Ultra Clean Titanium Zodiac Winch and Sampling Bottles for Antarctica

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NIOZ is an institute of the Netherlands Organisation for Scientific Research (NWO)
Why Ultraclean?

Iron is an important trace element in the Oceans

- Iron limits primary production in over 40% of the oceans
- Iron therefore influences the biogeochemical cycles of:
  a) carbon
  b) nitrogen
  c) and many other bio-essential elements

There is a need to understand the biogeochemistry of iron at all levels from its chemistry in seawater up to its large scale distribution in the oceans!
The concentration of dissolved Fe in the modern ocean

\[ 0.00000001 \text{ gram iron per liter seawater} = 10 \times 10^{-9} \text{ gram per liter} \]

that is dissolved in 40 million liters of water

OR

\[ 1 \times 15 \times \text{ (a small amount of iron)} \]

Why Ultraclean?
Measuring trace metals in the Antarctic

Wishes:

• Winch in zodiac
• Electrically driven
• Maximum sampling depth 650 m
• 8 x 500 m sampling depth/day
• Ultra clean
Large to small scale
How to measure trace elements using a zodiac

Ultra clean deep sea winch
• Mounted on large vessels
• With or without own A-frame
• 8500 m Super Aram cable with fiber optics
• 23 tons including powerpack

Ultra clean winch Antarctic
• Mounted on zodiac
• No a-frame needed
• 700 m 6 mm cable
• 400 kg
Titanium winch specifications

- Electric winch
- 2 traction batteries (24V)
- 700 m Tiptolest cruising cable
- Cable length monitor
- 650 m depth rated
- Maximum speed 1m/sec
Winch specifications:
• Rated line pull: 20,000lbs (9072kg)
• Motor 24V: 6.2hp / 4.2 kw
• Gearing: 315:1

Accu’s specifications:
• 2 x 12V = 24V
• Normal conditions 185Ah, 0ºC → 111Ah
• 80% allowed discharge means 89Ah
• 48 kg each
Cable details:

- ‘Tiptolest cruising’
- Plaited 100% polyester yarn with plaited core
- Non floating and kinking
- Easy to split
- Sheet or halyard for middle loads
- 1100daN breaking load
Wire reader features:

- Totalizer and position display (6 digits)
- Set value, scaling factor, momentary signal duration and operating mode programmable
- Interface RS232 (RS422, RS485)
Ultraclean CTD
• 24 bottles in frame

Large to small scale
From 24 to 4 liter

Antarctica special
• 1 single bottle
Bottle specifications:

- Tripped in the traditional way using a messenger weight
- Standard rope clamp to mount and unmount
- NIOZ designed butterfly valves

Two versions

- PP
- PVDF (Polyvinylideenfluoride, illuminating)
Small bottle specifications:
• Same design as Ultraclean CTD sampler
• PP or PVDF (depends on sample type)
• NIOZ designed butterfly valves
• 4 liters
• High flushing rate (67% compared to 34%)
• Closed by messenger
Additional instrumentation

- SBE 19plus Seacat Profiler CTD
- Cyclops-7 Fluorometer
- SBE 43 Oxygen sensor
Using DFe to investigate glacier melt inputs
12 stations surface transect (DFe concentration at 5 m depth)

Decreasing DFe from Sheldon glacier to the offshore station

Sheldon Glacier can be a source of DFe
Modifications and future plans

- Modified motor and gears -> improved breaking system
- Electric motor with belt driven -> noise reduction
- Smoother running system

*Belt driven*
Questions?