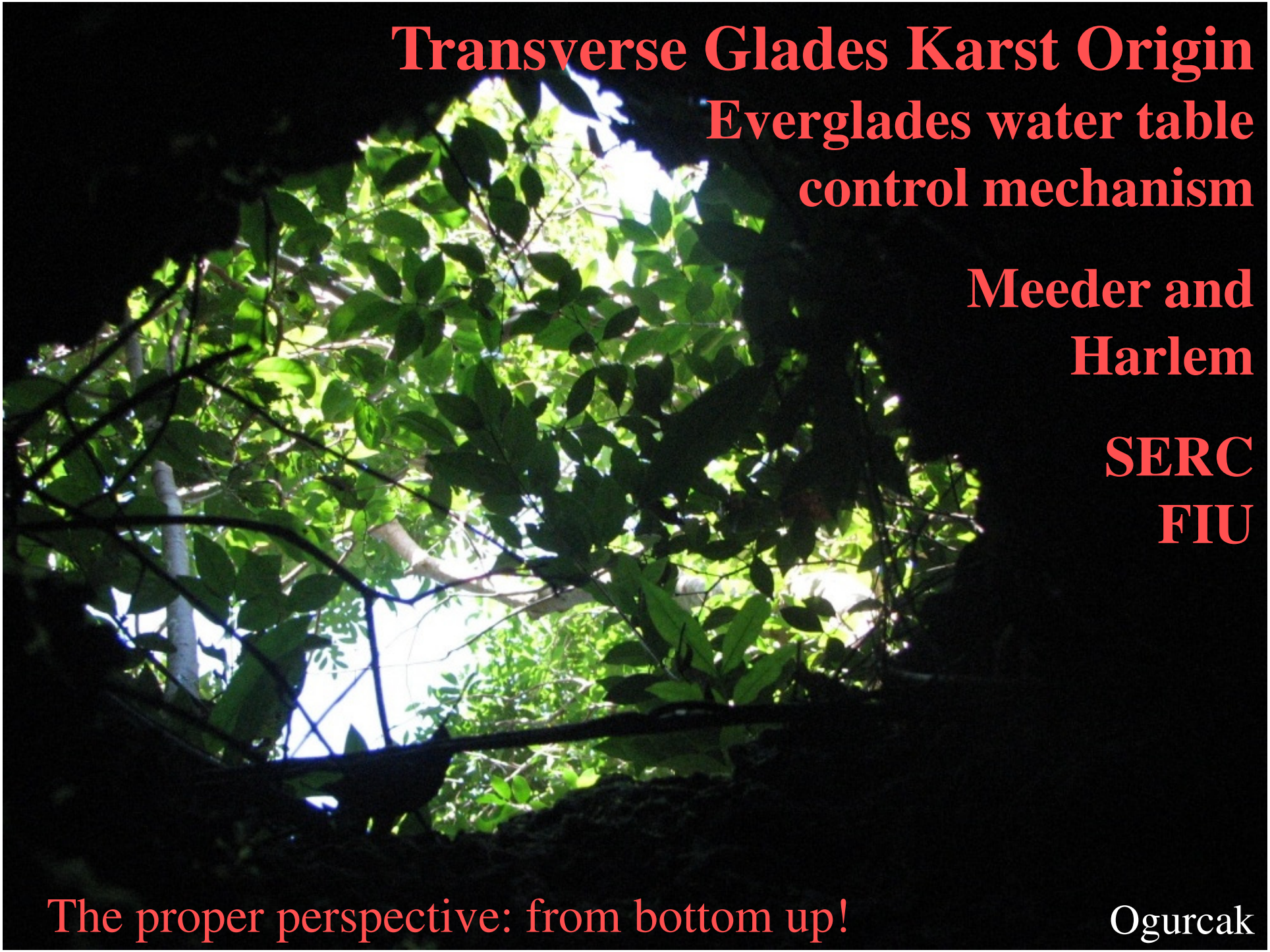

Transverse Glades Karst Origin
Everglades water table
control mechanism
Meeder and
Harlem
SERC
FIU
The proper perspective: from bottom up!
Ogurcak

CONCLUSIONS

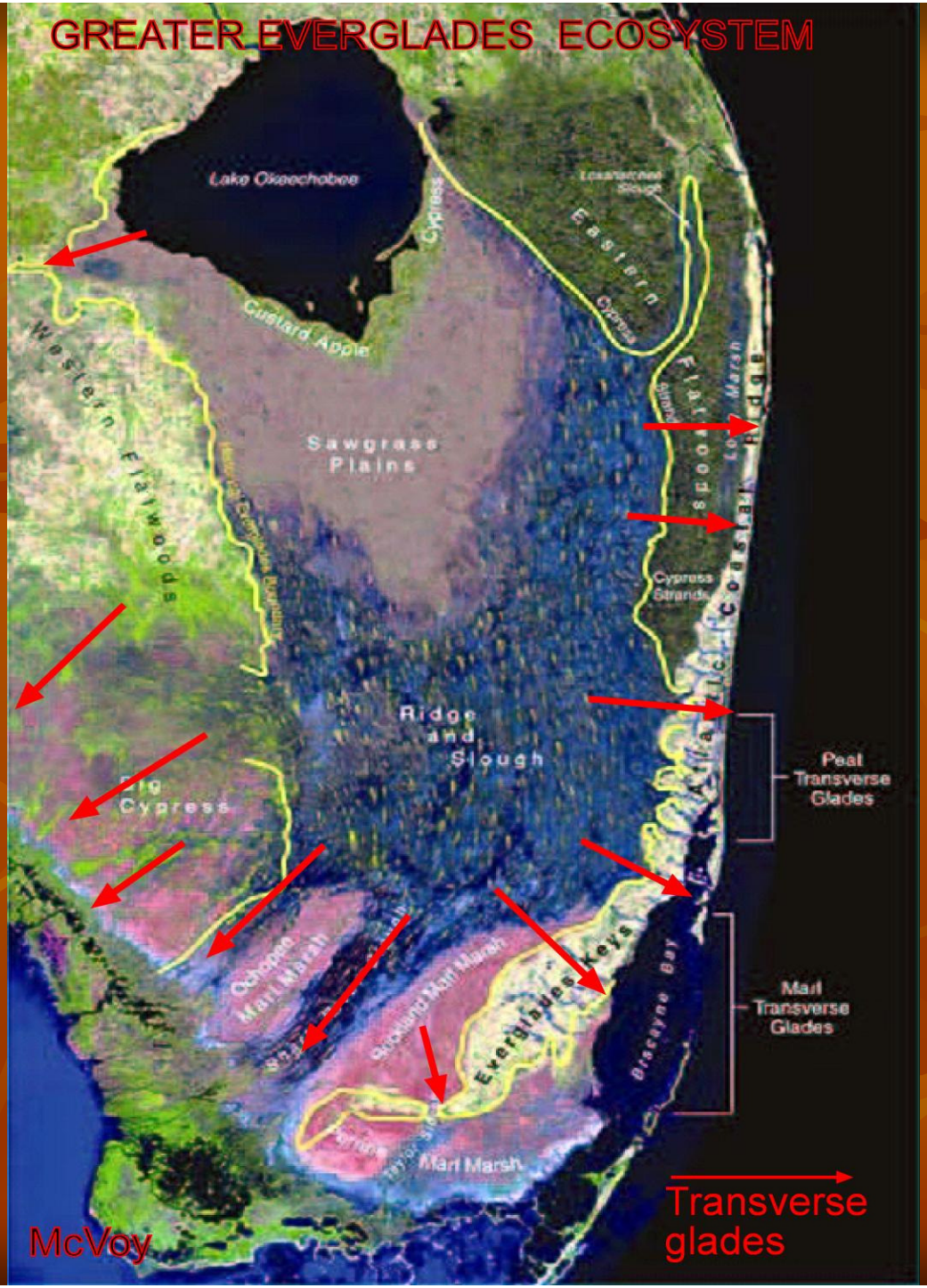
- Transverse glades are dynamic karst geological features
- TG morphology (nick points) control Everglades water table
- Changes in nick point elevation can produce hydroperiod changes (regardless of rainfall)
- Breaks in Everglades "seal" can produce hydroperiod changes (increased vertical drainage)

