

THIS MATERIAL MAY BE PROTECTED BY COPYRIGHT LAW (TITLE 17 US CODE).

DD698204

# CISTI ICIST

CI-04954963-5

Document Delivery Service  
in partnership with the **Canadian Agriculture Library**

Service de fourniture de Documents  
en collaboration avec la **Bibliothèque canadienne de l'agriculture**

**THIS IS NOT AN INVOICE / CECI N'EST PAS UNE FACTURE**

KAREN MCGREGOR  
INTERLIBRARY LOAN DEPT  
BAILEY/HOWE LIBRARY  
UNIVERSITY OF VERMONT  
  
BURLINGTON, VT 05405  
UNITED STATES

**ORDER NUMBER:** CI-04954963-5  
**Account Number:** DD698204  
**Delivery Mode:** ARI  
**Delivery Address:** vtul.uvm.edu  
**Submitted:** 2004/09/21 08:30:56  
**Received:** 2004/09/21 08:30:56  
**Printed:** 2004/09/21 13:06:26

Direct	Periodical	OCLC	UNITED STATES
\$25.00 IFM			
\$ 25.00			

Client Number: 8679659 /BIERMAN, PAUL  
**Title:** 28TH INTERNATIONAL ARCTIC WORKSHOP : ARCTIC AND ALPINE ENVIRONMENTS,  
PAST AND PRESENT : PROGRAM WITH ABSTRACTS : MARCH 12-14, 1998 /  
Author: INTERNATIONAL ARCTIC WORKSHOP (28TH : 1998 : BOULDER, COLO.)  
Vol./Issue: VOL XVIII  
Date: 1998  
Pages: 111-113  
Article Title: MARSELLA, K "REVISED GLACIAL CHRONOLOGY OF THE PANGNIRTUNG FJORD  
REGION,"  
Report Number: OCLC 45524931  
Publisher: BOULDER, COLORADO : INSTITUTE OF ARCTIC AND ALPINE RESEARCH, C1998.  
Information Source: OCLC &FORMAT: BOOK! LENDER: \*CAI,CAI,CAI

**INSTRUCTIONS: BILLING NOTES: FEIN 03-0179440 / UMI: B980011 / SAME AS ABOVE/UMI A/C  
AAG39B CLIOID: Z0041715/////**

**Estimated cost for this 3 page document: \$10.2 document supply fee + \$0  
copyright = \$10.2**

The attached document has been copied under license from Access Copyright/COPIBEC or other rights holders through direct agreements. Further reproduction, electronic storage or electronic transmission, even for internal purposes, is prohibited unless you are independently licensed to do so by the rights holder.

Phone/Téléphone: 1-800-668-1222 (Canada - U.S./E.-U.) (613) 998-8544 (International)  
www.nrc.ca/cisti Fax/Télécopieur: (613) 993-7619 www.cnrc.ca/icist  
info.cisti@nrc.ca info.icist@nrc.ca



# REVISED GLACIAL CHRONOLOGY OF THE PANGNIRTUNG FJORD REGION, CUMBERLAND PENINSULA, BAFFIN ISLAND, BASED ON $^{10}\text{Be}$ AND $^{26}\text{Al}$ EXPOSURE AGE DATING

Marsella, K.A.\*, Bierman, P.R., Davis, P.T.<sup>1</sup>, and Caffee, M. W.<sup>2</sup>

*Dept. of Geology, University of Vermont, Burlington, VT 05405*

<sup>1</sup>*Dept. of Natural Sciences, Bentley College, Waltham, MA 02154*

<sup>2</sup>*Center for Accelerator Mass Spectrometry, Lawrence Livermore National Laboratory, Livermore, CA 94550*

*\*Currently at INSTAAR, University of Colorado, Boulder, CO 80309*

*marsella@spot.colorado.edu; pbierman@zoo.uvm.edu; pdavis@bentley.edu; caffee1@llnl.gov*

Paired analyses of in situ-produced  $^{10}\text{Be}$  and  $^{26}\text{Al}$  provide direct age estimates for glacial deposits in the Pangnirtung Fjord region, southern Cumberland Peninsula, Baffin Island (Fig 1.). Our glacial chronology of the area is based on thirty-seven gneissic boulder samples and six samples of ice-molded gneissic bedrock that yield late Wisconsinan exposure ages (Fig. 2). Specifically, the prominent Duval moraines, previously estimated to be early Wisconsinan (100-60 ka; Dyke, 1977, 1979) in age, formed during the late Wisconsinan, between 25 and 10 ka (Marsella *et al.*, 1996) and represent a significant ice advance on southern Cumberland Peninsula. Because the Duval moraines appear to mark the most extensive ice advance in the area, their age is important for constructing regional glacial chronologies and determining the timing and extent of the last glaciation.

