The geochemistry of pāua as a potential proxy for past and present environmental change

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This is for you Dad.

ABSTRACT

Nearshore New Zealand mollusca (shellfish) have the potential to be important archives of environmental conditions and change. Ambient ocean chemistry can be incorporated into the calcium carbonate ($CaCO_3$) shell during the life span of the mollusc providing a high resolution temporal record of the chemical and physical changes of the environments the mollusc lived in. Previous studies on foraminifera and coral have shown that the substitution of magnesium or strontium for calcium (Mg, Sr/Ca) during the formation of the $CaCO_3$ shell is directly correlated with ocean temperatures. Other divalent cations (e.g., Sr^{2+}, Ba^{2+}, Pb^{2+}) can also provide information on ambient salinity, primary productivity or nutrient levels, and local anthropogenic pollution. This study uses new geochemical techniques that have been developed to measure the trace element chemistry of $CaCO_3$ mollusc shells at high temporal resolution, using laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) in order to calibrate shell chemistry with environmental conditions. This study is the first to explore the use of the geochemistry of *Haliotis iris* as a potential proxy for (paleo-) environmental conditions.

Pāua (*Haliotis iris*) were collected from six different localities around New Zealand and the Chatham Islands as well as a cultured environment (OceaNZ Blue Ltd). The shells were sectioned following the axis of maximum growth exposing both $CaCO_3$ layers; the prismatic (predominantly calcite) and nacreous (aragonite) layers. The shells were analysed by LA-ICP-MS at 25 μm spot sizes through a high temporal transect of both layers. Observed differences in the element/Ca ratios between the prismatic and nacreous layer reflect the differing crystallinity of each layer.

High temporal resolution Mg/Ca ratio data of the prismatic layer of the samples which grew in a cultured environment were compared with temperature and growth data supplied by OceaNZ Blue Ltd. The results showed that temperature was not the primary control on the uptake of Mg within the shells and that influences from biological factors including increased growth rate were also evident. Sr/Ca ratios show a weak inverse relationship with increased growth

rate assumed. These results, however, are not reproducible within samples collected from the wild, showing that external factors (high wave energy, diet, predation, lack of food) place metabolic stress on the pāua. The monitoring of other element/Ca including Ba/Ca, Al/Ca, Pb/Ca and Zn/Ca ratios have the potential to provide information into the past frequency of storm events that deliver sediment into the oceans and remobilise other sediments and changing levels of environmental pollution. This is reflected through increased Al/Ca, Pb/Ca and Zn/Ca ratios during the winter season in a number of samples (n = 3) gained from the high resolution analysis of the prismatic layers. Overall, element/Ca ratios are difficult to correlate environmental conditions in samples from the wild as there are many different parameters influencing the uptake of element/Ca ratios with the shells of pāua. Uncertainties lie with a lack of understanding of the biological controls influencing pāua during biomineralisation including the transportation of the elements within organism to the extrapallial fluid to be biomineralised, ontogeny, and the rate and regularity of biomineralisation of shell material.

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CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1. INTRODUCTION

1.1 GENERAL INTRODUCTION

The Earth system is a complex system regulated by physical, chemical and biological interactions between the atmosphere, oceans, cryosphere, continents and all living entities (Bradley, 2000; Henderson, 2002; IPCC, 2007a; Snyder, 2010). The ocean is particularly important within this system as it covers > 70% of Earth's surface (Lea, 2003). Both the oceans and its temperature affect Earth's climate through the high heat capacity of the ocean which is 1,000 times larger than that of the atmosphere (IPCC, 2007a). Heat is generally stored in the upper layers of the ocean and may move great distances and be exchanged between the oceans and atmosphere (Benton, 1974; Clark *et al.*, 2002; IPCC, 2007a). The transportation of heat around Earth in the form of the Thermohaline Circulation system has also been referred to as the 'Achilles Heel' in our understanding of Earth's climate system (Broecker, 1997).

Over the last 130 years, human documentation and advances in technology such as meteorological instruments have contributed to the understanding of the spatial-temporal variability of the Earth's climate system as a whole (Bradley, 2000; Broecker, 2001).Recently, climate scientists have also used observational data and computer modelling in order to understand present and future climate (Henderson, 2002). Current observations of the recent and ongoing changes in the Earth's climate have suggested significant anthropogenically-driven changes are taking place. The ocean, along with the rest of the planet, is warming due to the increase of anthropogenic CO_2 emissions (IPCC, 2007b). The Intergovernmental Panel on Climate Change (IPCC), provides the world with a clear scientific view on the current state of knowledge in climate change (IPCC, 2011). Climate scientists of the IPCC have created models in order to predict the future of Earth's climate. The scientific models predict that global mean temperatures will increase by > 4 ˚C in the coming century in a worst-case scenario (Fig. 1.1).

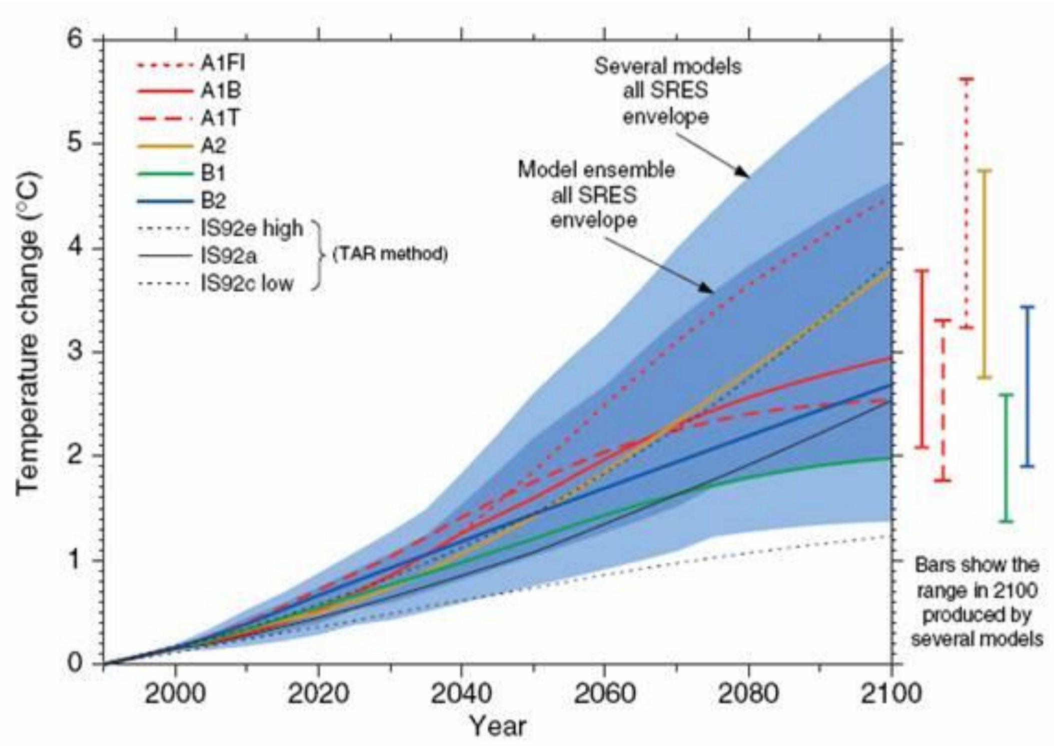

Fig. 1.1. IPCC diagram showing predicted global temperature change from 1999 to 2100. The predicted changes are based on six non-mitigation scenarios with respect to emissions of anthropogenic CO_2 (IPCC, 2007b).

New Zealand has also experienced local sea temperatures increase by 0.7˚C since 1871, with the Chatham Islands having experienced temperature increases of 1.0˚C over the last 100 yr (IPCC, 2007c). The relative sea levels in New Zealand have risen 1.6 mm on average each year since 1800 (IPCC, 2007c). This marked change in climate has been attributed to anthropogenic input of CO_2 and other pollutants into the atmosphere.

Plausible projected climate models, however, are judged on how well the models represent or mimic current climates (Bradley, 2000; Hargreaves and Annan, 2009; Shen *et al*., 1996). Natural forcing of current climate is strongly overprinted by anthropogenic influences (Bradley, 2000; Hargreaves and Annan, 2009). Thus researchers examine climate change in the geological past not only as a source of information about an Earth without the influence of human activity, but also to understand the potential climates and responses expected to occur in the future (Bauwens *et al.,* 2010; Hargreaves and Annan, 2009; Henderson, 2002; Snyder, 2010). Moreover, as anthropogenic activity increases, pre-industrial environmental baselines are an important aid to the assessment of the impacts caused to marine ecosystems by global climate change (Bauwens *et al.,* 2010; Carroll *et al*., 2009).

Geochemical proxies applied to biological archives are becoming increasingly important in gathering information on climates and environmental conditions that are no longer in existence. Advances in geochemical techniques allow biological shell archives to be analysed at high spatial resolutions. (Vander Putten *et al*., 2000). The application of Laser ablation plasma mass spectrometry (LA-ICP-MS) offer direct multi-elemental analysis of the shell material providing high temporal information of weekly or even daily events. The use of biological carbonate skeletons preserved in the geological record, along with geochemistry, can provide this information from the geological past (Henderson, 2002).

1.2 MOTIVATION FOR RESEARCH, THESIS OUTLINE AND OBJECTIVES

1.2.1 Importance for New Zealand

New Zealand is a 270,692 km^2 landmass located in the southwest Pacific Ocean with a coastline of 15,134 km. It is separated into two main islands (North and South Island), and a number of smaller islands (Stewart Island, Chatham Island, etc.). The climate in New Zealand is variable due to its latitude, isolated location and physical characteristics including high altitude mountainous regions and long coastlines. With the current attention about the projected increase in global temperatures by the IPCC (2007c), New Zealand faces many questions about how this region will respond, for example:

- How will New Zealand, with its isolated geographic position, respond to the projected global changes?

- Will regional temperature changes be magnified, muted or be consistent with the global average?

- How has New Zealand responded to past climate warming and cooling events?

- Past Northern Hemispheric events such as the Medieval Warm Period (MWP) and the Little Ice Age (LIA) have yet to be proven to have occurred in the Southern Hemisphere, and thus be global events (Broecker, 2001; Peetet, 1995; Villalba, 1994). Evidence from glacial extent, modelling and pollen records have proven that periods of warming and cooling of temperatures did occur around New Zealand, but to what extent were these events and are their timing synchronous in both hemispheres?

- What are the baseline temperatures prior to the Industrial Revolution around New Zealand, and what impact has anthropogenic pollution had on the climate and marine environment?

Pre-industrial baselines are important for quantitative assessment of the effects of anthropogenic activity on climate and ecosystems (Carroll *et al.*, 2009; Schöne *et al.*, 2005). Pre-pollution events are harder to monitor, due to the difficulty of finding archives that are able to track changes in the environment before, during and after these events.

The geochemistry of nearshore New Zealand mollusc carbonate shells can potentially be developed as a proxy for past and present environmental change. Establishing a modern calibration between element/Ca ratios within the shell, and recent environmental conditions of different species is the first step to utilising this approach. If successful, the modern calibration can then be applied to fossil shells that have been radiocarbon dated to trace the effect of past climatic change events of interest and anthropogenic activity in the New Zealand region.

1.2.2 Thesis Objectives

This thesis had two main objectives:

Analytical technique development – The development of techniques for the high temporal resolution analysis of the trace element chemistry of the carbonate shells of pāua shells using LA-ICP-MS. Pāua were chosen specifically for this study as they are abundant, easily accessible and are wide spread across New Zealand rocky coastal settings.

Modern shellfish chemistry – The analysis and interpretation of the LA-ICP-MS trace element data of multiple modern pāua samples from well constrained coastal marine settings around New Zealand and correlating the results with air and ocean temperatures and water chemistry.

1.2.3 Thesis Outline

This thesis is presented in seven chapters. Chapter Two outlines background information on the use of the trace element chemistry of carbonates as a paleoclimate proxy, and the factors that affect the trace element chemistry of carbonate shells. Chapter Two also introduces the mollusc species used in this research - *Haliotis iris* (pāua). Chapter Three describes the methodology and materials used to prepare and analyse the samples. Chapter Four presents the results obtained on the pāua samples. These results are then interpreted and discussed in Chapter Five. Chapter Six summarises the conclusions that were made as a result of this study and Chapter Seven briefly mentions future work that could potentially further the work carried out in this study.

2. BACKGROUND

2.1 TRACE ELEMENTS IN CARBONATE AS A PROXY FOR PALEOCLIMATOLOGY

Paleoclimatology has been at the forefront of geoscience research over the last 50 years (Henderson, 2002; Krantz, 1990; Latal *et al.,* 2006; Lazareth *et al.,* 2007; Lea, 2003). Many advances in paleoclimate studies have been made during this time, from the invention of the piston core to retrieve undisturbed foraminifera samples from sediment cores, through to the use of $\delta^{18}O$ content in carbonate species (e.g., foraminifera, corals) as a proxy for past ocean temperatures (Lea, 2003).

One research area that has advanced significantly is the analysis of trace element chemistry in calcareous skeletons of marine organisms (Lea, 2003). Frank Clarke was the first to recognise that these geochemical variations have the potential to record ocean temperatures when he documented the relationship between the magnesium (Mg) content of biogenic carbonates, and their growth temperature (Lea, 2003). Clarke and Wheeler (1922) identified that the Mg/Ca ratio in the ocean was relatively constant over long time-scales and, therefore, the Mg/Ca ratio variations in biogenic carbonate were caused by other variables such as temperature (Lea, 2003). A similar relationship was discovered in 1979 when it was established that the Sr/Ca ratios of scleractinian corals decrease by 0.8 % per ˚C increase in ocean temperature (Broecker, 2002; Shen *et al.,* 1996). Continual improvements in (micro-) sampling methodologies, analytical and geochemical techniques have led to higher temporal resolution climate records of the past.

2.1.1 Paleoclimate Records from Foraminifera and Coral

The calcium carbonate ($CaCO_3$) shells produced by marine organisms including foraminifera, ostracods, pteropods and corals have been shown to be excellent archives of the environment in which these organisms have lived (Freitas *et al.*, 2006; Mitsuguchi *et al.*, 1996; Pearce and Mann, 2006). Mg/Ca ratios in planktonic foraminifera are now widely used as a proxy for sea surface temperatures (SST) through establishing a temperature equation relating foraminiferal Mg/Ca to ocean temperature (below) (e.g., Anand *et al.*, 2003; Barker *et al*., 2005; Lea, 2003).

$$\text{Mg/Ca (mmol/mol)} = \text{B x exp}^{(\text{A x T})}$$

Where:

T = calcification temperature (˚C)

A and B = species-specific constants

The Mg/Ca ratios of a range of species of planktonic foraminifera were measured by Anand *et al.* (2003) and the Mg/Ca ratio was demonstrated to have a sensitivity of ca. 9% with every ˚C increase of temperature (Barker *et al.,* 2005).

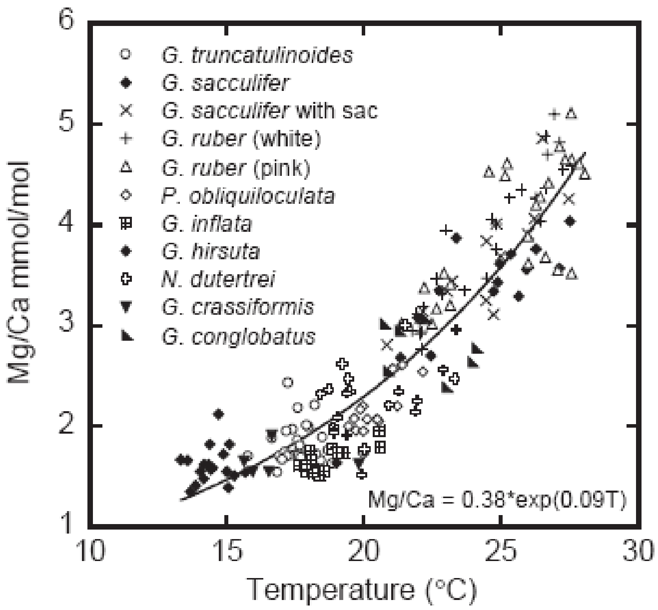

Fig. 2.1. Mg/Ca ratios of a range of planktonic foraminifera species and isotopically derived calcification temperatures studied by Anand *et al.* (2003) (Barker *et al*., 2005).

The application of Mg/Ca thermometry to foraminiferal calcite has been successfully used to reconstruct past ocean temperatures. Elderfield and Ganssen (2000) used Mg/Ca ratios along with $\delta^{18}O$ of 8 species of planktonic foraminifera to interpret glacial and interglacial changes in the North Atlantic from the Last Glacial Maximum (LGM) through to the Holocene. The Mg/Ca ratio in benthic foraminifera has also used to reconstruct a deep sea temperature record for the past 50 Myr (Lear *et al.,* 2000).

The Sr/Ca ratio in various species of coral has also been widely studied as a proxy for SST and sea surface salinity (SSS) (Lea, 2003; McCulloch *et al.,* 1996; Mitsuguchi *et al.,* 1996). Corals form annual bands within their aragonite skeletons, which allow for sub-annual environmental reconstruction (Henderson, 2002; Shen *et al.,* 1996). The relationship between coral and seawater temperature is derived by the equation below (Lea, 2003).

$$Sr/Ca_{\text{coral}}\ (\text{mmol mol}^{-1}) = b + m(\text{SST})$$

The substitution of Sr for Ca in aragonite of coral has an inverse relationship with temperature as the consequence of this being an exothermic reaction (Fig. 2.2) (Lea, 2003).

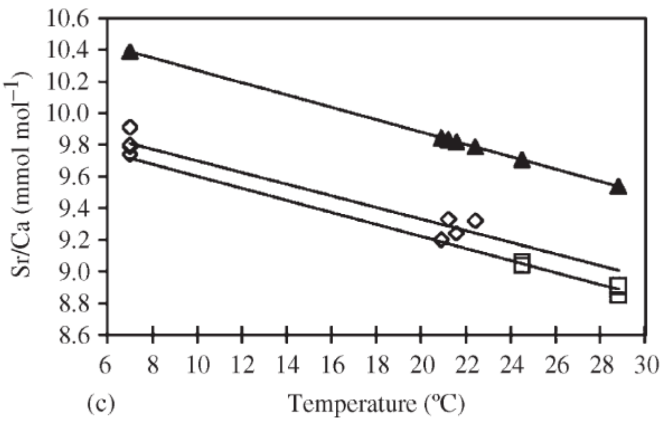

Fig. 2.2. Correlation of Sr/Ca with SST data for the asymbiont coral skeleton of *Astrangia* (squares), the night time skeleton of *Porites* (diamonds) and inorganic aragonite precipitated at equilibrium (triangles) (Lea, 2003). The slope is indicative of the temperature sensitivity of Sr/Ca uptake into the coral skeleton.

Although the potential of Sr/Ca ratios as a paleo-ocean thermometer has been known since the 1970s, the application only became effective in the early 1990s through the development of more precise analytical techniques (Broecker, 2002;

Lea, 2003; Shen *et al.,* 1996). The use of isotope dilution thermal ionisation mass spectrometry (ID-TIMS) was used to show clear Sr/Ca cycles associated with seasonal banding from a fossil coral from Vanuatu that had been radiocarbon dated to an age of 10,000 yr BP (Broecker, 2002; Lea, 2003). McCulloch *et al*. (1996) were then able to apply Sr/Ca calibrations to uplifted Holocene coral terraces from Papua New Guinea to attain almost weekly resolution SST data.

Both foraminifera and coral are limited in some ways with the paleoclimate information they can provide. Foraminifera only provide one mean temperature data throughout their life (Elderfield and Ganssen, 2000). Planktonic foraminifera also fluctuate within the water column throughout their lives, recording the isotopic and trace element signature at different depths. Corals provide high temporal resolution data through the successive deposition of their $CaCO_3$ shell layers over time however provide a record that is restricted to tropical environments and thus the records they preserve are of limited application in a global context (Gillikin, 2005; Henderson, 2002). Molluscan species, like coral, also successively deposit their $CaCO_3$ layers allowing a higher resolution of seasonal or daily events to be recorded. Molluscs,, however, are found widespread throughout the world in coastal and freshwater environments, and as such can contribute to theproviding more of an understand to the regional and global temperature changes.

2.2 MOLLUSCS AND THEIR POTENTIAL AS A PALEOCLIMATE ARCHIVE?

Mollusca are soft bodied metazoans with more than 35,000 fossil species and over 110,000 living mollusc species. Molluscs are the largest phylum on Earth and include the class of bivalves (mussels, oysters, clams and scallops), gastropods (pteropods, abalone), scaphopods (tusk shells) and cephalopods (nautilus) (Prothero, 1998; Simkiss and Wilbur, 1989). Some species precipitate external calcified structures that support their living tissue and protect against predators (Marin & Luquet, 2004; Davis, 2008).

Molluscs and more specifically bivalves have been widely studied as a potential archive for past and present environmental conditions due to their incremental deposition of shell material over time (Frietas *et al.,* 2006; Rosenthal and Katz, 1989; Schöne *et al.,* 2005; Wanamaker *et al.,* 2007). This shows their potential to reconstruct, at high temporal resolution, the varying environmental conditions that the animal has experienced during its life (Frietas *et al.,* 2006; Schöne *et al.,* 2005; Vander Putten *et al.,* 2000). Molluscs can be found today in a wide range of different habitats from shallow waters to deep sea environments (Schöne *et al.,* 2005). Mollusc shells are also abundant in the geologic record, which makes such shells an ideal potential archive of past and present environmental conditions (Frietas *et al.*, 2006; Killingley and Berger, 1979; Vander Putten *et al.*, 2000).

Recent studies have applied the use of trace element chemistry to different species of bivalves in order to correlate the geochemistry of the shells with environmental conditions (Vander Putten *et al.,* 2000). The geochemistry of *Mytilus spp.* has been widely studied as a potential proxy for past environmental conditions (Gillikin *et al.,* 2006; Klein *et al.,* 1996; Vander Putten *et al.,* 2000). The Mg/Ca chemistry of *M. trossulus* was investigated by Klein and others (1996a) in order to attempt to reconstruct SST. The temperature, salinity and seawater isotopic composition were collected from the habitat of the *M. trossulus* in order to make an empirical calibration of shell chemistry to environmental conditions (Klein *et al.,* 1996a). Mg/Ca ratios were calibrated to temperature with an accuracy of ± 1.5˚C (Klein *et al.,* 1996a). Vander Putten and colleagues (2000) also examined the environmental and biological factors that affect *M. edulis* during shell formation.

In addition, Freitas *et al.* (2006) investigated the effects of environmental and biological controls on elemental ratios of Mg/Ca, Sr/Ca and Mn/Ca in the king scallop *Pecten maximus*. Powdered samples were collected from the king scallop by milling the surface along the main axis of growth at increments ranging from 1 to 2 mm (Frietas *et al.,* 2006). It was shown that in this case seasonal variations existed that could potentially reflect intra-annual variations of dissolved Mn^{2+} in seawater, whereas Sr/Ca in the shell was mainly controlled by precipitation, and Mg/Ca was weakly correlated to temperature.

Fewer studies have looked into the geochemical signature recorded within gastropod shells. Each individual species of mollusc, however, will vary in the biological controls on biomineralisaton, which will result in each species displaying unique mineral properties, including size, shape, crystallinity and trace element composition (Frietas *et al.,* 2006). With this in mind, individual species need to be tested for their potential as archives of environmental change.

2.3 TRACE ELEMENT PROXIES

Trace elements are present in seawater in both dissolved and particulate matter, and vary widely in concentration and are taken up by $CaCO_3$ producing organisms in varying concentrations. The distribution of elements such as Mg, Sr, Ba, Mn and others has been measured within the shells of carbonate organisms and has provided proxies for paleotemperature, paleosalinity, primary production and pollution (Barker *et al.*, 2005; Carré *et al.,* 2006; Freitas *et al.*, 2006; Lazareth *et al.,* 2007; Pearce and Mann, 2006; Schöne *et al.*, 2005; Tynan *et al.,* 2005).

Several divalent cations, including Mg^{2+}, can be substituted for Ca^{2+} in the crystal lattice of $CaCO_3$ during the formation of biogenic carbonate (Barker *et al.*, 2005). The incorporation of such elements can then reflect the physico-chemical (including temperature and salinity), biological (primary productivity) and anthropogenic (pollution) conditions that the organism is exposed to during its life span (Barker *et al*., 2005; Lazareth *et al.,* 2003; Schöne *et al.,* 2005).

2.3.1 Mg and Sr in carbonate as proxies of paleo-ocean temperatures

Firstly, it is important to understand the mechanisms of elemental substitution in carbonates. Molluscs have the potential to precipitate $CaCO_3$ as any of its six polymorphs (Davis, 2008). The two main polymorphs that make up the mineralogy of $CaCO_3$ shell-bearing organisms are calcite and aragonite (Davis, 2008; Dodd, 1967; Ming, 2006; Skinner and Jahren, 2007). Both polymorphs are anhydrous, and have rhombohedral and orthorhombic crystal structures, respectively (Davis, 2008; Dodd, 1967; Ming, 2006). The uptake of Mg into the crystal structure of $CaCO_3$ is favoured in calcite over aragonite as the smaller Mg^{2+} ion more readily substitutes into the calcite lattice which is isostructural with magnesite (Dodd, 1967). The larger Sr^{2+} ion, which has a crystal lattice isostructural with strontianite has a stronger binding affinity within aragonite (Dodd, 1967).

The aforementioned use of Mg/Ca and Sr/Ca paleothermometry in foraminifera and corals has proven a reliable method. The uptake of Mg^{2+} into the $CaCO_3$ shell is thermodynamically controlled, and is influenced by the ambient temperature of the surrounding sea water, resulting in Mg/Ca ratios increasing with increasing temperatures (Barker *et al*., 2005; Lea, 2003). Few studies have successfully used Mg/Ca paleothermometry within molluscs as the internal biological controls affect the chemistry of the shell as well as temperature (Frietas *et al.,* 2006; Lazareth *et al.,* 2007).

Research into Sr/Ca ratios of aragonitic bivalves has also shown varying degrees of success in its application to paleo-ocean thermometry (Gillikin *et al.,* 2005). Gillikin *et al.* (2005) showed that Sr/Ca ratios in *Saxidomus giganteas* shells had a very weak correlation with temperature and could not be used as a reliable proxy. Vander Putten *et al.* (2000) presented results that indicate that processes other than variations in seawater chemistry and temperature were responsible for Sr/Ca ratio variations seen within the shell. Other research has discovered a strong Sr/Ca co-variance with shell growth rate which is, then in turn, influenced partly by seawater temperature (Frietas *et al.,* 2006).

2.3.2 Other trace elements as proxies of environmental conditions

Recent studies have delved into using Ba/Ca and Mn/Ca ratio of carbonates as a proxy for primary productivity events (Gillikin *et al.,* 2006; Lazareth *et al.,* 2003).

Ba generally enters seawater in particulate form from rivers and coastal ground water inputs (Carré *et al.,* 2006; Gillikin *et al.,* 2006; Lazareth *et al.,* 2003). Ba then enters the mollusc via ingestion or through the gills (Gillikin *et al*., 2006). Dissolved Ba^{2+} concentrations in seawater are low (34 nmol/L) and, therefore, the incorporation of Ba into carbonate shells is controlled by availability (Carré *et al.,* 2006). The formation of barite and primary productivity are closely associated, so any increase in Ba in $CaCO_3$ shells is usually attributed to a diatom bloom or other planktonic event caused by increased nutrients in the system (Carré *et al.,* 2006; Gillikin *et al.,* 2006; Lazareth *et al.,* 2003). High resolution study of *M. edulis* shells has been used to track fluctuating Ba and thus fluctuating nutrient supply in the ocean system (Gillikin *et al.,* 2006).

The incorporation of Mn^{2+} from seawater into inorganic calcite is directly linked to the dissolved Mn^{2+} concentration in the ocean through the ingestion of enriched particulate matter including phytoplankton and diatoms (Freitas *et al.,* 2006; Lazareth *et al.,* 2003). Thus, the Mn/Ca ratio could provide a proxy for seasonal changes in primary production and increased river discharge events that have been associated with phytoplankton blooms (Frietas *et al.,* 2006; Lazareth *et al.,* 2003; Vander Putten *et al.,* 2000). Mn/Ca ratios have been observed to co-vary with Ba/Ca in studies of the gastropod *Concholepas concholepas,* allowing their use as a proxy for primary productivity (Lazareth *et al*., 2003).

2.3.3 Trace metal contaminants: A tracer for anthropogenic pollution?

The monitoring of trace metal pollutants in shell-bearing molluscs also has the potential to record changes in the environmental conditions in which the organisms have lived (Boening, 1999; Carroll *et al.*, 2009; Pearce and Mann, 2006; Price and Pearce, 1997; Protasowicki *et al.*, 2008: Raith *et al.*, 1996; Tynan *et al.*, 2005; Whyte, 2006; Yap *et al.*, 2003). Trace metals are released into seawater from both natural sources (e.g., geochemical cycling), and anthropogenic sources (Chester, 1999; Protasowicki *et al.*, 2008). Such anthropogenic sources include paint leaching into storm drains or road runoff, partially-treated sewage, and waste discharge from mines, and galvanising and wood treatment plants (Whyte, 2006). Many trace metals found in the ocean have toxic effects on the ecosystem with many marine species suffering adverse effects to elevated trace metal concentrations (Boening, 1999).

Trace elements including aluminium (Al), zinc (Zn), lead (Pb) along with other heavy metals, can accumulate in both the soft tissue and hard $CaCO_3$ shell of molluscs (Price and Pearce, 1997; Protasowicki *et al.*, 2008; Tynan *et al.*, 2005). The shells, however, are more practical for use in monitoring metal contamination as they reveal less variability, can be preserved in the geological record (unlike soft tissue) and record the changing levels of pollutants over the life of the organism (Carroll *et al.,* 2009; Protasowicki *et al.*, 2008). This makes shells useful in assessing the extent of environmental contamination in marine ecosystems, and measuring levels prior to pollution events (Pearce and Mann, 2006; Protasowicki *et al.*, 2008; Raith *et al.*, 1996; Yap *et al.*, 2003). Molluscs also provide an archive for reconstructing the effects of pollution after it has taken place (Foster and Cravo, 2002; Carter, 1980). Price and Pearce (1997) investigated elements including Pb, Zn and U in the shell of the cockle *Cerastoderma edule* from the British Isles using LA-ICP-MS. Results showed that due to the high resolution of the laser ablation technique, it is possible to identify short-term pollution events within the shell layers.

2.4 FACTORS INFLUENCING TRACE ELEMENT INCORPORATION IN MOLLUSCS

Many factors need to be considered when examining the controls on the geochemistry of mollusc shells (Anadón *et al.,* 2006). Biological factors largely control the chemistry of the shell. Other controls are shell mineralogy and ambient trace element water chemistry (Anadón *et al.,* 2006; Carré *et al.,* 2006; Schöne, 2008; Wilbur and Saleuddin, 1983). Cessation of shell growth can occur due to predation, rough waters or lack of food. The ambient water chemistry has an effect on which elements will be incorporated into the shell, as only the elements the mollusc is exposed to can be taken up and incorporated into its shell. It is important to analyse each individual species as in some biological controls are constant enough to allow environmental conditions and trace element chemistry to be correlated (Carré *et al.,* 2006).

2.4.1 Shell Formation and Biomineralisation

To understand trace element incorporation into mollusc shells, it is important to first understand how the shell grows. There are four main divisions of the shell formation system. These are: (1) the external medium, (2) the hemolymph and body tissues, (3) the extrapallial fluid compartments (EPS), and (4) the shell itself (Fig. 2.3) (Wilbur and Saleuddin, 1983).

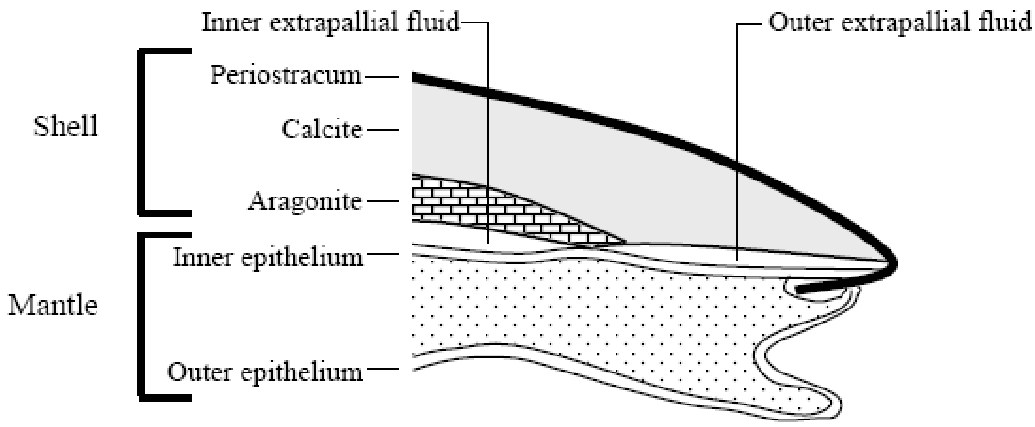

Fig. 2.3. Schematic cross section through a mussel shell (periostracum and the calcite and aragonite layers) and mantle (inner and outer epithelium) showing the internal compartments including the extrapallial fludi associated with shell formation (Gillikin, 2005).

Shell formation involves the movement of ions from the external medium through the soft tissue of the mollusc in order for biomineralisation to occur (Fig 2.4) (Wilbur and Saleuddin, 1983). Biomineralisation is the process by which living organisms influence the precipitation of mineral by converting ions in solution into solid materials (Davis, 2008; Lin and Meyers, 2005; Simkiss and Wilbur, 1989; Skinner and Jahren, 2007; Weiner and Dove, 2003).

This takes place in the extrapallial fluid, which is located between the mantle epithelium and the inner layer of the shell surface (Gillikin, 2005; Wilbur and Saleuddin, 1983).

The first stage of shell formation is the uptake of calcium (Ca^{2+}) and bicarbonate (HCO_3^-) ions from the external environment, through the body epithelium and hemolymph of the mollusc (Marin and Luquet, 2004; Wilbur and Saleuddin, 1983; Simkiss and Wilbur, 1989). Ions primarily enter the hemolymph through the gills (and occasionally through the gut) of the organism (Gillikin *et al.,* 2006). The mantle epithelium then transfers them from the hemolymph to the extrapallial fluid compartment where biomineralisation and shell deposition take place (Marin and Luquet, 2005; Wilbur and Saleuddin, 1983; Simkiss and Wilbur, 1989). The extrapallial fluid compartment, not only receives ions from the external sea water medium but from the tissue of the organism (Freitas *et al.,* 2006).

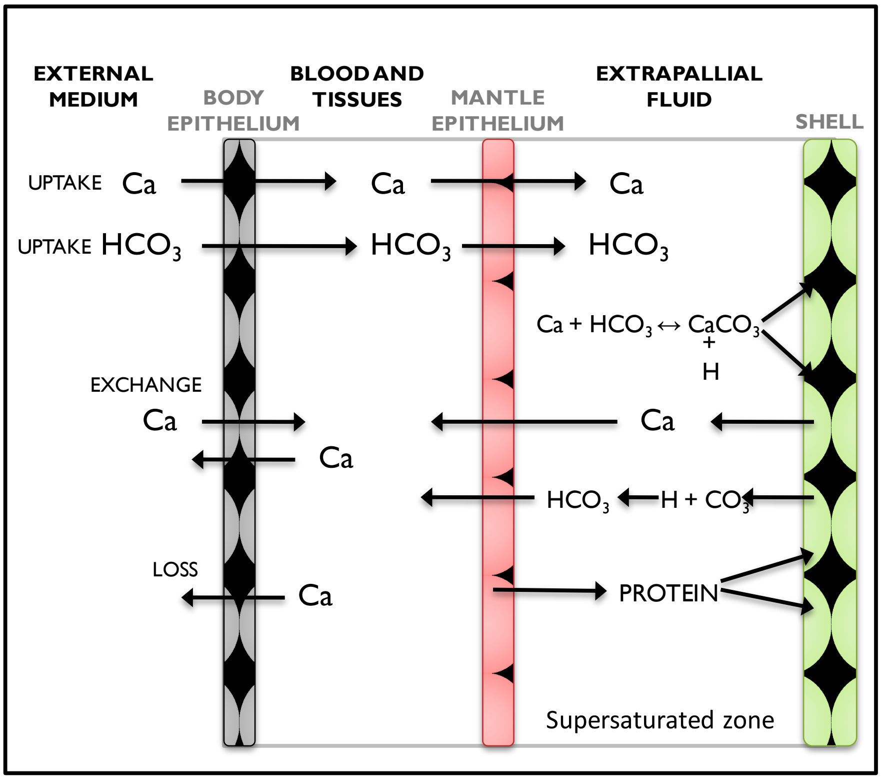

Fig. 2.4. The molluscan mineralising system as described by Wilbur and Saleuddin (1983). The diagram represents the movement of ions from the external medium to the extrapallial fluid.

The extrapallial fluid is an enclosed region with no contact to living tissue and the ambient seawater (Davis, 2008; Marin and Luquet, 2005). This creates optimum conditions for biomineralisation (Davis, 2008; Marin and Luquet, 2005; Wilbur and Saleuddin, 1983; Vander Putten *et al*., 2000). In order to create conditions favouring crystal nucleation, the extrapallial fluid must be supersaturated (Wilbur and Saleuddin, 1983). Calcification will occur when the extrapallial fluid is supersaturated, only allowing crystallisation to occur when appropriate, and controlling what is recorded in the carbonate shell (Marin and Luquet, 2004). Concentrations of Ca^{2+} and HCO_3^- must exceed the solubility of the products for the removal of H^+ ions to take place in order to form $CaCO_3$ (Davis, 2008; Wilbur and Saleuddin, 1983; Vander Putten *et al*., 2000). The formation of $CaCO_3$ minerals is based on a reaction between Ca^{2+} and HCO_3^- ions within the extrapallial space (Simkiss and Wilbur, 1989). Once mineralisation has started, H^+ ions need to be removed from the calcifying matrix in order for the process to continue (Crenshaw, 1980; Wilbur and Saleuddin, 1983).

$$Ca^{2+} + HCO_3^- \leftrightarrow CaCO_3 + H^+$$

Ca^{2+} and HCO_3^- are not the only inorganic ions in the extrapallial fluid, with Na^+, K^+, Mg^{2+} and Cl^- also being present (Simkiss and Wilbur, 1989). However, the uptake of ions other than Ca^{2+} into the body and their substitution into the shell is also dependent on the binding site affinity for each ion species and the channel pathway of the ions through the calcifying mantle (Carre *et al.,* 2006). Calcium channels are required to move Ca^{2+} around the body epithelium of the mollusc to the extrapallial fluid for biomineralisation. As Ca^{2+} ions are greatly out numbered by other ions in the ambient seawater, the calcium channels must be extremely selective to only allow an influx of Ca^{2+} rather than other cations (Hess and Tsien, 1984). Other trace elements (including Sr^{2+} and Ba^{2+}) have a stronger affinity to the binding sites within the calcium channels (Carré *et al*., 2006).

2.4.2 Shell Structure

Many mollusc shells are made up of three main layers: (1) the periostracum, (2) the outer prismatic layer, and (3) the inner nacreous layer (Fig. 2.5) (Simkiss and Wilbur, 1989). Both the prismatic and nacreous layers of the shell consist of $CaCO_3$ polymorphs, generally calcite, aragonite or both (Davis, 2008; Lin and Meyers, 2005; Simkiss and Wilbur, 1989; Skinner and Jahren, 2007). The two forms of $CaCO_3$ constitute up to 95-99% of the shell weight with the remaining shell weight made up of organic material (Lin and Meyers, 2005; Carter, 1980). The periostracum is a thin organic layer which forms the outermost part of the shell (Saleuddin and Petit, 1983). This layer is important for shell deposition, as it serves as a matrix for the carbonate crystals to grow on and also protects the shell from corrosion by seawater and colonization by epibionts and endobionts (Gray and Smith, 2004; Saleuddin and Petit, 1983).

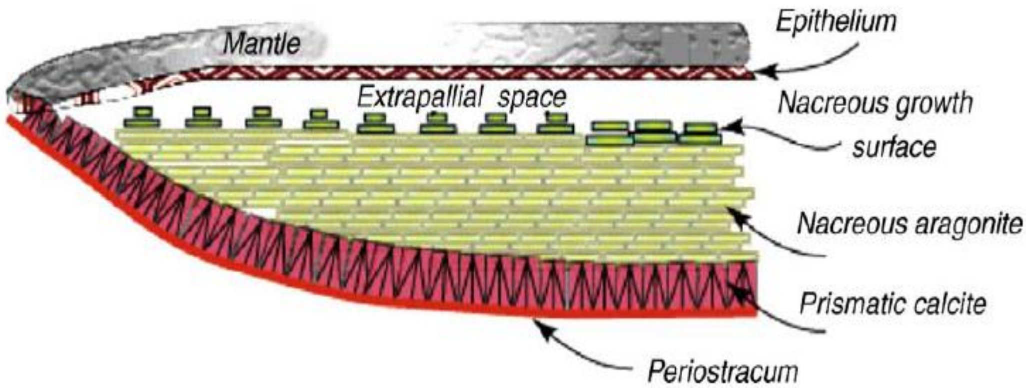

Fig. 2.5. Structure of a typical mollusc shell displaying the growth pattern in both the nacreous (aragonite crystals) and prismatic (calcite crystals) layers (Lin and Meyer, 2005).

2.4.2.1 Prismatic Layer

The prismatic layer is the outermost $CaCO_3$ layer, and is the first to be precipitated from the extrapallial fluid (Simkiss and Wilbur, 1989). This layer is made up of long prisms and spherulites, up to 100 nm in diameter, surrounded by an organic matrix which separates them (Gray and Smith, 2004; Simkiss and Wibur, 1989; Wilbur and Saleuddin, 1983). The calcite prisms are precipitated and grow inwards from the periostracum (Simkiss and Wilbur, 1989). The periostracum influences the deposition of the $CaCO_3$ prismatic layer, as it prevents lateral growth of the crystals, causing them to grow perpendicular to the periostracum (Saleuddin and Petit, 1983; Wilbur and Saleuddin, 1983). Wilbur and Saleuddin (1983) show evidence of the formation of the prismatic layer of many molluscs through the growth of spherulites (Fig. 2.6). The spherulites form in polygonal blocks at the outer shell as elongated crystal structures beginning to form. Spherulites at different stages of growth will be blocked by lack of space, and other crystals continue their growth and become larger in size. The organic material they are grow from will be displaced and replaced with the organic matrix.

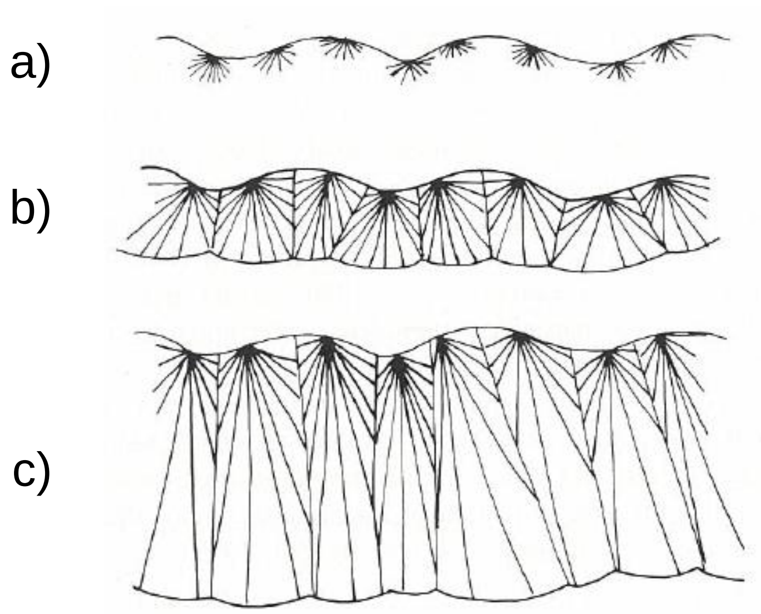

Fig. 2.6. The stages of crystal growth of the prismatic layer described by Wilbur and Saleuddin (1989).

2.4.2.2 Nacre

The nacre is the innermost layer of the shell and is composed of tabular, tiled crystalline aragonite surrounded by an organic matrix in a structure that resembles a brick and mortar (Fig. 2.7) (Gray and Smith, 2004; Lin and Meyers, 2005; Lin *et al*., 2008). This organic glycoprotein matrix only makes up 5 weight % of the *Haliotis* nacreous shell composition however increases the fracture resistance of the shell by. 3000 times the fracture resistance compared to a shell of completely composed of inorganic $CaCO_3$ crystals (Lin *et al*., 2008). Any energy related to defecting the brittle $CaCO_3$ is propagated along the organic layers instead of the crystals (Davis, 2008; Gray and Smith, 2004).

The formation of the nacre begins with the deposition of mineralised granules and the secretion of matrix. Through continual growth, the granules become rounded, flattened crystals which are then covered by the organic matrix. The crystals are deposited in conical stacks with the youngest precipitated crystals having the smallest diameter (Wilbur and Saleuddin, 1989). Sheets of matrix will then secrete, filling the gaps of the crystal stacks. The lateral growth of the crystals continues, bringing crystals in contact with neighbouring stacks. The organism injects the organic matrix periodically when the animal is arrested (Lin and Meyers, 2005). These nacre aragonite plates of *Haliotis iris* are ca. 300 to 450 nm thick (Gray and Smith, 2004).

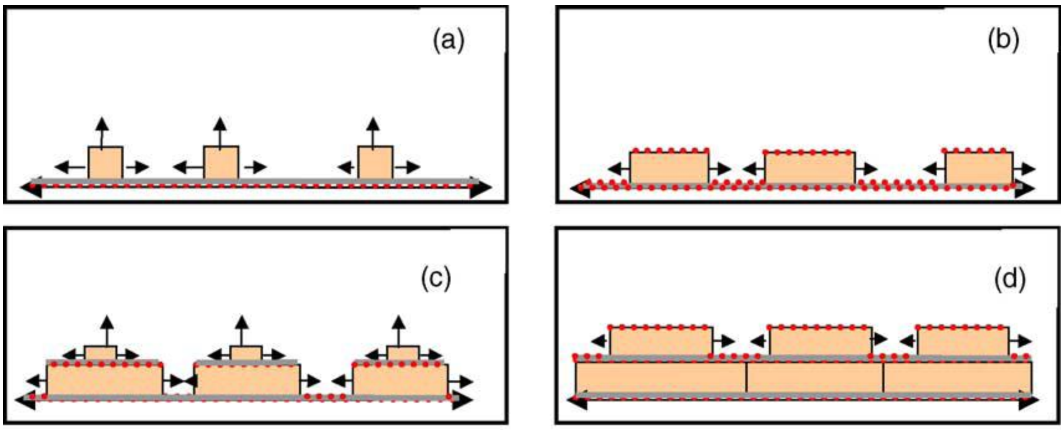

Fig. 2.7. A schematic representation of the formation of the nacreous layer in *Haliotis* species through the stacking of aragonite tiles (Lin and Meyers, 2005). Figure (a) represents the nucleation of aragonite intermittent with the protein layers (red dots). Figure (b-d) show the growth with the tiles periodically lain down protein layers.

2.4.3 Vital Effects

Metabolic and physiological processes play a large part in the geochemistry of a mollusc's shell (Schöne, 2008; Vander Putten *et al.,* 2000). The term 'vital effects' is given to metabolic processes that influence the chemical composition of the carbonate secreting fluid (Lazareth *et al.,* 2007; Schöne, 2008; Vander Putten *et al.,* 2000). The uptake of trace elements into the shell of molluscs is affected by many factors, including growth rate changes, pH variations of precipitating fluid and the transport of ions throughout the body tissue (Lazareth *et al.,* 2007). If the element is not favourable for the system tracts within the mollusc then it is less likely to make its way to the EPF and be secreted within the shell (Wilbur and Saleuddin, 1983).

Growth rates of mollusc shells appear to vary between juvenile and mature specimens with many $CaCO_3$-shell-bearing organisms experiencing growth deceleration with increasing age (Gardner *et al*., 1993; Wanamaker *et al.,* 2007) Some species actually cease growth of their carbonate shells on a regular daily or semi-diurnal basis, during spawning, and when placed under stressful situations (Schöne, 2008). The prominent growth bands (Fig. 2.8) in mollusc shells are formed through the waxing and waning of shell growth as carbonate production varies (Schöne, 2008).

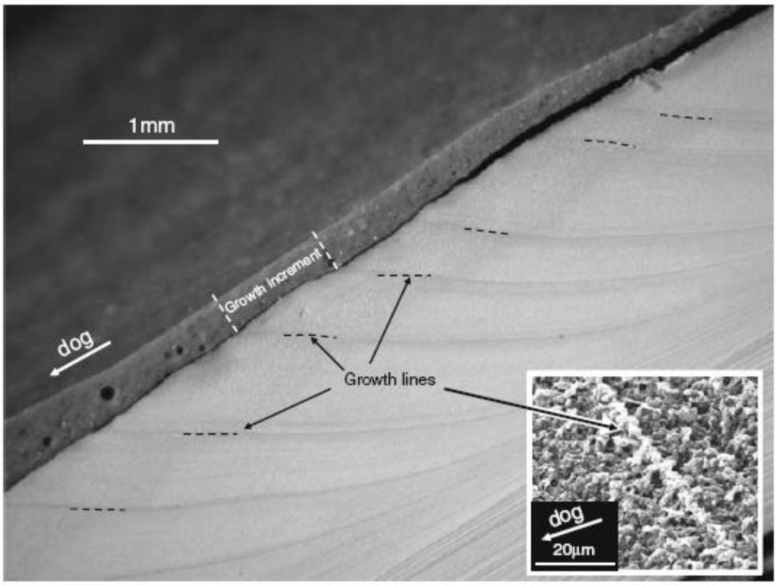

Fig 2.8. A polished cross section of an *Arctica islandica* showing the prominent growth lines from the cessation of precipitation of the calcium carbonate shell (Schöne, 2008).

2.4.4 ENVIRONMENTAL FACTORS

Environmental conditions, including temperature, salinity and pH levels can alter and affect shell shape, microstructure, mineralogy and chemistry (Dodd, 1965; Rhoads and Lutz, 1980).

Temperature is the primary environmental factor that can influence the survival of many species (Searle *et al.,* 2006; Schöne, 2008). Temperatures near the physiological optimum will favour shell production, whereas temperatures that exceed the species' thermal capacity will cause reduced shell production and even cause a cessation in shell growth (Schöne, 2008). In determining the upper thermal limit of organisms, thermal resistance has becoming increasingly important in the area of aquaculture development (Searle *et al*., 2006). The effect of temperature on the growth of *Haliotis iris* (pāua) has been investigated to determine optimal growth temperatures for the species (Searle *et al.,* 2006). The results presented show that juvenile pāua have a higher thermal maximum than adult pāua by 1-2°C (Searle *et al.,* 2006).

The salinity, pH, sedimentation rates, water chemistry, and water quality of an environment can also place stress upon organisms (Schöne, 2008). Donovan and Taylor (2008) investigated the metabolic response of pāua in high wave-swept environments. It was observed that even low-energy wave environments increase the metabolic rate of pāua, however, this is balanced by increased food availability and enhanced extraction of oxygen from the water (Donovan and Taylor, 2008).

Diet of the species and food availability are also important to the trace element chemistry of mollusc shells. Trace metals are taken up from all sources, including water and food. Therefore, high accumulated metal concentrations in a sample can be seen as an indicator of high ambient availabilities of that concentrated element (Protasowicki *et al*., 2007).

2.5 MOLLUSC SPECIES SELECTED FOR THIS STUDY

2.5.1 PĀUA

The species chosen for this study is the gastropod *Haliotis iris* which is commonly known as the black foot abalone or, locally, by the Māori name pāua (Gray and Smith, 2004).

The name *Haliotis iris* is derived from the Latin names *halios* (marine) *otus* (ear) and *iris* (rainbow). There are over 100 species of *Haliotis spp.* found worldwide with three species including *Haliotis iris* (i.e. *Haliotis australis* (yellow foot pāua) and *Haliotis virginea* (white foot paua)) endemic to modern New Zealand waters. Pāua are widely recognized by the iridescent blue and green colours of its shell (Fig. 2.9).

Fig. 2.9. The exterior and interior of a *Haliotis iris* shell. Photograph credit from gastropod.com.

Pāua is the largest of the New Zealand *Haliotis* family (maximum length = 180 mm). Pāua prefer low sedimentation rates, however, the environment in which they live varies from sheltered to very exposed locations (Gray and Smith, 2004).

Pāua grow larger in cooler waters in the lower North Island and the South Island, than in the warmer waters of the northern part of New Zealand (Estes *et al*., 2005; Gray and Smith, 2004). This is due to cooler waters favouring calcite precipitation (Carter, 1980). The deposition of the pāua shell occurs spirally represented by a line of pores (tremata) that form approximately parallel to the outer contour of the shell (Gray and Smith, 2004).

Pāua in the wild feed on larger seaweeds including *Polysiphonia spp.* and *Pterocladia lucida* (red algae) and *Carpoplyllum maschalocarpum* and *Ecklonia radiata* (brown algae) (Poore, 1972a). Donovan and Taylor (2008) describe pāua's feeding habits as a 'sit and wait' strategy which involves the pāua remaining stationary until they can trap the algae between their foot and the rocky substrate beneath them.

Pāua have been investigated in many different studies including an extensive study of 'the ecology of New Zealand abalones, *Haliotis* species' by Poore (1972a, 1972b). The stable oxygen isotope composition of pāua were analysed through an organised shell layer transect in order to validate the growth rate, age and reproductive patterns (Naylor *et al.,* 2007). In order to identify these factors, *H. iris* shells were tagged on a known date and with growth measured for a given period (Naylor *et al*., 2007). Oxygen isotopes can also be used in determining ambient temperatures during shell growth.

2.5.2 Pāua in *Aotearoa* New Zealand: Cultural and Economic Importance

Pāua have been harvested for several hundred years as a traditional food by Māori (Gray and Smith, 2004). Māori place great importance and reliance on fishing sources and customary fishing as *iwi* (tribe) and *hapu* (sub-tribe) from coastal regions (who did not go inland to hunt) would rely on the ocean for *kai moana.* Māori place strong spiritual connection on the ocean as *kai moana* within ocean are seen as the children of *Tangaroa* (Māori God of the Sea) which should be cherished and protected. The sustainability of *kai moana* is also respected and sustained in order to use it to support future generations. Pāua provides a food source for important events like *tangi* (funerals) or *hui* (meetings) and helps uphold the *mana* (prestige) of the hosts. The inner iridescent shell of pāua is also widely used in many Māori craft outlining the eyes and other features and bone and wood carvings on the *marae* (meeting house).

Pāua are in high demand worldwide for both their meat and shells (Gray and Smith, 2004; Symonds and Heath, 2008). The 2009 commercial market for both flesh and shells of pāua brought in over NZD $48 million with 85% of exportation going to Singapore and Hong Kong (New Zealand Seafood Industry Council, 2011). The iridescent, colourful inner shell has also created a demand for pāua jewellery products (Gray and Smith, 2004). Past years have seen a decline in wild stocks of pāua due to over-fishing and poaching, creating an under-supply of pāua on the worldwide market, resulting in the increase of development of aquaculture and pāua farming (Symonds and Heath, 2008).

New Zealand pāua fisheries are managed by the Quota Management Systems and enforced by the Ministry of Fisheries (New Zealand Seafood Industry Council, 2011). Legal harvesting size of pāua is 125 mm and with a maximum recreational catch of 10 pāua per fisher per day (MFISH, 2011).

3. MATERIALS AND METHODS

3.1 SAMPLE COLLECTION

Pāua used in this research were collected from two different types of environment; a cultured environment and a range of natural sites throughout New Zealand (Fig. 3.1).

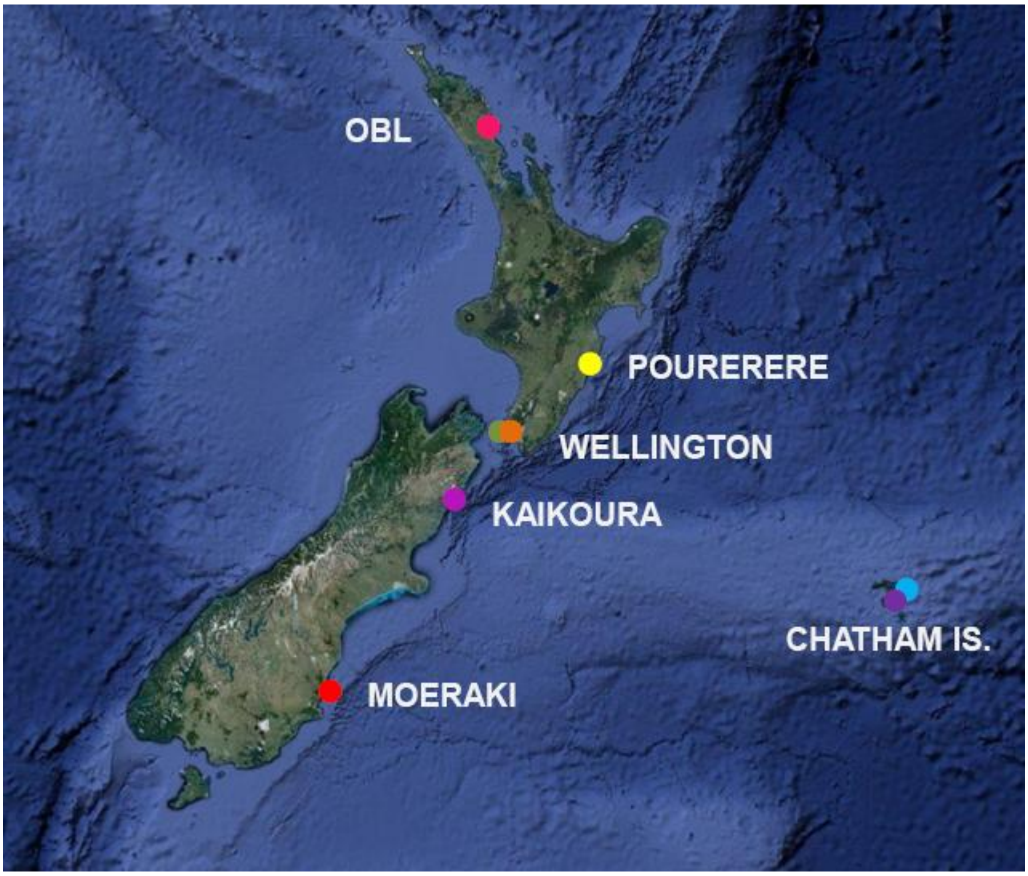

Fig. 3.1. The six pāua sample sites located around New Zealand and the Chatham Islands.

3.1.1 Cultured Environment

OceaNZ Blue Ltd (OBL) in collaboration with the National Institute of Water and Atmospheric Research (NIWA), have established an aquaculture pāua farm which involves spawning, settling, on-growing and processing pāua for supply to international food markets (OceaNZ Blue, 2011). OBL is located at NIWA's Bream Bay park facility in

Ruakaka, Northland. Creating the right environment for pāua to grow in is important with emphasis on controlling and maintaining environmental factors such as temperature, oxygen levels, pH, water salinity and sediment load (OceaNZ Blue, 2011).

Cultured pāua are grown in a system that uses both fresh and recirculated seawater from within the facility. Fresh incoming seawater is sourced 600 m offshore and at a depth of 10 m below the surface to ensure its cleanliness (OceaNZ Blue, 2011). This water is filtered through modern spin disc Arkal 10 µm sand filters to remove worms, plankton and parasites before it is added to the circulation system (OceaNZ Blue, 2011). The water in which the pāua are grown is recirculated in order to control water chemistry (oxygen and pH) and water temperature. Monitoring these factors keeps the environment in which the pāua grow at optimum levels (OceaNZ Blue, 2011).

Growth and health of the pāua are also monitored at OBL (Symonds and Heath, 2008). Each shell is tagged once the animal reaches 15 mm in size for easy identification (Symonds and Heath, 2008). The pāua at OBL are fed manufactured pellets containing alfalfa, soybeans and other plant products consistently throughout the day (Heath, 2006).

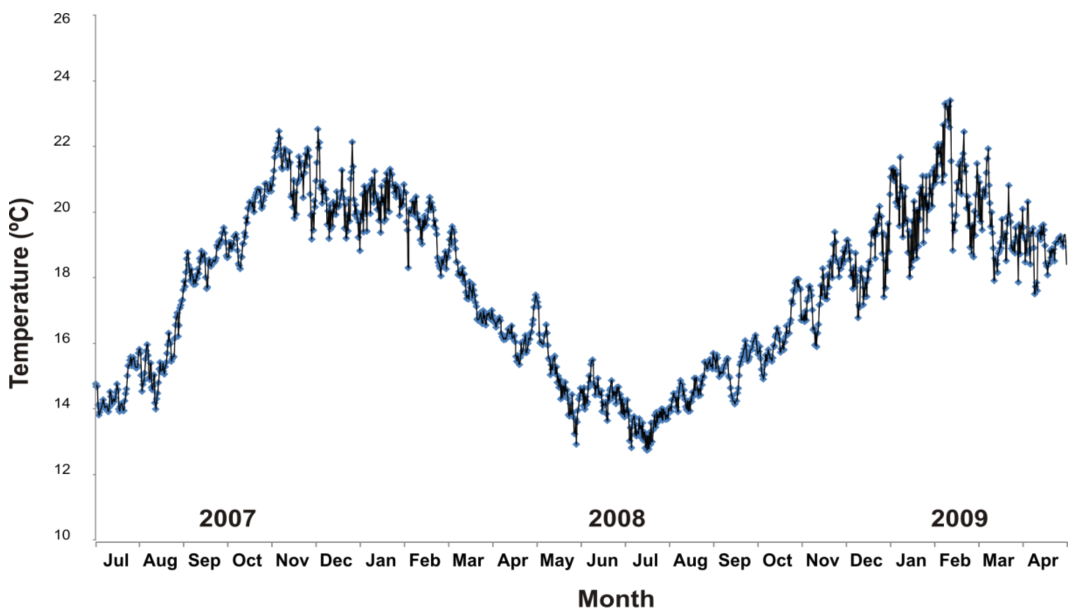

Fig. 3.2. Daily mean temperatures (˚C) (blue spots) of the recirculated water recorded by OBL over the months of July 2007 to April 2009.

For this study, minimum and maximum daily temperatures were recorded every month for 18-20 months prior to harvesting (dating back to August 2007) and supplied to the author by Rodney Roberts from OBL. Pāua were selected and killed on April 23rd 2009. Temperatures were electronically archived and recorded at 30 min intervals. The temperature thermocouple was checked and recalibrated with a silver and gold thermometer. In addition to temperature, growth data were also collected prior to harvesting for 18-20 months (with a few gaps in this record where the pāua were not found in the monthly sampling programme).

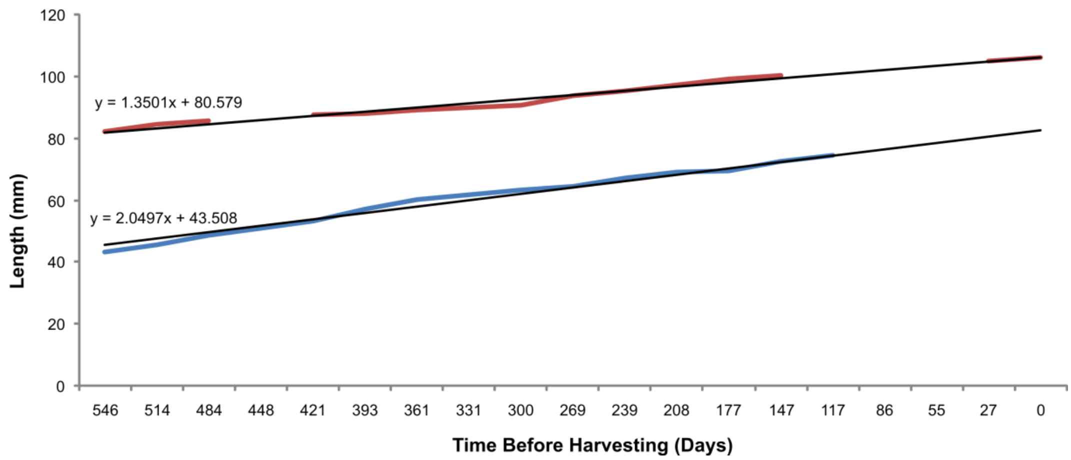

Fig. 3.3. Recorded length of shells RW75 (red) and A740 (blue) from OBL measured before death on April 23rd 2009.

3.1.2 Natural Environment

Live pāua were also collected from five sites from around New Zealand's coast: Pourerere, Kaikoura, Moeraki, two sites in Wellington (near Tarakena Bay and Moa Point) and the Chatham Islands (Ascot Reef and Manukau Reef). Pāua were collected by the Ministry of Fisheries (MFISH) or recreational fishers by free diving and removing the pāua from the rocks with a blunt knife or other tools as levers. Sample collection took place at different times from December 2009 to October 2010 (Table 3.1). As sampling was undertaken by others (many in which gathered the pāua during recreational dives), information regarding sampling depth, marine and terrestrial geomorphology were not recorded.

.

SAMPLE DESCRIPTIONS						NIWA 1971-2000 NEW ZEALAND AVERAGE TEMPERATURE DATA		
Prismatic Layer Colour	**Sample Name**	**Sample Site**	**Sampled Date**	**Length (mm)**	**Height (mm)**	**Temperature Recorded Location**	**Min Temp (°C)**	**Max Temp (°C)**
Light	K3A	Kaikoura	1/01/2010	130	26	Kaikoura	8.6	16.7
(White and Cream)	K1A1	Kaikoura	1/01/2010	129	37	Kaikoura	8.6	16.7
↑	MR2	Manukau Reef	27/10/2010	117	35	Chatham Island	8	15.1
	MP02A	Moa Point	24/12/2009			Wellington	8.8	17.1
	MD3	Moeraki	27/10/2010	126	25	Dunedin	6.5	15.2
	AR1	Ascot Reef	27/10/2010	127	42	Chatham Island	8	15.1
	SC2	South Coast	2/04/2010	155		Wellington	8.8	17.1
	SC1A	South Coast	2/04/2010	135		Wellington	8.8	17.1
	RW75	OBL	23/04/2009	105	27	Whangarei	11.2	20
	A740	OBL	23/04/2009	80	16	Whangarei	11.2	20
	MD1	Moeraki	27/10/2010	131	30	Dunedin	6.5	15.2
↓	P04A	Pourerere	30/12/2009	139	35	Napier	9.3	19.5
Dark	P1B	Pourerere	30/12/2009	134	35	Napier	9.3	19.5
(Blue and Green)	KD1B	Kaikoura	11/08/2010	150	41	Kaikoura	8.6	16.7

Table 3.1. Pāua sample descriptions including sample name, location and date collected along with length and height of each shell. The samples have also been grouped by environment (cultured versus wild) and colouring of the prismatic layer. NIWA 1971 – 2000 New Zealand average minimum and maximum temperature data from the six different sites are also shown.

3.1.2.1 Pourerere Beach

Pourerere is located in the central Hawke's Bay district ca. 30 km southeast of Waipawa on the east coast of the North Island of New Zealand. Pourerere has sandy beaches separated by hard shore rock and siltstone intertidal reef platforms. Prior to European settlement, the Hawke's Bay coasts were heavily populated with *pā* (fortified village) situated at Pourerere as the reef platform was and continues to be an important source of *kai moana* to local communities. Local *iwi* continue to use Pourerere as a site to gather *kai moana* due to its thriving marine ecosystem.

3.1.2.2 Wellington

Pāua were sampled from two locations in the Wellington region's south coast. Samples used in this study were collected near Tarakena Bay and Moa Point. Moa Point is the location of the Wellington Sewage Treatment Plant outlet. Sewage is initially treated through a series of screens, tanks, bioreactors, clarifiers and by ultraviolet treatment before being discharged into the Cook Strait at Moa Point (Wellington City Council, 2010).

3.1.2.3 Kaikoura

Kaikoura is located on the east coast of the South Island, 180 km north of Christchurch. The Kaikoura coast consists of steep slopes and cliffs bordered by high mountains on the west reaching maximum heights of 2885 m only 12 km from the ocean to the east (Rattenbury *et al*., 2006). The samples were collected near the Kaikoura township (Fig. 3.4b) off the rocky peninsula. The region attracts and sustains many forms of marine life, including sperm whales and dolphins who inhabit the deep canyons off the coast of Kaikoura.

3.1.2.4 Chatham Islands

Chatham Island (90 km^2) is 800 km due east of Christchurch off the mainland of New Zealand. Chatham Island is a renowned fishing area for pāua and other marine life. Pāua shells from two localities were chosen for analysis from the Chatham Islands; Ascot Reef and Manukau Reef, which both lie on the south-eastern coastline.

3.1.2.5 Moeraki

Moeraki is a small fishing village located on the eastern coastline of north Otago in the South Island of New Zealand (Boles *et al.*, 1985). Moeraki has a long history of Māori occupation as represented by a nearby historic *pā* site. Pāua shells from Moeraki were collected near the wharf by MFISH.

3.1.3 NIWA Temperatures

Mean monthly air temperature results taken from the NIWA database for 5 locations relatively close to sample locations were used to compare with the trace element chemistry obtained from each shell (Table 3.2). Air temperatures were used due to the lack of information of mean monthly sea temperature data for each region.

height of staton MSL	130 m	4 m	105 m	21 m	14 m
MONTH\YEAR	WAIPAWA (˚C)	WGTN AERO (˚C)	KAIKOURA (˚C)	PALMERSTON (˚C)	CHATHAM IS. (˚C)
Oct-10	11.4	12.1	11.2	10.6	11.4
Sep-10	11.1	12.4	11.5	8.7	10.6
Aug-10	9	10.8	8.9	7	9.9
Jul-10	7	8.5	7.6	5.1	8.2
Jun-10	7.8	10.4	8.5	5.6	9.6
May-10	10.6	12.7	11.2	8.1	11.6
Apr-10	12.9	15.7	14.7	12	13.8
Mar-10	15.3	16.9	15.9	14.1	15.1
Feb-10	18.2	17.9	16.6	15	15.8
Jan-10	17.1	16.8	15.9	14.4	16
Dec-09	15.7	16.0	14.9	13.6	10.6
Nov-09	13.5	14.2	13	12.3	10.5
Oct-09	10.3	11.3	9.4	8.4	
Sep-09	9.8	11.6	10.5	8.8	9.7
Aug-09	10.1	11.5	10.6	7.9	9.7
Jul-09	6.6	8.8	7.5	4.7	6.8
Jun-09	6.8	8.8	7.8	5.1	7.7
May-09	8.7	10.7	9	6.6	10.6
Apr-09	6.2	11.2	11.1	10.8	12.7
Mar-09	14.2	16.1	15	12.9	14.1
Feb-09	18.1	17.6	15.7	13.3	15.5
Jan-09	18.6	18.5	18.2	16.4	16.8
Dec-08	17	17.1	15.6	14	15.8
Nov-08	14.2	14.9	14.5	12.7	12.3
Oct-08	12.4	13.0	11.7	10.1	10.9
Sep-08	10.6	12.0	10.6	10.2	10.7
Aug-08	8.8	9.9	7.9	5.9	8.6
Jul-08	8.3	10.1	8.3	5.3	8.5
Jun-08	7.7	11.1	9.7	6.4	9.2
May-08	9.1	11.0	9.6	6.5	10.1

KEY					
Pourerere	South Coast	Moa Point	Kaikoura	Moeraki & C.I	KD1B

Table 3.2. Mean air surface temperatures recorded by NIWA over the months of May 2008 to October 2010. The temperatures from stations of varying heights (m) are the nearest air temperature measurements taken from the sample sites used in this study. The different colours represent the last recorded month the pāua would have lived at each sample sites.

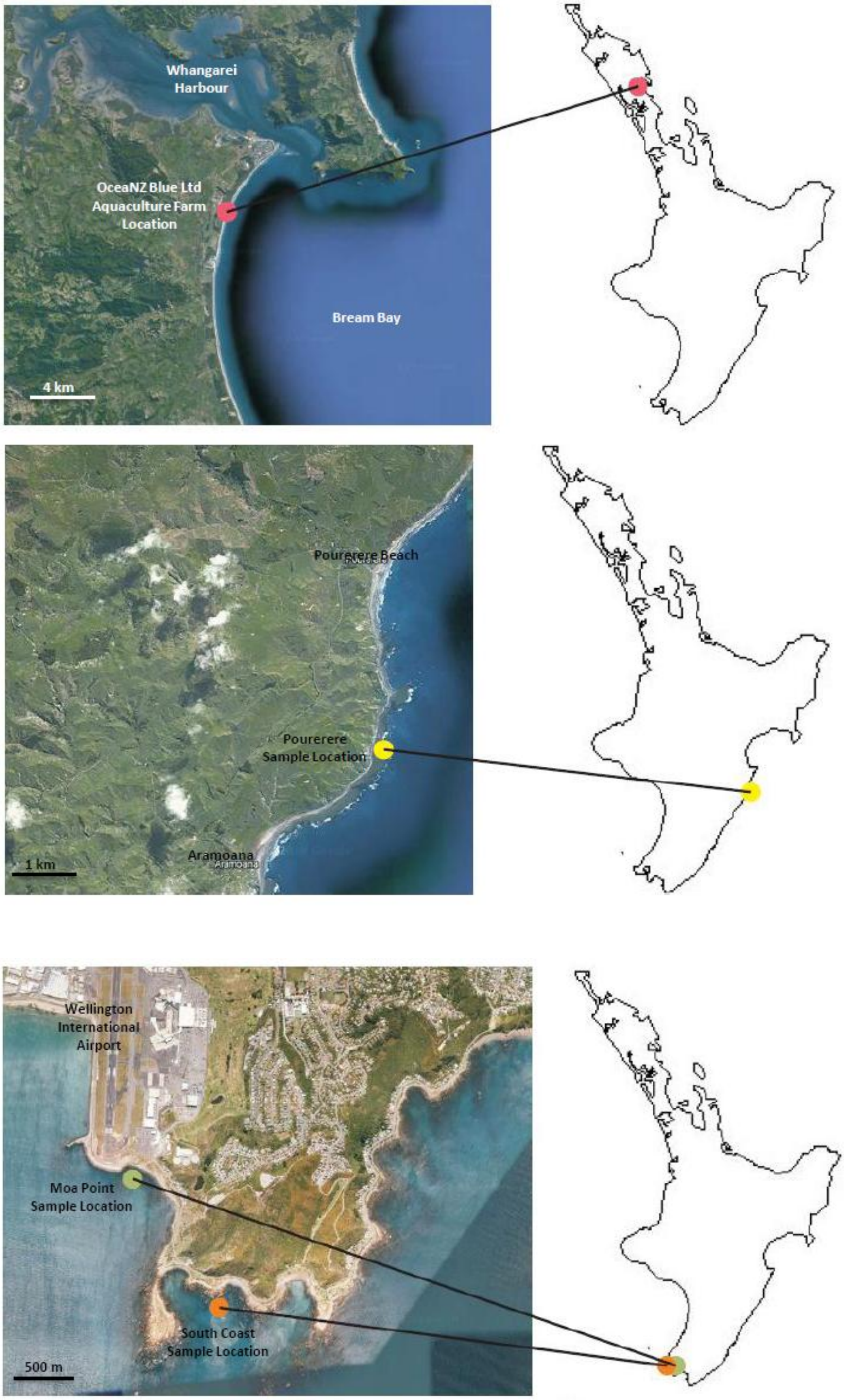

Fig. 3.4a. North Island pāua sample sites. **Top** - OceaNZ Blue Ltd site location in Ruakaka; **Middle** - Pourerere Beach in the Hawke's Bay; and **bottom** – The two Wellington sites, Moa Point (green) and south coast (orange).

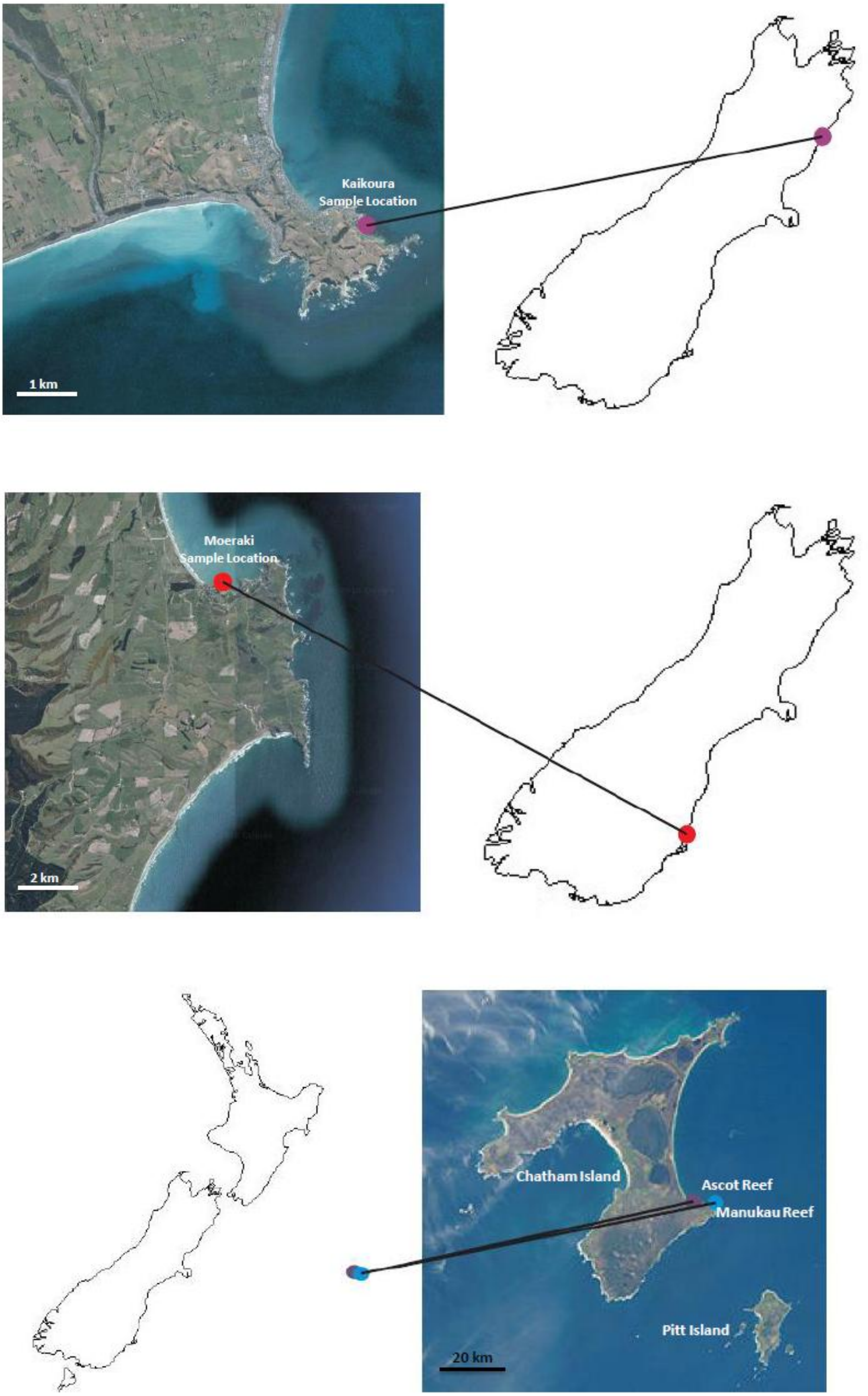

Fig. 3.4b. South Island sample pāua sites. **Top** – Kaikoura sample site; **Middle** – Moeraki sample site in Otago; and **bottom** – The two Chatham Island sites; Ascot Reef (purple) and Manukau Reef (blue).

3.2 SAMPLE DESCRIPTIONS

The physical nature of the pāua shells sampled varied considerably with location. Many of the collected shells were inappropriate for analysis as they were too porous or altered by external biological activity including burrowing by worms and the colonisation by epifauna such as barnacles and limpets. Shells in this condition were not analysed. Size and colour varied within each shell sample. Two shells from OBL (RW75 and A740) were very thin in cross section being only 1–2 mm thick. The colour of the prismatic layer was alternating light blue and white and the nacre was light brown in colour.

The samples from OBL differ from the shells sampled from the wild. The shells taken from the wild are legally required to be a minimum length of 125 mm. Shells that have been sampled from the wild were also stronger and thicker than the cultured pāua. There was also more variability of the colour of the prismatic layer of the shells sampled within the wild. This variation in the prismatic layer colour grading is described in Table 2.2 and is best observed in a cross section view through the shell (Fig. 3.8).

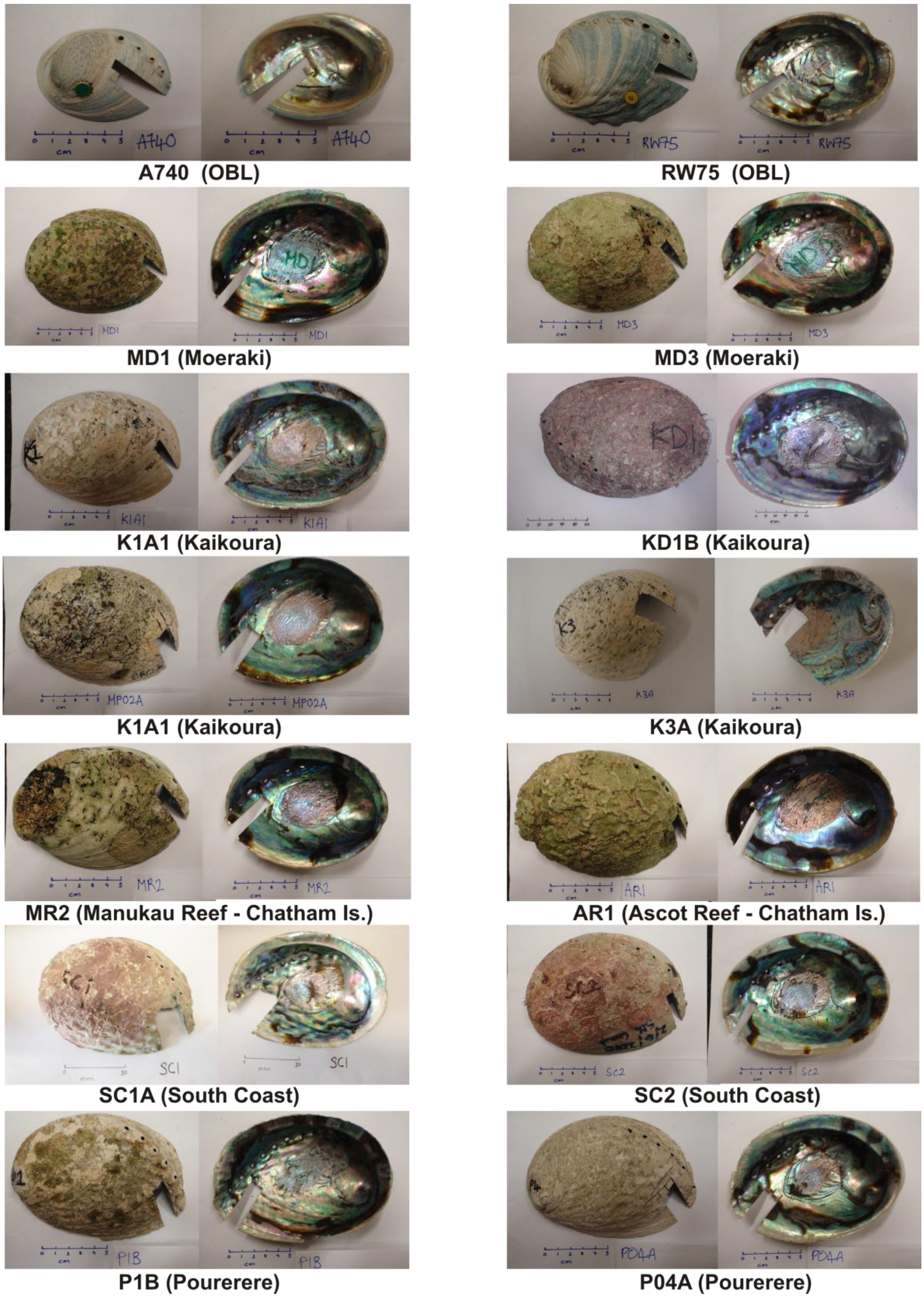

Fig. 3.5. Photographs of the exterior and interior of each sample analysed in this study, labelled with sample number and locality.

3.3 SAMPLE PREPARATION

The pāua flesh was removed from the shell prior to analysis. The shells were cleaned using a scrubbing brush under warm water to remove excess soft tissue, organic material and any algae growing on the exterior of the shell. The length and height of the shell were recorded. Each shell was then sectioned across a transect approximately 40 mm in length, following the tremata along the axis of maximal growth (Fig 3.6). Although the growth of the pāua is spiralled, the transect taken from each sample was cut in a straight line. The shell section was cleaned in a Metason50 ultrasonic bath for 2 min and left to dry for 24 hr on a hot plate at 52°C.

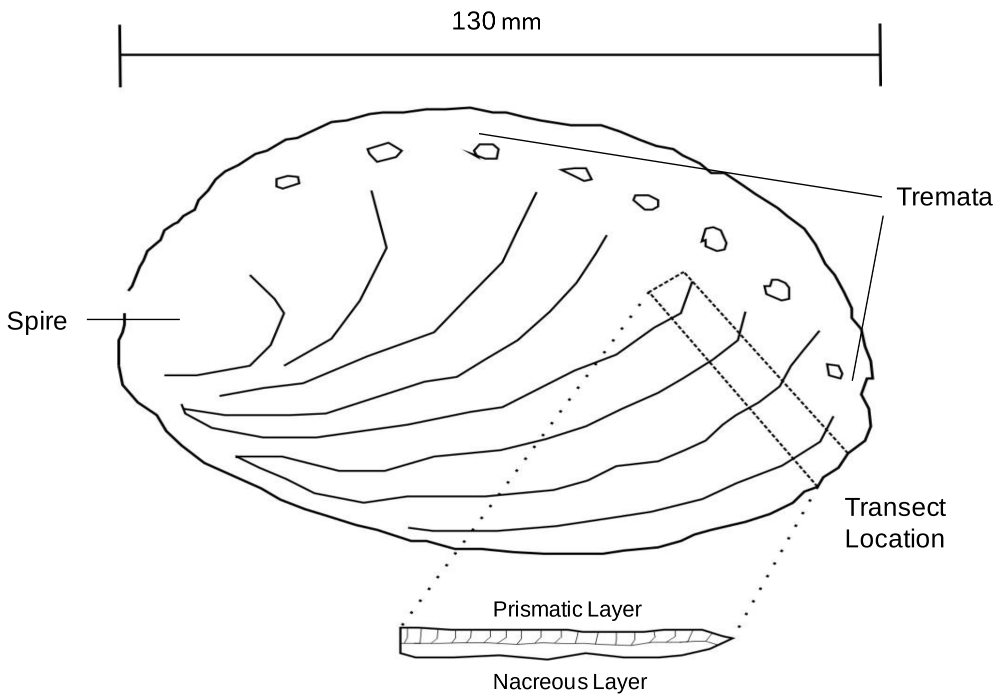

Fig. 3.6. Schematic diagram of the exterior of a pāua shell and transect location which follows the tremata along the axis of maximum growth. A cross section view of the transect highlighting the outer prismatic layer and inner nacreous layer is also shown.

The shell sample was snapped at random positions along its length in order to allow the shell fragments to fit inside the laser ablation chamber. The method of snapping the shell was preferred to sawing, as using a saw removes part of the shell material and thus the temporal record of shell chemistry. The sectioned shell was then mounted in a round epoxy mount oriented to expose growth bands and layers. The shells were set in epoxy resin with a fragment of the silicate glass standard NIST SRM 610, National Institute of Standard and Technology (NIST) (Pearce *et al.*, 1997), and left to harden on a hot plate at 52°C for 24 hr. Samples were then polished using sand paper grades of 400 µm, 600 µm, 1200 µm, 2500 µm and 4000 µm. Polishing using 3 µm and 1 µm sheets and diamond liquid was finally undertaken to complete the polishing process. Photographs were then taken of the samples under plane polarised and natural light (Fig. 3.8). Finally, the mounts were washed with distilled water in an ultrasonic bath before trace element analysis.

Three intra-shell transect paths were chosen for laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) trace element analyses (Fig. 3.7), including transects of (1) the prismatic layer, (2) the nacreous layer and (3) an individual growth band. The prismatic layer transect began at the foot of the shell and traversed inwards horizontally through a cross section of the shell. The nacreous layer transect began at the innermost part of the shell and traversed vertically through the nacre until it reached the base of the prismatic layer. The growth band transect began at the outmost part of the prismatic layer and traversed following the growth bands until it reached the prismatic-nacreous layer boundary. By beginning the transect of the prismatic layer at the foot of the shell to help correlate the trace element/Ca ratios in the youngest precipitated $CaCO_3$ shell material with the day of harvesting.

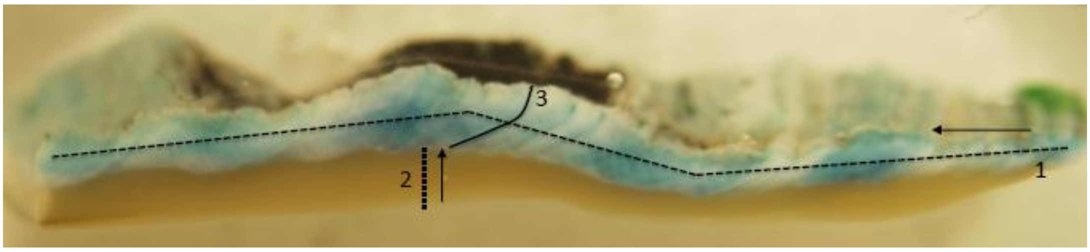

Fig. 3.7. The three intra-shell transects analysed per shell: (1) prismatic layer; (2) nacre and (3) an individual growth band within the prismatic layer. Arrows show the transect direction and growth direction from youngest part of the precipitated shell to older part of the precipitated shell.

Fig. 3.8. Photographs of each analysed sample. The blue material within the epoxy mounts is the NIST 610 glass standard.

3.4 PĀUA TRACE ELEMENT ANALYSIS

Analysis of the trace element chemistry of the pāua samples was undertaken by LA-ICP-MS. The epoxy mounts were inserted into the laser chamber as shown in Fig. 3.9.

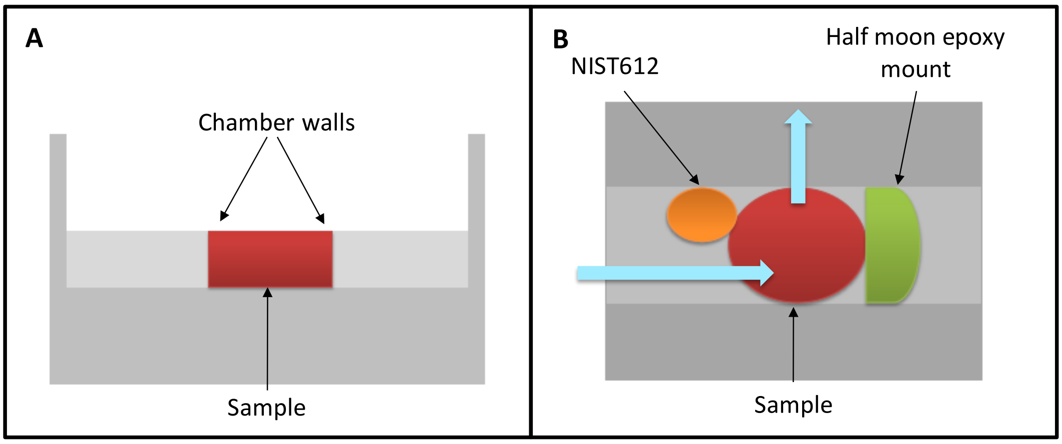

Fig. 3.9. Outline of the inside of the laser ablation chamber. **A.** A cross section view of the chamber showing the chamber walls and the sample. **B.** Plan view of the chamber outlining the location of the sample and NIST610 and half moon epoxy mount which directs gas flow. Helium gas flow is shown by bold blue arrows.

Tuning of the LA-ICP-MS was undertaken by rastering the laser across NIST610 between each run to ensure the signal stability was optimised prior to use. Laser ablation holes were spaced every 400 μm in the prismatic layer and every 50 μm in both the individual bands of the prismatic layer and nacre layer. Each laser spot was 25 μm in diameter and ablated at a frequency of 5 Hz and a laser power of 55%. The NIST 610 standard was analysed before and after every six sample spots. Each standard spot was 35 μm in diameter and measured at a frequency of 5 Hz and a laser power of 65%. A typical analytical run consisted of analyses of:

1. NIST610
2. 6 sample analyses
3. NIST610
4. 6 sample analyses
5. NIST610
6. 6 sample analyses
7. NIST610

A washout period of 120 s was utilised after each analysis. Both the sample and standard were ablated for 60 s. The ablated sample or standard material was transported into the plasma source of the ICP-MS in the form of an aerosol by a mixture of a helium-argon carrier gas where the elements were ionised. Trace elements measured were ^{7}Li, ^{11}B, ^{24}Mg, ^{27}Al, ^{43}Ca, ^{55}Mn, ^{66}Zn, ^{86}Sr, ^{88}Sr, ^{138}Ba, ^{208}Pb and ^{238}U. ICP-MS settings are shown in Table 3.3.

ICP-MS Settings		Laser Ablation Settings	
RF Power	1500 W	**Laser Frequency**	5 Hz
Sample Depth	3.5 mm	**Laser Power (Sample)**	55 %
Carrier Gas	0.85 L/min	**Laser Power (Standard)**	65 %
Optional Gas	70.0 to 98.0 L/min	**Ablation Pit Size (Sample)**	25 µm
		Ablation Pit Size (Standard)	35 µm

Table 3.3. ICP-MS and laser ablation settings used for the analysis of the pāua samples.

2.5 DATA REDUCTION AND PROCESSING

Data was recorded in a CSV file which contained the trace element counts per second (cps) measured every 0.3 s of each analytical run. In order to reduce the data, the average cps of each trace element was made for both the washout (background) and the for the ablation period of each spot.

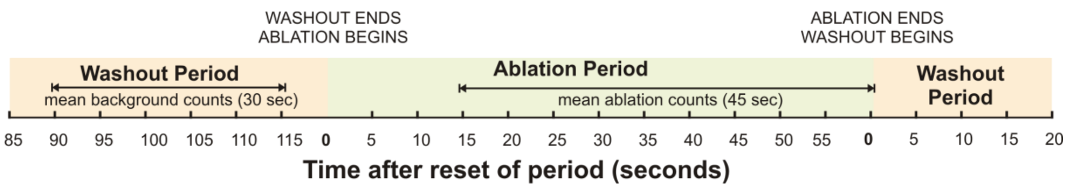

Fig. 3.10. Diagram illustrating the duration of washout (orange) and ablation (green) periods during an analytical run with respect to time (s) before the change from ablation to washout and vice versa. The period that was used to calculate mean counts per seconds are represented by the black line.

Mean background cps values were calculated by taking the mean of a 30 s washout period beginning 5 s prior to ablation commencing. The mean ablation period (sample or standard) was taken for a 45 s period, beginning 15 s after ablation commenced. By excluding the counts 5 s prior to ablation beginning and 15 s after ablation began, any surfacial contamination of the shell is not included in the results. The mean background cps were then subtracted from the mean ablation counts to give the background corrected cps. Each element was then corrected as a ratio to Ca by reference to the bracketing analyses of the NIST 610 standard using the equation below.

$$\frac{\text{Element}}{\text{Ca}}\text{pāua,} \quad \text{real} = \frac{\frac{\text{Element}}{\text{Ca}}\text{ pāua, measured}}{\frac{\text{Element}}{\text{Ca}}\text{ Std, measured}} \times \frac{\text{Element}}{\text{Ca}}\text{ Std,} \quad \text{real}$$

The measured pāua and standard element/Ca ratios were calculated in mmol/mol. The "real" standard value refers to the GeoReM preferred values for NIST610 shown in Table 3.4 (GeoReM, 2010).

GeoReM preferred NIST 610 value	
element	**element/Ca ratio (mmol/mol)**
Li	34.07
B	16.06
Mg	9.33
Al	195.13
Mn	4.30
Zn	3.47
Sr	2.87
Ba	1.54
Pb	1.00
U	0.95

Table 3.4. GeoReM preferred values of element/Ca ratio (mmol/mol) for the NIST610 standard used to correct the pāua trace element data for trace element fractionation during ablation and mass spectrometry.

4. RESULTS

This chapter presents laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) trace element analysis of the two main inorganic calcium carbonate layers; the prismatic layer and the nacreous layer, of pāua sampled from seven localities around New Zealand and the Chatham Islands.

4.1 AVERAGE INTER-SHELL CHEMISTRY VARIATIONS

4.1.1 Prismatic layer versus nacreous trace element chemistry

Mean element/Ca ratios of the prismatic and nacreous layers were calculated for each sample and are illustrated in Figures 4.1a and 4.1b. Mg/Ca, Li/Ca, Al/Ca and Mn/Ca ratios show higher element/Ca ratios in the prismatic layer compared with the nacreous layer. The Mg/Ca ratio in the prismatic layer ranges between 3.76 mmol/mol and 8.95 mmol/mol. These results are an order of magnitude higher than those in the nacreous layer, which range between 0.22 mmol/mol and 0.72 mmol/mol. The Li/Ca mean ratios are significantly higher in the prismatic layer across all samples when compared with the nacre. Al/Ca ratios are higher in the prismatic layer than the nacre, but also higher in shells sampled from Pourerere, Moa Point and one sample (KD1B) from Kaikoura. Mn/Ca mean values are generally similar in shells across all sample sites. OBL samples (A740 and RW75) and SC1A and K1A1 show higher element/Ca ratios in the nacre than in the prismatic layer, but the differences are small. As is the case with Al/Ca ratios, the highest Mn/Ca ratios within the prismatic layer are observed in sample MP02A and both samples from Pourerere.

Both Sr/Ca and B/Ca mean ratios are higher in the nacre of each shell compared to the outer prismatic layer. The highest Sr/Ca ratios in the nacre layer are seen in the Kaikoura sample K1A1. B/Ca generally shows higher values in nacre, compared with the prismatic layer, with the exception of SC1A, where the prismatic layer values exceeds nacreous layer values by 0.012 mmol/mol, and A740, in which prismatic layer values exceed nacre values by 0.0026 mmol/mol.

The remaining element ratios including Ba/Ca Zn/Ca, Pb/Ca and U/Ca, show variations in the relative elemental affinity to either the prismatic layer or the nacre. Apart from the shells that grew in the cultured environment, the samples from the North Island have lower values of Ba/Ca ratios within the nacreous layer than all other shells.

Zn/Ca ratios also show variable results between samples. Shells from OBL are again different from those from other sites, with both shells showing higher Zn/Ca ratios in the nacre than the prismatic layer. K1A1 has significantly higher nacre Zn/Ca values than any other shell, with Zn/Ca values of 0.014 mmol/mol.

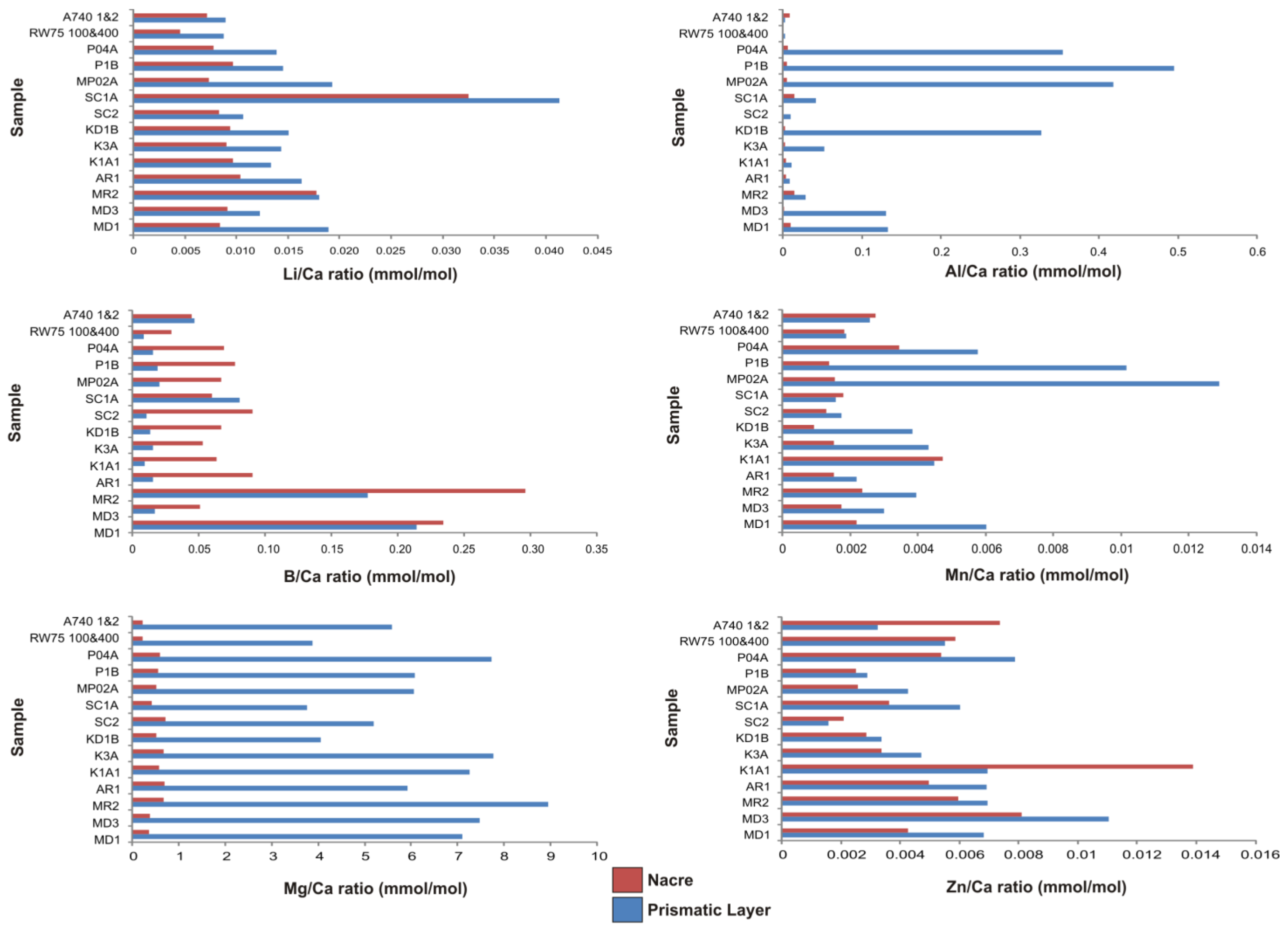

Fig. 4.1a. Shell mean element/Ca ratios (mmol/mol) of the prismatic (blue) and nacreous (red) layers in all samples. The samples are ordered by location, with the northernmost samples at the top and the southernmost samples shells at the bottom of each graph.

