Sedimentology and Geobiology of Deep Carbonate Slopes from the Osprey and Nearby Reefs (Queensland Plateau, NE Australia)*

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Search and Discovery Article #50631 (2012)**
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Abstract

The Queensland Plateau (QP) is a drowned small continent SE off Australia and is characterized by vast atoll-like reef platforms which have been poorly investigated only. The reefs are located on basement highs and exhibit carbonate deposits of up to 2000 m of thickness. Some of the reef slopes located at the western margin of the QP were investigated during a German expedition in 2009 (http://www.deepdownunder.de) using the 'Cherokee'-ROV from the MARUM (Bremen) down to ca. 800 m water depth. The expedition's goals were to investigate the steep slopes of the Osprey Reef and other reefs (Holmes-, Bougainville-, and Shark Reef), big allochthonous blocks ("Cipit Boulder" type - known from Triassic reef slopes of the Dolomites/Italy), microbial cementation processes, and benthic community analyses. Special foci were set on so-called "living fossils" like hexactinellid and lithistid sponges, echinoderms (e.g. stalked crinoids), deep water corals, and brachiopods, with observations on exceptionally deep-migrating (800 m) Nautilus communities. The slopes are characterized by often vertical walls down to 600 m which exhibit grooves where shallow water sediments are channelized during big storms and quakes. The talus deposits consist of carbonate sediments dominated by Halimeda chips, reef debris, and decametre-scale boulders. These boulders show distinctive dark microbial Fe/Mn crusts covering on the protected surfaces from normal sediment flux. Fluffy sediments covering the exposed top surfaces are cemented by microbial activity forming brownish microbialites like those known from deep reef cave environments. The talus blocks are settled by organisms mainly of the so-called "living fossils". Soft bottoms of the vast plains between the boulders are characterized by an intense bioturbation activity by endo- and

epibenthic assemblages (e.g. invertebrates and demersal fish). Geological settings and benthic distribution were analysed by sampling and imaging methods applied to underwater video footage gained by the ROV ‘Cherokee’.

References

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Websites

Deep Down Under: Web accessed 21 June 2012. http://www.deepdownunder.de

Sedimentology and Geobiology of Deep Carbonate Slopes from the Osprey- and nearby Reefs (Queensland Plateau, NE Australia) – The Search for Mesozoic/Cenozoic Relic Fauna - „Living Fossils“

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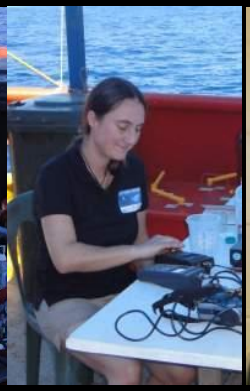
Osprey Reef
Landsat

