

Arabian Gulf, One More Time*

Eugene A. Shinn¹ and Christopher G. St. C. Kendall²

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¹College of Marine Science, University of South Florida, St. Petersburg, FL (eshinn@marine.usf.edu)

²University of South Carolina, Columbia, SC

Abstract

The sabkha, dolomite, evaporite/barrier islands of the Arabian Gulf remain one of petroleum geologists' most useful sedimentary models for understanding and exploiting ancient tidal-flat reservoirs, especially those in the Permian Basin area of West Texas. Repeated re-examination of the sabkhas, investigated before the advent of sequence stratigraphy and our understanding of rapid precipitation of micritic carbonates, have provided additional insights into the architecture and sedimentary processes that constructed these classical areas. In particular, ongoing dynamics of the carbonate chenier/beach-spit complexes and the creation of new beachrock and rapid sediment precipitation in the Gulf have significantly refined our knowledge of these special sedimentary processes since the seminal studies of the 1960s.

These modern reservoir-size accumulations include impermeable bored and eroded marine cemented layers that, under the guidelines of sequence stratigraphy, could be misinterpreted as flooding sequences. Such relatively impermeable synsedimentary rock layers may also explain early creation of compartmentalization and isolation of fluids in certain carbonate reservoirs. In addition, we now know that synsedimentary marine cementation creates hard surfaces that can, in turn, control distribution of fossils and sediment-producing organisms that, in turn, become cemented and thus perpetuate the process. Renewed field examination of these areas of sediment accumulation with these newly appreciated processes in mind may generate new ideas useful for both hydrocarbon and groundwater exploration. Is it time to reexamine the classical areas in the field while at the same time simulating and modeling these accumulations with our new digital tools?


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Eugene A. Shinn

Christopher G. St. C. Kendall



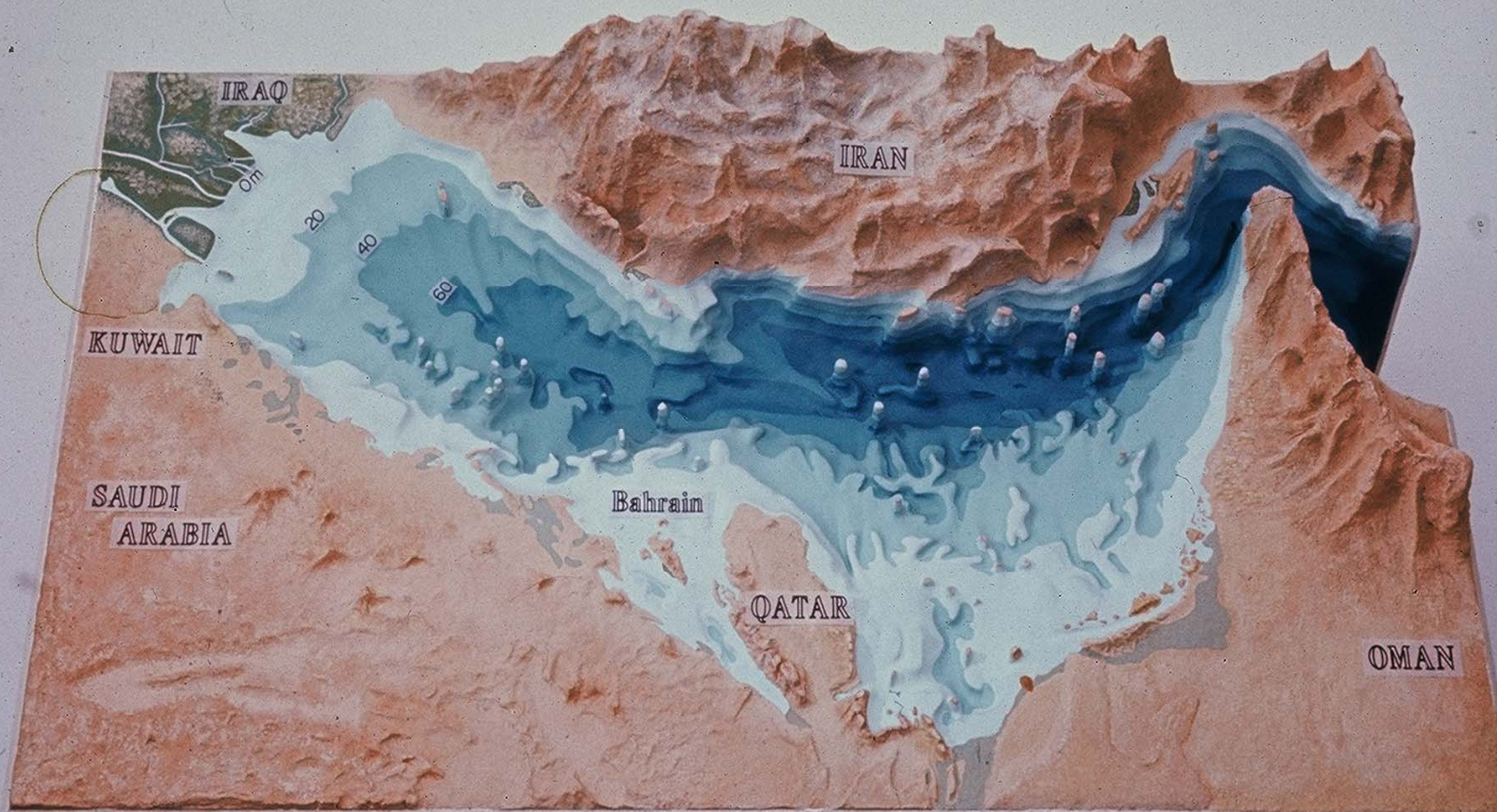
1967



In a place long
ago in a time
before
Sequence
Stratigraphy


INFORMATION GAPS

- Source of fine grained sediment
 - Marine Leaching
 - Marine Cementation
 - Reservoir Geometry
- Sequence Stratigraphy





First a Little History



Quaternary carbonate and evaporite sedimentary facies and their ancient analogues

