Advanced Structural Geology, Fall 2022

South Mountains Field Trip briefing

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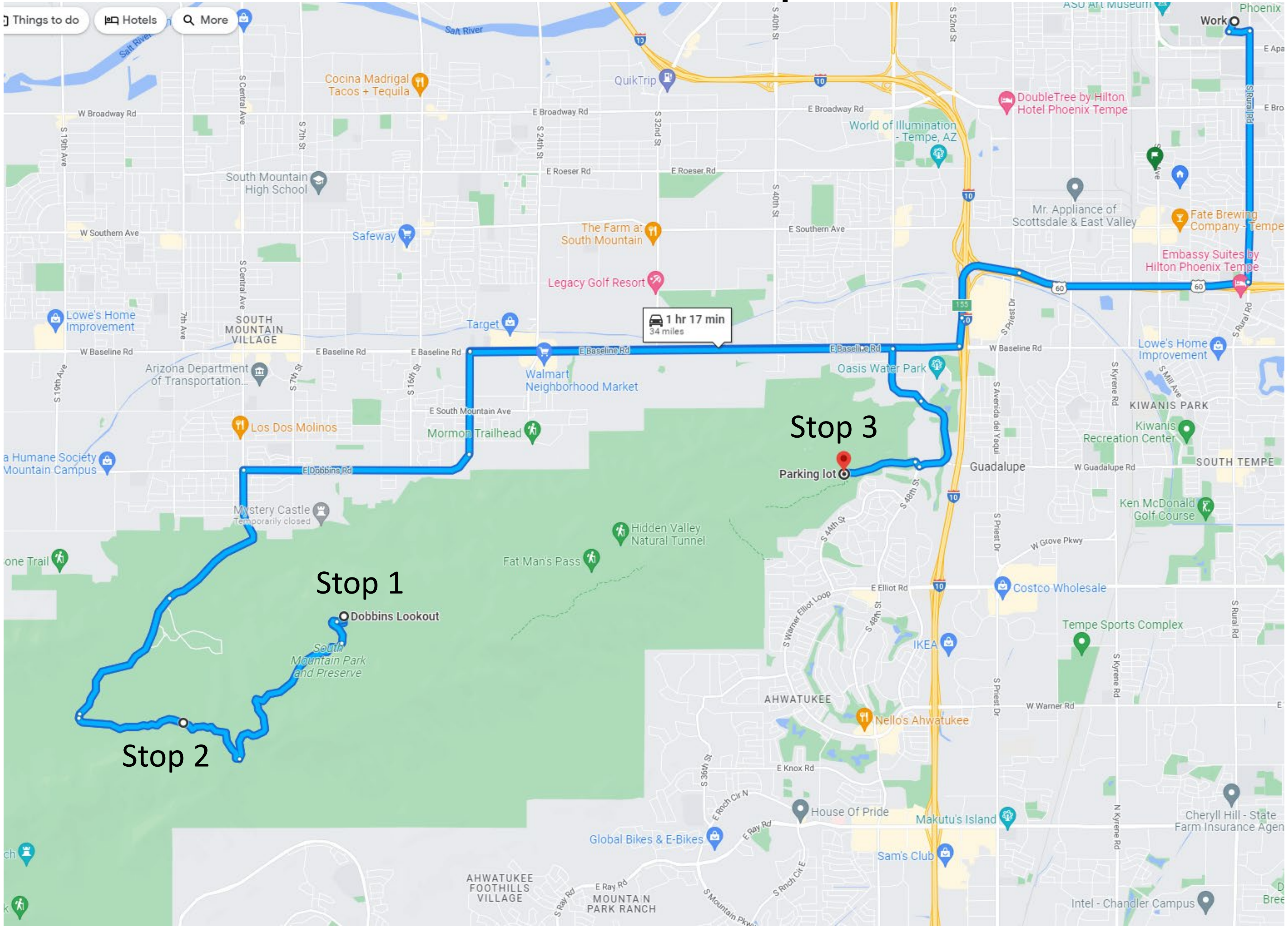
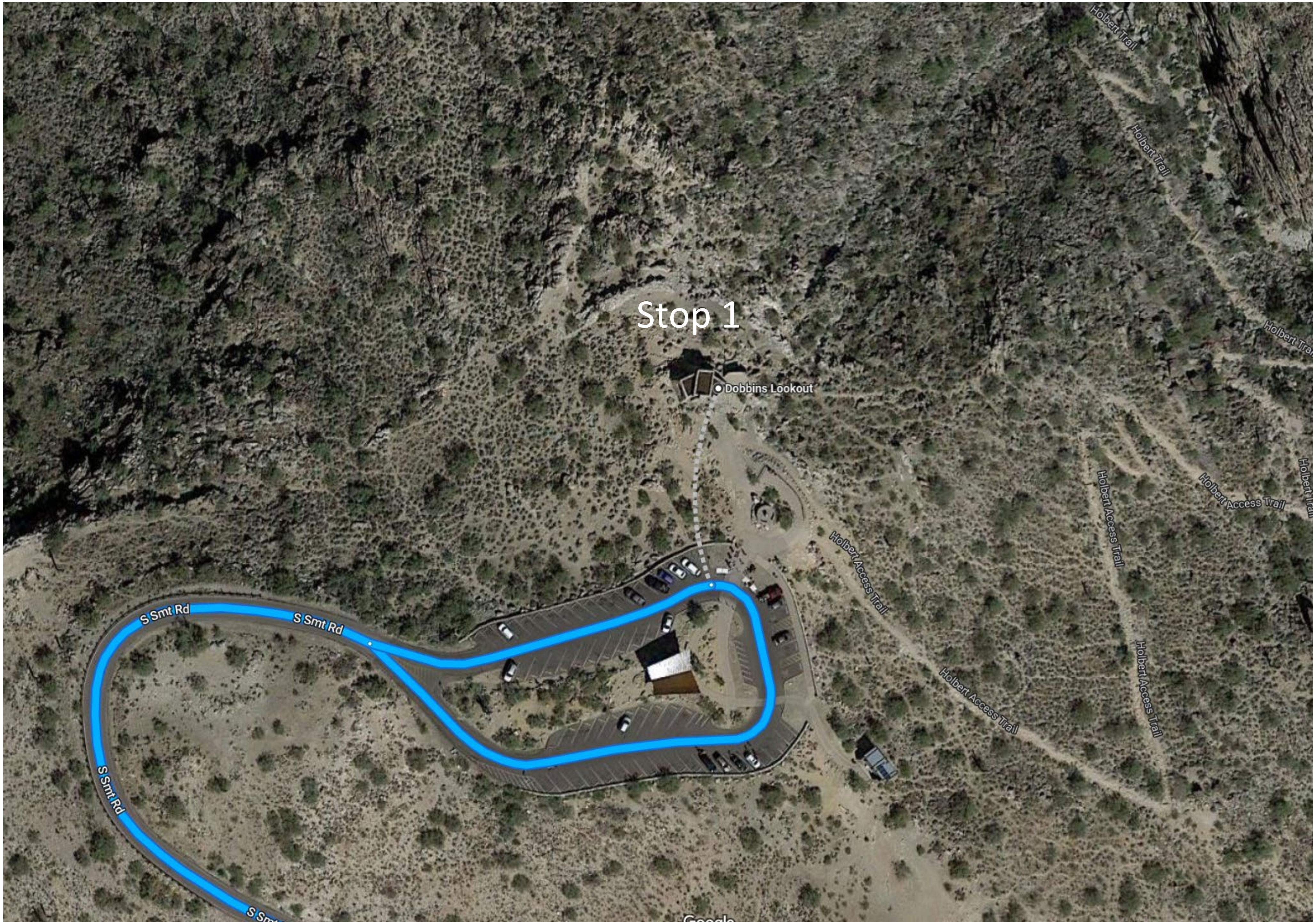
Arizona State University

South Mountains Field trip

- Stop1: Meet at **8 am Dobbins Lookout, Phoenix, AZ 85042**
- Stop 2: Faults and dikes near Telegraph Pass
- Stop 3: Pima Canyon Trailhead (Parking lot, 9904 S 48th St, Phoenix, AZ 85044)





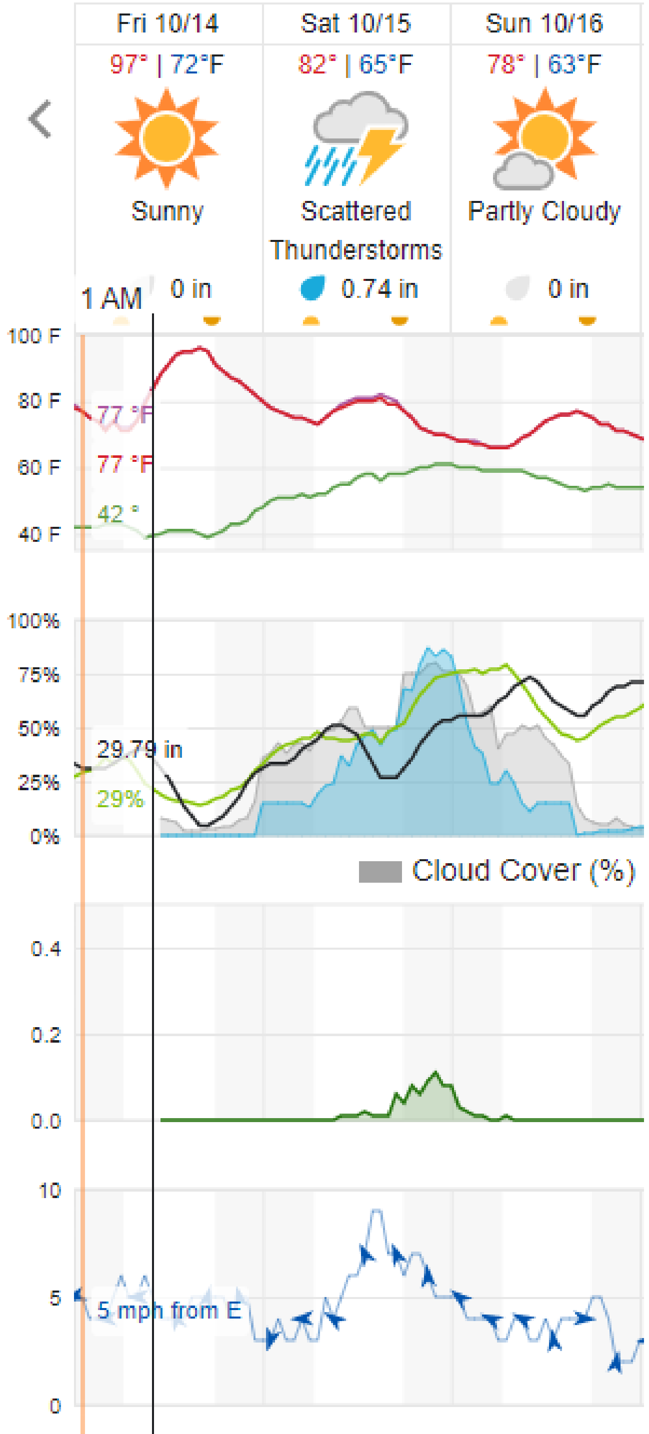
Stop 1
Dobbins Lookout
S Smt Rd
S Smt Rd
S Smt Rd
Holbert Trail
Holbert Trail
Holbert Access Trail
Holbert Access Trail
Holbert Access Trail
Holbert Access Trail