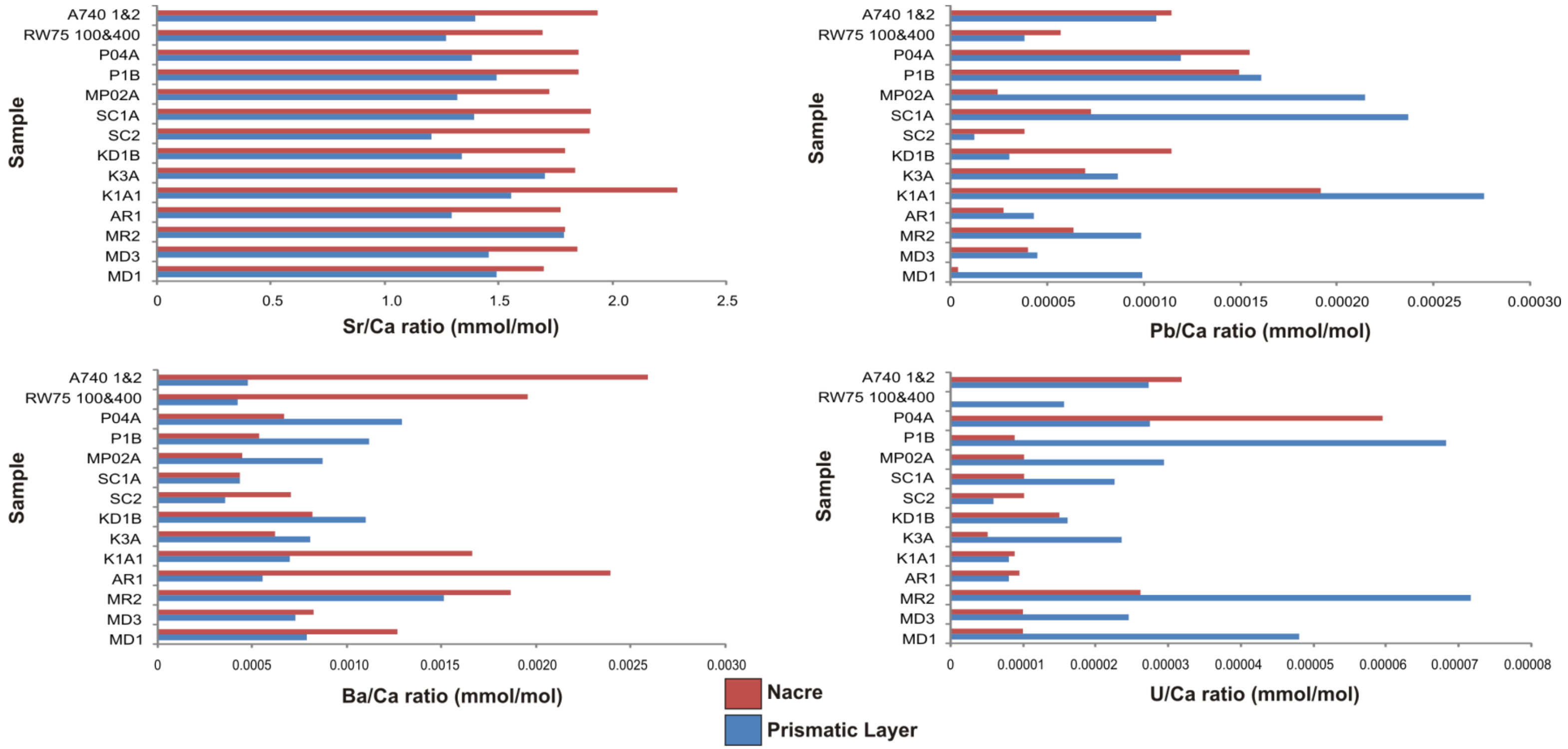

Fig. 4.1b. Shell mean element/Ca ratios (mmol/mol) of the prismatic (blue) and nacreous (red) layers in all samples. The samples are ordered by location, with the northernmost samples at the top and the southernmost samples shells at the base of each graph.

4.2 TEMPORAL CHANGES IN PĀUA SHELL CHEMISTRY

4.2.1 Prismatic Layer

The prismatic layers of the shell samples were analysed using 25 μm spots every 400 μm over transects approximately 40 mm in length. The results presented in Figures 4.2a through to 4.2g show a 3 point moving average of element/Ca ratios for each spot analysis. The results presented summarise the analyses from each site in order to show comparability between the trace element chemistries for each site. The gray bands within each figure are drawn to highlight areas of similar changes in element/Ca ratios. Each transect is then aligned with a photograph of the corresponding prismatic shell layer. Analyses were deleted if anomalies within the data were correlated with areas of contamination, for example, cracks or a poorly polished area of the shell.

4.2.1.1 OceaNZ Blue Ltd (OBL) (RW75 and A740)

Figure 4.2a illustrates element/Ca profiles through the prismatic layer of two pāua shells cultured in OceaNZ Blue Ltd's pāua-rearing farm. Mg/Ca ratios for the two shells have slightly different values with A740 consistently having slightly higher Mg/Ca ratios (1-2 mmol/mol) than RW75. The 3 point moving mean shows that Mg/Ca values change from ca. 2-12 mmol/mol, although variations in each shell are generally not well correlated between shells with the exception of the foot areas. Sr/Ca ratios for both shells show a restricted range (1.0-1.5 mmol/mol) and small-scale variability on a scale of 2-3 mm, but again, the variability within the two shells is not well correlated. Li/Ca ratios are low (0.0-0.1 mmol/mol) but generally slightly higher in shell RW75 compared with A740, with no obvious correlation of Li/Ca variations between each shells. B/Ca ratios are again low (0.0-0.02 mmol/mol) and comparable between shells RW75 and A740, with again no obvious correlation between shells. U/Ca ratios in both RW75 and A740 are extremely low (ca. < 0.0005 mmol/mol), however, unlike other element/Ca ratios, a significant number ($n = 7$) of (1-2 mm widths) U/Ca peaks in both shells appear to correlate. Ba/Ca, Mn/Ca, Zn/Ca and Al/Ca ratios in both OceaNZ Blue Ltd shells have comparable low ratios (all element/Ca ratios < 0.02 mmol/mol), but no clear correlation in the variations are observed in each shell.

4.2.1.2 Pourerere (P1B and P04A)

Figure 4.2b illustrates element/Ca profiles through the prismatic layer of two shells sampled from Pourerere in the Hawke's Bay on December 30th 2009. These shells, P04A and P1B, show similar values of Mg/Ca, Sr/Ca and Li/Ca. The 3 point moving average of Mg/Ca ratio for P04A ranges from 0.90-37.26 mmol/mol, and P1B range between 1.5-21.9 mmol/mol. The Mg/Ca ratios of both samples correlates reasonably well with similarities seen near the foot of the shell and 19 to 28 mm from the foot. Sr/Ca ratios for both shells show a restricted range (0.9-3.0 mmol/mol) and are not well correlated. Li/Ca ratios are low (0.0-0.5 mmol/mol) and again are not well correlated. B/Ca ratios are also low (0.0-0.15mmol/mol) with slightly higher ratios within P1B (0.1 mmol) than P04A. B/Ca ratios also show a number of peaks (n = 2) that are 1-2 mm in width and correlate well between shells. The first peak, located 16 mm from the foot, shows a small (0.8 mm) lag between P1B and P04A. This is also seen at the same point in the profiles for Mn/Ca and U/Ca, with slightly higher values in P1B than P04A. Pb/Ca ratios also exhibit higher values in P1B (ca. < 0.0003 mmol/mol), however, Pb/Ca ratios also have a higher number of peaks (n = 4) compared to other element/Ca ratios. Zn/Ca ratios are very low (ca. <0.01 mmol/mol) and are not well correlated between samples.

4.2.1.3 South Coast (SC1A and SC2)

The element/Ca profiles through the prismatic layers of two shells (SC1A and SC2) are illustrated in Figure 4.2c. Both shells were collected from Wellington's south coast on April 2nd 2010. Mg/Ca ratios for both shells are comparable, ranging from ca. 2-10 mmol/mol. Apart from the final ca. 15 mm of the profile, Mg/Ca variations in the shell are not well correlated. Sr/Ca ratios for both shells are poorly correlated, with a restricted range of ca. 0.8-1.8 mmol/mol and large scale variability on a scale of 10 mm. Li/Ca ratios are higher in SC1A (ca. 0.0-0.2 mmol/mol) compared with SC2 (ca. 0.00-0.02 mmol/mol). B/Ca, U/Ca, Pb/Ca, Ba/Ca, Zn/Ca and Al/Ca ratios also show higher SC1A values comparable with SC2 with low element/Ca ratios (ca. < 0.03 mmol/mol). B/Ca ratios in both SC1A and SC2 show a significant number (n = 6) of peaks which is unlike the other element/Ca profiles. Each peak appears to be 1-2 mm in width. U/Ca and Al/Ca ratios also show a few comparable peaks between both shell samples. Mn/Ca ratios for SC1A and SC2 are comparable with no clear correlation. Pb/Ca also has no clear correlation between both shells, with extremely low values (ca. < 0.00075 mmol/mol).

4.2.1.4 Moa Point (MP02A)

The element/Ca ratio profiles of the prismatic layer of MP02A are illustrated in Figure 4.2d. Mg/Ca ratios range between 2.0-17.0 mmol/mol. Close to the foot of the shell (0-24 mm) there are a series of changes in Mg/Ca, with gradual decreases in values over widths of 6.0-8.0 mm and sharp increases in values over widths of 1-2 mm. Sr/Ca ratios are restricted in range (1.0-2.5 mmol/mol). Li/Ca ratios of MP02A are low (ca. < 0.06 mmol/mol). The 3-point moving average of Li/Ca ratios near the foot of the shell shows consistently sharp changes in values over widths of 0.4 mm. This is followed by a flat period (5 mm) which is seen in both Mg/Ca and Sr/Ca ratios. B/Ca, Ba/Ca, Mn/Ca, Pb/Ca and Al/Ca ratios in MP02A show a correlation between a number of peaks (n = 3). These element/Ca ratio also have low values (0.0-0.6 mmol/mol). Pb/Ca ratios show variability over widths of 2-3 mm. Pb/Ca ratios are also extremely low (ca. < 0.0004 mmol/mol), and similar to U/Ca ratios (ca. < 0.0003 mmol/mol). Low in Zn/Ca ratios are also evident (0-0.015 mmol/mol).

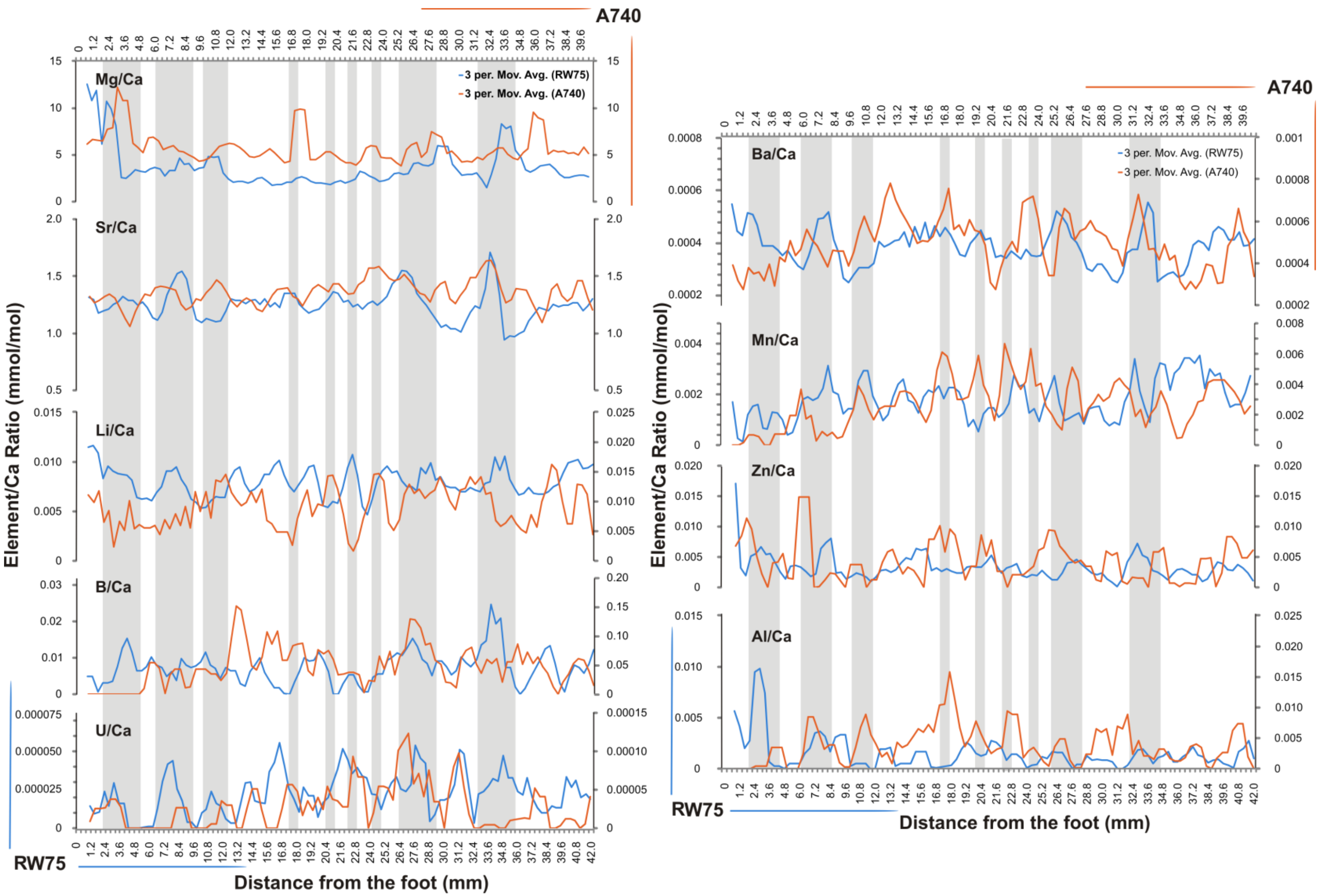

Fig. 4.2a. Plots of the 3-point moving average of element/Ca ratios of samples A740 (red) and RW75 (blue) from OceaNZ Blue Ltd measured from the foot of the shell through the prismatic layer.. The scale for RW75 is represented on the left and bottom axes with A740 represented on the right and top axes. Grey banding highlights element/Ca ratios that are well correlated.

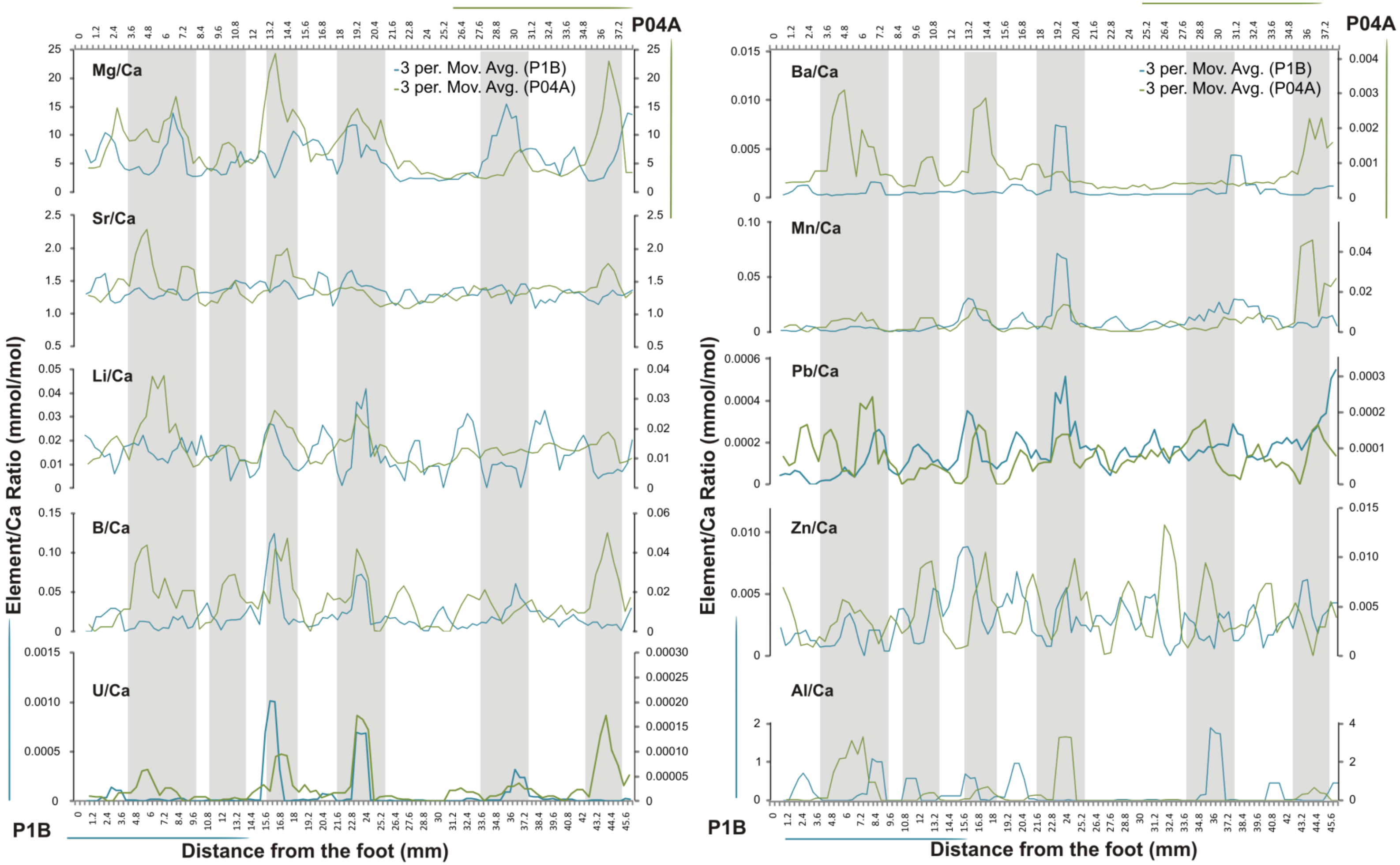

Fig. 4.2b. Plots of the 3-point moving average of element/Ca ratios of samples P04A (green) and P1B (blue) from Pourerere measured from the foot of the shell through the prismatic layer.. The scale for P1B is represented on the left and bottom axes with P04A represented on the right and top axes. Grey banding highlights element/Ca ratios that are well correlated.

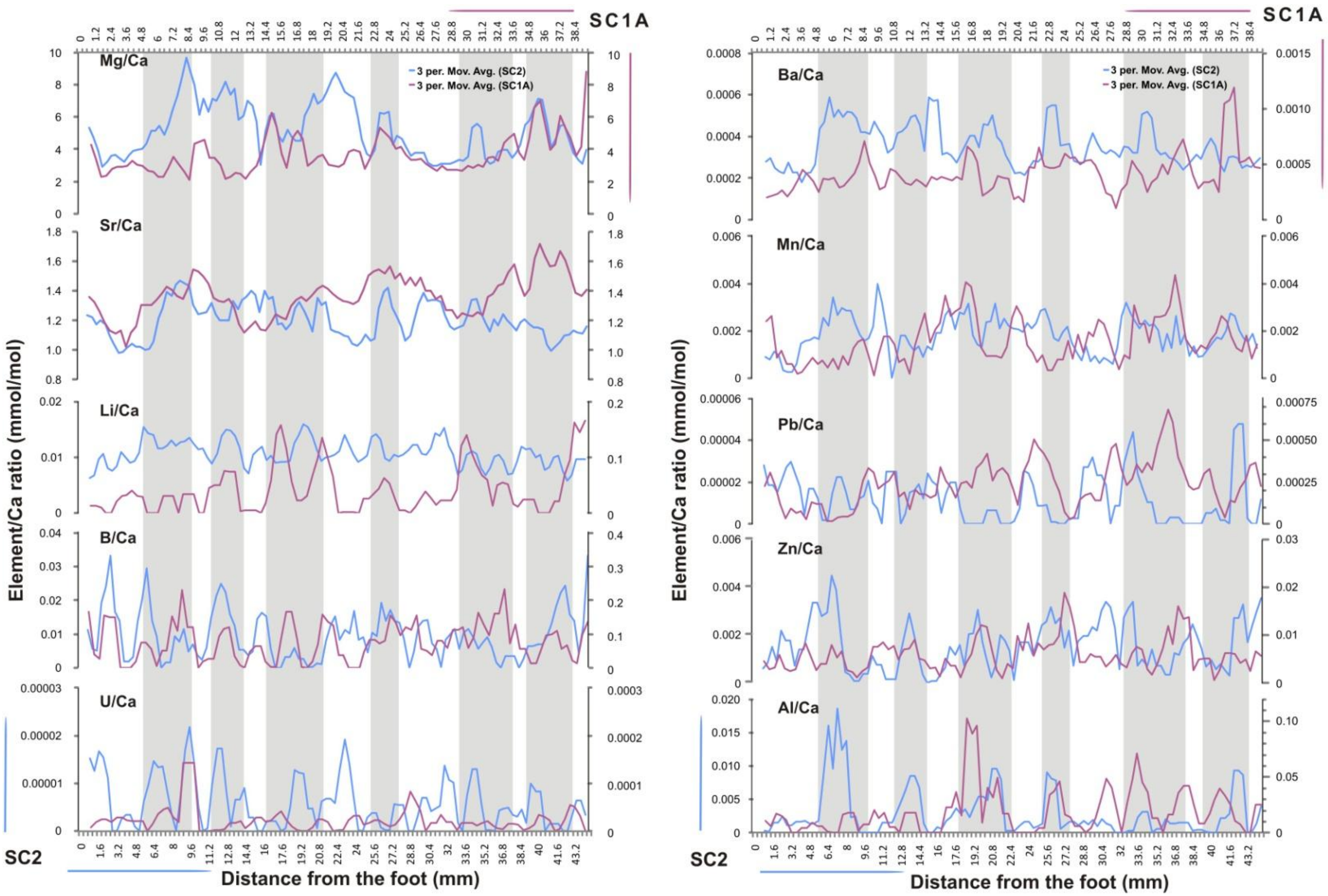

Fig. 4.2c. Plots of the 3-point moving average of element/Ca ratios of samples SC1A (pink) and SC2 (blue) from the Wellington south coast measured from the foot of the shell through the prismatic layer. The scale for SC2 is represented on the left and bottom axes with SC1A represented on the right and top axes. Grey banding highlights element/Ca ratios that are well correlated**.**

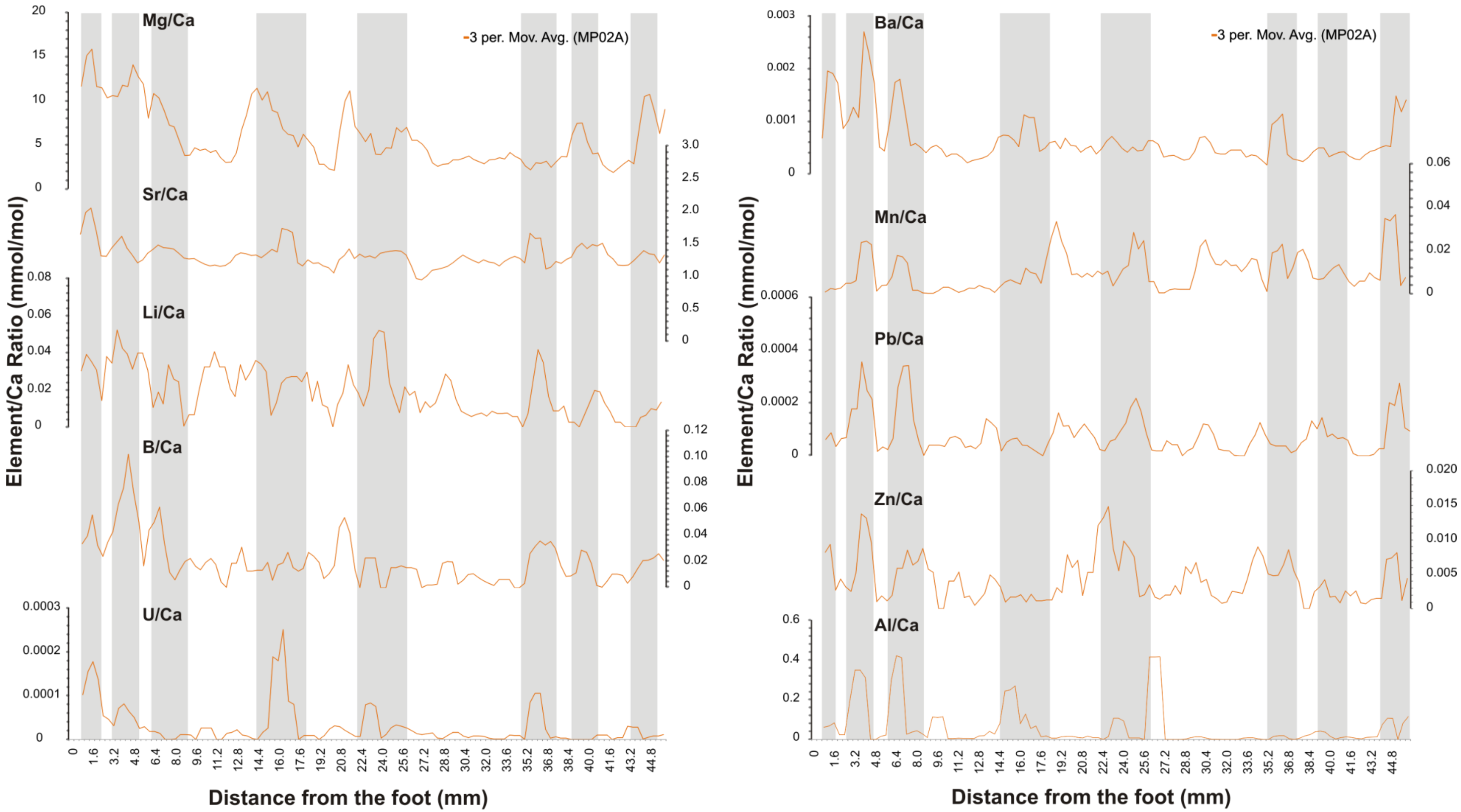

Fig. 4.2d. Plots of the 3-point moving average of the element/Ca ratios of samples MP02A from Moa Point in Wellington measured from the foot of the shell through the prismatic layer. Grey banding highlights element/Ca ratios that are well correlated.

4.2.1.5 Kaikoura (KD1B, K3A and K1A1)

Figure 4.2e illustrates the 3-point moving average of the element/Ca profiles of KD1B. The shell was collected in Kaikoura on August 11th 2010. The profile is long (< 80.0 mm) compared with the other samples analysed in this research (32-46 mm). Mg/Ca ratios range between 1.5-17.3 mmol/mol. Higher Mg/Ca ratios values are observed 0.0-20.0 mm from the foot before values fall below 10 mmol/mol. Sr/Ca ratios are also restricted (1.0-2.0 mmol/mol), with the exception of a peak observed 69 mm from the foot of the shell. The peak has a width of 2-3 mm and is reproduced in Ba/Ca, Mn/Ca and Zn/Ca ratios. Low values are also seen in Ba/Ca (0.004 mmol/mol), Mn/Ca (0.025 mmol/mol) and Zn/Ca ratios (0.005 mmol/mol). Zn/Ca, B/Ca and Li/Ca ratios are low (ca. 0.02 mmol/mol) and show small scale variability over 1-2 mm. U/Ca and Pb/Ca ratios are extremely low (ca. < 0.0001 mmol/mol) with large variability in values over small distances (<1 mm). Al/Ca ratios are low (0-0.04 mmol/mol).

Figure 4.2f illustrates the element/Ca profiles through the prismatic layer of two pāua shells (K3A and K1A1) from Kaikoura. The shells were collected from Kaikoura on January 1st 2010.

Mg/Ca ratios in both samples are comparable, ranging from ca. 3-20 mmol/mol. There are a number (n = 4) of peaks seen in both K3A and K1A1 that are 1-2 mm in width. With the exception of these peaks, the variations in each sample are generally not well correlated. Sr/Ca ratios in both samples are also not well correlated. K3A has a larger range in Sr/Ca (ca. 1.0-3.0 mmol/mol) compared with K1A1 (1.0-2.0 mmol/mol). Li/Ca ratios are comparable in both K3A and K1A1, with a range of between 0-0.04 mmol/mol. Apart from the first 0-10 mm from the foot, both samples are poorly correlated. B/Ca ratios are also low (ca. < 0.06 mmol/mol), but both samples are comparable and are moderately well correlated. Ba/Ca ratios are also very low (ca. < 0.002 mmol/mol) but comparable and also moderately well correlated. Mn/Ca ratios are also comparable, with a range from 0.000–0.017 mmol/mol. Pb/Ca ratios are extremely low (ca. < 0.0006 mmol/mol) with large-scale variability over minimum widths of 4 mm. Al/Ca ratios are higher in K3A (ca. < 0.50 mmol/mol) compared with K1A1 (ca. < 0.06 mmol/mol), however, the variations in both samples are poorly correlated.

4.2.1.6 Chatham Islands (MR2 and AR1)

Figure 4.2g illustrates the element/Ca profiles through the prismatic layer of MR2 and AR1. Both shells were collected off the east coast of the Chatham Islands on October 24th 2010. Mg/Ca ratios of both samples are comparable with a higher range seen in MR2 (ca. < 25 mmol/mol) compared with AR1 (ca. 13 mmol/mol). Mg/Ca and Sr/Ca ratios in both samples are also poorly correlated. The Sr/Ca ratios in AR1 range are restricted (ca. 1.0-2.0 mmol/mol) whereas a number of large peaks (n = 4) are observed in MR2 that have a width of 1.0-2.0 mm. Li/Ca ratios are low (0.0-0.06 mmol/mol) and are comparable between both samples but poorly correlated. B/Ca ratios for the two samples have different values, with MR2 consistently having higher B/Ca ratios than AR1 (0.2 mmol/mol). MR2 has higher values of U/Ca, Mn/Ca, Pb/Ca and Al/Ca when compared with AR1, and these are not well correlated between samples. All values are low (ca. < 0.2 mmol/mol). Ba/Ca ratios are comparable in both shells (ca. < 0.004 mmol/mol) but again, are poorly correlated. Zn/Ca values are low (0.00-0.02 mmol/mol) with a number of peaks (n = 4) seen in both shells. AR1 peaks precede that of MR2 by 0.4-1.2 mm. Apart from the peaks, there is no clear correlation in the Zn/Ca ratio of each shell.

4.2.1.7 Moeraki (MD1 and MD3)

The element/Ca profiles of two samples (MD1 and MD3) are illustrated Figure 4.2h. MD1 and MD3 were collected from Moeraki on October 27th 2010. The 3-point moving average of Mg/Ca ratios has a range of 3.0-17.0 mmol/mol. There are also a number of peaks (n = 3) which correlated well between samples. Sr/Ca ratios are restricted in range (1.0-2.2 mmol/mol), as seen in all other samples. Both individuals have poor correlation but comparable Sr/Ca values. Li/Ca ratios are low (0.00-0.06 mmol/mol) but slightly higher (0.03 mmol/mol) in MD1 compared with MD3. B/Ca ratios are also higher in MD1 (ca. < 0.6 mmol/mol) compared with MD3 (0.06 mmol/mol). B/Ca ratios again are poorly correlated. U/Ca and Pb/Ca ratios in both shells are extremely low (0.0000-0.0004 mmol/mol) but are comparable. Zn/Ca ratios are low (ca. < 0.04 mmol/mol) but comparable between samples. There is also a moderate Zn/Ca correlation with slightly higher values (0.0025-0.0050 mmol/mol) in MD1 compared with MD3. Ba/Ca ratios are poorly correlated, but have a number of peaks (n = 2) over widths of 1-2 mm that are similar in both samples. Ba/Ca, Mn/Ca and Al/Ca ratios in both shells are low (ca. < 0.80 mmol/mol) with slightly higher values seen in MD1 compared with MD3. As observed in other element/Ca profiles, there is no clear correlation seen in both samples.

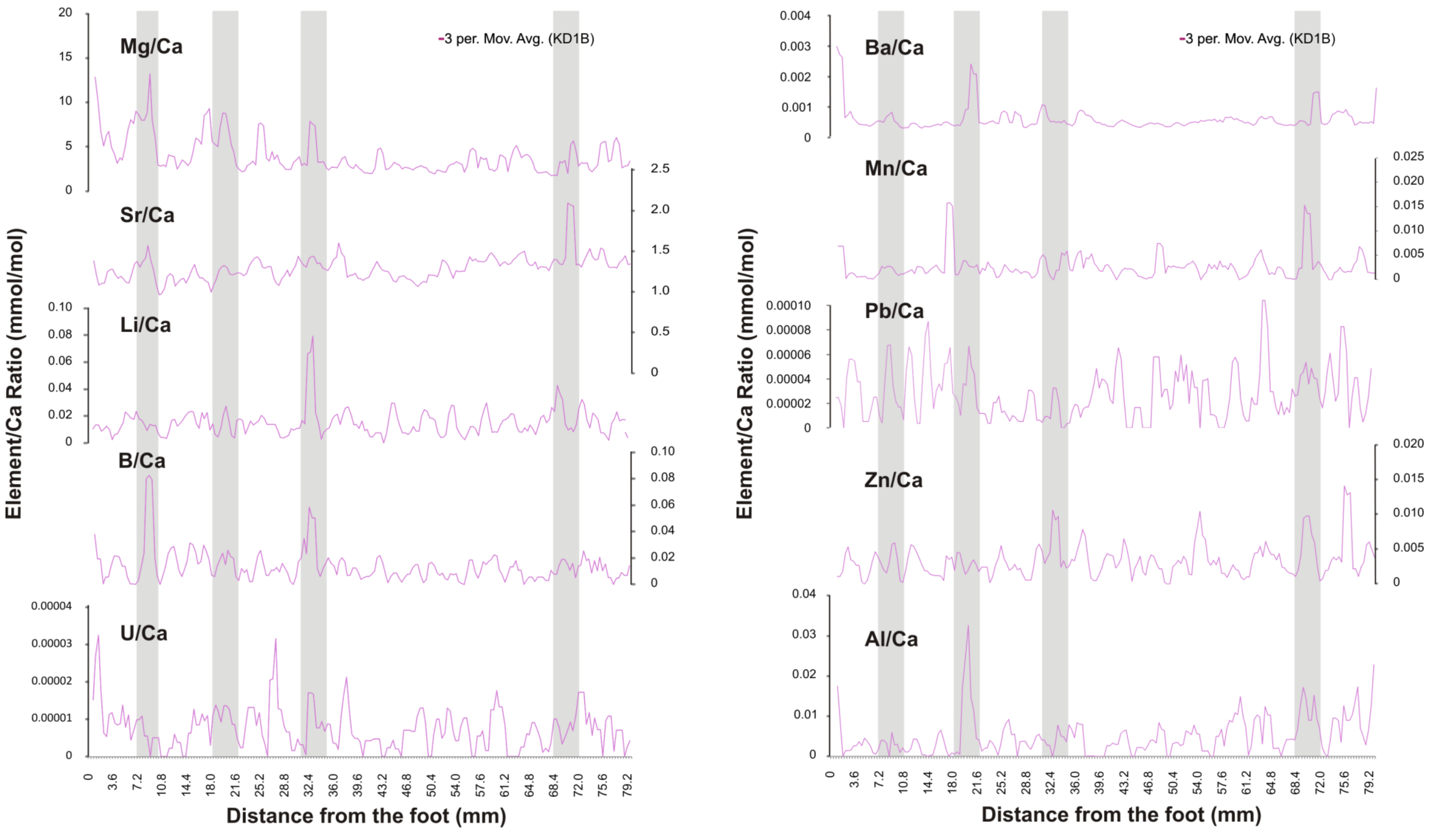

Fig. 4.2e. Plots of the 3-point moving average of the element/Ca ratios of samples KD1B from Kaikoura measured from the foot of the shell through the prismatic layer. Grey banding highlights element/Ca ratios that are well correlated.

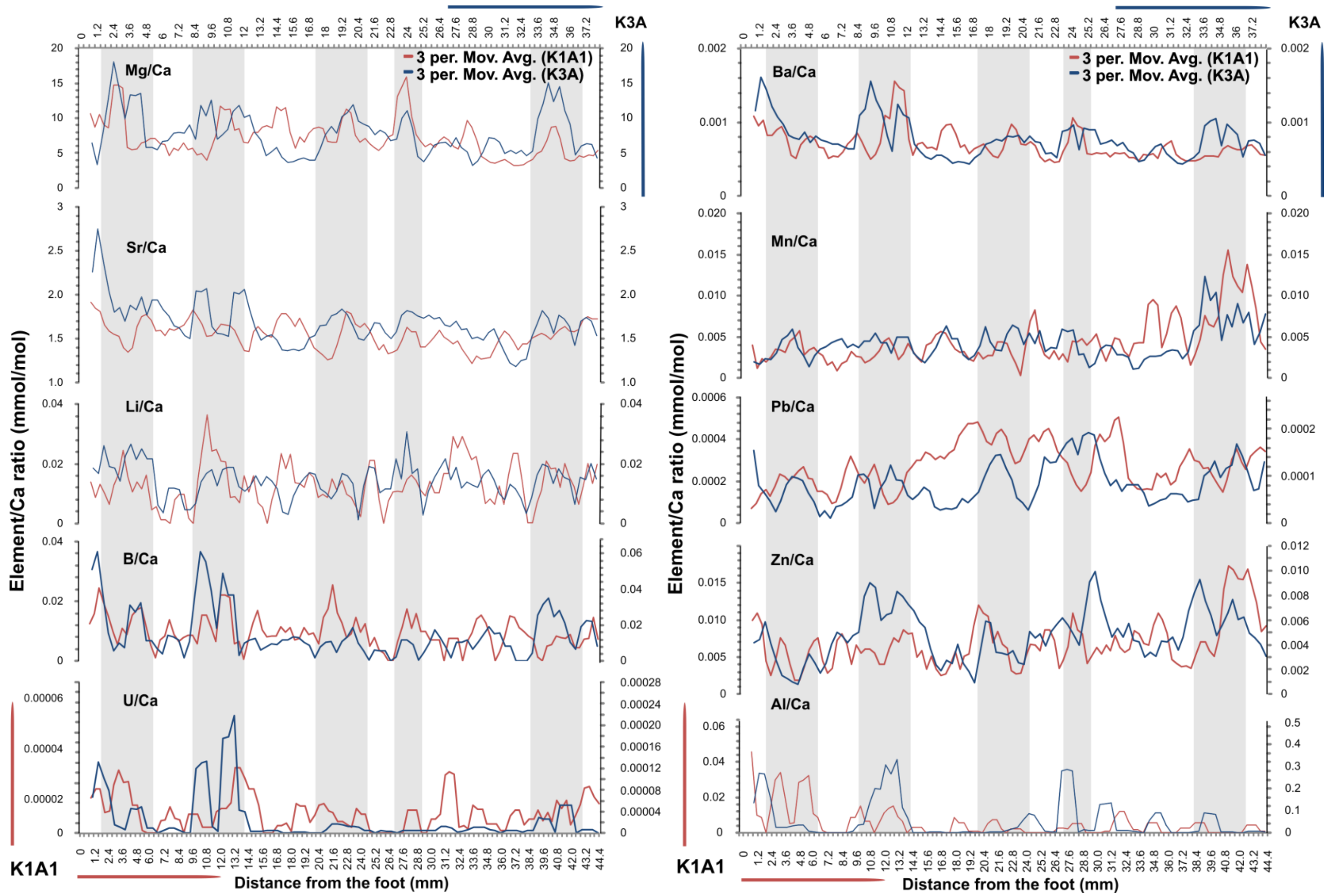

Fig. 4.2f. Plots of the 3-point moving average of the element/Ca ratios of samples K3A (blue) and K1A1 (red) from Kaikoura measured from the foot of the shell (mm) through the prismatic layer. The scale for K1A1 is represented on the left and bottom axes with K3A represented on the right and top axes. Grey banding highlights element/Ca ratios that are well correlated.

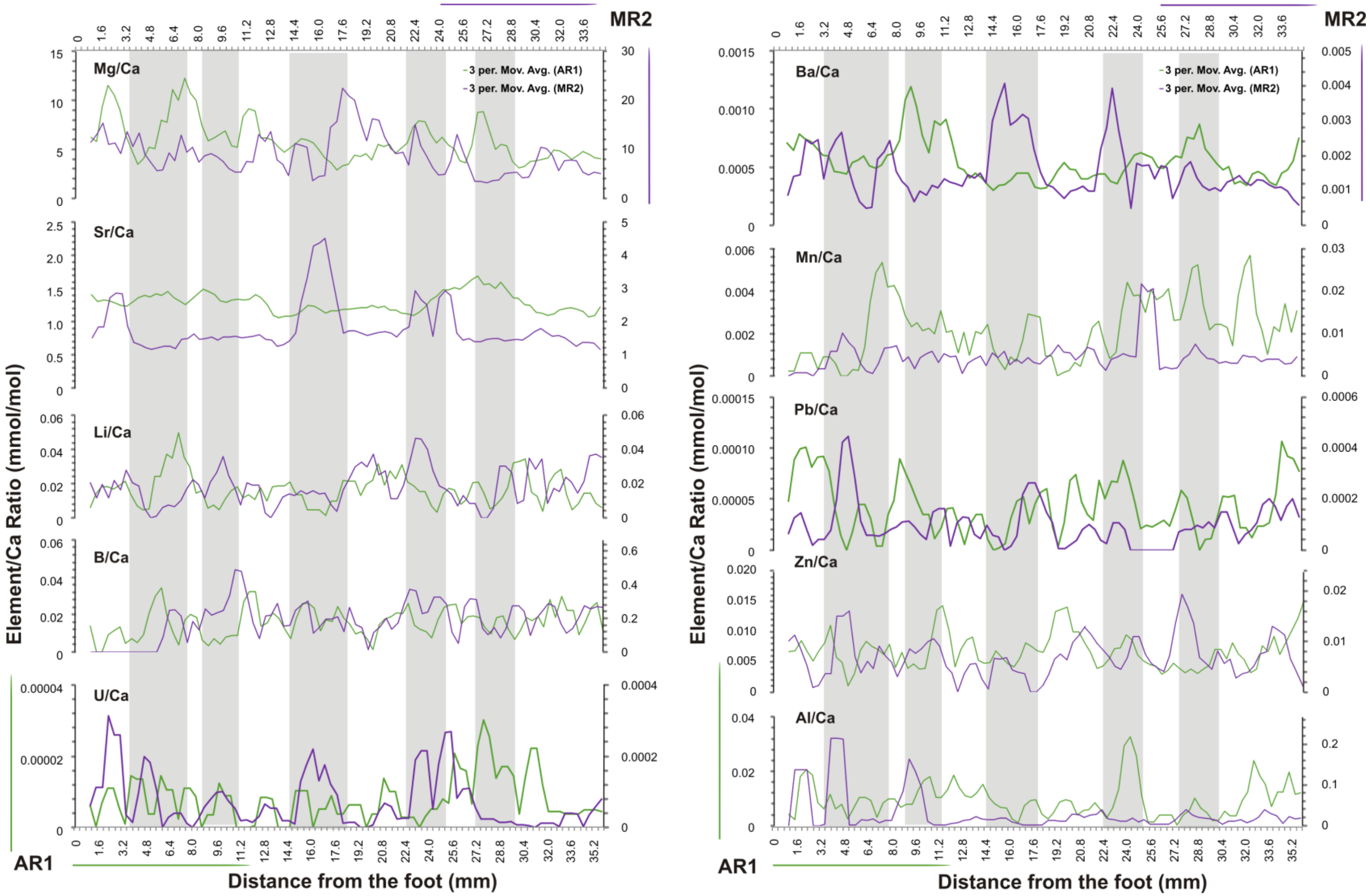

Fig. 4.2g. Plots of the 3-point moving average of the element/Ca ratios of samples AR1 (green) and MR2 (purple) from Chatham Islands measured from the foot of the shell through the prismatic layer. The scale for AR1 is represented on the left and bottom axes with MR2 represented on the right and top axes. Grey banding highlights element/Ca ratios that are well correlated.

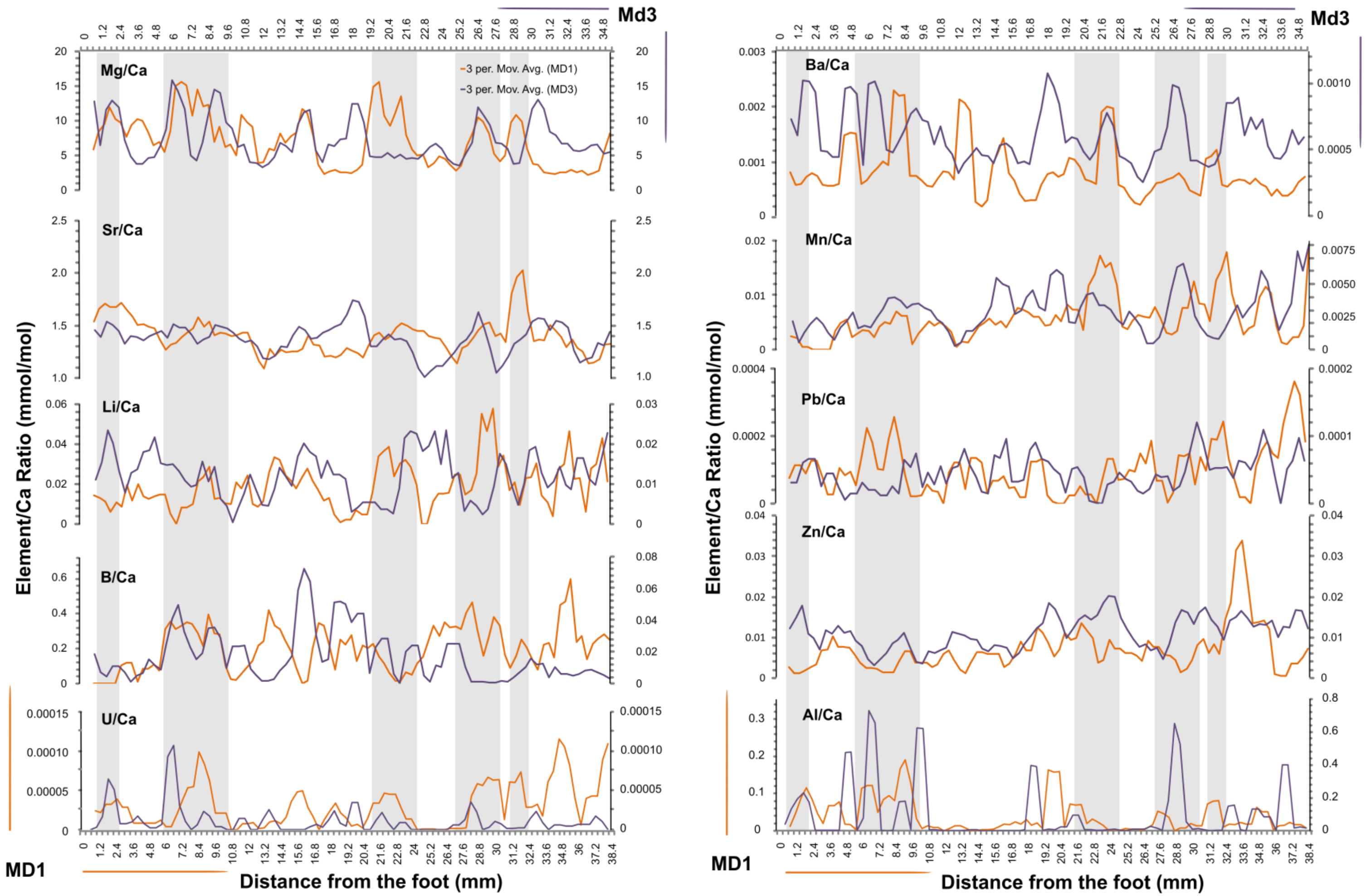

Fig. 4.2h. Plots of the 3-point moving average of the element/Ca ratios of samples MD1 (orange) and MD3 (purple) from Moeraki measured from the foot of the shell through the prismatic layer. The scale for MD1 is represented on the left and bottom axes with MD3 represented on the right and top axes. Grey banding highlights element/Ca ratios that are well correlated.

4.2.2 Nacreous Layer

At different locations within nacreous layer of each sample, a transect was analysed with 25 μm spot sizes every 50 μm across the axis of maximum growth. The transect paths can be seen in Figure 4.3 for sample K3A. The results of the nacreous layer analyses are then compared with photographs of the samples based on their element/Ca ratio, to examine if the nacre showed reproducible results at different locations across the shell. Laser ablation spots that were analysed on the black lines (Fig. 4.3) produced anomalously high trace element/Ca ratios and were removed from the graphs. Element/Ca ratios that did not show consistent results above background counts were not presented in graphical form in section 4.2.2, but the data can be viewed in the Appendix 5.

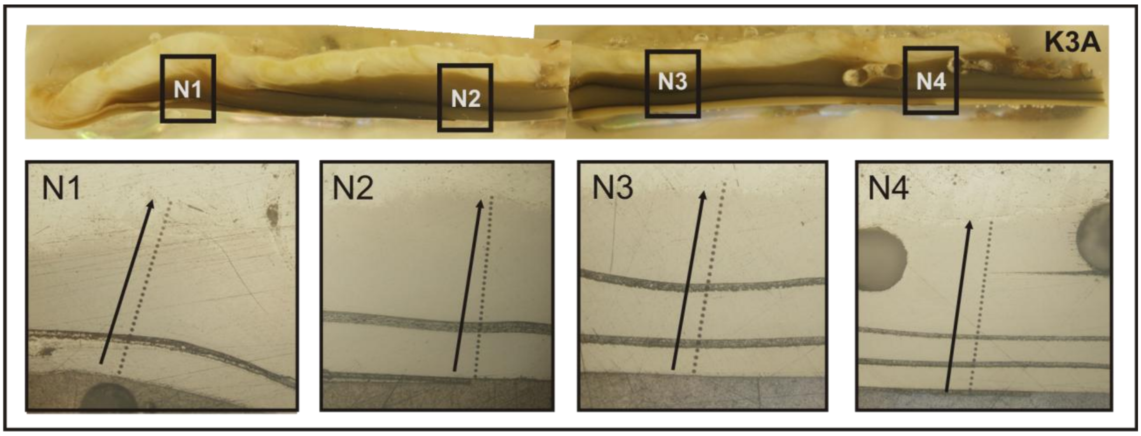

Fig. 4.3. Example of the transect direction of the analysis through the nacreous layer of shell K3A. The transect follows a growth band from the inner shell towards the prismatic-nacreous layer boundary with spots spaced 50 μm apart.

4.2.2.1 OceaNZ Blue Ltd (OBL) (A740 and RW75)

Figure 4.4a illustrates the element/Ca ratio profiles of the nacreous layer of A740 (top) and RW75 (bottom). Six different profiles were analysed in A740 and five profiles in RW75. Mg/Ca ratios of A740 are comparable in all transects. The 3-point moving average in both samples show a range from 0.0-0.5 mmol/mol. Mg/Ca ratios show a sharp increase over 1 mm adjacent to the boundary between the nacreous and prismatic layer boundary. This increase in Mg/Ca ratios correlates with a decrease in Ba/Ca. Ba/Ca ratios are very low (0.0012-0.0050 mmol/mol) with poor correlation across all nacre profiles. Sr/Ca ratios, on the other hand, are very similar in all transect profiles. Sr/Ca ratios are very restricted (ca. 1.5-2.5 mmol/mol) showing significant variability over distances of 0.4 mm. Mn/Ca ratios are comparable at low values (ca. < 0.005 mmol/mol) which are all poorly correlated.

Mg/Ca ratios of all the RW75 nacre transects are comparable, and range from ca. 0.0-0.5 mmol/mol. Mg/Ca ratios for N3 and N5 shows variable results over 0.1-0.2 mm. Sr/Ca ratios in all transects show very restricted values (ca. 1.5-2.0 mmol/mol) and are well correlated between samples. Ba/ Ca ratios of N2, N3 and N4 correlate well, with large-scale variability over 0.5 mm. N1 and N5 transects show small scale variability over 0.2 mm. Ba/Ca and Mn/Ca ratios are also very low (ca. < 0.005 mmol/mol). As observed in A740, Mn/Ca ratios are also poorly correlated in all profiles.

4.2.2.2 Pourerere (P1B and P04A)

The results of the nacreous layer transects of samples from Pourerere Beach, P04A (top) and P1B (bottom), are displayed in Figure 4.4b. Four nacre transects were measured in both shells at various distances from the foot. The Mg/Ca ratios of different profiles through the nacre of P04A are not comparable. N1 has a significantly lower Mg/Ca ratio (ca. < 0.2 mmol/mol) when compared with N2, N3 and N4 (0.2-1.4 mmol/mol). Sr/Ca ratios again show a restricted range (1.5-3.0 mmol/mol) with slightly higher values in P04A compared with P1B. Sr/Ca ratios of each nacre profile are not well correlated. Ba/Ca ratios are also not well correlated and show very low values (ca. < 0.0014 mmol/mol). Ba/Ca ratios show breaks within the first 0.2 mm of transects N2 and N3, which are also observed in the Mg/Ca and Sr/Ca profiles. B/Ca ratios show no obvious correlations, with values ranging from 0.0-0.2 mmol/mol.

Mg/Ca ratios in P1B are comparable with ranges ca. 0.2-0.8 mmol/mol. Variations generally occur ca. 0.2-0.4 mm within profiles N1 and N2, whereas

N3 and N4 show smaller-scale variation (over 2 mm) and are well correlated. Sr/Ca ratios show a narrow range, 1.5-2.5 mmol/mol, and are well correlated. Peaks in N1 compare with peaks in N2, N3 and N4, which have a width of 2-3 mm. Ba/Ca and Pb/Ca ratios are extremely low (ca. < 0.001 mmol/mol). Unlike the other transect profiles of Pb/Ca ratios, N3 shows more variability, ranging across 0.0000-0.0006 mmol/mol. B/Ca values are low (ca. < 0.08 mmol/mol) and do not correlate well in all transect profiles of P1B.

4.2.2.3 South Coast (SC1A and SC2)

The element/Ca ratio profiles of nacreous layer transects across SC1A (top) and SC2 (bottom) are illustrated in Figure 4.4c. The Mg/Ca ratios for SC1A show very different results, with N2 (0.3-0.6 mmol/mol) having higher values compared with N1 (0.2-0.4 mmol/mol). N3 also shows large Mg/Ca ratio variation (0.3-0.7 mmol/mol) over a small scale (0.1 mm). Sr/Ca ratios have a small range of ca. 1.5-2.5 mmol/mol with comparable results and good correlation between all three profiles. Peaks located 0.9 mm from the inner shell are also seen in Mg/Ca, Sr/Ca, Ba/Ca and B/Ca ratios, with widths of 0.1-0.2 mm. Ba/Ca and Pb/Ca ratios are extremely low (< 0.0007 mmol/mol) and do not correlate well between transects. B/Ca ratios are also low (< 0.2 mmol/mol) and do not correlate well in the nacre of SC1A.

The element/Ca ratios of 4 different transects across the nacreous layer of SC2 were analysed. The 3-point moving average of Mg/Ca ratios shows variation in all transects from 0.2-0.9 mmol/mol. All results are comparable but do not correlate well. Variability is observed in all transects from ca. 0.2-0.4 mm. Similarly to SC1A, Sr/Ca ratios are restricted in range (1.5-2.5 mmol/mol). N1 and N2 show more variability closer to the inner shell edge, with higher Sr/Ca values compared with N3 and N4. Ba/Ca ratios are again similar to SC1A and very low (ca. < 0.0012 mmol/mol). Small-scale variability is observed at widths of ca. 0.2-0.4 mm in the Ba/Ca ratio profiles, with all transects showing poor correlation with each other. B/Ca ratios are also poorly correlated. N1 has lower values (ca. < 0.06 mmol/mol) compared with N4 (0.06-0.12 mmol/mol). A large peak followed by a sharp decrease is observed at 1.6 mm from the inner shell in B/Ca of N2 and is also observed in Ba/Ca and Sr/Ca.

4.2.2.4 Moa Point (MP02A)

The element/Ca ratio profiles through the nacre of MP02A are illustrated in the upper diagram of Figure 4.4d. A number of profiles (n = 4) were measured in the shell, with Mg/Ca, Sr/Ca, Ba/Ca and B/Ca ratios presented in Figure 4.4d Mg/Ca ratios are well correlated in all transects, with values ca. < 1.5 mmol/mol. Sr/Ca ratios are restricted in value (1.5-2.5 mmol/mol). A peak is seen at 0.7 mm from the inner shell in both N3 and N4 profiles of Sr/Ca ratios. The beginning of each profile is well correlated but variations are observed 0.3 mm from the inner shell layer. Ba/Ca ratios are extremely low (0.00008 mmol/mol), with values that are variable in all profiles and a number of peaks (n = 2) that correlate well in N2, N3 and N4. Aside from the peaks, the nacre profiles are poorly correlated but compare well. B/Ca ratios are also low (0.02-0.10 mmol/mol). The variations in each profile are poorly correlated but two peaks compare well in N2 and N4.

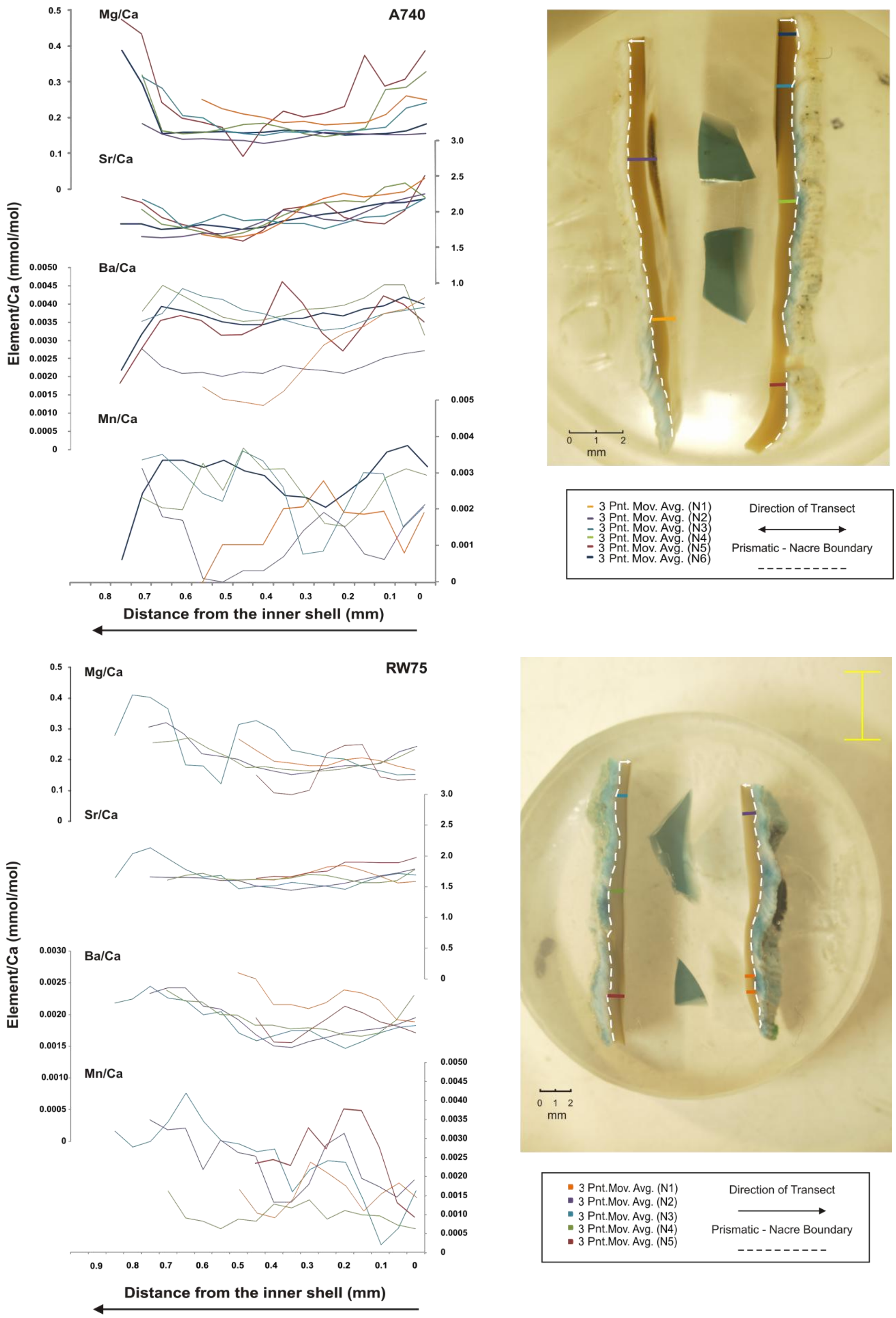

Fig. 4.4a. Plots of nacreous layer element/Ca ratios in samples A740 and RW75 from OBL. The left panel presents the element/Ca values through a high resolution analysis taken from the inner shell towards the prismatic-nacre boundary. The right panel shows transect locations on the sample mounts.

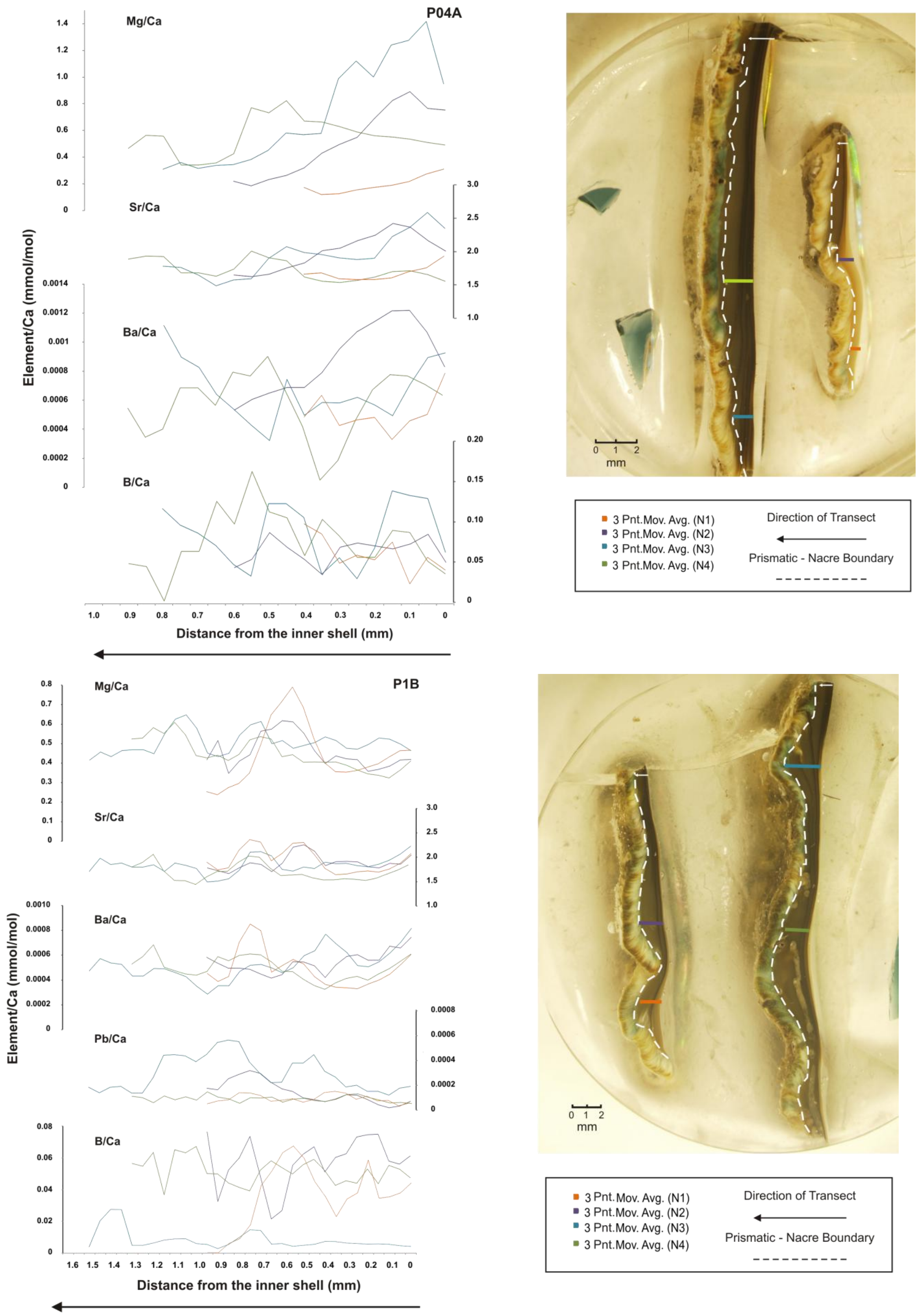

Fig. 4.4b. Plots of nacreous layer element/Ca ratios in samples P04A and P1B from Pourerere Beach. The left panel presents the element/Ca values through a high resolution analysis taken from the inner shell towards the prismatic-nacre boundary. The right panel shows transect locations on the sample mounts.

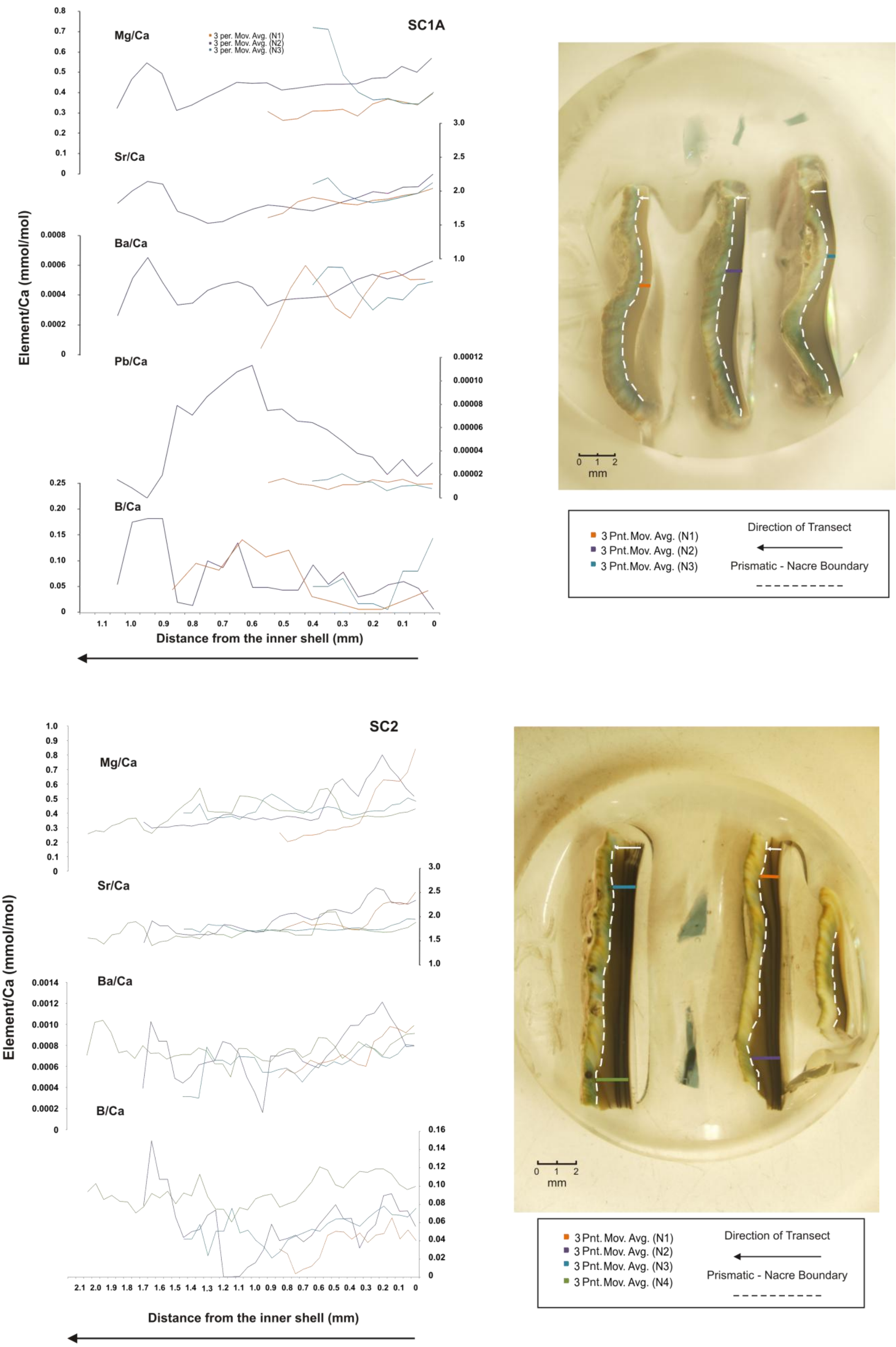

Fig. 4.4c. Plots of nacreous layer element/Ca ratios in samples SC1A and SC2 from South Coast, Wellington. The left panel presents the element/Ca values through a high resolution analysis taken from the inner shell towards the prismatic-nacre boundary. The right panel shows transect locations on the sample mounts.

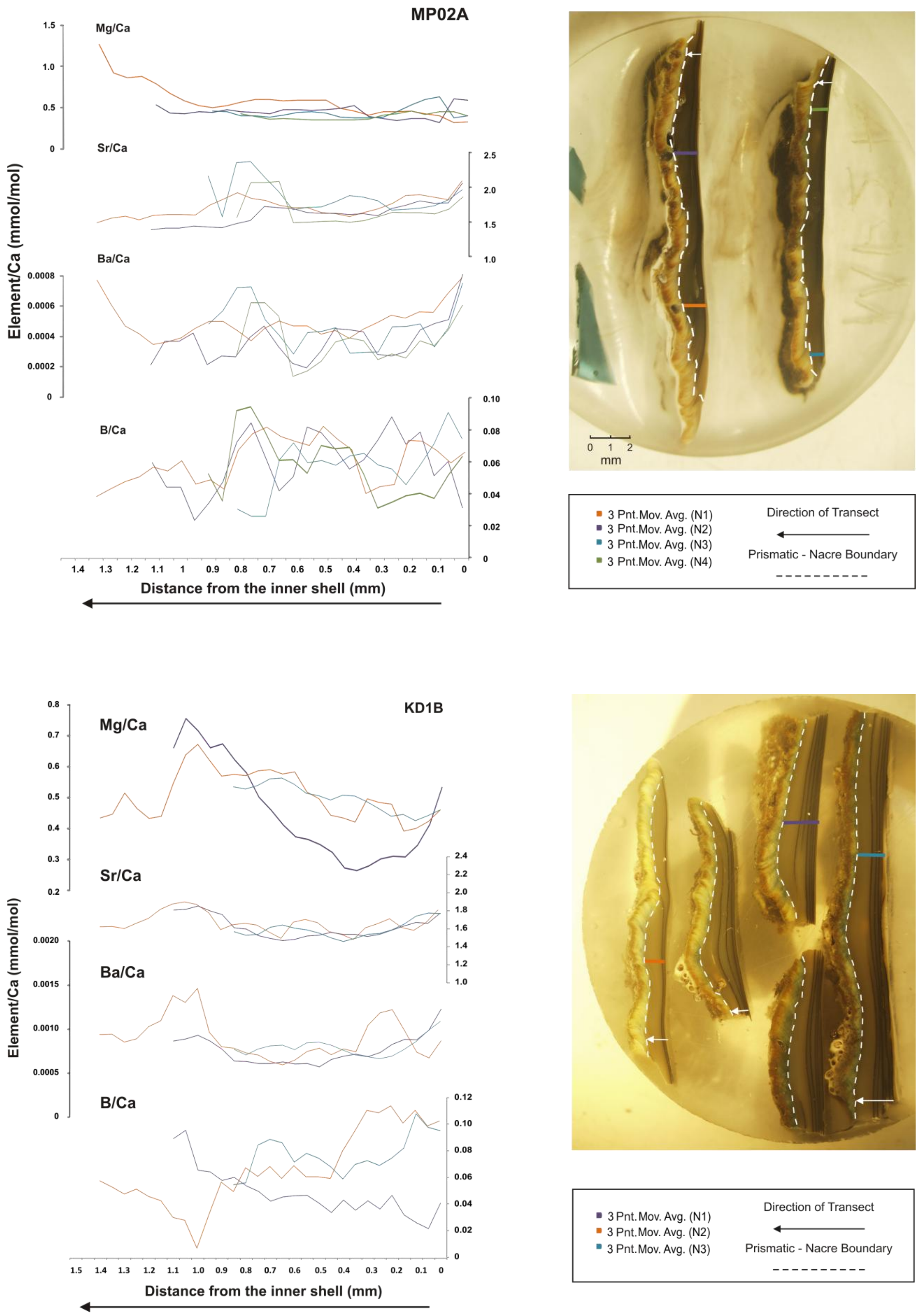

Fig. 4.4d. Plots of nacreous layer element/Ca ratios in samples MP02A from Moa Point and KD1B from Kaikoura. The left panel presents the element/Ca values through a high resolution analysis taken from the inner shell towards the prismatic-nacre boundary. The right panel shows transect locations on the sample mounts.

4.2.2.5 Kaikoura (KD1B, K1A1 and K3A)

The lower diagram of Figure 4.4d shows the element/Ca ratio profiles of three nacreous layer transects in sample KD1B. Mg/Ca ratios of each transect are variable with values ranging from 0.2-0.8 mmol/mol. Maximum values are observed in the same location on transects N1 and N2 at 1.1-1.2 mm from the inner shell, with slightly higher values observed in N1 (ca. 0.05 mmol/mol). Large-scale variation is also evident in N1 with increasing values of 0.5 mmol/mol over a width of 0.6 mm. Sr/Ca ratios are restricted (1.4-2.1 mmol/mol). All transects are well correlated with each other. N2 show small-scale variation over widths of 0.1-0.2 mm. Ba/Ca ratios are low (0.0005-0.0015 mmol/mol) and have values that compare well. N2 show a different relationship compared with N1 and N3, with a number of peaks (n = 2) along the Ba/Ca profile that have widths of 0.2-0.3 mm. B/Ca ratios are also low (0.02-0.12 mmol/mol) and are poorly correlated. N2 has significantly higher B/Ca ratios compared with N1 (0.06 mmol/mol) near the inner shell. N1 also exhibits increases in B/Ca ratios as distances from the inner shell increase, whereas N3 has decreasing B/Ca with increasing distance from the inner shell.

Figure 4.4e illustrates the element/Ca ratio profiles through the nacreous layers of K1A1 (top) and K3A (bottom). Five profiles were measured at different locations in the nacreous layer of K1A1, with four different transects taken from the nacreous layer of K3A. Mg/Ca ratios of K1A1 range between 0.2-1.1 mmol/mol. All transects (N1-N5) are comparable with each other but poorly correlated. Sr/Ca ratios have a restricted range (2.5-3.5 mmol/mol). Sr/Ca values also show small scale variations over distances of 0.1-0.2 mm. Although values closer to the inner shell are similar, the Sr/Ca ratio variations are poorly correlated. Ba/Ca ratios are low (ca. < 0.0025 mmol/mol) with poor correlation between all transects. B/Ca transects are also poorly correlated between each transect with values between 0.0-16 mmol/mol.

Mg/Ca ratios of K3A have variable results with a broad range (0.0-1.4 mmol/mol). Mg/Ca ratios also have a poor correlation between all nacre transects (N1-N4). A peak with a width of 0.3 mm is observed in the Mg/Ca ratio of N2. This peak is reproducible in Sr/Ca and Ba/Ca ratios. Sr/Ca ratios are restricted in range (2.0-3.5 mmol/mol) and are comparable. Sr/Ca ratios correlate well, with peaks observed in all transects at 0.8-1.1 mm from the inner shell. The Sr/Ca ratios in N1 are also consistently higher (ca. < 0.2 mmol/mol) than N2, N3 and N4. Ba/Ca ratios show a similar signal in all nacre transects to the Sr/Ca ratios. The Ba/Ca ratios in K3A are very low (0.0002-0.0014 mmol/mol). All transects are also comparable and correlated well, with prominent peaks seen in N1, N2 and N3. B/Ca ratios are also low (ca. < 0.10 mmol/mol). However, the variations in each transect of K3A show no clear correlation.

4.2.2.7 Moeraki (MD1 and MD3)

Figure 4.4f illustrates the element/Ca ratio of transects through the nacreous layer of two samples, MD1 (top) and MD3 (bottom) sampled from Moeraki, Otago. Only one element/Ca ratio profile was measured in the nacre of MD1. Mg/Ca ratios range between 0.1-0.6 mmol/mol and show variations over broad distances (0.5 mm). Sr/Ca ratios in MD1 has a restricted range (1.5-2.0 mmol/mol) and small-scale variation over distances of 0.2 mm. Ba/Ca ratios are extremely low (0.0005-0.0020 mmol/mol) and exhibit variations over large distances which are also seen in the Mg/Ca ratio profile. B/Ca ratios are also low (ca. < 0.5 mmol/mol) with a number of peaks (n = 2) with widths of 0.1-0.2 mm.

The element/Ca ratios of four nacre profiles (N1, N2, N3 and N4) of MD3 are shown in the lower diagram of Figure 3.4f. Mg/Ca ratios of the profiles range between 0.1-0.7 mmol/mol. N1 and N2 are well correlated close to the inner shell (0.0 to 0.6 mm). Mg/Ca ratios of N3 and N4 are variable with large-scale variations (0.2 mmol/mol) over distances of 0.2-0.3 mm. Sr/Ca ratios are again restricted in range (1.5-3.0 mmol/mol) as seen in the nacreous layer of samples from all locations. N1, N2 and N3 show comparable results, however, N4 has a number (n = 2) of peaks with relatively wide widths (ca. 0.3 mm). These peaks are reproduced in Mg/Ca and Ba/Ca profiles of N4. Ba/Ca ratios of all profiles show variable results, with low values (0.0004-0.0014 mmol/mol). N1 and N2 again are well correlated close to the inner shell (0.0 to 0.6 mm). B/Ca ratios are low (0.01-0.10 mmol/mol) and poorly correlated. All profiles of B/Ca ratios have a general decreasing trend as distances increase from the inner shell.

4.2.2.6 Chatham Islands (AR1 and MR2)

The element/Ca ratios of the nacreous layer of two samples AR1 (top) and MR2 (bottom) are illustrated in Figure 4.4g. Mg/Ca ratios of AR1 range between 0.1-0.9 mmol/mol. These values show large-scale variation (0.5 mm). Apart from close to the inner shell (0.0-0.6 mm), there is poor correlation. All transects (N1-N4) show a sharp decrease in Mg/Ca ratios in the final 0.1 mm of the profiles. Sr/Ca ratios show a restricted range (1.5-2.5 mmol/mol) and are comparable in each transect. N3 and N4 Sr/Ca profiles are well correlated whereas N1 and N2 are not. Ba/Ca ratios are extremely low (0.0000-0.0006 mmol/mol). N3 and N4 have consistently higher Ba/Ca ratios compared with N1 and N2, with poor correlation. B/Ca ratios vary between 0.01-0.9 mmol/mol and are poorly correlated in all transects as well.

Mg/Ca ratios of the four nacre transects of MR2 also have a broad range (0.4-2.0 mmol/mol). Transects N1, N3 and N4 are comparable and correlate well, with values ranging between 0.5-1.0 mmol/mol. N2, however, show an increases in Mg/Ca as distance increases from the inner shell which is not observed in other Mg/Ca profiles. The Sr/Ca ratios of MR2 are again restricted in range, with values between 1.5-2.5 mmol/mol. The values are comparable but do not correlate well. Ba/Ca ratios also do not correlate well, and have values that are extremely low (ca. < 0.0025 mmol/mol). Variability is also seen over distances of 0.3 mm in the Ba/Ca ratio profiles. B/Ca ratios are low (0.0-0.6 mmol/mol) with variations that have no apparent correlation.

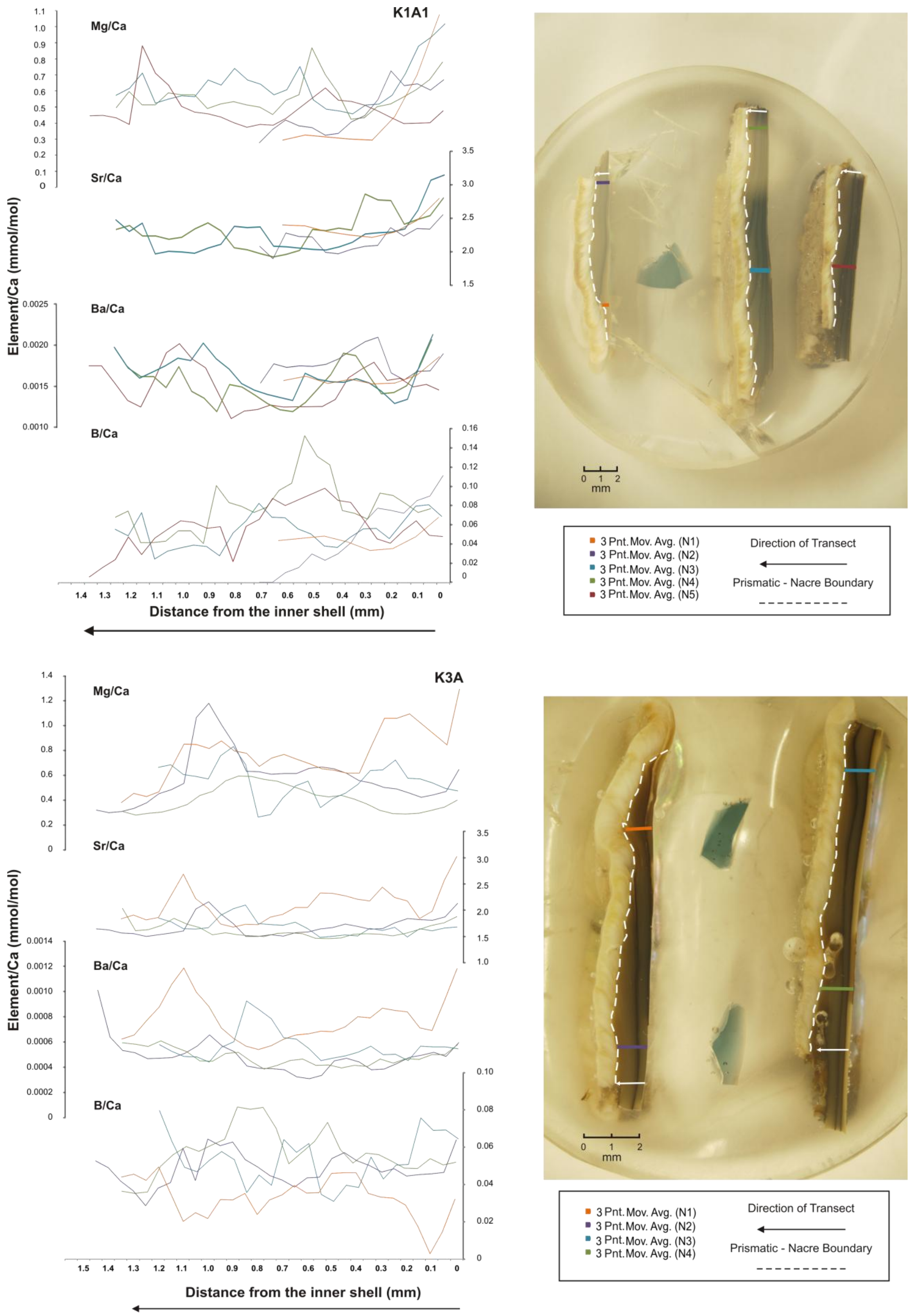

Fig. 4.4e. Plots of nacreous layer element/Ca ratios in samples K1A1 and K3A from Kaikoura. The left panel presents the element/Ca values through a high resolution analysis taken from the inner shell towards the prismatic-nacre boundary. The right panel shows transect locations on the sample mounts.

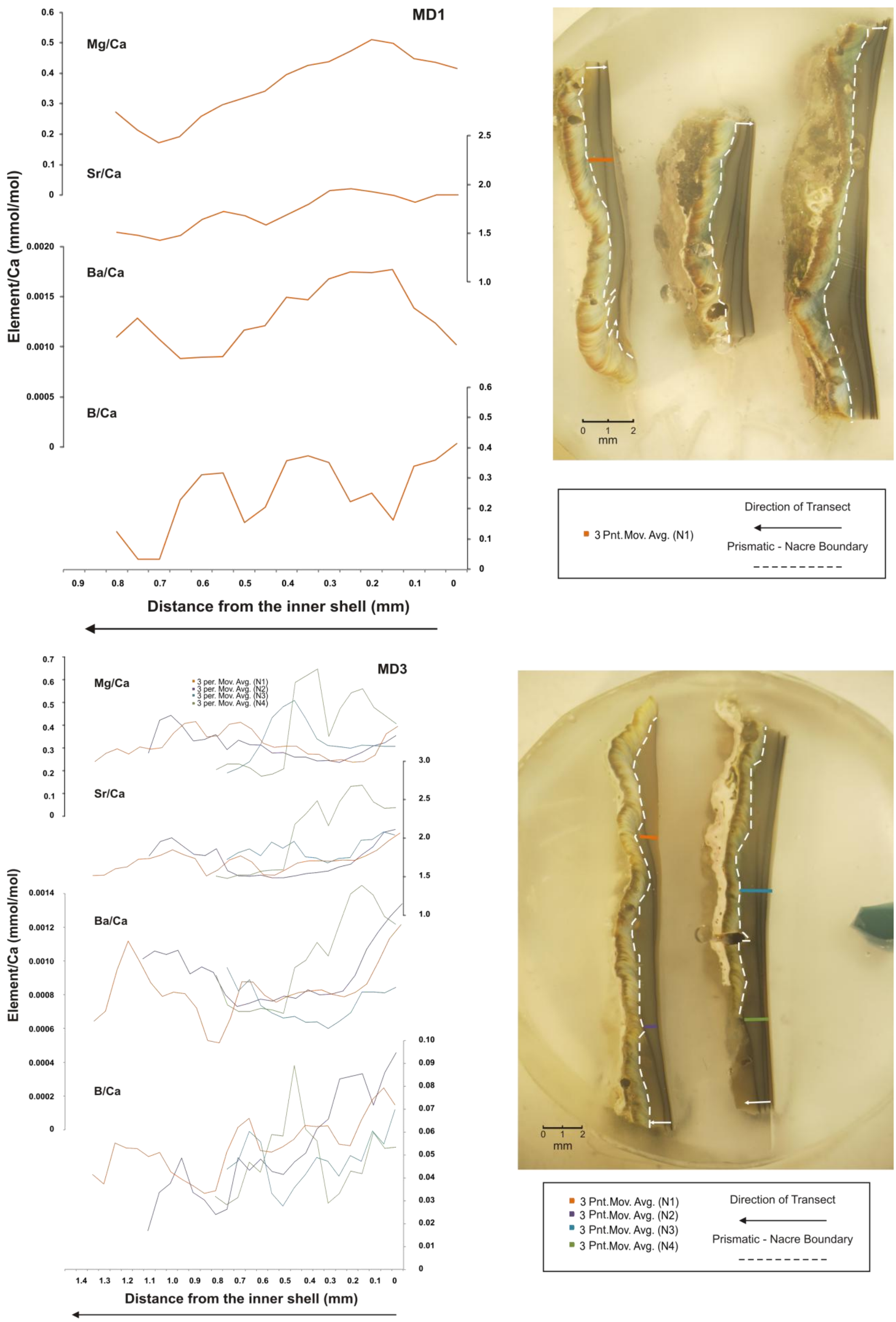

Fig. 4.4f. Plots of nacreous layer element/Ca ratios in samples MD1 and MD3 from Moeraki, Otago. The left panel presents the element/Ca values through a high resolution analysis taken from the inner shell towards the prismatic-nacre boundary. The right panel shows transect locations on the sample mounts.

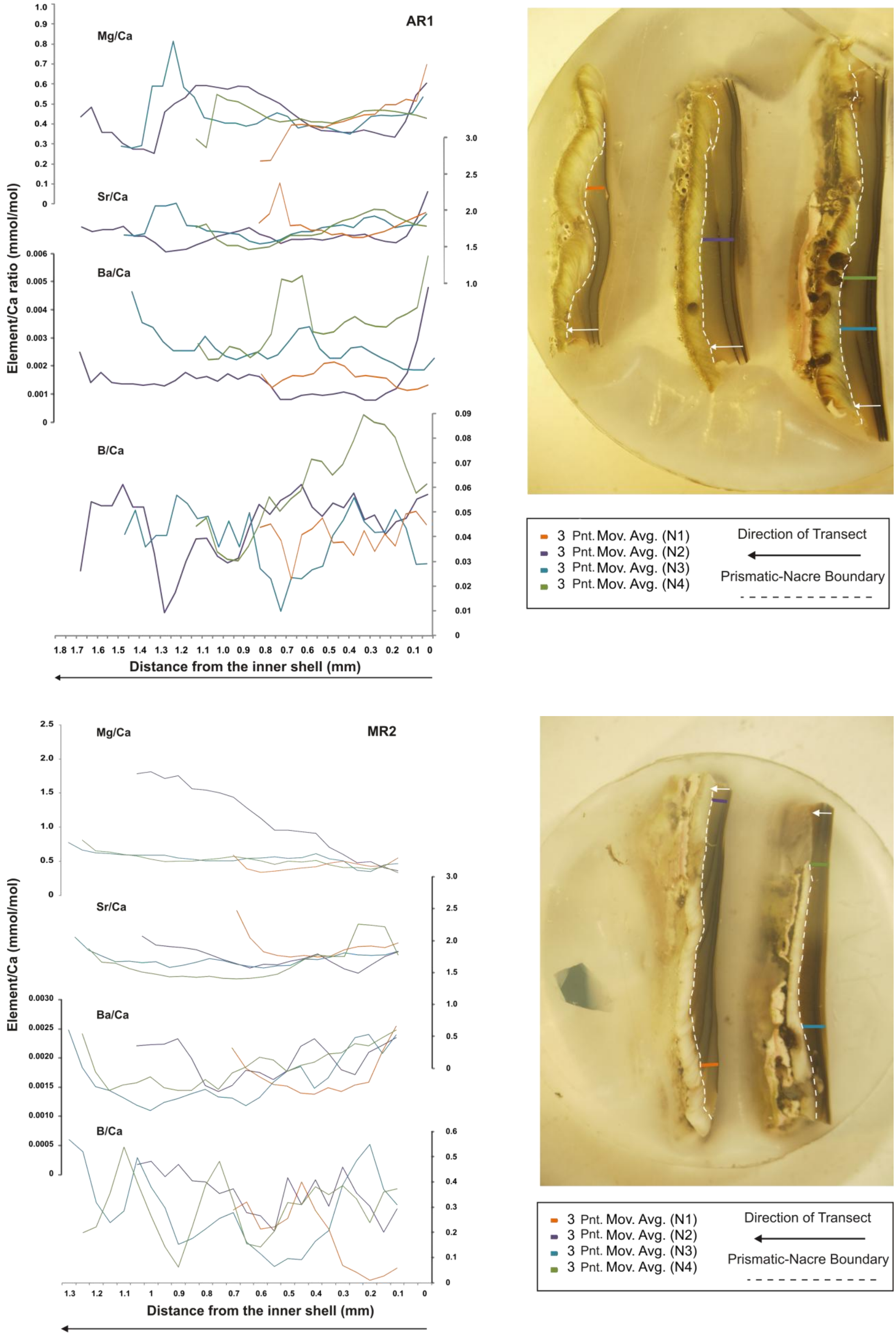

Fig. 4.4g. Plots of nacreous layer element/Ca ratios in samples AR1 and MR2 from the Chatham Islands. The left panel presents the element/Ca values through a high resolution analysis taken from the inner shell towards the prismatic-nacre boundary. The right panel shows transect locations on the sample mounts.

4.2.3 Individual Banding

Results of the analysis of multiple transects following individual growth banding within each shell sample (Fig. 4.5) are shown in Figures 4.6. The results that are presented show only elements that have trace element concentrations above background levels. LA-ICP-MS trace element analyses of the individual growth banding of all shells yielded data for Mg/Ca, Sr/Ca and Ba/Ca.

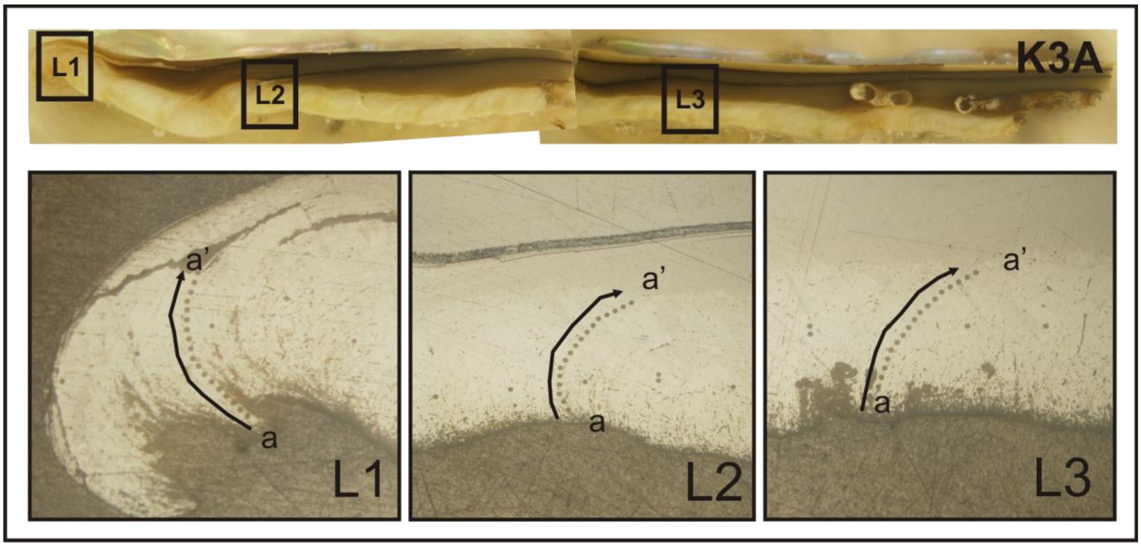

Fig. 4.5. Example of the transect direction of the individual growth bands throughout the shell of K3A. The transect follows a growth band from the outer shell (a), towards the nacre (a') with spots spaced 50 µm apart.

4.2.3.1 Mg/Ca ratios

The Mg/Ca ratios of a number of transects (n < 4) per sample are illustrated in Figure 4.6a. Mg/Ca ratios exhibit a broad range of values through these transects in all samples. Three Mg/Ca ratio profiles were measured through an individual growth band of RW75. All values range between 2.0-14.0 mmol/mol. All profiles are well correlated closer to the outer shell, with higher values seen in L1 and L2 compared with L3. A number of profiles (n = 2) were measured through an individual growth band of A740. The Mg/Ca ratio of both transects are poorly correlated, but have a peak seen in the same location in both profiles. The Mg/Ca ratios in P1B are variable compared to L2 and L3 but are well correlated closer to the prismatic-nacre boundary. P04A has variable results in each transect. L3 has consistently higher Mg/Ca ratios (ca. 2 mmol/mol) than L1. The profile for L2 has large scale Mg/Ca variability, showing changes in values (ca. 11-12 mmol/mol) over short distances. SC1A Mg/Ca profiles are well correlated closer to the prismatic-nacre boundary. L1 decreases in Mg/Ca (ca. 15 mmol/mol) as distances increase from the outer shell. The Mg/Ca ratios of transects of SC2 are broad with L2 having consistently higher values compared to L1 and L4. K1A1 transects of Mg/Ca ratio correlate well with values < 20 mmol/mol. All profiles show a general decrease in Mg/Ca ratios as distances increase from the outer shell. Three profiles of the individual growth bands of K3A were analysed. L1 and L3 are well correlated with each other and have comparable values. L2 has a number of peaks (n = 2) with large-scale variability (5-20 mmol/mol). MD3 has variable results. L1 has consistently stable values (5-10 mmol/mol) compared to L2 and L3. One profile each was measured for the element/Ca ratios of MP02A, KD1B, MD1, AR1 and MR2. The Mg/Ca ratio of MP02A has a broad range (6-16 mmol/mol), decreasing with distance away from the outer shell. KD1B and MD1 have variable results with Mg/Ca ratios that fluctuate along the profile. The Mg/Ca ratio of AR1 consists of high values (10-25 mmol/mol). Values are variable closer to the outer shell. Overall, Mg/Ca ratios of profiles of individual growth bands show considerable variability and do not show a consistent relationship decreasing from the outer shell towards the prismatic-nacre boundary.

4.2.3.2 Sr/Ca ratios

Figure 4.6b illustrates the Sr/Ca ratios of individual growth band profiles of all samples. A number of profiles (n = 3) were measured in RW75. All profiles have variable results and values. L3 transect has a consistent Sr/Ca ratio (1.0-1.5 mmol/mol) where L1 and L2 are poorly correlated. A740's individual growth bands (L1 and L2) are well correlated, with Sr/Ca ratios varying between 1.0-4.0 mmol/mol. Close to the outer shell, the Sr/Ca ratios in A740 decrease as distances increase from the outer shell. The Sr/Ca ratio of P1B is strongly correlated in all transects (n = 4). Close to the outer shell, L1 and L4 exhibit a sharp decrease in Sr/Ca ratios. The Sr/Ca ratios of a number of profiles (n = 3) of P04A range between 1.0-3.5 mmol/mol, but the variations in each transect do not correlate well. Sr/Ca ratios in the growth banding of SC2 have a restricted range (1.0-2.5 mmol/mol). L2 has consistently higher Sr/Ca ratios (0.1-0.3 mmol/mol) compared with L1 and L4. SC1A also has a restricted range (0.5-2.0 mmol/mol). Profiles have poor overall correlation, with L2 showing consistently lower Sr/Ca ratios compared with L1 and L3.

K3A has Sr/Ca ratios that are well correlated, with values that range between (1.0-2.5 mmol/mol). A number of transects (n = 3) of K3A show a broad range (1.0-5.0 mmol/mol) in Sr/Ca ratios. L2 and L3 show a good correlation closer to the prismatic-nacre boundary, whereas L1 and L2 show good correlation closer to the outer shell. The Sr/Ca ratios of a number (n = 3) of growth banding profiles of MD3 are comparable with a range between 1.0-4.0 mmol/mol. L3 has consistently higher Sr/Ca values (ca. 0.5 mmol/mol) compared to L1 and L2. All transects in MD3 correlate well as distances increase away from the outer shell.

Samples MP02A, KD1B, AR1, MR2 and MD1 have only one Sr/Ca ratio profile presented in Figure 3.6b. All Sr/Ca ratios have a restricted range (1.0-1.6 mmol/mol). MP02A and KD1B show a decreasing trend further away from the outer shell. This decreasing trend is also seen in the Sr/Ca ratio profile of MR2 which is then followed by a sharp increase in values at the prismatic-nacre boundary. AR1 and MD1 have variable Sr/Ca ratios throughout the profiles.

In general Sr/Ca ratios along growth bands show muted variations compared to Mg/Ca ratios and all samples are broadly comparable, with Sr/Ca values ranging between 0.5-5.0 mmol/mol.

4.2.3.3 Ba/Ca ratios

Figure 4.6c illustrates the Ba/Ca ratios of the growth banding transects of all samples. The Ba/Ca ratios of the growth banding of RW75 range between 0.0002-0.0008 mmol/mol with considerable scatter due to analytical error and the low concentration of Ba. All transects (L1, L2 and L3) are poorly correlated.

The Ba/Ca ratios of the profiles through A740 have a large range (ca. < 0.002 mmol/mol). The variations in both Ba/Ca ratio profiles of A740 are well correlated. Ba/Ca ratios of P04A growth banding profiles are larger than other samples (ca. < 0.01 mmol/mol). Variability in L1 and L3 profiles are comparable near the prismatic-nacre boundary. Both SC2 and SC1A have a number of profiles (n = 3) that are poorly correlated within each shell. The range of the Ba/Ca variation in the two shells is between 0.0000-0.0014 mmol/mol. Ba/Ca ratios of the growth banding of K1A1 are restricted in range (0.0005-0.0025 mmol/mol). Both profiles correlate reasonably well with comparable values. K3A and MD3 both have Ba/Ca ratios measured from three individual growth bands. Both shells have values < 0.006 mmol/mol. All profiles in K3A have poor correlation near the outer shell but show similar results near the prismatic/nacre boundary. L3 in MD3 has generally higher Ba/Ca ratios compared with L1 and L2 by 0.0005-0.0010 mmol/mol. L1 and L2 also show good correlation further away from the outer shell.

One profile was made of the Ba/Ca ratios of samples MP02A, KD1B, AR1, MR2 and MD3. All Ba/Ca ratios are between 0.0002-0.0014 mmol/mol. All samples show variation from one another, but a general decreasing trend of Ba/Ca ratios is evident further away from the outer shell.

