A significant acceleration of ice volume discharge preceded a major retreat of a West Antarctic paleo–ice stream

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The gray shade shows the extent of the Bindschadler Ice Stream (B) in the Whales Deep Basin on the eastern Ross Sea outer continental shelf during the LGM.
• This is a dip-oriented seismic line from the axis of the Whales Deep Basin. The southern end is near the modern calving front and the northern end extends to the shelf edge.

• Seismic correlations show that at least 7 grounding zone wedges (GZWs are labeled 1 thru 7 from oldest to youngest) were deposited by the Bindschadler Ice Stream after it retreated from the continental shelf edge.

• The small ice shelf fronting the paleo-Bindschadler Ice Stream broke up at the end of GZW4 deposition.
Here’s an isopach map showing the total sediment volume of GZWs 1 thru 7.
Column 2, row 1 shows the total volume of GZW sediment.

Column 1 rows 2 and 3 show our estimate of sediment deposited prior to and after the ice shelf break up (ISBU).

Columns 3 and 4 show the chronology of the grounding stillstands and durations.

From those data, we can calculate the paleo-BIS sediment flux (column 5).

From the sediment flux, we can estimate paleo-BIS velocity (column 8).

The paleo-BIS velocity averaged 500 ±120 m a⁻¹ over the entire grounding but was 1350 ±580 m a⁻¹ following the ice-shelf breakup at 12.3 ±0.2 kyr BP.

The long-term average is close to the estimated balance velocity of the ice stream (580 ±100 m a⁻¹), but the post-ISBU velocity implies an ~30 Gt a⁻¹ mass imbalance just before the the paleo-BIS grounding line retreated >200 km.

This case of paleo-ice stream retreat shortly after an ISBU substantiates the current concerns about a near-future rapid retreat of major glaciers in the Amundsen Sea sector (e.g., Pine Island Glacier and Thwaites Glacier).