EGU General Assembly 2022

TS2.2 – Current and past stress in the crust: quantitative techniques, case studies and rheological implications ?

Deciphering the tectonic complexity of the Central High Atlas Mountains using mesostructures and calcite mechanical twinning analysis

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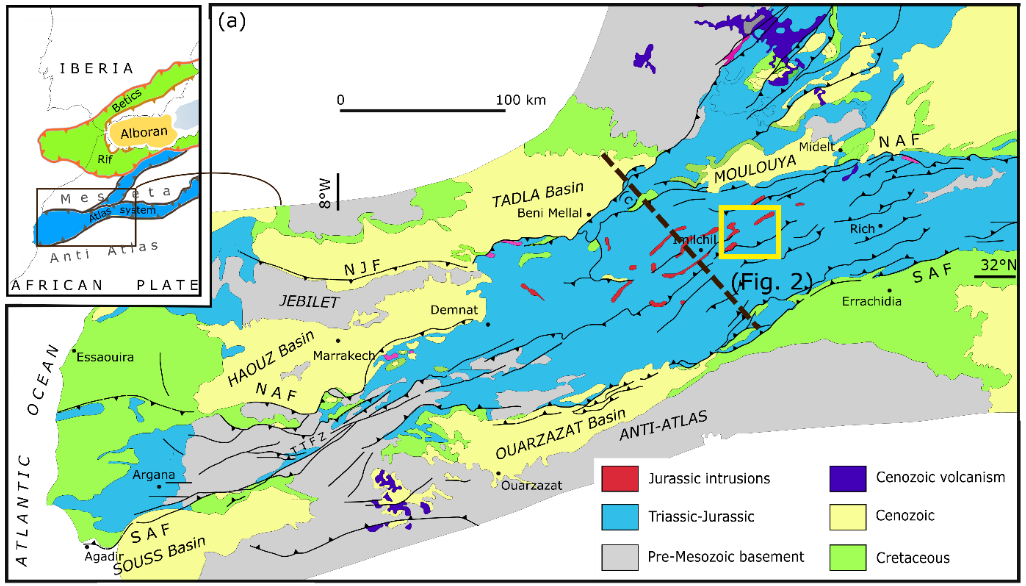


(modified from Teixell et al., 2003)

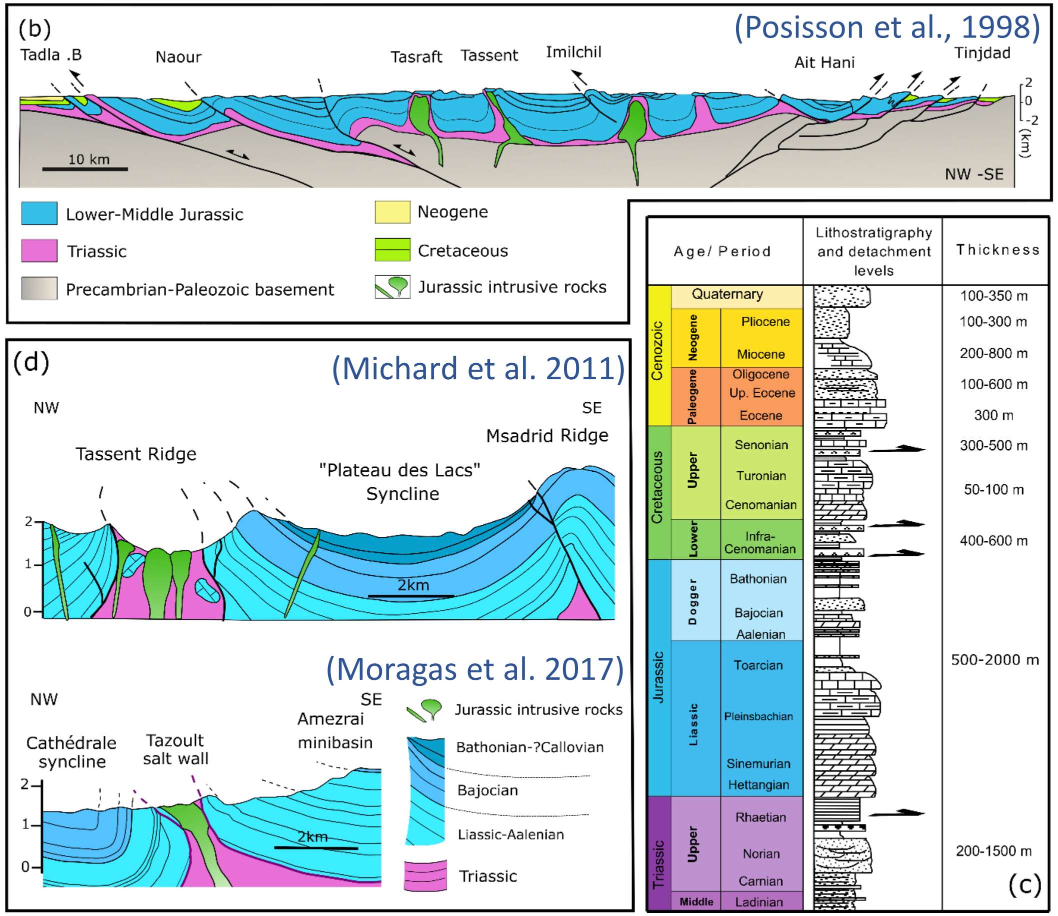


***Figure 1.** Sketch of the structural features of the Moroccan High Atlas belt.*

(El Harfi et al., 2006, modified)

