Links between shell chemistry and microstructure

A case study using *Arctica islandica*

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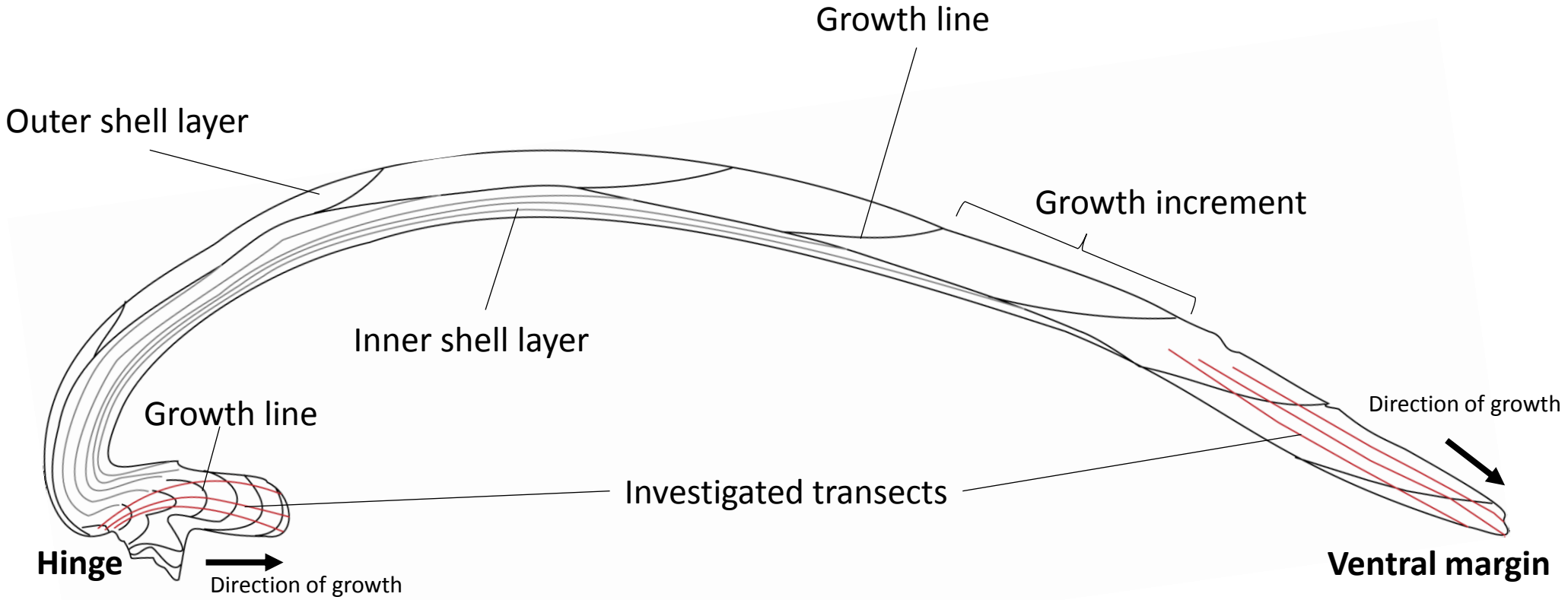
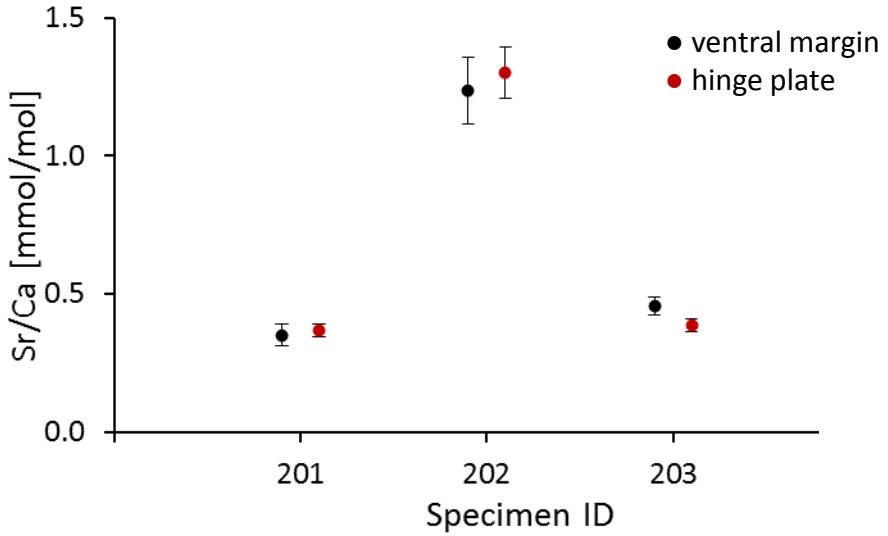
Bivalve cross section