Deep Down Under Expedition December 2009

Queensland Plateau
Search for relic fauna
„living fossils“

JR

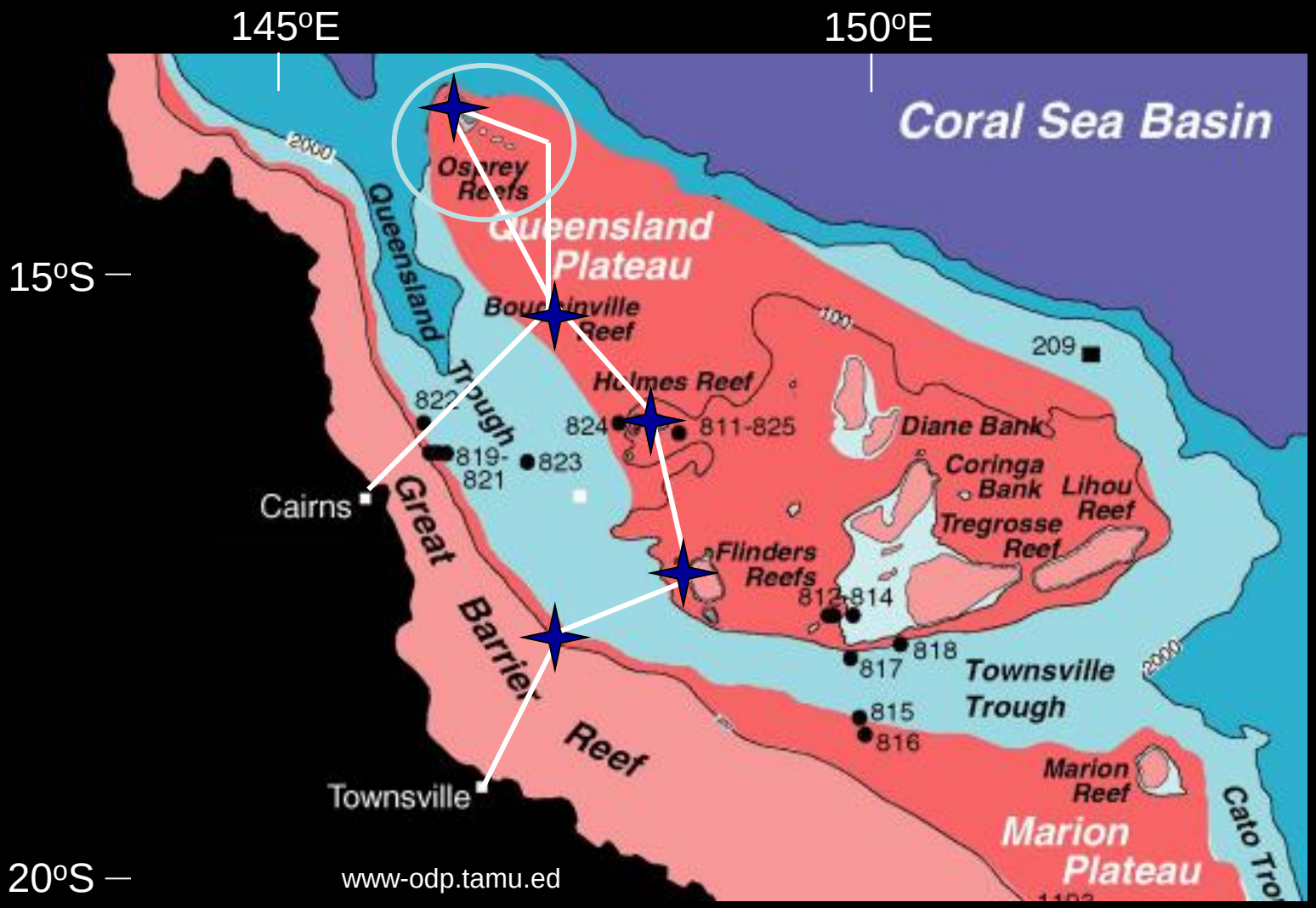


Nadia Queric

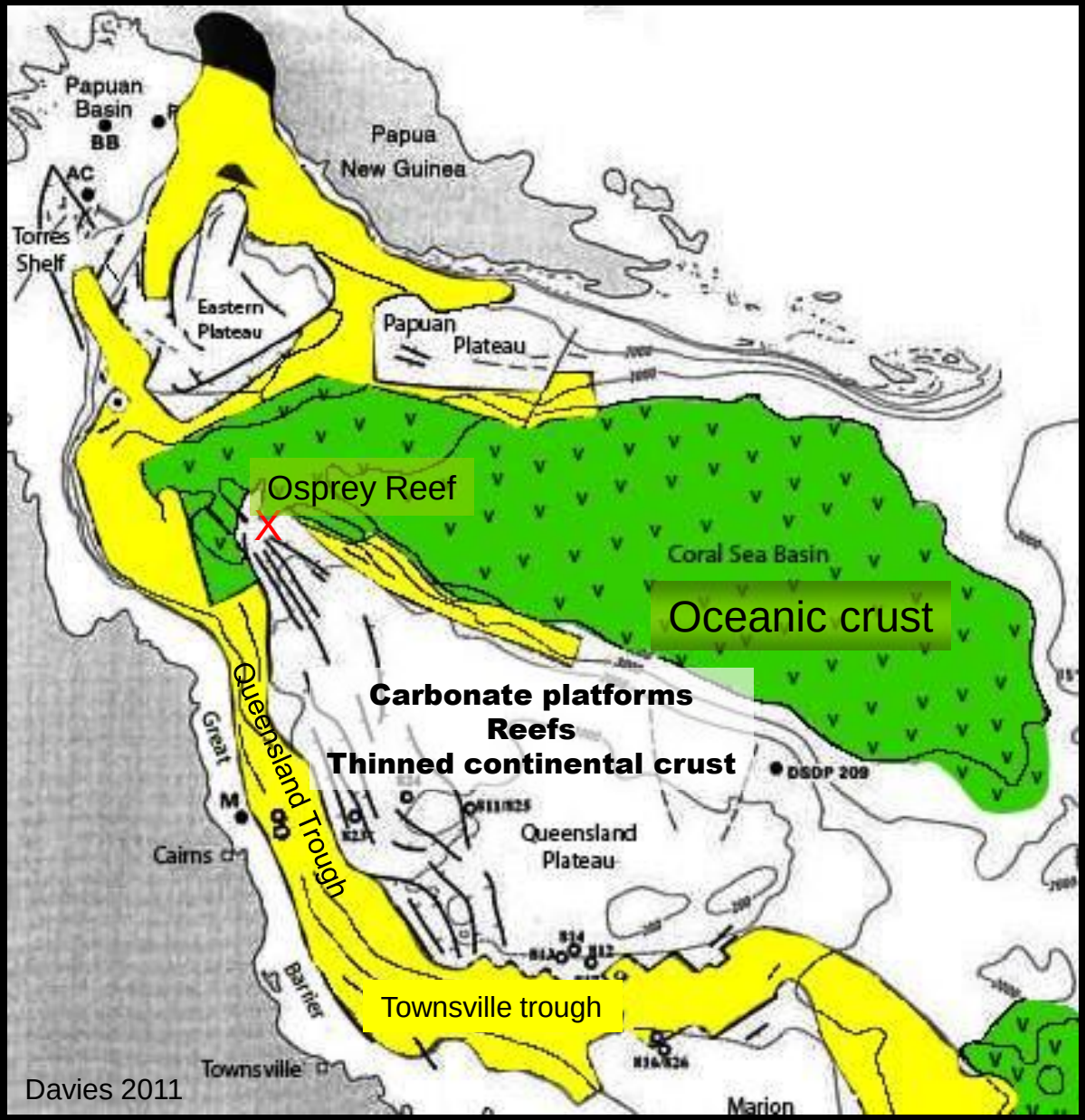
Gert Wörheide

Carsten Lüter

Expedition Route - DDU

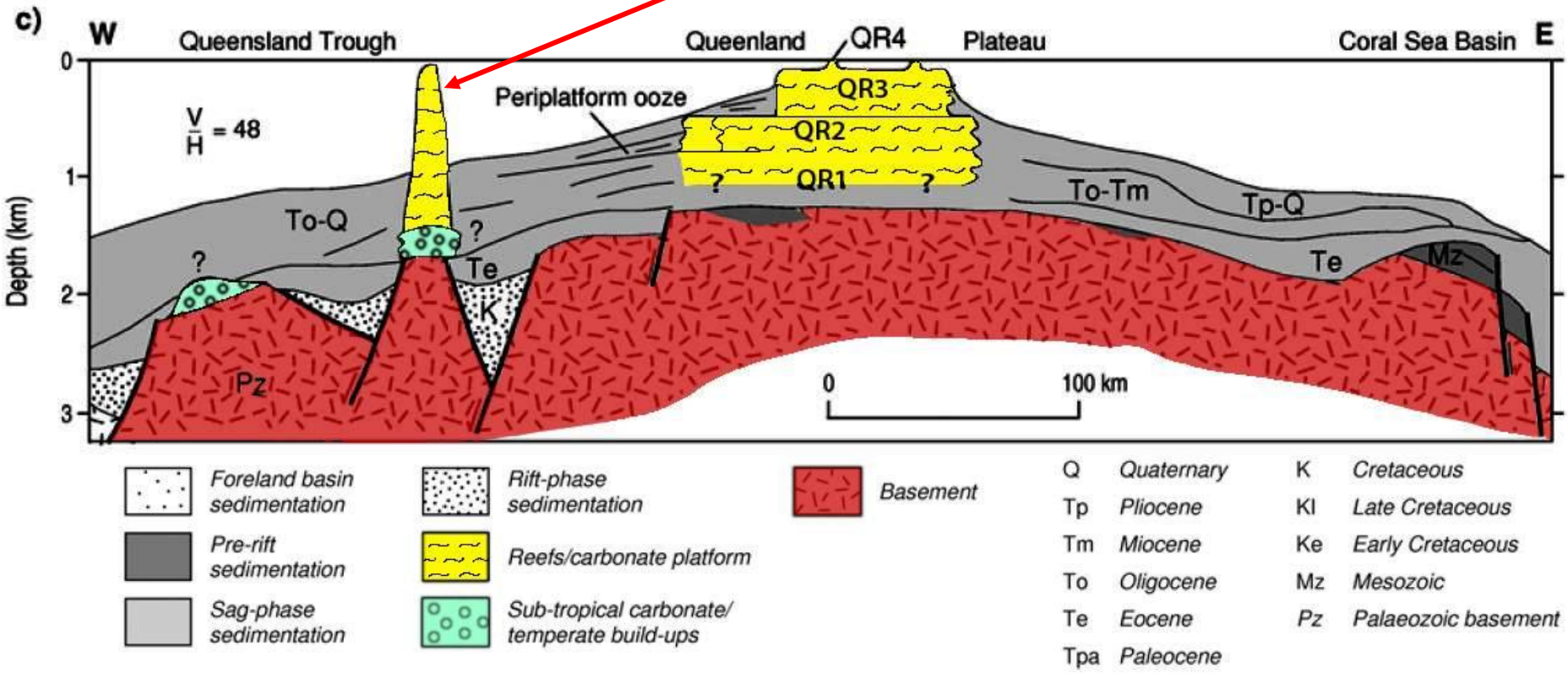


Basic Geology of the Queensland Plateau



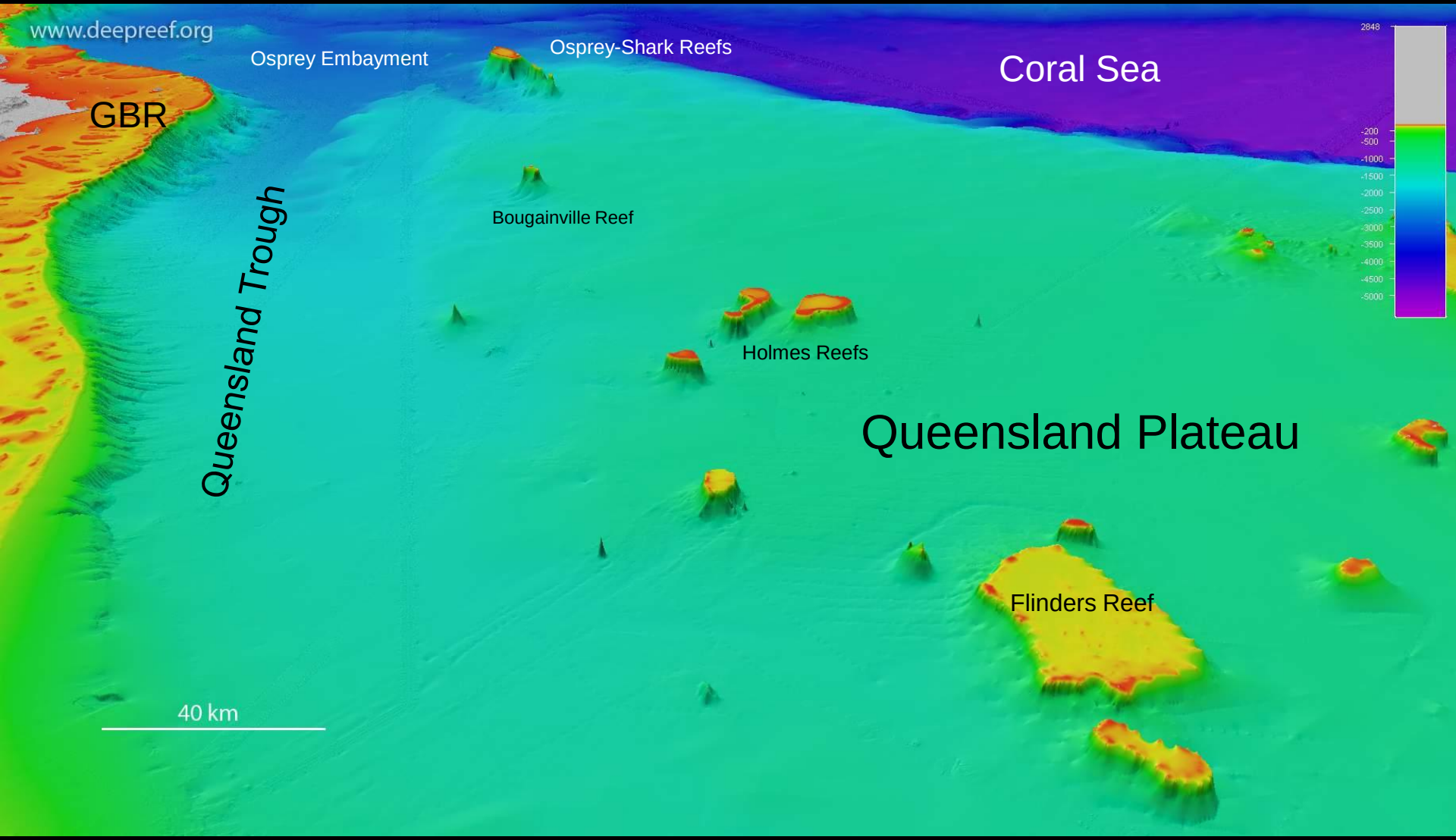
Basic Geology of the Queensland Plateau

Isolated atoll-like reefs, e.g. Osprey Reef

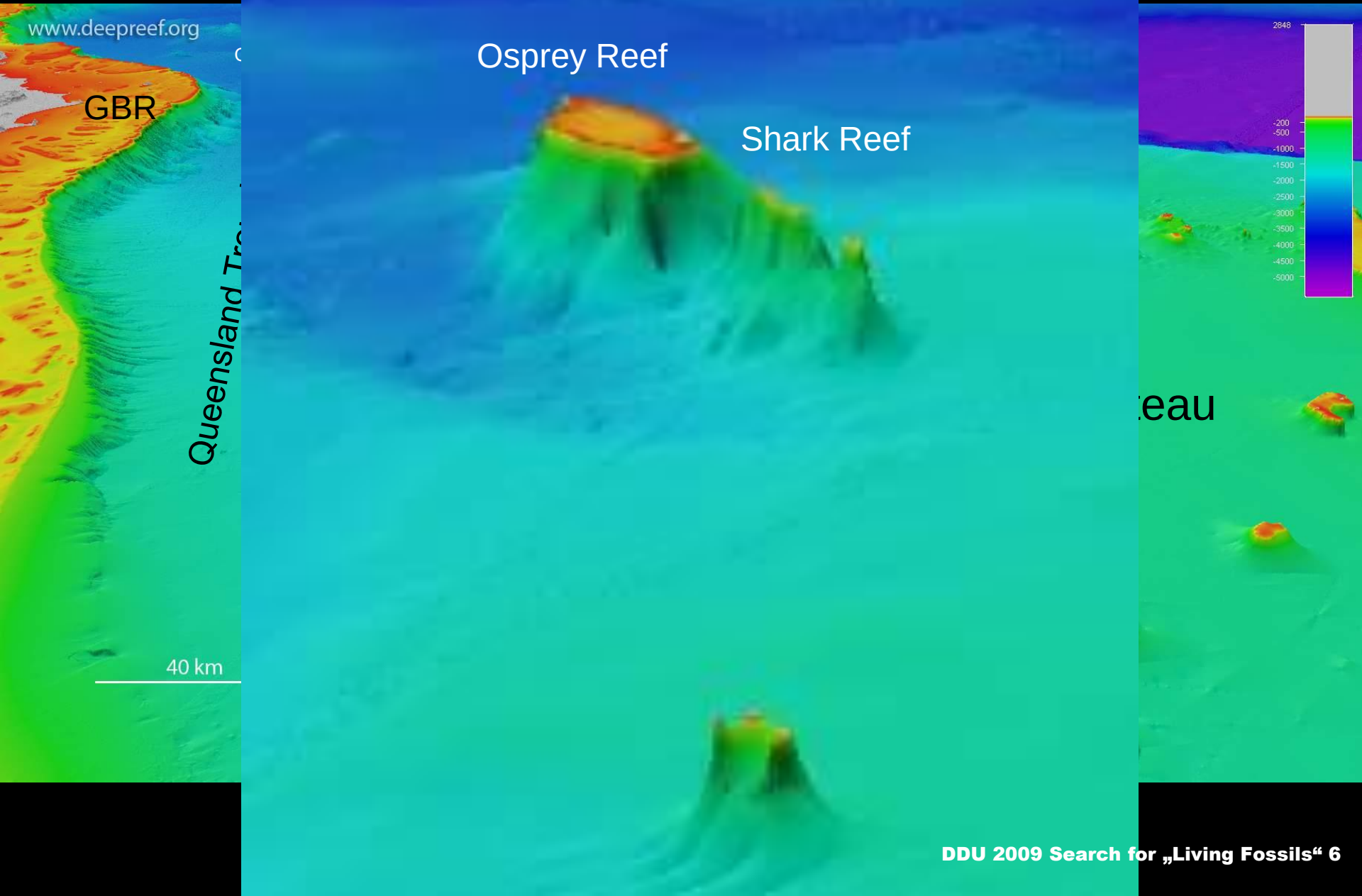


Wellman et al 1997

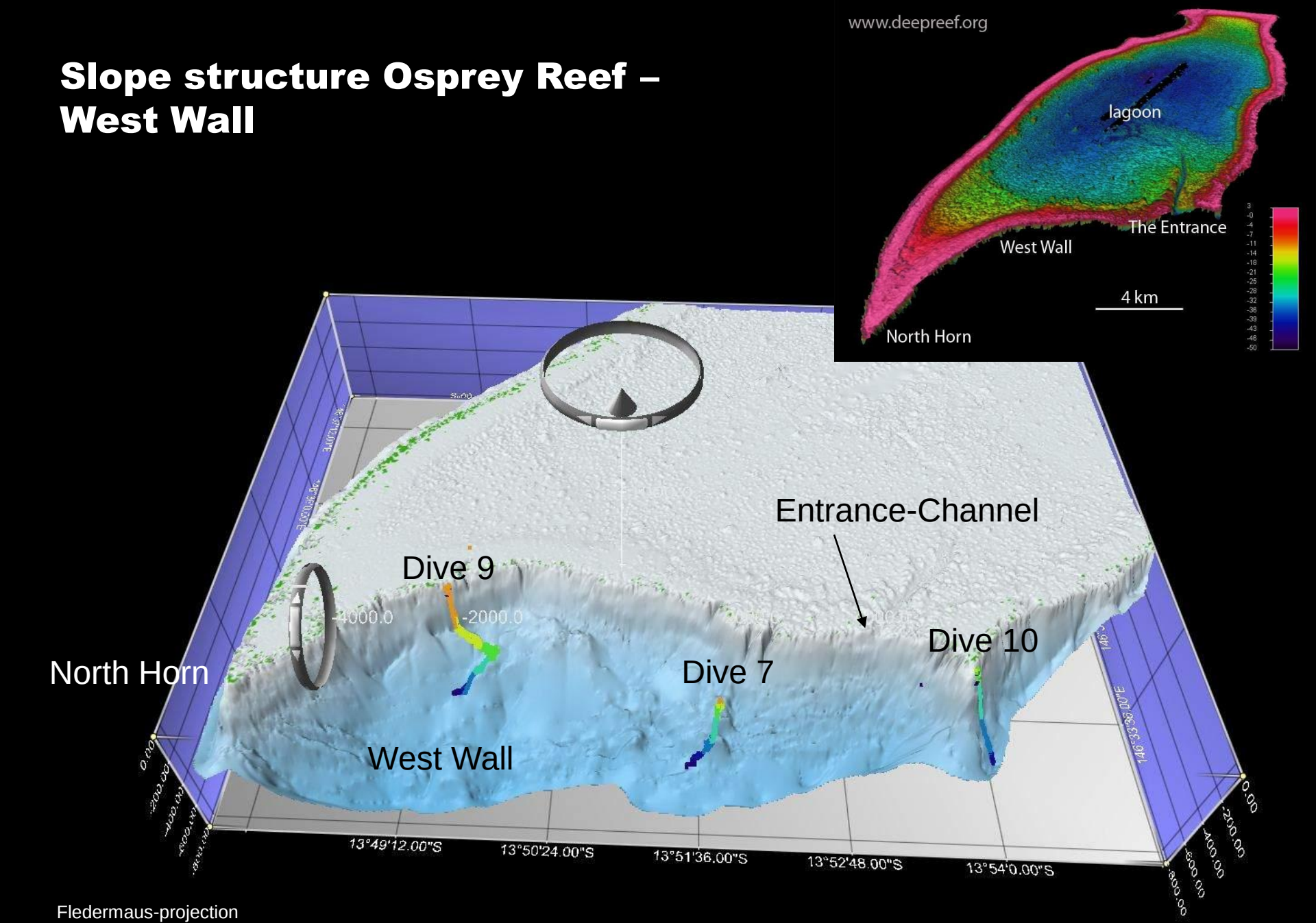