Stop 2; walk along road and trails: faults and dikes

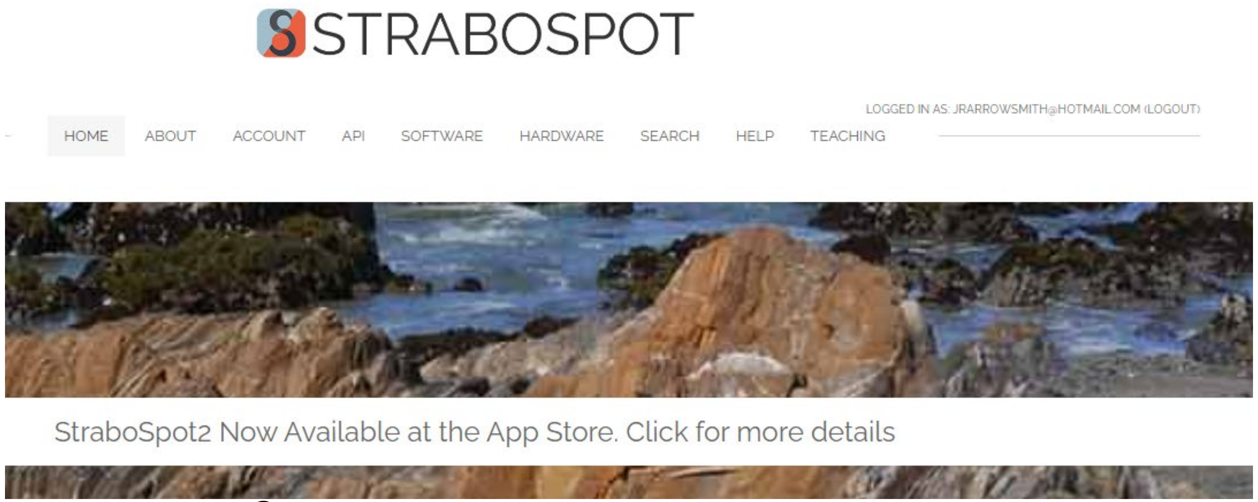
Stop 3; small faults along Marcos de Niza Trail

What to bring

- StraboSpot enabled tablet with data saved for offline use
- Layered clothing (cool in the shade)
- Lunch
- Water
- Hiking shoes



StraboSpot set up



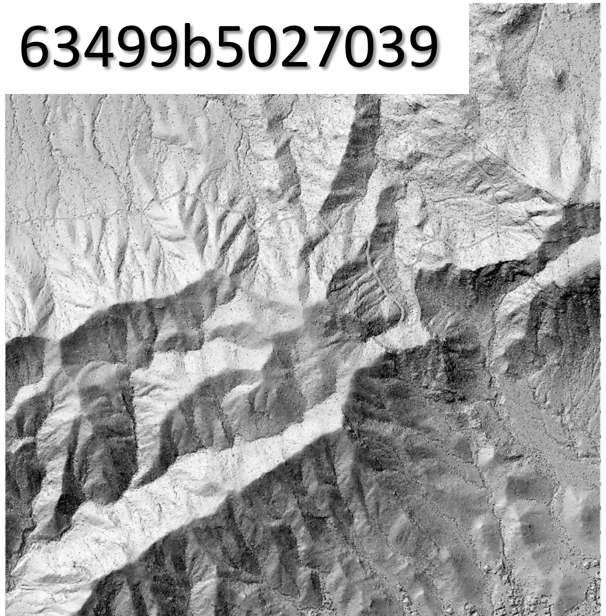
- Get your own account
- Use your own phone/tablet or borrow one from SESE. Use StraboSpot2 if you are installing fresh, StraboSpot1 is fine as well.
- Set up the project with a good name
- Add these base maps

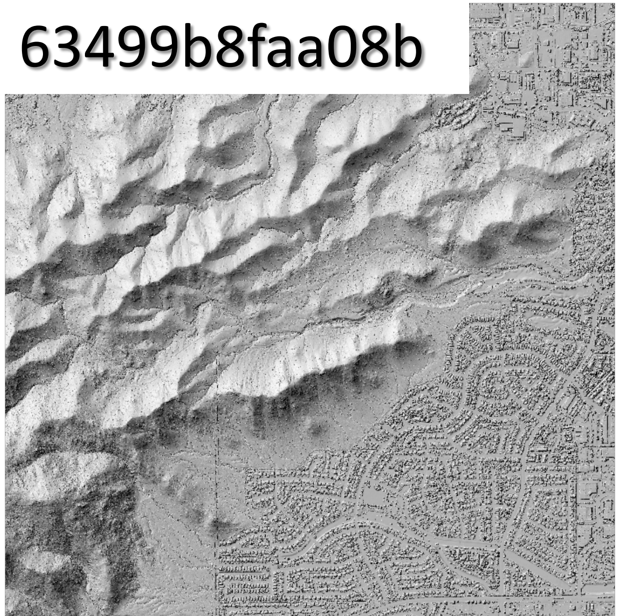
(USGS 3DEP from OpenTopography

AZ MaricopaPinal 1 2020)

- Save for offline (max resolution):
  - MapBox satellite
  - Mapbox Topo
  - Those two Hillshades

Custom maps
StraboSpot MyMaps



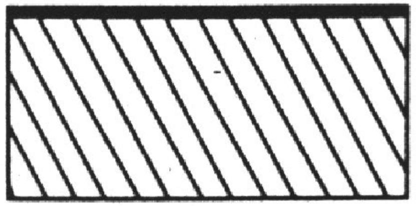


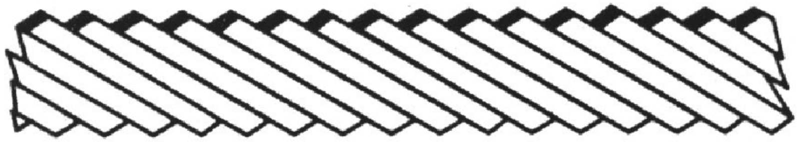
Davis and Reynolds

Normal fault geometries

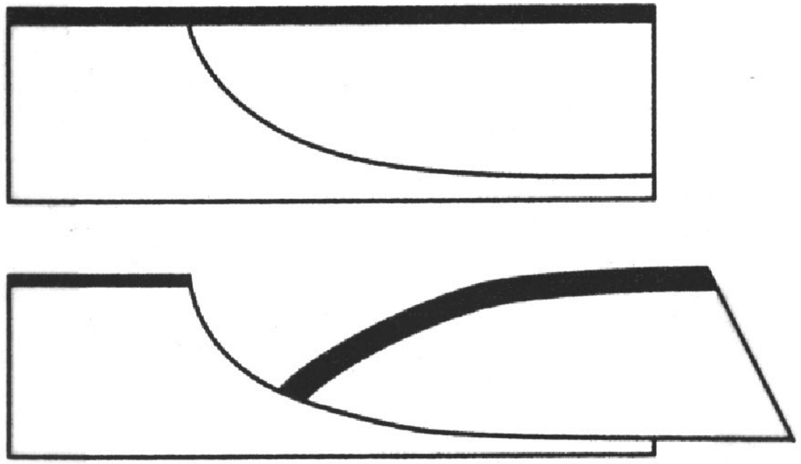
Figure 6.129 Some of the various normal fault geometries employed by nature to accomplish extension and stretching of the crust. (*A*) Domino-style normal faulting; (*B*) listric normal faulting with reverse drag; (*C*) imbricate listric normal faulting; and (*D*) listric normal faulting bounding a family of planar normal faults. [Reprinted with permission from *Journal of Structural Geology*, v. 4, B. Wernicke and B. C. Burchfiel, Modes of extension tectonics (1982), Elsevier Science, Ltd., Pergamon Imprint, Oxford, England.] Burchfiel (1982), Figs. 1, 4, 5, 7.]

