

Southern Scotia Sea basins as archives of global environmental changes

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Abstract

The Scotia Sea is a complex area located in the Southern Ocean, to the east of Drake Passage. Structural highs of a continental nature, from the former continental bridge between South-America and the Antarctic Peninsula, surround the southern abyssal plains (e.g. Dalziel et al., 2013; Eagles and Jokat, 2014). The small basins distributed over the southern Scotia Sea opened in a back-arc context resulting in the formation of major gateways for the Global Thermohaline Circulation (e.g. Tarakanov, 2012). The interplay between tectonics, oceanography and climate is explored in this work to trace a regional evolution linked to water mass interchange between the Weddell Sea and the Pacific and Atlantic oceans. The basins' stratigraphic architecture is studied in detail through a seismo-stratigraphic and morpho-structural analysis of available multichannel seismic profiles.

The resulting evolutionary model of the Scotia Sea entails the onset of formation of the Scotia Sea during Paleogene. Later, eastward progress of the Scotia Arc took place during Neogene and Quaternary times. Within the latter phase, a primary change in the tectonic stress field of the Scotia Sea occurred related to the end of the Weddell Sea subduction in early Miocene and entailed the first change in the stratigraphic pattern of the Scotia Sea basins (Maldonado et al., 2014; Pérez et al., 2014). A second major change in the stratigraphic pattern took place in the middle Miocene and is tied to adjustments in the oceanographic context due to the opening of main gateways around the Scotia Sea coeval with tectonic readjustments (Maldonado et al., 2006). This allowed the intrusion of Weddell Sea Deep Water into the Scotia Sea, shifting the former Circumpolar Deep Water to a northern position and establishing the former as the bottom flow of the southern Scotia Sea, up to the Present. Late Miocene and Late Pliocene oceanographic modifications with intrusion of some intermediate water masses on the area and enhanced the Weddell Sea Deep Water circulation in conjunction with climatic and tectonic episodes (Pérez et al., 2017).

Regional changes are recorded in the sedimentary stacking pattern of the Scotia Sea, while regional tectonic and oceanographic events involved in phases of intense plate tectonic activity and ice-sheet oscillations in Antarctica can be related to global tectonic and climatic events. The coeval occurrence of tectonic, oceanographic and climatic events points to close interplay between these factors and have been recorded in the sedimentary record of the south Scotia Sea basins.

Keywords: Scotia Sea; Weddell Sea Deep Water; Circumpolar Deep Water; sedimentary control factors

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