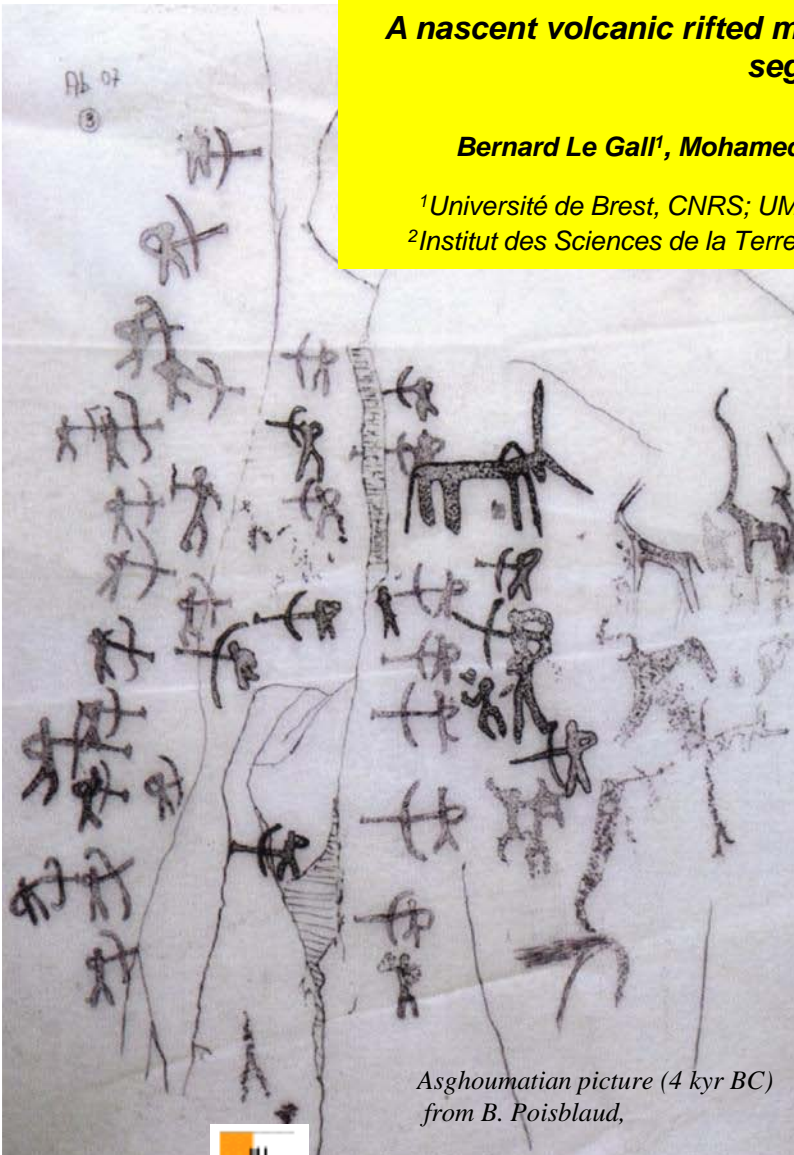


A nascent volcanic rifted margin along the Asal-South Danakil rift segment, SE Afar.

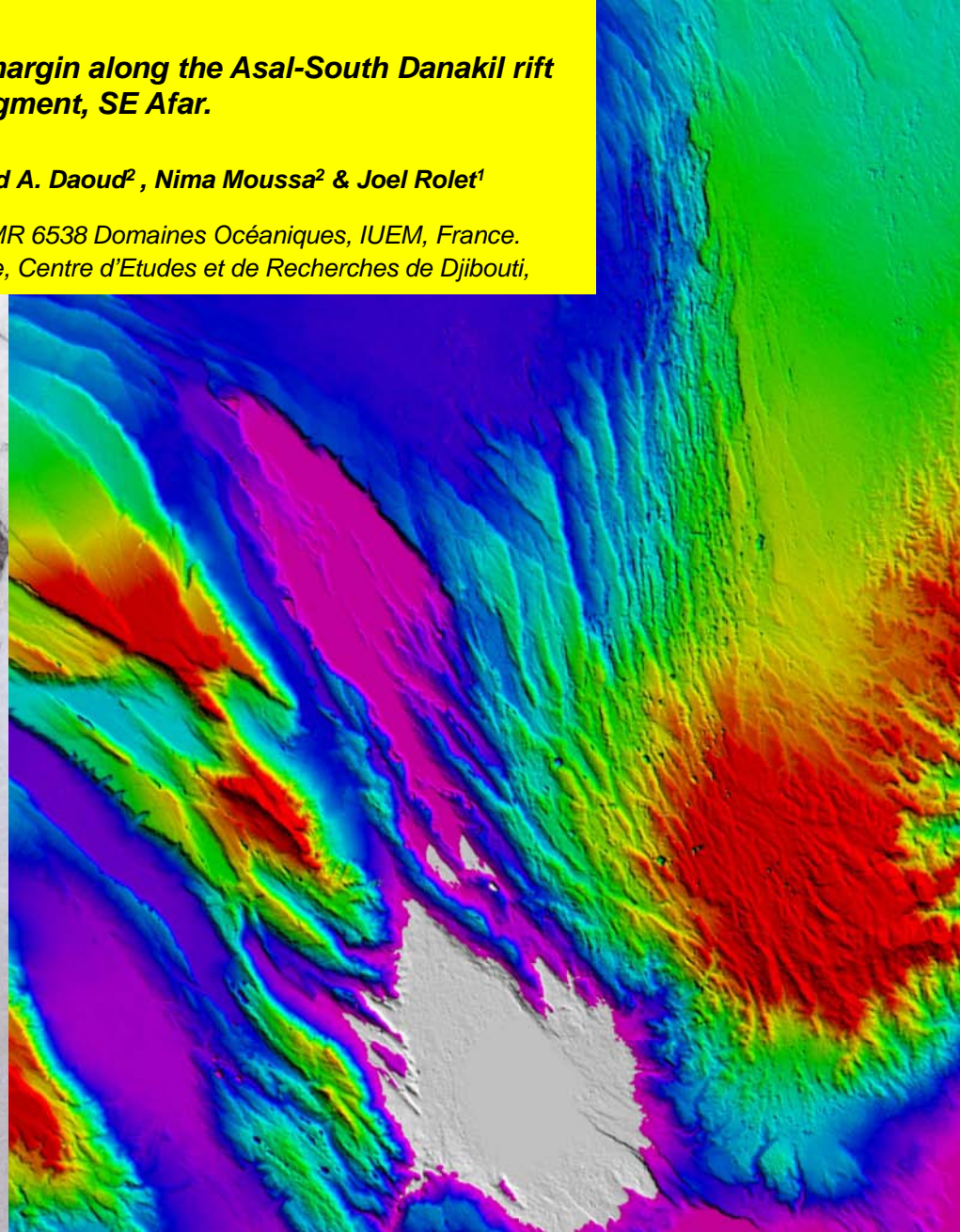
Bernard Le Gall¹, Mohamed A. Daoud², Nima Moussa² & Joel Rolet¹

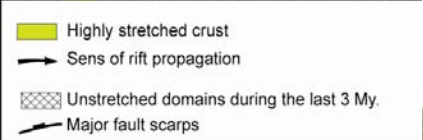
¹Université de Brest, CNRS; UMR 6538 Domaines Océaniques, IUEM, France.