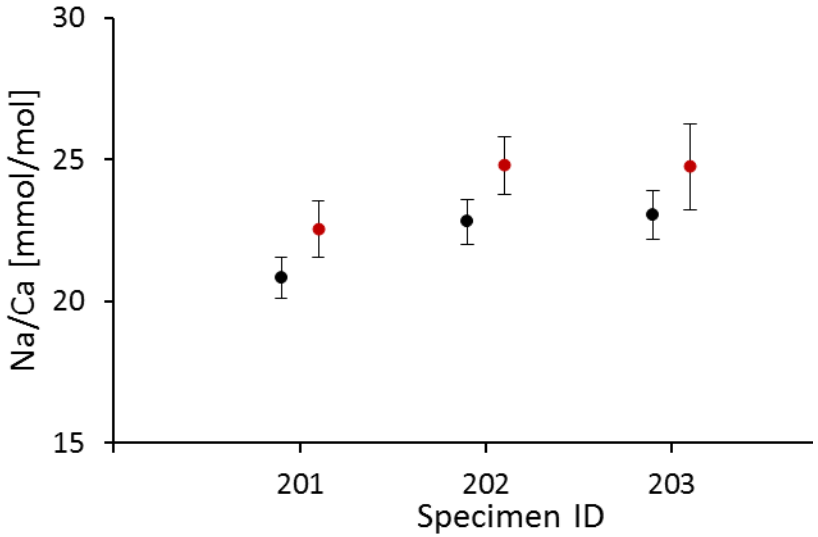


Element/Ca ratios in different specimens

In contemporaneous shell portions of specimen from the same site, Sr/Ca ratios can vastly differ from each other (more than 30% in the ventral margin).

Na/Ca ratios show less variation among specimen (below 1% in the ventral margin)