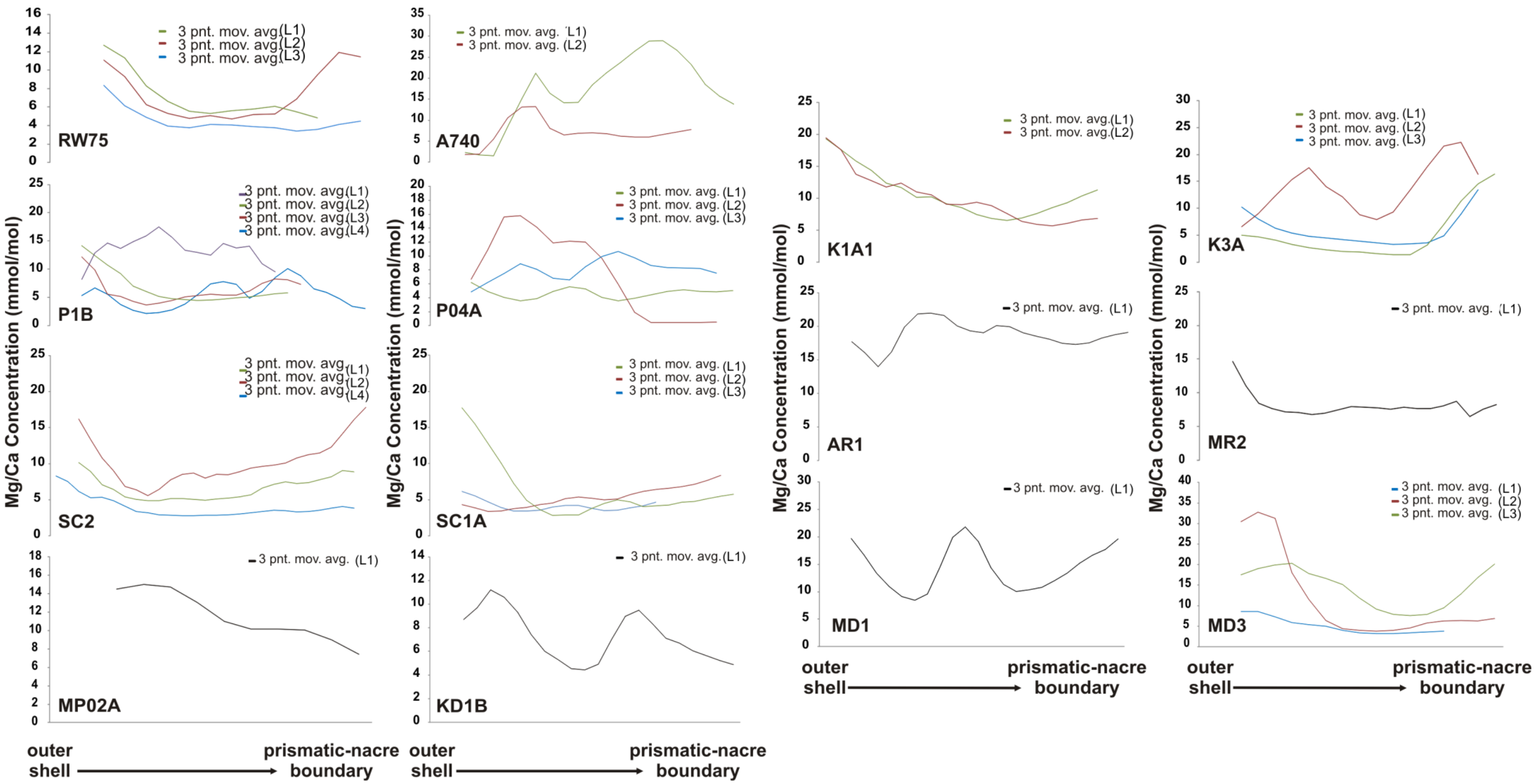

Fig. 4.6a. Mg/Ca ratios (mmol/mol) through transects of individual growth band transects for each sample. The transect is taken from the outer shell and follows the growth banding towards the prismatic-nacre boundary shown in Figure 4.5.

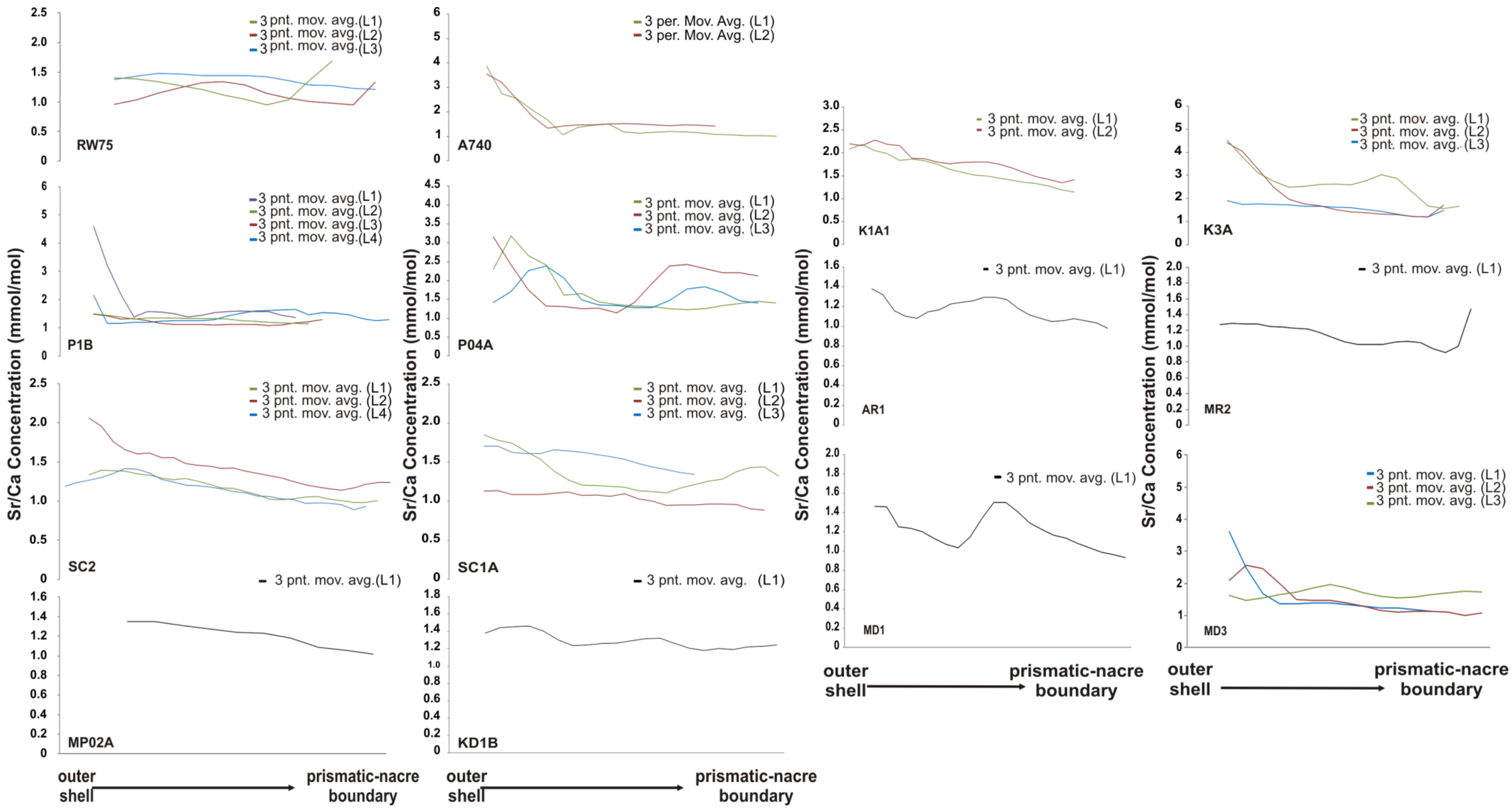

Fig. 4.6b. Sr/Ca ratios (mmol/mol) through transects of individual growth band transects for each sample. The transect is taken from the outer shell and follows the growth banding towards the prismatic-nacre boundary shown in Figure 4.5.

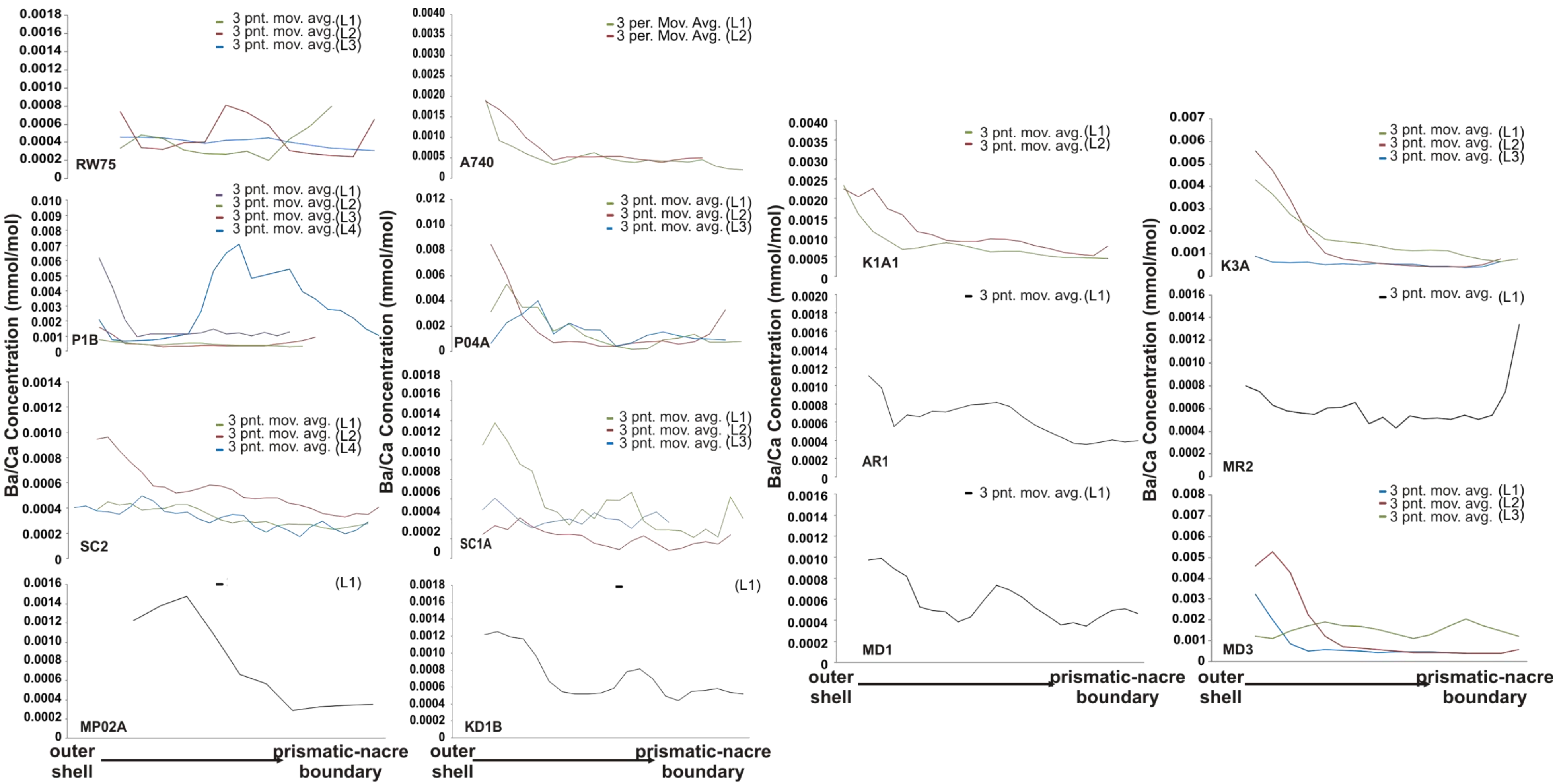

Fig. 4.6c. Ba/Ca ratios (mmol/mol) through transects of individual growth band transects for each sample. The transect is taken from the outer shell and follows the growth banding towards the prismatic-nacre boundary shown in Figure 4.5**.**

4.3 ELEMENT/CA RATIO CORRELATIONS

Pearsons Product Moment correlation coefficient is a measure of the correlation, or linear relationship, between two variables (*X* and *Y*) (Clark & Randal, 2011). The correlation is represented by a value, or coefficient, which ranges from -1 to 1, indicating the direction and strength of the correlation between the two variables. A coefficient of -1 represents a negative correlation, which indicates an inverse relationship between *X* and *Y*. A coefficient of 0 displays an independent relationship between the two variables, and a coefficient of 1 represents a positive correlation between *X* and *Y* (Clark & Randal, 2011). The correlation coefficient of element/Ca ratios with Sr/Ca, Ba/Ca and Mg/Ca ratios in both the prismatic and nacreous layers of each shell sample are shown in Tables 4.1-4.3. The 2 tailed significance is also displayed (Sig (2-tailed)) along with the with the test size (n). It is important to note that all element/Ca ratios that equal zero were excluded from the correlation analysis. The values that are highlighted orange represent element/Ca ratios that are well correlated and have significance between 0.0001-0.009. The logarithmic function was applied to element/Ca ratios that were not normally distributed. The element/Ca ratios that did not exhibit a strong relationship with Sr/Ca, Ba/Ca and Mg/Ca ratio are presented in Appendix 2. Both samples from OBL RW75 and A740 were also analysed twice. RW75 was analysed with ablation spot distances every 400 µm (RW75(400)) and every 100 µm (RW75(100)). A740 was also measured twice with each ablation spot measurement taken every 400 µm apart. A740(1) profile began at the foot of the shell of the transect and A740(2) analysis was offset by 200 µm from A740(1).

4.3.1 Prismatic Layer

Table 4.1 shows the Pearson's correlation coefficient comparing five element/Ca ratios with Sr/Ca ratio from data of the prismatic layer profiles. Sr/Ca and Ba/Ca ratios are strongly correlated (significance of ca. < 0.001) in all samples excluding SC1A. All samples have coefficients that range from 0.36-0.80. Mg/Ca and Sr/Ca ratios show a negative coefficient value in both samples from

OBL. RW75 has a strongly significant coefficient (ca. < 0.002) and A740 does not show significance with levels ranging between 0.022-0.26. All three samples from Wellington have coefficient values of 0.34, 0.54 and 0.35 respectively. A large number of samples (n = 8) gave a moderate coefficient value between Sr/Ca and U/Ca with high significance levels (ca < 0.005). K3A has the strongest correlation between Sr/Ca and U/Ca with a coefficient of 0.70. Al/Ca and B/Ca have are moderately correlated with Sr/Ca ratios in some samples. Both shells from Pourerere (P1B and P04A) have coefficients of 0.31 and 0.50, respectively, and significant values ca. <0.004.

The Pearson's correlation coefficient of element/Ca ratios compared with Ba/Ca ratios of each sample are presented in Table 4.2. Mg/Ca ratios are generally moderately correlated with Ba/Ca in the prismatic layer of each sample with coefficient values ranging between 0.33 and 0.55. However, a number of samples (n = 7) are poorly correlated at low significance levels. Mg/Ca versus Ba/Ca in RW75 and A740 from OBL are poorly correlated with negative coefficient values. A correlation of high significance between Ba/Ca and U/Ca is generally seen in the shells sampled from the wild in the North Island (Pourerere and Wellington) compared with those from the South Island and OBL. Shells SC2 and SC1A from Wellington, however, both show a negative correlation between Ba/Ca and U/Ca. Al/Ca and Ba/Ca ratios are moderately to well correlated with coefficient values ranging from 0.45-0.85. B/Ca and Mn/Ca ratios correlated against Ba/Ca show variable results in each sample.

SAMPLE NAME	Prismatic Layer Correlation Coefficient														
	Sr/Ca														
	Ba/Ca			Mg/Ca			U/Ca			Al/Ca			B/Ca		
	Pearsons	(sig. (2 tailed)	N	Pearsons	(sig. (2 tailed)	N	Pearsons	(sig. (2 tailed)	N	Pearsons	(sig. (2 tailed)	N	Pearsons	(sig. (2 tailed)	N
RW75 (400)	0.707	0.000*	105	-0.296	0.002	106	-0.212	0.070	74	0.055	0.657	68	0.366	0.001	77
RW75 (100)				-0.315	0.000*	330	0.225	0.005	155	-0.010	0.898	170	0.100	0.152	206
A740 (1)	0.602	0.000*	120	-0.208	0.022	120				-0.135	0.344	51			
A740 (2)	0.364	0.000*	100	-0.114	0.261	99	-0.051	0.752	41	0.078	0.575	54	-0.079	0.526	67
P1B	0.532	0.000*	109	0.455	0.000*	109	0.475	0.000*	62	0.270	0.032	63	0.312	0.004	82
P04A	0.717	0.000*	93	0.250	0.014	96	0.337	0.011	56	0.535	0.000*	70	0.502	0.000*	70
SC2	0.797	0.000*	116	0.339	0.000*	116	-0.125	0.350	58	0.175	0.177	61	-0.228	0.049	75
SC1A	0.236	0.021	95	0.525	0.000*	97	-0.051	0.712	55	0.195	0.206	44	-0.069	0.615	55
MP02A	0.627	0.000*	112	0.350	0.006	72	0.463	0.000*	63	0.322	0.006	72	0.277	0.015	77
K3A	0.780	0.000*	91	0.205	0.046	95	0.701	0.000*	54	0.407	0.001	61	0.494	0.000*	68
K1A1	0.586	0.000*	112	0.329	0.001	95	0.022	0.871	58	0.396	0.031	39	0.086	0.459	76
KD1B	0.417	0.000*	197	0.226	0.001	197	0.292	0.003	197	0.294	0.001	125	0.172	0.046	134
MR2	0.650	0.000*	61	-0.070	0.596	59	0.468	0.004	36	-0.129	0.440	38	0.141	0.372	42
AR1	0.480	0.000*	90	0.177	0.096	90	-0.077	0.633	41	-0.100	0.432	64	-0.099	0.424	68
MD1	0.457	0.000*	93	0.518	0.000*	95	0.382	0.005	52	0.364	0.005	59	-0.030	0.806	69
MD3	0.764	0.000*	87	0.232	0.030	88	0.469	0.002	41	0.422	0.001	58	0.444	0.000*	58

*p <0.001

Table 4.1. The Pearson's Product Moment correlation coefficient values, the significance (sig. 2 tailed), and test size (N) of Sr/Ca ratios of each analysed ablation spot in each sample in the prismatic layer. Orange highlighted boxes represented well correlated elements and grey boxes show element/Ca with no comparison.

SAMPLE NAME	Prismatic Layer Correlation Coefficient														
	Ba/Ca														
	Mg/Ca			U/Ca			Al/Ca			B/Ca			Mn/Ca		
	Pearsons	(sig. (2 tailed)	N	Pearsons	(sig. (2 tailed)	N	Pearsons	(sig. (2 tailed)	N	Pearsons	(sig. (2 tailed)	N	Pearsons	(sig. (2 tailed)	N
RW75 (400)	-0.010	0.922	105	-0.077	0.520	73	0.180	0.144	67	0.066	0.571	76	0.163	0.113	96
RW75 (100)															
A740 (1)	-0.155	0.087	122				-0.153	0.283	51						
A740 (2)	-0.106	0.302	97	0.044	0.787	41	0.118	0.400	53	0.176	0.530	67	0.057	0.614	80
P1B	0.341	0.001	89	0.549	0.000*	62	0.756	0.000*	96	0.358	0.001	82	0.385	0.000*	96
P04A	0.272	0.270	66	0.414	0.002	54	0.853	0.000*	69	0.596	0.000*	67	0.539	0.000*	64
SC2	0.545	0.000*	116	-0.190	0.888	58	0.217	0.092	61	-0.238	0.040	75	0.117	0.255	97
SC1A	0.164	0.113	95	-0.358	0.009	53	0.281	0.068	43				0.225	0.067	67
MP02A	0.488	0.000*	112	0.333	0.000*	112	0.668	0.000*	72	0.383	0.001	74	0.251	0.016	92
K3A	0.329	0.001	95	0.670	0.000*	54	0.662	0.000*	61	0.348	0.004	68	0.317	0.002	91
K1A1	0.539	0.000*	112	0.227	0.086	57	0.451	0.004	39	0.262	0.022	76	0.160	0.107	103
KD1B	0.482	0.000*	196	0.206	0.037	103	0.755	0.000*	126	0.323	0.000*	135	0.369	0.000*	153
MR2	0.162	0.221	59	0.339	0.043	36	0.017	0.917	38	0.083	0.601	42	0.274	0.062	47
AR1	0.241	0.043	90	-0.267	0.092	41	0.117	0.358	64	0.045	0.716	68	0.134	0.238	66
MD1	0.423	0.000*	93	0.158	0.273	50	0.509	0.000*	58	-0.089	0.474	67	-0.084	0.474	74
MD3	0.452	0.000*	87	0.413	0.007	41	0.611	0.000*	58	0.460	0.000*	58	0.213	0.060	79

*p <0.001

Table 4.2. The Pearson's Product Moment correlation coefficient values, the significance (sig. 2 tailed), and test size (N) produced by Ba/Ca ratios of each analysed ablation spot in each sample in the prismatic layer. Orange highlighted boxes represented well correlated elements and grey boxes show element/Ca with no comparison.

4.3.2 Nacreous Layer

Table 4.3 displays the Pearson's correlation coefficient of element/Ca ratios compared against Sr/Ca and Mg/Ca ratios in the nacreous layer of all samples. Ba/Ca ratios compared against Sr/Ca ratios have varying results. Both samples from OBL (RW75 and A740) and AR1 and MD1 are poorly correlated with low two tailed significance values (ca < 0.125). Almost all samples (excluding A740, P04A and MR2) have a strong relationship between Mg/Ca and Sr/Ca ratios within the nacreous layer. The largest coefficients of 0.81 and 0.81 are seen in RW75(100) and MD1 which also have small test sizes (ca. <28). U/Ca and Sr/Ca ratios are all poorly correlated with low significance levels. A number of samples (n = 5) also have a negative correlation between U/Ca and Sr/Ca. Two samples (RW75(100) and SC2) have a strong correlation between Ba/Ca and Mg/Ca with coefficients of 0.81 and 0.78. Only MP02A shows a correlation of modest significance levels when comparing Mg/Ca and B/Ca.

SAMPLE NAME	Nacreous Layer Correlation Coefficient														
	Sr/Ca									Mg/Ca					
	Ba/Ca			Mg/Ca			U/Ca			Ba/Ca			B/Ca		
	Pearsons	(sig. (2 tailed)	N	Pearsons	(sig. (2 tailed)	N	Pearsons	(sig. (2 tailed)	N	Pearsons	(sig. (2 tailed)	N	Pearsons	(sig. (2 tailed)	N
RW75 (400)	0.414	0.004	46	0.480	0.001	46				0.414	0.004	46			
RW75 (100)	0.291	0.125	29	0.814	0.000*	28	0.391	0.187	13	0.814	0.000*	28	0.289	0.144	27
A740 (1)	0.195	0.078	83	0.520	0.000*	81				-0.158	0.160	81			
A740 (2)	0.420	0.094	17	-0.059	0.822	17	-0.352	0.238	13	-0.333	0.191	17	0.312	0.222	17
P1B	0.766	0.000*	102	0.481	0.000*	99	-0.097	0.523	46	0.252	0.012	99	0.265	0.011	92
P04A	0.537	0.000*	55	0.284	0.037	54	-0.190	0.334	28	0.284	0.037	54	0.133	0.373	47
SC2	0.557	0.000*	105	0.784	0.000*	105	0.074	0.623	47	0.784	0.000*	105	0.118	0.236	102
SC1A	0.378	0.009	47	0.617	0.000*	48	0.108	0.591	27	0.378	0.009	47	0.115	0.568	27
MP02A	0.540	0.000*	80	0.582	0.001	84	0.290	0.086	36	0.429	0.000*	78	0.371	0.001	84
K3A	0.723	0.000*	106	0.563	0.000*	102	0.191	0.193	48	0.377	0.000*	101	0.125	0.210	102
K1A1	0.307	0.003	93	0.598	0.000*	89	-0.057	0.724	41	0.152	0.156	89	0.463	0.000	83
KD1B	0.665	0.000*	72	0.442	0.000*	71	-0.235	0.168	36	0.233	0.051	71	0.241	0.043	71
MR2	0.511	0.000*	89	0.221	0.038	89	0.125	0.408	46	0.174	0.103	89	0.200	0.079	78
AR1	0.244	0.014	100	0.442	0.000*	99	0.098	0.496	51	-0.038	0.707	99	-0.021	0.840	97
MD1	0.493	0.032	19	0.805	0.000*	19	0.251	0.431	12	0.495	0.031	19	0.051	0.851	16
MD3	0.708	0.000*	88	0.748	0.000*	89	0.056	0.707	47	0.453	0.000*	88	0.160	0.134	89

*$p < 0.001$

Table 4.3. The Pearson's Product Moment correlation coefficient values, the significance (sig. 2 tailed), and test size (N) produced by Sr/Ca and Mg/Ca ratios of each analysed ablation spot in each sample in the nacreous layer. Orange highlighted boxes represented well correlated elements and grey boxes show element/Ca with no comparison.

5. DISCUSSION

5.1 INTRA-INDIVIDUAL VARIATIONS IN SHELL CHEMISTRY

5.1.1 Uptake of elements into the different shell layers

Clear differences are observed in the element/Ca ratios of the prismatic and nacreous layers of all shell samples. Factors that account for the differences in mean element/Ca ratio include the crystallinity and microstructure of the layers, shell biomineralisation and variation of uptake of different trace elements through the mantle epithelium of the organism (Chave, 1954; Price and Pearce, 1997; Takesue *et al*., 2008; Wilbur, 1964).

Differences are observed in the Mg/Ca ratios in both layers of all samples, with the prismatic layer having significantly higher Mg/Ca values (by one order of magnitude), compared with the nacreous layer. The differences in Mg/Ca ratios can be explained by the variable lattice dimensions and crystallinty of the shell layers. The prismatic layer consists predominantly of calcite, whereas the nacreous layer is predominantly aragonite. Aragonite and calcite have similar crystal structures and thermodynamic stabilities, however, calcite is more stable than aragonite at ambient temperatures and pressures (Weiner and Addadi, 1997). Both calcite and aragonite are composed of alternating layers of calcium ions and carbonate ions perpendicular to the *c* axis (a vertically orientated crystal axis – usually the principal axis) (Weiner and Addadi, 1997). The calcium ions occupy almost the same plane in both structures but the carbonate ions in aragonite are raised in the *c* direction to allow the substitution of larger ions for Ca^{2+} (Fig. 5.1) (Weiner and Addadi, 1997). This accounts for the higher Mg/Ca ratios in the prismatic layers of all shell samples compared with that of the nacreous layers. The smaller Mg^{2+} ion substitutes more readily into the rhombohedral calcite lattice, which is isostructural with magnesite ($MgCO_3$) (Dodd, 1967). This also explains the higher element/Ca ratios of the other ions (including Mn, Zn, Li and Al) in the prismatic layer of the shell samples. The rhomobohedral structure allows Mn and Zn to substitute for Ca^{2+}

and form rhodochrosite ($MnCO_3$) and smithsonite ($ZnCO_3$), which are also isostructural with calcite (Foster and Chacko, 1995; Ming, 2006).

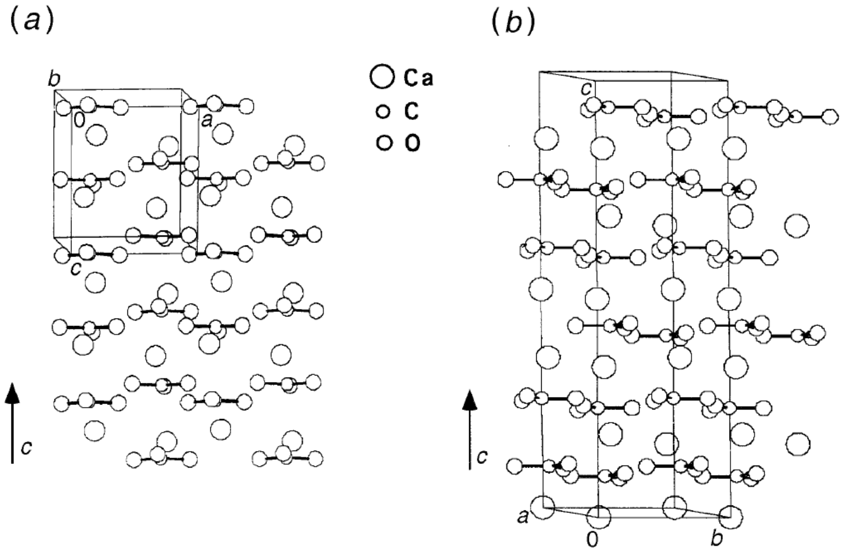

Fig. 5.1. The crystal structures of (a) aragonite and (b) calcite with the c arrow representing the *c* axis (Weiner and Addadi, 1997).

Average Sr/Ca ratios are similar in both the prismatic and nacreous layers in all shell samples, with only slightly higher Sr/Ca values in the nacre. Sr^{2+} has a larger ionic radius than Ca^{2+}, which is more readily available to substitute for Ca^{2+} in the crystal lattice of aragonite. Aragonite has an orthorhombic crystal structure that is isostructural with strontianite ($SrCO_3$) (Dodd, 1967). This principle can also be applied to account for the higher element/Ca ratios observed in the nacreous layer compared with the prismatic layer with respect to Ba and in some cases Pb. Both of these elements are large divalent cations with ionic radii ca. > 0.1 nm, and when substituted in place of Ca^{2+}, form witherite ($BaCO_3$) and cerussite ($PbCO_3$), which are isotructural with aragonite (Foster and Chacko, 1995; Ming, 2006; Sinclair and McCulloch, 2004).

Although B has a small ionic radius, higher values in the majority of shell samples are observed in the aragonitic nacreous layer. Takesue *et al.* (2008) concluded that, like Sr, B is exclusively found in the aragonitic fraction of some mollusc shells. B is present in seawater as the borate anion and substitutes for carbon in $CaCO_3$ (Takesue *et al*., 2008). Higher element/Ca ratios could also be due to the transect location (discussed further in section 5.3) as some trace element/Ca ratios are elevated closer to the outer surface of the shell.

Carbonate group	Ideal unit-cell formula	Crystal system	Specific gravity
Calcite group			
Calcite	$CaCO_3$	Hexagonal (rhomobohedral)	2.71
Magnesite	$MgCO_3$	Hexagonal	3.00
Siderite	$FeCO_3$	Hexagonal	3.97
Rhodochrosite	$MnCO_3$	Hexagonal	3.70
Smithsonite	$ZnCO_3$	Hexagonal	4.43
Otavite	$CdCO_3$	Hexagonal	4.96
Gaspéite	$NiCO_3$	Hexagonal	4.39
Aragonite group			
Aragonite	$CaCO_3$	Orthorhombic	2.95
Witherite	$BaCO_3$	Orthorhombic	4.3
Strontianite	$SrCO_3$	Orthorhombic	3.7
Cerussite	$PbCO_3$	Orthorhombic	6.55

Table 5.1. Selected properties including ideal unit-cell formula, crystal system and specific gravity of the common carbonates: calcite and aragonite (Ming, 2006).

Discrimination of Sr^{2+} during biomineralisation can also contribute to the increase of Sr/Ca ratios in either the prismatic and nacreous shell layers. Carré *et al.* (2006) discussed a model for Ca^{2+} transportation through the mantle epithelium of two bivalve species, *Mesodesma donacium* and *Chione subrugosa*. In summary, calcium channels have a higher sensitivity and selectivity to allow Ca^{2+} influx rather than any other cation due to suitable bind sites that facilitate diffusion and transport of Ca^{2+} from the surrounding medium (i.e. seawater) to the extrapallial fluid (Carré *et al*., 2006; Hess and Tsien, 1984). The calcium channel selectivity of ions other than Ca^{2+} is dependent on the channel type, the binding site affinity for each ion species and the chemical composition of the fluid either side of the channel (Carré *et al*., 2006). Both Sr^{2+} and Ba^{2+} have a higher affinity in replacing Ca^{2+} in the calcium channel.

5.1.2 Analyses of individual bands: best locations to extract data?

The element/Ca ratios along a transect following the growth bands of pāua were measured with the intent of investigating whether an individual growth band produced consistent trace element/Ca ratio results. This is important as it is essential to know where it is appropriate to place the temporal transect through the prismatic layer in order to measure reliable and comparable data. Anomalies throughout a transect could potentially reflect variations within the growth band, compared with environmental factors influencing the trace element chemistry of the overall shell through time. Sr/Ca and Ba/Ca ratios of all the individual growth bands have higher element/Ca ratios closer to the outermost part of the prismatic layer. The outer layer of pāua, and many other molluscs, is a non-mineralised protein layer called the periostracum (Su *et al.*, 2002). The periostracum is a 0.1-0.2 μm thick protein membrane that protects the carbonate shell (Su *et al.*, 2002). The periostracum is in direct contact with the ambient seawater, whereas the extrapallial fluid that precipitates the shell minerals is not. Hence, the shell material closest to the periostracum can adsorb the trace elements directly. Higher Sr/Ca and Ba/Ca ratios are observed closest to the periostracum, which could be due to adsorption. The surface of a crystal is the prime location for trace element adsorption (Weiner and Dove, 2003). Dodd (1967) also suggested that certain organic compounds may contain metallic elements which can contribute to the significant amounts of trace elements present in the shell.

The main observations drawn by form of analysis of growth banding is that the trace elements/Ca ratios along growth bands are variable. This study indicates that it is best to analyse the trace element/Ca ratios midway between the outer-most layer of the prismatic layer and the nacre where the Sr/Ca and Ba/Ca ratios are relatively constant. However, as such, uncertainties in results can be magnified due to issues in tracing the growth banding accurately. Due to the spot size (25 μm), sometimes it was hard to analyse the growth band itself. Furthermore, growth banding relates to a period of cessation of precipitation of $CaCO_3$ material and an increase of organic material precipitation. Anomalous

Sr/Ca ratios were sometimes observed in some shells. Cracks along the transect will also produce anomalous results, which could mask the environmental controls on trace element/Ca ratios.

5.2 INTER-INDIVIDUAL SHELL CHEMISTRY: REPRODUCIBILITY WITHIN SHELLS FROM THE SAME SAMPLING SITES

For a species to be an effective archive of past environmental conditions and changes, individual shells from the same site should produce similar chemistry data. As such, two or more shells were measured at each site to examine if both shells produced similar trace element chemistries.

Generally, shells from the same site produce comparable element/Ca ratios (Fig. 5.2). The Mg/Ca ratios of the prismatic layer of samples collected from the same sampling site vary by ca. 1-2 mmol/mol. A comparison of all samples shows that Mg/Ca ratios at a specific sample site show large variability. Mean Mg/Ca ratios can be misleading through anomalous spot values which could increase the mean values. As sea surface temperatures are generally colder in the south compared with northern waters, it will hold that thermodynamics and temperature are not solely responsible for the Mg/Ca ratios uptake into the pāua and biomineralisation of the shell, as samples collected from southern sites have higher Mg/Ca ratios compared with samples collected from northern sites. Also having samples collected from varying locations in the intertidal zone would mean that different species would be exposed to ambient seawater and air temperatures daily. Sr/Ca ratios are more comparable within samples from similar locations in both the nacreous and prismatic layers. However, there is generally a narrow range between Sr/Ca ratios sampled from all sites which like Mg/Ca, a distinguished Sr/Ca ratio can not be applied per sample site.

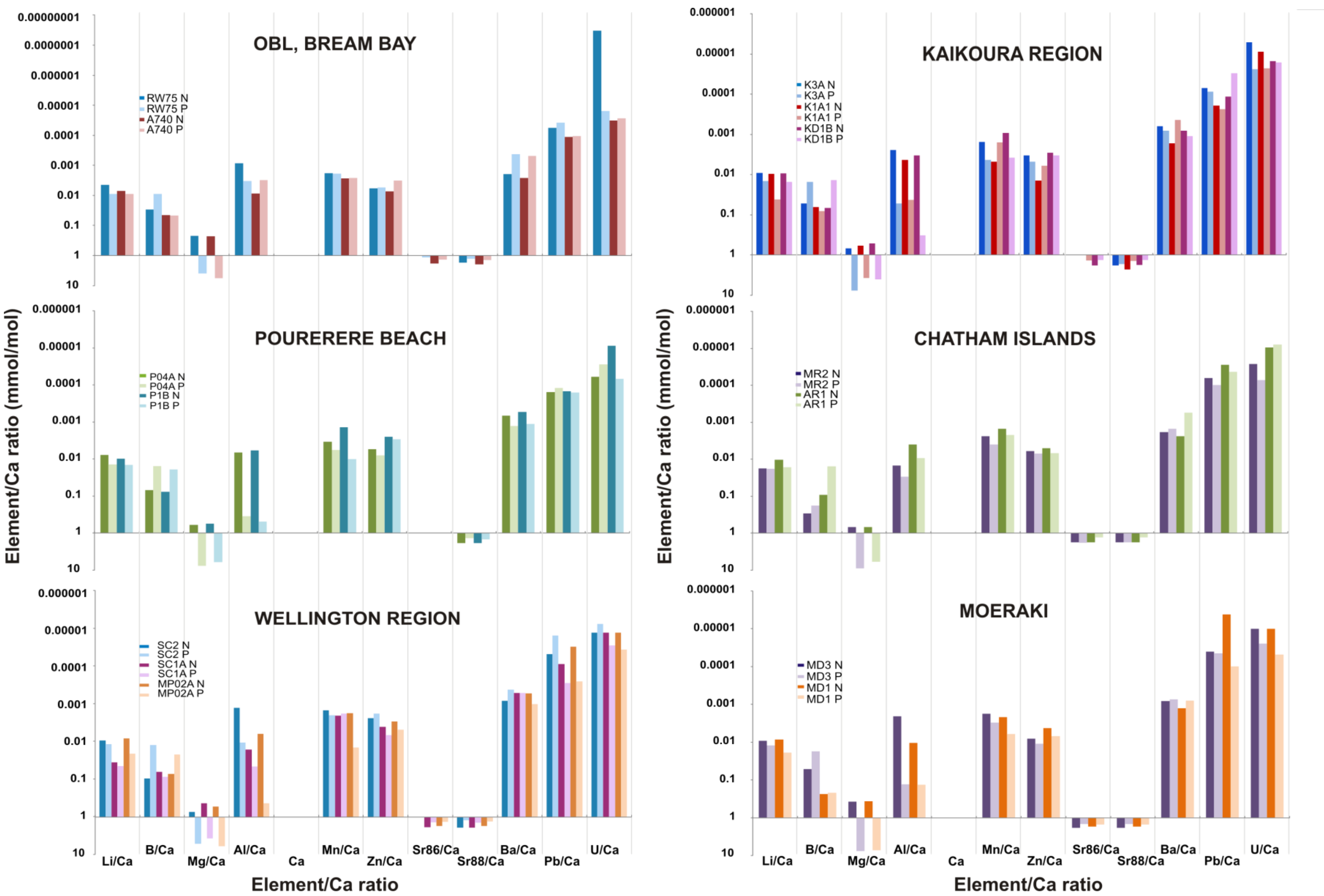

Fig. 5.2. The mean element/Ca ratio (mmol/mol) of the prismatic layer (P) and the nacreous layer (N) of individual pāua showing similarities based on sample site. All data is plotted on a logarithmic scale.

Mean Al/Ca ratios are comparable in all samples collected from the same location. However, elevated values were observed in samples KD1B from Kaikoura, MP02A from Moa Point and both samples from Pourerere, P04A and P1B. Similar values are seen in the prismatic shells from Moeraki (MD1 and MD3). The higher mean Al/Ca ratios observed in the samples can be assumed to reflect higher levels of Al in the ambient environment as the amount of metal incorporation into the shell is assumed to provide an indication of the degree of bioavailable metal present in the environment (Section 5.4) (Tynan *et al*., 2005). Very low Al/Ca ratios characterise the OBL samples (RW75 and A740), where the water chemistry and trace metals are measured, monitored and altered if conditions fluctuate from the optimum growing conditions for the pāua. As is the case for Al/Ca ratios, Ba/Ca and Mn/Ca ratios were also similar in shells based on sample site.

Ba/Ca ratios generally produce higher values within the nacreous layer, however, a number of samples (n = 5), have higher Ba/Ca ratios in the prismatic layer. Four of these samples (P04A, P1B, MP04A and KD1B) also show the anomalously high Al/Ca ratios in the prismatic shell. Mn/Ca ratios are also higher in the prismatic layer of these shells. The increase of Ba/Ca and Mn/Ca ratios in the prismatic layer of the aforementioned samples could be due to the increase of Ba and Mn in the ocean, associated with the increase of nutrients and primary productivity from diatom and phytoplankton blooms. Gillikin *et al.* (2006) suggests that the incorporation of elements in calcite with ionic radii larger than calcium is expected to be strongly affected by external factors. This strengthens the idea that the elevated Ba/Ca ratios in the prismatic layer could reflect the environmental conditions during growth.

Some differences in trace element/Ca ratios are also observed amongst individuals within each site (e.g., B/Ca and U/Ca ratios). Variations of the trace element/Ca ratios in each sample collected from the same location might be due to dietary differences (Beldi *et al*., 2006; Naylor *et al.*, 2006), subtle differences in local inputs of elements, exposure to energetic environments (Wells *et al*., 1998) and the ontogenetic stage of the animal (Arai *et al*., 2003; Klein *et al*., 1996b; Schöne, 2008).

Pāua live on both exposed and sheltered shores (Wells, *et al*., 1998). Exposure to the varying energy environments can not only add metabolic stress to the animal but also affect the abundance of food. Higher energy wave environments have the potential to drift more macro-algae to the pāua (Donovan and Taylor, 2008), compared to the pāua sheltered in crevices and behind rocks. Macro-algae is an additional source of trace elements to the pāua which could explain the variations in the trace element/Ca ratio chemistry in shells collected from the same site.

Having shells of different ontogenetic stages from the same site also adds further complexity to inter-individual chemistry differences observed at the same site. The growth of pāua slows significantly during ontogeny so the transect analysed will reflect different time spans (Schöne, 2008). Pirker and Schiel (1993) described the adult length of pāua as being ca. > 115 mm, with these individuals having significantly slower growth rates than that of juvenile pāua (< 70 mm). Faster precipitation of the shell would have the potential to record more of the environmental events versus the slower precipitation from the older organism. If age differences characterise shells at each location, the 30-40 mm transect analysed in this study will preferentially produce different element/Ca ratios as faster growing younger species would record shorter term fluctuations of environmental parameters (more winters and summers) (Vander Putten *et al*., 2000). Furthermore, it has also been shown that growth rate may affect the incorporation of trace elements into the shells of mollusc species (Schöne, 2008)

5.3 HIGH TEMPORAL RESOLUTION ANALYSIS OF PĀUA AS A (PALEO-) ENVIRONMENTAL PROXY?

5.3.1 Pāua prismatic layer colouration

The prismatic layers of many pāua samples show alternating lighter to darker blue and green bands. Past studies have identified the effect of diet on shell colouration of many *Haliotis* spp. (Poore, 1972a). Feeding experiments have found that the shell colouration in different organisms can be explained through changes in diet and the type of algae that the animal feeds on (Leighton and Boolootian, 1963; Olsen, 1968; Poore, 1972a; Sakai, 1960). Sakai (1960) investigated the colouration of *Haliotis spp*. shells with respect to the different types of algae consumed. When the animal consumed brown and green algae, the prismatic layer became bluish-green in colour (Sakai, 1960). However, when the animal consumed brown algae, it produced brown shell material (Sakai, 1960). Poore (1972a) also noted the effect of diet on the shell colour of *Haliotis iris*. In general, red algae (*Hymenocladia lanceolata*) promoted the growth of dark red or brown shell in pāua, and brown algae (*Macrocystis pyrifera* and *Lessonia variegata*) promoted growth of a light blue-green shell (Poore, 1972a). Studies of *Haliotis cracherodii* attribute the colour change from white to red in juvenile specimens to a change in diet from diatoms to calcareous algae (Leighton and Boolootian, 1963). The change to the red to darker green/dark bluish-black is then thought to be due to the introduction of macro-algae into the diet of the species as an adult (Leighton and Boolootian, 1963).

Figures 5.4a-5.4d shows Mg/Ca ratios overlain on photographic images of the shells studied in this thesis. Many samples have higher Mg/Ca ratios associated with lighter coloured parts of the prismatic layer and lower Mg/Ca ratios associated with darker coloured parts of the prismatic layer. Pāua feed on macro-algae with the greatest amounts of this food being available in the winter (Poore, 1972a). Different species of macro-algae (brown algae) have been recorded to be in greater densities in June/July and maximum size in August/September (Schiel and Nelson, 1990). The intake and abundance of food in winter could relate to the darker banding characterised during the Mg/Ca ratio minima which could indicate that both Mg/Ca ratios and colouration of shell could be an indication for potential temperature changes related to diet.

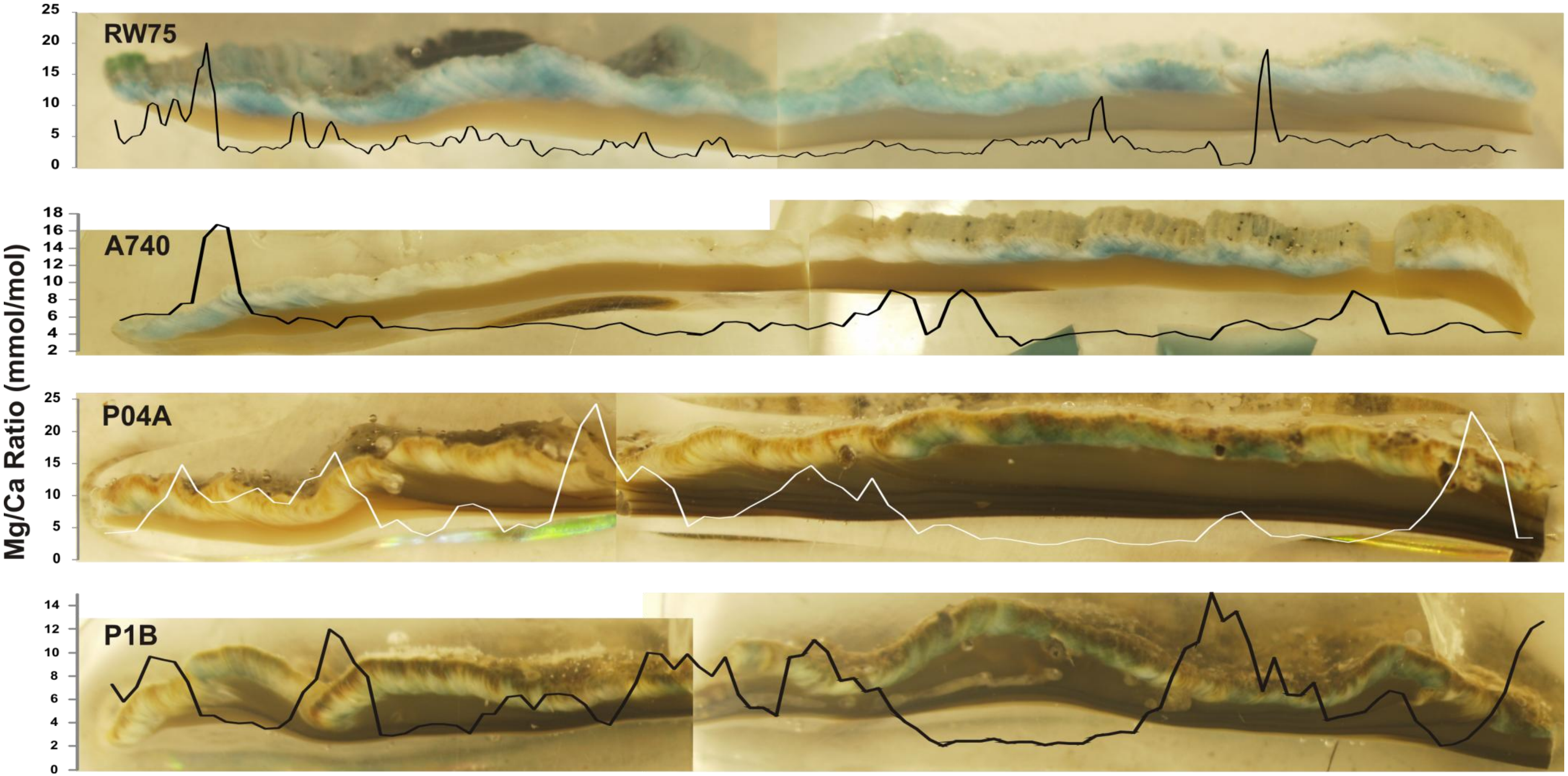

Fig. 5.3a. Mg/Ca ratios of a high temporal resolution transect through the prismatic layer of all samples (3 point moving average). The majority of the peaks in Mg/Ca ratios coincide with lighter coloured shell material.

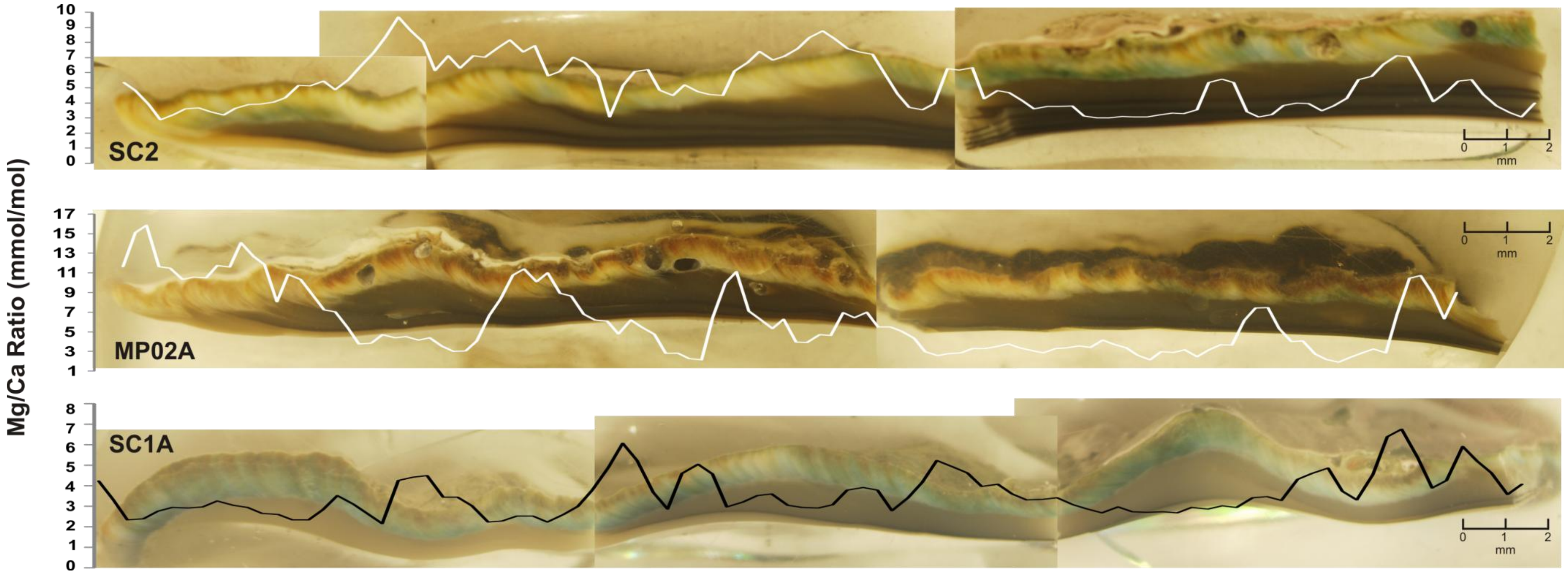

Fig. 5.3b. Mg/Ca ratios of a high temporal resolution transect through the prismatic layer of all samples (3 point moving average). The majority of the peaks in Mg/Ca ratios coincide with lighter coloured shell material.

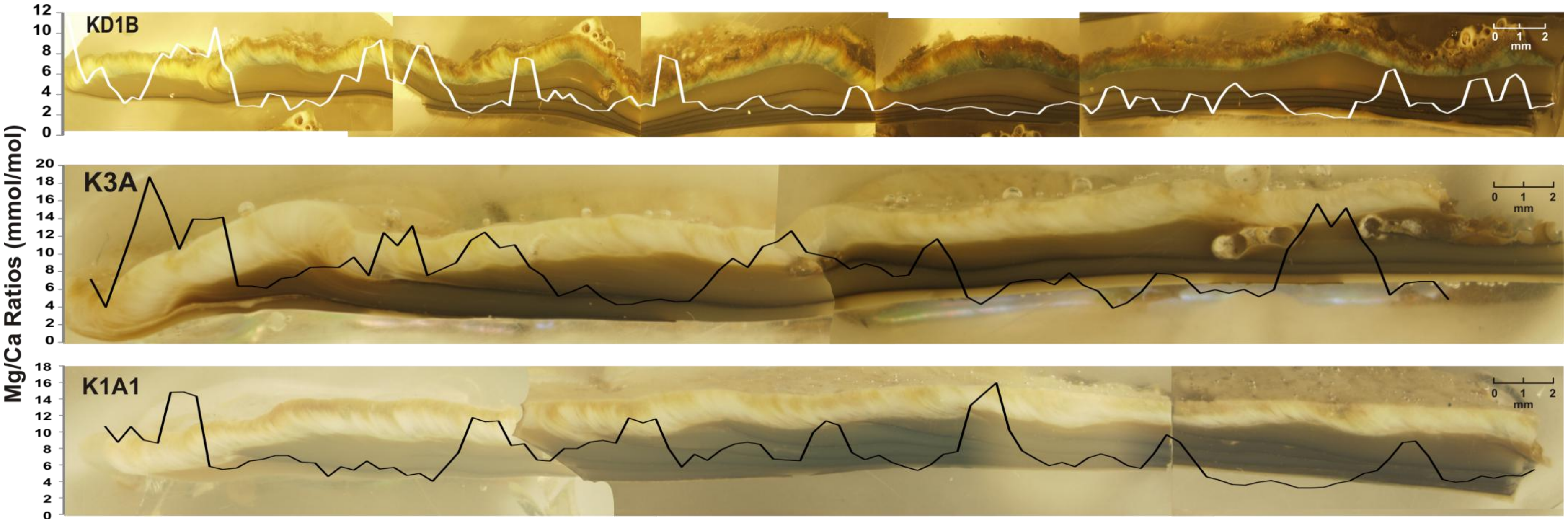

Fig. 5.3c. Mg/Ca ratios of a high temporal resolution transect through the prismatic layer of all samples (3 point moving average). The majority of the peaks in Mg/Ca ratios coincide with lighter coloured shell material.

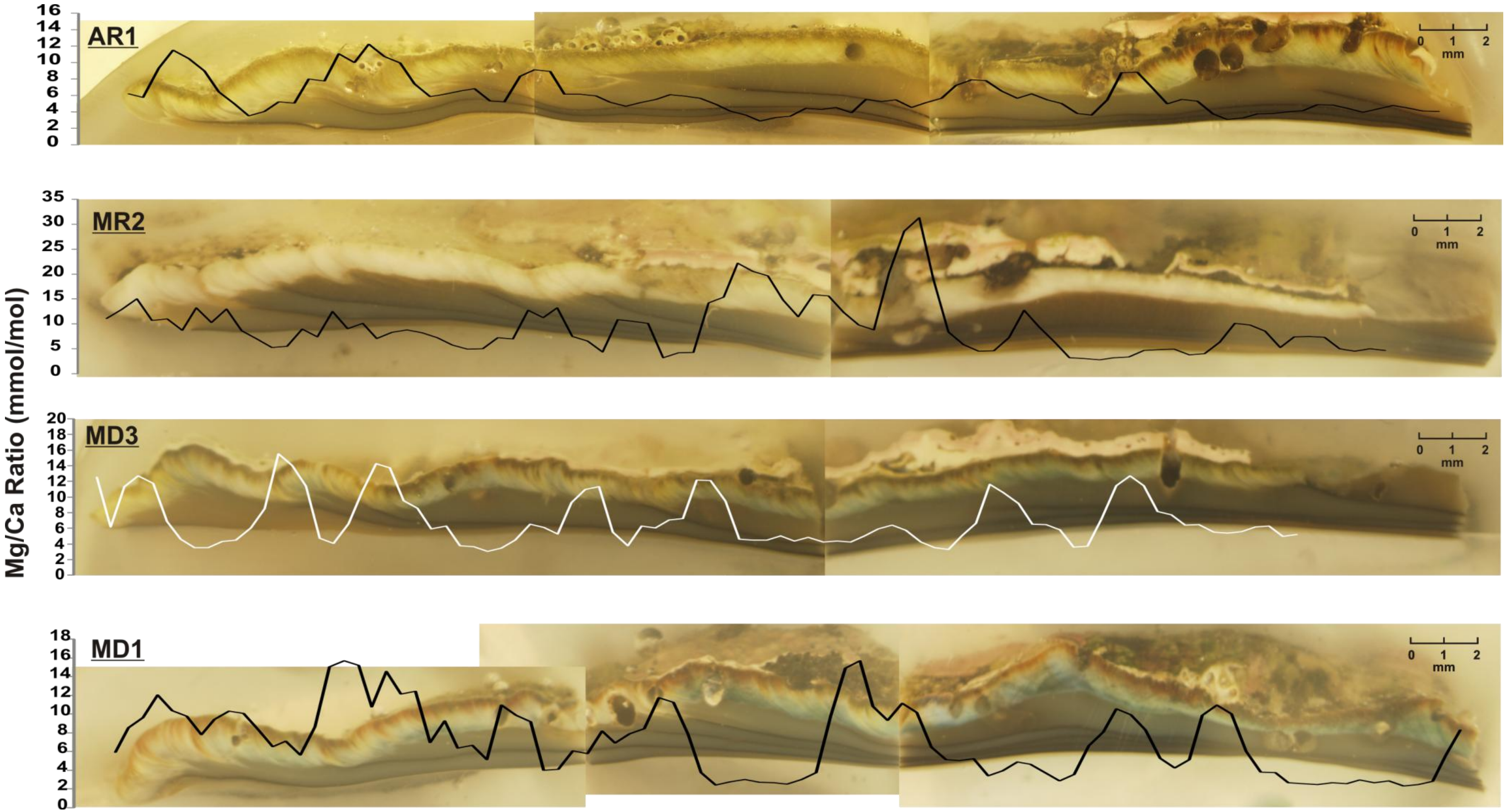

Fig. 5.3d. Mg/Ca ratios of a high temporal resolution transect through the prismatic layer of all samples (3 point moving average). The majority of the peaks in Mg/Ca ratios coincide with lighter coloured shell material.

5.3.2 Mg/Ca and Sr/Ca ratios in pāua as a paleo-ocean thermometer

5.3.2.1 OceaNZ Blue Ltd trace element/Ca and temperature correlation?

Mg/Ca and Sr/Ca ratios in foraminifera and coral, respectively, have routinely been used as to reconstruct past ocean temperatures (Elliot *et al*., 2009; McCulloch *et al*., 1996). These elemental ratios were measured in all pāua samples to examine if pāua also recorded changes in Mg/Ca and Sr/Ca ratios in response to temperature.

The cultured OceaNZ Blue Ltd pāua provide a particularly good example to examine this, as water temperature was continuously monitored and measured during pāua growth. In the first instance, the recorded monthly growth of both OBL samples was compared with recorded monthly temperatures provided by OBL. The results showed that A740, a juvenile pāua, had maximum growth when temperatures were high, whereas RW75, an adult specimen, showed an inverse relationship with maximum growth while temperatures were low. Juvenile pāua have been noted to show a positive correlation between water temperature and metabolic rate until thermal maxima is attained (Naylor *et al.,* 2006). Three other juvenile pāua were also provided by OBL and also showed maximum shell growth during warmer months (Appendix 2

.1). This is an effect of ontogeny with the larger adult sample showing a growth rate lag to temperature. With respect to the element/Ca ratios, it is important to note that growth rates are not consistent, with variations seen annually and throughout the life span of the pāua. Naylor *et al.* (2006) noted the onset of an inverse relationship of growth rate and temperature in adult pāua reflected the onset of sexual maturity as resources are relocated to gonad for development.

Mg/Ca ratios in both A740 and RW75 show higher values with increased temperature and increased growth rate, although peaks in both temperature and growth do not always exactly coincide. This suggests that a number of factors influence the incorporation of Mg within the shell of pāua including temperature and calcification rate. A temperature dependence of Mg/Ca ratio within the mussel shell of *Mytilus trossulus* was described by Klein *et al.* (1996a) with increased Mg/Ca ratios associated with warmer temperatures. The increase of Mg/Ca ratios also occurred during periods of increased growth rate.

There also seems to be a slight lag between peak temperatures and increased Mg/Ca which could suggest there is a time lag between the uptake of trace elements from the ambient environment, travel through the mantle epithelium, and precipitation into the carbonate shell. RW75 shows increased Mg/Ca ratios in February 2009, but fails to show elevated Mg/Ca ratios in 2008. Both A740 and RW75 show low Sr/Ca ratios with peak growth (represented by black boxes in Figure 5.5). Sr/Ca ratios in corals and molluscs have also been observed to be a function of calcification rate (Gillikin *et al*., 2005; Stecher III *et al*., 1996). This inverse relationship of growth or calcification rate with Sr/Ca ratios is also seen in corals and the bivalve, *Mytilus trossulus* (Gillikin *et al*., 2005; Klein *et al*., 1996b). As discussed in Section 5.1, Ca uptake is inhibited by calcium channels which allow Sr^{2+} to travel within similar pathways as Ca^{2+} (Gillikin et al., 2005). An important enzyme within the biomineralisation process is Ca^{2+}-ATPase (Gillikin *et al*., 2005; Klein *et al.,* 1996b). Ca^{2+}-ATPase is instrumental in pumping Ca^{2+}, removing H^{+} ions and concentrating CO_3^{2+} at the calcification site (Gillikin *et al*., 2005). When biomineralisation increases, Ca^{2+}-ATPase activity also increases and raises the Ca^{2+} affinity towards the enzyme site compared with Sr^{2+} explaining the inverse correlation between Sr/Ca ratios and growth rate (Gillikin *et al*., 2005). Growth rates have then been able to indirectly reflect temperature as some mollusc species experience increased growth during warmer temperatures (Gillikin *et al*., 2005 Klein *et al.,* 1996b). This tool used with pāua shells will produce unreliable results as growth rates and temperature of the water in which they grew in differ from individual to individual.

Sr/Ca ratios of A740 also show shorter-term oscillations on what appear to be monthly cycles (Fig. 5.4). Meibom *et al.,* (2003) recognised a similar Sr/Ca ratio relationship in the aragonitic coral *Porites lutea*. The monthly Sr/Ca and Ba/Ca ratio oscillations were explained due to metabolic effects that are synchronous with the lunar cycle (Meibom *et al*., 2003). Such metabolic effects including coral spawning and larval release, are possibly triggered due to lunar irradiance and cause the diversion of resources that are used for calcification (Meibom *et al.,* 2003). Reproduction in other marine species has also been linked to lunar and tidal changes (Baynes, 2009). Studies of *Haliotis asinia* in Indonesia have identified short-term reproductive cycles influenced by the lunar cycles (Setyono, 2006).

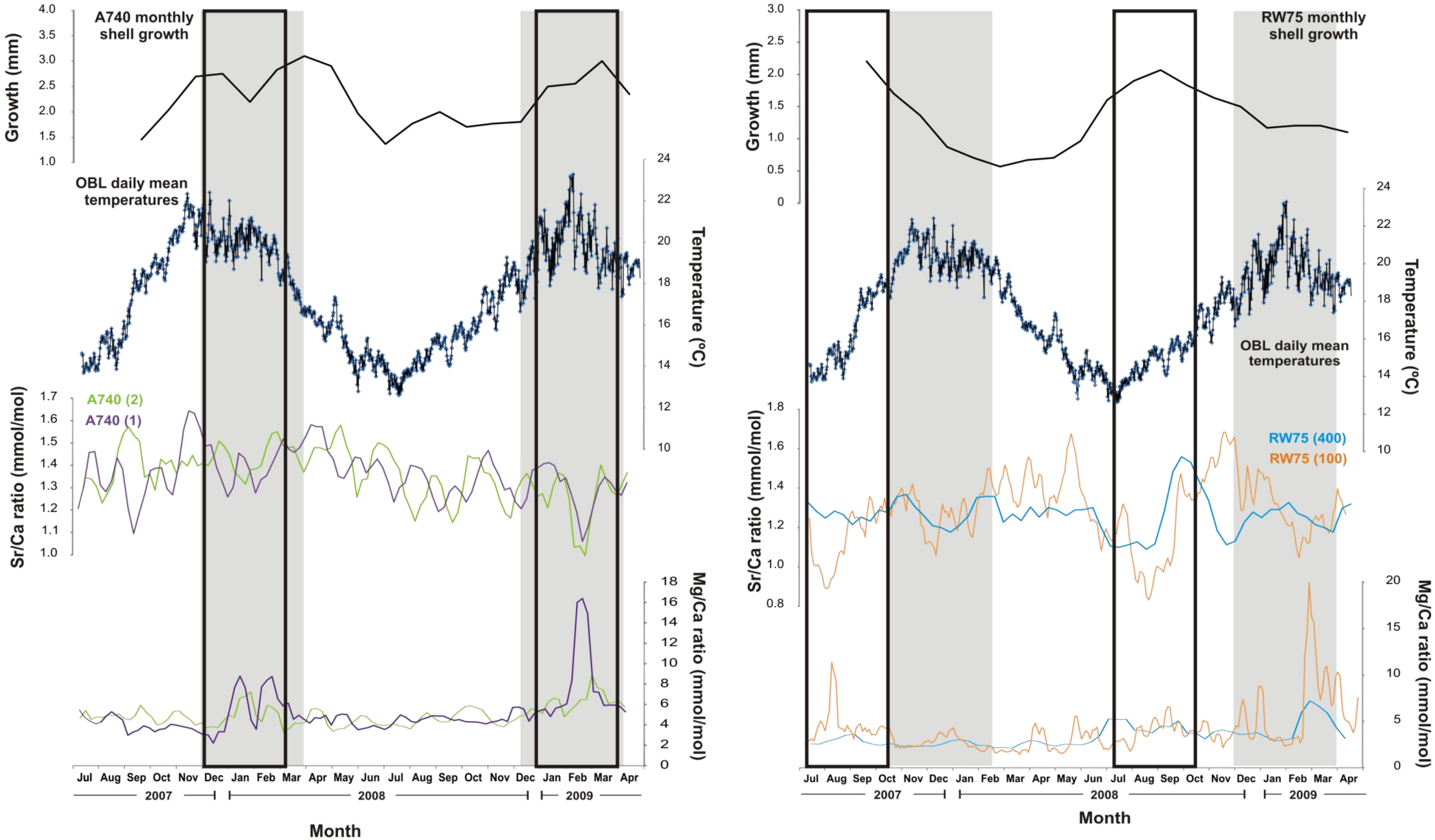

Fig. 5.4. Measured monthly shell growth of A740 (left) and RW75 (right) plotted against OBL daily temperatures and Sr/Ca and Mg/Ca ratios. Grey bands represent peaks in temperature where black boxes represent significant changes in element/Ca ratios. Also to note A740 has increased growth in warmer temperatures whereas RW75 has increased growth rate in colder temperatures.

5.3.2.2 A temperature record in pāua samples collected from the wild?

Before comparing temperature data (Table 3.1) with the Mg/Ca and Sr/Ca ratios of the prismatic layer of pāua shells collected from the wild, growth rates were calculated in order to map element/Ca ratios variations on to a temporal framework. The shells sampled from the wild range in size from 117-155 mm, which means that growth rates for each specimen vary due to each individual's ontogenetic development (Fig. 5.5). An average growth rate for the shells collected from the wild was calculated by estimating the daily growth rate (mm/day) of shells that were measured and analysed in three different studies on *Haliotis iris* (Table 5.2) (Heath and Moss, 2009; Naylor *et al.*, 2007; Poore, 1972b). This estimate assumes a constant annual growth rate and throughout the life span of the pāua. This approach can only be considered an approximation as shell growth rates are dependent on the waxing and wanning of shell precipitation, which is not constant throughout in the year (Schöne, 2008). Daily changes of shell growth rate also occur with night temperatures dropping below some species' thermal limit (Schöne, 2008).

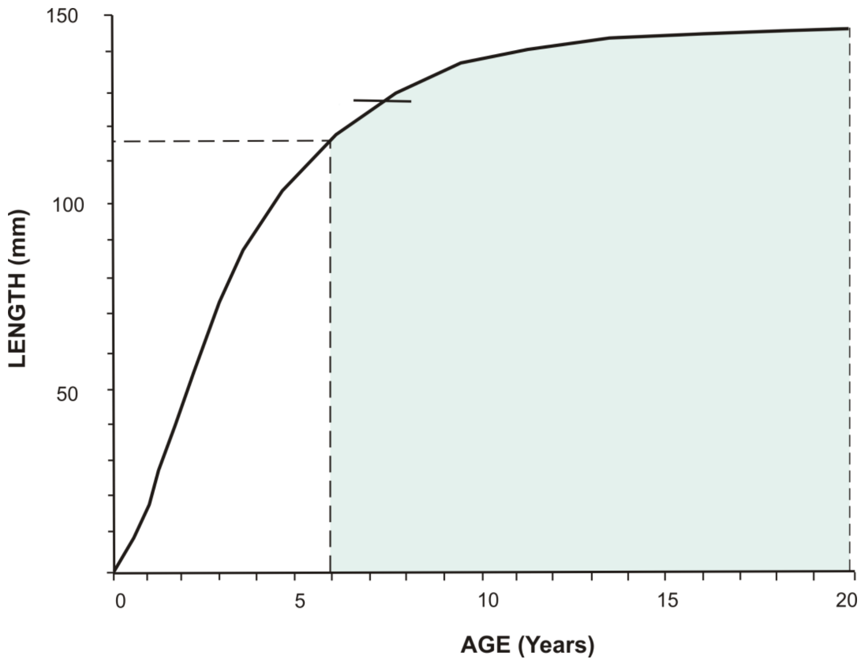

Fig. 5.5. The calculated von Bertalanffy curve showing growth (length versus age) for *Haliotis iris* taken from Poore (1972). The solid horizontal line on the curve represents the minimum legal size on pāua that can be recreationally taken from New Zealand coastal waters. The dashed horizontal line represents the minimum-sized sample measured in this study (117 mm) and the green box under the curve is the range of ages of pāua studied in this thesis.

Reference	Length at release (mm)	Length at recovery (mm)	Time at liberty (days)	Growth rate (mm/day)
Naylor *et al*., 2007	86	110	502	0.0478
	60	109	531	0.0923
	91	120	502	0.0578
	90	112	511	0.0431
	104	119	384	0.0391
Poore, 1972	70	116	1170	0.0393
	76	131	1170	0.0470
	81	120	1170	0.0333
	93	129	1200	0.0300
	98	137	1200	0.0325
	119	139	1170	0.0171
	135	146	1350	0.0081
OBL (RW75)	82	106	546	0.0440
Heath and Moss, 2009	10	17	176	0.0369
	15	24	176	0.0507
	22	31	176	0.0534
	14	22	176	0.0460
	10	18	175	0.0445
	14	22	176	0.0465
	19	27	170	0.0477
AVERAGE				**0.0429**

Table 5.2. Growth rates of pāua (mm/day) calculated by length of release and recovery of pāua in studies by Naylor *et al.* (2007) and Poore (1972) and using the growth data supplied by OBL for sample RW75. The average growth rate for adult pāua was applied to the shell samples collected from the wild in this study.

Mg/Ca ratios in the prismatic layer are variable in samples from the wild. Applied average growth rates were hard to compare with seasonal temperature variations and subsequently with Mg/Ca ratios. While MPO2A showed a correlation between Wellington monthly air temperatures and Mg/Ca ratios (Fig. 5.6), other shell samples from other sites failed to produce the same results. The relative dependency of Mg/Ca ratios observed in both OBL samples and MP02A reflect a 1 mmol/mol increase in Mg/Ca ratios with a 1˚C increase in temperatures. Peaks of Mg/Ca ratio in some samples (A740 in Fig 5.4) do not show a gradual increase of Mg/Ca ratios with increasing temperatures but instead exhibit sudden sharp peaks. As other biological effects occur during precipitation, this could be due to the redistribution of resources used for biomineralisation and transportation of ions to the EPF to other areas of the organism for gonad development or reproduction (Meibom *et al.,* 2003).

Pāua live in high wave-energy environments that can cause the metabolism of the pāua to shut down, which results in an interruption of the recording of element/Ca ratios within the shell (Schöne, 2008). Pāua also live in the subtidal zone, which means that water can retreat from the habitat during low tide and that no water temperature can be recorded (Schöne, 2008). These reasons might explain why Mg/Ca ratios have failed to be recorded reliably in the pāua shells from the wild. The lack of evident seasonal temperature fluctuations in the Mg/Ca ratio could also suggest that biological factors exert a predominant control on pāua Mg uptake. Many other molluscs (Elliot *et al.*, 2009; Lazareth *et al.*, 2007; Vander Putten *et al.*, 2000) also fail to show Mg/Ca ratios correlating with ambient ocean temperature changes.

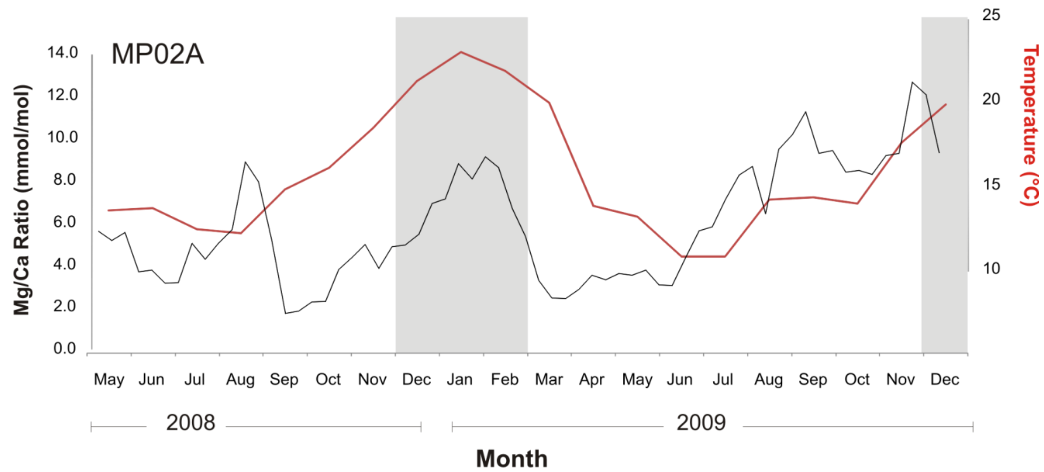

Fig. 5.6. The 3-point moving average of MP02A Mg/Ca ratios (black) using a daily shell growth rate of 0.043 mm/day compared with mean monthly air temperatures of Wellington from May 2008 to December 2009. Grey bands show correlations between peaks in temperature and Mg/Ca ratios.

Sr/Ca ratios in pāua do not appear to be a strong proxy for ambient ocean temperatures. Sr/Ca ratios have been widely studied in many different molluscan species yielding varying results (Gillikin *et al.*, 2005). Sr/Ca ratio peaks occurr out of cycle with minimum and maximum temperatures and highlight that primary factors influencing the uptake of Sr^{2+} into the $CaCO_3$ shell of pāua are not necessarily environmentally related, and physiology and vital effects could play a larger role (Schöne, 2008). Controls on the Sr/Ca ratios of the bivalve *Saxidomus giganteus* were studied extensively and showed that biological processes dominate (Gillikin *et al.*, 2005). This physiological effect not only could influence the amount of Sr in the carbonate secreting fluid in the EPF but also the timing and the rate at which the pāua shell grew (Schöne, 2008).

Mg/Ca and Sr/Ca ratios in other mollusc shells have also showed varying results, identifying the need for individual species-specific element/Ca ratio proxies to be established. Sr/Ca ratios have been shown to increase with increasing growth rate in the aragonitic bivalve *Saxidomus giganteus* (Gillinkin *et al*., 2005). However, without a clear understanding of vital effects of each species, it is difficult to know when the 'recording' of environments is accurate (Weiner and Dove, 2003).

Sr/Ca and Ba/Ca ratios show a moderate to strong correlation in the prismatic layer, with significance levels <0.001 in all samples excluding SC1A. One explanation for the strong correlation seen between Sr/Ca and Ba/Ca ratios in different layers of pāua could be the similar pathways that Sr^{2+} and Ba^{2+} travel from the external medium, through the mantle epithelium, to the extrapallial fluid ready for biomineralisation (Carré *et al*., 2006). However, high growth rates and other environmental conditions could also explain such correlations (Carré *et al*., 2006). Moderate correlations of Sr/Ca against B/Ca ratios, with coefficients between 0.31-0.50 and high significance (p <0.001) are seen in the prismatic layer of five samples. Similar relationships were seen in a shell of *C. amurensis* in studies by Takesue *et al.* (2008). It was suggested that B/Ca and Sr/Ca may have similar transportation through the mantle epithelial channels as Sr.

Both Naylor *et al.* (2007) and Kim and Hudson (2007) suggest that oxygen isotope ($\delta^{18}O$) profiles within pāua shells reflect water temperatures at the time of precipitation. The application of $\delta^{18}O$ mimics the relationship of ambient water. Stable isotope analysis of wild pāua samples as a 'temperature' gauge would help further understand if Mg/Ca ratios have any underlying environmental influence when the carbonate shell is being formed.

5.4 PĀUA AS AN ARCHIVE FOR POST POLLUTION EVENTS

Trace element/Ca ratios have been recorded at high temporal resolutions within the shell samples of pāua with results presented in section 4.2. The purpose of analysing trace metals in addition to Sr and Mg (e.g. Zn/Ca, Pb/Ca and Al/Ca ratios) was to investigate whether pāua have the potential to be a bioindicator of the ambient environments in which the pāua lived. Boening (1999) highlighted the key characteristics (Table 5.3) that are important for an organism to be potentially used as a bioindcator.

Tolerance to a wide range of metal exposures; ability to accumulate metals without suffering mortality
Sedentary habits; slow and limited range of movement
Sufficient life span to allow for sampling of more than a one year class
Abundance in the study area
Sufficient size to allow chemical analysis of tissue samples
Hardiness; ability to remain healthy during sampling and laboratory incubation
Relative ease of sampling and identification
High metal accumulation rates
Responsiveness to changes in metal exposure

Table 5.3. The key characteristics for useful bioindicator organisms (Boening, 1999).

Coastal zones and other aquatic environments in which pāua live, receive large amounts of metal pollution as a result of human industrial and agricultural activity (Beldi *et al.*, 2006; Luoma, 1989; Protasowicki *et al.*, 2008). Any metals incorporated into the carbonate structure can be assumed to have been taken up directly from the environment and actively metabolised by the pāua. The presence of some metals (Zn, Pb and Al) in the environment is a serious problem due to their toxicity and ability for available metals to accumulate in living organisms (bioavailability) (Beldi *et al.*, 2006; Brooks and Rumsby, 1965; John and Leventhal, 2005). Pāua are exposed to these trace metals through ingestion from either the surrounding aquatic medium or from food intake (Luoma, 1989; Rainbow, 1997; Rainbow, 2002). The fate of the trace metal is dependent on the physiology of the animal, specifically, as to whether the metal is to be used for an essential metabolic purpose, excreted, bond with biomolecules or stored in the body or shell (Rainbow, 2002). The substitution of such trace metals for Ca^{2+} ions can only occur once the elements reach the extrapallial fluid, where they can then be incorporated into the carbonate lattice. Measuring trace metal chemistry will help provide an indication of the extent of magnitude of environmental contamination introduced into the water system (Tynan *et al*., 2005). The bioaccumulation of such metals can have toxic effects to both pāua and also humans who consume them (Protasowicki *et al*., 2008).

5.4.1. Element/Ca ratios at Moa Point

Pāua from Moa Point (sample MP02A) were specifically investigated to examine how the trace elements that come out of the Moa Point sewage outlet would be recorded in the shell. Mean trace element/Ca ratios from the high temporal resolution transect of the prismatic layer of MP02A show significantly higher Pb/Ca, Al/Ca and Mn/Ca ratios compared with the other shells analysed in this study (Fig. 4.1a and 4.1b), suggesting an increase of such elements in the ambient environment around Moa Point The high temporal resolution analysis of the element/Ca ratios of MP02A shows stable fluctuations of element/Ca whereas other samples show more irregular changes. Mn/Ca, Ba/Ca, Zn/Ca and Pb/Ca ratios were plotted against the temperature data from NIWA, using daily growth rates of 0.043 mm/day (Table 5.2). The harvesting of the animal was on December 31, 2009. The temperature given for the dates between May 2008 and December 2009 show the increases of Zn/Ca and Pb/Ca ratios coincide with the colder months. Other samples show similar element/Ca ratio relationships (figure 5.7b).

Peak element/Ca ratio occurs between the months of June and October 2008 in sample MP02A. These months are in the winter season and exhibit increased wave action and energy from the increase frequency of storm events and colder, windier weather. The increase of element/Ca ratios could be due to many sources. Firstly, peak discharge flow at Moa Point Sewage Plant can increase due to storm water entering the plant, which will increase the flux of trace elements into the ambient environment. The increase in Pb/Ca could also be a result of increased terrestrial run off from heavy rains. The increase of Mn/Ca and Ba/Ca ratios could then be caused by nutrient blooms related to the increase of trace metals input into the system by the sewage outlet.

The increase of element/Ca ratios can also be due to desorption of bioavailable trace metals from sediments. Storm events can cause turbulent environments which can cause the resuspending of sediments (Gillikin *et al*., 2005). The trace elements can then be taken up by the mollusc and will contribute to the elevated element/Ca ratios in shell material. Where profiles show sudden increases in element/Ca ratios, this could be due to many factors. Increase in metal content in *Cerastoderma edule* was explained by Price and Pearce (1997) in three ways: (1) by brief periods of extreme pollution resulting from increase of water and sediment input into a region; (2) disturbances and remobilisation of existing particulate metals due to storm related events; and (3) an increase of sediments and elements due to anthropogenic activity. Any of these examples could provide information on the trace element/Ca ratios seen in the analysis of the prismatic layer. As discharges of effluent occur monthly, the disturbances of existing particulate material in the windier and stormier months could produced the anomalies in trace metal/Ca ratios in the MP02A shell.

Studies of pollution risk assessment require a comprehensive comparative study an ecosystem's response to nutrient increase in a localised environment (Brasier, 1995). It is also important to consider why trace element chemistry could be elevated in the environment, but it is also important to examine why trace element/Ca ratios are increased in the carbonate shell. Certain quantities of trace metals are essential in the body of aquatic invertebrates to meet metabolic needs, however, excessive amounts can potentially be toxic, with the need for excretion or detoxification (Rainbow, 2002).

Increases in local bioavailability of a trace metal, whether dissolved or in the diet, can cause an increase in the uptake rate of that particular metal into the body of the species (Rainbow, 2002). As discussed in Section 5.3.1, the uptake of feed of macro-algae for pāua is highest in winter (Poore, 1972a), with macro-algae also taking in a sufficient amount of trace metals as well (Phillips and Rainbow, 1988). Metal accumulation in a prey species, including the macro-algae, has the potential to be taken up by the pāua and accumulated in the soft tissue and shell depending on the accumulation pattern and uptake channels of particular trace metals (Rainbow, 2002). This could explain the elevated Zn/Ca and Pb/Ca ratios seen in MP02A and other samples (Fig. 5.7a,b). With excessive uptake of trace metals, a threshold can be reached where an equivalent amount of trace elements are excreted to match the rate of uptake (Rainbow, 2002). This threshold can also deliver toxic effects on to the aquatic organism and cause metabolic decline. This could explain a double peak of Zn/Ca, Mn/Ca and Pb/Ca ratios seen in around the months of July and October for in both 2008 and 2009, however a greater knowledge of the accumulation pattern of pāua for Zn, Pb and Mn would be essential in order to establish this. Before any inference on metal contamination in the shell can be made, a relationship between the trace metal chemistry in the environment and the flesh of the pāua needs to be established.

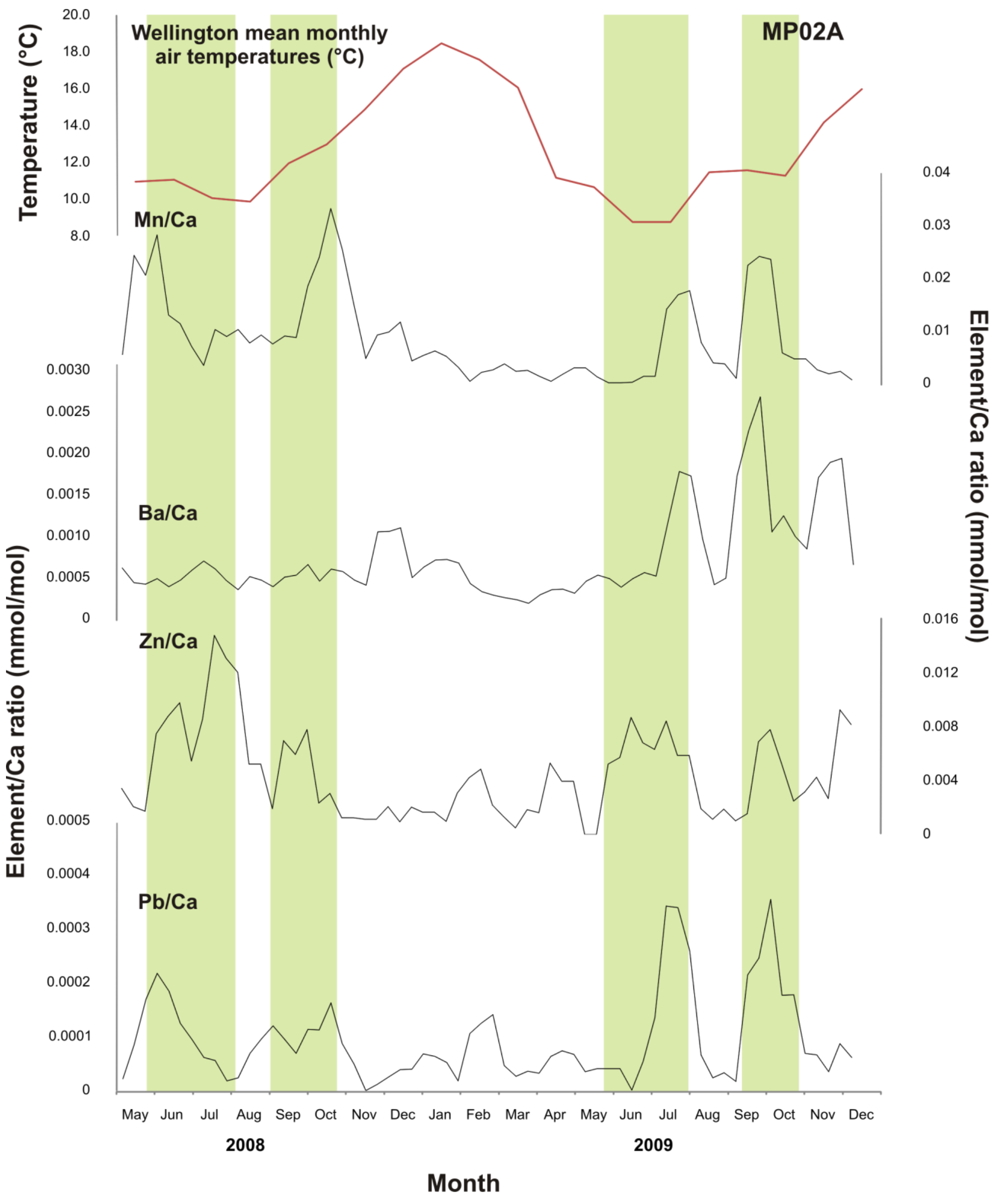

Fig. 5.7a. Element/Ca ratios of sample MP02A compared with the mean monthly air temperatures in Wellington (NIWA) from May 2008 – December 2009. The green bars represent the higher element/Ca ratios which correspond to the colder temperature months.

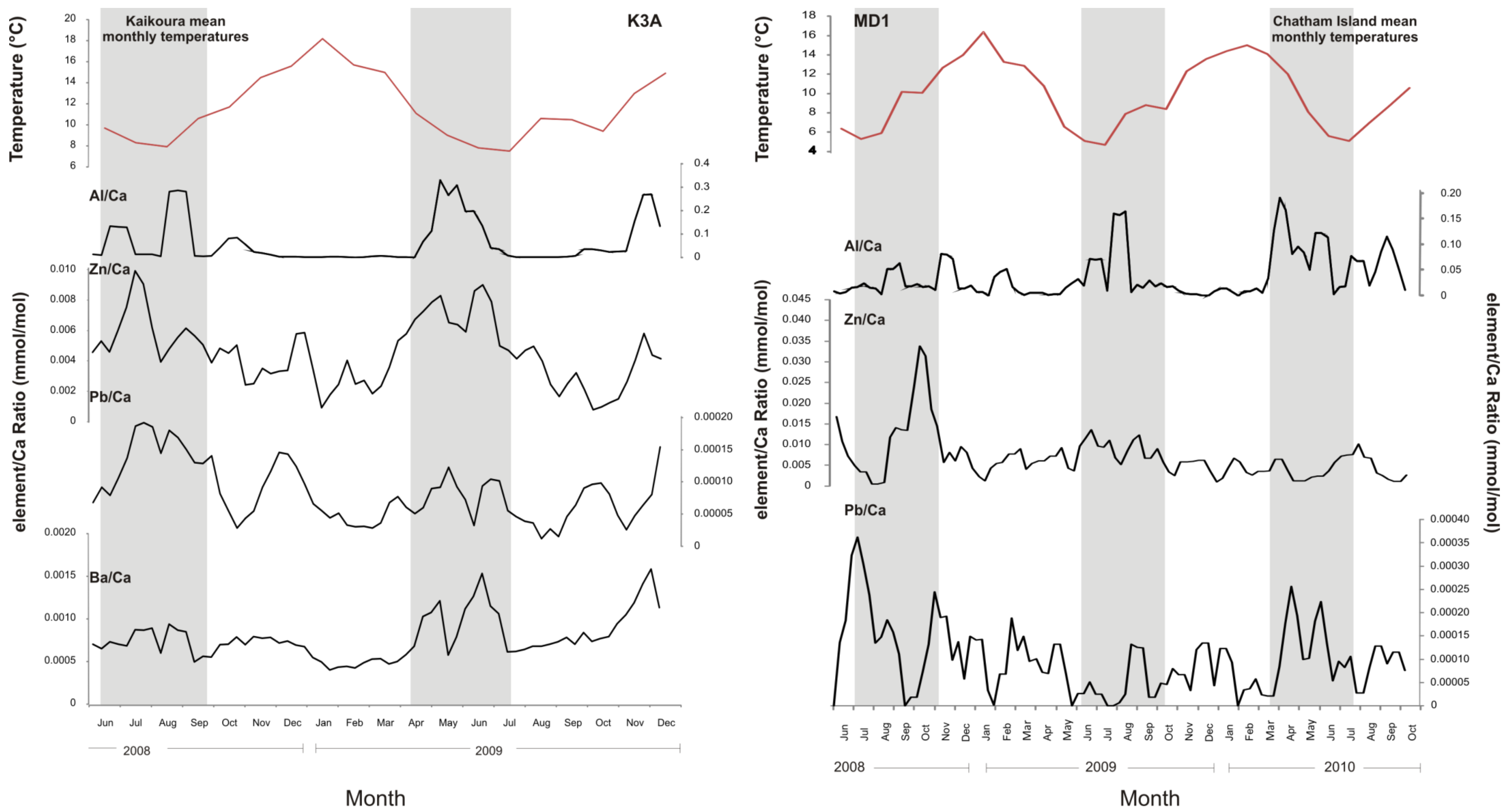

Fig 5.7b. Element/Ca ratios of sample K3A (left panel) and MD3 (right panel) compared with the NIWA mean monthly air temperatures of the sampling locations (Kaikoura and the Chatham Islands). The grey bars represent the higher element/Ca ratios which correspond to the colder temperature months.

Soft tissue and shell trace element/Ca ratio can present similar results. Pb levels in whole shells of the New Zealand cockle *Austrovenus stutchburyi* were also seen comparable to those in the soft tissue (Bellotto and Miekeley, 2007; Richardson *et al.*, 2001). Anderlini (1992) studied the effect of sewage from Wellington Harbour on the trace metal concentrations in the soft tissue of mussels *Mytilus edulis aoteanus* and *Perna canaliculus* collected from Fitzroy Bay. Collections were made once a month during February 1986 through to June 1987. Peaks were seen in the Zn, Mn and Pb concentrations within the *P. canaliculus* during the study period. Smaller peaks were also seen to occur in March and April (Fig. 5.8).

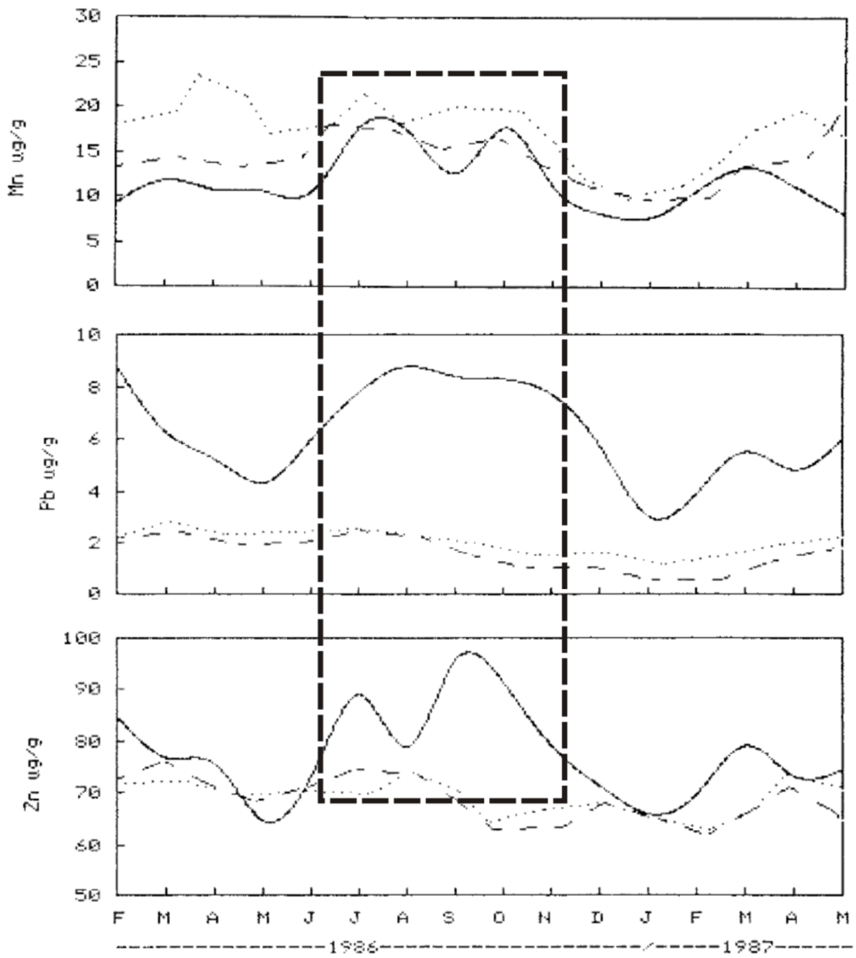

Fig. 5.8. Mn, Pb and Zn concentrations recorded in *Perna canaliculus* soft tissue from multiple locations at varying distances from the sewage outsource at Fitzroy Bay (Anderlini, 1992). The dashed box represents the concentrations between the months of June to November 1986 showing the double spike in Mn and Zn which can also been seen in the same months as that seen in MP02A (Fig. 5.8a). The Mn peaks lag that of Zn and Pb.

Beldi *et al* (2006) also found the highest recorded Zn concentrations in the bivalve *Donax trunculus* occurred during winter. The application of this in pāua does show promising results, and could potentially be explored at a higher temporal resolution. Metal contaminants, however, have different physiological routes of uptake available to them (Protasowicki *et al*., 2008). There are also many other issues that may corrupt the element/Ca ratios recorded in the shell. Pāua live in high energy environments in rocky coastal settings (Wells *et al*., 1998). The wave action and storm surges can disturb sediment and suspend contaminated material, which will possibly desorb the sediment bound metals and increase the trace metal bioavailable for the pāua to uptake (Boening, 1999). It has also been shown by Donovan and Taylor (2008) that wave action can cause increased metabolic demands and slower growth rates.

5.5 THE NACREOUS LAYER AS A USEFUL ARCHIVE OF PAST ENVIRONMENTAL CONDITIONS?

Shell growth is important to understanding the trace element chemistry seen in the nacreous layer of the shell. Element/Ca ratios are comparable across different profiles throughout different locations within the nacre. Sr/Ca ratio were almost always comparable in all samples, showing that similar signals are recorded in the same location across transects of the nacre. This can be attributed to the longitudinal growth of the nacre (Fig. 5.9) (Heinemann *et al.*, 2011).

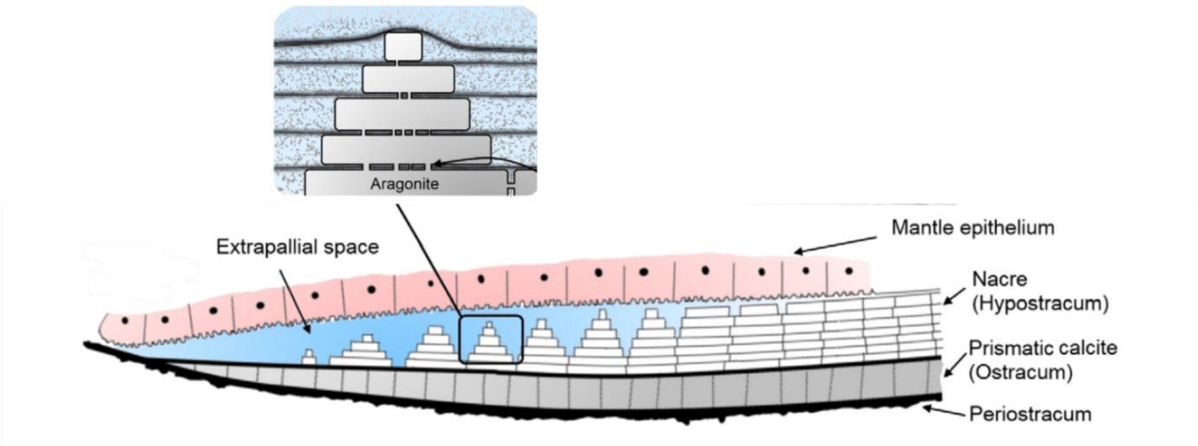

Fig. 5.9. A schematic vertical cross section of the outer mantle edge and growing shell in *Haliotis spp.*, taken from Heinemann *et al.* (2011). The mantle epithelium controls the composition of the extrapallial fluid from where the shell is biomineralised. The inset diagram shows nacre growth.

This study failed to produce a clear trace element/Ca correlation between the nacreous layer and the prismatic layer and/or the ambient environment, however, comparable relationships were seen between the same trace element/Ca ratios from different transect locations of the nacreous layer in the same shell sample. This shows that the nacreous layer is useful at recording a similar signal or element/Ca ratio across the same profile whereas the chemistry of an individual growth band within the prismatic layer is variable (section 5.6). The strongest comparable relationships were seen in Sr/Ca and Ba/Ca, which are more readily substituted for Ca into the aragonite crystal lattice, due to their large ion size (Section 5.1). The comparable nature of Sr/Ca and Ba/Ca ratios with each varying transect can be put down to their stronger affinity of these ions to be taken into the shell structure more easily than other elements.

The significant correlation between Sr/Ca and Mg/Ca ratio is observed in more samples (n = 12) in the nacreous layer than prismatic layer (n = 8). As Mg^{2+} has a smaller ionic radius than Sr^{2+} it be accomidated more readily in the crystal lattice of aragonite (nacre) than Sr^{2+} into calcite (prismatic layer).

The thick dark bands seen in the nacreous layer of other *Haliotis* species (H. *rufescens* and H. *fulgens*) were identified as protein layers or the conchiolin (Fig. 5.10) (Lin and Meyer, 2005). These protein layers were interpreted as being formed within the shell layer during periods of little calcification or growth cessation, and could represent seasonal changes and aging of the animal (Lin and Meyer, 2005). However, this still needs to be validated (Pirker and Schiel, 1993).

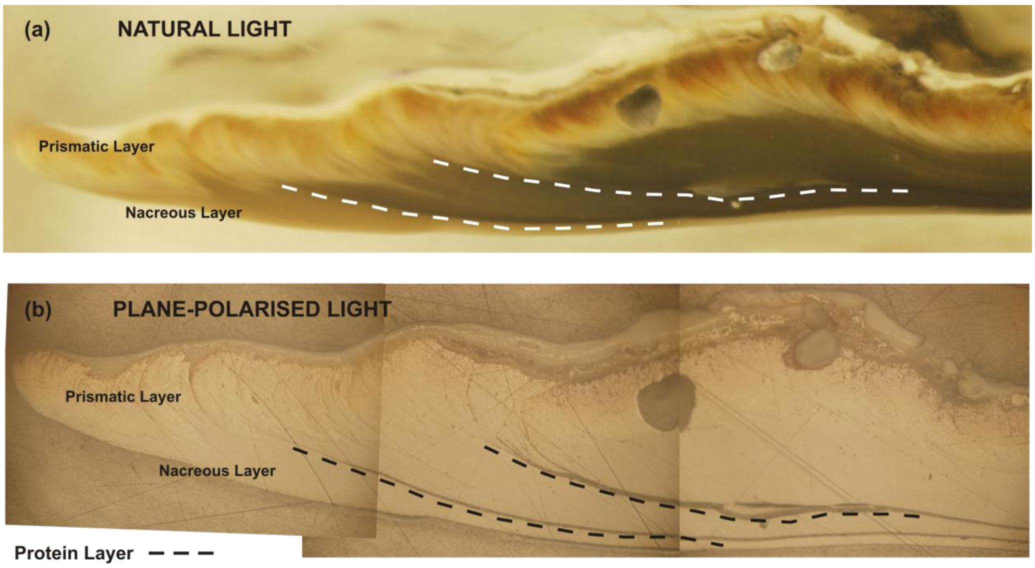

Fig. 5.10. Sample MP02A: (a) taken in natural light with the protein layers represented with white dashes and; (b) taken in plane polarised light with the protein layers represented by black dashes.

The conchiolin could also have formed when pāua have been put in undesirable conditions including suboptimal temperatures, environments or stressful situations, as these may inhibit $CaCO_3$ secretion and may stimulate the pāua to release protein matter. Laser ablation spots analysed on the black lines presented high anomalous results in trace element chemistry. The black lines also formed an indent in the sample, which could have accumulated foreign detritus and other matter which could cause anomalous trace element/Ca ratios during the preparation phase of the sample.

The anomalies were deleted from the results Figures 4.4a-4.4g. Temperature results were hard to compare with the element/Ca ratio, as there is no definite knowledge of the rate of precipitation of the nacreous layer.

5.5. SUMMARY

Evident differences in trace element/Ca ratios between the two layers; prismatic and nacreous, can be attributed primarily to the structural dimensions of the crystal lattice. Smaller cations will more readily substitute for Ca^{2+} in calcite and larger cations will more readily substitute for Sr^{2+} in aragonite. Sr/Ca ratios in the samples from OBL produce an inverse relationship with growth rates whereas Mg/Ca ratios increase with both increasing temperatures and growth rates. Shell samples collected from the wild, however, are harder to correlate with environmental factors. This could be due to more stresses including predation or minimum and maximum thermal temperatures that cause the metabolism of the pāua to slow or shut down, altering the potential environmental record. Shells collected from the coastal areas however do provide some insight into anthropogenic contamination to a region through increased trace metal/Ca ratios seen within the shell. Elevated Mn/Ca and Ba/Ca could also provide information within pāua shells of increased nutrients within an area.