²Institut des Sciences de la Terre, Centre d'Etudes et de Recherches de Djibouti,

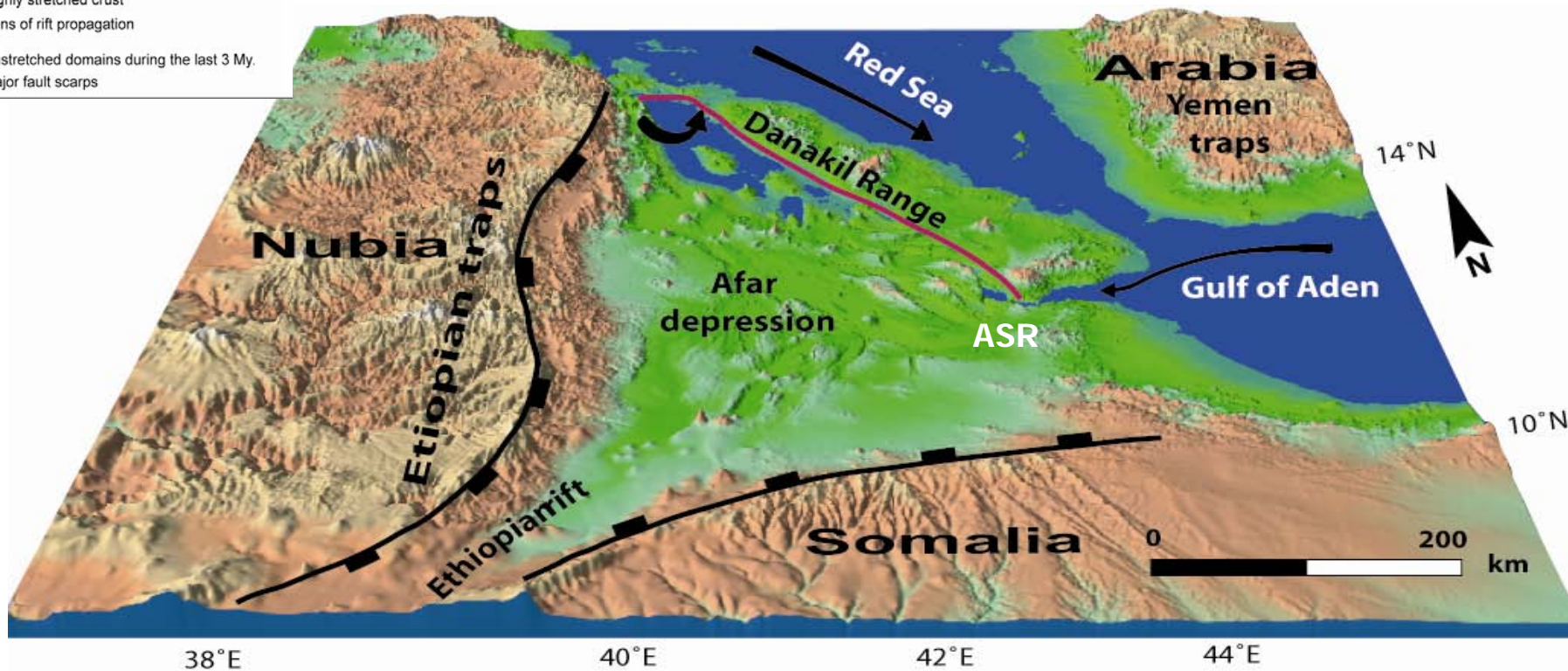


Asghomatian picture (4 kyr BC)
from B. Poisblaud,



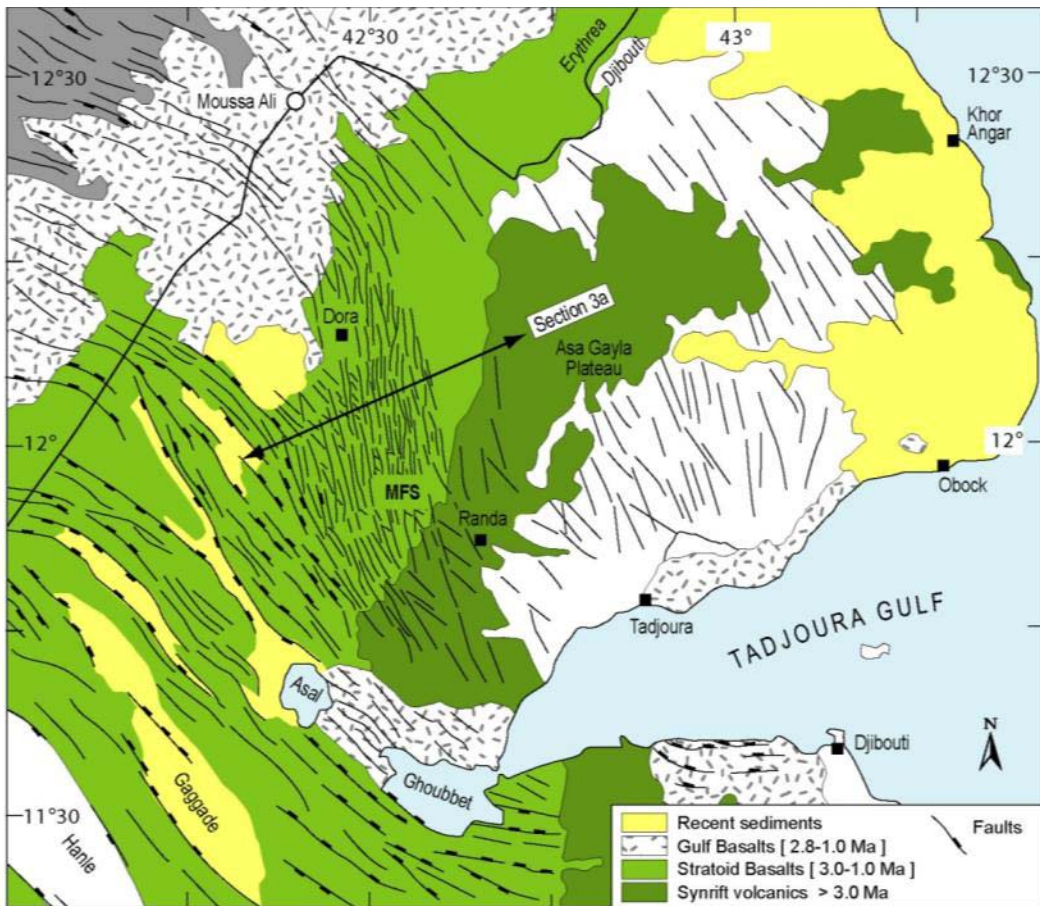


The Asal- Manda Inakir active rift axes :
 En echelon rift segments propagating since ~ 1 Ma along the developing SE margin of the Afar Depression

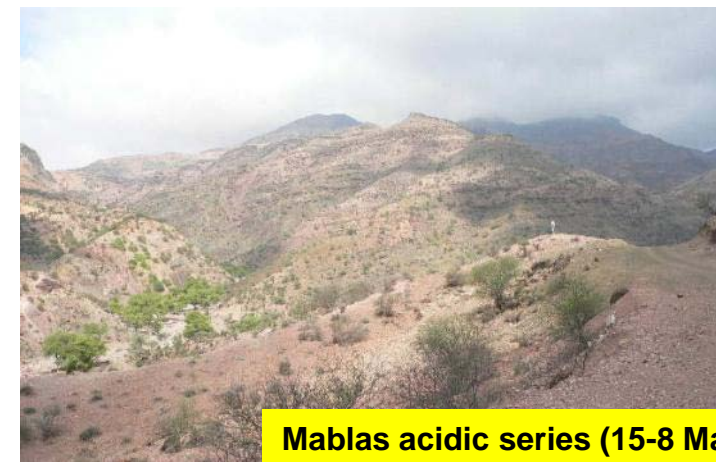


Geology of the Asal-South Danakil system :