A

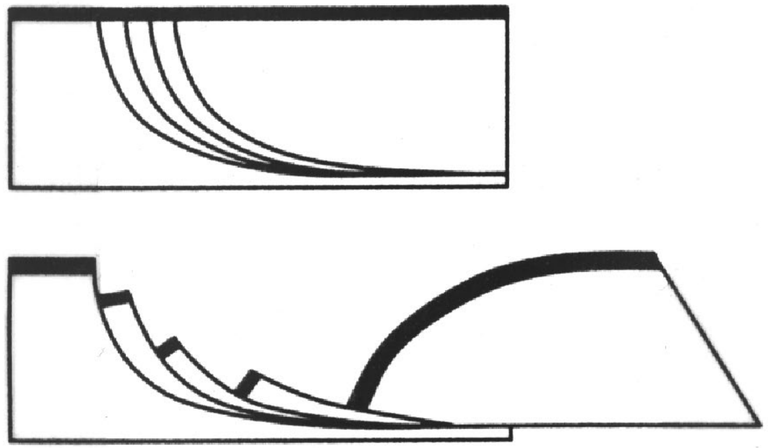




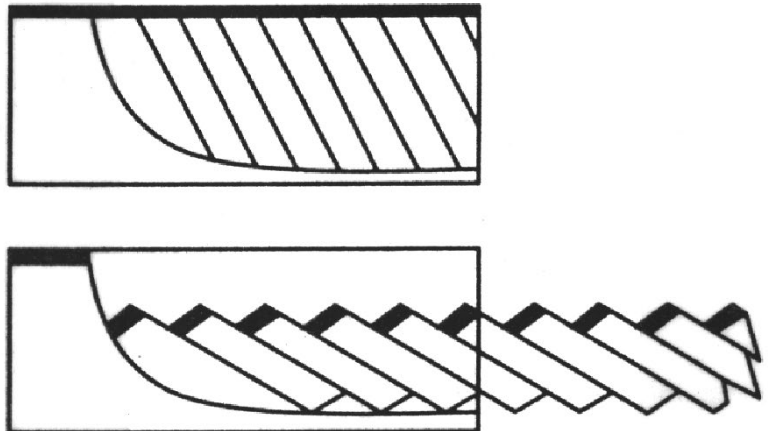
B

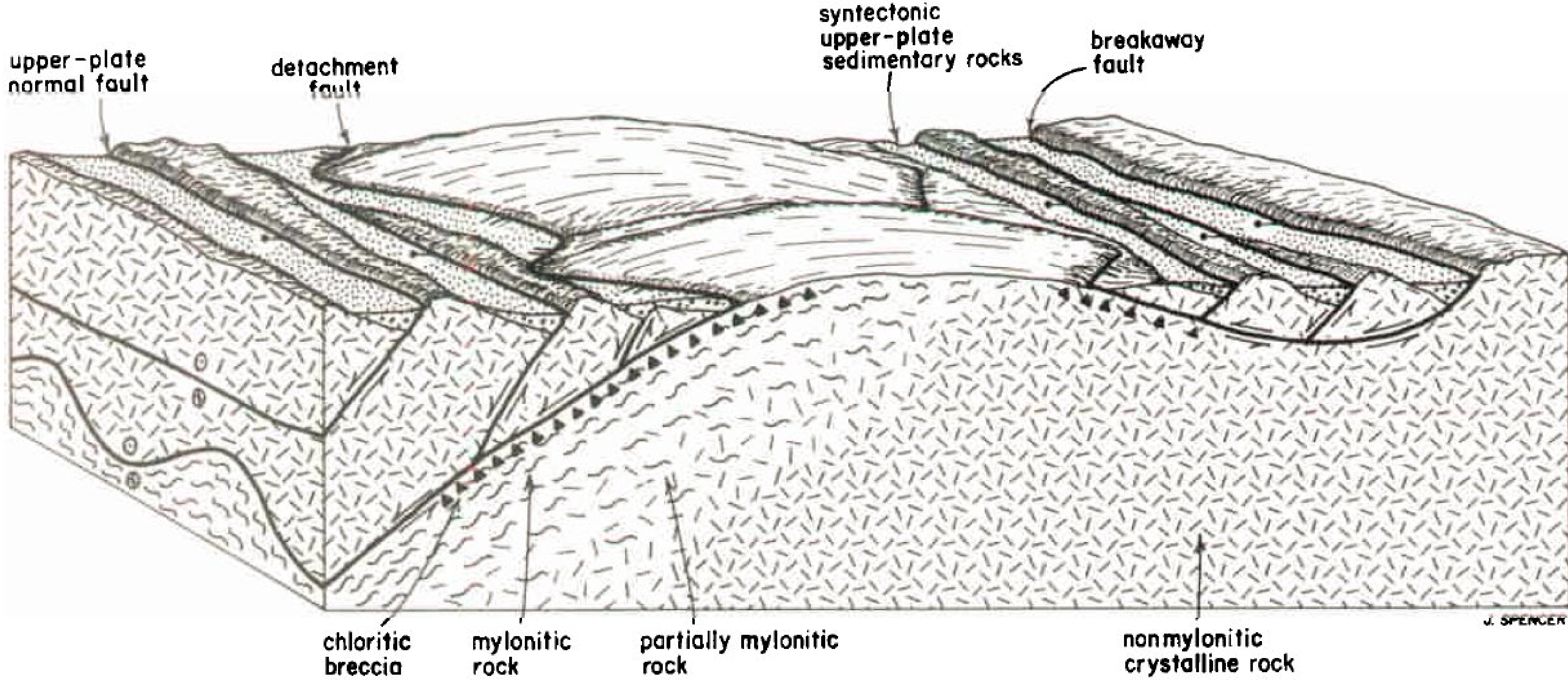


C



D



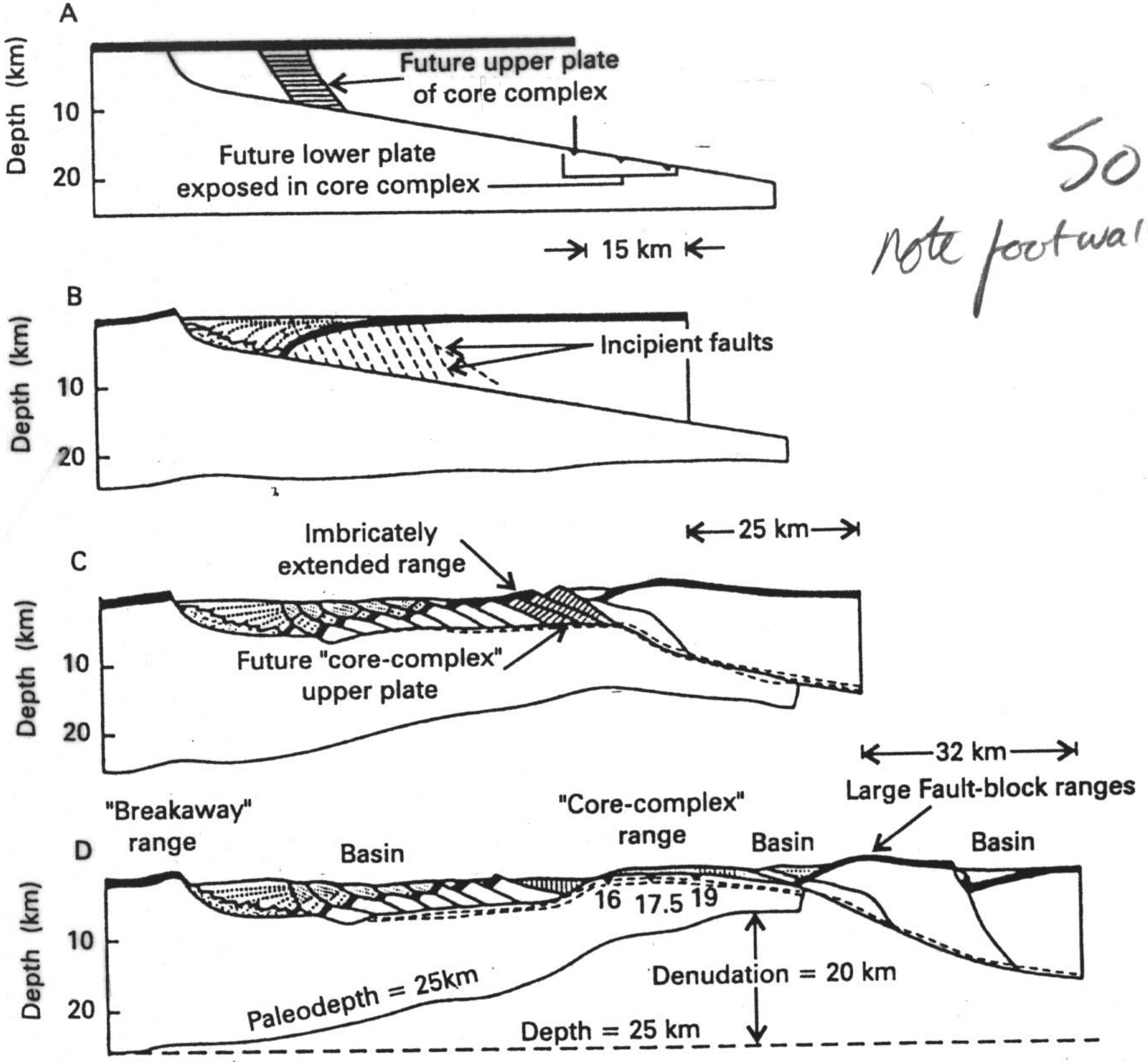


Idealized diagram of a metamorphic core complex or detachment system
--these are common in Arizona

