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GPS Constraints on the Active Deformation in Tunisia: Implications on the Geodynamics of the Western Mediterranean

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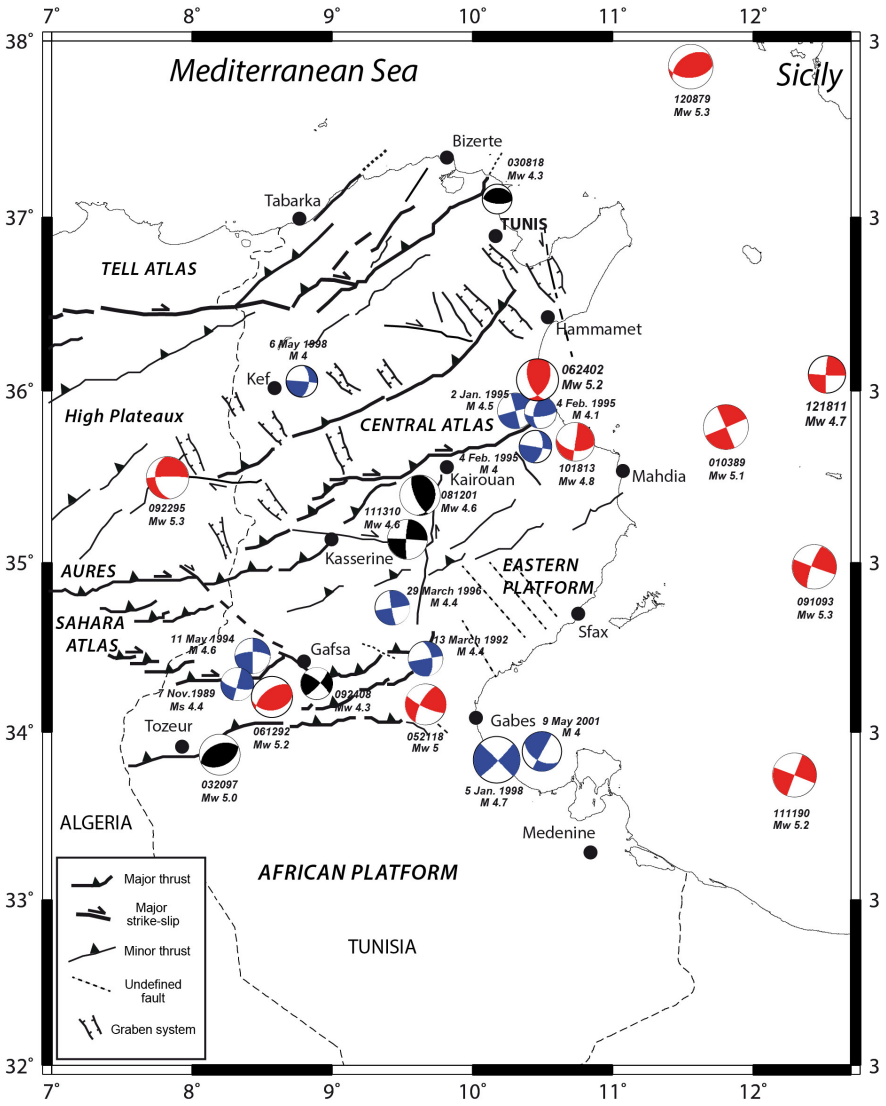
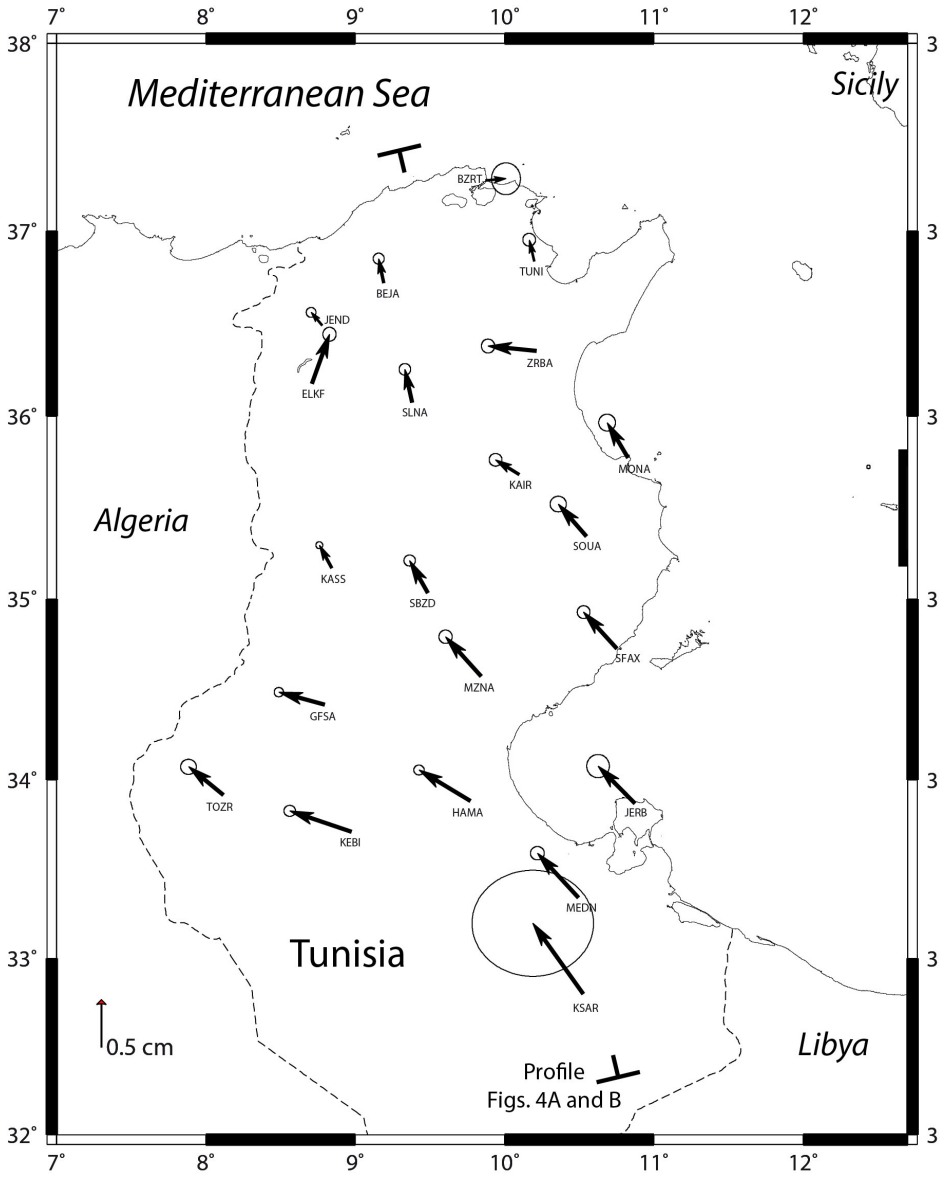
Abstract