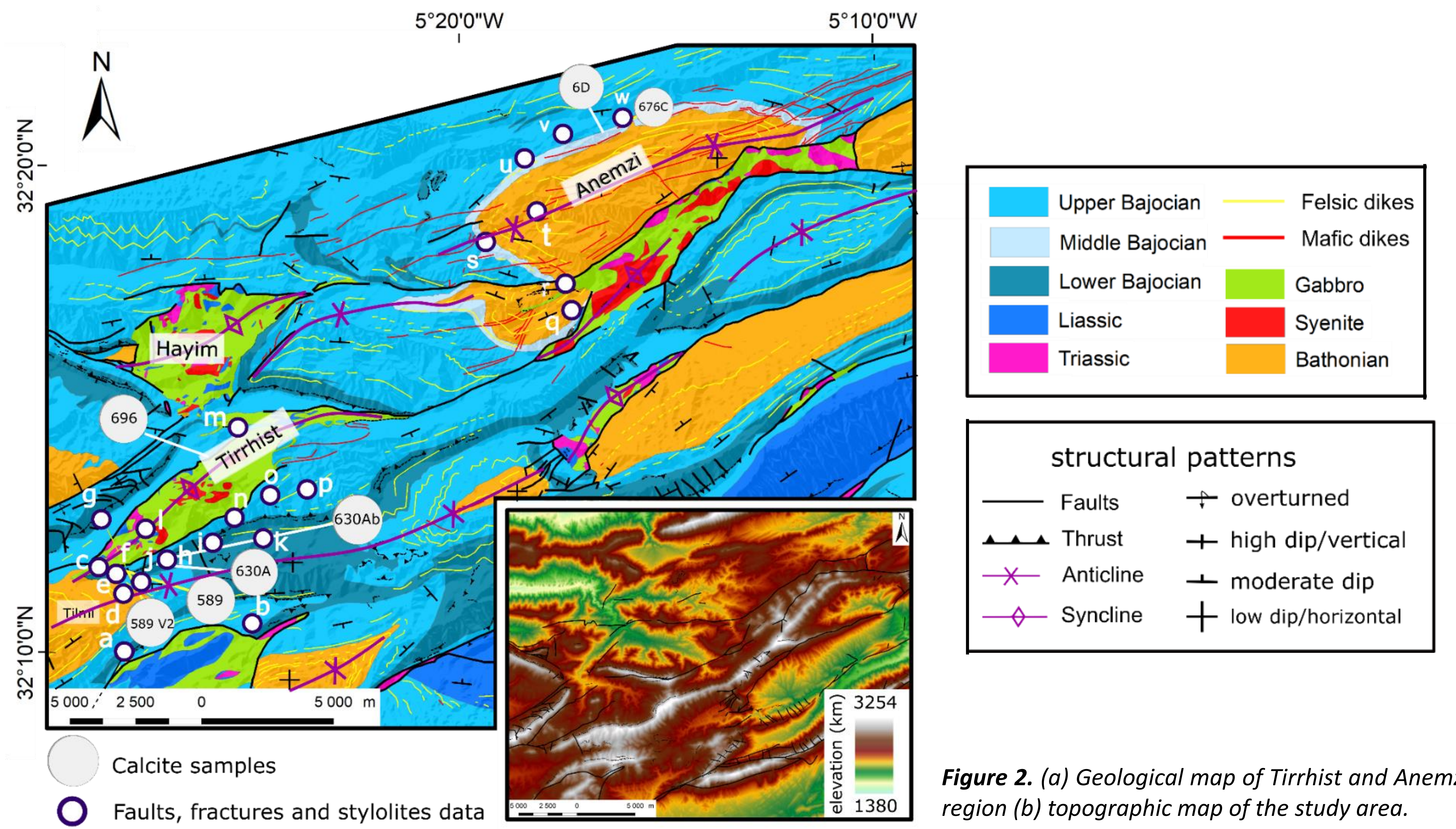
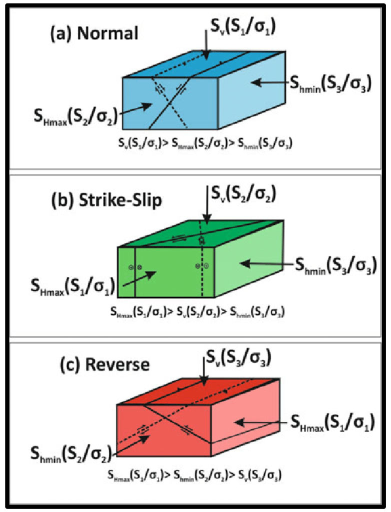


Figure 2. *(a) Geological map of Tirrhist and Anemzi region (b) topographic map of the study area.*

