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Plumes and Continental Break-up: Some observations from the North and South Atlantic

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Mantle Plumes are considered to play an important role in continental break-up or are even the driving force. Some researchers relate the break-up of continents and the extensive sub-aerial flood basalt magmatism directly to the arrival of a mantle plume. Despite ongoing research activities no consensus in the geoscience community has been achieved, if this model is correct. Competing ideas interpret the separation of continents as a consequence of plate tectonics.

Geophysical data, which can probe deeper crustal levels do not provide an unique interpretation. One of the most disputed issues is the origin of lower crustal high velocity bodies (LCB, $Vp > 7.0$ km/s), which are found along volcanic rifted margins. In the absence of any rock samples from the LCB no geochemical and/or age control on its nature and evolution is available, which might facilitate the interpretation.

In this contribution new geophysical data will be presented from the North Atlantic, the Namibian margin and the Atlantic sector of Antarctica to question the plume-continental break-up paradigm. Starting in the north it is striking that for the opening of the Arctic Ocean no plume location has been discovered so far, which can be considered to be responsible for the break-up. Towards the south, the East Greenland margin shows a quite variable crustal structure, which is difficult to understand in view of a large thermal plume anomaly. The crustal structure south of the Denmark Strait, however, shows classical structures, which are related to the occurrence of a plume during break-up.

In the southern hemisphere, the break-up of Gondwana is explained in most publications with the existence of several mantle plumes. Thus, Antarctica should have faced several magmatic events during its dispersal. However, this is not obvious from the onshore geology and especially the available geophysical data. Recent aeromagnetic

data show that the African and South American plates moved at different velocities from the beginning of seafloor spreading. Thus, rifting between these two plates is much older than the eruption of flood basalts (132-135 Myr) on both continents. This might point towards the fact that after the arrival of a plume beneath Africa/South America more than 10-30 Myr were necessary to separate the continents or that the thermal anomaly played a more passive role.