Late Eocene-Miocene sedimentation in the southeastern margin of the South Orkney Microcontinent, Drake Passage, Antarctica: Evidence for a major marine transgression

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Abstract

The opening of the Drake Passage-Scotia Sea leading up to the free transfer of water masses between the Pacific and Atlantic oceans was a major event which drastically affected sedimentation patterns, global oceanic and atmospheric circulation, Antarctic climate and ice sheet evolution. In particular, the established circulation led to the development of the eastward flow of the Antarctic Circumpolar Current (ACC), which likely contributed to the development/evolution of the continent-wide glaciation in Antarctica during the Eocene-Oligocene Transition (EOT; ~34 Ma).

Previous works suggest that the initial deepening of the seaway at the EOT led to the isolation of the South Orkney Microcontinent (SOM) from the West Antarctic continental margin due to the formation of Powell Basin [1]. Paleogeographic reconstructions place the SOM ~700 km northwest of its present-day location during the late Eocene. Therefore, the Cenozoic sedimentary record of Ocean Drilling Program (ODP) Leg 113 at Site 696 in the southeastern margin of the SOM was selected in order to gain a deeper understanding of the record of the gateway opening, subsequent deepening, and related paleoceanographic evolution of this sector of the Drake Passage. This work consists of a detailed sedimentological study of the interval extending from the late Eocene to the middle Miocene [2; 3], based on visual core descriptions and conventional sedimentological, petrographic and SEM analysis. Further ichnological, high-resolution core scanners incorporating X-ray fluorescence (XRF) and magnetic susceptibility (MST), biostratigraphic and paleomagnetic analysis are being carried out.

From bottom to top, the following sediment facies have been defined: (1) Facies-VI: sandy mudstone with abundant skeletal grains including assemblages of benthic foraminifera and mollusks (bivalve and gastropod shells). (2) Facies-V: glauconitic sandy mudstone. (3) Facies-IV: silty to sandy mudstone. (4) Facies-III: claystone and clayey mudstone locally intercalated

with black carbonaceous-rich mudstone bands. (5) Facies-II: sandy mudstone with glauconite-bearing sandstone facies. (6) Facies-I: mud-bearing diatom ooze.

In general terms, the identified sediment facies record a progressive deepening-upward trend extending from the late Eocene to the Miocene, starting from a shallow-water depositional environment (i.e. above the drop-off of the West Antarctic continental margin). The only exception is Facies-II that may record a minor regressive event with increased sediment supply or an uplift event. Along this evolutionary pattern, the most distinctive events are recorded during the EOT and marked by a process of syn-depositional glauconitization under conditions of slow sedimentation and rapid sea-level rise during the late Eocene and by oceanic anoxic events during the Oligocene.

Although the EOT in this Site is well constrained, an Oligocene-Miocene age model based on paleomagnetic data combined with biostratigraphic ages for the Site 696 is being developed to improve the chronostratigraphic framework and will strengthen the connection with well-known climatic events.

Keywords: Drake Passage, South Orkney Microcontinent, Eocene-Oligocene transition, Paleoceanography.

References

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