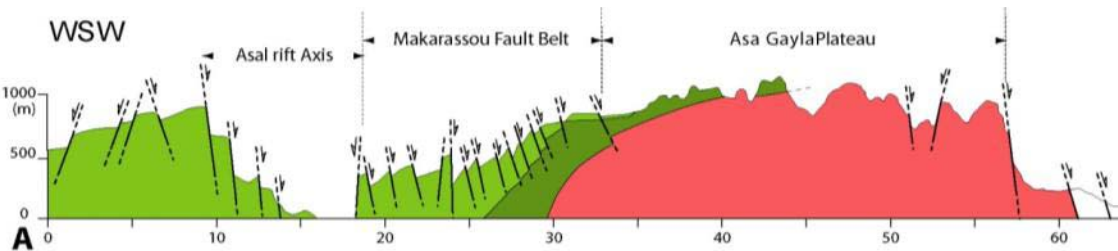
Pre-Stratoid synrift volcanics of the South Danakil Range

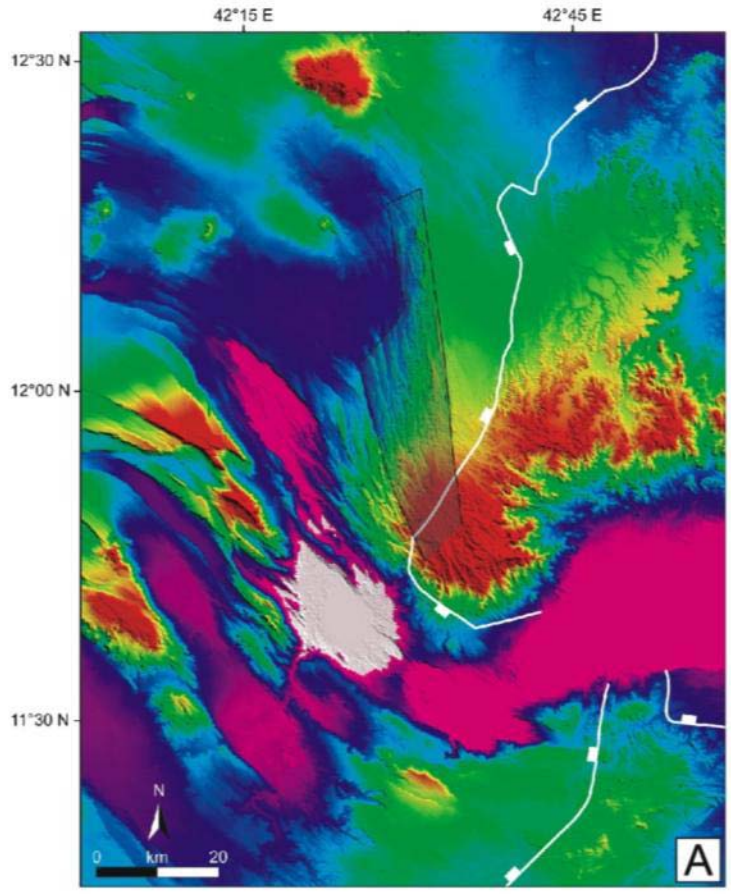
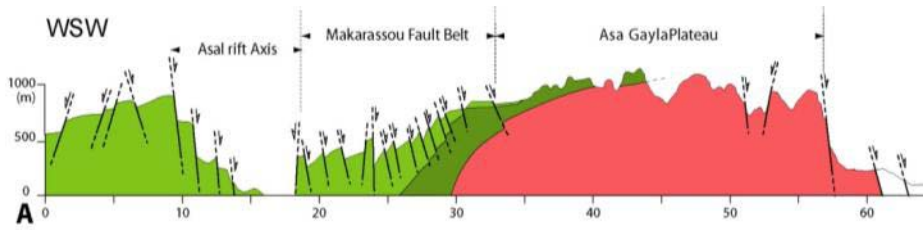


Dalha Basalts (8.6-3.8 Ma)



Mablás acidic series (15-8 Ma)



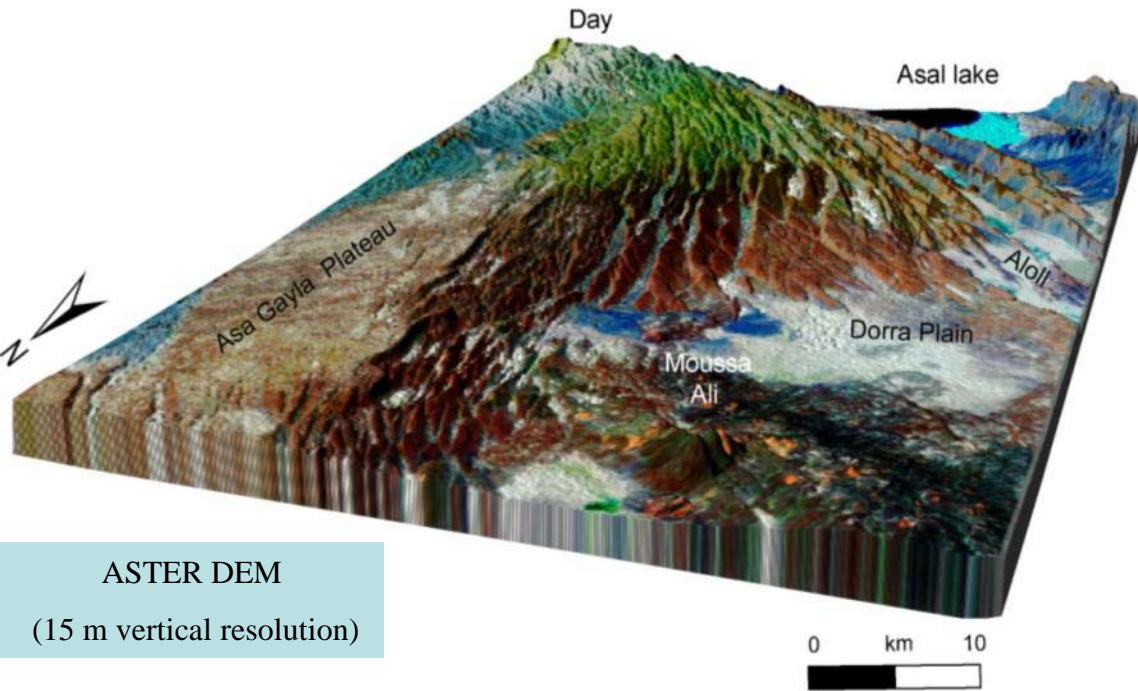


Geology of the Asal-South Danakil system :