Numerous cosmogenic isotope measurements allow us to revise prior estimates of the timing and extent of glaciation in the Pangnirtung Fjord area (Fig. 2.). Extensive ice filled Pangnirtung Fjord and advanced to the Duval morainal position at least 25,000 years ago. The Duval moraines were deposited during a long-lived (~15,000 years) ice advance in the late Wisconsinan. At about 10,000 years, ice retreated from the Duval moraines. Just prior to that time ice also retreated from the mouth of Kingnait Fjord. A large glaciomarine delta at 99-m a.s.l. formed along Kingnait Fjord between 11,000 and 10,000 years ago as meltwater and sediment drained across the foreland from the Duval morainal position. Following the deposition of this delta, the ice appears to have retreated rapidly, producing at least two recessional moraines before retreating from Pangnirtung Fjord. Ice filling the Kolik tributary valley appears to have retreated just prior to the fjord ice.

Extensive ice, filling Pangnirtung Fjord, represents an expansion of the Penny ice cap; ice from Pangnirtung Fjord may have merged with expanded Laurentide ice in adjacent Cumberland Sound (Jennings, 1993; Jennings *et al.*, 1996). The observation that none of the Duval moraines slope down towards the fjord shores suggests that the two ice masses merged. The ice in Cumberland Sound advanced beyond the sound before 14,000 years ago, but had retreated into the sound by about 10,200 years ago (Jennings *et al.*, 1996). Ice retreat from the Cumberland Sound area may have initiated the rapid retreat of ice in Pangnirtung Fjord, and possibly Kingnait Fjord by causing rapid down-draw and ice calving at the fjord mouths.

Our revised chronology of the Pangnirtung region, based on cosmogenic exposure dating, demonstrates that on southeastern Baffin Island, ice extent was not restricted to the fjord heads, that an expanded Penny icecap filled the fjord during the late Wisconsinan at the same time as Laurentide ice filled adjacent Cumberland Sound (Jennings *et al.*, 1996), that the maximum extent of ice occurred during the late Wisconsinan, and that ice filled the fjord for approximately 15,000 years before rapid retreat at approximately 10 ka.

The temporal and spatial distribution of cosmogenic exposure ages from the Pangnirtung Fjord area not only indicates that the late Wisconsinan margin was far more extensive than previously believed, but also provides evidence suggesting that observed weathering zones were produced through differing basal ice regimes, and that the morphologically distinct Duval moraines do not mark a significant chronological boundary. Our study demonstrates the utility of

cosmogenic isotopes for dating and distinguishing glacial features produced during the Wisconsinan, provides evidence supporting an expanded northeastern margin of the Laurentide icesheet, and suggests that while warm-based ice actively eroded the fjord and valleys, cold-based ice may have persisted in regions above 700 m a.s.l.

References cited:

- Dyke, A. S., 1977, Quaternary geomorphology, glacial chronology, and climatic and sea-level history of southwestern Cumberland Peninsula, Baffin Island, Northwest Territories, Canada [Ph.D. dissertation thesis]: Ph.D., University of Colorado.
- Dyke, A. S., 1979, Glacial and sea-level history of southwestern Cumberland Peninsula, Baffin Island, N.W.T., Canada: *Arctic and Alpine Research*, v. 11, p. 179-202.
- Jennings, A. E., 1993, The Quaternary history of Cumberland Sound, southeastern Baffin Island: The marine evidence: *Geographie physique et Quaternaire*, v. 47, p. 21-42.
- Jennings, A. E., Tedesco, K. A., Andrews, J. T., and Kirby, M. E., 1996, Shelf erosion and glacial proximity in the Labrador Sea during and after Heinrich events (H-3 or 4 to H-0) as shown by foraminifera, *in* Andrews, J. T., Austin, W. E. N., Bergsten, H., and Jennings, A. E., eds., *Late Quaternary Palaeoceanography of the North Atlantic Margins*: Boulder, Geological Society of America, p. 29-49.
- Marsella, K.A., Davis, P.T., Bierman, P.R., and Caffee, M.R., 1996, Stage II "big ice" on Baffin Island: *Geological Society of America, Abstracts with Programs*, v. 28, no. 7, p. A-433.