Everglades Basin Definition

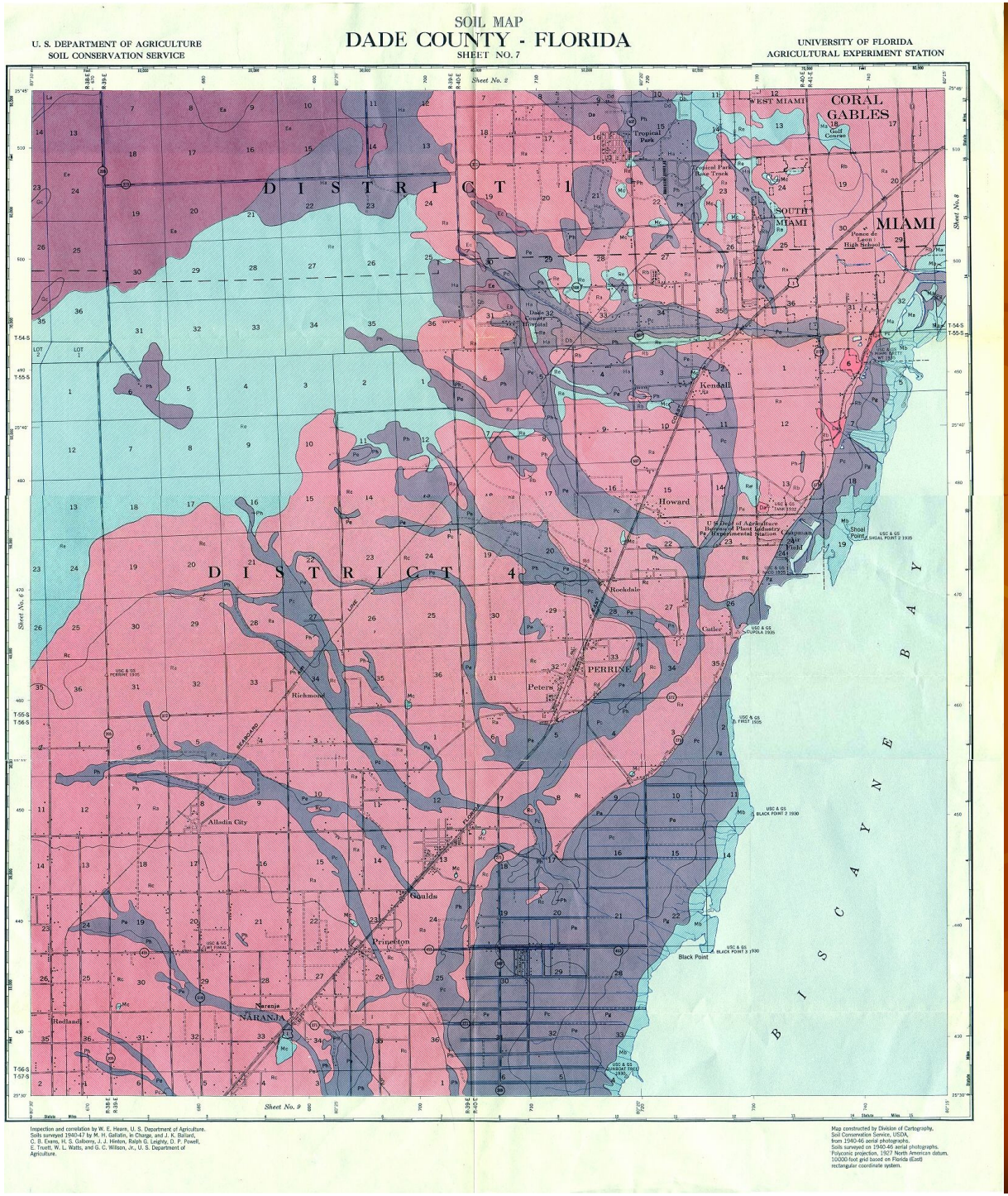
The Everglades Basin is a nearly "closed topographic valley, with a southern dip suggestive of a collapsed karst underground drainage system (plunging karst syncline)"

TRANSVERSE GLADE DEFINITION

- A Transverse Glade is a surface-shallow ground water drainage pathway moving water out of the main Everglades Basin and controls the Everglades water table".
- These Transverse Glades are karst valleys with changing nick point elevations as karst development progresses.



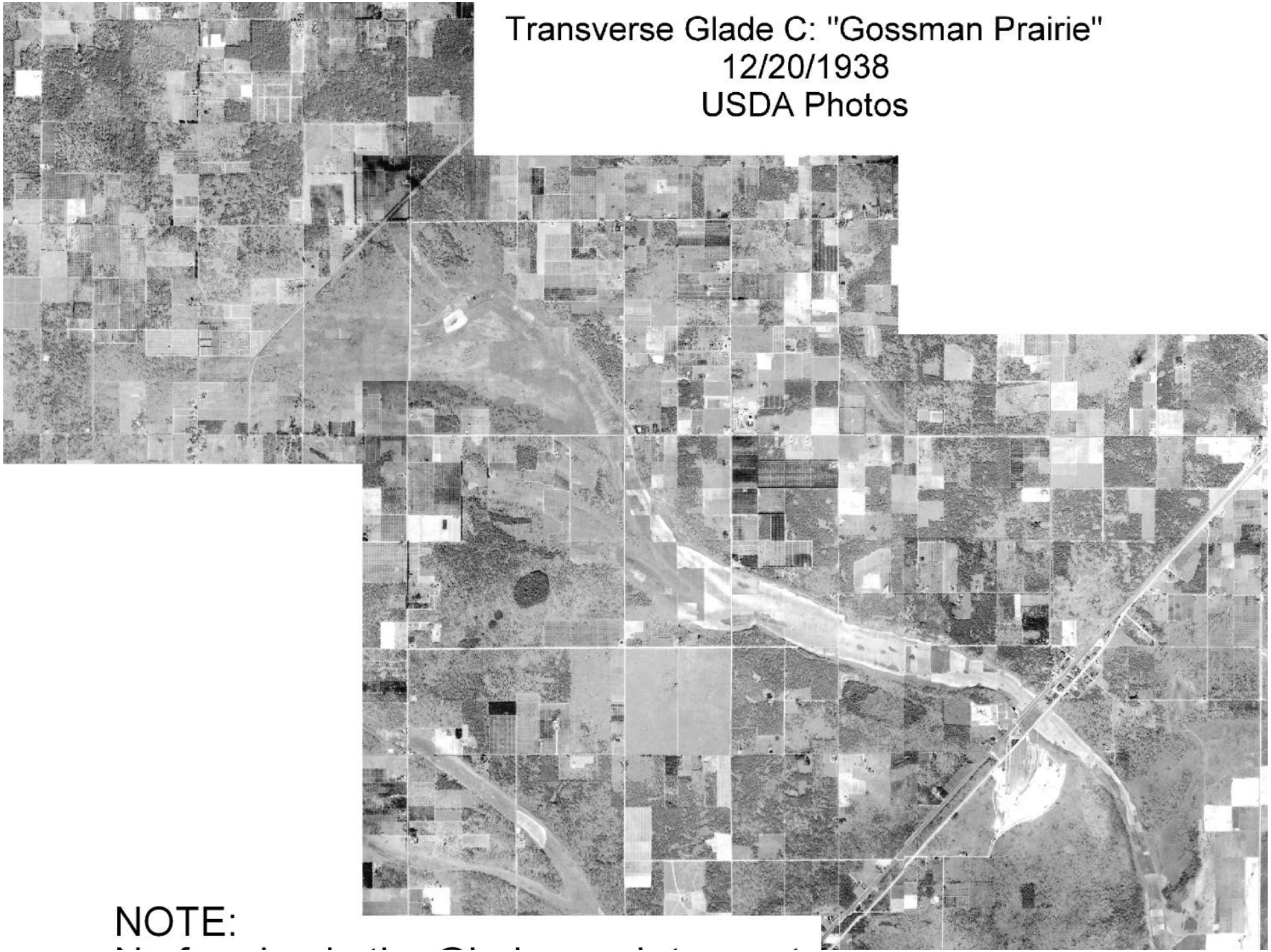
Transverse glades (Karst Valleys) describe a radial pattern of drainage around the main central karst valley- the "Everglades". The Everglades is a semi-closed basin which is dipping to the south- a plunging karst syncline.



