



A textbook example of triply-folded Ediacaran carbonates – insights into geodynamics and geomorphology (Hat Plateau, Jabal Akhdar Dome, Oman Mountains)

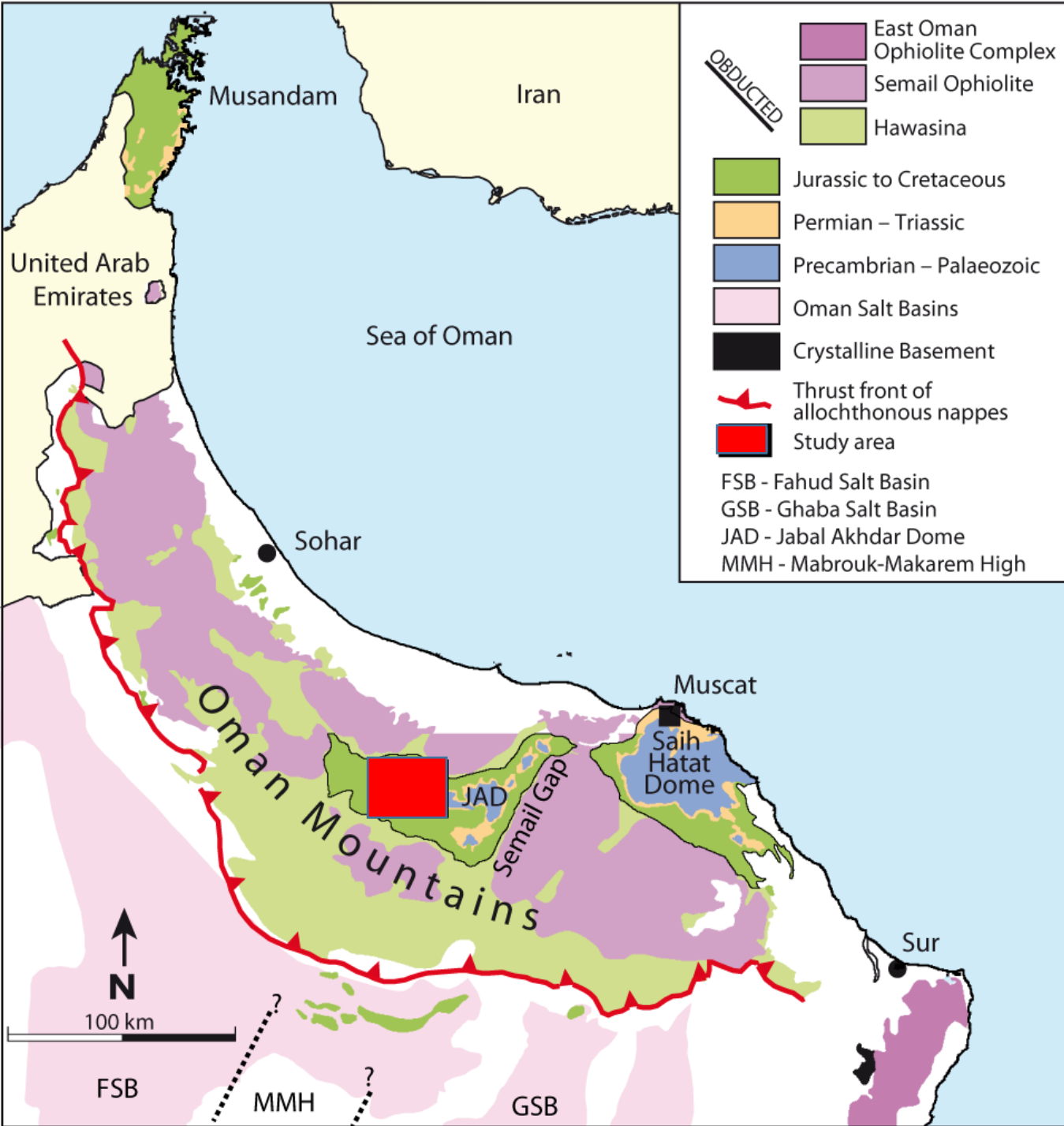
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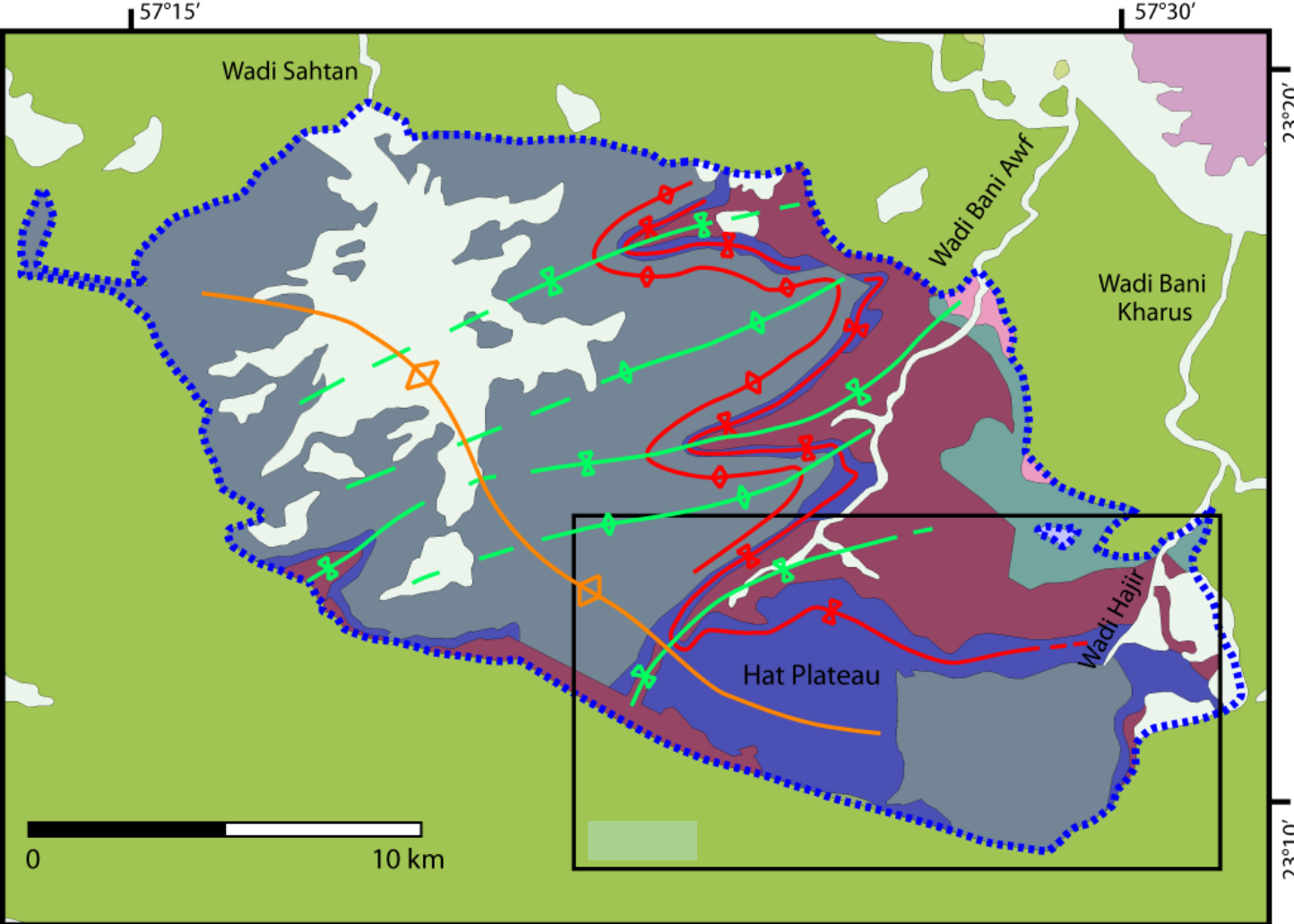
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Study area