N-View Queensland Plateau



N-View

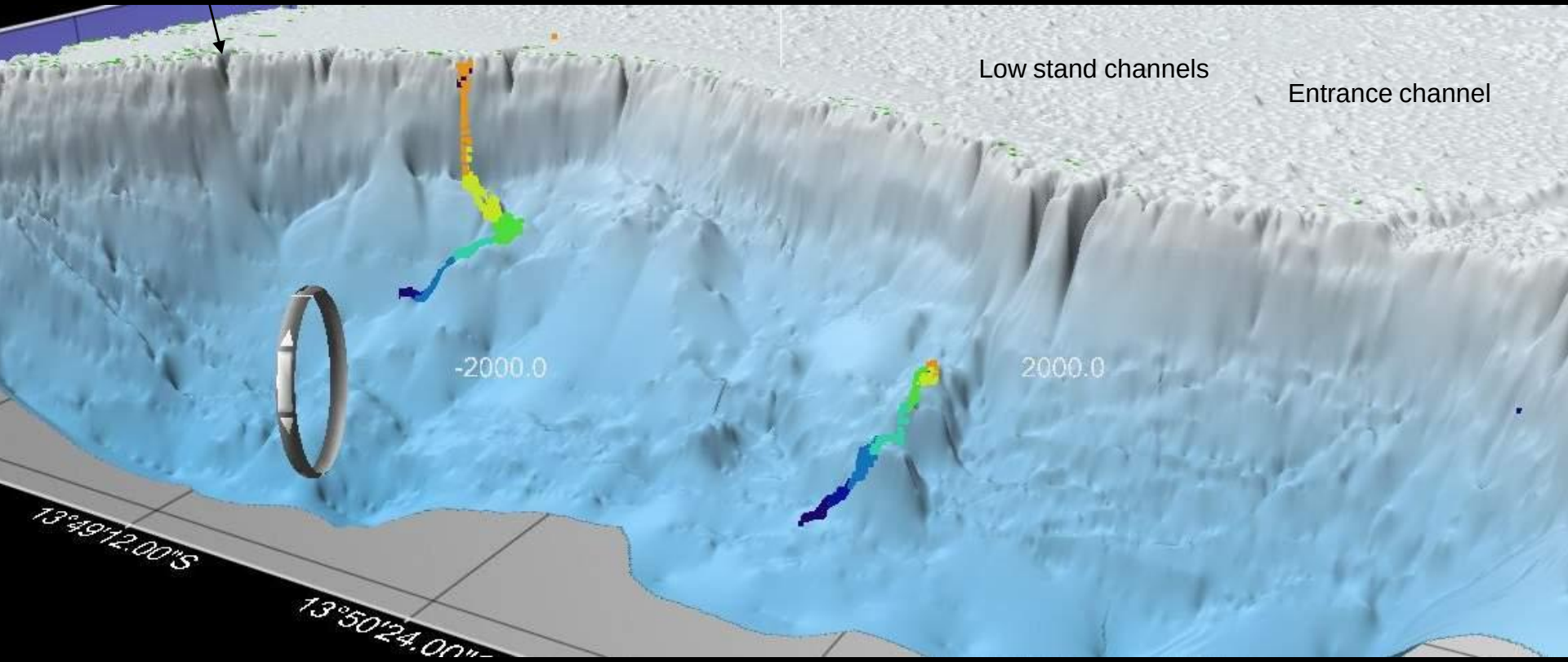

www.deepreef.org
GBR
Queensland Tr
Osprey Reef
Shark Reef
eau
40 km
2848
-200
-500
-1000
-1500
-2000
-2500
-3000
-3500
-4000
-4500
-5000

Slope structure Osprey Reef – West Wall

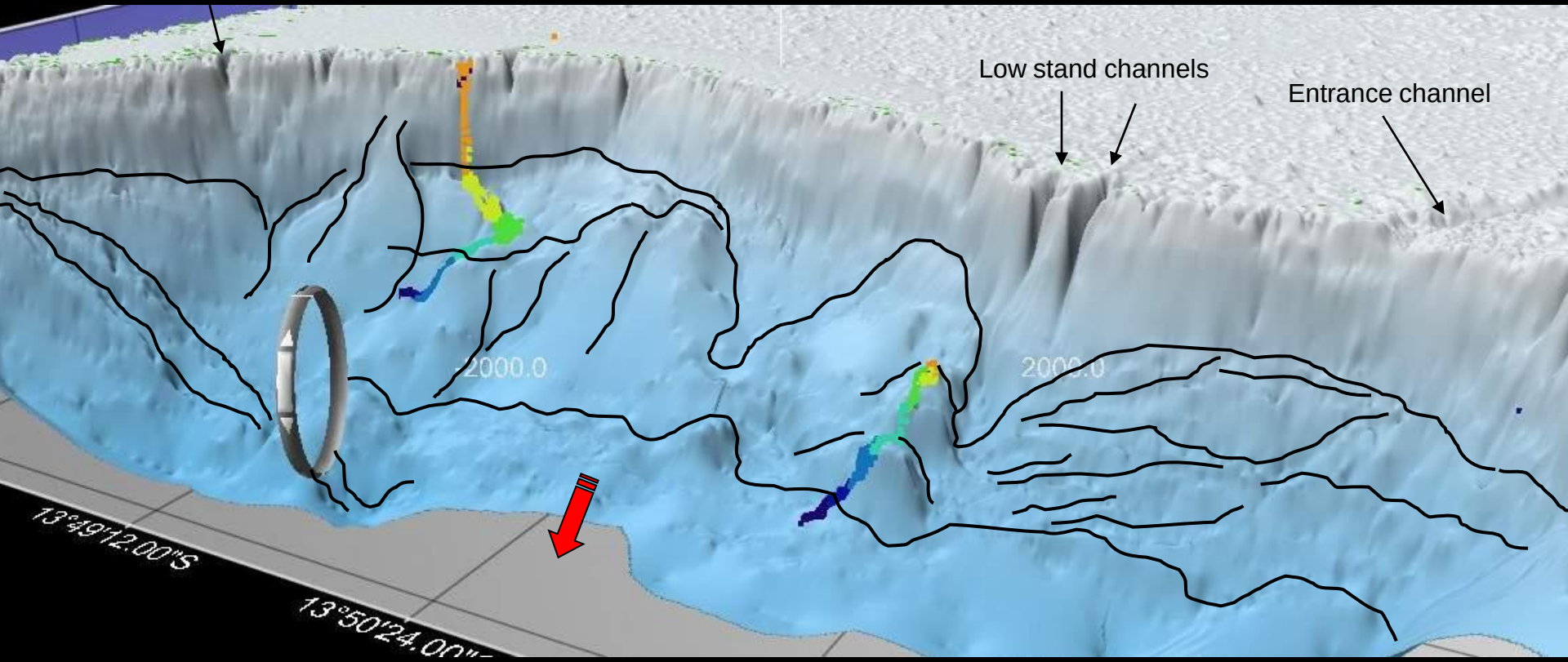


Fledermaus-projection

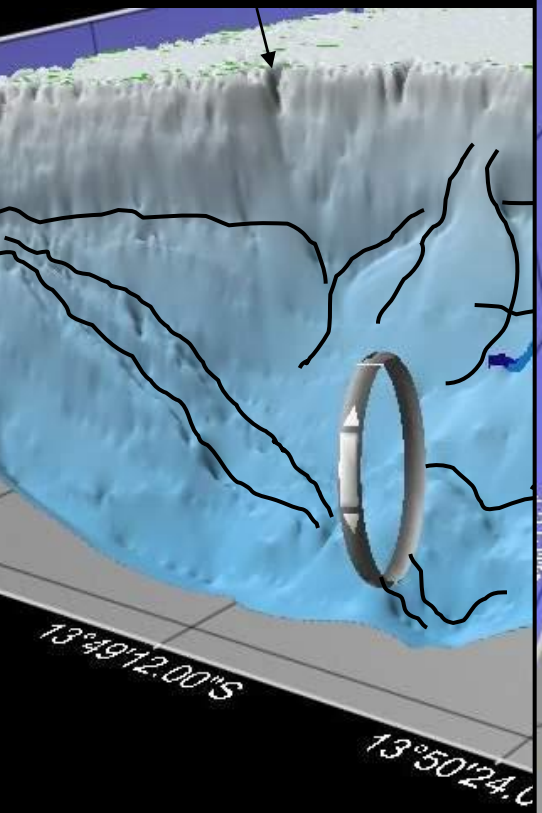
Slope structure Osprey Reef
Slide structures

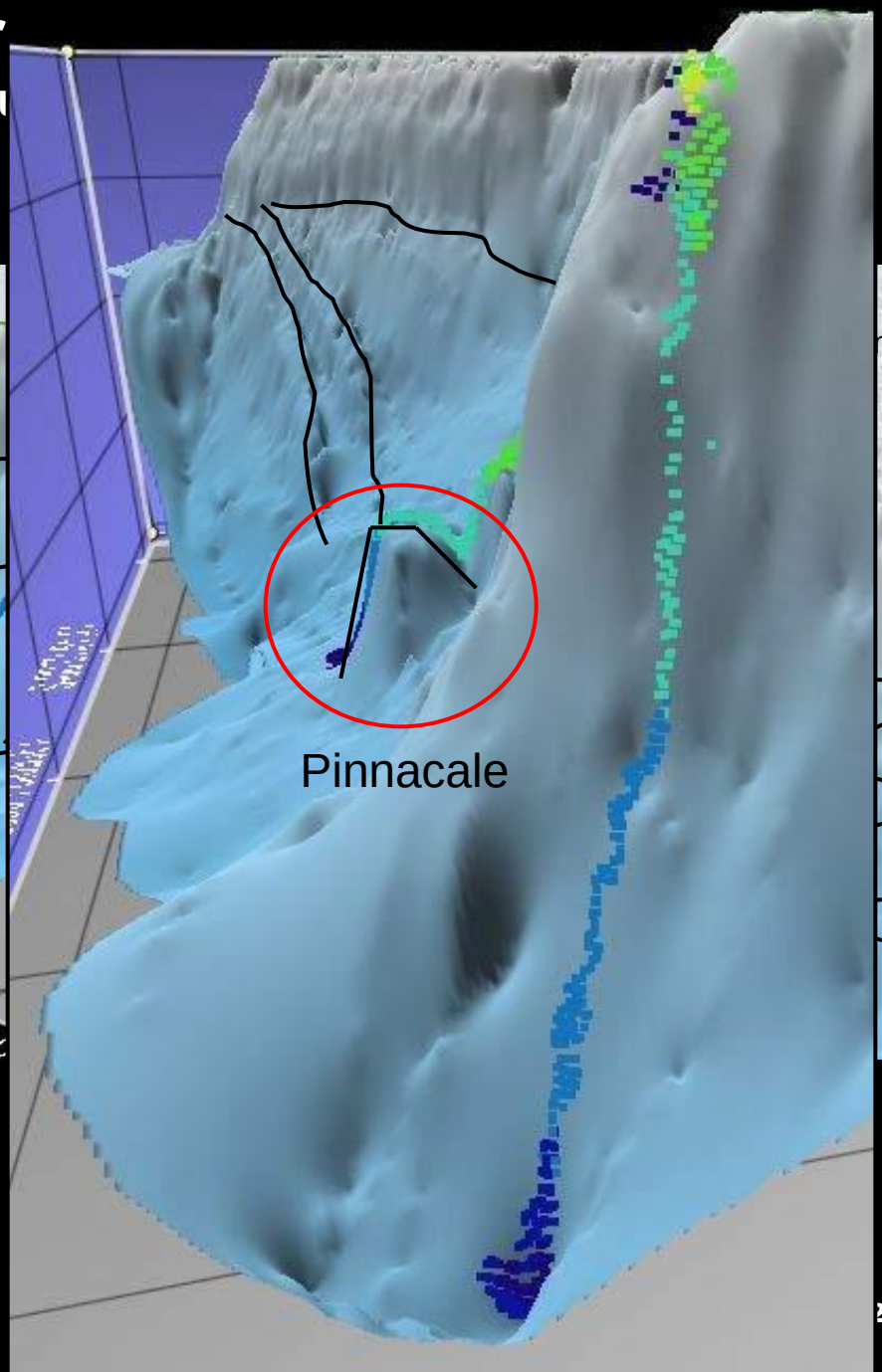


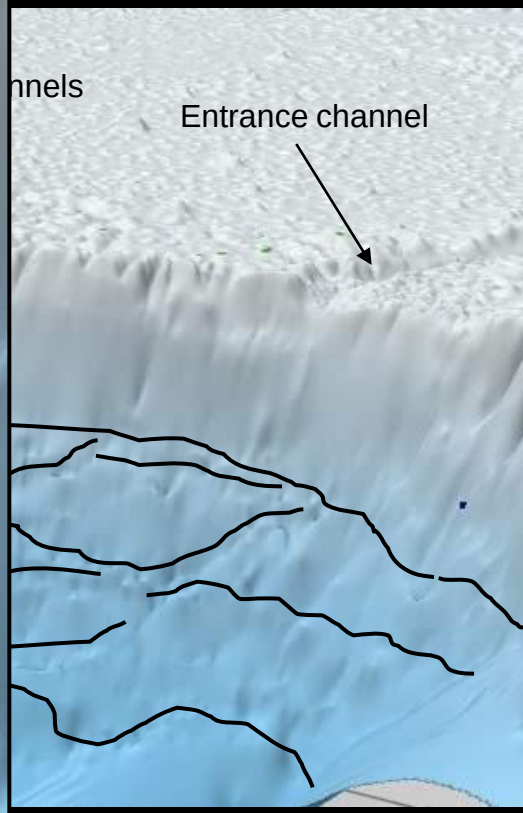
Slope structure Osprey Reef
Slide structures



