The Viento Formation: Syndeposited Deltaic System Records Adjacent Passive Salt Rise Diapir, La Popa Basin, Mexico

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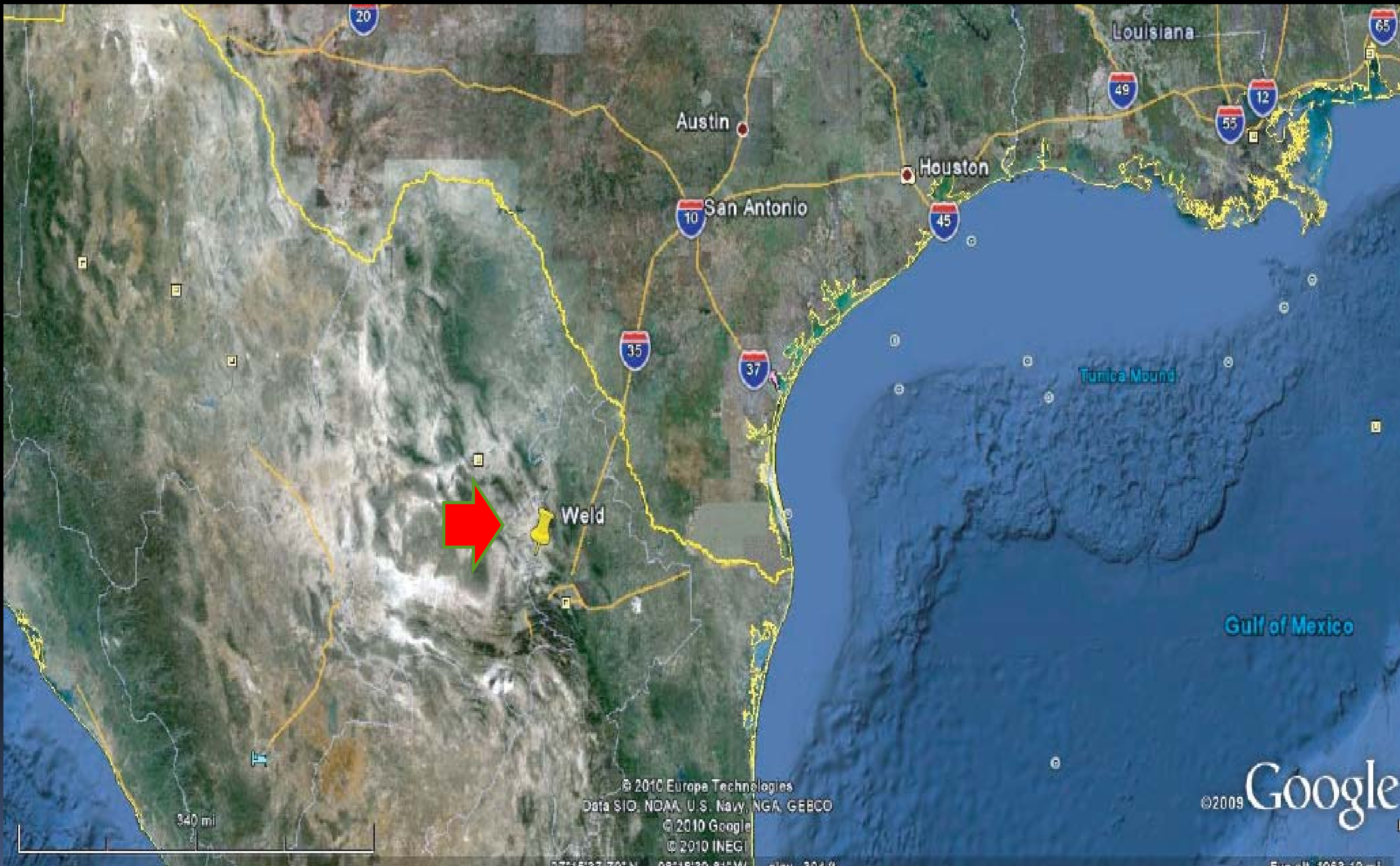
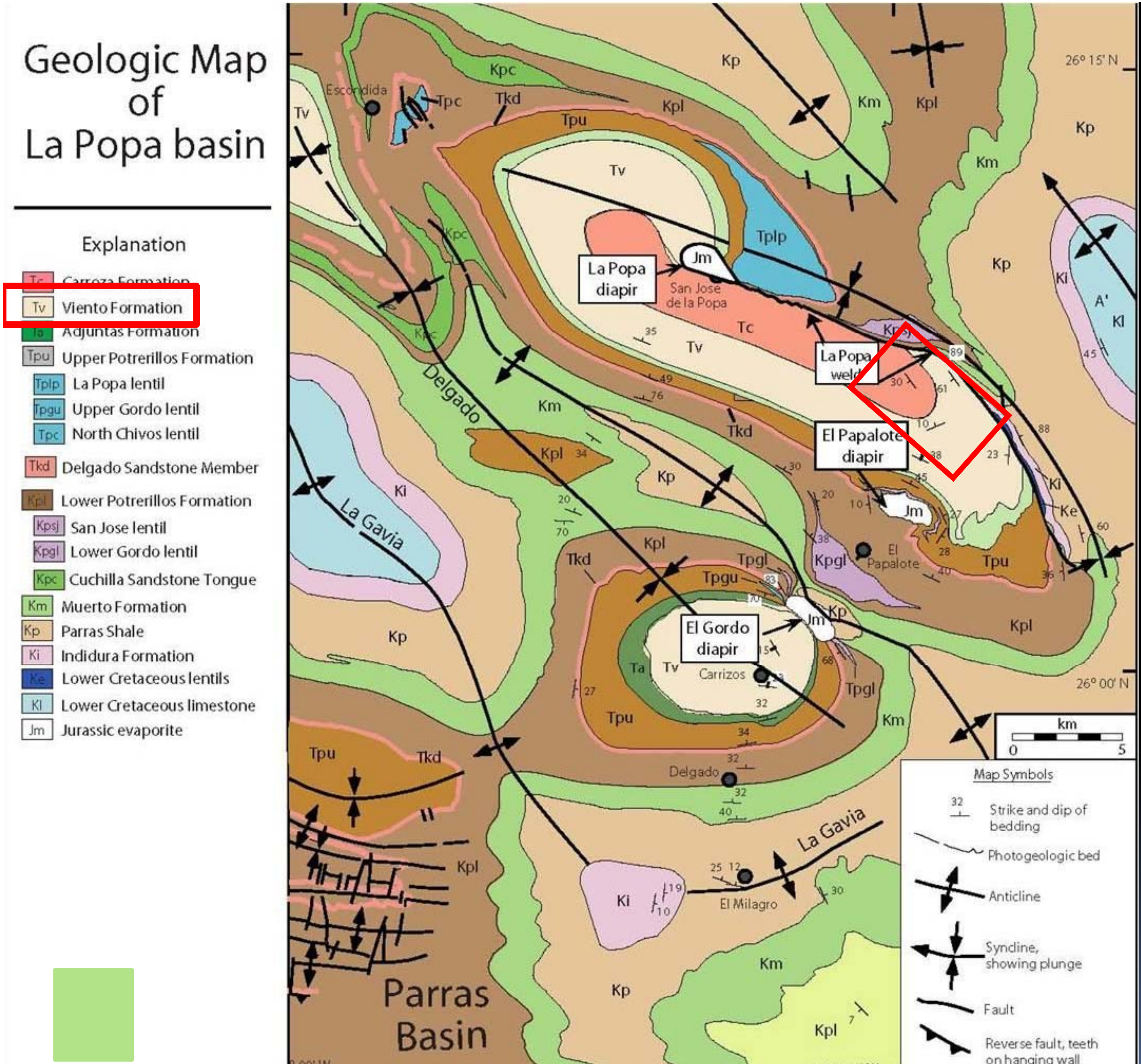
Location of the Study Area

