Role of erosion in creating thrust recesses in a critical wedge: An example from eastern Tibet

Dujiangyan irrigation system
(since ~256 B.C.)

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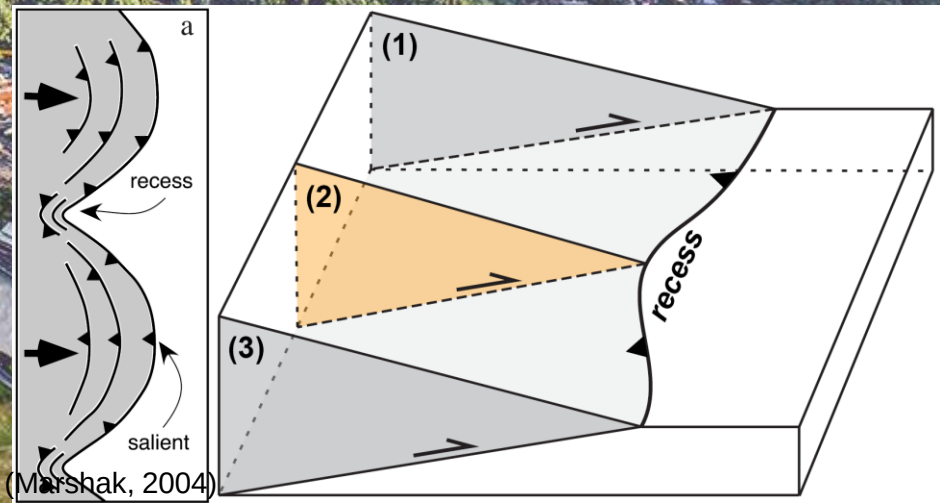


(Marshak, 2004)

How to make a recess in a critical-taper wedge? A new classification diagram

For a simplified subaerial wedge in 2-D:

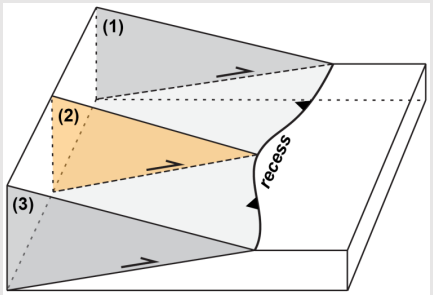
$$\alpha + \beta = \frac{\beta + F}{1 + W}$$

(Suppe, 2007, Geology)