Slope str
Slide structu

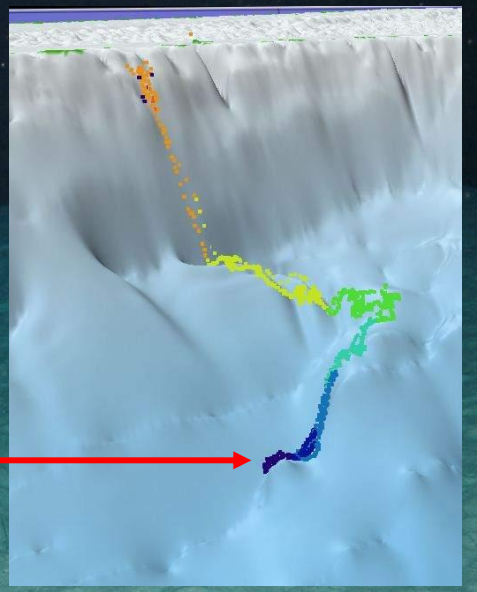






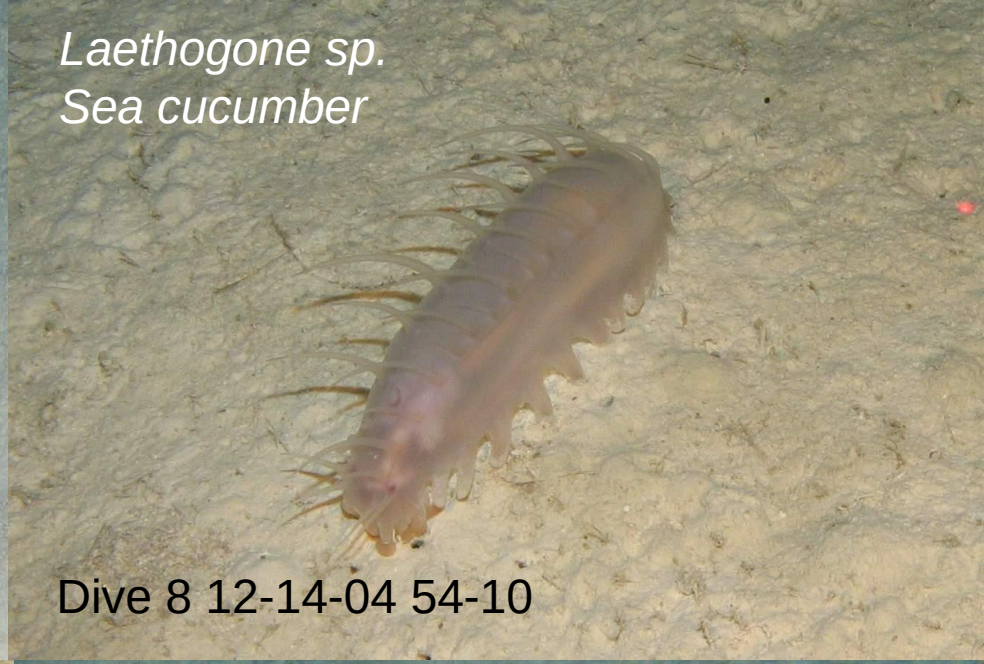
Depositional Environments

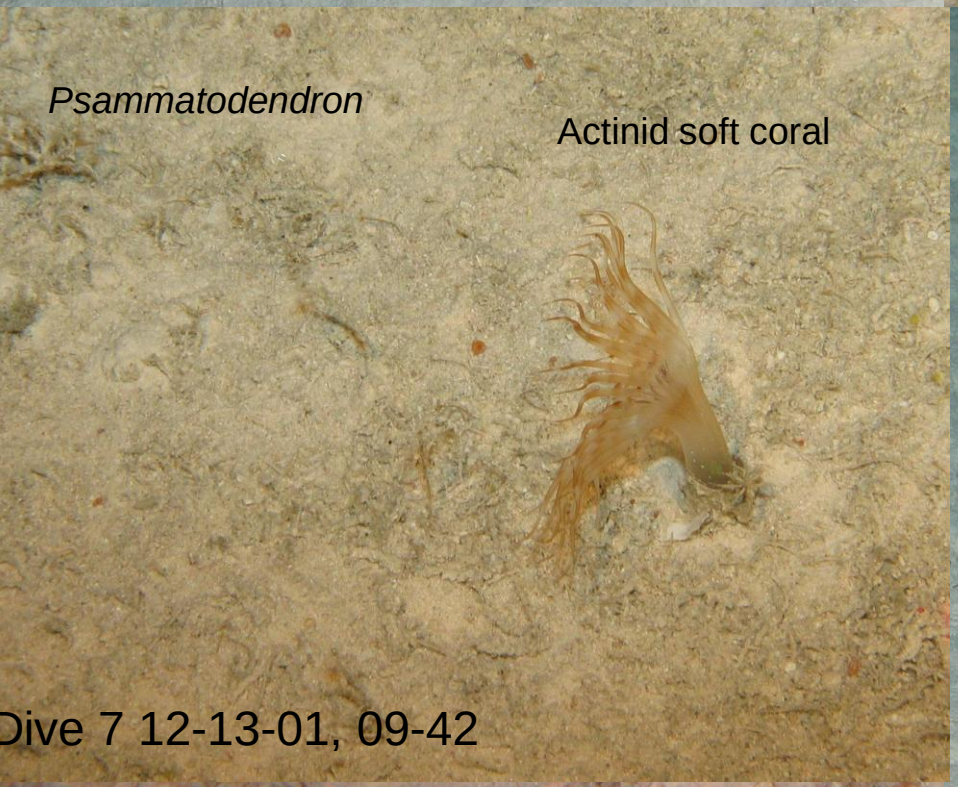
Osprey Reef West Wall
Deep Soft Bottoms (800-500m)
Calcareous-coccolith ooze

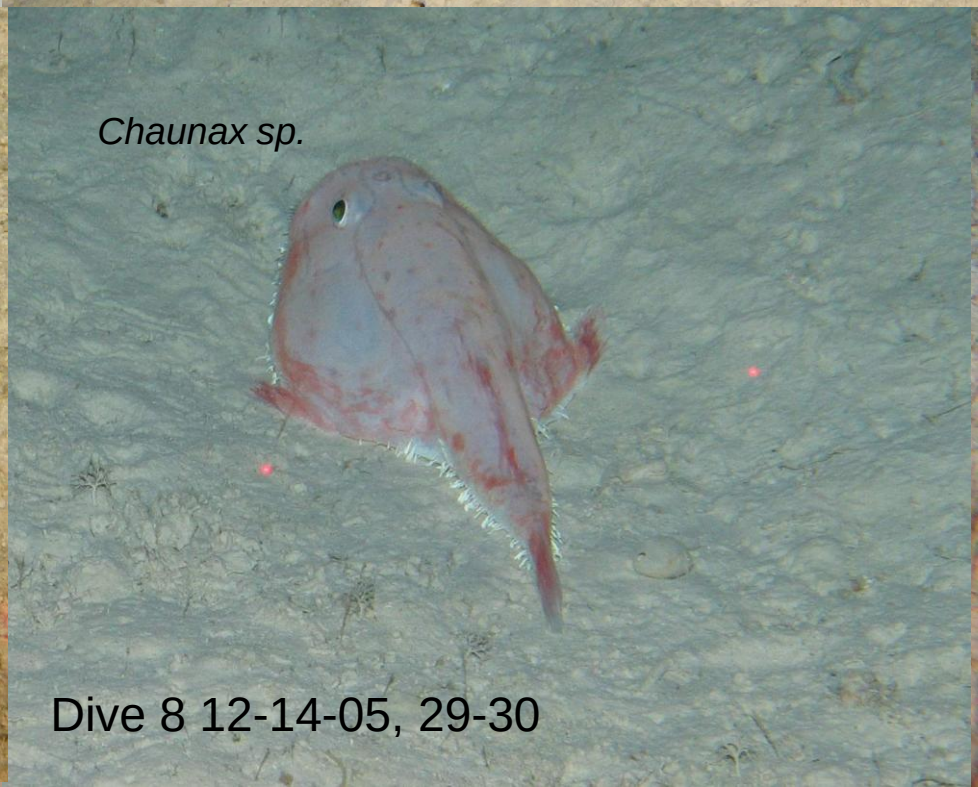


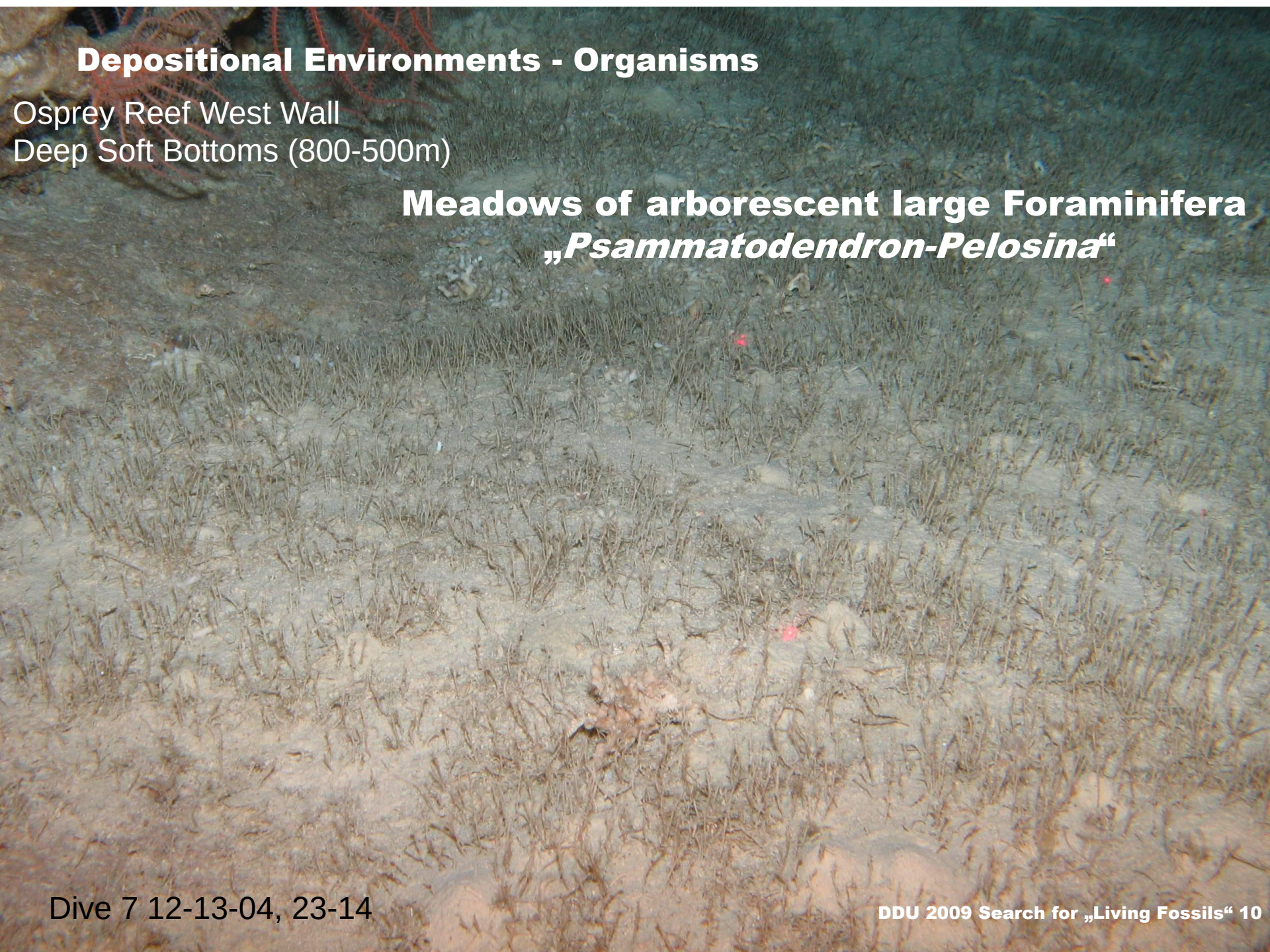
Dive 9 12-15-06, 28-54


Araeosoma cf. Belli
Irregular echinid
Dive 7 12-13-02, 11-56


Laethogone sp.
Sea cucumber
Dive 8 12-14-04 54-10


Psammatodendron
Actinid soft coral
Dive 7 12-13-01, 09-42


Chaunax sp.
Dive 8 12-14-05, 29-30



Depositional Environments - Organisms

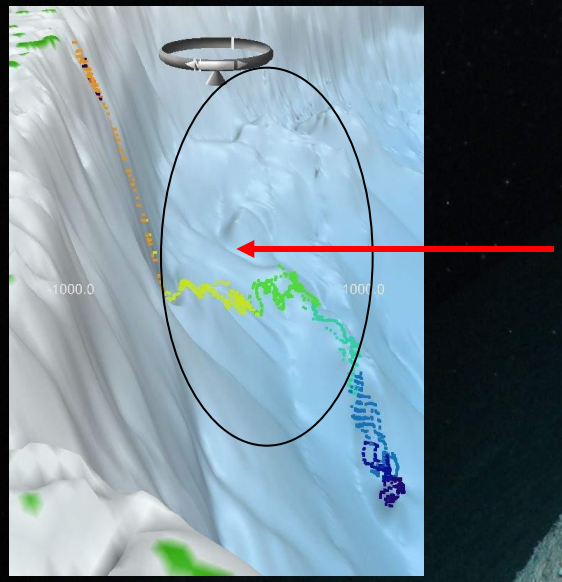
Osprey Reef West Wall
Deep Soft Bottoms (800-500m)