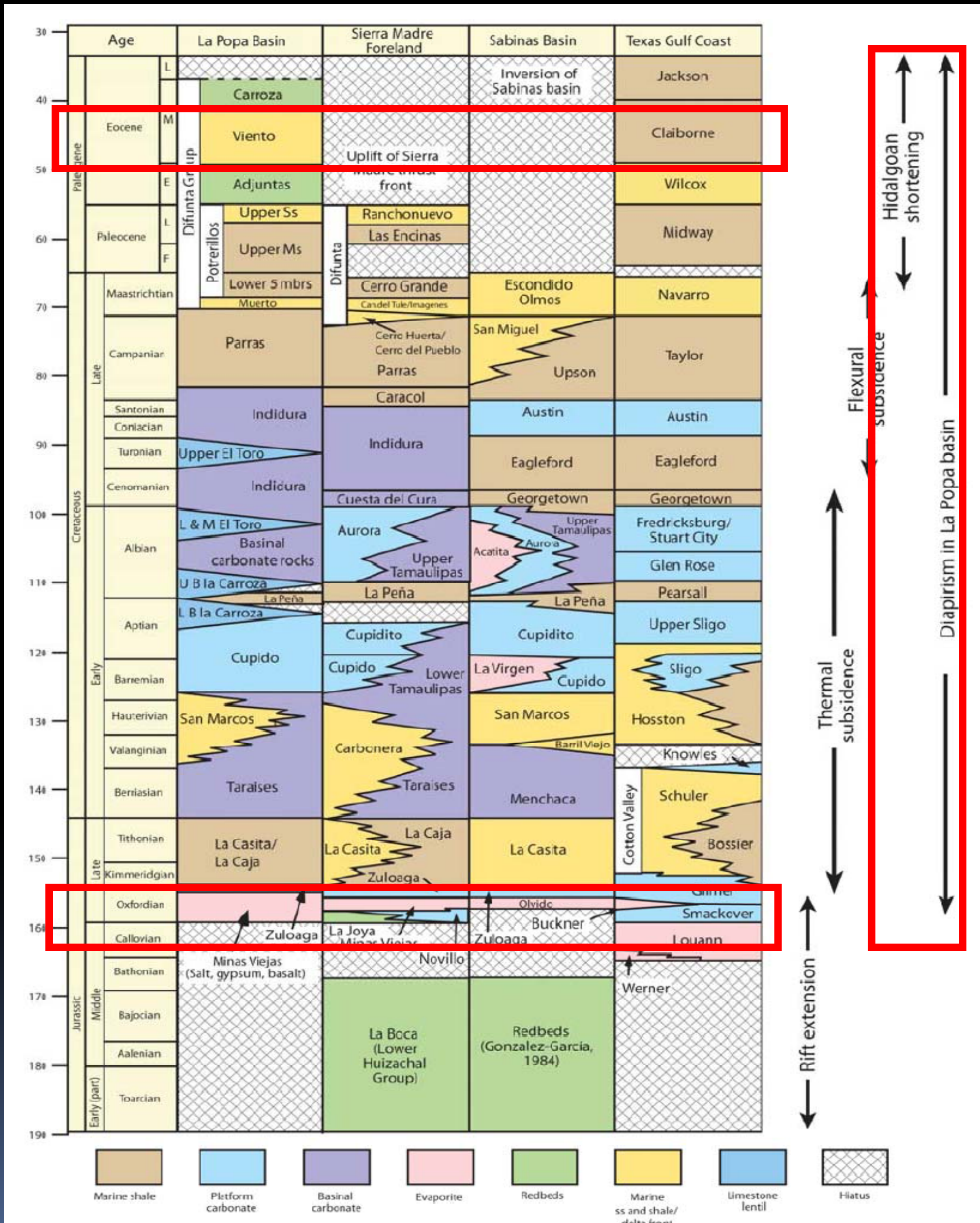




Basin evolution influenced by salt tectonics

Present salt features:
El Papalote,
El Gordo diapirs
& La Popa weld
and diapir

(Modified, from Giles & Lawton, 1999)



Chronostratigraphy of La Popa Basin & Texas Gulf Coast

Viento Formation:

- Middle Eocene ?
- Youngest marine unit of the Difunta Group
- Overlain and underlain by terrestrial deposits
  - Carroza Fm. above
  - Adjuntas Fm. below