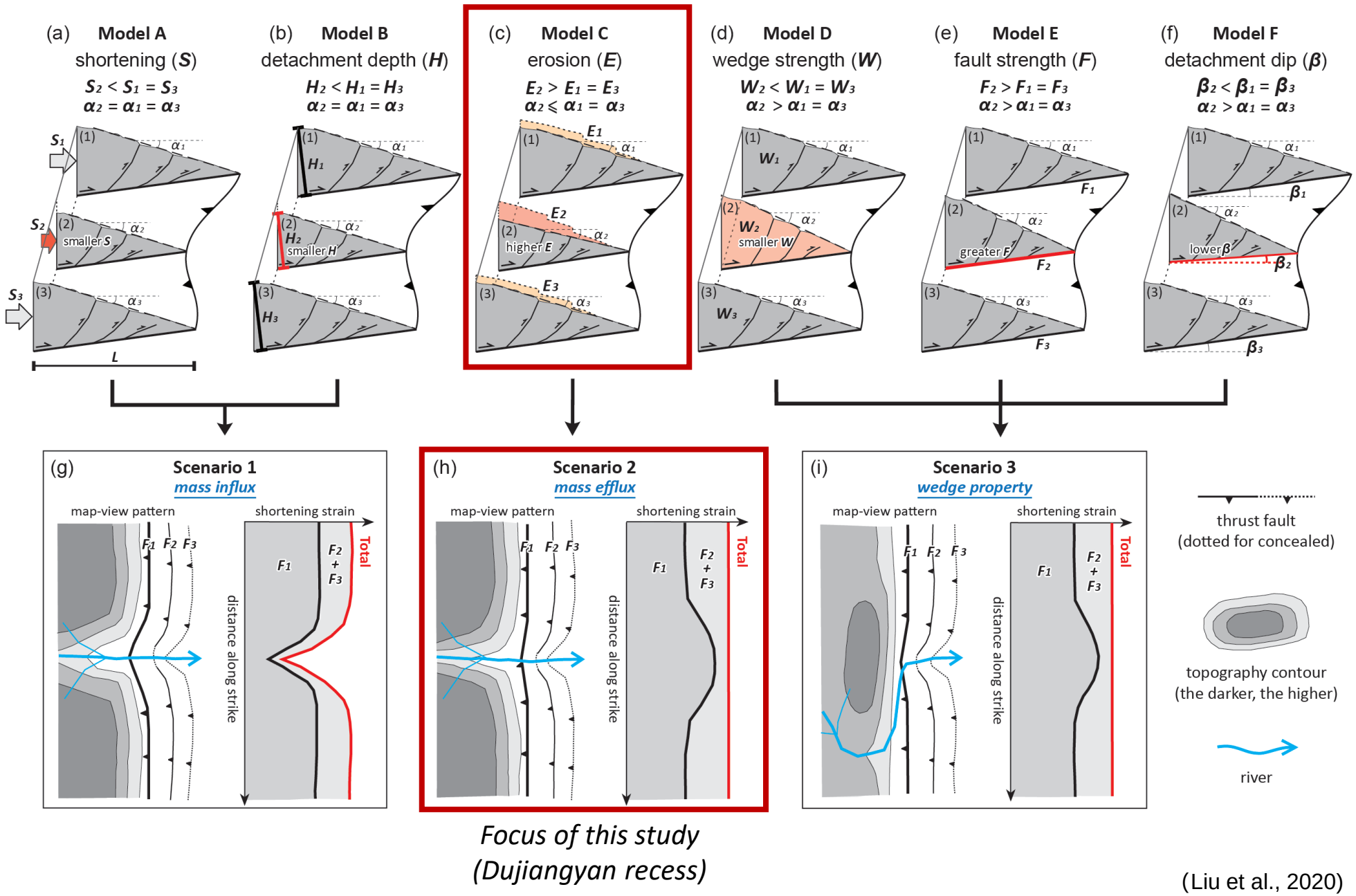
To make a recess in 3-D:

6 independent variables:

- Shortening strain (***S***)
- Detachment depth (***H***)
- **Erosion (*E*)**
- Wedge strength (***W***)
- Detachment strength (***F***)
- Detachment dip (***β***)