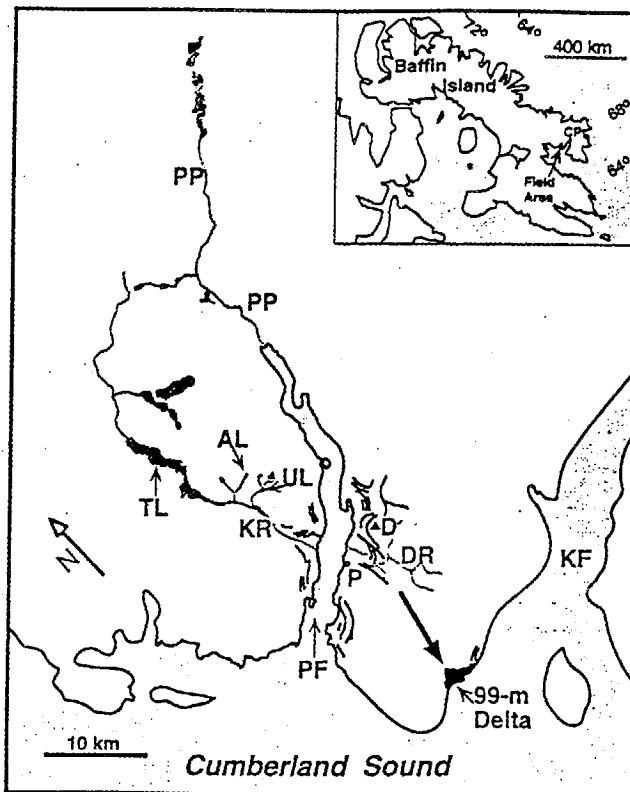


Figure 1 Location map of Baffin Island (inset) and Pangnirtung Fjord field area on southeastern Cumberland Peninsula, Baffin Island. Black line segments represent Duval moraines; large black arrow indicates large meltwater channel that drained from Duval moraines to form delta (black). CP=Cumberland Peninsula; PF=Pangnirtung Fjord; KF=Kingnait Fjord; P= Pangnirtung hamlet; D=Mt. Duval; DR= Duval River; KR=Kolik River; TL=Tasikutaq Lake; AL=Amarok Lake; UL=Ukalik Lake; PP=Pangnirtung Pass; 99-m delta labeled.

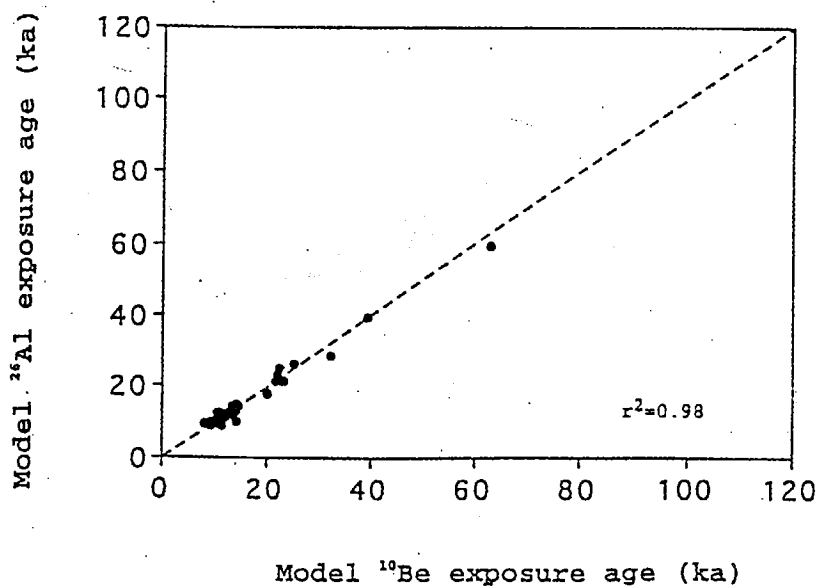


Figure 2.  $^{26}\text{Al}$  vs  $^{10}\text{Be}$  model exposure ages (ka) for gneissic boulder and bedrock samples from glacial features in the Pangnirtung Fjord region. Dashed line represents 1:1 ratio of  $^{26}\text{Al}$  and  $^{10}\text{Be}$  model ages;  $r^2=0.98$