Basement architecture and sedimentary cover in the Amundsen Sea Embayment: Parameters for controlling and reconstructing ice-sheet expansion?

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An understanding of the glacial history of the Amundsen Sea Embayment and Pine Island Bay (PIB) is essential for proposing models on the future development of the West Antarctic Ice Sheet (WAIS). It requires both an understanding of the tectonic history, because basement morphology and inherited erosional features may control the flow direction of ice-sheets and the influx of Circum-Polar Deep Water (CDW) at later times. We, therefore, attempt to reconstruct the tectonic history with the aim to search for basement features and crustal boundaries which may be correlated to the flow and dynamics of ice-sheet advances.

The Amundsen Sea Embayment of West Antarctica is in a prominent location for a series of tectonic and magmatic events from Paleozoic to Cenozoic times. Seismic, magnetic and gravity data from the embayment and PIB reveal the crustal thickness and significant tectonic features. NE-SW trending magnetic and gravity anomalies and the thin crust indicate a former rift zone which was active during or in the run-up to the breakup process between Chatham Rise and West Antarctica before or at 90 Ma. NW-SE trending gravity and magnetic anomalies, following a prolongation of Peacock Sound, indicate the extensional southern boundary to the Bellingshausen Plate which was active between 79 and 61 Ma. It is likely that the prominent Pine Island Trough follows a structural boundary between the crustal blocks of Ellsworth Land and Marie Byrd Land.

We will show newly collected multichannel seismic reflection data from inner PIB which are interpreted in context with published reconstructions for the retreat history in this area. Differences in the behaviour of the ice-sheet are shown to exist for the western and eastern parts of PIB due to basement structures affecting the inflow of CDW which has been made responsible to the recent fast retreat of the Pine Island and Thwaites Glacier systems.