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The Variability of Si/Ca Ratios in Ostracod Shells

Abstract

This project attempted to study the variability of Si/Ca in ostracod shells compared to other trace-elements like magnesium, strontium, sodium etc, which act as paleo-proxies to help understand past paleoenvironmental conditions (like temperatures and salinity).

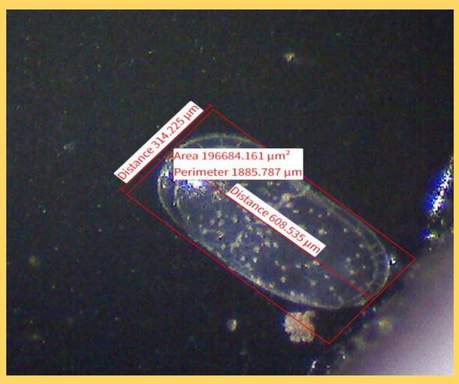
Introduction

Through analysing the shell chemistry as magnesium and strontium calcium ratios of ostracods, we can eventually reconstruct past environmental conditions like water temperature and salinity (Rodriguez et al. 2019). It is ideal to use ostracods for "long-term quantitative paleoecological analyses" because of their high abundance and excellent fossil record (Hong 2016). Preservation, instars and inter-species variability seem to affect the element/calcium ratios (E/Ca) of ostracod shells.

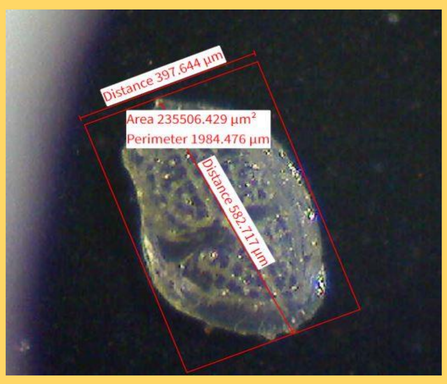
Since we do not have data of concentration for Mg, Ca or Sr in Hong Kong waters (but we can make estimations considering the concentration of sea water and freshwater), the objective was to study how the water concentration of silica affects the shell concentration of Si. Using the relative change of Si in ostracod shells in comparison to the other trace-elements – mostly Mg, Sr and Na, I aimed to explore if preservation, instars and inter-species affect Si/Ca and therefore its potential as paleoenvironmental proxy.

Materials & Methods

I prepared and cleaned over 100 samples of ostracods collected from various areas and sites in Hong Kong. Two species of ostracods were used - *Sinocytheridea impressa* (SC) and *Neomonoceratina delicate* (NM).

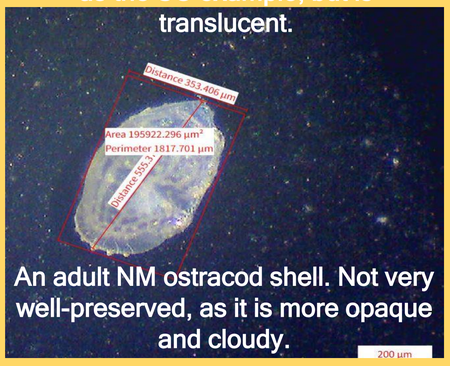


An adult SC ostracod shell I collected. It is a nice well-preserved one, given its transparence and clear

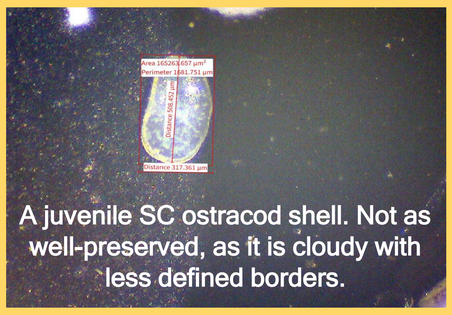


An adult NM ostracod shell I collected. It is not as well-preserved as the SC example, but is translucent.