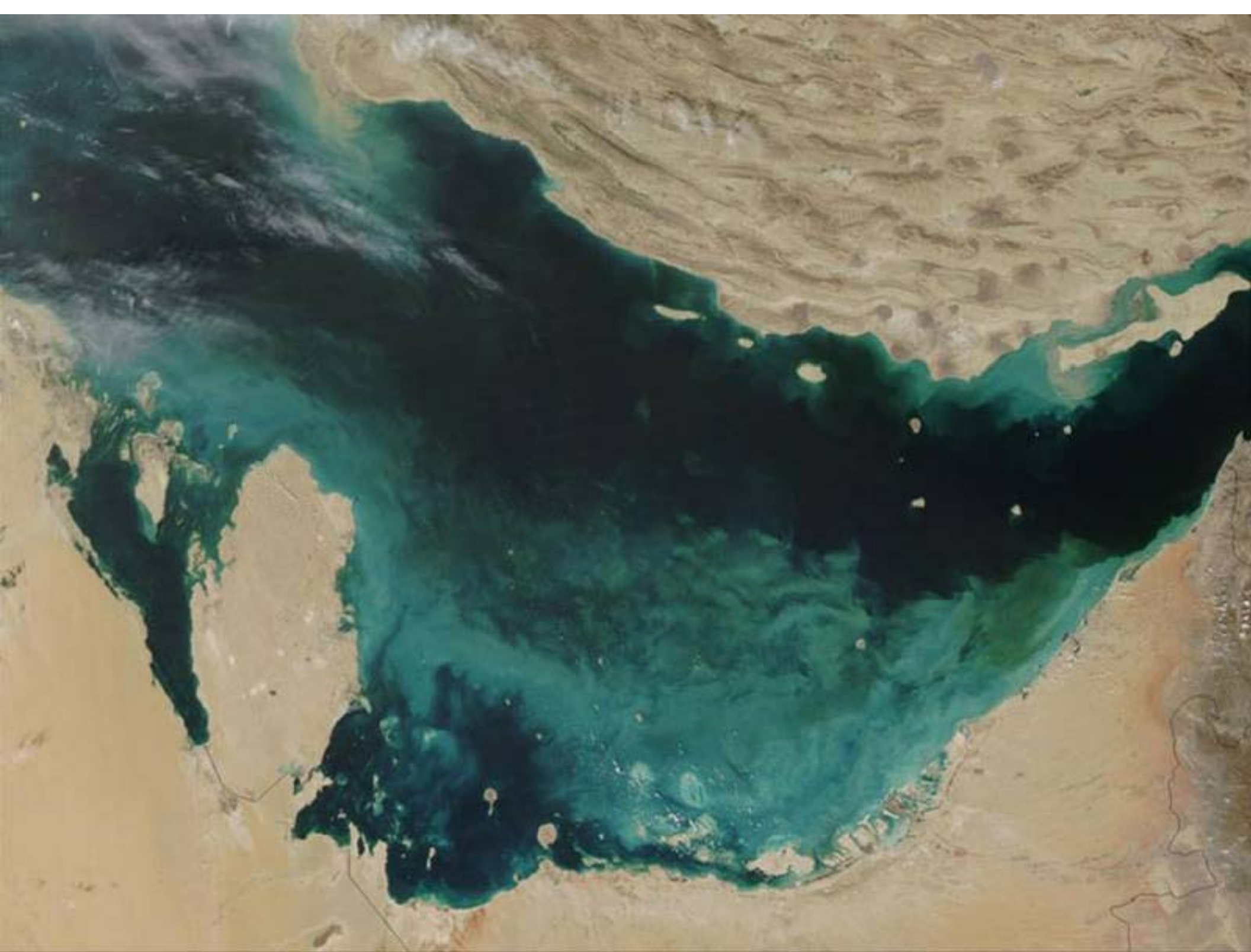
A Tribute to
Douglas James Shearman

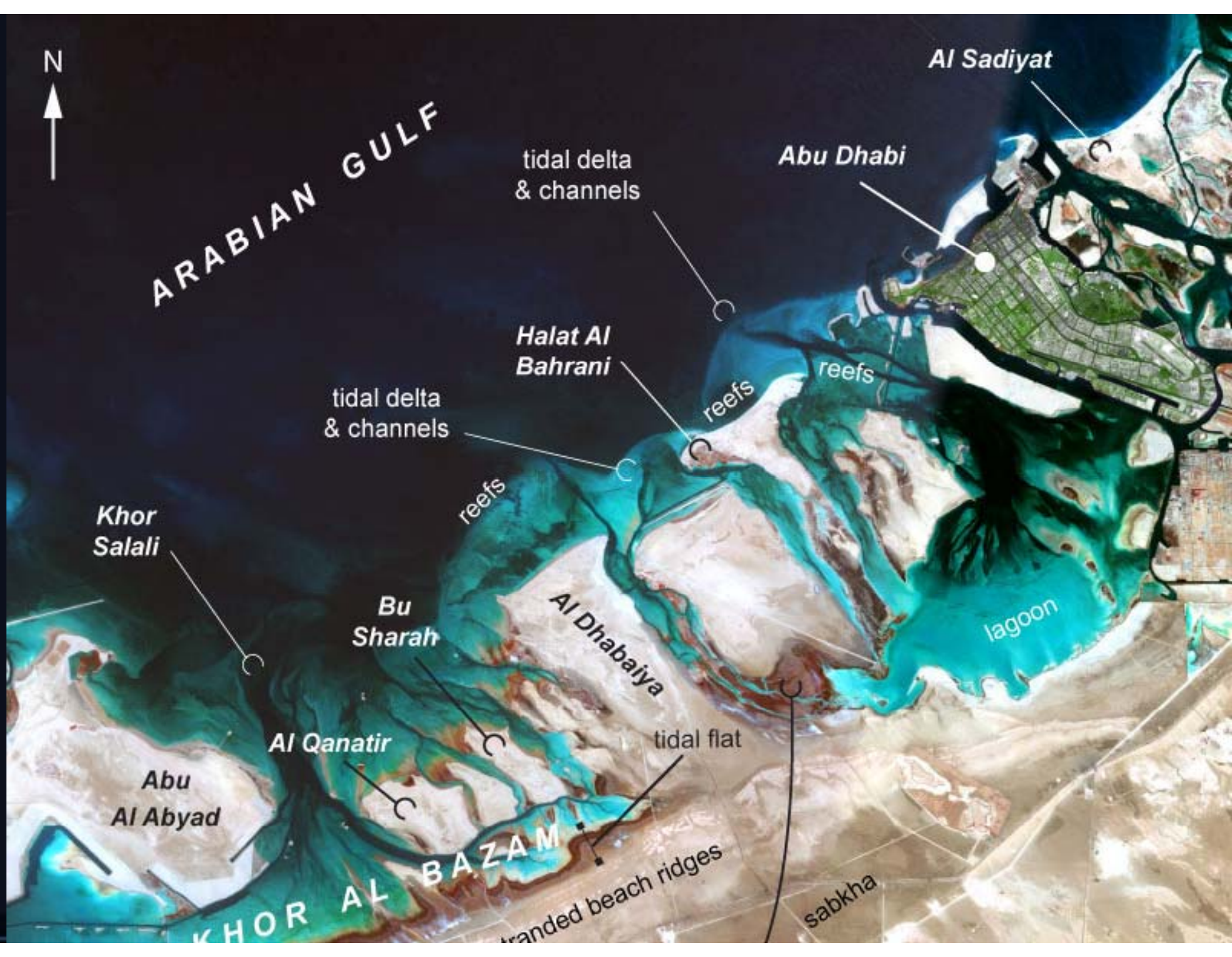
Edited by
Christopher G.St.C. Kendall
Abdulrahman S. Alsharhan

Special Publication
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of Sedimentologists

