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# Glacial morphology and sediment formation in the Mertz Trough, East Antarctica

Katherine McMullen [a,*], Eugene Domack [a], Amy Leventer [b], Caroline Olson [b], Robert Dunbar [c], Stefanie Brachfeld [d]

[a] *Department of Geosciences, Hamilton College, Clinton, NY 13323, USA*
[b] *Department of Geology, Colgate University, Hamilton, NY 13346, USA*
[c] *Department of Geological and Environmental Sciences, Stanford University, Stanford, CA 94305, USA*
[d] *Department of Geology, Montclair State University, Upper Montclair, NJ 07043, USA*

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**Abstract**

The *Nathaniel B. Palmer* 01-01 cruise produced a SeaBeam map showing unprecedented detail of the bathymetry in the Mertz Trough of East Antarctica. In addition, seismic reflection surveys and sediment core collection were completed in the region. The morphology of the Mertz Trough is combined with core data to interpret the sequence of events that occurred in this area since the Last Glacial Maximum. These complementary data indicate that an ice sheet once covered the Mertz Trough, which deposited diamicton and formed mega-scale glacial lineations during glacial maximal conditions and grounding-line wedges during recession. An erosional feature caused by subglacial meltwater breaching at least one of the grounding-line deposits is also recognized, along with a fan of sediment deposited seaward of the breach. Sediment cores from the Mertz Trough consist of two distinct units, the diamicton deposited subglacially and a diatom mud and ooze, deposited after the ice retreated. The latter unit has been preferentially deposited in deeper areas of the trough as a hemipelagic drape and shows that a change in the nature of the diatom unit occurred about 3300 $^{14}$C yr BP.


*Keywords:* Antarctica; Bathymetry; Deglaciation; Glacial geology; Glaciomarine sedimentation; Ice streams

## 1. Introduction

Underwater troughs and banks dominate the Wilkes Land continental shelf of East Antarctica. Troughs occur seaward of major glacial outlets where ice-flow converges and where velocity increases, ice streams can form (Anderson et al., 2001; Wellner et al., 2001). Evidence of past ice streaming is shown by the presence of mega-scale glacial lineations. In West Antarctica, it has been shown that areas with maximum discharge have ice sheet profiles that are generally low and the ice sheet usually terminates in an ice shelf (Anderson et al., 2001), which is believed to have happened in the Mertz Trough. As ice sheets become unstable, they change in size. Instability can occur because of a rise in sea level and/or thinning of the margin, both of which result in landward retreat of the ice margin (Anderson et al., 2001). This retreat could occur gradually (Domack et al., 1999) and/or episodically, or catastrophically. As ice retreated in the Mertz Trough, it paused in at least two locations leaving grounding-line wedge deposits. Grounding-line wedges consist of dipping beds of dia-

* Corresponding author. Tel.: +1 315 859 4699; fax: +1 315 859 4744.
*E-mail address:* kmcmulle@hamilton.edu (K. McMullen).

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micton overlain by horizontal layers of diamicton (Benn and Evans, 1998). They are formed from sediment that is transported beneath the glacier towards its margin and are deposited when ice pauses during its retreat (Anderson et al., 2001). Grounding-line wedges form as ice pushes subglacial debris at the grounding line, deforming sedimentary beds and originating gravity flows, which add layers of sediment to the ice-distal side of the wedge (Powell and Domack, 2002). Another source of sediment in grounding-line wedges is from undermelt of an ice shelf (Powell and Domack, 2002). Both megascale glacial lineations and grounding-line wedges are present in the Mertz Trough and are composed of diamicton with overlying diatomaceous sediments.