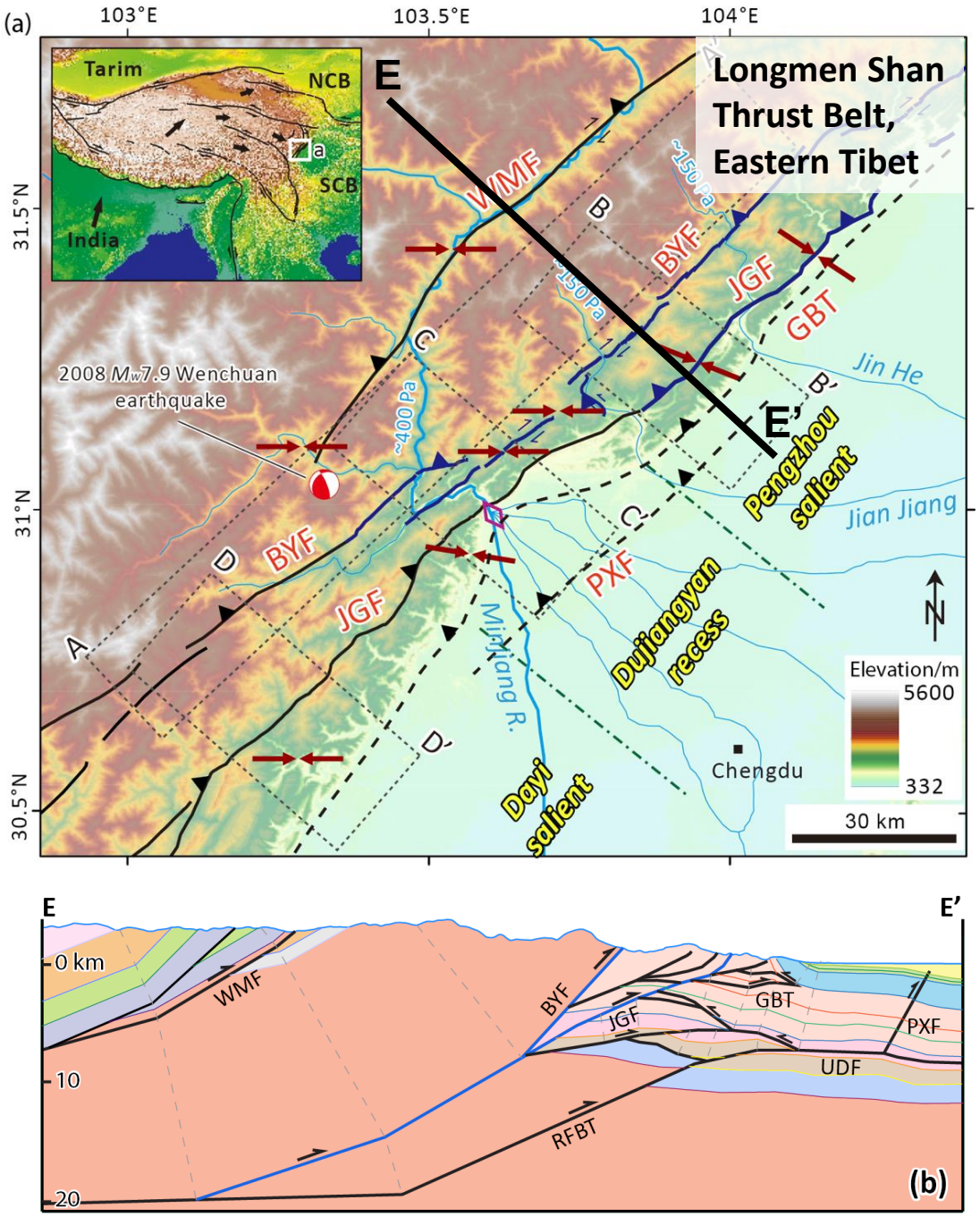


(2) "experiment group"
(1) & (3) "control group"