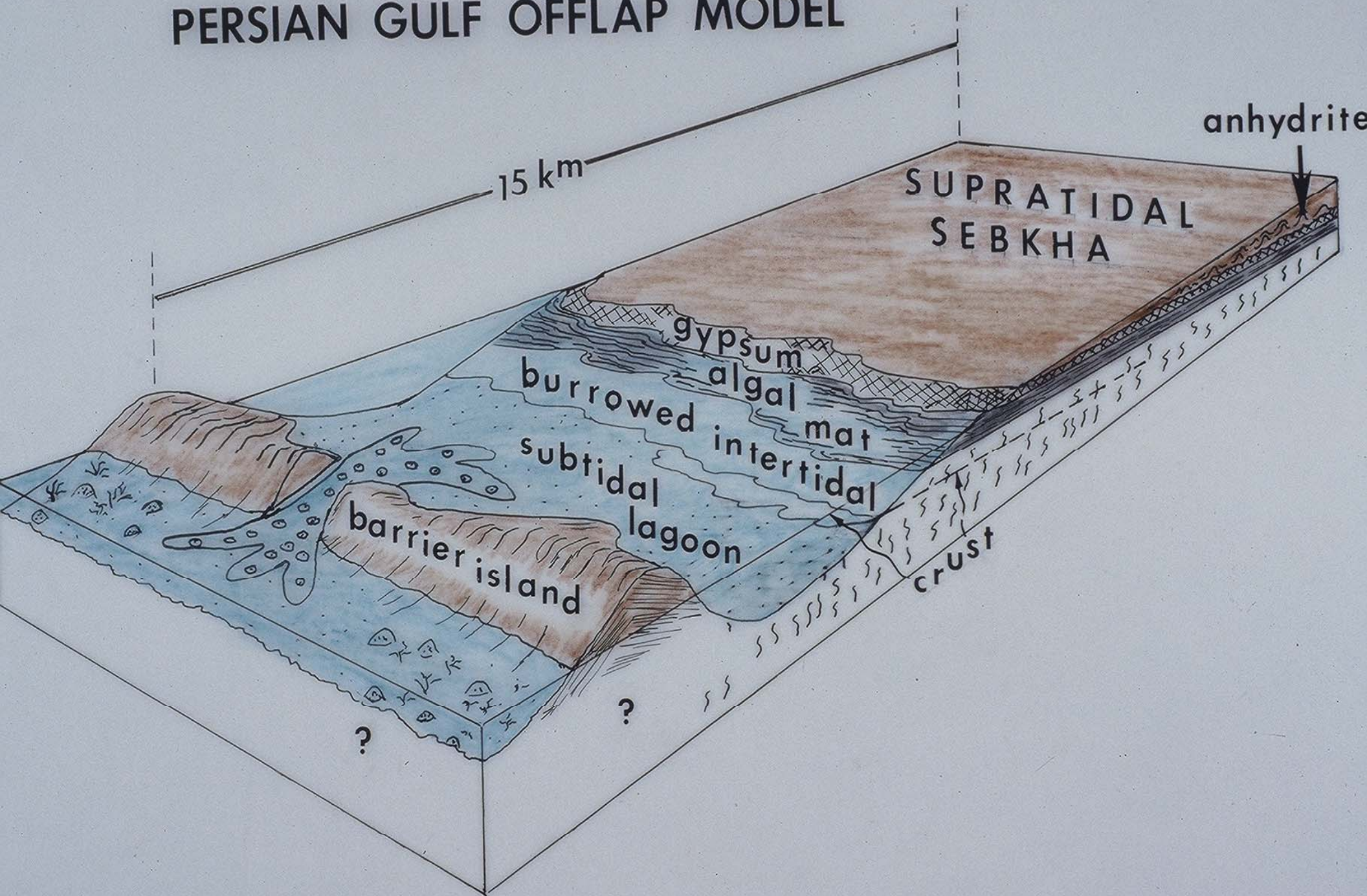
 WILEY-BLACKWELL







PERSIAN GULF OFFLAP MODEL





*Marine Cementation

*Barrier Islands

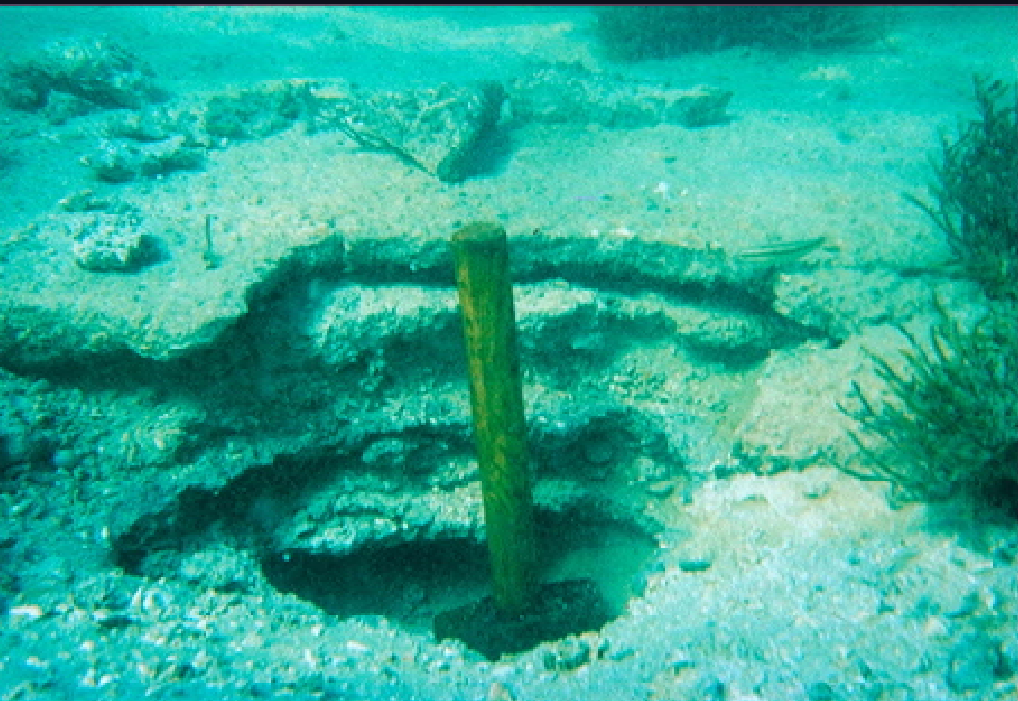
*Sabkhas

*Dolomite

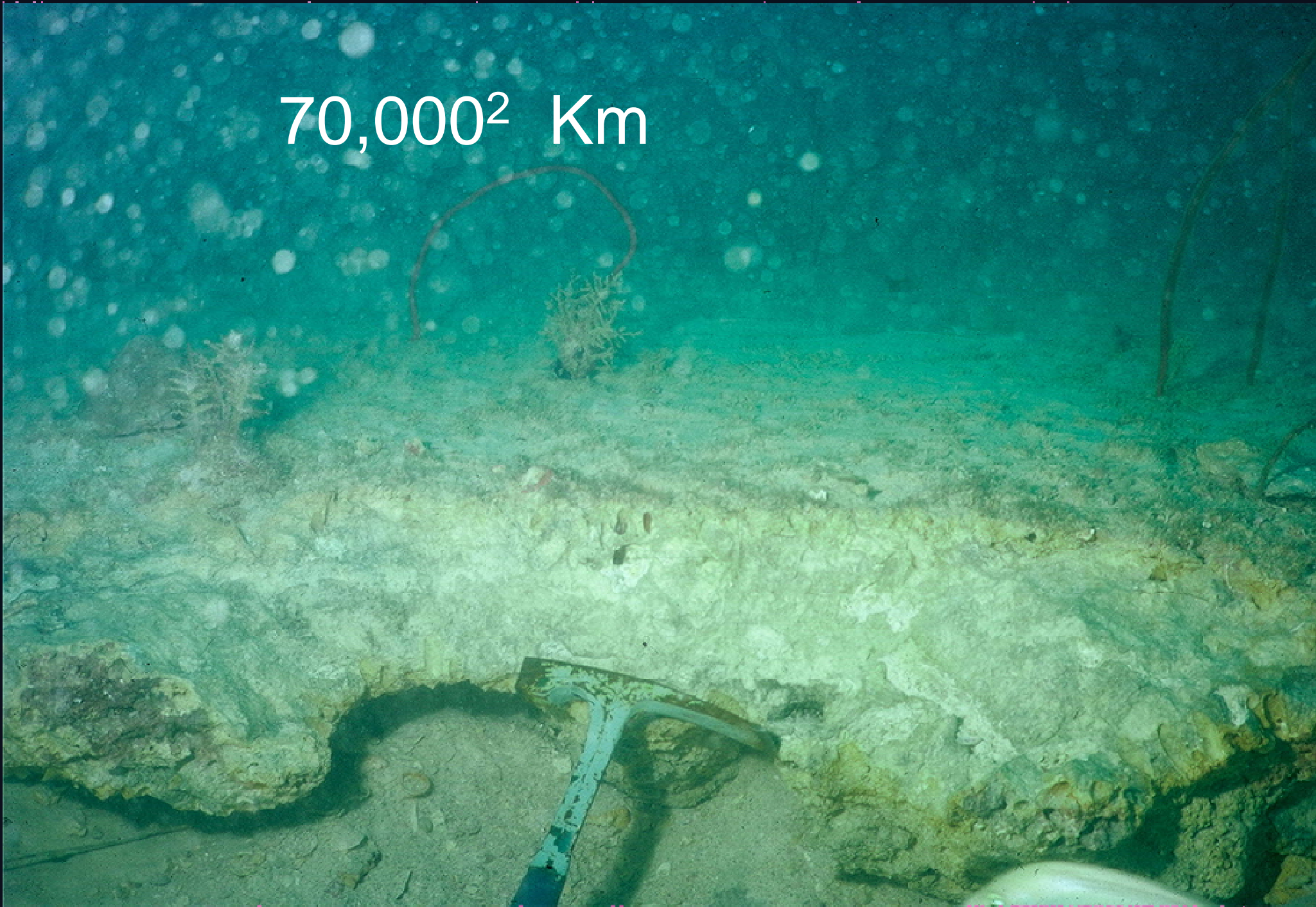
*Evaporites

*Beachrock

*Tidal Channels



70,000² Km



Dubai Tidal Channel 1967

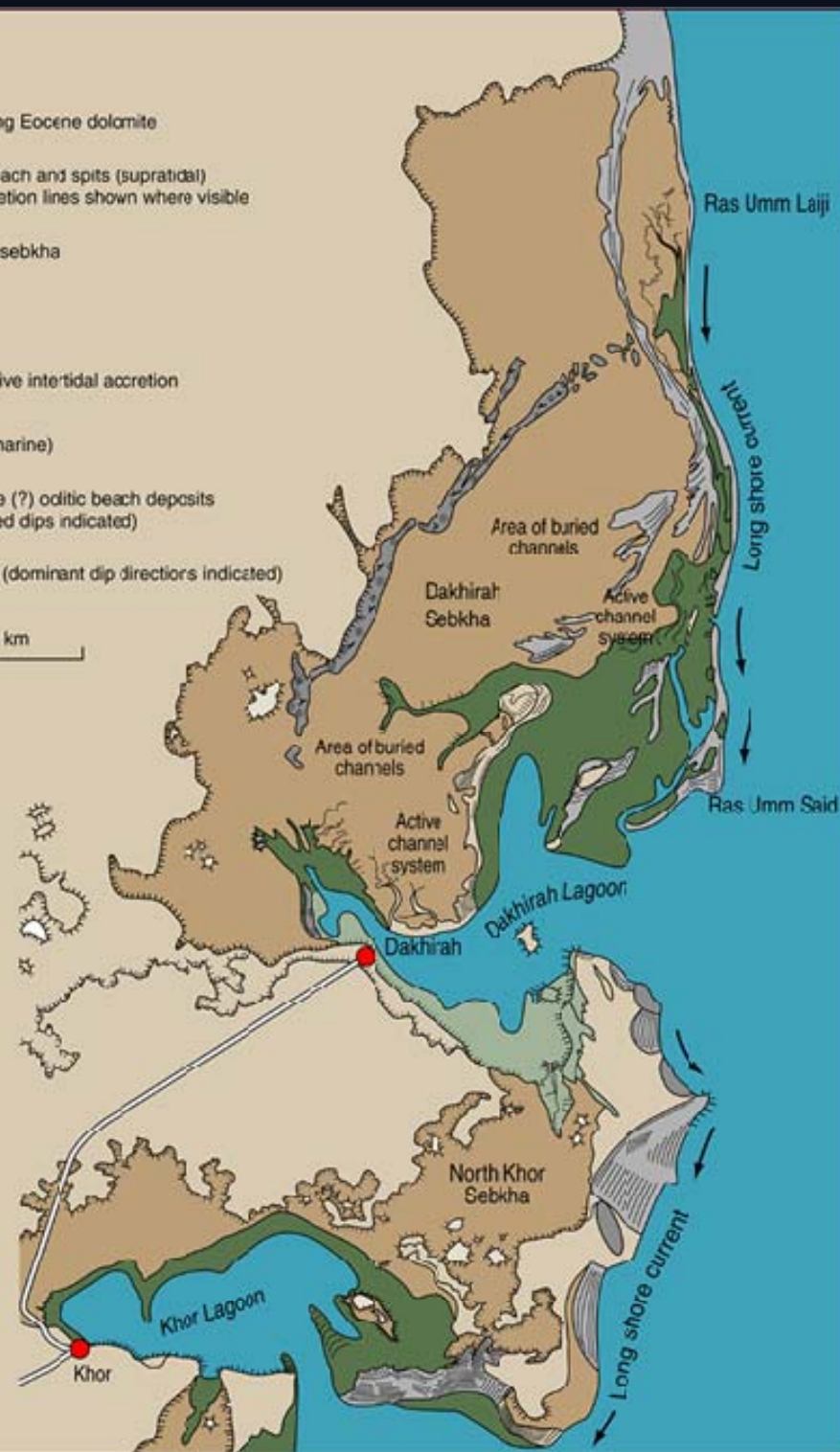




LEGEND

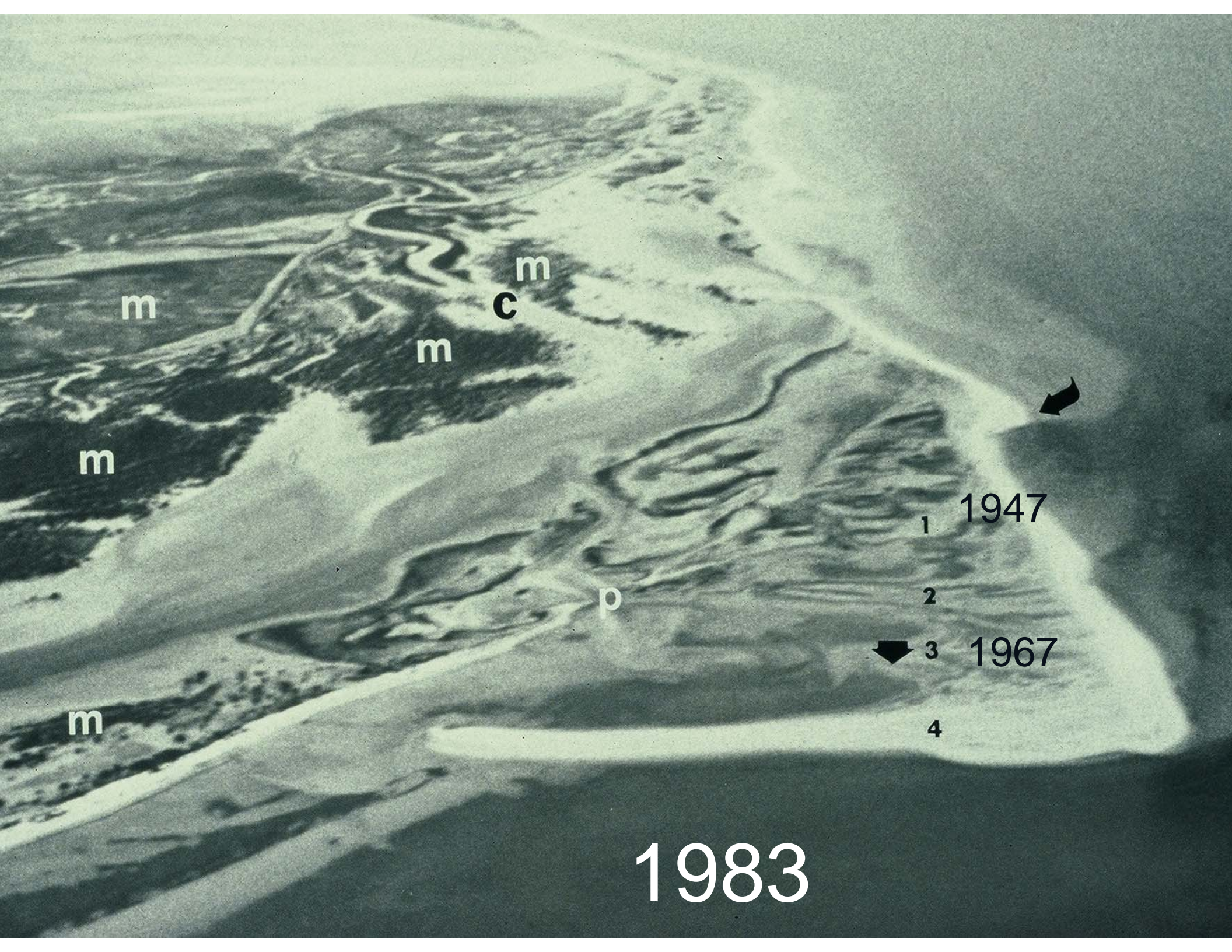
-  Outcropping Eocene dolomite
-  Chenier beach and spits (supratidal)
major accretion lines shown where visible
-  Supratidal sebkha
-  Intertidal
-  Area of active intertidal accretion
-  Subtidal (marine)
-  Pleistocene (?) oolitic beach deposits
(major x-bed dips indicated)
-  Dune area (dominant dip directions indicated)

2 km





1966



m

m
c

m

m

m

p

1 1947

