Tectonic Movements Related to Initiation of Paleo-OCC in the Troodos Ophiolite, Cyprus: Paleomagnetic Evidence

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Quick view

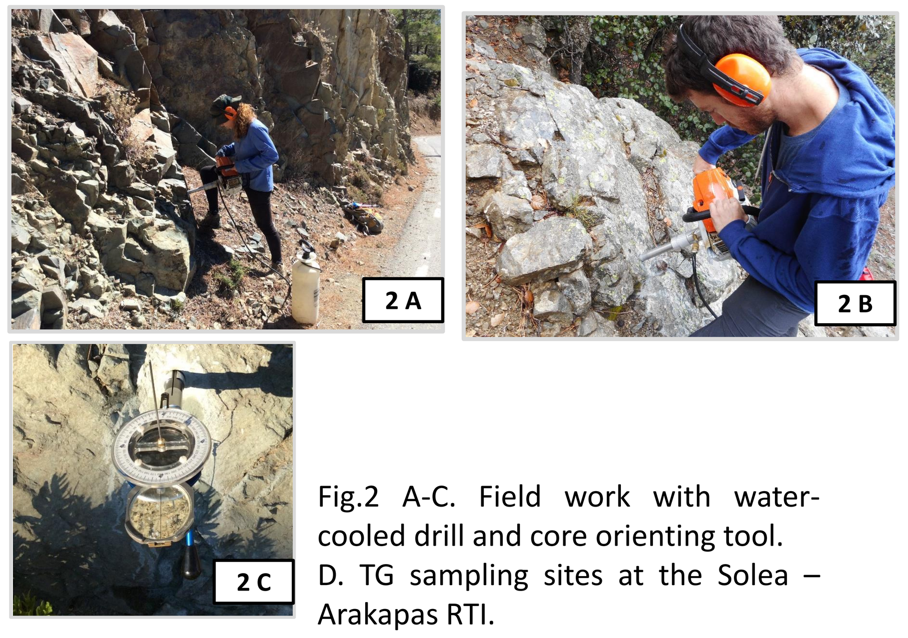
The Amiandos fault (AF) juxtaposes lower crust with a mantle dome and participated in the spreading hydrothermal system. These characteristics align with oceanic core complexes (OCC) of modern mid-ocean ridges. Here we use new paleomagnetic data from the Gabbro suite to reconstruct tectonic movements related to the AF. **The rotational pattern found in this research on both sides of the AF conforms with OCC's detachment fault during its initiation stage (ref.1-4).**

Introduction

Oceanic Core Complexes (OCC's) develop at slow and ultra-slow mid-ocean ridges, by exhumation of deep lower crust and/or mantle rocks to the ocean floor. This mechanism involves tectonic slip on major low-angel normal fault, known as detachment, at or near the spreading axis (Fig. 1).

One feature of the Solea paleo-slow spreading axis at the Troodos massif is a major normal fault- the Amiandos Fault (AF). Two characteristics of a modern OCC in the Troodos massif form the basis of this research: 1. The AF fault was part of a distinct spreading system (ref. 5-6) and situated in a dome-shaped serpentinite mantle and lower crust exposure. 2. Dikes around the plutonic suite are flat (20-30 dip) and rotated similarly as the gabbro suite (ref. 7)