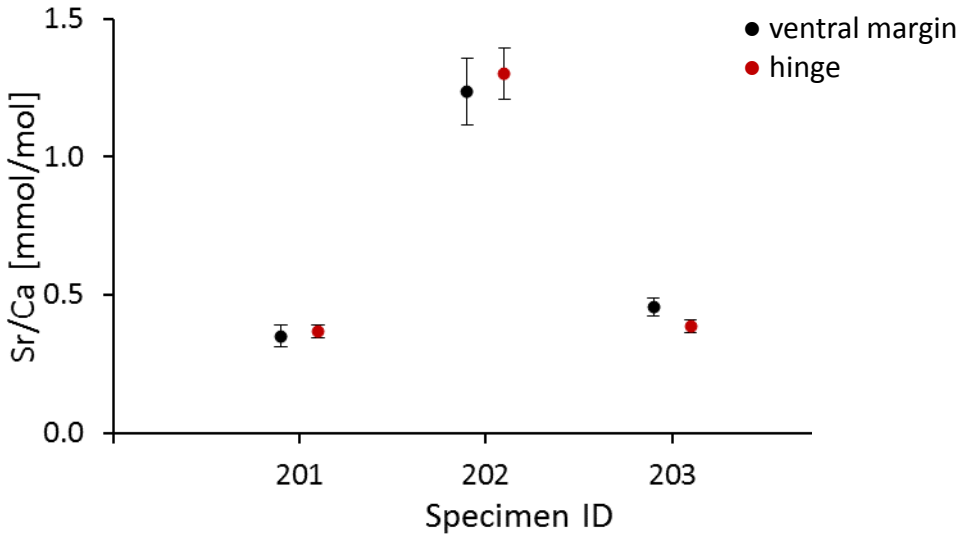


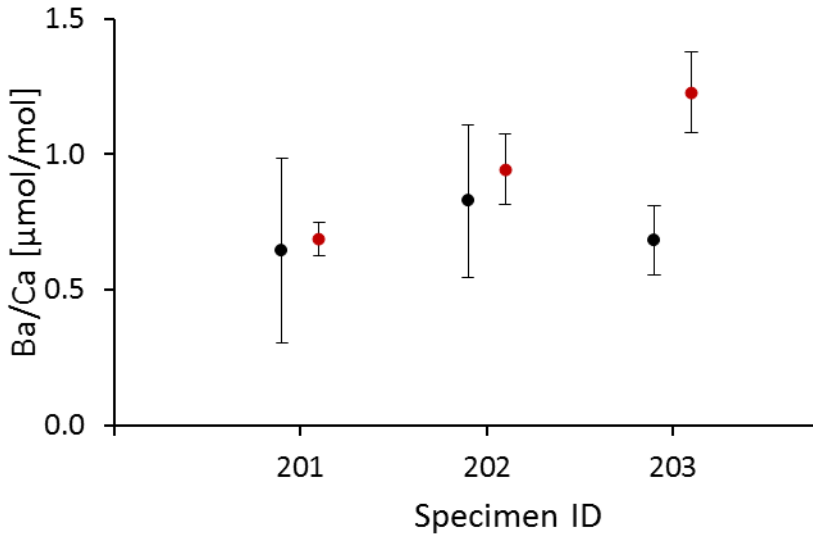
The plotted values are arithmetic means of all values measured in one annual increment with one standard deviation.

Element/Ca ratios in hinge and ventral margin

Within the same specimen, isochronous shell portions of the hinge plate and the ventral margin show nearly identical Sr/Ca ratios.

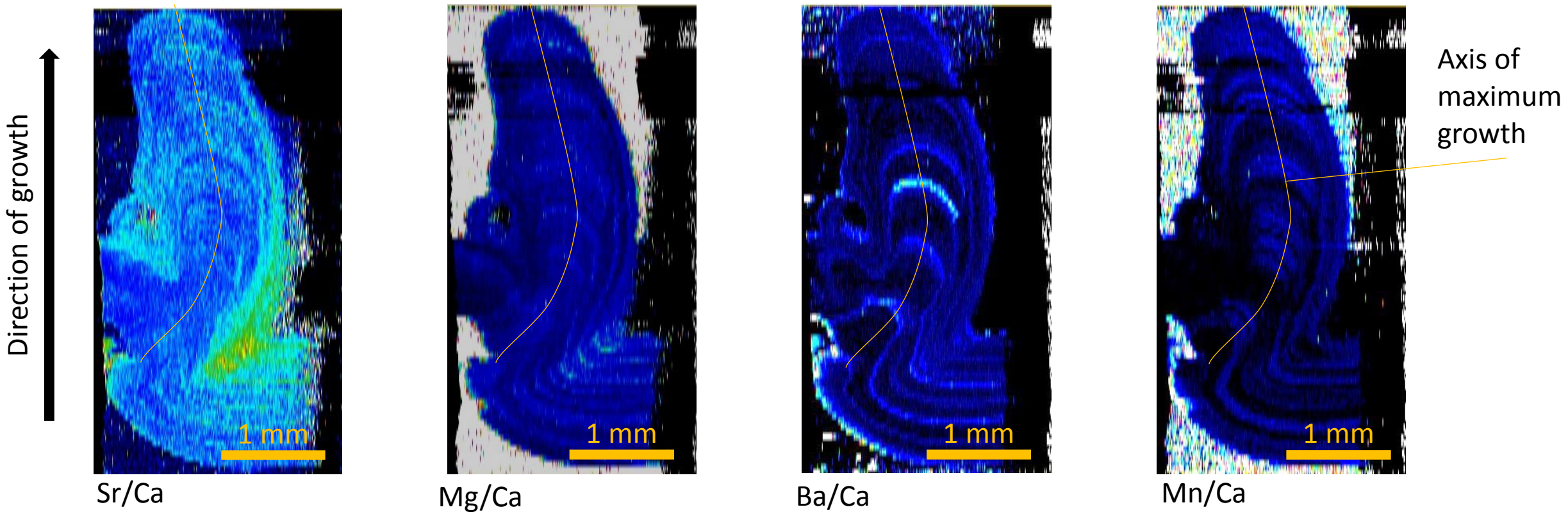
For all specimen, Ba/Ca, B/Ca and Na/Ca tend to be larger in the hinge.