Dark banding within the prismatic layer of some pāua shell samples seem to correlate well with low Mg/Ca ratios where lighter coloured shell seem to coincide with increased Mg/Ca ratios. The colouration of paua shells has seen to be attributed due to diet. Low Mg/Ca ratios during darker shell material could indirectly reflect temperature as pāua increase their food intake in winters compared to any other time of year. The nacreous layer failed to produce concise information on environmental conditions within the pāua, however, showed reproducible element/Ca ratios along different transects of the nacreous layer. The nacre shell growth initially begins laterally before growth continues towards the epithelium. This growth style has been explained to look like a brick and mortar and can also explain why lateral similarities are recorded in the element/Ca ratios. The analysis of individual growth bands also highlighted that the most stable element/Ca ratios are best analysed between the middle of the prismatic layer and close to the prismatic-nacreous boundary.

6. CONCLUSIONS

The main objectives of this thesis were to develop and apply *in situ* geochemical techniques to investigate whether pāua (*Haliotis iris*) could potentially be used as a proxy for present environmental conditions and past environmental change. The following are the key outcomes of this work:

- The prismatic (calcitic) and nacreous (aragonitic) layers of pāua shells have distinctive trace element chemistries reflecting the ease of incorporation of different trace elements into calcite and aragonite mineral structures.
- Individual pāua from the same sites generally have reproducible shell chemistries.
- The incorporation of Mg in pāua shells appears to be influenced by a number of factors. Two primary factors include temperature and growth rate.
- The incorporation of Sr in pāua shells has an inverse relationship with shell growth rate.
- Environmental controls on trace element/Ca ratios of pāua collected from the wild are too weak to develop suitable proxies with the available data. Vital effects play a large role on the trace element chemistry and interrupt the potential record that could be documented.
- Mg/Ca ratios appear to co-vary with the colouration of the pāua shells that may reflect dietary changes related to seasonality and ocean temperatures.
- Trace metals such as Pb/Ca and Zn/Ca ratios in some pāua shells have show seasonal variations and with additional information has the potential to be used as a proxy for environmental contamination and anthropogenic pollution events. Increases of Mn/Ca and Ba/Ca ratios have also been observed to increase with increased trace metals/Ca ratio which could reflect primary productivity responses to environmental controls.

7. SUGGESTIONS FOR FURTHER WORK

This research has raised further questions regarding the use of the geochemistry of pāua and its potential application as an archive of past and present environmental change. In particular, a lack of published information regarding interactions of pāua and its environment has restricted an in-depth linking of the measured trace element/Ca ratios to environmental conditions.

Firstly, the shell samples measure from OceaNZ Blue Ltd showed promising relationships between Mg/Ca and Sr/Ca ratios and temperature and growth rate, however, samples from the wild were harder to constrain or failed to produce similar results. The $\delta^{18}O$ of paua has seen to reflect ambient temperatures of the ambient water during the time of precipitation (Naylor *et al*., 2007). Thus, an important area for future research would be to link $\delta^{18}O$ measurements with element/Ca ratio data to examine the different controls of Mg uptake into pāua shells.

The comparison of the chemistry of fossil pāua with modern pāua might also allow for a detailed evaluation of environment changes at particular coastal sites around New Zealand. A second important line of research would thus be to examine how the trace metal chemistry differs in modern pāua compared with pāua from midden sites post-māori arrival to New Zealand and recent shells.

Lastly, a comprehensive understanding between the trace element chemistry of the ambient environment and the soft tissue of pāua can help provide additional information into the potential of pāua shells as a biomonitor and a proxy for environmental contamination and anthropogenic pollution events.

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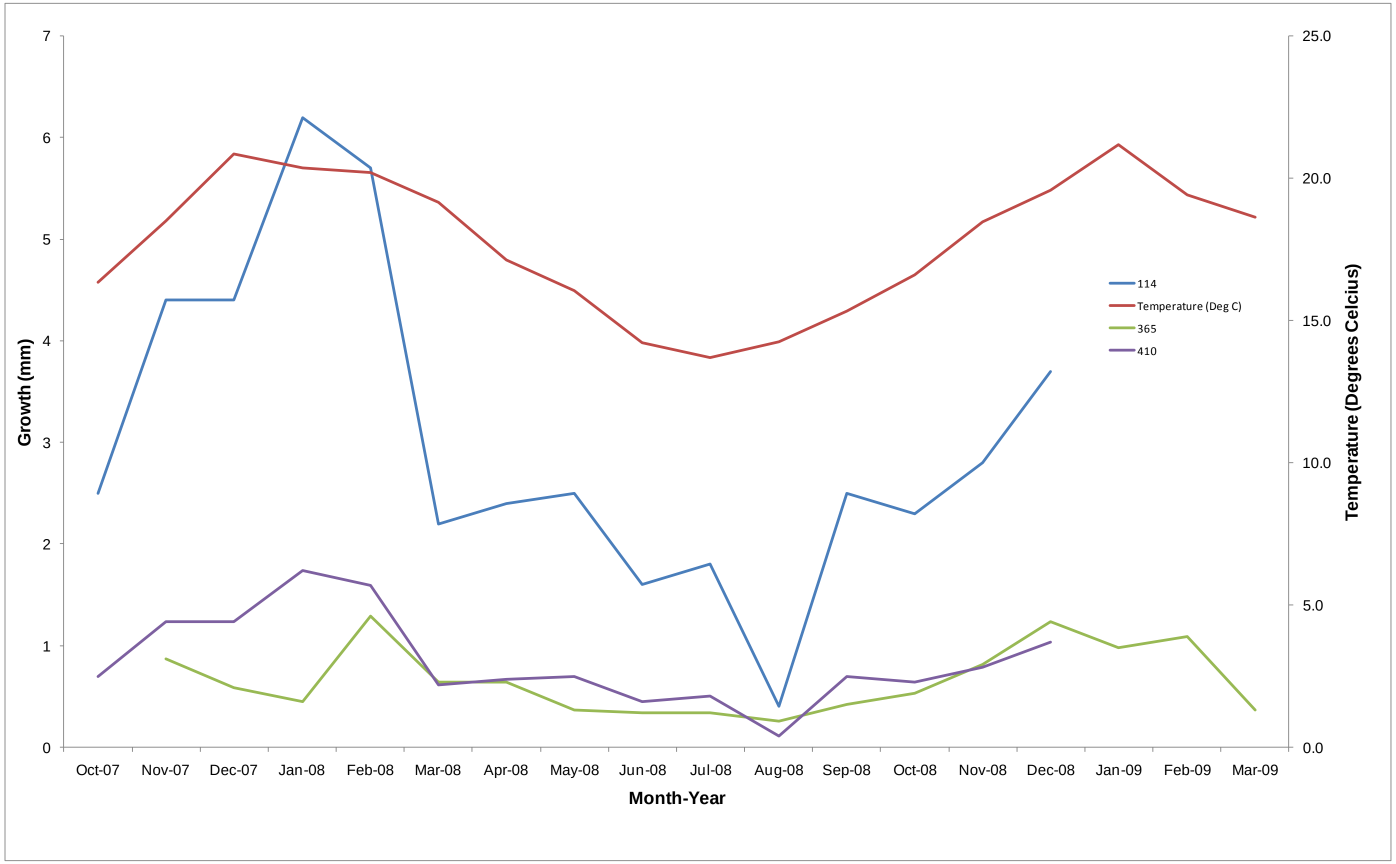
APPENDICES

APPENDIX 1.1 Lists of samples and collected sites

RW75	OceaNZ Blue Ltd, Bream Bay, Ruakaka
A740	OceaNZ Blue Ltd, Bream Bay, Ruakaka
P04A	Pourerere, Hawke's Bay
P1B	Pourerere, Hawke's Bay
SC2	South Coast, Wellington
SC1A	South Coast, Wellington
MP02A	Moa Point, Wellington
KD1B	Kaikoura Coast, Kaikoura
K3A	Kaikoura
K1A1	Kaikoura
AR1	Ascot Reef, Chatham Islands
MR2	Manukau Reef, Chatham Islands
MD1	Moeraki, Otago
MD3	Moeraki, Otago

APPENDIX 2.1 OceaNZ Blue Ltd growth data



Appendix 2.1. Monthly growth data (mm) from October 2007 to March 2009 of pāua shells 114, 365 and 410, three juvenile pāua from OBL. Maximum growth in the juvenile pāua occurs during warmer temperatures.

APPENDIX 3.1 Prismatic layer correlation matrices

A740(2) Correlations Prismatic Layer		Li/Ca	Mg/Ca	Sr86/Ca	Sr88/Ca	Ba/Ca	Pb/Ca	U/Ca	B/Ca Log10	Al/Ca Log10	Mn/Ca Log10	Zn/Ca Log10
Li/Ca	Pearson Correlation		.040	.254*	.260*	.226*	.156	.064	.121	.185	-.011	-.187
	Sig. (2-tailed)		.718	.017	.015	.038	.294	.721	.371	.214	.927	.203
	N		84	87	87	85	47	34	57	47	71	48
Mg/Ca	Pearson Correlation			-.120	-.114	-.106	.084	-.151	-.041	-.151	-.055	.138
	Sig. (2-tailed)			.238	.261	.302	.528	.358	.743	.286	.630	.311
	N			99	99	97	59	39	65	52	80	56
Sr86/Ca	Pearson Correlation				.982**	.329**	-.104	-.078	-.090	.085	.047	.047
	Sig. (2-tailed)				.000	.001	.431	.626	.467	.541	.675	.727
	N				102	100	60	41	67	54	82	57
Sr88/Ca	Pearson Correlation					.364**	-.088	-.051	-.079	.078	.029	.036
	Sig. (2-tailed)					.000	.506	.752	.526	.575	.798	.793
	N					100	60	41	67	54	82	57
Ba/Ca	Pearson Correlation						-.071	.044	.176	.118	.057	.209
	Sig. (2-tailed)						.589	.787	.153	.400	.614	.125
	N						60	41	67	53	80	55
Pb/Ca	Pearson Correlation							-.300	.018	.041	-.019	.117
	Sig. (2-tailed)							.145	.912	.823	.902	.490
	N							25	39	32	45	37
U/Ca	Pearson Correlation								-.111	-.067	.263	.043
	Sig. (2-tailed)								.553	.749	.127	.831
	N								31	25	35	27
B/Ca Log10	Pearson Correlation									.173	-.159	-.022
	Sig. (2-tailed)									.306	.232	.892
	N									37	58	41
Al/Ca Log10	Pearson Correlation										.030	.077
	Sig. (2-tailed)										.839	.708
	N										49	26
Mn/Ca Log10	Pearson Correlation											.157
	Sig. (2-tailed)											.303
	N											45
Zn/Ca Log10	Pearson Correlation											
	Sig. (2-tailed)											
	N											

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

A740(1) Correlations Prismatic Layer		Mg/Ca	Al/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Al/Ca Log10	Zn/Ca Log10
Mg/Ca	Pearson Correlation		.000	-.177	-.208*	-.155	.103	-.045
	Sig. (2-tailed)		.999	.161	.022	.087	.471	.726
	N		51	64	120	122	51	64
Al/Ca	Pearson Correlation			.700**	-.078	.039	.653**	.380*
	Sig. (2-tailed)			.000	.586	.785	.000	.042
	N			29	51	51	51	29
Zn/Ca	Pearson Correlation				-.085	.507**	.532**	.798**
	Sig. (2-tailed)				.513	.000	.003	.000
	N				62	64	29	64
Sr/Ca	Pearson Correlation					.602**	-.135	-.022
	Sig. (2-tailed)					.000	.344	.865
	N					120	51	62
Ba/Ca	Pearson Correlation						-.153	.233
	Sig. (2-tailed)						.283	.063
	N						51	64
Al/Ca Log10	Pearson Correlation							.435*
	Sig. (2-tailed)							.018
	N							29
Zn/Ca Log10	Pearson Correlation							
	Sig. (2-tailed)							
	N							

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Appendix 3.1a. Pearson's Product Moment Correlation Coefficient between element/Ca ratios in the prismatic layer of A740 transect (1) and transect (2). ** Correlation is significant at the 0.01 level and * correlation is significant at the 0.05 level.

RW75 (100) Correlations Prismatic Layer		Li/Ca Log10	B/Ca Log10	Al/Ca Log10	Mn/Ca Log10	Zn/Ca Log10	Pb/Ca Log10	U/Ca Log10	Mg/Ca	Sr86/Ca	Sr88/Ca
Li/Ca Log10	Pearson Correlation		.135	.139	.000	.155*	.171*	.197*	.011	.077	.073
	Sig. (2-tailed)		.114	.149	.999	.028	.028	.041	.868	.284	.274
	N		138	109	170	202	165	108	215	195	225
B/Ca Log10	Pearson Correlation			.004	.054	.065	-.041	.066	.035	.103	.100
	Sig. (2-tailed)			.970	.513	.381	.620	.524	.625	.161	.152
	N			103	150	186	148	95	199	187	206
Al/Ca Log10	Pearson Correlation				-.064	.180*	.145	.333**	-.068	-.024	-.010
	Sig. (2-tailed)				.480	.028	.099	.003	.384	.772	.898
	N				126	148	131	79	164	150	170
Mn/Ca Log10	Pearson Correlation					-.003	.130	-.032	.082	-.110	-.076
	Sig. (2-tailed)					.960	.081	.739	.201	.094	.224
	N					226	180	114	247	233	255
Zn/Ca Log10	Pearson Correlation						.170*	.017	.003	.023	.024
	Sig. (2-tailed)						.013	.840	.961	.705	.682
	N						211	140	289	266	300
Pb/Ca Log10	Pearson Correlation							.008	-.057	.054	.053
	Sig. (2-tailed)							.931	.383	.433	.410
	N							119	233	212	241
U/Ca Log10	Pearson Correlation								-.020	.232**	.225**
	Sig. (2-tailed)								.805	.007	.005
	N								149	135	155
Mg/Ca	Pearson Correlation									-.327**	-.315**
	Sig. (2-tailed)									.000	.000
	N									304	330
Sr86/Ca	Pearson Correlation										.992**
	Sig. (2-tailed)										.000
	N										305
Sr88/Ca	Pearson Correlation										
	Sig. (2-tailed)										
	N										

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

RW75 (400) Correlations Prismatic Layer		Al/Ca Log10	Mn/Ca Log10	Zn/Ca Log10	U/Ca Log10	Li/Ca	B/Ca	Mg/Ca	Sr88/Ca	Ba/Ca
Al/Ca Log10	Pearson Correlation		.002	.290*	.088	.093	.003	.344**	.055	.180
	Sig. (2-tailed)		.986	.020	.562	.449	.982	.004	.657	.144
	N		62	64	46	68	47	68	68	67
Mn/Ca Log10	Pearson Correlation			.035	.113	-.163	.005	.014	-.112	.163
	Sig. (2-tailed)			.739	.362	.110	.967	.896	.274	.113
	N			91	67	97	71	97	97	96
Zn/Ca Log10	Pearson Correlation				-.133	-.041	.036	.033	.279**	.493**
	Sig. (2-tailed)				.279	.687	.765	.747	.005	.000
	N				68	99	70	99	99	98
U/Ca Log10	Pearson Correlation					.160	-.053	.197	-.212	-.077
	Sig. (2-tailed)					.174	.705	.093	.070	.520
	N					74	54	74	74	73
Li/Ca	Pearson Correlation						-.112	.283**	.109	.181
	Sig. (2-tailed)						.333	.003	.268	.064
	N						77	106	106	105
B/Ca	Pearson Correlation							-.141	.366**	.066
	Sig. (2-tailed)							.221	.001	.571
	N							77	77	76
Mg/Ca	Pearson Correlation								-.296**	-.010
	Sig. (2-tailed)								.002	.922
	N								106	105
Sr88/Ca	Pearson Correlation									.707**
	Sig. (2-tailed)									.000
	N									105
Ba/Ca	Pearson Correlation									
	Sig. (2-tailed)									
	N									

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix 3.1b. Pearsons correlation between element/Ca ratios in the prismatic layer of RW75 transect (400) and transect (100). ** Correlation is significant at the 0.01 level and * correlation is significant at the 0.05 level.

P1B Correlations Prismatic Layer		Li/Ca Log10	B/Ca Log10	Mg/Ca Log10	Al/Ca Log10	Mn/Ca Log10	Zn/Ca Log10	Ba/Ca Log10	Pb/Ca Log10	U/Ca Log10	Sr88/Ca
Li/Ca Log10	Pearson Correlation		.077	-.014	.193	.059	.043	.044	.083	.376**	.080
	Sig. (2-tailed)		.544	.894	.163	.605	.734	.695	.469	.005	.474
	N		65	89	54	78	64	83	79	55	83
B/Ca Log10	Pearson Correlation			.341**	.202	.257*	.249*	.358**	.102	.476**	.312**
	Sig. (2-tailed)			.001	.154	.023	.039	.001	.366	.000	.004
	N			89	51	78	69	82	81	54	82
Mg/Ca Log10	Pearson Correlation				.531**	.258**	.046	.637**	.131	.285*	.455**
	Sig. (2-tailed)				.000	.009	.670	.000	.184	.018	.000
	N				67	102	88	109	105	69	109
Al/Ca Log10	Pearson Correlation					.218	.071	.756**	.210	.489**	.270*
	Sig. (2-tailed)					.092	.626	.000	.111	.001	.032
	N					61	50	63	59	43	63
Mn/Ca Log10	Pearson Correlation						.103	.385**	.339**	.445**	.189
	Sig. (2-tailed)						.367	.000	.001	.000	.066
	N						79	96	93	62	96
Zn/Ca Log10	Pearson Correlation							.102	.244*	.318*	.008
	Sig. (2-tailed)							.363	.026	.024	.944
	N							81	83	50	81
Ba/Ca Log10	Pearson Correlation								.165	.549**	.532**
	Sig. (2-tailed)								.103	.000	.000
	N								99	62	109
Pb/Ca Log10	Pearson Correlation									.382**	-.107
	Sig. (2-tailed)									.002	.291
	N									64	99
U/Ca Log10	Pearson Correlation										.475**
	Sig. (2-tailed)										.000
	N										62
Sr88/Ca	Pearson Correlation										
	Sig. (2-tailed)										
	N										

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

P04A Correlations Prismatic Layer		B/Ca Log10	Mg/Ca Log10	Al/Ca Log10	Mn/Ca Log10	Zn/Ca Log10	Ba/Ca Log10	Pb/Ca Log10	U/Ca Log10	Li/Ca	Sr88/Ca
B/Ca Log10	Pearson Correlation		.400**	.533**	.416**	-.012	.596**	.209	.293	.428**	.501**
	Sig. (2-tailed)		.001	.000	.002	.932	.000	.141	.057	.000	.000
	N		70	54	52	56	67	51	43	70	70
Mg/Ca Log10	Pearson Correlation			.583**	.272*	-.164	.524**	.091	.262	.532**	.250*
	Sig. (2-tailed)			.000	.027	.154	.000	.458	.051	.000	.014
	N			70	66	77	93	68	56	95	96
Al/Ca Log10	Pearson Correlation				.522**	.223	.853**	.285*	.399**	.621**	.535**
	Sig. (2-tailed)				.000	.102	.000	.041	.007	.000	.000
	N				53	55	69	52	44	70	70
Mn/Ca Log10	Pearson Correlation					.087	.539**	.256	.513**	.464**	.383**
	Sig. (2-tailed)					.546	.000	.082	.001	.000	.001
	N					50	64	47	42	66	66
Zn/Ca Log10	Pearson Correlation						.143	.182	-.121	-.032	.068
	Sig. (2-tailed)						.221	.176	.433	.779	.560
	N						75	57	44	77	77
Ba/Ca Log10	Pearson Correlation							.225	.414**	.618**	.717**
	Sig. (2-tailed)							.070	.002	.000	.000
	N							66	54	92	93
Pb/Ca Log10	Pearson Correlation								.011	.147	.114
	Sig. (2-tailed)								.948	.232	.353
	N								37	68	68
U/Ca Log10	Pearson Correlation									.381**	.337*
	Sig. (2-tailed)									.004	.011
	N									55	56
Li/Ca	Pearson Correlation										.327**
	Sig. (2-tailed)										.001
	N										95
Sr88/Ca	Pearson Correlation										
	Sig. (2-tailed)										
	N										

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix 3.1c. Pearsons correlation between element/Ca ratios in the prismatic layer of samples P1B and P04A from Pourerere. ** Correlation is significant at the 0.01 level and * correlation is significant at the 0.05 level.

SC2 Correlations Prismatic Layer		B/Ca Log10	Mg/Ca Log10	Al/Ca Log10	Mn/Ca Log10	Zn/Ca Log10	Pb/Ca Log10	Li/Ca	Sr88/Ca	Ba/Ca	U/Ca
B/Ca Log10	Pearson Correlation		-.092	.164	-.118	-.185	-.155	-.100	-.228*	-.238*	.249
	Sig. (2-tailed)		.433	.324	.354	.193	.388	.391	.049	.040	.149
	N		75	38	64	51	33	75	75	75	35
Mg/Ca Log10	Pearson Correlation			.172	.275**	.046	.034	.469**	.339**	.545**	.196
	Sig. (2-tailed)			.184	.006	.691	.811	.000	.000	.000	.140
	N			61	97	77	52	116	116	116	58
Al/Ca Log10	Pearson Correlation				.072	.238	.100	.037	.175	.217	-.203
	Sig. (2-tailed)				.609	.119	.598	.775	.177	.092	.283
	N				53	44	30	61	61	61	30
Mn/Ca Log10	Pearson Correlation					-.016	.050	.063	-.008	.117	.045
	Sig. (2-tailed)					.897	.757	.538	.937	.255	.756
	N					65	41	97	97	97	50
Zn/Ca Log10	Pearson Correlation						-.002	.260*	.087	.131	-.158
	Sig. (2-tailed)						.993	.022	.453	.256	.332
	N						36	77	77	77	40
Pb/Ca Log10	Pearson Correlation							-.079	-.054	-.051	-.078
	Sig. (2-tailed)							.577	.706	.720	.719
	N							52	52	52	24
Li/Ca	Pearson Correlation								.387**	.523**	.294*
	Sig. (2-tailed)								.000	.000	.025
	N								116	116	58
Sr88/Ca	Pearson Correlation									.797**	-.125
	Sig. (2-tailed)									.000	.350
	N									116	58
Ba/Ca	Pearson Correlation										-.019
	Sig. (2-tailed)										.888
	N										58
U/Ca	Pearson Correlation										
	Sig. (2-tailed)										
	N										

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

SC1A Correlations Prismatic Layer		Li/Ca	Mg/Ca	Zn/Ca	Sr86/Ca	Sr88/Ca	Ba/Ca	Pb/Ca	B/Ca Log10	Al/Ca Log10	Mn/Ca Log10	U/Ca Log10
Li/Ca	Pearson Correlation		-.172	-.393*	.056	.047	-.006	.055	.116	.265	.062	.286
	Sig. (2-tailed)		.243	.021	.706	.756	.971	.717	.550	.201	.729	.139
	N		48	34	48	47	47	46	29	25	34	28
Mg/Ca	Pearson Correlation			.177	.536**	.525**	.164	.033	-.258	.308*	.171	-.143
	Sig. (2-tailed)			.149	.000	.000	.113	.765	.055	.042	.160	.293
	N			68	97	97	95	86	56	44	69	56
Zn/Ca	Pearson Correlation				.123	.137	.181	.093	.110	.101	-.033	-.313
	Sig. (2-tailed)				.316	.267	.136	.471	.498	.596	.826	.055
	N				69	68	69	62	40	30	47	38
Sr86/Ca	Pearson Correlation					.957**	.267**	-.030	-.109	.194	-.094	-.103
	Sig. (2-tailed)					.000	.008	.785	.425	.206	.441	.456
	N					97	96	86	56	44	69	55
Sr88/Ca	Pearson Correlation						.236*	.035	-.069	.195	-.131	-.051
	Sig. (2-tailed)						.021	.752	.615	.206	.287	.712
	N						95	85	55	44	68	55
Ba/Ca	Pearson Correlation							-.164	-.369**	.281	.225	-.358**
	Sig. (2-tailed)							.136	.006	.068	.067	.009
	N							84	55	43	67	53
Pb/Ca	Pearson Correlation								.142	-.016	-.094	-.170
	Sig. (2-tailed)								.342	.923	.462	.242
	N								47	39	63	49
B/Ca Log10	Pearson Correlation									-.191	-.005	.130
	Sig. (2-tailed)									.330	.974	.471
	N									28	42	33
Al/Ca Log10	Pearson Correlation										.171	.004
	Sig. (2-tailed)										.341	.986
	N										33	23
Mn/Ca Log10	Pearson Correlation											-.092
	Sig. (2-tailed)											.571
	N											40
U/Ca Log10	Pearson Correlation											
	Sig. (2-tailed)											
	N											

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix 3.1d .Pearsons correlation between element/Ca ratios in the prismatic layer of samples SC2 and SC1A from the South Coast of Wellington. ** Correlation is significant at the 0.01 level and * correlation is significant at the 0.05 level.

MP02A Correlations Prismatic Layer		Li/Ca Log10	B/Ca Log10	Mg/Ca Log10	Al/Ca Log10	Mn/Ca Log10	Zn/Ca Log10	Ba/Ca Log10	Pb/Ca Log10	U/Ca Log10	Sr86/Ca	Sr88/Ca
Li/Ca Log10	Pearson Correlation		.344**	.212	.274*	-.076	.083	.124	-.089	.552**	.177	.186
	Sig. (2-tailed)		.010	.054	.041	.533	.531	.270	.496	.000	.109	.092
	N		56	83	56	70	59	81	61	47	83	83
B/Ca Log10	Pearson Correlation			.351**	.468**	.112	.428**	.383**	.219	.432**	.291*	.277*
	Sig. (2-tailed)			.002	.001	.375	.002	.001	.105	.003	.010	.015
	N			77	51	65	50	74	56	45	77	77
Mg/Ca Log10	Pearson Correlation				.490**	.003	.214	.488**	.036	.296*	.320**	.350**
	Sig. (2-tailed)				.000	.977	.059	.000	.752	.018	.000	.000
	N				72	96	79	112	80	63	116	116
Al/Ca Log10	Pearson Correlation					-.142	.171	.668**	.144	.531**	.330**	.322**
	Sig. (2-tailed)					.288	.229	.000	.302	.000	.005	.006
	N					58	51	72	53	45	72	72
Mn/Ca Log10	Pearson Correlation						.195	.251*	.437**	.018	.203*	.190
	Sig. (2-tailed)						.108	.016	.000	.900	.047	.064
	N						69	92	67	51	96	96
Zn/Ca Log10	Pearson Correlation							.117	.457**	.282	.037	.008
	Sig. (2-tailed)							.315	.000	.058	.747	.943
	N							76	57	46	79	79
Ba/Ca Log10	Pearson Correlation								.143	.333**	.611**	.627**
	Sig. (2-tailed)								.215	.008	.000	.000
	N								77	62	112	112
Pb/Ca Log10	Pearson Correlation									.012	.092	.056
	Sig. (2-tailed)									.935	.419	.624
	N									49	80	80
U/Ca Log10	Pearson Correlation										.520**	.463**
	Sig. (2-tailed)										.000	.000
	N										63	63
Sr86/Ca	Pearson Correlation											.960**
	Sig. (2-tailed)											.000
	N											116
Sr88/Ca	Pearson Correlation											
	Sig. (2-tailed)											
	N											

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

KD1B Correlations Prismatic Layer		Li/Ca Log10	B/Ca Log10	Al/Ca Log10	Mn/Ca Log10	Ba/Ca Log10	Pb/Ca Log10	U/Ca Log10	Mg/Ca	Zn/Ca	Sr86/Ca	Sr88/Ca
Li/Ca Log10	Pearson Correlation		.164	.168	.126	.159*	.053	-.057	.119	.029	.065	.117
	Sig. (2-tailed)		.093	.084	.165	.047	.606	.603	.137	.750	.420	.144
	N		106	107	123	158	98	85	157	120	158	158
B/Ca Log10	Pearson Correlation			.449**	.166	.323**	.224*	.313**	.210*	.220*	.148	.172*
	Sig. (2-tailed)			.000	.089	.000	.038	.009	.015	.021	.087	.046
	N			89	106	135	86	69	133	110	134	134
Al/Ca Log10	Pearson Correlation				.429**	.755**	.419**	.140	.511**	.450**	.225*	.294**
	Sig. (2-tailed)				.000	.000	.000	.245	.000	.000	.011	.001
	N				102	126	80	71	124	94	125	125
Mn/Ca Log10	Pearson Correlation					.369**	.286**	.226*	.207*	.136	.102	.129
	Sig. (2-tailed)					.000	.005	.038	.011	.141	.209	.113
	N					153	95	84	151	118	152	152
Ba/Ca Log10	Pearson Correlation						.322**	.206*	.482**	.367**	.428**	.417**
	Sig. (2-tailed)						.000	.037	.000	.000	.000	.000
	N						117	103	196	153	197	197
Pb/Ca Log10	Pearson Correlation							.141	.257**	.303**	.168	.124
	Sig. (2-tailed)							.274	.006	.004	.071	.186
	N							62	115	91	116	116
U/Ca Log10	Pearson Correlation								.167	-.135	.321**	.292**
	Sig. (2-tailed)								.094	.246	.001	.003
	N								101	76	102	102
Mg/Ca	Pearson Correlation									.315**	.232**	.226**
	Sig. (2-tailed)									.000	.001	.001
	N									151	197	197
Zn/Ca	Pearson Correlation										.203*	.273**
	Sig. (2-tailed)										.012	.001
	N										152	152
Sr86/Ca	Pearson Correlation											.977**
	Sig. (2-tailed)											.000
	N											197
Sr88/Ca	Pearson Correlation											
	Sig. (2-tailed)											
	N											

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix 3.1e. Pearsons correlation between element/Ca ratios in the prismatic layer of samples MP02A from Moa Point and KD1B from Kaikoura. ** Correlation is significant at the 0.01 level and * correlation is significant at the 0.05 level.

K3A Correlations Prismatic Layer		Li/Ca	Mg/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	Pb/Ca	B/Ca	Al/Ca Log10	U/Ca Log10
Li/Ca	Pearson Correlation		.244*	.221	-.028	.251*	.271*	.103	.171	.243	.229
	Sig. (2-tailed)		.028	.050	.807	.025	.015	.383	.180	.080	.110
	N		81	79	78	80	80	74	63	53	50
Mg/Ca	Pearson Correlation			.229*	-.027	.205*	.329**	-.067	.298*	.287*	.196
	Sig. (2-tailed)			.028	.799	.046	.001	.538	.013	.024	.152
	N			92	92	95	95	88	69	62	55
Mn/Ca	Pearson Correlation				.112	.094	.317**	.194	.275*	.254*	.116
	Sig. (2-tailed)				.297	.378	.002	.077	.023	.050	.410
	N				89	91	91	84	68	60	53
Zn/Ca	Pearson Correlation					-.006	.207*	.200	.053	.125	.067
	Sig. (2-tailed)					.954	.049	.069	.668	.341	.636
	N					91	91	84	68	60	53
Sr88/Ca	Pearson Correlation						.780**	.116	.494**	.407**	.701**
	Sig. (2-tailed)						.000	.285	.000	.001	.000
	N						95	87	68	61	54
Ba/Ca	Pearson Correlation							.133	.348**	.662**	.670**
	Sig. (2-tailed)							.219	.004	.000	.000
	N							87	68	61	54
Pb/Ca	Pearson Correlation								-.011	.048	.130
	Sig. (2-tailed)								.932	.722	.354
	N								62	58	53
B/Ca	Pearson Correlation									.341*	.513**
	Sig. (2-tailed)									.018	.001
	N									48	42
Al/Ca Log10	Pearson Correlation										.526**
	Sig. (2-tailed)										.001
	N										38
U/Ca Log10	Pearson Correlation										
	Sig. (2-tailed)										
	N										

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

K1A1 Correlations Prismatic Layer		Li/Ca	B/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	Pb/Ca	Mg/Ca Log10	Al/Ca Log10	Mn/Ca Log10	U/Ca Log10
Li/Ca	Pearson Correlation		.080	-.088	.058	.006	.136	-.105	.125	.079	.105
	Sig. (2-tailed)		.565	.461	.610	.955	.237	.355	.519	.508	.497
	N		54	73	79	79	78	79	29	73	44
B/Ca	Pearson Correlation			.065	.086	.262*	-.002	.188	.191	.125	.121
	Sig. (2-tailed)			.593	.459	.022	.989	.105	.321	.310	.445
	N			70	76	76	75	76	29	68	42
Zn/Ca	Pearson Correlation				.116	.158	.047	.040	.227	.352**	.172
	Sig. (2-tailed)				.237	.108	.635	.689	.183	.000	.219
	N				105	105	104	105	36	96	53
Sr88/Ca	Pearson Correlation					.586**	-.039	.262**	.396*	.014	.022
	Sig. (2-tailed)					.000	.681	.005	.013	.886	.871
	N					112	111	112	39	103	58
Ba/Ca	Pearson Correlation						-.194*	.539**	.451**	.160	.227
	Sig. (2-tailed)						.042	.000	.004	.107	.086
	N						111	112	39	103	58
Pb/Ca	Pearson Correlation							-.041	-.119	.074	-.033
	Sig. (2-tailed)							.668	.479	.460	.806
	N							111	38	102	57
Mg/Ca Log10	Pearson Correlation								.309	.101	.127
	Sig. (2-tailed)								.055	.308	.344
	N								39	103	58
Al/Ca Log10	Pearson Correlation									.174	.249
	Sig. (2-tailed)									.311	.252
	N									36	23
Mn/Ca Log10	Pearson Correlation										.122
	Sig. (2-tailed)										.386
	N										53
U/Ca Log10	Pearson Correlation										
	Sig. (2-tailed)										
	N										

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix 3.1f. Pearsons correlation between element/Ca ratios in the prismatic layer of samples K3A and K1A1 from Kaikoura. ** Correlation is significant at the 0.01 level and * correlation is significant at the 0.05 level.

AR1 Correlations Prismatic Layer		B/Ca Log10	Mg/Ca Log10	Al/Ca Log10	U/Ca Log10	Li/Ca	Mn/Ca	Zn/Ca	Sr86/Ca	Sr88/Ca	Ba/Ca	Pb/Ca
B/Ca Log10	Pearson Correlation		.078	.234	.065	.105	.024	-.033	-.040	-.099	.045	-.251
	Sig. (2-tailed)		.527	.109	.709	.484	.869	.798	.744	.424	.716	.101
	N		68	48	35	47	48	62	68	68	68	44
Mg/Ca Log10	Pearson Correlation			.128	.124	.182	.189	.014	.213*	.177	.214*	.043
	Sig. (2-tailed)			.312	.441	.151	.128	.896	.044	.096	.043	.738
	N			64	41	64	66	84	90	90	90	64
Al/Ca Log10	Pearson Correlation				-.342	-.183	.295*	-.067	-.083	-.100	.117	-.057
	Sig. (2-tailed)				.065	.240	.047	.607	.517	.432	.358	.715
	N				30	43	46	61	64	64	64	44
U/Ca Log10	Pearson Correlation					-.043	-.037	.196	-.102	-.077	-.267	.212
	Sig. (2-tailed)					.820	.851	.244	.524	.633	.092	.269
	N					31	29	37	41	41	41	29
Li/Ca	Pearson Correlation						-.082	.072	-.193	-.206	-.141	-.005
	Sig. (2-tailed)						.575	.581	.126	.102	.266	.971
	N						49	61	64	64	64	48
Mn/Ca	Pearson Correlation							-.099	.260*	.273*	.134	-.135
	Sig. (2-tailed)							.445	.035	.027	.283	.371
	N							62	66	66	66	46
Zn/Ca	Pearson Correlation								-.106	-.119	.140	.125
	Sig. (2-tailed)								.338	.282	.205	.336
	N								84	84	84	61
Sr86/Ca	Pearson Correlation									.986**	.475**	-.211
	Sig. (2-tailed)									.000	.000	.095
	N									90	90	64
Sr88/Ca	Pearson Correlation										.480**	-.199
	Sig. (2-tailed)										.000	.116
	N										90	64
Ba/Ca	Pearson Correlation											.065
	Sig. (2-tailed)											.609
	N											64
Pb/Ca	Pearson Correlation											
	Sig. (2-tailed)											
	N											

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

MR2 Correlations Prismatic Layer		Li/Ca Log10	B/Ca Log10	Al/Ca Log10	Zn/Ca Log10	Sr86/Ca Log10	Sr88/Ca Log10	Ba/Ca Log10	Pb/Ca Log10	U/Ca Log10	Mg/Ca	Mn/Ca
Li/Ca Log10	Pearson Correlation		-.043	.089	-.090	-.064	-.049	.037	-.019	-.295	.252	.222
	Sig. (2-tailed)		.808	.640	.591	.662	.740	.801	.919	.120	.087	.180
	N		34	30	38	49	49	49	30	29	47	38
B/Ca Log10	Pearson Correlation			.376*	.313	.124	.141	.083	-.030	.045	.037	.070
	Sig. (2-tailed)			.040	.076	.433	.372	.601	.885	.828	.819	.691
	N			30	33	42	42	42	26	26	40	35
Al/Ca Log10	Pearson Correlation				.128	-.141	-.129	.017	-.076	-.070	-.046	.279
	Sig. (2-tailed)				.492	.399	.440	.917	.724	.746	.788	.122
	N				31	38	38	38	24	24	37	32
Zn/Ca Log10	Pearson Correlation					-.329*	-.323*	-.204	-.055	-.280	.231	.142
	Sig. (2-tailed)					.022	.025	.164	.785	.142	.122	.401
	N					48	48	48	27	29	46	37
Sr86/Ca Log10	Pearson Correlation						.997**	.643**	.132	.475**	-.068	-.096
	Sig. (2-tailed)						.000	.000	.428	.003	.611	.523
	N						61	61	38	36	59	47
Sr88/Ca Log10	Pearson Correlation							.650**	.130	.468**	-.070	-.101
	Sig. (2-tailed)							.000	.438	.004	.596	.499
	N							61	38	36	59	47
Ba/Ca Log10	Pearson Correlation								.259	.339*	.162	.274
	Sig. (2-tailed)								.117	.043	.221	.062
	N								38	36	59	47
Pb/Ca Log10	Pearson Correlation									.408	.219	.171
	Sig. (2-tailed)									.054	.192	.342
	N									23	37	33
U/Ca Log10	Pearson Correlation										-.499**	-.357
	Sig. (2-tailed)										.002	.062
	N										35	28
Mg/Ca	Pearson Correlation											.199
	Sig. (2-tailed)											.184
	N											46
Mn/Ca	Pearson Correlation											
	Sig. (2-tailed)											
	N											

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix 3.1g. Pearsons correlation between element/Ca ratios in the prismatic layer of samplesAR1 and MR2 from Chatham Island. ** Correlation is significant at the 0.01 level and * correlation is significant at the 0.05 level.

MD1 Correlations Prismatic Layer		Li/Ca Log10	B/Ca Log10	Mg/Ca Log10	Al/Ca Log10	Mn/Ca Log10	Zn/Ca Log10	U/Ca Log10	Sr86/Ca	Sr88/Ca	Ba/Ca	Pb/Ca
Li/Ca Log10	Pearson Correlation		.185	-.027	-.242	.341**	.105	.382*	.071	-.141	-.097	.282
	Sig. (2-tailed)		.189	.819	.132	.008	.474	.010	.550	.241	.430	.060
	N		52	73	40	60	49	44	73	71	69	45
B/Ca Log10	Pearson Correlation			-.118	.133	.169	.076	.141	.173	-.030	-.089	.335*
	Sig. (2-tailed)			.328	.376	.202	.604	.411	.148	.806	.474	.028
	N			71	46	59	49	36	71	69	67	43
Mg/Ca Log10	Pearson Correlation				.247	.045	-.038	.102	.071	.518**	.423**	-.036
	Sig. (2-tailed)				.057	.693	.757	.465	.491	.000	.000	.789
	N				60	78	68	54	97	95	93	58
Al/Ca Log10	Pearson Correlation					-.002	-.105	.064	.076	.364**	.509**	-.155
	Sig. (2-tailed)					.987	.507	.742	.566	.005	.000	.366
	N					46	42	29	60	59	58	36
Mn/Ca Log10	Pearson Correlation						.166	.386**	.115	.101	-.084	.245
	Sig. (2-tailed)						.231	.007	.316	.386	.474	.105
	N						54	48	78	76	74	45
Zn/Ca Log10	Pearson Correlation							-.115	.040	.074	.020	-.045
	Sig. (2-tailed)							.505	.743	.550	.871	.775
	N							36	68	67	66	43
U/Ca Log10	Pearson Correlation								.533**	.382**	.158	.118
	Sig. (2-tailed)								.000	.005	.273	.519
	N								54	52	50	32
Sr86/Ca	Pearson Correlation									.983**	.419**	-.020
	Sig. (2-tailed)									.000	.000	.881
	N									95	93	58
Sr88/Ca	Pearson Correlation										.457**	-.107
	Sig. (2-tailed)										.000	.426
	N										93	57
Ba/Ca	Pearson Correlation											-.127
	Sig. (2-tailed)											.352
	N											56
Pb/Ca	Pearson Correlation											
	Sig. (2-tailed)											
	N											

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

MD3 Correlations Prismatic Layer		B/Ca Log10	Mg/Ca Log10	Al/Ca Log10	Mn/Ca Log10	Pb/Ca Log10	U/Ca Log10	Li/Ca	Zn/Ca	Sr86/Ca	Sr88/Ca	Ba/Ca
B/Ca Log10	Pearson Correlation		.311*	.387*	.119	.150	.114	.318*	.054	.500**	.444**	.460**
	Sig. (2-tailed)		.017	.015	.405	.360	.579	.030	.692	.000	.000	.000
	N		59	39	51	39	26	47	56	59	58	58
Mg/Ca Log10	Pearson Correlation			.427**	.128	.128	.283	.144	.089	.330**	.232*	.452**
	Sig. (2-tailed)			.001	.255	.339	.073	.241	.417	.002	.030	.000
	N			59	81	58	41	68	86	89	88	87
Al/Ca Log10	Pearson Correlation				.256	.131	.182	.219	.178	.488**	.422**	.611**
	Sig. (2-tailed)				.064	.402	.319	.135	.190	.000	.001	.000
	N				53	43	32	48	56	59	58	58
Mn/Ca Log10	Pearson Correlation					-.112	.133	.024	-.001	.226*	.185	.213
	Sig. (2-tailed)					.423	.426	.850	.993	.042	.101	.060
	N					53	38	63	78	81	80	79
Pb/Ca Log10	Pearson Correlation						.223	-.009	.231	.204	.112	.108
	Sig. (2-tailed)						.245	.954	.086	.124	.405	.423
	N						29	44	56	58	57	57
U/Ca Log10	Pearson Correlation							-.132	.117	.451**	.469**	.413**
	Sig. (2-tailed)							.471	.485	.003	.002	.007
	N							32	38	41	41	41
Li/Ca	Pearson Correlation								.165	.225	.062	.203
	Sig. (2-tailed)								.187	.065	.618	.100
	N								66	68	67	67
Zn/Ca	Pearson Correlation									-.009	-.021	.172
	Sig. (2-tailed)									.937	.852	.118
	N									86	85	84
Sr86/Ca	Pearson Correlation										.996**	.764**
	Sig. (2-tailed)										.000	.000
	N										88	87
Sr88/Ca	Pearson Correlation											.763**
	Sig. (2-tailed)											.000
	N											87
Ba/Ca	Pearson Correlation											
	Sig. (2-tailed)											
	N											

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix 3.1h. Pearsons correlation between element/Ca ratios in the prismatic layer of samples MD1 and MD3 from Moeraki. ** Correlation is significant at the 0.01 level and * correlation is significant at the 0.05 level.

APPENDIX 3.2 Nacreous layer correlations matrices

A740 (1) Correlations Nacreous Layer		Mg/Ca	Sr88/Ca	Ba/Ca	Al/Ca Log10	Mn/Ca Log10	Zn/Ca Log10
Mg/Ca	Pearson Correlation		.520**	-.158	.056	.255	.062
	Sig. (2-tailed)		.000	.160	.746	.051	.638
	N		81	81	36	59	61
Sr88/Ca	Pearson Correlation			.195	.054	.050	-.157
	Sig. (2-tailed)			.078	.747	.704	.222
	N			83	38	60	62
Ba/Ca	Pearson Correlation				.293	.093	.535**
	Sig. (2-tailed)				.074	.478	.000
	N				38	60	62
Al/Ca Log10	Pearson Correlation					.597**	.507**
	Sig. (2-tailed)					.002	.010
	N					24	25
Mn/Ca Log10	Pearson Correlation						.288*
	Sig. (2-tailed)						.047
	N						48
Zn/Ca Log10	Pearson Correlation						
	Sig. (2-tailed)						
	N						

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

A740 (2) Correlations Nacreous Layer		Al/Ca Log10	Ba/Ca	Li/Ca	B/Ca	Mg/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	U/Ca
Al/Ca Log10	Pearson Correlation		-.527	-.013	.040	-.139	.080	.474	-.399	-.043	-.159
	Sig. (2-tailed)		.096	.971	.907	.683	.826	.141	.224	.900	.706
	N		11	10	11	11	10	11	11	11	8
Ba/Ca	Pearson Correlation			.451	-.076	-.333	-.007	.066	.440	.303	.037
	Sig. (2-tailed)			.079	.772	.191	.978	.803	.077	.237	.904
	N			16	17	17	16	17	17	17	13
Li/Ca	Pearson Correlation				-.272	-.137	-.028	-.193	-.257	-.129	.056
	Sig. (2-tailed)				.308	.613	.922	.475	.337	.634	.862
	N				16	16	15	16	16	16	12
B/Ca	Pearson Correlation					.312	-.232	.213	.439	-.093	-.351
	Sig. (2-tailed)					.222	.386	.411	.078	.723	.240
	N					17	16	17	17	17	13
Mg/Ca	Pearson Correlation						-.575*	-.443	-.059	-.822**	-.213
	Sig. (2-tailed)						.020	.075	.822	.000	.486
	N						16	17	17	17	13
Mn/Ca	Pearson Correlation							.226	-.154	.628**	-.344
	Sig. (2-tailed)							.401	.570	.009	.250
	N							16	16	16	13
Zn/Ca	Pearson Correlation								-.073	.357	-.011
	Sig. (2-tailed)								.780	.159	.972
	N								17	17	13
Sr88/Ca	Pearson Correlation									.420	-.352
	Sig. (2-tailed)									.094	.238
	N									17	13
Ba/Ca	Pearson Correlation										-.245
	Sig. (2-tailed)										.421
	N										13
U/Ca	Pearson Correlation										
	Sig. (2-tailed)										
	N										

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Appendix 3.2a. Pearsons correlation between element/Ca ratios in the nacreous layer of samples A740 (1 &2) from OBL. ** Correlation is significant at the 0.01 level and * correlation is significant at the 0.05 level.

RW75 (100) Correlations Nacreous Layer		Al/Ca Log10	Mn/Ca Log10	Pb/Ca Log10	Li/Ca	B/Ca	Mg/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	U/Ca
Al/Ca Log10	Pearson Correlation		.076	.061	.725*	.063	-.010	-.161	.034	.031	.585
	Sig. (2-tailed)		.787	.823	.027	.810	.968	.524	.895	.903	.168
	N		15	16	9	17	17	18	18	18	7
Mn/Ca Log10	Pearson Correlation			-.387	.183	-.259	-.011	-.132	.301	.018	-.035
	Sig. (2-tailed)			.068	.481	.222	.960	.530	.144	.931	.914
	N			23	17	24	24	25	25	25	12
Pb/Ca Log10	Pearson Correlation				-.323	.230	.191	.062	-.267	.068	-.448
	Sig. (2-tailed)				.222	.258	.351	.759	.178	.736	.167
	N				16	26	26	27	27	27	11
Li/Ca	Pearson Correlation					-.536*	-.033	-.046	-.230	.021	-.052
	Sig. (2-tailed)					.027	.898	.857	.358	.934	.886
	N					17	18	18	18	18	10
B/Ca	Pearson Correlation						.289	.444*	.382*	.406*	.241
	Sig. (2-tailed)						.144	.018	.045	.032	.427
	N						27	28	28	28	13
Mg/Ca	Pearson Correlation							.137	.276	.814**	.131
	Sig. (2-tailed)							.485	.155	.000	.684
	N							28	28	28	12
Zn/Ca	Pearson Correlation								.180	.416*	-.147
	Sig. (2-tailed)								.349	.025	.631
	N								29	29	13
Sr88/Ca	Pearson Correlation									.291	.391
	Sig. (2-tailed)									.125	.187
	N									29	13
Ba/Ca	Pearson Correlation										.109
	Sig. (2-tailed)										.722
	N										13
U/Ca	Pearson Correlation										
	Sig. (2-tailed)										
	N										

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

RW75 (400) Correlations Nacreous Layer		Al/Ca Log10	Mg/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca
Al/Ca Log10	Pearson Correlation		.266	-.084	.238	.264	.168
	Sig. (2-tailed)		.148	.655	.190	.144	.357
	N		31	31	32	32	32
Mg/Ca	Pearson Correlation			.303*	.334*	.480**	.414**
	Sig. (2-tailed)			.046	.023	.001	.004
	N			44	46	46	46
Mn/Ca	Pearson Correlation				.106	-.010	.095
	Sig. (2-tailed)				.489	.950	.536
	N				45	45	45
Zn/Ca	Pearson Correlation					.450**	.349*
	Sig. (2-tailed)					.002	.016
	N					47	47
Sr88/Ca	Pearson Correlation						.591**
	Sig. (2-tailed)						.000
	N						47
Ba/Ca	Pearson Correlation						
	Sig. (2-tailed)						
	N						

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix 3.2b. Pearsons correlation between element/Ca ratios in the nacreous layer of samples RW75 (1 &2) from OBL. ** Correlation is significant at the 0.01 level and * correlation is significant at the 0.05 level.

P1B Correlations Nacreous Layer		B/Ca Log10	Al/Ca Log10	Mn/Ca Log10	Zn/Ca Log10	Pb/Ca Log10	U/Ca Log10	Li/Ca	Mg/Ca	Sr88/Ca	Ba/Ca
B/Ca Log10	Pearson Correlation		-.046	.003	-.073	.000	-.230	-.209	.265*	.254*	.092
	Sig. (2-tailed)		.748	.980	.575	.998	.143	.106	.011	.014	.383
	N		52	57	61	87	42	61	92	93	93
Al.Ca Log10	Pearson Correlation			.228	.086	.229	.354	.203	.035	-.103	-.120
	Sig. (2-tailed)			.181	.613	.106	.082	.249	.805	.453	.385
	N			36	37	51	25	34	52	55	55
Mn/Ca Log10	Pearson Correlation				-.113	.032	.432*	.218	-.044	.120	.348**
	Sig. (2-tailed)				.507	.814	.024	.181	.740	.361	.006
	N				37	57	27	39	58	60	60
Zn/Ca Log10	Pearson Correlation					.411**	.185	.236	.006	-.138	-.081
	Sig. (2-tailed)					.001	.347	.107	.962	.262	.510
	N					65	28	48	66	68	68
Pb/Ca Log10	Pearson Correlation						.188	.259*	.133	-.126	-.038
	Sig. (2-tailed)						.215	.046	.203	.220	.715
	N						45	60	93	96	96
U/Ca Log10	Pearson Correlation							-.077	-.178	-.128	-.097
	Sig. (2-tailed)							.690	.248	.397	.523
	N							29	44	46	46
Li/Ca	Pearson Correlation								.085	.097	.247*
	Sig. (2-tailed)								.509	.441	.047
	N								63	65	65
Mg/Ca	Pearson Correlation									.481**	.252*
	Sig. (2-tailed)									.000	.012
	N									99	99
Sr88/Ca	Pearson Correlation										.766**
	Sig. (2-tailed)										.000
	N										102
Ba/Ca	Pearson Correlation										
	Sig. (2-tailed)										
	N										

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

P04A Correlations Nacreous Layer		B/Ca Log10	Al/Ca Log10	Mn/Ca Log10	Zn/Ca Log10	Pb/Ca Log10	U/Ca Log10	Li/Ca	Mg/Ca	Sr88/Ca	Ba/Ca
B/Ca Log10	Pearson Correlation		-.173	-.010	-.045	.170	.105	.216	.133	.211	-.062
	Sig. (2-tailed)		.419	.963	.819	.417	.642	.220	.373	.150	.688
	N		24	25	28	25	22	34	47	48	45
Al/Ca Log10	Pearson Correlation			.012	-.094	.014	-.160	-.164	.153	-.065	-.124
	Sig. (2-tailed)			.963	.701	.963	.568	.491	.428	.738	.547
	N			16	19	14	15	20	29	29	26
Mn/Ca Log10	Pearson Correlation				.669**	.247	.018	.172	.143	-.017	.201
	Sig. (2-tailed)				.001	.322	.944	.410	.434	.925	.271
	N				20	18	17	25	32	33	32
Zn/Ca Log10	Pearson Correlation					.623**	.125	-.192	.327	.118	.112
	Sig. (2-tailed)					.004	.623	.309	.052	.493	.527
	N					19	18	30	36	36	34
Pb/Ca Log10	Pearson Correlation						.455	.185	.158	.100	.083
	Sig. (2-tailed)						.137	.434	.414	.605	.680
	N						12	20	29	29	27
U/Ca Log10	Pearson Correlation							.180	-.270	-.190	-.147
	Sig. (2-tailed)							.400	.164	.334	.482
	N							24	28	28	25
Li/Ca	Pearson Correlation								-.071	-.069	-.071
	Sig. (2-tailed)								.655	.662	.653
	N								42	43	42
Mg/Ca	Pearson Correlation									.759**	.284*
	Sig. (2-tailed)									.000	.037
	N									58	54
Sr88/Ca	Pearson Correlation										.537**
	Sig. (2-tailed)										.000
	N										55
Ba/Ca	Pearson Correlation										
	Sig. (2-tailed)										
	N										

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix 3.2c. Pearsons correlation between element/Ca ratios in the nacreous layer of samples P1B and P04A from Pourerere. ** Correlation is significant at the 0.01 level and * correlation is significant at the 0.05 level.

SC2 Correlations Nacreous Layer		U/Ca Log10	Zn/Ca Log10	Mn/Ca Log10	Al/Ca Log10	Li/Ca	B/Ca	Mg/Ca	Sr88/Ca	Ba/Ca	Pb/Ca
U/Ca Log10	Pearson Correlation		.045	-.329	.372	.168	-.344*	.134	.074	-.004	.077
	Sig. (2-tailed)		.793	.061	.106	.235	.019	.370	.623	.978	.696
	N		36	33	20	52	46	47	47	49	28
Zn/Ca Log10	Pearson Correlation			.314	.271	.165	-.148	-.193	-.095	-.046	.042
	Sig. (2-tailed)			.066	.190	.173	.252	.136	.461	.716	.808
	N			35	25	70	62	61	63	65	36
Mn/Ca Log10	Pearson Correlation				.045	.042	.026	.021	.090	.197	.097
	Sig. (2-tailed)				.827	.749	.849	.876	.504	.138	.591
	N				26	61	54	56	57	58	33
Al/Ca Log10	Pearson Correlation					.033	-.145	-.003	-.047	-.074	-.168
	Sig. (2-tailed)					.821	.347	.985	.764	.630	.402
	N					48	44	44	44	45	27
Li/Ca	Pearson Correlation						-.154	.178	.224*	.243*	.082
	Sig. (2-tailed)						.120	.069	.020	.011	.532
	N						103	105	108	110	61
B/Ca	Pearson Correlation							.118	.022	.109	.056
	Sig. (2-tailed)							.236	.823	.274	.689
	N							102	103	103	53
Mg/Ca	Pearson Correlation								.784**	.557**	.033
	Sig. (2-tailed)								.000	.000	.808
	N								105	105	55
Sr88/Ca	Pearson Correlation									.650**	.112
	Sig. (2-tailed)									.000	.408
	N									108	57
Ba/Ca	Pearson Correlation										.017
	Sig. (2-tailed)										.898
	N										58
Pb/Ca	Pearson Correlation										
	Sig. (2-tailed)										
	N										

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

SC1A Correlation Nacreous Layer		B/Ca Log10	Al/Ca Log10	Mn/Ca Log10	Li/Ca	Mg/Ca	Zn/Ca	Sr86/Ca	Sr88/Ca	Ba/Ca	Pb/Ca	U/Ca
B/Ca Log10	Pearson Correlation		-.197	.061	-.670**	.115	.011	.119	.079	.139	-.013	.319
	Sig. (2-tailed)		.611	.815	.003	.568	.969	.556	.696	.489	.954	.247
	N		9	17	17	27	15	27	27	27	21	15
Al/Ca Log10	Pearson Correlation			.091	.242	-.044	.341	.051	.098	.221	.284	.179
	Sig. (2-tailed)			.748	.449	.858	.254	.834	.689	.363	.305	.644
	N			15	12	19	13	19	19	19	15	9
Mn/Ca Log10	Pearson Correlation				.012	.087	-.280	-.047	.017	-.070	-.147	-.463*
	Sig. (2-tailed)				.963	.631	.196	.794	.926	.702	.482	.040
	N				17	33	23	33	33	32	25	20
Li/Ca	Pearson Correlation					-.028	-.135	-.169	-.113	-.098	.117	.512
	Sig. (2-tailed)					.891	.605	.400	.576	.634	.634	.074
	N					27	17	27	27	26	19	13
Mg/Ca	Pearson Correlation						-.046	.645**	.617**	.378**	.116	-.085
	Sig. (2-tailed)						.813	.000	.000	.009	.495	.673
	N						29	48	48	47	37	27
Zn/Ca	Pearson Correlation							.057	.127	.080	.253	-.107
	Sig. (2-tailed)							.771	.513	.681	.256	.653
	N							29	29	29	22	20
Sr86/Ca	Pearson Correlation								.967**	.486**	-.044	.108
	Sig. (2-tailed)								.000	.001	.796	.591
	N								48	47	37	27
Sr88/Ca	Pearson Correlation									.522**	-.028	.123
	Sig. (2-tailed)									.000	.871	.542
	N									47	37	27
Ba/Ca	Pearson Correlation										.128	-.101
	Sig. (2-tailed)										.449	.617
	N										37	27
Pb/Ca	Pearson Correlation											-.080
	Sig. (2-tailed)											.723
	N											22
U/Ca	Pearson Correlation											
	Sig. (2-tailed)											
	N											

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix 3.2d. Pearsons correlation between element/Ca ratios in the nacreous layer of samples SC2 and SC1A from the South Coast of Wellington. ** Correlation is significant at the 0.01 level and * correlation is significant at the 0.05 level.

MP02A Correlations Nacreous Layer		A/Ca Log10	Mn/Ca Log10	Zn/Ca Log10	Pb/Ca Log10	U/Ca Log10	Li/Ca	B/Ca	Mg/Ca	Sr86/Ca	Sr88/Ca	Ba/Ca
A/Ca Log10	Pearson Correlation		.174	.153	.292	-.361	.132	.194	.037	.115	.047	-.277
	Sig. (2-tailed)		.385	.486	.239	.099	.547	.258	.831	.491	.780	.092
	N		27	23	18	22	23	36	35	38	37	38
Mn/Ca Log10	Pearson Correlation			.137	.332	.332	.199	.003	.055	.288*	.009	.385**
	Sig. (2-tailed)			.455	.105	.078	.309	.983	.695	.031	.949	.004
	N			32	25	29	28	54	53	56	54	53
Zn/Ca Log10	Pearson Correlation				.068	.110	.127	.142	.070	.252	.124	.303*
	Sig. (2-tailed)				.763	.636	.527	.301	.615	.058	.362	.027
	N				22	21	27	55	54	57	56	53
Pb/Ca Log10	Pearson Correlation					.270	.047	.149	.081	.390*	.114	.354*
	Sig. (2-tailed)					.250	.834	.377	.636	.014	.502	.027
	N					20	22	37	37	39	37	39
U/Ca Log10	Pearson Correlation						.398	-.052	.312	.147	.290	.402*
	Sig. (2-tailed)						.091	.762	.068	.385	.086	.014
	N						19	36	35	37	36	37
Li/Ca	Pearson Correlation							-.173	.219	.257	.245	.311
	Sig. (2-tailed)							.287	.180	.105	.127	.050
	N							40	39	41	40	40
B/Ca	Pearson Correlation								.371**	.136	.141	-.049
	Sig. (2-tailed)								.001	.216	.198	.670
	N								84	85	85	79
Mg/Ca	Pearson Correlation									.536**	.582**	.429**
	Sig. (2-tailed)									.000	.000	.000
	N									84	84	78
Sr86/Ca	Pearson Correlation										.992**	.757**
	Sig. (2-tailed)										.000	.000
	N										86	82
Sr88/Ca	Pearson Correlation											.540**
	Sig. (2-tailed)											.000
	N											80
Ba/Ca	Pearson Correlation											
	Sig. (2-tailed)											
	N											

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

KD1B Correlations NacreousLayer		Li/Ca Log10	Al/Ca Log10	Mn/Ca Log10	Ba/Ca Log10	Pb/Ca Log10	U/Ca Log10	B/Ca	Mg/Ca	Zn/Ca	Sr86/Ca	Sr88/Ca
Li/Ca Log10	Pearson Correlation		-.146	-.154	.007	-.009	-.213	-.039	-.082	.064	-.180	-.190
	Sig. (2-tailed)		.496	.426	.964	.962	.297	.791	.572	.677	.207	.182
	N		24	29	51	29	26	50	50	45	51	51
Al/Ca Log10	Pearson Correlation			.242	.070	.170	.306	.060	.114	-.293	.150	.147
	Sig. (2-tailed)			.334	.698	.500	.267	.743	.533	.123	.403	.414
	N			18	33	18	15	32	32	29	33	33
Mn/Ca Log10	Pearson Correlation				.390*	.073	-.039	.323*	.352*	.086	.436**	.420**
	Sig. (2-tailed)				.011	.740	.864	.039	.024	.641	.004	.006
	N				42	23	22	41	41	32	42	42
Ba/Ca Log10	Pearson Correlation					.112	-.249	.055	.233	.100	.669**	.665**
	Sig. (2-tailed)					.486	.143	.648	.051	.455	.000	.000
	N					41	36	71	71	58	72	72
Pb/Ca Log10	Pearson Correlation						.601**	.125	.342*	.047	-.037	.033
	Sig. (2-tailed)						.008	.441	.031	.791	.817	.838
	N						18	40	40	34	41	41
U/Ca Log10	Pearson Correlation							.285	.266	.004	-.215	-.235
	Sig. (2-tailed)							.092	.117	.984	.209	.168
	N							36	36	29	36	36
B/Ca	Pearson Correlation								.241*	.031	.086	.135
	Sig. (2-tailed)								.043	.820	.476	.263
	N								71	57	71	71
Mg/Ca	Pearson Correlation									-.023	.414**	.442**
	Sig. (2-tailed)									.863	.000	.000
	N									57	71	71
Zn/Ca	Pearson Correlation										.003	-.010
	Sig. (2-tailed)										.982	.939
	N										58	58
Sr86/Ca	Pearson Correlation											.986**
	Sig. (2-tailed)											.000
	N											72
Sr88/Ca	Pearson Correlation											
	Sig. (2-tailed)											
	N											

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix 3.2e. Pearsons correlation between element/Ca ratios in the nacreous layer of samples MP02A from Moa Point and KD1B from Kaikoura. ** Correlation is significant at the 0.01 level and * correlation is significant at the 0.05 level.

K3A Correlation NacreousLayer		Li/Ca Log10	Al/Ca Log10	Mn/Ca Log10	Zn/Ca Log10	Pb/Ca Log10	U/Ca Log10	B/Ca	Mg/Ca	Sr88/Ca	Ba/Ca
Li/Ca Log10	Pearson Correlation		-.044	-.065	-.157	-.053	.115	.056	.095	-.013	-.117
	Sig. (2-tailed)		.776	.614	.193	.684	.492	.622	.416	.910	.303
	N		44	62	70	61	38	79	76	80	80
Al/Ca Log10	Pearson Correlation			-.084	.046	.010	.391*	.174	.129	.108	.123
	Sig. (2-tailed)			.612	.764	.950	.039	.236	.393	.454	.395
	N			39	45	40	28	48	46	50	50
Mn/Ca Log10	Pearson Correlation				.249*	.171	-.123	.008	-.108	.071	-.003
	Sig. (2-tailed)				.045	.205	.468	.949	.372	.545	.978
	N				65	57	37	73	70	75	75
Zn/Ca Log10	Pearson Correlation					.220	-.243	-.035	-.011	.192	.258*
	Sig. (2-tailed)					.065	.131	.744	.921	.071	.014
	N					71	40	87	84	89	90
Pb/Ca Log10	Pearson Correlation						-.331*	-.246*	.135	.087	.165
	Sig. (2-tailed)						.025	.030	.244	.445	.141
	N						46	78	76	80	81
U/Ca Log10	Pearson Correlation							.255	.125	.191	.097
	Sig. (2-tailed)							.087	.418	.193	.509
	N							46	44	48	49
B/Ca	Pearson Correlation								.125	.033	-.018
	Sig. (2-tailed)								.210	.739	.857
	N								102	105	104
Mg/Ca	Pearson Correlation									.563**	.377**
	Sig. (2-tailed)									.000	.000
	N									102	101
Sr88/Ca	Pearson Correlation										.723**
	Sig. (2-tailed)										.000
	N										106
Ba/Ca	Pearson Correlation										
	Sig. (2-tailed)										
	N										

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

K1A1 Correlation Nacreous Layer		Li/Ca Log10	Mg/Ca Log10	Al/Ca Log10	Pb/Ca Log10	U/Ca Log10	B/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca
Li/Ca Log10	Pearson Correlation		.333*	-.029	.113	.174	.172	-.078	.014	.361*	.053
	Sig. (2-tailed)		.024	.913	.455	.440	.265	.606	.928	.013	.726
	N		46	17	46	22	44	46	45	47	47
Mg/Ca Log10	Pearson Correlation			.004	.216*	-.160	.463**	-.037	-.386**	.598**	.152
	Sig. (2-tailed)			.983	.047	.323	.000	.736	.000	.000	.156
	N			31	85	40	83	85	88	89	89
Al/Ca Log10	Pearson Correlation				-.392*	.405	.049	.249	.010	-.007	-.127
	Sig. (2-tailed)				.027	.151	.802	.185	.957	.970	.490
	N				32	14	29	30	31	32	32
Pb/Ca Log10	Pearson Correlation					-.368*	-.201	-.069	.099	.108	-.044
	Sig. (2-tailed)					.021	.074	.530	.362	.313	.684
	N					39	80	85	87	89	89
U/Ca Log10	Pearson Correlation						-.025	-.166	-.132	-.057	-.235
	Sig. (2-tailed)						.884	.298	.418	.724	.139
	N						37	41	40	41	41
B/Ca	Pearson Correlation							-.237*	-.359**	.335**	-.097
	Sig. (2-tailed)							.033	.001	.002	.385
	N							81	82	83	83
Mn/Ca	Pearson Correlation								.416**	-.111	.438**
	Sig. (2-tailed)								.000	.305	.000
	N								86	88	88
Zn/Ca	Pearson Correlation									-.273**	.407**
	Sig. (2-tailed)									.009	.000
	N									91	91
Sr88/Ca	Pearson Correlation										.307**
	Sig. (2-tailed)										.003
	N										93
Ba/Ca	Pearson Correlation										
	Sig. (2-tailed)										
	N										

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix 3.2f. Pearsons correlation between element/Ca ratios in the nacreous layer of samples K3A and K1A1 from Kaikoura. ** Correlation is significant at the 0.01 level and * correlation is significant at the 0.05 level.

AR1 Correlations Nacreous Layer		Li/Ca Log10	Mn/Ca Log10	Zn/Ca Log10	Pb/Ca Log10	U/Ca Log10	B/Ca	Mg/Ca	Al/Ca	Sr86/Ca	Sr88/Ca	Ba/Ca
Li/Ca Log10	Pearson Correlation		-.070	-.109	.074	.263	.109	-.087	-.194	.171	.042	-.022
	Sig. (2-tailed)		.621	.337	.615	.080	.344	.443	.169	.112	.714	.839
	N		53	80	49	45	78	79	52	87	80	89
Mn/Ca Log10	Pearson Correlation			-.137	-.165	-.170	.127	-.129	.379*	.450**	.100	-.101
	Sig. (2-tailed)			.302	.321	.330	.349	.345	.016	.000	.458	.411
	N			59	38	35	56	56	40	67	57	69
Zn/Ca Log10	Pearson Correlation				-.256	-.022	.003	-.049	.093	.012	-.124	.087
	Sig. (2-tailed)				.057	.883	.976	.658	.506	.910	.255	.399
	N				56	48	84	85	54	95	86	97
Pb/Ca Log10	Pearson Correlation					-.027	-.197	-.241	-.339	-.161	-.102	.199
	Sig. (2-tailed)					.889	.134	.066	.058	.210	.444	.115
	N					30	59	59	32	62	59	64
U/Ca Log10	Pearson Correlation						.296*	.075	-.170	.122	.098	-.047
	Sig. (2-tailed)						.039	.602	.343	.385	.496	.731
	N						49	51	33	53	51	55
B/Ca	Pearson Correlation							-.021	.003	.185	.184	.203*
	Sig. (2-tailed)							.840	.981	.068	.069	.044
	N							97	54	98	98	98
Mg/Ca	Pearson Correlation								.170	.437**	.442**	-.038
	Sig. (2-tailed)								.220	.000	.000	.797
	N								54	99	99	99
Al/Ca	Pearson Correlation									.451**	.467**	-.222
	Sig. (2-tailed)									.000	.000	.083
	N									60	55	62
Sr86/Ca	Pearson Correlation										.989**	.009
	Sig. (2-tailed)										.000	.930
	N										100	110
Sr88/Ca	Pearson Correlation											.244*
	Sig. (2-tailed)											.014
	N											100
Ba/Ca	Pearson Correlation											
	Sig. (2-tailed)											
	N											

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

MR2 Correlations Nacreous Layer		Mn/Ca Log10	Zn/Ca Log10	Pb/Ca Log10	U/Ca Log10	Li/Ca	B/Ca	Mg/Ca	Al/Ca	Sr86/Ca	Sr88/Ca	Ba/Ca
Mn/Ca Log10	Pearson Correlation		-.003	-.289	-.140	.311	-.029	.134	.023	.046	.063	-.164
	Sig. (2-tailed)		.984	.171	.496	.065	.845	.352	.904	.752	.662	.255
	N		36	24	26	66	47	50	31	50	50	50
Zn/Ca Log10	Pearson Correlation			.006	-.166	.166	.248	-.092	.269	-.167	-.144	-.056
	Sig. (2-tailed)			.971	.363	.300	.074	.475	.081	.191	.261	.660
	N			35	32	41	53	63	43	63	63	63
Pb/Ca Log10	Pearson Correlation				.174	.239	-.018	.045	-.205	-.065	-.066	.129
	Sig. (2-tailed)				.417	.181	.914	.771	.295	.673	.670	.402
	N				24	33	40	44	28	44	44	44
U/Ca Log10	Pearson Correlation					-.041	.121	.277	.092	.128	.125	-.006
	Sig. (2-tailed)					.832	.462	.063	.623	.397	.408	.968
	N					29	39	46	31	46	46	46
Li/Ca	Pearson Correlation						-.114	.059	.092	-.106	-.091	.079
	Sig. (2-tailed)						.409	.648	.579	.410	.483	.541
	N						55	62	39	62	62	62
B/Ca	Pearson Correlation							.238*	-.178	-.025	-.022	.200
	Sig. (2-tailed)							.036	.206	.829	.845	.079
	N							78	52	78	78	78
Mg/Ca	Pearson Correlation								-.264*	.212*	.221*	.174
	Sig. (2-tailed)								.045	.047	.038	.103
	N								58	89	89	89
Al/Ca	Pearson Correlation									-.202	-.171	-.249
	Sig. (2-tailed)									.128	.198	.059
	N									58	58	58
Sr86/Ca	Pearson Correlation										.994**	.503**
	Sig. (2-tailed)										.000	.000
	N										89	89
Sr88/Ca	Pearson Correlation											.511**
	Sig. (2-tailed)											.000
	N											89
Ba/Ca	Pearson Correlation											
	Sig. (2-tailed)											
	N											

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Appendix 3.2g. Pearsons correlation between element/Ca ratios in the nacreous layer of samples AR1 and MR2 from Chatham Islands. ** Correlation is significant at the 0.01 level and * correlation is significant at the 0.05 level.

MD1 Correlations Nacreous Layer		Al/Ca Log10	U/Ca Log10	Li/Ca	B/Ca	Mg/Ca	Mn/Ca	Zn/Ca	Sr86/Ca	Sr88/Ca	Ba/Ca	Pb/Ca
Al/Ca Log10	Pearson Correlation		-.107	-.041	-.173	-.156	.204	.609*	.055	.035	-.096	-.277
	Sig. (2-tailed)		.753	.894	.553	.549	.504	.027	.834	.894	.715	.470
	N		11	13	14	17	13	13	17	17	17	9
U/Ca Log10	Pearson Correlation			.028	.125	.324	.377	-.303	.215	.251	.401	-.397
	Sig. (2-tailed)			.948	.715	.305	.317	.394	.502	.431	.197	.436
	N			8	11	12	9	10	12	12	12	6
Li/Ca	Pearson Correlation				.174	.151	.159	.220	.403	.400	.000	-.805*
	Sig. (2-tailed)				.569	.590	.621	.541	.137	.140	.999	.029
	N				13	15	12	10	15	15	15	7
B/Ca	Pearson Correlation					.051	-.113	-.059	.105	.051	-.386	-.135
	Sig. (2-tailed)					.851	.728	.862	.700	.852	.140	.773
	N					16	12	11	16	16	16	7
Mg/Ca	Pearson Correlation						-.081	-.069	.823**	.805**	.495*	.125
	Sig. (2-tailed)						.784	.814	.000	.000	.031	.749
	N						14	14	19	19	19	9
Mn/Ca	Pearson Correlation							.145	-.045	.046	.278	-.292
	Sig. (2-tailed)							.670	.877	.877	.335	.574
	N							11	14	14	14	6
Zn/Ca	Pearson Correlation								.149	.108	.250	-.730
	Sig. (2-tailed)								.611	.713	.388	.062
	N								14	14	14	7
Sr86/Ca	Pearson Correlation									.985**	.456*	-.182
	Sig. (2-tailed)									.000	.050	.640
	N									19	19	9
Sr88/Ca	Pearson Correlation										.493*	-.103
	Sig. (2-tailed)										.032	.793
	N										19	9
Ba/Ca	Pearson Correlation											-.419
	Sig. (2-tailed)											.262
	N											9
Pb/Ca	Pearson Correlation											
	Sig. (2-tailed)											
	N											

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

MD3 Correlations Nacreous Layer		Al/Ca Log10	Mn/Ca Log10	Pb/Ca Log10	U/Ca Log10	Li/Ca	B/Ca	Mg/Ca	Zn/Ca	Sr86/Ca	Sr88/Ca	Ba/Ca
Al/Ca Log10	Pearson Correlation		.011	-.044	.410*	-.296	.056	.078	-.263	.043	.053	-.111
	Sig. (2-tailed)		.951	.812	.033	.084	.714	.612	.088	.779	.728	.469
	N		31	32	27	35	45	45	43	45	45	45
Mn/Ca Log10	Pearson Correlation			.293	.093	.032	.072	.016	-.233	.069	.046	-.059
	Sig. (2-tailed)			.059	.590	.826	.573	.903	.068	.588	.716	.644
	N			42	36	49	64	64	62	64	64	63
Pb/Ca Log10	Pearson Correlation				-.177	-.024	-.222	-.042	.041	-.055	-.060	-.102
	Sig. (2-tailed)				.366	.871	.085	.751	.765	.676	.646	.440
	N				28	50	61	61	57	61	61	60
U/Ca Log10	Pearson Correlation					-.239	-.053	.138	-.263	.071	.056	-.059
	Sig. (2-tailed)					.127	.725	.354	.085	.637	.707	.696
	N					42	47	47	44	47	47	47
Li/Ca	Pearson Correlation						-.129	.024	.150	.062	.078	.042
	Sig. (2-tailed)						.288	.841	.232	.610	.519	.733
	N						70	70	65	70	70	69
B/Ca	Pearson Correlation							.160	.070	.232*	.234*	.346**
	Sig. (2-tailed)							.134	.528	.028	.028	.001
	N							89	83	89	89	88
Mg/Ca	Pearson Correlation								.101	.759**	.748**	.453**
	Sig. (2-tailed)								.362	.000	.000	.000
	N								83	89	89	88
Zn/Ca	Pearson Correlation									.263*	.273*	.408**
	Sig. (2-tailed)									.017	.013	.000
	N									83	83	82
Sr86/Ca	Pearson Correlation										.996**	.705**
	Sig. (2-tailed)										.000	.000
	N										89	88
Sr88/Ca	Pearson Correlation											.708**
	Sig. (2-tailed)											.000
	N											88
Ba/Ca	Pearson Correlation											
	Sig. (2-tailed)											
	N											

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix 3.2h. Pearsons correlation between element/Ca ratios in the nacreous layer of samples MD1 and MD3 from Moeraki. ** Correlation is significant at the 0.01 level and * correlation is significant at the 0.05 level.

APPENDIX 4.1 CREAMED PĀUA RECIPE

Note: This appendix has been added in response to the many enquiries from the academic community at the Geosciences 2010 Conference in Auckland for delicious ways to cook pāua.

Ingredients

3 medium sized pāua	300ml bottle of cream
1 onion (diced)	1 teaspoon of crushed garlic
300ml bottle of cream	2 tablespoons of flour
Salt and pepper	1 tablespoon of oil

Method

Shuck the pāua from the shell and clean

Remove the sac and teeth from the pāua and slice the meat thinly (5 mm thickness)

Heat a pan with the 1 tablespoon of oil

Once hot, fry the onions and crushed garlic until brown

Add the thinly sliced paua and fry until it starts to caramelize

Add the bottle of cream and bring to the boil

Add flour to thicken and salt and pepper to taste

Serve hot or cold

APPENDIX 5.1a RW75 400 prismatic layer data

Spot Number	Distance from the foot (mm)	RW75 400 prismatic layer transect data (mmol/mol)								
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	U/Ca
1	0.0	0.00757	0.00000	10.24	0.00520	0.00427	0.04491	1.23	0.000726	0.0000434
2	0.4	0.01059	0.01424	2.75	0.00672	0.00035	0.00469	1.52	0.000492	0.0000000
3	0.8	0.01618	0.00000	24.77	0.00511	0.00042	0.00165	1.20	0.000419	0.0000000
4	1.2	0.00818	0.00000	4.97	0.00071	0.00000	0.00302	1.18	0.000411	0.0000274
5	1.6	0.00839	0.00200	5.84	0.00000	0.00000	0.00120	1.16	0.000451	0.0000031
6	2.0	0.00843	0.00738	7.60	0.00736	0.00361	0.01109	1.27	0.000669	0.0000402
7	2.4	0.01185	0.00000	18.81	0.02106	0.00099	0.00423	1.21	0.000396	0.0000000
8	2.8	0.00685	0.00342	3.34	0.00105	0.00022	0.00474	1.27	0.000327	0.0000481
9	3.2	0.00777	0.01934	2.16	0.00000	0.00081	0.00705	1.33	0.000436	0.0000000
10	3.6	0.01164	0.01529	2.27	0.00080	0.00080	0.00479	1.37	0.000393	0.0000000
11	4.0	0.00658	0.01139	3.03	0.00000	0.00228	0.00030	1.17	0.000329	0.0000000
12	4.4	0.00629	0.00756	3.44	0.00000	0.00068	0.00235	1.33	0.000384	0.0000000
13	4.8	0.00640	0.00000	3.61	0.00000	0.00000	0.00159	1.25	0.000333	0.0000000
14	5.2	0.00607	0.01133	2.59	0.00144	0.00050	0.00656	1.25	0.000390	0.0000019
15	5.6	0.00638	0.01149	3.29	0.00000	0.00100	0.00279	1.18	0.000286	0.0000019
16	6.0	0.00583	0.00761	4.47	0.00000	0.00167	0.00052	0.96	0.000247	0.0000000
17	6.4	0.00848	0.00495	3.23	0.00439	0.00267	0.00466	1.20	0.000355	0.0000365
18	6.8	0.00815	0.00959	2.65	0.00155	0.00133	0.00000	1.39	0.000437	0.0000545
19	7.2	0.01046	0.00000	2.25	0.00456	0.00124	0.00206	1.41	0.000402	0.0000334
20	7.6	0.00860	0.00922	5.02	0.00487	0.00303	0.01690	1.48	0.000630	0.0000424
21	8.0	0.00930	0.00182	2.58	0.00000	0.00235	0.00315	1.68	0.000448	0.0000000
22	8.4	0.00676	0.01800	6.25	0.00000	0.00394	0.00402	1.49	0.000463	0.0000113
23	8.8	0.00647	0.00415	3.08	0.00923	0.00000	0.00000	1.25	0.000312	0.0000000
24	9.2	0.00541	0.00000	2.96	0.00081	0.00207	0.00338	1.09	0.000293	0.0000000
25	9.6	0.00576	0.01896	3.98	0.00000	0.00158	0.00067	1.01	0.000184	0.0000000
26	10.0	0.00473	0.00761	3.83	0.00000	0.00063	0.00109	1.17	0.000259	0.0000302
27	10.4	0.00581	0.00824	3.06	0.00136	0.00210	0.00509	1.20	0.000383	0.0000057
28	10.8	0.00768	0.00815	7.42	0.00000	0.00484	0.00000	0.97	0.000264	0.0000346
29	11.2	0.00583	0.00465	3.79	0.00000	0.00186	0.00000	1.13	0.000256	0.0000083

Spot Number	Distance from the foot (mm)	RW75 400 prismatic layer transect data (mmol/mol) continued...								
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	U/Ca
30	11.6	0.00558	0.00000	3.21	0.00000	0.00211	0.00290	1.22	0.000388	0.0000000
31	12.0	0.00779	0.01700	2.11	0.00000	0.00180	0.00200	1.23	0.000316	0.0000101
32	12.4	0.01138	0.00202	1.81	0.00562	0.00055	0.00326	1.44	0.000501	0.0000000
33	12.8	0.00815	0.00000	2.37	0.00011	0.00056	0.00341	1.19	0.000331	0.0000000
34	13.2	0.00885	0.00639	2.19	0.00058	0.00251	0.00062	1.22	0.000342	0.0000452
35	13.6	0.00643	0.00000	1.94	0.00000	0.00261	0.00447	1.37	0.000539	0.0000425
36	14.0	0.00559	0.01201	1.75	0.00098	0.00209	0.00686	1.27	0.000344	0.0000016
37	14.4	0.00954	0.01207	2.63	0.00050	0.00305	0.00319	1.26	0.000435	0.0000093
38	14.8	0.00803	0.00584	3.00	0.00000	0.00016	0.00373	1.22	0.000362	0.0000384
39	15.2	0.00852	0.00000	1.99	0.00456	0.00180	0.01195	1.43	0.000578	0.0000000
40	15.6	0.00972	0.00509	1.57	0.00029	0.00186	0.00246	1.05	0.000282	0.0000710
41	16.0	0.01073	0.00027	1.64	0.00011	0.00197	0.00463	1.32	0.000567	0.0000573
42	16.4	0.00995	0.00000	2.18	0.00000	0.00260	0.00134	1.31	0.000382	0.0000372
43	16.8	0.00519	0.00000	1.51	0.00000	0.00165	0.00364	1.43	0.000434	0.0000248
44	17.2	0.00749	0.00000	2.39	0.00037	0.00275	0.00284	1.32	0.000454	0.0000146
45	17.6	0.00812	0.01017	2.23	0.00036	0.00112	0.00256	1.30	0.000474	0.0000169
46	18.0	0.00758	0.00808	2.87	0.00030	0.00288	0.00261	1.16	0.000360	0.0000000
47	18.4	0.00977	0.01169	2.81	0.00197	0.00278	0.00185	1.18	0.000354	0.0000630
48	18.8	0.01097	0.00710	1.88	0.00335	0.00058	0.00233	1.19	0.000341	0.0000000
49	19.2	0.00805	0.00908	1.80	0.00233	0.00144	0.00570	1.23	0.000347	0.0000000
50	19.6	0.00483	0.01858	2.18	0.00090	0.00018	0.00208	1.21	0.000495	0.0000210
51	20.0	0.00367	0.00000	1.89	0.00115	0.00139	0.00219	1.35	0.000416	0.0000286
52	20.4	0.00765	0.00000	1.69	0.00167	0.00000	0.00582	1.35	0.000422	0.0000098
53	20.8	0.00654	0.00000	1.99	0.00150	0.00225	0.00419	1.39	0.000390	0.0000480
54	21.2	0.00335	0.00000	2.41	0.00508	0.00208	0.00579	1.32	0.000435	0.0000576
55	21.6	0.01198	0.00855	2.31	0.00117	0.00000	0.00066	1.12	0.000198	0.0000488
56	22.0	0.01273	0.00743	1.32	0.00000	0.00117	0.00070	1.42	0.000417	0.0000263
57	22.4	0.00731	0.00000	2.92	0.00132	0.00259	0.00826	1.15	0.000398	0.0000305
58	22.8	0.00576	0.00000	3.04	0.00286	0.00108	0.00135	1.18	0.000277	0.0000603
59	23.2	0.00324	0.00181	3.63	0.00000	0.00463	0.00189	1.31	0.000377	0.0000109

Spot Number	Distance from the foot (mm)	RW75 400 prismatic layer transect data (mmol/mol) continued...								
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	U/Ca
60	23.6	0.00483	0.00000	2.61	0.00000	0.00114	0.00235	1.30	0.000353	0.0000267
61	24.0	0.01065	0.01175	1.93	0.00027	0.00141	0.00063	1.24	0.000387	0.0000278
62	24.4	0.00894	0.00455	2.90	0.00063	0.00126	0.00328	1.20	0.000307	0.0000092
63	24.8	0.00753	0.00028	1.64	0.00041	0.00156	0.00204	1.39	0.000346	0.0000000
64	25.2	0.01208	0.02317	2.08	0.00252	0.00000	0.00295	1.37	0.000391	0.0000564
65	25.6	0.00696	0.00696	3.41	0.00000	0.00328	0.00060	1.54	0.000455	0.0000312
66	26.0	0.00814	0.00379	3.48	0.00244	0.00318	0.00000	1.51	0.000491	0.0000113
67	26.4	0.00903	0.02101	2.24	0.00216	0.00171	0.00311	1.62	0.000607	0.0000342
68	26.8	0.00534	0.01327	2.96	0.00000	0.00000	0.00392	1.50	0.000395	0.0000254
69	27.2	0.00792	0.01144	3.82	0.00000	0.00113	0.00505	1.34	0.000408	0.0000247
70	27.6	0.00780	0.01452	5.31	0.00000	0.00203	0.00348	1.22	0.000457	0.0001116
71	28.0	0.01233	0.00249	3.19	0.00129	0.00029	0.00499	1.32	0.000330	0.0000000
72	28.4	0.00623	0.00787	3.09	0.00000	0.00148	0.00249	1.19	0.000285	0.0000137
73	28.8	0.01118	0.00492	5.08	0.00246	0.00068	0.00149	1.04	0.000282	0.0000000
74	29.2	0.00703	0.01419	4.13	0.00000	0.00210	0.00307	1.11	0.000301	0.0000133
75	29.6	0.00719	0.00831	8.71	0.00031	0.00172	0.00144	1.00	0.000361	0.0000416
76	30.0	0.00853	0.00000	4.83	0.00202	0.00073	0.00247	1.10	0.000284	0.0000000
77	30.4	0.00653	0.00758	4.03	0.00000	0.00041	0.00000	1.01	0.000224	0.0000178
78	30.8	0.00721	0.01140	3.09	0.00000	0.00113	0.00012	1.01	0.000257	0.0000675
79	31.2	0.00721	0.01140	3.09	0.00000	0.00113	0.00012	1.01	0.000257	0.0000675
80	31.6	0.00660	0.00316	2.36	0.00000	0.00009	0.00371	1.29	0.000329	0.0000092
81	32.0	0.00832	0.00768	3.16	0.00086	0.00385	0.00845	1.25	0.000487	0.0000000
82	32.4	0.00644	0.01701	3.20	0.00227	0.00243	0.00435	1.19	0.000298	0.0000000
83	32.8	0.00608	0.01557	2.71	0.00231	0.00392	0.00883	1.22	0.000330	0.0000656
84	33.2	0.01084	0.01127	1.00	0.00120	0.00000	0.00264	1.76	0.000771	0.0000053
85	33.6	0.00711	0.04659	0.77	0.00038	0.00044	0.00290	2.14	0.0002533	0.0000120
86	34.0	0.01348	0.00000	6.99	0.00000	0.00228	0.00279	0.88	0.000253	0.0000786
87	34.4	0.00673	0.01572	5.96	0.00293	0.00512	0.00154	0.97	0.000244	0.0000000
88	34.8	0.01141	0.00618	11.97	0.00089	0.00231	0.00129	0.97	0.000296	0.0000624
89	35.2	0.00650	0.00000	5.47	0.00102	0.00200	0.00098	0.98	0.000300	0.0000348

Spot Number	Distance from the foot (mm)	RW75 400 prismatic layer transect data (mmol/mol) continued...								
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	U/Ca
90	35.6	0.00396	0.00000	6.67	0.00000	0.00218	0.00442	0.95	0.000258	0.0000000
91	36.0	0.00939	0.00000	4.24	0.00101	0.00426	0.00325	1.06	0.000237	0.0000370
92	36.4	0.00701	0.00463	3.14	0.00249	0.00266	0.00147	1.05	0.000329	0.0000277
93	36.8	0.00580	0.00787	2.74	0.00096	0.00332	0.00323	1.21	0.000370	0.0000327
94	37.2	0.00757	0.00714	3.64	0.00292	0.00429	0.00153	1.25	0.000468	0.0000000
95	37.6	0.00673	0.01347	3.76	0.00000	0.00207	0.00139	1.21	0.000373	0.0000075
96	38.0	0.00597	0.01686	3.99	0.00058	0.00422	0.00000	1.17	0.000341	0.0000222
97	38.4	0.00829	0.00916	4.04	0.00122	0.00039	0.00280	1.21	0.000387	0.0000000
98	38.8	0.00811	0.00000	3.88	0.00056	0.00433	0.00559	1.39	0.000585	0.0000205
99	39.2	0.00672	0.00000	2.44	0.00081	0.00349	0.00385	1.10	0.000402	0.0000189
100	39.6	0.01180	0.00190	2.32	0.00014	0.00061	0.00229	1.26	0.000349	0.0000000
101	40.0	0.01109	0.01336	2.98	0.00000	0.00205	0.00244	1.38	0.000473	0.0000799
102	40.4	0.00714	0.00860	2.47	0.00000	0.00182	0.00372	1.16	0.000405	0.0000000
103	40.8	0.01248	0.00000	2.76	0.00506	0.00091	0.00502	1.25	0.000440	0.0000126
104	41.2	0.00816	0.00856	3.21	0.00099	0.00204	0.00059	1.17	0.000313	0.0000469
105	41.6	0.00744	0.01584	2.37	0.00201	0.00322	0.00136	1.28	0.000417	0.0000063
106	42.0	0.01352	0.01204	2.41	0.00000	0.00289	0.00130	1.46	0.000508	0.0000034

APPENDIX 5.1b RW75 100 prismatic layer data

Spot Number	Distance from the foot (mm)	RW75 100 prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.0	0.0258	0.0000	11.59	0.00309	0.00000	0.0558	1.26	0.000989	0.0001376	0.0000000
2	0.4	0.0096	0.0000	8.37	0.00975	0.00000	0.0763	1.29	0.000913	0.0000838	0.0000113
3	0.8	0.0093	0.0000	2.88	0.00000	0.00000	0.0137	1.25	0.000562	0.0000381	0.0000046
4	1.2	0.0156	0.0151	2.93	0.00000	0.00000	0.0187	1.33	0.000476	0.0000069	0.0000114
5	1.6	0.0130	0.0000	5.64	0.00300	0.00000	0.0259	1.42	0.000448	0.0000355	0.0000000
6	2.0	0.0029	0.0104	4.65	0.00000	0.00000	0.0019	1.31	0.000456	0.0000385	0.0000094
7	2.4	0.0073	0.0136	4.61	0.00000	0.00000	0.0058	1.46	0.000486	0.0000289	0.0000152
8	2.8	0.0000	0.0240	5.93	0.00000	0.00000	0.0063	1.13	0.000355	0.0000225	0.0000002
9	3.2	0.0000	0.0000	5.17	0.01158	0.00000	0.0000	1.21	0.000338	0.0000435	0.0000000
10	3.6	0.0186	0.0127	7.78	0.00491	0.00024	0.0095	1.22	0.000430	0.0000000	0.0000000
11	4.0	0.0122	0.0247	16.78	0.00333	0.00000	0.0164	1.08	0.000356	0.0000153	0.0000000
12	4.4	0.0000	0.0000	6.54	0.00682	0.00086	0.0040	1.29	0.000401	0.0000000	0.0000000
13	4.8	0.0059	0.0000	6.57	0.00069	0.00190	0.0061	1.21	0.000385	0.0000128	0.0000000
14	5.2	0.0022	0.0000	8.18	0.00000	0.00008	0.0074	1.29	0.000459	0.0000224	0.0000000
15	5.6	0.0022	0.0006	5.47	0.00389	0.00000	0.0033	1.24	0.000425	0.0000491	0.0000146
16	6.0	0.0168	0.0200	13.21	0.00000	0.00196	0.0063	1.17	0.000347	0.0000148	0.0000000
17	6.4	0.0182	0.0299	14.31	0.09983	0.00219	0.0058	1.36	0.000643	0.0000578	0.0000360
18	6.8	0.0000	0.0268	4.70	0.01474	0.00125	0.0732	1.19	0.000785	0.0000552	0.0000101
19	7.2	0.0206	0.0000	6.37	0.00978	0.00295	0.0072	1.14	0.000342	0.0000000	0.0000213
20	7.6	0.0094	0.0000	10.99	0.00000	0.00131	0.0015	1.04	0.000243	0.0000586	0.0000018
21	8.0	0.0189	0.0000	8.75	0.00556	0.00000	0.0047	1.17	0.000431	0.0000155	0.0000016
22	8.4	0.0178	0.0410	17.76	0.02794	0.00092	0.0119	1.22	0.000559	0.0000423	0.0000291
23	8.8	0.0011	0.0000	20.91	0.00000	0.00128	0.0058	1.06	0.000551	0.0000000	0.0000000
24	9.2	0.0159	0.0006	10.42	0.00836	0.00044	0.0092	1.04	0.000417	0.0001027	0.0000176
25	9.6	0.0099	0.0057	28.83	0.00000	0.00210	0.0044	1.04	0.000399	0.0000000	0.0000200
26	10.0	0.0062	0.0255	4.79	0.04531	0.00048	0.0136	1.20	0.000961	0.0001113	0.0000071
27	10.4	0.0099	0.0152	2.29	0.00526	0.00136	0.0041	1.25	0.000311	0.0000641	0.0000000
28	10.8	0.0167	0.0046	3.00	0.00000	0.00277	0.0093	1.23	0.000344	0.0000335	0.0000000
29	11.2	0.0142	0.0095	2.81	0.00370	0.00000	0.0139	1.14	0.000292	0.0001107	0.0000123

Spot Number	Distance from the foot (mm)	RW75 100 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	Pb/Ca	U/Ca
60	23.6	0.0000	0.0000	2.95	0.00000	0.00000	0.0061	1.64	0.000528	0.0000000	0.0000000
61	24.0	0.0000	0.0126	4.22	0.01177	0.00211	0.0089	1.60	0.000643	0.0000511	0.0000000
62	24.4	0.0137	0.0380	2.02	0.00524	0.00074	0.0009	1.45	0.000451	0.0000000	0.0000000
63	24.8	0.0034	0.0000	1.95	0.00000	0.00261	0.0039	1.51	0.000592	0.0000697	0.0000000
64	25.2	0.0000	0.0111	2.58	0.01305	0.00042	0.0057	1.55	0.000494	0.0000784	0.0000000
65	25.6	0.0000	0.0000	5.50	0.00222	0.00187	0.0060	1.61	0.000643	0.0000022	0.0000103
66	26.0	0.0063	0.0138	3.03	0.00000	0.00283	0.0012	1.50	0.000491	0.0000112	0.0000000
67	26.4	0.0196	0.0000	2.37	0.01556	0.00458	0.0082	1.39	0.000478	0.0000461	0.0000170
68	26.8	0.0082	0.0075	2.97	0.00041	0.00315	0.0146	1.51	0.000544	0.0000517	0.0000000
69	27.2	0.0048	0.0000	3.85	0.00000	0.00171	0.0106	1.38	0.000554	0.0001247	0.0000000
70	27.6	0.0063	0.0090	4.10	0.00060	0.00228	0.0043	1.45	0.000551	0.0000427	0.0000000
71	28.0	0.0078	0.0232	6.83	0.00476	0.00349	0.0134	1.30	0.000435	0.0001234	0.0000193
72	28.4	0.0000	0.0017	4.17	0.00029	0.00486	0.0020	1.38	0.000381	0.0000000	0.0000154
73	28.8	0.0196	0.0000	4.52	0.00341	0.00393	0.0000	1.26	0.000416	0.0000227	0.0000106
74	29.2	0.0005	0.0132	3.54	0.00224	0.00224	0.0069	1.39	0.000379	0.0000210	0.0000156
75	29.6	0.0000	0.0000	3.71	0.00671	0.00000	0.0000	1.37	0.000450	0.0000340	0.0000000
76	30.0	0.0031	0.0130	4.14	0.00000	0.00200	0.0026	1.36	0.000303	0.0000212	0.0000192
77	30.4	0.0182	0.0000	4.21	0.00000	0.00115	0.0000	1.34	0.000244	0.0000000	0.0000000
78	30.8	0.0000	0.0010	3.65	0.00000	0.00000	0.0063	1.40	0.000427	0.0000190	0.0000123
79	31.2	0.0176	0.0014	4.16	0.00582	0.00000	0.0023	1.49	0.000403	0.0000168	0.0000099
80	31.6	0.0081	0.0000	2.82	0.00000	0.00340	0.0039	1.52	0.000363	0.0000136	0.0000100
81	32.0	0.0150	0.0017	3.14	0.00572	0.00063	0.0022	1.26	0.000326	0.0000853	0.0000074
82	32.4	0.0089	0.0214	4.57	0.00657	0.00200	0.0026	1.16	0.000231	0.0000000	0.0000168
83	32.8	0.0090	0.0112	6.33	0.00000	0.00130	0.0067	0.88	0.000277	0.0000183	0.0000246
84	33.2	0.0000	0.0059	4.08	0.00000	0.00000	0.0028	1.08	0.000317	0.0000000	0.0000057
85	33.6	0.0000	0.0106	3.75	0.00148	0.00000	0.0000	1.05	0.000262	0.0000000	0.0000000
86	34.0	0.0056	0.0090	4.00	0.00735	0.00212	0.0051	1.00	0.000209	0.0000155	0.0000033
87	34.4	0.0108	0.0184	6.49	0.00000	0.00327	0.0040	1.00	0.000248	0.0000000	0.0000000
88	34.8	0.0087	0.0161	9.13	0.00480	0.00257	0.0036	0.92	0.000292	0.0000412	0.0000167
89	35.2	0.0000	0.0000	4.32	0.00452	0.00304	0.0025	1.04	0.000262	0.0000171	0.0000066

Spot Number	Distance from the foot (mm)	RW75 100 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	Pb/Ca	U/Ca
90	35.6	0.0023	0.0115	4.59	0.00000	0.00000	0.0038	1.02	0.000239	0.0000756	0.0000007
91	36.0	0.0158	0.0139	4.06	0.00008	0.00000	0.0000	0.94	0.000182	0.0000425	0.0000000
92	36.4	0.0109	0.0000	4.53	0.00000	0.00217	0.0047	0.96	0.000306	0.0000000	0.0000000
93	36.8	0.0127	0.0105	5.15	0.00000	0.00108	0.0062	0.81	0.000238	0.0000083	0.0000000
94	37.2	0.0000	0.0000	6.24	0.00000	0.00286	0.0056	0.80	0.000245	0.0000000	0.0000039
95	37.6	0.0000	0.0000	5.03	0.00233	0.00282	0.0009	0.88	0.000219	0.0000556	0.0000109
96	38.0	0.0008	0.0000	3.87	0.00475	0.00000	0.0024	0.87	0.000208	0.0000028	0.0000000
97	38.4	0.0184	0.0000	2.94	0.00211	0.00246	0.0030	1.09	0.000261	0.0000019	0.0000183
98	38.8	0.0000	0.0000	3.44	0.00000	0.00000	0.0032	0.96	0.000174	0.0000007	0.0000000
99	39.2	0.0069	0.0090	3.89	0.00000	0.00000	0.0000	0.87	0.000121	0.0000408	0.0000038
100	39.6	0.0000	0.0273	3.52	0.00000	0.00425	0.0026	0.92	0.000297	0.0000000	0.0000000
101	40.0	0.0015	0.0172	6.36	0.00689	0.00166	0.0014	1.01	0.000305	0.0000000	0.0000021
102	40.4	0.0074	0.0000	3.23	0.00000	0.00359	0.0090	1.09	0.000367	0.0000620	0.0000000
103	40.8	0.0194	0.0000	3.38	0.01056	0.00388	0.0161	1.11	0.000378	0.0000822	0.0000000
104	41.2	0.0210	0.0000	1.79	0.00000	0.00201	0.0098	1.27	0.000414	0.0001189	0.0000284
105	41.6	0.0000	0.0064	1.25	0.00000	0.00188	0.0081	1.42	0.000399	0.0000462	0.0000000
106	42.0	0.0061	0.0065	2.37	0.00088	0.00000	0.0064	1.19	0.000340	0.0000969	0.0000051
107	42.4	0.0057	0.0044	3.16	0.00000	0.00101	0.0000	1.34	0.000334	0.0000454	0.0000000
108	42.8	0.0000	0.0000	2.90	0.00864	0.00000	0.0000	1.25	0.000234	0.0000141	0.0000000
109	43.2	0.0000	0.0129	3.53	0.01214	0.00875	0.0000	1.12	0.000302	0.0000000	0.0000000
110	43.6	0.0323	0.0184	2.64	0.00000	0.00000	0.0149	1.13	0.000286	0.0001357	0.0000184
111	44.0	0.0553	0.0066	2.55	0.03290	0.00000	0.0000	1.22	0.000331	0.0000754	0.0000201
112	44.4	0.0000	0.0000	3.46	0.10132	0.00144	0.0311	1.03	0.000415	0.0001116	0.0000000
113	44.8	0.0323	0.0401	2.49	0.01602	0.00052	0.0027	1.18	0.000314	0.0000640	0.0000287
114	45.2	0.0105	0.0000	1.79	0.00000	0.00442	0.0000	1.30	0.000326	0.0000604	0.0000156
115	45.6	0.0000	0.0000	2.18	0.00695	0.00805	0.0244	1.09	0.000463	0.0000000	0.0000000
116	46.0	0.0000	0.0286	2.01	0.00000	0.00174	0.0165	1.03	0.000234	0.0001108	0.0000000
117	46.4	0.0168	0.0000	2.17	0.00383	0.00285	0.0000	1.12	0.000276	0.0000000	0.0000000
118	46.8	0.0250	0.0000	1.95	0.00000	0.00425	0.0056	1.29	0.000312	0.0000661	0.0000000
119	47.2	0.0030	0.0000	3.93	0.00650	0.00021	0.0056	1.26	0.000539	0.0000000	0.0000000

