

Antarctic cryosphere variability during the Miocene Climatic Optimum: results from International Ocean Discovery Program (IODP) 374 Expedition, Ross Sea

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INTRODUCTION

The Miocene Climatic Optimum (MCO, ~17-15 Ma) possibly represents the best analogue to the end of the century warm climate state¹. Studying this time interval in marine sedimentary archives retrieved from close to the Antarctic continent holds the **potential to help predicting Antarctic Ice Sheet (AIS) (in)stability and the role of a warm ocean in the sensitivity of marine-based ice sheets**. Here we investigate the late Early to Middle Miocene (~ 17.8 to ~ 15.8 Ma) sedimentary record of Site U1521 retrieved during IODP Expedition 374^{2,3} to investigate the (in)stability of the AIS to warming.

IODP 374 SITE U1521

Site U1521 is located in the Pennell Basin (central Ross Sea) on the outer continental shelf (75°41.0351'S, 179°40.3108'W) at a depth of ~500 meters² (Figure 1). The location is selected to depict the response of the Western AIS to climate change

METHODOLOGY

We use palynology (dinoflagellate cysts, other aquatic palynomorphs, and pollen and spores) to study ocean conditions and cryosphere response during the MCO interval and increase the resolution to millennial timescales in a selected interval with 100% recovery (188 - 204 mbsf, cores 20R - 22R). (Red box in the Figure 2)

