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Glaciation of East Antarctic margin: understanding from seismic startigraphy

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Advance of the Antarctic Ice Sheet upon the shelves at the early stage of Antarctic glaciation has triggered active down-slope depositional processes which resulted in formation of deepwater canyons (channels) and levee deposits as well as debris flow packages on the continental margin. Along-slope currents contributed also notably into depositional process (especially in the Neogene) to form contourite drifts. This study is mostly based on more than 50 000 km of MCS data acquired by Russian Antarctic Expedition during almost 20 years between 7^o E and 115^oE with use of other seismic data, available from SDLS, and DCDP/ODP drilling reports.

Unified seismic stratigraphy model worked out for the East Antarctic (EA) Margin includes 5 mayor unconformities (disconformities) numbered up-section from “1” to “5”, with letter abbreviation depending on an offshore region (RLS - in the Riiser-Larsen Sea; CS - in the Cosmonaut Sea, Cooperation Sea and Davis Sea and WL - in the Wilkes Land Margin), where unconformity “1” is break-up one. Post-breakup unconformities “3”, “4” and “5” are correlated continuously throughout the EA margin and are thought to be isochronous interfaces caused by environmental changes in the Southern Ocean. MCS data analysis shows that facies related to down-slope processes (channels/levees and/or debris flow/turbidites) occur on the different stratigraphic levels, which are controlled by mayor unconformities. These facies appear above unconformity “3” on the western Wilkes Land margin, above intermediate level between unconformities “3” and “4” in the central Cooperation Sea (off Prydz Bay) and above unconformity “4” almost everywhere on the EA margin. Unconformity “5” marks the wide development of current-controlled drifts on the Antarctic continental

rise.

Based on seismic data interpretation, ODP results and existing numerical models of Antarctic glaciation, it is proposed: 1) Ice sheet first reached western Wilkes Land margin (flowing from the Gamburtsev Mountains and Vostok Subglacial Highlands through the Aurora Subglacial Basin) probably in the late (middle?) Eocene - early Oligocene. Contemporaneously, fluvial environments dominated on some margins to the west (Davis Sea, Prydz Bay). 2) Afterwards, likely in the early Oligocene, ice sheet advanced on the Prydz Bay shelf (flowing from the Gamburtsev Mountains through the Lambert Valley). 3) In the middle - late Oligocene ice sheet expanded onto the most of EA shelves to form the widespread deep-water unconformity “4” which thus corresponds to the onset of continental-scale glaciation. 4) From the early - middle Miocene, westward-flowing bottom currents encompassed the EA margin (except possibly Princess Elizabeth margin where no any evidence of bottom current activity was identified). 5) Rate of glaciogenic sedimentation was noticeably higher on the western Wilkes Land margin and off Prydz Bay suggesting more active sedimentary input and likely faster ice movement toward these regions from the hinterland.