Two hundred ninety-seven cores were collected at 38 sites



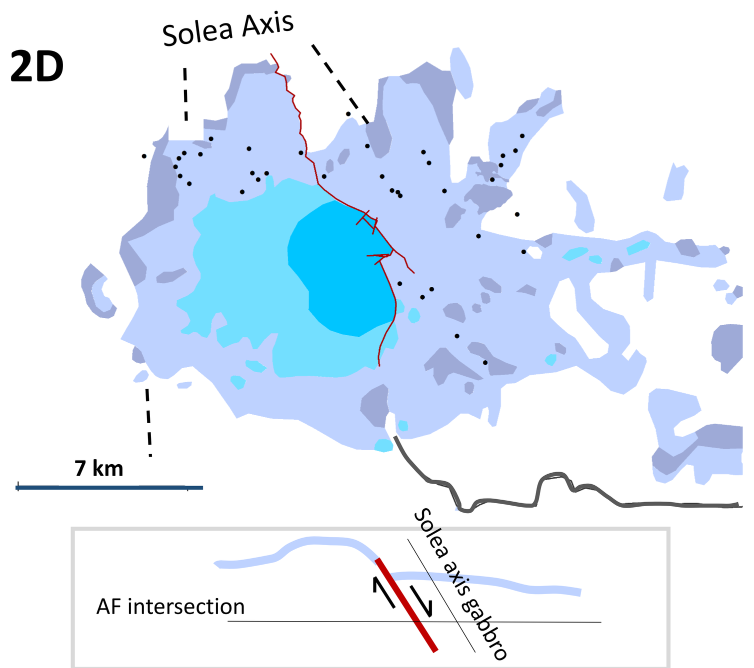


Fig.2 A-C. Field work with water-cooled drill and core orienting tool. D. TG sampling sites at the Solea – Arakapas RTI.

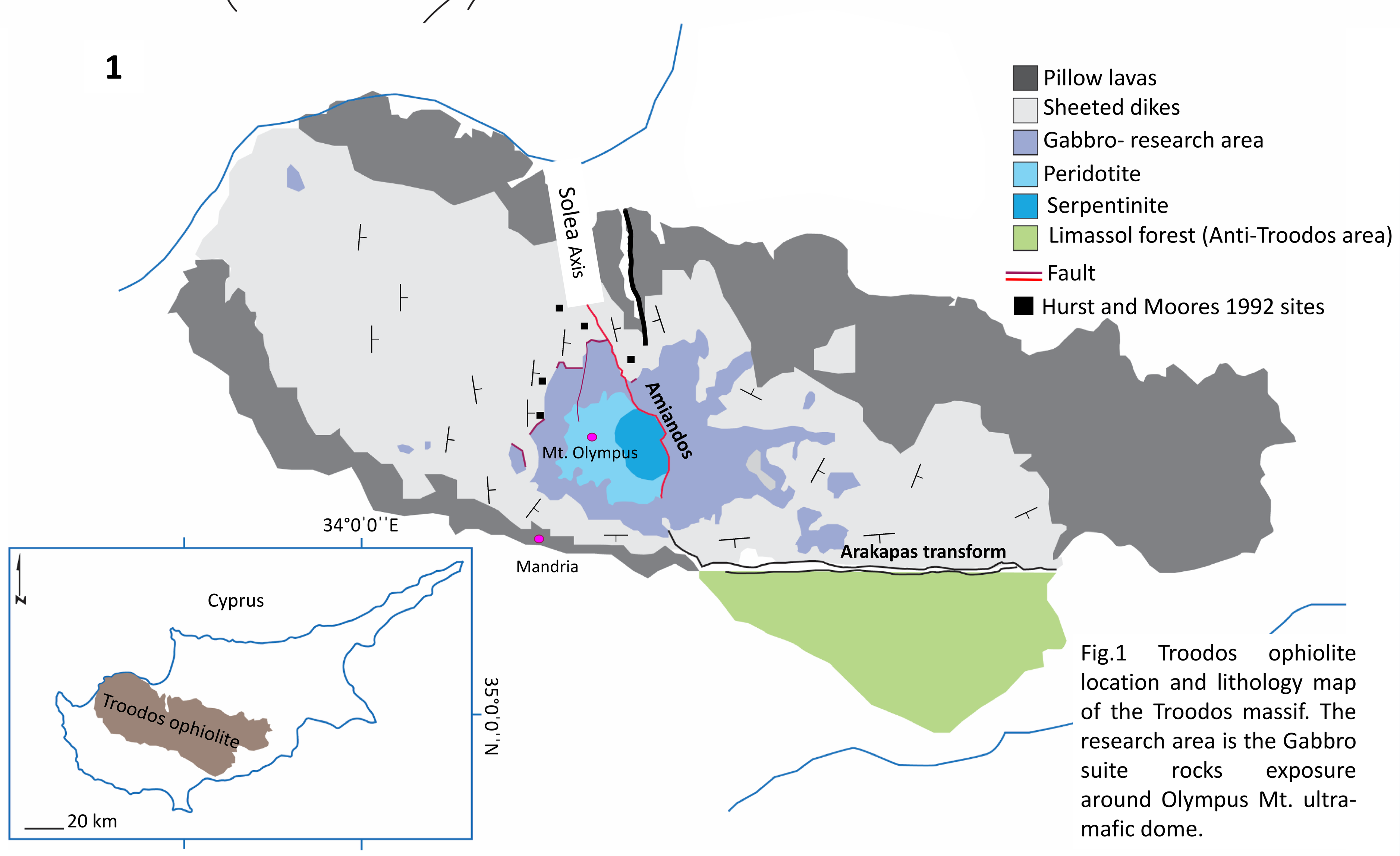


Fig.1 Troodos ophiolite location and lithology map of the Troodos massif. The research area is the Gabbro suite rocks exposure around Olympus Mt. ultra-mafic dome.