- The Jabal Akhdar Dome is part of the Oman Mountains.
- Rocks within the Jabal Akhdar Dome are superbly exposed (Ediacaran carbonates and siliciclastics).
- The carbonates are resistant against erosion (semi-arid climate).
- The 100-m-thick carbonates record three folding events.
- The siliciclastics above the carbonates have been largely eroded.



- Quaternary deposits
- Semail Ophiolite
- Hawasina nappes undifferentiated
- Hajar Supergroup undifferentiated (Autochthonous Unit B)

Hercynian Unconformity



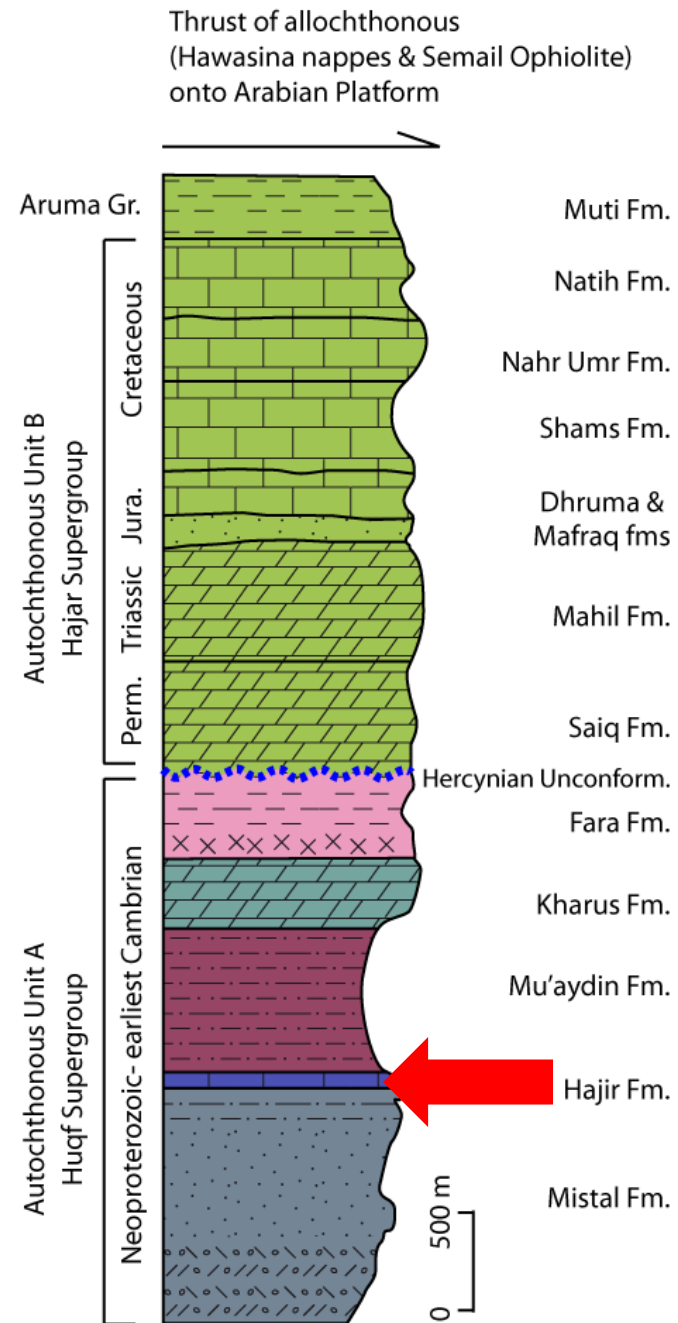
Autochthonous Unit A

Huqf Supergroup

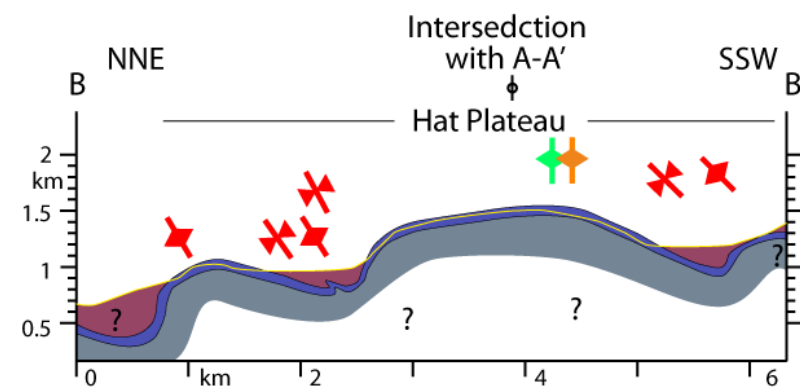
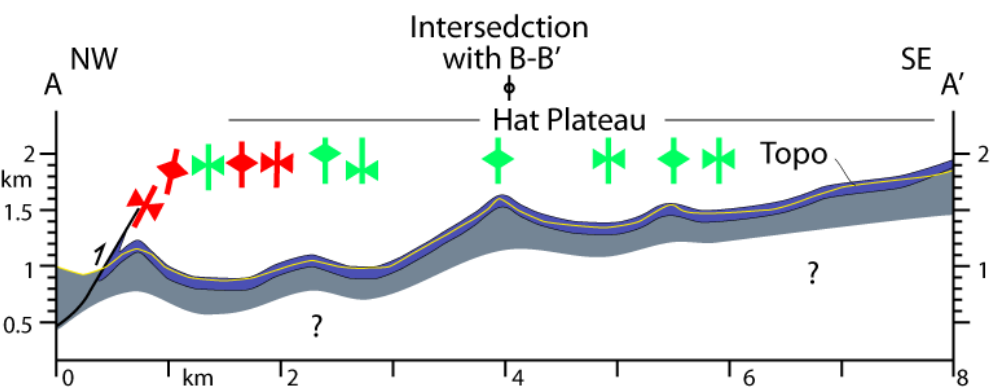
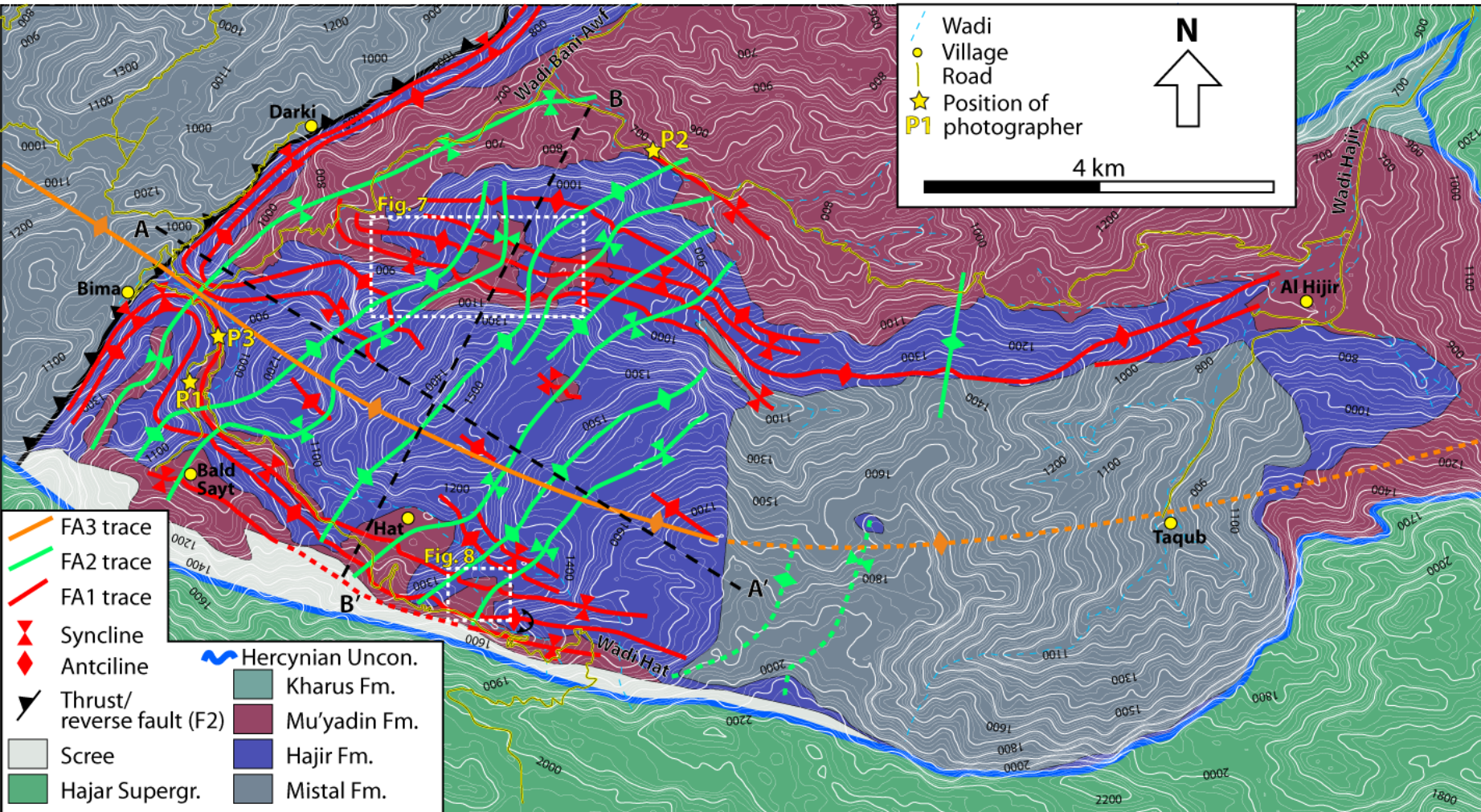
- Fara Fm.
- Kharus Fm.
- Mu'aydin Fm.
- Hajir Fm.
- Mistal Fm.

- F3 trace
- F2 trace
- F1 trace
- Syncline
- Anticline

- Diamictite
- Sandstone
- Siltstone
- Shale
- Dolostone
- Limestone
- Extrusives