2

3 1967

4

1983





Image © 2006 DigitalGlobe
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1987





Image © 2006 DigitalGlobe
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Google™

Pointer 25°45'33.90" N 51°35'32.58" E elev 4 m Streaming ||||| 100%

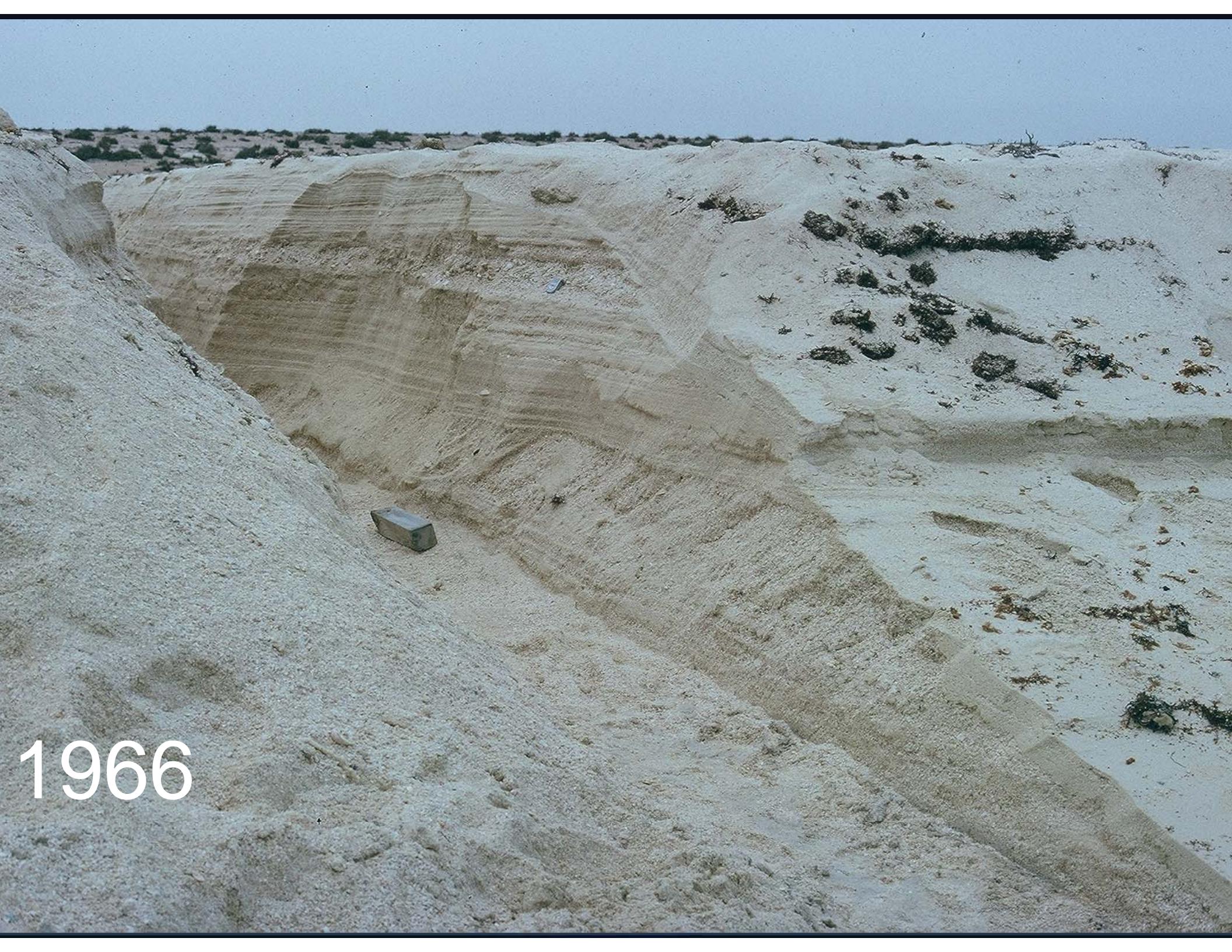
Eye alt 524 m



2005



2005



1966

A photograph of a coastal scene. In the foreground, a person wearing a light-colored long-sleeved shirt and bright yellow shorts stands on a narrow, rocky path that runs along the edge of a body of water. The water is calm and reflects the sky. In the background, another person in a white shirt and dark pants is walking away from the camera on the sandy beach. The sky is a clear, deep blue. The overall scene is arid and desolate.