Meadows of arborescent large Foraminifera „*Psammatodendron-Pelosina*“

Dive 7 12-13-04, 23-14

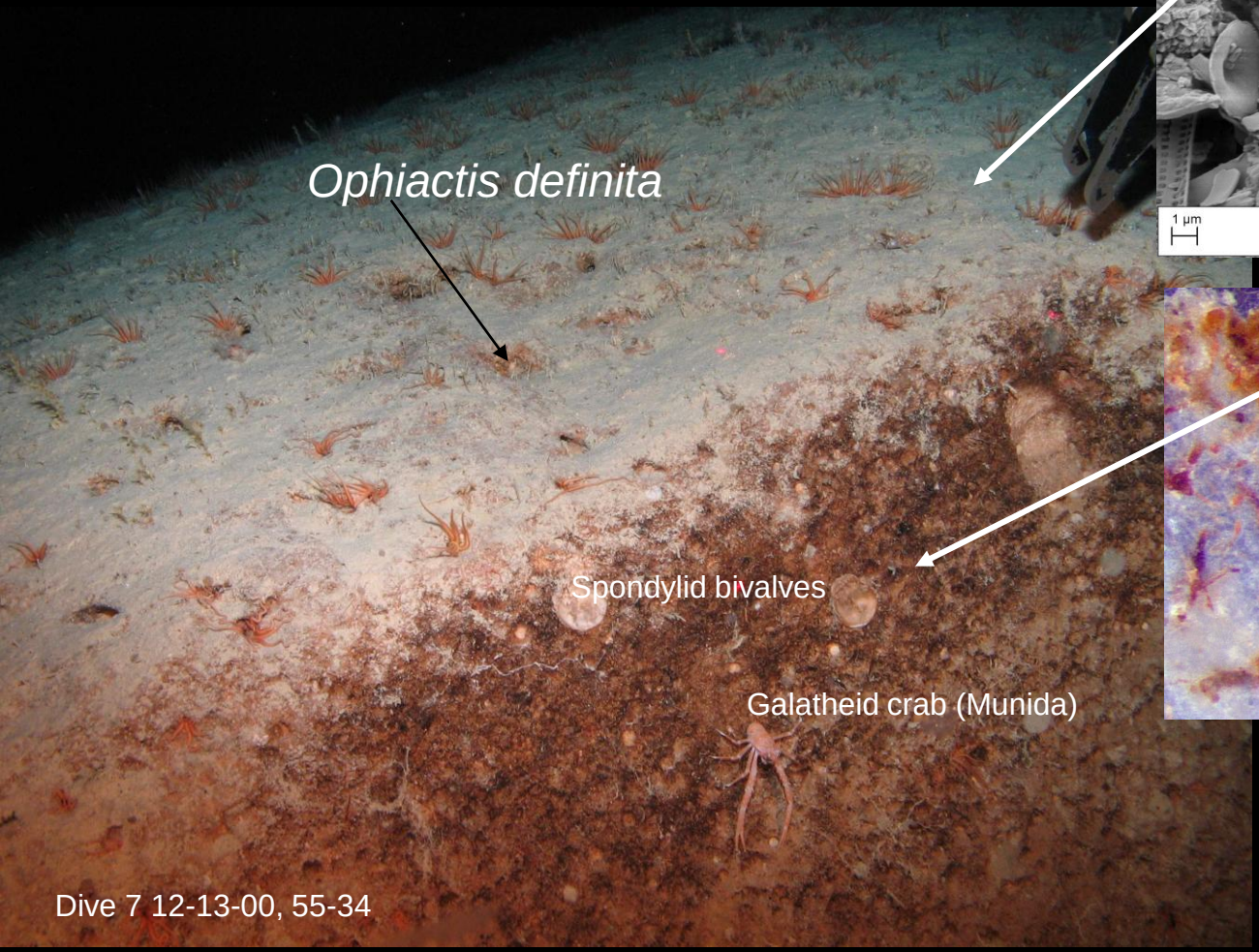
Osprey Reef West Wall

Depositional Environments – Mound Structures 600-500m

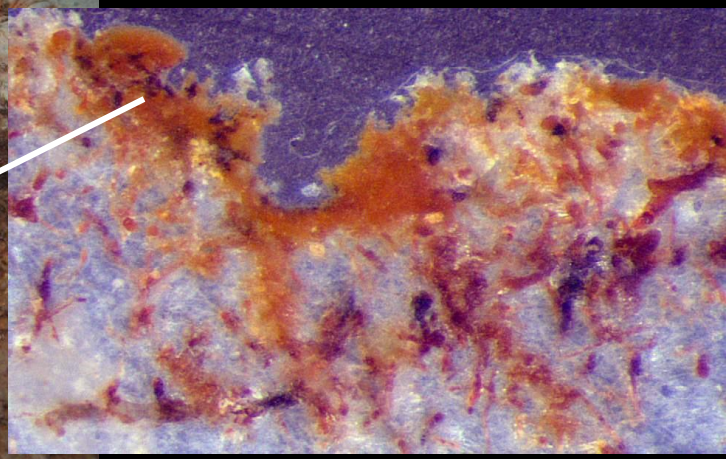


Dive 8 12-14-06, 09-02

Osprey Reef West Wall
Mound Structures 600-500m



Dive 7 12-13-00, 55-34



Thin microbialitic crust –
Fe-hydroxid + Mg calcite

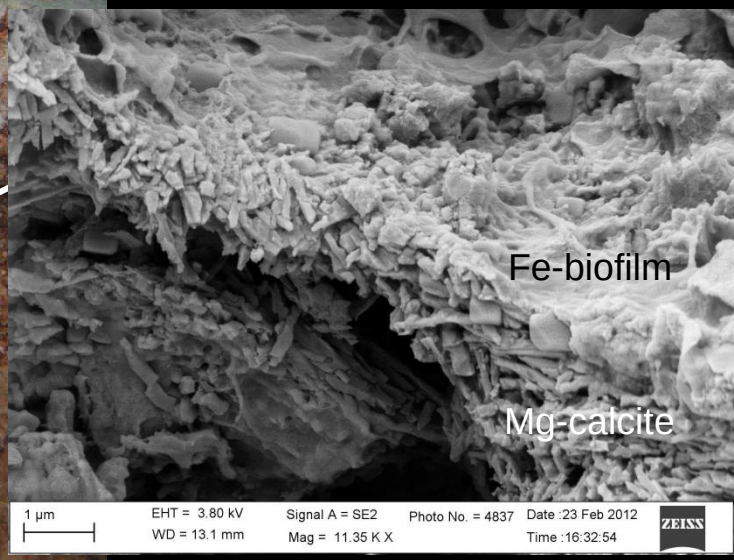
Osprey Reef West Wall
Mound Structures 600-500m

Ophiactis definita

Spondylid bivalves

Galatheid crab (Munida)

Dive 7 12-13-00, 55-34



Thin microbialitic crust –
Fe-hydroxid + Mg calcite

Osprey Reef West Wall

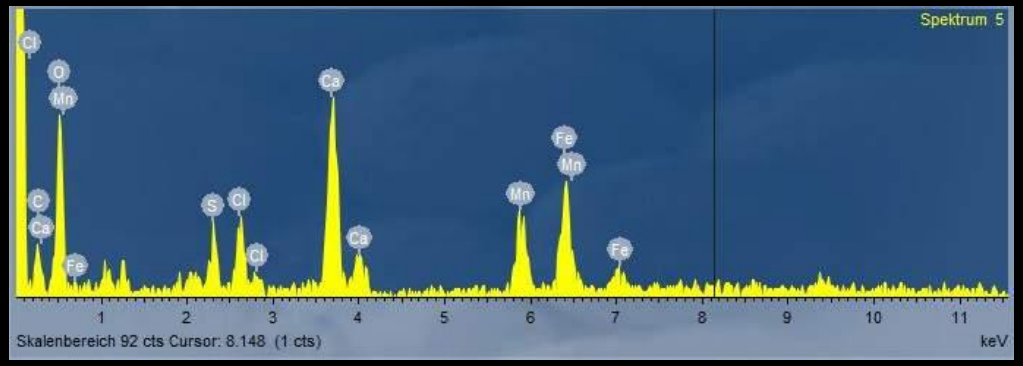
Depositional Environments – Steep Walls + Mn Hardgrounds 800-400m

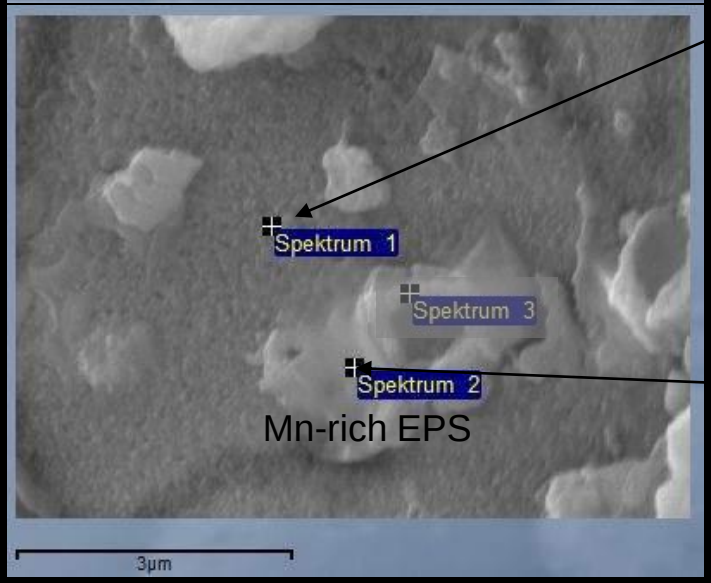
Mn+Fe microbial hardground formation
on „Marine Snow“ -sediment protected areas

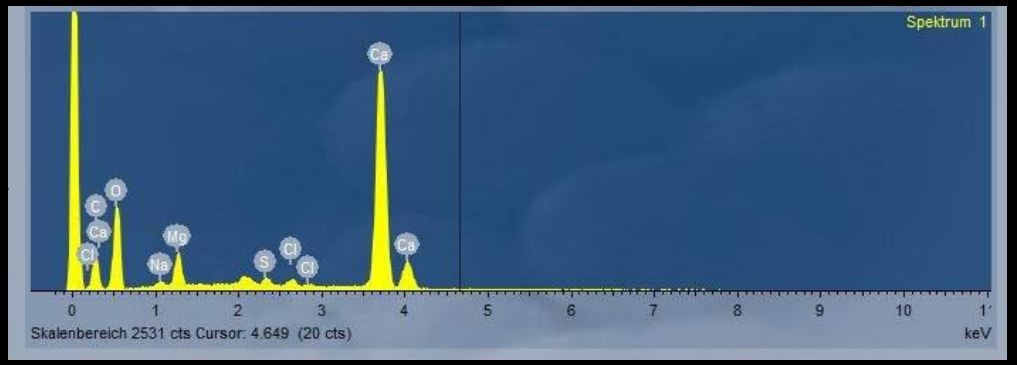

Osprey Reef West Wall
Steep Walls + Mn Hardgrounds 800-400m
Biodiversity hotspots
Dyscolia johannisdavisi

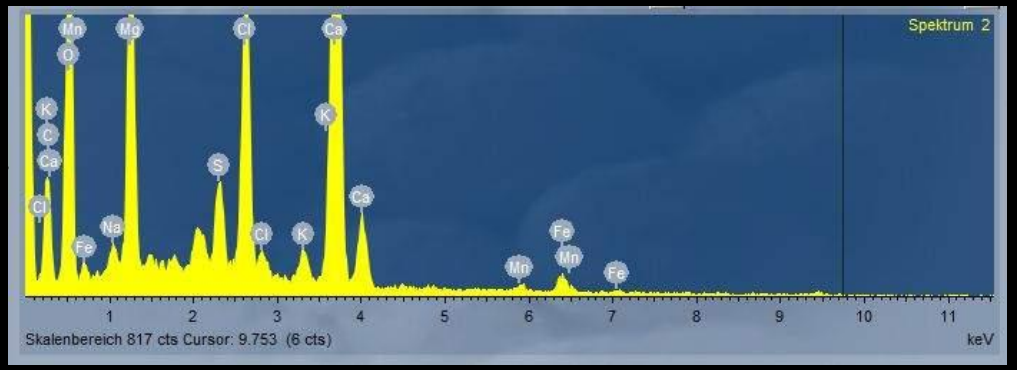
Osprey Reef West Wall
Mn Hardgrounds 800-400m