Field investigation

- **Faults**
- **Veins**
- **Stylolites**



Calcite mechanical twinning

- **Calcite Stress Inversion Technique (Etechopar, 1984)**

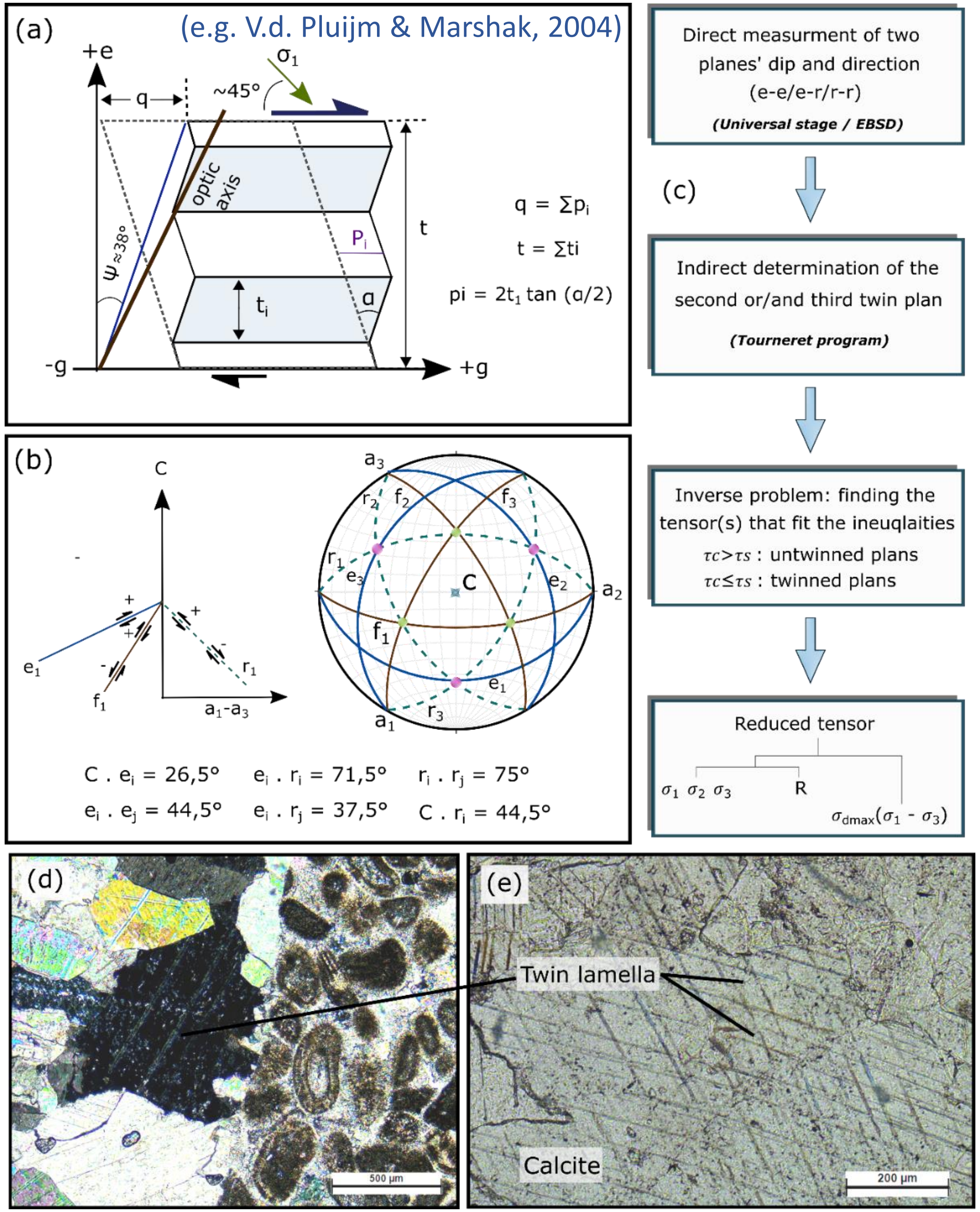


Figure 3. *Simplified sketch of calcite twins method* (e.g. V.d. Pluijm & Marshak, 2004; Amrouch, 2010; Lacombe et al. 2021)

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Mesostructures: tensil mode fractures (or veins) & pressure-solution seams