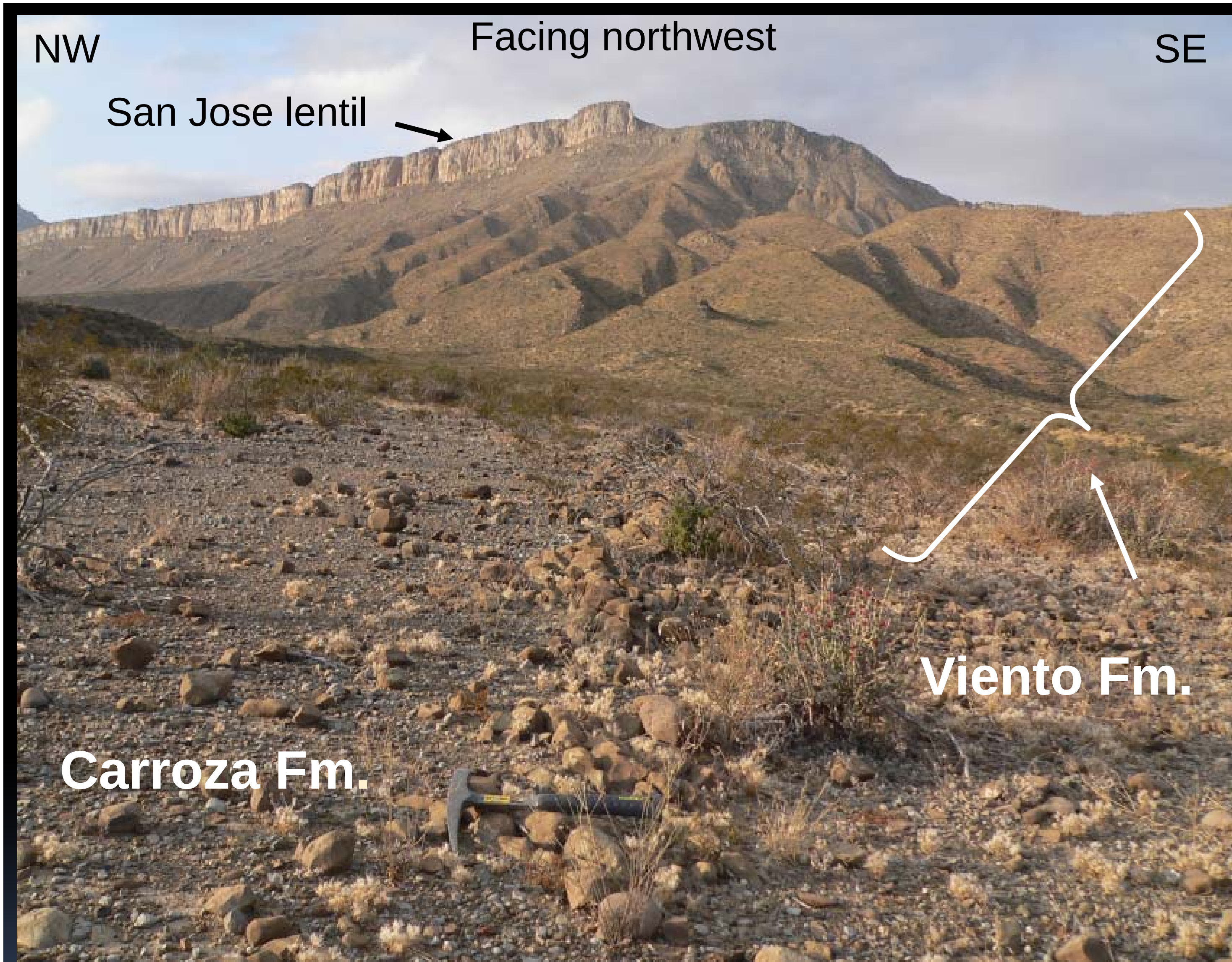
(From Lawton et al., 2001)

Research Questions:

1. How did salt rise of La Popa wall impact the sedimentology and depositional facies distribution of Eocene Viento Formation?

2. How do internal facies relationships and stacking patterns determine the depositional sequence stratigraphy?

3. How do structural geometries and angular unconformities of the Viento Formation determine halokinetic sequence style and determination of composite sequence boundary?



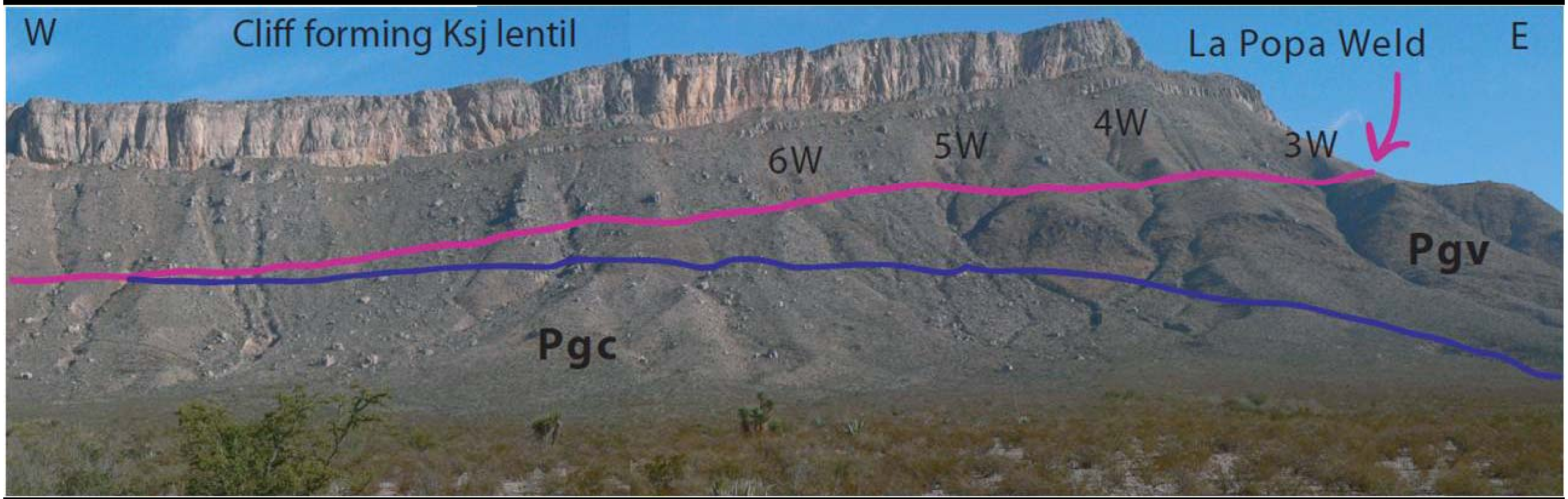
Study Area

Carroza Fm. foreground.