Methods

We performed two magnetic measurements on the specimens at the HUJI paleomagnetic lab:

- Anisotropy of Magnetic Susceptibility (future research on magma flow).
- Demagnetization - A total of 325 specimens were subjected to Thermal (peak temp. 600c°) or Alternating Field (up to 100 mT) incremental demagnetization, according to the behavior of pilot specimens from each site (Fig. 3).

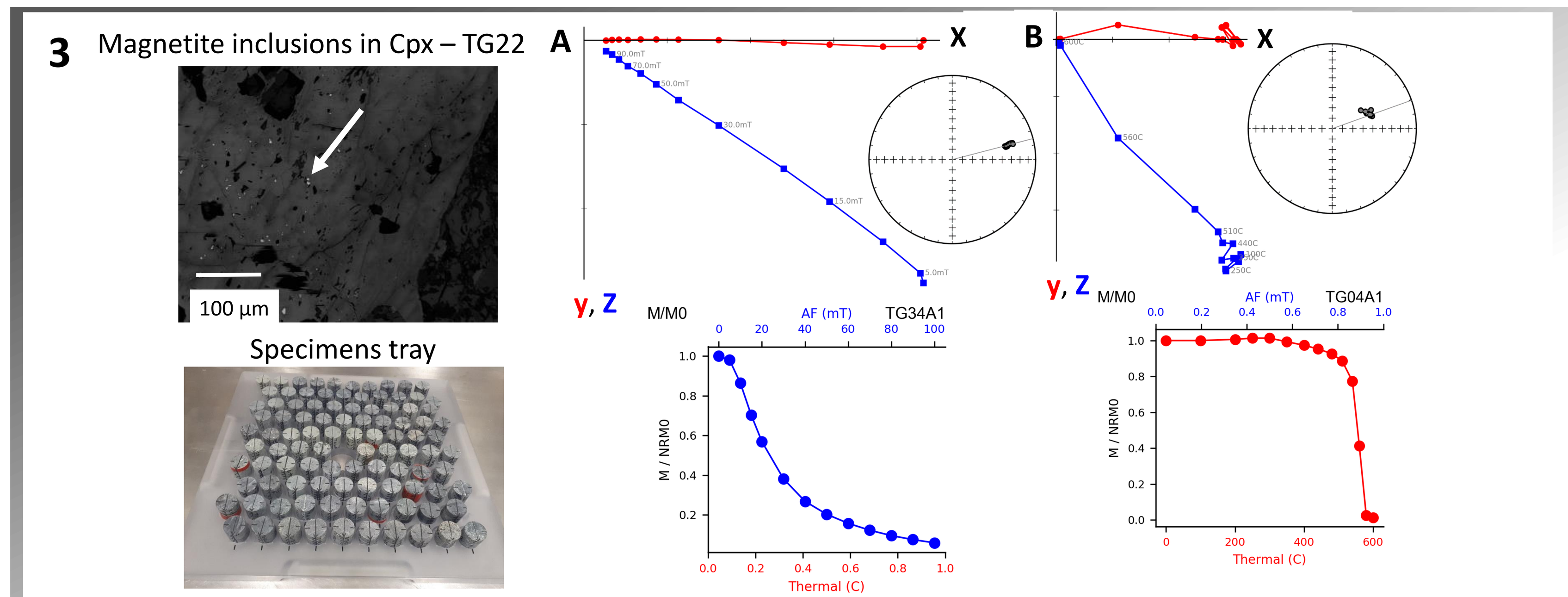


Fig. 3. Zijderveld and intensity plot of : A. TG34A1- AF demagnetization shows consistent decrease in intensity with MDF of 24 mT. B. TG4A1- Thermal demagnetization shows a sharp drop near 585c°.

