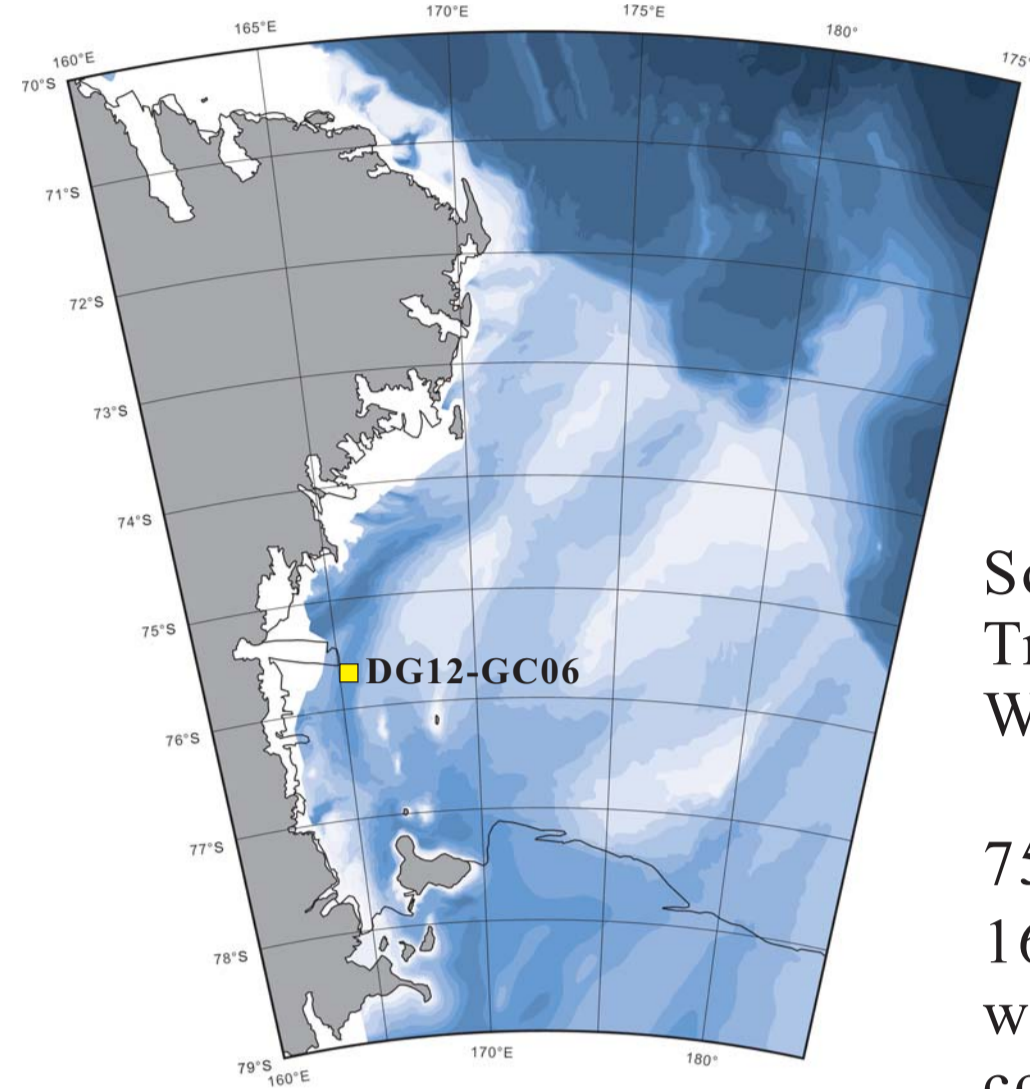


Open marine sedimentation in the southwestern Ross Sea during the Last Glacial Maximum

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Core location



Southern Drygalski Trough,
Western Ross Sea

75° 39.57'S
165° 23.84'E
water depth 859m
core length 3.96m
gravity core

Sediment facies and radiocarbon ages

Bulk AIO radiocarbon ages

- (0cm) 3,910 ± 30 yr BP
- (20cm) 5,280 ± 30 yr BP
- (40cm) 6,620 ± 30 yr BP
- (60cm) 7,190 ± 30 yr BP
- (80cm) 7,950 ± 30 yr BP
- (100cm) 9,640 ± 40 yr BP
- (119cm) 14,130 ± 50 yr BP
- (127cm) 12,060 ± 50 yr BP
- (172cm) 30,140 ± 170 yr BP