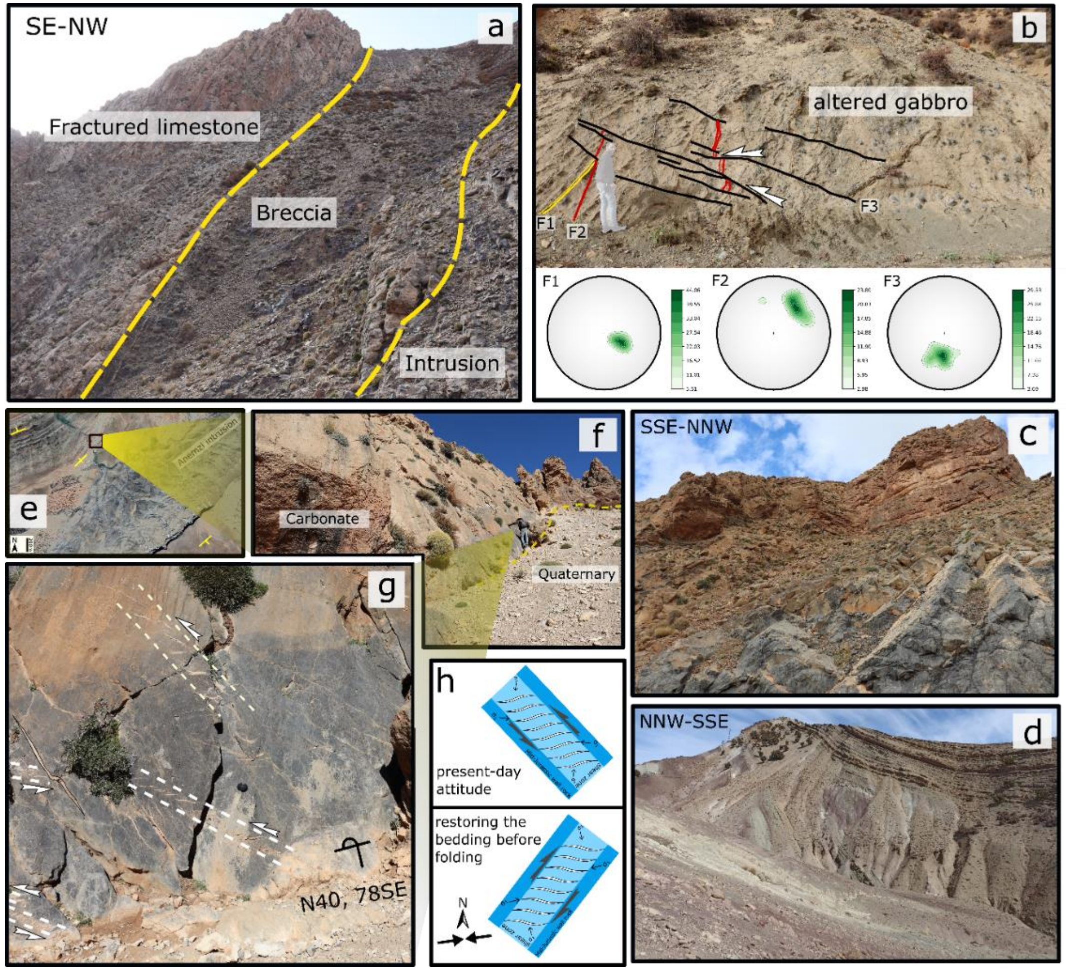


Figure 4. *Field pictures from the studied sectors.*

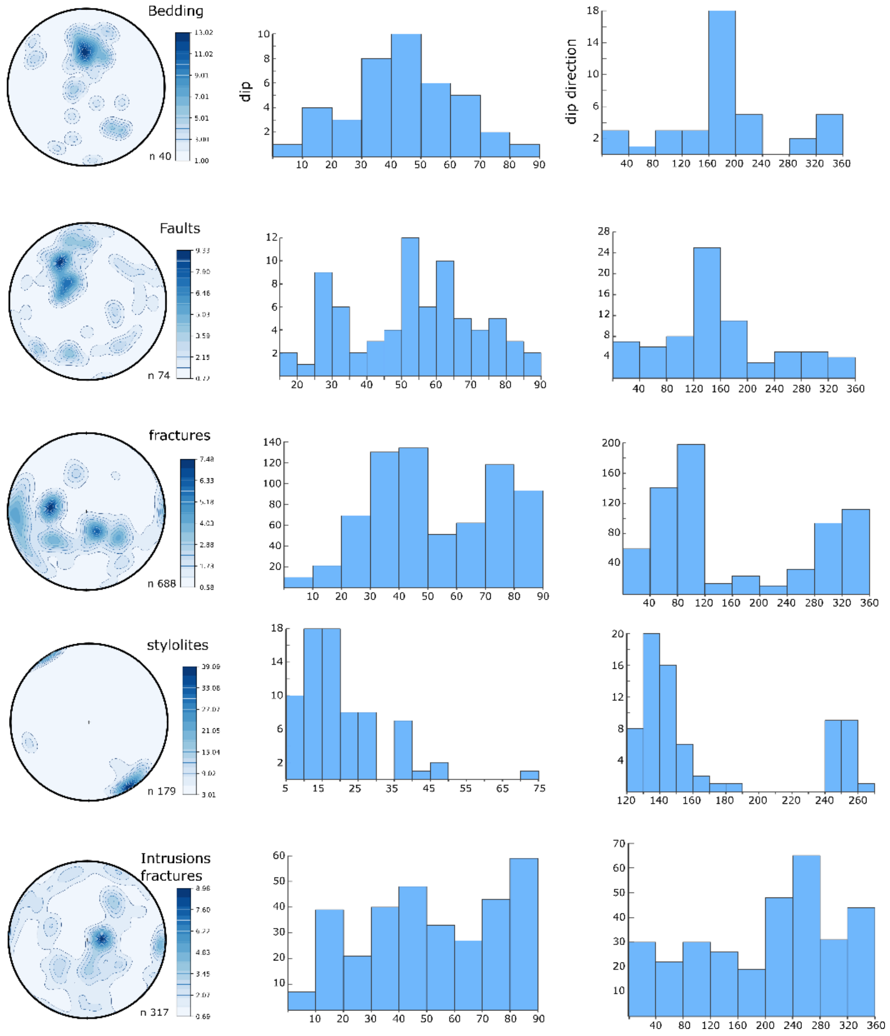


Figure 5. *statistical distribution of the measured structural data*

Mesostructures: micro-shear fractures (or veins) & striated fault planes

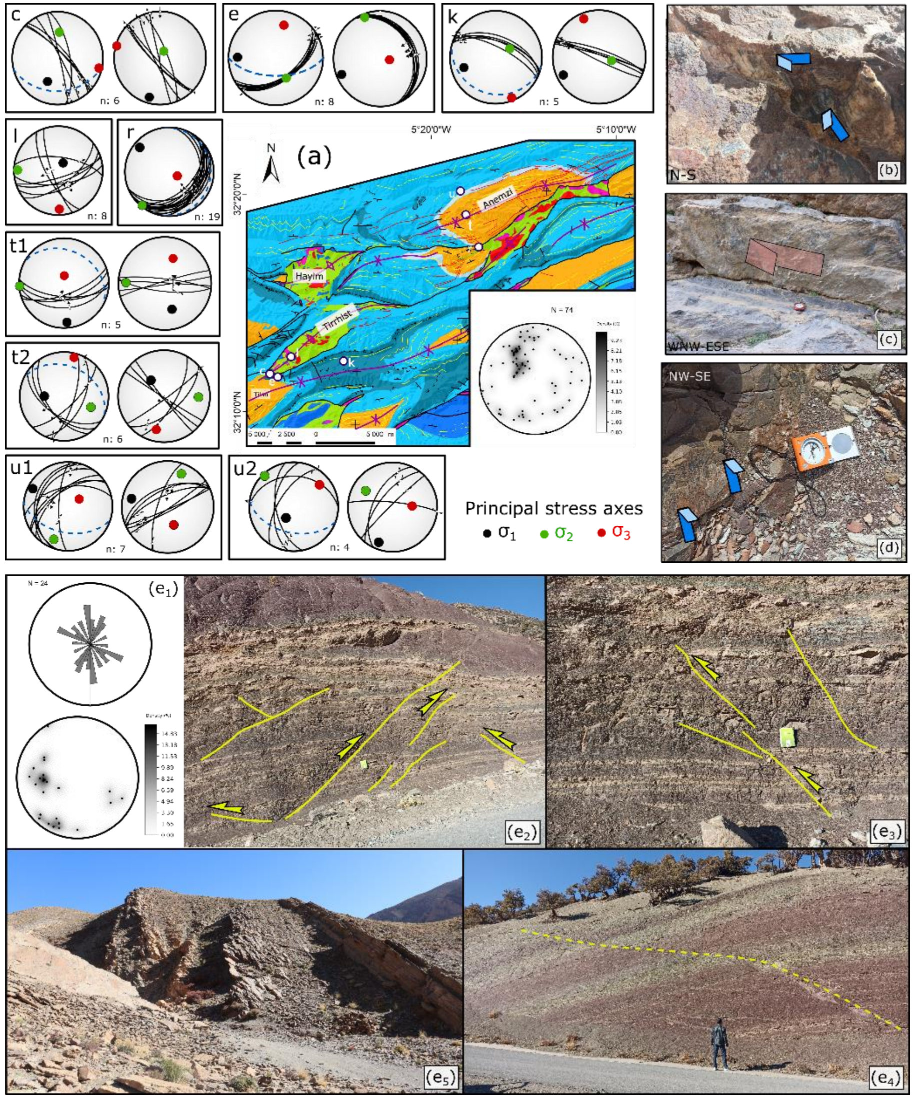


Figure 6. *Striated fault planes stations and the related datasets at the current state and after untilting the bedding*

