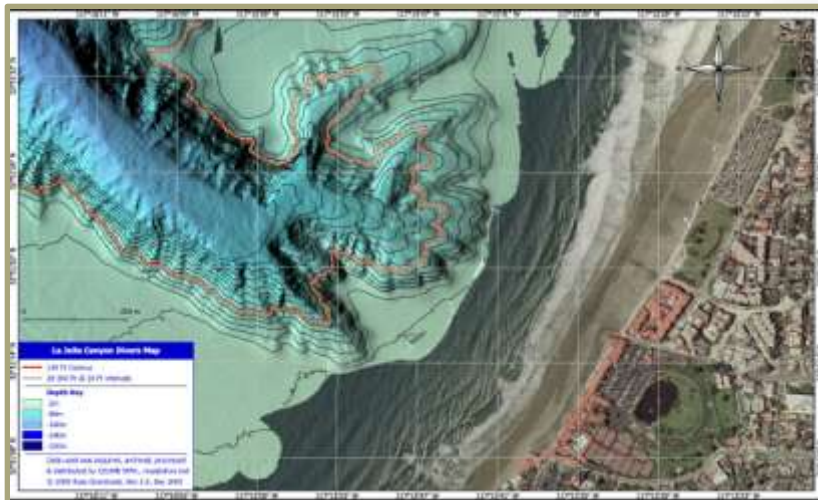
Monterey canyon head



Smith Douglas P., et al, 2007

2^{as} Jornadas de Engenharia Hidrográfica
Lisboa 20,21 e 22 de Junho de 2012

La Jolla canyon head



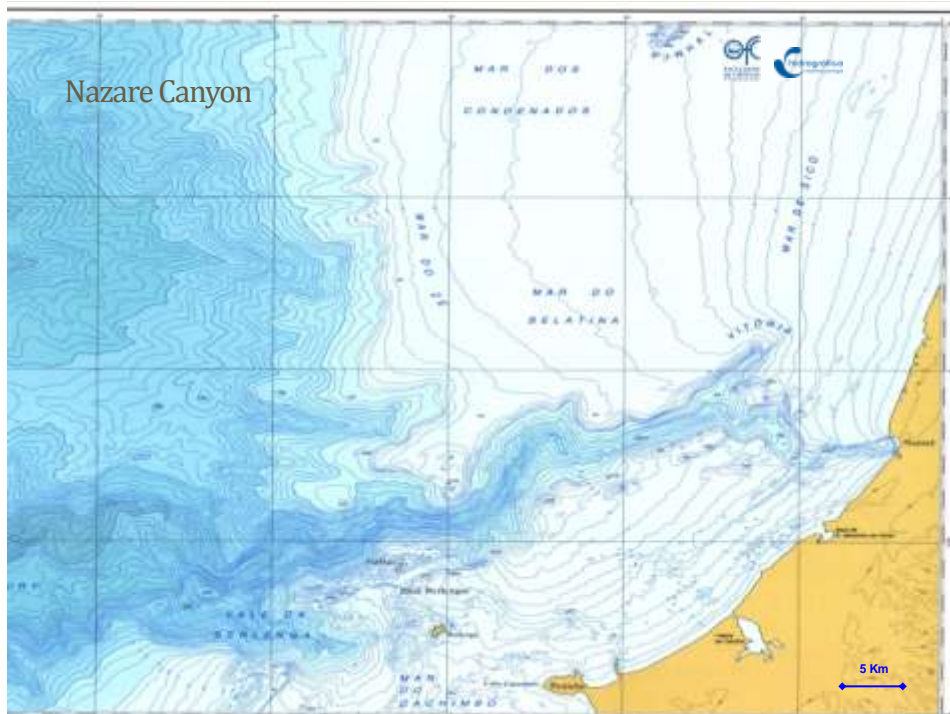
Ross Overstreet 2005

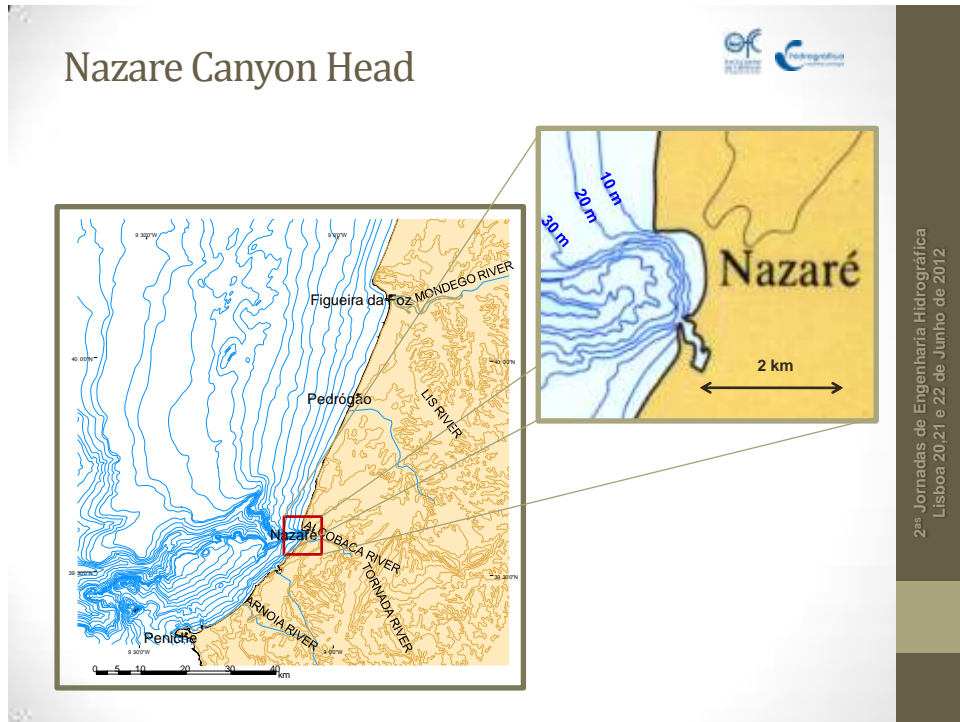
2^{as} Jornadas de Engenharia Hidrográfica
Lisboa 20,21 e 22 de Junho de 2012

Submarine canyons with coastal signature

Sediment conduits

- Sometimes linked with rivers but **mostly they're not**
- Major sediment transport system
- Large coarse sediment catastrophic events (sand, gravel, pebles and blocs)
- Examples:
 - Congo canyon: 60 submarine cable cuts in 100 years (Khripounouff, A., *et al*, 2003)
 - Var Canyon: landfill colapse on canyon head originated a tsunamy, bulldozer transported to 1400 m depth, 2 cable cuts more than 100 km and 2600 m depth (Mulder, *et al*, 2000)





Canyon heads & B2C Project

- The erosional power seems to be mostly injected on the canyon head
- Coarse sediment and axial incision are linked
- Precursors:
 - Project SECNA - Instituto Hidrográfico 1999/2000
 - EUROSTRATAFORM, HERMES, MONICAN & SIMOC PROJECTS

2^{as} Jornadas de Engenharia Hidrográfica
Lisboa 20/21 e 22 de Junho de 2012



Issues to address

- Coastal sink of unknown magnitude (sediment budget);
- Nature and scale of the canyon-head processes influence on the coastline evolution
- Can we identify a positive retroactive process of nearshore incision and sand injection processes?
- Distal contribution (terminal fan sedimentation)