Facies 1
(0-124cm):
Bioturbated
olive gray
diatomaceous
mud

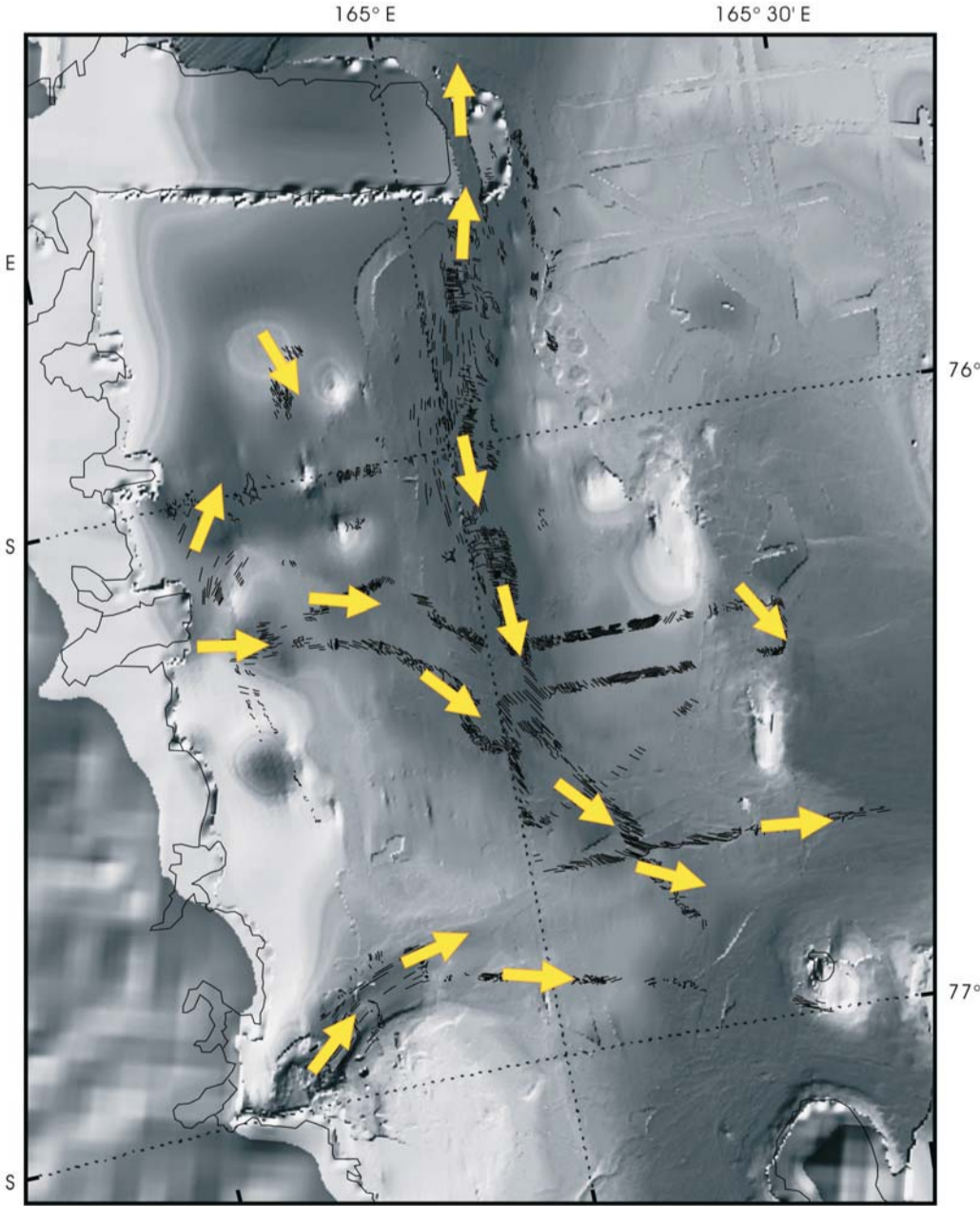
124-125: dark greenish gray mud
125-132: greenish gray mottled mud

172-173: greenish yellow mud
173-206: alternated
greenish gray and
dark greenish gray layers