Biofilms of Mn+Fe oxidising microbes



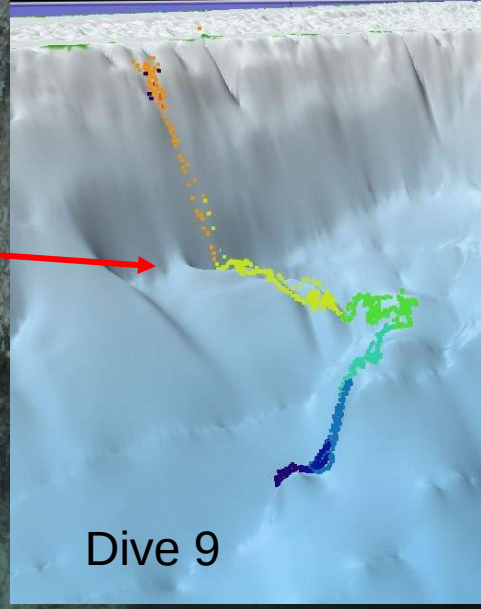






Osprey Reef West Wall

Depositional Environments – Steep Walls 400-50m

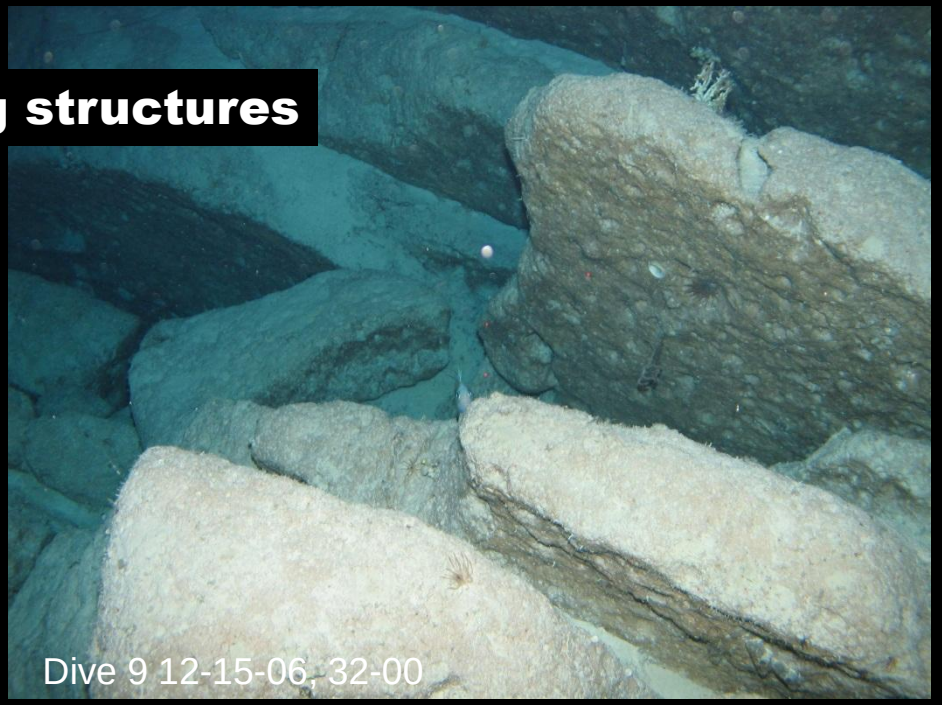


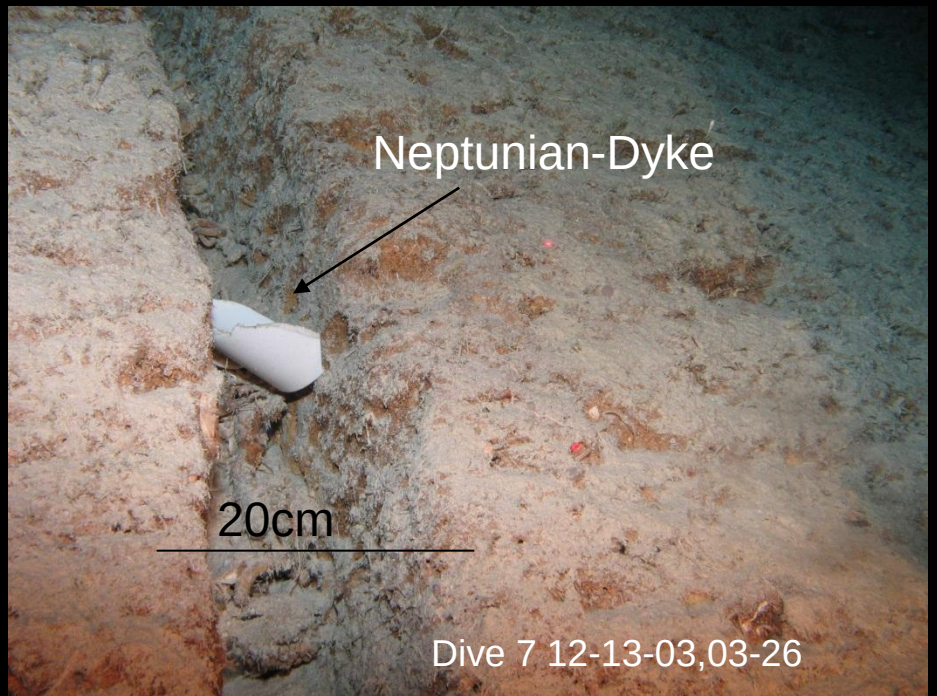
Porphyrocrinus cf. *verrucosus*

Dive 9 12-15-06, 29-26

Osprey Reef West Wall

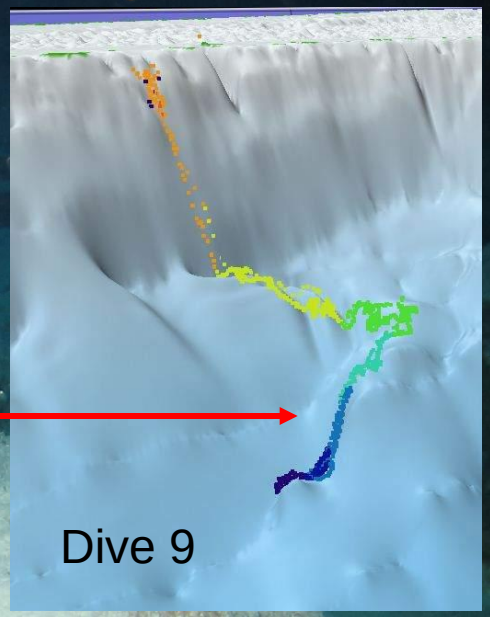
Steep Walls – tectonic and bedding structures





