CORDILLERAN ICE SHEET IMPACT ON VANCOUVER ISLAND MARGIN SEDIMENTOLOGY, MARINE PRODUCTIVITY AND SEDIMENTARY GEOCHEMISTRY DURING THE LAST GLACIAL MAXIMUM

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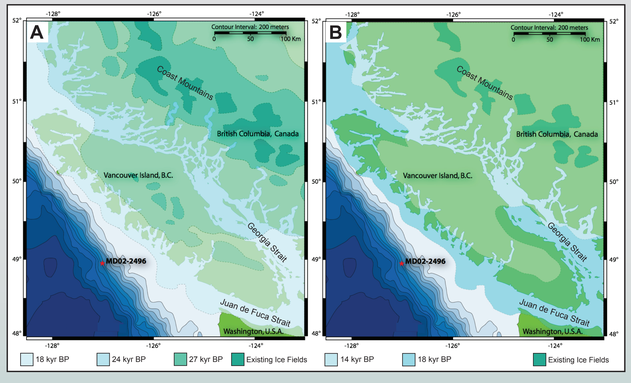
1. INTRODUCTION

The modern southwest British Columbian margin is highly productive during the summer upwelling season. However, what happened over the last 50 kyr? How did the advance and retreat of the Cordilleran Ice Sheet (CIS) affect coastal sedimentology, marine productivity and sedimentary geochemistry? Were sedimentary pore waters more or less oxygen depleted? High-resolution records from a 38-m long core provide an opportunity to answer such questions.

