

Microfacies Analysis of a Transect along a Pennsylvanian to Early Permian Shelf Margin and its Adjacent Slopes: Sverdrup Basin, Arctic Canada*

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Abstract

The Sverdrup Basin, Arctic Canada, contains one of the world's largest Pennsylvanian to Early Permian shelf margins at a thickness of up to 2.0 km and a length of 400 km. Eight stratigraphic sections were measured along Borup Fiord, Ellesmere Island, in order to construct a shelf to basin transect. Petrographic analysis and field observations identified four main depositional environments: (1) a back reef, (2) reef, and (3) shelf comprised dominantly of the Nansen Formation, and (4) a slope setting comprised dominantly of the Hare Fiord Formation.

Introduction

The Sverdrup Basin is host to world-class outcrops making it an ideal location to study large-scale depositional systems. Borup Fiord, Ellesmere Island contains near continuous outcrops of Pennsylvanian to Early Permian carbonate strata displaying shallow water facies of the Nansen formation (back reef, reef and shelf environments) and deeper water facies of the Hare Fiord Formation (slope environments). The Nansen and Hare Fiord formations represent a correlative shelf to basin sequence.

Method/Results

Eight stratigraphic sections were measured in an east-west orientation along Borup Fiord resulting in a transect along a carbonate margin and its adjacent slopes. Petrographic analysis was used to determine biota, mineralogy and rock fabric relating to depositional energy and the classification of microfacies. These microfacies were linked to determine stratigraphic relationships and cyclicity of stratigraphic intervals. Preliminary petrographical analysis and field observations have revealed a laminated dolomitic back reef, phylloid algae and *Palaeoaplysinia*

rich reef mounds, cyclical shelf sediments and slope deposits with preserved Bouma sequences ([Figure 1](#)). More than 2,900 m of true stratigraphic thickness were measured and 723 samples were collected.

Conclusions

The Nansen and Hare Fiord formations form a correlative shelf to basin sequence within the Sverdrup Basin, Cyclicality within the Nansen Formation during this time are related to fluctuations in sea level, likely due to Gondwanaland glacier advance and retreat, leading to a series of high frequency transgressive-regressive sequences (Embry and Beauchamp, 2008). Preliminary results from petrographic analysis and field observations suggest a vast number of microfacies that contribute to the interrelationships between the shelf margin and the adjacent slopes.

Reference Cited

Embry, A., and B. Beauchamp, 2008, Chapter 13, Sverdrup basin *in* A.D. Miall, ed., The sedimentary basins of the United States and Canada: Elsevier, Amsterdam, The Netherlands, p. 451-471.

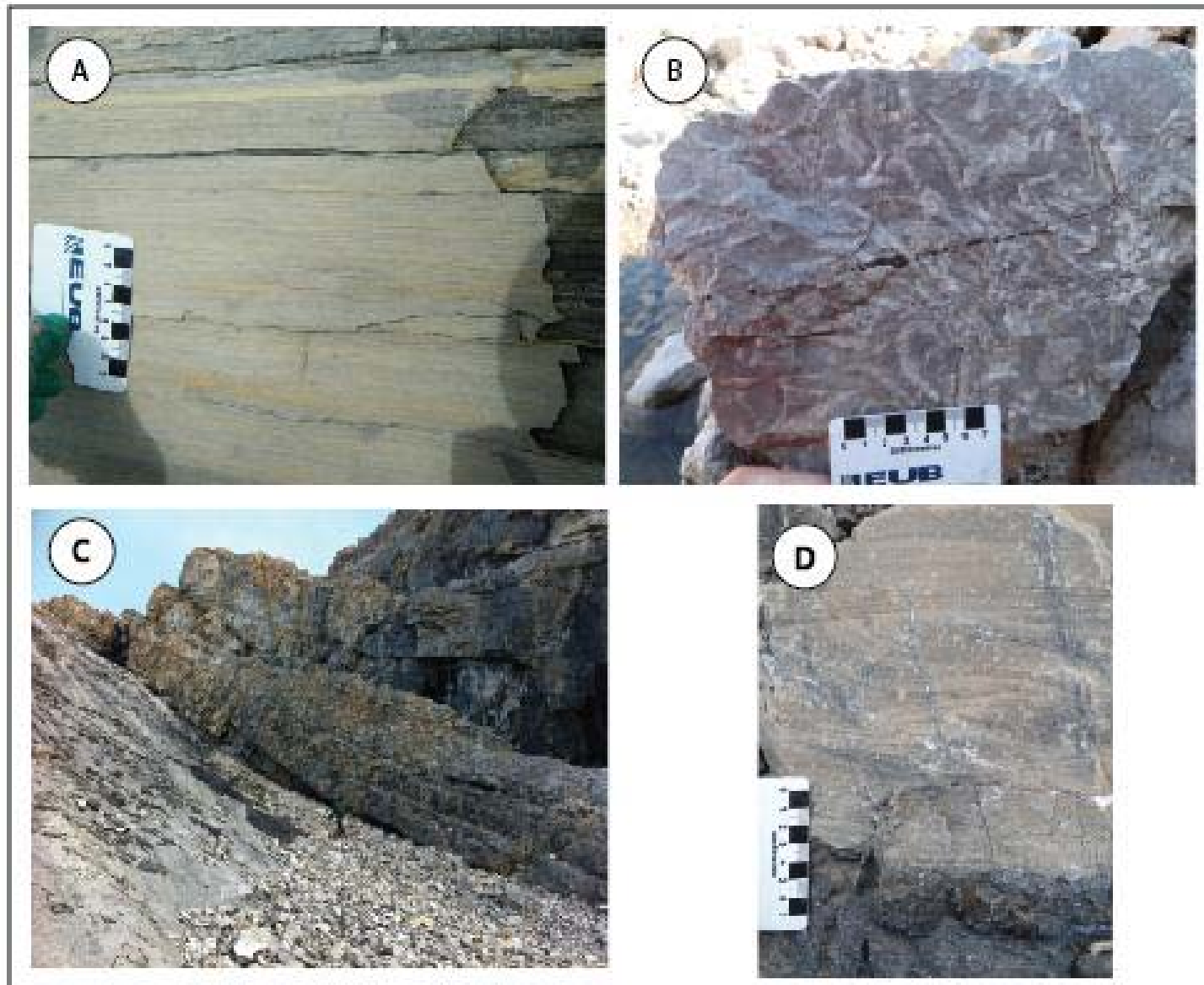


Figure 1. Outcrop photos displaying different carbonate environments throughout the shelf to basin transect. (A) Laminated back reef of the Nansen Formation. (B) Paleaplysinia-rich reef environment. (C) Photograph displaying a portion of cyclical shelf environment. (D) Well preserved Bouma sequence in the slope environment.