Viento Fm. forms prominent ridges.

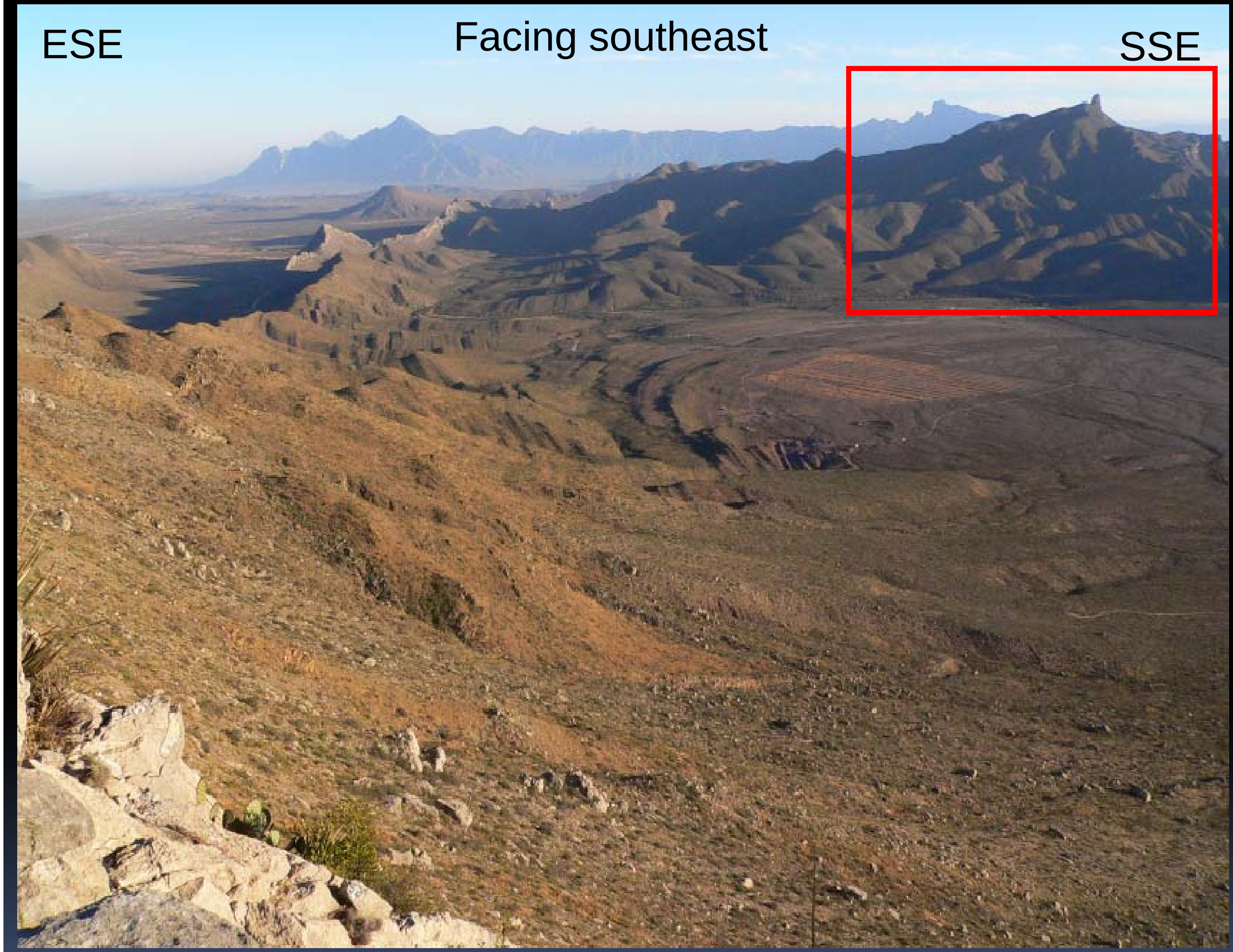
San Jose lentil forms NW skyline

Northwest Zone of the Study Area



Cliff Top = ~ 1300 m elev.   Valley Floor = ~ 900 m elev.

