Geophysical Research Abstracts,
Vol. 10, EGU2008-A-04016, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-04016
EGU General Assembly 2008

Cenozoic uplift and subsidence in the North Atlantic region

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The existence of the bordering mountain ranges of the North Atlantic is enigmatic and has puzzled researchers for decades. The margins around the North Atlantic are typically considered 'passive' due to their relative tectonic quiescence since the termination of active faulting, rifting and magmatism. Nevertheless, several features indicate significant Cenozoic differential vertical movement including onshore elevated erosion surfaces, offshore tilt of the Tertiary sedimentary sequence, and large progradational sedimentary wedges.

No single method can exclusively measure uplift. Most methods are based on identification of increases in erosion and removal of overburden or deduction of the cooling history of an area. All these indicators of uplift can have other causes. We compare the results of previous studies with the aim of mapping the timing and amplitude of relative vertical movement in the region.

Substantial inversion and compression of the North Atlantic region complicate the studies. Discrimination between localized inversion-driven exhumation and regional uplift-driven exhumation requires a study of the whole region. Inversion has been documented to occur in four phases; late Cretaceous, middle Palaeocene, late Eocene-early Oligocene and late Oligocene-Miocene. The Cenozoic compressional domes offshore Norway and around the Faroe-Rockall-Shetland area show conspicuously similar timing to the inversion phases, although debated.

There seems to be a general consensus on regional uplift of the NW European Atlantic margins and E and W Greenland, in the Palaeocene-early Eocene, although not all authors agree on the timing and uplift has been suggested to occur during most of

the Cenozoic. However, it is debated if there were one or several main stages. Underplating generated by the Iceland plume and rift flank uplift are popular contenders as generating mechanisms.

Only few authors suggest uplift in the Eocene, but many propose a phase of rapid subsidence, mostly attributed to the waning of the Iceland plume. Oligocene uplift appears to be the most distinct event which can be regionally correlated along the NW European margin. It may, together with Miocene uplift, be related to inversion/compression tectonics. However, an almost contemporaneous event on the East and West margins of Greenland is only slightly earlier in the late Eocene-middle Oligocene.

The existence and nature of the suggested late Neogene uplift and subsidence event around ca 4Ma can be regionally correlated across the NW European margin and the margins of East and West Greenland. There seems to be little evidence of simultaneous inversion and compression. Isostatic balancing has been suggested as a cause, but it is not clear how this could generate the ‘domal’ shape, of f. ex. the southern Scandes. Erosion caused by climactic effects can generate peak uplift via isostatic adjustment, while maintaining or slightly lowering the mean elevation. Both sides of the North Atlantic have been subject to variation in glaciation and it might have caused uplift of several hundred meters. This talk will discuss the nature, timing, cause and magnitude of the proposed Cenozoic uplift and subsidence of the North Atlantic region.