Sediment deposition in response to the glacial-interglacial changes on the continental slope of eastern Pennell-Iselin Bank in the Ross Sea, Antarctica

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Abstract

In order to understand the growth and retreat of glaciers in response to the glacial-interglacial changes, subglacial marine sedimentary sequences have been studied extensively in the continental shelf areas of the Ross Sea. The purpose is to comprehend the glaciomarine sedimentation change on the continental slope of eastern Pennell-Iselin Bank in the Ross Sea, using three gravity cores (C1, C2, C3) and three box cores (BC1, BC2, BC3) collected from sites (RS14-1, 2, 3), respectively, across the continental slope to the eastern side of the Pennell-Iselin Bank during XXIX° (2014) PNRA expedition (Rosslope II project). Several sedimentological (grain size, magnetic susceptibility), elemental (XRF), geochemical (biogenic opal, total organic carbon, total nitrogen, C/N ratios, $CaCO_3$), and isotopic ($\delta^{13}C$ and $\delta^{15}N$ of organic matter) parameters were measured along sediment cores with AMS ^{14}C dating of bulk sediments. Core-sediments consist mostly of hemipelagic sandy clay or silty clay with scattered IRDs (Ice-Rafted Debris). A comparison of sediment properties between box cores and the top of gravity cores reveals that the loss of sediment during sampling is trivial. Sediment colors of gravity cores alternate between brown and gray downward. Based on the variation patterns of sediment properties, sediment lithology was divided into different units (A and B), and subunits (B1 and B2). AMS ^{14}C dates and sediment properties assign Unit A, Unit B1, and Unit B2 to interglacial, deglacial, and glacial conditions, respectively. Unit A represents the Holocene and interglacial sediments deposited mainly by the suspension settling of biogenic particles with IRDs in the open marine condition. Unit B1 reflects the deglacial sediments with an increase in IRDs showing the transition of sediment properties from Unit B2 to Unit A by the retreat of subglacial ices. Unit B2 is characterized by different sediment properties, mainly supplied by the continuously lateral melt-water plume or distal part of debris flow originating from the front of grounding floes in the subglacial continental shelf under the ice shelf during the glacial period. Thus, Unit B contains mostly reworked and eroded sediments from the continental shelf with scattered IRDs. The influence of subglacial continental shelf sedimentation in terms of melt-water transport and/or distal stage of debris flow was limited as far as to the middle slope areas (Site 2) during the deglacial and glacial periods. The deeper Site 1 remains in seasonally open marine conditions during the glacial period, due to the peaks of biogenic opal and TOC contents.

Keywords: sediment property, subglacial activity, continental slope, Ross Sea