Spot Number	Distance from the foot (mm)	RW75 100 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	Pb/Ca	U/Ca
120	47.6	0.0248	0.0035	3.16	0.00000	0.00714	0.0178	1.14	0.000489	0.0000000	0.0000133
121	48.0	0.0153	0.0000	6.25	0.00580	0.00777	0.0000	1.32	0.000460	0.0001110	0.0000000
122	48.4	0.0460	0.0000	2.84	0.00000	0.00438	0.0048	1.23	0.000581	0.0000111	0.0000000
123	48.8	0.0037	0.0187	3.28	0.00412	0.00143	0.0101	1.29	0.000493	0.0000347	0.0000234
124	49.2	0.0000	0.0239	3.40	0.01483	0.00528	0.0097	1.44	0.000855	0.0000739	0.0000000
125	49.6	0.0236	0.0123	4.74	0.00000	0.00017	0.0070	1.33	0.000719	0.0000000	0.0000000
126	50.0	0.0000	0.0082	4.00	0.00000	0.00000	0.0073	1.35	0.000539	0.0000000	0.0000017
127	50.4	0.0220	0.0000	2.02	0.00555	0.00000	0.0056	1.52	0.000548	0.0000180	0.0000000
128	50.8	0.0000	0.0000	3.28	0.00182	0.00227	0.0000	1.58	0.000497	0.0000149	0.0000056
129	51.2	0.0250	0.0000	7.66	0.00000	0.00344	0.0021	1.62	0.000533	0.0000000	0.0000000
130	51.6	0.0099	0.0032	5.67	0.01087	0.00163	0.0017	1.67	0.000581	0.0000436	0.0000225
131	52.0	0.0334	0.0019	3.59	0.00000	0.00314	0.0011	1.74	0.000536	0.0000000	0.0000000
132	52.4	0.0106	0.0000	2.59	0.00000	0.00134	0.0043	1.50	0.000411	0.0000159	0.0000191
133	52.8	0.0137	0.0159	2.11	0.00000	0.00000	0.0016	1.56	0.000536	0.0000202	0.0000000
134	53.2	0.0000	0.0000	1.95	0.00987	0.00000	0.0067	1.39	0.000535	0.0001497	0.0000013
135	53.6	0.0000	0.0138	1.54	0.00000	0.00000	0.0097	1.39	0.000493	0.0000560	0.0000000
136	54.0	0.0045	0.0097	1.51	0.00000	0.00000	0.0018	1.40	0.000533	0.0000414	0.0000000
137	54.4	0.0000	0.0211	1.66	0.00921	0.00266	0.0140	1.30	0.000464	0.0000540	0.0000147
138	54.8	0.0000	0.0043	1.72	0.00000	0.00000	0.0053	1.27	0.000384	0.0000542	0.0000000
139	55.2	0.0075	0.0078	2.53	0.00000	0.00270	0.0104	1.53	0.000505	0.0000587	0.0000000
140	55.6	0.0051	0.0117	2.08	0.01217	0.00412	0.0056	1.25	0.000469	0.0000800	0.0000000
141	56.0	0.0000	0.0012	1.91	0.00919	0.00118	0.0064	1.26	0.000396	0.0000733	0.0000000
142	56.4	0.0024	0.0000	1.57	0.00000	0.00120	0.0124	1.22	0.000530	0.0000670	0.0000000
143	56.8	0.0140	0.0276	1.92	0.00723	0.00095	0.0181	1.40	0.000538	0.0000591	0.0000013
144	57.2	0.0000	0.0000	5.50	0.00000	0.00000	0.0055	1.46	0.000659	0.0000116	0.0000156
145	57.6	0.0045	0.0000	5.05	0.00000	0.00026	0.0043	1.53	0.000675	0.0000000	0.0000000
146	58.0	0.0000	0.0000	2.54	0.00605	0.00282	0.0138	1.42	0.000517	0.0001426	0.0000114
147	58.4	0.0133	0.0282	3.40	0.00532	0.00157	0.0004	1.29	0.000431	0.0000276	0.0000266
148	58.8	0.0000	0.0054	6.70	0.00000	0.00059	0.0033	1.49	0.000531	0.0000675	0.0000000
149	59.2	0.0185	0.0109	4.46	0.00000	0.00487	0.0032	1.59	0.000510	0.0000000	0.0000000

Spot Number	Distance from the foot (mm)	RW75 100 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	Pb/Ca	U/Ca
150	59.6	0.0000	0.0280	1.73	0.00000	0.00575	0.0047	1.53	0.000443	0.0000374	0.0000277
151	60.0	0.0043	0.0000	1.77	0.00000	0.00243	0.0072	1.55	0.000607	0.0000260	0.0000000
152	60.4	0.0316	0.0154	1.57	0.00000	0.00069	0.0090	1.46	0.000417	0.0000207	0.0000000
153	60.8	0.0262	0.0177	2.70	0.00716	0.00134	0.0160	1.36	0.000566	0.0001109	0.0000368
154	61.2	0.0000	0.0266	1.42	0.00056	0.00141	0.0152	1.30	0.000439	0.0000357	0.0000014
155	61.6	0.0210	0.0185	1.57	0.00698	0.00000	0.0169	1.30	0.000631	0.0000650	0.0000306
156	62.0	0.0000	0.0000	1.44	0.00000	0.00186	0.0000	1.30	0.000514	0.0000136	0.0000232
157	62.4	0.0068	0.0042	2.35	0.00132	0.00199	0.0090	1.38	0.000485	0.0001362	0.0000019
158	62.8	0.0126	0.0345	1.68	0.00000	0.00013	0.0039	1.31	0.000462	0.0000527	0.0000198
159	63.2	0.0166	0.0031	1.97	0.00432	0.00310	0.0061	1.52	0.000480	0.0000550	0.0000000
160	63.6	0.0163	0.0293	1.93	0.00987	0.00340	0.0080	1.48	0.000624	0.0000331	0.0000000
161	64.0	0.0000	0.0009	1.41	0.00000	0.00000	0.0043	1.46	0.000497	0.0000000	0.0000140
162	64.4	0.0154	0.0000	1.94	0.00000	0.00185	0.0153	1.61	0.000662	0.0001143	0.0000094
163	64.8	0.0075	0.0000	2.04	0.00311	0.00223	0.0040	1.29	0.000459	0.0000449	0.0000000
164	65.2	0.0155	0.0000	1.93	0.02797	0.00092	0.0133	1.40	0.000452	0.0000873	0.0000132
165	65.6	0.0210	0.0048	1.57	0.00897	0.00642	0.0158	1.43	0.000457	0.0001167	0.0000088
166	66.0	0.0000	0.0158	1.63	0.00000	0.00197	0.0076	1.25	0.000386	0.0000000	0.0000001
167	66.4	0.0000	0.0000	1.65	0.00000	0.00063	0.0068	1.48	0.000362	0.0000000	0.0000000
168	66.8	0.0000	0.0099	2.90	0.00000	0.00460	0.0190	1.54	0.000822	0.0000510	0.0000041
169	67.2	0.0141	0.0268	2.49	0.00102	0.00119	0.0166	1.49	0.000754	0.0000191	0.0000000
170	67.6	0.0139	0.0130	1.92	0.00792	0.00000	0.0123	1.48	0.000496	0.0000752	0.0000000
171	68.0	0.0122	0.0072	1.65	0.00000	0.00053	0.0170	1.29	0.000526	0.0000802	0.0000000
172	68.4	0.0028	0.0000	1.80	0.00233	0.00181	0.0128	1.32	0.000624	0.0000611	0.0000000
173	68.8	0.0195	0.0090	1.98	0.00000	0.00043	0.0093	1.51	0.000539	0.0000102	0.0000185
174	69.2	0.0096	0.0000	1.87	0.00000	0.00000	0.0009	1.21	0.000443	0.0000000	0.0000194
175	69.6	0.0123	0.0000	2.53	0.00000	0.00098	0.0037	1.21	0.000299	0.0000677	0.0000213
176	70.0	0.0213	0.0000	2.36	0.00000	0.00322	0.0093	1.25	0.000351	0.0000534	0.0000032
177	70.4	0.0045	0.0000	2.18	0.00363	0.00205	0.0000	0.99	0.000222	0.0000000	0.0000000
178	70.8	0.0000	0.0001	2.37	0.00000	0.00285	0.0000	1.25	0.000431	0.0000381	0.0000000
179	71.2	0.0000	0.0000	2.31	0.00000	0.00005	0.0024	1.37	0.000362	0.0000528	0.0000000

Spot Number	Distance from the foot (mm)	RW75 100 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	Pb/Ca	U/Ca
180	71.6	0.0145	0.0142	3.27	0.00322	0.00006	0.0086	1.29	0.000433	0.0000239	0.0000089
181	72.0	0.0000	0.0063	2.86	0.00000	0.00249	0.0052	1.38	0.000397	0.0000119	0.0000040
182	72.4	0.0046	0.0107	3.15	0.00000	0.00235	0.0013	1.30	0.000398	0.0000501	0.0000000
183	72.8	0.0079	0.0201	3.17	0.01115	0.00064	0.0065	1.09	0.000359	0.0000119	0.0000107
184	73.2	0.0022	0.0000	3.63	0.00000	0.00101	0.0107	1.15	0.000379	0.0000657	0.0000000
185	73.6	0.0000	0.0185	4.27	0.00701	0.00578	0.0061	1.39	0.000309	0.0000833	0.0000072
186	74.0	0.0000	0.0182	5.08	0.00000	0.00000	0.0110	1.25	0.000323	0.0000454	0.0000000
187	74.4	0.0072	0.0000	3.22	0.00000	0.00246	0.0000	1.26	0.000239	0.0000476	0.0000000
188	74.8	0.0000	0.0000	3.47	0.00075	0.00245	0.0065	1.24	0.000291	0.0000000	0.0000000
189	75.2	0.0136	0.0076	3.30	0.00000	0.00080	0.0046	1.35	0.000415	0.0000000	0.0000053
190	75.6	0.0011	0.0059	3.80	0.00137	0.00326	0.0047	1.24	0.000261	0.0000326	0.0000155
191	76.0	0.0049	0.0049	3.99	0.00566	0.00182	0.0071	1.36	0.000503	0.0000000	0.0000124
192	76.4	0.0325	0.0050	3.90	0.00217	0.00443	0.0071	1.12	0.000272	0.0000000	0.0000000
193	76.8	0.0000	0.0060	2.95	0.00775	0.00359	0.0071	0.99	0.000178	0.0000000	0.0000082
194	77.2	0.0000	0.0000	2.39	0.00000	0.00335	0.0030	1.06	0.000274	0.0000234	0.0000044
195	77.6	0.0000	0.0222	3.10	0.00694	0.00045	0.0247	1.24	0.000402	0.0000000	0.0000049
196	78.0	0.0152	0.0375	2.74	0.00000	0.00204	0.0091	1.05	0.000257	0.0000991	0.0000000
197	78.4	0.0018	0.0112	2.98	0.00000	0.00504	0.0073	1.10	0.000298	0.0000415	0.0000000
198	78.8	0.0000	0.0054	3.03	0.00000	0.00439	0.0057	1.22	0.000292	0.0000519	0.0000000
199	79.2	0.0060	0.0000	2.34	0.00000	0.00000	0.0025	1.03	0.000341	0.0000278	0.0000036
200	79.6	0.0062	0.0034	2.34	0.00000	0.00191	0.0098	1.35	0.000397	0.0000135	0.0000000
201	80.0	0.0131	0.0118	2.29	0.00000	0.00227	0.0000	1.25	0.000406	0.0000338	0.0000015
202	80.4	0.0000	0.0096	2.63	0.00000	0.00023	0.0000	1.41	0.000452	0.0000008	0.0000146
203	80.8	0.0234	0.0115	2.05	0.01223	0.00000	0.0019	1.34	0.000341	0.0000619	0.0000000
204	81.2	0.0080	0.0114	2.26	0.00666	0.00269	0.0024	1.34	0.000394	0.0000224	0.0000000
205	81.6	0.0325	0.0049	2.97	0.00000	0.00353	0.0069	1.58	0.000533	0.0000107	0.0000117
206	82.0	0.0000	0.0148	1.96	0.00000	0.00000	0.0114	1.21	0.000159	0.0000031	0.0000000
207	82.4	0.0000	0.0000	2.31	0.00000	0.00000	0.0279	1.30	0.000437	0.0000000	0.0000000
208	82.8	0.0048	0.0000	2.23	0.00468	0.00000	0.0050	1.34	0.000418	0.0000000	0.0000317
209	83.2	0.0000	0.0380	2.34	0.00262	0.00000	0.0090	1.44	0.000561	0.0001364	0.0000042

Spot Number	Distance from the foot (mm)	RW75 100 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	Pb/Ca	U/Ca
210	83.6	0.0148	0.0354	1.79	0.00000	0.00000	0.0065	1.43	0.000471	0.0000000	0.0000279
211	84.0	0.0107	0.0000	2.98	0.00560	0.00000	0.0017	1.25	0.000373	0.0000000	0.0000144
212	84.4	0.0082	0.0378	1.85	0.00000	0.00000	0.0015	1.42	0.000099	0.0000000	0.0000000
213	84.8	0.0350	0.0000	4.56	0.00033	0.00156	0.0046	1.28	0.000347	0.0000316	0.0000040
214	85.2	0.0000	0.0507	4.61	0.02131	0.00090	0.0023	1.30	0.000433	0.0001518	0.0000084
215	85.6	0.0064	0.0000	4.22	0.00000	0.00445	0.0097	1.18	0.000316	0.0000535	0.0000034
216	86.0	0.0190	0.0644	4.07	0.00188	0.00000	0.0011	1.43	0.000342	0.0000213	0.0000197
217	86.4	0.0095	0.0342	4.69	0.00222	0.00000	0.0074	1.20	0.000286	0.0000599	0.0000132
218	86.8	0.0000	0.0420	4.83	0.00000	0.00000	0.0079	1.41	0.000251	0.0000000	0.0000000
219	87.2	0.0000	0.0062	4.09	0.00685	0.00411	0.0000	1.26	0.000385	0.0000284	0.0000172
220	87.6	0.0121	0.0101	3.35	0.00000	0.00072	0.0023	1.25	0.000407	0.0000763	0.0000000
221	88.0	0.0126	0.0136	3.27	0.00959	0.00110	0.0000	1.25	0.000414	0.0000374	0.0000000
222	88.4	0.0019	0.0081	4.24	0.00124	0.00205	0.0027	1.16	0.000416	0.0000197	0.0000000
223	88.8	0.0046	0.0000	3.21	0.00593	0.00226	0.0046	1.42	0.000382	0.0000000	0.0000000
224	89.2	0.0000	0.0000	5.11	0.00000	0.00028	0.0000	1.44	0.000274	0.0000504	0.0000000
225	89.6	0.0090	0.0000	3.44	0.00000	0.00402	0.0034	1.21	0.000300	0.0001162	0.0000000
226	90.0	0.0396	0.0334	4.51	0.00597	0.00000	0.0043	1.18	0.000353	0.0000096	0.0000080
227	90.4	0.0000	0.0000	3.92	0.00000	0.00023	0.0080	1.06	0.000333	0.0000000	0.0000032
228	90.8	0.0043	0.0008	5.92	0.00392	0.00000	0.0007	1.32	0.000399	0.0000000	0.0000332
229	91.2	0.0000	0.0000	4.00	0.00246	0.00000	0.0000	1.21	0.000369	0.0000034	0.0000000
230	91.6	0.0054	0.0000	2.79	0.00000	0.00000	0.0041	1.22	0.000047	0.0000000	0.0000000
231	92.0	0.0027	0.0121	2.52	0.00000	0.00415	0.0000	1.32	0.000191	0.0000243	0.0000000
232	92.4	0.0019	0.0000	6.47	0.00000	0.00481	0.0068	1.20	0.000459	0.0000000	0.0000092
233	92.8	0.0285	0.0000	3.46	0.00000	0.00002	0.0012	1.33	0.000306	0.0000000	0.0000301
234	93.2	0.0145	0.0168	3.96	0.01365	0.00265	0.0022	1.26	0.000357	0.0000172	0.0000000
235	93.6	0.0000	0.0447	4.35	0.00099	0.00000	0.0019	1.09	0.000251	0.0000034	0.0000000
236	94.0	0.0084	0.0000	4.41	0.00000	0.00354	0.0044	1.06	0.000078	0.0000000	0.0000000
237	94.4	0.0176	0.0163	4.18	0.00563	0.00228	0.0014	1.04	0.000305	0.0000000	0.0000000
238	94.8	0.0274	0.0000	4.77	0.01220	0.00782	0.0000	1.15	0.000245	0.0000000	0.0000000
239	95.2	0.0138	0.0321	19.06	0.00421	0.00513	0.0038	1.03	0.000338	0.0000087	0.0000000

Spot Number	Distance from the foot (mm)	RW75 100 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	Pb/Ca	U/Ca
240	95.6	0.0280	0.0185	7.36	0.00127	0.00146	0.0000	0.93	0.000263	0.0000517	0.0000317
241	96.0	0.0000	0.0000	7.87	0.00253	0.00412	0.0000	0.95	0.000267	0.0000579	0.0000000
242	96.4	0.0000	0.0134	3.29	0.00000	0.00229	0.0000	0.95	0.000000	0.0000000	0.0000000
243	96.8	0.0102	0.0267	4.11	0.00000	0.00000	0.0087	0.91	0.000204	0.0001189	0.0000000
244	97.2	0.0000	0.0000	4.65	0.01259	0.00102	0.0000	0.83	0.000112	0.0000348	0.0000000
245	97.6	0.0327	0.0000	5.36	0.00322	0.00233	0.0045	0.93	0.000221	0.0000000	0.0000105
246	98.0	0.0000	0.0456	5.25	0.00222	0.00449	0.0000	0.94	0.000230	0.0000000	0.0000000
247	98.4	0.0205	0.0000	2.99	0.00000	0.00000	0.0000	0.99	0.000191	0.0000000	0.0000089
248	98.8	0.0122	0.0058	3.21	0.00000	0.00000	0.0039	1.04	0.000002	0.0000000	0.0000000
249	99.2	0.0000	0.0055	2.63	0.00000	0.00062	0.0083	1.01	0.000173	0.0001321	0.0000000
250	99.6	0.0000	0.0000	3.67	0.00596	0.00000	0.0013	0.97	0.000213	0.0000000	0.0000000
251	100.0	0.0088	0.0014	2.60	0.00000	0.00000	0.0026	1.06	0.000154	0.0000000	0.0000000
252	100.4	0.0000	0.0000	2.73	0.01286	0.00000	0.0087	1.19	0.000278	0.0000587	0.0000251
253	100.8	0.0000	0.0410	2.36	0.00343	0.00000	0.0034	1.49	0.000401	0.0000844	0.0000000
254	101.2	0.0156	0.0122	2.37	0.00000	0.00000	0.0000	1.28	0.000119	0.0000000	0.0000000
255	101.6	0.0258	0.0000	2.55	0.00000	0.00411	0.0082	1.36	0.000374	0.0000530	0.0000607
256	102.0	0.0016	0.0175	2.68	0.00759	0.00641	0.0000	1.15	0.000216	0.0000000	0.0000000
257	102.4	0.0000	0.0000	2.19	0.01905	0.00355	0.0071	1.25	0.000085	0.0000262	0.0000000
258	102.8	0.0000	0.0102	3.13	0.00244	0.00393	0.0081	1.02	0.000177	0.0000000	0.0000000
259	103.2	0.0078	0.0000	2.17	0.01864	0.00000	0.0000	1.34	0.000328	0.0000020	0.0000000
260	103.6	0.0344	0.0000	2.39	0.00000	0.00248	0.0001	1.35	0.000000	0.0000000	0.0000000
261	104.0	0.0081	0.0357	2.57	0.00015	0.00000	0.0091	1.53	0.000345	0.0000000	0.0000000
262	104.4	0.0122	0.0000	2.73	0.00538	0.00000	0.0116	1.42	0.000449	0.0000202	0.0000000
263	104.8	0.0082	0.0031	3.38	0.00000	0.00137	0.0000	1.34	0.000385	0.0000696	0.0000141
264	105.2	0.0132	0.0000	3.08	0.00000	0.00114	0.0055	1.24	0.000377	0.0000000	0.0002636
265	105.6	0.0095	0.0000	2.79	0.03286	0.00108	0.0030	1.24	0.000393	0.0000000	0.0000000
266	106.0	0.0000	0.0000	3.74	0.00000	0.00087	0.0000	1.26	0.000000	0.0000000	0.0000000
267	106.4	0.0431	0.0019	6.07	0.00000	0.00037	0.0101	1.08	0.000299	0.0000000	0.0000048
268	106.8	0.0170	0.0465	0.51	0.00000	0.00000	0.0051	2.41	0.001049	0.0001708	0.0002451
269	107.2	0.0091	0.0389	0.27	0.00000	0.00084	0.0019	1.98	0.000621	0.0001175	0.0000379

Spot Number	Distance from the foot (mm)	RW75 100 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	Pb/Ca	U/Ca
270	107.6	0.0000	0.0000	0.44	0.00658	0.00235	0.0030	1.58	0.000413	0.0001342	0.0000000
271	108.0	0.0120	0.0166	0.33	0.00000	0.00191	0.0040	1.98	0.001696	0.0000157	0.0000000
272	108.4	0.0088	0.0277	0.33	0.00000	0.00000	0.0022	2.00	0.001577	0.0000000	0.0000000
273	108.8	0.0000	0.0157	1.08	0.00271	0.00000	0.0100	1.84	0.002019	0.0000000	0.0000000
274	109.2	0.0185	0.0524	0.55	0.00000	0.00176	0.0073	1.67	0.002195	0.0000174	0.0000000
275	109.6	0.0000	0.0538	0.46	0.00000	0.00157	0.0071	1.75	0.001998	0.0001712	0.0000290
276	110.0	0.0077	0.0470	0.34	0.00000	0.00715	0.0096	1.91	0.002354	0.0001049	0.0000218
277	110.4	0.0000	0.0490	0.97	0.00000	0.00000	0.0081	2.42	0.002503	0.0000132	0.0000000
278	110.8	0.0000	0.0430	6.23	0.00000	0.00376	0.0078	1.47	0.000970	0.0000000	0.0000000
279	111.2	0.0000	0.0213	33.08	0.00000	0.00821	0.0019	0.90	0.000221	0.0000000	0.0000000
280	111.6	0.0000	0.0332	12.57	0.00000	0.00311	0.0086	1.03	0.000375	0.0000000	0.0000000
281	112.0	0.0286	0.0281	11.32	0.00000	0.00576	0.0048	0.93	0.000362	0.0000750	0.0000231
282	112.4	0.0000	0.0181	4.62	0.00000	0.00474	0.0180	0.89	0.000348	0.0000000	0.0000000
283	112.8	0.0186	0.0124	3.21	0.02359	0.00453	0.0095	0.91	0.000201	0.0000952	0.0000000
284	113.2	0.0000	0.0000	4.55	0.00000	0.00105	0.0193	1.06	0.000190	0.0000000	0.0000000
285	113.6	0.0209	0.0208	5.42	0.01120	0.00254	0.0210	1.09	0.000427	0.0000617	0.0002294
286	114.0	0.0000	0.0026	5.54	0.00498	0.00337	0.0274	1.04	0.000384	0.0000396	0.0000000
287	114.4	0.0000	0.0082	4.29	0.03444	0.00292	0.0037	1.13	0.000246	0.0000434	0.0000304
288	114.8	0.0000	0.0000	4.90	0.00000	0.00620	0.0117	1.00	0.000308	0.0000825	0.0000188
289	115.2	0.0273	0.0000	4.69	0.02963	0.00051	0.0090	1.16	0.000403	0.0000000	0.0000303
290	115.6	0.0099	0.1009	4.36	0.00000	0.00258	0.0028	1.14	0.000223	0.0000020	0.0000000
291	116.0	0.0000	0.0222	3.84	0.00000	0.00266	0.0126	1.12	0.000320	0.0000000	0.0000000
292	116.4	0.0000	0.0019	3.95	0.00000	0.00089	0.0044	1.07	0.000319	0.0000000	0.0000468
293	116.8	0.0258	0.0000	4.00	0.00798	0.00221	0.0025	1.01	0.000220	0.0000531	0.0000142
294	117.2	0.0000	0.0299	4.66	0.00013	0.00067	0.0047	1.02	0.000260	0.0000749	0.0000038
295	117.6	0.0000	0.0000	4.58	0.02850	0.00346	0.0105	1.10	0.000261	0.0001074	0.0000000
296	118.0	0.0000	0.0000	4.43	0.00000	0.00242	0.0102	1.12	0.000000	0.0000000	0.0000000
297	118.4	0.0430	0.0277	3.94	0.01226	0.00076	0.0137	1.22	0.000259	0.0000962	0.0000000
298	118.8	0.0480	0.0125	3.83	0.00000	0.00144	0.0187	1.16	0.000401	0.0001201	0.0000245
299	119.2	0.0211	0.0186	3.48	0.00000	0.00565	0.0096	1.22	0.000305	0.0000261	0.0000000

Spot Number	Distance from the foot (mm)	RW75 100 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	Pb/Ca	U/Ca
300	119.6	0.0044	0.0000	3.03	0.00000	0.00378	0.0065	1.04	0.000298	0.0000000	0.0000416
301	120.0	0.0000	0.0000	3.40	0.02042	0.00846	0.0135	1.34	0.000307	0.0000649	0.0000227
302	120.4	0.0283	0.0359	4.77	0.00000	0.00385	0.0058	1.18	0.000000	0.0000000	0.0000000
303	120.8	0.0000	0.0248	3.63	0.00000	0.00481	0.0000	1.17	0.000352	0.0000091	0.0000274
304	121.2	0.0160	0.0000	4.48	0.00000	0.00261	0.0020	1.11	0.000374	0.0001748	0.0000116
305	121.6	0.0000	0.0057	3.85	0.00000	0.00308	0.0000	1.26	0.000252	0.0001085	0.0000000
306	122.0	0.0000	0.0151	5.63	0.00435	0.00475	0.0058	1.20	0.000392	0.0000793	0.0000000
307	122.4	0.0126	0.0000	4.72	0.00877	0.00362	0.0116	1.13	0.000294	0.0000000	0.0000107
308	122.8	0.0000	0.0135	4.88	0.00208	0.00000	0.0087	1.07	0.000039	0.0000000	0.0000000
309	123.2	0.0109	0.0116	5.81	0.00000	0.00693	0.0112	1.24	0.000466	0.0000579	0.0000018
310	123.6	0.0000	0.0253	5.31	0.00000	0.00375	0.0000	1.22	0.000367	0.0000000	0.0000000
311	124.0	0.0436	0.0000	3.95	0.01380	0.00012	0.0128	1.17	0.000298	0.0000963	0.0000229
312	124.4	0.0000	0.0000	3.87	0.01060	0.00272	0.0051	1.07	0.000333	0.0000000	0.0000000
313	124.8	0.0398	0.0110	4.79	0.00000	0.00311	0.0078	1.18	0.000363	0.0000597	0.0000000
314	125.2	0.0147	0.0218	3.19	0.00000	0.00387	0.0070	1.26	0.000368	0.0000491	0.0000000
315	125.6	0.0251	0.0000	3.91	0.00000	0.00377	0.0219	1.31	0.000550	0.0000706	0.0000000
316	126.0	0.0000	0.0000	2.76	0.00000	0.00441	0.0133	1.11	0.000394	0.0000000	0.0000000
317	126.4	0.0000	0.0000	3.06	0.01329	0.00000	0.0076	1.21	0.000404	0.0000068	0.0000140
318	126.8	0.0075	0.0143	3.58	0.00263	0.00617	0.0000	1.08	0.000446	0.0000021	0.0000055
319	127.2	0.0092	0.0069	3.98	0.00000	0.00585	0.0075	1.33	0.000613	0.0000041	0.0000000
320	127.6	0.0074	0.0246	3.70	0.00000	0.00301	0.0065	1.31	0.000465	0.0000000	0.0000000
321	128.0	0.0000	0.0000	3.78	0.00864	0.00203	0.0188	1.31	0.000614	0.0000718	0.0000000
322	128.4	0.0000	0.0110	2.74	0.02914	0.00231	0.0094	1.26	0.000407	0.0000000	0.0000000
323	128.8	0.0126	0.0014	2.68	0.02733	0.00103	0.0223	1.22	0.000522	0.0000000	0.0000000
324	129.2	0.0215	0.0000	2.83	0.00000	0.00048	0.0152	1.25	0.000461	0.0001718	0.0000086
325	129.6	0.0000	0.0193	2.74	0.01219	0.00223	0.0174	1.28	0.000468	0.0001170	0.0000000
326	130.0	0.0089	0.0214	2.30	0.00447	0.00023	0.0045	1.26	0.000312	0.0000000	0.0000000
327	130.4	0.0209	0.0000	3.39	0.00798	0.00686	0.0283	1.35	0.000553	0.0000778	0.0000000
328	130.8	0.0000	0.0000	2.62	0.00000	0.00447	0.0144	1.20	0.000481	0.0000000	0.0000054
329	131.2	0.0044	0.0000	2.66	0.00000	0.00000	0.0194	1.20	0.000338	0.0000610	0.0000424

Spot Number	Distance from the foot (mm)	RW75 100 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	Pb/Ca	U/Ca
330	131.6	0.0105	0.0340	2.46	0.01677	0.00000	0.0085	1.33	0.000353	0.0000313	0.0000000
331	132.0	0.0138	0.0000	3.05	0.00000	0.00586	0.0044	1.27	0.000470	0.0000284	0.0000425
332	132.4	0.0000	0.0000	3.25	0.00261	0.00000	0.0072	1.30	0.000352	0.0000979	0.0000000
333	132.8	0.0353	0.0253	4.30	0.00000	0.00235	0.0083	1.19	0.000421	0.0000000	0.0000000
334	133.2	0.0000	0.0200	3.16	0.00851	0.00594	0.0246	1.15	0.000420	0.0000000	0.0000181
335	133.6	0.0172	0.0116	2.86	0.00316	0.00147	0.0083	1.43	0.000557	0.0000950	0.0000000
336	134.0	0.0360	0.0241	1.79	0.00000	0.00274	0.0035	1.22	0.000439	0.0000489	0.0000165
337	134.4	0.0000	0.0000	2.74	0.00330	0.00273	0.0028	1.37	0.000475	0.0000540	0.0000000
338	134.8	0.0000	0.0000	2.51	0.00000	0.00393	0.0060	1.27	0.000381	0.0000436	0.0000000
339	135.2	0.0000	0.0386	3.30	0.00000	0.00204	0.0111	1.43	0.000399	0.0000801	0.0000000
340	135.6	0.0148	0.0030	2.69	0.04680	0.00133	0.0058	1.55	0.000484	0.0000541	0.0000000
341	136.0	0.0240	0.0000	2.00	0.00395	0.00284	0.0099	1.44	0.000313	0.0000000	0.0000000

APPENDIX 5.1c A740 (1) Prismatic layer data

Spot Number	Distance from the foot (mm)	A740 1 prismatic layer transect corrected data (mmol/mol)					
		Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca
1	0.0	4.65	0.00000	0.00604	0.00000	1.51	0.0005459
2	0.4	5.49	0.00000	0.00000	0.00360	1.27	0.0004191
3	0.8	6.80	0.00000	0.00219	0.00000	1.32	0.0003962
4	1.2	6.20	0.00000	0.00054	0.00000	1.36	0.0005238
5	1.6	5.95	0.01354	0.00000	0.00000	1.13	0.000122
6	2.0	6.73	0.00725	0.00692	0.00000	1.38	0.0003471
7	2.4	6.15	0.00000	0.00218	0.00000	1.50	0.0004478
8	2.8	9.79	0.00000	0.00164	0.00413	1.32	0.0003692
9	3.2	6.89	0.00000	0.00305	0.00259	1.01	0.0001759
10	3.6	29.13	0.00000	0.00000	0.00000	1.14	0.0003965
11	4.0	14.27	0.00462	0.00257	0.00000	0.87	0.0002514
12	4.4	5.75	0.00000	0.00112	0.00000	1.14	0.0003356
13	4.8	6.15	0.00264	0.00000	0.00000	1.12	0.0001975
14	5.2	7.34	0.00051	0.00351	0.00326	1.52	0.0007032
15	5.6	4.98	0.00315	0.00307	0.00000	1.43	0.0005622
16	6.0	5.69	0.00099	0.00000	0.00031	1.15	0.0003537
17	6.4	4.86	0.00000	0.00000	0.00000	1.36	0.0003788
18	6.8	7.17	0.00379	0.00014	0.00269	1.13	0.0005443
19	7.2	5.23	0.00000	0.00251	0.00428	1.34	0.0004321
20	7.6	3.99	0.00000	0.00000	0.00000	1.33	0.0004383
21	8.0	4.93	0.00000	0.00139	0.00007	1.30	0.0004937
22	8.4	8.82	0.00000	0.00536	0.00413	1.47	0.0005541
23	8.8	4.64	0.00000	0.00139	0.00000	1.23	0.0003465
24	9.2	4.72	0.00000	0.00000	0.00236	1.16	0.0003243
25	9.6	4.75	0.00000	0.00343	0.00244	1.13	0.0002089
26	10.0	5.24	0.00248	0.00291	0.00372	1.28	0.0004085
27	10.4	4.19	0.00000	0.00438	0.00000	1.32	0.0003833
28	10.8	4.53	0.00000	0.00381	0.00000	1.37	0.0004329
29	11.2	4.60	0.01395	0.00425	0.00000	1.40	0.0003185

Spot Number	Distance from the foot (mm)	A740 1 prismatic layer transect corrected data (mmol/mol) continued...					
		Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca
30	11.6	4.57	0.00000	0.00000	0.00225	1.33	0.0004224
31	12.0	4.75	0.00000	0.00635	0.00000	1.56	0.00058209
32	12.4	4.69	0.00022	0.00000	0.00000	1.39	0.00062853
33	12.8	4.63	0.00515	0.00412	0.00429	1.37	0.00040738
34	13.2	5.32	0.00000	0.00310	0.00668	1.13	0.00034522
35	13.6	4.43	0.00000	0.00000	0.00000	1.08	0.00034295
36	14.0	5.22	0.00000	0.00004	0.00525	1.25	0.00027799
37	14.4	6.00	0.00537	0.00151	0.00374	1.33	0.00040268
38	14.8	4.49	0.00000	0.00282	0.00000	1.36	0.00044345
39	15.2	5.35	0.00000	0.00429	0.00000	1.37	0.00045623
40	15.6	5.34	0.00488	0.00371	0.00410	1.33	0.000505
41	16.0	4.06	0.00000	0.00450	0.00618	1.08	0.00027394
42	16.4	4.38	0.00000	0.00000	0.00000	1.26	0.00032522
43	16.8	5.60	0.00049	0.00000	0.00366	1.13	0.00024128
44	17.2	5.34	0.00000	0.00807	0.00000	1.26	0.00042615
45	17.6	5.04	0.00000	0.00000	0.00000	1.42	0.00060473
46	18.0	3.93	0.00040	0.00567	0.00021	1.47	0.00086909
47	18.4	3.54	0.00539	0.00000	0.00000	1.38	0.00051035
48	18.8	4.24	0.00350	0.00157	0.00000	1.56	0.00067609
49	19.2	4.60	0.00000	0.00635	0.00000	1.52	0.00066663
50	19.6	4.04	0.00158	0.00454	0.00745	1.41	0.00041938
51	20.0	3.75	0.00005	0.00034	0.00000	1.47	0.00044104
52	20.4	4.23	0.00000	0.00000	0.00645	1.15	0.00031057
53	20.8	3.67	0.00705	0.00196	0.00000	1.39	0.00050079
54	21.2	5.44	0.00000	0.00341	0.01705	1.24	0.00052943
55	21.6	7.07	0.00000	0.00569	0.00000	1.65	0.00064976
56	22.0	3.76	0.00068	0.00000	0.00254	1.56	0.00052012
57	22.4	4.97	0.00204	0.00358	0.00000	1.51	0.00063698
58	22.8	4.27	0.00000	0.00356	0.00056	1.55	0.00061621
59	23.2	6.68	0.00270	0.00622	0.00102	1.36	0.000384
60	23.6	4.03	0.00000	0.00133	0.00000	1.49	0.00058556

Spot Number	Distance from the foot (mm)	A740 1 prismatic layer transect corrected data (mmol/mol) continued...					
		Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca
61	24.0	4.52	0.00000	0.00501	0.00000	1.58	0.0005433
62	24.4	5.01	0.00081	0.00462	0.00377	1.36	0.00057756
63	24.8	5.13	0.00000	0.00264	0.00000	1.32	0.00049099
64	25.2	5.81	0.00108	0.00195	0.00000	1.43	0.00049349
65	25.6	3.81	0.00254	0.00318	0.00308	1.52	0.00067157
66	26.0	9.85	0.00000	0.00921	0.00000	1.50	0.00038309
67	26.4	5.00	0.01604	0.00161	0.00416	1.41	0.00064035
68	26.8	5.88	0.00748	0.00413	0.00562	1.56	0.00055547
69	27.2	16.45	0.00000	0.00233	0.00075	1.67	0.00056942
70	27.6	3.82	0.00083	0.00481	0.00046	1.38	0.00038261
71	28.0	3.90	0.00921	0.00557	0.00000	1.40	0.00037987
72	28.4	4.09	0.00000	0.00291	0.00658	1.41	0.00044948
73	28.8	6.58	0.00000	0.00040	0.00852	1.34	0.00037003
74	29.2	13.26	0.00589	0.00902	0.00000	1.39	0.00061868
75	29.6	7.64	0.01546	0.00241	0.00434	1.22	0.00067377
76	30.0	3.35	0.00000	0.00025	0.00514	1.42	0.00053987
77	30.4	6.48	0.00000	0.00755	0.00376	1.48	0.00045426
78	30.8	1.21	0.00000	0.00229	0.01684	1.49	0.00239995
79	31.2	3.34	0.00000	0.00405	0.00087	1.49	0.00025472
80	31.6	3.23	0.00419	0.00007	0.00000	1.52	0.00039319
81	32.0	3.52	0.01204	0.00165	0.00000	1.31	0.00024349
82	32.4	3.51	0.00000	0.00219	0.00106	1.37	0.00047924
83	32.8	4.08	0.00512	0.00000	0.00000	1.55	0.00040249
84	33.2	4.38	0.00000	0.00080	0.00396	1.28	0.0006958
85	33.6	3.87	0.00000	0.00214	0.00000	1.50	0.00054927
86	34.0	4.41	0.00000	0.00165	0.00000	1.41	0.00027719
87	34.4	4.69	0.00000	0.00115	0.00000	1.34	0.00031733
88	34.8	4.16	0.00000	0.00683	0.00064	1.34	0.00051093
89	35.2	3.18	0.01025	0.00014	0.00000	1.59	0.00043268
90	35.6	4.46	0.00708	0.00526	0.00414	1.29	0.00037802

Spot Number	Distance from the foot (mm)	A740 1 prismatic layer transect corrected data (mmol/mol) continued...					
		Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca
91	36.0	3.45	0.00000	0.00117	0.00504	1.40	0.00032836
92	36.4	4.36	0.00000	0.00000	0.00000	1.19	0.00034675
93	36.8	5.02	0.00000	0.00156	0.00527	1.51	0.00043373
94	37.2	2.11	0.00000	0.00427	0.01319	1.51	0.00186443
95	37.6	3.87	0.00000	0.00492	0.00190	1.50	0.00061101
96	38.0	4.06	0.00323	0.00028	0.00000	1.56	0.00039622
97	38.4	6.55	0.00640	0.00575	0.00383	1.64	0.00063259
98	38.8	5.20	0.00000	0.00390	0.00000	1.42	0.00052849
99	39.2	5.17	0.00000	0.00328	0.00000	1.35	0.00051103
100	39.6	5.30	0.00000	0.00121	0.00000	1.21	8.0132E-05
101	40.0	3.51	0.00784	0.00000	0.00090	1.27	0.00026032
102	40.4	4.61	0.00000	0.00221	0.00282	1.23	0.00039561
103	40.8	6.06	0.00207	0.00283	0.00000	1.42	0.00057584
104	41.2	4.58	0.00846	0.00126	0.00441	1.38	0.00020996
105	41.6	6.79	0.00746	0.00244	0.00876	1.24	0.00052634
106	42.0	5.76	0.00000	0.00140	0.00150	1.26	0.00043475
107	42.4	6.89	0.00000	0.00404	0.00000	1.06	0.00031613
108	42.8	14.44	0.00000	0.00134	0.00000	0.96	0.00016905
109	43.2	3.43	0.00000	0.00242	0.00023	1.16	0.00041105
110	43.6	4.89	0.06412	0.00637	0.01281	1.34	0.00060026
111	44.0	3.77	0.00657	0.00363	0.00345	1.42	0.00063234
112	44.4	3.69	0.00532	0.00079	0.00036	1.13	0.00021114
113	44.8	4.34	0.00475	0.00000	0.00440	1.32	0.00036622
114	45.2	4.15	0.00075	0.00061	0.00000	1.42	0.00046385
115	45.6	5.21	0.00142	0.00370	0.00369	1.33	0.00038149
116	46.0	6.49	0.00000	0.00624	0.00227	1.21	0.00049623
117	46.4	4.25	0.00000	0.00000	0.00000	1.36	0.0005053
118	46.8	4.09	0.00000	0.00280	0.01073	1.25	0.00034221
119	47.2	4.17	0.00056	0.00000	0.00379	1.45	0.00035125
120	47.6	4.42	0.00000	0.00164	0.00000	1.55	0.00054064
121	48.0	4.39	0.00000	0.00000	0.00230	1.20	0.00023953
122	48.4	3.33	0.00000	0.00000	0.00000	1.31	0.00047883

APPENDIX 5.1d A740 (2) prismatic layer transect data

Spot Number	Distance from the foot (mm)	A740 2 prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.0	0.0039	0.0000	4.93	0.0000	0.00000	0.00836	1.42	0.000463	0.000000	0.0000000
2	0.4	0.0119	0.0000	7.37	0.0000	0.00000	0.00000	1.27	0.000410	0.000000	0.0000000
3	0.8	0.0172	0.0000	6.04	0.0000	0.00000	0.01191	1.28	0.000299	0.000226	0.0000268
4	1.2	0.0002	0.0000	6.45	0.0000	0.00000	0.01359	1.25	0.000232	0.000333	0.0000498
5	1.6	0.0181	0.0000	7.16	0.0000	0.00040	0.00844	1.33	0.000287	0.000000	0.0000000
6	2.0	0.0013	0.0000	5.70	0.0000	0.00163	0.00669	1.39	0.000612	0.000175	0.0000289
7	2.4	0.0057	0.0000	10.18	0.0013	0.00000	0.00000	1.32	0.000150	0.000188	0.0000820
8	2.8	0.0000	0.0000	7.81	0.0000	0.00000	0.00000	1.22	0.000306	0.000266	0.0000000
9	3.2	0.0144	0.0000	18.76	0.0000	0.00000	0.00000	1.14	0.000489	0.000352	0.0000000
10	3.6	0.0011	0.0000	5.76	0.0103	0.00000	0.01205	1.02	0.000386	0.000085	0.0000000
11	4.0	0.0149	0.0000	7.82	0.0000	0.00213	0.00029	1.02	0.000000	0.000000	0.0000000
12	4.4	0.0000	0.0000	5.08	0.0000	0.00000	0.00414	1.53	0.000897	0.000506	0.0000000
13	4.8	0.0033	0.0000	4.44	0.0000	0.00000	0.00000	1.26	0.000326	0.000057	0.0000000
14	5.2	0.0131	0.0288	6.17	0.0000	0.00579	0.00000	1.24	0.000298	0.000000	0.0000000
15	5.6	0.0000	0.1321	9.86	0.0000	0.00000	0.04430	1.48	0.000687	0.000011	0.0000000
16	6.0	0.0047	0.0020	4.72	0.0069	0.00512	0.00000	1.48	0.000413	0.000000	0.0000000
17	6.4	0.0085	0.0000	4.95	0.0184	0.00002	0.00000	1.28	0.000586	0.000254	0.0000000
18	6.8	0.0077	0.0000	6.95	0.0000	0.00072	0.00000	1.46	0.000538	0.000259	0.0000000
19	7.2	0.0000	0.0975	5.48	0.0000	0.00000	0.00036	1.43	0.000324	0.000093	0.0000000
20	7.6	0.0161	0.0309	5.47	0.0094	0.00188	0.00317	1.25	0.000427	0.000069	0.0000790
21	8.0	0.0017	0.0000	5.18	0.0022	0.00000	0.00326	1.09	0.000397	0.000336	0.0000000
22	8.4	0.0097	0.0000	5.28	0.0000	0.00065	0.00000	1.29	0.000560	0.000000	0.0000000
23	8.8	0.0050	0.0351	4.41	0.0008	0.00060	0.00000	1.33	0.000412	0.000000	0.0000000
24	9.2	0.0201	0.0944	4.41	0.0000	0.00040	0.00000	1.29	0.000399	0.000398	0.0000000
25	9.6	0.0000	0.0000	4.14	0.0000	0.00319	0.01130	1.26	0.000342	0.000202	0.0000000
26	10.0	0.0149	0.0353	4.73	0.0105	0.00334	0.00000	1.52	0.000612	0.000340	0.0000000
27	10.4	0.0067	0.0679	5.18	0.0100	0.00513	0.00000	1.43	0.000702	0.000000	0.0000165
28	10.8	0.0190	0.0000	5.89	0.0060	0.00132	0.00000	1.46	0.000559	0.000000	0.0000000
29	11.2	0.0143	0.0011	6.58	0.0006	0.00052	0.00378	1.41	0.000413	0.000185	0.0000888

Spot Number	Distance from the foot (mm)	A740 2 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
30	11.6	0.0101	0.1064	5.72	0.0053	0.00306	0.00000	1.20	0.000540	0.000000	0.0000000
31	12.0	0.0102	0.1791	6.34	0.0000	0.00354	0.00849	1.23	0.000821	0.000131	0.0000000
32	12.4	0.0102	0.1684	6.39	0.0025	0.00108	0.00894	1.27	0.000775	0.000000	0.0000000
33	12.8	0.0072	0.0852	4.59	0.0000	0.00293	0.00121	1.34	0.000743	0.000000	0.0000000
34	13.2	0.0118	0.0295	5.17	0.0102	0.00365	0.00181	1.31	0.000589	0.000098	0.0000802
35	13.6	0.0159	0.0293	4.56	0.0000	0.00388	0.00358	1.19	0.000617	0.000265	0.0000737
36	14.0	0.0019	0.0633	4.50	0.0016	0.00307	0.00466	1.13	0.000593	0.000020	0.0000000
37	14.4	0.0185	0.0965	5.53	0.0141	0.00321	0.00000	1.26	0.000451	0.000517	0.0000000
38	14.8	0.0000	0.1598	5.74	0.0037	0.00235	0.00000	1.38	0.000445	0.000176	0.0000000
39	15.2	0.0000	0.0000	5.58	0.0000	0.00069	0.00000	1.36	0.000622	0.000044	0.0000000
40	15.6	0.0146	0.1639	4.27	0.0177	0.00149	0.02359	1.41	0.000441	0.000161	0.0000000
41	16.0	0.0000	0.0108	4.19	0.0000	0.00456	0.00000	1.41	0.000519	0.000078	0.0000767
42	16.4	0.0000	0.0000	3.92	0.0132	0.00880	0.00654	1.38	0.000830	0.000018	0.0000914
43	16.8	0.0076	0.2373	4.86	0.0183	0.00488	0.01104	1.18	0.000625	0.000052	0.0000000
44	17.2	0.0133	0.0214	20.42	0.0156	0.00370	0.01116	1.34	0.000807	0.000000	0.0000503
45	17.6	0.0080	0.0007	4.32	0.0000	0.00533	0.00357	1.19	0.000248	0.000122	0.0000000
46	18.0	0.0142	0.0961	4.62	0.0041	0.00000	0.00000	1.43	0.000684	0.000006	0.0000558
47	18.4	0.0000	0.0000	4.37	0.0064	0.00355	0.00000	1.55	0.000660	0.000310	0.0000125
48	18.8	0.0144	0.1307	4.55	0.0051	0.00587	0.01038	1.31	0.000479	0.000000	0.0000498
49	19.2	0.0135	0.0784	5.42	0.0117	0.00353	0.00000	1.34	0.000526	0.000000	0.0000091
50	19.6	0.0150	0.0150	5.84	0.0000	0.00819	0.01549	1.45	0.000644	0.000000	0.0001046
51	20.0	0.0147	0.0839	4.78	0.0000	0.00000	0.00000	1.50	0.000283	0.000073	0.0000000
52	20.4	0.0064	0.0000	4.05	0.0075	0.00135	0.00792	1.36	0.000000	0.000000	0.0000000
53	20.8	0.0022	0.0177	4.66	0.0018	0.00336	0.00000	1.30	0.000542	0.000000	0.0000817
54	21.2	0.0000	0.0939	3.77	0.0010	0.00503	0.00000	1.37	0.000592	0.000249	0.0000000
55	21.6	0.0026	0.0000	3.94	0.0255	0.01154	0.00000	1.38	0.000221	0.000139	0.0001980
56	22.0	0.0082	0.0069	4.01	0.0000	0.00000	0.00609	1.54	0.000695	0.000000	0.0000000
57	22.4	0.0104	0.0000	5.33	0.0009	0.00213	0.00000	1.48	0.000444	0.000000	0.0000000
58	22.8	0.0118	0.0642	7.78	0.0044	0.00887	0.00000	1.70	0.000928	0.000352	0.0000000
59	23.2	0.0213	0.0000	4.83	0.0036	0.00149	0.00806	1.54	0.000749	0.000027	0.0000587

Spot Number	Distance from the foot (mm)	A740 2 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
60	23.6	0.0108	0.1300	5.16	0.0022	0.00850	0.00229	1.51	0.000482	0.000190	0.0001033
61	24.0	0.0083	0.0000	4.29	0.0011	0.00162	0.00791	1.54	0.000607	0.000111	0.0000000
62	24.4	0.0000	0.0899	4.40	0.0000	0.00198	0.00944	1.40	0.000221	0.000000	0.0000508
63	24.8	0.0071	0.0092	5.27	0.0000	0.00397	0.01079	1.44	0.000187	0.000000	0.0000572
64	25.2	0.0134	0.0903	2.84	0.0107	0.00000	0.00773	1.58	0.000614	0.000132	0.0001949
65	25.6	0.0130	0.1344	3.30	0.0039	0.00019	0.00177	1.54	0.000909	0.000120	0.0000830
66	26.0	0.0122	0.1620	10.61	0.0000	0.00270	0.00806	1.27	0.000458	0.000240	0.0000901
67	26.4	0.0088	0.0867	4.35	0.0000	0.00814	0.00404	1.41	0.000543	0.000000	0.0000000
68	26.8	0.0152	0.0900	3.93	0.0002	0.00449	0.00000	1.38	0.000528	0.000000	0.0001217
69	27.2	0.0077	0.0774	6.00	0.0000	0.00000	0.00939	1.21	0.000590	0.000292	0.0000000
70	27.6	0.0111	0.0938	5.99	0.0069	0.00009	0.00080	1.23	0.000581	0.000085	0.0001039
71	28.0	0.0168	0.0017	10.47	0.0000	0.00712	0.00000	1.68	0.000635	0.000193	0.0000000
72	28.4	0.0146	0.0587	4.83	0.0128	0.00114	0.00303	1.39	0.000448	0.000156	0.0000000
73	28.8	0.0059	0.0000	5.47	0.0050	0.00178	0.00000	1.30	0.000545	0.000152	0.0000000
74	29.2	0.0097	0.0000	5.21	0.0016	0.00565	0.01459	1.22	0.000588	0.000000	0.0001321
75	29.6	0.0100	0.0343	5.41	0.0000	0.00206	0.00109	1.25	0.000269	0.000077	0.0001072
76	30.0	0.0159	0.1463	3.83	0.0193	0.00455	0.00121	1.50	0.000528	0.000000	0.0000524
77	30.4	0.0105	0.0447	3.43	0.0000	0.00658	0.00041	1.42	0.000360	0.000000	0.0000000
78	30.8	0.0160	0.0500	5.74	0.0072	0.00074	0.00000	1.56	0.000652	0.000000	0.0000000
79	31.2	0.0121	0.0594	3.50	0.0000	0.00347	0.00448	1.49	0.000827	0.000290	0.0000000
80	31.6	0.0143	0.0000	4.87	0.0063	0.00142	0.00000	1.66	0.000698	0.000000	0.0000000
81	32.0	0.0070	0.1195	4.98	0.0000	0.00211	0.00000	1.75	0.000299	0.000000	0.0000126
82	32.4	0.0132	0.0379	5.01	0.0000	0.00000	0.00000	1.52	0.000402	0.000000	0.0000000
83	32.8	0.0000	0.0233	5.96	0.0044	0.00407	0.01743	1.41	0.000700	0.000080	0.0000000
84	33.2	0.0044	0.0000	6.29	0.0051	0.00337	0.00000	1.23	0.000140	0.000000	0.0000000
85	33.6	0.0147	0.1415	4.87	0.0000	0.00320	0.00218	1.16	0.000630	0.000104	0.0000000
86	34.0	0.0038	0.0232	3.97	0.0000	0.00130	0.00000	1.50	0.000478	0.000229	0.0000293
87	34.4	0.0000	0.0935	5.06	0.0039	0.00002	0.00000	1.52	0.000195	0.000000	0.0000021
88	34.8	0.0121	0.0377	4.39	0.0000	0.00000	0.00039	1.15	0.000265	0.000000	0.0000051
89	35.2	0.0021	0.0856	6.14	0.0017	0.00150	0.00155	1.47	0.000359	0.000112	0.0000315

Spot Number	Distance from the foot (mm)	A740 2 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
90	35.6	0.0089	0.0349	6.42	0.0091	0.00268	0.00000	1.20	0.000312	0.000220	0.0000000
91	36.0	0.0059	0.0684	16.18	0.0010	0.00176	0.00000	0.90	0.000166	0.000000	0.0001241
92	36.4	0.0149	0.0379	4.26	0.0000	0.00396	0.01408	1.18	0.000467	0.000489	0.0000000
93	36.8	0.0160	0.0000	5.66	0.0000	0.00309	0.00000	1.54	0.000553	0.000000	0.0000000
94	37.2	0.0177	0.0000	5.32	0.0000	0.00521	0.00020	1.43	0.000141	0.000000	0.0000000
95	37.6	0.0121	0.0000	5.51	0.0050	0.00451	0.00000	1.33	0.000212	0.000000	0.0000000
96	38.0	0.0000	0.0602	5.18	0.0026	0.00314	0.00666	1.23	0.000563	0.000108	0.0000092
97	38.4	0.0064	0.0431	5.42	0.0000	0.00516	0.01827	1.29	0.000674	0.000000	0.0000283
98	38.8	0.0120	0.0555	4.86	0.0161	0.00332	0.00000	1.43	0.000330	0.000000	0.0000000
99	39.2	0.0200	0.0820	5.41	0.0057	0.00195	0.00314	1.67	0.000972	0.000021	0.0000000
100	39.6	0.0062	0.0385	4.63	0.0000	0.00352	0.01126	1.27	0.000349	0.000000	0.0000000
101	40.0	0.0072	0.0000	7.37	0.0000	0.00061	0.00000	0.97	0.000171	0.000258	0.0000165
102	40.4	0.0000	0.0083	3.35	0.0000	0.00354	0.00703	1.38	0.000483	0.000014	0.0001071

APPENDIX 5.1e P1B prismatic layer transect data

Spot Number	Distance from the foot (mm)	P1B prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.0	0.0202	0.0000	13.41	0.013	0.00090	0.00436	1.38	0.000180	0.000000	0.0000000
2	0.4	0.0112	0.0000	5.72	0.009	0.00300	0.00141	1.29	0.000425	0.000096	0.0000058
3	0.8	0.0352	0.0000	2.91	0.000	0.00000	0.00104	1.23	0.000424	0.000026	0.0000000
4	1.2	0.0157	0.0000	6.80	0.001	0.00137	0.00000	1.37	0.000533	0.000026	0.0000082
5	1.6	0.0000	0.0572	7.51	0.816	0.00000	0.00249	1.42	0.001322	0.000086	0.0000132
6	2.0	0.0319	0.0000	10.81	0.878	0.00101	0.00291	1.85	0.001735	0.000091	0.0000952
7	2.4	0.0074	0.0143	13.06	0.418	0.00514	0.00000	1.39	0.000917	0.000000	0.0000000
8	2.8	0.0046	0.0737	5.97	0.229	0.01045	0.00325	2.99	0.002304	0.000000	0.0003274
9	3.2	0.0056	0.0026	6.66	0.000	0.00000	0.00049	1.03	0.000244	0.000000	0.0000000
10	3.6	0.0211	0.0000	3.79	0.001	0.00260	0.00000	1.29	0.000441	0.000000	0.0000057
11	4.0	0.0256	0.0000	1.76	0.000	0.00042	0.00170	1.24	0.000281	0.000045	0.0000185
12	4.4	0.0073	0.0094	5.88	0.008	0.00065	0.00057	1.29	0.000374	0.000006	0.0000064
13	4.8	0.0242	0.0027	4.64	0.000	0.00000	0.00000	1.36	0.000087	0.000000	0.0000000
14	5.2	0.0224	0.0272	3.11	0.000	0.00065	0.00199	1.45	0.000396	0.000090	0.0000000
15	5.6	0.0198	0.0086	2.21	0.000	0.00525	0.00254	1.35	0.000406	0.000049	0.0000195
16	6.0	0.0040	0.0000	3.59	0.000	0.00283	0.00466	1.17	0.000378	0.000104	0.0000350
17	6.4	0.0189	0.0046	4.89	0.041	0.00700	0.00315	1.20	0.000345	0.000000	0.0000088
18	6.8	0.0131	0.0000	6.11	0.283	0.00497	0.00000	1.27	0.000520	0.000000	0.0000083
19	7.2	0.0057	0.0124	11.52	0.206	0.00189	0.00000	1.32	0.000594	0.000210	0.0000059
20	7.6	0.0130	0.0000	8.19	0.000	0.00296	0.00000	1.23	0.000348	0.000079	0.0000000
21	8.0	0.0273	0.0454	21.87	3.033	0.00850	0.00616	1.56	0.003996	0.000170	0.0000612
22	8.4	0.0102	0.0000	3.04	0.000	0.00000	0.00000	1.30	0.000393	0.000485	0.0000153
23	8.8	0.0265	0.0132	3.18	0.007	0.00000	0.00000	1.13	0.000309	0.000127	0.0000000
24	9.2	0.0075	0.0000	3.30	0.001	0.00282	0.00112	1.19	0.000342	0.000073	0.0000011
25	9.6	0.0247	0.0048	1.98	0.000	0.00000	0.00005	1.31	0.000274	0.000017	0.0000000
26	10.0	0.0087	0.0493	2.86	0.003	0.00119	0.00488	1.29	0.000343	0.000071	0.0000041
27	10.4	0.0331	0.0225	3.82	0.000	0.00000	0.00646	1.35	0.000378	0.000039	0.0000000
28	10.8	0.0000	0.0365	5.67	1.715	0.00239	0.00022	1.33	0.001023	0.000127	0.0000226
29	11.2	0.0010	0.0000	2.81	0.010	0.00000	0.00289	1.31	0.000362	0.000166	0.0000233

Spot Number	Distance from the foot (mm)	P1B prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
30	11.6	0.0436	0.0054	2.99	0.000	0.00243	0.00000	1.32	0.000371	0.000235	0.0000000
31	12.0	0.0092	0.0016	3.29	0.000	0.00014	0.00000	1.39	0.000477	0.000168	0.0000156
32	12.4	0.0000	0.0349	3.08	0.000	0.00427	0.00328	1.39	0.000536	0.000093	0.0000000
33	12.8	0.0000	0.0096	9.41	0.000	0.00597	0.00616	1.38	0.000536	0.000167	0.0000096
34	13.2	0.0229	0.0000	2.85	0.000	0.00516	0.00698	1.36	0.000369	0.000053	0.0000000
35	13.6	0.0124	0.0378	9.17	0.325	0.00703	0.00249	1.78	0.001123	0.000124	0.0000333
36	14.0	0.0000	0.0342	3.50	0.002	0.00000	0.00000	1.27	0.000317	0.000063	0.0000313
37	14.4	0.0010	0.0280	4.71	0.000	0.00723	0.00934	1.35	0.000441	0.000013	0.0000000
38	14.8	0.0162	0.0000	8.04	0.364	0.01254	0.00727	1.52	0.000921	0.000190	0.0000000
39	15.2	0.0090	0.0000	9.24	0.000	0.00923	0.00745	1.47	0.000631	0.000142	0.0000396
40	15.6	0.0420	0.2066	3.01	1.735	0.05611	0.01162	6.97	0.012180	0.000387	0.0020442
41	16.0	0.0307	0.1297	1.65	0.000	0.02726	0.00745	4.60	0.004621	0.000528	0.0009662
42	16.4	0.0065	0.0363	2.75	0.038	0.00367	0.00472	1.32	0.000385	0.000070	0.0000000
43	16.8	0.0205	0.0074	7.59	0.000	0.01583	0.00206	1.46	0.000513	0.000108	0.0000000
44	17.2	0.0142	0.0104	9.96	0.000	0.01233	0.00159	1.52	0.000595	0.000144	0.0000000
45	17.6	0.0000	0.0084	9.28	0.017	0.00336	0.00170	1.57	0.000660	0.000071	0.0000000
46	18.0	0.0106	0.0294	12.86	0.251	0.00399	0.00406	1.32	0.000699	0.000076	0.0000347
47	18.4	0.0116	0.0000	7.00	0.000	0.00152	0.00590	1.14	0.000373	0.000071	0.0000090
48	18.8	0.0045	0.0090	4.87	0.000	0.00239	0.00216	1.22	0.000484	0.000156	0.0000075
49	19.2	0.0182	0.0105	14.43	1.388	0.00696	0.00722	1.40	0.002101	0.000111	0.0000235
50	19.6	0.0307	0.0036	8.50	1.522	0.02322	0.00336	1.23	0.001619	0.000289	0.0000260
51	20.0	0.0073	0.0134	3.89	0.007	0.01004	0.00984	1.22	0.000508	0.000346	0.0000000
52	20.4	0.0420	0.0365	11.17	0.108	0.02025	0.00137	2.45	0.001680	0.000043	0.0002151
53	20.8	0.0202	0.0023	1.86	0.002	0.00000	0.00195	1.15	0.000203	0.000185	0.0000000
54	21.2	0.0000	0.0278	3.92	0.001	0.00416	0.00273	1.07	0.000323	0.000145	0.0000000
55	21.6	0.0000	0.0150	3.77	0.000	0.00364	0.00016	1.12	0.000436	0.000158	0.0000000
56	22.0	0.0033	0.0325	8.62	0.000	0.00954	0.00200	1.52	0.000573	0.000063	0.0000057
57	22.4	0.0180	0.0213	21.68	0.013	0.02798	0.00025	1.75	0.001179	0.000143	0.0000568
58	22.8	0.0043	0.0289	4.86	0.002	0.00782	0.00000	1.58	0.000591	0.000123	0.0000029
59	23.2	0.0868	0.1632	8.76	17.634	0.17811	0.01101	5.43	0.020799	0.001042	0.0020242

Spot Number	Distance from the foot (mm)	P1B prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
60	23.6	0.0090	0.0274	4.69	0.004	0.01794	0.00345	1.35	0.000473	0.000000	0.0000000
61	24.0	0.0300	0.0000	11.70	0.015	0.00273	0.00216	1.49	0.000678	0.000508	0.0000305
62	24.4	0.0004	0.0000	5.81	0.002	0.01077	0.00000	1.43	0.000557	0.000188	0.0000035
63	24.8	0.0242	0.0332	4.25	0.000	0.00694	0.00749	1.32	0.000620	0.000200	0.0000104
64	25.2	0.0068	0.0028	5.65	0.000	0.00594	0.00000	1.40	0.000315	0.000127	0.0000057
65	25.6	0.0092	0.0228	4.62	0.000	0.00329	0.00000	1.35	0.000352	0.000217	0.0000053
66	26.0	0.0112	0.0240	1.56	0.000	0.00104	0.00589	1.25	0.000297	0.000143	0.0000116
67	26.4	0.0096	0.0069	1.72	0.002	0.00814	0.00391	0.99	0.000233	0.000150	0.0000000
68	26.8	0.0000	0.0062	2.17	0.000	0.00290	0.00000	1.14	0.000428	0.000000	0.0000101
69	27.2	0.0000	0.0146	2.35	0.002	0.01617	0.00457	1.46	0.000477	0.000060	0.0000000
70	27.6	0.0435	0.0174	3.07	0.000	0.01809	0.00275	1.47	0.000412	0.000064	0.0000034
71	28.0	0.0167	0.0000	1.82	0.033	0.00888	0.00196	1.20	0.000329	0.000206	0.0000216
72	28.4	0.0000	0.0000	2.06	0.000	0.00288	0.00955	1.12	0.000240	0.000188	0.0000000
73	28.8	0.0000	0.0027	3.18	0.000	0.00000	0.00059	1.11	0.000356	0.000133	0.0000056
74	29.2	0.0273	0.0000	1.76	0.000	0.00011	0.00000	1.32	0.000412	0.000082	0.0000000
75	29.6	0.0000	0.0430	2.23	0.011	0.00737	0.00567	1.44	0.000451	0.000184	0.0000000
76	30.0	0.0000	0.0337	1.96	0.000	0.00361	0.00170	1.12	0.000298	0.000128	0.0000000
77	30.4	0.0000	0.0183	2.12	0.011	0.00678	0.00713	1.30	0.000228	0.000234	0.0000000
78	30.8	0.0228	0.0019	2.46	0.018	0.01508	0.00521	1.35	0.000486	0.000249	0.0000095
79	31.2	0.0184	0.0045	2.06	0.000	0.00876	0.00276	1.29	0.000402	0.000302	0.0000000
80	31.6	0.0330	0.0039	2.10	0.003	0.00058	0.00000	1.53	0.000423	0.000000	0.0000000
81	32.0	0.0267	0.0094	4.57	0.001	0.00865	0.00000	1.35	0.000416	0.000101	0.0000163
82	32.4	0.0348	0.0000	3.07	0.002	0.00349	0.00000	1.33	0.000260	0.000198	0.0000549
83	32.8	0.0227	0.0221	2.76	0.000	0.00530	0.00230	1.16	0.000474	0.000234	0.0000000
84	33.2	0.0000	0.0017	1.91	0.000	0.01191	0.00078	1.38	0.000415	0.000108	0.0000040
85	33.6	0.0000	0.0115	11.24	0.000	0.00204	0.00750	1.28	0.000288	0.000081	0.0000010
86	34.0	0.0000	0.0205	4.82	0.014	0.02620	0.00058	1.44	0.000569	0.000152	0.0000360
87	34.4	0.0297	0.0237	13.51	0.005	0.00295	0.00000	1.37	0.000420	0.000174	0.0000000
88	34.8	0.0000	0.0042	11.47	0.392	0.01709	0.00369	1.32	0.001082	0.000165	0.0000000
89	35.2	0.0030	0.0153	13.63	0.099	0.00978	0.00000	1.55	0.000826	0.000120	0.0000254

Spot Number	Distance from the foot (mm)	P1B prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
90	35.6	0.0245	0.0654	21.44	5.215	0.03556	0.00117	1.92	0.005976	0.000253	0.0002609
91	36.0	0.0000	0.0192	3.89	0.000	0.00824	0.00061	1.15	0.000413	0.000158	0.0000039
92	36.4	0.0000	0.0977	14.62	0.002	0.03870	0.00859	3.67	0.003782	0.000162	0.0006917
93	36.8	0.0006	0.0132	2.63	0.019	0.00629	0.00000	1.50	0.000467	0.000255	0.0000238
94	37.2	0.0234	0.0000	5.50	0.005	0.00408	0.00223	1.41	0.000432	0.000131	0.0000000
95	37.6	0.0359	0.0630	15.01	10.562	0.07908	0.00151	2.15	0.012339	0.000483	0.0001391
96	38.0	0.0263	0.0143	2.25	0.000	0.00484	0.00000	1.21	0.000297	0.000110	0.0000000
97	38.4	0.0183	0.0044	2.31	0.000	0.00322	0.00374	0.96	0.000225	0.000105	0.0000000
98	38.8	0.0539	0.0414	9.61	6.587	0.06008	0.00719	1.45	0.003410	0.000173	0.0000562
99	39.2	0.0000	0.0018	2.29	0.000	0.00841	0.00155	1.09	0.000402	0.000123	0.0000107
100	39.6	0.0000	0.0007	3.46	0.000	0.00213	0.00000	1.13	0.000402	0.000059	0.0000086
101	40.0	0.0229	0.0177	3.08	0.004	0.01577	0.00036	1.31	0.000479	0.000198	0.0000094
102	40.4	0.0182	0.0219	10.69	1.348	0.02665	0.00479	1.45	0.001684	0.000155	0.0000436
103	40.8	0.0001	0.0103	6.39	0.000	0.00000	0.00000	1.28	0.000574	0.000225	0.0000054
104	41.2	0.0271	0.0342	6.56	0.027	0.00879	0.00292	1.40	0.000443	0.000225	0.0000000
105	41.6	0.0311	0.0000	1.88	0.007	0.00459	0.00573	1.26	0.000367	0.000137	0.0000000
106	42.0	0.0088	0.0009	1.50	0.018	0.00183	0.00089	1.33	0.000306	0.000304	0.0000055
107	42.4	0.0124	0.0248	2.58	0.014	0.00670	0.00000	1.21	0.000395	0.000144	0.0000002
108	42.8	0.0000	0.0098	1.97	0.000	0.01635	0.01019	1.07	0.000341	0.000195	0.0000309
109	43.2	0.0000	0.0030	2.18	0.002	0.00356	0.00795	1.28	0.000307	0.000154	0.0000000
110	43.6	0.0166	0.0000	3.51	0.005	0.00319	0.00047	1.08	0.000365	0.000258	0.0000000
111	44.0	0.0029	0.0239	6.84	0.000	0.00557	0.00120	1.40	0.000707	0.000328	0.0000000
112	44.4	0.0000	0.0000	6.10	0.000	0.00647	0.00380	1.39	0.001755	0.000221	0.0000000
113	44.8	0.0213	0.0038	9.61	0.004	0.02942	0.00475	1.28	0.000507	0.000407	0.0000086
114	45.2	0.0000	0.0000	17.55	0.644	0.00251	0.00233	1.20	0.000876	0.000395	0.0000000
115	45.6	0.0104	0.0469	14.56	0.714	0.01228	0.00588	1.35	0.002156	0.000716	0.0000679
116	46.0	0.0505	0.0429	8.62	0.007	0.00161	0.00474	1.37	0.000489	0.000530	0.0000000

APPENDIX 5.1f P04A prismatic layer transects data

Spot Number	Distance from the foot (mm)	P04A prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.0	0.0093	0.0111	2.26	0.003	0.00000	0.00648	1.26	0.000274	0.000076	0.0000054
2	0.4	0.0066	0.0000	2.37	0.000	0.00000	0.00654	1.39	0.000446	0.000156	0.0000000
3	0.8	0.0087	0.0000	7.92	0.075	0.00679	0.00779	1.17	0.000605	0.000000	0.0000273
4	1.2	0.0141	0.0000	2.53	0.002	0.00336	0.00179	1.20	0.000306	0.000000	0.0000000
5	1.6	0.0076	0.0075	3.06	0.004	0.00000	0.00098	1.13	0.000461	0.000186	0.0000000
6	2.0	0.0194	0.0000	17.13	0.000	0.00000	0.00038	1.48	0.000587	0.000285	0.0000009
7	2.4	0.0216	0.0000	8.97	0.000	0.00000	0.00226	1.49	0.000395	0.000030	0.0000000
8	2.8	0.0119	0.0253	18.40	0.340	0.00547	0.00000	1.64	0.001323	0.000000	0.0000511
9	3.2	0.0090	0.0091	5.10	0.002	0.00189	0.00366	1.44	0.000630	0.000162	0.0000019
10	3.6	0.0079	0.0000	3.37	0.029	0.00000	0.00074	1.16	0.000378	0.000247	0.0000000
11	4.0	0.0337	0.0946	18.76	4.393	0.01479	0.00470	3.09	0.005989	0.000047	0.0000855
12	4.4	0.0237	0.0319	8.55	2.158	0.00311	0.00507	2.25	0.002542	0.000058	0.0000973
13	4.8	0.0152	0.0052	6.18	0.047	0.00179	0.00742	1.52	0.000755	0.000000	0.0000108
14	5.2	0.0742	0.0246	12.17	7.185	0.01496	0.00351	1.44	0.010829	0.000060	0.0000000
15	5.6	0.0112	0.0216	7.84	0.000	0.00000	0.00204	1.22	0.000465	0.000000	0.0000255
16	6.0	0.0286	0.0351	17.08	2.836	0.01434	0.00829	1.38	0.003450	0.000618	0.0000552
17	6.4	0.0163	0.0000	14.26	0.002	0.00220	0.00089	1.37	0.000520	0.000009	0.0000000
18	6.8	0.0202	0.0000	19.05	0.001	0.00213	0.00000	1.13	0.000419	0.000104	0.0000004
19	7.2	0.0061	0.0626	0.90	0.002	0.00000	0.00277	2.65	0.001052	0.000056	0.0000000
20	7.6	0.0082	0.0000	8.95	0.001	0.00038	0.00489	1.38	0.000590	0.000128	0.0000000
21	8.0	0.0070	0.0000	5.27	0.000	0.00000	0.00465	0.98	0.000269	0.000000	0.0000283
22	8.4	0.0082	0.0037	4.52	0.003	0.00311	0.00072	1.16	0.000385	0.000000	0.0000000
23	8.8	0.0162	0.0094	3.63	0.000	0.00000	0.00144	1.22	0.000308	0.000000	0.0000000
24	9.2	0.0080	0.0020	3.06	0.000	0.00000	0.00646	1.22	0.000383	0.000044	0.0000000
25	9.6	0.0108	0.0174	8.04	0.000	0.00397	0.00395	1.06	0.000340	0.000000	0.0000014
26	10.0	0.0216	0.0523	14.01	0.980	0.01713	0.01611	1.66	0.002354	0.000094	0.0000118
27	10.4	0.0109	0.0154	4.04	0.143	0.00000	0.00803	1.42	0.000800	0.000037	0.0000000
28	10.8	0.0085	0.0193	5.17	0.001	0.00439	0.00468	1.41	0.000415	0.000037	0.0000115
29	11.2	0.0085	0.0197	3.83	0.005	0.00000	0.00261	1.09	0.000320	0.000078	0.0000000

Spot Number	Distance from the foot (mm)	P04A prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
30	11.6	0.0110	0.0047	7.61	0.004	0.00083	0.00000	1.21	0.000305	0.000010	0.0000000
31	12.0	0.0060	0.0206	3.40	0.002	0.00000	0.00225	1.19	0.000509	0.000004	0.0000488
32	12.4	0.0084	0.0095	7.03	0.011	0.00652	0.00000	1.45	0.000797	0.000000	0.0000272
33	12.8	0.0285	0.0331	31.11	0.236	0.00967	0.00018	1.41	0.016772	0.000000	0.0000241
34	13.2	0.0255	0.0000	24.74	0.006	0.00630	0.00290	1.22	0.000328	0.000060	0.0000104
35	13.6	0.0244	0.0923	17.06	1.242	0.02066	0.01485	3.04	0.006289	0.000322	0.0002370
36	14.0	0.0215	0.0155	6.95	0.667	0.00715	0.00574	1.43	0.001401	0.000119	0.0000365
37	14.4	0.0160	0.0351	12.67	0.263	0.00378	0.01083	1.53	0.000957	0.000000	0.0000001
38	14.8	0.0228	0.0149	24.09	0.143	0.00000	0.00037	1.75	0.001422	0.000000	0.0000570
39	15.2	0.0087	0.0000	2.59	0.003	0.00000	0.00346	1.36	0.000484	0.000000	0.0000000
40	15.6	0.0093	0.0000	6.67	0.000	0.00000	0.00325	1.46	0.000602	0.000000	0.0000434
41	16.0	0.0065	0.0000	6.38	0.000	0.00472	0.00047	1.37	0.000472	0.000048	0.0000122
42	16.4	0.0111	0.0266	7.09	0.000	0.00072	0.00294	1.25	0.000621	0.000130	0.0000089
43	16.8	0.0069	0.0044	6.03	0.000	0.00081	0.00691	1.25	0.000489	0.000108	0.0000009
44	17.2	0.0162	0.0283	7.16	0.720	0.00285	0.01086	1.36	0.001630	0.000000	0.0000254
45	17.6	0.0167	0.0158	11.61	0.153	0.00440	0.00701	1.42	0.000796	0.000000	0.0000267
46	18.0	0.0165	0.0069	9.82	0.002	0.00068	0.00000	1.41	0.000421	0.000171	0.0000000
47	18.4	0.0143	0.0212	11.12	0.005	0.00254	0.00254	1.31	0.000570	0.000014	0.0000259
48	18.8	0.0194	0.0260	19.10	0.087	0.00161	0.00239	1.49	0.000916	0.000000	0.0000634
49	19.2	0.0406	0.0789	13.77	9.832	0.02674	0.00288	1.29	0.016772	0.000369	0.0004307
50	19.6	0.0054	0.0017	4.32	0.015	0.01308	0.01265	1.31	0.000577	0.000049	0.0000000
51	20.0	0.0147	0.0000	15.66	0.000	0.00000	0.00588	1.15	0.000440	0.000000	0.0000000
52	20.4	0.0123	0.0000	7.88	0.004	0.00393	0.01104	1.03	0.000370	0.000134	0.0000000
53	20.8	0.0169	0.0000	14.67	0.028	0.00373	0.00000	1.12	0.000615	0.000000	0.0000255
54	21.2	0.0128	0.0160	3.11	0.001	0.00094	0.00857	1.28	0.000326	0.000069	0.0000041
55	21.6	0.0031	0.0181	2.60	0.000	0.00153	0.00055	1.09	0.000305	0.000161	0.0000000
56	22.0	0.0092	0.0247	6.64	0.003	0.00115	0.00000	1.10	0.000155	0.000098	0.0000107
57	22.4	0.0134	0.0271	6.91	0.004	0.00044	0.00000	1.07	0.000465	0.000018	0.0000000
58	22.8	0.0051	0.0035	2.84	0.000	0.00000	0.00103	1.08	0.000257	0.000009	0.0000000
59	23.2	0.0043	0.0008	3.69	0.001	0.00095	0.00917	1.27	0.000241	0.000068	0.0000000

Spot Number	Distance from the foot (mm)	P04A prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
60	23.6	0.0065	0.0000	3.11	0.004	0.00000	0.00876	1.25	0.000346	0.000095	0.0000005
61	24.0	0.0099	0.0080	3.37	0.001	0.00000	0.00477	1.01	0.000252	0.000044	0.0000000
62	24.4	0.0068	0.0000	3.04	0.006	0.00121	0.00609	1.27	0.000491	0.000046	0.0000000
63	24.8	0.0084	0.0000	1.81	0.000	0.00000	0.00000	1.44	0.000226	0.000162	0.0000000
64	25.2	0.0081	0.0000	2.26	0.001	0.00223	0.00000	1.23	0.000415	0.000000	0.0000004
65	25.6	0.0090	0.0008	3.20	0.001	0.00129	0.00568	1.11	0.000121	0.000126	0.0000633
66	26.0	0.0137	0.0231	3.44	0.000	0.00240	0.01094	1.25	0.000415	0.000103	0.0000000
67	26.4	0.0172	0.0180	3.40	0.051	0.00670	0.02320	1.43	0.000499	0.000070	0.0000153
68	26.8	0.0089	0.0153	2.86	0.001	0.00712	0.00244	1.15	0.000319	0.000038	0.0000384
69	27.2	0.0105	0.0201	1.61	0.008	0.00000	0.00248	1.70	0.000444	0.000158	0.0000019
70	27.6	0.0103	0.0137	2.88	0.000	0.00126	0.00000	1.25	0.000435	0.000105	0.0000015
71	28.0	0.0173	0.0298	2.64	0.002	0.00251	0.00000	1.22	0.000371	0.000091	0.0000000
72	28.4	0.0125	0.0000	2.86	0.009	0.00194	0.00611	1.27	0.000475	0.000257	0.0000315
73	28.8	0.0115	0.0000	3.54	0.007	0.00000	0.01093	1.37	0.000386	0.000137	0.0000000
74	29.2	0.0091	0.0118	2.20	0.003	0.00000	0.01129	1.25	0.000348	0.000143	0.0000165
75	29.6	0.0152	0.0081	9.71	0.001	0.00544	0.00035	1.45	0.000549	0.000040	0.0000759
76	30.0	0.0116	0.0093	8.45	0.000	0.00202	0.00000	1.09	0.000344	0.000000	0.0000000
77	30.4	0.0128	0.0184	4.49	0.005	0.01510	0.00685	1.35	0.000576	0.000071	0.0000315
78	30.8	0.0125	0.0153	3.20	0.000	0.00159	0.00146	1.47	0.000220	0.000000	0.0000450
79	31.2	0.0104	0.0151	3.43	0.004	0.00234	0.00000	1.37	0.000418	0.000000	0.0000000
80	31.6	0.0135	0.0000	3.93	0.000	0.00859	0.00795	1.30	0.000398	0.000043	0.0000000
81	32.0	0.0199	0.0000	4.31	0.002	0.01094	0.00087	1.59	0.000482	0.000189	0.0000236
82	32.4	0.0120	0.0210	2.41	0.006	0.00000	0.00280	1.38	0.000337	0.000014	0.0000099
83	32.8	0.0126	0.0087	2.65	0.012	0.01650	0.01546	1.26	0.000540	0.000130	0.0000000
84	33.2	0.0155	0.0101	3.17	0.008	0.00340	0.00375	1.39	0.000416	0.000050	0.0000000
85	33.6	0.0108	0.0073	3.76	0.000	0.00000	0.00270	1.28	0.000372	0.000030	0.0000000
86	34.0	0.0116	0.0169	4.48	0.003	0.00000	0.00058	1.30	0.000438	0.000063	0.0000451
87	34.4	0.0156	0.0041	5.67	0.038	0.00538	0.00750	1.43	0.000987	0.000093	0.0000258
88	34.8	0.0142	0.0072	3.92	0.000	0.00393	0.00374	1.23	0.000446	0.000000	0.0000000
89	35.2	0.0143	0.0250	11.64	0.143	0.00431	0.00478	1.53	0.000919	0.000000	0.0000000

Spot Number	Distance from the foot (mm)	P04A prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
90	35.6	0.0155	0.0546	14.83	0.844	0.11925	0.28091	1.44	0.023307	0.003946	0.0002104
91	36.0	0.0230	0.0299	17.07	0.102	0.00875	0.00000	2.00	0.001578	0.000118	0.0001896
92	36.4	0.0181	0.0658	37.26	1.105	0.00930	0.00000	1.86	0.003000	0.000181	0.0001222
93	36.8	0.0076	0.0118	4.16	0.005	0.00503	0.00882	1.09	0.000499	0.000198	0.0000000
94	37.2	0.0000	0.0000	3.35	0.000	0.05852	0.00000	1.35	0.003420	0.000000	0.0000943
95	37.6	0.0195	0.0190	2.68	0.001	0.00386	0.00787	1.28	0.000355	0.000102	0.0000000
96	38.0	0.0104	0.0336	4.30	0.042	0.01683	0.06104	1.34	0.001022	0.000135	0.0000643

APPENDIX 5.1g SC2 prismatic layer transect data

Spot Number	Distance from the foot (mm)	SC2 prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.0	0.0076	0.0144	4.12	0.0000	0.00028	0.00000	1.31	0.000319	0.0000000	0.0000000
2	0.4	0.0113	0.0136	5.76	0.0016	0.00000	0.00187	1.33	0.000415	0.0000000	0.0000120
3	0.8	0.0118	0.0000	6.16	0.0000	0.00000	0.00162	1.07	0.000366	0.0000168	0.0000142
4	1.2	0.0058	0.0334	2.50	0.0000	0.00000	0.00025	1.25	0.000247	0.0000000	0.0000000
5	1.6	0.0118	0.0165	3.07	0.0008	0.00233	0.00000	1.20	0.000198	0.0000286	0.0000211
6	2.0	0.0036	0.0092	3.10	0.0000	0.00000	0.00000	1.15	0.000330	0.0000005	0.0000208
7	2.4	0.0036	0.0079	3.55	0.0000	0.00043	0.00183	1.17	0.000304	0.0000559	0.0000035
8	2.8	0.0133	0.0000	4.16	0.0006	0.00197	0.00069	0.98	0.000261	0.0000000	0.0000132
9	3.2	0.0124	0.0076	3.27	0.0039	0.00099	0.00199	0.96	0.000186	0.0000000	0.0000332
10	3.6	0.0065	0.0506	2.82	0.0000	0.00000	0.00002	0.98	0.000248	0.0000458	0.0000000
11	4.0	0.0055	0.0140	3.53	0.0034	0.00000	0.00459	1.02	0.000235	0.0000180	0.0000000
12	4.4	0.0107	0.0356	4.60	0.0000	0.00084	0.00075	1.03	0.000342	0.0000178	0.0000000
13	4.8	0.0090	0.0000	3.56	0.0000	0.00000	0.00000	1.08	0.000107	0.0000535	0.0000000
14	5.2	0.0133	0.0059	3.65	0.0050	0.00095	0.00143	0.96	0.000232	0.0000000	0.0000075
15	5.6	0.0076	0.0000	4.94	0.0000	0.00343	0.00282	1.04	0.000197	0.0000000	0.0000025
16	6.0	0.0061	0.0000	4.44	0.0004	0.00031	0.00000	1.01	0.000241	0.0000140	0.0000000
17	6.4	0.0144	0.0097	6.09	0.0037	0.00110	0.00429	0.98	0.000249	0.0000366	0.0000000
18	6.8	0.0120	0.0310	4.88	0.0000	0.00378	0.00585	1.19	0.000303	0.0000000	0.0000000
19	7.2	0.0199	0.1198	5.35	0.2046	0.00013	0.00000	1.47	0.000762	0.0000000	0.0000186
20	7.6	0.0111	0.0279	4.41	0.0161	0.00380	0.00258	1.18	0.000344	0.0000054	0.0000101
21	8.0	0.0112	0.0000	6.83	0.3584	0.00267	0.00622	1.52	0.000663	0.0000000	0.0000153
22	8.4	0.0125	0.0000	7.98	0.0030	0.00379	0.00472	1.38	0.000474	0.0000386	0.0000143
23	8.8	0.0112	0.0000	7.10	0.0341	0.00152	0.00068	1.42	0.000449	0.0000290	0.0000108
24	9.2	0.0127	0.0047	9.93	0.0000	0.00364	0.00073	1.60	0.000562	0.0000000	0.0000000
25	9.6	0.0153	0.0000	11.98	0.0071	0.00339	0.00000	1.33	0.000547	0.0000181	0.0000000
26	10.0	0.0083	0.0232	4.62	0.0000	0.00151	0.00030	1.37	0.000433	0.0000028	0.0000000
27	10.4	0.0147	0.0000	7.39	0.0003	0.00204	0.00000	1.22	0.000485	0.0000000	0.0000222
28	10.8	0.0158	0.0113	6.39	0.0000	0.00193	0.00000	1.14	0.000344	0.0000332	0.0000285
29	11.2	0.0103	0.0034	7.60	0.0000	0.00077	0.00115	1.40	0.000439	0.0000073	0.0000145

Spot Number	Distance from the foot (mm)	SC2 prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
30	11.6	0.0112	0.0063	4.93	0.0000	0.00241	0.00000	1.23	0.000449	0.0000224	0.0000000
31	12.0	0.0127	0.0012	8.86	0.0000	0.00337	0.00232	1.32	0.000525	0.0000000	0.0000000
32	12.4	0.0110	0.0000	7.27	0.0000	0.00617	0.00000	1.16	0.000322	0.0000000	0.0000000
33	12.8	0.0062	0.0161	6.86	0.0045	0.00000	0.00000	1.12	0.000351	0.0000000	0.0000016
34	13.2	0.0092	0.0281	10.38	0.0000	0.00000	0.00045	1.31	0.000299	0.0000747	0.0000270
35	13.6	0.0167	0.0203	4.84	0.0000	0.00000	0.00000	1.16	0.000385	0.0000000	0.0000234
36	14.0	0.0158	0.0264	8.11	0.0096	0.00246	0.00000	1.53	0.000568	0.0000000	0.0000013
37	14.4	0.0125	0.0212	4.47	0.0045	0.00296	0.00359	1.14	0.000321	0.0000000	0.0000000
38	14.8	0.0161	0.0000	5.66	0.0055	0.00000	0.00261	1.35	0.000454	0.0000146	0.0000014
39	15.2	0.0130	0.0164	10.93	0.0157	0.00135	0.00258	1.59	0.000707	0.0000308	0.0000184
40	15.6	0.0061	0.0000	3.47	0.0044	0.00217	0.00101	1.26	0.000351	0.0000030	0.0000000
41	16.0	0.0053	0.0000	2.75	0.0000	0.00050	0.00000	1.27	0.000306	0.0000233	0.0000086
42	16.4	0.0100	0.0112	2.97	0.0000	0.00000	0.00000	1.23	0.000330	0.0000103	0.0000000
43	16.8	0.0161	0.0034	9.74	0.1482	0.00357	0.00000	1.69	0.001124	0.0000396	0.0000000
44	17.2	0.0078	0.0285	5.49	0.0000	0.00000	0.00026	1.12	0.000258	0.0000114	0.0000000
45	17.6	0.0119	0.0170	3.43	0.0016	0.00219	0.00000	1.27	0.000348	0.0000051	0.0000000
46	18.0	0.0088	0.0000	5.61	0.0000	0.00355	0.00097	1.13	0.000340	0.0000000	0.0000061
47	18.4	0.0105	0.0000	4.42	0.0037	0.00228	0.00104	1.14	0.000278	0.0000377	0.0000000
48	18.8	0.0076	0.0000	5.58	0.0035	0.00299	0.00252	1.14	0.000313	0.0000227	0.0000000
49	19.2	0.0095	0.0000	4.24	0.0038	0.00089	0.00000	1.25	0.000231	0.0000000	0.0000000
50	19.6	0.0104	0.0097	3.83	0.0012	0.00442	0.00224	1.46	0.000412	0.0000000	0.0000014
51	20.0	0.0081	0.0000	5.42	0.0057	0.00277	0.00000	1.27	0.000438	0.0000000	0.0000132
52	20.4	0.0189	0.0078	9.06	0.0000	0.00230	0.00393	1.06	0.000364	0.0000000	0.0000234
53	20.8	0.0152	0.0000	5.57	0.0062	0.00038	0.00237	1.28	0.000408	0.0000000	0.0000000
54	21.2	0.0135	0.0000	7.62	0.0102	0.00160	0.00287	1.04	0.000271	0.0000000	0.0000126
55	21.6	0.0177	0.0008	7.37	0.0000	0.00195	0.00000	1.73	0.000703	0.0000000	0.0000016
56	22.0	0.0102	0.0000	6.29	0.0047	0.00350	0.00000	1.13	0.000388	0.0000197	0.0000000
57	22.4	0.0064	0.0033	9.10	0.0240	0.00174	0.00070	1.12	0.000417	0.0000000	0.0000000
58	22.8	0.0114	0.0000	9.57	0.0001	0.00421	0.00156	1.17	0.000396	0.0000000	0.0000183
59	23.2	0.0120	0.0212	7.67	0.0000	0.00032	0.00378	1.09	0.000314	0.0000000	0.0000017

Spot Number	Distance from the foot (mm)	SC2 prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
60	23.6	0.0070	0.0169	7.57	0.0010	0.00299	0.00000	1.09	0.000218	0.0000000	0.0000000
61	24.0	0.0126	0.0079	7.56	0.0000	0.00330	0.00037	1.11	0.000281	0.0000000	0.0000160
62	24.4	0.0135	0.0000	7.04	0.0000	0.00000	0.00000	1.08	0.000173	0.0000048	0.0000217
63	24.8	0.0161	0.0258	7.00	0.0032	0.00292	0.00478	0.93	0.000223	0.0000173	0.0000197
64	25.2	0.0071	0.0045	3.93	0.0017	0.00294	0.00029	1.07	0.000248	0.0000551	0.0000008
65	25.6	0.0085	0.0201	2.84	0.0000	0.00114	0.00000	1.16	0.000282	0.0000000	0.0000000
66	26.0	0.0121	0.0000	4.38	0.0006	0.00220	0.00324	1.08	0.000324	0.0000005	0.0000000
67	26.4	0.0083	0.0074	3.42	0.0025	0.00370	0.00199	0.94	0.000234	0.0000255	0.0000000
68	26.8	0.0106	0.0060	4.08	0.0010	0.00267	0.00201	1.21	0.000342	0.0000000	0.0000087
69	27.2	0.0220	0.0179	11.28	0.0234	0.00245	0.00375	1.71	0.001031	0.0000027	0.0000024
70	27.6	0.0099	0.0044	3.18	0.0000	0.00210	0.00378	1.26	0.000283	0.0000000	0.0000000
71	28.0	0.0077	0.0356	4.55	0.0000	0.00051	0.00000	1.30	0.000340	0.0000000	0.0000000
72	28.4	0.0120	0.0017	5.05	0.0018	0.00208	0.00440	1.32	0.000448	0.0000000	0.0000004
73	28.8	0.0084	0.0142	4.82	0.0014	0.00330	0.00000	1.06	0.000296	0.0000000	0.0000000
74	29.2	0.0111	0.0260	4.14	0.0018	0.00116	0.00221	1.10	0.000355	0.0000086	0.0000164
75	29.6	0.0108	0.0000	3.45	0.0017	0.00000	0.00000	1.03	0.000203	0.0000000	0.0000000
76	30.0	0.0096	0.0000	3.23	0.0000	0.00225	0.00305	1.16	0.000268	0.0000000	0.0000000
77	30.4	0.0133	0.0000	4.65	0.0037	0.00000	0.00290	1.44	0.000353	0.0000813	0.0000000
78	30.8	0.0140	0.0146	3.45	0.0000	0.00177	0.00000	1.34	0.000446	0.0000000	0.0000000
79	31.2	0.0095	0.0223	3.29	0.0021	0.00034	0.00418	1.39	0.000448	0.0000142	0.0000089
80	31.6	0.0085	0.0048	2.67	0.0010	0.00073	0.00238	1.26	0.000209	0.0000554	0.0000121
81	32.0	0.0135	0.0159	3.01	0.0031	0.00082	0.00252	1.37	0.000332	0.0000000	0.0000000
82	32.4	0.0127	0.0011	3.29	0.0000	0.00106	0.00526	1.38	0.000416	0.0000000	0.0000000
83	32.8	0.0166	0.0000	3.03	0.0003	0.00033	0.00170	1.22	0.000262	0.0000000	0.0000139
84	33.2	0.0120	0.0000	2.92	0.0000	0.00039	0.00000	1.10	0.000296	0.0000263	0.0000018
85	33.6	0.0174	0.0251	3.25	0.0000	0.00307	0.00000	1.16	0.000346	0.0000000	0.0000254
86	34.0	0.0066	0.0045	3.42	0.0000	0.00444	0.00824	1.14	0.000421	0.0000602	0.0000050
87	34.4	0.0072	0.0047	3.30	0.0009	0.00204	0.00117	1.14	0.000275	0.0000511	0.0000000
88	34.8	0.0068	0.0080	3.14	0.0000	0.00178	0.00083	1.20	0.000275	0.0000212	0.0000000
89	35.2	0.0090	0.0185	4.15	0.0063	0.00336	0.00018	1.36	0.000411	0.0000000	0.0000000

Spot Number	Distance from the foot (mm)	SC2 prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
90	35.6	0.0156	0.0080	8.75	0.1076	0.00122	0.00198	1.46	0.000839	0.0000317	0.0000219
91	36.0	0.0089	0.0000	3.80	0.0000	0.00277	0.00000	1.21	0.000307	0.0000000	0.0000170
92	36.4	0.0075	0.0087	3.45	0.0000	0.00264	0.00219	1.10	0.000328	0.0000000	0.0000000
93	36.8	0.0079	0.0136	3.04	0.0019	0.00148	0.00000	1.27	0.000380	0.0000000	0.0000007
94	37.2	0.0051	0.0047	2.76	0.0000	0.00193	0.00000	1.01	0.000233	0.0000000	0.0000000
95	37.6	0.0113	0.0000	3.84	0.0043	0.00000	0.00104	1.35	0.000356	0.0000000	0.0000000
96	38.0	0.0142	0.0000	4.87	0.0000	0.00370	0.00000	1.14	0.000300	0.0000097	0.0000000
97	38.4	0.0061	0.0000	3.25	0.0000	0.00009	0.00271	1.24	0.000214	0.0000000	0.0000132
98	38.8	0.0076	0.0108	3.71	0.0044	0.00407	0.00084	1.21	0.000304	0.0000000	0.0000011
99	39.2	0.0069	0.0000	3.49	0.0000	0.00010	0.00145	1.06	0.000199	0.0000000	0.0000002
100	39.6	0.0066	0.0000	4.16	0.0000	0.00143	0.00340	1.13	0.000287	0.0000000	0.0000089
101	40.0	0.0138	0.0000	5.23	0.0008	0.00126	0.00251	1.36	0.000379	0.0000006	0.0000000
102	40.4	0.0152	0.0083	7.24	0.0005	0.00140	0.00000	1.14	0.000275	0.0000000	0.0000048
103	40.8	0.0053	0.0107	4.77	0.0000	0.00000	0.00182	1.03	0.000221	0.0000000	0.0000000
104	41.2	0.0144	0.0000	7.66	0.0000	0.00139	0.00028	1.30	0.000540	0.0000162	0.0000248
105	41.6	0.0104	0.0102	8.96	0.0000	0.00231	0.00079	1.13	0.000406	0.0000000	0.0000000
106	42.0	0.0068	0.0109	4.55	0.0000	0.00085	0.00065	0.99	0.000123	0.0000056	0.0000000
107	42.4	0.0060	0.0069	3.15	0.0067	0.00203	0.00096	0.98	0.000276	0.0000000	0.0000000
108	42.8	0.0118	0.0218	4.58	0.0000	0.00208	0.00000	1.02	0.000293	0.0000000	0.0000043
109	43.2	0.0121	0.0261	6.38	0.0021	0.00186	0.00000	1.10	0.000336	0.0000000	0.0000000
110	43.6	0.0068	0.0187	5.36	0.0259	0.00427	0.00815	1.05	0.000290	0.0001358	0.0000000
111	44.0	0.0036	0.0285	4.90	0.0000	0.00180	0.00000	1.13	0.000264	0.0000085	0.0000000
112	44.4	0.0067	0.0000	3.37	0.0000	0.00000	0.00166	1.12	0.000192	0.0000000	0.0000000
113	44.8	0.0101	0.0132	3.11	0.0000	0.00330	0.00342	1.14	0.000333	0.0000000	0.0000095
114	45.2	0.0122	0.0000	3.55	0.0004	0.00134	0.00208	1.10	0.000235	0.0000000	0.0000099
115	45.6	0.0067	0.0250	2.58	0.0038	0.00101	0.00344	1.09	0.000260	0.0000000	0.0000000
116	46.0	0.0099	0.0747	5.85	0.0075	0.00146	0.00510	1.28	0.000393	0.0000353	0.0000000

APPENDIX 5.1h SC1A prismatic layer transect data

Spot Number	Distance from the foot (mm)	SC1A prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.0	0.0000	0.391	4.72	0.0267	0.00159	0.01361	1.37	0.000334	0.000000	0.0000000
2	0.4	0.0109	0.043	5.53	0.0000	0.00534	0.00000	1.37	0.000279	0.000294	0.0000223
3	0.8	0.0267	0.068	2.64	0.0052	0.00033	0.00000	1.33	0.000000	0.000384	0.0000013
4	1.2	0.0000	0.011	1.89	0.0127	0.00225	0.00845	1.28	0.000378	0.000248	0.0000331
5	1.6	0.0000	0.000	2.36	0.0338	0.00000	0.00142	1.18	0.000316	0.000034	0.0000392
6	2.0	0.0000	0.453	2.81	0.0000	0.00125	0.00781	1.09	0.000109	0.000074	0.0000000
7	2.4	0.0000	0.000	3.11	0.0000	0.00056	0.00000	1.12	0.000211	0.000000	0.0000167
8	2.8	0.0633	0.000	2.88	0.0000	0.00000	0.00000	1.12	0.000506	0.000200	0.0000681
9	3.2	0.0295	0.000	2.75	0.0000	0.00000	0.00883	1.15	0.000368	0.000000	0.0000000
10	3.6	0.0020	0.000	3.31	0.0123	0.00082	0.00851	0.79	0.000479	0.000038	0.0000000
11	4.0	0.0881	0.000	3.75	0.0000	0.00090	0.00796	1.40	0.000357	0.000042	0.0000604
12	4.4	0.0000	0.055	2.13	0.0142	0.00087	0.00000	1.28	0.000206	0.000321	0.0000000
13	4.8	0.0000	0.173	2.98	0.0028	0.00000	0.00000	1.24	0.000193	0.000000	0.0000000
14	5.2	0.0000	0.000	2.84	0.0000	0.00139	0.01192	1.39	0.000719	0.000048	0.0000000
15	5.6	0.0000	0.000	1.90	0.0010	0.00000	0.00000	1.27	0.000178	0.000008	0.0000436
16	6.0	0.0000	0.019	2.17	0.0000	0.00110	0.01224	1.36	0.000241	0.000000	0.0000616
17	6.4	0.0903	0.133	2.86	0.0000	0.00000	0.00406	1.51	0.000461	0.000117	0.0000293
18	6.8	0.0000	0.000	3.46	0.0500	0.00167	0.00379	1.42	0.000217	0.000014	0.0000562
19	7.2	0.0000	0.329	4.32	0.0047	0.00000	0.00000	1.29	0.000407	0.000000	0.0000000
20	7.6	0.0000	0.000	1.54	0.0000	0.00214	0.00342	1.39	0.000627	0.000171	0.0000017
21	8.0	0.0999	0.361	1.98	0.0000	0.00251	0.00000	4.29	0.002339	0.000181	0.0004285
22	8.4	0.0000	0.000	2.83	0.0228	0.00029	0.00415	1.46	0.000788	0.000432	0.0000000
23	8.8	0.0000	0.000	8.17	0.0000	0.00000	0.00563	1.63	0.000224	0.000385	0.0000000
24	9.2	0.0000	0.000	2.48	0.0393	0.00000	0.01319	1.50	0.000179	0.000109	0.0000000
25	9.6	0.0000	0.059	3.14	0.0000	0.00289	0.00413	1.36	0.000415	0.000149	0.0000000
26	10.0	0.1358	0.019	4.77	0.0144	0.00243	0.00843	1.48	0.000305	0.000451	0.0000000
27	10.4	0.0134	0.000	2.49	0.0000	0.00000	0.00856	1.23	0.000648	0.000180	0.0000044
28	10.8	0.0000	0.262	1.83	0.0000	0.00186	0.00626	1.29	0.000358	0.000317	0.0000000
29	11.2	0.2136	0.081	2.22	0.0000	0.00021	0.00000	1.46	0.000157	0.000000	0.0000054