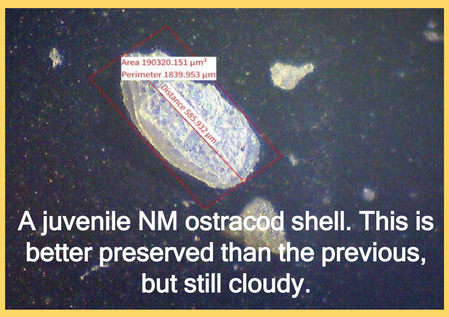
An adult SC ostracod shell. It is less well-preserved, given its opacity and unclear borders.



An adult NM ostracod shell. Not very well-preserved, as it is more opaque and cloudy.



A juvenile SC ostracod shell. Not as well-preserved, as it is cloudy with less defined borders.



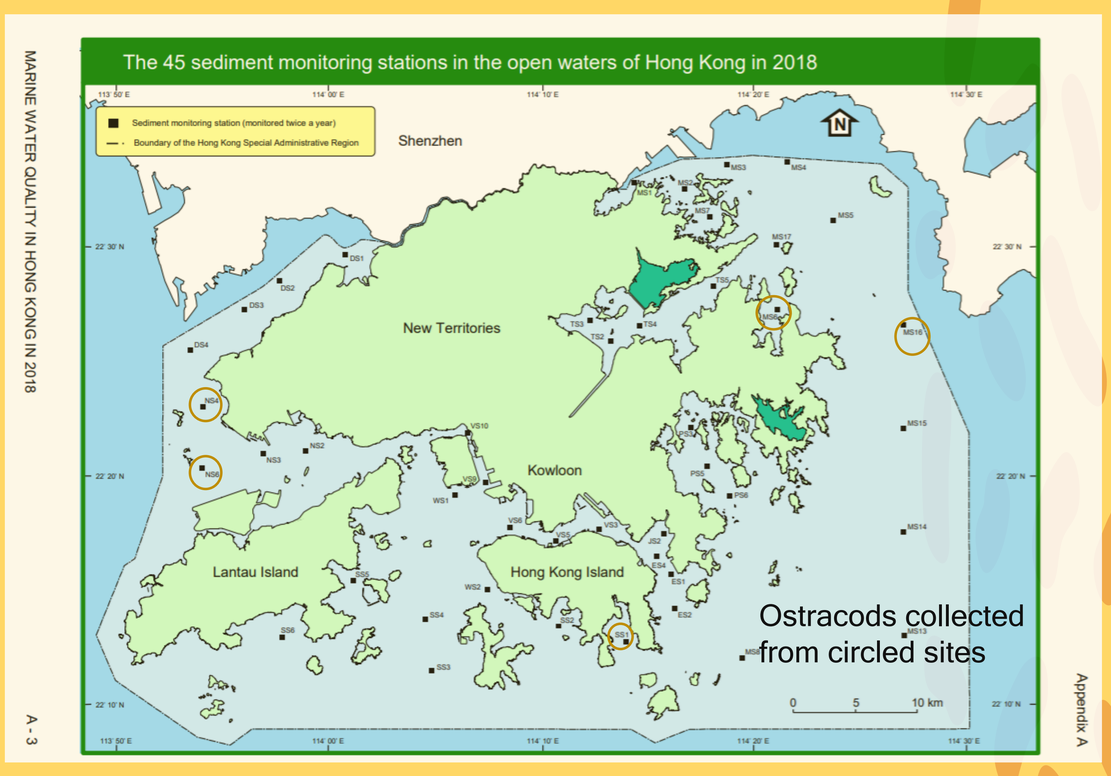
A juvenile NM ostracod shell. This is better preserved than the previous, but still cloudy.

Methodology: Cleaning ostracods via Sonication

1. Prepare and clean petri dish with milli-Q water before placing ostracod shell on dish
2. Insert methanol on dish with cleaned pipette tips (clean these first)
3. Using a fine tiny brush, brush away any visible dirt (if unable, note down shells whose dirt weren't removable)
4. After cleaning, put shells in micro-vials, then insert methanol in vial via pipette tip
5. Sonicate
6. Remove methanol from vial with new clean pipette tips after sonification.

