Geophysical Research Abstracts
Vol. 13, EGU2011-11697, 2011
EGU General Assembly 2011

Reconstructing the Scotia Sea: an evaluation of existing plate reconstructions and their kinematic and dynamic implications

Rainer Nerlich (1,2), Stuart Clark (1), and Hans-Peter Bunge (2)

(1) Simula Research Laboratory, Department of Computational Geosciences, Oslo, Norway (rainer@simula.no), (2) Department of Earth and Environmental Sciences, Geophysics, Munich University, Munich, Germany (bunge@lmu.de)

The Scotia Sea Region in the South Atlantic is a complex tectonic area, mainly characterized by back-arc spreading processes active on various time scales. It has played a key role for the global climate, as the opening of Drake Passage possibly led to the onset of the Antarctic Circumpolar Current (ACC). Unfortunately, geophysical data for this region is relatively sparse and plate reconstructions suffer from disagreement about the ages of much of the seafloor in the region. In particular, the ambiguity dating magnetic lineations for the Protector, Dove, and Discovery basin allows for several scenarios for the Scotia Sea to form. Other great uncertainty lies in the central Scotia Sea: here models suggest it could either be a Mesozoic South American plate fragment or a Miocene back-arc basin. Furthermore, the nature of Discovery Bank, an elevated area in the southeast of the Scotia Sea, has remained controversial. It has been interpreted as a remnant arc of a former subduction zone in the northern Weddell Sea, or as stretched continental fragment probably originating from the tip of South America. We present these scenarios using digital reconstructions of the different lithospheric components and calculate the dynamic topography of each basin using sediment thickness estimations from literature, including error estimation, where available. Our results show mostly isostatically compensated crust or little dynamic topography of up to 500 m for the former Phoenix Plate and Western Scotia Sea, respectively. The central Scotia Sea, if a Miocene age is assumed, shows a very similar appearance with respect to its westerly neighbors. The idea of a Mesozoic central Scotia Sea plate fragment, on the other hand, leads to a strong positive dynamic topography signal of more than 1.5 km. As for the East Scotia Sea, negative dynamic topography of approximately 1 km was calculated. Furthermore, we observed a trend in the dynamic topography, that is a slight increase from north to south. These results may indicate a lateral mantle flow from underneath West Scotia, around the northern rim of the central Scotia and as far as East Scotia, where the negative dynamic topography may be related to overriding of the Sandwich trench slab. The relative high dynamic topography signal in the basins of southern Scotia Sea may relate to the hypothesized remnant arc, the Discovery Bank, and may be an explanation for potential blockage of lateral mantle flow in this region.