Early Glacial High-energy Fluvial System of East Antarctica

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Abstract

Fore mayor seismic horizons numbered up-section from WL1 to WL4 are identified in sedimentary cover of the Wilkes Land continental margin. Horizon WL1 is the top of the rift unit and corresponds to asynchronous breakup between Australia and Antarctica at about 80 Ma and 65 Ma. WL2 is an early post-breakup boundary of the late Upper Cretaceous age. Horizon WL3 is most prominent reflector in seismic records and marks a remarkable change in seismic patterns from parallel-bedded below to more complex above with predominant development of channel-related facies. Its age is defined by the relationship with the top of the oceanic magmatic crust dated from magnetic anomalies. WL3 onlaps a basement close to anomaly 20o and so is not older than 43 Ma. Horizon WL4 marks the initiation of active mass-wasting processes on the East Antarctic margin caused by large-scale Antarctic glaciation at the latest Eocene. On the Wilkes Land margin, the unit between WL3 and WL4 is variable in thickness and forms a very prominent submarine deep-water fan off the Totten Glacier (central Wilkes Land margin between 115 E and 122 E; Fig. 1). It is 1.5-2.5 km thick and occupies about 250 000 square km. In other parts of the Wilkes land margin unit WL3-WL4 is much thinner and pinches out locally in the area of IODP Site 1356 which discovered a sedimentary hiatus from 48 to 34 m.y.
The Late Eocene deep-water fan off the Totten Glacier was deposited by at least two generations of large submarine channel/levee systems which probably formed during marine regressions (sea level low-stands). The rate of sedimentation within the fan was unprecedentedly high and exceeded 200-250 m/m.y., i.e. was 5-10 times higher than in the other parts of the East Antarctic margin (Fig.1). Active supply of sediments to the central Wilkes Land margin indicates the development of a high-energy fluvial system with a large drainage basin during the Late Eocene, from c. 43 to 34 Ma. Initiation and existence of this system were supposed to be caused by the early Antarctic glaciation in Central Antarctica (in the area of Gamburtesev Mts and Vostok subglacial Highlands) at this time. River energy, input of clastic material to the margin and, ultimately, submarine fan formation were governed by fluctuations (growth and decay) of ice caps and sea-level changes.

Keywords: submarine fan, fluvial system, early Antarctic glaciation.

Fig.1 Thickness of Late Eocene (43-34 Ma) unit on the East Antarctic margin.