- The Atlas Mountains of Tunisia belong to the seismically active zone of the Africa (Nubia) - Eurasia plate boundary in the central-western Mediterranean.
- We study the eastern section of the Maghrebian thrust belt using GPS data and active tectonics.
- To the south, the velocities indicate nearly WNW-ESE-trending right-lateral motion of the Sahara fault-related Atlas fold belt with respect to the Sahara Platform.
- Farther north and northeast, the significant decrease in velocities between the Eastern Platform (Sahel), Central Atlas and Tell Atlas and the clockwise rotation mark the NNW-trending shortening deformation associated with local ENE-WSW extension visible in the Quaternary grabens.
- The velocity field and strain distribution associated with the active E-W- to WNW-ESE-trending right-lateral faulting and NE-SW fault-related folds illustrate the transpression tectonics and support the identification of four tectonic domains north of the Africa-Nubia Platform in Tunisia.
- The transpression reduces northward when reaching the Central and Tell Atlas.
- These results change our perception of the Africa-Eurasia plate boundary previously located along the western Mediterranean coastline.

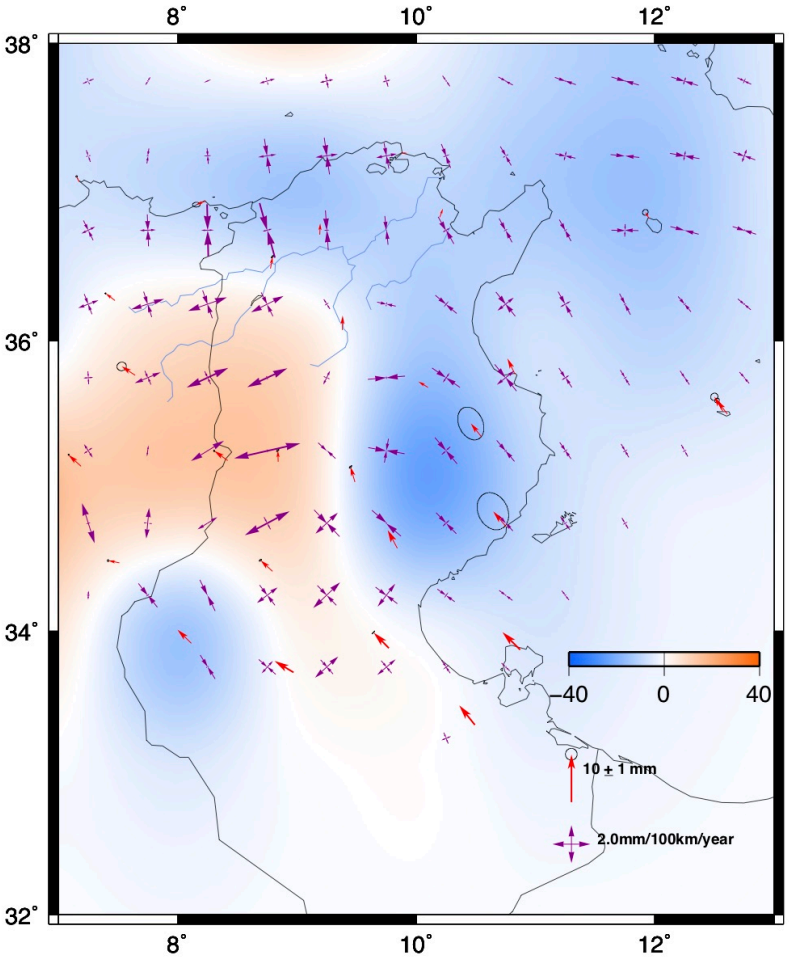


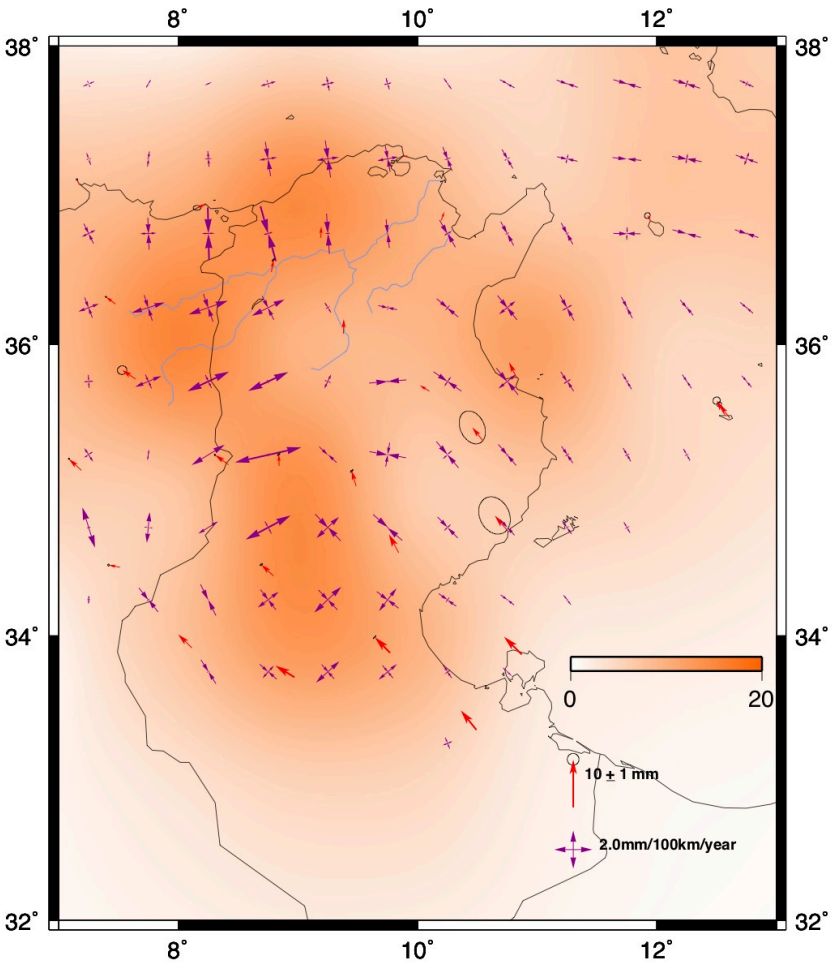
Seismotectonic map of Tunisia

Neotectonic faulting is from Bahrouni et al. (2014) and focal mechanism solutions for the largest instrumental earthquakes are from CMT-Harvard database (2019) (red), RCMT-INGV (n.d.) (black) and Institut National Meteorologie of Tunis (blue).



GPS velocities (black arrows) across continental Tunisia.