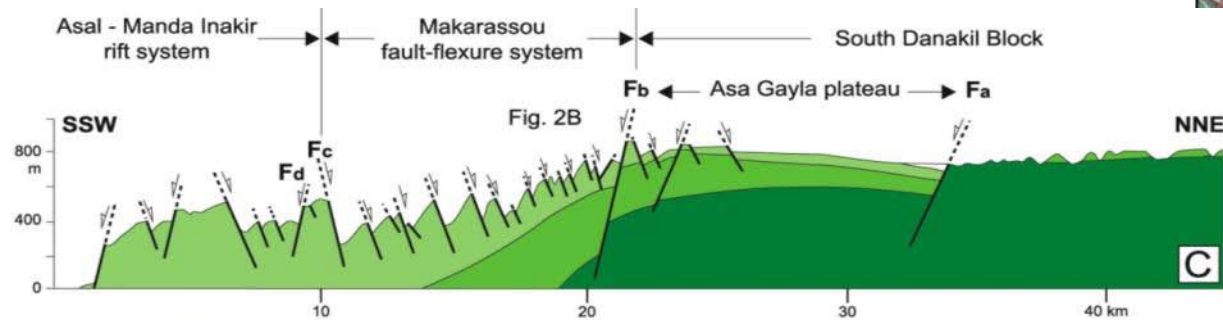
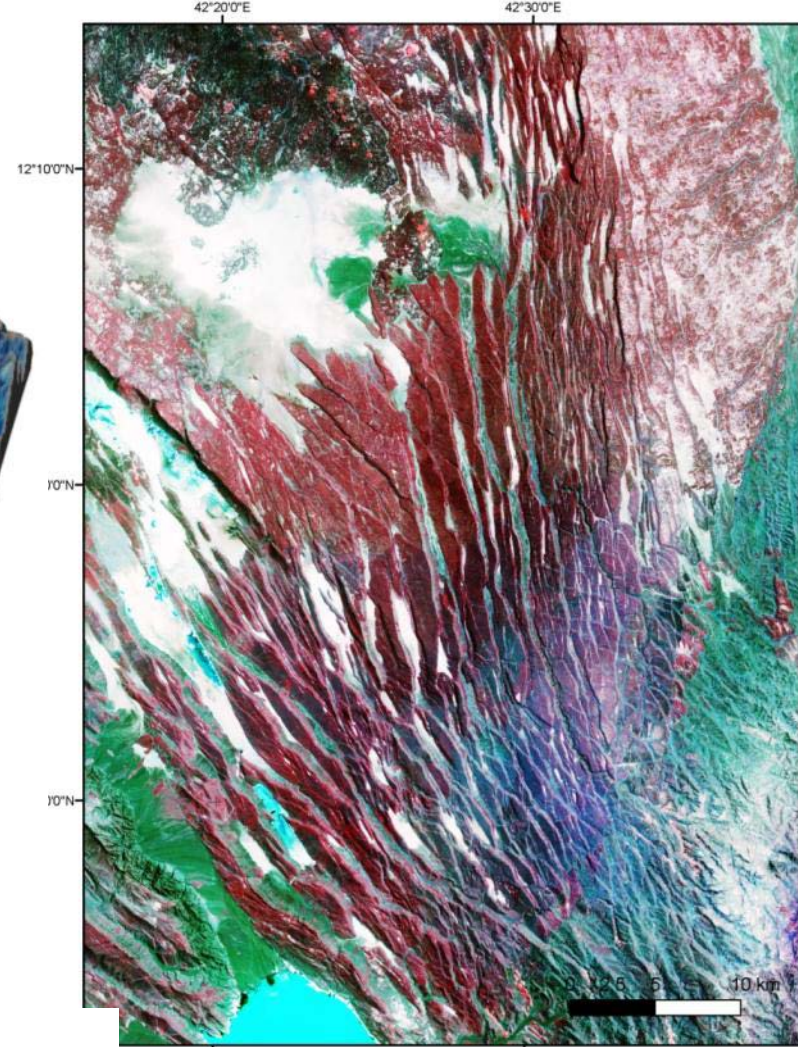
The Stratoid flood basalts : A riftward-thickening volcanic prism that recorded successive uplift events of the South Danakil Range



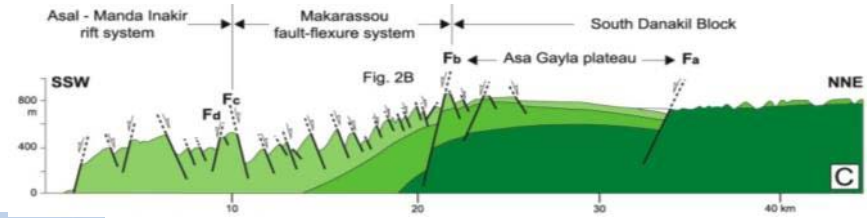
The Makarassou fault-flexure



ASTER DEM
(15 m vertical resolution)



The Stratoid tilted fault blocks in the Makarassou fault belt



West

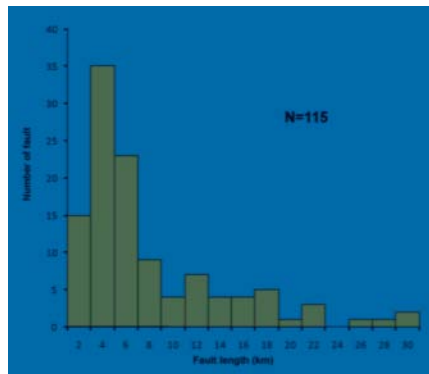


East

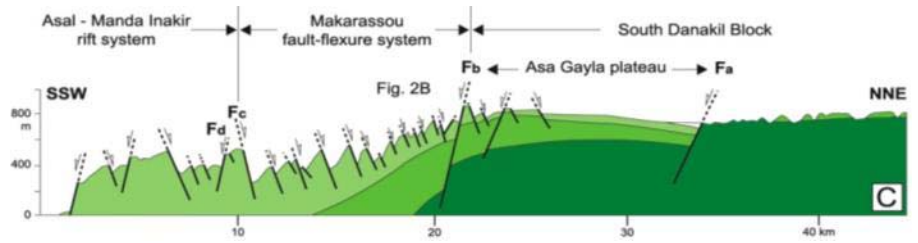
- Block rotation ($30^{\circ}W$ max)
- Mean fault spacing (500 m)
- Fault length (30-2 km)
- Dominantly dip-slip displacement (700 m max)