Spot Number	Distance from the foot (mm)	SC1A prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	Pb/Ca	U/Ca
30	11.6	0.0088	0.020	2.73	0.0543	0.00039	0.01494	1.28	0.000475	0.000259	0.0000443
31	12.0	0.0000	0.002	2.57	0.0000	0.00000	0.00696	1.13	0.000321	0.000000	0.0000000
32	12.4	0.0000	0.000	2.19	0.0000	0.00373	0.00514	1.11	0.000279	0.000360	0.0000190
33	12.8	0.0125	0.000	1.78	0.0000	0.00232	0.00355	1.12	0.000410	0.000181	0.0000000
34	13.2	0.0000	0.148	3.79	0.0000	0.00216	0.00546	1.25	0.000215	0.000000	0.0000260
35	13.6	0.0000	0.048	3.42	0.0000	0.00000	0.00000	1.21	0.000543	0.000287	0.0000582
36	14.0	0.0000	0.000	4.32	0.0000	0.00405	0.00430	0.95	0.000332	0.000232	0.0000000
37	14.4	0.0538	0.006	7.24	0.0000	0.00297	0.00000	1.23	0.000295	0.000503	0.0000000
38	14.8	0.1219	0.000	7.20	0.0685	0.00347	0.01090	1.35	0.000497	0.000039	0.0000657
39	15.2	0.2489	0.000	1.67	0.0000	0.00151	0.00000	1.15	0.000280	0.000110	0.0000358
40	15.6	0.1005	0.245	2.34	0.0412	0.00349	0.00000	1.17	0.000390	0.000325	0.0000244
41	16.0	0.0000	0.252	4.56	0.0047	0.00389	0.00388	1.31	0.000427	0.000291	0.0000054
42	16.4	0.0695	0.004	7.16	0.2629	0.00480	0.00865	1.41	0.001175	0.000147	0.0000002
43	16.8	0.0000	0.000	3.77	0.0000	0.00297	0.00594	1.30	0.000236	0.000213	0.0000000
44	17.2	0.0000	0.000	3.07	0.0268	0.00102	0.01551	1.37	0.000162	0.000642	0.0000016
45	17.6	0.0898	0.000	2.06	0.0000	0.00000	0.01485	1.34	0.000243	0.000244	0.0000000
46	18.0	0.1062	0.059	4.51	0.0950	0.00180	0.00504	1.40	0.000345	0.000376	0.0000203
47	18.4	0.1011	0.150	4.08	0.0000	0.00106	0.00000	1.51	0.000271	0.000166	0.0000553
48	18.8	0.1980	0.263	2.29	0.0524	0.00000	0.00323	1.40	0.000559	0.000400	0.0000000
49	19.2	0.0000	0.000	2.78	0.0000	0.00159	0.00000	1.34	0.000316	0.000432	0.0000000
50	19.6	0.0000	0.115	3.76	0.0000	0.00241	0.00913	1.39	0.000228	0.000066	0.0000000
51	20.0	0.0000	0.000	2.19	0.0000	0.00372	0.00000	1.33	0.000000	0.000121	0.0000047
52	20.4	0.0060	0.000	3.32	0.0000	0.00297	0.02030	1.27	0.000393	0.000162	0.0000000
53	20.8	0.0000	0.000	5.97	0.0000	0.00123	0.00000	1.39	0.000101	0.000643	0.0000633
54	21.2	0.0000	0.000	2.62	0.0000	0.00000	0.01689	1.28	0.000932	0.000337	0.0000334
55	21.6	0.0000	0.000	2.93	0.0005	0.00201	0.00000	1.32	0.000358	0.000537	0.0000000
56	22.0	0.0761	0.141	2.80	0.0138	0.00000	0.00807	1.63	0.000677	0.000495	0.0000035
57	22.4	0.0000	0.111	4.58	0.0000	0.00097	0.01290	1.57	0.000415	0.000227	0.0000463
58	22.8	0.0298	0.000	5.42	0.0890	0.00000	0.00272	1.38	0.000316	0.000369	0.0000187
59	23.2	0.0992	0.108	6.06	0.0238	0.00000	0.00868	1.68	0.000676	0.000215	0.0000000

Spot Number	Distance from the foot (mm)	SC1A prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	**B/Ca**	**Mg/Ca**	**Al/Ca**	**Mn/Ca**	**Zn/Ca**	**Sr88/Ca**	**Ba/Ca**	**Pb/Ca**	**U/Ca**
60	23.6	0.0613	0.131	3.58	0.0263	0.00231	0.01840	1.49	0.000454	0.000000	0.0000271
61	24.0	0.0000	0.229	4.51	0.0000	0.00000	0.02950	1.52	0.000648	0.000000	0.0000017
62	24.4	0.0153	0.039	3.96	0.0169	0.00245	0.00000	1.43	0.000553	0.000094	0.0000093
63	24.8	0.0000	0.024	3.98	0.0000	0.00000	0.00582	1.61	0.000492	0.000046	0.0000646
64	25.2	0.0000	0.297	2.98	0.0000	0.00304	0.00714	1.29	0.000447	0.000304	0.0000567
65	25.6	0.0000	0.020	3.06	0.0000	0.00026	0.00000	1.57	0.000659	0.000175	0.0001278
66	26.0	0.0341	0.151	4.05	0.0139	0.00250	0.01120	1.44	0.000512	0.000078	0.0000000
67	26.4	0.0396	0.000	3.18	0.0256	0.00256	0.00519	1.47	0.000300	0.000175	0.0000000
68	26.8	0.0424	0.000	2.05	0.0511	0.00235	0.00000	1.31	0.000358	0.000181	0.0000000
69	27.2	0.0000	0.109	3.34	0.0698	0.00192	0.00546	1.44	0.000057	0.000547	0.0000522
70	27.6	0.0000	0.133	2.64	0.0000	0.00066	0.00846	1.30	0.000234	0.000640	0.0000000
71	28.0	0.0672	0.000	2.93	0.0000	0.00050	0.00362	1.36	0.000016	0.000259	0.0000489
72	28.4	0.0000	0.045	2.58	0.0000	0.00000	0.00000	1.15	0.000544	0.000089	0.0000078
73	28.8	0.0000	0.290	2.57	0.0776	0.00245	0.00597	1.30	0.000399	0.000355	0.0000000
74	29.2	0.1236	0.000	2.99	0.0656	0.00000	0.01267	1.19	0.000650	0.000365	0.0000000
75	29.6	0.2374	0.068	2.40	0.0717	0.00684	0.00413	1.24	0.000354	0.000353	0.0000525
76	30.0	0.0596	0.106	3.46	0.0000	0.00000	0.00452	1.27	0.000211	0.000204	0.0000000
77	30.4	0.0229	0.099	2.74	0.0393	0.00000	0.00000	1.18	0.000191	0.000544	0.0000000
78	30.8	0.1799	0.288	2.91	0.0000	0.00455	0.00077	1.32	0.000608	0.000228	0.0000332
79	31.2	0.0000	0.000	3.14	0.0000	0.00317	0.01124	1.21	0.000347	0.000634	0.0000164
80	31.6	0.0000	0.000	4.32	1.4457	0.00000	0.00973	1.56	0.000551	0.000869	0.0000125
81	32.0	0.0398	0.485	3.04	0.0335	0.00482	0.01463	1.36	0.000324	0.000550	0.0000060
82	32.4	0.1113	0.000	2.57	0.0000	0.00427	0.00000	1.38	0.000730	0.000412	0.0000000
83	32.8	0.0146	0.217	7.58	0.0749	0.00394	0.03356	1.60	0.000852	0.000243	0.0000066
84	33.2	0.0299	0.000	3.96	0.0520	0.00099	0.00658	1.60	0.000597	0.000310	0.0000410
85	33.6	0.0030	0.168	3.42	0.0000	0.00000	0.00137	1.53	0.000223	0.000137	0.0000000
86	34.0	0.0000	0.000	3.92	0.0252	0.00311	0.00000	1.23	0.000388	0.000166	0.0000000
87	34.4	0.0713	0.000	2.63	0.0000	0.00000	0.01375	1.33	0.000226	0.000349	0.0000067
88	34.8	0.0000	0.039	7.39	0.0000	0.00105	0.00178	1.67	0.000397	0.000390	0.0000114
89	35.2	0.0000	0.000	9.75	0.0512	0.00265	0.00000	1.87	0.000388	0.000249	0.0000227

Spot Number	Distance from the foot (mm)	SC1A prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	Pb/Ca	U/Ca
90	35.6	0.0000	0.110	3.82	0.0378	0.00110	0.00000	1.61	0.000307	0.000000	0.0000654
91	36.0	0.0000	0.183	2.91	0.0294	0.00199	0.00803	1.43	0.000050	0.000095	0.0000000
92	36.4	0.0000	0.004	5.14	0.9345	0.00484	0.01078	1.64	0.002793	0.000032	0.0000000
93	36.8	0.0625	0.140	4.94	0.0219	0.00044	0.00000	1.64	0.000386	0.000295	0.0000000
94	37.2	0.0000	0.022	8.16	0.0000	0.00000	0.00761	1.73	0.000396	0.000070	0.0000125
95	37.6	0.1394	0.040	2.88	0.0000	0.00341	0.00494	1.46	0.000762	0.000279	0.0000598
96	38.0	0.1434	0.000	3.16	0.0000	0.00000	0.00252	1.33	0.000447	0.000444	0.0000928
97	38.4	0.2065	0.000	4.83	0.0000	0.00203	0.00000	1.36	0.000486	0.000330	0.0000000
98	38.8	0.0832	0.300	4.39	0.0758	0.00041	0.01732	1.40	0.000489	0.000323	0.0000000
99	39.2	0.2083	0.111	17.13	0.0000	0.00179	0.00003	1.46	0.000423	0.000025	0.0000000

APPENDIX 5.1i MP02A prismatic layer transect data

Spot Number	Distance from the foot (mm)	MP02A prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.0	0.0462	0.0316	5.96	0.050	0.00000	0.0000	1.38	0.00039	0.000000	0.0000902
2	0.4	0.0115	0.0000	7.71	0.016	0.00152	0.0246	1.25	0.00057	0.000154	0.0000000
3	0.8	0.0331	0.0696	21.27	0.120	0.00118	0.0000	2.30	0.00106	0.000031	0.0002184
4	1.2	0.0727	0.0504	16.33	2.906	0.00484	0.0033	2.39	0.00423	0.000076	0.0002492
5	1.6	0.0000	0.0474	9.89	0.049	0.00000	0.0048	1.46	0.00043	0.000000	0.0000652
6	2.0	0.0196	0.0000	8.66	0.000	0.00338	0.0048	1.24	0.00051	0.000122	0.0000967
7	2.4	0.0231	0.0250	15.85	1.737	0.01111	0.0000	1.24	0.00165	0.000084	0.0000000
8	2.8	0.0711	0.0800	6.54	0.392	0.00000	0.0027	1.44	0.00089	0.000326	0.0000426
9	3.2	0.0088	0.0245	9.38	0.316	0.00680	0.0129	1.61	0.00125	0.000121	0.0000526
10	3.6	0.0766	0.0870	15.56	19.871	0.06430	0.0256	1.53	0.01620	0.000616	0.0001179
11	4.0	0.0416	0.1183	10.37	1.033	0.00167	0.0009	1.69	0.00415	0.000000	0.0000739
12	4.4	0.0000	0.1017	8.89	0.000	0.00186	0.0022	1.08	0.00043	0.000028	0.0000000
13	4.8	0.0516	0.0000	22.98	0.000	0.00000	0.0000	1.22	0.00065	0.000026	0.0000760
14	5.2	0.0681	0.0504	6.28	0.046	0.00990	0.0034	1.31	0.00045	0.000046	0.0000000
15	5.6	0.0000	0.0000	6.29	0.020	0.00226	0.0000	1.23	0.00020	0.000000	0.0000125
16	6.0	0.0235	0.0820	11.54	0.834	0.01171	0.0024	1.51	0.00230	0.000152	0.0000435
17	6.4	0.0084	0.0699	14.66	2.397	0.03937	0.0153	1.50	0.00273	0.000625	0.0000000
18	6.8	0.0244	0.0333	4.84	0.000	0.00000	0.0000	1.41	0.00038	0.000242	0.0000000
19	7.2	0.0047	0.0000	7.14	0.052	0.00341	0.0101	1.40	0.00042	0.000159	0.0000000
20	7.6	0.0713	0.0017	9.76	0.058	0.00125	0.0090	1.48	0.00082	0.000005	0.0000000
21	8.0	0.0016	0.0162	4.15	0.021	0.00000	0.0015	1.38	0.00051	0.000000	0.0000031
22	8.4	0.0000	0.0222	2.30	0.007	0.00000	0.0158	1.19	0.00019	0.000000	0.0000320
23	8.8	0.0000	0.0220	4.86	0.000	0.00092	0.0000	1.27	0.00050	0.000122	0.0000000
24	9.2	0.0196	0.0230	4.35	0.335	0.00000	0.0000	1.33	0.00082	0.000000	0.0000000
25	9.6	0.0000	0.0046	4.89	0.000	0.00357	0.0000	1.20	0.00032	0.000000	0.0000000
26	10.0	0.0401	0.0138	3.91	0.011	0.00575	0.0000	1.14	0.00028	0.000107	0.0000798
27	10.4	0.0571	0.0403	4.72	0.002	0.00000	0.0120	1.21	0.00039	0.000095	0.0000000
28	10.8	0.0000	0.0128	3.79	0.000	0.00000	0.0000	1.13	0.00047	0.000022	0.0000002
29	11.2	0.0644	0.0000	4.66	0.015	0.00187	0.0041	1.18	0.00027	0.000075	0.0000000

Spot Number	Distance from the foot (mm)	MP02A prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
30	11.6	0.0323	0.0000	2.18	0.000	0.00268	0.0008	1.14	0.00019	0.000000	0.0000000
31	12.0	0.0000	0.0014	2.24	0.000	0.00336	0.0007	1.18	0.00017	0.000034	0.0000430
32	12.4	0.0299	0.0551	4.75	0.013	0.00155	0.0000	1.34	0.00040	0.000047	0.0000066
33	12.8	0.0193	0.0000	5.24	0.041	0.00686	0.0032	1.44	0.00026	0.000060	0.0000172
34	13.2	0.0513	0.0384	10.03	0.001	0.00000	0.0034	1.30	0.00025	0.000316	0.0000078
35	13.6	0.0055	0.0000	9.75	0.080	0.00000	0.0081	1.29	0.00052	0.000000	0.0000000
36	14.0	0.0318	0.0000	12.47	0.000	0.00170	0.0013	1.37	0.00057	0.000001	0.0000000
37	14.4	0.0702	0.0408	12.00	0.162	0.00809	0.0000	1.31	0.00099	0.000055	0.0000000
38	14.8	0.0000	0.0000	5.82	0.580	0.00630	0.0017	1.17	0.00066	0.000100	0.0000483
39	15.2	0.0192	0.0176	15.20	0.015	0.00470	0.0033	1.56	0.00055	0.000036	0.0000293
40	15.6	0.0000	0.0000	5.74	0.221	0.35373	0.0000	1.50	0.00072	0.015897	0.0004891
41	16.0	0.0194	0.0343	5.01	0.003	0.00432	0.0029	1.06	0.00029	0.000044	0.0000198
42	16.4	0.0514	0.0232	9.69	0.164	0.01940	0.0000	2.64	0.00235	0.000034	0.0002422
43	16.8	0.0085	0.0236	3.87	0.000	0.00614	0.0034	1.43	0.00059	0.000000	0.0000000
44	17.2	0.0218	0.0000	4.65	0.040	0.00251	0.0000	0.94	0.00027	0.000000	0.0000000
45	17.6	0.0512	0.0149	5.87	0.000	0.00621	0.0000	1.25	0.00042	0.000000	0.0000000
46	18.0	0.0000	0.0297	8.13	0.013	0.03702	0.0038	1.27	0.00077	0.000148	0.0000283
47	18.4	0.0374	0.0367	2.32	0.006	0.03366	0.0000	1.23	0.00058	0.000115	0.0000000
48	18.8	0.0042	0.0056	3.76	0.000	0.02933	0.0055	1.09	0.00051	0.000225	0.0000000
49	19.2	0.0321	0.0157	2.41	0.036	0.00936	0.0015	1.29	0.00033	0.000000	0.0000000
50	19.6	0.0000	0.0000	2.26	0.012	0.01729	0.0165	1.09	0.00119	0.000116	0.0000263
51	20.0	0.0000	0.0171	2.13	0.000	0.00000	0.0000	1.00	0.00012	0.000092	0.0000470
52	20.4	0.0000	0.0347	2.02	0.021	0.01035	0.0045	1.07	0.00027	0.000078	0.0000213
53	20.8	0.0367	0.0866	15.30	0.000	0.01264	0.0013	1.68	0.00083	0.000190	0.0000186
54	21.2	0.0181	0.0398	12.49	0.028	0.00512	0.0099	1.21	0.00037	0.000018	0.0000232
55	21.6	0.0454	0.0000	5.55	0.000	0.00592	0.0046	1.36	0.00039	0.000000	0.0000000
56	22.0	0.0045	0.0000	3.24	0.000	0.02014	0.0217	1.25	0.00036	0.000055	0.0000000
57	22.4	0.0052	0.0000	10.08	0.000	0.00126	0.0132	1.41	0.00069	0.000000	0.0000220
58	22.8	0.0241	0.0686	2.72	0.044	0.00973	0.0096	1.21	0.00082	0.000114	0.0002164
59	23.2	0.0302	0.0000	6.02	0.280	0.00000	0.0031	1.32	0.00064	0.000072	0.0000110

Spot Number	Distance from the foot (mm)	MP02A prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
60	23.6	0.0886	0.0000	3.14	0.000	0.01188	0.0038	1.30	0.00036	0.000097	0.0000000
61	24.0	0.0371	0.0000	2.56	0.000	0.02282	0.0226	1.43	0.00047	0.000205	0.0000000
62	24.4	0.0271	0.0000	8.39	0.021	0.00476	0.0000	1.39	0.00040	0.000250	0.0000328
63	24.8	0.0076	0.0459	2.88	0.000	0.05752	0.0000	1.35	0.00066	0.000197	0.0000490
64	25.2	0.0132	0.0000	9.54	0.000	0.00000	0.0053	1.44	0.00026	0.000060	0.0000190
65	25.6	0.0023	0.0046	6.92	0.000	0.01585	0.0010	1.37	0.00045	0.000000	0.0000217
66	26.0	0.0489	0.0422	4.53	1.262	0.00129	0.0041	1.17	0.00119	0.000007	0.0000388
67	26.4	0.0000	0.0000	5.07	0.000	0.00000	0.0000	0.90	0.00025	0.000049	0.0000000
68	26.8	0.0089	0.0000	6.89	0.001	0.00000	0.0000	0.82	0.00023	0.000000	0.0000000
69	27.2	0.0145	0.0000	3.27	0.000	0.00118	0.0059	1.11	0.00047	0.000124	0.0000341
70	27.6	0.0173	0.0063	2.94	0.000	0.00446	0.0000	1.08	0.00032	0.000000	0.0000045
71	28.0	0.0000	0.0000	2.70	0.000	0.00123	0.0042	1.08	0.00027	0.000000	0.0000063
72	28.4	0.0214	0.0014	2.07	0.000	0.00028	0.0022	1.16	0.00032	0.000000	0.0000000
73	28.8	0.0399	0.0546	3.60	0.007	0.00457	0.0120	1.14	0.00020	0.000060	0.0000000
74	29.2	0.0243	0.0048	2.90	0.021	0.00157	0.0012	1.16	0.00033	0.000028	0.0000290
75	29.6	0.0113	0.0000	3.37	0.014	0.02452	0.0069	1.31	0.00075	0.000123	0.0000196
76	30.0	0.0088	0.0034	3.65	0.002	0.03970	0.0034	1.31	0.00098	0.000211	0.0000004
77	30.4	0.0055	0.0142	3.50	0.001	0.01040	0.0024	1.34	0.00042	0.000021	0.0000061
78	30.8	0.0069	0.0122	4.16	0.000	0.00445	0.0000	1.17	0.00038	0.000009	0.0000070
79	31.2	0.0047	0.0059	2.45	0.000	0.02625	0.0020	1.21	0.00041	0.000048	0.0000112
80	31.6	0.0092	0.0052	2.68	0.001	0.00921	0.0004	1.24	0.00034	0.000005	0.0000054
81	32.0	0.0086	0.0052	3.43	0.000	0.01071	0.0005	1.30	0.00038	0.000002	0.0000050
82	32.4	0.0000	0.0000	3.76	0.000	0.01955	0.0067	1.11	0.00064	0.000000	0.0000000
83	32.8	0.0169	0.0000	2.91	0.000	0.00981	0.0000	1.20	0.00034	0.000000	0.0000000
84	33.2	0.0050	0.0197	3.97	0.017	0.00154	0.0000	1.16	0.00036	0.000000	0.0000051
85	33.6	0.0000	0.0000	3.32	0.009	0.02676	0.0131	1.32	0.00025	0.000138	0.0000000
86	34.0	0.0173	0.0000	5.13	0.000	0.02055	0.0079	1.33	0.00046	0.000100	0.0000267
87	34.4	0.0000	0.0000	2.71	0.000	0.00000	0.0059	1.27	0.00031	0.000138	0.0000000
88	34.8	0.0000	0.0000	2.33	0.000	0.00024	0.0092	1.22	0.00000	0.000000	0.0000000
89	35.2	0.0000	0.0106	2.80	0.000	0.00261	0.0000	1.14	0.00020	0.000000	0.0000000

Spot Number	Distance from the foot (mm)	MP02A prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
90	35.6	0.0212	0.0682	1.35	0.047	0.05381	0.0052	2.62	0.00262	0.000111	0.0002542
91	36.0	0.0548	0.0162	4.78	0.010	0.00323	0.0093	0.99	0.00024	0.000000	0.0000624
92	36.4	0.0489	0.0234	2.61	0.000	0.01158	0.0046	1.15	0.00055	0.000000	0.0000000
93	36.8	0.0000	0.0584	2.10	0.000	0.00619	0.0117	1.20	0.00031	0.000037	0.0000087
94	37.2	0.0000	0.0248	2.67	0.000	0.01867	0.0000	1.07	0.00000	0.000026	0.0000000
95	37.6	0.0264	0.0075	4.61	0.019	0.03240	0.0000	1.40	0.00048	0.000089	0.0000098
96	38.0	0.0000	0.0187	3.74	0.035	0.01047	0.0000	1.12	0.00022	0.000076	0.0000000
97	38.4	0.0078	0.0000	2.56	0.017	0.00216	0.0000	1.25	0.00024	0.000233	0.0000000
98	38.8	0.0000	0.0086	12.16	0.066	0.00912	0.0075	1.50	0.00082	0.000000	0.0000000
99	39.2	0.0000	0.0254	7.50	0.044	0.00874	0.0021	1.56	0.00041	0.000198	0.0000000
100	39.6	0.0000	0.0520	2.73	0.000	0.00348	0.0030	1.46	0.00026	0.000019	0.0000000
101	40.0	0.0198	0.0037	5.78	0.000	0.01727	0.0000	1.26	0.00031	0.000032	0.0000000
102	40.4	0.0182	0.0000	3.51	0.005	0.01540	0.0025	1.73	0.00053	0.000148	0.0000000
103	40.8	0.0211	0.0013	2.99	0.025	0.00755	0.0001	1.41	0.00038	0.000027	0.0000297
104	41.2	0.0178	0.0000	1.76	0.007	0.00460	0.0053	1.38	0.00034	0.000000	0.0000000
105	41.6	0.0000	0.0135	1.86	0.000	0.00475	0.0002	1.22	0.00028	0.000000	0.0000000
106	42.0	0.0075	0.0174	2.08	0.009	0.00100	0.0022	1.20	0.00024	0.000000	0.0000000
107	42.4	0.0000	0.0000	3.19	0.000	0.01170	0.0000	1.09	0.00028	0.000000	0.0000126
108	42.8	0.0000	0.0106	3.29	0.023	0.00459	0.0000	1.19	0.00056	0.000000	0.0000000
109	43.2	0.0000	0.0000	3.22	0.011	0.01270	0.0039	1.23	0.00044	0.000018	0.0000787
110	43.6	0.0000	0.0143	2.09	0.002	0.00537	0.0007	1.28	0.00036	0.000066	0.0000048
111	44.0	0.0000	0.0305	15.12	0.214	0.00075	0.0000	1.42	0.00072	0.000000	0.0000000
112	44.4	0.0158	0.0177	14.15	11.205	0.09814	0.0209	1.47	0.01338	0.000539	0.0000000
113	44.8	0.0030	0.0148	2.91	0.000	0.00209	0.0012	1.14	0.00032	0.000035	0.0000144
114	45.2	0.0112	0.0362	9.34	3.120	0.00936	0.0024	1.37	0.00265	0.000247	0.0000117
115	45.6	0.0136	0.0273	6.68	0.165	0.00000	0.0000	1.10	0.00058	0.000037	0.0000000
116	46.0	0.0150	0.0000	10.95	0.065	0.01308	0.0107	1.50	0.00099	0.000000	0.0000221

APPENDIX 5.1j KD1B prismatic layer transect data

Spot Number	Distance from the foot (mm)	KD1B prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr8/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.0	0.0102	0.0549	11.60	0.3835	0.00000	0.00000	1.72	0.001184	0.0000000	0.0000000
2	0.4	0.0000	0.0006	14.74	0.0175	0.00000	0.00329	1.29	0.000657	0.0000183	0.0000000
3	0.8	0.0213	0.0576	12.23	5.6329	0.02065	0.00000	1.19	0.007106	0.0000554	0.0000454
4	1.2	0.0185	0.0000	3.40	0.0000	0.00000	0.00000	1.17	0.000436	0.0000000	0.0000352
5	1.6	0.0009	0.0000	4.65	0.0000	0.00000	0.00548	0.94	0.000335	0.0000000	0.0000167
6	2.0	0.0072	0.0019	7.29	0.0046	0.00095	0.00769	1.25	0.001169	0.0000000	0.0000017
7	2.4	0.0225	0.0151	6.96	0.0000	0.00259	0.00287	1.19	0.000730	0.0001188	0.0000000
8	2.8	0.0078	0.0000	5.91	0.0002	0.00098	0.00000	1.36	0.000680	0.0000493	0.0000139
9	3.2	0.0000	0.0284	1.84	0.0078	0.00000	0.00710	1.32	0.000480	0.0000000	0.0000197
10	3.6	0.0000	0.0365	4.85	0.0000	0.00064	0.00111	1.21	0.000474	0.0001135	0.0000013
11	4.0	0.0191	0.0000	2.76	0.0032	0.00134	0.00000	1.15	0.000389	0.0000000	0.0000055
12	4.4	0.0009	0.0255	3.71	0.0050	0.00000	0.00000	1.20	0.000426	0.0000000	0.0000182
13	4.8	0.0129	0.0160	4.15	0.0055	0.00091	0.00000	1.28	0.000444	0.0000151	0.0000026
14	5.2	0.0307	0.0000	6.97	0.0010	0.00000	0.00149	1.06	0.000376	0.0000000	0.0000205
15	5.6	0.0253	0.0015	9.61	0.0017	0.00000	0.00376	1.06	0.000310	0.0000000	0.0000000
16	6.0	0.0069	0.0000	7.59	0.0000	0.00042	0.00509	1.25	0.000552	0.0000455	0.0000128
17	6.4	0.0235	0.0000	5.60	0.0000	0.00178	0.00520	1.44	0.000598	0.0000300	0.0000000
18	6.8	0.0225	0.0000	13.90	0.0055	0.00188	0.00106	1.42	0.000467	0.0000000	0.0000080
19	7.2	0.0242	0.0090	6.38	0.0067	0.00461	0.00248	1.32	0.000534	0.0000000	0.0000216
20	7.6	0.0077	0.0305	3.67	0.0000	0.00076	0.00240	1.23	0.000508	0.0000122	0.0000000
21	8.0	0.0186	0.0313	14.01	0.1789	0.00306	0.00000	1.62	0.001004	0.0001004	0.0000107
22	8.4	0.0151	0.1780	5.35	0.1858	0.00444	0.00710	4.41	0.004161	0.0000890	0.0004747
23	8.8	0.0000	0.0392	12.42	0.0059	0.00008	0.01019	1.55	0.000654	0.0000144	0.0000000
24	9.2	0.0275	0.0200	3.47	0.0000	0.00000	0.00060	1.28	0.000406	0.0000000	0.0000000
25	9.6	0.0111	0.0000	2.49	0.0032	0.00272	0.00000	1.03	0.000343	0.0000509	0.0000146
26	10.0	0.0000	0.0000	2.82	0.0000	0.00101	0.00078	1.00	0.000335	0.0000000	0.0000000
27	10.4	0.0117	0.0000	3.21	0.0033	0.00000	0.00000	0.91	0.000237	0.0000000	0.0000000
28	10.8	0.0000	0.0204	2.74	0.0000	0.00380	0.00506	1.06	0.000405	0.0000196	0.0000000
29	11.2	0.0000	0.0183	2.35	0.0000	0.00150	0.00721	1.20	0.000343	0.0001198	0.0000000

Spot Number	Distance from the foot (mm)	KD1B prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr8/Ca	Ba/Ca	Pb/Ca	U/Ca
30	11.6	0.0100	0.0316	7.25	0.0058	0.00103	0.00488	1.34	0.000622	0.0000583	0.0000000
31	12.0	0.0150	0.0325	2.32	0.0072	0.00134	0.00428	1.17	0.000474	0.0000000	0.0000064
32	12.4	0.0251	0.0227	2.04	0.0000	0.00604	0.00477	1.14	0.000251	0.0000112	0.0000000
33	12.8	0.0123	0.0081	3.11	0.0014	0.00056	0.00220	0.96	0.000323	0.0000000	0.0000113
34	13.2	0.0000	0.0000	3.47	0.0000	0.00077	0.00144	1.30	0.000343	0.0000000	0.0000000
35	13.6	0.0311	0.0107	3.94	0.0001	0.00259	0.00217	1.27	0.000449	0.0001274	0.0000000
36	14.0	0.0190	0.0254	2.44	0.0000	0.00126	0.00204	0.99	0.000265	0.0001024	0.0000000
37	14.4	0.0099	0.0173	2.24	0.0008	0.00273	0.00000	1.13	0.000361	0.0000306	0.0000000
38	14.8	0.0389	0.0520	5.39	0.0005	0.00376	0.00178	1.46	0.000527	0.0000000	0.0000186
39	15.2	0.0215	0.0215	5.62	0.0068	0.00279	0.00193	1.26	0.000357	0.0000166	0.0000000
40	15.6	0.0089	0.0000	6.89	0.0096	0.00000	0.00000	1.33	0.000458	0.0000755	0.0000194
41	16.0	0.0136	0.0248	4.76	0.0032	0.00193	0.00156	1.14	0.000396	0.0000153	0.0000060
42	16.4	0.0097	0.0273	4.22	0.0000	0.00221	0.00000	1.10	0.000624	0.0000000	0.0000000
43	16.8	0.0447	0.0377	16.70	8.9357	0.04311	0.01063	1.33	0.010851	0.0001414	0.0000282
44	17.2	0.0000	0.0120	5.33	0.0000	0.00233	0.00000	1.03	0.000319	0.0000182	0.0000000
45	17.6	0.0230	0.0083	6.02	0.0018	0.00007	0.00109	1.04	0.000500	0.0000366	0.0000042
46	18.0	0.0056	0.0000	5.40	0.0000	0.00104	0.00494	0.97	0.000348	0.0000298	0.0000047
47	18.4	0.0136	0.0093	4.45	0.0017	0.00195	0.00774	1.27	0.000399	0.0000099	0.0000239
48	18.8	0.0000	0.0305	5.30	0.0000	0.00375	0.00065	1.27	0.000465	0.0000213	0.0000124
49	19.2	0.0003	0.0163	11.91	0.0506	0.00628	0.00000	1.32	0.000834	0.0000000	0.0000000
50	19.6	0.0317	0.0249	9.32	0.4056	0.00156	0.00364	1.40	0.001401	0.0000876	0.0000150
51	20.0	0.0333	0.0036	4.99	0.0147	0.00073	0.00230	1.30	0.000582	0.0000170	0.0000258
52	20.4	0.0164	0.0496	6.84	2.1834	0.00578	0.00284	1.25	0.005260	0.0000947	0.0000000
53	20.8	0.0000	0.0098	3.66	0.0083	0.00128	0.00542	1.16	0.000421	0.0000376	0.0000121
54	21.2	0.0000	0.0000	2.81	0.0007	0.00244	0.00000	1.27	0.000552	0.0000000	0.0000137
55	21.6	0.0105	0.0088	2.06	0.0035	0.00000	0.00000	1.29	0.000477	0.0000116	0.0000000
56	22.0	0.0399	0.0000	2.52	0.0000	0.00469	0.00727	1.20	0.000399	0.0000237	0.0000000
57	22.4	0.0040	0.0271	2.06	0.0028	0.00101	0.00000	1.24	0.000473	0.0000000	0.0000067
58	22.8	0.0063	0.0000	2.40	0.0037	0.00545	0.00000	1.21	0.000540	0.0000109	0.0000000
59	23.2	0.0090	0.0069	4.17	0.0056	0.00149	0.00067	1.27	0.000530	0.0000000	0.0000185

Spot Number	Distance from the foot (mm)	KD1B prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr8/Ca	Ba/Ca	Pb/Ca	U/Ca
60	23.6	0.0174	0.0000	2.58	0.0010	0.00000	0.00251	1.53	0.000553	0.0000000	0.0000209
61	24.0	0.0226	0.0000	3.47	0.0000	0.00000	0.00538	1.37	0.000318	0.0000616	0.0000000
62	24.4	0.0000	0.0387	2.78	0.0000	0.00182	0.00337	1.40	0.000497	0.0000000	0.0000184
63	24.8	0.0219	0.0265	16.42	0.0086	0.00305	0.00785	1.58	0.001618	0.0000159	0.0000061
64	25.2	0.0266	0.0120	3.78	0.0113	0.00451	0.00000	1.25	0.000495	0.0000213	0.0000104
65	25.6	0.0136	0.0093	1.94	0.0053	0.00000	0.00100	1.15	0.000312	0.0000039	0.0000000
66	26.0	0.0150	0.0000	5.42	0.0112	0.00077	0.00507	1.54	0.000682	0.0000039	0.0000000
67	26.4	0.0129	0.0110	2.73	0.0000	0.00389	0.00078	1.30	0.000453	0.0000087	0.0000000
68	26.8	0.0130	0.0209	5.23	0.1423	0.00187	0.00268	1.14	0.001425	0.0000169	0.0000613
69	27.2	0.0154	0.0000	2.84	0.0000	0.00000	0.00265	1.13	0.000446	0.0000000	0.0000008
70	27.6	0.0125	0.0185	4.16	0.0074	0.00204	0.00144	1.10	0.000312	0.0000000	0.0000326
71	28.0	0.0000	0.0094	2.49	0.0039	0.00293	0.00000	1.06	0.000298	0.0000154	0.0000047
72	28.4	0.0000	0.0202	2.10	0.0000	0.00000	0.00028	1.37	0.000387	0.0000000	0.0000000
73	28.8	0.0116	0.0064	2.82	0.0035	0.00110	0.00146	1.24	0.000483	0.0000283	0.0000193
74	29.2	0.0026	0.0000	2.42	0.0020	0.00000	0.00000	1.24	0.000452	0.0000640	0.0000000
75	29.6	0.0030	0.0007	2.00	0.0043	0.00079	0.00630	1.15	0.000356	0.0000000	0.0000000
76	30.0	0.0252	0.0000	5.34	0.0086	0.00330	0.00918	1.45	0.000577	0.0000186	0.0000047
77	30.4	0.0000	0.0175	3.13	0.0038	0.00853	0.00186	1.42	0.001525	0.0000000	0.0000000
78	30.8	0.0079	0.0343	3.19	0.0000	0.00366	0.00347	1.49	0.001134	0.0000000	0.0000092
79	31.2	0.0243	0.0096	2.30	0.0086	0.00157	0.00363	1.29	0.000479	0.0000135	0.0000000
80	31.6	0.0182	0.0604	3.87	0.0000	0.00000	0.00433	1.27	0.000401	0.0000147	0.0000000
81	32.0	0.0000	0.0000	2.52	0.0000	0.00000	0.00585	1.40	0.000657	0.0000000	0.0000011
82	32.4	0.1804	0.1150	17.30	29.0871	0.17113	0.02190	1.61	0.044943	0.0004403	0.0000497
83	32.8	0.0221	0.0359	2.93	0.0058	0.00396	0.00000	1.35	0.000341	0.0000650	0.0000000
84	33.2	0.0357	0.0000	1.86	0.0097	0.00015	0.00736	1.39	0.000701	0.0000000	0.0000000
85	33.6	0.0082	0.0000	4.93	0.0000	0.01262	0.00000	1.36	0.000432	0.0000000	0.0000228
86	34.0	0.0000	0.0180	3.02	0.0050	0.00260	0.00277	1.37	0.000550	0.0000000	0.0000000
87	34.4	0.0000	0.0181	2.06	0.0061	0.00243	0.00429	1.21	0.000327	0.0000000	0.0000053
88	34.8	0.0238	0.0135	2.79	0.0128	0.00112	0.00066	1.31	0.000402	0.0000096	0.0000148
89	35.2	0.0067	0.0293	2.35	0.0014	0.00205	0.00578	1.32	0.000434	0.0000029	0.0000060

Spot Number	Distance from the foot (mm)	KD1B prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr8/Ca	Ba/Ca	Pb/Ca	U/Ca
90	35.6	0.0037	0.0054	2.97	0.0000	0.00906	0.00364	1.37	0.000637	0.0000298	0.0000048
91	36.0	0.0416	0.0080	2.74	0.0242	0.06589	0.00503	1.56	0.001351	0.0000250	0.0000000
92	36.4	0.0153	0.0089	2.14	0.0000	0.00292	0.00999	1.40	0.000694	0.0000000	0.0000053
93	36.8	0.0071	0.0344	4.71	0.0000	0.00196	0.00857	1.90	0.000577	0.0000000	0.0000000
94	37.2	0.0184	0.0180	4.21	0.0000	0.00864	0.00200	1.18	0.000932	0.0000445	0.0000276
95	37.6	0.0383	0.0000	2.82	0.0004	0.00237	0.00000	1.26	0.000648	0.0000063	0.0000213
96	38.0	0.0218	0.0034	2.05	0.0000	0.00494	0.00074	1.15	0.000472	0.0000000	0.0000149
97	38.4	0.0200	0.0176	3.23	0.0000	0.00304	0.00081	1.25	0.000527	0.0000670	0.0000000
98	38.8	0.0203	0.0166	2.49	0.0000	0.00000	0.00000	1.26	0.000442	0.0000378	0.0000030
99	39.2	0.0000	0.0035	3.22	0.0000	0.00262	0.00303	1.22	0.000511	0.0000400	0.0000115
100	39.6	0.0210	0.0086	2.10	0.0000	0.00269	0.00368	1.07	0.000339	0.0000193	0.0000000
101	40.0	0.0114	0.0000	1.85	0.0000	0.00350	0.00424	1.25	0.000449	0.0000605	0.0000000
102	40.4	0.0165	0.0072	2.21	0.0081	0.00332	0.00517	1.15	0.000301	0.0000369	0.0000000
103	40.8	0.0000	0.0104	2.20	0.0000	0.00000	0.00323	1.14	0.000356	0.0000079	0.0000124
104	41.2	0.0133	0.0000	1.52	0.0019	0.00000	0.00373	1.29	0.000390	0.0000235	0.0000000
105	41.6	0.0000	0.0128	2.36	0.0071	0.00000	0.00000	1.37	0.000646	0.0000282	0.0000000
106	42.0	0.0000	0.0179	3.83	0.0000	0.00308	0.00486	1.35	0.000493	0.0000952	0.0000138
107	42.4	0.0222	0.0304	7.92	0.0101	0.00281	0.00613	1.46	0.000584	0.0000730	0.0000000
108	42.8	0.0000	0.0173	2.81	0.0091	0.00131	0.00861	1.19	0.000520	0.0000000	0.0000000
109	43.2	0.0000	0.0018	1.95	0.0005	0.00257	0.00119	1.22	0.000355	0.0000000	0.0000000
110	43.6	0.0002	0.0025	2.58	0.0000	0.00311	0.00000	1.41	0.000436	0.0000000	0.0000000
111	44.0	0.0206	0.0000	2.94	0.0000	0.00078	0.00000	1.17	0.000408	0.0000000	0.0000068
112	44.4	0.0317	0.0154	2.98	0.0000	0.00076	0.00686	1.08	0.000276	0.0000000	0.0000000
113	44.8	0.0367	0.0110	3.88	0.0069	0.00061	0.00224	1.19	0.000347	0.0000496	0.0000061
114	45.2	0.0194	0.0000	2.46	0.0000	0.00054	0.00287	1.14	0.000418	0.0000000	0.0000000
115	45.6	0.0000	0.0049	2.59	0.0000	0.00000	0.00039	1.29	0.000432	0.0000000	0.0000000
116	46.0	0.0192	0.0000	2.52	0.0047	0.00000	0.00065	1.20	0.000457	0.0000000	0.0000000
117	46.4	0.0036	0.0112	3.07	0.0033	0.00141	0.00891	1.16	0.000517	0.0000000	0.0000208
118	46.8	0.0000	0.0120	2.25	0.0041	0.00000	0.00305	1.18	0.000441	0.0000000	0.0000000
119	47.2	0.0146	0.0000	2.42	0.0049	0.00282	0.00000	1.17	0.000377	0.0000000	0.0000000

Spot Number	Distance from the foot (mm)	KD1B prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr8/Ca	Ba/Ca	Pb/Ca	U/Ca
120	47.6	0.0091	0.0251	2.49	0.0010	0.01953	0.00590	1.08	0.000590	0.0001742	0.0000200
121	48.0	0.0126	0.0202	3.07	0.0194	0.00000	0.00073	1.08	0.000367	0.0000000	0.0000000
122	48.4	0.0040	0.0000	2.67	0.0000	0.00078	0.00000	1.10	0.000286	0.0000000	0.0000120
123	48.8	0.0093	0.0000	2.85	0.0000	0.00324	0.00000	1.18	0.000423	0.0000751	0.0000266
124	49.2	0.0461	0.0038	2.59	0.0000	0.00452	0.00003	1.16	0.000335	0.0000190	0.0000000
125	49.6	0.0191	0.0080	2.46	0.0000	0.00000	0.00020	1.07	0.000368	0.0000000	0.0000000
126	50.0	0.0055	0.0350	1.61	0.0093	0.00419	0.00733	1.45	0.000615	0.0000265	0.0000000
127	50.4	0.0308	0.0077	2.10	0.0010	0.00364	0.00097	1.15	0.000461	0.0000312	0.0000000
128	50.8	0.0188	0.0000	2.13	0.0000	0.00000	0.00199	1.06	0.000336	0.0000822	0.0000178
129	51.2	0.0000	0.0183	2.88	0.0071	0.00362	0.00588	1.41	0.000445	0.0000000	0.0000119
130	51.6	0.0031	0.0030	1.87	0.0019	0.00378	0.00420	1.34	0.000371	0.0000956	0.0000000
131	52.0	0.0088	0.0044	1.82	0.0099	0.00228	0.00000	1.48	0.000518	0.0000193	0.0000024
132	52.4	0.0000	0.0061	2.65	0.0064	0.00392	0.00000	1.36	0.000582	0.0000400	0.0000161
133	52.8	0.0101	0.0000	4.04	0.0003	0.00556	0.00409	1.18	0.000400	0.0000000	0.0000200
134	53.2	0.0546	0.0182	2.40	0.0167	0.00000	0.01364	1.20	0.000558	0.0000991	0.0000002
135	53.6	0.0195	0.0035	2.83	0.0000	0.00000	0.00649	1.17	0.000505	0.0000000	0.0000000
136	54.0	0.0090	0.0025	4.70	0.0000	0.00000	0.01130	1.45	0.000629	0.0000000	0.0000126
137	54.4	0.0050	0.0000	1.85	0.0042	0.00269	0.00312	1.18	0.000479	0.0000000	0.0000000
138	54.8	0.0073	0.0000	2.48	0.0000	0.00210	0.00490	1.19	0.000595	0.0001165	0.0000115
139	55.2	0.0000	0.0000	2.07	0.0000	0.00479	0.00180	1.46	0.000635	0.0000000	0.0000192
140	55.6	0.0000	0.0285	3.83	0.0000	0.00014	0.00146	1.41	0.000436	0.0000046	0.0000000
141	56.0	0.0211	0.0271	7.90	0.0000	0.00412	0.00696	1.48	0.000750	0.0000273	0.0000000
142	56.4	0.0150	0.0000	2.77	0.0151	0.00209	0.00000	1.30	0.000386	0.0000000	0.0000000
143	56.8	0.0000	0.0016	2.83	0.0000	0.00543	0.00467	1.49	0.000578	0.0000000	0.0000000
144	57.2	0.0156	0.0125	2.32	0.0052	0.00042	0.00000	1.40	0.000558	0.0000000	0.0000161
145	57.6	0.0000	0.0136	6.31	0.1085	0.00276	0.00000	1.30	0.000847	0.0000000	0.0000000
146	58.0	0.0368	0.0259	2.15	0.0087	0.00328	0.00295	1.46	0.000537	0.0000000	0.0000043
147	58.4	0.0391	0.0058	2.65	0.0092	0.00410	0.00250	1.47	0.000642	0.0000274	0.0000000
148	58.8	0.0136	0.0196	2.61	0.0076	0.00000	0.00288	1.49	0.000583	0.0000456	0.0000000
149	59.2	0.0019	0.0313	2.01	0.0158	0.00000	0.00104	1.54	0.000639	0.0000883	0.0000374

Spot Number	Distance from the foot (mm)	KD1B prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr8/Ca	Ba/Ca	Pb/Ca	U/Ca
150	59.6	0.0076	0.0160	2.20	0.0081	0.00000	0.00195	1.33	0.000469	0.0000394	0.0000000
151	60.0	0.0155	0.0174	3.30	0.0208	0.00110	0.00000	1.34	0.000497	0.0000307	0.0000152
152	60.4	0.0000	0.0000	6.77	0.0012	0.00083	0.00000	1.34	0.000473	0.0000000	0.0000245
153	60.8	0.0232	0.0053	1.71	0.0000	0.00119	0.00303	1.44	0.000549	0.0000000	0.0000000
154	61.2	0.0273	0.0000	2.73	0.0000	0.00465	0.00000	1.38	0.000352	0.0000161	0.0000000
155	61.6	0.0026	0.0180	2.12	0.0075	0.00262	0.00654	1.25	0.000282	0.0000000	0.0000000
156	62.0	0.0269	0.0220	6.13	0.0203	0.00641	0.00685	1.47	0.000733	0.0000577	0.0000000
157	62.4	0.0358	0.0000	5.72	0.0031	0.00695	0.00021	1.53	0.000849	0.0000000	0.0000000
158	62.8	0.0010	0.0321	3.64	0.0063	0.00515	0.00922	1.32	0.000512	0.0000000	0.0000000
159	63.2	0.0000	0.0005	3.96	0.0000	0.00000	0.00240	1.59	0.000511	0.0001330	0.0000000
160	63.6	0.0243	0.0000	3.67	0.0311	0.00275	0.00672	1.59	0.000854	0.0001794	0.0000075
161	64.0	0.0000	0.0000	4.42	0.0000	0.00057	0.00602	1.37	0.000675	0.0000000	0.0000000
162	64.4	0.0090	0.0100	4.42	0.0000	0.00112	0.00000	1.20	0.000488	0.0000696	0.0000106
163	64.8	0.0169	0.0071	2.89	0.0060	0.00165	0.00669	1.48	0.000408	0.0000192	0.0000065
164	65.2	0.0141	0.0000	2.51	0.0000	0.00501	0.00380	1.34	0.000484	0.0000000	0.0000098
165	65.6	0.0000	0.0000	2.02	0.0005	0.00115	0.00264	1.34	0.000428	0.0000323	0.0000110
166	66.0	0.0043	0.0169	1.74	0.0000	0.00000	0.00090	1.22	0.000340	0.0000000	0.0000000
167	66.4	0.0349	0.0000	2.48	0.0074	0.00036	0.00348	1.43	0.000448	0.0000317	0.0000029
168	66.8	0.0168	0.0000	2.27	0.0055	0.00038	0.00110	1.31	0.000457	0.0000000	0.0000000
169	67.2	0.0091	0.0089	1.82	0.0000	0.00000	0.00000	1.24	0.000333	0.0000180	0.0000036
170	67.6	0.0192	0.0000	1.89	0.0076	0.00000	0.00339	1.29	0.000392	0.0000197	0.0000000
171	68.0	0.0241	0.0238	1.52	0.0049	0.00082	0.00000	1.58	0.000608	0.0000577	0.0000076
172	68.4	0.0355	0.0000	2.02	0.0075	0.00627	0.00278	1.39	0.000620	0.0000000	0.0000223
173	68.8	0.0111	0.0000	1.64	0.0268	0.00000	0.00982	1.26	0.000422	0.0000231	0.0000000
174	69.2	0.0814	0.0429	6.37	16.9871	0.03965	0.01581	1.43	0.038405	0.0001054	0.0000007
175	69.6	0.0151	0.0136	1.63	0.0021	0.00143	0.00376	1.37	0.000374	0.0000081	0.0000089
176	70.0	0.0000	0.0000	2.38	0.0160	0.00000	0.00992	1.52	0.000518	0.0000476	0.0000047
177	70.4	0.0261	0.0326	8.25	0.1918	0.00508	0.00762	3.45	0.003454	0.0000515	0.0005306
178	70.8	0.0025	0.0000	8.10	0.0145	0.00360	0.00043	1.29	0.000507	0.0000467	0.0000137
179	71.2	0.0048	0.0157	3.17	0.0045	0.00274	0.00000	1.48	0.000532	0.0000238	0.0000000

Spot Number	Distance from the foot (mm)	KD1B prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr8/Ca	Ba/Ca	Pb/Ca	U/Ca
180	71.6	0.0180	0.0000	2.89	0.0022	0.00321	0.00098	1.28	0.000390	0.0000493	0.0000184
181	72.0	0.0175	0.0254	2.47	0.0000	0.00000	0.00144	1.31	0.000381	0.0000000	0.0000329
182	72.4	0.0423	0.0186	4.22	0.0000	0.00000	0.00337	1.38	0.000561	0.0000000	0.0000000
183	72.8	0.0374	0.0322	2.82	0.0000	0.00000	0.00117	1.52	0.000674	0.0000853	0.0000184
184	73.2	0.0068	0.0032	2.50	0.0123	0.00000	0.00512	1.54	0.001043	0.0000559	0.0000072
185	73.6	0.0058	0.0224	2.08	0.0163	0.00438	0.00537	1.58	0.000688	0.0000415	0.0000094
186	74.0	0.0206	0.0000	2.00	0.0000	0.00080	0.00000	1.25	0.000867	0.0000242	0.0000000
187	74.4	0.0406	0.0313	3.54	0.0109	0.00260	0.00639	1.41	0.000957	0.0000000	0.0000214
188	74.8	0.0000	0.0000	3.31	0.0000	0.00181	0.00304	1.60	0.000600	0.0000603	0.0000000
189	75.2	0.0117	0.0312	9.14	0.0271	0.00036	0.03303	1.67	0.001208	0.0001875	0.0000000
190	75.6	0.0104	0.0000	4.13	0.0000	0.00309	0.00241	1.35	0.000419	0.0000000	0.0000000
191	76.0	0.0000	0.0160	3.46	0.0000	0.00149	0.00409	1.22	0.000417	0.0000000	0.0000284
192	76.4	0.0057	0.0000	2.45	0.0311	0.00473	0.00000	1.39	0.000408	0.0000000	0.0000038
193	76.8	0.0000	0.0000	4.54	0.0097	0.00551	0.00241	1.33	0.000500	0.0000741	0.0000000
194	77.2	0.0387	0.0000	9.67	0.0113	0.01033	0.00087	1.26	0.000639	0.0000483	0.0000000
195	77.6	0.0148	0.0140	3.93	0.0000	0.00274	0.00409	1.34	0.000282	0.0000000	0.0000209
196	78.0	0.0156	0.0000	2.16	0.0036	0.00030	0.00456	1.54	0.000530	0.0000000	0.0000000
197	78.4	0.0187	0.0138	1.82	0.0052	0.00173	0.00833	1.35	0.000615	0.0000139	0.0000000
198	78.8	0.0184	0.0076	4.54	0.0108	0.00238	0.00529	1.49	0.000415	0.0000217	0.0000000
199	79.2	0.0140	0.0000	2.21	0.0215	0.00011	0.00119	1.23	0.000380	0.0000411	0.0000084
200	79.6	0.0070	0.0355	2.79	0.0361	0.00183	0.00503	3.42	0.004081	0.0000826	0.0007646

APPENDIX 5.1k K3A prismatic layer transect data

Spot Number	Distance from the foot (mm)	K3A prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.0	0.0247	0.0095	11.90	0.0507	0.0028088	0.0046680	1.19	0.000389	0.0003151	0.0000000
2	0.4	0.0000	0.0708	4.32	0.0122	0.0000000	0.0018997	2.73	0.001453	0.0000872	0.0001110
3	0.8	0.0312	0.0728	3.28	0.3388	0.0030973	0.0059630	2.87	0.001637	0.0000608	0.0000919
4	1.2	0.0188	0.0393	2.42	0.4599	0.0019760	0.0053686	2.66	0.001746	0.0000939	0.0001948
5	1.6	0.0283	0.0000	18.65	0.0035	0.0018763	0.0061604	1.54	0.000936	0.0000377	0.0000185
6	2.0	0.0099	0.0072	17.67	0.0055	0.0028722	0.0007268	1.90	0.000962	0.0000104	0.0000259
7	2.4	0.0173	0.0107	17.94	0.0684	0.0044535	0.0011079	1.96	0.001321	0.0000279	0.0000034
8	2.8	0.0155	0.0121	7.81	0.0000	0.0068846	0.0027374	1.69	0.000632	0.0001047	0.0000029
9	3.2	0.0355	0.0000	4.10	0.0000	0.0041217	0.0000000	1.45	0.000505	0.0001112	0.0000137
10	3.6	0.0287	0.0814	28.15	0.0896	0.0067975	0.0002802	2.50	0.001250	0.0000787	0.0001191
11	4.0	0.0000	0.0000	7.61	0.0133	0.0003729	0.0021782	1.53	0.000540	0.0000984	0.0000000
12	4.4	0.0463	0.0157	4.84	0.0038	0.0009627	0.0039591	1.89	0.000814	0.0000938	0.0000280
13	4.8	0.0186	0.0189	4.81	0.0000	0.0029679	0.0035880	1.89	0.000832	0.0000000	0.0000000
14	5.2	0.0000	0.0000	7.61	0.0053	0.0044503	0.0000000	2.04	0.000785	0.0000452	0.0000000
15	5.6	0.0000	0.0027	4.10	0.0000	0.0032768	0.0014751	1.89	0.000665	0.0000000	0.0000000
16	6.0	0.0106	0.0088	8.22	0.0000	0.0037511	0.0059641	1.56	0.000748	0.0000352	0.0000134
17	6.4	0.0248	0.0317	8.06	0.0028	0.0059853	0.0045887	1.80	0.000703	0.0000000	0.0000138
18	6.8	0.0000	0.0000	7.35	0.0010	0.0040641	0.0044041	1.58	0.000675	0.0000722	0.0000035
19	7.2	0.0093	0.0035	8.41	0.0000	0.0044277	0.0052113	1.47	0.000624	0.0000440	0.0000000
20	7.6	0.0044	0.0024	7.87	0.0000	0.0025368	0.0029242	1.55	0.000632	0.0000224	0.0000000
21	8.0	0.0000	0.0264	10.84	0.0255	0.0055001	0.0060253	1.49	0.000665	0.0000997	0.0000000
22	8.4	0.0154	0.0832	2.20	0.0798	0.0031434	0.0060780	3.08	0.001972	0.0001830	0.0003613
23	8.8	0.0261	0.0737	22.40	0.0135	0.0048035	0.0116884	1.55	0.000900	0.0000292	0.0000311
24	9.2	0.0092	0.0087	6.36	0.3141	0.0054903	0.0093022	1.59	0.001806	0.0000677	0.0000084
25	9.6	0.0187	0.0354	8.87	0.2687	0.0059874	0.0049201	1.77	0.001175	0.0000000	0.0000000
26	10.0	0.0100	0.0102	5.70	0.0068	0.0014985	0.0036104	1.33	0.000452	0.0001496	0.0000000
27	10.4	0.0252	0.1005	8.31	0.6501	0.0054408	0.0106815	3.82	0.004694	0.0001277	0.0005256
28	10.8	0.0218	0.0000	11.23	0.1393	0.0020829	0.0053249	1.71	0.000753	0.0000898	0.0000107
29	11.2	0.0098	0.0094	13.30	0.2018	0.0075655	0.0089772	2.34	0.001729	0.0000566	0.0001178

Spot Number	Distance from the foot (mm)	K3A prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
30	11.6	0.0054	0.0000	11.09	0.0000	0.0054145	0.0093685	1.97	0.000834	0.0001230	0.0000000
31	12.0	0.0172	0.0207	5.90	0.0000	0.0020528	0.0035536	1.88	0.000612	0.0000000	0.0000000
32	12.4	0.0156	0.0151	14.20	0.0000	0.0015723	0.0073700	1.64	0.000680	0.0000281	0.0000089
33	12.8	0.0148	0.0028	3.64	0.0005	0.0034410	0.0065330	1.39	0.000533	0.0001538	0.0000000
34	13.2	0.0073	0.0011	2.93	0.0024	0.0005659	0.0021985	1.42	0.000373	0.0000493	0.0000000
35	13.6	0.0248	0.0197	7.30	0.0087	0.0041824	0.0021439	1.77	0.000596	0.0000000	0.0000134
36	14.0	0.0102	0.0075	5.39	0.0049	0.0062936	0.0027299	1.45	0.000707	0.0000582	0.0000000
37	14.4	0.0000	0.0000	4.86	0.0000	0.0048704	0.0007515	1.24	0.000362	0.0000258	0.0000000
38	14.8	0.0016	0.0277	3.07	0.0000	0.0077872	0.0047573	1.42	0.000469	0.0000091	0.0000036
39	15.2	0.0078	0.0071	2.99	0.0000	0.0017141	0.0019585	1.43	0.000519	0.0000558	0.0000000
40	15.6	0.0183	0.0058	5.06	0.0038	0.0050099	0.0054666	1.29	0.000416	0.0000334	0.0000018
41	16.0	0.0127	0.0263	4.16	0.0035	0.0017669	0.0000000	1.36	0.000443	0.0000654	0.0000033
42	16.4	0.0145	0.0000	3.59	0.0000	0.0000000	0.0000000	1.51	0.000431	0.0000334	0.0000000
43	16.8	0.0239	0.0000	4.20	0.0002	0.0064121	0.0027995	1.64	0.000694	0.0000674	0.0000000
44	17.2	0.0110	0.0051	4.26	0.0021	0.0052116	0.0074371	1.46	0.000604	0.0000971	0.0000002
45	17.6	0.0000	0.0191	8.24	0.0000	0.0070195	0.0074341	1.83	0.000805	0.0001263	0.0000000
46	18.0	0.0196	0.0079	10.26	0.0076	0.0008884	0.0025125	1.67	0.000759	0.0001495	0.0000211
47	18.4	0.0054	0.0063	8.07	0.0009	0.0023730	0.0002630	1.77	0.000738	0.0001533	0.0000291
48	18.8	0.0074	0.0000	5.28	0.0000	0.0068226	0.0072751	1.91	0.000731	0.0001340	0.0000000
49	19.2	0.0378	0.0260	17.24	0.0328	0.0070265	0.0020600	1.82	0.000958	0.0000637	0.0000180
50	19.6	0.0025	0.0139	9.88	0.0201	0.0054837	0.0012820	1.60	0.000708	0.0000777	0.0000219
51	20.0	0.0001	0.0158	8.87	0.0177	0.0056816	0.0042375	1.53	0.000789	0.0000228	0.0000000
52	20.4	0.0015	0.0000	9.96	0.1289	0.0012981	0.0018210	1.36	0.000672	0.0000298	0.0000133
53	20.8	0.0367	0.0014	8.76	0.1086	0.0093195	0.0091277	1.56	0.000983	0.0000322	0.0000000
54	21.2	0.0188	0.0000	7.90	0.0058	0.0021152	0.0026612	1.76	0.000541	0.0001038	0.0000016
55	21.6	0.0000	0.0167	6.38	0.0131	0.0057334	0.0027679	1.71	0.000655	0.0001089	0.0000000
56	22.0	0.0120	0.0000	10.57	0.0000	0.0019387	0.0062425	1.55	0.000536	0.0002082	0.0000122
57	22.4	0.0232	0.0000	6.66	0.0000	0.0036279	0.0062523	1.45	0.000576	0.0000696	0.0000000
58	22.8	0.0000	0.0000	3.25	0.0159	0.0054004	0.0045385	1.49	0.000450	0.0001117	0.0000000
59	23.2	0.0422	0.0066	11.17	0.8283	0.0088102	0.0077375	1.80	0.001603	0.0002703	0.0000000

Spot Number	Distance from the foot (mm)	K3A prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
60	23.6	0.0026	0.0282	15.56	0.0134	0.0028642	0.0044512	2.02	0.000635	0.0001256	0.0000167
61	24.0	0.0474	0.0000	6.55	0.0020	0.0057633	0.0022519	1.65	0.000666	0.0001446	0.0000000
62	24.4	0.0000	0.0000	3.63	0.0000	0.0000000	0.0051775	1.75	0.000580	0.0001643	0.0000000
63	24.8	0.0076	0.0016	3.37	0.0353	0.0031236	0.0112702	1.88	0.001509	0.0002477	0.0000143
64	25.2	0.0007	0.0131	4.14	0.0011	0.0007421	0.0108357	1.57	0.000598	0.0001642	0.0000000
65	25.6	0.0241	0.0161	6.89	0.0000	0.0013649	0.0077401	1.85	0.000596	0.0001482	0.0000016
66	26.0	0.0215	0.0231	7.46	0.3853	0.0086110	0.0041125	1.77	0.000936	0.0001003	0.0000132
67	26.4	0.0101	0.0000	4.93	0.0043	0.0022003	0.0063593	1.62	0.000654	0.0000707	0.0000233
68	26.8	0.0338	0.0002	7.16	0.0117	0.0009490	0.0033819	1.59	0.000682	0.0000669	0.0000023
69	27.2	0.0000	0.0054	5.62	0.0113	0.0054174	0.0062204	1.70	0.000697	0.0001374	0.0000033
70	27.6	0.0225	0.0262	8.99	0.0135	0.0021257	0.0041956	1.81	0.000812	0.0000000	0.0000000
71	28.0	0.0128	0.0000	2.95	0.0081	0.0000000	0.0067231	1.29	0.000358	0.0001100	0.0000054
72	28.4	0.0065	0.0089	3.61	0.0000	0.0012539	0.0021120	1.73	0.000585	0.0001349	0.0000121
73	28.8	0.0197	0.0104	3.24	0.0000	0.0022761	0.0037665	1.48	0.000468	0.0000008	0.0000165
74	29.2	0.0102	0.0120	4.73	0.0000	0.0032262	0.0030531	1.35	0.000422	0.0000589	0.0000056
75	29.6	0.0184	0.0223	7.39	0.1639	0.0025935	0.0032539	1.63	0.000853	0.0000515	0.0000121
76	30.0	0.0258	0.0231	9.41	0.1092	0.0020128	0.0028132	1.72	0.000757	0.0000182	0.0000000
77	30.4	0.0000	0.0000	4.44	0.0000	0.0036245	0.0068509	1.48	0.000508	0.0000778	0.0000037
78	30.8	0.0044	0.0245	5.85	0.0000	0.0040976	0.0029392	1.21	0.000446	0.0000611	0.0000000
79	31.2	0.0192	0.0000	4.54	0.0000	0.0026950	0.0041161	1.35	0.000577	0.0000475	0.0000112
80	31.6	0.0158	0.0009	5.65	0.0000	0.0032790	0.0036794	1.11	0.000313	0.0000796	0.0000057
81	32.0	0.0000	0.0000	4.67	0.0000	0.0012545	0.0060341	1.09	0.000406	0.0000574	0.0000000
82	32.4	0.0101	0.0000	5.80	0.0000	0.0048216	0.0105566	1.56	0.000731	0.0000000	0.0000000
83	32.8	0.0000	0.0000	3.22	0.0130	0.0112641	0.0080010	1.15	0.000426	0.0000898	0.0000168
84	33.2	0.0163	0.0137	6.91	0.0054	0.0032174	0.0091824	1.83	0.000637	0.0000603	0.0000000
85	33.6	0.0325	0.0629	19.48	0.2516	0.0226376	0.0054861	2.00	0.001798	0.0001502	0.0000724
86	34.0	0.0110	0.0184	9.66	0.0000	0.0026033	0.0043748	1.62	0.000629	0.0001250	0.0000046
87	34.4	0.0135	0.0246	16.09	0.0000	0.0060117	0.0043717	1.58	0.000723	0.0001193	0.0000023
88	34.8	0.0159	0.0317	11.54	0.0080	0.0052893	0.0080119	1.49	0.000707	0.0000460	0.0000010
89	35.2	0.0256	0.0287	16.06	0.0000	0.0117428	0.0073096	2.22	0.001489	0.0001811	0.0001543

Spot Number	Distance from the foot (mm)	K3A prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
90	35.6	0.0050	0.0032	5.65	0.0021	0.0016187	0.0075558	1.45	0.000531	0.0001432	0.0000000
91	36.0	0.0137	0.0000	5.64	0.0000	0.0138902	0.0033318	1.24	0.000487	0.0001802	0.0000014
92	36.4	0.0008	0.0170	2.94	0.0012	0.0045923	0.0077707	1.56	0.000582	0.0001044	0.0000000
93	36.8	0.0319	0.0410	9.55	0.0226	0.0055465	0.0037813	2.29	0.001163	0.0000373	0.0000176
94	37.2	0.0111	0.0104	6.38	0.0000	0.0022946	0.0021786	1.36	0.000529	0.0000654	0.0000000
95	37.6	0.0174	0.0146	2.92	0.0011	0.0087976	0.0061584	1.44	0.000462	0.0001161	0.0000000
96	38.0	0.0165	0.0000	3.53	0.0116	0.0121678	0.0008882	1.80	0.000666	0.0002093	0.0000000

APPENDIX 5.1l K1A1 prismatic layer transect data

spot number	Distance from the foot (mm)	K1A1 prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.0	0.0270	0.0028	13.54	0.1063	0.00900	0.00873	1.96	0.001265	0.000160	0.0000000
2	0.4	0.0000	0.0063	7.29	0.0043	0.00049	0.00633	1.83	0.000814	0.000051	0.0000000
3	0.8	0.0147	0.0282	11.12	0.0260	0.00259	0.01495	1.95	0.001177	0.000000	0.0000416
4	1.2	0.0119	0.0128	7.84	0.0000	0.00060	0.01146	1.77	0.000853	0.000235	0.0000114
5	1.6	0.0131	0.0319	12.82	0.0000	0.00379	0.00182	1.70	0.001049	0.000185	0.0000000
6	2.0	0.0051	0.0134	6.31	0.0000	0.00149	0.00000	1.49	0.000584	0.000061	0.0000129
7	2.4	0.0007	0.0000	6.77	0.0423	0.00250	0.00564	1.57	0.000846	0.000144	0.0000140
8	2.8	0.0333	0.0163	31.17	0.0472	0.00671	0.00793	1.60	0.001260	0.000321	0.0000305
9	3.2	0.0157	0.0000	6.46	0.0129	0.00107	0.00904	1.41	0.000716	0.000236	0.0000301
10	3.6	0.0248	0.0169	5.26	0.0000	0.00172	0.00303	1.18	0.000456	0.000114	0.0000000
11	4.0	0.0070	0.0099	5.72	0.0027	0.01057	0.00013	1.45	0.000504	0.000258	0.0000313
12	4.4	0.0000	0.0194	5.36	0.0139	0.00260	0.00246	1.56	0.000583	0.000295	0.0000025
13	4.8	0.0348	0.0224	5.74	0.0684	0.00411	0.00307	1.91	0.000980	0.000191	0.0000000
14	5.2	0.0000	0.0118	8.29	0.0074	0.00173	0.00551	1.77	0.000743	0.000322	0.0000003
15	5.6	0.0136	0.0000	5.89	0.0216	0.00439	0.00945	1.65	0.000711	0.000132	0.0000000
16	6.0	0.0000	0.0037	7.11	0.0031	0.00513	0.00636	1.70	0.000849	0.000181	0.0000000
17	6.4	0.0037	0.0000	8.30	0.0006	0.00000	0.00696	1.39	0.000427	0.000144	0.0000000
18	6.8	0.0000	0.0173	3.62	0.0000	0.00322	0.00000	1.68	0.000663	0.000129	0.0000146
19	7.2	0.0000	0.0074	6.75	0.0000	0.00142	0.00149	1.51	0.000446	0.000141	0.0000015
20	7.6	0.0000	0.0168	3.39	0.0000	0.00116	0.00907	1.64	0.000519	0.000017	0.0000156
21	8.0	0.0243	0.0027	7.11	0.0000	0.00000	0.01122	1.63	0.000631	0.000150	0.0000005
22	8.4	0.0054	0.0000	5.56	0.0000	0.00428	0.00421	1.59	0.000626	0.000338	0.0000000
23	8.8	0.0000	0.0205	6.71	0.0000	0.00198	0.00494	1.75	0.000856	0.000281	0.0000000
24	9.2	0.0000	0.0052	4.17	0.0263	0.00338	0.00294	1.84	0.000840	0.000336	0.0000225
25	9.6	0.0000	0.0000	6.18	0.0000	0.00266	0.01203	1.89	0.000878	0.000209	0.0000000
26	10.0	0.0442	0.0122	3.73	0.0197	0.00177	0.00155	1.52	0.000479	0.000122	0.0000000
27	10.4	0.0333	0.0338	4.97	0.0000	0.00124	0.00465	1.56	0.000505	0.000240	0.0000071
28	10.8	0.0321	0.0000	3.33	0.0000	0.00363	0.01207	1.49	0.000504	0.000345	0.0000000
29	11.2	0.0073	0.0000	8.81	0.0000	0.00321	0.00000	1.55	0.000672	0.000251	0.0000000

spot number	Distance from the foot (mm)	K1A1 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
30	11.6	0.0353	0.0199	10.29	0.0161	0.00308	0.00000	1.74	0.000983	0.000072	0.0000256
31	12.0	0.0203	0.0466	15.97	0.0182	0.00727	0.01221	1.70	0.001611	0.000091	0.0000041
32	12.4	0.0061	0.0000	7.25	0.0071	0.00422	0.00614	1.53	0.000561	0.000111	0.0000000
33	12.8	0.0000	0.0174	10.68	0.0195	0.00000	0.00441	1.71	0.002501	0.000091	0.0000320
34	13.2	0.0209	0.0000	7.07	0.0000	0.00246	0.01068	1.55	0.001352	0.000148	0.0000455
35	13.6	0.0000	0.0021	7.85	0.0000	0.00651	0.01093	1.19	0.000441	0.000249	0.0000000
36	14.0	0.0267	0.0000	4.77	0.0000	0.00373	0.00277	1.34	0.000513	0.000325	0.0000199
37	14.4	0.0047	0.0193	6.76	0.0093	0.00000	0.01100	1.52	0.000719	0.000229	0.0000333
38	14.8	0.0162	0.0193	12.35	0.0000	0.00403	0.00133	1.86	0.000882	0.000343	0.0000000
39	15.2	0.0000	0.0124	4.73	0.0000	0.00188	0.00527	1.53	0.000590	0.000331	0.0000000
40	15.6	0.0000	0.0000	9.16	0.0000	0.00611	0.00364	1.35	0.000487	0.000340	0.0000000
41	16.0	0.0000	0.0119	12.92	0.0000	0.00496	0.00652	1.71	0.000905	0.000314	0.0000000
42	16.4	0.0242	0.0134	3.76	0.0000	0.00468	0.00000	1.47	0.000481	0.000262	0.0000000
43	16.8	0.0155	0.0000	18.31	0.3477	0.00746	0.00115	1.93	0.001286	0.000381	0.0000095
44	17.2	0.0310	0.0209	11.07	0.3176	0.00426	0.00706	1.95	0.001110	0.000282	0.0000000
45	17.6	0.0085	0.0080	5.29	0.0000	0.00148	0.00397	1.48	0.000538	0.000345	0.0000026
46	18.0	0.0301	0.0050	7.51	0.0175	0.00491	0.00622	1.75	0.000889	0.000423	0.0000000
47	18.4	0.0023	0.0082	4.33	0.0000	0.00316	0.00000	1.68	0.000545	0.000486	0.0000324
48	18.8	0.0079	0.0098	9.97	0.0000	0.00163	0.00903	1.77	0.000643	0.000428	0.0000000
49	19.2	0.0259	0.0156	5.35	0.0022	0.00217	0.00743	1.44	0.000532	0.000505	0.0000000
50	19.6	0.0174	0.0014	8.26	0.0000	0.00251	0.01119	1.31	0.000741	0.000494	0.0000130
51	20.0	0.0035	0.0108	11.83	0.0000	0.00468	0.01727	1.45	0.000752	0.000443	0.0000086
52	20.4	0.0053	0.0051	6.10	0.0000	0.00000	0.00441	1.29	0.000637	0.000365	0.0000120
53	20.8	0.0209	0.0282	7.42	0.0155	0.00350	0.00977	1.20	0.000475	0.000366	0.0000144
54	21.2	0.0000	0.0187	6.53	0.0065	0.00481	0.00657	1.28	0.000529	0.000389	0.0000000
55	21.6	0.0237	0.0298	5.77	0.0000	0.00480	0.00910	1.36	0.000568	0.000528	0.0000101
56	22.0	0.0103	0.0000	7.23	0.0000	0.00354	0.00443	1.61	0.000785	0.000422	0.0000035
57	22.4	0.0091	0.0087	16.76	0.0000	0.00432	0.00516	1.88	0.001155	0.000292	0.0000000
58	22.8	0.0100	0.0148	9.93	0.0067	0.00110	0.00000	1.93	0.000989	0.000319	0.0000068
59	23.2	0.0070	0.0042	5.60	0.0000	0.00001	0.00295	1.54	0.000568	0.000238	0.0000000

spot number	Distance from the foot (mm)	K1A1 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
60	23.6	0.0000	0.0250	6.94	0.0000	0.00000	0.00553	1.53	0.000564	0.000332	0.0000229
61	24.0	0.0000	0.0000	7.29	0.0000	0.01146	0.00668	1.82	0.000938	0.000483	0.0000000
62	24.4	0.0397	0.0123	7.20	0.0000	0.00928	0.00790	1.68	0.000712	0.000394	0.0000000
63	24.8	0.0240	0.0027	4.43	0.0006	0.00400	0.00523	1.31	0.000388	0.000381	0.0000000
64	25.2	0.0000	0.0082	5.70	0.0000	0.00000	0.00462	1.44	0.000495	0.000390	0.0000000
65	25.6	0.0000	0.0000	5.84	0.0000	0.00454	0.01628	1.37	0.000524	0.000537	0.0000000
66	26.0	0.0000	0.0000	6.48	0.0000	0.00255	0.00514	1.49	0.000470	0.000427	0.0000000
67	26.4	0.0224	0.0000	9.50	0.0016	0.00290	0.00050	1.12	0.000372	0.000277	0.0000000
68	26.8	0.0095	0.0000	6.78	0.0063	0.00144	0.00487	1.43	0.000549	0.000327	0.0000000
69	27.2	0.0003	0.0196	23.26	0.0000	0.00452	0.00827	1.56	0.000908	0.000334	0.0000000
70	27.6	0.0218	0.0150	13.62	0.0000	0.00000	0.00593	1.45	0.000731	0.000201	0.0000000
71	28.0	0.0218	0.0177	10.88	0.0159	0.00886	0.01870	1.88	0.001548	0.000169	0.0000274
72	28.4	0.0054	0.0000	6.18	0.0000	0.00447	0.00130	1.40	0.000576	0.000176	0.0000000
73	28.8	0.0161	0.0295	5.94	0.0000	0.00099	0.00430	1.46	0.000629	0.000116	0.0000000
74	29.2	0.0116	0.0000	8.04	0.0000	0.00647	0.00670	1.35	0.000527	0.000259	0.0000000
75	29.6	0.0000	0.0000	3.69	0.0000	0.00635	0.00462	1.40	0.000534	0.000350	0.0000006
76	30.0	0.0310	0.0214	7.20	0.0000	0.00340	0.00743	1.62	0.000693	0.000500	0.0000161
77	30.4	0.0000	0.0000	6.41	0.0000	0.00077	0.00421	1.54	0.000502	0.000424	0.0000000
78	30.8	0.0000	0.0000	6.82	0.0025	0.00214	0.00828	1.62	0.000563	0.000246	0.0000065
79	31.2	0.0502	0.0000	8.65	0.0000	0.00666	0.00515	1.40	0.000542	0.000574	0.0000628
80	31.6	0.0000	0.0228	5.16	0.0234	0.00575	0.01036	1.44	0.000639	0.000647	0.0000035
81	32.0	0.0375	0.0003	3.89	0.0124	0.00168	0.00351	1.49	0.000556	0.000295	0.0000040
82	32.4	0.0383	0.0000	7.67	0.0000	0.00216	0.00308	1.49	0.000570	0.000203	0.0000000
83	32.8	0.0116	0.0000	10.37	0.0052	0.00425	0.01164	1.16	0.000423	0.000150	0.0000050
84	33.2	0.0263	0.0200	10.87	0.0000	0.00614	0.01106	1.23	0.000579	0.000194	0.0000000
85	33.6	0.0261	0.0079	4.92	0.0000	0.00255	0.00170	1.25	0.000422	0.000151	0.0000280
86	34.0	0.0150	0.0139	4.40	0.0000	0.00417	0.00787	1.41	0.000682	0.000139	0.0000000
87	34.4	0.0052	0.0244	4.32	0.0168	0.02028	0.01037	1.15	0.000570	0.000199	0.0000000
88	34.8	0.0000	0.0002	3.65	0.0000	0.00423	0.00972	1.27	0.000475	0.000144	0.0000107
89	35.2	0.0191	0.0000	2.86	0.0000	0.00197	0.01256	1.44	0.000475	0.000371	0.0000000

spot number	Distance from the foot (mm)	K1A1 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
91	36.0	0.0192	0.0097	4.81	0.0000	0.00908	0.00402	1.63	0.000632	0.000200	0.0000034
92	36.4	0.0000	0.0136	3.46	0.0000	0.00968	0.00191	1.68	0.000608	0.000202	0.0000000
93	36.8	0.0297	0.0217	2.80	0.0000	0.00759	0.00652	1.32	0.000460	0.000214	0.0000171
94	37.2	0.0405	0.0088	3.34	0.0073	0.00481	0.00259	1.39	0.000466	0.000392	0.0000105
95	37.6	0.0000	0.0033	3.47	0.0000	0.00008	0.00228	1.40	0.000505	0.000315	0.0000000
96	38.0	0.0004	0.0177	3.00	0.0000	0.00000	0.00566	1.51	0.000456	0.000357	0.0000000
97	38.4	0.0005	0.0045	4.80	0.0163	0.00888	0.00809	1.41	0.000472	0.000227	0.0000167
98	38.8	0.0000	0.0000	4.36	0.0000	0.00527	0.00729	1.61	0.000580	0.000293	0.0000000
99	39.2	0.0207	0.0000	5.74	0.0000	0.00856	0.00571	1.58	0.000592	0.000259	0.0000107
100	39.6	0.0132	0.0000	5.69	0.0000	0.00571	0.00467	1.50	0.000457	0.000242	0.0000038
101	40.0	0.0286	0.0154	8.87	0.0000	0.00433	0.00492	1.52	0.000565	0.000171	0.0000105
102	40.4	0.0130	0.0009	11.49	0.0000	0.01240	0.01334	1.45	0.000587	0.000136	0.0000000
103	40.8	0.0141	0.0092	6.20	0.0000	0.02106	0.02417	1.69	0.000773	0.000144	0.0000286
104	41.2	0.0096	0.0134	3.39	0.0000	0.01321	0.01440	1.67	0.000694	0.000339	0.0000013
105	41.6	0.0370	0.0000	3.00	0.0000	0.00290	0.01159	1.56	0.000485	0.000429	0.0000089
106	42.0	0.0000	0.0136	5.29	0.0000	0.01738	0.02069	1.51	0.000713	0.000298	0.0000000
107	42.4	0.0000	0.0000	3.70	0.0000	0.01100	0.01399	1.66	0.000681	0.000146	0.0000118
108	42.8	0.0196	0.0000	4.88	0.0128	0.01311	0.01596	1.64	0.000659	0.000325	0.0000224
109	43.2	0.0181	0.0220	4.57	0.0000	0.00929	0.01318	1.86	0.000739	0.000486	0.0000198
110	43.6	0.0224	0.0008	4.69	0.0000	0.00294	0.00788	1.75	0.000507	0.000221	0.0000136
111	44.0	0.0000	0.0209	4.57	0.0028	0.00097	0.00429	1.56	0.000431	0.000378	0.0000092
112	44.4	0.0373	0.0000	6.95	0.0000	0.00670	0.01553	1.85	0.000731	0.000429	0.0000129

APPENDIX 5.1m AR1 prismatic layer transect data

Spot Number	Distance from the foot (mm)	AR1 prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.0	0.0182	0.0413	11.64	0.0120	0.00000	0.00683	1.64	0.000826	0.0000237	0.0000173
2	0.4	0.0000	0.0000	2.60	0.0000	0.00066	0.00783	1.28	0.000528	0.0000496	0.0000000
3	0.8	0.0000	0.0000	4.39	0.0000	0.00000	0.00535	1.31	0.000771	0.0000709	0.0000008
4	1.2	0.0416	0.0000	10.29	0.0063	0.00000	0.00733	1.33	0.000629	0.0001459	0.0000000
5	1.6	0.0124	0.0000	13.31	0.0481	0.00322	0.01272	1.34	0.000962	0.0000807	0.0000198
6	2.0	0.0000	0.0274	10.90	0.0075	0.00000	0.00000	1.29	0.000648	0.0000758	0.0000130
7	2.4	0.0371	0.0065	7.26	0.0000	0.00000	0.00267	1.21	0.000548	0.0000879	0.0000000
8	2.8	0.0202	0.0067	8.77	0.0180	0.00091	0.01767	1.23	0.000806	0.0001098	0.0000031
9	3.2	0.0064	0.0000	3.32	0.0000	0.00179	0.00420	1.26	0.000468	0.0000784	0.0000000
10	3.6	0.0144	0.0151	2.85	0.0167	0.00000	0.01127	1.40	0.000523	0.0000428	0.0000407
11	4.0	0.0000	0.0000	4.34	0.0013	0.00000	0.00190	1.45	0.000398	0.0000000	0.0000000
12	4.4	0.0000	0.0126	5.00	0.0058	0.00003	0.00141	1.36	0.000451	0.0000000	0.0000000
13	4.8	0.0155	0.0485	6.32	0.0000	0.00000	0.00000	1.33	0.000471	0.0000000	0.0000117
14	5.2	0.0565	0.0287	3.86	0.0126	0.00086	0.00772	1.57	0.000698	0.0000522	0.0000000
15	5.6	0.0000	0.0253	13.78	0.0186	0.00000	0.01302	1.30	0.000519	0.0000818	0.0000320
16	6.0	0.0558	0.0043	5.63	0.0000	0.00321	0.00454	1.48	0.000571	0.0000000	0.0000000
17	6.4	0.0483	0.0000	13.75	0.0088	0.00739	0.00523	1.31	0.000458	0.0000102	0.0000000
18	6.8	0.0460	0.0065	10.55	0.0000	0.00394	0.01158	1.16	0.000451	0.0000000	0.0000072
19	7.2	0.0124	0.0448	12.48	0.0164	0.00474	0.00176	1.31	0.000642	0.0000000	0.0000259
20	7.6	0.0314	0.0092	9.14	0.0133	0.00384	0.01045	1.51	0.000721	0.0001052	0.0000000
21	8.0	0.0000	0.0013	8.30	0.0000	0.00421	0.00000	1.40	0.000492	0.0000404	0.0000000
22	8.4	0.0164	0.0080	4.87	0.0064	0.00318	0.00920	1.55	0.000982	0.0001235	0.0000000
23	8.8	0.0000	0.0000	4.37	0.0172	0.00118	0.00273	1.41	0.001754	0.0000630	0.0000104
24	9.2	0.0058	0.0127	9.20	0.0000	0.00263	0.00208	1.27	0.000835	0.0000000	0.0000000
25	9.6	0.0085	0.0000	6.07	0.0227	0.00372	0.00669	1.28	0.000466	0.0000794	0.0000268
26	10.0	0.0194	0.0107	5.26	0.0268	0.00000	0.00291	1.34	0.001010	0.0000237	0.0000001
27	10.4	0.0193	0.0158	4.71	0.0042	0.00297	0.01607	1.38	0.000408	0.0000000	0.0000000
28	10.8	0.0159	0.0000	5.68	0.0000	0.00299	0.02180	1.30	0.001265	0.0000105	0.0000000
29	11.2	0.0000	0.0650	14.67	0.0271	0.00320	0.00482	1.30	0.000922	0.0000548	0.0000000

Spot Number	Distance from the foot (mm)	AR1 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
30	11.6	0.0242	0.0318	6.99	0.0123	0.00000	0.00346	1.40	0.000542	0.0000572	0.0000000
31	12.0	0.0074	0.0000	5.09	0.0164	0.00325	0.00408	1.53	0.000715	0.0000116	0.0000014
32	12.4	0.0217	0.0090	6.44	0.0134	0.00000	0.01354	1.16	0.000241	0.0000032	0.0000241
33	12.8	0.0000	0.0373	6.87	0.0032	0.00294	0.00830	1.10	0.000487	0.0000000	0.0000000
34	13.2	0.0329	0.0161	4.54	0.0144	0.00000	0.00554	1.02	0.000488	0.0000741	0.0000000
35	13.6	0.0234	0.0000	4.14	0.0186	0.00339	0.00188	1.05	0.000369	0.0000304	0.0000000
36	14.0	0.0000	0.0213	5.43	0.0122	0.00253	0.00677	1.17	0.000356	0.0000000	0.0000000
37	14.4	0.0397	0.0000	5.87	0.0002	0.00135	0.00606	1.03	0.000325	0.0000000	0.0000000
38	14.8	0.0000	0.0331	5.31	0.0118	0.00000	0.00763	1.11	0.000217	0.0000000	0.0000307
39	15.2	0.0000	0.0444	7.12	0.0078	0.00090	0.00325	1.35	0.000498	0.0000062	0.0000000
40	15.6	0.0144	0.0000	5.30	0.0000	0.00000	0.00326	1.27	0.000351	0.0000111	0.0000000
41	16.0	0.0000	0.0260	4.62	0.0000	0.00177	0.00585	1.08	0.000327	0.0000778	0.0000000
42	16.4	0.0000	0.0073	4.83	0.0030	0.00022	0.00777	1.21	0.000678	0.0000549	0.0000157
43	16.8	0.0038	0.0188	2.89	0.0192	0.00301	0.01070	1.11	0.000344	0.0000234	0.0000000
44	17.2	0.0251	0.0226	3.08	0.0057	0.00556	0.00402	1.18	0.000330	0.0000000	0.0000114
45	17.6	0.0000	0.0312	2.73	0.0033	0.00000	0.00566	1.20	0.000325	0.0001122	0.0000000
46	18.0	0.0404	0.0000	4.22	0.0030	0.00280	0.00994	1.19	0.000298	0.0000575	0.0000000
47	18.4	0.0233	0.0133	3.45	0.0009	0.00000	0.01083	1.17	0.000348	0.0000110	0.0000190
48	18.8	0.0000	0.0160	5.65	0.0099	0.00000	0.01927	1.24	0.000507	0.0000000	0.0000000
49	19.2	0.0163	0.0033	3.76	0.0155	0.00000	0.01105	1.24	0.000551	0.0000000	0.0000000
50	19.6	0.0426	0.0000	4.24	0.0036	0.00052	0.01192	1.15	0.000555	0.0000799	0.0000000
51	20.0	0.0061	0.0005	3.75	0.0079	0.00033	0.00695	1.35	0.000352	0.0001243	0.0000113
52	20.4	0.0467	0.0435	8.55	0.0000	0.00102	0.01091	1.13	0.000535	0.0000164	0.0000000
53	20.8	0.0044	0.0081	3.58	0.0089	0.00000	0.00666	1.22	0.000319	0.0000000	0.0000301
54	21.2	0.0311	0.0046	4.32	0.0085	0.00299	0.00223	1.16	0.000347	0.0000876	0.0000000
55	21.6	0.0329	0.0501	5.73	0.0080	0.00381	0.00310	1.13	0.000615	0.0000000	0.0000000
56	22.0	0.0300	0.0071	5.28	0.0000	0.00097	0.00765	1.08	0.000369	0.0001161	0.0000086
57	22.4	0.0000	0.0204	5.98	0.0000	0.00000	0.00536	1.15	0.000352	0.0000340	0.0000000
58	22.8	0.0259	0.0157	10.46	0.0189	0.00155	0.00845	1.07	0.000417	0.0000527	0.0000000
59	23.2	0.0205	0.0000	7.27	0.0217	0.00183	0.00822	1.21	0.000304	0.0001135	0.0000000

Spot Number	Distance from the foot (mm)	AR1 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
60	23.6	0.0000	0.0167	5.64	0.0478	0.00579	0.01157	1.39	0.000657	0.0000970	0.0000093
61	24.0	0.0000	0.0062	6.70	0.0292	0.00558	0.00593	1.38	0.000623	0.0000000	0.0000064
62	24.4	0.0094	0.0291	4.61	0.0000	0.00000	0.00093	1.39	0.000539	0.0000450	0.0000000
63	24.8	0.0327	0.0360	7.33	0.0038	0.00582	0.00861	1.66	0.000707	0.0000167	0.0000177
64	25.2	0.0092	0.0106	4.44	0.0000	0.00318	0.00420	1.37	0.000561	0.0000113	0.0000027
65	25.6	0.0063	0.0307	3.33	0.0000	0.00320	0.00000	1.50	0.000469	0.0000404	0.0000417
66	26.0	0.0077	0.0042	3.63	0.0117	0.00443	0.00480	1.59	0.000457	0.0000249	0.0000057
67	26.4	0.0184	0.0220	3.94	0.0000	0.00375	0.00576	1.57	0.000556	0.0000222	0.0000007
68	26.8	0.0354	0.0317	8.78	0.0000	0.00417	0.00371	1.72	0.000642	0.0000239	0.0000137
69	27.2	0.0084	0.0016	13.56	0.0002	0.00000	0.00218	1.77	0.000599	0.0000738	0.0000544
70	27.6	0.0000	0.0061	4.10	0.0111	0.00386	0.00361	1.20	0.000516	0.0000785	0.0000224
71	28.0	0.0062	0.0206	3.35	0.0049	0.00711	0.00551	1.75	0.001157	0.0000000	0.0000000
72	28.4	0.0159	0.0281	7.54	0.0139	0.00430	0.00000	1.57	0.000564	0.0000000	0.0000188
73	28.8	0.0131	0.0088	5.61	0.0000	0.00430	0.00611	1.47	0.000880	0.0000000	0.0000324
74	29.2	0.0238	0.0000	2.86	0.0000	0.00138	0.00725	1.41	0.000525	0.0000299	0.0000000
75	29.6	0.0587	0.0110	2.87	0.0054	0.00080	0.00778	1.22	0.000379	0.0000041	0.0000113
76	30.0	0.0170	0.0228	3.55	0.0000	0.00513	0.00597	1.44	0.000696	0.0000587	0.0000000
77	30.4	0.0270	0.0214	3.41	0.0105	0.00141	0.00269	1.10	0.000366	0.0000958	0.0000304
78	30.8	0.0000	0.0062	4.30	0.0003	0.00034	0.01587	1.20	0.000448	0.0000000	0.0000361
79	31.2	0.0109	0.0294	3.68	0.0000	0.00253	0.00041	1.13	0.000257	0.0000649	0.0000000
80	31.6	0.0000	0.0043	4.05	0.0278	0.00845	0.00000	1.04	0.000425	0.0000000	0.0000000
81	32.0	0.0503	0.0509	4.66	0.0092	0.00448	0.00937	1.09	0.000350	0.0000000	0.0000134
82	32.4	0.0270	0.0000	6.01	0.0353	0.00410	0.00222	1.21	0.000560	0.0000353	0.0000000
83	32.8	0.0081	0.0387	3.86	0.0106	0.00014	0.01136	1.23	0.000478	0.0000352	0.0000000
84	33.2	0.0058	0.0273	3.50	0.0000	0.00214	0.00647	1.16	0.000276	0.0000000	0.0000112
85	33.6	0.0000	0.0000	4.53	0.0100	0.00080	0.00999	1.25	0.000373	0.0000435	0.0000000
86	34.0	0.0188	0.0000	4.98	0.0268	0.00401	0.00206	1.13	0.000375	0.0001210	0.0000000
87	34.4	0.0249	0.0475	4.79	0.0000	0.00152	0.01221	1.08	0.000609	0.0001547	0.0000149
88	34.8	0.0000	0.0246	3.73	0.0325	0.00463	0.01583	1.00	0.000440	0.0000000	0.0000000
89	35.2	0.0000	0.0074	3.82	0.0019	0.00000	0.00878	1.20	0.000606	0.0001130	0.0000000
90	35.6	0.0179	0.0000	4.57	0.0014	0.00463	0.02033	1.46	0.001215	0.0001184	0.0000132

APPENDIX 5.1n MR2 prismatic layer transect corrected data

Spot Number	Distance from the foot (mm)	MR2 prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.0	0.0339	0.0000	11.47	0.0000	0.0000	0.0092	1.46	0.00076	0.000000	0.000108
2	0.4	0.0000	0.0000	6.14	0.0000	0.0000	0.0079	1.36	0.00056	0.000000	0.000000
3	0.8	0.0280	0.0000	16.61	0.0000	0.0000	0.0130	1.72	0.00132	0.000191	0.000074
4	1.2	0.0071	0.0000	16.93	0.4090	0.0023	0.0129	2.43	0.00234	0.000185	0.000265
5	1.6	0.0237	0.0000	12.49	0.0000	0.0000	0.0000	1.33	0.00069	0.000057	0.000000
6	2.0	0.0034	0.0000	3.55	0.0000	0.0000	0.0025	4.38	0.00437	0.000000	0.000672
7	2.4	0.0388	0.0000	17.86	0.0000	0.0000	0.0000	2.86	0.00194	0.000000	0.000104
8	2.8	0.0064	0.0000	5.71	0.0000	0.0054	0.0012	1.28	0.00109	0.000127	0.000000
9	3.2	0.0380	0.0000	17.18	0.0076	0.0000	0.0093	1.43	0.00101	0.000000	0.000000
10	3.6	0.0172	0.0000	8.92	0.6361	0.0121	0.0000	1.39	0.00418	0.000108	0.000046
11	4.0	0.0000	0.0000	13.79	0.0000	0.0054	0.0354	1.11	0.00221	0.000482	0.000241
12	4.4	0.0000	0.0000	4.16	0.0000	0.0129	0.0092	1.09	0.00158	0.000677	0.000310
13	4.8	0.0000	0.0036	3.96	0.0034	0.0054	0.0031	1.27	0.00122	0.000176	0.000000
14	5.2	0.0031	0.0000	8.66	0.0026	0.0015	0.0081	1.25	0.00048	0.000000	0.000000
15	5.6	0.0149	0.2560	4.90	0.0366	0.0018	0.0000	1.22	0.00034	0.000159	0.000000
16	6.0	0.0042	0.4867	14.40	0.0000	0.0000	0.0099	1.28	0.00066	0.000009	0.000082
17	6.4	0.0000	0.0160	3.79	0.0100	0.0000	0.0038	1.04	0.00057	0.000000	0.000037
18	6.8	0.0257	0.1440	20.27	0.0097	0.0088	0.0134	2.09	0.00448	0.000158	0.000000
19	7.2	0.0238	0.0000	4.08	0.0175	0.0112	0.0041	1.36	0.00125	0.000033	0.000000
20	7.6	0.0172	0.3932	7.05	0.0091	0.0005	0.0000	1.43	0.00156	0.000051	0.000000
21	8.0	0.0178	0.0000	11.09	0.1282	0.0095	0.0048	1.64	0.00182	0.000191	0.000069
22	8.4	0.0000	0.3784	7.68	0.1157	0.0000	0.0125	1.40	0.00046	0.000089	0.000101
23	8.8	0.0448	0.2788	8.57	0.2490	0.0043	0.0082	1.59	0.00101	0.000057	0.000073
24	9.2	0.0342	0.0450	9.27	0.0347	0.0007	0.0020	1.35	0.00054	0.000127	0.000123
25	9.6	0.0291	0.4143	4.88	0.0000	0.0079	0.0154	1.68	0.00138	0.000000	0.000106
26	10.0	0.0107	0.5426	4.16	0.0000	0.0074	0.0122	1.57	0.00071	0.000000	0.000000
27	10.4	0.0115	0.5083	6.85	0.0039	0.0024	0.0037	1.44	0.00135	0.000442	0.000060
28	10.8	0.0000	0.3832	5.02	0.0000	0.0000	0.0112	1.51	0.00117	0.000043	0.000000
29	11.2	0.0500	0.0718	10.84	0.0000	0.0132	0.0000	1.68	0.00145	0.000000	0.000005

Spot Number	Distance from the foot (mm)	MR2 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
30	11.6	0.0075	0.0618	6.16	0.0123	0.0003	0.0000	1.51	0.00108	0.000002	0.000039
31	12.0	0.0000	0.0984	22.27	0.0070	0.0004	0.0000	1.62	0.00106	0.000312	0.000052
32	12.4	0.0000	0.4794	6.38	0.0164	0.0013	0.0106	1.31	0.00122	0.000069	0.000108
33	12.8	0.0000	0.0742	12.05	0.0206	0.0071	0.0059	1.41	0.00210	0.000000	0.000000
34	13.2	0.0186	0.3117	4.90	0.0303	0.0036	0.0004	1.07	0.00074	0.000118	0.000058
35	13.6	0.0173	0.0677	3.77	0.0000	0.0036	0.0014	1.41	0.00165	0.000012	0.000000
36	14.0	0.0062	0.1005	5.31	0.0146	0.0000	0.0000	1.78	0.00124	0.000156	0.000000
37	14.4	0.0148	0.5761	24.40	0.0263	0.0130	0.0183	1.79	0.00609	0.000000	0.000030
38	14.8	0.0264	0.1578	2.86	0.0146	0.0000	0.0012	4.21	0.00328	0.000000	0.000355
39	15.2	0.0000	0.1688	4.14	0.0122	0.0047	0.0008	4.02	0.00283	0.000000	0.000139
40	15.6	0.0209	0.0000	3.69	0.0014	0.0030	0.0108	4.60	0.00250	0.000048	0.000166
41	16.0	0.0210	0.2752	5.65	0.0000	0.0040	0.0000	4.51	0.00363	0.000115	0.000087
42	16.4	0.0017	0.3102	4.38	0.0000	0.0021	0.0000	4.47	0.00339	0.000487	0.000276
43	16.8	0.0000	0.0000	33.59	0.0018	0.0069	0.0000	1.57	0.00218	0.000186	0.000000
44	17.2	0.0086	0.3116	8.99	0.0000	0.0009	0.0000	1.66	0.00096	0.000116	0.000000
45	17.6	0.0397	0.0524	24.91	0.0012	0.0009	0.0036	1.72	0.00141	0.000323	0.000039
46	18.0	0.0189	0.4329	28.74	0.0338	0.0108	0.0066	1.78	0.00114	0.000000	0.000005
47	18.4	0.0306	0.0000	6.23	0.0000	0.0041	0.0090	1.63	0.00076	0.000000	0.000000
48	18.8	0.0478	0.0000	10.47	0.0000	0.0070	0.0067	1.55	0.00090	0.000019	0.000000
49	19.2	0.0109	0.0343	18.54	0.0306	0.0057	0.0031	1.59	0.00064	0.000000	0.000000
50	19.6	0.0536	0.3113	19.50	0.0504	0.0038	0.0194	1.78	0.00143	0.000048	0.000026
51	20.0	0.0110	0.0986	9.80	0.0033	0.0019	0.0107	1.67	0.00102	0.000066	0.000108
52	20.4	0.0179	0.1878	8.56	0.0069	0.0094	0.0087	1.66	0.00094	0.000122	0.000072
53	20.8	0.0049	0.1122	11.89	0.0676	0.0091	0.0154	1.62	0.00097	0.000114	0.000000
54	21.2	0.0112	0.2102	6.79	0.0073	0.0000	0.0055	1.30	0.00105	0.000000	0.000000
55	21.6	0.0411	0.5367	43.04	0.0417	0.0000	0.0043	2.34	0.00454	0.000000	0.000077
56	22.0	0.0409	0.3669	36.82	0.0000	0.0041	0.0116	1.90	0.00275	0.000077	0.000000
57	22.4	0.0572	0.1800	15.10	0.0000	0.0076	0.0001	4.55	0.00451	0.000242	0.000493
58	22.8	0.0402	0.1304	6.27	0.0301	0.0018	0.0023	1.52	0.00085	0.000000	0.000154
59	23.2	0.0226	0.4078	4.68	0.0000	0.0063	0.0185	1.45	0.00023	0.000000	0.000000