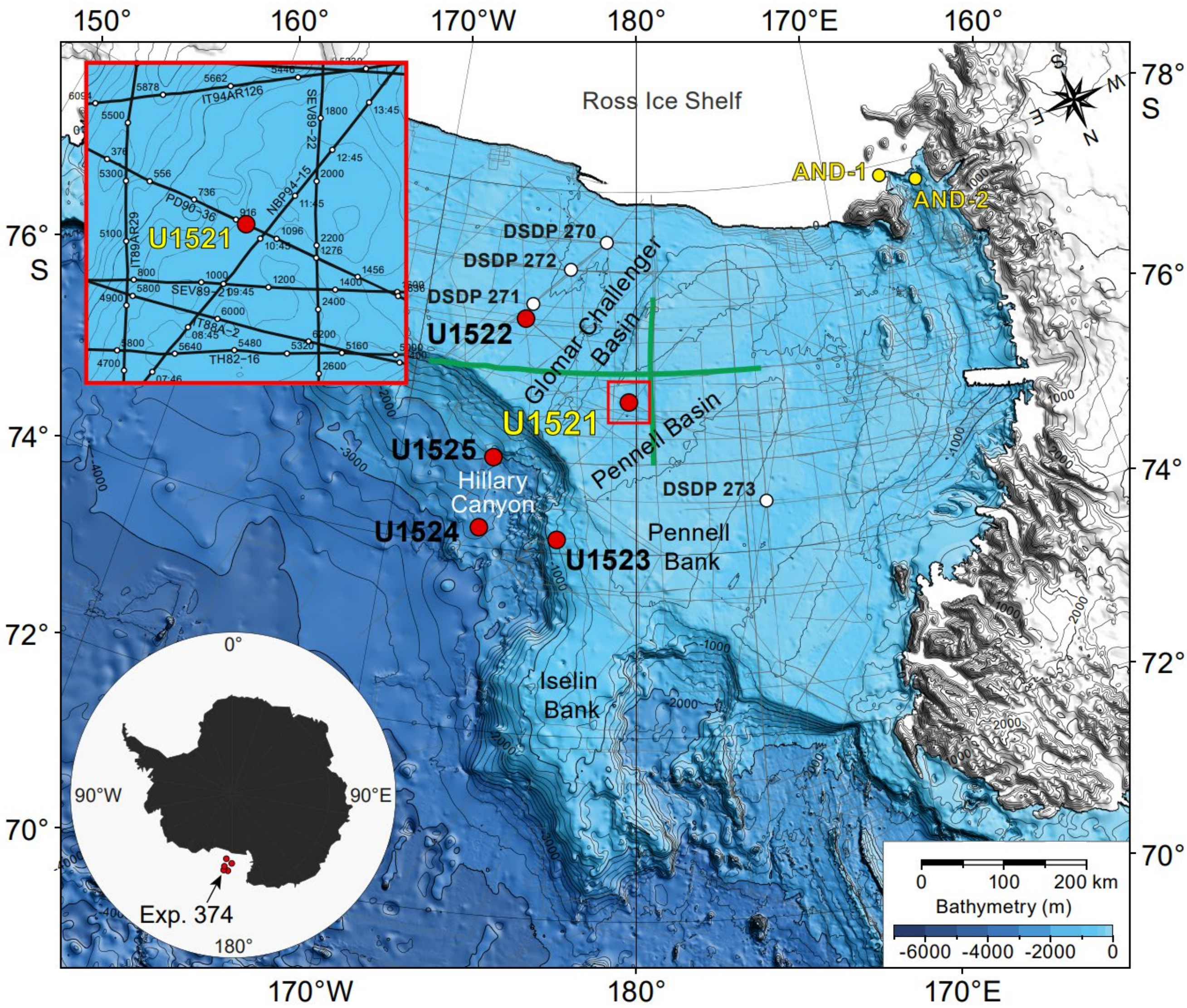


Figure 1: Location of Site U1521²

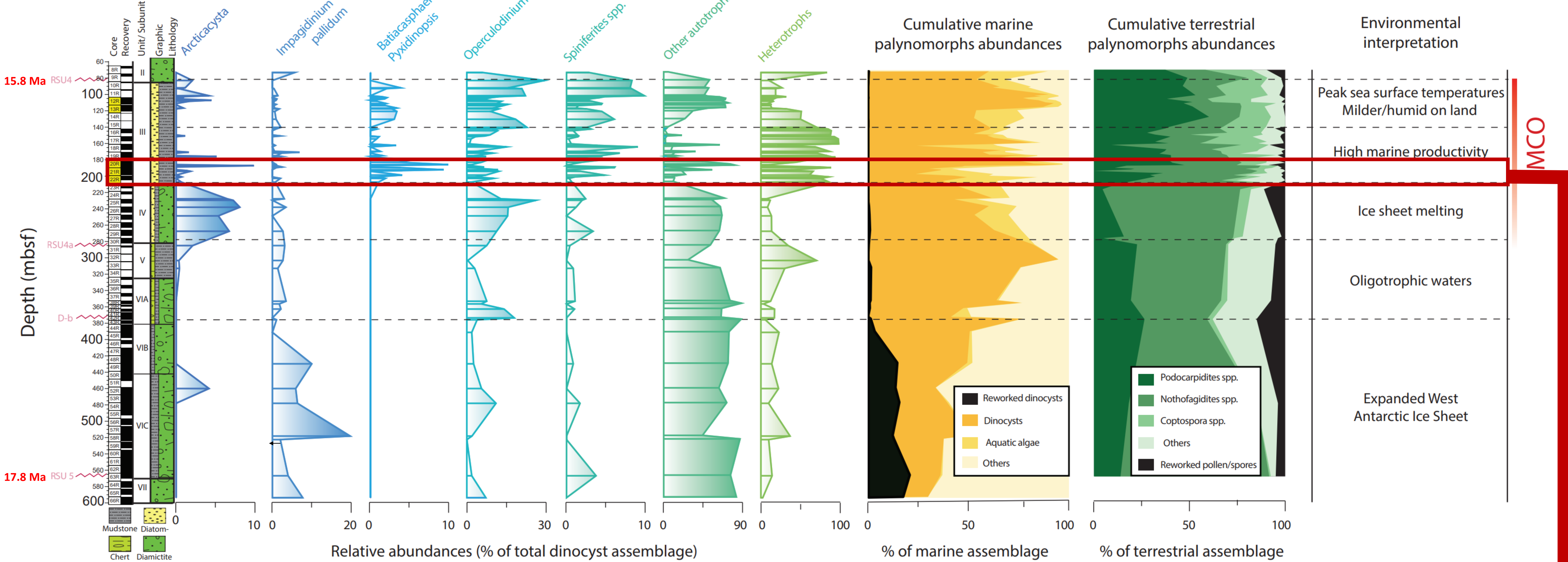


Figure 2: Relative abundances of dinoflagellate cysts (dinocysts) as a percentage of total dinocyst counts, cumulative marine palynomorph abundances, cumulative terrestrial palynomorph abundances and environmental interpretation plotted against lithological units². **Red box presents the selected interval (~16.6-16.7 Ma³).**