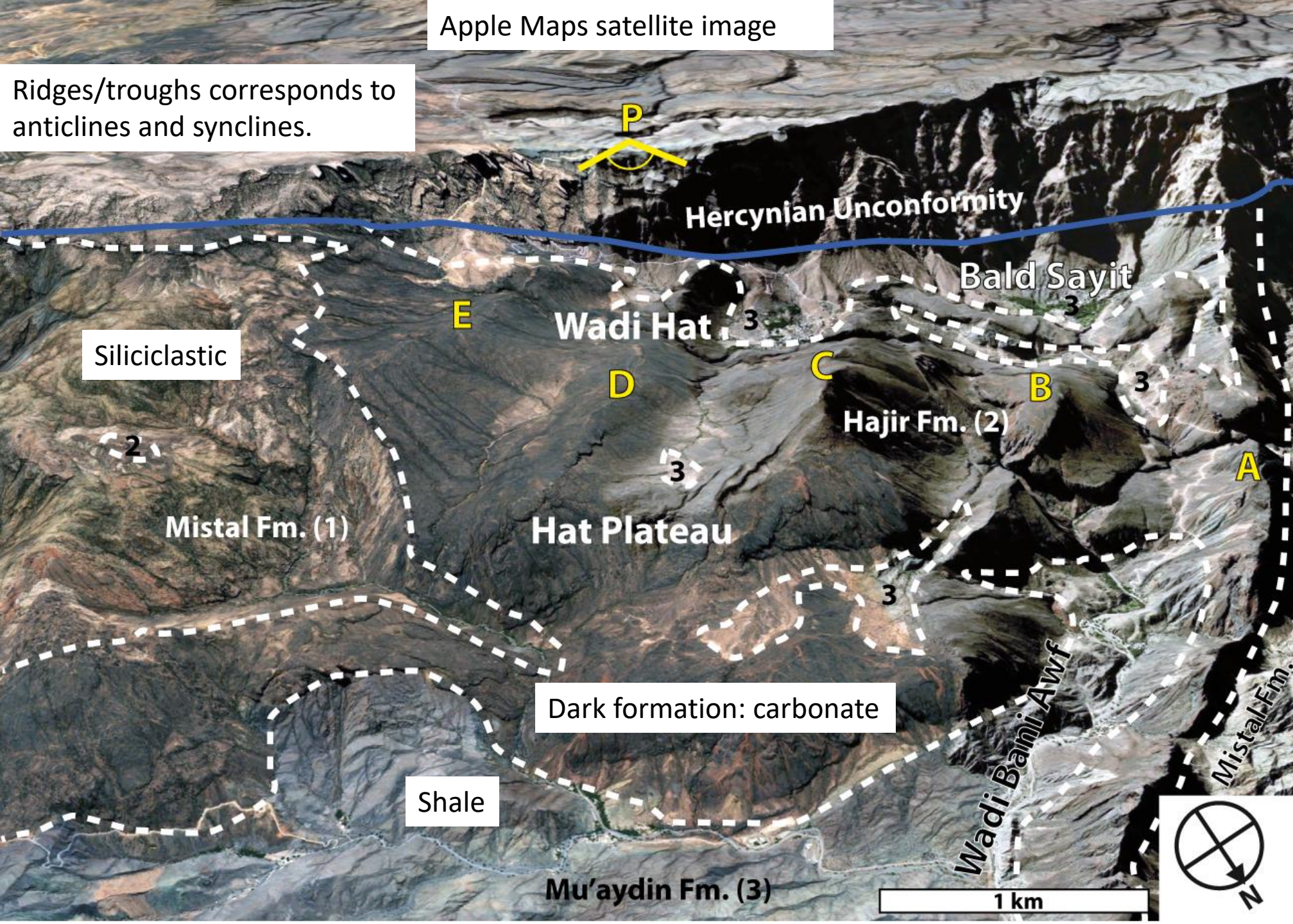


Geological/structural map

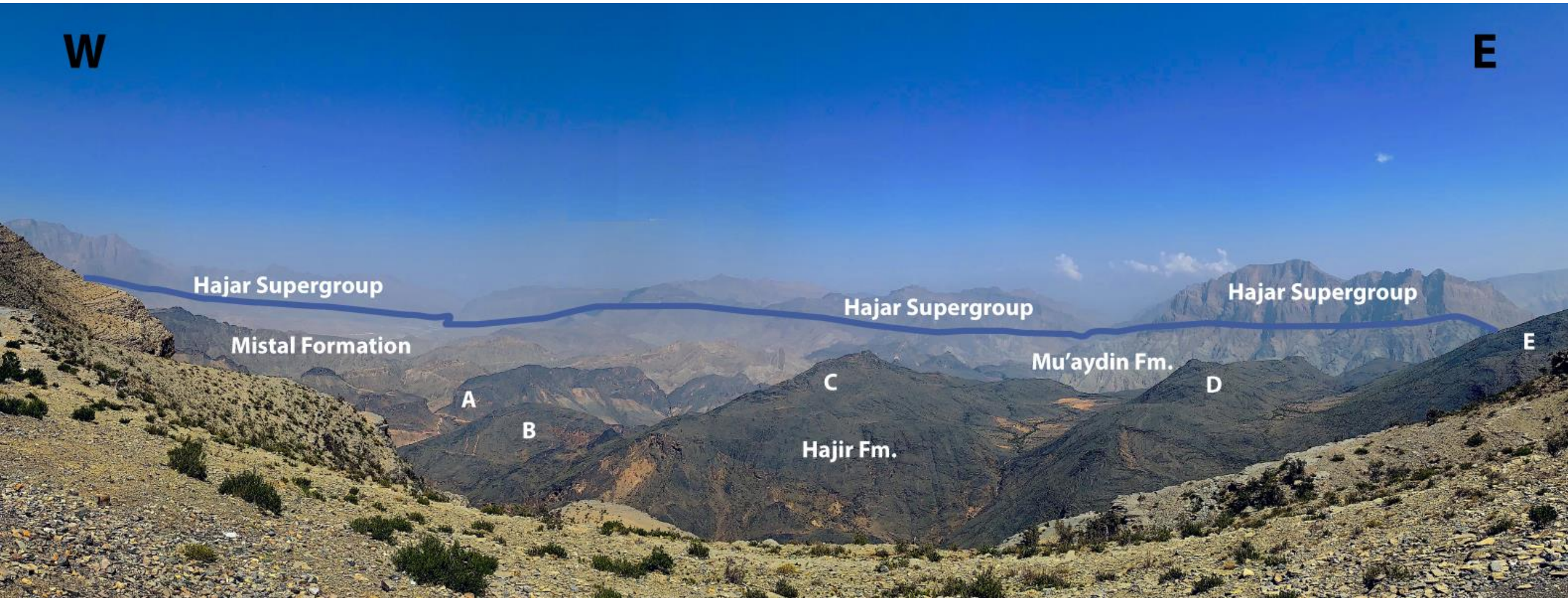


Apple Maps satellite image

Ridges/troughs corresponds to anticlines and synclines.