Study Area

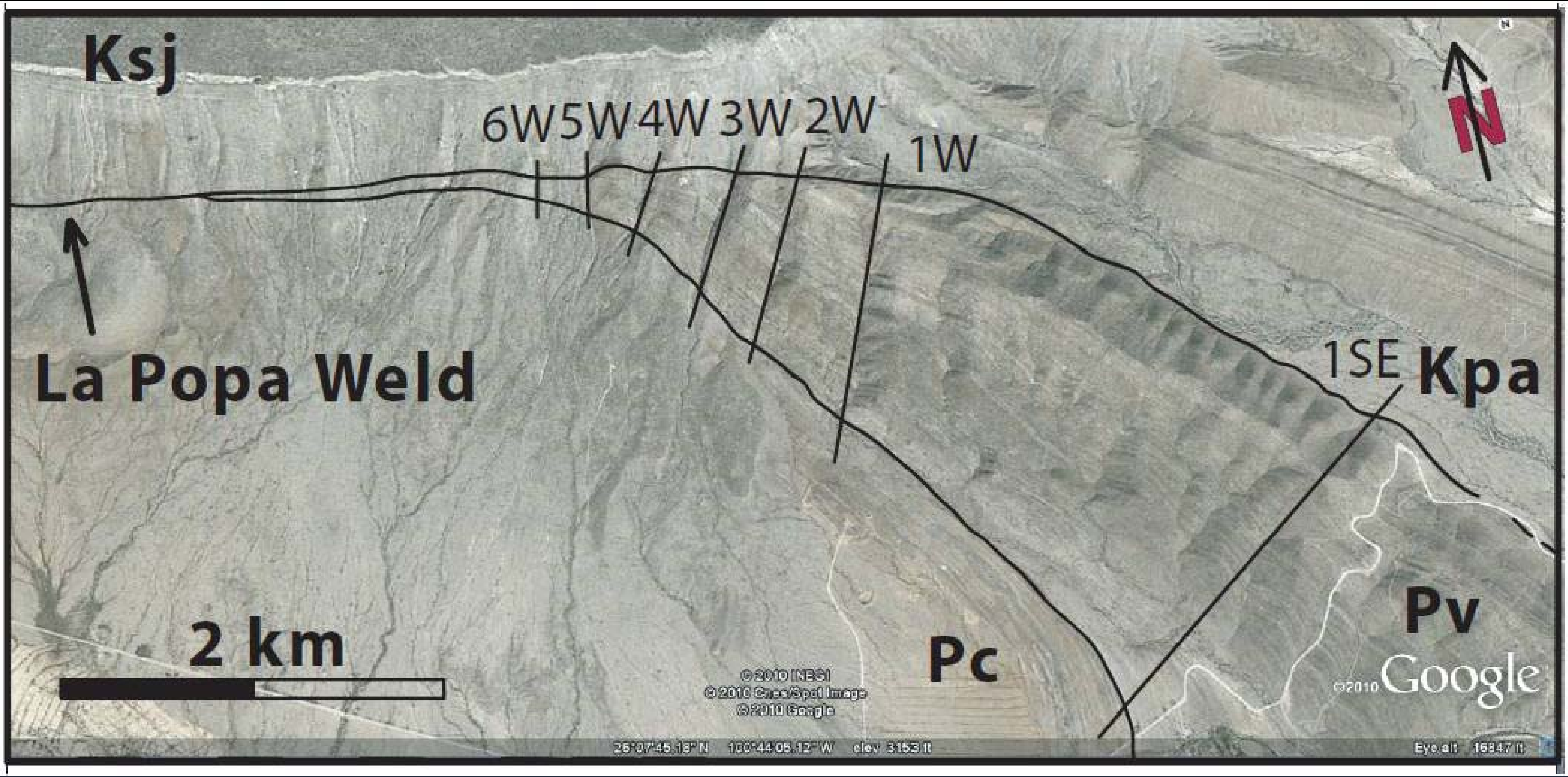


From the Weld Zone looking across the Carroza Syncline

Viento Fm. to South of Study Area at ~1500 m Elevation.

Evidence for Laramide shortening initiated in Latest Cretaceous time.

Plan View – Measured Stratigraphic Sections



Depositional Facies: Basinward to Landward

Prodelta– 4 Facies

Horizontal heterolithic sandstone-siltstone

Shale (gray and purple)

Limestone buildup & Oyster reef deposit (diapir roof facies)

Delta front and platform – 4 Facies

Bioturbated sandstone

Inclined heterolithic sandstone-siltstone

Ripple-laminated sandstone

Ball and pillow sandstone

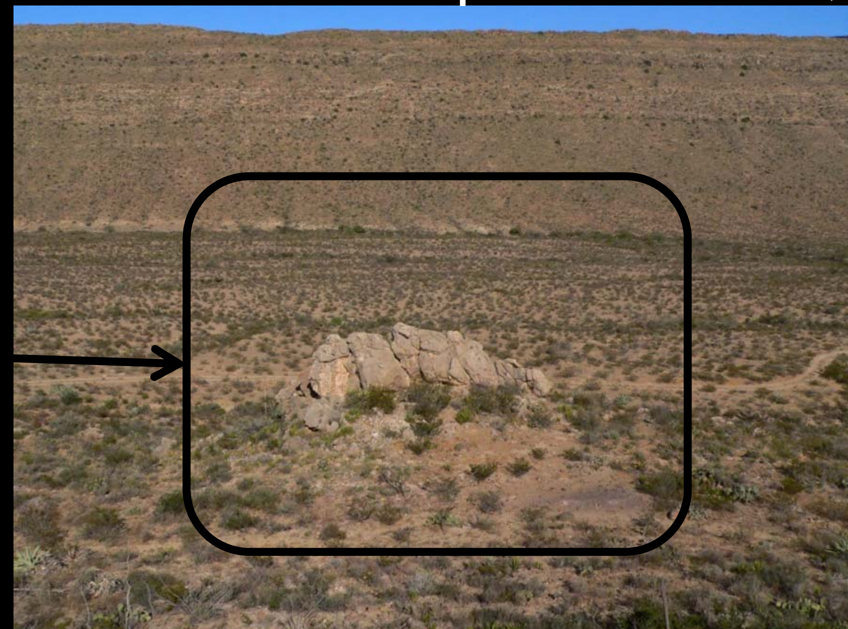
Fluvial-deltaic distributary channels – 9 Facies

Trough X-bedded sandstone

Conglomeratic sandstone

Pebbly sandstone

Limestone Buildup (Shallow Marine – Diapir Proximal)



Agglutinated foram and algae fragments under petrographic microscope

Tan & Purple
Fissile Shale Facies

(Prodelta – Diapir
Proximal/Roof)

Horizontal Heterolithic Sandstone-Siltstone Facies

Oyster Reef Facies

(Shallow Marine & Prodelta)

Bioturbated & Ripple Laminated Sandstone Facies (Delta Front and Platform)

Trough cross-bedded
Sandstone Facies

Inclined Heterolithic
Sandstone-Siltstone
Herringbone Facies

(Delta Front & Platform)

Mud ripped up Clasts &
Mud Chips
Sandstone Facies

Ball & Pillow
Sandstone Facies

(Delta Front & Platform)

Wood fragments & logs, lag deposits & large-size Oyster Sandstone Facies (Fluvial –Deltaic Channels)

Pebbly Sandstone,
Metaigneous & Limestone
Clasts and
Conglomeratic Sandstone
Facies

(Fluvial – Deltaic Channels)

Metaigneous Blocks within the Gypsum Cap Rock

Major Flooding and Erosional events of Pebbly and Conglomeratic Sandstone Facies

Facies Associations:

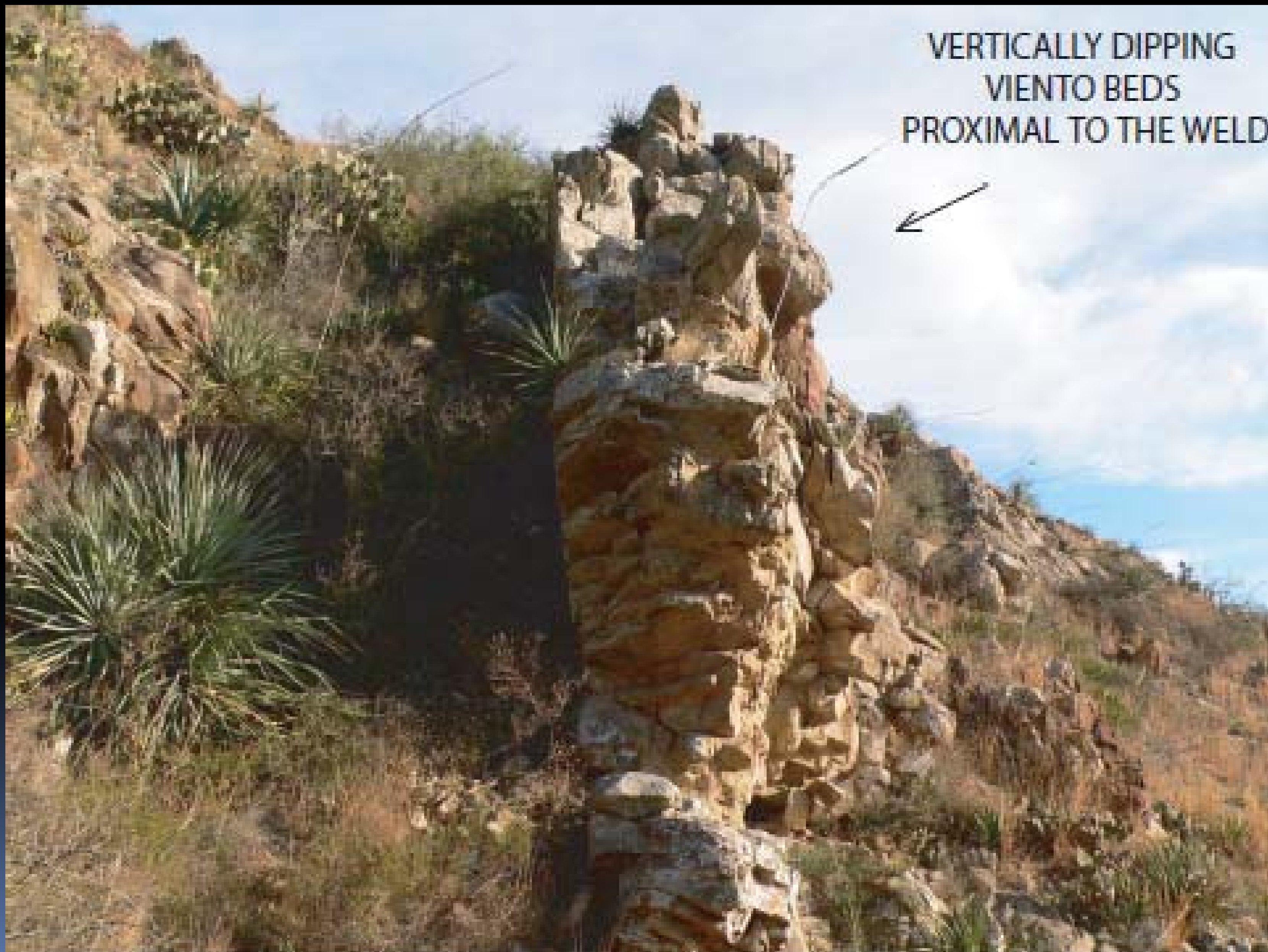
1) Prodelta with diapir roof carbonate buildups

2) Proximal to distal delta front and platform

3) Fluvial-deltaic distributary channels

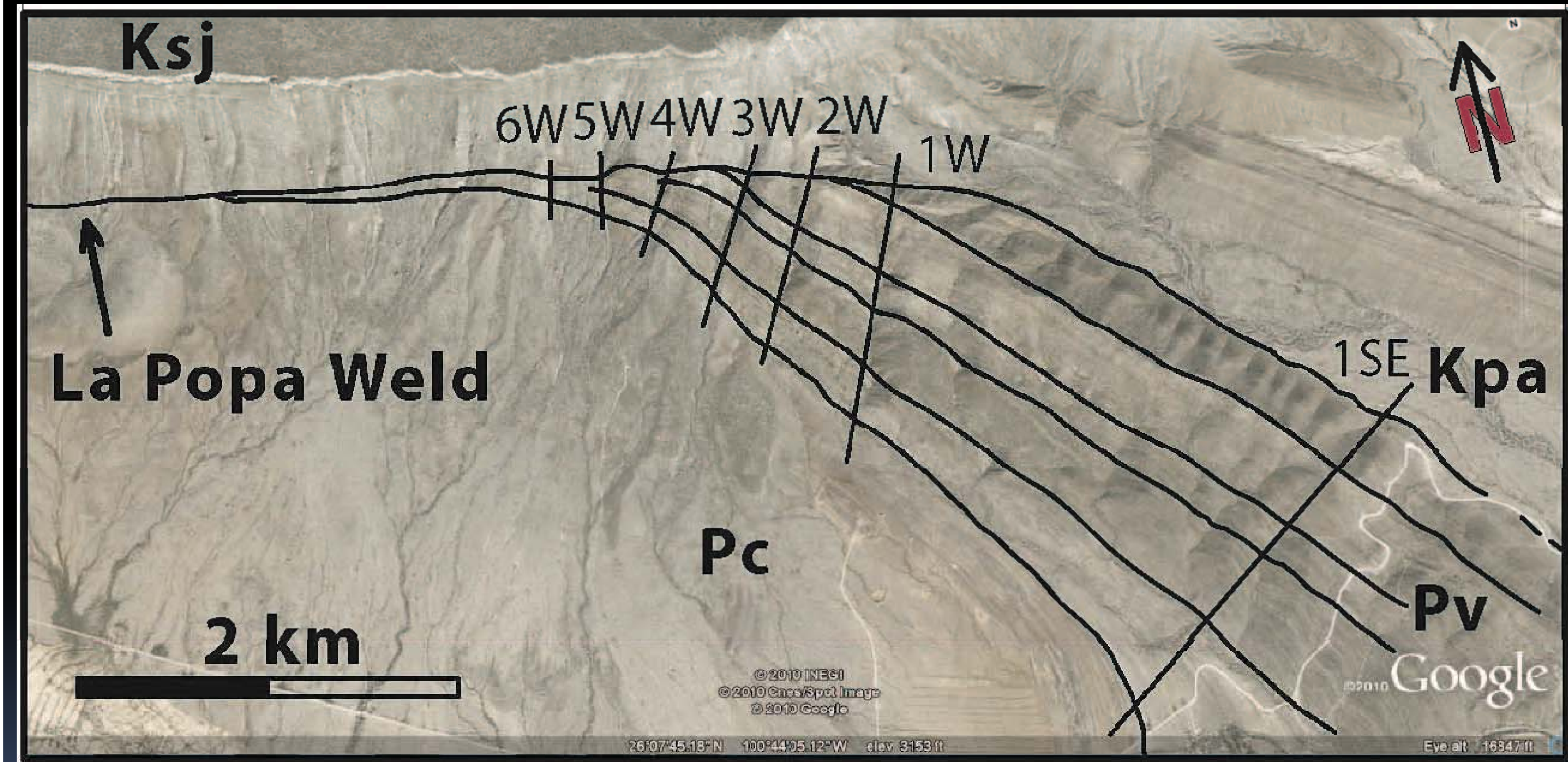
Overall Shallowing Upward to form a
Regressive System