Results

Zijderveld plot (Fig. 3) shows one or two magnetic components, with convergence to the origin. Coercivity spectra (80-100 mT) and blocking temperature (460-600 c°) confirm that phases of Magnetite and Titano-magnetite comprise the ferromagnetic sources in the Gabbro (ref. 8)

A comparison of the ChRM vectors to the Troodos Mean Vector (TMV) (ref.11) reveals rotations on a horizontal axis. The results grouped into three tectonic domains with deferential tilting: West 30° - 40°, Central 80° - 90°, both domains are west of the AF, and East 10°, east of the AF.

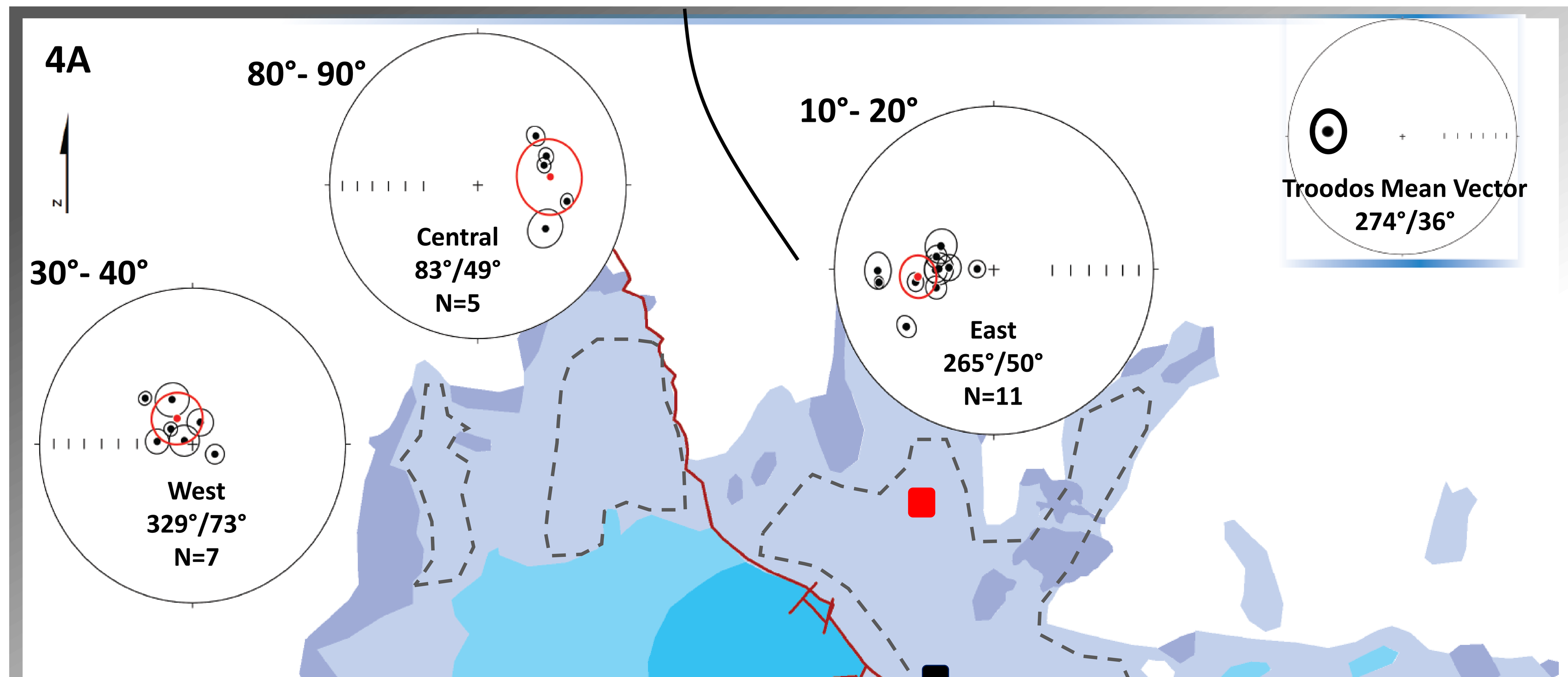
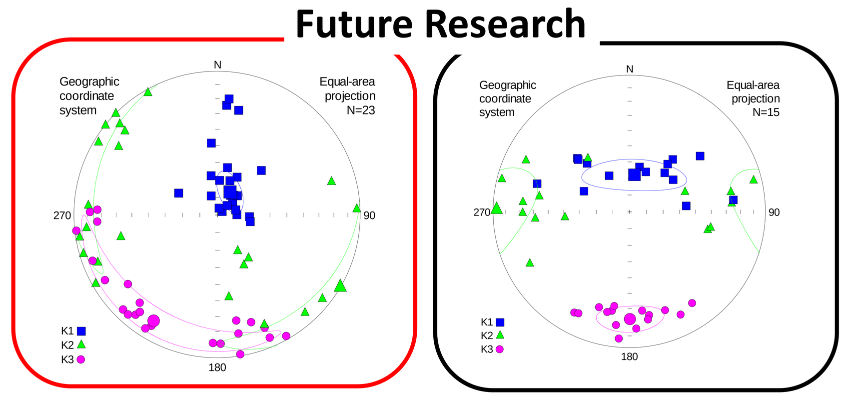