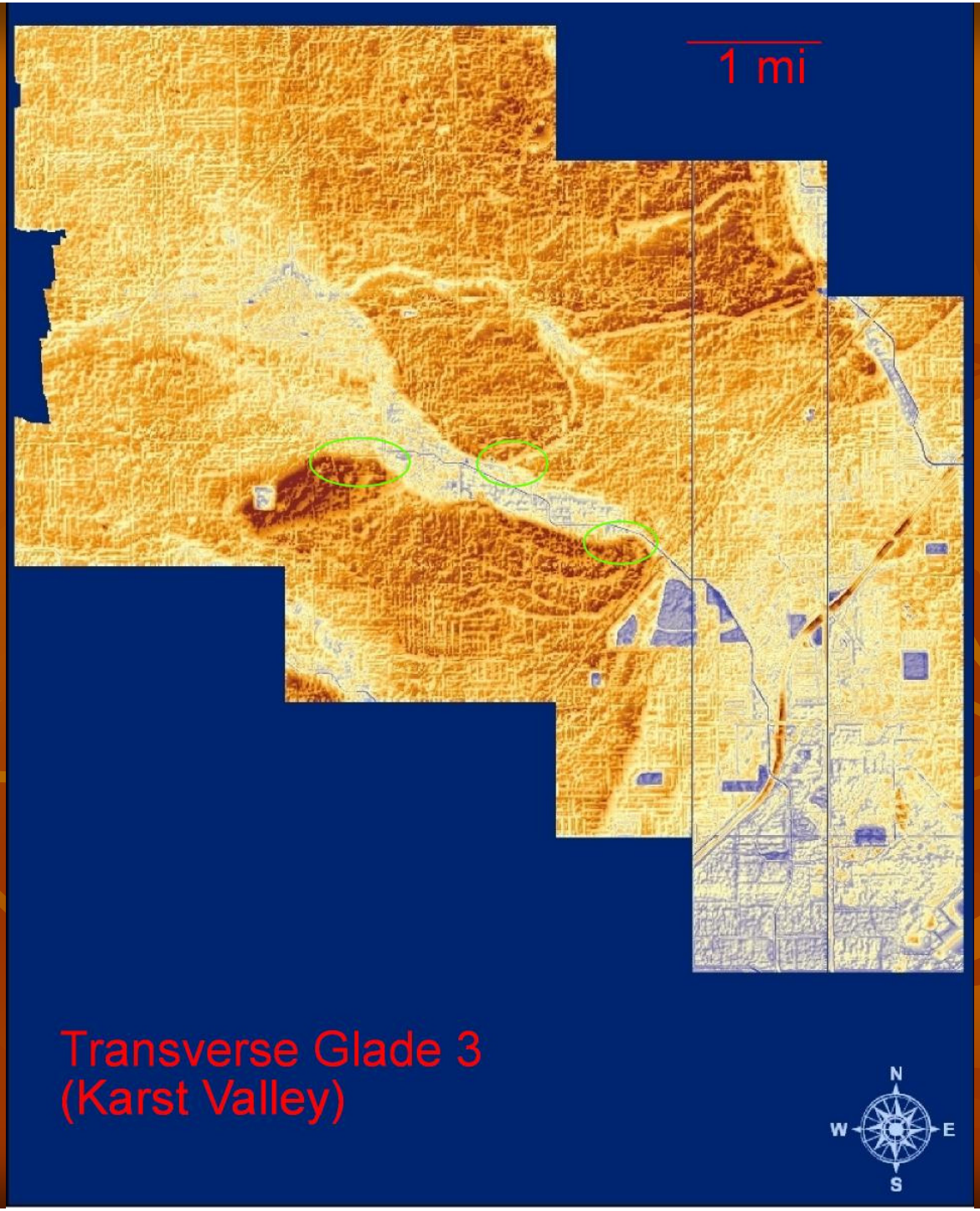
Transverse Glades

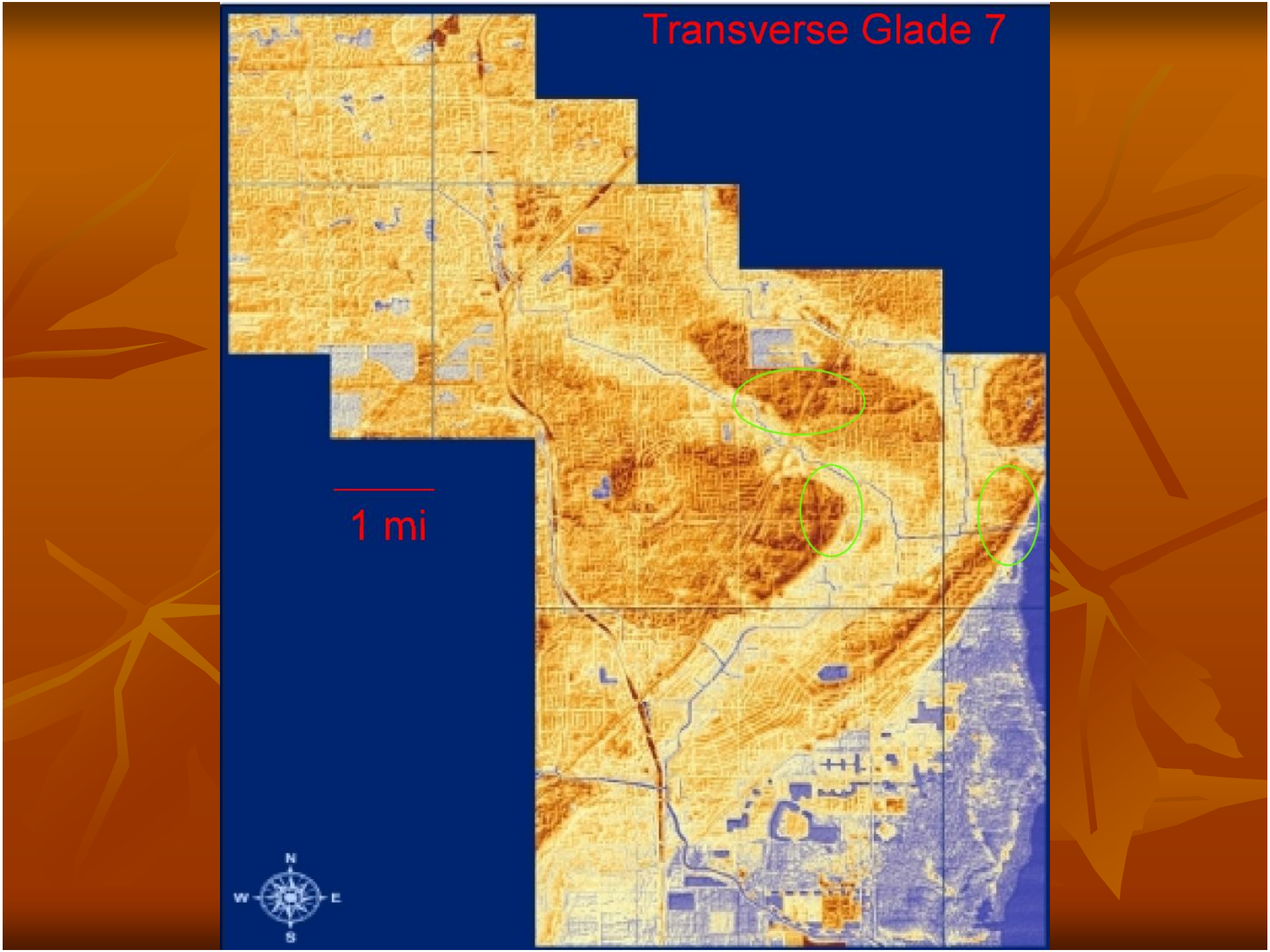
- Typically 1-2 km wide.
- Typically 1-2 m deep.
- Increased gradient compared to Everglades.
- Nick points
- Bedrock controlled
- Elevation decreases southward

Transverse Glade C: "Gossman Prairie"
12/20/1938
USDA Photos



NOTE:


1 mi
Transverse Glade 3
(Karst Valley)
N
W
E
S

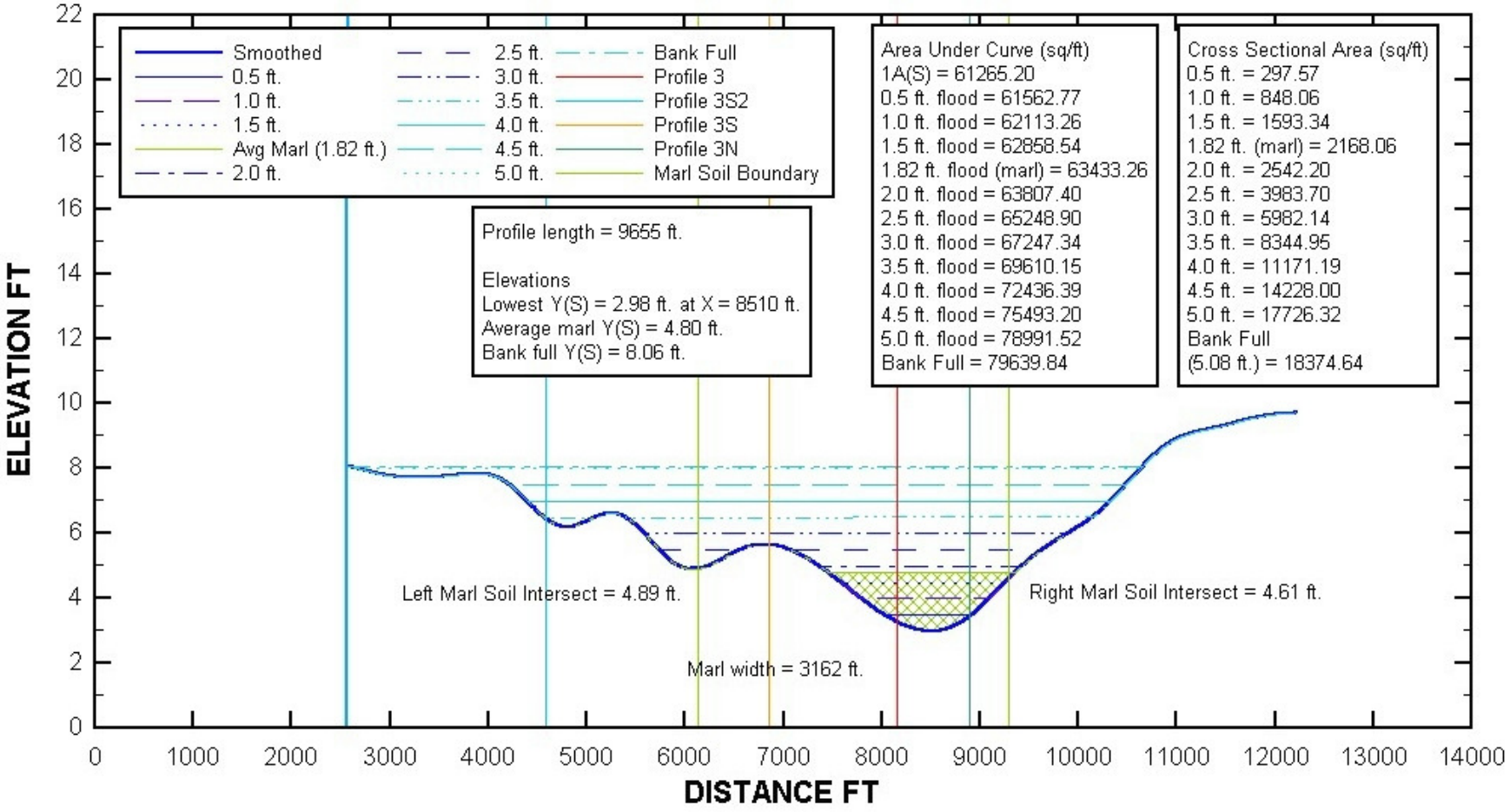

Transverse Glade 7
1 mi
N
W
E
S

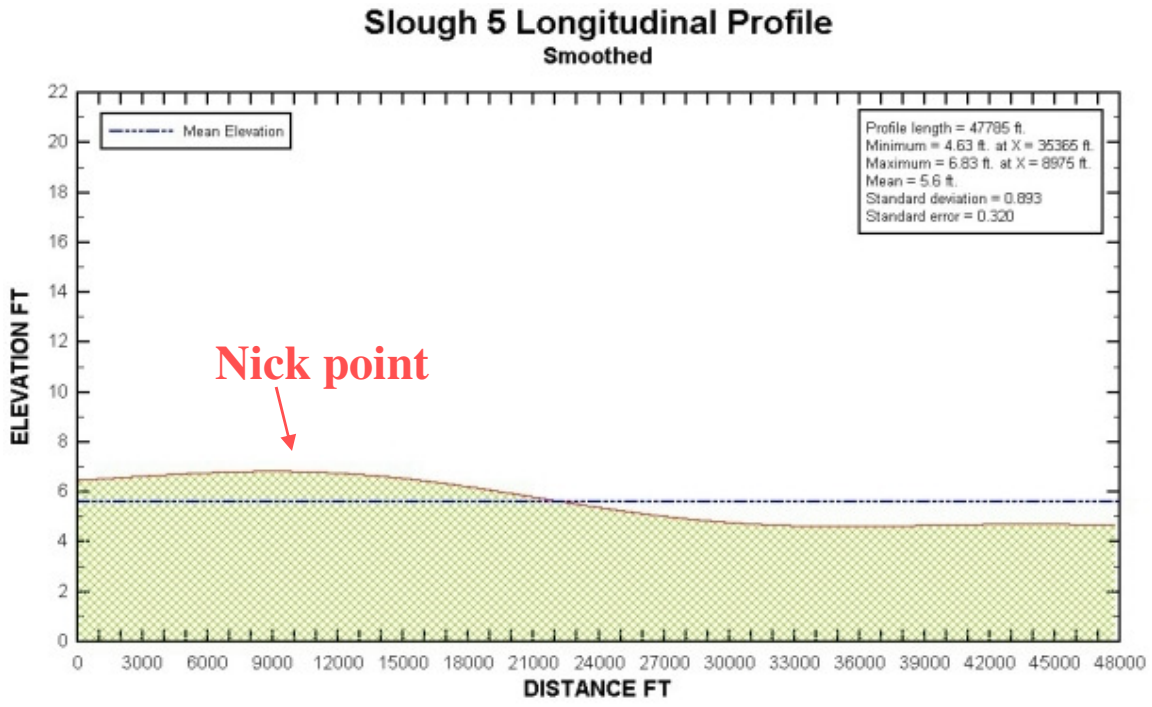

Transverse Glade 7
Profiles A - N
7A
7B
7C
7D
7E
7F
7G
7H
7I
7J
7K
7M
7L
7M
7N
1 mi
N
W
E
S

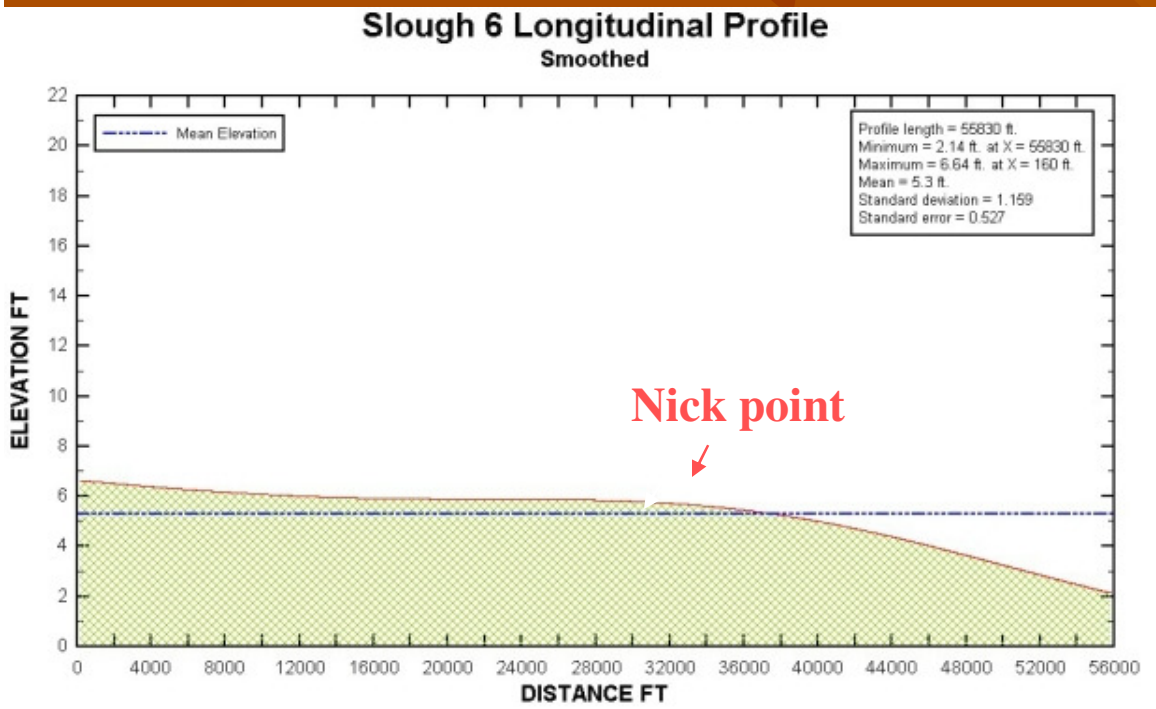
Slough 3 Cross Section B

Stage

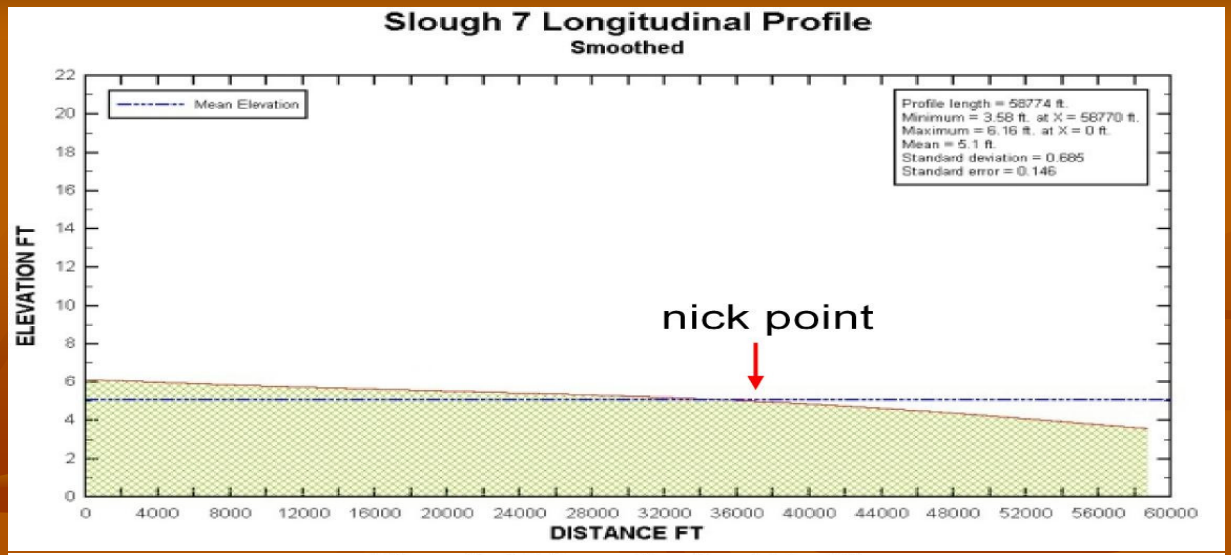
9458 ft. from Start

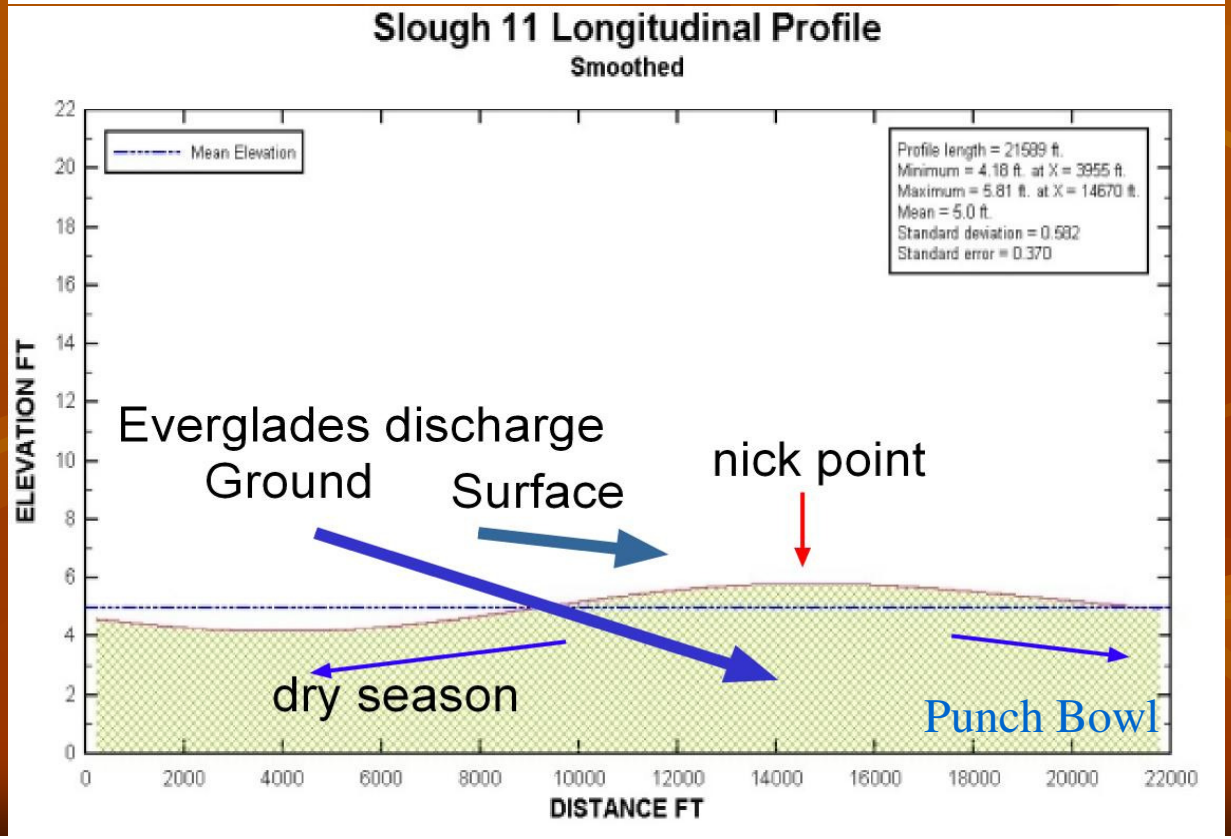






- Longitudinal profiles of two Transverse Glades 5 and 6.
- NOTE: nick points at different elevations and positions along glade





- Longitudinal profiles of Transverse Glades 7 and 11
- Note: TG 11's nick point is very high encouraging groundwater flow and forms watershed divide during dry season