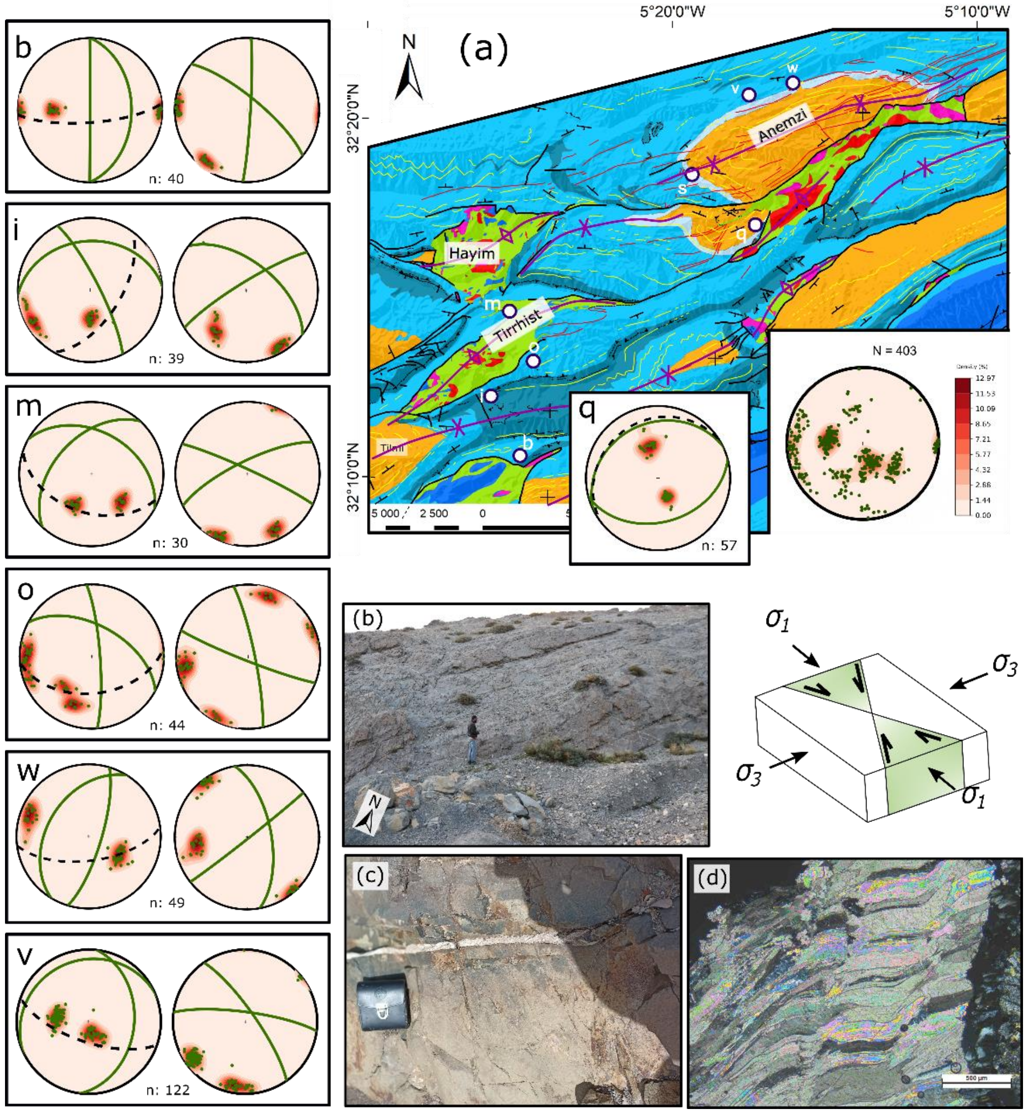


Figure 7. *Stations of conjugate micro-shear fractures data and the associated fractures sets at the current state and after untilting the bedding*