Facies 2
(132-363cm):
Crudely-
stratified
diamicton

278-360: alternated
greenish gray and
dark gray layers

Facies 3 (363-396cm):
Greenish yellow
diatomaceous
mud



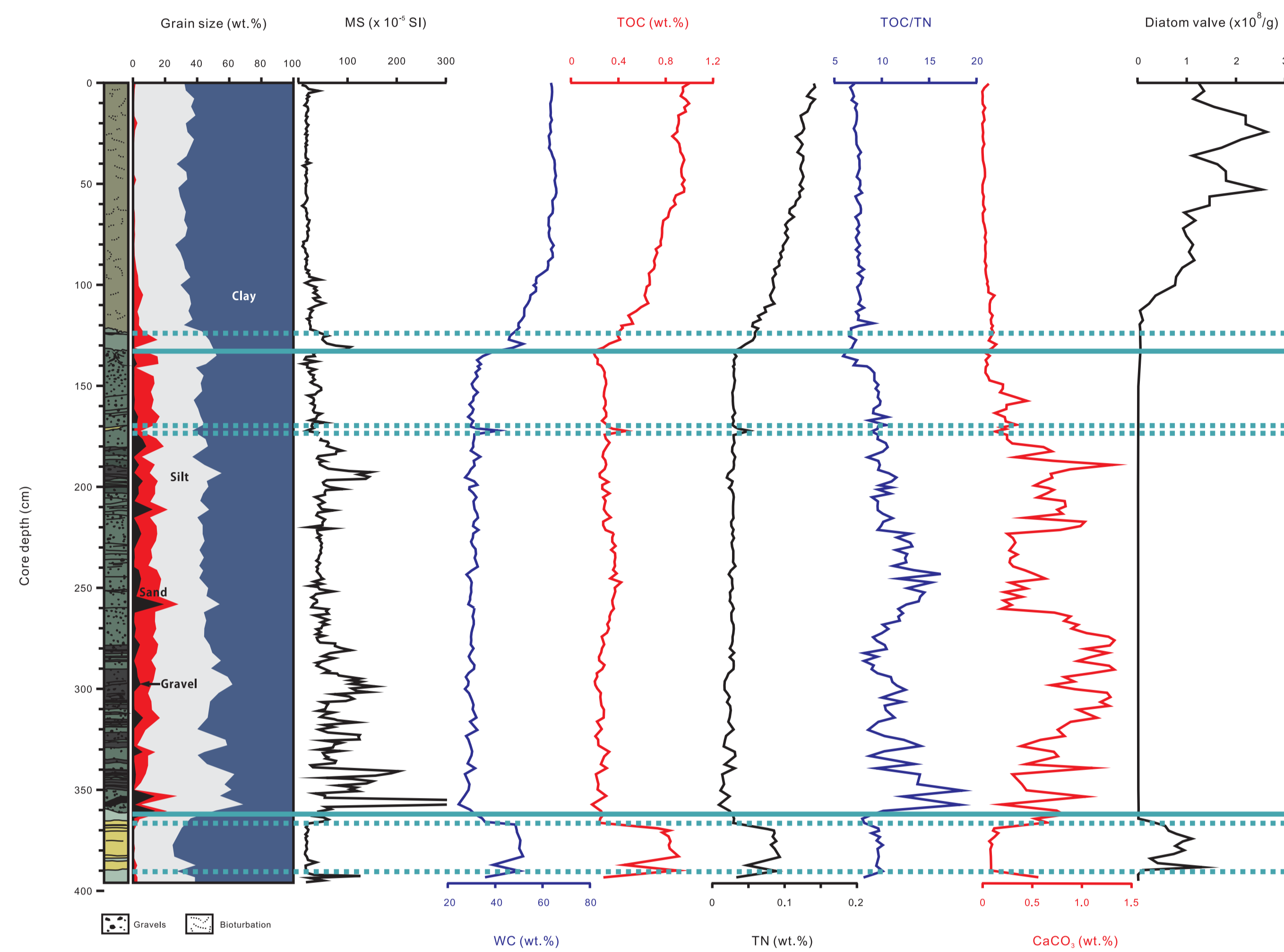
Glacial ice flow interpretation

Ramped pyrolysis radiocarbon ages

- (370cm) 22,700 ± 680 yr BP
- (370cm) 35,650 ± 280 yr BP
- (379cm) 32,500 ± 220 yr BP
- (383cm) 24,500 ± 860 yr BP
- (383cm) 39,250 ± 410 yr BP