2^{as} Jornadas de Engenharia Hidrográfica
Lisboa 20/21 e 22 de Junho de 2012

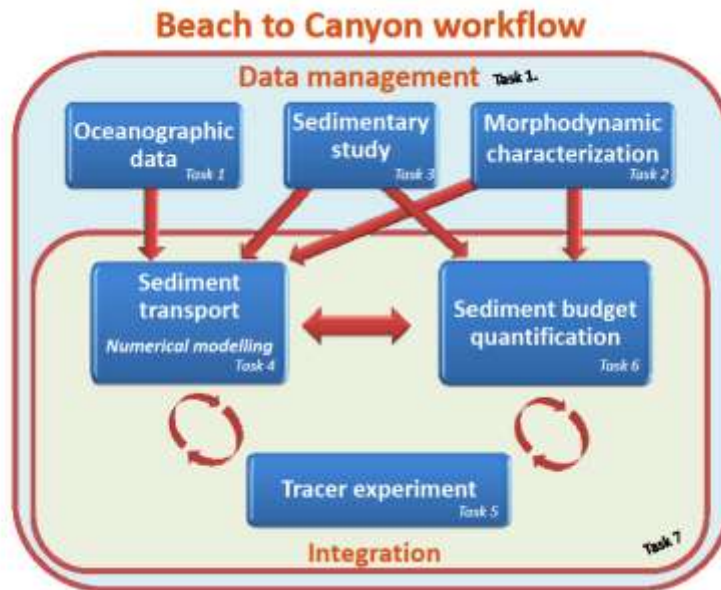


Objectives

- Understand the sedimentary injection/capture process into the canyon head
- Recognize the most important forcing mechanisms
- Identify sediment paths, geomorphological constrains and morphodynamics

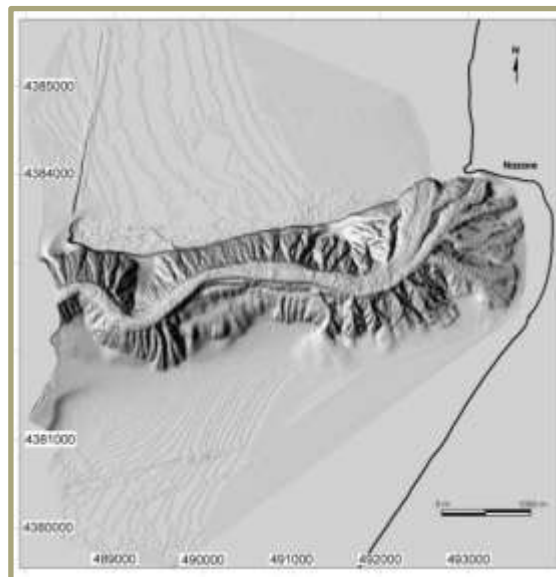
2^{as} Jornadas de Engenharia Hidrográfica
Lisboa 20/21 e 22 de Junho de 2012

Task Structure



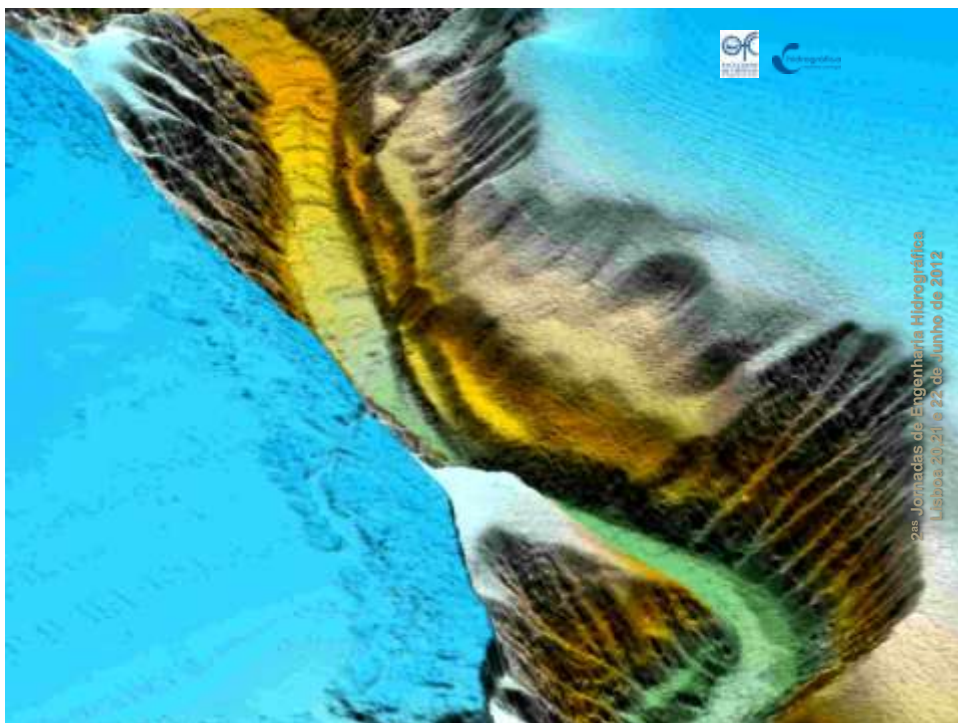
2^{as} Jornadas de Engenharia Hidrográfrica
Lisboa 20,21 e 22 de Junho de 2012