Panorama view at the Hat Plateau

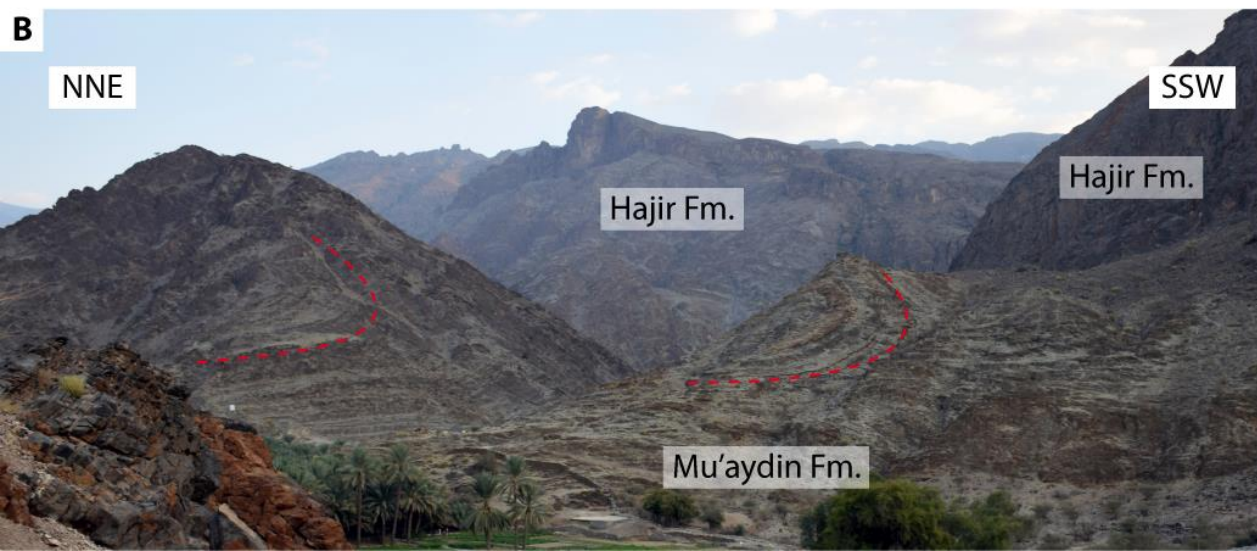


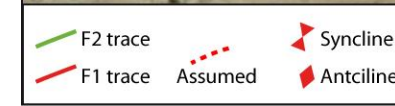
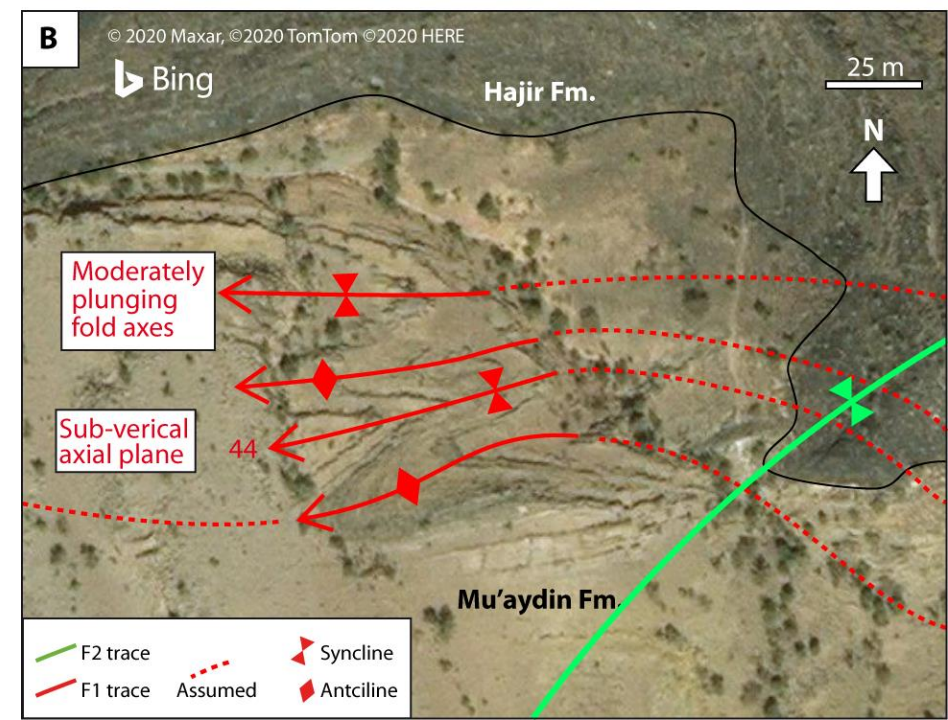
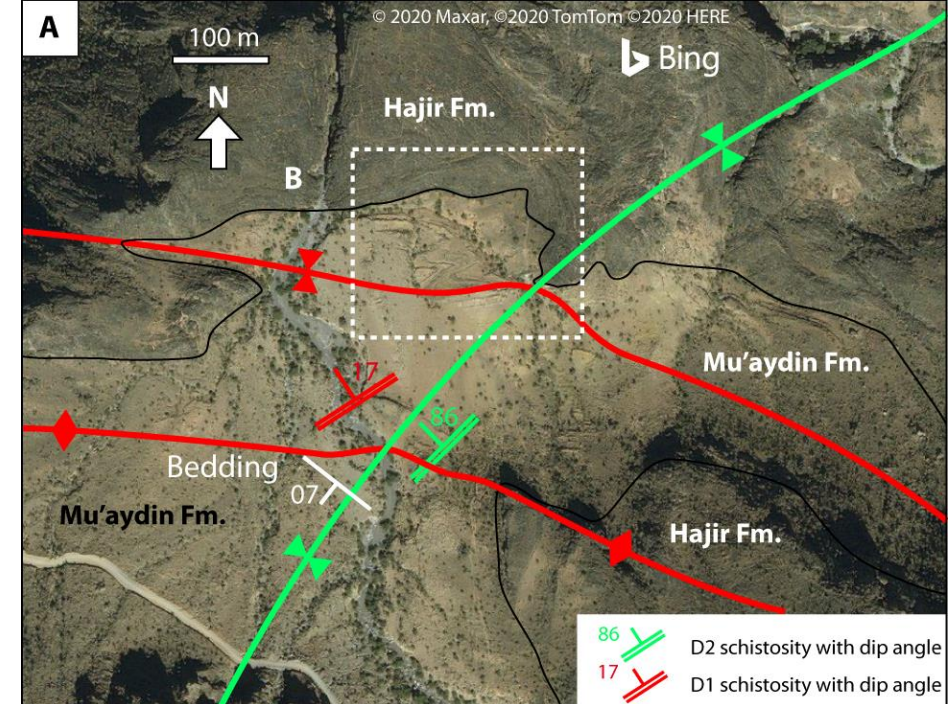