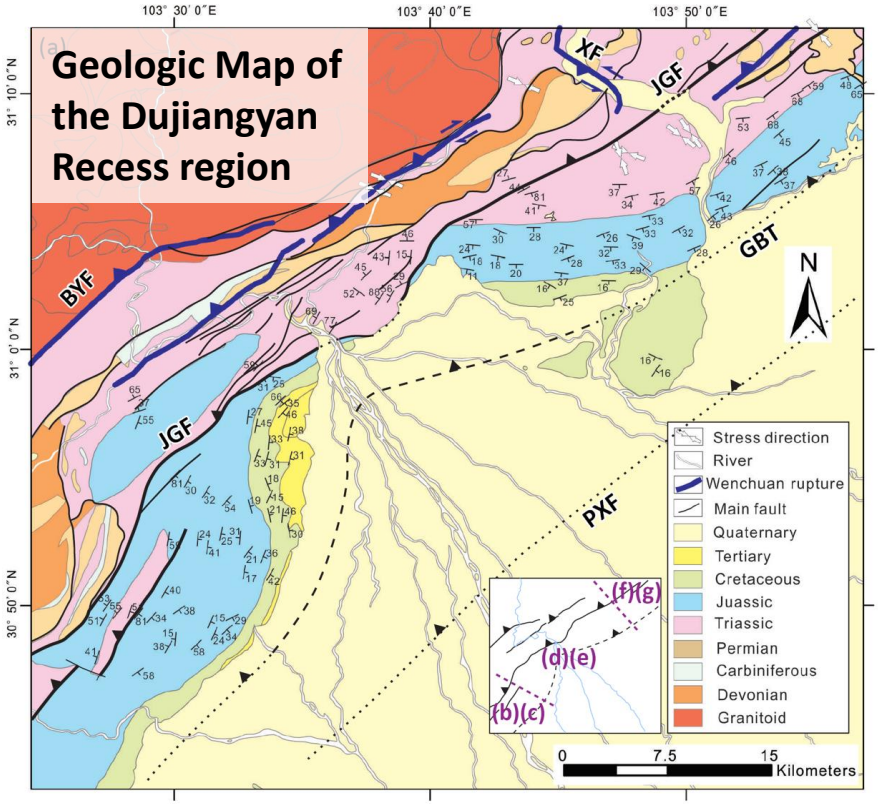


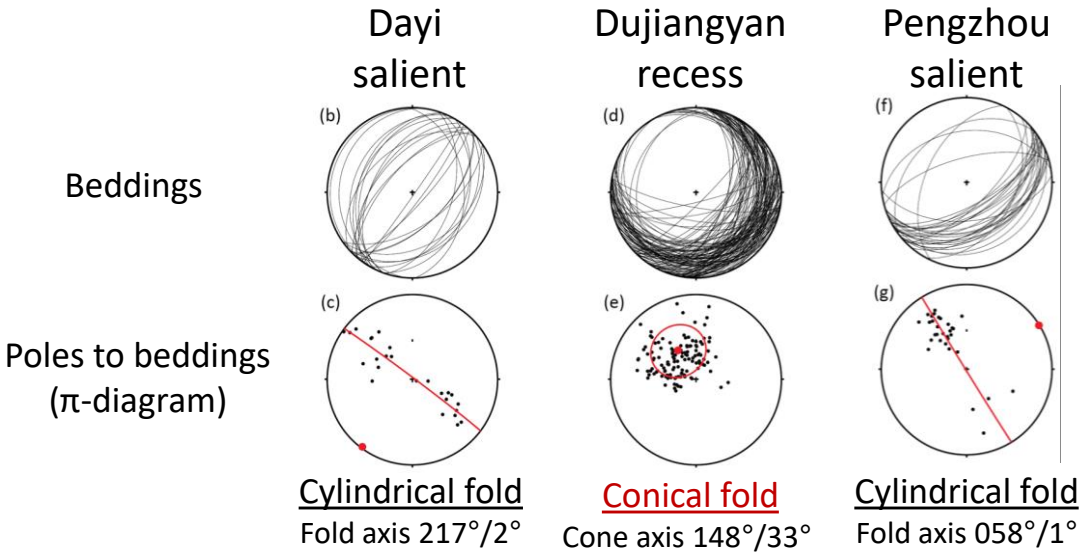
Focus of this study
(Dujiangyan recess)

(Liu et al., 2020)



(Liu et al., 2020)