The plotted values are arithmetic means of all values measured in one annual increment with one standard deviation.

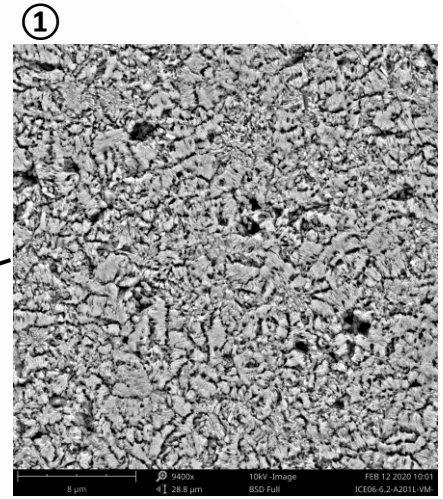
Element/Ca variations within the hinge plate

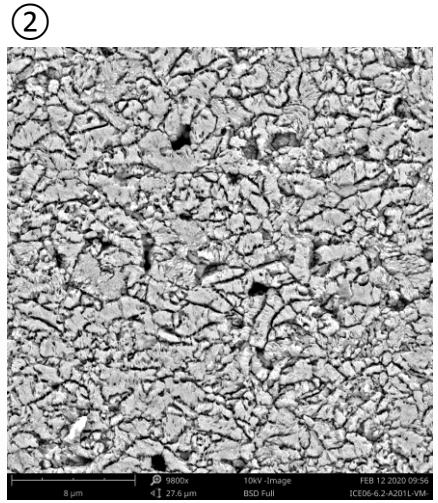


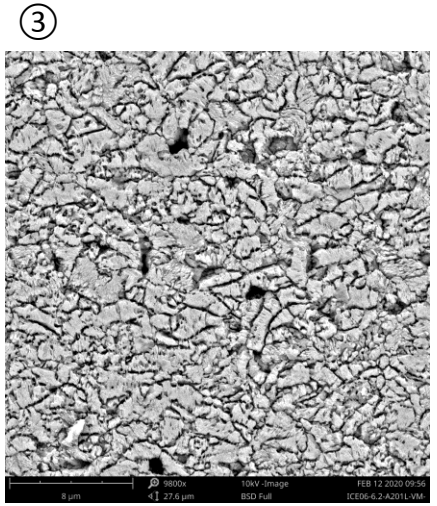
The pictures show relative element-to-calcium ratios in the hinge plate measured by LA-ICP-MS. Light color indicates high ratios. Within isochronous portions, the highest values occur on the axis of maximum growth. The element-to-calcium ratios gradually decrease in slower growing shell portions.