Mesostructures: tensil mode fractures (or veins) & pressure-solution seams

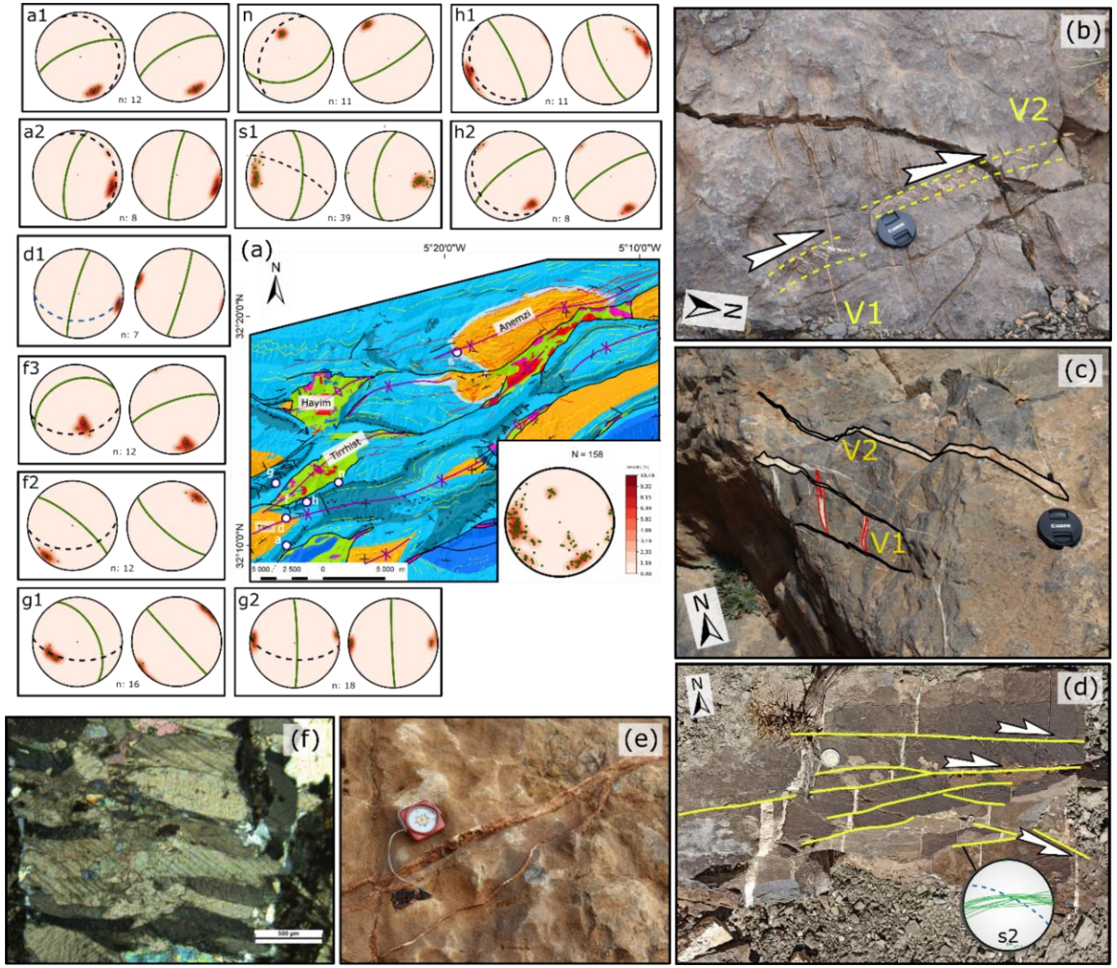


__Figure 8.__ Tensile mode veins results

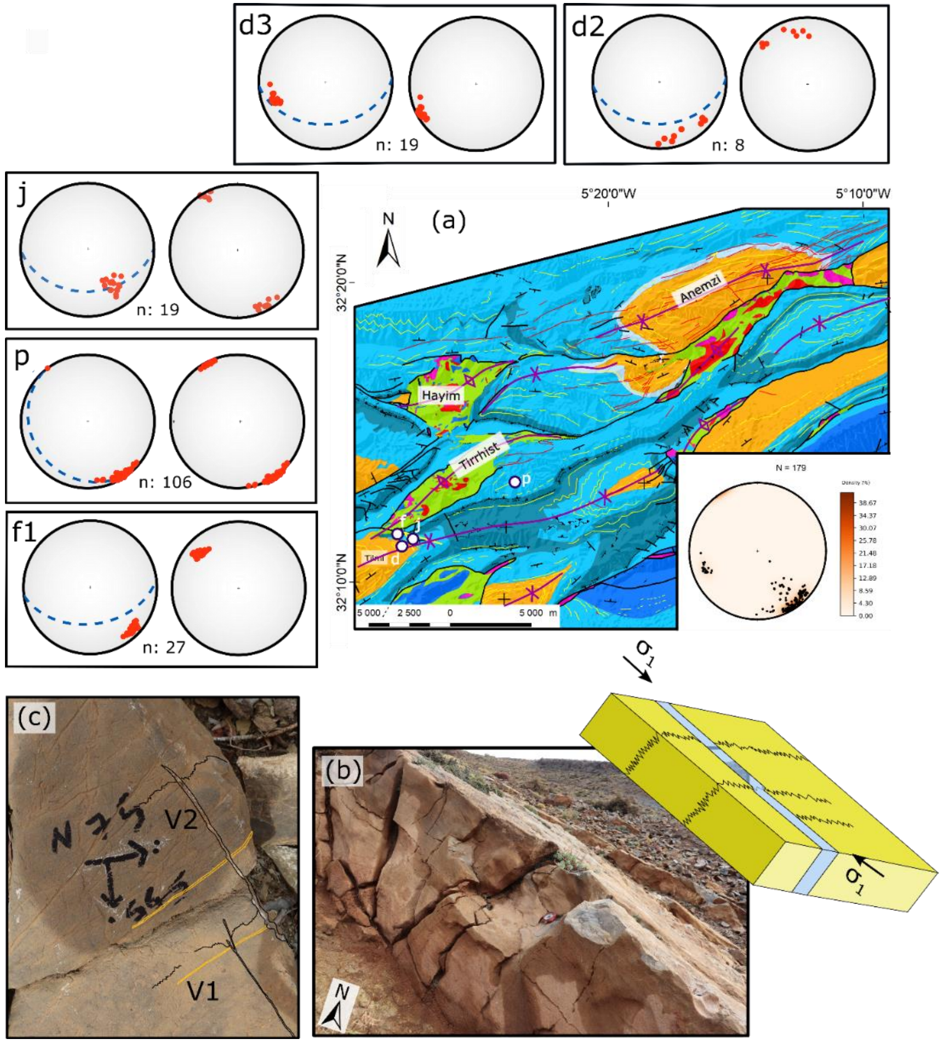


__Figure 9.__ Stylolites (or pressure-solution) datasets.

Calcite Stress Inversion Technique (CSIT)