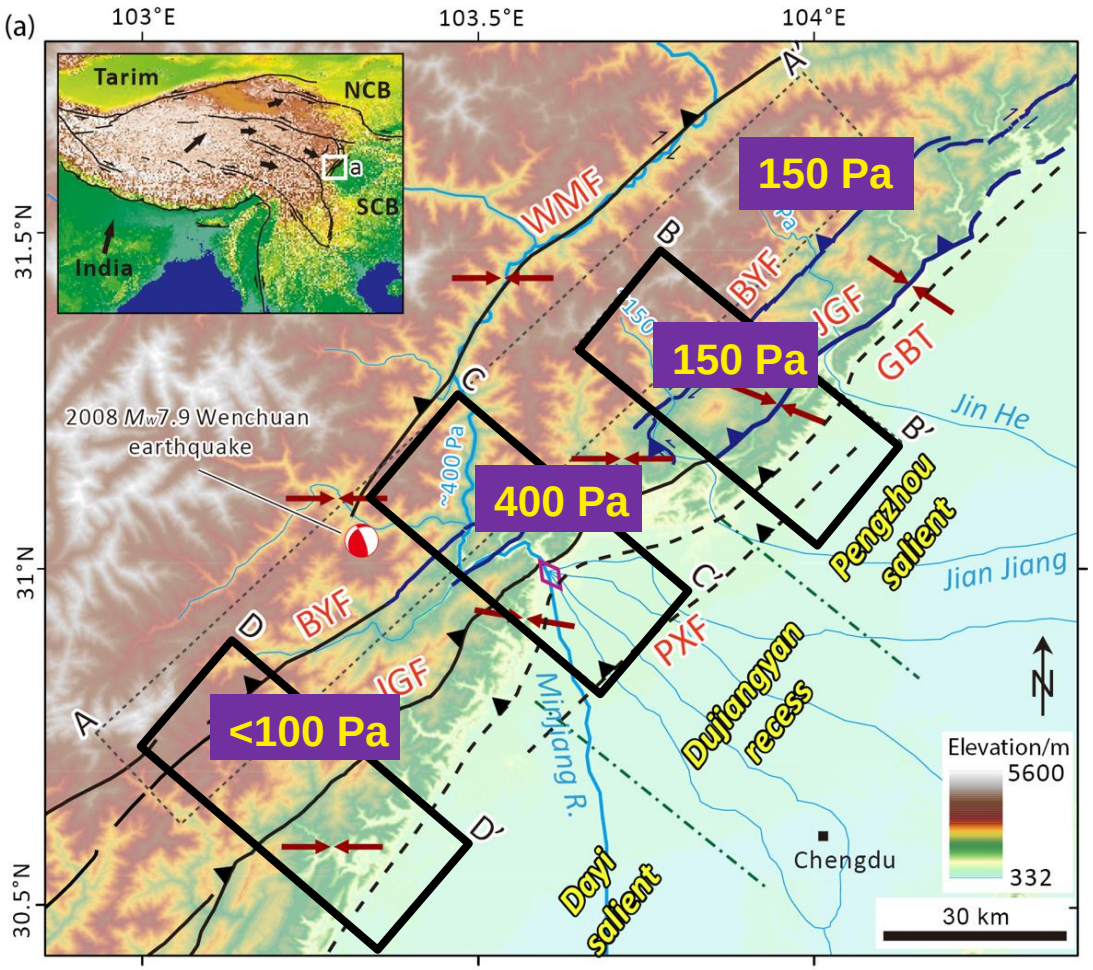


Cylindrical fold
Fold axis 217°/2°

Conical fold
Cone axis 148°/33°
apical angle 52°

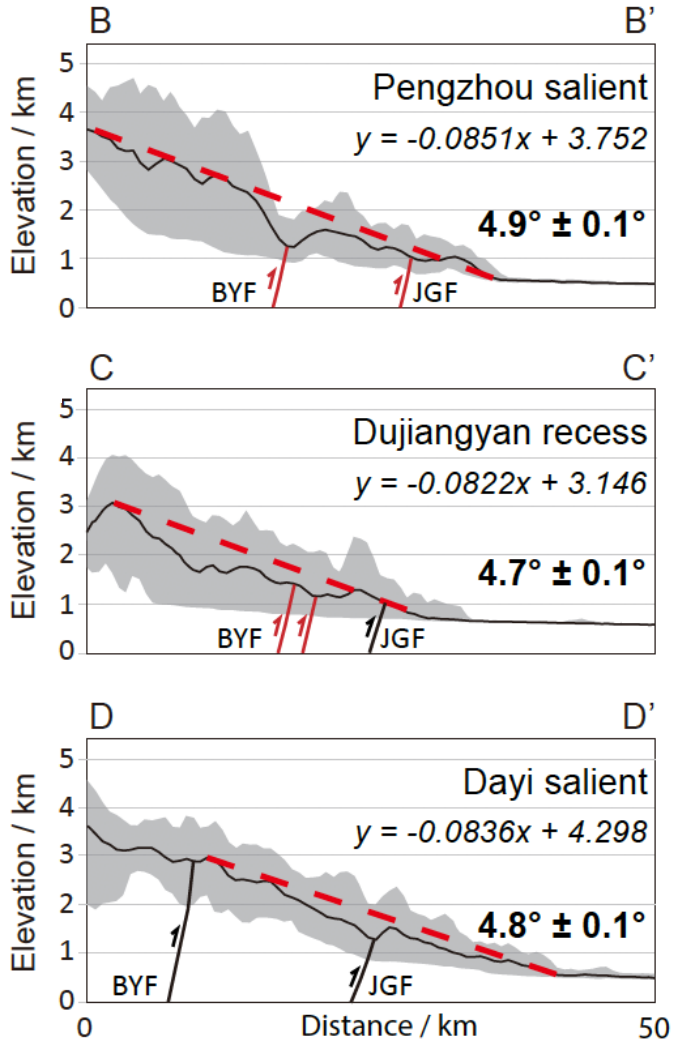
Cylindrical fold
Fold axis 058°/1°

Surface characteristics along Longmen Shan



(Liu et al., 2020)