East

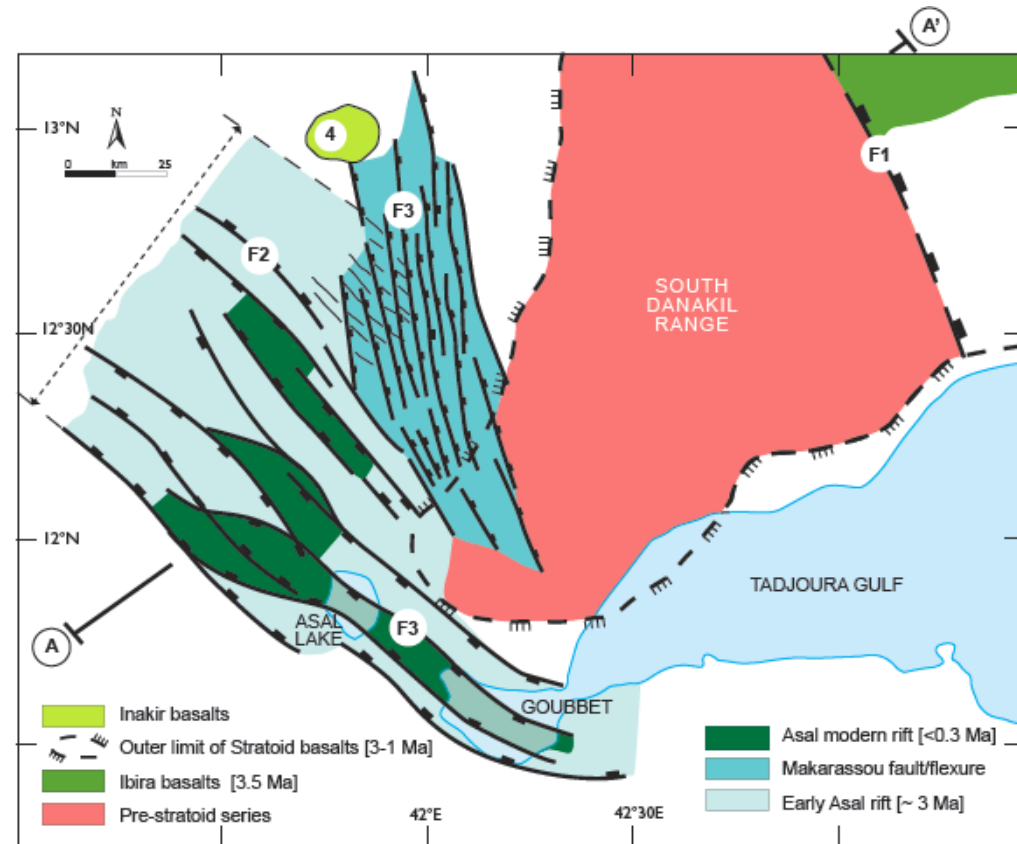
West



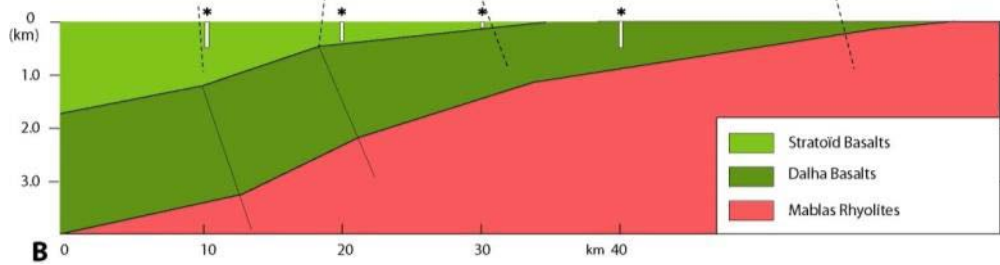
Timing of strain in the Makarassou fault-flexure



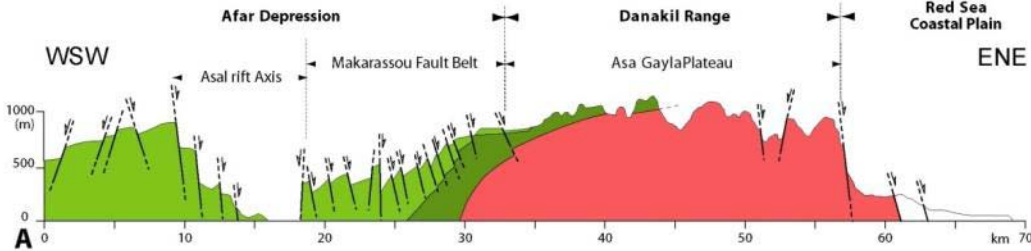
- (4) 0.3 Ma : Dorra undeformed basalts (K/Ar)
- (3) - **Makarassou fault-flexure**
- (2) - Early Asal rift faulting
- (1) 1.35 Ma : Stratoid basalts (K/Ar)



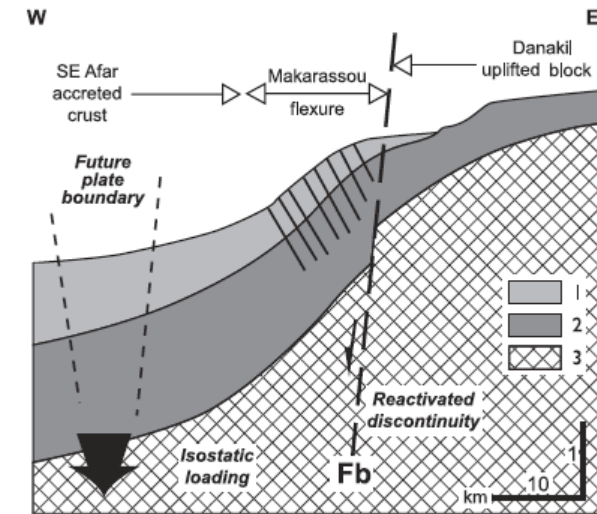
Restored cross-section of the Dalha-Stratoid volcanic prism



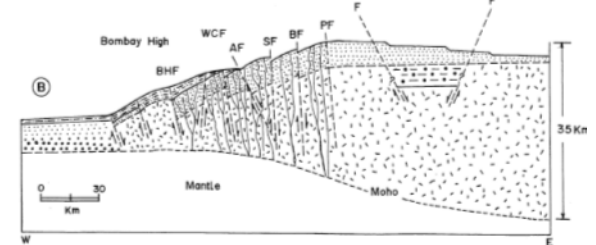
- Riftward-facing topographic flexure
- Outward-dipping extensional faults
- Riftward-thickening basaltic prism (Stratoid and Dalha Fms)



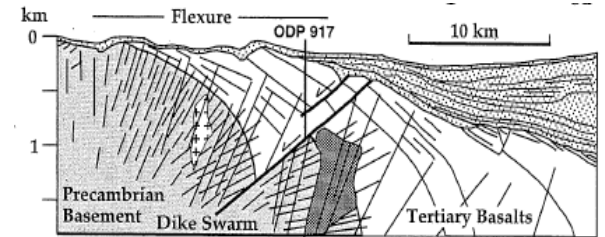
Tectono-magmatic pattern similar to volcanic rifted margins



Crustal downwarping as the flexural response to differential loading of the magmatically-accreted Afar crust

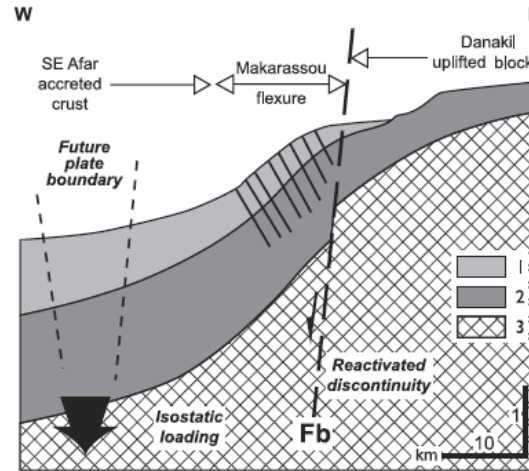
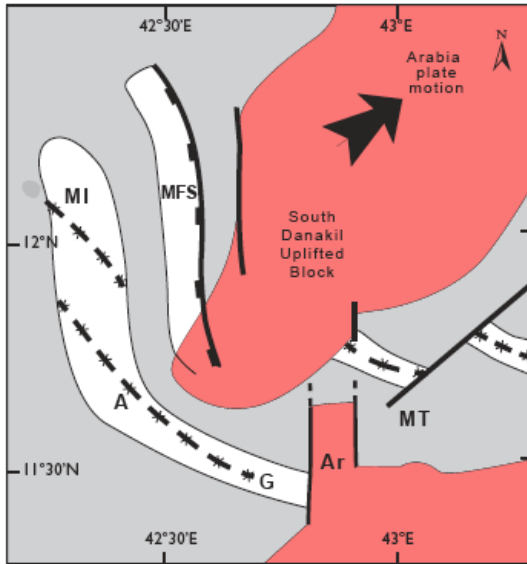


