Late Cretaceous-Paleocene tectonics of the East Greenland margin

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The East Greenland margin is a long stretch starting from 60ºN up to 81ºN in a distance of more than 3000 km. It represents the conjugate of the European margin now separated by the North East Atlantic. Separation between Greenland and Europe began at 55 Ma after a long period of E-W extension and almost N-S oriented rift basins formed during the Late Jurassic-Early Cretaceous rift. In Early Eocene the line of breakup followed NE-SW oriented trends together with the emplacement of the North Atlantic Igneous Province. Post-breakup thermal subsidence followed in the Eocene, while the Oligocene initiated a period of plate re-organization with the initial separation of the Jan Mayen Micro Continent. At this time a complex tectonic history with inversion structures and uplifts along both the East Greenland and European margins initiate. Along the East Greenland margin the effects of this tectono-magmatic history are documented by exhumed sedimentary basins, dyke swarms, fault systems, intrusive centers, shield volcanoes and plateau lavas constituting, in some cases, highest mountain of Greenland with peaks up to 3700 m.

During fieldwork in East Greenland to collect new geological and structural data describing brittle deformation related to the North East Atlantic tectonics, four areas were visited: Skjoldungen 63ºN, Kangerlussuaq 68ºN, Traill Ø 72ºN and Wollaston Forland 75ºN. More than 1000 fault-slip data for structural analysis of major faults together with hundreds of kilometers of helicopter flights and thousands of oblique pictures for 3D-photogeology and 3D-mapping were collected.

Kinematic analysis of brittle deformation associated with a Late Cretaceous-Paleocene rift shows strike-slip movements (Guarnieri 2011). Paleostress tensors reconstructed from fault-slip data highlight a NE-SW maximum horizontal stress in a strike-slip tectonic setting along the entire East Greenland margin pre-dating the breakup of the NE Atlantic (Guarnieri et al. 2012). Structural data allow to interpret a two-stage evolution for the Kangerlussuaq Basin from pull-apart in Campanian-Danian to oblique rift in Selandian-Thanetian associated with volcanism, magmatic segmentation of macro-dyke complexes and activation of ENE-WSW trending fracture zones. The latter are represented by former Proterozoic lineaments (2,0 Ga) re-activated during the NE Atlantic rifting.

Pull-apart basins, oblique rifting and strike-slip deformation along the East Greenland margin reflect the pre-breakup counterclockwise rotation of Greenland in response to the rifting and opening of the Labrador Sea (Guarnieri 2012).

References

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