Davis and Reynolds

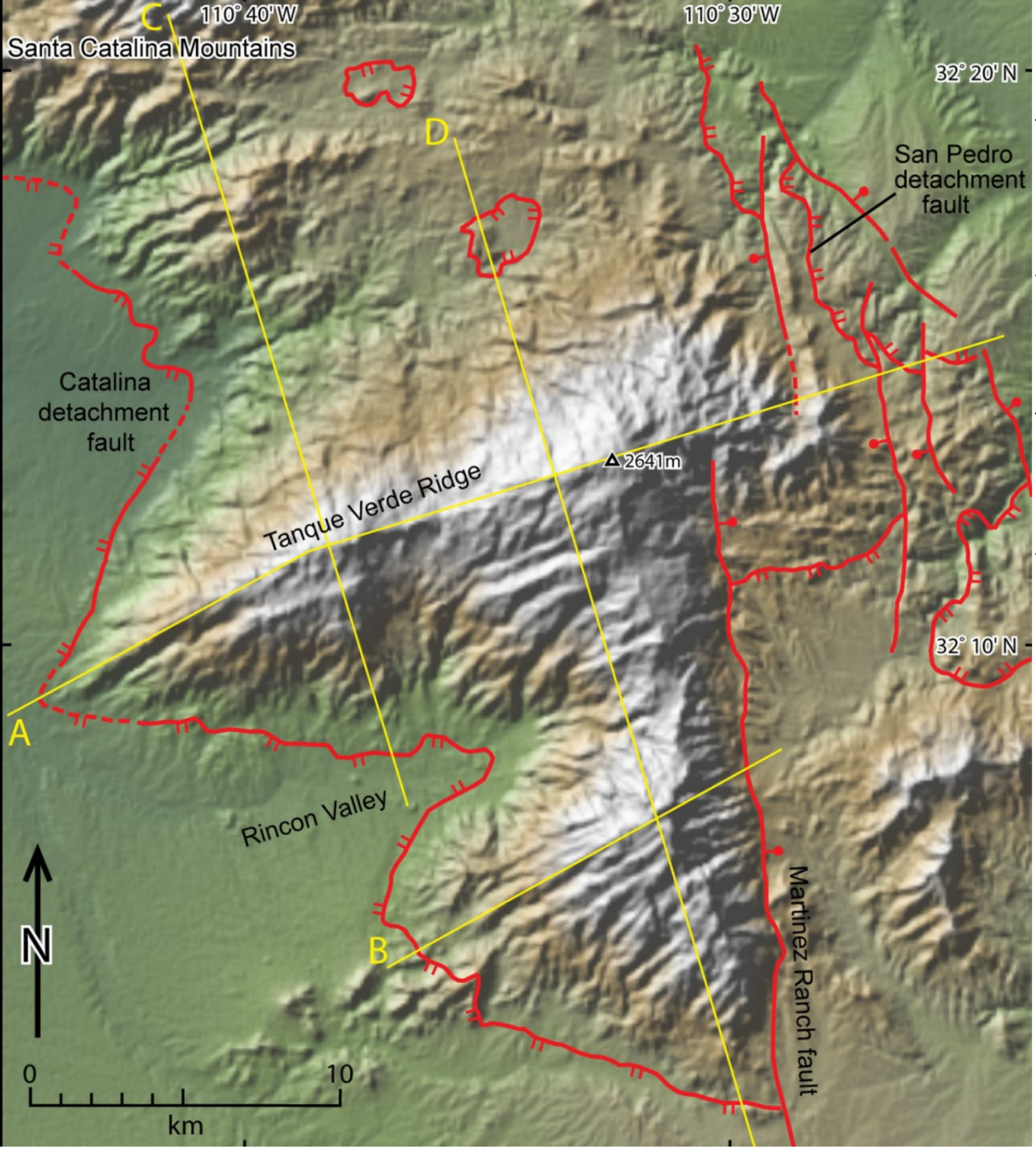
Normal faults

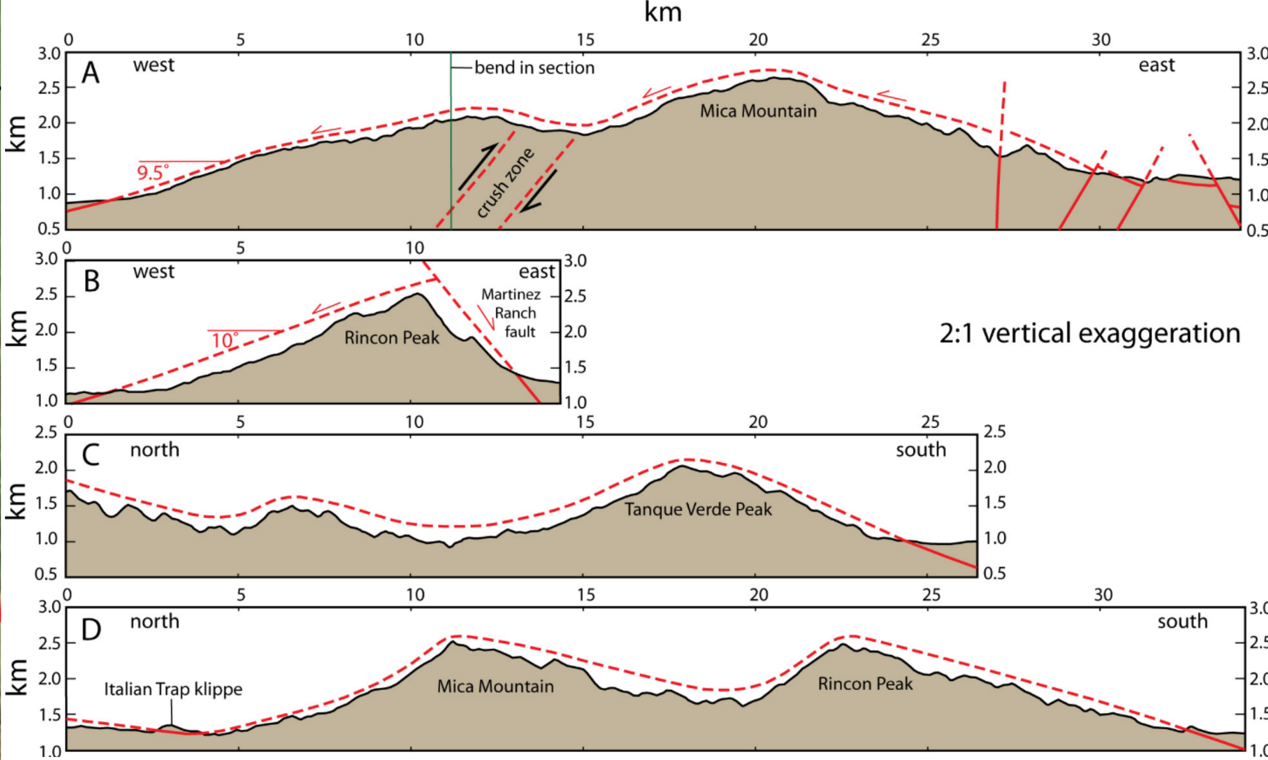
Development of extensional systems



South mtns
Note footwall/hanging wall paths

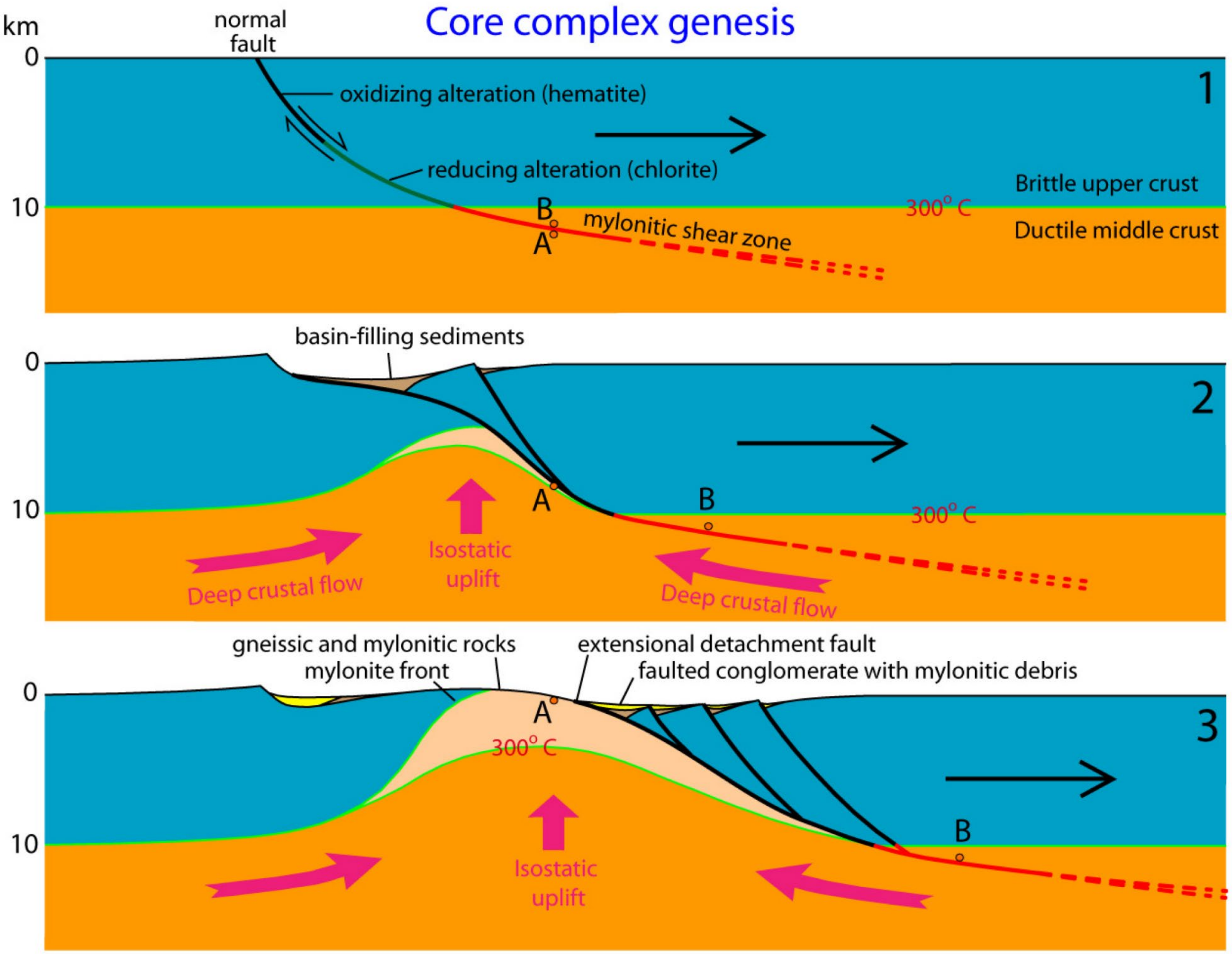
Figure 6.131 Low-angle detachment faulting and the formation of a metamorphic core complex. (*A*) Starting configuration, including original locations of domains of rock that will eventually become upper plate and lower plate. (*B*) Low-angle normal faulting is marked by breakaway zone at surface. Deeper reaches of the fault penetrate the middle crust. At that depth level, displacement is achieved by shearing and the formation of mylonites. Growth fault basins at surface steadily form and steadily fill with sediment. (*C*) Shear zone rocks are "drawn" closer to surface via continued normal displacement. Unroofing of the upper level rocks triggers isostatic adjustment and doming. (*D*) The final configuration of core complex and detachment faulting. [After Wernicke (1985), v. 291, reprinted courtesy of the Canadian Journal of Earth Sciences.]



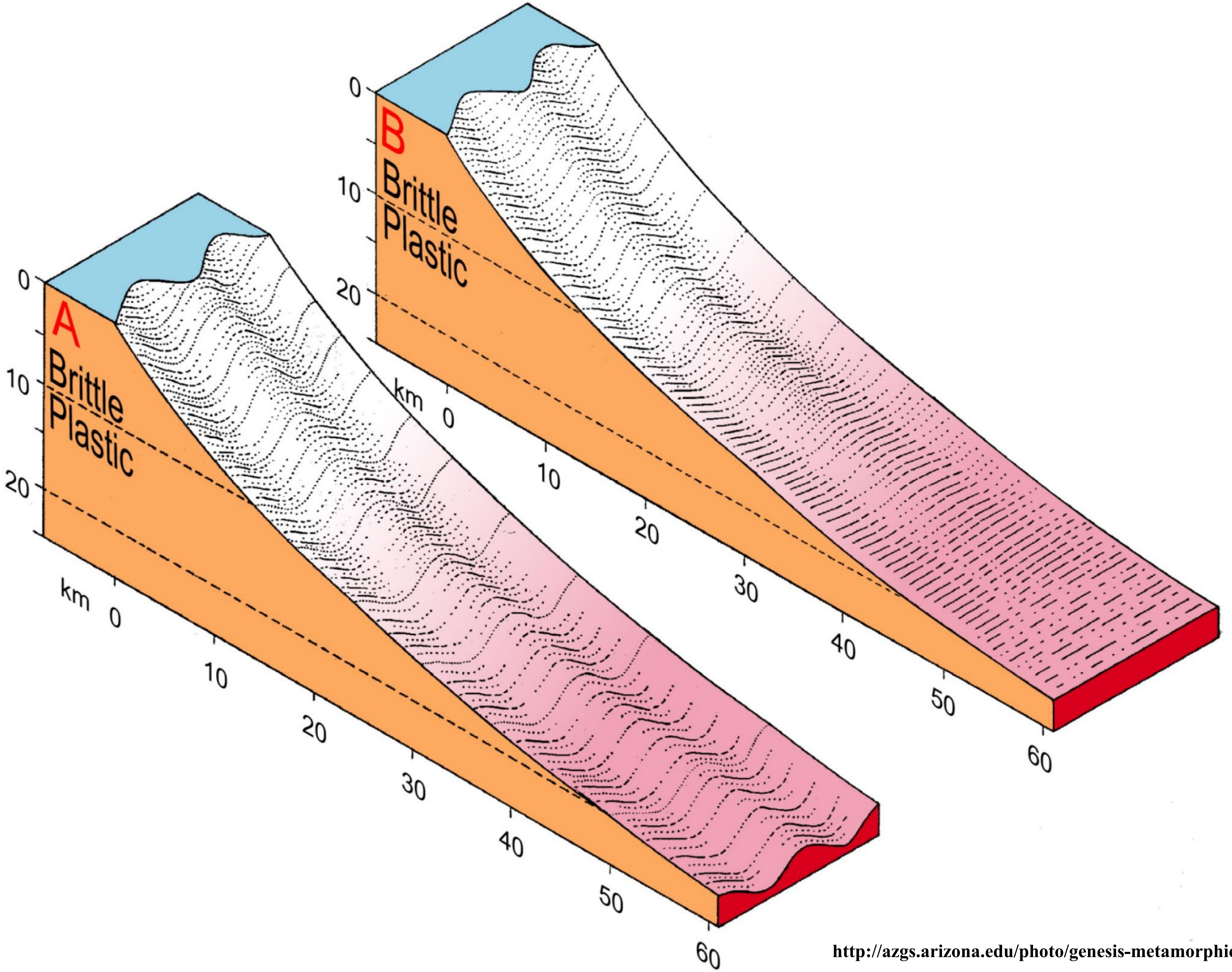


Deformed, low angle detachment fault surface

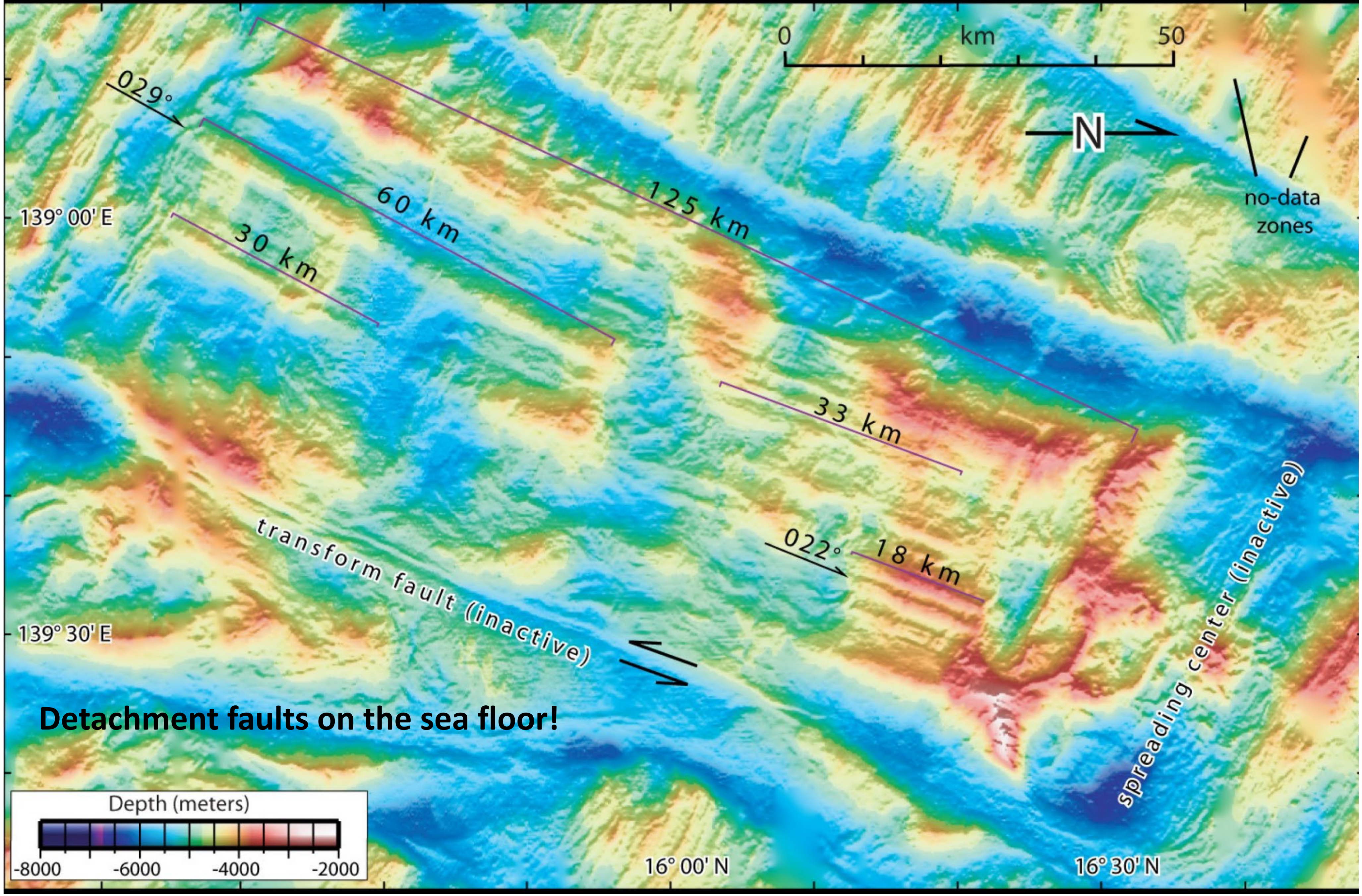
http://azgs.arizona.edu/photo/genesis-metamorphic-core-complex



http://azgs.arizona.edu/photo/genesis-metamorphic-core-complex



http://azgs.arizona.edu/photo/genesis-metamorphic-core-complex



Detachment faults on the sea floor!