Spot Number	Distance from the foot (mm)	MR2 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
60	23.6	0.0196	0.4409	7.50	0.0221	0.0058	0.0126	1.71	0.00044	0.000000	0.000000
61	24.0	0.0135	0.1290	2.30	0.0055	0.0014	0.0026	5.02	0.00467	0.000000	0.000534
62	24.4	0.9830	94.9266	361.75	14.8474	0.0578	0.0954	2.06	0.00000	0.008198	0.007424
63	24.8	0.0139	0.0999	12.86	0.0000	0.0000	0.0090	1.30	0.00050	0.000000	0.000002
64	25.2	0.0000	0.0042	13.21	0.0068	0.0041	0.0010	1.60	0.00350	0.000000	0.000160
65	25.6	0.0252	0.7103	3.13	0.0000	0.0005	0.0028	1.40	0.00111	0.000000	0.000163
66	26.0	0.0000	0.2313	3.90	0.0000	0.0018	0.0188	1.44	0.00038	0.000000	0.000007
67	26.4	0.0000	0.0000	3.48	0.0385	0.0030	0.0197	1.34	0.00082	0.000000	0.000000
68	26.8	0.0000	0.1836	2.81	0.0379	0.0010	0.0204	1.41	0.00239	0.000210	0.000069
69	27.2	0.0000	0.1267	3.14	0.0413	0.0086	0.0109	1.65	0.00178	0.000032	0.000000
70	27.6	0.0165	0.1246	4.65	0.0005	0.0056	0.0101	1.44	0.00129	0.000000	0.000000
71	28.0	0.0740	0.0000	3.36	0.0189	0.0083	0.0000	1.38	0.00103	0.000260	0.000044
72	28.4	0.0002	0.2994	6.93	0.0329	0.0030	0.0077	1.45	0.00107	0.000000	0.000000
73	28.8	0.0050	0.5308	5.12	0.0000	0.0011	0.0064	1.48	0.00092	0.000064	0.000008
74	29.2	0.0194	0.0000	3.81	0.0051	0.0080	0.0111	1.46	0.00127	0.000192	0.000013
75	29.6	0.0059	0.1981	3.40	0.0035	0.0000	0.0000	1.42	0.00076	0.000186	0.000000
76	30.0	0.0792	0.0954	5.87	0.0218	0.0024	0.0090	1.78	0.00167	0.000071	0.000000
77	30.4	0.0000	0.3019	10.62	0.0068	0.0066	0.0000	1.92	0.00149	0.000000	0.000000
78	30.8	0.0245	0.3359	14.76	0.0131	0.0000	0.0027	1.69	0.00114	0.000000	0.000039
79	31.2	0.0000	0.2335	4.90	0.0000	0.0079	0.0098	1.44	0.00108	0.000180	0.000000
80	31.6	0.0270	0.2430	6.90	0.0239	0.0055	0.0037	1.57	0.00123	0.000052	0.000000
81	32.0	0.0187	0.0187	5.03	0.0342	0.0000	0.0096	1.71	0.00163	0.000086	0.000009
82	32.4	0.0252	0.0734	11.24	0.0567	0.0045	0.0113	1.26	0.00100	0.000398	0.000113
83	32.8	0.0186	0.3220	7.17	0.0000	0.0077	0.0188	1.25	0.00089	0.000115	0.000000
84	33.2	0.0000	0.2239	4.48	0.0165	0.0000	0.0074	1.30	0.00132	0.000000	0.000000
85	33.6	0.0456	0.2810	4.41	0.0000	0.0042	0.0084	1.55	0.00111	0.000237	0.000006
86	34.0	0.0631	0.2598	5.58	0.0478	0.0044	0.0044	1.27	0.00055	0.000275	0.000098
87	34.4	0.0032	0.2715	5.97	0.0000	0.0006	0.0000	1.19	0.00058	0.000095	0.000068
88	34.8	0.0400	0.2708	3.49	0.0082	0.0082	0.0000	1.05	0.00065	0.000021	0.000077

APPENDIX 5.1o MD1 prismatic layer transect data

Spot Number	Distance from the foot (mm)	MD1 prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.0	0.0161	0.000	9.97	0.033	0.00269	0.0080	1.49	0.001327	0.0000000	0.0000717
2	0.4	0.0122	0.000	3.52	0.000	0.00475	0.0000	1.29	0.000472	0.0000000	0.0000000
3	0.8	0.0146	0.000	4.18	0.000	0.00000	0.0000	1.82	0.000536	0.0002286	0.0000000
4	1.2	0.0126	0.000	17.76	0.145	0.00166	0.0034	1.85	0.000668	0.0001160	0.0000656
5	1.6	0.0064	0.000	6.83	0.123	0.00000	0.0000	1.46	0.000512	0.0000000	0.0000314
6	2.0	0.0001	0.000	11.37	0.079	0.00000	0.0016	1.70	0.000905	0.0001554	0.0000000
7	2.4	0.0267	0.000	12.69	0.054	0.00000	0.0062	1.87	0.000896	0.0002297	0.0000863
8	2.8	0.0000	0.317	5.14	0.004	0.00000	0.0018	1.58	0.000353	0.0000000	0.0000000
9	3.2	0.0318	0.034	5.35	0.000	0.00000	0.0123	1.48	0.000414	0.0000129	0.0000000
10	3.6	0.0040	0.000	17.59	0.197	0.00000	0.0069	1.70	0.000873	0.0000680	0.0000237
11	4.0	0.0244	0.000	7.82	0.006	0.01011	0.0112	1.33	0.000334	0.0000000	0.0000000
12	4.4	0.0132	0.256	4.70	0.029	0.00449	0.0049	1.51	0.000512	0.0002485	0.0000000
13	4.8	0.0000	0.000	12.40	2.309	0.00187	0.0065	1.63	0.003495	0.0000000	0.0000251
14	5.2	0.0285	0.064	2.25	0.004	0.00050	0.0104	1.27	0.000466	0.0000364	0.0000000
15	5.6	0.0158	0.160	6.45	0.002	0.00633	0.0000	1.20	0.000484	0.0001267	0.0000104
16	6.0	0.0000	0.695	8.01	0.338	0.00389	0.0007	1.33	0.000785	0.0002397	0.0000000
17	6.4	0.0000	0.204	11.33	0.026	0.00000	0.0064	1.43	0.000658	0.0003057	0.0000000
18	6.8	0.0000	0.025	25.60	0.003	0.00309	0.0000	1.24	0.000881	0.0000000	0.0000602
19	7.2	0.0251	0.751	10.04	0.121	0.00941	0.0000	1.50	0.001051	0.0000000	0.0000527
20	7.6	0.0000	0.268	9.82	0.128	0.00258	0.0037	1.56	0.000999	0.0002977	0.0000466
21	8.0	0.0053	0.000	12.27	0.035	0.00221	0.0000	1.37	0.000676	0.0002824	0.0000650
22	8.4	0.0585	0.590	21.48	4.652	0.01612	0.0000	1.82	0.005108	0.0001894	0.0001865
23	8.8	0.0072	0.047	2.50	0.299	0.00000	0.0114	1.29	0.000700	0.0000619	0.0000000
24	9.2	0.0208	0.535	13.19	0.082	0.00242	0.0081	1.52	0.000726	0.0000000	0.0000000
25	9.6	0.0097	0.273	5.08	0.000	0.00031	0.0000	1.41	0.000745	0.0000000	0.0000624
26	10.0	0.0092	0.023	9.41	0.017	0.00585	0.0027	1.37	0.000689	0.0000622	0.0000000
27	10.4	0.0131	0.000	4.40	0.000	0.00601	0.0080	1.49	0.000461	0.0000076	0.0000000
28	10.8	0.0077	0.059	6.07	0.024	0.00370	0.0000	1.34	0.000470	0.0001034	0.0000000
29	11.2	0.0420	0.000	4.77	0.000	0.00327	0.0000	1.39	0.000646	0.0000000	0.0000000

Spot Number	Distance from the foot (mm)	MD1 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
30	11.6	0.0041	0.119	21.80	0.000	0.00827	0.0100	1.57	0.000871	0.0000000	0.0000212
31	12.0	0.0268	0.161	2.90	0.000	0.00100	0.0074	1.32	0.000901	0.0000000	0.0000000
32	12.4	0.0000	0.111	2.71	0.018	0.00030	0.0028	0.97	0.000580	0.0002770	0.0000046
33	12.8	0.0000	0.372	6.28	0.023	0.00000	0.0030	1.21	0.000472	0.0000901	0.0000000
34	13.2	0.0340	1.566	3.12	0.000	0.00384	0.0000	6.55	0.005225	0.0000000	0.0005987
35	13.6	0.0445	0.460	8.58	0.000	0.00000	0.0000	1.35	0.000385	0.0000407	0.0000191
36	14.0	0.0217	0.198	5.49	0.000	0.00451	0.0109	1.08	0.000080	0.0003627	0.0000030
37	14.4	0.0307	0.268	10.40	0.000	0.00835	0.0078	1.38	0.000288	0.0000000	0.0000000
38	14.8	0.0205	0.272	4.70	0.008	0.00160	0.0000	1.28	0.000141	0.0000000	0.0000435
39	15.2	0.0144	0.000	8.38	0.000	0.00722	0.0099	1.12	0.000388	0.0000985	0.0000649
40	15.6	0.0184	0.000	12.04	2.365	0.00468	0.0075	1.37	0.002281	0.0001006	0.0000352
41	16.0	0.0382	0.000	14.67	0.020	0.00380	0.0000	1.34	0.000748	0.0000000	0.0000496
42	16.4	0.0275	0.051	6.82	0.017	0.00354	0.0000	1.52	0.001152	0.0001393	0.0000000
43	16.8	0.0000	0.555	1.96	0.011	0.00972	0.0101	1.10	0.000388	0.0000000	0.0000000
44	17.2	0.0246	0.421	2.30	0.043	0.00947	0.0074	1.30	0.000355	0.0000054	0.0000000
45	17.6	0.0110	0.009	2.78	0.000	0.00269	0.0093	1.21	0.000451	0.0000498	0.0000377
46	18.0	0.0034	0.230	3.09	0.044	0.00836	0.0034	1.13	0.000000	0.0000000	0.0000326
47	18.4	0.0000	0.000	3.03	0.000	0.00698	0.0076	1.25	0.000395	0.0003225	0.0000311
48	18.8	0.0000	0.524	1.81	0.018	0.00281	0.0258	1.29	0.000447	0.0000540	0.0000000
49	19.2	0.0063	0.131	3.00	0.000	0.00350	0.0000	1.31	0.000813	0.0000196	0.0000132
50	19.6	0.0000	0.162	2.58	0.473	0.00733	0.0000	1.17	0.001005	0.0000000	0.0000000
51	20.0	0.0152	0.089	3.23	0.000	0.00829	0.0157	1.23	0.000537	0.0000000	0.0000072
52	20.4	0.0000	0.398	5.21	0.006	0.00000	0.0050	1.19	0.000568	0.0000000	0.0000000
53	20.8	0.0000	0.109	20.83	0.021	0.01654	0.0122	1.52	0.001153	0.0000000	0.0000373
54	21.2	0.0470	0.163	18.57	0.188	0.00517	0.0108	1.49	0.001415	0.0000740	0.0000637
55	21.6	0.0547	0.181	7.53	0.000	0.00000	0.0059	1.28	0.000442	0.0000000	0.0000000
56	22.0	0.0073	0.000	6.22	0.025	0.00565	0.0239	1.33	0.000781	0.0000793	0.0000765
57	22.4	0.0540	0.000	14.13	0.032	0.02935	0.0050	1.58	0.000731	0.0000000	0.0000576
58	22.8	0.0106	0.050	12.88	0.038	0.00640	0.0000	1.53	0.000334	0.0000000	0.0000000
59	23.2	0.0271	0.000	3.39	0.000	0.01602	0.0060	1.47	0.000645	0.0000000	0.0000273

Spot Number	Distance from the foot (mm)	MD1 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
60	23.6	0.0585	0.145	3.03	0.006	0.02294	0.0070	4.86	0.004638	0.0002041	0.0010382
61	24.0	0.0000	0.000	8.75	0.000	0.00882	0.0146	1.46	0.000609	0.0001914	0.0000000
62	24.4	0.0000	0.195	3.20	0.003	0.00385	0.0000	1.43	0.000550	0.0000000	0.0000000
63	24.8	0.0001	0.255	3.61	0.000	0.00000	0.0069	1.45	0.000529	0.0000164	0.0000028
64	25.2	0.0000	0.273	3.29	0.013	0.00718	0.0114	1.31	0.000450	0.0001987	0.0000000
65	25.6	0.0342	0.453	4.81	0.000	0.00893	0.0000	1.39	0.000059	0.0000890	0.0000000
66	26.0	0.0112	0.085	6.43	0.000	0.00294	0.0050	1.44	0.000190	0.0000000	0.0000000
67	26.4	0.0000	0.504	2.47	0.004	0.00616	0.0071	1.06	0.000372	0.0003578	0.0000000
68	26.8	0.0361	0.360	2.22	0.018	0.00821	0.0150	1.15	0.000456	0.0000000	0.0000050
69	27.2	0.0379	0.110	3.71	0.028	0.00918	0.0009	1.20	0.000499	0.0002057	0.0000000
70	27.6	0.0000	0.462	4.62	0.109	0.00000	0.0071	1.50	0.000801	0.0000000	0.0000000
71	28.0	0.0064	0.629	11.29	0.000	0.00012	0.0091	1.24	0.000533	0.0000000	0.0000064
72	28.4	0.0440	0.288	8.23	0.000	0.00816	0.0000	1.40	0.000634	0.0000045	0.0001223
73	28.8	0.0251	0.000	12.06	0.000	0.00188	0.0036	1.73	0.000902	0.0000930	0.0000460
74	29.2	0.0965	0.180	9.35	0.020	0.01264	0.0000	1.41	0.000753	0.0003296	0.0000000
75	29.6	0.0178	0.595	3.28	0.000	0.00854	0.0030	1.44	0.000307	0.0000000	0.0001539
76	30.0	0.0585	0.350	3.09	0.040	0.01624	0.0100	1.36	0.000321	0.0001198	0.0000354
77	30.4	0.0095	0.032	6.23	0.000	0.00074	0.0111	1.47	0.000578	0.0000537	0.0000016
78	30.8	0.0346	0.110	5.85	0.000	0.00804	0.0072	1.20	0.000207	0.0002393	0.0000000
79	31.2	0.0076	0.131	17.42	0.216	0.00696	0.0000	2.75	0.002306	0.0000000	0.0001797
80	31.6	0.0208	0.227	9.44	0.022	0.02298	0.0172	1.93	0.000717	0.0003370	0.0000000
81	32.0	0.0000	0.397	2.99	0.004	0.01376	0.0000	1.40	0.000533	0.0002322	0.0000401
82	32.4	0.0482	0.000	5.50	0.005	0.01678	0.0262	1.58	0.000412	0.0001652	0.0000459
83	32.8	0.0218	0.000	2.78	0.046	0.00000	0.0293	1.07	0.000633	0.0000000	0.0000000
84	33.2	0.0209	0.240	2.83	0.000	0.00305	0.0385	1.45	0.000802	0.0000555	0.0000505
85	33.6	0.0010	0.416	2.20	0.021	0.00514	0.0337	1.55	0.000525	0.0000000	0.0000000
86	34.0	0.0109	0.030	2.46	0.034	0.00338	0.0000	1.52	0.000571	0.0000000	0.0001310
87	34.4	0.0000	0.000	2.53	0.000	0.00444	0.0067	1.30	0.000642	0.0000000	0.0000913
88	34.8	0.0716	1.305	2.80	0.154	0.02099	0.0342	1.37	0.000780	0.0003332	0.0001257
89	35.2	0.0181	0.084	2.27	0.000	0.00920	0.0013	1.22	0.000287	0.0001408	0.0001020

Spot Number	Distance from the foot (mm)	MD1 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
90	35.6	0.0498	0.386	3.62	0.000	0.00109	0.0000	1.51	0.000517	0.0000800	0.0000173
91	36.0	0.0000	0.243	1.99	0.008	0.00278	0.0012	1.12	0.000291	0.0002236	0.0000000
92	36.4	0.0188	0.177	2.74	0.033	0.00000	0.0001	1.13	0.000631	0.0001002	0.0000000
93	36.8	0.0000	0.000	2.06	0.003	0.00000	0.0000	1.17	0.000140	0.0003906	0.0001187
94	37.2	0.0649	0.501	2.47	0.033	0.00677	0.0100	1.14	0.000333	0.0004188	0.0000105
95	37.6	0.0247	0.263	3.79	0.014	0.00000	0.0000	1.25	0.000851	0.0002787	0.0000000
96	38.0	0.0392	0.070	10.31	0.000	0.00655	0.0048	1.57	0.000622	0.0002720	0.0002570
97	38.4	0.0000	0.409	10.64	0.008	0.05084	0.0168	1.17	0.000626	0.0000000	0.0000727

APPENDIX 5.1p MD3 prismatic layer transect data

Spot Number	Distance from the foot (mm)	MD3 prismatic layer transect corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.0	0.0190	0.0336	28.55	0.075	0.00505	0.0055	1.58	0.001026	0.0000000	0.0000000
2	0.4	0.0050	0.0218	3.92	0.002	0.00000	0.0099	1.43	0.000634	0.0000950	0.0000000
3	0.8	0.0095	0.0000	5.98	0.263	0.00148	0.0208	1.36	0.000515	0.0000000	0.0000053
4	1.2	0.0318	0.0000	9.39	0.124	0.00012	0.0136	1.39	0.000665	0.0000000	0.0000283
5	1.6	0.0288	0.0140	19.39	0.337	0.00231	0.0187	1.86	0.001875	0.0001812	0.0001014
6	2.0	0.0000	0.0182	10.17	0.008	0.00339	0.0000	1.26	0.000496	0.0000177	0.0000004
7	2.4	0.0112	0.0000	6.45	0.001	0.00167	0.0106	1.24	0.000427	0.0000000	0.0000143
8	2.8	0.0123	0.0031	4.94	0.005	0.00076	0.0100	1.49	0.000542	0.0000598	0.0000000
9	3.2	0.0151	0.0000	3.26	0.000	0.00144	0.0141	1.47	0.000472	0.0000742	0.0000196
10	3.6	0.0137	0.0118	3.22	0.003	0.00000	0.0081	1.22	0.000311	0.0000000	0.0000150
11	4.0	0.0253	0.0081	4.94	0.000	0.00365	0.0160	1.39	0.000550	0.0000000	0.0000000
12	4.4	0.0163	0.0260	5.68	0.950	0.00287	0.0087	1.59	0.001998	0.0000141	0.0000047
13	4.8	0.0237	0.0000	3.67	0.002	0.00195	0.0095	1.29	0.000363	0.0000308	0.0000000
14	5.2	0.0057	0.0000	9.68	0.001	0.00001	0.0094	1.47	0.000393	0.0000000	0.0000127
15	5.6	0.0150	0.0730	13.10	0.151	0.00358	0.0045	3.32	0.001606	0.0000619	0.0001739
16	6.0	0.0246	0.0496	24.68	1.302	0.00138	0.0000	1.55	0.001590	0.0000000	0.0000417
17	6.4	0.0000	0.0249	5.13	0.006	0.00232	0.0045	1.40	0.000427	0.0000000	0.0000204
18	6.8	0.0079	0.0239	5.26	0.000	0.00570	0.0090	1.48	0.000685	0.0000343	0.0000000
19	7.2	0.0202	0.0190	4.57	0.000	0.00376	0.0048	1.37	0.000372	0.0000000	0.0000000
20	7.6	0.0012	0.0024	3.17	0.005	0.00260	0.0117	1.15	0.000378	0.0000443	0.0000123
21	8.0	0.0255	0.0356	12.81	0.345	0.00488	0.0116	1.59	0.000891	0.0000000	0.0000339
22	8.4	0.0050	0.0657	16.98	0.012	0.00203	0.0097	1.44	0.000675	0.0001519	0.0000000
23	8.8	0.0127	0.0047	13.90	0.004	0.00337	0.0010	1.49	0.000735	0.0000114	0.0000075
24	9.2	0.0012	0.0166	11.12	1.240	0.00518	0.0011	1.54	0.001011	0.0000609	0.0000000
25	9.6	0.0000	0.0090	4.37	0.000	0.00098	0.0081	1.40	0.000419	0.0000000	0.0000000
26	10.0	0.0000	0.0441	11.12	0.013	0.00274	0.0102	1.36	0.000680	0.0000757	0.0000000
27	10.4	0.0119	0.0163	3.21	0.001	0.00327	0.0000	1.35	0.000512	0.0000108	0.0000278
28	10.8	0.0111	0.0115	5.35	0.001	0.00000	0.0097	1.32	0.000824	0.0000784	0.0000000
29	11.2	0.0145	0.0000	3.67	0.000	0.00081	0.0126	1.40	0.000239	0.0000000	0.0000000

Spot Number	Distance from the foot (mm)	MD3 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
30	11.6	0.0000	0.0051	2.84	0.000	0.00000	0.0113	1.18	0.000330	0.0000803	0.0000000
31	12.0	0.0000	0.0000	3.47	0.000	0.00073	0.0085	0.98	0.000382	0.0000845	0.0000271
32	12.4	0.0137	0.0000	4.97	0.004	0.00344	0.0116	1.38	0.000463	0.0000775	0.0000232
33	12.8	0.0126	0.0093	5.88	0.009	0.00000	0.0087	1.28	0.000505	0.0000071	0.0000000
34	13.2	0.0161	0.0156	9.59	0.000	0.00216	0.0074	1.25	0.000568	0.0000313	0.0000000
35	13.6	0.0069	0.0120	3.71	0.000	0.00488	0.0052	1.37	0.000285	0.0000137	0.0000000
36	14.0	0.0060	0.0242	3.41	0.000	0.00289	0.0068	1.62	0.000500	0.0000000	0.0000000
37	14.4	0.0382	0.1404	21.53	2.565	0.00872	0.0119	3.88	0.008295	0.0002025	0.0005845
38	14.8	0.0161	0.0514	8.87	0.000	0.00349	0.0047	1.30	0.000553	0.0000000	0.0000000
39	15.2	0.0000	0.0000	4.42	0.000	0.00225	0.0057	1.46	0.000533	0.0000867	0.0000073
40	15.6	0.0346	0.0399	4.03	0.000	0.00241	0.0041	1.39	0.000437	0.0000087	0.0000054
41	16.0	0.0001	0.0012	3.66	0.000	0.00436	0.0082	1.45	0.000222	0.0000000	0.0000000
42	16.4	0.0126	0.0051	12.05	0.011	0.00512	0.0126	1.52	0.000557	0.0000974	0.0000243
43	16.8	0.0245	0.1466	3.26	0.777	0.00419	0.0095	4.11	0.002733	0.0001408	0.0006332
44	17.2	0.0000	0.0034	6.72	0.000	0.00035	0.0144	1.51	0.000689	0.0000328	0.0000083
45	17.6	0.0092	0.0000	12.57	0.006	0.00442	0.0163	1.69	0.000913	0.0000248	0.0000000
46	18.0	0.0000	0.1129	18.03	0.011	0.01219	0.0248	2.04	0.001608	0.0001279	0.0000682
47	18.4	0.0034	0.0187	6.63	0.000	0.00170	0.0096	1.46	0.000382	0.0000000	0.0000000
48	18.8	0.0130	0.0005	4.58	0.045	0.00311	0.0069	1.25	0.000537	0.0000000	0.0000000
49	19.2	0.0000	0.0000	3.46	0.000	0.00142	0.0129	1.19	0.000739	0.0000477	0.0000000
50	19.6	0.0032	0.0675	6.22	0.188	0.00162	0.0158	1.46	0.000490	0.0001082	0.0000244
51	20.0	0.0078	0.0176	4.59	0.000	0.00673	0.0139	1.44	0.000494	0.0000047	0.0000183
52	20.4	0.0000	0.0000	5.20	0.012	0.00428	0.0164	1.36	0.000460	0.0000057	0.0000000
53	20.8	0.0000	0.0000	4.23	0.000	0.00204	0.0125	1.31	0.000311	0.0000000	0.0000000
54	21.2	0.0270	0.0000	5.92	0.009	0.00372	0.0175	1.47	0.000675	0.0000000	0.0000177
55	21.6	0.0378	0.0602	3.49	0.000	0.00438	0.0252	1.26	0.001003	0.0000000	0.0000000
56	22.0	0.0050	0.0118	4.57	0.015	0.00111	0.0178	1.00	0.000651	0.0000869	0.0000000
57	22.4	0.0249	0.0000	5.44	0.003	0.00134	0.0170	1.02	0.000383	0.0000106	0.0000000
58	22.8	0.0246	0.0032	5.91	0.001	0.00329	0.0097	1.00	0.000308	0.0000421	0.0000000
59	23.2	0.0094	0.0000	7.22	0.000	0.00406	0.0089	1.17	0.000596	0.0000551	0.0000000

Spot Number	Distance from the foot (mm)	MD3 prismatic layer transect corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
60	23.6	0.0355	0.0317	6.91	0.019	0.00000	0.0099	1.19	0.000286	0.0000000	0.0000000
61	24.0	0.0000	0.0000	3.97	0.000	0.00115	0.0039	0.99	0.000000	0.0000000	0.0000000
62	24.4	0.0348	0.0430	2.74	0.019	0.00036	0.0112	1.37	0.000474	0.0000435	0.0000000
63	24.8	0.0000	0.0317	4.76	0.033	0.00000	0.0053	1.39	0.000602	0.0000219	0.0000113
64	25.2	0.0037	0.0000	3.17	0.000	0.00244	0.0055	1.22	0.000379	0.0000655	0.0000000
65	25.6	0.0064	0.0000	8.23	0.004	0.00380	0.0029	1.50	0.000522	0.0000309	0.0000254
66	26.0	0.0075	0.0033	9.33	0.358	0.00688	0.0165	1.63	0.001085	0.0000249	0.0000446
67	26.4	0.0000	0.0000	18.23	0.939	0.00823	0.0218	1.74	0.001335	0.0000000	0.0000000
68	26.8	0.0000	0.0000	4.87	0.107	0.00460	0.0120	1.05	0.000473	0.0000506	0.0000000
69	27.2	0.0109	0.0025	5.17	0.000	0.00255	0.0143	1.03	0.000457	0.0000905	0.0000050
70	27.6	0.0169	0.0000	10.35	0.017	0.00063	0.0135	1.07	0.000312	0.0001200	0.0000153
71	28.0	0.0248	0.0033	4.80	0.011	0.00184	0.0205	1.25	0.000481	0.0001499	0.0000000
72	28.4	0.0030	0.0000	3.03	0.000	0.00082	0.0182	1.29	0.000375	0.0000000	0.0000021
73	28.8	0.0000	0.0084	3.76	0.000	0.00000	0.0040	1.44	0.000238	0.0000000	0.0000000
74	29.2	0.0111	0.0124	5.13	0.004	0.00167	0.0154	1.37	0.000543	0.0001568	0.0000039
75	29.6	0.0198	0.0097	13.27	0.001	0.00300	0.0082	1.45	0.000642	0.0000000	0.0000000
76	30.0	0.0247	0.0257	16.81	0.298	0.00288	0.0184	1.80	0.001358	0.0000074	0.0000288
77	30.4	0.0136	0.0000	8.96	0.013	0.00433	0.0184	1.46	0.000535	0.0001071	0.0000180
78	30.8	0.0000	0.0124	9.43	0.000	0.00001	0.0129	1.42	0.000781	0.0000771	0.0000000
79	31.2	0.0138	0.0000	6.87	0.000	0.00503	0.0128	1.49	0.000490	0.0000000	0.0000000
80	31.6	0.0183	0.0186	7.65	0.264	0.00593	0.0118	1.74	0.000954	0.0000719	0.0000111
81	32.0	0.0108	0.0000	5.50	0.001	0.00712	0.0151	1.36	0.000517	0.0001430	0.0000000
82	32.4	0.0000	0.0000	7.03	0.168	0.00254	0.0121	1.33	0.000701	0.0001128	0.0000085
83	32.8	0.0152	0.0147	4.90	0.000	0.00020	0.0152	1.08	0.000348	0.0000000	0.0000000
84	33.2	0.0341	0.0038	5.07	0.001	0.00174	0.0028	1.04	0.000247	0.0000000	0.0000126
85	33.6	0.0000	0.0055	7.63	0.796	0.00579	0.0194	1.42	0.000687	0.0000000	0.0000000
86	34.0	0.0000	0.0163	6.63	0.000	0.00305	0.0146	1.12	0.000515	0.0001532	0.0000134
87	34.4	0.0296	0.0000	5.53	0.030	0.01364	0.0158	1.46	0.000741	0.0000370	0.0000205
88	34.8	0.0191	0.0000	3.67	0.015	0.00129	0.0188	1.35	0.000357	0.0001029	0.0000000
89	35.2	0.0195	0.0105	7.19	0.017	0.00924	0.0014	1.50	0.000668	0.0000509	0.0000000

APPENDIX 5.2a RW75 nacreous layer data

Spot Number	Distance from inner shell (mm)	RW75 nacreous layer transect N1 corrected data (mmol/mol)					
		Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca
1	0.05	0.275	0.000171	0.00149	0.00391	1.57	0.00239
2	0.10	0.256	0.000713	0.00182	0.00358	1.66	0.00296
3	0.15	6.833	0.000000	0.00145	0.00570	2.97	0.00123
4	0.20	0.201	0.000000	0.00026	0.00658	1.58	0.00219
5	0.25	0.185	0.000000	0.00157	0.00408	1.64	0.00214
6	0.30	0.176	0.000107	0.00237	0.00306	1.78	0.00216
7	0.35	0.176	0.000000	0.00321	0.00168	1.77	0.00202
8	0.40	0.188	0.000000	0.00065	0.00715	1.90	0.00243
9	0.45	0.233	0.000575	0.00137	0.01722	1.85	0.00274
10	0.50	0.191	0.000079	0.00126	0.00379	1.54	0.00189
11	0.55	0.161	0.000152	0.00202	0.00150	1.63	0.00208
12	0.60	0.179	0.000272	0.00221	0.00177	1.53	0.00180
13	0.65	0.156	0.000000	0.00010	0.00378	1.59	0.00181

Spot Number	Distance from inner shell (mm)	RW75 nacreous layer transect N2 corrected data (mmol/mol)					
		Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca
1	0.00	0.278	0.000495	0.00397	0.00359	1.68	0.00217
2	0.05	0.287	0.000161	0.00164	0.00378	1.60	0.00217
3	0.10	0.357	0.000181	0.00480	0.00695	1.72	0.00270
4	0.15	14.442	0.014564	0.00892	0.03345	4.30	0.00367
5	0.20	0.214	0.000393	0.00169	0.00884	1.60	0.00216
6	0.25	0.227	0.000130	0.00268	0.00454	1.71	0.00213
7	0.30	0.196	0.000256	0.00447	0.00569	1.53	0.00201
8	0.35	0.185	0.000201	0.00073	0.00373	1.61	0.00164
9	0.40	0.152	0.000088	0.00237	0.00420	1.45	0.00140
10	0.45	0.157	0.000260	0.00092	0.00328	1.43	0.00149
11	0.50	0.150	0.000127	0.00073	0.00374	1.49	0.00157
12	0.55	0.175	0.000009	0.00373	0.00550	1.56	0.00170
13	0.60	0.197	0.000294	0.00400	0.00276	1.52	0.00168
14	0.65	0.173	0.000000	0.00164	0.00860	1.62	0.00178
15	0.70	0.178	0.000000	0.00023	0.00254	1.76	0.00182
16	0.75	0.218	0.000000	0.00336	0.00182	1.68	0.00178
17	0.80	0.285	0.000301	0.00082	0.00685	1.76	0.00197
18	0.85	0.233	0.000000	0.00157	0.00766	1.95	0.00214

Spot Number	Distance from inner shell (mm)	RW75 nacreous layer transect N3 corrected data (mmol/mol)					
		Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca
1	0	0.289	0.000250	0.00287	0.00191	1.67	0.00232
2	0.05	0.270	0.000000	0.00353	0.00859	1.63	0.00204
3	0.1	1.368	0.000180	0.00146	0.00466	2.96	0.00197
4	0.15	0.551	0.000866	0.00204	0.01292	2.45	0.00244
5	0.2	0.254	0.000079	0.00382	0.01023	1.81	0.00245
6	0.25	0.293	0.000054	0.00448	0.00707	1.60	0.00189
7	0.3	0.000	0.000985	0.00431	0.00572	1.92	0.00232
8	0.35	0.244	0.000599	0.00158	0.00381	1.46	0.00177
9	0.4	3.771	0.000601	0.00448	0.00858	3.82	0.00178
10	0.45	0.386	0.000825	0.00413	0.00747	1.47	0.00165
11	0.5	0.270	0.000000	0.00120	0.00302	1.54	0.00152
12	0.55	0.234	0.000000	0.00285	0.01237	1.52	0.00182
13	0.6	0.190	0.000479	0.00076	0.00215	1.66	0.00190
14	0.65	0.234	0.000000	0.00296	0.00332	1.44	0.00153
15	0.7	0.195	0.000720	0.00356	0.00438	1.43	0.00136
16	0.75	0.179	0.000297	0.00062	0.00310	1.52	0.00151
17	0.8	0.157	0.001137	0.00000	0.01098	1.77	0.00188
18	0.85	0.155	0.000000	0.00000	0.00837	1.71	0.00176
19	0.9	0.142	0.000000	0.00191	0.00562	1.66	0.00176
20	0.95	0.160	0.000471	0.00299	0.00707	1.70	0.00197

Spot Number	Distance from inner shell (mm)	RW75 nacreous layer transect N4 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0190	0.0228	0.239	0.00366	0.00239	0.0057	1.53	0.00252	0.0000823	0.0000014
2	0.05	0.0061	0.0452	0.248	0.00000	0.00041	0.0058	1.48	0.00223	0.0000569	0.0000000
3	0.10	0.0095	0.0464	0.283	0.00249	0.00214	0.0123	1.91	0.00239	0.0000000	0.0000176
4	0.15	0.0106	0.0232	0.250	0.00273	0.00020	0.0014	1.76	0.00202	0.0000324	0.0000146
5	0.20	0.0130	0.0372	0.282	0.00000	0.00018	0.0073	1.59	0.00217	0.0000771	0.0000201
6	0.25	0.0000	0.0264	0.176	0.00082	0.00155	0.0068	1.67	0.00177	0.0000491	0.0000000
7	0.30	0.0000	0.0248	0.175	0.00101	0.00094	0.0118	1.69	0.00198	0.0000179	0.0000000
8	0.35	0.0000	0.0141	0.177	0.00000	0.00000	0.0101	1.60	0.00171	0.0000261	0.0000014
9	0.40	0.0000	0.0285	0.182	0.00408	0.00291	0.0057	1.67	0.00176	0.0000467	0.0000000
10	0.45	0.0000	0.0166	0.152	0.00206	0.00066	0.0063	1.76	0.00178	0.0000431	0.0000000
11	0.50	0.0183	0.0437	0.161	0.00000	0.00063	0.0056	1.77	0.00177	0.0000600	0.0000000
12	0.55	0.0000	0.0342	0.179	0.00044	0.00137	0.0060	1.64	0.00168	0.0000557	0.0000002
13	0.60	0.0019	0.0266	0.169	0.00000	0.00136	0.0021	1.57	0.00153	0.0001517	0.0000117
14	0.65	0.0071	0.0420	0.193	0.00255	0.00030	0.0084	1.60	0.00169	0.0002788	0.0000015
15	0.70	0.0139	0.0313	0.201	0.00723	0.00126	0.0087	1.63	0.00185	0.0001634	0.0000000
16	0.75	0.0105	0.0467	0.223	0.00643	0.00068	0.0083	1.68	0.00215	0.0000577	0.0000000
17	0.80	0.0000	0.0499	0.277	0.00302	0.00000	0.0133	2.13	0.00286	0.0000832	0.0000000

Spot Number	Distance from the foot (mm)	RW75 nacreous layer transect N5 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0143	0.0321	0.401	0.00000	0.00425	0.0047	1.75	0.00278	0.0000586	0.0000048
2	0.05	0.0266	0.0096	0.170	0.00000	0.00288	0.0036	1.50	0.00146	0.0000205	0.0000163
3	0.10	0.0139	0.0216	0.132	0.00336	0.00000	0.0022	1.65	0.00159	0.0000222	0.0000000
4	0.15	0.0000	0.0416	0.128	0.00000	0.00453	0.0079	1.85	0.00164	0.0000134	0.0000000
5	0.20	0.0000	0.0101	0.138	0.01383	0.00243	0.0026	1.47	0.00143	0.0000872	0.0000000
6	0.25	0.0062	0.0366	0.206	0.00000	0.00298	0.0070	1.85	0.00218	0.0000163	0.0000171
7	0.30	0.0000	0.0384	0.704	0.01500	0.00289	0.0035	1.92	0.00217	0.0000239	0.0000214
8	0.35	0.0158	0.0136	0.259	0.00000	0.00555	0.0036	1.91	0.00202	0.0000233	0.0000000
9	0.40	0.0032	0.0000	0.218	0.00041	0.00285	0.0037	1.85	0.00186	0.0000725	0.0000000
10	0.45	0.0000	0.0512	0.201	0.01116	0.00000	0.0064	1.89	0.00176	0.0000460	0.0000000
11	0.50	0.0146	0.0178	0.210	0.00650	0.00121	0.0048	1.91	0.00180	0.0000000	0.0000071
12	0.55	0.0067	0.0360	0.227	0.00000	0.00168	0.0033	2.11	0.00155	0.0000416	0.0000000

APPENDIX 5.2b A740 nacreous layer data

Spot Number	Distance from inner shell (mm)	A740 nacreous layer transect N1 corrected data (mmol/mol)					
		Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca
1	0.00	0.284	0.00000	0.00000	0.00177	1.82	0.00223
2	0.05	0.231	0.00015	0.00000	0.00000	1.57	0.00145
3	0.10	0.234	0.00313	0.00000	0.00431	1.66	0.00148
4	0.15	0.204	0.00734	0.00307	0.00000	1.67	0.00123
5	0.20	0.191	0.00000	0.00000	0.00241	1.62	0.00120
6	0.25	0.203	0.00164	0.00000	0.00000	1.82	0.00117
7	0.30	0.163	0.00910	0.00605	0.00000	2.10	0.00242
8	0.35	0.199	0.00545	0.00016	0.00574	2.27	0.00307
9	0.40	0.177	0.00000	0.00213	0.00000	2.18	0.00310
10	0.45	0.170	0.00000	0.00347	0.00368	2.32	0.00341
11	0.50	0.207	0.00000	0.00000	0.00000	2.13	0.00361
12	0.55	0.248	0.00000	0.00239	0.00000	2.26	0.00417
13	0.60	0.321	0.01688	0.00000	0.00638	2.46	0.00378
14	0.65	0.176	0.00000	0.00334	0.00449	2.68	0.00452

Spot Number	Distance from inner shell (mm)	A740 nacreous layer transect N2 corrected data (mmol/mol)					
		Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca
1	0.00	0.175	0.00755	0.00027	0.00154	1.67	0.00249
2	0.05	0.145	0.00000	0.00482	0.00000	1.56	0.00214
3	0.10	0.141	0.00000	0.00028	0.00329	1.67	0.00216
4	0.15	0.133	0.00419	0.00000	0.00000	1.72	0.00194
5	0.20	0.148	0.00000	0.00000	0.00000	1.71	0.00221
6	0.25	0.133	0.00652	0.00000	0.00350	1.65	0.00185
7	0.30	0.128	0.00372	0.00092	0.00358	1.91	0.00227
8	0.35	0.125	0.00454	0.00000	0.00025	2.02	0.00209
9	0.40	0.157	0.00979	0.00117	0.00000	2.13	0.00250
10	0.45	0.156	0.00712	0.00309	0.00000	1.79	0.00200
11	0.50	0.162	0.00000	0.00148	0.00037	1.76	0.00196
12	0.55	0.146	0.00000	0.00000	0.00051	2.05	0.00227
13	0.60	0.151	0.00000	0.00080	0.00075	2.16	0.00256
14	0.65	0.161	0.01168	0.00104	0.00345	2.12	0.00264
15	0.70	0.146	0.00000	0.00285	0.00401	2.27	0.00265
16	0.75	0.157	0.00000	0.00251	0.00198	2.36	0.00279

Spot Number	Distance from inner shell (mm)	A740 nacreous layer transect N3 corrected data (mmol/mol)					
		Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca
1	0.00	0.352	0.00000	0.00360	0.00663	2.02	0.00348
2	0.05	0.407	0.00000	0.00295	0.00345	2.81	0.00266
3	0.10	0.178	0.00000	0.00343	0.01629	1.71	0.00464
4	0.15	0.252	0.00000	0.00406	0.02024	1.63	0.00411
5	0.20	0.182	0.00000	0.00146	0.02924	2.01	0.00462
6	0.25	0.160	0.00000	0.00174	0.02657	1.94	0.00402
7	0.30	0.145	0.00000	0.00340	0.02135	1.94	0.00386
8	0.35	0.157	0.00536	0.00556	0.01808	1.76	0.00379
9	0.40	0.147	0.00000	0.00095	0.01955	1.98	0.00374
10	0.45	0.170	0.00100	0.00126	0.01569	1.76	0.00340
11	0.50	0.154	0.00000	0.00005	0.01256	1.77	0.00333
12	0.55	0.167	0.00000	0.00119	0.01381	1.75	0.00339
13	0.60	0.154	0.00000	0.00441	0.01155	2.00	0.00356
14	0.65	0.173	0.00000	0.00334	0.00740	2.03	0.00390
15	0.70	0.184	0.00679	0.00111	0.00920	1.78	0.00394
16	0.75	0.318	0.00324	0.00000	0.00880	2.29	0.00382
17	0.80	0.215	0.00395	0.00498	0.00202	2.51	0.00412

Spot Number	Distance from inner shell (mm)	A740 nacreous layer transect N4 corrected data (mmol/mol)					
		Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca
1	0.00	0.621	0.01099	0.00460	0.00000	2.40	0.00225
2	0.05	0.186	0.01381	0.00194	0.01701	1.86	0.00492
3	0.10	0.151	0.00000	0.00050	0.01491	1.84	0.00438
4	0.15	0.155	0.00000	0.00374	0.00658	1.75	0.00428
5	0.20	0.158	0.00000	0.00180	0.01763	1.73	0.00409
6	0.25	0.161	0.00000	0.00428	0.01067	1.63	0.00352
7	0.30	0.185	0.01892	0.00151	0.00809	1.58	0.00349
8	0.35	0.195	0.00623	0.00529	0.01267	1.90	0.00377
9	0.40	0.175	0.00000	0.00255	0.00950	1.94	0.00361
10	0.45	0.141	0.00101	0.00155	0.01711	2.01	0.00385
11	0.50	0.147	0.00000	0.00305	0.01445	2.23	0.00424
12	0.55	0.154	0.00000	0.00029	0.00996	2.14	0.00366
13	0.60	0.166	0.00293	0.00131	0.01784	2.08	0.00411
14	0.65	0.195	0.00000	0.00453	0.01669	2.18	0.00482
15	0.70	0.474	0.00580	0.00280	0.00628	2.78	0.00466
16	0.75	0.183	0.00764	0.00206	0.01446	2.25	0.00410
17	0.80	5.167	0.00415	0.00401	0.00000	1.58	0.00097

Spot Number	Distance from inner shell (mm)	A740 nacreous layer transect N5 corrected data (mmol/mol)					
		Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca
1	0.00	0.352	0.00000	0.0051	0.00767	1.98	0.00116
2	0.05	0.653	0.00000	0.0026	0.00216	2.44	0.00162
3	0.10	0.422	0.00000	0.0000	0.01219	2.21	0.00269
4	0.15	0.229	0.00000	0.0074	0.01939	1.74	0.00385
5	0.20	0.082	0.06029	0.0000	0.03140	1.80	0.00408
6	0.25	0.292	0.00000	0.0000	0.00868	1.92	0.00308
7	0.30	0.194	0.00000	0.0088	0.00000	1.55	0.00345
8	0.35	0.038	0.15809	0.0000	0.00000	1.47	0.00290
9	0.40	0.046	0.00000	0.0279	0.00000	1.72	0.00312
10	0.45	0.440	0.23329	0.0000	0.03346	2.03	0.00422
11	0.50	0.171	0.53019	0.0315	0.04726	2.34	0.00648
12	0.55	0.000	0.16931	0.0964	0.11083	1.84	0.00139
13	0.60	0.468	0.84181	0.0277	0.00000	2.19	0.00172
14	0.65	0.227	0.00000	0.0000	0.00000	1.72	0.00502
15	0.70	0.427	0.00000	0.0177	0.10789	1.63	0.00346
16	0.75	0.214	0.43278	0.0000	0.00000	2.12	0.00417
17	0.80	0.284	0.00000	0.0000	0.01513	2.29	0.00434
18	0.85	0.667	0.00134	0.0000	0.00000	3.10	0.00200

Spot Number	Distance from inner shell (mm)	A740 nacreous layer transect N6 corrected data (mmol/mol)								
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	U/Ca
1	0.00	0.0096	0.0415	0.351	0.00190	0.00000	0.0050	1.67	0.00195	0.0000000
2	0.05	0.0067	0.0376	0.425	0.00000	0.00122	0.0025	1.99	0.00243	0.0000256
3	0.10	0.0134	1.1410	7.402	0.00305	0.00373	0.0401	4.91	0.00278	0.0000784
4	0.15	0.0065	0.0083	0.162	0.00000	0.00367	0.0067	1.68	0.00386	0.0000537
5	0.20	0.0054	0.0427	0.147	0.00435	0.00302	0.0110	1.84	0.00399	0.0000336
6	0.25	0.0079	0.0122	0.166	0.00766	0.00333	0.0070	1.82	0.00362	0.0000520
7	0.30	0.0075	0.0399	0.167	0.00482	0.00312	0.0138	1.80	0.00346	0.0000000
8	0.35	0.0103	0.0216	0.148	0.00823	0.00357	0.0124	1.75	0.00344	0.0000281
9	0.40	0.0101	0.0191	0.157	0.00000	0.00247	0.0123	1.72	0.00341	0.0000983
10	0.45	0.0139	0.0195	0.172	0.00000	0.00277	0.0038	1.90	0.00345	0.0000280
11	0.50	0.0114	0.0490	0.168	0.00464	0.00191	0.0081	2.01	0.00390	0.0000000
12	0.55	0.0099	0.0218	0.150	0.00070	0.00232	0.0051	1.85	0.00348	0.0000717
13	0.60	0.0084	0.0159	0.152	0.00000	0.00196	0.0115	2.03	0.00386	0.0000000
14	0.65	0.0085	0.0151	0.152	0.00143	0.00312	0.0010	2.11	0.00369	0.0000583
15	0.70	0.0077	0.0381	0.154	0.00187	0.00355	0.0151	2.09	0.00405	0.0000213
16	0.75	0.0000	0.0435	0.162	0.00295	0.00403	0.0085	2.16	0.00411	0.0000259
17	0.80	0.0077	0.0341	0.175	0.00086	0.00366	0.0069	2.13	0.00439	0.0000115
18	0.85	0.0051	0.0553	0.209	0.00000	0.00182	0.0093	2.26	0.00348	0.0000613

APPENDIX 5.2c PIB nacreous layer data

Spot Number	Distance from inner shell (mm)	P1B nacreous layer transect N1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0000	0.0000	0.282	0.0000	0.00000	0.01694	2.19	0.000683	0.000067	0.0000000
2	0.05	0.0006	0.0000	0.234	0.0219	0.00000	0.00000	1.73	0.000404	0.000012	0.0000119
3	0.10	0.0000	0.0000	0.222	0.0000	0.00000	0.00062	1.78	0.000431	0.000055	0.0000313
4	0.15	0.0295	0.0000	0.236	0.0000	0.00000	0.00243	1.71	0.000467	0.000134	0.0000450
5	0.20	0.0000	0.0176	0.343	0.0000	0.00000	0.00021	1.85	0.000537	0.000041	0.0000379
6	0.25	0.0000	1.2510	6.983	0.0256	0.00000	0.00000	2.88	0.001372	0.000224	0.0000114
7	0.30	0.0742	5.8058	44.410	0.0522	0.00486	0.01675	5.84	0.003228	0.000000	0.0001076
8	0.35	0.0000	0.0424	0.486	0.0023	0.00000	0.00000	1.75	0.000415	0.000000	0.0000146
9	0.40	0.0000	0.0608	0.804	0.0000	0.00000	0.00000	2.10	0.000618	0.000130	0.0000000
10	0.45	0.0152	0.0858	0.855	0.0000	0.00000	0.00000	2.38	0.000700	0.000090	0.0000080
11	0.50	0.0127	0.0552	0.714	0.0035	0.00007	0.00000	2.39	0.000584	0.000036	0.0000000
12	0.55	0.0000	0.0374	0.484	0.0016	0.00157	0.00000	2.15	0.000487	0.000043	0.0000132
13	0.60	0.0008	0.0417	0.366	0.0053	0.00675	0.00241	1.62	0.000351	0.000156	0.0000364
14	0.65	0.0063	0.0264	0.338	0.0000	0.00046	0.00000	1.53	0.000381	0.000208	0.0000268
15	0.70	0.0000	0.0000	0.349	0.0000	0.00327	0.00314	1.76	0.000408	0.000073	0.0000000
16	0.75	0.0000	0.0749	0.357	0.0063	0.00000	0.00160	1.66	0.000335	0.000113	0.0000000
17	0.80	0.0000	0.0382	0.366	0.0146	0.00000	0.00000	1.67	0.000359	0.000055	0.0000000
18	0.85	0.0000	0.0616	0.399	0.0000	0.00000	0.00000	1.80	0.000536	0.000148	0.0000245
19	0.90	0.0027	0.0029	0.413	0.0000	0.00202	0.00000	1.59	0.000447	0.000000	0.0000000
20	0.95	0.0105	0.0408	0.471	0.0000	0.00000	0.00000	1.88	0.000514	0.000067	0.0000000
21	1.00	0.0333	0.0691	0.496	0.0009	0.00000	0.00356	2.15	0.000787	0.000015	0.0000000
22	1.05	0.0065	0.0214	0.421	0.0082	0.00215	0.00305	2.20	0.000736	0.000069	0.0000282

Spot Number	Distance from inner Shell (mm)	P1B nacreous layer transect N2 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0000	0.0759	0.167	0.0100	0.00421	0.00000	1.69	0.000605	0.000255	0.0000000
2	0.05	0.0367	0.1829	0.692	0.0000	0.00000	0.00288	1.86	0.000558	0.000093	0.0000000
3	0.10	0.0264	0.6163	3.047	0.0066	0.00456	0.00000	2.67	0.000818	0.000195	0.0000000
4	0.15	0.0041	0.0323	0.361	0.0090	0.00054	0.00312	1.57	0.000514	0.000230	0.0000099
5	0.20	0.0060	0.0717	0.360	0.0000	0.00000	0.00871	1.74	0.000475	0.000272	0.0000105
6	0.25	0.0000	0.0743	0.548	0.0013	0.00000	0.00267	2.02	0.000495	0.000360	0.0000284
7	0.30	0.0071	7.9105	57.220	0.0000	0.02420	0.00203	3.39	0.001276	0.000093	0.0000000
8	0.35	0.0000	0.0204	0.598	0.0132	0.00000	0.00506	1.66	0.000402	0.000229	0.0000413
9	0.40	0.0000	0.0218	0.571	0.0000	0.00004	0.00359	1.73	0.000431	0.000210	0.0000000
10	0.45	0.0065	0.0369	0.711	0.0155	0.00000	0.00226	2.22	0.000499	0.000065	0.0000067
11	0.50	0.0249	0.1060	0.579	0.0000	0.00110	0.00083	2.66	0.000712	0.000170	0.0000023
12	0.55	0.0154	0.0428	0.402	0.0000	0.00071	0.00684	1.87	0.000422	0.000051	0.0000081
13	0.60	0.0000	0.0509	0.445	0.0000	0.00307	0.00000	1.81	0.000405	0.000023	0.0000102
14	0.65	0.0135	0.0582	0.383	0.0161	0.00000	0.00815	1.77	0.000433	0.000127	0.0000000
15	0.70	0.0160	0.0702	0.518	0.0059	0.00000	0.00219	2.11	0.000725	0.000110	0.0000000
16	0.75	0.0000	0.0581	0.403	0.0136	0.00099	0.00000	1.84	0.000607	0.000128	0.0000141
17	0.80	0.0078	0.0899	0.367	0.0213	0.00000	0.00194	1.73	0.000477	0.000118	0.0000000
18	0.85	0.0332	0.0741	0.342	0.0145	0.00000	0.00182	1.82	0.000592	0.000000	0.0000000
19	0.90	0.0109	0.0596	0.435	0.0000	0.00000	0.00051	1.78	0.000605	0.000000	0.0000000
20	0.95	0.0000	0.0390	0.416	0.0008	0.00293	0.00867	2.01	0.000814	0.000048	0.0000000
21	1.00	0.0000	0.0683	0.434	0.0136	0.00091	0.00568	1.75	0.000554	0.000046	0.0000000
22	1.05	0.0376	0.0751	0.442	0.0021	0.00448	0.00000	2.35	0.000858	0.000112	0.0000000

Spot Number	Distance from inner Shell (mm)	P1B nacreous layer transect N3 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0108	0.0141	0.336	0.0104	0.00000	0.00542	1.34	0.000346	0.000243	0.0000000
2	0.05	0.0150	0.0604	0.481	0.0000	0.00000	0.00081	2.23	0.000647	0.000040	0.0000000
3	0.10	0.0029	0.0491	0.434	0.0086	0.00335	0.00515	1.54	0.000427	0.000246	0.0000000
4	0.15	0.0001	0.4949	1.457	0.0028	0.00086	0.00338	2.15	0.000648	0.000107	0.0000172
5	0.20	0.0071	4.2678	19.795	0.0085	0.00605	0.00000	3.30	0.001488	0.000484	0.0000404
6	0.25	0.0000	0.0480	0.464	0.0179	0.00233	0.00388	1.59	0.000403	0.000257	0.0000000
7	0.30	0.0236	0.0530	0.474	0.0044	0.00037	0.00216	2.00	0.000461	0.000000	0.0000000
8	0.35	0.0357	22.0627	74.182	0.0474	0.02154	0.01773	3.69	0.001532	0.000555	0.0001278
9	0.40	0.0113	0.0747	0.422	0.0000	0.00000	0.01205	1.68	0.000525	0.000507	0.0000000
10	0.45	0.0218	0.0902	0.680	0.0286	0.00000	0.00000	1.73	0.000458	0.000360	0.0000000
11	0.50	0.0000	0.1051	0.773	0.0000	0.00000	0.00435	2.21	0.000395	0.000450	0.0000241
12	0.55	0.0082	0.0775	0.491	0.0072	0.00152	0.01124	1.53	0.000425	0.000479	0.0000000
13	0.60	0.0000	0.0000	0.474	0.0000	0.00029	0.00637	1.55	0.000228	0.000222	0.0000000
14	0.65	0.0000	0.0890	0.390	0.0000	0.00000	0.00699	1.39	0.000206	0.000622	0.0000000
15	0.70	0.0895	0.0017	0.437	0.0000	0.00000	0.01060	1.58	0.000629	0.000770	0.0000000
16	0.75	0.0064	0.0765	0.526	0.0049	0.00070	0.00802	1.68	0.000227	0.000278	0.0000000
17	0.80	0.0551	0.2163	0.668	0.0446	0.00619	0.00000	1.91	0.000554	0.000583	0.0000000
18	0.85	0.0293	0.8484	2.551	0.0320	0.00400	0.00295	2.69	0.000772	0.000276	0.0000000
19	0.90	0.0199	0.0663	0.560	0.0230	0.00068	0.00000	1.72	0.000248	0.000000	0.0000000
20	0.95	0.0191	0.0497	0.440	0.0358	0.00216	0.00136	1.65	0.000471	0.000363	0.0000680
21	1.00	0.0000	0.0650	0.548	0.0081	0.00000	0.00026	1.87	0.000654	0.000287	0.0000037
22	1.05	0.0000	0.0165	0.439	0.0337	0.00000	0.00638	1.61	0.000373	0.000461	0.0000336
23	1.10	0.0000	0.0683	0.484	0.0000	0.00103	0.00752	1.90	0.000758	0.000363	0.0000000
24	1.15	0.0000	0.0854	0.595	0.0090	0.00530	0.00000	1.78	0.000777	0.000490	0.0000197
25	1.20	0.0073	0.0686	0.526	0.0000	0.00456	0.00096	2.00	0.000771	0.000063	0.0000000
26	1.25	0.0000	0.0653	0.425	0.0020	0.00063	0.00000	1.80	0.000524	0.000224	0.0000000
27	1.30	0.0303	0.0597	0.478	0.0067	0.00421	0.00603	1.79	0.000574	0.000247	0.0000478
28	1.35	0.0136	0.0582	0.515	0.0000	0.00189	0.00230	1.87	0.000450	0.000104	0.0000044
29	1.40	0.0153	0.0569	0.495	0.0198	0.00516	0.00276	1.73	0.000496	0.000077	0.0000000
30	1.45	0.0128	0.0609	0.575	0.0000	0.00607	0.00000	1.94	0.000694	0.000252	0.0000000
31	1.50	0.0066	0.0504	0.498	0.0000	0.00686	0.00014	2.12	0.000661	0.000008	0.0000000
32	1.55	0.0000	0.0308	0.424	0.0010	0.00413	0.00134	2.11	0.000756	0.000246	0.0000000
33	1.60	0.0216	0.0477	0.472	0.0000	0.00470	0.00560	2.43	0.001035	0.000293	0.0000205

Spot Number	Distance from inner Shell (mm)	P1B nacreous layer transect N4 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0000	0.0240	0.348	0.0000	0.00424	0.00000	1.52	0.000359	0.000106	0.0000000
2	0.50	0.0243	0.0378	0.433	0.0064	0.00178	0.00000	1.59	0.000402	0.000184	0.0000107
3	0.10	0.0000	0.1099	0.821	0.0000	0.00351	0.00000	2.35	0.000827	0.000054	0.0000000
4	0.30	0.0057	0.0186	0.361	0.0000	0.00000	0.00234	1.80	0.000539	0.000071	0.0000227
5	0.35	0.0179	1.4601	5.350	0.0103	0.00081	0.00378	2.82	0.000855	0.000052	0.0000168
6	0.40	0.0024	0.0557	0.762	0.0058	0.00120	0.00179	1.68	0.000469	0.000165	0.0000000
7	0.45	0.0189	0.0763	0.472	0.0131	0.00000	0.00378	1.40	0.000485	0.000011	0.0000000
8	0.50	0.0000	0.0600	0.428	0.0000	0.00000	0.00000	1.52	0.000399	0.000157	0.0000000
9	0.55	0.0054	11.6918	38.433	0.0000	0.01199	0.00768	4.27	0.001981	0.000117	0.0000000
10	0.60	0.0051	0.0414	0.450	0.0000	0.00000	0.00139	1.70	0.000545	0.000145	0.0000000
11	0.65	0.0000	0.0596	0.455	0.0022	0.00076	0.00000	1.75	0.000635	0.000071	0.0000009
12	0.70	0.0000	0.0334	0.373	0.0112	0.00161	0.00000	1.73	0.000486	0.000066	0.0000201
13	0.75	0.0000	0.0327	0.541	0.0189	0.00222	0.00445	2.27	0.000674	0.000038	0.0000000
14	0.80	0.0038	0.0527	0.677	0.0000	0.00000	0.00000	2.14	0.000671	0.000203	0.0000224
15	0.85	0.0132	0.0737	0.420	0.0020	0.00057	0.00000	1.65	0.000462	0.000065	0.0000011
16	0.90	0.0143	0.0505	0.503	0.0000	0.00266	0.00000	1.60	0.000507	0.000059	0.0000000
17	0.95	0.0020	0.0395	0.410	0.0000	0.00000	0.00048	1.67	0.000446	0.000084	0.0000089
18	1.00	0.0032	0.0615	0.452	0.0006	0.00000	0.00163	1.68	0.000458	0.000134	0.0000000
19	1.05	0.0068	0.0685	0.386	0.0000	0.00256	0.00095	1.64	0.000319	0.000079	0.0000000
20	1.10	0.0232	0.0497	0.416	0.0000	0.00269	0.00150	1.47	0.000303	0.000029	0.0000000
21	1.15	0.0176	0.0401	0.448	0.0000	0.00258	0.00000	1.54	0.000367	0.000109	0.0000081
22	1.20	0.0319	0.0394	0.389	0.0000	0.00184	0.00258	1.65	0.000471	0.000137	0.0000037
23	1.25	0.0183	0.0590	0.369	0.0000	0.00204	0.00374	1.54	0.000408	0.000141	0.0000000
24	1.30	0.0047	0.0353	0.376	0.0000	0.00000	0.00136	1.52	0.000416	0.000126	0.0000166
25	1.35	0.0000	0.0670	0.329	0.0051	0.00005	0.00097	1.57	0.000379	0.000050	0.0000000
26	1.40	0.0208	0.0302	0.345	0.0000	0.00000	0.00408	1.68	0.000555	0.000080	0.0000000
27	1.45	0.0247	0.0709	0.340	0.0000	0.00177	0.00000	1.76	0.000546	0.000054	0.0000298
28	1.50	0.0025	0.0593	0.442	0.0064	0.00311	0.00555	1.82	0.000549	0.000064	0.0000401
29	1.55	0.0000	0.0137	0.486	0.0000	0.00824	0.00000	2.00	0.000731	0.000049	0.0000111

APPENDIX 5.2d P04A nacreous layer transects data

Spot Number	Distance from inner shell (mm)	P04A nacreous layer transect N1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.00252	0.055	0.279	0.0344	0.0043	0.01866	1.56	0.000282	0.000000	0.0001801
2	0.05	0.00000	0.108	0.124	0.0000	0.0117	0.00000	1.78	0.001080	0.000000	0.0000000
3	0.10	0.01719	0.125	0.118	0.0405	0.0000	0.00188	1.65	0.000082	0.000000	0.0000000
4	0.15	0.00818	0.018	0.113	0.0145	0.0000	0.00125	1.62	0.000724	0.000248	0.0000000
5	0.20	0.00506	0.000	0.147	0.0000	0.0091	0.00206	1.51	0.000462	0.000434	0.0000000
6	0.25	0.00000	0.155	0.200	0.0002	0.0000	0.00647	1.61	0.000191	0.000146	0.0000000
7	0.30	0.00093	0.000	0.170	0.0000	0.0108	0.00360	1.63	0.000781	0.000294	0.0000000
8	0.35	0.00000	0.066	0.195	0.0068	0.0128	0.00000	1.58	0.000000	0.000125	0.0000000
9	0.40	0.01956	0.000	0.282	0.0044	0.0001	0.00069	1.90	0.000579	0.000000	0.0000911
10	0.45	0.00000	0.099	0.339	0.0000	0.0002	0.00000	1.80	0.000911	0.000409	0.0001559
11	0.50	0.01956	0.019	4.535	0.0000	0.0098	0.00000	2.11	0.000858	0.000000	0.0000000

Spot Number	Distance from inner shell (mm)	P04A nacreous layer transect N2 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.00236	0.059	0.304	0.0060	0.0024	0.01174	1.68	0.000475	0.000378	0.0000584
2	0.05	0.00926	0.000	0.166	0.0000	0.0000	0.00988	1.63	0.000584	0.000000	0.0000000
3	0.10	0.00000	0.067	0.195	0.0222	0.0001	0.00043	1.63	0.000535	0.000068	0.0000000
4	0.15	0.01446	0.091	0.204	0.0156	0.0012	0.00329	1.60	0.000688	0.000525	0.0000333
5	0.20	0.01715	0.101	0.307	0.0004	0.0028	0.00215	1.74	0.000722	0.000000	0.0000671
6	0.25	0.00576	0.012	0.293	0.0000	0.0027	0.00568	1.91	0.000644	0.000000	0.0000000
7	0.30	0.00282	0.045	0.370	0.0000	0.0011	0.00000	1.83	0.000693	0.000006	0.0000000
8	0.35	0.01559	0.044	0.636	0.0077	0.0000	0.00084	2.29	0.001028	0.000090	0.0000956
9	0.40	0.01042	0.115	0.490	0.0050	0.0000	0.00596	2.02	0.001138	0.000000	0.0000075
10	0.45	0.00380	0.061	0.528	0.0084	0.0014	0.00000	2.18	0.001038	0.000000	0.0000480
11	0.50	0.00654	0.032	1.075	0.0000	0.0000	0.00180	2.53	0.001239	0.000061	0.0000105
12	0.55	0.00220	0.104	0.879	0.0000	0.0000	0.00246	2.55	0.001356	0.000297	0.0000000
13	0.60	0.00000	0.080	0.726	0.0025	0.0057	0.01160	2.00	0.001048	0.000268	0.0000000
14	0.65	0.01858	0.068	0.698	0.0000	0.0082	0.00382	1.94	0.000797	0.000317	0.0000000
15	0.70	0.00284	0.000	0.847	0.0093	0.0006	0.00600	2.07	0.000644	0.000000	0.0000000

Spot Number	Distance from inner shell (mm)	P04A nacreous layer transect N3 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.01607	0.134	0.266	0.0120	0.0138	0.01496	1.80	0.001327	0.000362	0.000000
2	0.05	0.00000	10.695	42.750	0.0000	0.0268	0.00376	4.00	0.000989	0.000000	0.000000
3	0.10	0.01002	0.095	0.364	0.0000	0.0000	0.01771	1.77	0.000894	0.000000	0.000000
4	0.15	0.00622	17.976	73.396	0.0000	0.0626	0.03297	3.48	0.004062	0.000622	0.000000
5	0.20	0.02194	0.075	0.278	0.0000	0.0000	0.00000	1.54	0.000751	0.000578	0.000188
6	0.25	0.00284	0.064	0.409	0.0000	0.0000	0.00000	1.45	0.000523	0.000063	0.000103
7	0.30	0.01065	0.000	0.360	0.0000	0.0010	0.00648	1.75	0.000329	0.000163	0.000115
8	0.35	0.00000	3.005	8.648	0.0305	0.0038	0.00000	2.84	0.000824	0.000000	0.000032
9	0.40	0.01056	0.242	0.548	0.0054	0.0012	0.00000	2.06	0.000314	0.000283	0.000208
10	0.45	0.01406	0.000	0.621	0.0000	0.0071	0.00000	2.11	0.001168	0.000000	0.000000
11	0.50	0.01107	0.070	0.543	0.0010	0.0000	0.01709	1.81	0.000000	0.000617	0.000546
12	0.55	0.00000	4.021	21.404	0.0000	0.0409	0.01409	3.36	0.000867	0.000758	0.000285
13	0.60	0.00000	0.040	1.433	0.0000	0.0000	0.01594	2.01	0.001159	0.000000	0.000000
14	0.65	0.01549	0.018	0.808	0.0100	0.0062	0.01310	1.76	0.000075	0.000000	0.000123
15	0.70	0.01759	0.142	0.761	0.0305	0.0077	0.00000	1.94	0.000457	0.000251	0.000000
16	0.75	0.00526	0.251	2.151	0.0000	0.0100	0.01248	3.01	0.000943	0.000000	0.000000
17	0.80	0.00000	0.000	0.910	0.0285	0.0000	0.00000	2.16	0.000717	0.000532	0.000000
18	0.85	0.01644	0.132	1.186	0.0000	0.0000	0.02008	2.62	0.001007	0.000667	0.000000
19	0.90	0.00511	0.052	0.753	0.0000	0.0000	0.01847	2.29	0.001039	0.000000	0.000412

Spot Number	Distance from the foot (mm)	P04A nacreous layer transect N5 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.00094	0.054	0.269	0.0000	0.0000	0.00000	1.80	0.000946	0.000000	0.0000405
2	0.05	0.01277	0.085	0.340	0.0000	0.0000	0.00049	1.75	0.000692	0.000001	0.0000000
3	0.10	0.00000	0.000	0.785	0.0105	0.0000	0.03030	2.12	0.000000	0.000000	0.0001938
4	0.15	0.00279	2.083	9.692	0.0000	0.0164	0.00391	2.64	0.001006	0.000000	0.0005585
5	0.20	0.02635	0.000	0.328	0.0047	0.0033	0.00000	1.74	0.000805	0.000000	0.0003407
6	0.25	0.00920	0.124	0.355	0.0000	0.0000	0.00000	1.63	0.000564	0.000000	0.0001113
7	0.30	0.02236	2.657	12.083	0.0098	0.0000	0.01243	3.33	0.001275	0.001134	0.0000000
8	0.35	0.00000	1.944	8.594	0.0000	0.0048	0.02739	2.33	0.001495	0.001117	0.0000000
9	0.40	0.01006	0.096	0.426	0.0302	0.0000	0.00000	1.74	0.000794	0.000000	0.0000000
10	0.45	0.00000	0.227	1.113	0.0000	0.0009	0.00749	2.29	0.000743	0.000388	0.0000660
11	0.50	0.00000	0.011	0.661	0.0099	0.0000	0.00000	1.71	0.001166	0.000000	0.0000000
12	0.55	0.01390	0.072	0.697	0.0216	0.0000	0.00218	1.62	0.000091	0.000000	0.0000000
13	0.60	0.00000	0.086	0.654	0.0000	0.0000	0.00000	1.54	0.000000	0.000000	0.0001465
14	0.65	0.00000	0.145	0.636	0.0215	0.0000	0.00000	1.52	0.000058	0.000000	0.0000000
15	0.70	0.00913	0.010	0.597	0.0149	0.0115	0.02175	1.57	0.000500	0.000213	0.0000308
16	0.75	0.00097	0.009	0.533	0.0000	0.0007	0.01104	1.63	0.000826	0.000000	0.0000999
17	0.80	0.00000	0.144	0.548	0.0000	0.0080	0.00000	1.67	0.000692	0.000058	0.0000000
18	0.85	0.00000	0.111	0.571	0.0000	0.0122	0.00000	1.80	0.000810	0.001125	0.0000000
19	0.90	0.02219	0.000	0.490	0.0000	0.0216	0.01607	1.67	0.000803	0.000000	0.0000025
20	0.95	0.01070	0.038	0.468	0.0000	0.0070	0.00000	1.51	0.000512	0.000000	0.0001334
21	1.00	0.00000	0.063	0.515	0.0085	0.0000	0.00000	1.50	0.000593	0.000000	0.0000000

APPENDIX 5.2e SC2 nacreous layer transect data

Spot Number	Distance from inner shell (mm)	SC2 nacreous layer transect N1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0096	0.0406	0.386	0.00305	0.0000	0.00322	1.73	0.000291	0.0000659	0.0000000
2	0.05	0.0130	0.0473	0.190	0.00000	0.0000	0.00000	1.66	0.000640	0.0001122	0.0000555
3	0.10	0.0118	0.0034	0.216	0.00101	0.0037	0.00351	1.69	0.000527	0.0000179	0.0000008
4	0.15	0.0075	0.3326	1.539	0.00000	0.0035	0.00000	1.98	0.000534	0.0000937	0.0000000
5	0.20	0.0182	5.3652	30.488	0.00464	0.0172	0.01497	4.86	0.002250	0.0000751	0.0000548
6	0.25	0.0065	0.0083	0.247	0.00232	0.0000	0.00041	1.81	0.000622	0.0000693	0.0000000
7	0.30	0.0079	0.0149	0.249	0.00246	0.0000	0.00639	1.83	0.000692	0.0000332	0.0000000
8	0.35	0.0035	0.0398	0.275	0.00000	0.0000	0.00228	1.84	0.000561	0.0000000	0.0000000
9	0.40	0.0120	0.0819	0.319	0.00000	0.0020	0.00049	1.89	0.000667	0.0000000	0.0000000
10	0.45	0.0158	0.0283	0.255	0.00317	0.0007	0.00000	1.75	0.000756	0.0000000	0.0000000
11	0.50	0.0054	0.0374	0.337	0.00000	0.0000	0.00110	1.72	0.000721	0.0000000	0.0000000
12	0.55	0.0075	0.0586	0.329	0.00232	0.0012	0.00000	1.72	0.000512	0.0000058	0.0000156
13	0.60	0.0109	2.0398	7.929	0.00000	0.0060	0.00326	5.96	0.003160	0.0000000	0.0000121
14	0.65	0.0067	0.0166	0.532	0.00332	0.0012	0.00000	1.94	0.000687	0.0001326	0.0000543
15	0.70	0.0066	0.0750	0.600	0.00000	0.0025	0.00000	2.28	0.000991	0.0000000	0.0000264
16	0.75	0.0113	0.0511	0.752	0.00000	0.0000	0.00004	2.55	0.000985	0.0000670	0.0000584
17	0.80	0.0139	0.0681	0.525	0.00000	0.0024	0.01090	2.07	0.000973	0.0000000	0.0000139
18	0.85	0.0093	0.0057	0.581	0.00000	0.0000	0.00000	2.10	0.000931	0.0000000	0.0000675
19	0.90	0.0058	0.0805	0.937	0.00164	0.0022	0.00054	2.62	0.000866	0.0001697	0.0000339
20	0.95	0.0108	0.0336	1.008	0.00000	0.0012	0.00307	2.75	0.001182	0.0000233	0.0000447

Spot Number	Distance from inner shell (mm)	SC2 nacreous layer transect N2 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0000	221.0092	2524.069	0.00000	0.1231	0.28555	1.77	0.003588	0.0000000	0.0001969
2	0.05	0.0075	0.0256	0.336	0.00265	0.0059	0.00000	1.82	0.000311	0.0000000	0.0000086
3	0.10	0.0098	0.0574	0.464	0.00000	0.0000	0.00019	1.69	0.000282	0.0000113	0.0000000
4	0.15	0.0140	7.8813	41.971	0.00000	0.0146	0.00243	4.58	0.001865	0.0000000	0.0000000
5	0.20	0.0086	2.8131	15.142	0.00000	0.0000	0.00600	4.46	0.001846	0.0000000	0.0000000
6	0.25	0.0109	0.0231	0.350	0.00092	0.0000	0.00107	1.85	0.000777	0.0000000	0.0000000
7	0.30	0.0122	0.0770	0.388	0.00020	0.0010	0.00000	1.81	0.000519	0.0001474	0.0000000
8	0.35	0.0281	7.8311	30.716	0.00013	0.0073	0.00000	4.72	0.001976	0.0000000	0.0000533
9	0.40	0.0113	0.0736	0.368	0.00000	0.0000	0.00000	1.73	0.000692	0.0000000	0.0000000
10	0.45	0.0036	0.0227	0.347	0.00288	0.0000	0.00000	1.70	0.000680	0.0000248	0.0000000
11	0.50	0.0038	0.0572	0.468	0.00000	0.0000	0.00517	1.73	0.000671	0.0000958	0.0000000
12	0.55	0.0210	7.0188	34.988	0.00815	0.0093	0.00512	5.30	0.002376	0.0000364	0.0000474
13	0.60	0.0063	0.0084	0.525	0.00246	0.0033	0.00232	1.70	0.000394	0.0000489	0.0000505
14	0.65	0.0080	0.0326	0.538	0.00257	0.0000	0.00531	1.79	0.000669	0.0000014	0.0000762
15	0.70	0.0090	0.0410	0.438	0.00013	0.0028	0.00339	1.71	0.000611	0.0000000	0.0000020
16	0.75	0.0090	0.0484	0.412	0.00000	0.0007	0.00505	1.74	0.000438	0.0001107	0.0000625
17	0.80	0.0099	3.2235	15.241	0.00000	0.0024	0.00481	2.97	0.000776	0.0000000	0.0000345
18	0.85	0.0067	1.3245	8.269	0.00324	0.0017	0.01086	4.76	0.001950	0.0000000	0.0000000
19	0.90	0.0097	0.0521	0.400	0.00000	0.0076	0.00689	1.76	0.000531	0.0000998	0.0000287
20	0.95	0.0092	0.0476	0.459	0.00000	0.0000	0.00027	1.75	0.000695	0.0000532	0.0000000
21	1.00	0.0074	0.0756	0.473	0.00170	0.0050	0.00000	1.69	0.000543	0.0000000	0.0000000
22	1.05	0.0034	0.0668	0.371	0.00613	0.0031	0.00000	1.76	0.000672	0.0000000	0.0000000
23	1.10	0.0083	0.0479	0.379	0.00000	0.0003	0.00000	1.78	0.000605	0.0000000	0.0000000
24	1.15	0.0082	0.0630	0.405	0.00000	0.0029	0.00000	1.79	0.000673	0.0000546	0.0000007
25	1.20	0.0104	0.0555	0.391	0.00000	0.0049	0.00233	1.77	0.000944	0.0000000	0.0000243
26	1.25	0.0047	0.0739	0.437	0.00172	0.0016	0.00106	1.68	0.000803	0.0000000	0.0000000
27	1.30	0.0082	0.0854	0.418	0.00419	0.0045	0.00210	1.77	0.000523	0.0001725	0.0000031
28	1.35	0.0066	0.0733	0.387	0.00000	0.0000	0.00317	1.81	0.000725	0.0000000	0.0000000
29	1.40	0.0116	0.0461	0.563	0.00000	0.0024	0.00587	1.92	0.000759	0.0000015	0.0000000
30	1.45	0.0086	0.0831	0.445	0.00000	0.0053	0.00000	1.91	0.000651	0.0001440	0.0000000
31	1.50	0.0070	0.0676	0.505	0.00333	0.0000	0.00206	2.08	0.000994	0.0000000	0.0000000
32	1.55	0.0106	0.0744	0.496	0.00501	0.0000	0.00089	1.89	0.000737	0.0000044	0.0000000

Spot Number	Distance from inner shell (mm)	SC2 nacreous layer transect N3 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0025	0.0565	0.223	0.0000	0.0011	0.00000	1.60	0.000182	0.0000000	0.0000000
2	0.05	0.0117	0.0406	0.266	0.0065	0.0000	0.00000	1.56	0.000441	0.0000000	0.0000000
3	0.10	0.0154	5.2883	31.601	0.0006	0.0000	0.00846	3.13	0.001100	0.0000000	0.0000365
4	0.15	0.0094	0.3972	2.135	0.0000	0.0058	0.00314	2.94	0.001230	0.0001379	0.0000023
5	0.20	0.0090	0.0405	0.260	0.0055	0.0039	0.00587	1.46	0.000640	0.0000000	0.0000200
6	0.25	0.0044	0.0340	0.343	0.0000	0.0040	0.00000	1.84	0.000769	0.0000000	0.0000000
7	0.30	0.0059	0.0565	0.352	0.0029	0.0000	0.00000	1.74	0.000599	0.0001460	0.0000559
8	0.35	0.0115	0.1903	1.613	0.0000	0.0000	0.00580	2.10	0.000546	0.0001766	0.0000000
9	0.40	0.0343	25.9166	179.821	0.0117	0.0003	0.02707	5.48	0.002738	0.0009499	0.0000000
10	0.45	0.0013	0.0640	0.269	0.0000	0.0016	0.00234	1.50	0.000776	0.0001809	0.0000000
11	0.50	0.0140	0.0165	0.220	0.0000	0.0000	0.00195	1.34	0.000577	0.0000000	0.0000216
12	0.55	0.0054	0.0699	0.418	0.0000	0.0000	0.00006	1.65	0.000582	0.0000689	0.0000000
13	0.60	0.0077	0.0730	0.364	0.0000	0.0000	0.00341	1.57	0.000610	0.0000000	0.0000000
14	0.65	0.0017	0.0740	0.396	0.0000	0.0028	0.00272	1.64	0.000476	0.0000000	0.0000069
15	0.70	0.0141	0.0392	0.571	0.0171	0.0018	0.00000	1.57	0.000700	0.0000465	0.0000590
16	0.75	0.0191	6.6903	36.090	0.0000	0.0029	0.00440	3.91	0.001563	0.0000000	0.0000222
17	0.80	0.0003	0.2611	1.712	0.0169	0.0000	0.00714	2.40	0.001420	0.0000025	0.0000217
18	0.85	0.0116	0.0469	0.401	0.0037	0.0000	0.00000	1.72	0.000732	0.0000000	0.0000000
19	0.90	0.0081	0.0086	0.392	0.0000	0.0018	0.00000	1.58	0.000569	0.0000000	0.0000611
20	0.95	0.0182	4.6343	22.826	0.0000	0.0051	0.00497	3.76	0.001370	0.0001781	0.0000331
21	1.00	0.0006	0.6426	3.718	0.0063	0.0023	0.00140	2.97	0.001240	0.0001161	0.0000000
22	1.05	0.0061	0.0603	0.511	0.0000	0.0000	0.00446	1.69	0.000621	0.0000000	0.0000022
23	1.10	0.0042	0.0266	0.517	0.0107	0.0000	0.00000	1.83	0.000669	0.0000369	0.0000000
24	1.15	0.0080	0.0777	0.478	0.0000	0.0000	0.00523	1.71	0.000450	0.0000000	0.0000151
25	1.20	0.0069	0.0850	0.444	0.0000	0.0000	0.00912	1.80	0.000478	0.0001900	0.0000000
26	1.25	0.0044	0.0552	0.382	0.0000	0.0044	0.00530	1.77	0.000606	0.0000000	0.0000000
27	1.30	0.0066	0.0599	0.403	0.0007	0.0005	0.00000	1.64	0.000618	0.0000357	0.0000000
28	1.35	0.0083	0.0654	0.437	0.0003	0.0023	0.00240	1.75	0.000621	0.0001550	0.0000109
29	1.40	0.0043	0.0629	0.368	0.0028	0.0000	0.00000	1.53	0.000671	0.0000000	0.0000000

Spot Number	Distance from inner shell (mm)	SC2 nacreous layer transect N3 corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
30	1.45	0.0018	0.0401	0.359	0.0006	0.0000	0.00000	1.62	0.000491	0.0000000	0.0000258
31	1.50	0.0129	0.0692	0.574	0.0055	0.0003	0.00103	1.75	0.000680	0.0000000	0.0000529
32	1.55	0.0029	0.1053	0.721	0.0000	0.0017	0.00188	2.82	0.000964	0.0000000	0.0000219
33	1.60	0.0056	0.0392	0.388	0.0165	0.0000	0.00000	1.77	0.000487	0.0002061	0.0000000
34	1.65	0.0017	0.0598	0.345	0.0000	0.0000	0.00976	1.75	0.000532	0.0000000	0.0000023

Spot Number	Distance from inner shell (mm)	SC2 nacreous layer transect N4 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0084	0.0890	0.334	0.00000	0.0003	0.00000	1.79	0.000781	0.0000334	0.0000000
2	0.05	0.0076	0.0802	0.347	0.00000	0.0012	0.00150	1.71	0.000792	0.0000000	0.0000000
3	0.10	0.0133	0.0667	0.377	0.00493	0.0025	0.00393	1.74	0.000686	0.0000000	0.0000000
4	0.15	0.0086	0.0876	0.362	0.00000	0.0015	0.00863	1.71	0.000626	0.0000000	0.0000000
5	0.20	0.0096	0.0652	0.337	0.00000	0.0000	0.00000	1.65	0.000661	0.0000000	0.0000000
6	0.25	0.0078	0.0672	0.380	0.00000	0.0000	0.00248	1.71	0.000731	0.0000067	0.0000041
7	0.30	0.0080	0.0609	0.390	0.00000	0.0000	0.00561	1.72	0.000861	0.0000000	0.0000000
8	0.35	0.0033	0.0914	0.379	0.00000	0.0000	0.00000	1.79	0.000685	0.0000000	0.0000000
9	0.40	0.0068	0.0307	0.401	0.00000	0.0016	0.00091	1.84	0.000747	0.0000879	0.0000144
10	0.45	0.0024	0.0791	0.462	0.00000	0.0021	0.00000	2.04	0.000882	0.0001294	0.0000008

APPENDIX 5.2f SC1A necrous layer transect data

Spot Number	Distance from inner shell (mm)	SC1A nacreous layer transect N1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0789	0.0000	0.399	0.0000	0.00671	0.00000	1.64	0.000000	0.000000	0.0000000
2	0.05	0.0331	0.0380	0.231	0.0415	0.00135	0.00499	1.53	0.000069	0.000132	0.0000000
3	0.10	0.0000	0.0920	0.290	0.0000	0.00058	0.00000	1.71	0.000066	0.000048	0.0000000
4	0.15	0.0000	0.1522	0.263	0.0000	0.00000	0.00000	1.84	0.000572	0.000100	0.0000000
5	0.20	0.0000	0.0000	0.258	0.0554	0.00279	0.00381	2.04	0.000711	0.000000	0.0000250
6	0.25	0.0143	0.2672	0.403	0.0128	0.00000	0.00000	1.90	0.000519	0.000000	0.0000000
7	0.30	0.0000	0.0539	0.271	0.0000	0.00147	0.00304	1.73	0.000170	0.000000	0.0000000
8	0.35	0.0800	0.0387	0.279	0.0630	0.00000	0.00136	1.89	0.000252	0.000126	0.0000000
9	0.40	0.0000	0.0000	0.299	0.0000	0.00163	0.00996	1.82	0.000323	0.000000	0.0000143
10	0.45	0.0000	0.0191	0.454	0.0000	0.00203	0.00000	1.92	0.000655	0.000119	0.0000000
11	0.50	0.0000	0.0000	0.350	0.0000	0.00566	0.00132	1.95	0.000642	0.000069	0.0000197
12	0.55	0.0621	0.0000	0.259	0.0000	0.00000	0.00000	1.98	0.000392	0.000068	0.0000000
13	0.60	0.0338	0.0706	0.409	0.0000	0.00000	0.00000	2.03	0.000477	0.000000	0.0000000
14	0.65	0.0556	0.0544	0.515	0.0058	0.00073	0.00000	2.17	0.000656	0.000082	0.0000000

Spot Number	Distance from inner shell (mm)	SC1A nacreous layer transect N2 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0000	0.0000	0.272	0.0000	0.00000	0.00000	1.80	0.000079	0.000021	0.0000612
2	0.05	0.0000	0.1611	0.300	0.0230	0.00695	0.00861	1.73	0.000240	0.000026	0.0000110
3	0.10	0.0816	0.0000	0.397	0.0063	0.00016	0.00673	1.94	0.000467	0.000000	0.0000645
4	0.15	0.0863	0.3628	0.696	0.0000	0.00151	0.00580	2.35	0.000836	0.000000	0.0000365
5	0.20	0.0000	1.9056	10.212	0.0000	0.00337	0.00000	4.01	0.001516	0.000024	0.0000227
6	0.25	0.0818	0.0000	0.290	0.0070	0.00224	0.00797	1.86	0.000134	0.000040	0.0000000
7	0.30	0.0000	0.0388	0.336	0.0000	0.00000	0.00000	1.55	0.000530	0.000119	0.0000000
8	0.35	0.0496	0.0000	0.389	0.0495	0.00000	0.00508	1.47	0.000376	0.000055	0.0000088
9	0.40	0.0836	0.2591	0.409	0.0000	0.00000	0.00393	1.56	0.000387	0.000086	0.0000081
10	0.45	0.0000	0.0000	0.442	0.0000	0.00016	0.00633	1.62	0.000647	0.000152	0.0000222
11	0.50	0.1572	0.1443	0.501	0.0000	0.00752	0.00992	1.77	0.000433	0.000085	0.0000028
12	0.55	0.0078	0.0000	0.392	0.0000	0.00277	0.00659	1.82	0.000280	0.000104	0.0000083
13	0.60	0.0000	0.0000	0.451	0.0000	0.00223	0.00024	1.80	0.000269	0.000036	0.0000013
14	0.65	0.0000	0.1289	0.397	0.0000	0.00000	0.00000	1.71	0.000547	0.000089	0.0000159
15	0.70	0.0387	0.0000	0.416	0.0000	0.00000	0.00000	1.70	0.000315	0.000073	0.0000000
16	0.75	0.0313	0.1463	0.485	0.0000	0.00000	0.00520	1.72	0.000287	0.000032	0.0000079
17	0.80	0.0000	0.0173	0.420	0.0000	0.00060	0.00849	1.91	0.000572	0.000070	0.0000062
18	0.85	0.0529	0.0708	0.422	0.0000	0.00579	0.00411	1.91	0.000486	0.000044	0.0000025
19	0.90	0.0000	0.0000	0.488	0.0124	0.00045	0.00248	1.90	0.000459	0.000000	0.0000000
20	0.95	0.0514	0.0384	0.498	0.0246	0.00015	0.01321	2.17	0.000668	0.000060	0.0000134
21	1.00	0.0077	0.1213	0.437	0.0000	0.00440	0.00000	1.83	0.000398	0.000000	0.0000141
22	1.05	0.0213	0.0185	0.654	0.0357	0.00000	0.00000	2.18	0.000543	0.000039	0.0000012
23	1.10	0.1208	0.0000	0.408	0.0507	0.00291	0.00644	2.18	0.000816	0.000017	0.0000000
24	1.15	0.0201	0.0000	0.642	0.0112	0.00327	0.00225	2.39	0.000521	0.000034	0.0000244

Spot Number	Distance from inner shell (mm)	SC1A nacreous layer transect N3 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.1221	0.0000	0.493	0.0000	0.00000	0.00427	1.73	0.000327	0.000051	0.0000670
2	0.05	0.0449	0.0000	0.990	0.0289	0.00319	0.00000	2.47	0.000360	0.000164	0.0000000
3	0.10	0.0590	0.1470	0.669	0.0264	0.00552	0.00374	2.06	0.000739	0.000217	0.0000000
4	0.15	0.0000	0.0000	0.463	0.1414	0.00280	0.00000	2.01	0.000681	0.000089	0.0000000
5	0.20	0.0610	0.0464	0.321	0.0000	0.00092	0.01323	1.75	0.000348	0.000305	0.0000136
6	0.25	0.0000	0.0000	0.415	0.0000	0.00226	0.00586	1.79	0.000250	0.000026	0.0000110
7	0.30	0.0000	0.0000	0.353	0.0000	0.00217	0.01054	1.88	0.000319	0.000074	0.0000000
8	0.35	0.0599	0.0132	0.343	0.0000	0.00234	0.00000	1.86	0.000596	0.000084	0.0000000
9	0.40	0.0000	0.2233	0.337	0.0497	0.00191	0.00000	1.95	0.000204	0.000139	0.0000270
10	0.45	0.0000	0.0000	0.348	0.0000	0.00067	0.00000	2.03	0.000624	0.000096	0.0000212
11	0.50	0.0178	0.2031	0.513	0.0000	0.00000	0.01334	2.34	0.000655	0.000000	0.0000000

APPENDIX 5.2g MP02A nacreous layer data

Spot Number	Distance from inner shell (mm)	MP02A nacreous layer transect N1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0000	0.0291	0.337	0.0054	0.00352	0.00890	1.34	0.001091	0.0000476	0.0000000
2	0.05	0.0000	0.0495	0.288	0.0000	0.00000	0.00670	1.44	0.000696	0.0000000	0.0000000
3	0.10	0.0000	0.0360	0.356	0.0000	0.00000	0.00262	1.65	0.000516	0.0000439	0.0000157
4	0.15	0.0510	2.4152	13.548	0.0000	0.00128	0.00000	3.26	0.001050	0.0000293	0.0000000
5	0.20	0.0033	0.0587	0.442	0.0067	0.00000	0.00213	1.49	0.000413	0.0000504	0.0000000
6	0.25	0.0006	0.0418	0.418	0.0048	0.00210	0.00000	1.54	0.000415	0.0000000	0.0000064
7	0.30	0.0000	0.0689	0.525	0.0000	0.00589	0.00121	1.70	0.000203	0.0000000	0.0000000
8	0.35	0.0000	0.0517	0.423	0.0064	0.00000	0.00000	1.52	0.000462	0.0000263	0.0000000
9	0.40	0.0037	0.0604	0.406	0.0080	0.00079	0.00160	1.55	0.000497	0.0000000	0.0000000
10	0.45	0.0279	0.0250	0.406	0.0148	0.00439	0.00000	1.69	0.000391	0.0000000	0.0000115
11	0.50	0.0000	0.0604	0.574	0.0000	0.00024	0.00334	1.94	0.000601	0.0000239	0.0000029
12	0.55	0.0000	8.2161	50.333	0.0357	0.00846	0.01100	4.11	0.001955	0.0001538	0.0000300
13	0.60	0.0000	0.0738	0.617	0.0000	0.00000	0.00416	1.87	0.000267	0.0000000	0.0000000
14	0.65	0.0196	0.0810	0.569	0.0125	0.00506	0.00693	1.77	0.000465	0.0000000	0.0000000
15	0.70	0.0000	0.0898	0.588	0.0000	0.00241	0.00236	1.74	0.000620	0.0000000	0.0000172
16	0.75	0.0006	0.0557	0.601	0.0000	0.00395	0.00476	1.66	0.000405	0.0000000	0.0000000
17	0.80	0.0155	0.0729	0.599	0.0000	0.00002	0.00000	1.66	0.000372	0.0000043	0.0000000
18	0.85	0.0000	0.0812	0.596	0.0159	0.00000	0.00439	1.75	0.000616	0.0000000	0.0000073
19	0.90	0.0000	0.0918	0.503	0.0000	0.00000	0.00000	1.45	0.000246	0.0000000	0.0000000
20	0.95	0.0309	0.0493	0.470	0.0280	0.00000	0.00226	1.61	0.000441	0.0000455	0.0000219
21	1.00	0.0283	0.0611	0.531	0.0124	0.00119	0.00534	1.62	0.000460	0.0000000	0.0000191
22	1.05	0.0136	0.0096	0.587	0.0005	0.00114	0.00000	1.63	0.000431	0.0000241	0.0000084
23	1.10	0.0000	0.0621	0.626	0.0000	0.00000	0.00000	1.76	0.000571	0.0000000	0.0000000
24	1.15	0.0000	0.0652	0.819	0.0000	0.00052	0.00000	1.86	0.000605	0.0000623	0.0000000
25	1.20	0.0000	0.0926	0.927	0.0000	0.00667	0.00153	1.98	0.000377	0.0000000	0.0000000
26	1.25	0.0198	0.0604	0.881	0.0038	0.00311	0.00132	1.79	0.000688	0.0000000	0.0000608
27	1.30	0.0296	0.0472	0.771	0.0174	0.00237	0.01141	1.76	0.000595	0.0000000	0.0000648
28	1.35	0.0000	0.0697	1.117	0.0000	0.00102	0.00299	1.88	0.000740	0.0000533	0.0000138
29	1.40	0.0345	0.0803	1.907	0.0000	0.00000	0.00468	2.58	0.001000	0.0000000	0.0000680

Spot Number	Distance from inner shell (mm)	MP02A nacreous layer transect N2 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0045	0.0564	0.283	0.0000	0.00147	0.00922	1.36	0.000107	0.0000277	0.0000000
2	0.05	0.0022	0.2815	1.179	0.0161	0.00242	0.00000	2.00	0.000488	0.0000632	0.0000079
3	0.10	0.0179	0.0627	0.301	0.0000	0.00103	0.00139	1.40	0.000319	0.0001150	0.0000092
4	0.15	0.0000	0.0259	0.338	0.0140	0.00123	0.00000	1.41	0.000419	0.0000047	0.0000038
5	0.20	0.0283	4.1552	16.291	0.0167	0.00974	0.00000	3.63	0.001226	0.0001418	0.0000107
6	0.25	0.0229	0.0208	0.405	0.0000	0.00000	0.00000	1.46	0.000429	0.0000532	0.0000135
7	0.30	0.0000	0.0476	0.326	0.0000	0.00399	0.00000	1.38	0.000000	0.0000000	0.0000000
8	0.35	0.0111	0.0748	0.293	0.0000	0.00276	0.00304	1.39	0.000387	0.0001143	0.0000000
9	0.40	0.0050	0.0952	0.489	0.0146	0.00070	0.00000	1.63	0.000409	0.0000727	0.0000168
10	0.45	0.0000	15.7149	96.957	0.0000	0.01564	0.01324	4.84	0.002272	0.0002518	0.0000000
11	0.50	0.0402	0.0313	0.567	0.0000	0.00000	0.00000	1.80	0.000531	0.0000639	0.0000000
12	0.55	0.0000	0.0523	0.411	0.0333	0.00414	0.00387	1.60	0.000139	0.0000000	0.0000000
13	0.60	0.0000	0.0689	0.447	0.0000	0.00000	0.00042	1.68	0.000000	0.0000000	0.0000000
14	0.65	0.0303	0.1256	0.542	0.0000	0.00361	0.00614	1.63	0.000441	0.0000000	0.0000000
15	0.70	0.0272	0.0415	0.430	0.0088	0.00000	0.00169	1.56	0.000476	0.0000436	0.0000000
16	0.75	0.0000	0.0366	0.446	0.0849	0.00776	0.00000	1.67	0.000445	0.0000000	0.0000022
17	0.80	0.0000	0.0890	0.393	0.0000	0.00168	0.00000	1.58	0.000419	0.0000000	0.0000135
18	0.85	0.0031	0.0592	0.500	0.0108	0.00000	0.00365	1.60	0.000432	0.0000000	0.0000000
19	0.90	0.0315	0.0742	0.460	0.0000	0.00581	0.00240	1.57	0.000000	0.0000000	0.0000000
20	0.95	0.0000	0.1326	0.477	0.0000	0.00235	0.00000	1.91	0.000387	0.0000000	0.0000000
21	1.00	0.0218	0.0072	0.396	0.0000	0.00065	0.00948	1.73	0.000518	0.0000341	0.0000105
22	1.05	0.0000	0.0972	0.471	0.0130	0.00000	0.00522	1.76	0.000435	0.0001507	0.0000313
23	1.10	0.0395	0.0498	0.408	0.0000	0.00000	0.00511	1.81	0.000505	0.0000223	0.0000000
24	1.15	0.0000	0.0342	0.426	0.0000	0.00000	0.00000	1.76	0.000605	0.0001019	0.0000281
25	1.20	0.0000	0.0097	0.761	0.0000	0.00846	0.00000	2.60	0.001330	0.0000000	0.0000522

Spot Number	Distance from inner shell (mm)	MP02A nacreous layer transect N3 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0000	0.0587	0.431	0.0000	0.00038	0.00000	2.73	0.000394	0.0000000	0.0000000
2	0.05	0.0202	0.0365	0.380	0.0009	0.00000	0.00038	1.54	0.000572	0.0000237	0.0000000
3	0.10	0.0445	5.0129	21.351	0.0053	0.01550	0.01035	3.74	0.001465	0.0000000	0.0000000
4	0.15	0.0049	1.0574	6.061	0.0201	0.00298	0.00080	2.04	0.000708	0.0000805	0.0000542
5	0.20	0.0123	0.0737	0.630	0.0000	0.00000	0.00000	2.33	0.000723	0.0000000	0.0000000
6	0.25	0.0000	0.0767	0.565	0.0000	0.00100	0.00483	2.37	0.000735	0.0001212	0.0000031
7	0.30	0.0000	0.0455	0.406	0.0000	0.00184	0.00809	1.67	0.000078	0.0000000	0.0000000
8	0.35	0.0117	0.0376	0.380	0.0076	0.00018	0.00000	1.69	0.000412	0.0001676	0.0000000
9	0.40	0.0000	0.0772	0.376	0.0052	0.00018	0.00000	1.59	0.000367	0.0000856	0.0000142
10	0.45	0.0000	0.0294	0.374	0.0109	0.00063	0.00118	1.77	0.000503	0.0000508	0.0000143
11	0.50	0.0000	0.0715	0.372	0.0000	0.00000	0.00246	1.71	0.000432	0.0000237	0.0000000
12	0.55	0.0000	0.0735	0.410	0.0154	0.00126	0.00503	1.81	0.000443	0.0000000	0.0000064
13	0.60	0.0000	0.0309	0.529	0.0000	0.00000	0.00551	2.04	0.000000	0.0000000	0.0000000
14	0.65	0.0000	0.0389	0.404	0.0000	0.00000	0.00113	1.64	0.000445	0.0000000	0.0000000
15	0.70	0.0146	0.0313	0.398	0.0032	0.00250	0.00096	1.66	0.000449	0.0000000	0.0000000
16	0.75	0.0090	0.0376	0.431	0.0000	0.00000	0.00468	1.62	0.000501	0.0000000	0.0000000
17	0.80	0.0005	0.0469	0.334	0.0049	0.00315	0.00000	1.67	0.000455	0.0000121	0.0000000
18	0.85	0.0000	0.0348	0.447	0.0144	0.00288	0.00442	1.72	0.000493	0.0000000	0.0000373
19	0.90	0.0000	0.0309	0.434	0.0000	0.00000	0.00235	1.73	0.000048	0.0000000	0.0000000
20	0.95	0.0000	0.0753	0.486	0.0000	0.00292	0.00194	1.92	0.000838	0.0000000	0.0000354
21	1.00	0.0173	0.0584	1.270	0.0007	0.00544	0.01367	2.16	0.001372	0.0000000	0.0001201

