

Early glaciation already during the Early Miocene in the Amundsen Sea, Southern Pacific: Indications from the distribution of sedimentary sequences

The distribution and internal architecture of seismostratigraphic sequences observed on the Antarctic continental slope and rise are results of sediment transport and deposition by bottom currents and ice sheets. Analysis of seismic reflection data allows to reconstruct sediment input and sediment transport patterns and to infer past changes in climate and oceanography. We observe four seismostratigraphic units which show distinct differences in location and shape of their depocentres and which accumulated at variable sedimentation rates. We used an age-depth model based on DSDP Leg 35 Site 324 for the Plio/Pleistocene and a correlation with seismic reflection characteristics from the Ross and Bellingshausen Seas, which unfortunately has large uncertainties. For the period before 21 Ma, we interpret low energy input of detritus via a palaeo-delta originating in an area of the Amundsen Sea shelf, where a palaeo-ice stream trough (Pine Island Trough East, PITE) is located today, and deposition of this material on the continental rise under sea ice coverage. For the period 21-14.1 Ma we postulate glacial erosion for the hinterland of this part of West Antarctica, which resulted in a larger depocentre and an increase in mass transport deposits. Warming during the Mid Miocene Climatic Optimum resulted in a polythermal ice sheet and led to a higher sediment supply along a broad front but with a focus via two palaeo-ice stream troughs, PITE and Abbot Trough (AT). Most of the glaciogenic debris was transported onto the eastern Amundsen Sea rise where it was shaped into levee-drifts by a re-circulating bottom current. A reduced sediment accumulation in the deep-sea subsequent to the onset of climatic cooling after 14 Ma indicates a reduced sediment supply probably in response to a colder and drier ice sheet. A dynamic ice sheet since 4 Ma delivered material offshore mainly via AT and Pine Island Trough West (PITW). Interaction of this glaciogenic detritus with a west-setting bottom current resulted in the continued formation of levee-drifts in the eastern and central Amundsen Sea.