http://azgs.arizona.edu/photo/genesis-metamorphic-core-complex

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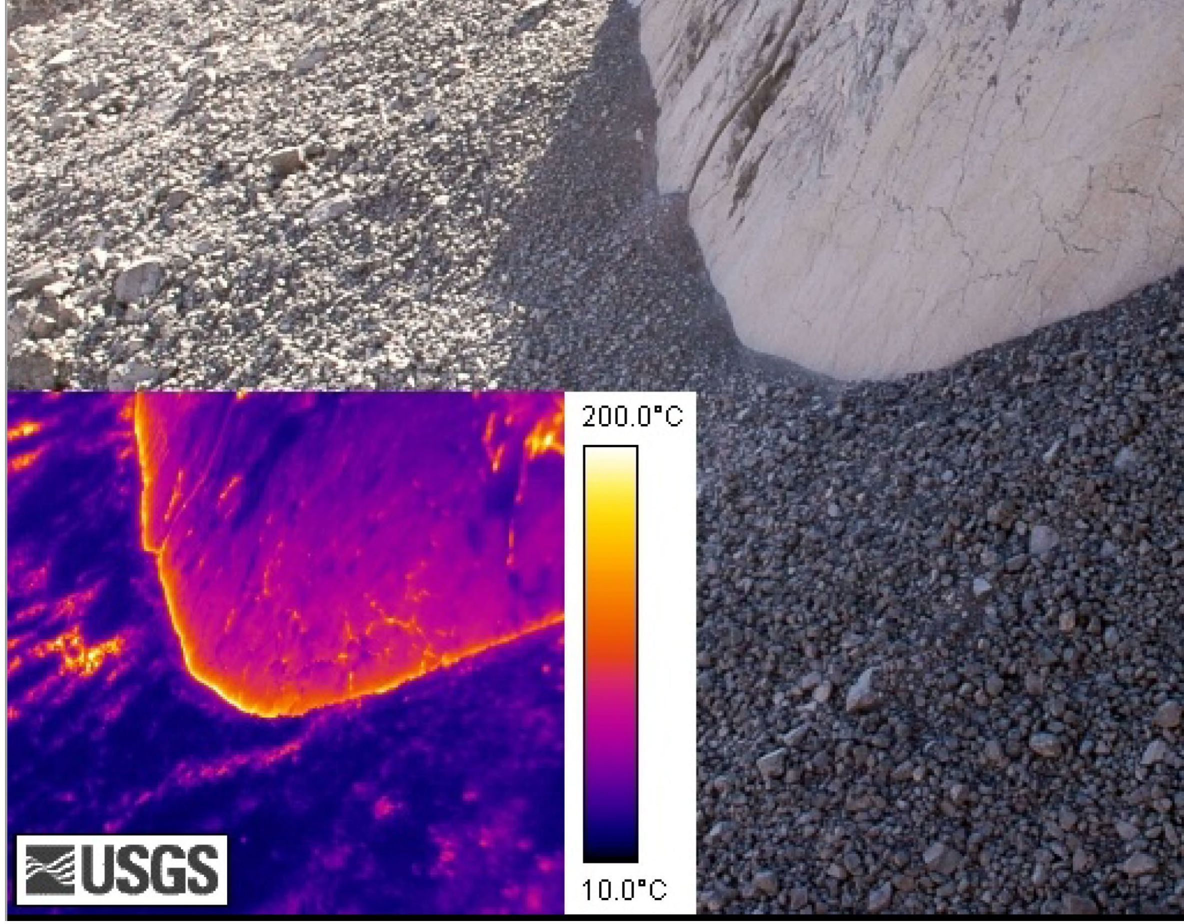
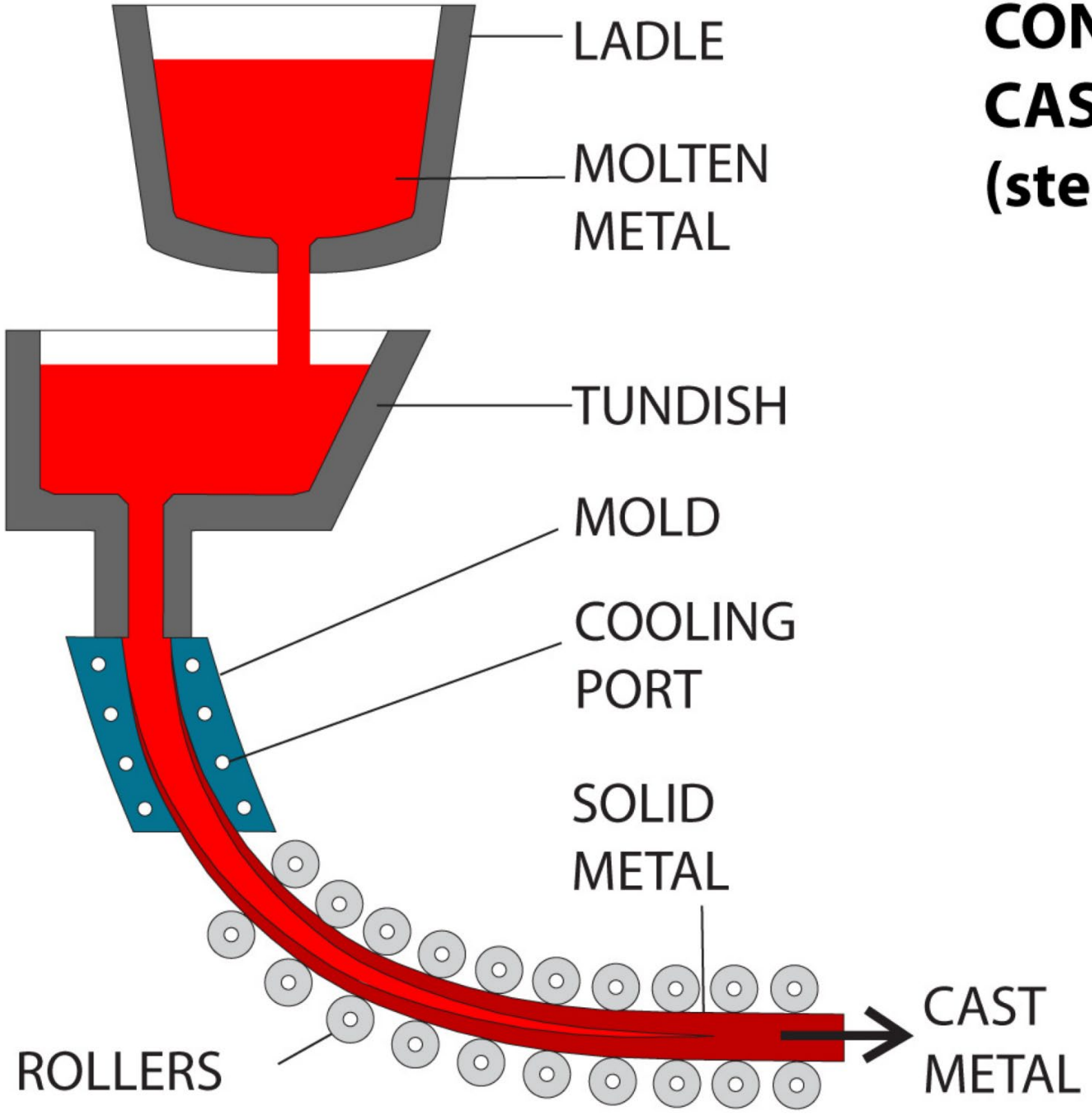


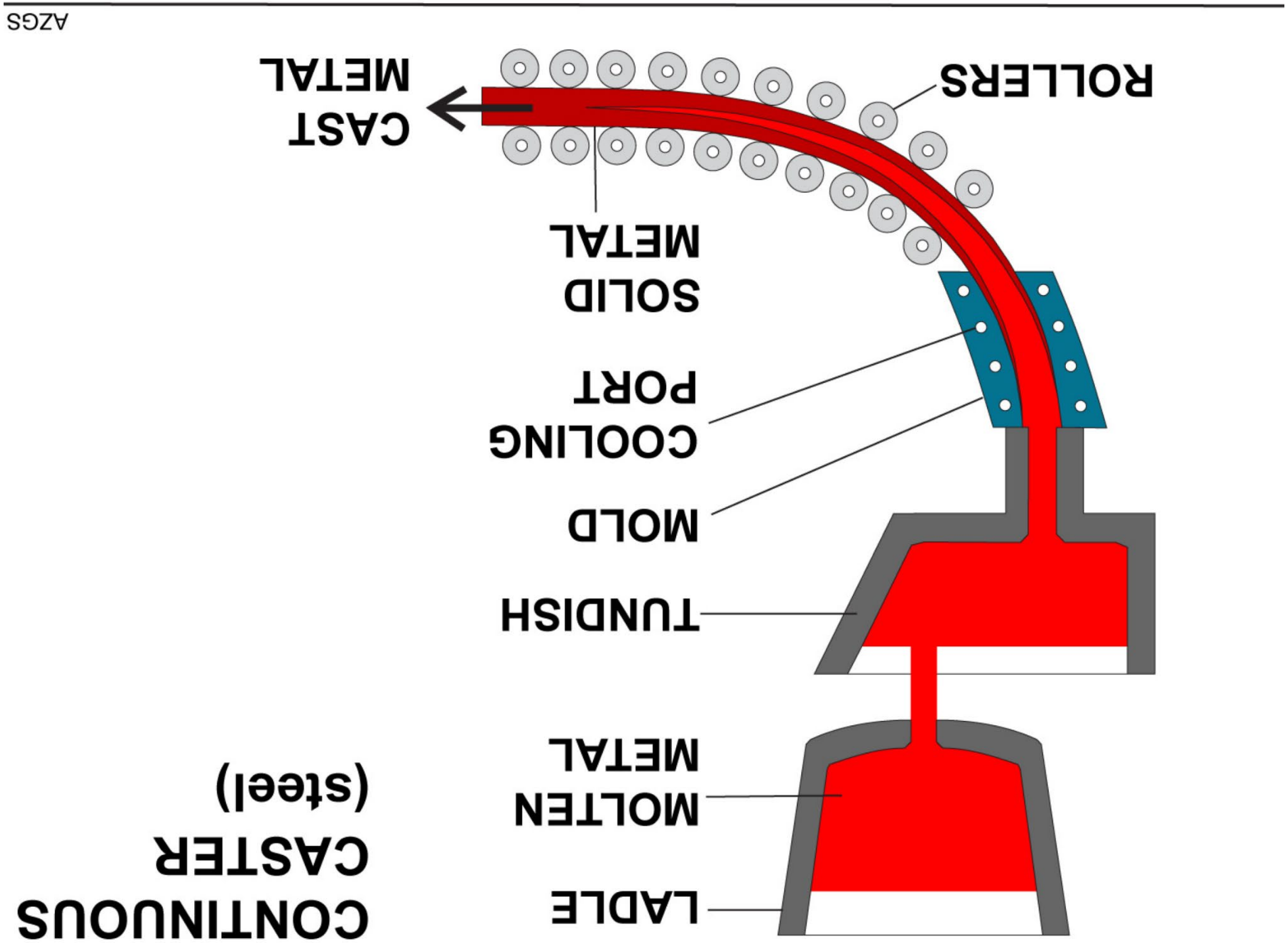
Mount Saint Helens dome

http://azgs.arizona.edu/photo/genesis-metamorphic-core-complex

CONTINUOUS CASTER (steel)



Core complexes are like upside-down continuous casters!