Karst escarpment along Snapper Creek Transverse Glade at (Sardowski Park)

Karst produced rock fractures, Deering Estate


4 Fillies Cave
Snapper Creek
Kressler


1/20/2006

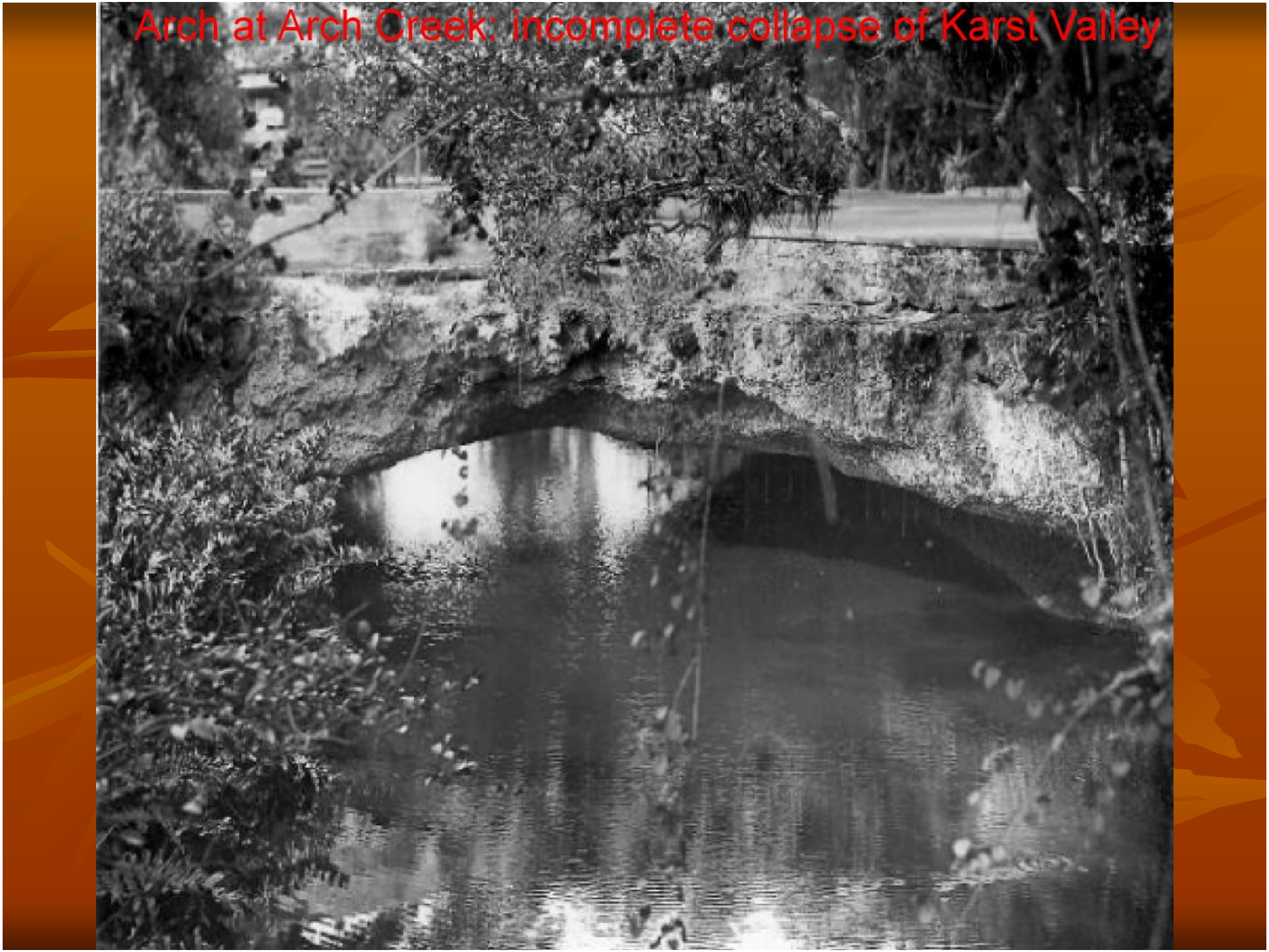
Lower water table cave system at Deering Estate

Large slumping boulder along karst escarpment
Deering Estate, north wall

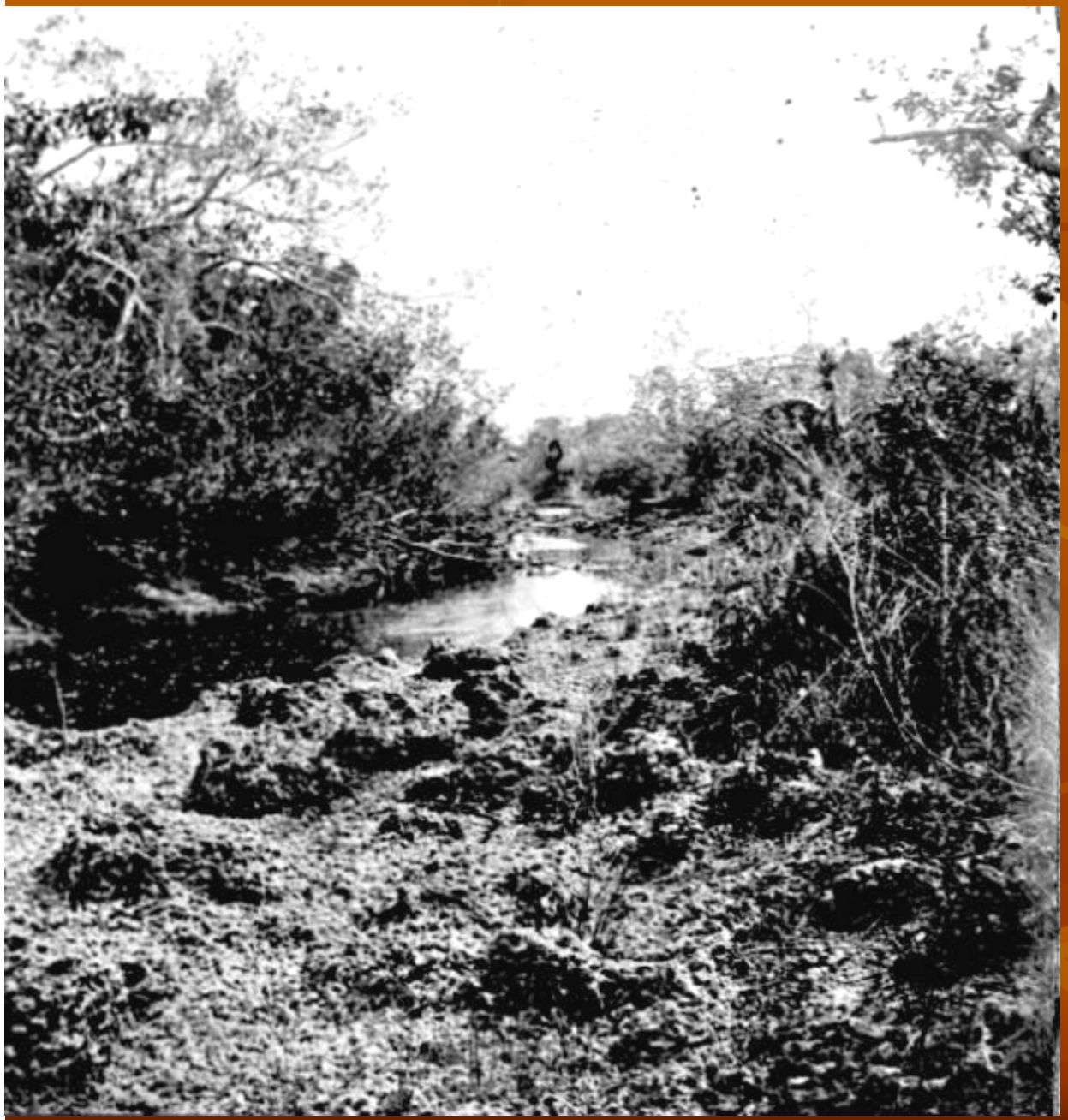

Coalescing dolines forming blind valley
Matheson Hammock


Swallow at Matheson Hammock
at the end of a blind valley

Abandoned spring along eastern side of the Coastal ridge, Deering Estate


Arch at Arch Creek: incomplete collapse of Karst Valley

Arch at Deering Estate:remanents of a collapsed karst valley.



