Geophysical Research Abstracts
Vol. 12, EGU2010-9095, 2010
EGU General Assembly 2010

Crustal accretion at anomalous spreading centres: Rheological control of crustal thickness

Harro Schmeling

Goethe University Frankfurt, Institute of Geoscience, Section geophysics, Frankfurt/M, Germany
(schmeling@geophysik.uni-frankfurt.de)

New determinations of lateral crustal thickness variations at anomalous oceanic spreading centres such as Iceland have shown that the crust may be thinner at the ridge axis above the plume thickening towards the sides (Bjarnason and Schmeling, 2009). To understand this behaviour crustal accretion models have been carried out solving the conservation equations of mass, momentum and energy with melting, melt extraction, and feed back of extracted material as newly formed crust for an extending lithosphere system underlain by a hot mantle plume. The dynamics of rifting are thermally and rheologically controlled by the feed back due to accreted new crust. Three accretional modes with characteristic crustal thickness variations are identified depending on the width of the volcanic emplacement zone and the accretional heating rate. This rate can be associated with the thickness of the surface layer in which magmatic emplacement takes place. Mode 1: Zero crustal thickness at the spreading axis develops for cool accretion and a wide emplacement zone. Mode 2: Constant crustal thickness or moderately crustal thickening to the sides develops in case of warm (deeper reaching) accretion. Dynamic topography shows only a weak or no regional minimum at all near the axis. This mode may be identified with the situation in Iceland. Mode 3: A stagnating central crustal block evolves for cool accretion and narrow emplacement. No accretional mode with maximum crustal thickness above the plume at the rift axis has been found. The absence of mode 1 accretion (with zero crust at ridge axis) on earth may be an indication that in general crustal accretion is not cold (and shallow).

Bjarnason, I. T. and H. Schmeling, 2009: The structure of the lithosphere and asthenosphere of Iceland from surface waves. Geophys. J. Int. , 178, 394 – 418..