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Spencer, J. E.
Publication Date
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Graphics for core-complex morphology and geologic continuous casting

Basic Information

Author: Spencer, J. E.
Description: The essential process in continuous casting is cooling and solidification of the cast medium during heat loss across a slip surface followed by extrusion from a mold. There are implications here for the manner in which core complexes form.
Publication Date: 2009
Resource Language: English

▸ Intellectual Originator Contact

Available Files:
Graphics for core-complex morphology and geologic continuous casting

Resource Information

Resource ID: OFR-09-03
Access Statement: Spencer, J. E., 2009, Graphics for core-complex morphology and geologic continuous casting. Arizona Geological Survey Open File Report, OFR-09-03, 44 p.

▸ Resource Distribution Contact

▸ Geographic Extent

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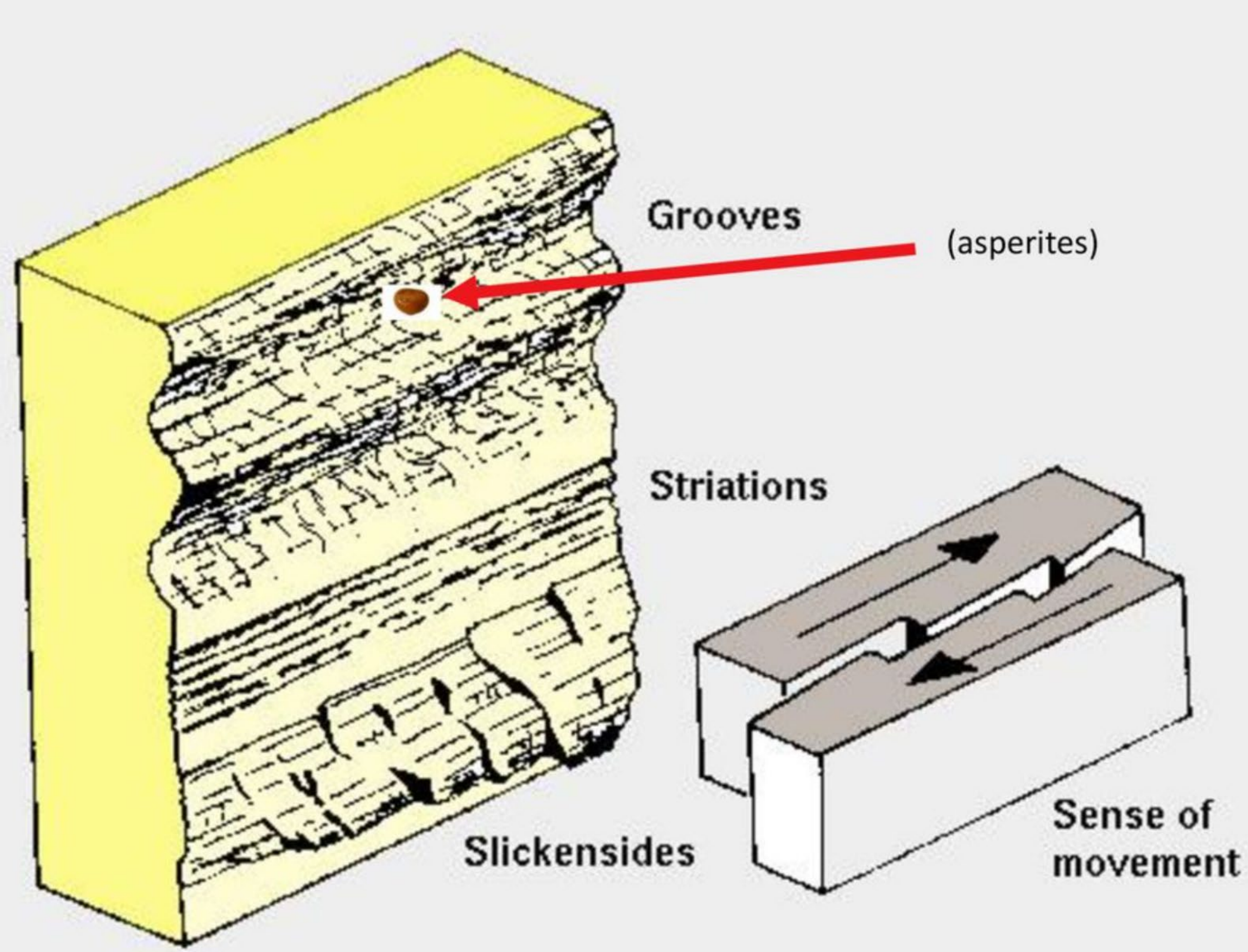
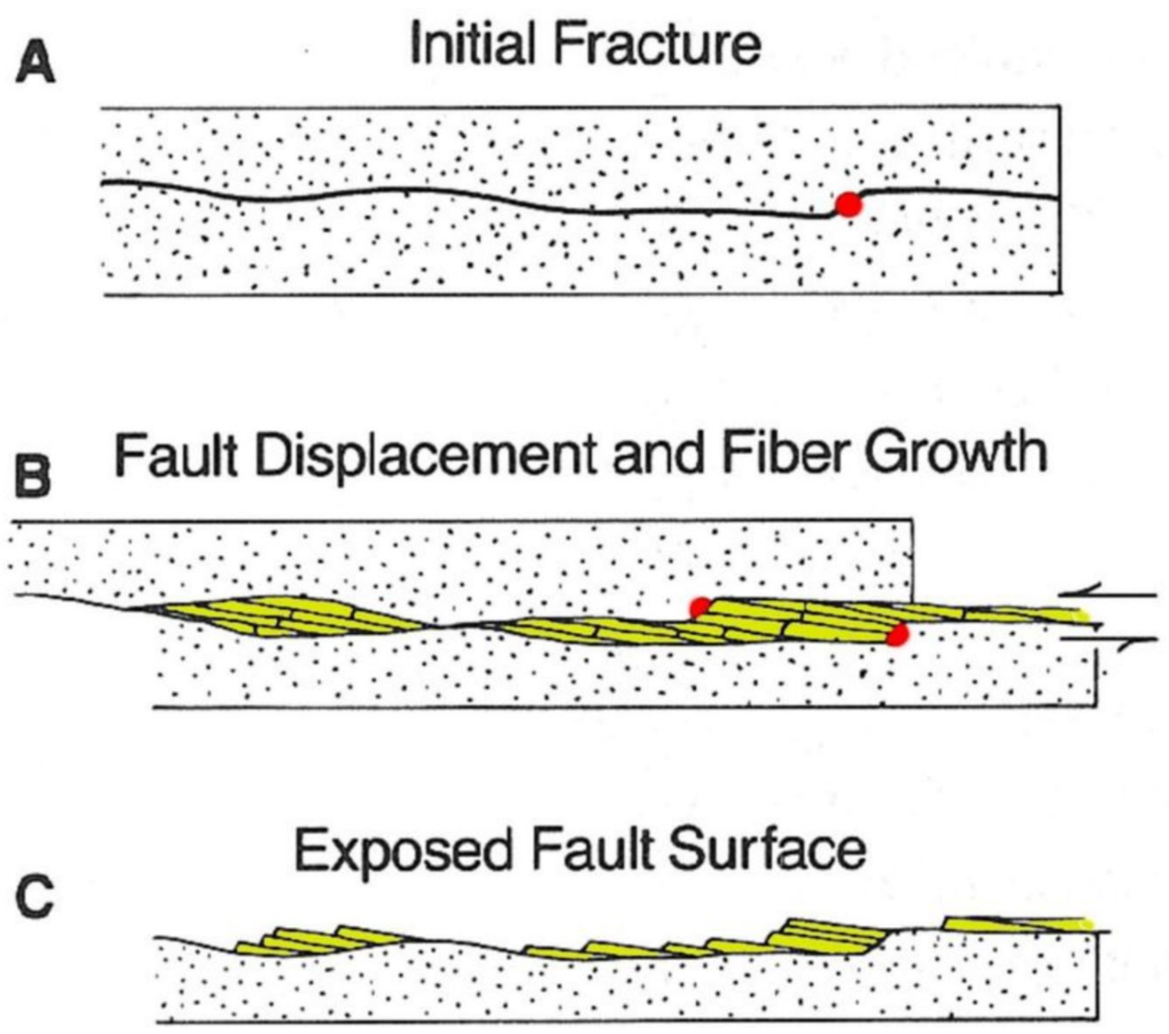
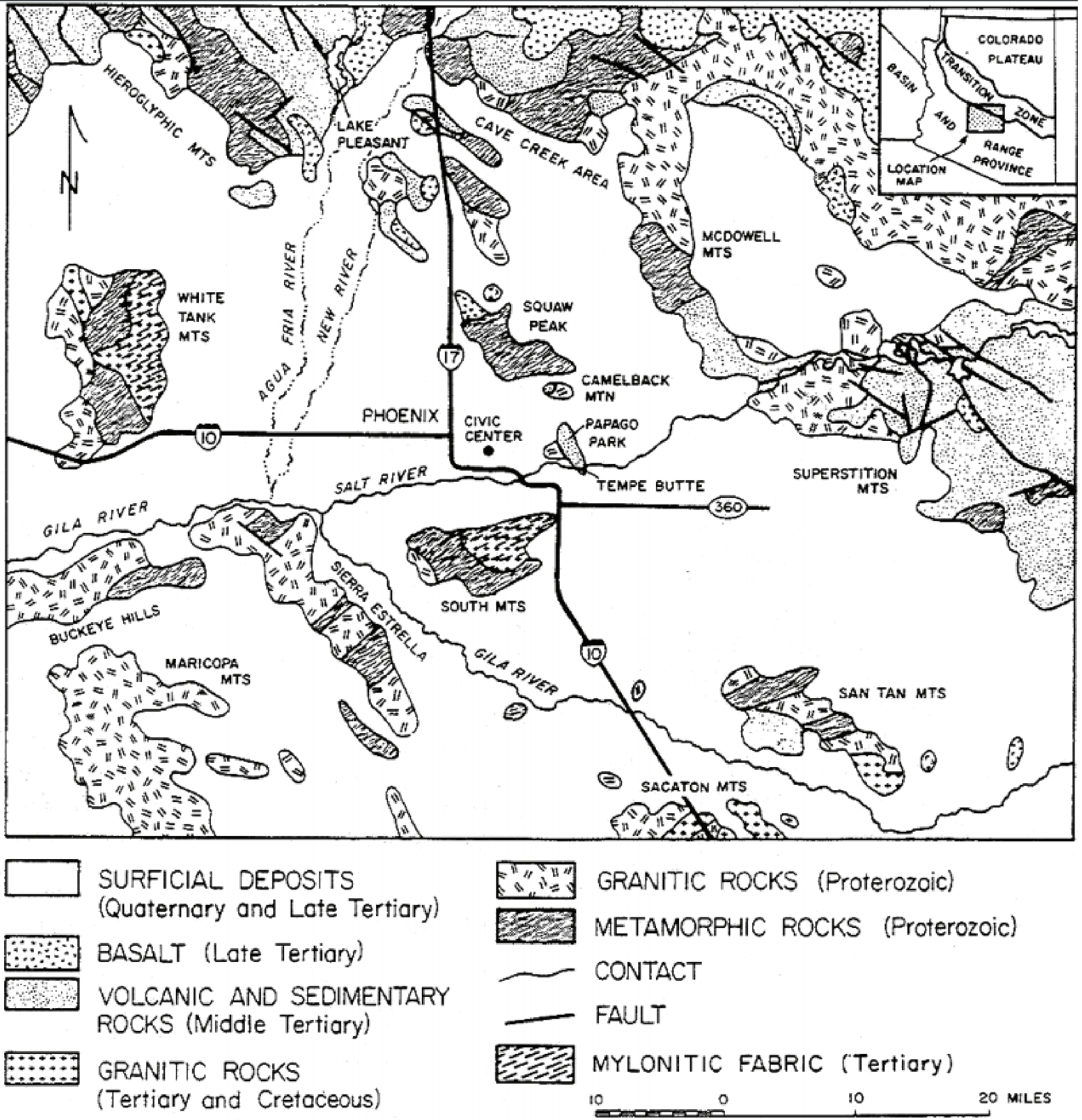