Previous results (2000)

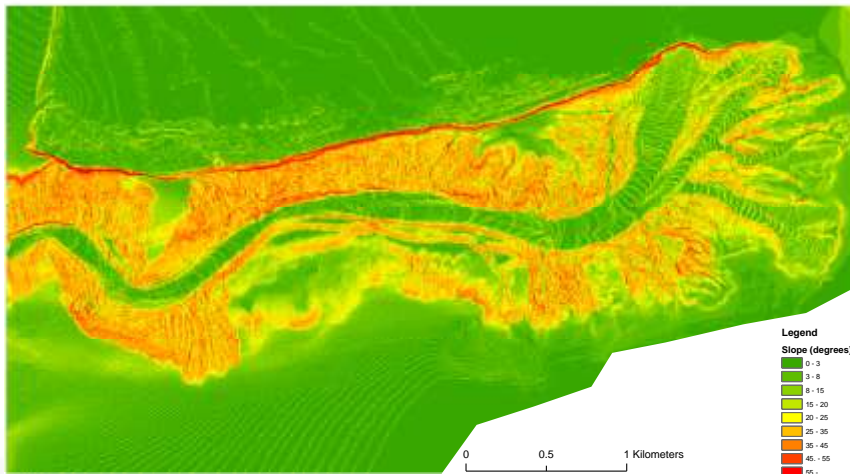


Kongsberg EM950 survey

2^{as} Jornadas de Engenharia Hidrográfrica
Lisboa 20,21 e 22 de Junho de 2012



Previous results (2000)