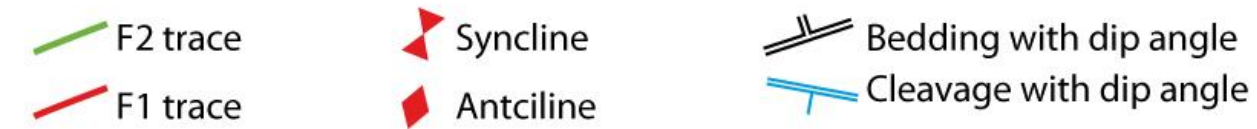
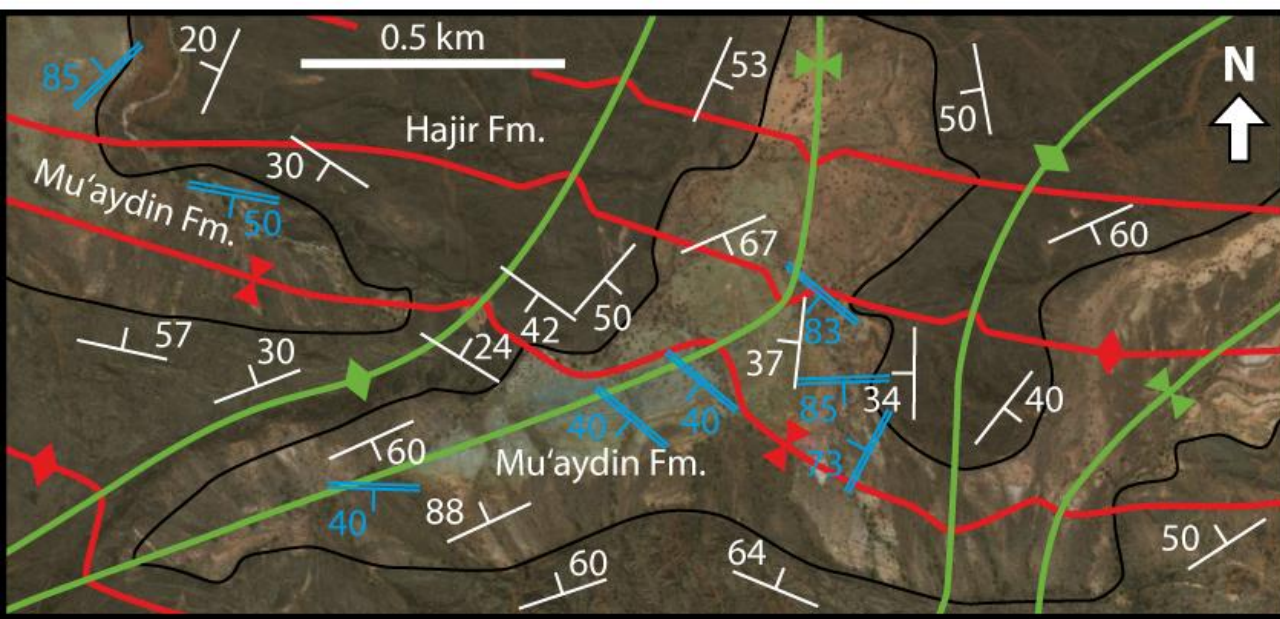
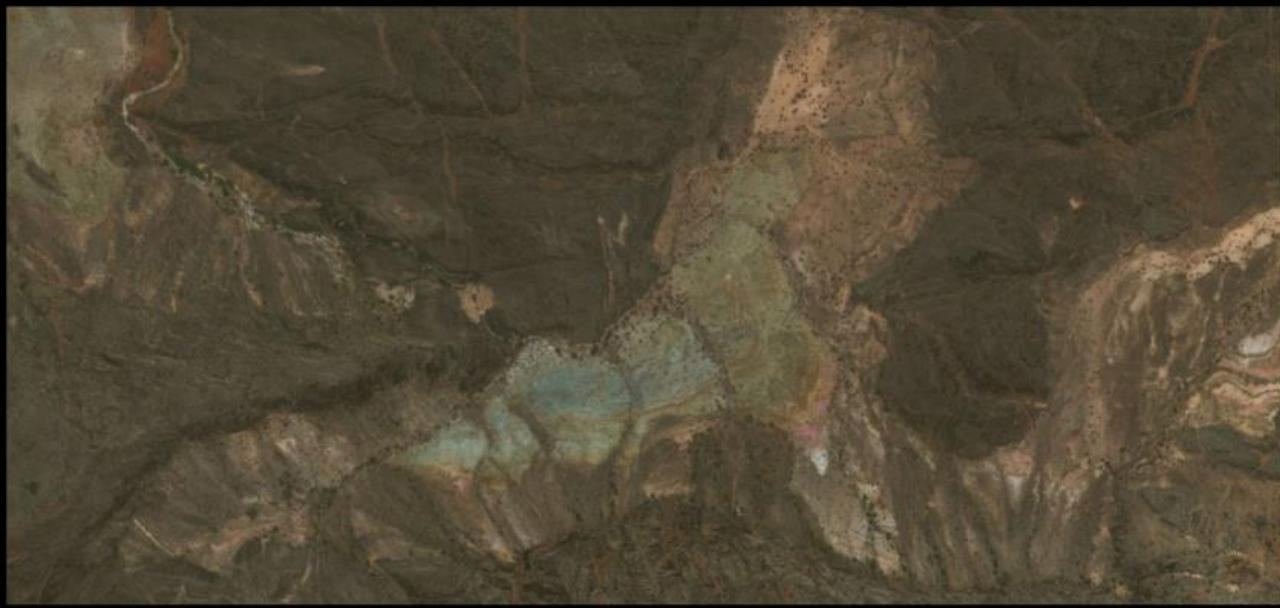
Ridges/troughs correspond to anticlines and synclines.