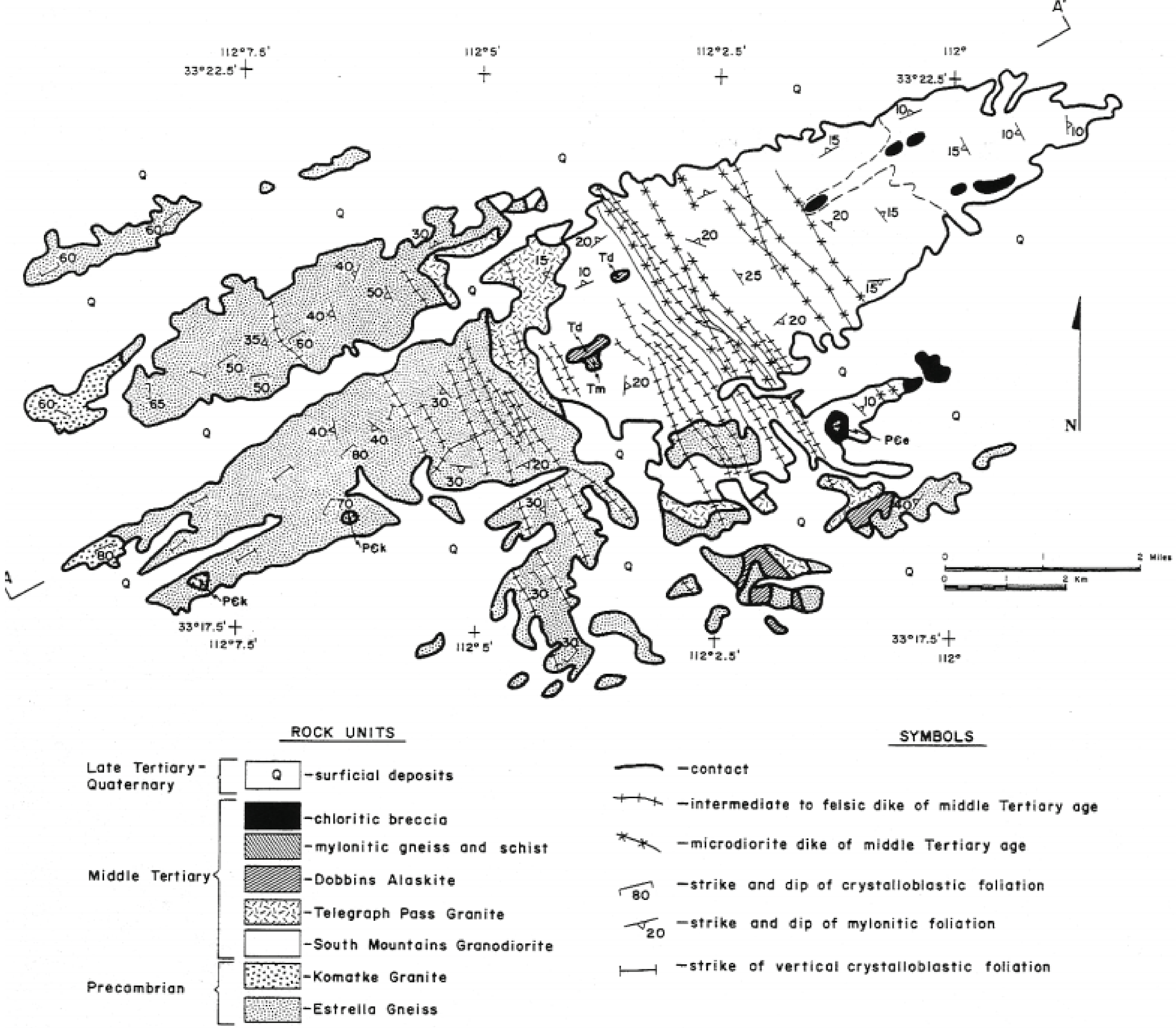


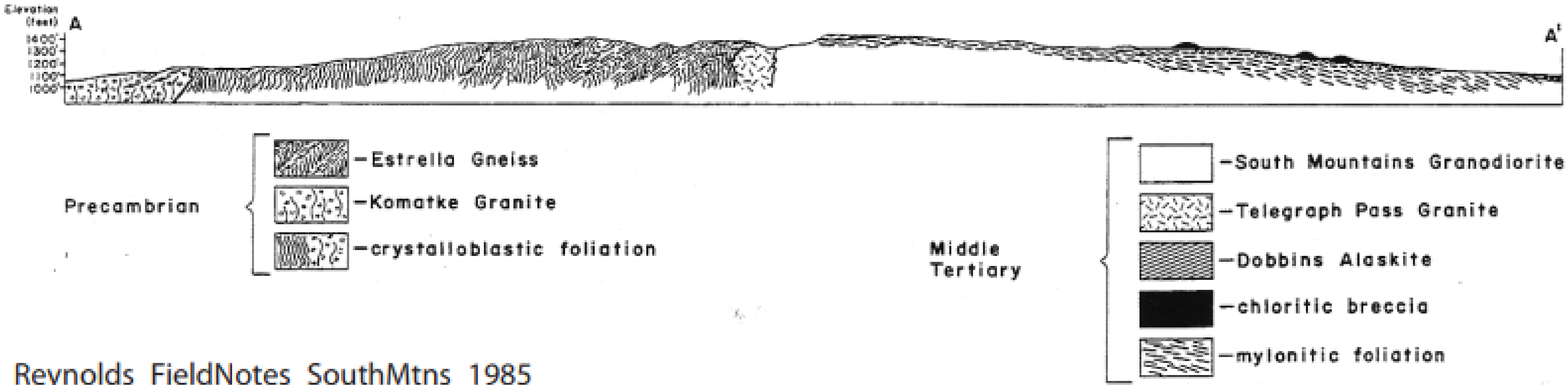
Determining sense of shear along fault surfaces

https://slideplayer.com/slide/14062204/



Reynolds, S. M., Geologic highlights of the Phoenix region, 1987

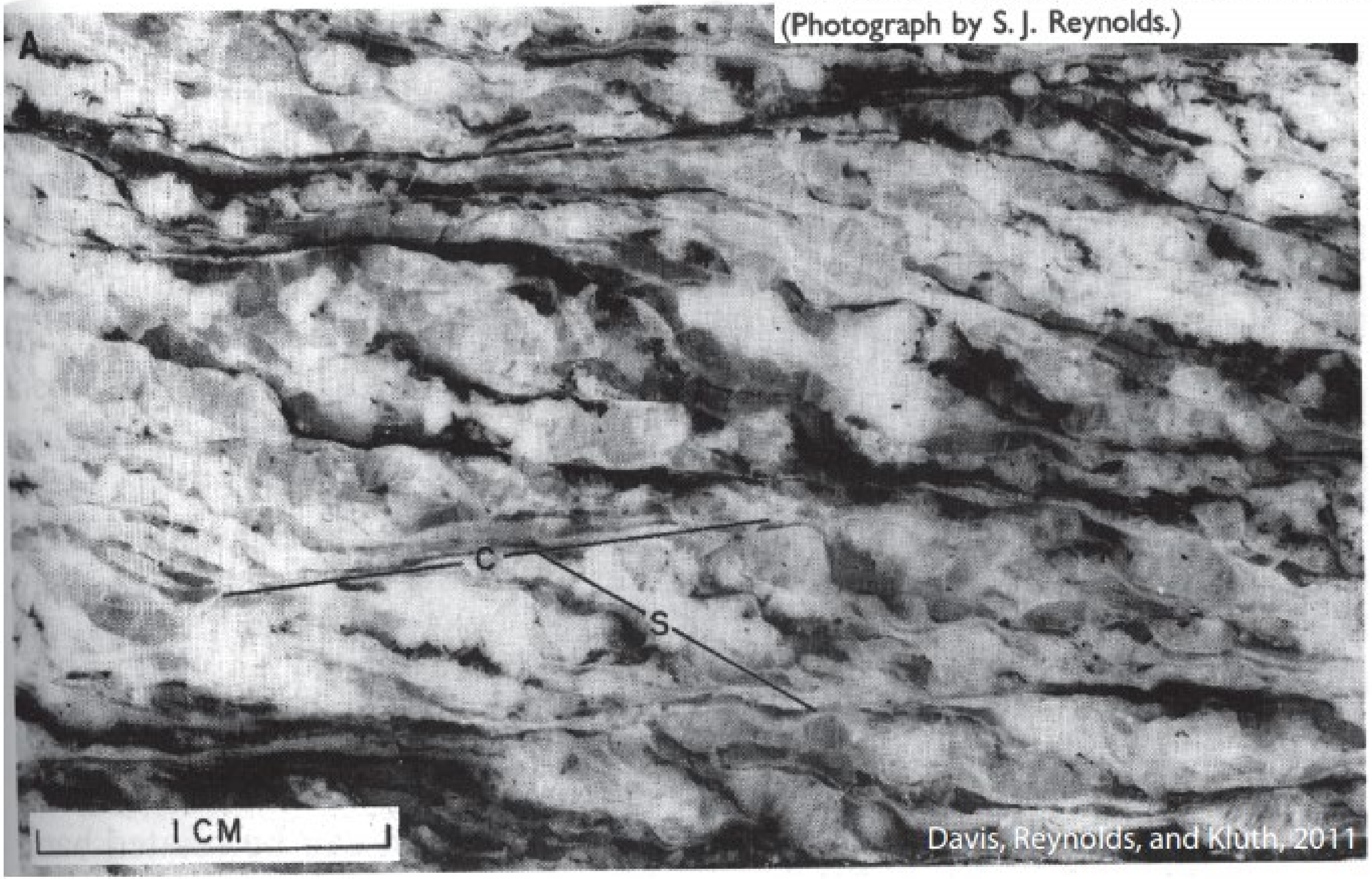

A'
112°7.5'
112°5'
112°2.5'
112°
33°22.5'
33°17.5'
Q
Td
Tm
P€k
P€e
N
A
0 1 2 Miles
0 1 2 Km
ROCK UNITS
Late Tertiary-Quaternary
Q -surficial deposits
Middle Tertiary
-chloritic breccia
-mylonitic gneiss and schist
-Dobbins Alaskite
-Telegraph Pass Granite
-South Mountains Granodiorite
Precambrian
-Komatke Granite
-Estrella Gneiss
SYMBOLS
-contact
-intermediate to felsic dike of middle Tertiary age
-microdiorite dike of middle Tertiary age
-strike and dip of crystalloblastic foliation
-strike and dip of mylonitic foliation
-strike of vertical crystalloblastic foliation