High resolution slope chart

2^{as} Jornadas de Engenharia Hidrográfica
Lisboa 20/21 e 22 de Junho de 2012

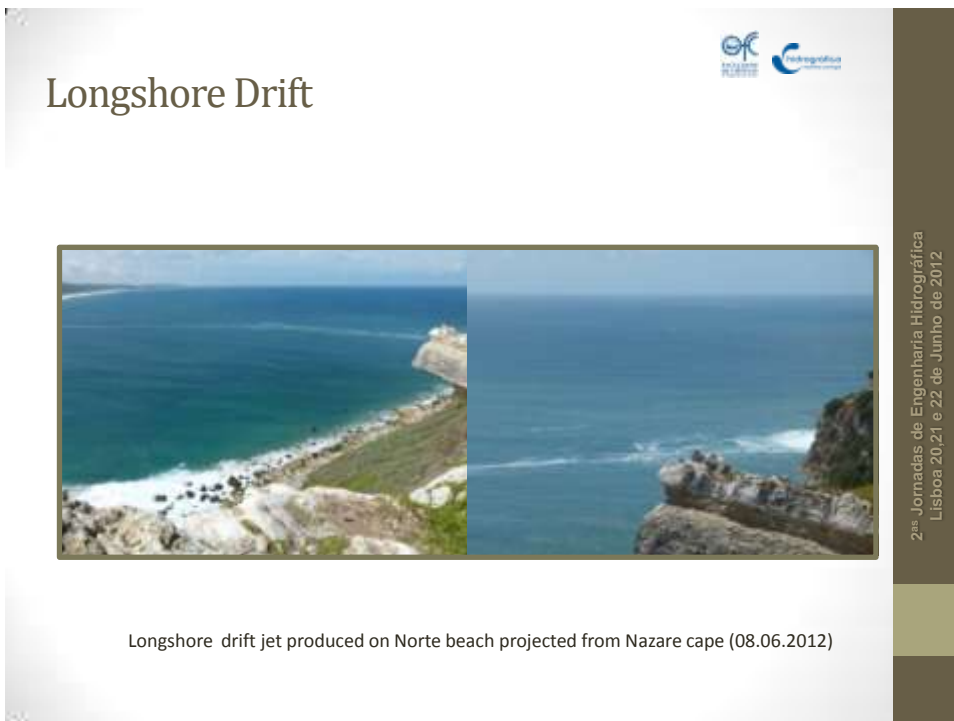
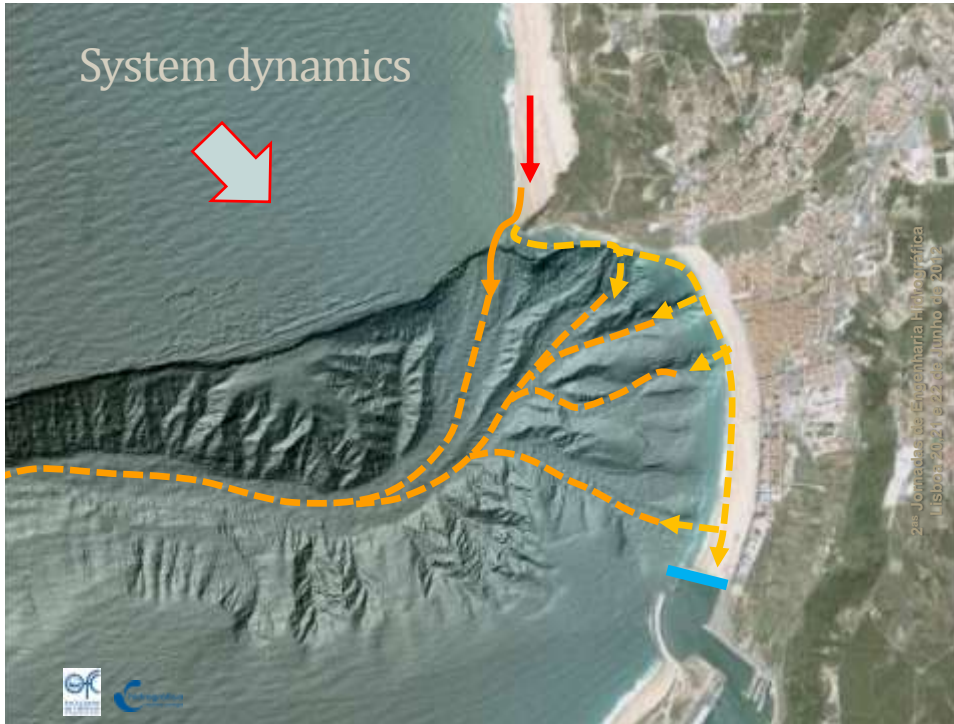
Sediment supply