Vertically Dipping to Upturned Beds Near Diapir

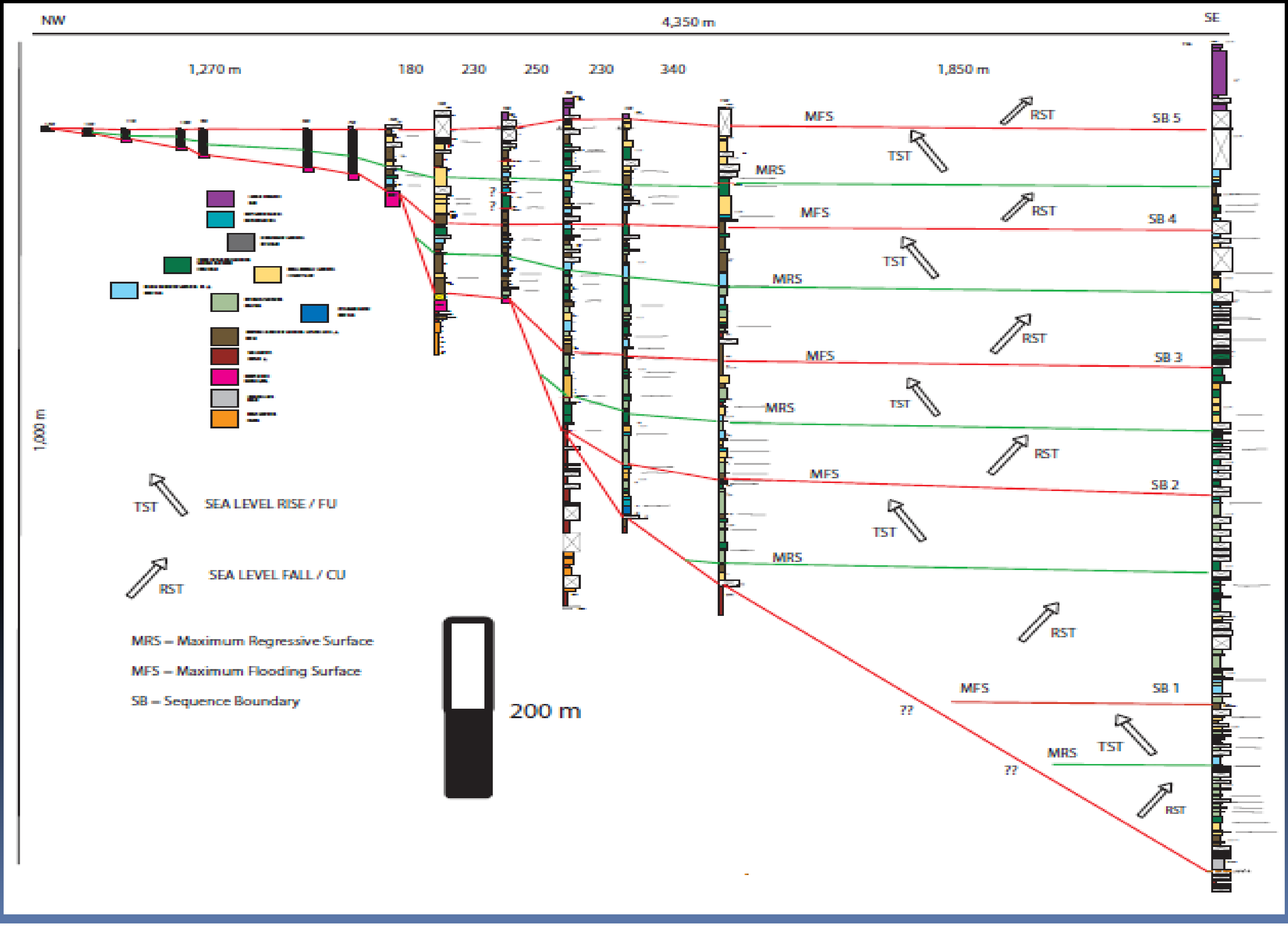


~15° Angular Unconformity

Plan View – Correlation of Measured Stratigraphic Sections (in total over 3,500 m log)



Fence Diagram showing Shallowing Upward Facies Distribution

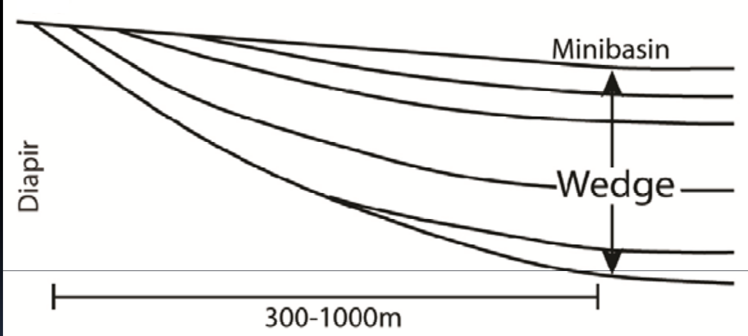


Interpretation of Halokinetic Sequence Stratigraphy

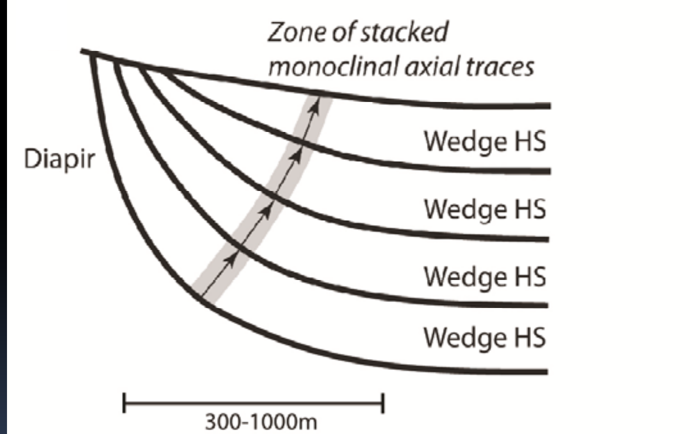
Based on the models from *Giles and Rowan, 2011*