The Mertz Trough is located off the George V Coast of Wilkes Land to the northeast of the Mertz Glacier Tongue and to the north of the Ninnis Glacier Tongue, covering an area of about 5000 km$^2$ (Fig. 1). It was

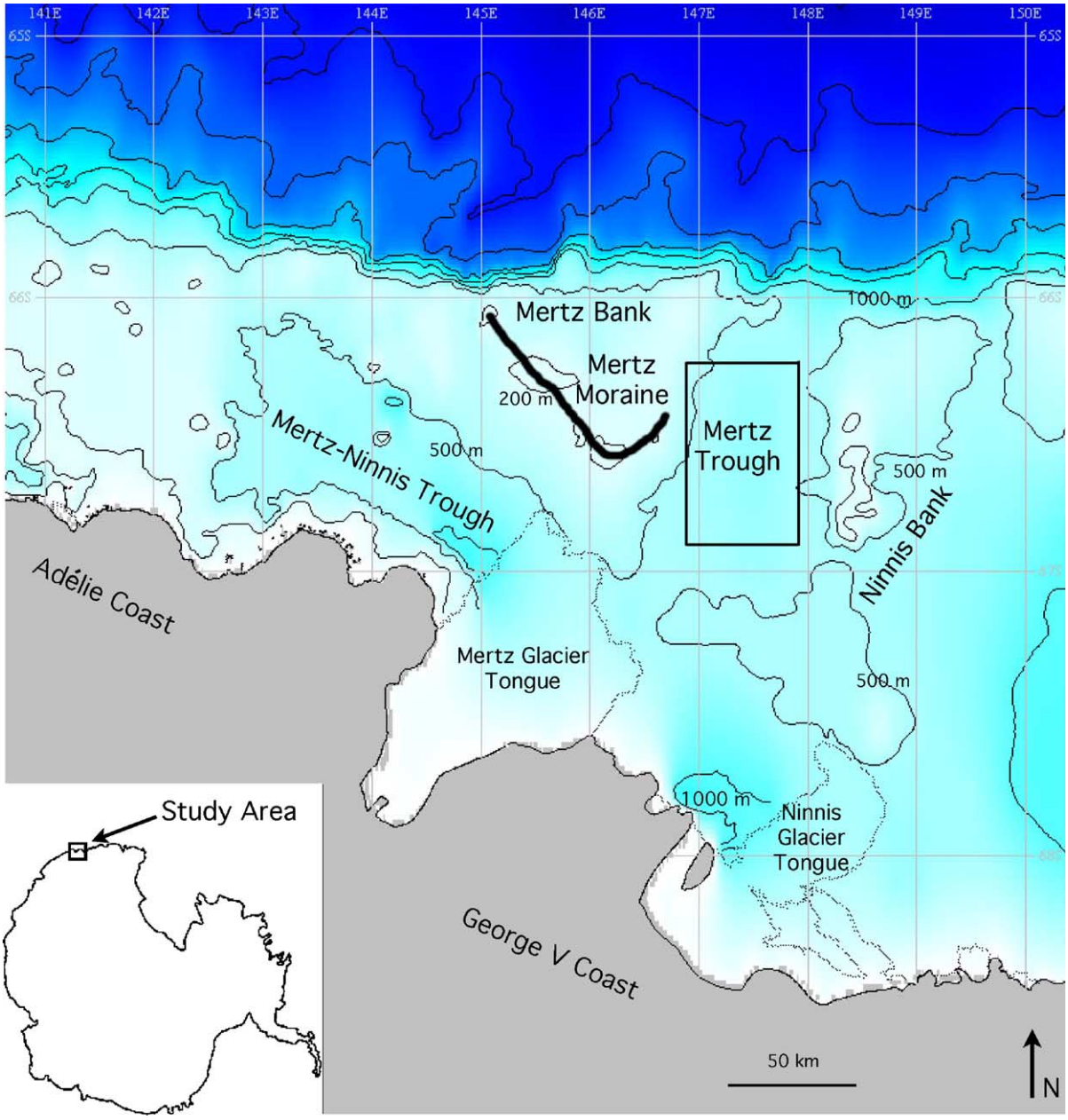


Fig. 1. Location map of study area in the Mertz Trough, East Antarctica. Mertz Moraine from Eittreim et al. (1995) and Barnes (1987). GEBCO bathymetric contours in 500 m intervals, also included is 200 m contour line.