Down-core variations in grain size and other proxies

Variations in Grain size distribution, magnetic susceptibility (MS), water content (WC), total organic carbon content (TOC), total nitrogen content (TN), TOC/TN, carbonate content (CaCO₃), and abundance of diatom valves

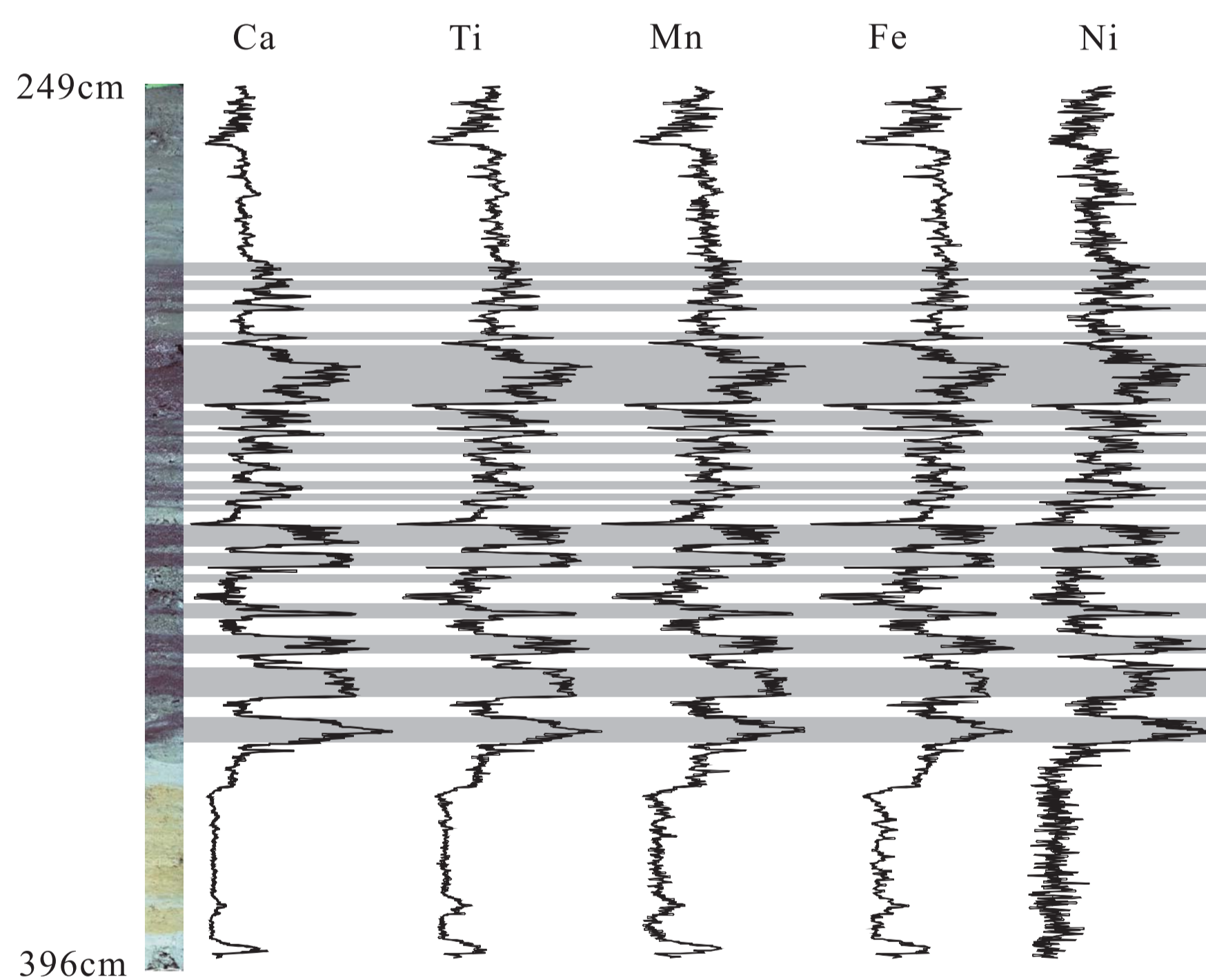


Facies 1:
diatomaceous mud
high TOC, TN
low TOC/TN
high diatom valve
→ seasonally open marine