Negligible along-strike variation in surface slope



Significant along-strike variation in fluvial erosion

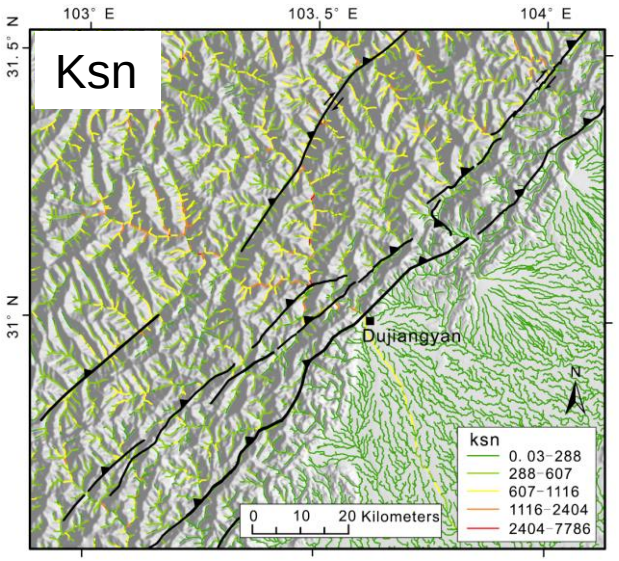
Fluvial shear stress

$$\tau = \rho g \frac{(Q \cdot N)^{\frac{3}{5}} S^{\frac{7}{10}}}{W^{\frac{3}{5}}}$$

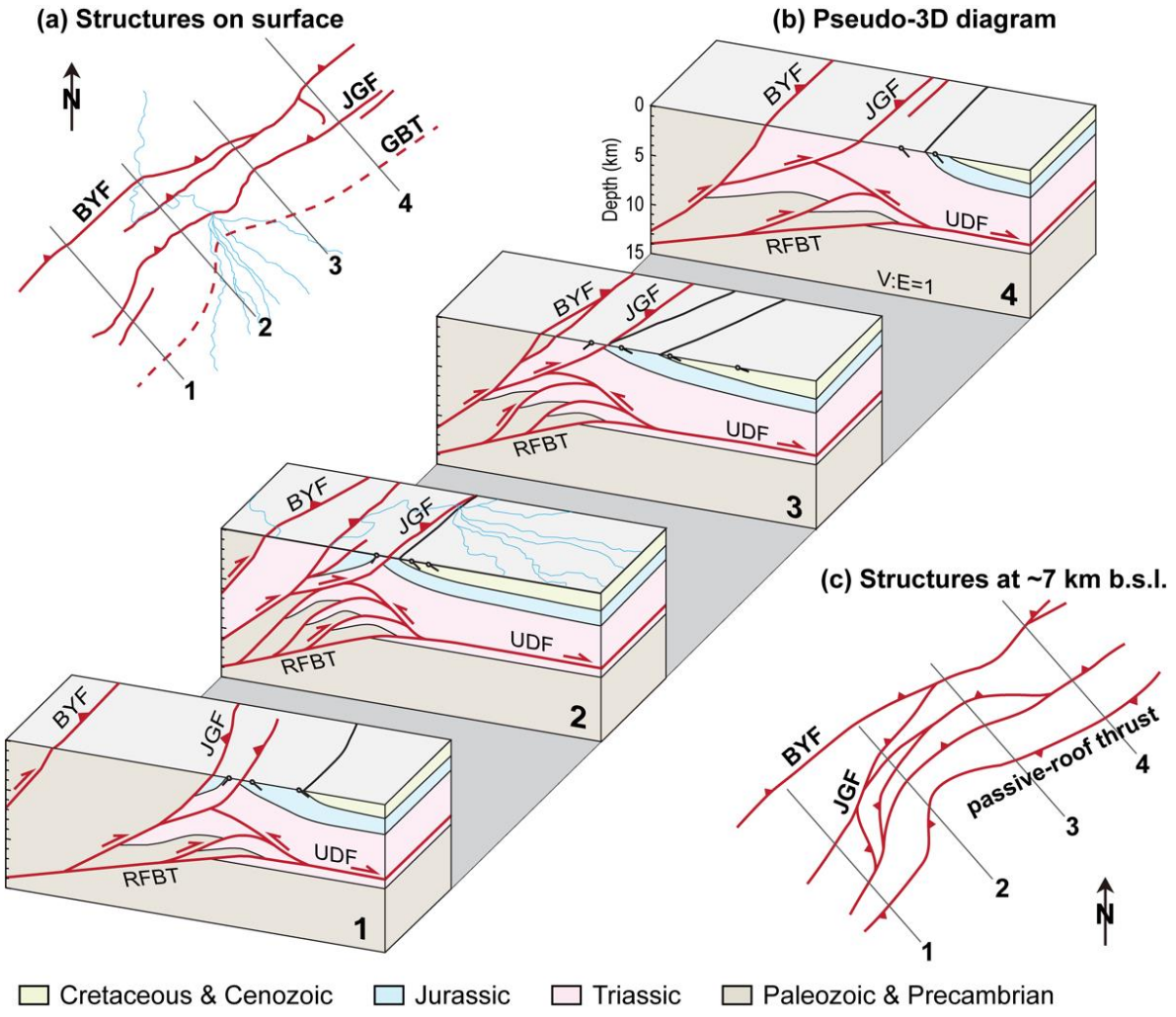
rho, water density,
Q, water discharge
N, channel roughness
S, stream slope
W, channel width