Fig. 4. A. Domain mean vector (red) and Site Mean Vector (SMV) (black) of West, Central and East domains. Dashed line - region of each domain. TMV (ref. 11) represent the direction of the island during the Cretaceous.

Future Research

The database (TG sites and previous- ref. 6-8;10) will be analyzed to: Construct a deformation map of the lower crust at RTI; Assess questions on magmatic flow from AMS results (Fig.4 B).



Conclusions

1. The deformation of the lower crust is in accord with initial stage of an OCC detachment system: High rotation at the AF footwall (Fig 6.) and small rotation at the hanging wall.
2. Detachment on a listric normal fault developed between the upper and lower crust as they are tilted together at similar rotation amounts (Fig 5.).
3. We suggest that localized serpentinite doming lifted the structure and enlarged rotations on the AF and at the Central domain.

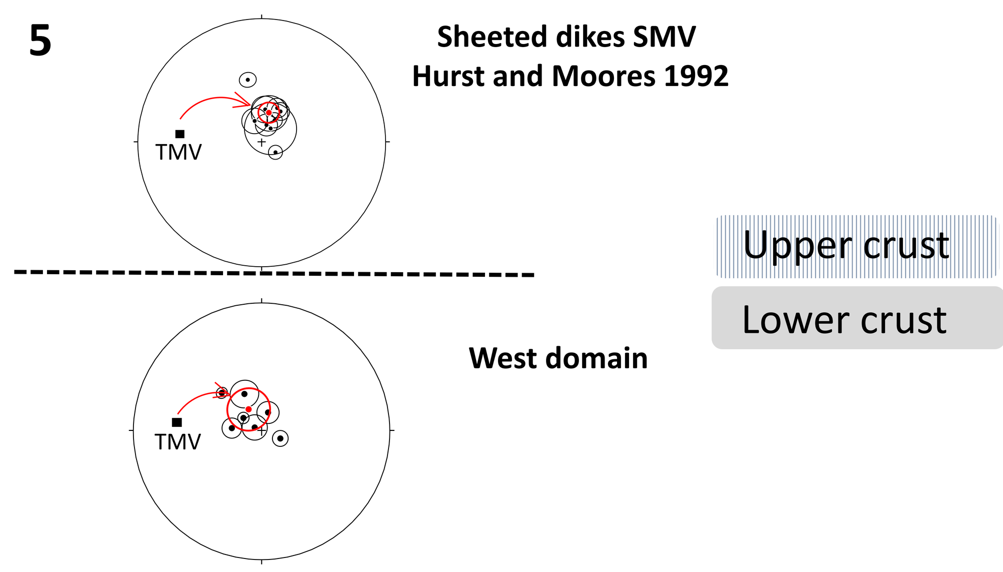


Fig. 5. Rotation west of Solea axis (site location shown in Fig. 1) include TG 31 and the rotation accepted at the lower crust.

