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# Depth Through Time in the South Atlantic

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## ABSTRACT

At first order, plate tectonics controls paleobathymetry both by determining the changes in the geographical location of the lithosphere and the changes in its vertical level (through the mechanism of thermal subsidence). For this reason, knowledge of the tectonic motions leading to the separation of South America and Africa provides the keys to modelling paleobathymetry. Here, we present a series of high resolution paleobathymetric reconstructions for the South Atlantic. With the plate tectonic model of Perez-Diaz et al. (2014) as the starting point, the modelling procedure follows a number of steps. First, we calculate an "idealised" basement surface by applying plate-cooling theory to seafloor ages and integrating the results with COTZ depths as predicted by removing the effects of post-breakup processes on their present-day bathymetry. Then, we refine the depths of this basement surface to account for the effects of sedimentation, variations in crustal thickness and mantle fluctuations. Some steps within this process are relatively well understood and so are their associated uncertainties, such as modelling thermal subsidence. Others, such as dynamic topography modelling, are more susceptible to errors due to the large number of assumptions they require and, in some cases, (such as modelling of COTZs) uncertainties are much more difficult to quantify due to the sometimes poor understanding of the processes shaping these areas. We present early Cretaceous to present paleobathymetric reconstructions of the South Atlantic. Most of the paleodepths are accurate to <1 km, offering a strong quantitative basis for studies of paleocirculation, paleoclimate and paleobiogeography. Circulation in an initially salty and anoxic ocean, restricted by the topography of the Falkland Plateau, Rio Grande Ridge and Walvis Rise, favoured deposition of thick evaporites in shallow water of the Brazilian-Angolan margins. This ceased as seafloor spreading propagated northwards, opening an equatorial gateway to shallow and intermediate circulation. This gateway, together with subsiding volcano-tectonic barriers would have played a key role in Late Cretaceous climate changes. Later deepening and widening of the South Atlantic, together with gateway opening at Drake Passage would lead, by mid-Miocene (~15 Ma) to the establishment of modern-style thermohaline circulation.