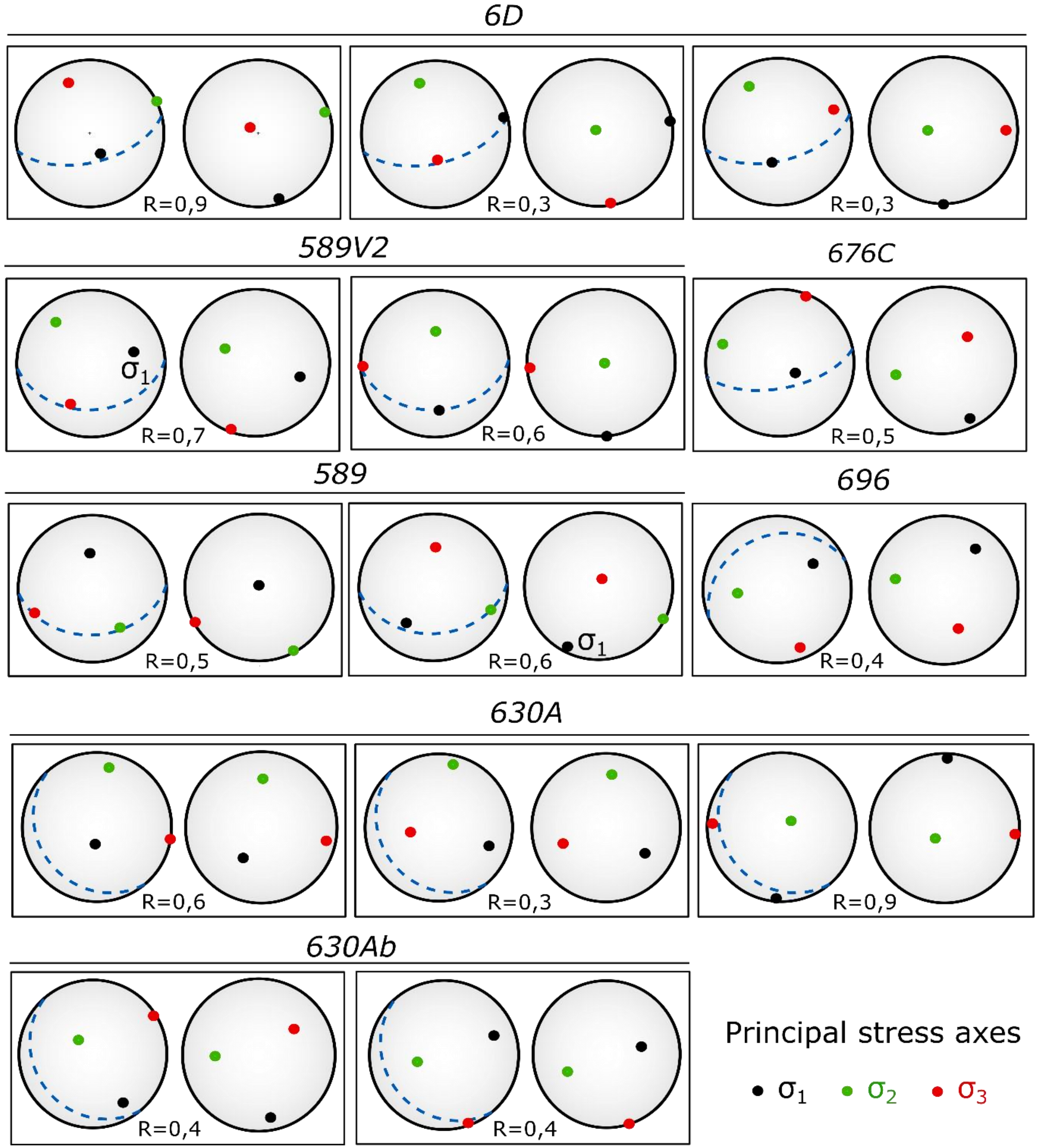
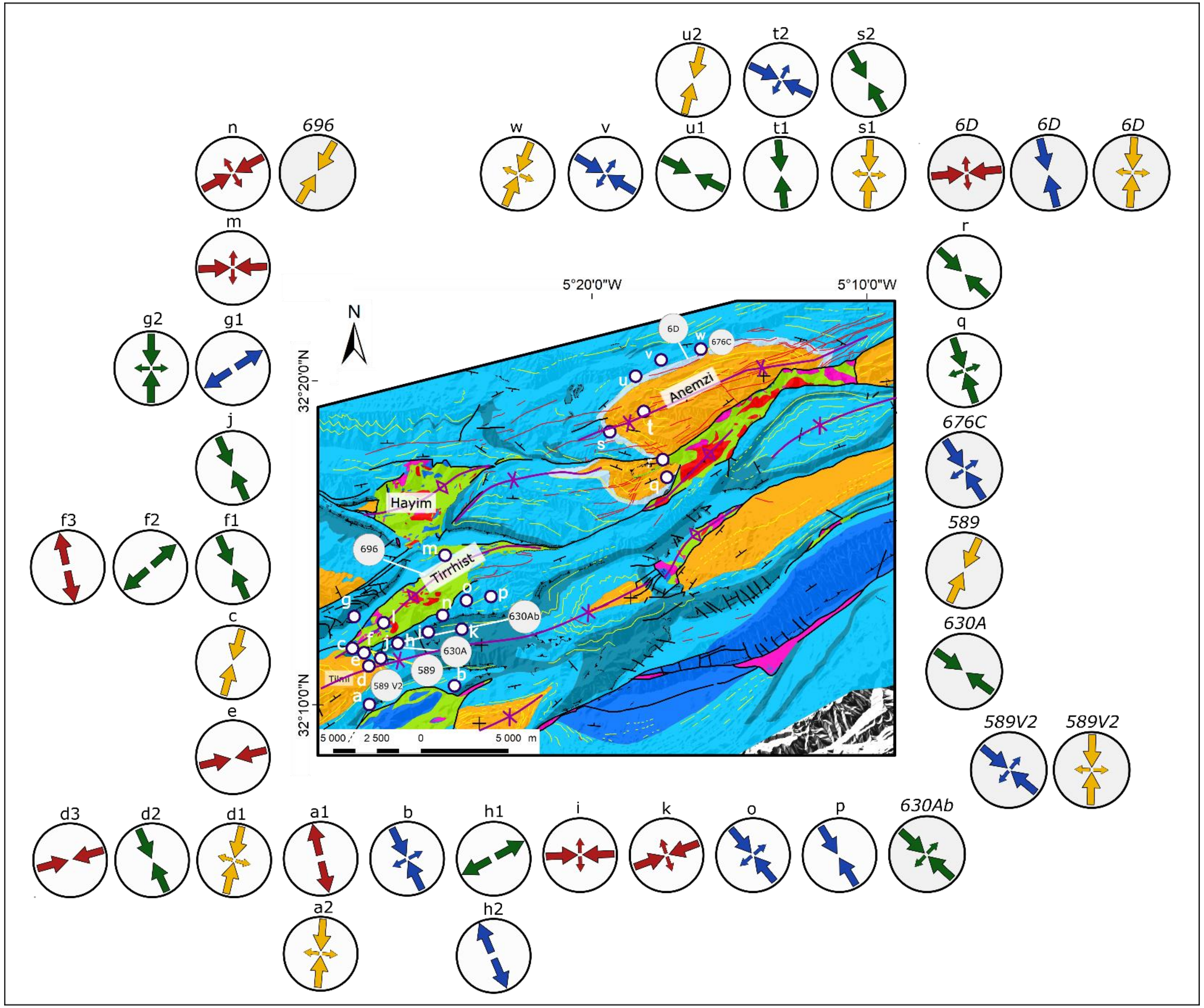