Arid Tidal Flats, the movie

1983

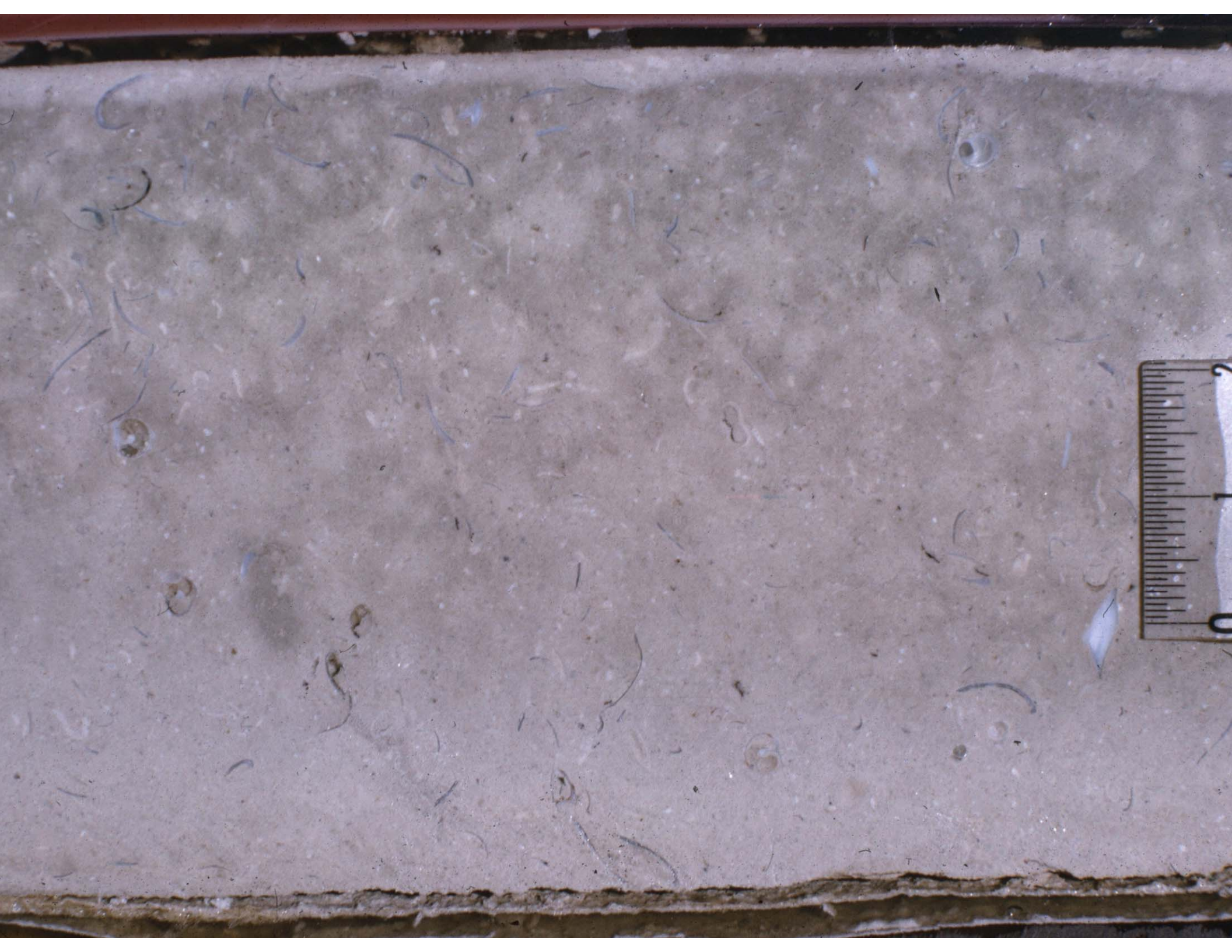


2005



1966







Permian West Texas

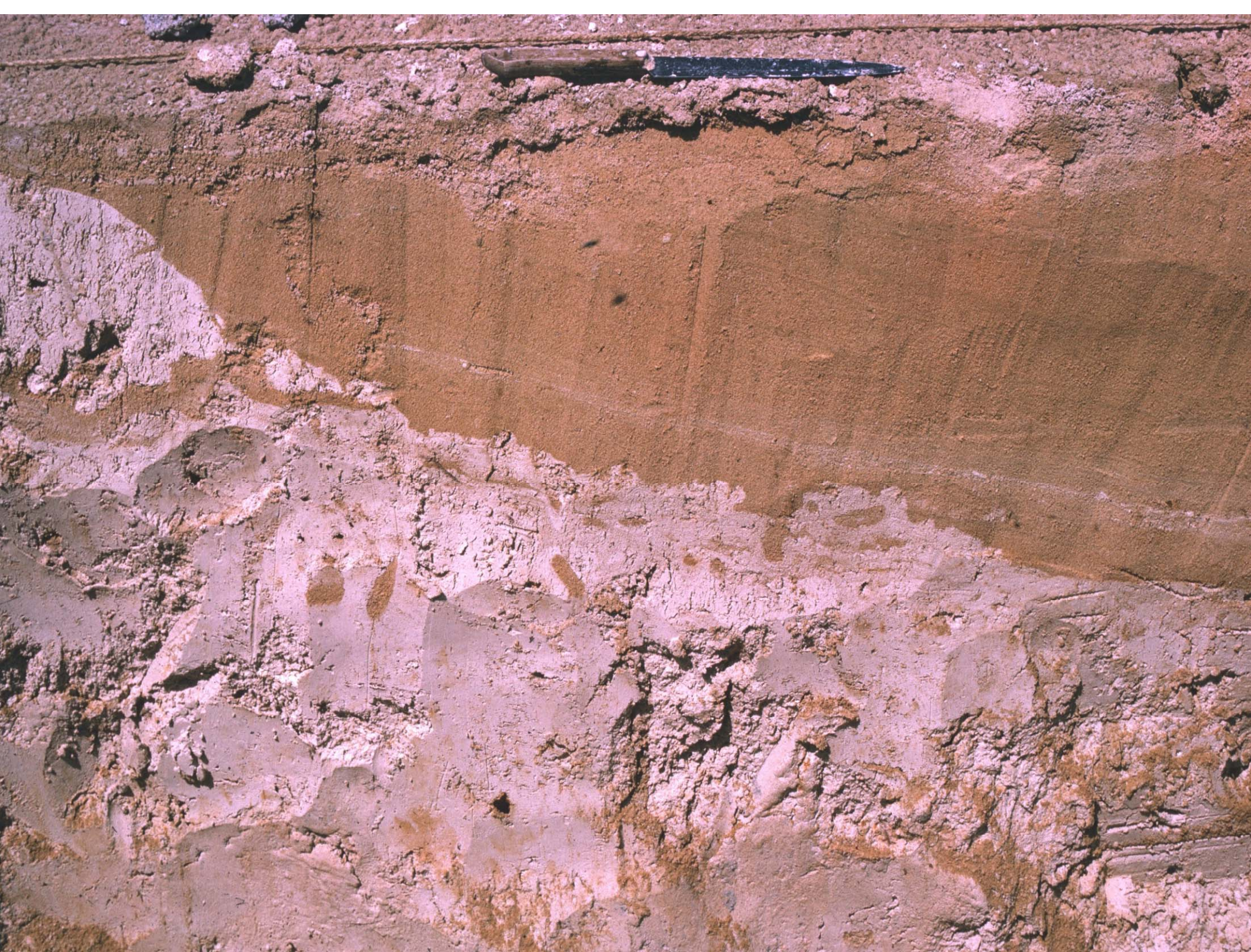
Filled Tidal Channels



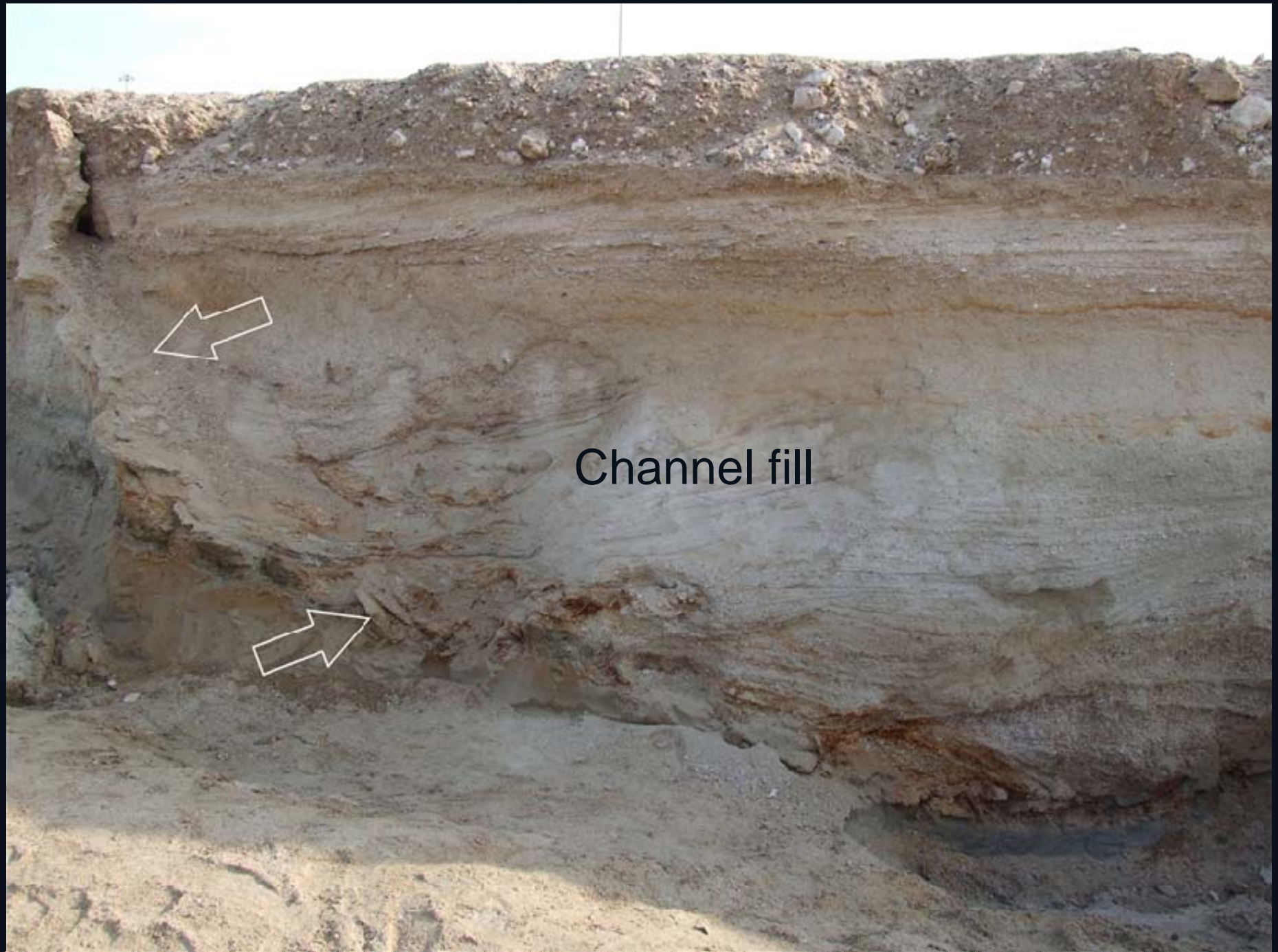
1966



966

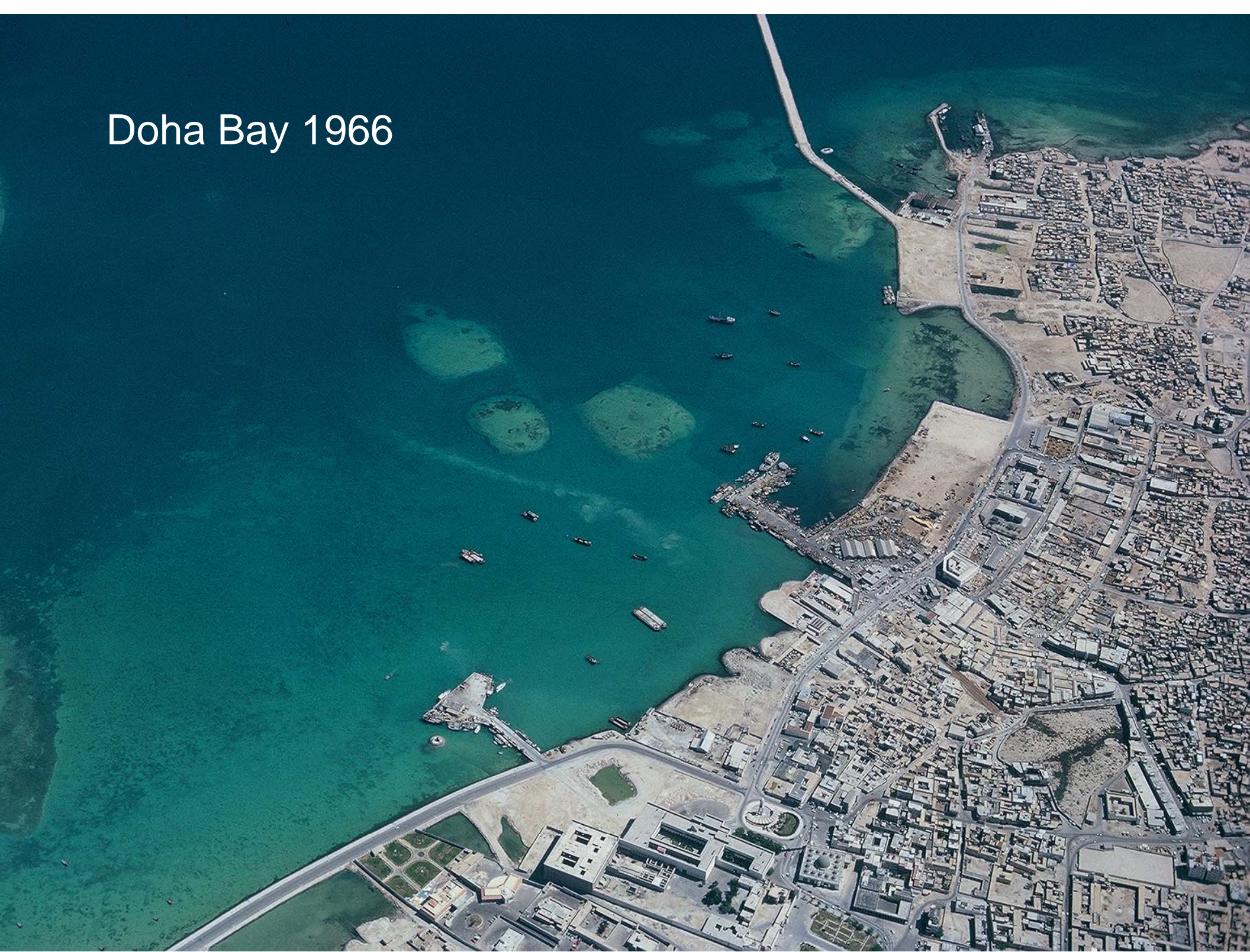






Channel fill