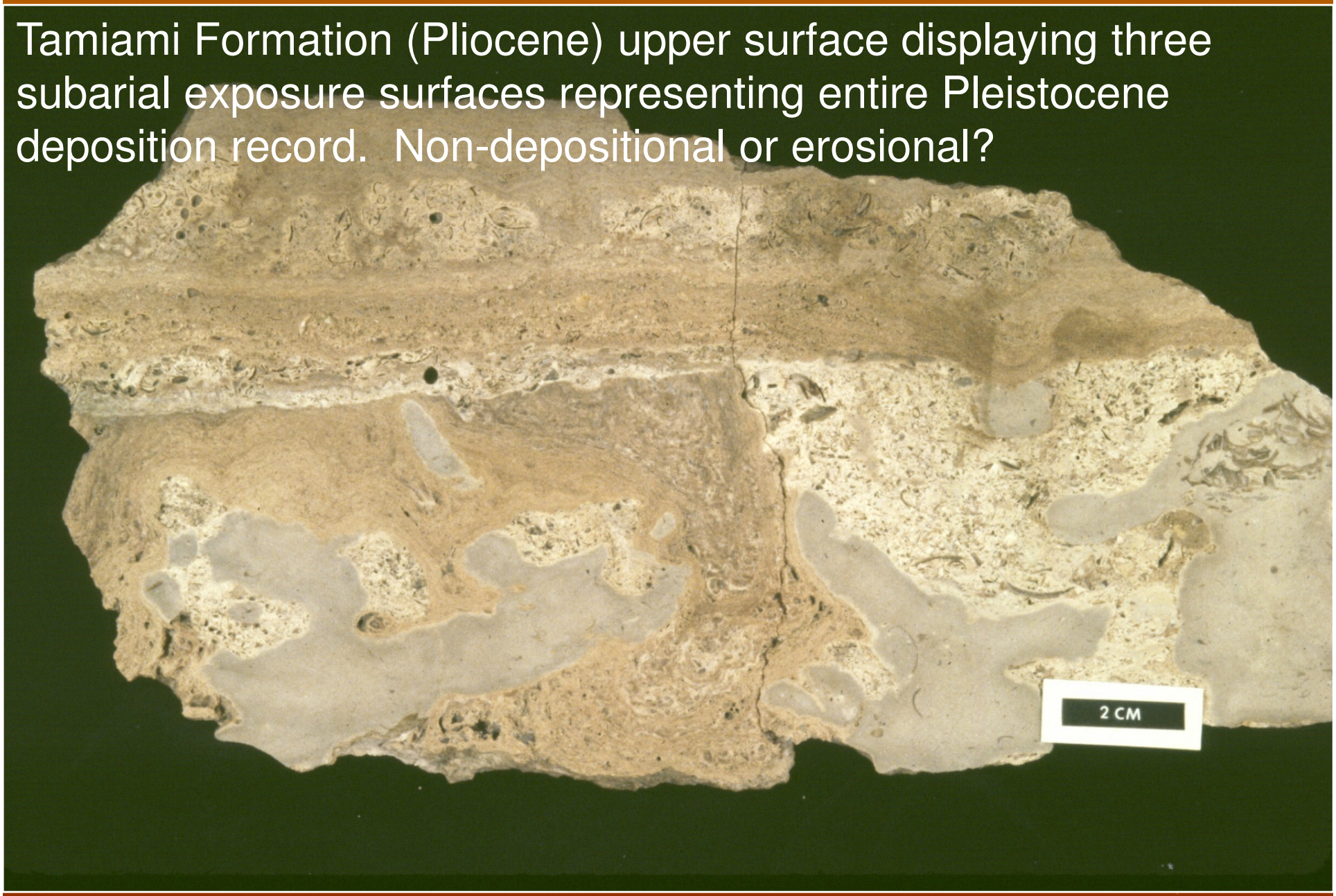
Nick point along a karst valey.

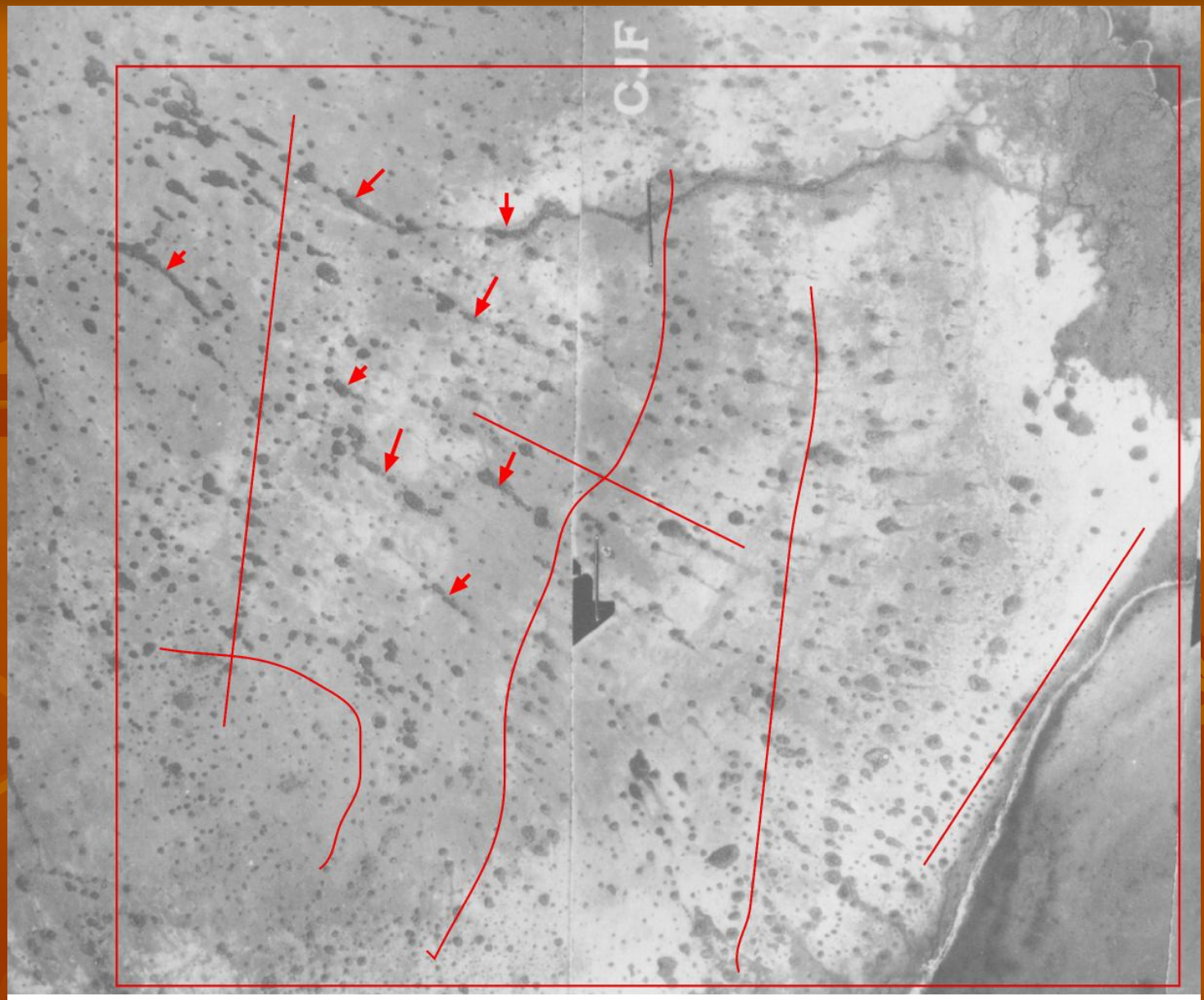
MIAMI RIVER RAPIDS, THE BIG BEND

DURING LOW WATER, CIRCA 1919.
FLORIDA STATE ARCHIVES

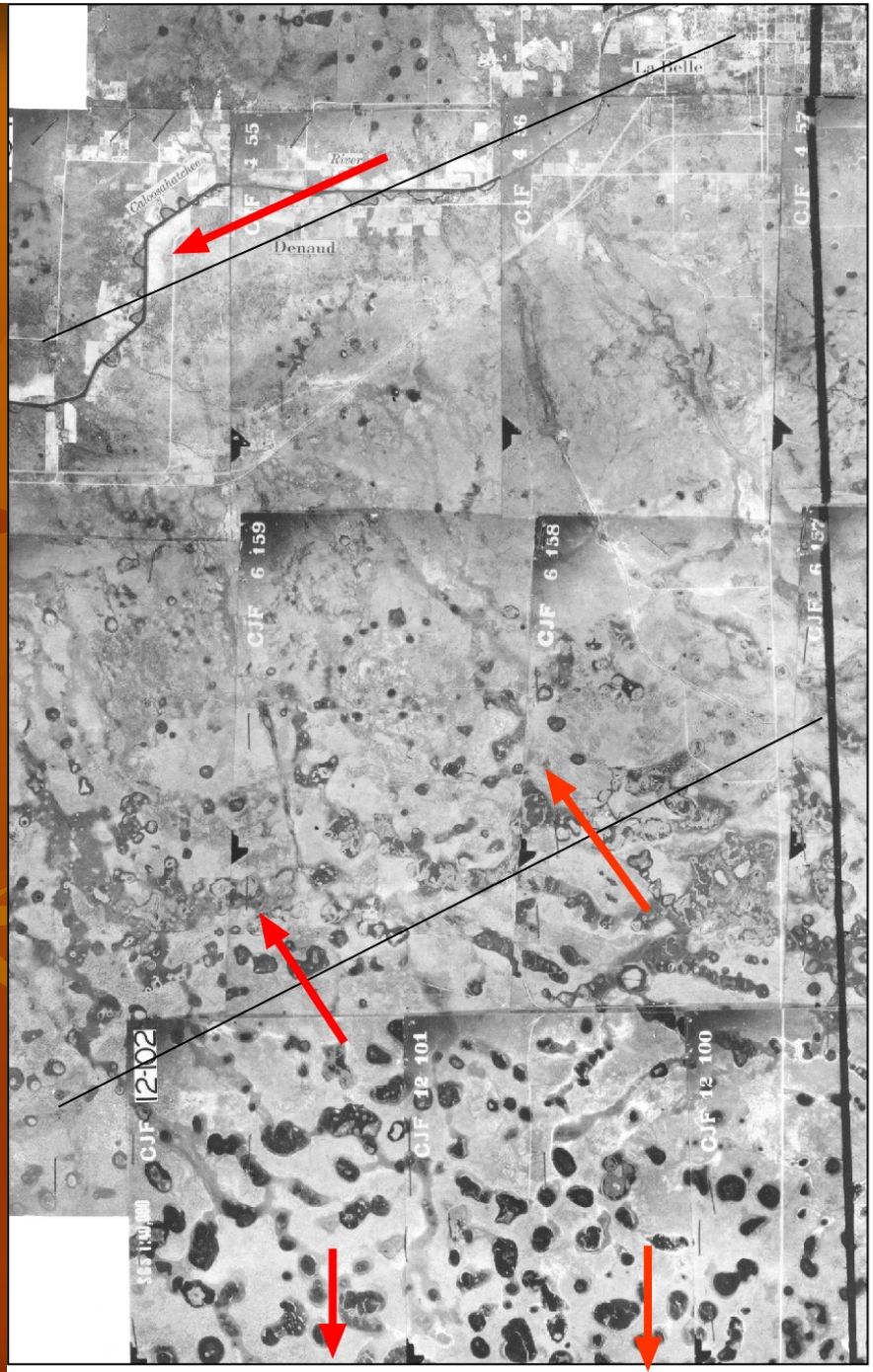

Erosional remanent on ridge at Deering Estate
30cm

Tamiami Formation (Pliocene) upper surface displaying three subarial exposure surfaces representing entire Pleistocene deposition record. Non-depositional or erosional?