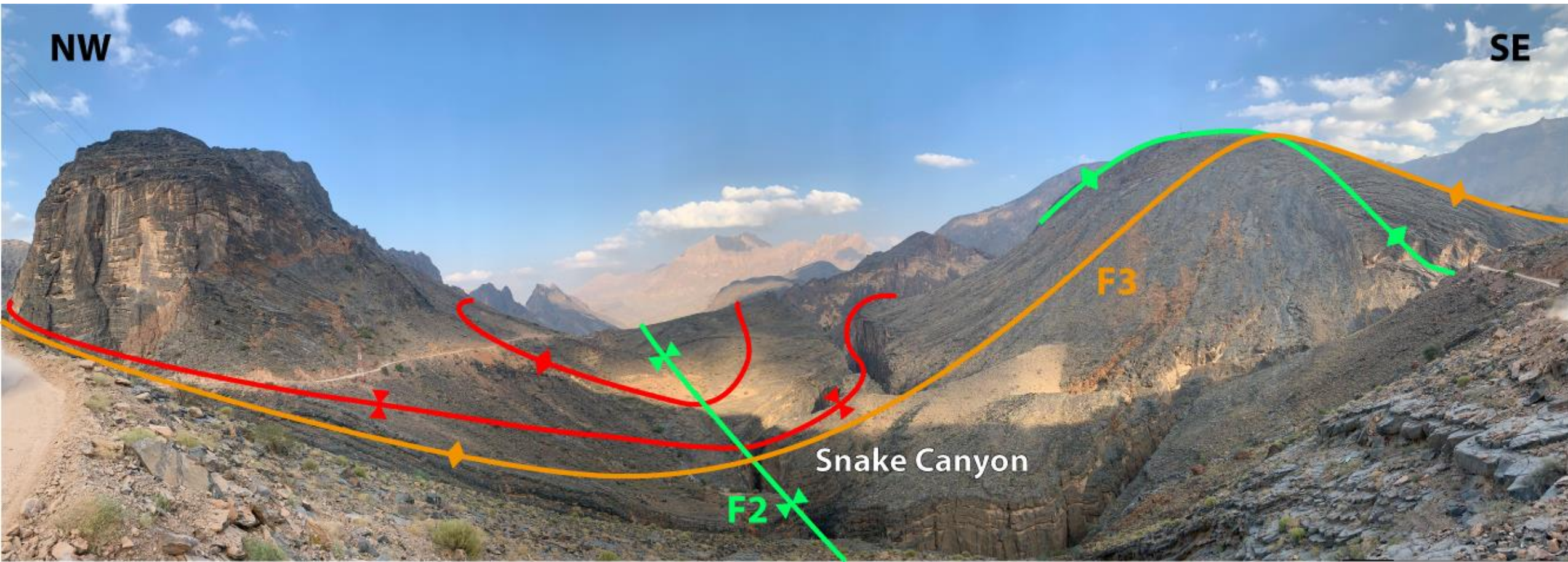
Letters A-E correspond to F2 ridges (see previous slide).