Doha Bay 1966



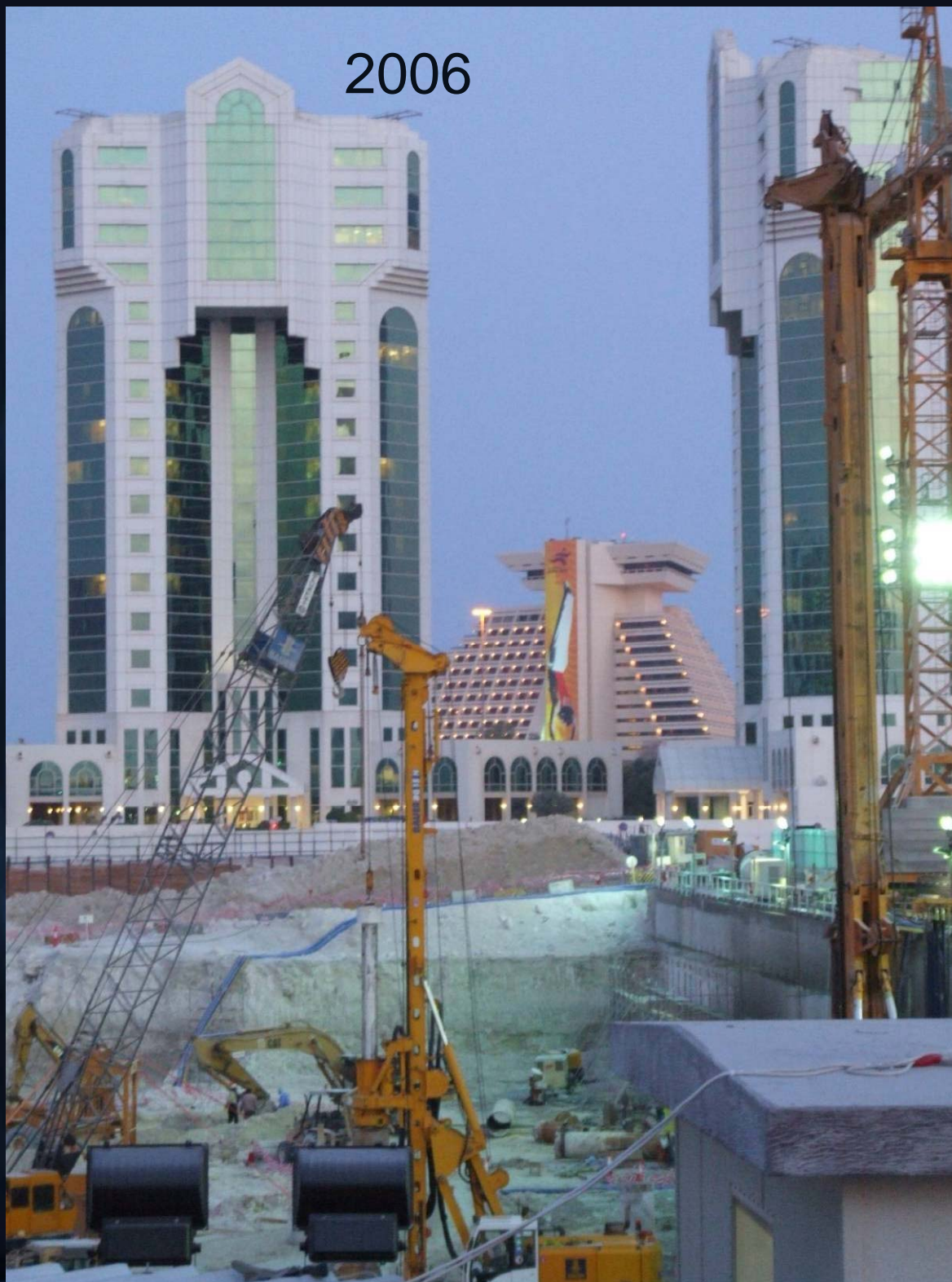
Doha 1983



Doha 1983



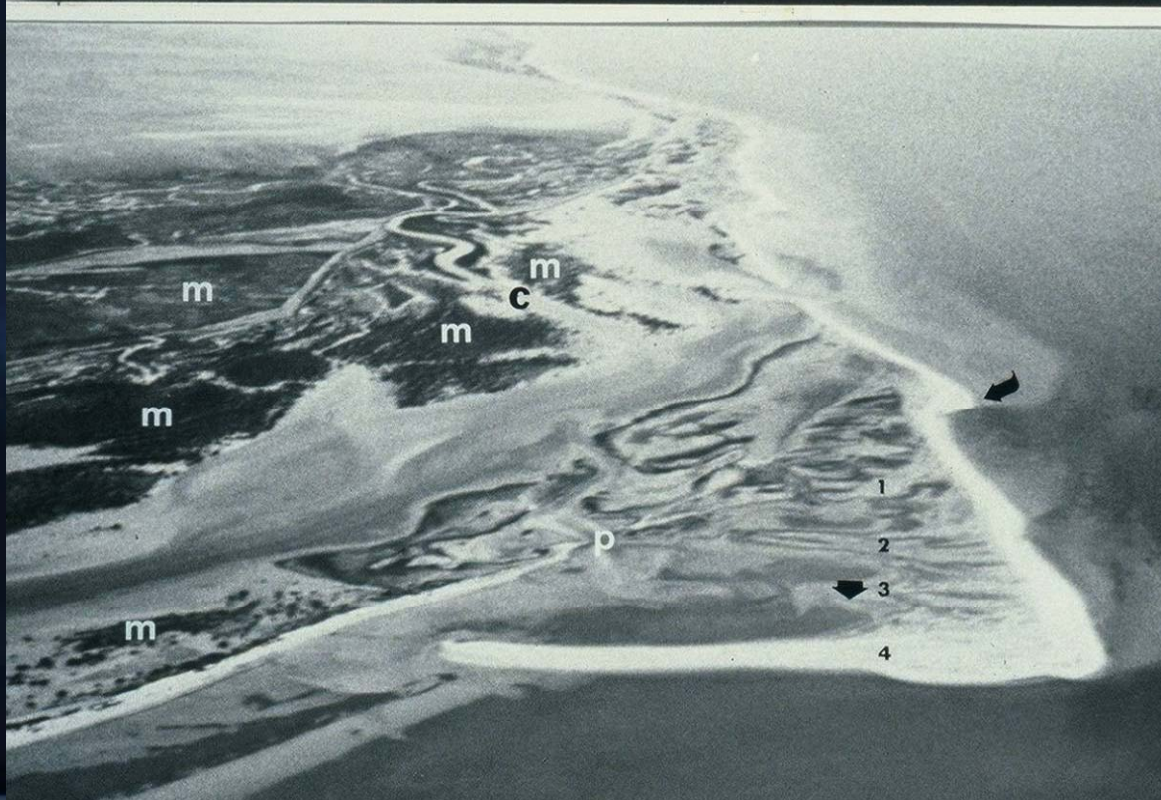
2006

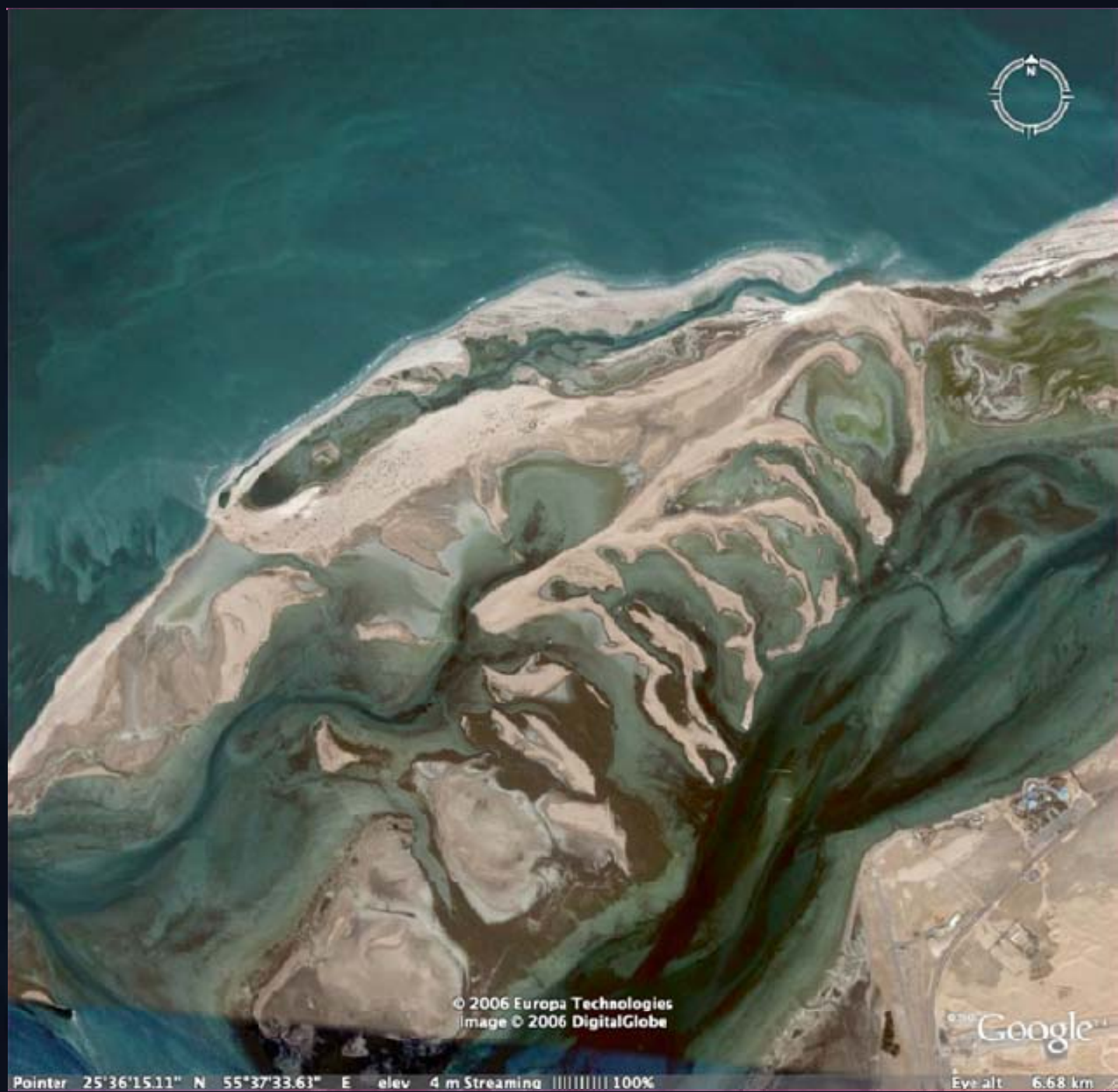




Not a Flooding Surface







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Image © 2006 DigitalGlobe

Google

Pointer 25°36'15.11" N 55°37'33.61" E elev 4 m Streaming 100%

Elev alt 6.68 km

FUTURE and continued offlapp model

- Tidal flats with supratidal anhydrite and marine synsedimentary horizontal seals
- Shore parallel carbonate beach reservoirs (and hooked spits)
- Shore perpendicular tidal channel reservoirs (connected)