1940 aerial photo of the Turkey Point Area. Doline orientations (red line) and examples of coalescing dolines forming valleys (red arrows).



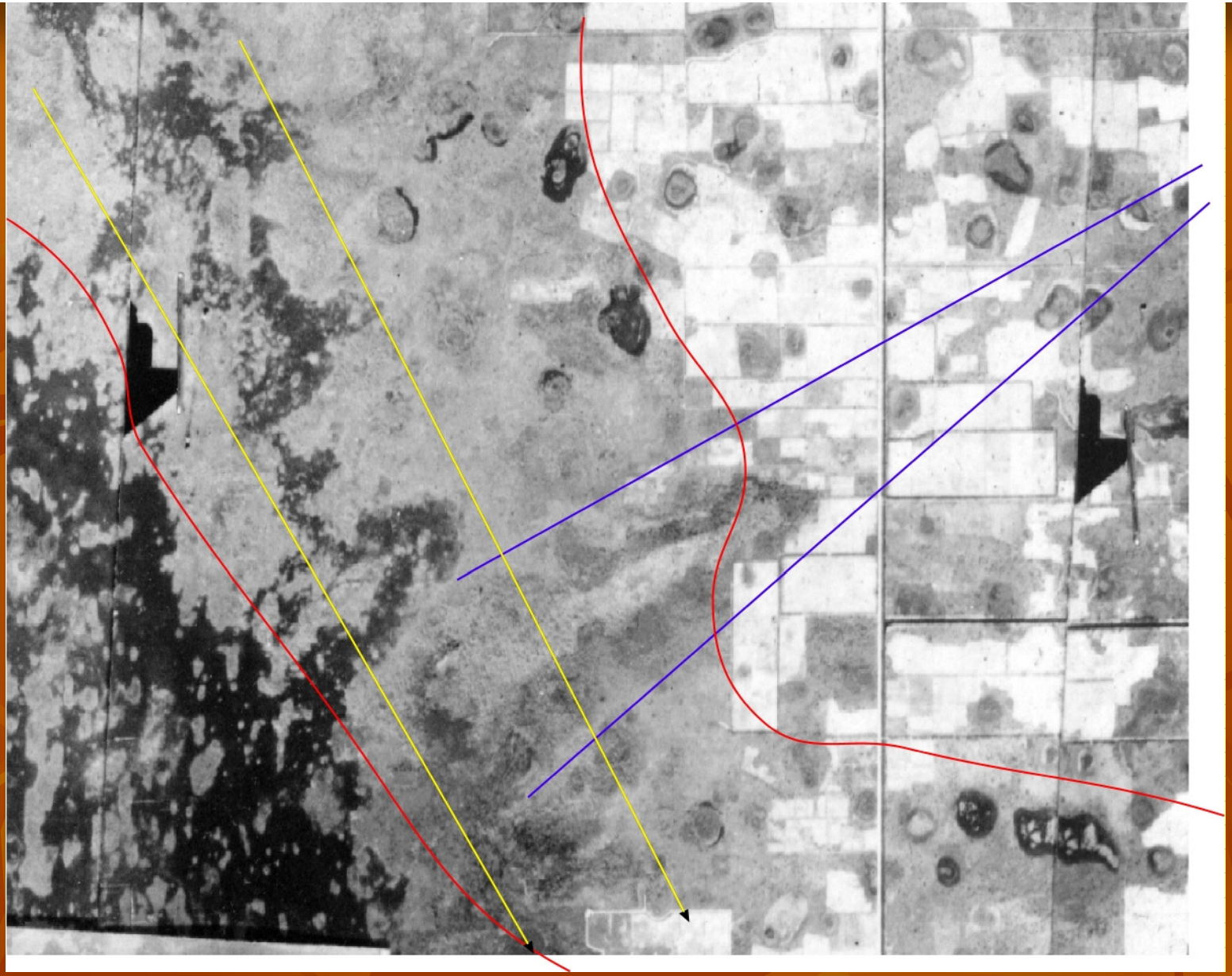
Caloosahatchee River, LaBelle

Flood Plain

High water mark

Surface karst recharge area (To north in dry season and south in wet season)

1940 aerial photograph composite south of LaBelle.



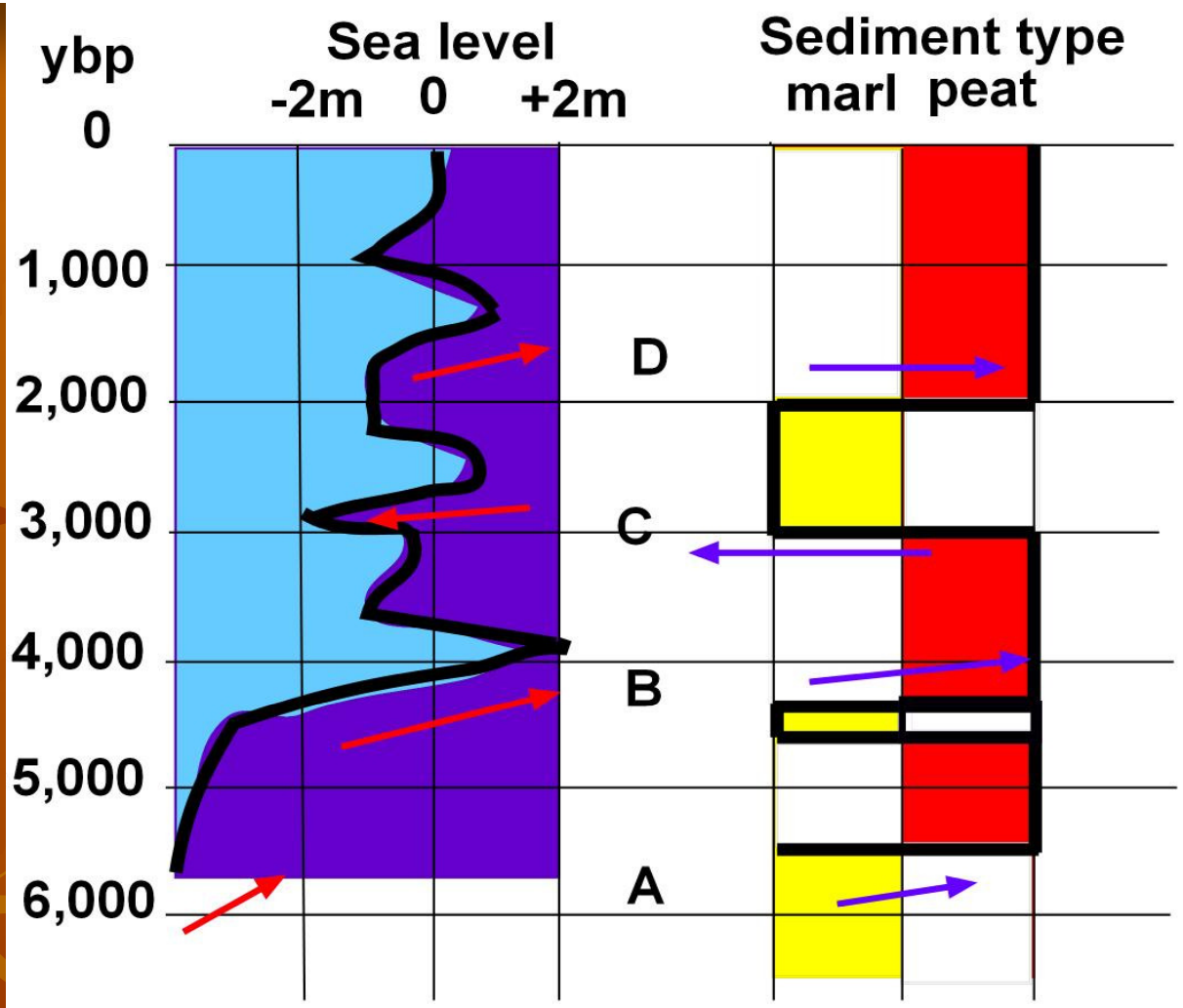
1938 West Palm Beach. Dolines and coalescing dolines under a sand mantle forming indistinct sloughs until inundated. Red lines separate uplands, intermediate wetlands and open marsh. Blue lines outline a headward eroding karst valley. Yellow lines delineate a slough.

Stages in Transverse Glade (Karst Valley) Development.

- 1. Dolines along trends
- 2. Coalescing dolines forming blind valleys
- 3. Blind valleys coalescing into karst valleys
- 4. Collapse of karst valleys
- 5. Infilling of valley
- 6. Rejuvenation, terrace development
-
- NOTE: With rising sea level, however, the TG control of water table decreases but continued solution of limestone will continue by migration of salt water mixing zone inland along paleo-water table caves.