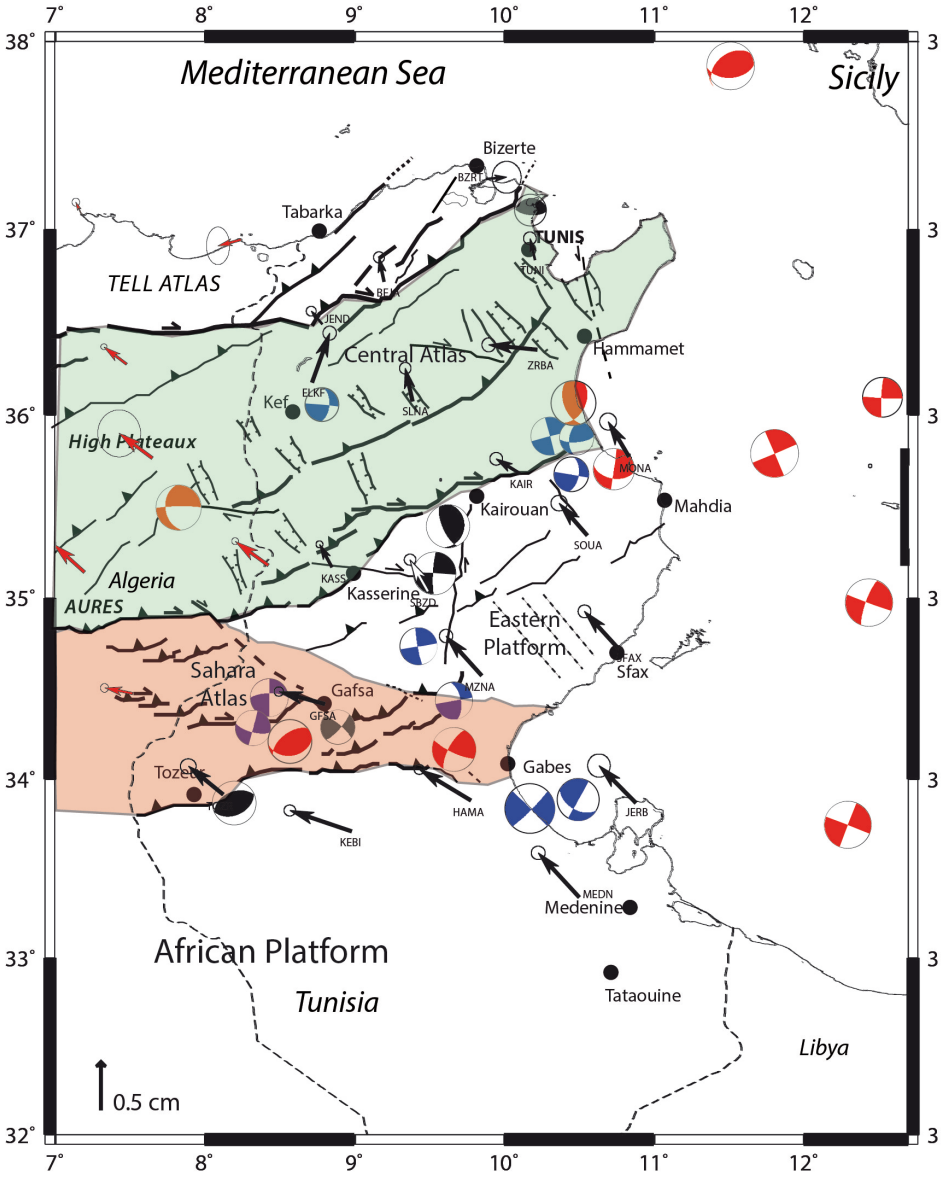


Strain distribution.

Left : First invariant indicating extension and compression zones.

Rigth : maximum shear.

(color scale in nanostrain/yr)



Tectonic domains (background color) with fault kinematics and active deformation as shown by GPS velocities. The NNW-SSE decrease in velocities across Tunisia is shown by significant shortening along quasi-NNW-trending velocities for stations KSAR, MEDN, MZNA, NKLG, SLNA and BEJA. Right-lateral deformation is well observed between the African Platform and South Atlas -Eastern Platform region. The change in vector directions becomes more obvious for northern stations SLNA, BEJA, TUNI, and ALKF and significant for both velocity and trend at stations JEND, BEJA and BZRT. The correlation of active tectonic structures with GPS velocities implies the tectonic domain subdivision consisting of the Sahara Atlas, Eastern Platform, Central Atlas and Tell Atlas.