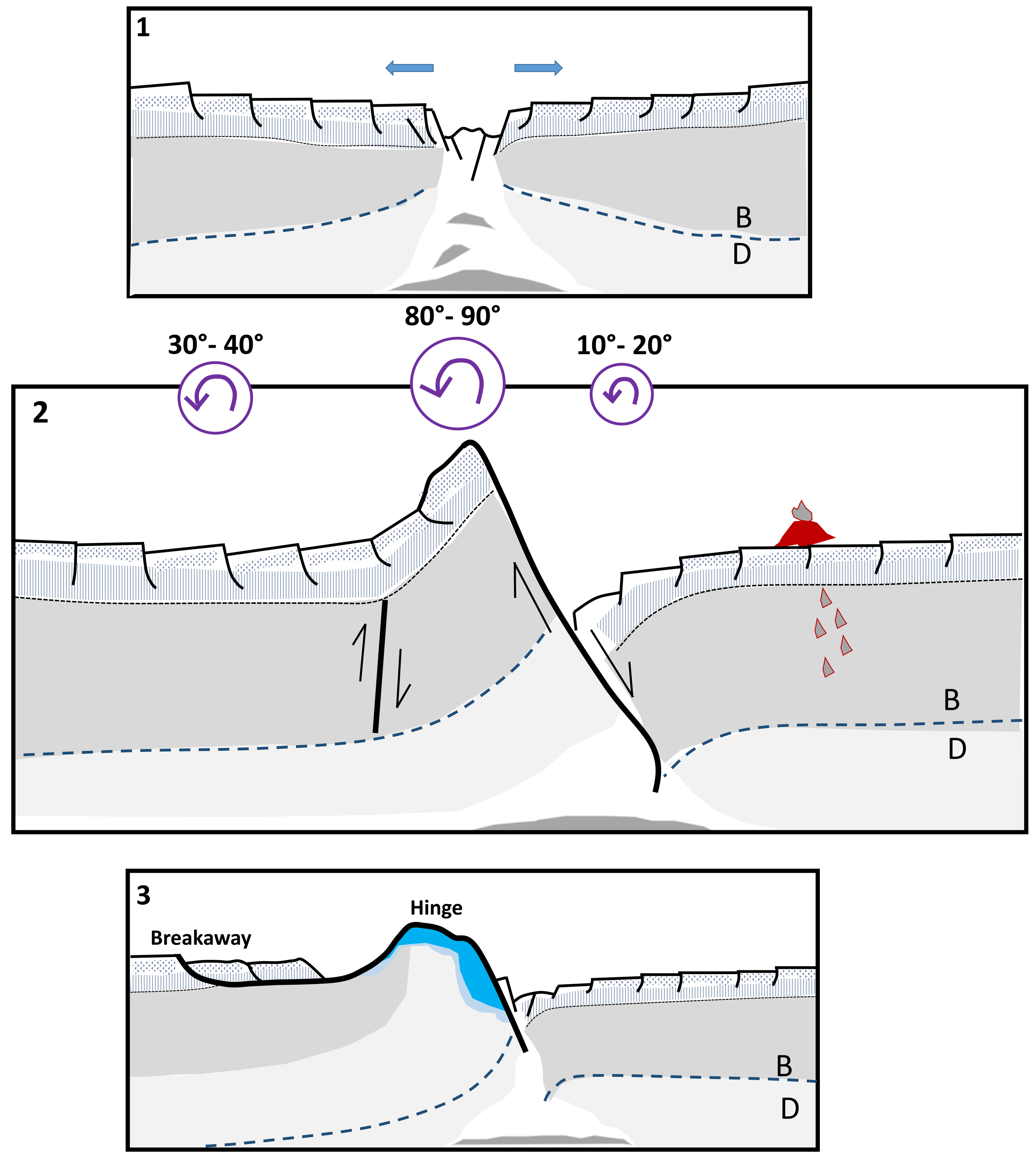


Fig. 6. Geologic history during melt- poor slow spreading at Solea axis :1. Normal faults accommodate continuous extension at low magmatic period, 2. Formation of a steep tectonic fault (AF) and isostatic response of the lithosphere. Deformation of the crust results in differential rotation amounts at the footwall, 3. Mature modern OCC model.

References: 1. Buck 1988; 2. Lavier et al.1999; 3. Reches and Eidelman 1995, 4. Blackman et al.1998; 5. Nuriel et al. 2009; 6. Abelson et al. 2002; 7. Granot et al. 2006; 8. Ebert et al. 2010; 9. Feinberg et al. 2005; 10. Shaar (In prep.), 11. Clube et al. 1985.

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