Osprey Reef West Wall

Depositional Environments – Boulder Fields 700-400 m *„Cipit“-Boulders*

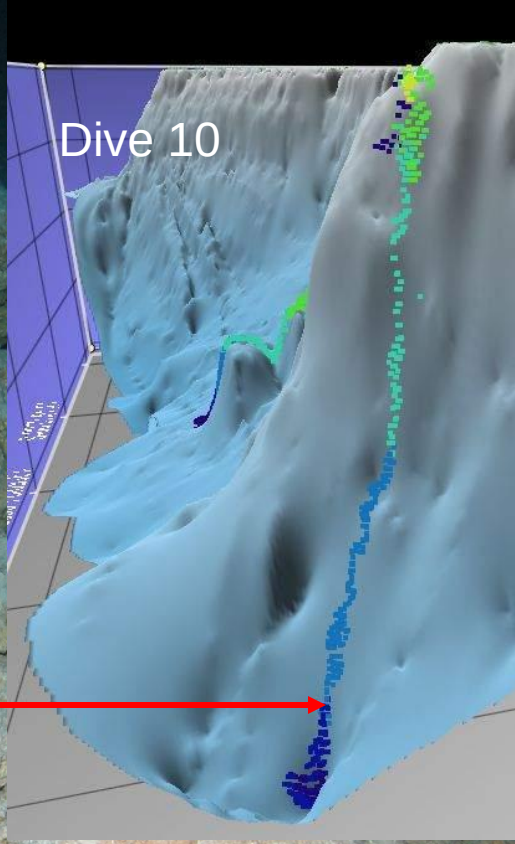


20cm

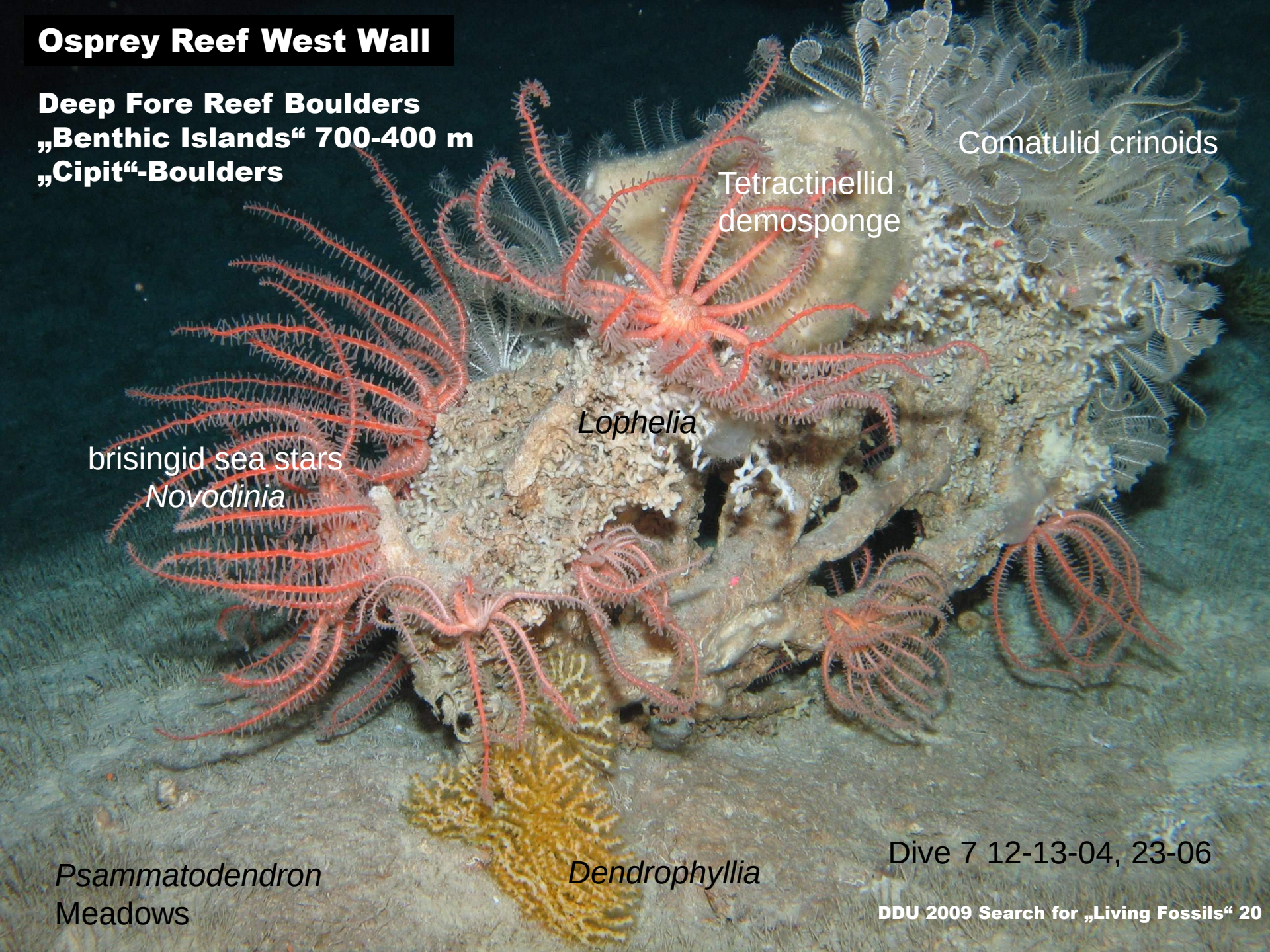
Dive 9 12-15-06, 31-34

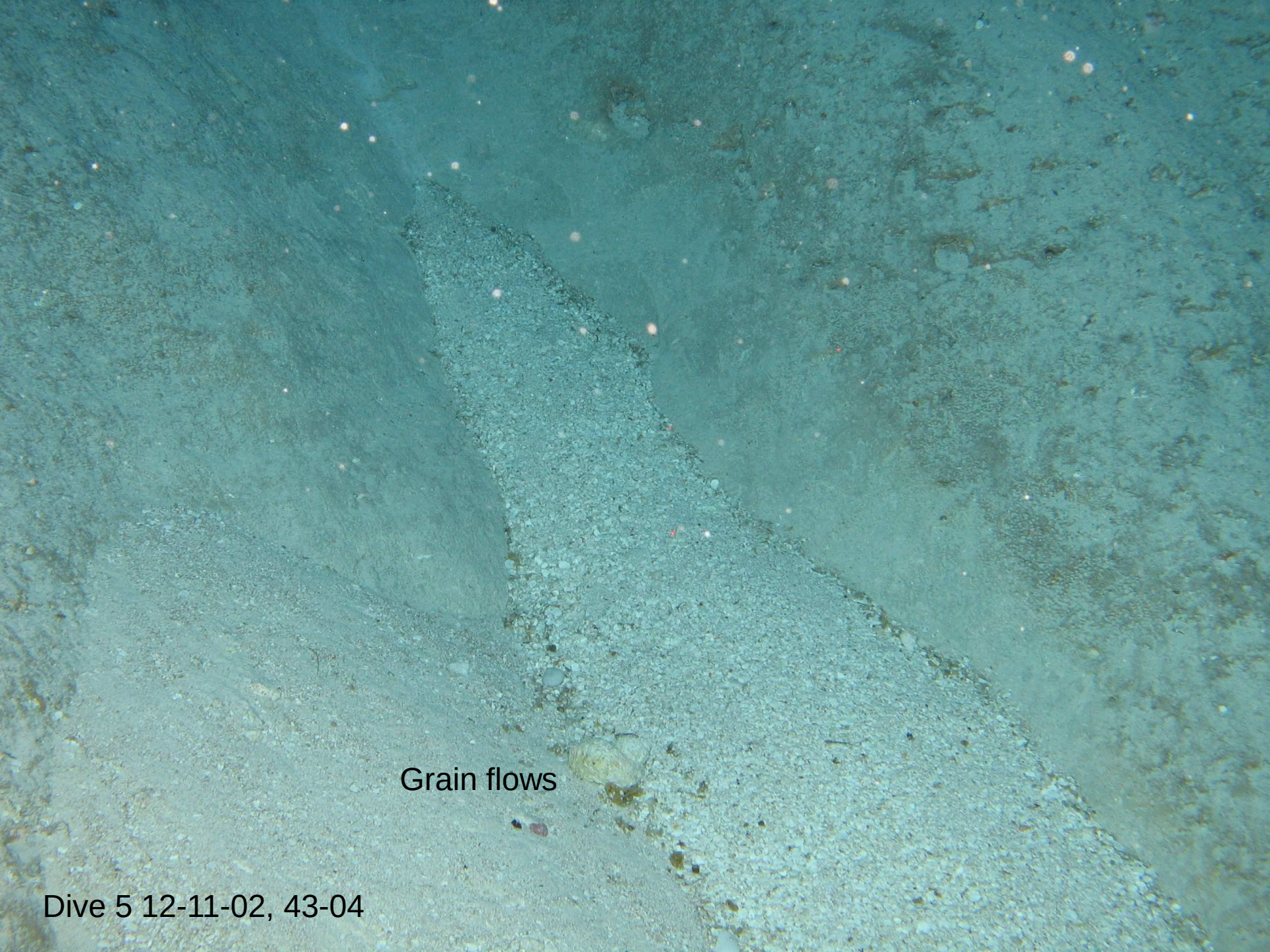
Osprey Reef West Wall

Depositional Environments – Deep Fore Reef channel lag debris 700-400 m



Dive 10 12-16-04, 21-36


Osprey Reef West Wall
Deep Fore Reef Boulders
„Benthic Islands“ 700-400 m
„Cipit“-Boulders
Comatulid crinoids
Tetractinellid demosponge
Lophelia
brisingid sea stars
Novodinia
Psammatodendron Meadows
Dendrophyllia
Dive 7 12-13-04, 23-06
DDU 2009 Search for „Living Fossils“ 20

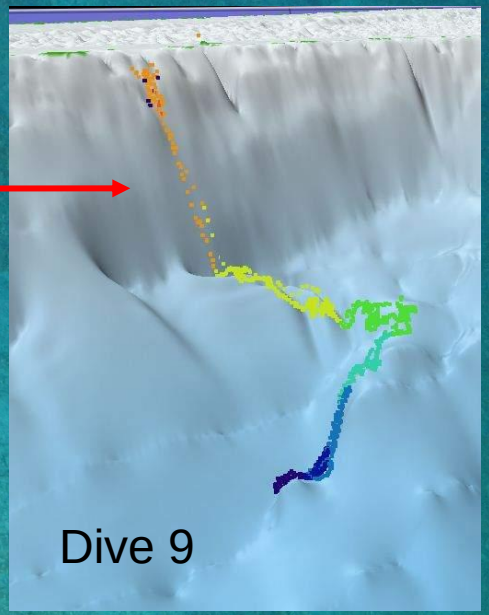


Dive 5 12-11-02, 43-04

Osprey Reef West Wall

Depositional Environments – Steep Walls 300m

fractures



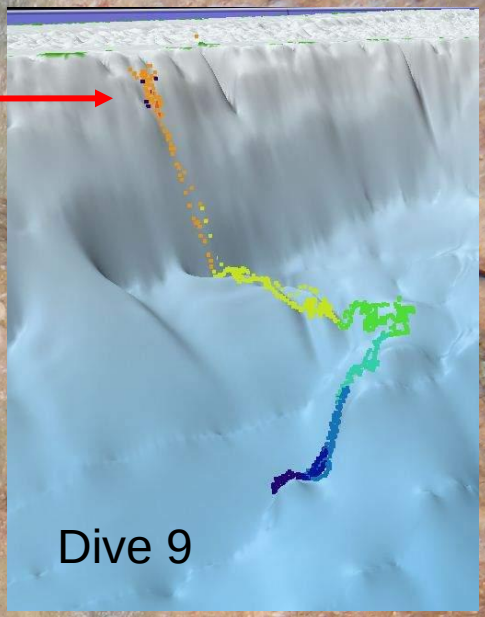
Firm microbial mounds „polished“ by downward sediment transport

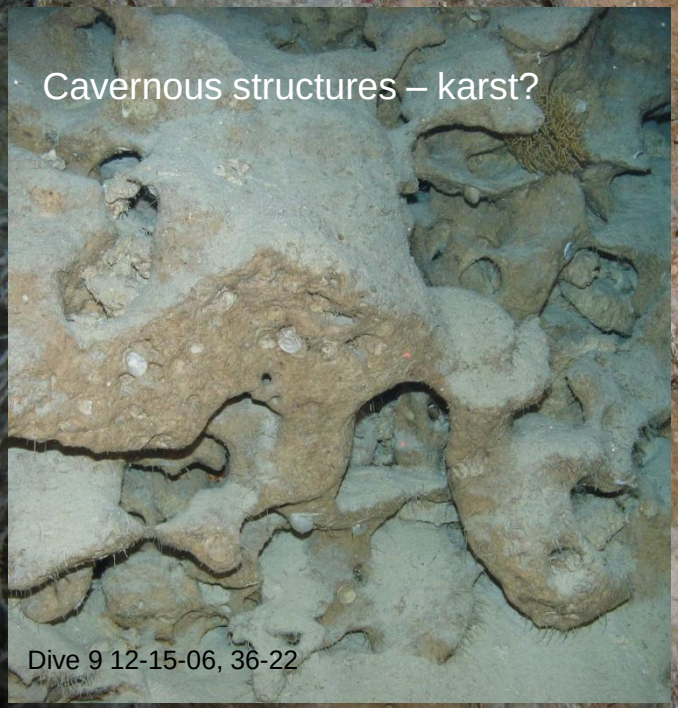
Dive 5/9 12-11-03, 24-52

Osprey Reef West Wall

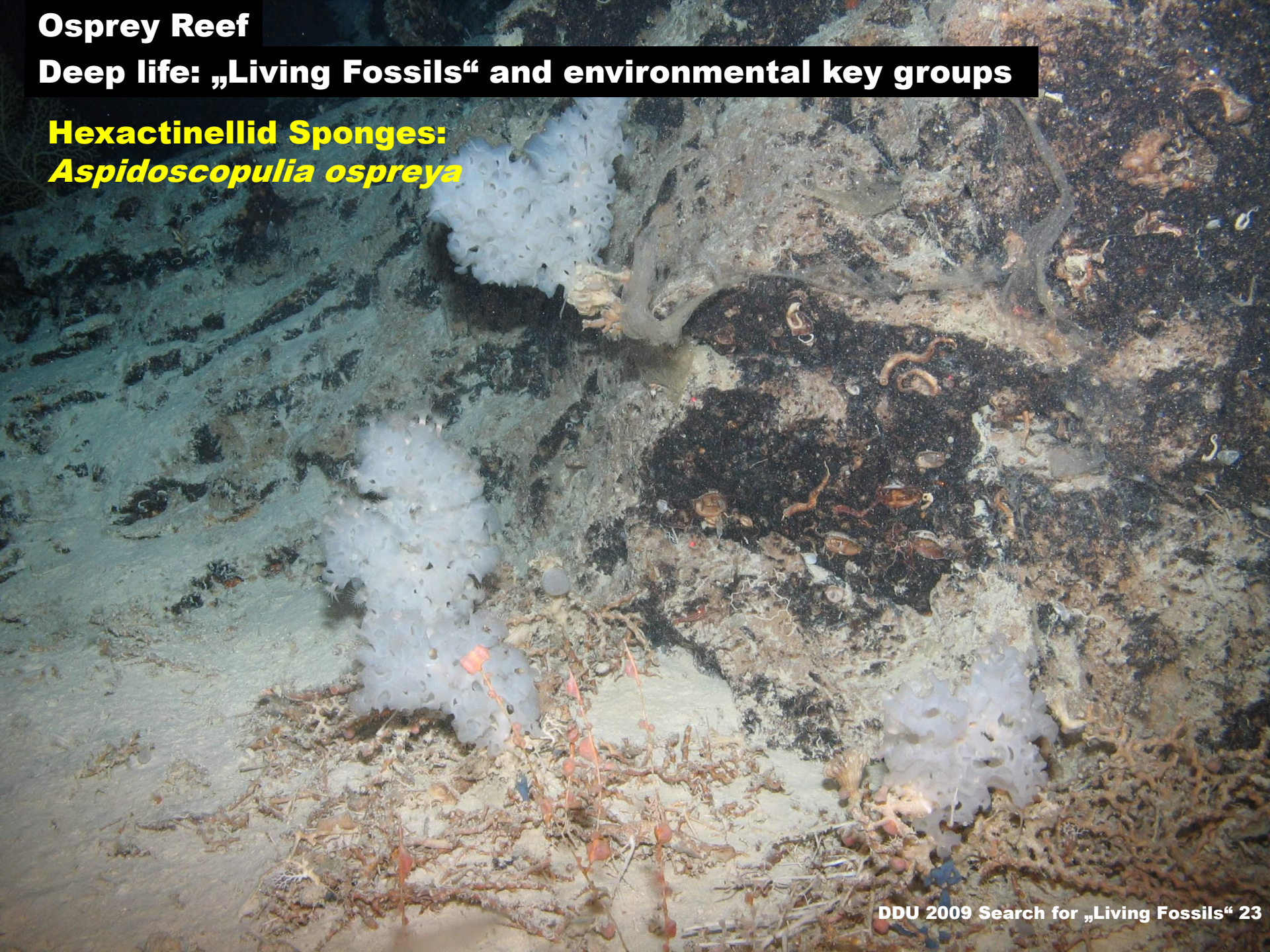
Depositional Environments – Steep Walls 250m

Begin of the photic zone
Steep walls with karst fabrics





Dive 9 12-15-06, 37-08


Osprey Reef
Deep life: „Living Fossils“ and environmental key groups
Hexactinellid Sponges:
Aspidoscopulia ospreya

Osprey Reef

Deep life: „Living Fossils“ and environmental key groups

Hexactinellid Sponges:
Psilocalyx wilsoni

Dive 6 12-12-01, 09-36

Dive 4 12-10-04, 04-46


Osprey Reef
Deep life: „Living Fossils“ and environmental key groups
Lithistid Demosponges: Mesozoic (Cretaceous) relics!
Pleroma cf. aotea

Dive 7 12-13-04, 07-42


Scleritoderma camusi
Dive 10 12-16-04, 21-02

Osprey Reef

Deep life: „Living Fossils“ and environmental key groups

Stalked Crinoids – Triassic relatives

Mound surfaces fixed on microbial cements

Porphyrocrinus* cf. *verrucosus

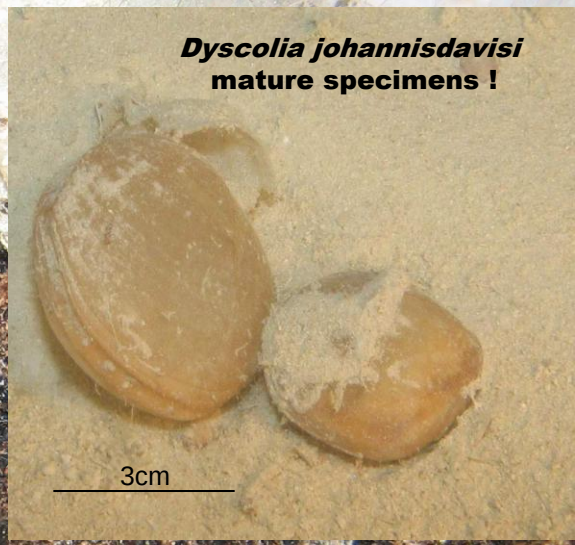
Dive 9 12-15-06, 29-04

Osprey Reef

Deep life: „Living Fossils“ and environmental key groups

Terebratulid Brachiopods

Dyscolia johannisdavisi
Young specimens



Dyscolia johannisdavisi
mature specimens !