Methodology: Cleaning ostracods via Bleach

1. Following the sonication, insert bleach into micro-vials and leave the shells overnight
2. Next day, note down how long the shells were dissolving in bleach overnight
3. Remove bleach via more cleaned pipette tips
4. Rinse the shells using milli-Q. Rinse twice
5. During the second rinse, use new set of pipette tips for each vial - 1 tip for 1 vial (to add and remove Milli q)



Analysis at the ICP-MS

After the cleaning methods were implemented on the shells, their chemistry needed to be analysed using inductively couple plasma mass spectrometer (ICP-MS). This is used for the chemical analysis and measurement of single shells. Before this was done, the ostracod shells were transferred from their micro-vials to test tubes filled with 2% nitric acid solution, where they dissolved.

Consequently, the shells were weighed through a balance, with their weights all noted down (shown right on the table). Then finally, I could bring them over to the ICP-MS and measure with the administration of my supervisor. Unfortunately due to COVID-19 restraints, I was only able to weigh out 24 samples of my cleaned shells.

Sample	Tube 1 /g (~5ml)	Tube 2 /g (~2ml)	Tube 3 /g (~15ml)
CP01	12.5577	9.3177	23.0773
CP02	12.2032	9.4746	21.6408
CP03	12.5400	9.6290	21.8263
CP04	12.4648	10.3770	22.451
CP05	12.6765	9.5624	22.3690
CP06	-	-	-
CP07	12.0304	10.0249	23.1630
CP08	12.1443	9.0018	21.6675

Sample	Tube 1 /g (~5ml)	Tube 2 /g (~2ml)	Tube 3 /g (~15ml)
CP09	11.8232	9.6460	21.6985
CP10	11.9135	9.9553	22.0210
CP11	12.6605	9.4240	22.4478
CP12	13.5158	9.0877	22.0283
CP13	13.0267	9.5586	22.5029
CP14	11.7258	9.3853	22.0528
CP15	12.6780	8.9801	21.8676
CP16	12.4863	9.0934	22.1244

Sample	Tube 1 (~5ml)	Tube 2 (~2ml)	Tube 3 (~15ml)
CP17	13.0590	10.2362	21.6835
CP18	12.0623	9.0132	21.5915
CP19	12.4998	9.3665	21.4219
CP20	13.5541	9.5591	22.2402
CP21	11.5911	9.3261	22.2397
CP22	12.0660	9.7430	21.9037
CP23	13.2634	9.2397	22.6304
CP24	12.6798	9.1958	22.3018
CP25	12.0262	9.5313	22.4185

References

Environmental Protection Department of Hong Kong. (2018). *Marine Water Quality in Hong Kong in 2018*. https://www.epd.gov.hk/epd/sites/default/files/epd/english/environmentinhk/water/hkwqrc/files/waterquality/annual-report/marinereport2018.pdf

Hong, Y. (2016). Hong Kong shallow marine benthic ecosystem history: conservation paleoecology approach based on microfossil ostracods. The University of Hong Kong, Hong Kong SAR, China

L.R. Roberts, J.A. Holmes, M.J. Leng, H.J. Sloane, D.J. Horne (2018). Effects of cleaning methods upon preservation of stable isotopes and trace elements in shells of Cyprideis torosa. Quaternary Science Reviews Volume 189, Pages 197-209.

Passlow, V. (1997). Quaternary ostracods as palaeoceanographic indicators: a case study off southern Australia. *Palaeogeography, Palaeoclimatology, Palaeoecology*, *131*(3-4), 315-325. https://doi.org/10.1016/s0031-0182(97)00009-6

Rodriguez M., De Baere B., François R., Yasuhara M. & Not C. (2019). Trace element distribution in marine shells of ostracods. Copernicus GmbH.