Deccan volcanic margin, Dessai & Bertrand, 1995



East Greenland volcanic margin, Karson et al., 1998

Structural inheritance and geometry of the MFS

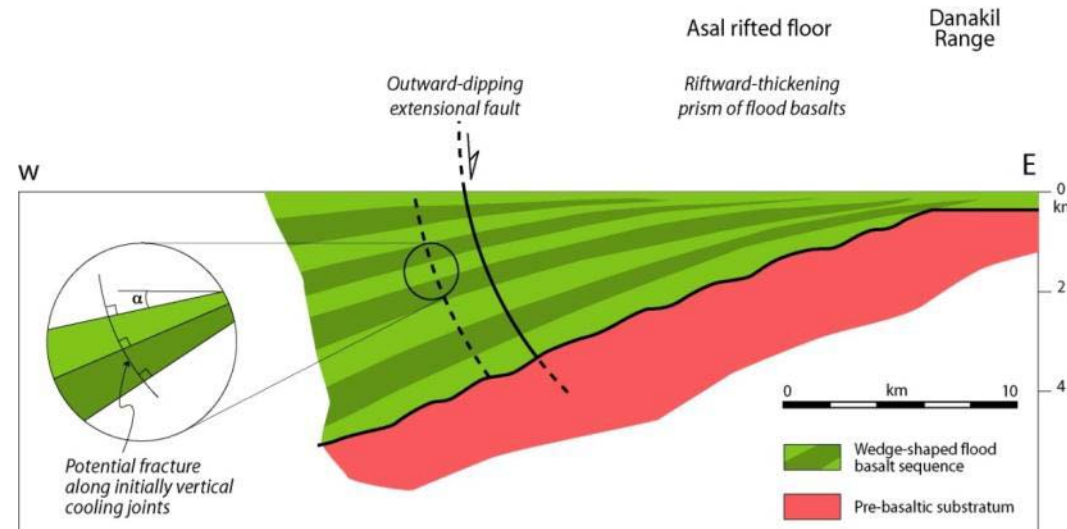


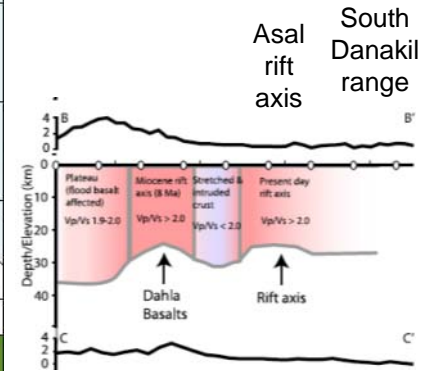
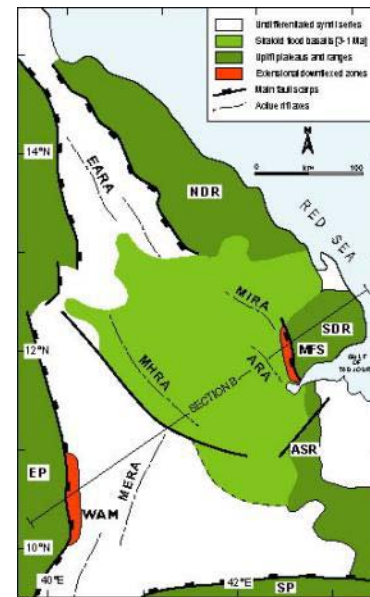
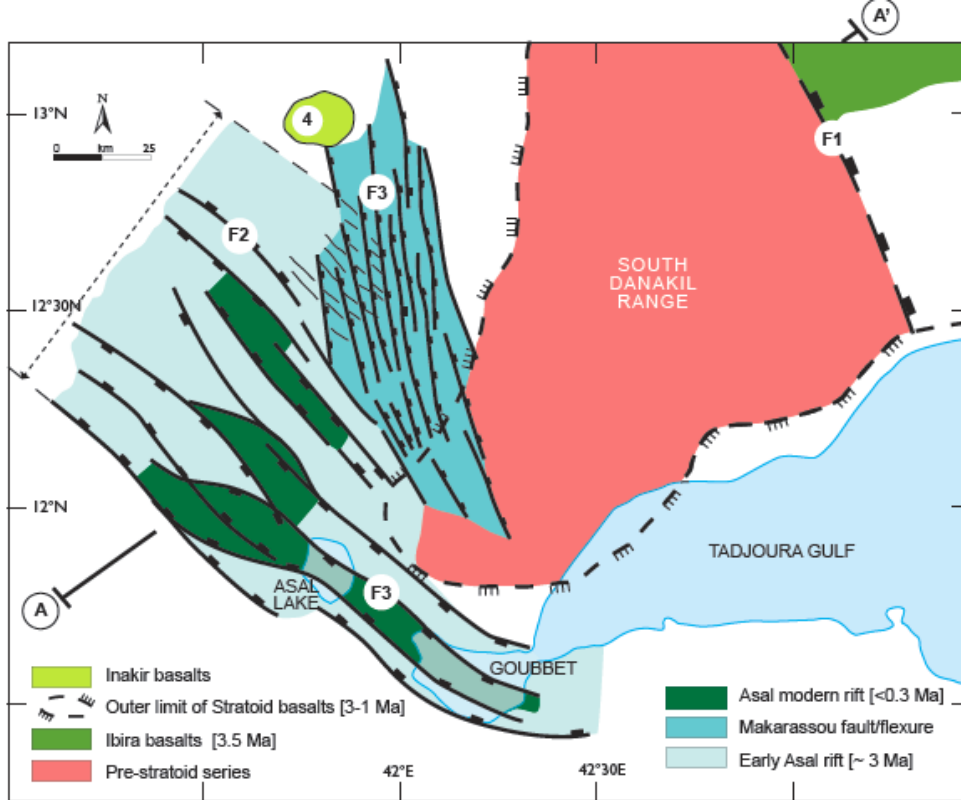
>3 Ma pre-existing discontinuities

Nucleation of the Makarassou flexure above a steep NS-trending discontinuity, reactivated as a dip-slip shear zone during magma-driven isostatic loading.

Stratoid cooling joint pattern

Antithetic extensional fault array splaying upward into the hangingwall was triggered by the listric trajectory of rotated volcanic cooling joints