Dive 4 12-10-02, 52-48

Osprey Reef

Deep life: „Living Fossils“ and environmental key groups

Ahermatype scleractinian corals

Lophelia pertusa

Dive 9 12-15-06, 32-28

Osprey Reef

Deep life: „Living Fossils“ and environmental key groups

Ahermatype scleractinian corals

Dive 10 12-16-04, 21-32

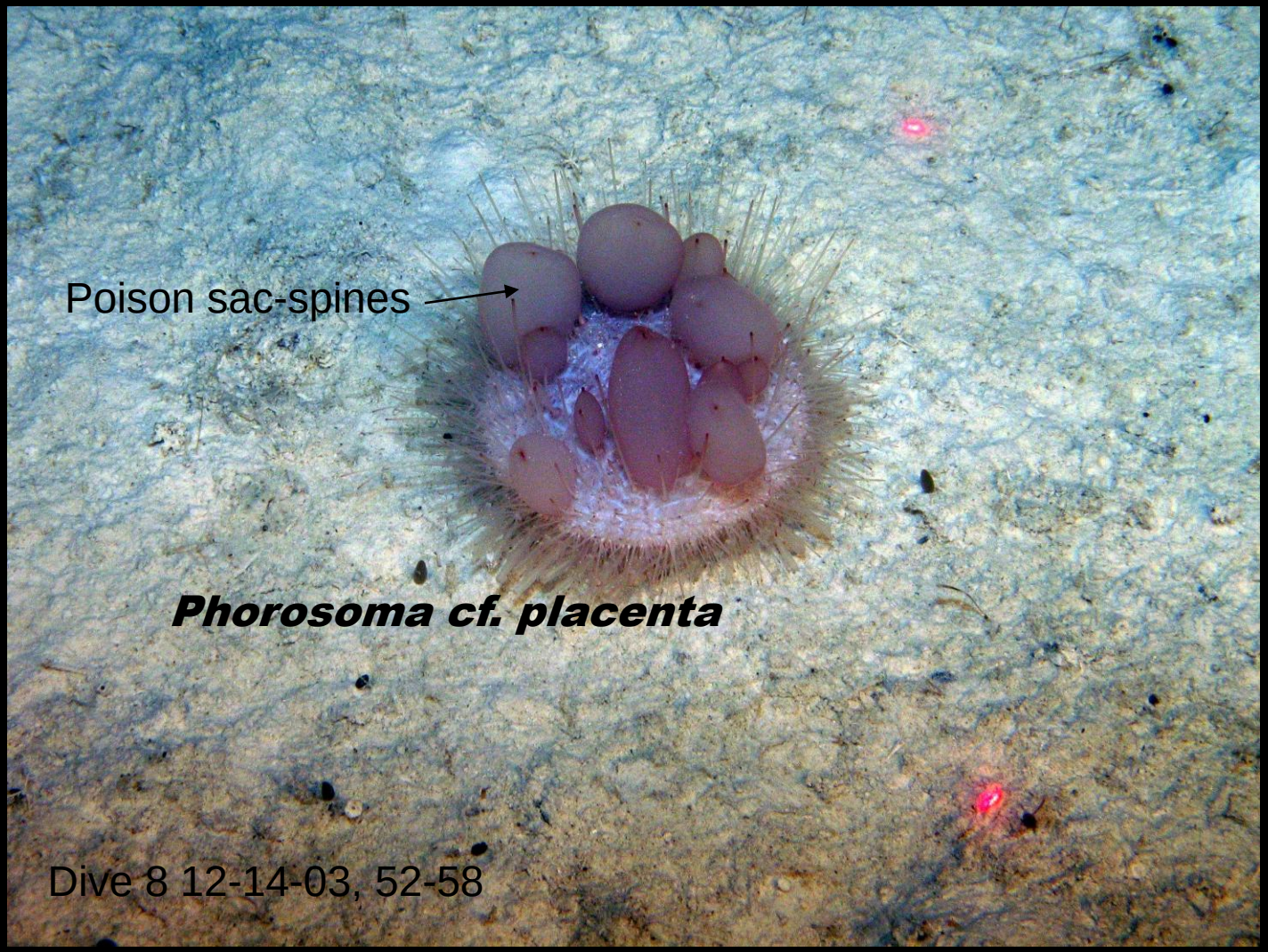
Dive 4 12-10-03, 31-36

Dive 9 12-15-06, 32-28

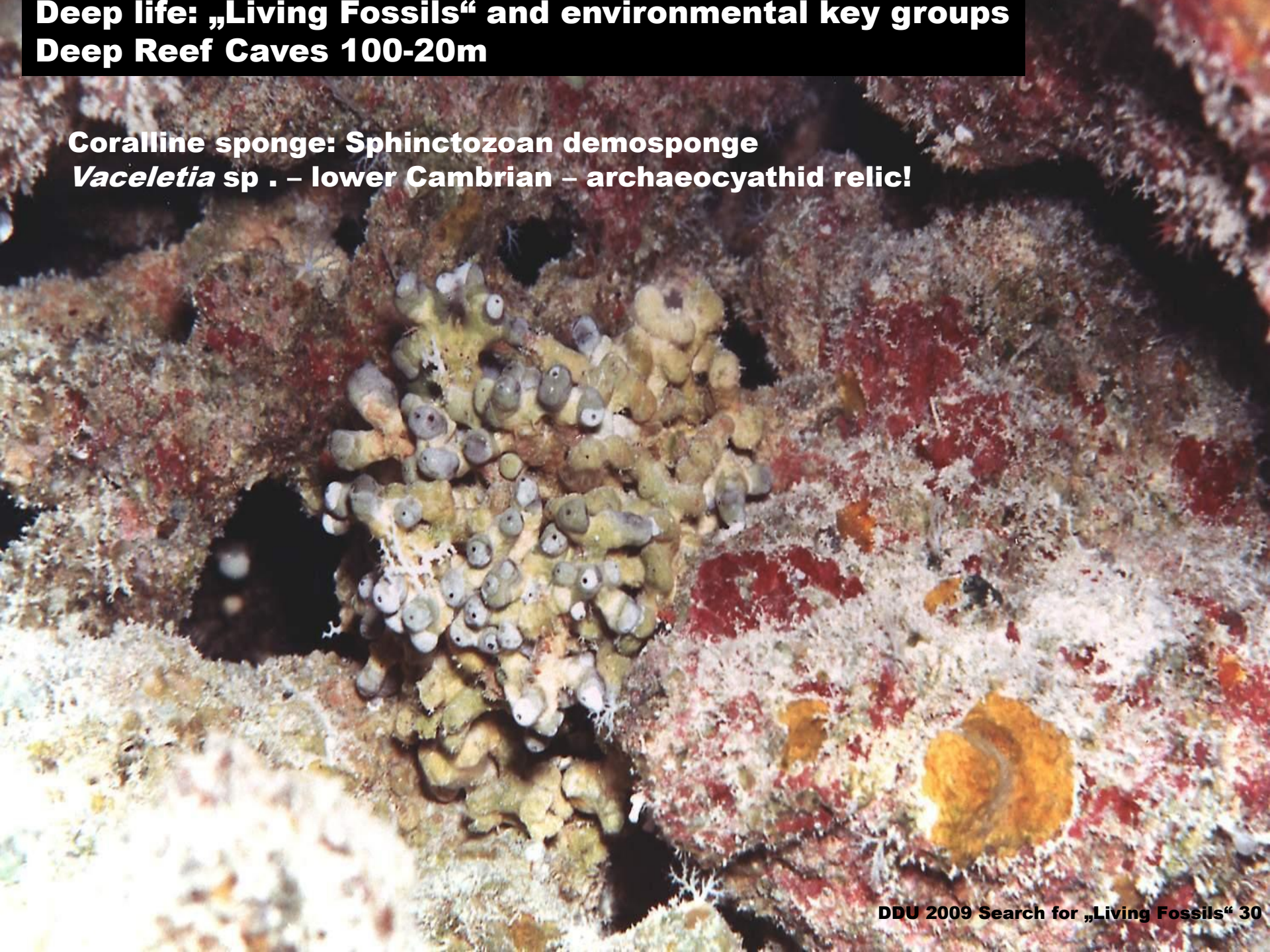
Osprey Reef

Deep life: „Living Fossils“ and environmental key groups

Echinothuria – Jurassic remnats of deep water regular Echinids



Deep life: „Living Fossils“ and environmental key groups
Deep Reef Caves 100-20m



Coralline sponge: Sphinctozoan demosponge
***Vaceletia* sp . – lower Cambrian – archaeocyathid relic!**

Osprey Reef

Deep life: „Living Fossils“ and environmental key groups

Nautilus pomilius **feeding experiment in 800m water depth**

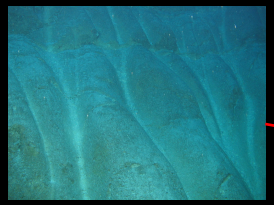
Dive 11 12-17-05, 57-36

Conclutions: Osprey Reef Deep Slope

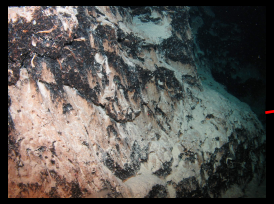
Sedimentary Facies

Cavernous structures
250-100m

Steep walls, polished
Microbial mounds
350-200 m



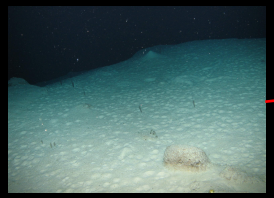
Steep walls with
Mn/Fe hard grounds
(800) 400-200m

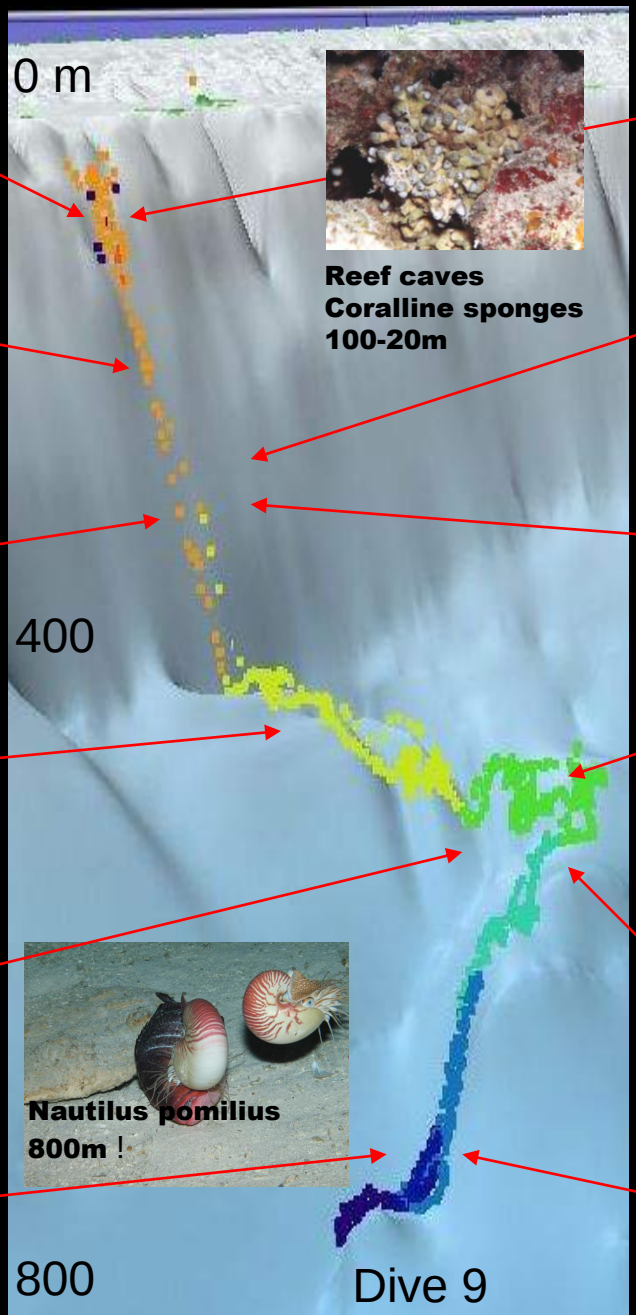


Microbial mounds
600-500m

Boulder Fields
„Cipit“ boulders
700-400m

Soft bottom
800-500m



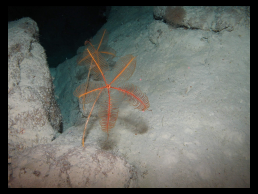


Key organisms-“living fossils“

First light-green algae
250m

Terebratulid brachiopods
Mn/Fe hard grounds
400m

Hexactinellid sponges
Mn/Fe hard grounds
600-400m



Stalked crinoids
Microbial mounds
600-500m

Lithistid sponges
Microbial mounds
600-500m

Echinothurid echinids
Soft bottom
800-500m

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Crew of the RV PMG Pride

Scientific crew of the Deep Down Under Expedition 2009

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Queensland Museum

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Further reading: www.deepdownunder.de/