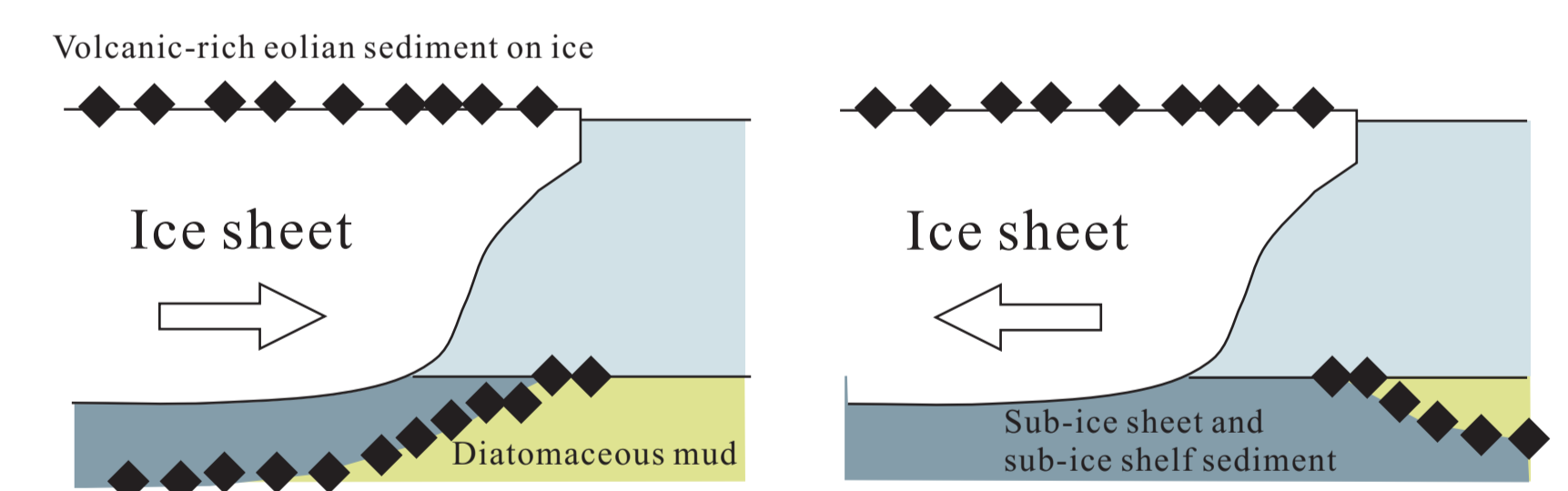
Facies 2:
stratified muddy diamicton
low water content
low TOC, TN
high TOC/TN
few diatom valves
→ sub-ice shelf ~ subglacial

Facies 3:
diatomaceous mud
high TOC, TN
low TOC/TN
high diatom valve
→ (seasonally) open marine

Origin of dark gray layers in Facies 2 (stratified diamicton)



- Stratigraphic position: between diatomaceous mud and diamicton
- Texture: sorting become worse upward
- Composition: ITRAX XRF scan reveals that the layers are high in Ca, Ti, Mn, Fe, and Ni.
- Interpretation: Calving line facies
: Concentration of eolian sediment on ice, rich in mafic volcanic/pyroclastic particles
→ Deposition onto the seafloor at the edge of ice shelf



Western Ross Sea glacial history during and since the LGM

1. Retreat of ice sheet from the western Ross Sea
: ~ 24.5 uncorrected ¹⁴C ky BP
: (seasonally) open marine environment persisted more than 1800 years
: can be a response to the Antarctic Isotope Maximum 2 (AIM2) event
2. Advance of ice sheet onto the western Ross Sea
: after ~22.7 uncorrected ¹⁴C ky BP
: Preservation of underlying mud layers suggests that this ice sheet did not ground onto the sea-floor (present water depth: 859m).
3. Final retreat of the ice sheet
: later than ~10 ky BP.
: Multibeam swath bathymetry indicates that the latest ice sheet in the southern Drygalski Trough retreated to the west.

Isotope records from Antarctic ice cores. The coldest period between 28 and 22 ky BP was interrupted by AIM2 ('2' on WDC graph) between 24 and 23 ky BP. (WAIS Divide Project Members, 2013, Nature)

