Latitudinal variation in calcification: Vulnerability of Antarctic benthic calcifiers to ocean acidification

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Talk outline

• Background
• Sample sites and species
• Trends in calcification
• Shell structure & composition
• Cost of shell production
• Vulnerability of Antarctic benthic calcifiers
Background

- Calcified marine benthic invertebrates
  - Molluscs, brachiopods, echinoderms

- Very abundant in worlds oceans – key species in marine ecosystems

- Commercial value – shellfish aquaculture, pearl industry

- Staple food source for indigenous communities
Existing knowledge

• Poleward trends

  – In snails: thinner shells (Graus, 1973) & a reduction in ornamentation (Nicol, 1965; Nicol, 1967)

1) At high latitudes, shell-building materials (Ca$_2^+$) are more difficult to remove from seawater (Clarke, 1990; Clarke, 1993) because of the saturation state of CaCO$_3$

  Dissolution: annual loss 3-40 µm in thickness at 0°C (Harper, 2000)

2) Fewer predators (MacArthur, 1972; Paine, 1996)

  – Absence of shell damaging predators
CaCO₃ saturation state

- Lower saturation state in polar regions
- Climate change likely to have a large impact on polar regions. Acidification (Orr et al., 2005) and ocean warming (Clarke et al., 2007)
Sample locations

78.95°N Arctic, Svalbard
50.95°N Southampton, UK
1.22°N Singapore
19.13°S Townsville, Australia
37.49°S Melbourne, Australia
45.87°S Dunedin, New Zealand
67.34°S Rothera, Antarctica

51.67°S Falkland Islands

Samples were collected by SCUBA or from the intertidal (shallow 0 – 30 m depth)
Gastropod snails
Superfamily: Buccinoidea

Bivalve clams
Genus: *Laternula*

Brachiopods
Genus: *Liothyrella*

Urchins
Family: Echinidae

Tropical
*Cantharus fumosus*

*L. boschasina*

*L. truncata*

Scale bars = 1 cm

Temperate
*Cantharus fumosus*

*Buccinum undatum*

*L. recta*

*Liothyrella neozelanica*

*Psammechinus miliaris*

Polar
*Neobuccinum eatoni*

*L. elliptica*

*Liothyrella uva*

*Stereochirus neumayeri*

Antarctic interest: chose most abundant Antarctic benthic calcifiers
Phylogenetically constrained: closely-related species (congeneric, confamilial)
Sorry, unpublished data have been removed from this presentation. We expect these data to be published next year. For further information please contact Sue-Ann Watson at suwa@noc.soton.ac.uk

All photos © Sue-Ann Watson, unless otherwise stated
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References


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