UN ANSWERED QUESTIONS

- ✎ Marine leaching, ?where is it?
- ✎ Marine cement (additional criteria)
- ✎ Origin of fine grained sediment (no Penecillus, no mullet...Top down)
- ✎ Holocene sealevel fluctuations
- ✎ Dolomite

Pleistocene carbonate
dune

Dunes migrating
into the sea

RECENT CARBONATE BEACH

Area of Pisolite
Formation

LINE OF SECTION IN
ENCLOSURE

A

B

C

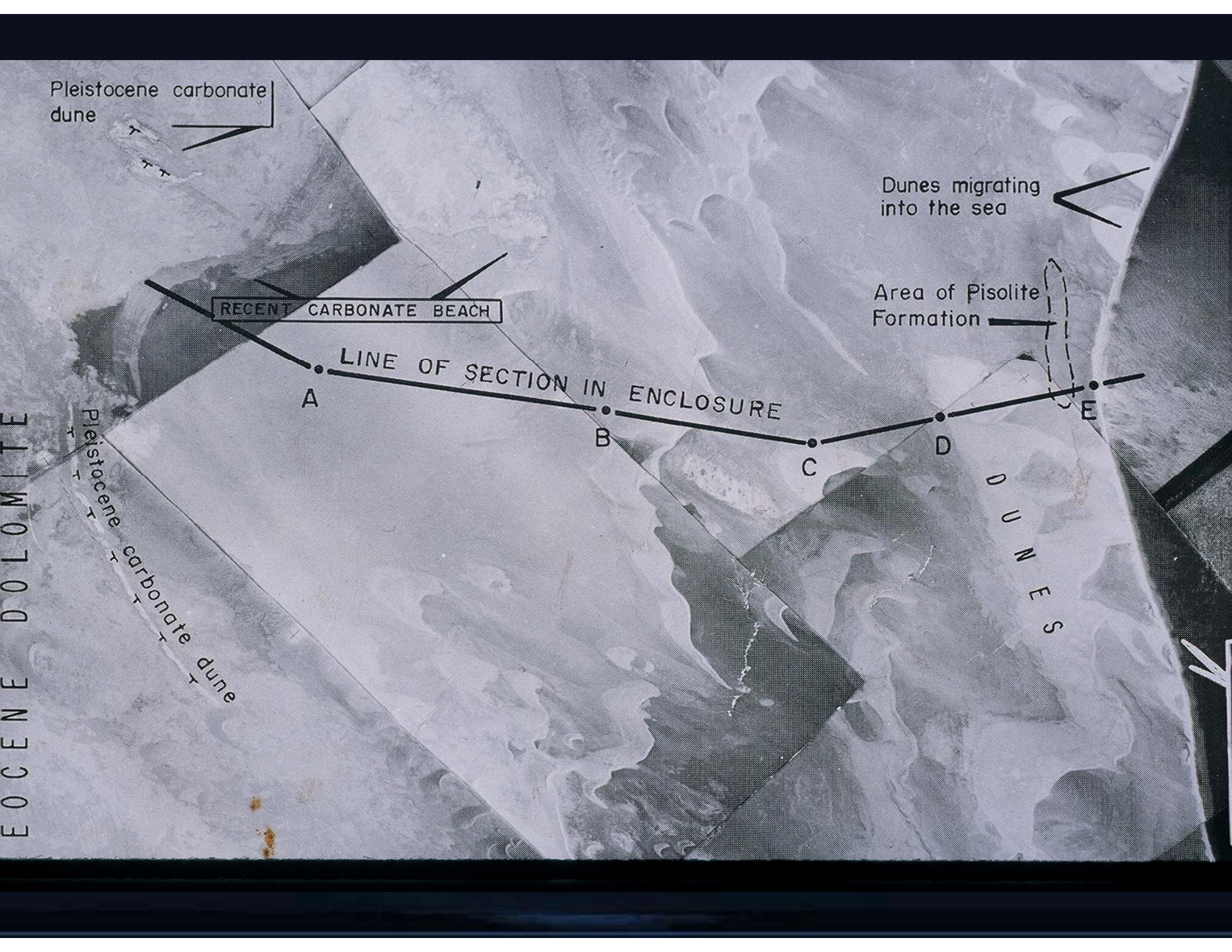
D

E

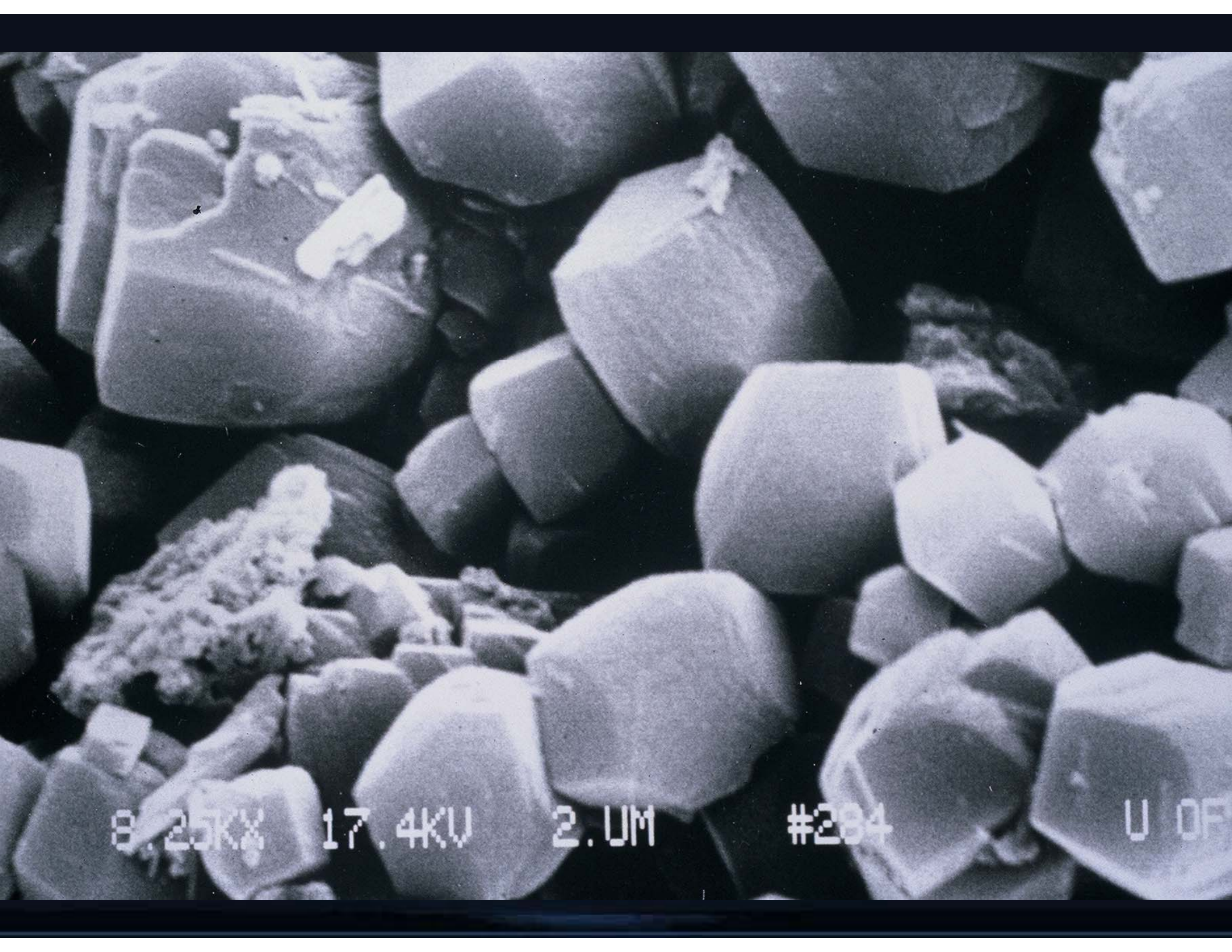
Eocene dolomite

Pleistocene carbonate dune

DUNES







8.25KV

17.4KV

2.UM

#284

U OF



SPECIAL THANKS

Douglas Shearman

Bruce Purser

Kees DeGroot

Michael Lloyd

Peter Scholle

Robert Halley

Paul Harris

AAPG (Arid Tidal Flats, the movie)