The 3 facies associations *wedge* toward the diapir to form a *Tapered Composite Halokinetic Sequence*

Sediment Accumulation Rate > Salt Rise Rate



- Drape folding 300-1000m from diapir.
- <30 degree angular unconformities.
- Broad zone of gradational facies changes.



- Convergent base and top boundaries.
- Broad zone of thinning toward diapir.
- Axial trace of monocline progressively inclined from diapir.

Stratigraphic Architecture Conclusions

1. Overall, lateral decrease in thickness from ~ 900 m to pinch out over ~ 5 km distance form a series of 5 wedges, each wedge ~ 150 m tick

2. Wedges forming angular truncations of ~15° becomes conformable within tens of meters

3. Beds flatten in basin but are overturned near salt wall

Halokinetic Sequence Stratigraphy Conclusions

1. Metaigneous clasts at top of sequence indicate slow, continuous salt rise due of sediment load

2. Metaigneous clasts through out the sequence indicate episodic salt rise due to compression events

3. Increase in local third order net sediment accumulation rates relative to salt rise rates formed a Tapered Composite Halokinetic Sequence

Depositional Environment Conclusions

1. Facies include Prodelta, Proximal and Distal Delta Front and Platform, and Terrestrial deposits and indicate that deposition and salt rise were coeval

1. Deposited in a Tidally Influenced Delta System

2. Overall shallows upward to form a Regressive System

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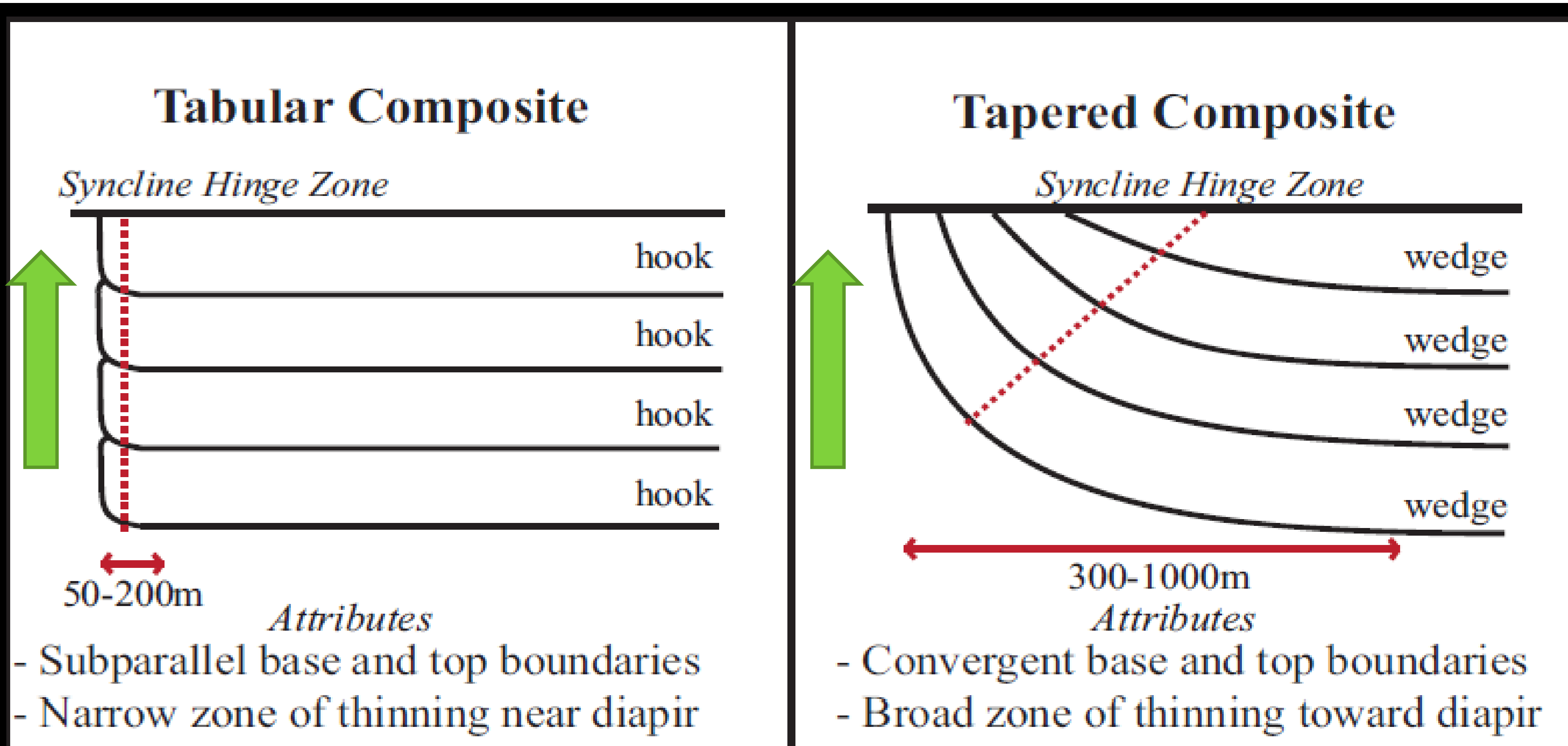

Tabular (J hook): Syncline hinge near the diapir

Salt rise rate > Sediment accumulation rate

vs.

Tapered (wedge): Syncline hinge away from diapir

Salt rise rate < Sediment accumulation rate