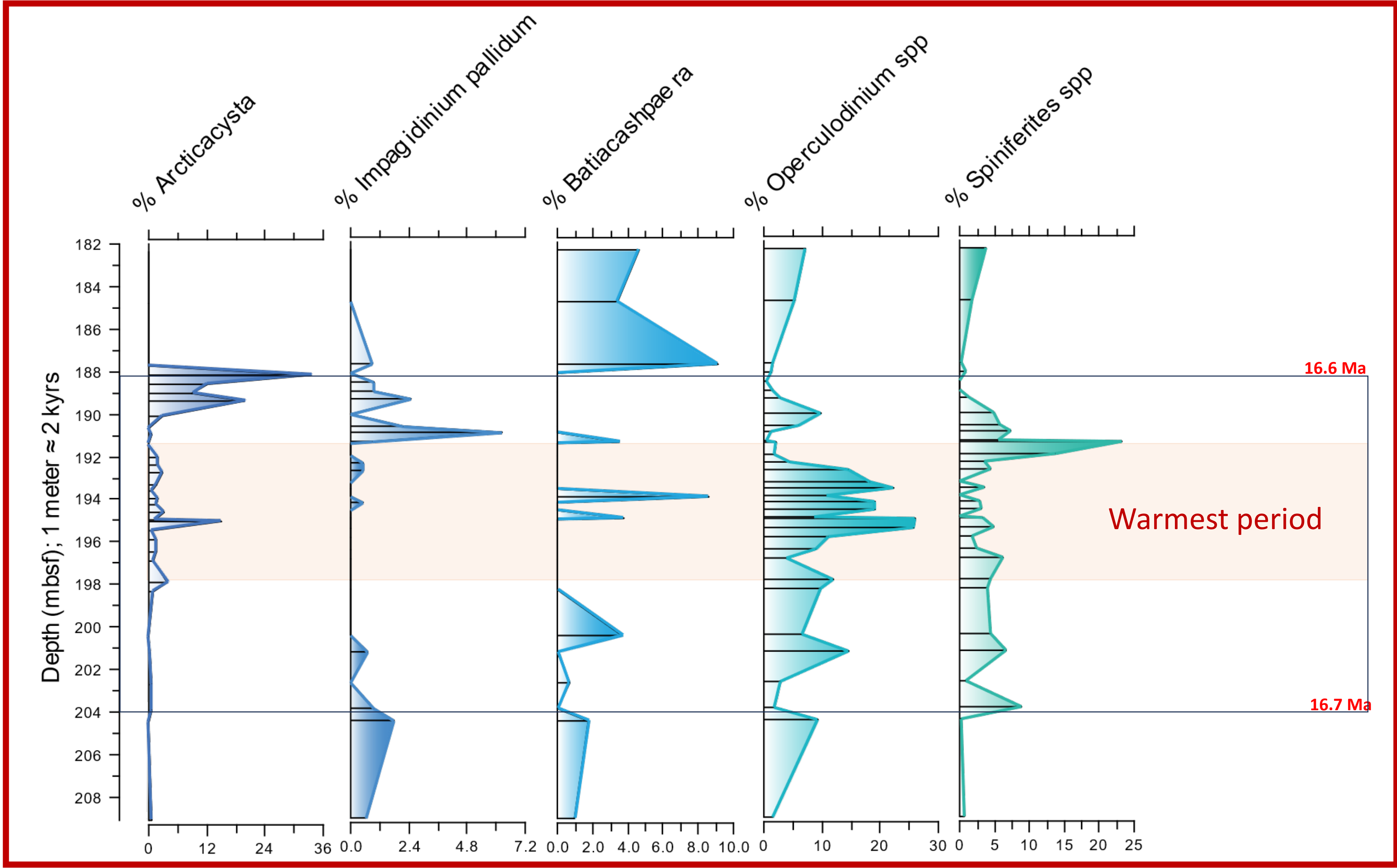


Figure 3: Relative abundances of dinocysts as a percentage of total dinocyst counts in the selected MCO interval at millennial-scale resolution.

RESULTS AND INTERPRETATION

The MCO interval is marked by an increase in freshwater algae indicating meltwater, followed by an increase in heterotrophic dinoflagellate cysts indicating high productivity (Figure 2).

Autotrophic dinoflagellate cysts occur, together with palynomorphs indicating increased and prolonged meltwater (Figure 2).

Operculodinium spp. and *Spiniferites* spp. abundances, currently absent south of the Polar Front (PF) are contrast with *Impagidinium* spp abundance (Figures 2 and 3).

Variability in ocean conditions at millennial timescale is detected by the variability in the abundance of *Operculodinium* spp. and *Spiniferites* spp. (Figure 3)