Figure 10. *Calcite twins-derived stress tensors*

__Figure 11.__ Interpretation of the aleostress reconstruction based on mesostructures (white circles) and calcite mechanical twinning (grey circles)



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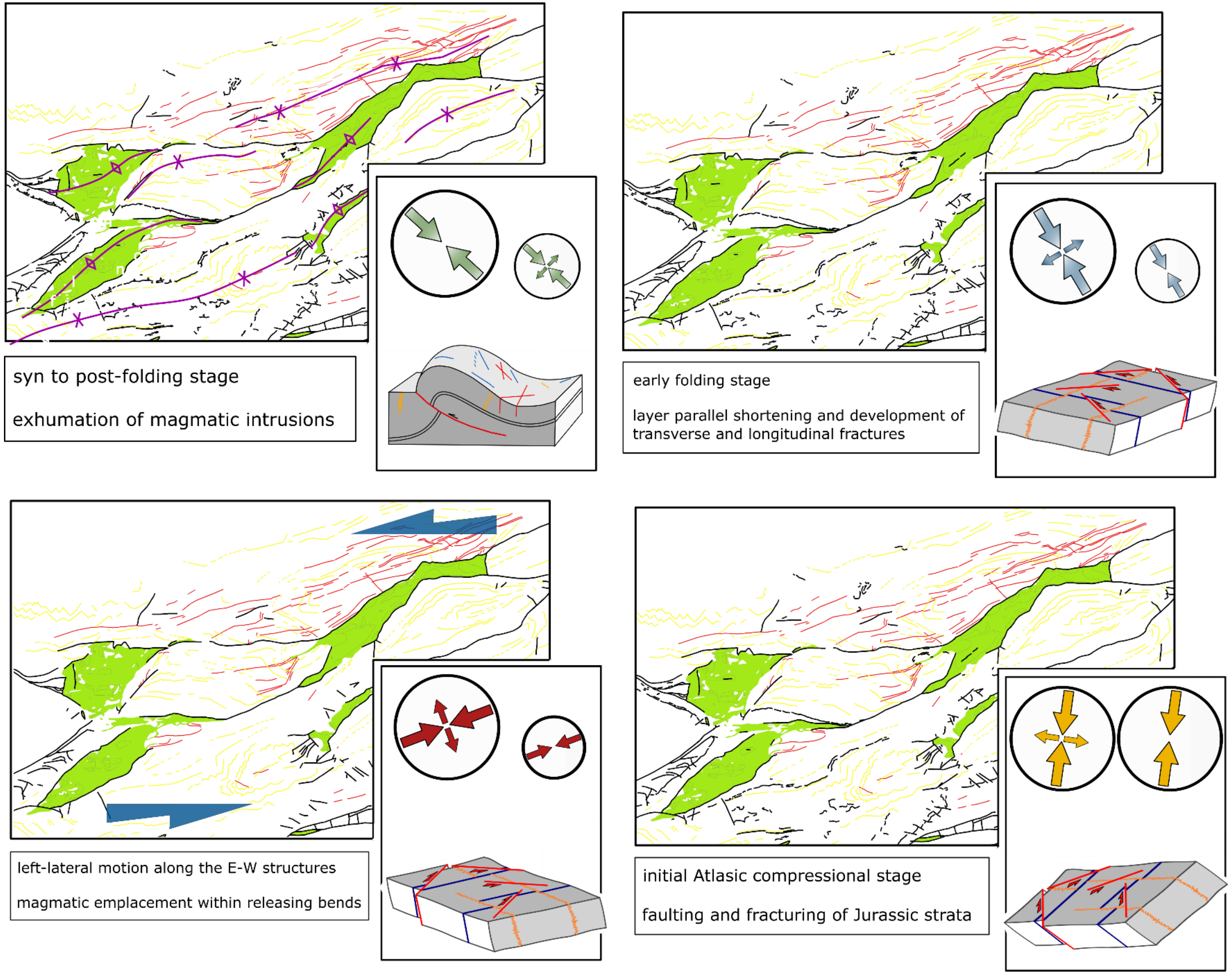

Figure 12. *Conceptual structural evolution model for the study area based on the results of the present study*

Examining the structural development of the Central High Atlas post-rift basin evolution reveals complex stress history.

Four main structural stages have been identified: an early compressional event is pointed out characterized by ~N70° to N90° trending maximum horizontal principal stress. This event is believed to be linked to Middle Jurassic-Early Cretaceous wrench tectonics throughout the Central High Atlas basin, coeval with the emplacement of intraplate alkaline magmatism. Subsequently, the Jurassic layers have been submitted to NNE-SSW and NW-SE compression. These two stress tensors are relatively younger than the E-W compression and are likely ascribed to the Late Cretaceous-Cenozoic Alpine phases. A recent post-folding NW-SE striking compression is highlighted, and it is coherent with the recent Alpine phase that is widely described at the scale of the Atlas orogenic system.

A broader-scale paleostress reconstruction and quantification is required to deeply understand the structural history of the range.


THANK YOU