THE MEANING OF MARLS

- Dissolution of limestone is a basic karst process and provides the material for the biogeochemical production of Calcite mud (marl).
- Marl soils are deposited in low areas, are not very permeable and can perch the water table.
- Marl production requires an extended hydroperiod (+200 days inundated)
- Marls form the Everglades basal "seal"
- Hydroperiods extended after seal and produced peats
- Changes in hydroperiods caused by lowered water table:
- decreased rainfall (favored interpretation)
- decreased surface water storage capacity
- break in seal and vertical drainage because of lowered base level
- Back to marl

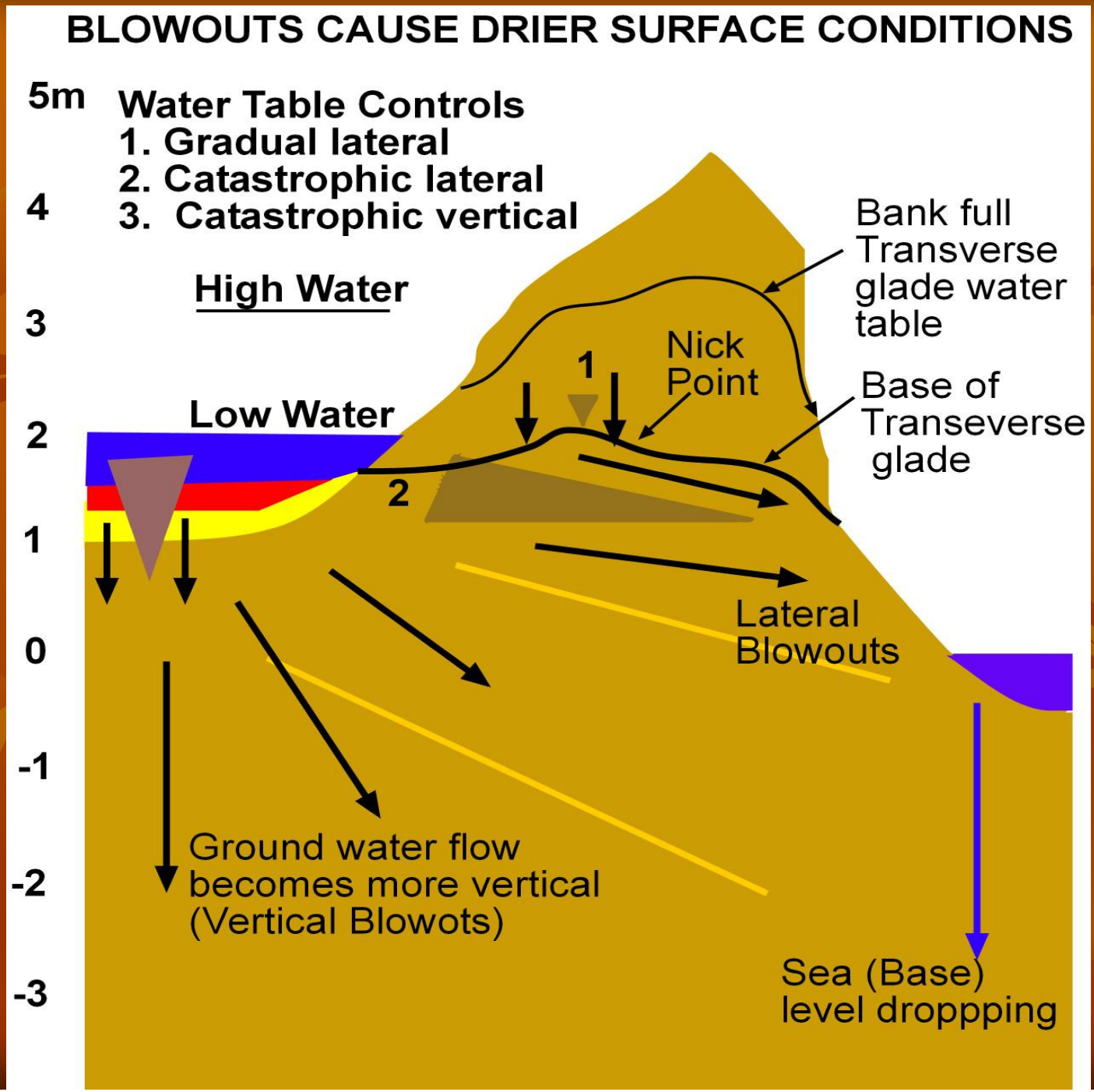


Comparison between sea level and sedimet type.

Surface water drainage is vertical and morerapid when sea levels are low. The lower the surface water storage capacity the more likely marl soils will occur.

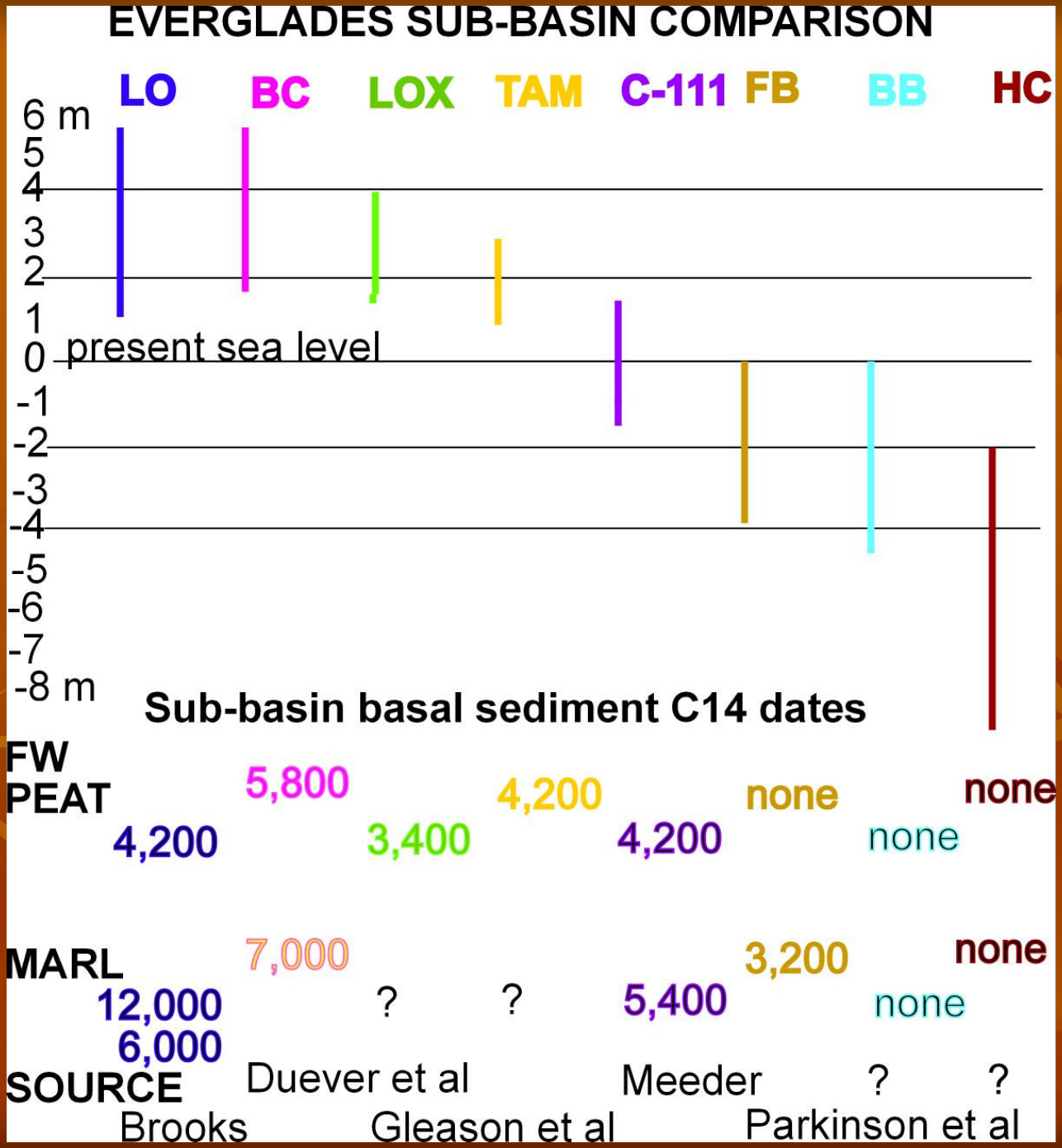
Pairs A thru D are probable examples of this relationship

BLOWOUTS CAUSE DRIER SURFACE CONDITIONS



Results of Blowouts or lower sea level stands

- Decreased surface water storage
- Decreased hydroperiod
- Drier surface conditions
- Increased vertical drainage and karstification


EVERGLADES SUB-BASIN COMPARISON
LO
BC
LOX
TAM
C-111
FB
BB
HC
6 m
5
4
3
2
1
0
present sea level
-1
-2
-3
-4
-5
-6
-7
-8 m
Sub-basin basal sediment C14 dates
FW PEAT
4,200
5,800
3,400
4,200
4,200
none
none
none
MARL
12,000
6,000
7,000
?
?
5,400
3,200
none
none
SOURCE
Brooks
Duever et al
Gleason et al
Meeder
Parkinson et al
?
?

C-111Basin Core (E-146) Three cycles of marl-to-peat

(Basal marl not figured)

The result of change in hydroperiod or $CaCO_3$ solubility?

Change in hydroperiod may result from decreased rainfall, or decreased water storage capacity.

EVIDENCE FOR LOWER WATER TABLE (rather than decreased rainfall)

- 1. Different sub-basin histories

- 2. Two or more sets of water table cave systems
  - Developed at high historic water table (+2 - 6ft)
  - Present, rejuvenated ancient water table (0 - +3ft
  - Ancient water table below present water table (-1 to -3)

  - 3. Peat to marl to peat sequences.
  - 4. Different karst valley developmental stages

CONCLUSIONS

- Transverse Glades are dynamic geologic features with changing nick points
- Dropping base level (sea level) creates drier conditions, locally and regionally
- Breach of marl "seal" caused drier surface conditions locally
- Decreased rainfall creates drier surface conditions regionally
- Therefore, sub-basin hydroperiod changes more likely to be controlled by non-climatic changes

RESTORATION IMPLICATIONS

- Sea level is more important than rainfall in determining Everglades development
- Periods of “drier climate” may result from lower soil moisture levels not less rainfall
- Karst and karst processes dominate the ecosystem, creating TG and nick points
- Degradation of a single TG or a “Blowout” could result in catastrophic drainage
- Not understanding the karst origin will probably result in the failure of major “replumbing” operations

ACKNOWLEDGEMENTS

- Photo credits to Dallas Hazelton, Peter Harlem, John Kressler, John Meeder, Danielle Ogurcak, Jennifer Richards, Pablo Ruiz, Len Scinto and Van.
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- SERC for support.