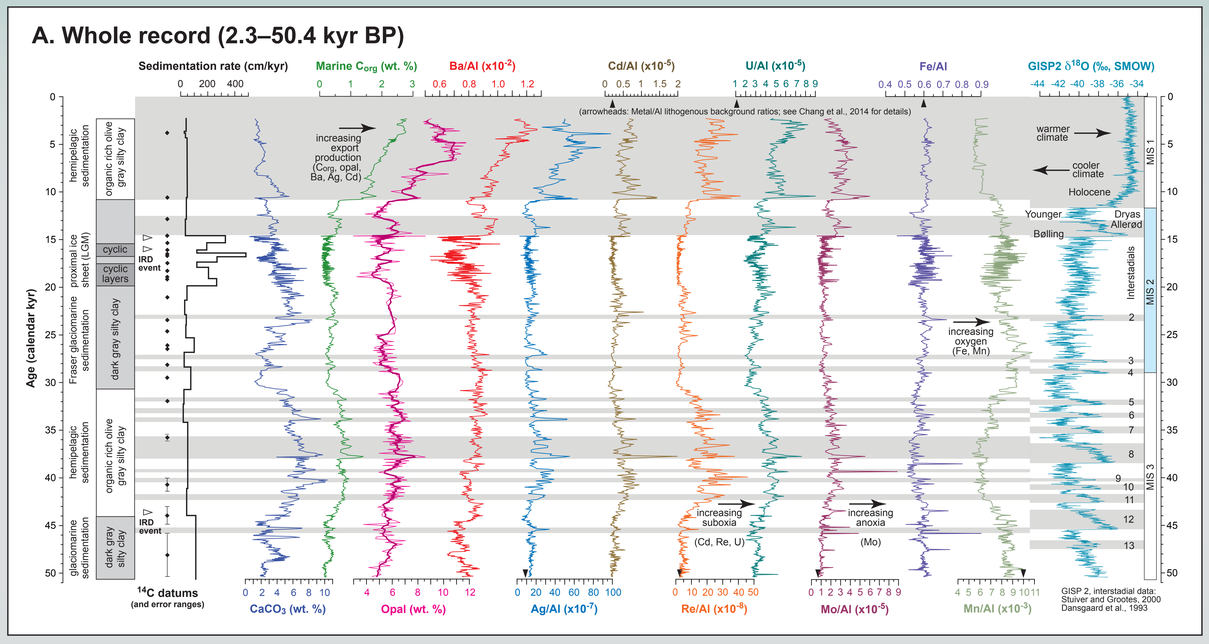
2. STUDY SETTING

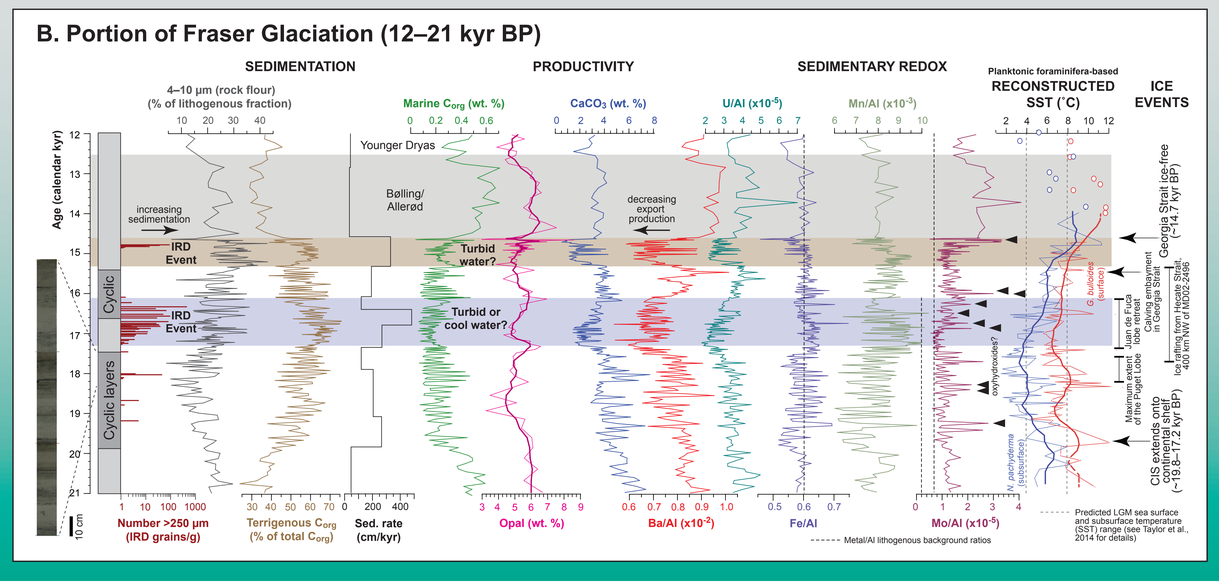


Core MD02-2496 (48˚58.47' N and 127˚02.14' W, 1243 m depth) recovered in 2002 by the R/V *Marion Dufresne*. Modern oxygen minimum zone ([O_2] ≤ 0.5 mL/L) in the region lies between 750 and 1300 m depth.

Growth (A) and decay (B) of the southern limb (Juan de Fuca lobe) of the Cordilleran Ice Sheet during the Last Glacial Maximum (LGM) (modified from Clague and James, 2002). Approximate ice sheet margins at different calendar dates are shown.

3. SEDIMENTARY AND GEOCHEMICAL RECORDS





4. SUMMARY

Advance and retreat of the Cordilleran Ice Sheet on the Vancouver Island continental margin greatly affected sedimentation patterns, marine productivity and sedimentary pore-water oxygen contents, as compared to ice-free time intervals.

These results indicate that the Vancouver Island margin is a sensitive region for recording biological, geological, oceanographic and climatic changes over glacial-interglacial cycles.

Whole record (A) shows that during warmer climates (MIS 1, Bølling/Allerød, and/or MIS 3 interstadials), there was:

- **increased export production (opal, C_{org}, Ag, Cd in diatoms; $CaCO_3$ in calcareous plankton; Ba, C_{org} in organic particles)**
- **Low Holocene $CaCO_3$ due to dissolution; low MIS 3 Ba due to dissolution from sulfate reduction**
- **hemipelagic sedimentation and more reducing sediments (higher Cd, Re, U [suboxic] and Mo [anoxic])**

During cooler climates (Younger Dryas, MIS 2, MIS 3 stadials, below 44 kyr BP), there was:

- **reduced export production**
- **glaciomarine sedimentation and less reducing sediments**
- **intermittent pore-water oxygenation (Fe and Mn above background, signifying Fe- and Mn-oxyhydroxide formation)**

During CIS proximity (starting at 19.8 kyr BP) (B):

- **ice approached within ~35 km of MD02-2496**
- **cyclic sedimentation resulted from glacial outburst floods**

During CIS retreat, beginning at 17.2 kyr BP, there was:

- **increased terrigenous sedimentation (high sedimentation rate, more ice-rafted debris [IRD], rock flour and terrigenous C_{org}) during two intervals of ice melting and calving**
- **corresponding decreased productivity, likely due to turbid waters and/or local input of low-temperature water from melting ice, not conducive for phytoplankton growth, despite a warming ocean**
- **coincident pore water oxygenation (increased Fe, Mn and Mo associated with oxyhydroxide formation) due to decreased organic matter burial and decay**

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