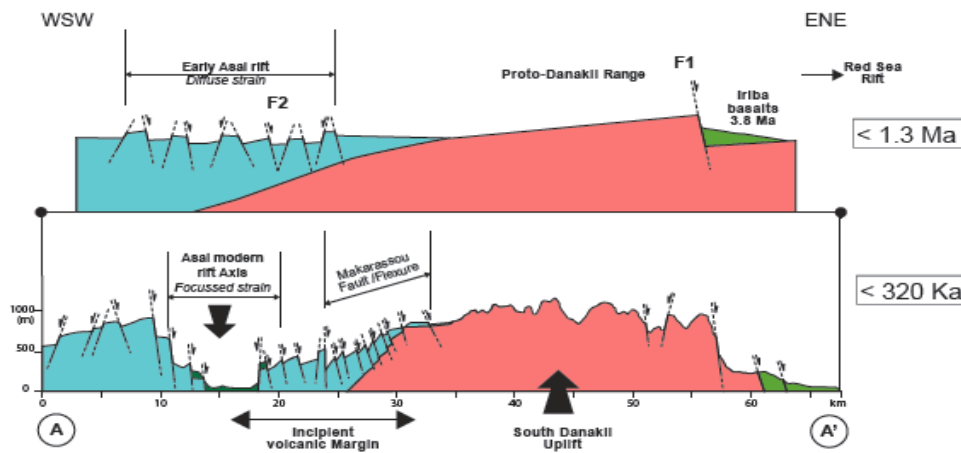


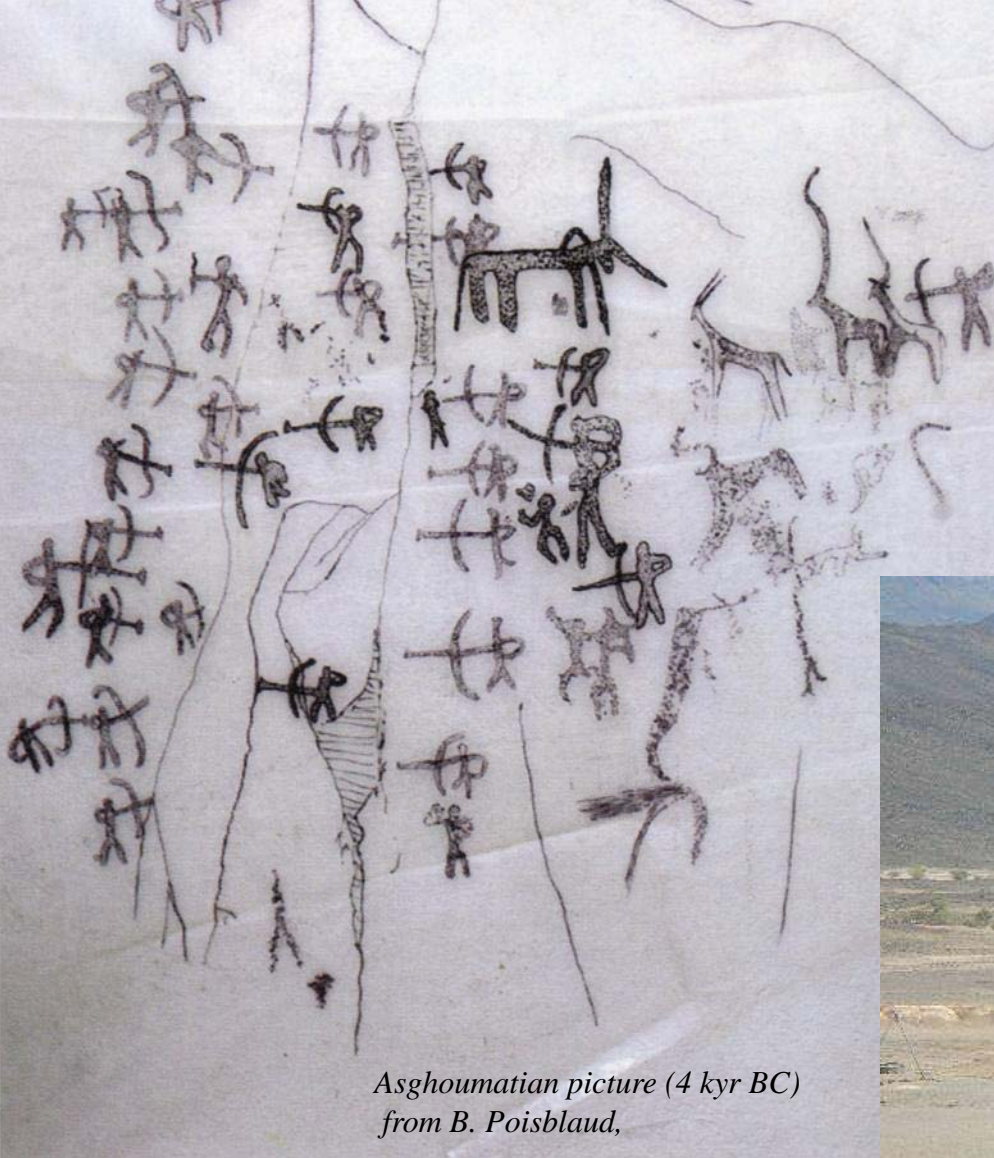


Hammond et al., 2011

Conclusions

- The Makarassou fault-flexure is a young magma-driven structure controlled by inherited fabrics in the upper crust.
- It recorded the 2-stage uplift history of the South Danakil Range.
- It is the structural expression of a nascent volcanic rifted margin along the SE Afar edge.
- The Stratoid basaltic floor of the A.D. is a possible analog to SDR's
- The Danakil micro-block is a young (~1 Ma) structure.