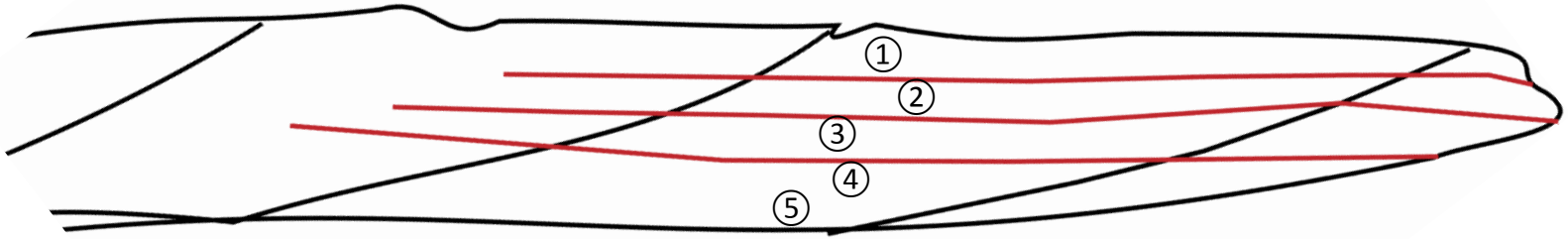
Microstructure

homogeneous microstructure

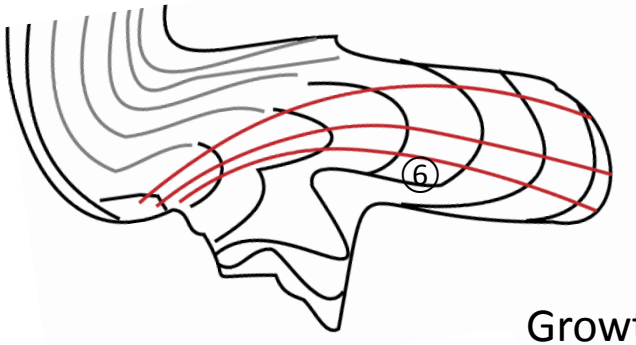




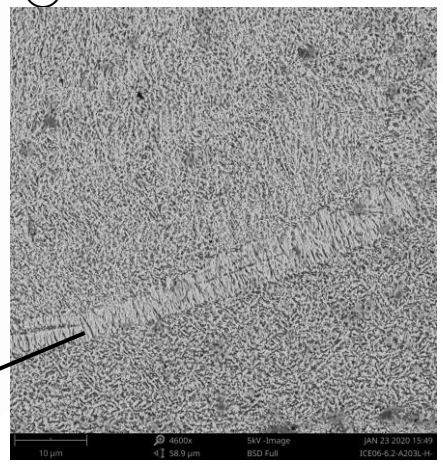


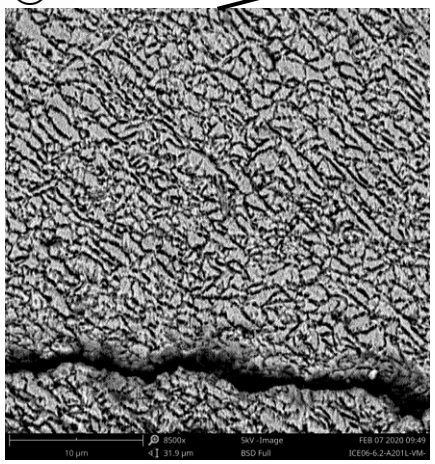


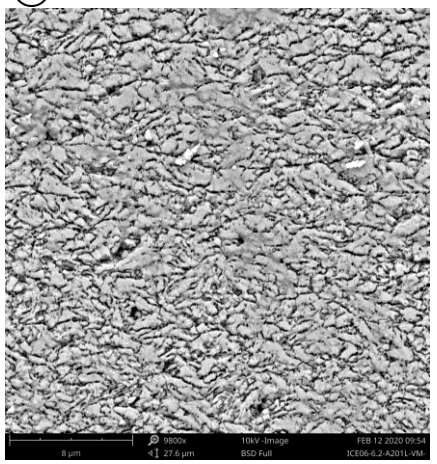
Crossed acicular microstructure



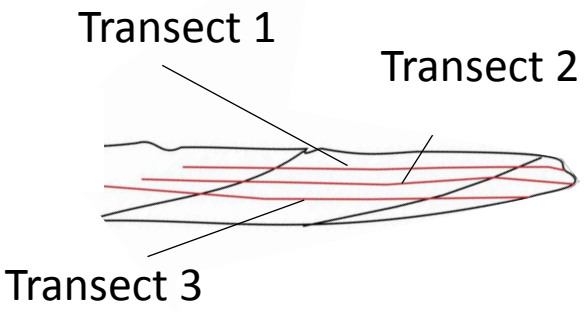
Growth line irregular simple prisms





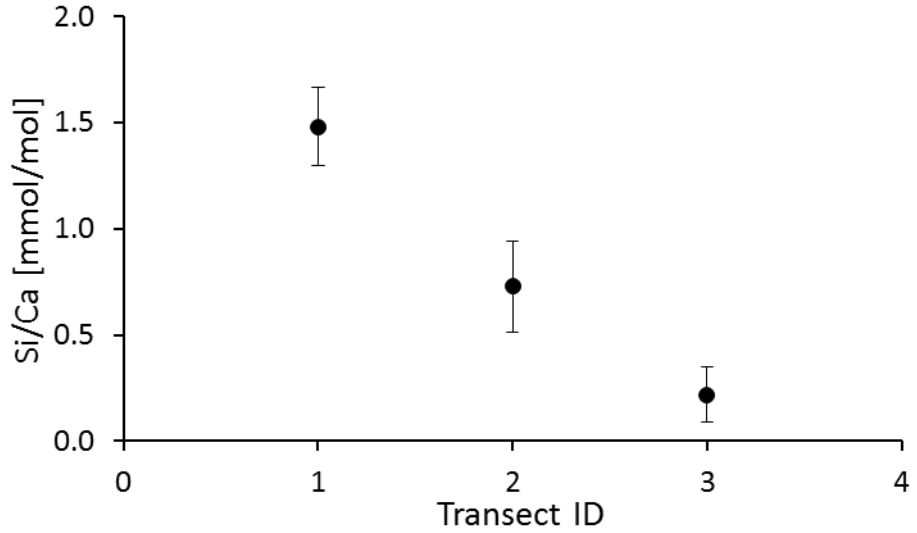


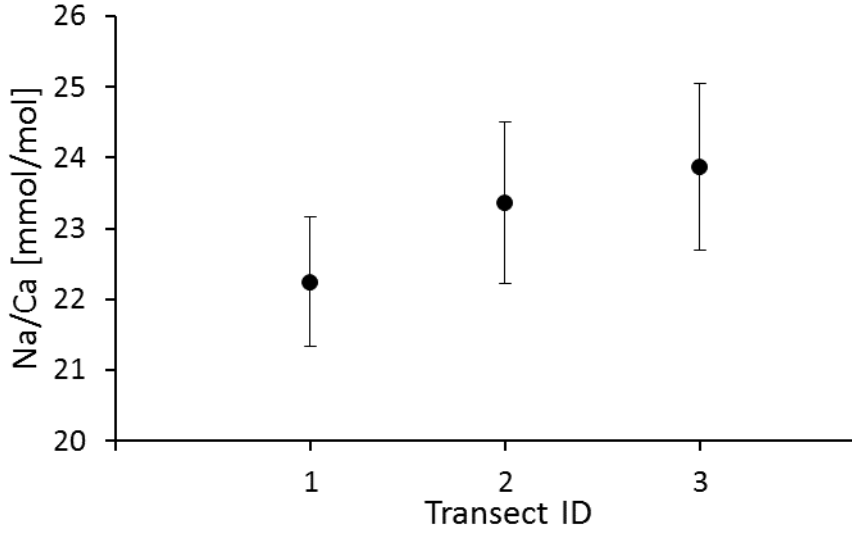
Si/Ca & Na/Ca variations within the ventral margin



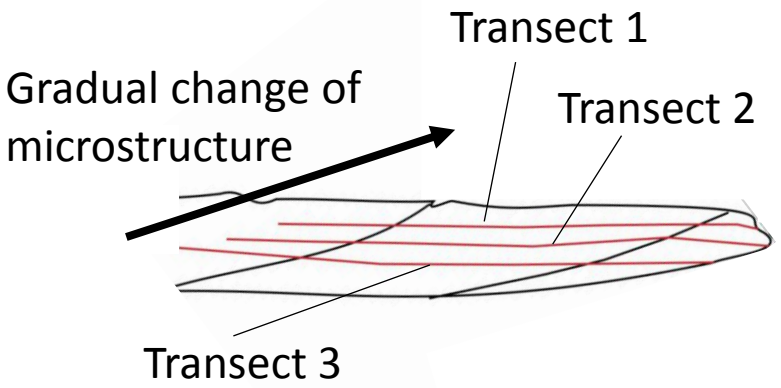
The diagrams show the Si/Ca and the Na/Ca ratios of specimen 202 in different regions of the ventral margin.

Si/Ca is significantly higher in the outer portion of the shell layer, whereas Na/Ca is lower.





Links between chemistry and microstructure



From the inner to the outer part of the outer portion of the outer shell layer, the microstructure of *Arctica islandica* in the ventral margin gradually changes from crossed-acicular to homogeneous. The element chemistry of the shells was exculsively measured (by LA-ICP-MS) in shell portions consisting of homogeneous microstructure. Nevertheless, there are visible differences between the biomineral units concerning shape, size and preferential orientation.

Along with the microstructure changes, element-to-calcium ratios, like Si/Ca or Na/Ca, change as well. This suggests that these phenomena are linked.

Work in progress:
Identification and quantification of relevant microstructural parameters