- Tight non-plunging F1 folds – WNW/ESE-trending
 - Partly overturned; vergence towards the NNE
 - Amplitude: few meters to several tens of meters
 - F1 folds contain a gently to moderately SSW-ward dipping penetrative axial plane cleavage.
 - F1 folds were previously unrecognized.
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- F1 folds were refolded by upright, open to tight, non-plunging km-scale NNE/SSW-trending F2 folds.
 - F2 folds contain a penetrative sub-vertical axial plane schistosity (parallel oriented to the F2 fold axis).





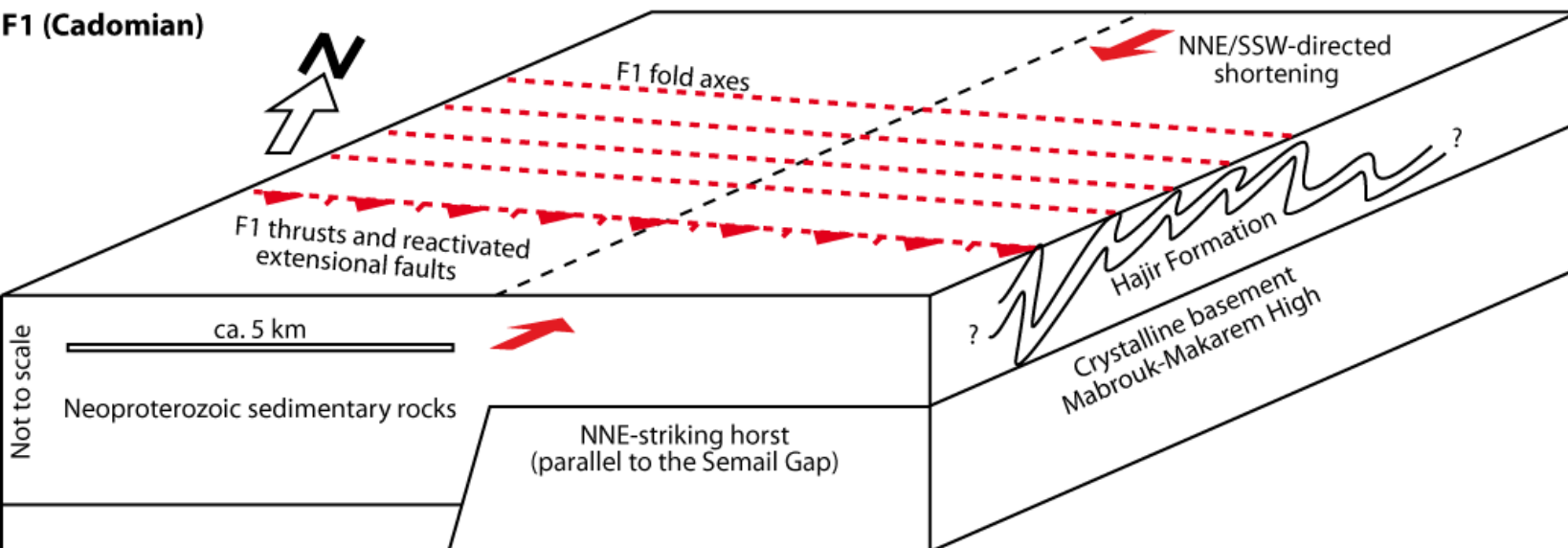


The F3 folding event produced one open and broad anticline.
The F3 anticline is WNW/ESE-trending and related to the Eocene doming of the Jabal Akhdar Dome.

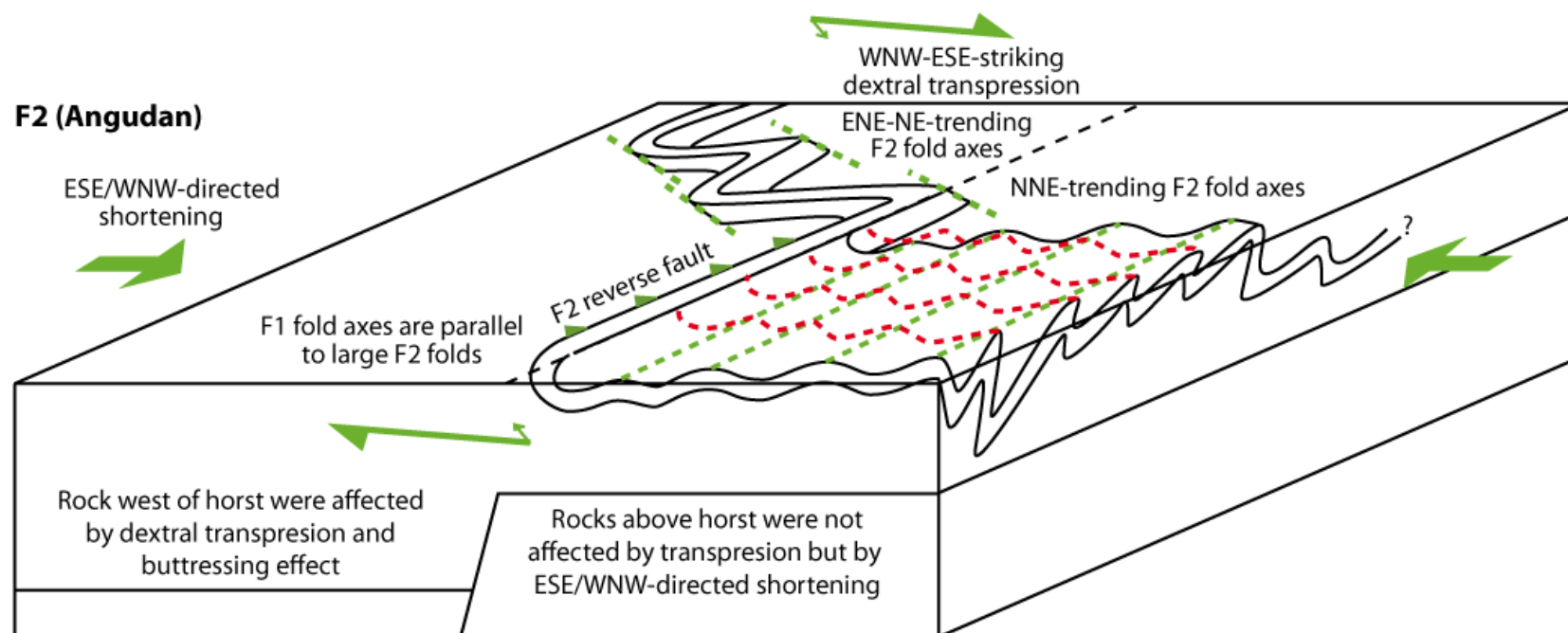
F2 deformation style

- Sharp change in F2 deformation style along a NNE-trending line of the western Hat Plateau
- West of it: F2 structures are ENE-oriented; large fold amplitude (ca. 3 km)
- East of it: F2 structures are NE to NNE-oriented; small fold amplitude (<1 km)
- We assume that a pre-existing basement structure (Makarem-Mabrouk High/Horst) is below the western study area → buttressing effect during NW/SE to WNW/ESE-directed F2 shortening