Longshore Drift

Inner shelf transport

2^{as} Jornadas de Engenharia Hidrográfica
Lisboa 20/21 e 22 de Junho de 2012



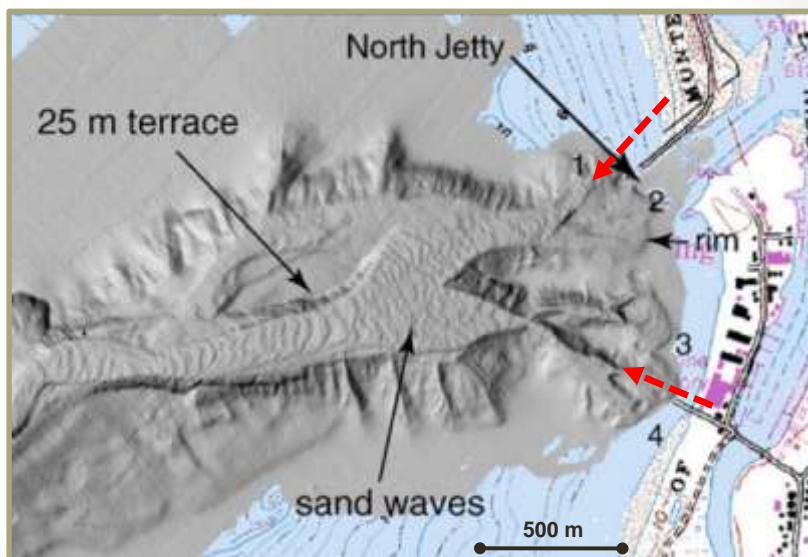
Canyons 2003 – RV Pelagia



Medium sized sands at 800 m depth on the Nazare canyon axis

2^{as} Jornadas de Engenharia Hidrográfica
Lisboa 20/21 e 22 de Junho de 2012

Monterey canyon head



Smith, Douglas P., et al, 2007

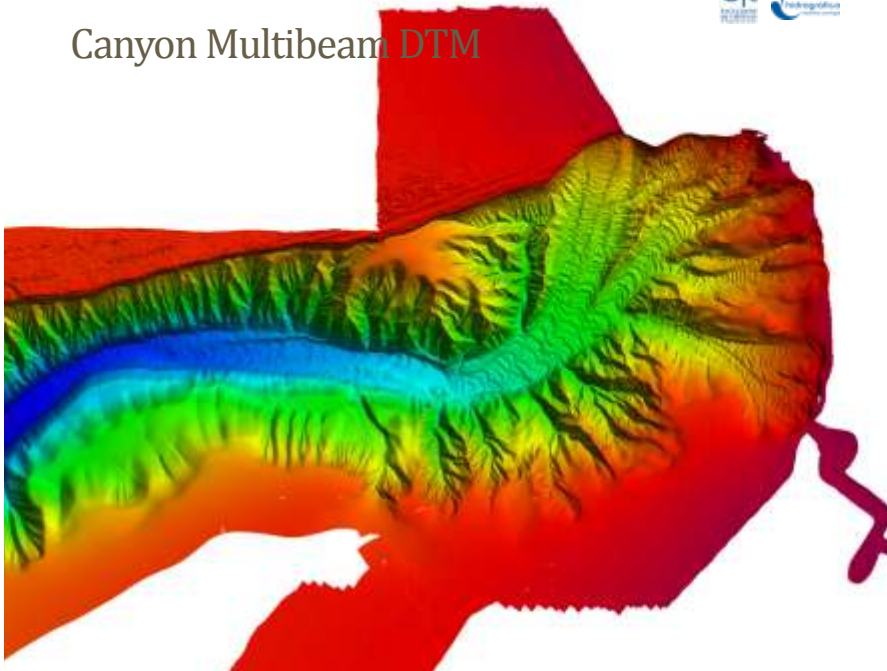
2^{as} Jornadas de Engenharia Hidrográfica
Lisboa 20/21 e 22 de Junho de 2012

B2C task status

- Multibeam survey of the canyon head using a EM3002 Kongsberg system combined with a EM710 (NRP Almirante Gago Coutinho)
- EM710 multibeam survey of Tributário de Vitória head
- Vibrocores samples of the direct sink sand spots inside the canyon head (aprox. 100 m)
- Beach topography and sediment sampling
- Video monitoring of Norte beach, wave swelling area and Baía da Nazaré beach

2^{as} Jornadas de Engenharia Hidrográfica
Lisboa 20,21 e 22 de Junho de 2012

Canyon Multibeam DTM



2^{as} Jornadas de Engenharia Hidrográfica
Lisboa 20,21 e 22 de Junho de 2012

Vibrocore samples



2^{as} Jornadas de Engenharia Hidrográfica
Lisboa 20,21 e 22 de Junho de 2012

Video monitoring



- Sítio da Nazaré



2^{as} Jornadas de Engenharia Hidrográfica
Lisboa 20,21 e 22 de Junho de 2012

Video monitoring


- Sítio da Nazaré



2^{as} Jornadas de Engenharia Hidrográfica
Lisboa 20,21 e 22 de Junho de 2012

Video monitoring

- Norte beach and wave swelling area



2^{as} Jornadas de Engenharia Hidrográfica
Lisboa 20,21 e 22 de Junho de 2012