Reynolds_FieldNotes_SouthMtns_1985

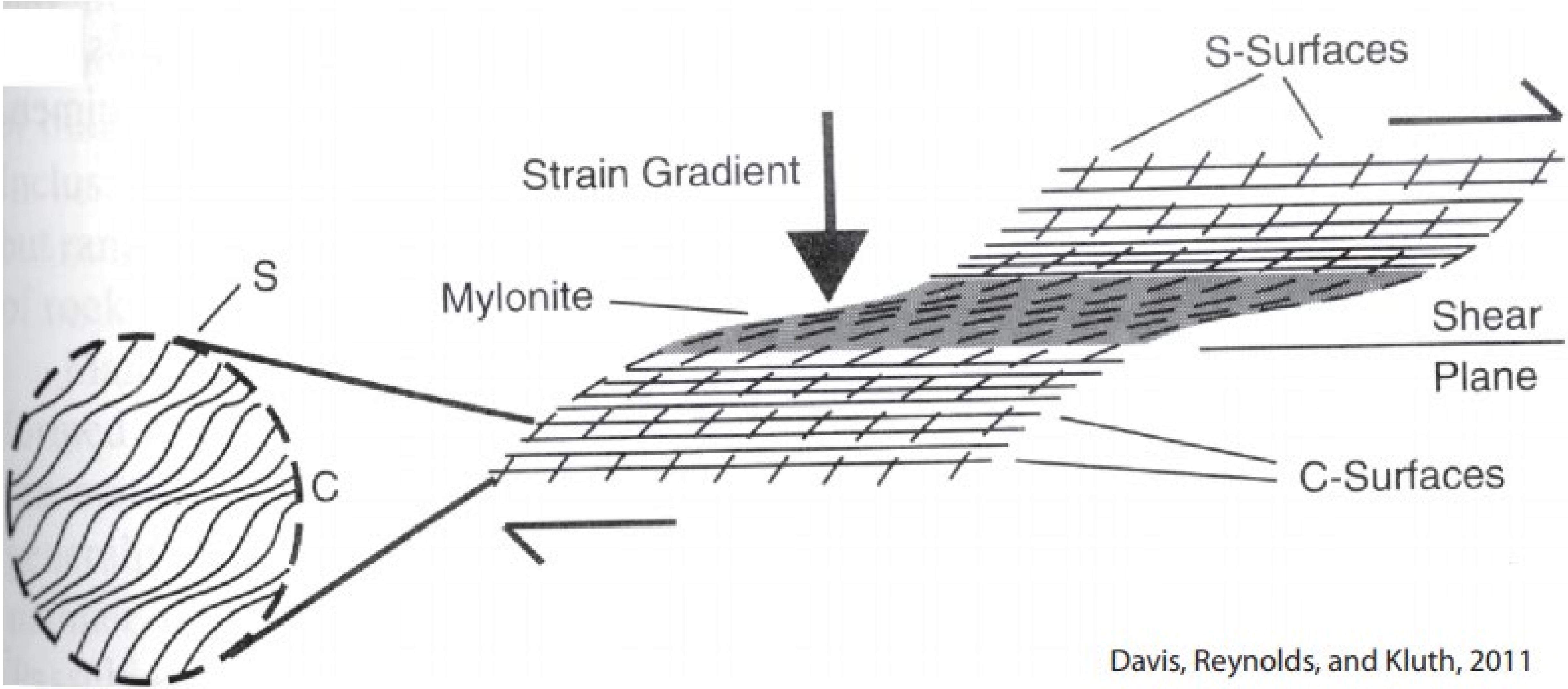
Figure 2. *Simplified geologic map and cross section of the South Mountains.*

Davis and Reynolds



S-C fabrics. (*A*) S-C fabric in polished slab of Tertiary granodiorite, South Mountains, Arizona. Sense of shear is sinistral. (Photograph by S. J. Reynolds.)

Davis and Reynolds



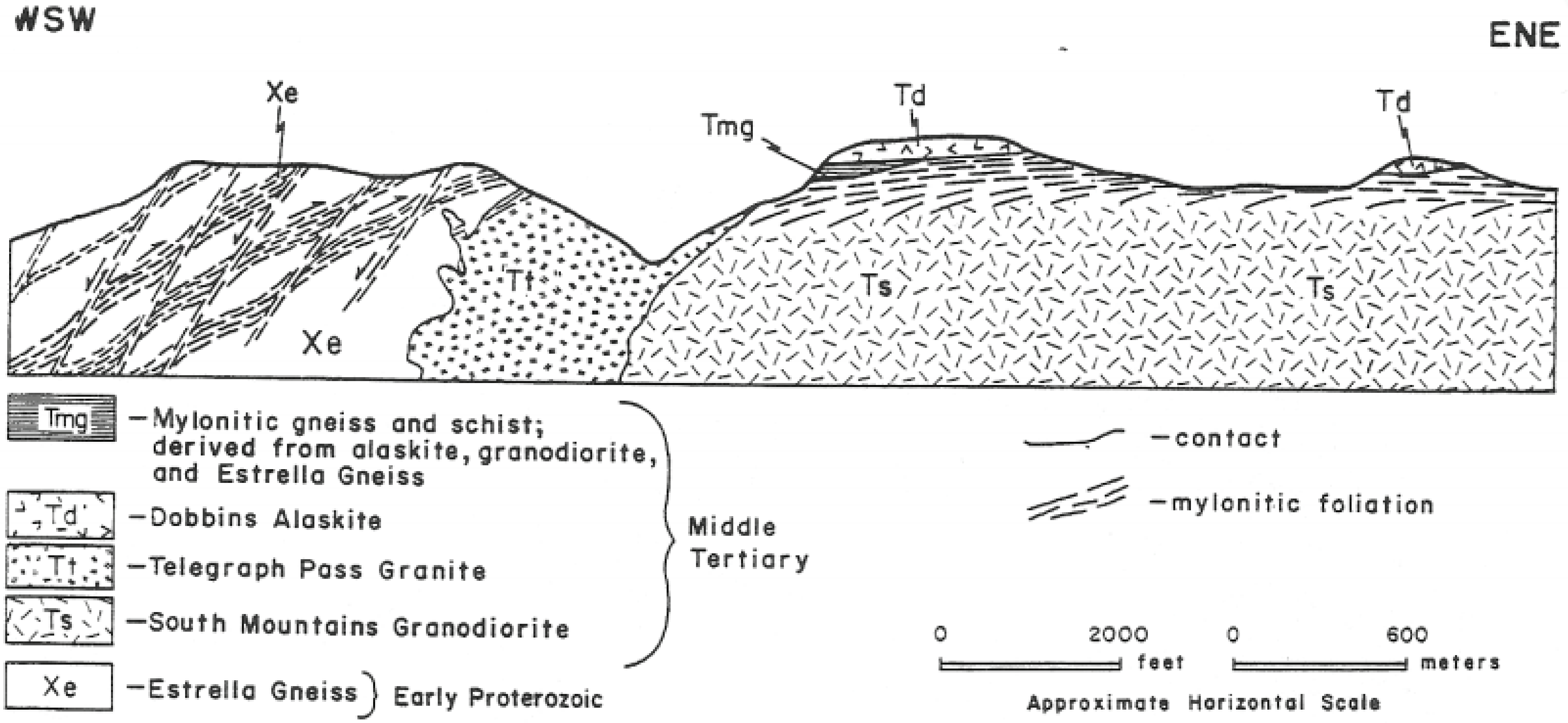


Figure 3. Schematic cross section of Telegraph Pass (Stop 3), Mount Suppoa (the high central peak), and Dobbins Lookout (the eastern peak of alaskite; Stop 1). Mylonitic front (Stop 3) is shown schematically in Proterozoic Estrella Gneiss (modified from Reynolds, 1985).

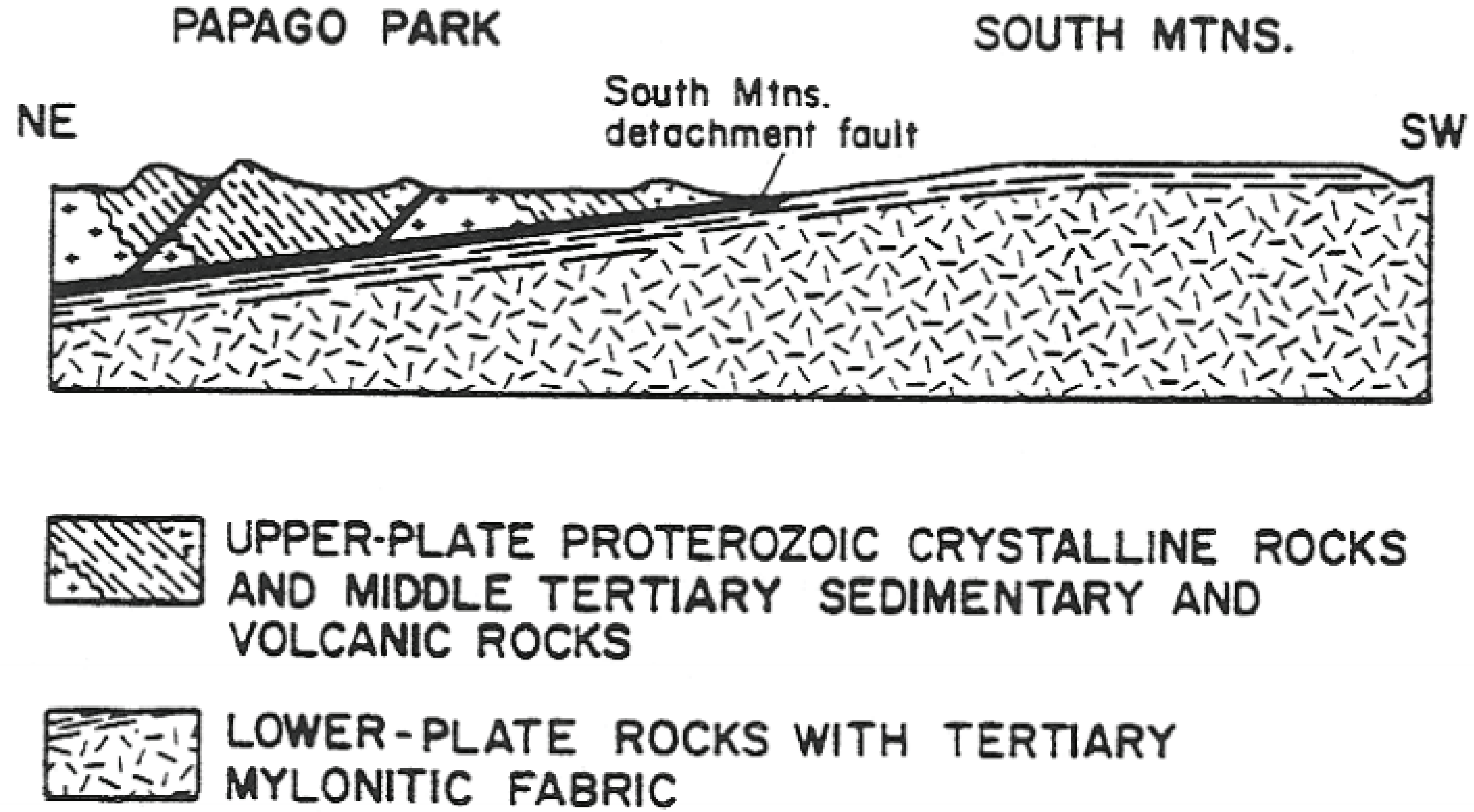


Figure 4. Schematic, interpretive cross section showing relation between South Mountains detachment fault and upper-plate rocks in Papago Park (Stop 5).

Our main project:
How do the smaller faults and dikes inform the state of stress and strength of the main detachment fault?