F1 (Cadomian)



F2 (Angudan)

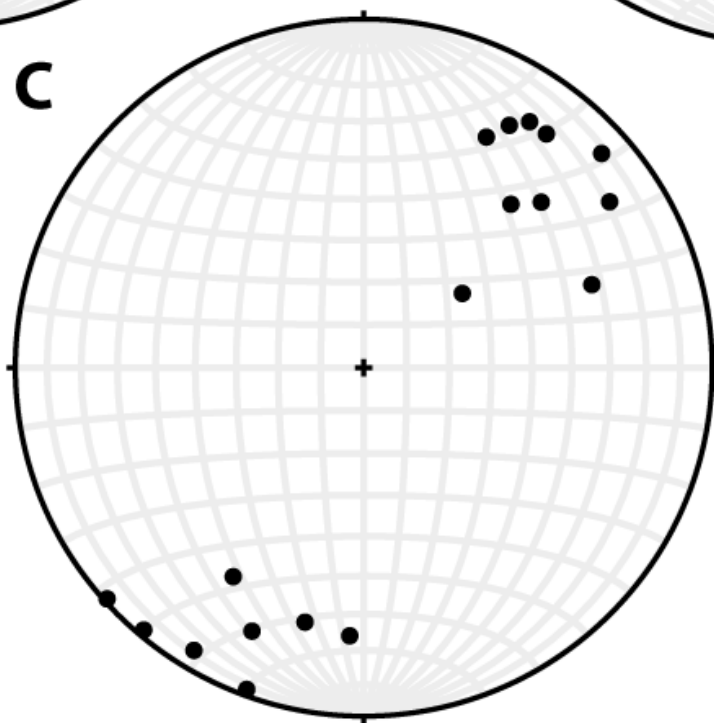
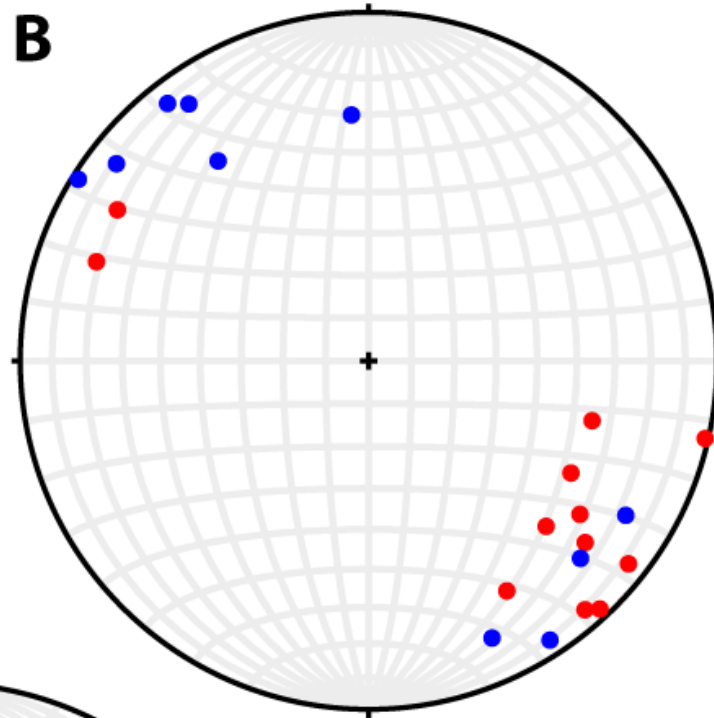
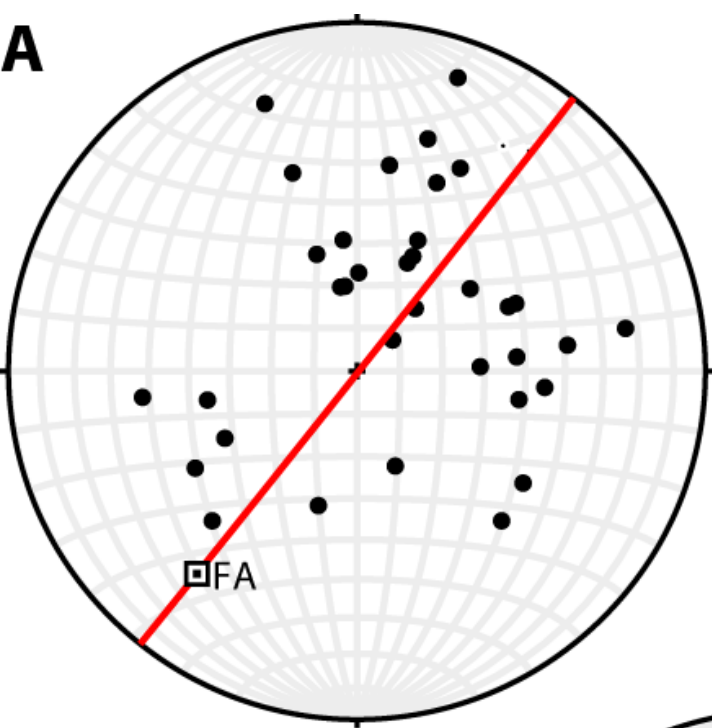


Buttressing effect of a basement structure is responsible for different F2 styles.

Summary/Conclusions

- The deformation pattern of a carbonate formation can be used to visualize the amount of deformation phases, the style and shortening direction of the respective events.
- Geomorphology indirectly provides novel details on the pre-Permian deformation history of eastern Arabia.
- 3 deformation events can be demonstrated.
 - (1. Cadomian; NE/SW-shortening)
 - (2. Angudan; NW/SE-shortening)
 - (3. Doming of the Jabal Akhdar; NNE/SSW-shortening)

Appendix



A: S1 schistosity pole points
S1 schistosity is folded by F2 (fold axis and axial plane).

B: Pole points of S2, blue and red pole points are from the western and eastern study area, respectively.

C: Pole points of S3 schistosity.