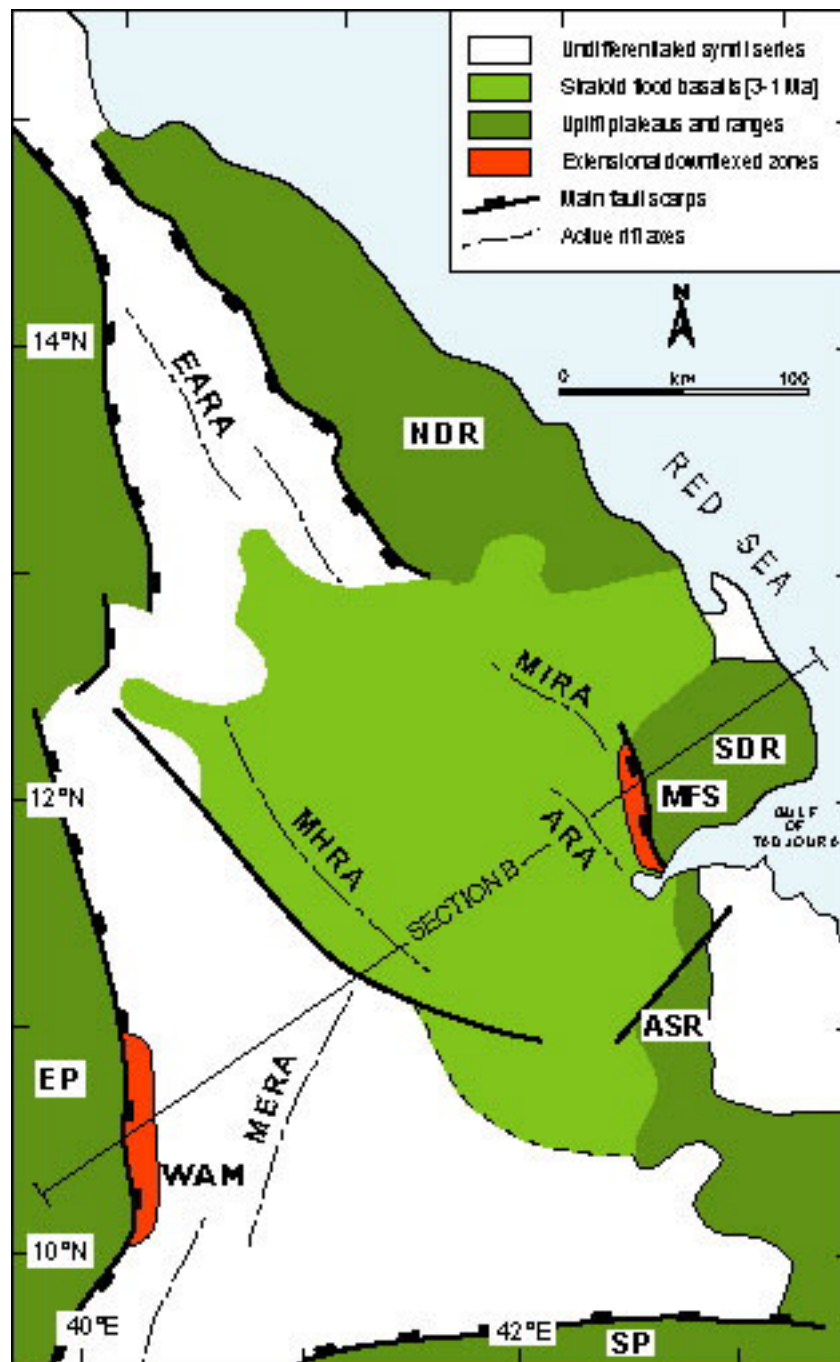


*Asghoumatian picture (4 kyr BC)
from B. Poisblaud,*

Thanks for your
attention

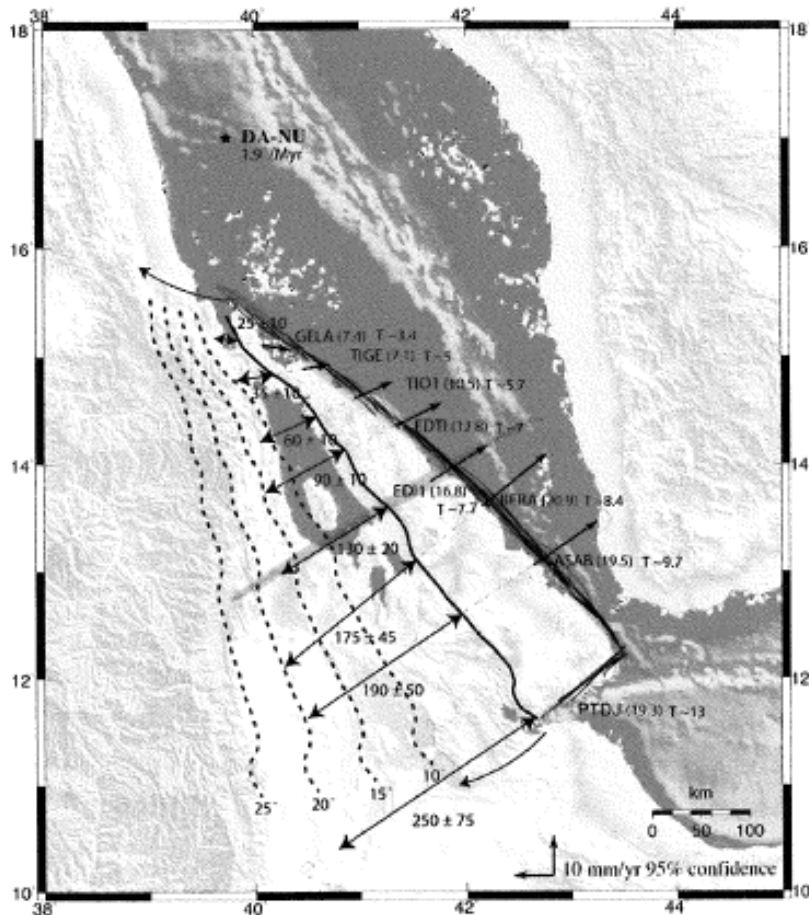
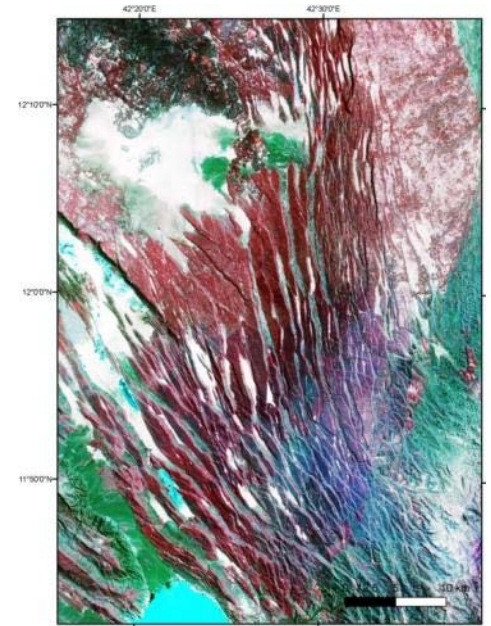
Amassa ginaloh



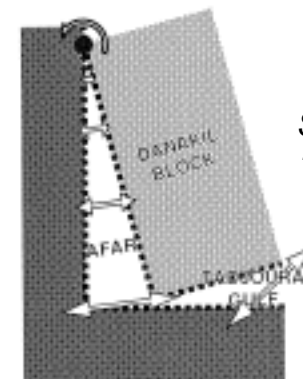


En projet

- Analyse statistique des populations de failles - Quantification de paramètres (longueur, rejet, espacement,)



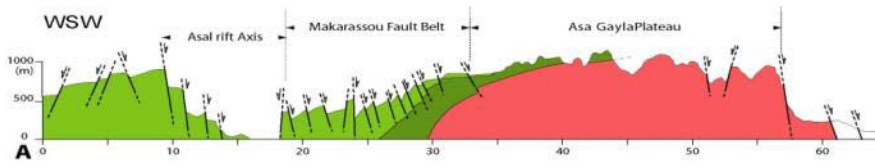
- Signification et mise en place du Bloc Danakil
- Individualisation de micro-blocs continentaux (Jan Mayen, ...)



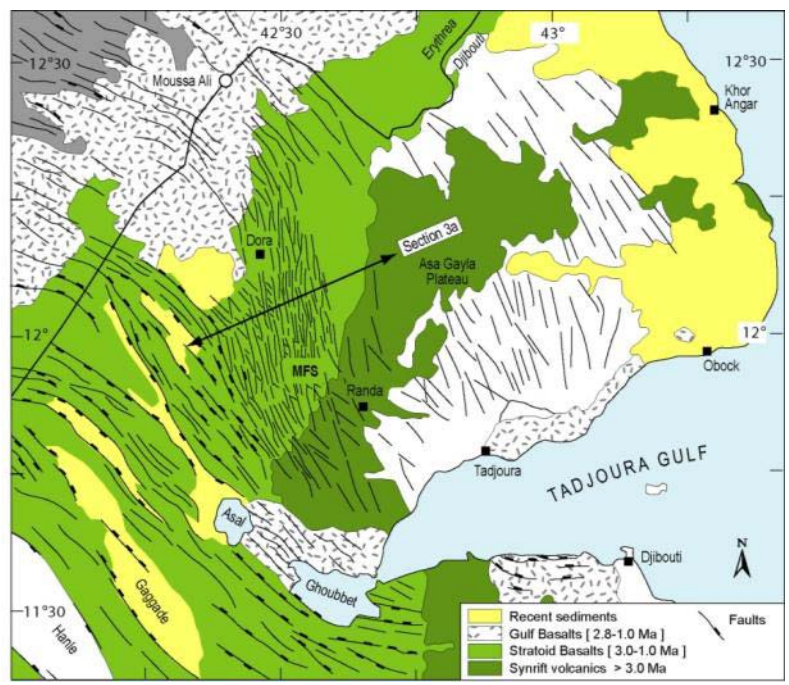
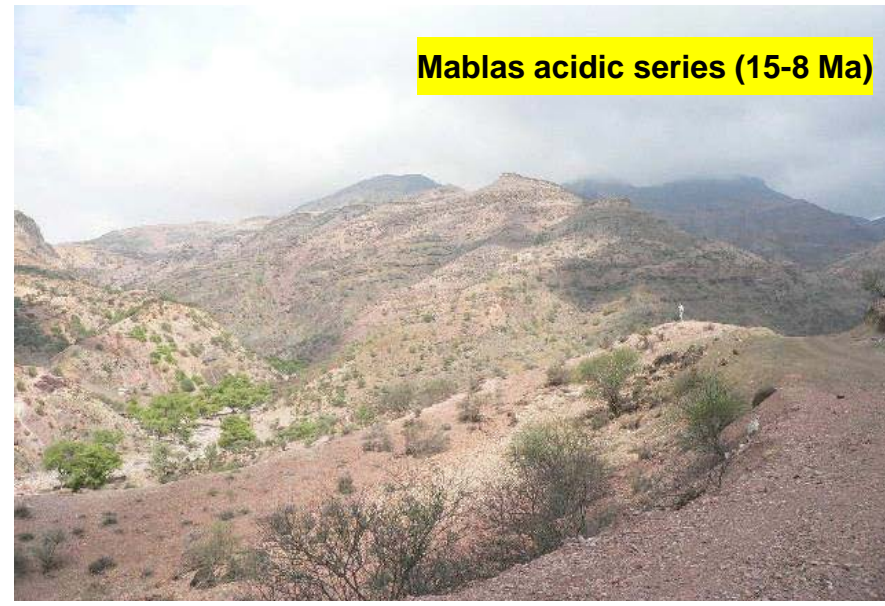
Souriot & Brun, 1990

Old synrift volcanics in the South Danakil Range

Dalha Basalts (8.6-3.8 Ma)



Mablas acidic series (15-8 Ma)





MRAV Conference, Addis Ababa, 11-13 January 2012