(Godard et al., 2010)

Greatest in Dujiangyan recess (400 Pa)



Deformation style in 3-D:
A warped & decapitated passive-roof duplex



(Liu et al., 2020)

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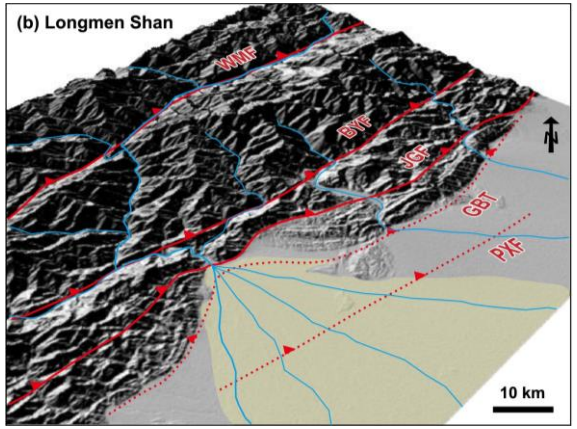
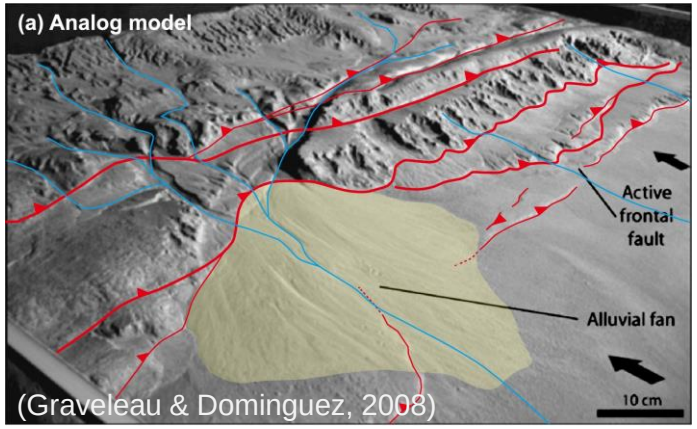
Dujiangyan recess vs. analog model





(Graveleau & Dominguez, 2008)

Conclusion: Recess formation under localized deformation-erosion interactions