Spot Number	Distance from inner shell (mm)	MP02A nacreous layer transect N4 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0000	0.0347	0.346	0.0000	0.00114	0.00403	1.63	0.000100	0.0000000	0.0000000
2	0.05	0.0000	1.5544	9.566	0.0080	0.00482	0.00612	3.32	0.000778	0.0000537	0.0000000
3	0.10	0.0000	0.0256	0.452	0.0000	0.00000	0.00090	1.45	0.000453	0.0001244	0.0000000
4	0.15	0.0000	0.5428	1.916	0.0199	0.00000	0.00248	2.63	0.000800	0.0000000	0.0000000
5	0.20	0.0353	5.1308	19.952	0.0355	0.00386	0.00308	2.78	0.000770	0.0000830	0.0000000
6	0.25	0.0000	0.0612	0.422	0.0068	0.00106	0.00000	1.49	0.000271	0.0000000	0.0000000
7	0.30	0.0000	0.0824	0.501	0.0000	0.00000	0.00368	1.44	0.000000	0.0000000	0.0000000
8	0.35	0.0050	0.0346	0.363	0.0098	0.00170	0.00119	1.49	0.000243	0.0000907	0.0000000
9	0.40	0.0104	0.0649	0.366	0.0000	0.00266	0.00000	1.52	0.000466	0.0000160	0.0000135
10	0.45	0.0303	0.0739	0.341	0.0000	0.00000	0.00457	1.45	0.000379	0.0000000	0.0000000
11	0.50	0.0082	0.0525	0.352	0.0089	0.00000	0.00471	1.44	0.000332	0.0000000	0.0000082
12	0.55	0.0102	0.0693	0.375	0.0122	0.00248	0.00000	1.58	0.000407	0.0000453	0.0000490
13	0.60	0.0000	0.0526	0.337	0.0000	0.00506	0.00000	1.63	0.000000	0.0000000	0.0000000
14	0.65	0.0000	0.0442	0.356	0.0281	0.00000	0.00086	1.63	0.000452	0.0000000	0.0000000
15	0.70	0.0000	0.0396	0.384	0.0000	0.00000	0.00327	1.55	0.000319	0.0000176	0.0000286
16	0.75	0.0000	0.0897	0.358	0.0081	0.00162	0.00000	1.64	0.000343	0.0000000	0.0000398
17	0.80	0.0151	0.0851	0.351	0.0000	0.00133	0.00648	1.58	0.000358	0.0000350	0.0000044
18	0.85	0.0107	0.0986	0.469	0.0000	0.00085	0.00414	1.76	0.000634	0.0000000	0.0000000
19	0.90	0.0000	0.0399	0.468	0.0000	0.00373	0.00000	2.16	0.000835	0.0000252	0.0000000

APPENDIX 5.2h KD1B nacreous layer transect data

Spot Number	Distance from inner shell (mm)	KD1B nacreous layer transect N1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0000	0.0510	0.39	0.00000	0.00129	0.00000	1.91	0.00081	0.0000566	0.0000000
2	0.05	0.0035	0.1375	0.76	0.00000	0.00108	0.00369	1.91	0.00068	0.0010296	0.0000814
3	0.10	0.0144	0.0635	0.81	0.00275	0.00000	0.00370	2.20	0.00104	0.0000406	0.0000056
4	0.15	0.0357	0.0690	0.67	0.00000	0.00000	0.00309	1.95	0.00087	0.0000536	0.0000000
5	0.20	0.0004	0.0519	0.64	0.01202	0.00180	0.00425	2.05	0.00081	0.0000699	0.0000087
6	0.25	0.0351	15.3125	91.16	0.00000	0.02923	0.03155	3.09	0.00219	0.0000274	0.0000086
7	0.30	0.0000	0.0567	0.69	0.00194	0.00000	0.00000	1.85	0.00068	0.0000000	0.0000000
8	0.35	0.0217	0.0563	0.53	0.00000	0.00000	0.00049	1.69	0.00055	0.0000194	0.0000000
9	0.40	0.0151	0.0381	0.49	0.00524	0.00056	0.00000	1.72	0.00060	0.0000208	0.0000209
10	0.45	0.0004	0.0452	0.46	0.00000	0.00000	0.00101	1.58	0.00061	0.0000000	0.0000141
11	0.50	0.0000	0.0356	0.41	0.00000	0.00001	0.00287	1.57	0.00055	0.0000680	0.0000083
12	0.55	0.0000	0.0466	0.35	0.00399	0.00008	0.00378	1.63	0.00066	0.0000362	0.0000152
13	0.60	0.0000	0.0478	0.35	0.00000	0.00000	0.00000	1.64	0.00054	0.0000345	0.0000000
14	0.65	0.0112	0.0366	0.38	0.00000	0.00000	0.00518	1.71	0.00056	0.0000297	0.0000042
15	0.70	0.0108	0.0296	0.30	0.00000	0.00193	0.00763	1.66	0.00054	0.0000410	0.0000000
16	0.75	0.0087	0.0278	0.28	0.00102	0.00060	0.00576	1.76	0.00079	0.0000473	0.0000106
17	0.80	0.0200	0.0636	0.23	0.00264	0.00000	0.00133	1.62	0.00068	0.0000013	0.0000010
18	0.85	0.0111	0.0075	0.27	0.00000	0.00000	0.00000	1.66	0.00061	0.0000000	0.0000000
19	0.90	0.0233	0.0480	0.33	0.00495	0.00080	0.00256	1.68	0.00071	0.0000000	0.0000019
20	0.95	0.0136	0.0459	0.30	0.00350	0.00077	0.00008	1.70	0.00081	0.0000000	0.0000004
21	1.00	0.0120	0.0367	0.30	0.00000	0.00075	0.00000	1.83	0.00088	0.0000000	0.0000231
22	1.05	0.0249	0.0062	0.31	0.00000	0.00000	0.00399	1.85	0.00089	0.0000000	0.0000059
23	1.10	0.0045	0.0295	0.41	0.00118	0.00000	0.00370	1.85	0.00079	0.0000000	0.0000239
24	1.15	0.0105	0.0242	0.50	0.01128	0.00086	0.00379	1.80	0.00121	0.0000692	0.0000000
25	1.20	0.0065	0.0606	0.67	0.00308	0.00249	0.00701	2.24	0.00161	0.0000000	0.0000041

Spot Number	Distance from inner shell (mm)	KD1B nacreous layer transect N2 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0011	0.0612	0.41	0.00000	0.00100	0.00440	1.76	0.00090	0.0000441	0.0000000
2	0.05	0.0060	0.0631	0.44	0.00000	0.00276	0.00257	1.88	0.00095	0.0000000	0.0000000
3	0.10	0.0000	0.0338	0.45	0.00000	0.00295	0.00672	1.68	0.00090	0.0000840	0.0000000
4	0.15	0.0082	1.6841	11.17	0.00185	0.00420	0.00324	2.56	0.00105	0.0000043	0.0000000
5	0.20	0.0051	0.0533	0.58	0.00819	0.00000	0.00310	1.82	0.00076	0.0000357	0.0000000
6	0.25	0.0014	0.0410	0.35	0.00000	0.00526	0.00287	1.82	0.00098	0.0000435	0.0000000
7	0.30	0.0069	0.0320	0.37	0.00000	0.00306	0.00600	2.02	0.00128	0.0000324	0.0000015
8	0.35	0.0000	0.0444	0.60	0.01131	0.00195	0.00153	2.18	0.00096	0.0000000	0.0000000
9	0.40	0.0226	0.0070	0.67	0.00698	0.00000	0.00536	2.04	0.00183	0.0000476	0.0000000
10	0.45	0.0092	0.7719	3.25	0.01892	0.00269	0.00037	2.11	0.00105	0.0000300	0.0000000
11	0.50	0.0000	2.4298	13.96	0.00000	0.00606	0.00656	3.85	0.00195	0.0000252	0.0000000
12	0.55	0.0118	0.0300	0.62	0.00119	0.00176	0.00127	1.82	0.00083	0.0000000	0.0000000
13	0.60	0.0000	0.0734	0.52	0.00000	0.00272	0.00000	1.65	0.00073	0.0000205	0.0000210
14	0.65	0.0102	0.0330	0.58	0.01929	0.00205	0.00132	1.94	0.00072	0.0001100	0.0000000
15	0.70	0.0096	0.0783	0.61	0.00323	0.00409	0.00000	1.87	0.00068	0.0000000	0.0000000
16	0.75	0.0000	0.0558	0.56	0.00000	0.00028	0.00000	1.58	0.00065	0.0000765	0.0000000
17	0.80	0.0150	0.0529	0.59	0.00489	0.00000	0.00683	1.66	0.00050	0.0000000	0.0000000
18	0.85	0.0000	7.8759	37.76	0.00000	0.00539	0.01189	2.53	0.00111	0.0000000	0.0000000
19	0.90	0.0055	0.0732	0.58	0.00000	0.00207	0.00391	2.01	0.00075	0.0000000	0.0000151
20	0.95	0.0000	0.0377	0.46	0.00000	0.00000	0.00000	1.73	0.00069	0.0000000	0.0000084
21	1.00	0.0000	0.0550	0.45	0.00000	0.00000	0.00000	1.74	0.00084	0.0000574	0.0000000
22	1.05	0.0204	0.0705	0.42	0.01455	0.00000	0.00039	1.65	0.00052	0.0000179	0.0000234
23	1.10	0.0089	0.0936	0.43	0.00000	0.00000	0.00485	1.62	0.00090	0.0000000	0.0000182
24	1.15	0.0000	0.0952	0.41	0.00000	0.00193	0.00654	1.54	0.00075	0.0000000	0.0000067
25	1.20	0.0000	0.1133	0.64	0.00420	0.00000	0.00652	2.12	0.00143	0.0000316	0.0000107
26	1.25	0.0397	0.0883	0.40	0.01010	0.00039	0.00000	1.79	0.00132	0.0000000	0.0000109
27	1.30	0.0258	0.1097	0.39	0.00000	0.00000	0.00354	1.74	0.00085	0.0000000	0.0000141
28	1.35	0.0000	0.0782	0.38	0.00189	0.00048	0.00218	1.75	0.00071	0.0000000	0.0000000
29	1.40	0.0000	0.1138	0.43	0.00260	0.00000	0.00450	1.69	0.00059	0.0000408	0.0000000
30	1.45	0.0017	0.0780	0.46	0.01305	0.00157	0.00223	2.05	0.00066	0.0000000	0.0000000
31	1.50	0.0011	0.0885	0.50	0.00000	0.00000	0.00354	2.25	0.00128	0.0000000	0.0000000

Spot Number	Distance from inner shell (mm)	KD1B nacreous layer transect N3 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0000	0.0597	0.53	0.01239	0.00000	0.00193	1.80	0.00091	0.0016615	0.0000000
2	0.05	0.0110	0.0330	0.56	0.00000	0.00000	0.00326	1.79	0.00076	0.0000000	0.0000004
3	0.10	0.0171	0.0526	0.51	0.00000	0.00178	0.00000	1.50	0.00055	0.0000552	0.0001324
4	0.15	0.0092	0.0626	0.51	0.00000	0.00039	0.00362	1.65	0.00073	0.0000343	0.0000000
5	0.20	0.0298	0.0985	0.59	0.00000	0.00324	0.00292	1.81	0.00096	0.0000581	0.0000239
6	0.25	0.0000	0.0631	0.57	0.00000	0.00000	0.00135	1.80	0.00066	0.0000413	0.0000026
7	0.30	0.0092	0.0565	0.52	0.00000	0.00372	0.00355	1.74	0.00075	0.0000930	0.0000388
8	0.35	0.0000	0.0651	0.53	0.00000	0.00117	0.00205	1.69	0.00081	0.0000000	0.0000000
9	0.40	0.0051	0.0780	0.48	0.00000	0.00138	0.00180	1.72	0.00089	0.0003819	0.0000257
10	0.45	0.0000	0.0479	0.50	0.02306	0.00101	0.00162	1.61	0.00077	0.0000000	0.0000163
11	0.50	0.0262	0.0505	0.49	0.00326	0.00000	0.00774	1.50	0.00070	0.0012022	0.0000000
12	0.55	0.0019	0.0569	0.53	0.00000	0.00000	0.00075	1.58	0.00071	0.0000000	0.0001823
13	0.60	0.0000	0.0728	0.49	0.01107	0.00211	0.00467	1.72	0.00062	0.0000000	0.0000893
14	0.65	0.0116	0.0572	0.44	0.00000	0.00000	0.00849	1.66	0.00064	0.0000242	0.0000000
15	0.70	0.0000	0.0489	0.47	0.00000	0.00003	0.00000	1.63	0.00065	0.0000000	0.0001018
16	0.75	0.0082	0.0851	0.42	0.00382	0.00000	0.00574	1.86	0.00070	0.0000386	0.0000000
17	0.80	0.0476	0.0746	0.46	0.00000	0.00203	0.00275	1.89	0.00086	0.0014102	0.0000000
18	0.85	0.0088	0.1085	0.41	0.01091	0.00000	0.00566	1.97	0.00092	0.0000159	0.0000000
19	0.90	0.0162	0.0619	0.46	0.00000	0.00170	0.00020	1.98	0.00108	0.0000000	0.0000000
20	0.95	0.0099	0.0685	0.51	0.00348	0.00000	0.00296	1.89	0.00116	0.0000000	0.0000000

APPENDIX 5.2i K3A nacreous layer transect data

Spot Number	Distance from inner shell (mm)	K3A nacreous layer transect N1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0000	0.0524	0.25	0.00000	0.00188	0.00947	1.68	0.00061	0.000275	0.0000000
2	0.05	0.0000	0.0610	0.51	0.00000	0.00000	0.00300	2.13	0.00072	0.000396	0.0000000
3	0.10	0.0360	0.0407	0.39	0.00166	0.00398	0.00628	1.80	0.00056	0.000438	0.0000087
4	0.15	0.0016	0.0578	0.48	0.00000	0.00000	0.00668	1.90	0.00071	0.000395	0.0000000
5	0.20	0.0014	0.1313	3.90	0.00000	0.00020	0.00562	2.65	0.00106	0.000278	0.0000252
6	0.25	0.0124	0.2640	8.34	0.00615	0.00512	0.02749	4.12	0.00348	0.000540	0.0000004
7	0.30	0.0178	1.9727	19.72	0.00976	0.02311	0.02968	4.49	0.00730	0.000314	0.0000000
8	0.35	0.0006	0.0232	0.87	0.00129	0.00145	0.00489	2.72	0.00119	0.000300	0.0000012
9	0.40	0.0151	0.0344	0.86	0.00000	0.00000	0.00805	1.79	0.00081	0.000220	0.0000029
10	0.45	0.0204	0.0182	0.76	0.00078	0.00241	0.00320	1.70	0.00067	0.000219	0.0000004
11	0.50	0.0000	0.0589	1.06	0.00000	0.00082	0.00270	1.83	0.00068	0.000126	0.0000000
12	0.55	0.0072	0.0333	0.61	0.00000	0.00335	0.00272	1.60	0.00056	0.000222	0.0000090
13	0.60	0.0000	0.0309	0.70	0.00000	0.00179	0.00000	1.87	0.00047	0.000041	0.0000000
14	0.65	0.0090	0.0189	0.73	0.00412	0.00051	0.00583	1.81	0.00060	0.000149	0.0000058
15	0.70	0.0087	0.0607	0.82	0.00256	0.00356	0.00156	2.03	0.00065	0.000058	0.0000000
16	0.75	0.0000	0.0408	0.79	0.00000	0.00087	0.00438	2.03	0.00063	0.000137	0.0000000
17	0.80	0.0000	0.0367	0.61	0.00000	0.00286	0.00341	2.20	0.00071	0.000016	0.0000035
18	0.85	0.0105	0.0461	0.72	0.01125	0.00021	0.00192	2.04	0.00067	0.000092	0.0000000
19	0.90	33.2205	15.1640	9.17	194.65587	4.28961	3.35728	2.85	1.52752	0.951116	0.8994688
20	0.95	0.0173	0.0611	0.59	0.00000	0.00074	0.00840	2.17	0.00070	0.000008	0.0000000
21	1.00	0.0036	0.0469	0.67	0.00000	0.00088	0.00324	1.91	0.00075	0.000074	0.0000001
22	1.05	0.0269	0.0540	2.26	0.00559	0.00095	0.00658	2.66	0.00097	0.000100	0.0000076
23	1.10	0.0159	0.0223	1.04	0.00000	0.00000	0.00296	2.07	0.00068	0.000085	0.0000000
24	1.15	0.0086	0.0400	1.12	0.00628	0.00129	0.00429	2.69	0.00098	0.000088	0.0000183
25	1.20	0.0005	0.0518	12.72	0.00903	0.00700	0.00960	2.06	0.00091	0.000037	0.0000085
26	1.25	0.0252	0.0089	7.15	0.00000	0.00469	0.00494	1.88	0.00064	0.000000	0.0000000
27	1.30	0.0370	0.0000	8.10	0.01080	0.00497	0.00159	1.69	0.00060	0.000067	0.0000112
28	1.35	0.0000	0.0000	8.29	0.00459	0.00020	0.00620	2.47	0.00085	0.000068	0.0000094
29	1.40	0.0000	0.0497	0.86	0.00000	0.00287	0.00676	3.66	0.00136	0.000102	0.0000353
30	1.45	0.0112	0.0625	1.77	0.01814	0.00010	0.00522	3.03	0.00134	0.000023	0.0000671

Spot Number	Distance from inner shell (mm)	K3A nacreous layer transect N2 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0092	0.0622	0.36	0.00000	0.00431	0.00619	1.78	0.00171	0.000060	0.0000000
2	0.05	0.0254	0.0574	0.30	0.00000	0.00031	0.00091	1.71	0.00081	0.000018	0.0000000
3	0.10	0.0150	0.0526	0.31	0.00000	0.00022	0.00000	1.54	0.00052	0.000102	0.0000035
4	0.15	0.0000	0.0518	0.30	0.00000	0.00000	0.00369	1.73	0.00059	0.000000	0.0000000
5	0.20	0.0134	0.0360	0.32	0.00320	0.00100	0.00000	1.53	0.00050	0.000012	0.0000080
6	0.25	0.0095	0.0371	0.39	0.00000	0.00070	0.00174	1.50	0.00047	0.000108	0.0000000
7	0.30	0.0152	0.0275	0.43	0.00180	0.00329	0.00357	1.57	0.00045	0.000000	0.0000000
8	0.35	0.0021	0.0644	0.54	0.00000	0.00242	0.00322	1.64	0.00052	0.000000	0.0000000
9	0.40	0.0068	3.5386	28.60	0.00000	0.02498	0.01152	4.22	0.00278	0.000044	0.0000000
10	0.45	0.0134	7.3680	43.85	0.00000	0.02853	0.01275	4.69	0.00277	0.000111	0.0000060
11	0.50	0.0106	0.0472	1.06	0.00000	0.00175	0.00053	2.06	0.00057	0.000051	0.0000242
12	0.55	0.0324	0.0913	1.30	0.00000	0.00000	0.00706	2.34	0.00075	0.000092	0.0000041
13	0.60	0.0155	0.0587	0.66	0.00845	0.00018	0.00106	1.49	0.00040	0.000000	0.0000000
14	0.65	0.0053	0.0529	0.60	0.00000	0.00160	0.00325	1.51	0.00044	0.000000	0.0000000
15	0.70	0.0167	0.0635	0.64	0.00208	0.00222	0.00045	1.60	0.00041	0.000029	0.0000112
16	0.75	0.0000	0.0468	0.65	0.00334	0.00000	0.00505	1.50	0.00034	0.000056	0.0000000
17	0.80	0.0083	0.0386	0.54	0.00000	0.00029	0.00165	1.61	0.00043	0.000078	0.0000000
18	0.85	0.0179	0.0566	0.65	0.00516	0.00335	0.00359	1.50	0.00038	0.000082	0.0000000
19	0.90	0.0000	0.0353	0.65	0.00000	0.00373	0.00000	1.71	0.00018	0.000000	0.0000000
20	0.95	0.0175	0.0534	0.67	0.00093	0.00000	0.00072	1.64	0.00038	0.000081	0.0000136
21	1.00	0.0030	0.0581	0.68	0.00000	0.00256	0.00000	1.68	0.00046	0.000000	0.0000000
22	1.05	0.0000	0.0653	0.60	0.00000	0.00000	0.00216	1.79	0.00052	0.000000	0.0000031
23	1.10	0.0166	0.0627	0.56	0.00340	0.00000	0.00000	1.83	0.00045	0.000027	0.0000000
24	1.15	0.0140	0.0452	0.51	0.00000	0.00019	0.00406	1.55	0.00038	0.000065	0.0000036
25	1.20	0.0092	0.0578	0.54	0.00000	0.00105	0.00227	1.65	0.00033	0.000000	0.0000000
26	1.25	0.0037	0.0518	0.46	0.00147	0.00297	0.00363	1.87	0.00046	0.000004	0.0000000
27	1.30	0.0163	0.0505	0.48	0.00000	0.00057	0.00392	1.88	0.00050	0.000132	0.0000000
28	1.35	0.0328	0.0463	0.44	0.00246	0.00014	0.00000	1.88	0.00048	0.000000	0.0000177
29	1.40	0.0074	0.0539	0.35	0.00000	0.00022	0.00629	1.80	0.00051	0.000011	0.0000055
30	1.45	0.0180	0.0517	0.53	0.00062	0.00000	0.00261	1.84	0.00058	0.000030	0.0000000
31	1.50	0.0000	0.0488	0.53	0.00000	0.00170	0.00236	2.08	0.00038	0.000000	0.0000000
32	1.55	0.0223	0.1060	0.88	0.00000	0.00177	0.00209	2.56	0.00084	0.000000	0.0000000

Spot Number	Distance from inner shell (mm)	K3A nacreous layer transect N3corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0000	0.0791	0.61	0.00000	0.00291	0.00455	1.96	0.00069	0.000000	0.0000000
2	0.05	0.0122	0.0865	0.73	0.00800	0.00137	0.00602	2.02	0.00057	0.000000	0.0000116
3	0.10	0.0129	0.0733	0.66	0.00188	0.00421	0.00144	1.73	0.00049	0.000068	0.0000109
4	0.15	0.0000	0.0298	0.67	0.00967	0.00303	0.00038	1.74	0.00053	0.000082	0.0000000
5	0.20	0.0238	0.0446	0.49	0.00000	0.00018	0.00000	1.62	0.00045	0.000026	0.0000189
6	0.25	0.0026	0.0665	0.62	0.00024	0.00037	0.00000	1.72	0.00047	0.000000	0.0000039
7	0.30	0.0261	0.0477	0.60	0.00000	0.00378	0.00139	1.81	0.00040	0.000000	0.0000000
8	0.35	0.0043	0.0589	1.06	0.00723	0.00000	0.00579	2.34	0.00080	0.000033	0.0000000
9	0.40	0.0174	0.0196	12.92	0.00029	0.00316	0.00471	1.34	0.00043	0.000071	0.0000000
10	0.45	0.0069	0.0123	0.31	0.00000	0.00000	0.00920	1.96	0.00105	0.000022	0.0000000
11	0.50	0.0214	0.0781	0.22	0.00000	0.00000	0.00297	1.64	0.00066	0.000085	0.0000040
12	0.55	0.0045	0.0283	0.32	0.00761	0.00000	0.00141	1.74	0.00064	0.000000	0.0000000
13	0.60	0.0000	0.0864	0.71	0.00000	0.00000	0.00000	1.91	0.00061	0.000073	0.0000080
14	0.65	0.0061	6.5111	33.49	0.00145	0.02104	0.01304	4.85	0.00227	0.000628	0.0000117
15	0.70	0.0051	0.0376	0.40	0.00000	0.00000	0.00000	1.48	0.00049	0.000064	0.0000064
16	0.75	0.0039	0.0317	0.28	0.00000	0.00000	0.00546	1.59	0.00041	0.000000	0.0000000
17	0.80	0.0000	0.0236	0.56	0.00218	0.00031	0.00239	1.59	0.00052	0.000114	0.0000066
18	0.85	0.0056	0.0637	0.53	0.00577	0.00000	0.00775	1.56	0.00055	0.000058	0.0000000
19	0.90	0.0071	0.0280	0.49	0.00000	0.00000	0.00404	1.54	0.00050	0.000059	0.0000027
20	0.95	0.0202	0.0724	0.90	0.00000	0.00000	0.00167	2.02	0.00066	0.000037	0.0000000
21	1.00	0.0019	0.0286	0.55	0.01014	0.00000	0.00339	1.43	0.00034	0.000000	0.0000000
22	1.05	0.9471	681.5120	3382.44	0.00000	1.29877	0.98715	1.82	0.00000	0.000000	0.0000000
23	1.10	0.0019	0.0732	0.60	0.00745	0.00000	0.00336	1.66	0.00056	0.000025	0.0000000
24	1.15	0.0146	0.0782	0.54	0.00000	0.00000	0.00065	1.74	0.00057	0.000065	0.0000000
25	1.20	0.0031	0.0560	0.48	0.00872	0.00265	0.00254	1.58	0.00055	0.000131	0.0000228
26	1.25	0.0000	0.0739	0.46	0.00239	0.00000	0.00785	1.81	0.00056	0.000027	0.0000089
27	1.30	0.0000	0.0639	0.48	0.00000	0.00000	0.00306	1.79	0.00053	0.000004	0.0000172

Spot Number	Distance from inner shell (mm)	K3A nacreous layer transect N4 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0036	0.0425	0.41	0.00000	0.02801	0.00000	2.97	0.00398	0.000000	0.0000000
2	0.05	0.0040	0.0338	0.25	0.00080	0.00431	0.00744	1.61	0.00061	0.000000	0.0000000
3	0.10	0.0000	0.0337	0.26	0.00000	0.00000	0.00531	1.62	0.00057	0.000110	0.0000195
4	0.15	0.0000	0.0389	0.32	0.00882	0.00021	0.00007	1.70	0.00055	0.000060	0.0000000
5	0.20	0.0301	13.2470	83.46	0.00000	0.06245	0.00905	3.94	0.00212	0.000000	0.0000000
6	0.25	0.0016	0.0609	0.28	0.00446	0.00000	0.00178	1.78	0.00066	0.000039	0.0000122
7	0.30	0.0118	0.0515	0.37	0.00339	0.00125	0.00633	1.97	0.00046	0.000000	0.0000000
8	0.35	0.0122	0.0694	0.43	0.00822	0.00223	0.00497	1.55	0.00044	0.000055	0.0000000
9	0.40	0.0000	0.0534	0.50	0.00476	0.00038	0.00354	1.58	0.00045	0.000115	0.0000018
10	0.45	0.0196	13.7553	59.44	0.00674	0.02645	0.00494	2.78	0.00107	0.000008	0.0000000
11	0.50	0.0192	0.0757	0.60	0.00730	0.00398	0.00909	1.63	0.00056	0.000096	0.0000000
12	0.55	0.0004	0.0878	0.58	0.00000	0.00368	0.00497	1.50	0.00046	0.000000	0.0000000
13	0.60	0.0000	0.0787	0.58	0.00000	0.00025	0.00000	1.50	0.00030	0.000079	0.0000000
14	0.65	0.0092	0.0784	0.53	0.00000	0.00485	0.00330	1.60	0.00039	0.000038	0.0000000
15	0.70	0.0087	0.0541	0.55	0.00000	0.00356	0.00204	1.67	0.00055	0.000084	0.0000177
16	0.75	0.0000	0.0215	0.47	0.00000	0.00000	0.00547	1.54	0.00041	0.000063	0.0000000
17	0.80	0.0261	0.0968	0.42	0.00392	0.00107	0.00000	1.53	0.00042	0.000015	0.0000099
18	0.85	0.0000	0.0718	0.42	0.00000	0.00107	0.00075	1.43	0.00041	0.000006	0.0000139
19	0.90	0.0085	0.0520	0.42	0.00188	0.00000	0.00000	1.52	0.00042	0.000000	0.0000000
20	0.95	0.0227	0.0533	0.46	0.01079	0.00181	0.00687	1.57	0.00035	0.000074	0.0000218
21	1.00	0.0000	0.0498	0.34	0.00769	0.00000	0.00440	1.64	0.00046	0.000051	0.0000083
22	1.05	0.0060	0.0683	0.30	0.01533	0.00069	0.00000	1.54	0.00040	0.000046	0.0000070
23	1.10	0.0153	0.0506	0.31	0.00266	0.00414	0.00582	1.55	0.00052	0.000000	0.0000000
24	1.15	0.0129	0.0393	0.26	0.00000	0.00114	0.00532	1.55	0.00037	0.000013	0.0000000
25	1.20	0.0000	0.0572	0.29	0.00000	0.00000	0.00000	1.67	0.00051	0.000018	0.0000000
26	1.25	0.0236	0.0500	0.32	0.00849	0.00225	0.00291	1.77	0.00050	0.000084	0.0000072
27	1.30	0.0004	0.0550	0.33	0.00896	0.00069	0.00487	1.77	0.00048	0.000000	0.0000000
28	1.35	0.0041	0.0471	0.37	0.00000	0.00203	0.00000	1.83	0.00051	0.000074	0.0000035
29	1.40	0.0166	0.0545	0.49	0.00000	0.00401	0.00207	2.12	0.00074	0.000057	0.0000000

APPENDIX 5.2j K1A1 nacreous layer transect data

Spot Number	Distance from inner shell (mm)	K1A1 nacreous layer transect N1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0342	0.0402	0.24	0.00000	0.00242	0.0238	2.41	0.00145	0.000255	0.0000000
2	0.05	0.0000	0.0446	0.32	0.00000	0.00696	0.0261	2.54	0.00186	0.000302	0.0000208
3	0.10	0.0000	0.0471	0.31	0.00000	0.00410	0.0214	2.21	0.00143	0.000267	0.0000000
4	0.15	0.0000	0.0470	0.34	0.00000	0.00505	0.0171	2.38	0.00161	0.000350	0.0000000
5	0.20	0.0103	0.0512	0.28	0.00000	0.00678	0.0179	2.28	0.00160	0.000232	0.0000000
6	0.25	0.0000	0.0295	0.27	0.00000	0.00474	0.0142	2.05	0.00158	0.000235	0.0000000
7	0.30	0.0141	0.0205	0.32	0.00000	0.00482	0.0145	2.27	0.00143	0.000237	0.0000294
8	0.35	0.0376	0.0572	0.73	0.00000	0.00783	0.0172	2.51	0.00163	0.000260	0.0000165
9	0.40	0.0150	0.0656	1.08	0.00000	0.00639	0.0188	2.57	0.00188	0.000333	0.0000074
10	0.45	0.0000	0.0806	1.50	0.00144	0.00356	0.0060	3.26	0.00210	0.000334	0.0000106

Spot Number	Distance from inner shell (mm)	K1A1 nacreous layer transect N2 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0000	0.0000	0.26	0.0007	0.00000	0.0115	2.08	0.00153	0.000148	0.0000000
2	0.05	0.0022	2.8317	19.75	0.0125	0.00995	0.0318	3.29	0.00219	0.000122	0.0000000
3	0.10	0.0000	11.3518	93.35	0.0000	0.05009	0.0880	3.29	0.00305	0.000369	0.0000000
4	0.15	0.0000	0.0000	0.34	0.0000	0.00000	0.0373	1.90	0.00177	0.000000	0.0000000
5	0.20	0.0140	0.0200	0.47	0.0000	0.00000	0.0063	2.66	0.00167	0.000122	0.0000000
6	0.25	0.0000	0.0257	0.29	0.0029	0.00000	0.0177	2.12	0.00178	0.000029	0.0000000
7	0.30	0.0092	0.0416	0.31	0.0101	0.00028	0.0180	1.89	0.00176	0.000083	0.0000000
8	0.35	0.0000	0.0000	0.32	0.0058	0.00017	0.0241	1.96	0.00175	0.000148	0.0000000
9	0.40	0.0000	0.0462	0.33	0.0118	0.00644	0.0357	2.05	0.00199	0.000112	0.0000272
10	0.45	0.0258	0.0758	0.54	0.0092	0.00969	0.0300	2.09	0.00209	0.000094	0.0000000
11	0.50	0.0000	5.3192	22.38	0.1233	0.02133	0.0535	3.21	0.00158	0.000200	0.0000321
12	0.55	0.0000	1.3368	8.84	0.0000	0.01196	0.0280	3.44	0.00234	0.000000	0.0000351
13	0.60	0.0146	0.0735	0.73	0.0310	0.00789	0.0118	2.35	0.00166	0.000019	0.0000000
14	0.65	0.0000	0.0674	0.54	0.0161	0.00390	0.0011	2.12	0.00148	0.000056	0.0000264
15	0.70	0.0123	0.1088	0.67	0.0000	0.00914	0.0174	2.55	0.00189	0.000115	0.0000000
16	0.75	0.0232	0.1444	1.11	0.0245	0.00269	0.0137	2.68	0.00171	0.000245	0.0000000
17	0.80	0.0000	0.3314	2.92	0.0000	0.00039	0.0135	4.41	0.00223	0.000138	0.0000251

Spot Number	Distance from inner shell (mm)	K1A1 nacreous layer transect N3 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0000	0.0389	0.34	0.00000	0.01140	0.0119	2.41	0.00211	0.000429	0.0000041
2	0.05	0.0000	0.0000	0.44	0.00000	0.00890	0.0291	2.06	0.00202	0.000378	0.0000076
3	0.10	0.0000	0.1299	0.98	0.00000	0.00398	0.0119	2.95	0.00174	0.000300	0.0000000
4	0.15	0.0000	0.0179	0.48	0.00000	0.00134	0.0033	1.90	0.00143	0.000278	0.0000039
5	0.20	0.0509	8.3875	50.75	0.00000	0.03876	0.0228	6.14	0.00707	0.000330	0.0000060
6	0.25	0.0000	0.0314	0.60	0.00000	0.01102	0.0189	2.01	0.00189	0.000224	0.0000000
7	0.30	0.0092	0.0347	0.53	0.00000	0.00913	0.0116	1.98	0.00158	0.000223	0.0000000
8	0.35	0.0000	0.0437	0.63	0.00000	0.00652	0.0154	1.94	0.00202	0.000200	0.0000000
9	0.40	0.2937	64.7668	491.55	0.00000	0.13388	0.2839	3.84	0.00390	0.000575	0.0000000
10	0.45	0.0000	0.0322	0.74	0.00000	0.00634	0.0196	2.13	0.00201	0.000294	0.0000000
11	0.50	0.0000	0.0237	0.56	0.00000	0.01308	0.0168	2.06	0.00163	0.000366	0.0000224
12	0.55	0.0224	0.1012	0.97	0.00000	0.00101	0.0000	2.92	0.00146	0.000235	0.0000000
13	0.60	0.0296	0.0698	0.53	0.00000	0.00930	0.0043	2.09	0.00146	0.000375	0.0000029
14	0.65	0.0000	0.0797	0.48	0.00000	0.00204	0.0091	2.08	0.00139	0.000342	0.0000050
15	0.70	0.0146	0.0566	0.77	0.00047	0.00411	0.0091	2.05	0.00131	0.000355	0.0000000
16	0.75	0.0000	19.0908	84.35	0.00000	0.04349	0.0905	3.69	0.00201	0.000109	0.0000000
17	0.80	0.0000	0.4513	2.92	0.00000	0.00721	0.0568	4.14	0.00377	0.000953	0.0000040
18	0.85	0.0000	0.0511	0.56	0.00000	0.00704	0.0226	2.02	0.00164	0.000461	0.0000000
19	0.90	0.0000	0.0260	0.44	0.00052	0.00226	0.0159	2.01	0.00150	0.000340	0.0000014
20	0.95	0.0026	0.0337	0.46	0.00000	0.00285	0.0178	2.16	0.00149	0.000390	0.0000013
21	1.00	0.0229	0.0834	0.50	0.00000	0.00422	0.0124	2.23	0.00162	0.000328	0.0000004
22	1.05	0.0241	0.0524	0.61	0.02839	0.00066	0.0072	2.37	0.00162	0.000311	0.0000249
23	1.10	0.0000	0.0351	0.48	0.00000	0.00075	0.0076	2.24	0.00133	0.000444	0.0000000
24	1.15	0.0000	0.0517	0.67	0.00000	0.00281	0.0093	2.25	0.00131	0.000427	0.0000000
25	1.20	0.0722	0.1027	1.02	0.00000	0.00349	0.0005	2.54	0.00118	0.000262	0.0000000
26	1.25	0.0000	0.0877	1.00	0.00000	0.00044	0.0043	3.07	0.00148	0.000422	0.0000000
27	1.30	0.0000	0.0559	0.84	0.00000	0.00350	0.0060	3.65	0.00259	0.000576	0.0000282
28	1.35	0.0000	0.0658	1.28	0.00000	0.00523	0.0143	2.77	0.00227	0.000541	0.0000002

Spot Number	Distance from inner shell (mm)	K1A1 nacreous layer transect N4 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0067	0.0509	0.32	0.0000	0.01209	0.0146	2.17	0.00235	0.000034	0.0000016
2	0.05	0.0000	0.0852	0.69	0.0268	0.00344	0.0038	2.53	0.00163	0.000149	0.0000000
3	0.10	0.0057	2.6338	19.98	0.0000	0.01205	0.0171	5.74	0.00397	0.000119	0.0000000
4	0.15	0.0180	0.0636	0.52	0.0104	0.01145	0.0108	2.28	0.00191	0.000060	0.0000161
5	0.20	0.0000	0.0187	0.52	0.0025	0.00206	0.0077	2.22	0.00142	0.000137	0.0000000
6	0.25	0.0000	9.3506	49.22	0.0339	0.01425	0.0182	3.11	0.00120	0.000359	0.0000000
7	0.30	0.0106	0.0668	0.68	0.0049	0.00408	0.0130	2.18	0.00164	0.000191	0.0000000
8	0.35	0.0000	0.0404	0.50	0.0000	0.00648	0.0157	2.28	0.00193	0.000016	0.0000000
9	0.40	0.0000	0.3428	1.74	0.0000	0.00402	0.0066	2.62	0.00089	0.000162	0.0000000
10	0.45	0.0979	29.0603	206.60	0.0000	0.07473	0.1065	4.48	0.00198	0.000000	0.0002560
11	0.50	0.0156	0.1010	0.53	0.0000	0.00367	0.0097	2.05	0.00160	0.000235	0.0000140
12	0.55	0.0192	0.0654	0.56	0.0219	0.00651	0.0086	2.11	0.00154	0.000031	0.0000000
13	0.60	0.0320	0.0711	0.48	0.0055	0.00456	0.0104	1.99	0.00149	0.000115	0.0000236
14	0.65	0.0000	0.0816	0.48	0.0286	0.00878	0.0124	1.85	0.00132	0.000009	0.0000000
15	0.70	0.0055	0.0814	0.42	0.0096	0.00271	0.0099	1.97	0.00121	0.000128	0.0000142
16	0.75	0.0000	0.1246	0.75	0.0061	0.00148	0.0014	2.09	0.00128	0.000090	0.0000165
17	0.80	0.0000	20.9977	64.36	0.0000	0.01910	0.0525	3.67	0.00202	0.000293	0.0000432
18	0.85	0.0000	0.1808	1.02	0.0000	0.00141	0.0004	2.60	0.00144	0.000092	0.0000155
19	0.90	0.0008	0.0817	0.41	0.0000	0.00659	0.0100	2.07	0.00160	0.000175	0.0000070
20	0.95	0.0082	0.1040	0.37	0.0000	0.00540	0.0125	2.44	0.00203	0.000009	0.0000000
21	1.00	0.0559	0.0393	0.51	0.0000	0.00480	0.0117	2.52	0.00220	0.000000	0.0000370
22	1.05	0.0000	0.3488	1.54	0.0000	0.00000	0.0035	3.69	0.00152	0.000044	0.0000000
23	1.10	0.0366	0.0928	0.50	0.0046	0.00060	0.0132	2.18	0.00131	0.000062	0.0000000
24	1.15	0.0183	0.0934	0.55	0.0332	0.00188	0.0089	2.48	0.00154	0.000046	0.0000000
25	1.20	0.0000	0.0856	0.67	0.0046	0.00660	0.0038	2.61	0.00158	0.000078	0.0000000
26	1.25	0.0000	0.0679	0.64	0.0096	0.00241	0.0009	2.39	0.00153	0.000060	0.0000578
27	1.30	0.0000	0.0646	0.75	0.0000	0.00598	0.0126	2.68	0.00220	0.000022	0.0000000
28	1.35	0.0230	0.0973	0.99	0.0000	0.00641	0.0083	3.40	0.00258	0.000105	0.0000000

Spot Number	Distance from inner shell (mm)	K1A1 nacreous layer transect N5 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0116	0.0178	0.39	0.0152	0.00927	0.0254	1.99	0.00197	0.000277	0.0000000
2	0.05	0.0069	0.0000	0.47	0.0000	0.00674	0.0105	1.98	0.00164	0.000236	0.0000238
3	0.10	0.0069	0.0000	0.47	0.0000	0.00674	0.0105	1.98	0.00164	0.000236	0.0000238
4	0.15	0.0373	0.0477	0.39	0.0000	0.01031	0.0233	2.13	0.00196	0.000025	0.0000000
5	0.20	0.0000	0.2032	1.25	0.0000	0.00556	0.0009	2.07	0.00101	0.000306	0.0000000
6	0.25	0.0087	0.3554	2.62	0.0149	0.00296	0.0000	2.56	0.00100	0.000375	0.0000415
7	0.30	0.0000	0.0293	0.88	0.0000	0.01262	0.0189	2.25	0.00172	0.000209	0.0000000
8	0.35	0.0000	0.0630	0.54	0.0000	0.00767	0.0195	2.22	0.00197	0.000296	0.0000000
9	0.40	0.0392	0.0749	0.49	0.0000	0.00639	0.0227	2.11	0.00203	0.000095	0.0000000
10	0.45	0.0030	0.0548	0.48	0.0000	0.00840	0.0252	2.12	0.00204	0.000200	0.0000000
11	0.50	0.0000	0.0582	0.44	0.0000	0.00398	0.0133	1.89	0.00140	0.000094	0.0000750
12	0.55	0.0390	4.6201	7.27	0.0000	0.00639	0.0133	3.42	0.00152	0.000166	0.0000349
13	0.60	0.0000	2.5107	11.21	0.0000	0.00652	0.0066	3.77	0.00187	0.000239	0.0000000
14	0.65	0.0035	0.0220	0.40	0.0372	0.00550	0.0115	1.84	0.00111	0.000166	0.0000000
15	0.70	0.0019	0.0950	0.34	0.0000	0.00239	0.0075	2.01	0.00129	0.000005	0.0000000
16	0.75	0.0609	0.0803	0.43	0.0000	0.00027	0.0118	2.11	0.00125	0.000152	0.0000264
17	0.80	0.0000	13.6106	93.27	0.0000	0.03587	0.0408	4.58	0.00282	0.000238	0.0000000
18	0.85	0.0000	0.4775	3.50	0.0202	0.00000	0.0000	4.13	0.00204	0.000067	0.0000000
19	0.90	34.9370	17.0944	9.36	190.4312	4.28018	3.5072	2.89	1.58845	1.078390	1.0038803
20	0.95	0.0000	8.4830	29.32	0.0000	0.01456	0.0231	4.81	0.00261	0.000238	0.0000000
21	1.00	0.0514	0.0980	0.62	0.0293	0.00473	0.0111	2.37	0.00125	0.000195	0.0000000
22	1.05	0.0000	0.0730	0.46	0.0002	0.00375	0.0092	2.08	0.00143	0.000146	0.0000429
23	1.10	0.0128	0.0797	0.52	0.0006	0.00235	0.0129	2.24	0.00213	0.000150	0.0000184
24	1.15	0.0054	0.0421	0.55	0.0000	0.00359	0.0084	2.01	0.00156	0.000226	0.0000348
25	1.20	0.0000	0.0143	0.36	0.0205	0.00411	0.0098	2.04	0.00169	0.000036	0.0000313
26	1.25	0.0130	0.0671	0.39	0.0000	0.00327	0.0079	1.89	0.00146	0.000051	0.0000000
27	1.30	0.0056	0.0792	0.44	0.0000	0.00677	0.0100	2.01	0.00163	0.000088	0.0000227
28	1.35	0.0103	0.0464	0.36	0.0000	0.00157	0.0095	2.06	0.00139	0.000096	0.0000151
29	1.40	0.0000	0.0225	0.41	0.0000	0.00259	0.0088	2.10	0.00155	0.000000	0.0000731
30	1.45	0.0000	0.0755	0.65	0.0000	0.00336	0.0039	2.07	0.00144	0.000000	0.0000000

APPENDIX 5.2k AR1 nacreous layer data

Spot Number	Distance from inner shell (mm)	AR1 nacreous layer transect N1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0075	0.0425	0.21	0.0065	0.00410	0.00574	1.55	0.00315	0.0000000	0.0000183
2	0.05	0.0319	0.0529	0.21	0.0000	0.00571	0.00391	1.51	0.00081	0.0000000	0.0000000
3	0.10	0.0076	0.0399	1.29	0.0237	0.00428	0.00168	2.35	0.00101	0.0000000	0.0000000
4	0.15	0.0000	7.6680	78.06	0.0409	0.02634	0.03062	4.29	0.00170	0.0000000	0.0000000
5	0.20	0.0262	0.1935	6.81	0.0093	0.00078	0.00701	3.89	0.00160	0.0000000	0.0000171
6	0.25	0.0059	0.0241	0.39	0.0117	0.00000	0.00324	1.76	0.00156	0.0000000	0.0000022
7	0.30	0.0000	0.0602	0.40	0.0103	0.00000	0.00592	1.80	0.00162	0.0000495	0.0000000
8	0.35	0.0203	0.0498	0.37	0.0009	0.00210	0.00781	1.55	0.00186	0.0000000	0.0000170
9	0.40	0.0204	0.0370	0.36	0.0010	0.00357	0.00000	1.75	0.00266	0.0000000	0.0000030
10	0.45	0.0447	0.0302	0.46	0.0000	0.00193	0.00524	1.62	0.00176	0.0000000	0.0000000
11	0.50	0.0000	0.0503	0.40	0.0068	0.00000	0.00000	1.61	0.00144	0.0000000	0.0000211
12	0.55	0.0010	0.0213	0.42	0.0126	0.00385	0.00743	1.58	0.00149	0.0000016	0.0000000
13	0.60	0.0277	0.0602	0.51	0.0075	0.00000	0.00126	1.62	0.00190	0.0000570	0.0000000
14	0.65	0.0104	0.0250	0.41	0.0000	0.00000	0.00276	1.74	0.00135	0.0000389	0.0000138
15	0.70	0.0000	0.0426	0.57	0.0101	0.00278	0.00279	1.69	0.00133	0.0000189	0.0000240
16	0.75	0.0052	0.0454	0.51	0.0104	0.00325	0.00112	1.80	0.00091	0.0001005	0.0000058
17	0.80	0.0283	0.0640	0.49	0.0103	0.00000	0.00287	1.97	0.00104	0.0000014	0.0000188
18	0.85	0.0000	0.0459	0.54	0.0235	0.00562	0.00000	1.87	0.00150	0.0000202	0.0000152
19	0.90	0.0205	0.0291	1.06	0.0045	0.00068	0.00409	2.01	0.00130	0.0000242	0.0000151

Spot Number	Distance from inner shell (mm)	AR1 nacreous layer transect N2 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0000	0.0225	0.29	0.0000	0.00000	0.00138	1.65	0.00574	0.0000671	0.0000138
2	0.05	0.0149	0.0593	0.23	0.0000	0.00000	0.00369	1.65	0.00371	0.0000777	0.0000000
3	0.10	0.0120	0.0448	0.32	0.0000	0.00000	0.00124	1.64	0.00444	0.0000830	0.0000000
4	0.15	0.0000	8.4611	23.75	0.0000	0.00515	0.00000	3.48	0.00243	0.0000000	0.0000000
5	0.20	0.0190	0.0296	0.26	0.0000	0.00053	0.00518	1.69	0.00320	0.0000586	0.0000000
6	0.25	0.0142	0.0539	0.92	0.0000	0.00000	0.00329	2.40	0.00286	0.0000000	0.0000000
7	0.30	0.0193	3.9889	22.41	0.0004	0.01664	0.00004	3.75	0.00147	0.0000000	0.0000000
8	0.35	0.0000	0.0628	0.71	0.0000	0.00000	0.01016	1.77	0.00319	0.0000011	0.0000197
9	0.40	0.0200	0.0469	0.45	0.0000	0.00009	0.00432	1.79	0.00290	0.0000359	0.0000405
10	0.45	0.0097	0.0364	0.44	0.0027	0.00304	0.00961	1.75	0.00299	0.0000661	0.0000000
11	0.50	0.0030	0.0660	0.39	0.0000	0.00000	0.00296	1.57	0.00190	0.0000669	0.0000000
12	0.55	0.0151	0.0090	0.42	0.0000	0.00000	0.00341	1.76	0.00203	0.0000885	0.0000000
13	0.60	0.0200	0.0685	0.39	0.0075	0.00000	0.00153	1.70	0.00263	0.0000000	0.0000000
14	0.65	0.0029	0.0343	0.39	0.0000	0.00000	0.00390	1.52	0.00236	0.0000000	0.0000008
15	0.70	0.0055	0.0509	0.38	0.0001	0.00075	0.01021	1.48	0.00243	0.0000323	0.0000185
16	0.75	0.0096	0.0000	0.43	0.0077	0.00000	0.00293	1.59	0.00189	0.0000000	0.0000096
17	0.80	0.0004	0.0218	0.47	0.0000	0.00421	0.00707	1.58	0.00281	0.0000224	0.0000002
18	0.85	0.0000	3.0594	6.22	0.0123	0.01053	0.00978	3.69	0.00381	0.0000103	0.0000000
19	0.90	0.0065	0.0275	0.39	0.0000	0.00000	0.00764	1.74	0.00324	0.0000000	0.0000000
20	0.95	0.0131	0.0206	0.36	0.0000	0.00000	0.00246	1.64	0.00305	0.0001194	0.0000000
21	1.00	0.0000	0.0353	0.41	0.0066	0.00000	0.00105	1.71	0.00146	0.0000000	0.0000000
22	1.05	0.0018	0.0319	0.38	0.0025	0.00235	0.00994	1.90	0.00220	0.0000000	0.0000244
23	1.10	0.0141	0.0579	0.33	0.0000	0.00049	0.00573	1.69	0.00306	0.0000000	0.0000535
24	1.15	0.0089	0.0548	0.35	0.0040	0.00404	0.00867	1.78	0.00254	0.0000714	0.0000000
25	1.20	0.0000	0.0591	0.35	0.0000	0.00132	0.00000	1.79	0.00236	0.0000367	0.0000000
26	1.25	0.0198	0.0283	0.46	0.0000	0.00000	0.00094	2.06	0.00239	0.0000000	0.0000000
27	1.30	0.0210	0.0419	0.48	0.0000	0.00000	0.00957	1.88	0.00201	0.0001806	0.0000405
28	1.35	0.0013	0.0598	0.37	0.0046	0.00000	0.00248	1.60	0.00179	0.0000744	0.0000000
29	1.40	0.0000	0.0556	0.45	0.0000	0.00318	0.00880	1.76	0.00172	0.0000366	0.0000000
30	1.45	0.0275	0.0188	0.49	0.0100	0.00000	0.00351	1.99	0.00194	0.0000000	0.0000000
31	1.50	0.0037	0.0159	0.41	0.0014	0.00000	0.00013	1.61	0.00185	0.0001196	0.0000000
32	1.55	0.0026	0.0560	0.70	0.0108	0.00149	0.00168	2.21	0.00290	0.0000000	0.0000000

Spot Number	Distance from inner shell (mm)	AR1 nacreous layer transect N3 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0150	0.0000	0.31	0.0000	0.00127	0.00520	1.77	0.00441	0.0000000	0.0000028
2	0.05	0.0064	0.0554	0.56	0.0131	0.00000	0.00687	1.78	0.00067	0.0000188	0.0000000
3	0.10	0.0102	5.2268	25.59	0.0000	0.00639	0.00970	3.71	0.00236	0.0000000	0.0000000
4	0.15	0.0067	0.0559	0.40	0.0070	0.00405	0.00595	1.65	0.00120	0.0000000	0.0000000
5	0.20	0.0000	0.0525	0.31	0.0000	0.00231	0.01186	1.83	0.00178	0.0000072	0.0000214
6	0.25	0.0192	2.2128	16.33	0.0000	0.01028	0.00573	2.83	0.00125	0.0000000	0.0000000
7	0.30	0.0130	0.0728	0.29	0.0000	0.00000	0.00000	1.74	0.00108	0.0000385	0.0000000
8	0.35	0.0222	0.0346	0.25	0.0077	0.00061	0.00000	1.57	0.00172	0.0000000	0.0000140
9	0.40	0.0302	1.5154	8.58	0.0010	0.00908	0.00823	2.67	0.00113	0.0000208	0.0000000
10	0.45	0.0085	2.0805	8.51	0.0000	0.00450	0.00379	2.54	0.00124	0.0000000	0.0000495
11	0.50	0.0000	0.0106	0.46	0.0000	0.00389	0.00096	1.44	0.00149	0.0000287	0.0000000
12	0.55	0.0061	0.0268	0.54	0.0000	0.00135	0.00248	1.48	0.00171	0.0000947	0.0000000
13	0.60	0.0162	0.0575	0.59	0.0000	0.00259	0.00106	1.51	0.00212	0.0000700	0.0000262
14	0.65	0.0007	0.0380	0.64	0.0078	0.00071	0.01160	1.63	0.00082	0.0000375	0.0000079
15	0.70	0.0000	0.0270	0.54	0.0000	0.00000	0.01172	1.62	0.00195	0.0000000	0.0000475
16	0.75	0.0071	0.0359	0.57	0.0000	0.00000	0.00000	1.70	0.00156	0.0000209	0.0000029
17	0.80	0.0112	0.0295	0.61	0.0000	0.00153	0.00417	1.74	0.00162	0.0000405	0.0000000
18	0.85	0.0208	5.1213	18.08	0.0000	0.00728	0.00885	3.45	0.00140	0.0000294	0.0000000
19	0.90	0.0193	0.0613	0.56	0.0000	0.00471	0.00000	1.79	0.00207	0.0000000	0.0000000
20	0.95	0.0000	0.0481	0.54	0.0000	0.00281	0.00000	1.56	0.00140	0.0000118	0.0000000
21	1.00	0.0161	0.0422	0.49	0.0054	0.00118	0.00539	1.56	0.00049	0.0000106	0.0000000
22	1.05	0.0000	0.0785	0.48	0.0047	0.00115	0.00000	1.54	0.00051	0.0000346	0.0000000
23	1.10	0.0011	0.0552	0.42	0.0063	0.00127	0.00969	1.72	0.00142	0.0000000	0.0000012
24	1.15	0.0264	0.0544	0.37	0.0042	0.00000	0.00000	1.55	0.00093	0.0000000	0.0000244
25	1.20	0.0000	0.0516	0.38	0.0043	0.00105	0.00503	1.57	0.00063	0.0000000	0.0000000
26	1.25	0.0099	0.0434	0.35	0.0073	0.00000	0.00289	1.67	0.00128	0.0000810	0.0000227
27	1.30	0.0090	0.0707	0.36	0.0096	0.00000	0.00292	1.63	0.00107	0.0000000	0.0000161
28	1.35	0.0054	0.0458	0.36	0.0000	0.00420	0.00298	1.71	0.00085	0.0000811	0.0000161

Spot Number	Distance from inner shell (mm)	AR1 nacreous layer transect N3 corrected data (mmol/mol) continued...									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
29	1.40	0.0133	0.0614	0.35	0.0020	0.00311	0.00000	1.64	0.00100	0.0000000	0.0000206
30	1.45	0.0090	0.0386	0.40	0.0060	0.00278	0.00298	1.68	0.00053	0.0000426	0.0000099
31	1.50	0.0000	0.0515	0.33	0.0000	0.00427	0.00410	1.51	0.00085	0.0000048	0.0000000
32	1.55	0.0000	0.0372	0.31	0.0005	0.00166	0.01278	1.54	0.00168	0.0000589	0.0000217
33	1.60	0.0059	0.0542	0.37	0.0154	0.00000	0.00221	1.62	0.00108	0.0000448	0.0000035
34	1.65	0.0099	0.0554	0.56	0.0000	0.00249	0.01401	1.78	0.00244	0.0000412	0.0000375
35	1.70	0.0089	0.0613	0.70	0.0000	0.00000	0.00108	2.29	0.00525	0.0000555	0.0000227
36	1.75	0.0094	0.0592	0.55	0.0000	0.00000	0.00466	2.72	0.00669	0.0000000	0.0000142

Spot Number	Distance from inner shell (mm)	AR1 nacreous layer transect N4 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0206	0.0424	0.36	0.0000	0.00535	0.00000	1.68	0.00340	0.0000463	0.0000000
2	0.05	0.0139	0.0490	0.28	0.0000	0.00108	0.00920	1.76	0.00367	0.0000632	0.0000000
3	0.10	0.0131	0.1474	1.66	0.0071	0.00364	0.01269	2.18	0.00101	0.0000421	0.0000290
4	0.15	0.0070	4.2999	17.40	0.0060	0.01086	0.00409	4.46	0.00175	0.0000608	0.0000029
5	0.20	0.0177	0.0353	0.54	0.0006	0.00041	0.00788	1.56	0.00373	0.0000000	0.0000504
6	0.25	0.0091	0.0290	0.48	0.0075	0.00000	0.00698	1.38	0.00231	0.0000000	0.0000000
7	0.30	0.0251	0.0307	0.49	0.0036	0.00003	0.00506	1.49	0.00148	0.0000000	0.0000125
8	0.35	0.0153	0.0525	0.46	0.0044	0.00291	0.00881	1.38	0.00285	0.0000000	0.0000074
9	0.40	0.0129	0.0557	0.40	0.0001	0.00254	0.01338	1.43	0.00313	0.0000000	0.0000212
10	0.45	0.0000	0.0649	0.39	0.0000	0.00000	0.00598	1.56	0.00313	0.0000837	0.0000345
11	0.50	0.0014	0.0349	0.42	0.0025	0.00159	0.01210	1.57	0.00867	0.0000845	0.0000056
12	0.55	0.0053	0.0708	0.42	0.0083	0.00000	0.00047	1.70	0.00285	0.0000207	0.0000178
13	0.60	0.0000	0.0746	0.42	0.0000	0.00176	0.01012	1.57	0.00378	0.0000000	0.0000000
14	0.65	0.0123	0.0738	0.38	0.0090	0.00000	0.01178	1.57	0.00272	0.0000447	0.0000000
15	0.70	0.0056	0.0677	0.42	0.0037	0.00000	0.00000	1.78	0.00262	0.0000122	0.0000000
16	0.75	0.0068	0.0582	0.40	0.0064	0.00000	0.01050	1.89	0.00404	0.0000000	0.0000000
17	0.80	0.0000	0.0864	0.43	0.0000	0.00000	0.00002	1.77	0.00372	0.0000000	0.0000250
18	0.85	0.0118	0.0964	0.46	0.0049	0.00480	0.00261	1.89	0.00319	0.0000185	0.0000000
19	0.90	0.0017	0.0907	0.49	0.0000	0.00000	0.00177	2.10	0.00332	0.0000551	0.0000000
20	0.95	0.0120	0.0769	0.44	0.0025	0.00203	0.00551	1.91	0.00340	0.0000000	0.0000000
21	1.00	0.0031	0.0936	0.46	0.0000	0.00223	0.01199	1.88	0.00315	0.0000093	0.0000405
22	1.05	0.0000	0.0752	0.47	0.0000	0.00111	0.00658	1.83	0.00418	0.0000000	0.0000036
23	1.10	0.0057	0.0400	0.41	0.0017	0.00000	0.00567	1.72	0.00397	0.0000551	0.0000000
24	1.15	0.0145	0.0624	0.43	0.0023	0.00037	0.01372	1.73	0.00376	0.0000281	0.0000052
25	1.20	0.0243	0.0864	0.42	0.0000	0.00366	0.01336	1.78	0.00967	0.0000000	0.0000000

APPENDIX 5.2l MR2 nacreous layer transect data

Spot Number	Distance from inner shell (mm)	MR2 nacreous layer transect N1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0455	0.095	0.690	0.0076	0.00000	0.00632	2.10	0.00294	0.0000608	0.0000093
2	0.05	0.0000	0.083	0.515	0.0408	0.00000	0.00560	1.96	0.00268	0.0000237	0.0000525
3	0.10	0.0229	0.000	0.438	0.0242	0.00000	0.00516	1.83	0.00196	0.0000949	0.0000000
4	0.15	0.0087	0.000	0.328	0.0200	0.00000	0.01065	1.87	0.00165	0.0000000	0.0000385
5	0.20	0.0055	0.029	0.508	0.0000	0.00000	0.00000	2.05	0.00108	0.0000204	0.0000000
6	0.25	0.0096	0.094	0.538	0.0203	0.00459	0.00392	1.80	0.00183	0.0000226	0.0000419
7	0.30	0.0014	0.081	0.454	0.0131	0.00532	0.00213	1.72	0.00132	0.0000000	0.0000000
8	0.35	0.0143	0.463	0.417	0.0000	0.00273	0.01185	1.76	0.00126	0.0001624	0.0000054
9	0.40	0.0441	0.313	0.384	0.0201	0.00586	0.00000	1.75	0.00150	0.0000000	0.0001061
10	0.45	0.0000	0.427	0.392	0.0000	0.00068	0.00773	1.79	0.00138	0.0000000	0.0000000
11	0.50	0.0118	0.026	0.351	0.0000	0.00004	0.00000	1.69	0.00162	0.0000000	0.0000000
12	0.55	0.0351	0.211	0.321	0.0292	0.00000	0.00000	1.82	0.00159	0.0003187	0.0000000
13	0.60	0.0435	0.406	0.333	0.0220	0.00000	0.01033	1.97	0.00175	0.0001830	0.0000000
14	0.65	0.0296	0.347	0.507	0.0000	0.00000	0.00757	2.36	0.00209	0.0002295	0.0000000
15	0.70	0.0149	0.115	0.915	0.0086	0.00472	0.00025	3.09	0.00262	0.0000363	0.0000474

Spot Number	Distance from inner shell (mm)	MR2 nacreous layer transect N2 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0000	0.436	0.310	0.0306	0.00000	0.00000	1.88	0.00228	0.0000000	0.0000000
2	0.05	0.0201	0.158	0.285	0.0222	0.00276	0.01171	1.85	0.00205	0.0000000	0.0000036
3	0.10	0.0000	0.287	0.484	0.0343	0.01109	0.01801	1.75	0.00266	0.0000263	0.0000387
4	0.15	0.0061	0.158	0.433	0.0000	0.00518	0.00032	1.66	0.00187	0.0000000	0.0000000
5	0.20	0.0318	0.463	0.572	0.0087	0.00000	0.00772	1.44	0.00169	0.0003441	0.0000000
6	0.25	0.0320	0.451	0.427	0.0288	0.00126	0.00044	1.38	0.00153	0.0001009	0.0000000
7	0.30	0.0000	0.460	0.788	0.0137	0.00251	0.01643	1.84	0.00211	0.0000000	0.0000000
8	0.35	0.0151	0.000	0.901	0.0103	0.00000	0.01343	1.79	0.00256	0.0000000	0.0000000
9	0.40	0.0220	0.763	1.040	0.0083	0.00000	0.00338	1.75	0.00227	0.0002057	0.0000000
10	0.45	0.0000	0.167	0.856	0.0526	0.00000	0.00000	1.62	0.00171	0.0000000	0.0001077
11	0.50	0.0171	0.321	0.960	0.0349	0.00663	0.00677	1.67	0.00131	0.0000000	0.0000000
12	0.55	0.0705	0.129	1.055	0.0155	0.00558	0.00000	1.58	0.00181	0.0000000	0.0000000
13	0.60	0.0384	0.349	1.366	0.0095	0.00257	0.00000	1.65	0.00207	0.0000000	0.0000795
14	0.65	0.0187	0.356	1.420	0.0029	0.00000	0.00000	1.49	0.00142	0.0000000	0.0001608
15	0.70	0.0273	0.413	1.529	0.0000	0.00000	0.01488	1.77	0.00104	0.0000000	0.0000997
16	0.75	0.0422	0.293	1.550	0.0073	0.00517	0.00064	1.85	0.00176	0.0000371	0.0000290
17	0.80	0.0246	0.497	1.550	0.0000	0.00271	0.00000	1.73	0.00172	0.0002230	0.0000000
18	0.85	0.0055	0.424	1.573	0.0207	0.00301	0.00095	2.00	0.00246	0.0000889	0.0000384
19	0.90	0.0511	0.490	2.142	0.0000	0.00000	0.00000	1.95	0.00276	0.0000000	0.0000000
20	0.95	0.0265	0.352	1.419	0.0232	0.00000	0.00482	1.78	0.00144	0.0000000	0.0000000
21	1.00	0.0000	0.603	1.873	0.0048	0.00472	0.00425	2.07	0.00242	0.0000000	0.0000346
22	1.05	0.0078	0.451	2.049	0.0118	0.00499	0.01489	2.35	0.00270	0.0001490	0.0000562

Spot Number	Distance from inner shell (mm)	MR2 nacreous layer transect N3corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0000	0.254	0.343	0.0256	0.00033	0.00447	1.78	0.00335	0.0003136	0.0000760
2	0.05	0.0421	0.186	0.742	0.0519	0.00532	0.03919	1.94	0.00163	0.0000000	0.0000366
3	0.10	0.0000	0.490	0.314	0.0000	0.00000	0.02028	1.79	0.00216	0.0000000	0.0000000
4	0.15	0.0000	0.435	0.289	0.0048	0.00000	0.01480	1.61	0.00239	0.0002933	0.0000000
5	0.20	0.0351	0.725	0.436	0.0000	0.00606	0.00564	1.91	0.00262	0.0000473	0.0000000
6	0.25	0.0000	0.294	0.379	0.0000	0.01419	0.00000	1.81	0.00199	0.0000000	0.0000062
7	0.30	0.0495	0.146	0.702	0.0000	0.00778	0.00000	1.69	0.00137	0.0000000	0.0000000
8	0.35	0.0190	0.184	0.520	0.0486	0.00060	0.00000	1.72	0.00155	0.0000000	0.0000000
9	0.40	0.0000	1.188	1.828	0.0418	0.00416	0.01512	2.31	0.00243	0.0000000	0.0000000
10	0.45	0.0000	0.000	0.584	0.0000	0.00000	0.01175	1.70	0.00212	0.0000000	0.0000044
11	0.50	0.0397	0.191	0.496	0.0524	0.00000	0.00932	1.53	0.00138	0.0000000	0.0000000
12	0.55	0.0280	0.000	0.606	0.0000	0.00266	0.00105	1.60	0.00119	0.0000455	0.0000000
13	0.60	0.0210	0.154	0.539	0.0000	0.00546	0.00000	1.60	0.00133	0.0000000	0.0001152
14	0.65	0.0000	0.328	0.480	0.0260	0.00875	0.01434	1.59	0.00097	0.0001200	0.0000221
15	0.70	0.0310	0.353	0.506	0.0632	0.00312	0.01289	1.71	0.00158	0.0001190	0.0000000
16	0.75	0.0000	0.086	0.536	0.0144	0.00000	0.00525	1.77	0.00138	0.0002556	0.0000364
17	0.80	0.0626	0.204	0.480	0.0000	0.00448	0.00000	1.69	0.00137	0.0000812	0.0000446
18	0.85	0.0000	0.236	0.575	0.0000	0.00203	0.00971	1.53	0.00136	0.0000000	0.0000000
19	0.90	0.0263	0.020	0.583	0.0261	0.00000	0.00000	1.63	0.00113	0.0000000	0.0000000
20	0.95	0.0018	0.640	0.597	0.0000	0.00839	0.00000	1.59	0.00116	0.0000008	0.0000000
21	1.00	0.0013	0.479	0.582	0.0000	0.00270	0.00000	1.79	0.00095	0.0000188	0.0001464
22	1.05	0.0000	0.373	0.579	0.0615	0.00000	0.01015	1.58	0.00141	0.0000932	0.0000000
23	1.10	0.0165	0.000	0.609	0.0000	0.00000	0.00000	1.67	0.00154	0.0000000	0.0000244
24	1.15	0.0140	0.342	0.638	0.0072	0.00339	0.00335	1.78	0.00132	0.0000000	0.0000000
25	1.20	0.0336	0.615	0.619	0.0000	0.00751	0.01036	1.83	0.00162	0.0000073	0.0000000
26	1.25	0.0429	0.601	0.723	0.0147	0.00550	0.01820	1.94	0.00251	0.0001551	0.0000000
27	1.30	0.0288	0.489	0.977	0.0132	0.00000	0.00000	2.39	0.00326	0.0000000	0.0000646

Spot Number	Distance from inner shell (mm)	MR2 nacreous layer transect N4 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0337	0.284	0.223	0.0097	0.00000	0.00138	1.95	0.00299	0.0001287	0.0000000
2	0.05	0.0080	0.694	0.462	0.0148	0.00010	0.00354	1.75	0.00243	0.0002030	0.0000352
3	0.10	0.0318	0.141	0.302	0.0000	0.00873	0.00425	1.63	0.00195	0.0000000	0.0000000
4	0.15	0.0000	0.246	0.493	0.0000	0.00000	0.00371	3.27	0.00262	0.0000000	0.0001177
5	0.20	0.0000	0.326	0.362	0.0000	0.00136	0.01376	1.82	0.00199	0.0000002	0.0000162
6	0.25	0.0314	0.427	0.365	0.0031	0.00855	0.00000	1.69	0.00206	0.0000000	0.0000000
7	0.30	0.0278	0.401	0.489	0.0000	0.00227	0.00531	1.75	0.00216	0.0001982	0.0000709
8	0.35	0.0000	0.221	0.480	0.0000	0.00000	0.01028	1.82	0.00192	0.0001425	0.0000000
9	0.40	0.0236	0.519	0.572	0.0177	0.00190	0.01393	1.76	0.00164	0.0000000	0.0000370
10	0.45	0.0339	0.189	0.418	0.0381	0.00314	0.00262	1.53	0.00201	0.0000000	0.0000000
11	0.50	0.0269	0.247	0.501	0.0000	0.00000	0.00417	1.43	0.00161	0.0001725	0.0000785
12	0.55	0.0000	0.179	0.432	0.0186	0.00000	0.00414	1.46	0.00224	0.0000000	0.0000114
13	0.60	0.0000	0.000	0.575	0.0217	0.00000	0.00851	1.41	0.00213	0.0000308	0.0000153
14	0.65	0.0000	0.284	0.607	0.0038	0.00060	0.00575	1.36	0.00110	0.0000000	0.0000000
15	0.70	0.0000	0.683	0.532	0.0253	0.00193	0.01820	1.44	0.00195	0.0000000	0.0000571
16	0.75	0.0045	0.477	0.485	0.0349	0.00000	0.00506	1.44	0.00129	0.0002184	0.0000000
17	0.80	0.0000	0.000	0.549	0.0257	0.00974	0.00169	1.45	0.00160	0.0000000	0.0000662
18	0.85	0.0000	0.186	0.458	0.0104	0.00000	0.00000	1.39	0.00139	0.0000000	0.0000355
19	0.90	0.0000	0.000	0.497	0.0334	0.00606	0.00454	1.49	0.00128	0.0000000	0.0000000
20	0.95	0.0000	0.239	0.522	0.0064	0.00146	0.00000	1.43	0.00175	0.0002552	0.0000448
21	1.00	0.0192	0.552	0.570	0.0215	0.00000	0.01096	1.50	0.00195	0.0000000	0.0000209
22	1.05	0.0194	0.400	0.630	0.0183	0.00000	0.00000	1.60	0.00096	0.0000958	0.0000157
23	1.10	0.0328	0.666	0.605	0.0329	0.00000	0.00000	1.59	0.00164	0.0000289	0.0000564
24	1.15	0.0208	0.000	0.658	0.0000	0.00000	0.01717	1.74	0.00166	0.0001596	0.0000658
25	1.20	0.0157	0.000	0.686	0.0000	0.00000	0.01189	1.66	0.00193	0.0000000	0.0000481
26	1.25	0.0034	0.595	1.080	0.0000	0.00064	0.00728	2.20	0.00360	0.0000961	0.0000910

APPENDIX 5.2m MD1 nacreous layer data

Spot Number	Distance from inner shell (mm)	MD1 nacreous layer transect N1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0239	0.2727	0.34	0.0000	0.00000	0.0000	1.50	0.000499	0.0000000	0.0000000
2	0.05	0.0123	0.0000	0.29	0.0007	0.00000	0.0053	1.48	0.001571	0.0000719	0.0000000
3	0.10	0.0136	0.1027	0.19	0.0345	0.00897	0.0081	1.46	0.001226	0.0000000	0.0000476
4	0.15	0.0108	0.0000	0.16	0.0047	0.00039	0.0064	1.41	0.001066	0.0001342	0.0000000
5	0.20	0.0000	0.0000	0.16	0.0112	0.00534	0.0025	1.32	0.000946	0.0000000	0.0000247
6	0.25	0.0152	0.6889	0.25	0.0117	0.00513	0.0000	1.62	0.000646	0.0000000	0.0000000
7	0.30	0.0361	0.2493	0.36	0.0060	0.00281	0.0063	1.91	0.001095	0.0000003	0.0000432
8	0.35	0.0002	0.0197	0.28	0.0143	0.00107	0.0000	1.55	0.000969	0.0001868	0.0000052
9	0.40	0.0000	0.1950	0.32	0.0134	0.00000	0.0105	1.49	0.001444	0.0000000	0.0000241
10	0.45	0.0007	0.4010	0.43	0.0000	0.00228	0.0006	1.62	0.001227	0.0000000	0.0001155
11	0.50	0.0000	0.4803	0.44	0.0085	0.00563	0.0118	1.88	0.001805	0.0000427	0.0000508
12	0.55	0.0116	0.2455	0.41	0.0166	0.00000	0.0000	1.81	0.001381	0.0001034	0.0000405
13	0.60	0.0241	0.3332	0.47	0.0123	0.00366	0.0052	2.04	0.001835	0.0000000	0.0000000
14	0.65	0.0260	0.0937	0.54	0.0124	0.00425	0.0070	1.94	0.002022	0.0000000	0.0000418
15	0.70	0.0036	0.3291	0.52	0.0049	0.00285	0.0000	1.71	0.001361	0.0000000	0.0000000
16	0.75	0.0124	0.0693	0.43	0.0025	0.00680	0.0044	1.93	0.001922	0.0001361	0.0000366
17	0.80	0.0271	0.6218	0.39	0.0080	0.00300	0.0080	1.74	0.000881	0.0000000	0.0000101
18	0.85	0.0000	0.3914	0.49	0.0020	0.00000	0.0006	1.93	0.000901	0.0002800	0.0000365
19	0.90	0.0093	0.2365	0.37	0.0628	0.00358	0.0127	1.92	0.001287	0.0000479	0.0000000

APPENDIX 5.2n MD3 nacreous layer transect data

Spot Number	Distance from inner shell (mm)	MD3 nacreous layer transect N1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0000	0.0498	0.213	0.00000	0.00000	0.0000	1.50	0.000430	0.0000000	0.0000000
2	0.05	0.0008	0.0333	0.260	0.00000	0.00000	0.0134	1.50	0.000555	0.0000374	0.0000000
3	0.10	0.0000	0.0421	0.380	0.00000	0.00344	0.0076	1.53	0.000665	0.0001038	0.0000000
4	0.15	0.0186	17.8210	116.078	0.02567	0.04072	0.0790	3.58	0.002279	0.0003739	0.0000000
5	0.20	0.0085	0.0691	0.297	0.00000	0.00044	0.0072	1.66	0.001041	0.0000100	0.0000000
6	0.25	0.0103	0.0376	0.334	0.00641	0.00000	0.0202	1.58	0.001009	0.0000078	0.0000000
7	0.30	0.0000	0.0526	0.412	0.00000	0.00000	0.0134	1.91	0.000664	0.0000000	0.0000000
8	0.35	0.0257	0.0589	0.269	0.00108	0.00000	0.0121	1.69	0.000659	0.0000054	0.0000000
9	0.40	0.0190	0.0428	0.352	0.00000	0.00201	0.0075	1.73	0.000772	0.0000220	0.0000129
10	0.45	0.0000	0.0271	0.605	0.00715	0.00142	0.0060	2.11	0.000735	0.0000466	0.0000000
11	0.50	0.0018	0.0491	0.397	0.00293	0.00000	0.0029	1.49	0.000631	0.0001546	0.0000101
12	0.55	0.0000	0.0346	0.375	0.00000	0.00000	0.0091	1.58	0.000520	0.0000548	0.0000000
13	0.60	0.0000	0.0170	0.401	0.00000	0.00444	0.0131	1.44	0.000156	0.0000000	0.0000000
14	0.65	0.0101	0.0528	0.411	0.00508	0.00230	0.0060	1.73	0.000589	0.0000840	0.0000203
15	0.70	0.0110	0.0851	0.530	0.00000	0.00000	0.0077	1.97	0.000954	0.0000041	0.0000166
16	0.75	0.0198	0.0496	0.425	0.00000	0.00046	0.0077	1.59	0.000814	0.0000000	0.0000541
17	0.80	0.0150	0.0643	0.321	0.00000	0.00087	0.0062	1.49	0.000577	0.0000000	0.0000000
18	0.85	0.0000	0.0430	0.343	0.00164	0.00221	0.0012	1.47	0.000721	0.0000319	0.0000000
19	0.90	0.0000	0.0473	0.372	0.00385	0.00000	0.0041	1.58	0.000688	0.0000669	0.0000000
20	0.95	0.0118	0.0712	0.339	0.00139	0.00000	0.0116	1.71	0.000684	0.0000871	0.0000000
21	1.00	0.0095	0.0531	0.341	0.00000	0.00009	0.0165	1.72	0.000790	0.0000082	0.0000113
22	1.05	0.0000	0.0652	0.268	0.00161	0.00000	0.0086	1.67	0.000716	0.0000000	0.0000088
23	1.10	0.0147	0.0700	0.334	0.00000	0.00000	0.0148	1.71	0.000705	0.0000067	0.0000000
24	1.15	0.0139	0.0541	0.257	0.00000	0.00000	0.0043	1.71	0.000707	0.0000232	0.0000010
25	1.20	0.0000	0.0412	0.283	0.00000	0.00280	0.0064	1.71	0.000676	0.0000269	0.0000000
26	1.25	0.0140	0.0677	0.300	0.00115	0.00303	0.0038	1.70	0.000782	0.0000081	0.0000000
27	1.30	0.0137	0.0878	0.267	0.00000	0.00066	0.0086	1.88	0.000855	0.0000462	0.0000000
28	1.35	0.0322	0.0680	0.366	0.00000	0.00083	0.0111	1.93	0.001068	0.0000000	0.0000046
29	1.40	0.0028	0.0830	0.582	0.00200	0.00083	0.0082	2.06	0.001194	0.0000000	0.0000054
30	1.45	0.0132	0.0655	0.363	0.00000	0.00033	0.0164	2.19	0.001102	0.0000000	0.0000122

Spot Number	Distance from inner shell (mm)	MD3 nacreous layer transect N2 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0051	0.0136	0.247	0.00304	0.00262	0.0159	1.78	0.00111	0.0000737	0.0000000
2	0.05	0.0000	0.0278	0.235	0.00061	0.00462	0.0035	1.65	0.00082	0.0000215	0.0000000
3	0.10	0.0177	0.0096	0.478	0.00079	0.00000	0.0000	1.91	0.00083	0.0000771	0.0000057
4	0.15	0.0000	0.0641	0.676	0.00119	0.00015	0.0085	2.34	0.00125	0.0000000	0.0000028
5	0.20	0.0115	0.0393	0.299	0.00175	0.00000	0.0046	1.80	0.00076	0.0000298	0.0000000
6	0.25	0.0008	0.0431	0.340	0.00335	0.00136	0.0075	1.60	0.00090	0.0000230	0.0000162
7	0.30	0.0181	0.0188	0.482	0.00000	0.00026	0.0186	2.01	0.00277	0.0000989	0.0000000
8	0.35	0.0144	0.0292	0.319	0.00000	0.00105	0.0084	1.74	0.00084	0.0002086	0.0000000
9	0.40	0.0078	1.4325	5.229	0.01126	0.00516	0.0171	3.49	0.00181	0.0000887	0.0000286
10	0.45	0.0153	0.0234	0.353	0.00000	0.00056	0.0000	1.43	0.00057	0.0000000	0.0000109
11	0.50	0.0000	0.0747	0.400	0.00000	0.00408	0.0019	1.61	0.00070	0.0000000	0.0000000
12	0.55	0.0262	0.0322	0.320	0.00013	0.00405	0.0167	1.52	0.00069	0.0001395	0.0000005
13	0.60	0.0172	0.0381	0.346	0.00000	0.00259	0.0017	1.48	0.00065	0.0000767	0.0000000
14	0.65	0.0003	0.0583	0.297	0.00118	0.00140	0.0071	1.50	0.00067	0.0000252	0.0000045
15	0.70	0.0112	0.0285	0.324	0.00000	0.00106	0.0105	1.51	0.00078	0.0001172	0.0000139
16	0.75	0.0002	0.0548	0.290	0.00685	0.00545	0.0026	1.55	0.00060	0.0000000	0.0000284
17	0.80	0.0047	0.0695	0.294	0.00556	0.00270	0.0010	1.59	0.00083	0.0000000	0.0000138
18	0.85	0.0099	0.0607	0.276	0.00294	0.00039	0.0057	1.55	0.00069	0.0000000	0.0000176
19	0.90	0.0037	0.0673	0.297	0.00000	0.00096	0.0070	1.61	0.00062	0.0000000	0.0000000
20	0.95	0.0110	0.1224	0.267	0.01881	0.00797	0.0045	1.75	0.00088	0.0000000	0.0000078
21	1.00	0.0047	0.0641	0.346	0.00000	0.00000	0.0000	1.66	0.00097	0.0000245	0.0000000
22	1.05	0.0165	0.0706	0.362	0.00199	0.00180	0.0151	1.97	0.00108	0.0000519	0.0000156
23	1.10	0.0000	0.0809	0.349	0.00136	0.00060	0.0175	2.07	0.00118	0.0000000	0.0000000
24	1.15	0.0000	0.1069	0.383	0.00514	0.00268	0.0157	2.23	0.00125	0.0000785	0.0000421
25	1.20	0.0096	0.0968	0.460	0.00305	0.00467	0.0127	2.08	0.00130	0.0000000	0.0000025

Spot Number	Distance from inner shell (mm)	MD3 nacreous layer transect N3 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0192	0.0216	0.196	0.00395	0.00067	0.0059	1.72	0.000597	0.0000159	0.0000000
2	0.05	0.0154	0.0453	0.206	0.00371	0.00241	0.0048	1.80	0.000831	0.0000060	0.0000254
3	0.10	0.0268	0.0756	0.364	0.00046	0.00671	0.0106	1.93	0.000758	0.0000000	0.0000000
4	0.15	0.0152	1.8824	13.492	0.00000	0.01195	0.0093	3.94	0.001903	0.0000000	0.0000184
5	0.20	0.0000	0.0362	0.360	0.00392	0.00099	0.0017	1.63	0.000524	0.0000000	0.0000000
6	0.25	0.0000	0.0304	0.597	0.00000	0.00173	0.0034	2.28	0.000674	0.0000696	0.0000000
7	0.30	0.0086	0.0162	0.622	0.00000	0.00229	0.0018	1.72	0.000505	0.0000000	0.0000413
8	0.35	0.0079	0.0604	0.441	0.00219	0.00000	0.0136	1.89	0.000557	0.0000567	0.0000000
9	0.40	0.0118	0.0478	0.364	0.00000	0.00285	0.0046	1.68	0.000571	0.0000147	0.0000000
10	0.45	0.0000	0.0387	0.348	0.00911	0.00161	0.0023	1.68	0.000510	0.0000664	0.0000283
11	0.50	0.0142	0.0558	0.356	0.00000	0.00234	0.0065	1.69	0.000441	0.0000577	0.0000070
12	0.55	0.0278	0.0280	0.348	0.00753	0.00186	0.0020	1.86	0.000698	0.0001465	0.0000030
13	0.60	0.0004	0.0655	0.329	0.00726	0.00080	0.0000	1.71	0.000662	0.0000760	0.0000000
14	0.65	0.0076	0.0485	0.395	0.00000	0.00137	0.0034	2.37	0.000806	0.0000000	0.0000271
15	0.70	0.0109	0.0679	0.346	0.00000	0.00375	0.0127	1.89	0.000700	0.0000336	0.0000158
16	0.75	0.0036	0.0481	0.315	0.00774	0.00000	0.0103	2.00	0.000647	0.0000000	0.0000027
17	0.80	0.0001	0.0936	0.399	0.00066	0.00000	0.0052	2.26	0.000900	0.0000000	0.0000062

Spot Number	Distance from inner shell (mm)	MD3 nacreous layer transect N4 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0133	0.0422	0.257	0.00112	0.00000	0.0150	1.49	0.001057	0.0000596	0.0000000
2	0.05	0.0169	0.0352	0.212	0.00000	0.00351	0.0031	1.45	0.000727	0.0000000	0.0000632
3	0.10	0.0011	0.0187	0.275	0.00000	0.00312	0.0095	1.57	0.000680	0.0001128	0.0000000
4	0.15	0.0205	0.0313	0.330	0.00955	0.00000	0.0081	1.41	0.000535	0.0000676	0.0000184
5	0.20	0.0012	0.0446	0.211	0.00238	0.00049	0.0074	1.57	0.000608	0.0000000	0.0000301
6	0.25	0.0000	0.0653	0.221	0.00187	0.00233	0.0117	1.59	0.000680	0.0001281	0.0000178
7	0.30	0.0169	0.0179	0.220	0.00000	0.00088	0.0165	1.54	0.000588	0.0000000	0.0000019
8	0.35	0.0000	0.0940	0.244	0.00000	0.00618	0.0024	1.62	0.000585	0.0000789	0.0000000
9	0.40	0.0116	0.0635	0.290	0.00000	0.00000	0.0120	1.60	0.000617	0.0001216	0.0000000
10	0.45	0.0117	0.1107	1.356	0.00625	0.00394	0.0115	3.32	0.001397	0.0000046	0.0000463
11	0.50	0.0065	0.0102	0.333	0.01234	0.00374	0.0080	2.04	0.000718	0.0000709	0.0000000
12	0.55	0.0037	0.0482	0.378	0.00000	0.00000	0.0093	2.09	0.000934	0.0000000	0.0000152
13	0.60	0.0172	0.0284	0.467	0.00000	0.00231	0.0039	2.34	0.001158	0.0000627	0.0000033
14	0.65	0.0136	0.0232	0.701	0.00000	0.00000	0.0000	2.98	0.001275	0.0000270	0.0000628
15	0.70	0.0171	0.0777	0.589	0.00305	0.00000	0.0189	2.69	0.001474	0.0000346	0.0000006
16	0.75	0.0085	0.0247	0.518	0.00102	0.00460	0.0151	2.39	0.001314	0.0001768	0.0000442
17	0.80	0.0056	0.0782	0.456	0.00000	0.00170	0.0172	2.33	0.001097	0.0000305	0.0000000
18	0.85	0.0157	0.0562	0.480	0.00000	0.00469	0.0113	2.43	0.001100	0.0000759	0.0000000
19	0.90	0.0188	0.0262	0.411	0.00000	0.00360	0.0115	2.42	0.001176	0.0000017	0.0000175

APPENDIX 5.3a RW75 growth band data

Spot Number	Distance from outer shell (mm)	RW75 growth band transect L1 corrected data (mmol/mol)								
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	U/Ca
1	0.00	0.0000	0.0084	22.70	0.00000	0.00000	0.00000	1.44	0.000000	0.0000000
2	0.05	0.0147	0.0000	15.02	0.00119	0.00025	0.00237	1.40	0.000491	0.0000004
3	0.10	0.0101	0.0065	10.30	0.00168	0.00124	0.01038	1.38	0.000517	0.0000183
4	0.15	0.0103	0.0000	8.57	0.00282	0.00121	0.00522	1.38	0.000434	0.0000000
5	0.20	0.0076	0.0132	6.04	0.00200	0.00133	0.00185	1.27	0.000377	0.0000000
6	0.25	0.0006	0.0019	5.20	0.00000	0.00064	0.00569	1.18	0.000145	0.0000000
7	0.30	0.0058	0.0000	5.35	0.00000	0.00104	0.00120	1.18	0.000309	0.0000316
8	0.35	0.0065	0.0197	5.44	0.00071	0.00043	0.00190	1.01	0.000352	0.0000000
9	0.40	0.0089	0.0060	5.96	0.00100	0.00134	0.00112	0.94	0.000250	0.0000208
10	0.45	0.0007	0.0000	6.03	0.00000	0.00000	0.00053	0.89	0.000000	0.0000000
11	0.50	0.0107	0.0030	6.18	0.29391	0.00484	0.01140	1.28	0.001063	0.0000702
12	0.55	0.0116	0.0000	4.23	0.00000	0.00074	0.00455	1.93	0.000681	0.0000000
13	0.60	0.0076	0.0225	4.00	0.00000	0.00000	0.00402	1.84	0.000657	0.0000840

Spot Number	Distance from outer shell (mm)	RW75 growth band transect L2 corrected data (mmol/mol)								
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	U/Ca
1	0.00	0.0081	0.0423	2.51	0.00137	0.00062	0.00810	3.39	0.001561	0.0000279
2	0.05	0.0110	0.0000	13.44	0.00014	0.00234	0.00151	0.90	0.000369	0.0000179
3	0.10	0.0062	0.0151	8.66	0.00204	0.00185	0.00209	1.01	0.000282	0.0000000
4	0.15	0.0075	0.0000	5.74	0.00000	0.00111	0.00568	1.20	0.000381	0.0000097
5	0.20	0.0072	0.0000	4.37	0.00000	0.00135	0.00259	1.23	0.000297	0.0000000
6	0.25	0.0095	0.0087	5.82	0.25146	0.00114	0.00313	1.28	0.000512	0.0000223
7	0.30	0.0095	0.0166	4.20	0.06200	0.00322	0.01841	1.46	0.002183	0.0000186
8	0.35	0.0086	0.0010	5.14	0.02727	0.00178	0.00657	1.28	0.001110	0.0000009
9	0.40	0.0056	0.0000	4.77	0.00243	0.00168	0.00398	1.13	0.000355	0.0000169
10	0.45	0.0047	0.0006	5.61	0.00000	0.00327	0.00305	1.04	0.000299	0.0000330
11	0.50	0.0080	0.0040	5.36	0.00077	0.00097	0.00115	1.02	0.000269	0.0000141
12	0.55	0.0088	0.0000	9.57	0.00000	0.00126	0.00227	0.95	0.000267	0.0000252
13	0.60	0.0111	0.0117	13.43	0.00011	0.00084	0.00199	0.97	0.000232	0.0000000
14	0.65	0.0127	0.0104	12.67	0.00000	0.00340	0.00359	0.93	0.000226	0.0000189
15	0.70	0.0153	0.0139	8.24	0.00000	0.00315	0.00336	2.09	0.001485	0.0000009

Spot Number	Distance from outer shell (mm)	RW75 growth band transect L3 corrected data (mmol/mol)								
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	U/Ca
2	0.05	0.0182	0.0000	11.19	0.00154	0.00227	0.00517	1.30	0.000476	0.0000126
3	0.10	0.0139	0.0083	6.17	0.00117	0.00115	0.00484	1.36	0.000428	0.0000742
4	0.15	0.0142	0.0190	7.75	0.00254	0.00114	0.00301	1.46	0.000465	0.0000000
5	0.20	0.0117	0.0087	4.42	0.00037	0.00098	0.00808	1.47	0.000478	0.0000000
6	0.25	0.0139	0.0063	2.52	0.00000	0.00092	0.00093	1.51	0.000407	0.0000032
7	0.30	0.0132	0.0166	4.85	0.00000	0.00090	0.00181	1.44	0.000390	0.0000353
8	0.35	0.0092	0.0091	3.99	0.00026	0.00241	0.00260	1.37	0.000365	0.0000067
9	0.40	0.0085	0.0103	3.46	0.00000	0.00257	0.00318	1.51	0.000505	0.0000209
10	0.45	0.0131	0.0242	4.78	0.00000	0.00168	0.00548	1.45	0.000416	0.0000139
11	0.50	0.0082	0.0198	3.34	0.00215	0.00282	0.00846	1.31	0.000434	0.0000032
12	0.55	0.0096	0.0240	3.25	0.00281	0.00250	0.00616	1.32	0.000351	0.0000536
13	0.60	0.0082	0.0080	3.62	0.00116	0.00295	0.00124	1.22	0.000333	0.0000000
14	0.65	0.0067	0.0000	3.93	0.00141	0.00208	0.00331	1.29	0.000315	0.0000401
15	0.70	0.0087	0.0003	4.78	0.00000	0.00121	0.00132	1.19	0.000315	0.0000098
16	0.75	0.0085	0.0136	4.78	0.00309	0.00305	0.00261	1.15	0.000296	0.0000000

APPENDIX 5.3b A740 growth band transect data

Spot Number	Distance from outer shell (mm)	A740 growth band transect L1 corrected data (mol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	2.9480	0.3633	1.73	39.79950	3.99474	0.55214	7.19	6.361937	3.657352	9.227115
2	0.05	0.0097	0.0769	2.13	0.01075	0.00000	0.00901	3.78	0.002236	0.000081	0.000444
3	0.10	0.0059	0.0628	1.68	0.00638	0.00083	0.00427	3.35	0.001548	0.000001	0.000275
4	0.15	0.0091	0.0675	2.08	0.00442	0.00076	0.00681	3.51	0.001274	0.000000	0.000132
5	0.20	0.0073	0.0315	12.88	0.00711	0.00351	0.00414	2.75	0.001352	0.000105	0.000063
6	0.25	0.0145	0.0073	16.81	0.00000	0.00079	0.00118	1.26	0.000360	0.000036	0.000000
7	0.30	0.0052	0.0035	9.72	0.00000	0.00000	0.00101	1.41	0.000529	0.000083	0.000000
8	0.35	2.9646	0.3611	1.74	39.92795	4.00887	0.55567	7.24	6.438205	3.706980	9.385571
9	0.40	0.0105	0.0000	6.54	0.00361	0.00000	0.00203	1.42	0.000518	0.000000	0.000006
10	0.45	0.0063	0.0000	6.40	0.00706	0.00000	0.00486	1.51	0.000535	0.000068	0.000000
11	0.50	0.0172	0.0190	7.86	0.00038	0.00428	0.00465	1.47	0.000528	0.000004	0.000001
12	0.55	0.0110	0.0100	6.58	0.00263	0.00198	0.00684	1.57	0.000538	0.000017	0.000002
13	0.60	0.0087	0.0180	6.08	0.00000	0.00094	0.00068	1.52	0.000565	0.000000	0.000000
14	0.65	0.0053	0.0000	5.85	0.00088	0.00293	0.00000	1.42	0.000339	0.000046	0.000000
15	0.70	2.9284	0.3569	1.72	39.95397	4.01076	0.55650	7.25	6.450161	3.696299	9.397410
16	0.75	0.0075	0.0000	6.06	0.00448	0.00200	0.00467	1.47	0.000440	0.000030	0.000000
17	0.80	0.0061	0.0356	7.19	0.00418	0.00117	0.00159	1.46	0.000479	0.000055	0.000032
18	0.85	0.0066	0.0345	8.45	0.00000	0.00378	0.00944	1.44	0.000548	0.000000	0.000000
19	0.90	0.0031	0.0000	7.71	0.00000	0.00274	0.00572	1.38	0.000496	0.000049	0.000000

Spot Number	Distance from outer shell (mm)	A740 growth band transect L2 corrected data (mol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0125	0.0922	2.62	0.00000	0.00494	0.01836	4.93	0.003496	0.000064	0.000969
2	0.05	0.0111	0.0823	2.33	0.00587	0.00416	0.00971	3.98	0.002501	0.000069	0.000771
3	0.10	0.0079	0.0765	1.71	0.00583	0.00282	0.01339	3.66	0.002254	0.000010	0.000824
4	0.15	0.0078	0.0631	1.47	0.01087	0.00268	0.01560	3.85	0.002300	0.000048	0.000885
5	0.20	0.0127	0.0854	1.25	0.00507	0.00234	0.01476	4.31	0.004276	0.000073	0.000780
6	0.25	0.0177	0.0073	4.27	0.00729	0.00107	0.00255	1.40	0.000434	0.000152	0.000000
7	0.30	0.0157	0.0000	3.13	0.00256	0.00000	0.00208	1.53	0.000493	0.000000	0.000024
8	0.35	0.0119	0.0130	2.62	0.00603	0.00080	0.00277	1.41	0.000571	0.000013	0.000000
9	0.40	0.0166	0.0000	2.77	0.00473	0.00491	0.00178	1.49	0.000456	0.000029	0.000000
10	0.45	0.0120	0.0000	3.59	0.00148	0.00158	0.00065	1.41	0.000353	0.000000	0.000024
11	0.50	0.0026	0.0187	3.48	0.00000	0.00000	0.00422	1.50	0.000476	0.000080	0.000000
12	0.55	0.0081	0.0000	3.97	0.00482	0.00360	0.00000	1.46	0.000438	0.000020	0.000000
13	0.60	0.0084	0.0179	4.51	0.00000	0.00255	0.00229	1.37	0.000495	0.000029	0.000000
14	0.65	0.0082	0.0000	5.29	0.00078	0.00504	0.00000	1.48	0.000587	0.000000	0.000005
15	0.70	0.0059	0.0000	5.03	0.00930	0.00201	0.00309	1.51	0.000459	0.000024	0.000024
16	0.75	0.0067	0.0003	4.50	0.00320	0.00000	0.00000	1.23	0.000378	0.000000	0.000013
17	0.80	0.0057	0.0308	5.13	0.00573	0.00416	0.00000	1.14	0.000248	0.000000	0.000007
18	0.85	0.0048	0.0123	5.74	0.00000	0.00172	0.00434	1.13	0.000303	0.000006	0.000000

Spot Number	Distance from outer shell (mm)	A740 growth band transect L3 corrected data (mol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0095	0.0523	1.51	0.00000	0.00179	0.00566	3.96	0.002390	0.000080	0.000711
2	0.05	0.0092	0.0694	1.58	0.00358	0.00391	0.01065	3.53	0.001992	0.000000	0.000788
3	0.10	0.0122	0.0334	16.43	0.00407	0.00860	0.00091	1.41	0.000615	0.000000	0.000076
4	0.15	0.0147	0.0289	11.07	0.00243	0.01100	0.00100	1.18	0.000449	0.000095	0.000000
5	0.20	0.0087	0.0042	5.95	0.00312	0.00407	0.00099	1.49	0.000579	0.000020	0.000024
6	0.25	0.0051	0.0352	4.18	0.00554	0.00265	0.00128	1.54	0.000723	0.000066	0.000040
7	0.30	0.0108	0.0292	4.38	0.00686	0.00205	0.00356	1.54	0.000558	0.000000	0.000014
8	0.35	0.0152	0.0180	3.75	0.00502	0.00386	0.00000	1.53	0.000494	0.000016	0.000000
9	0.40	0.0079	0.0065	3.81	0.00494	0.00401	0.00555	1.54	0.000729	0.000000	0.000020
10	0.45	0.0102	0.0000	3.95	0.00000	0.00322	0.00000	1.45	0.000666	0.000042	0.000014
11	0.50	0.0132	0.0115	3.92	0.00367	0.00726	0.00045	1.49	0.000474	0.000000	0.000000
12	0.55	0.0086	0.0000	3.60	0.00000	0.00340	0.00000	1.66	0.000678	0.000011	0.000000
13	0.60	0.0082	0.0000	3.91	0.00131	0.00287	0.00000	1.61	0.000584	0.000000	0.000000
14	0.65	0.0102	0.0000	5.43	0.00722	0.00610	0.00000	1.69	0.000671	0.000021	0.000000
15	0.70	0.0101	0.0062	4.89	0.00000	0.00101	0.00117	1.58	0.000508	0.000000	0.000000

Spot Number	Distance from outer shell (mm)	A740 growth band transect L4 corrected data (mol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0119	0.0926	1.22	0.01117	0.00572	0.01343	2.99	0.001633	0.000226	0.000419
2	0.05	0.0123	0.0424	0.88	0.00080	0.00196	0.00739	3.02	0.001514	0.000127	0.000473
3	0.10	0.0078	0.0485	0.72	0.01321	0.00000	0.00798	3.20	0.001488	0.000057	0.000500
4	0.15	0.0125	0.0333	3.55	0.01007	0.00000	0.00300	3.20	0.001128	0.000000	0.000308
5	0.20	0.0123	0.0060	6.74	0.00325	0.00049	0.00439	1.13	0.000373	0.000056	0.000020
6	0.25	0.0140	0.0158	6.97	0.00000	0.00250	0.00000	1.29	0.000350	0.000000	0.000000
7	0.30	0.0100	0.0104	4.71	0.00000	0.00448	0.00096	1.45	0.000548	0.000000	0.000000
8	0.35	0.0097	0.0155	3.42	0.00174	0.00358	0.00458	1.62	0.000556	0.000033	0.000000
9	0.40	0.0074	0.0028	4.71	0.00000	0.00127	0.00000	1.40	0.000307	0.000027	0.000000
10	0.45	0.0138	0.0191	3.53	0.01002	0.00145	0.00137	1.70	0.000532	0.000000	0.000000
11	0.50	0.0135	0.0237	3.54	0.00519	0.00000	0.00000	1.60	0.000525	0.000000	0.000000
12	0.55	0.0153	0.0035	6.61	0.00422	0.00494	0.00000	1.53	0.000438	0.000009	0.000025
13	0.60	0.0081	0.0000	5.26	0.00000	0.00191	0.00532	1.42	0.000430	0.000000	0.000000
14	0.65	0.0059	0.0091	6.60	0.00000	0.00119	0.00204	1.26	0.000399	0.000000	0.000235
15	0.70	0.0087	0.0697	2.08	0.00129	0.00000	0.00001	2.32	0.001553	0.000016	0.000032

APPENDIX 5.3c P1B growth band transect data

Spot Number	Distance from the outer shell (mm)	P1B growth band transect L1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0071	0.211	2.55	0.249	0.02287	0.00012	5.41	0.00694	0.000404	0.0021919
2	0.05	0.0278	0.140	7.78	2.597	0.02860	0.01120	4.40	0.00730	0.000408	0.0011359
3	0.10	0.0177	0.094	14.19	1.999	0.01838	0.00014	3.93	0.00423	0.000396	0.0006978
4	0.15	0.0158	0.034	16.80	1.073	0.01099	0.00448	1.29	0.00130	0.000340	0.0000372
5	0.20	0.0124	0.000	12.96	0.215	0.00737	0.00244	1.35	0.00065	0.000545	0.0000302
6	0.25	0.0334	0.001	11.33	0.089	0.00557	0.00256	1.53	0.00086	0.000369	0.0000692
7	0.30	0.0014	0.007	20.28	1.582	0.00908	0.00234	1.83	0.00188	0.000523	0.0000974
8	0.35	0.0381	0.024	16.07	0.067	0.00301	0.00378	1.32	0.00069	0.000415	0.0000000
9	0.40	0.0052	0.019	16.14	0.155	0.00117	0.00310	1.34	0.00085	0.000385	0.0000286
10	0.45	0.0352	0.038	14.74	1.026	0.00456	0.00000	1.51	0.00190	0.000484	0.0000450
11	0.50	0.0000	0.020	9.17	0.184	0.00039	0.00377	1.50	0.00084	0.000300	0.0000057
12	0.55	0.0169	0.033	15.11	1.189	0.00636	0.00470	1.61	0.00160	0.000388	0.0000549
13	0.60	0.0327	0.011	13.11	0.201	0.00105	0.00000	1.60	0.00094	0.000262	0.0000015
14	0.65	0.0365	0.015	15.42	0.223	0.00442	0.00002	1.56	0.00108	0.000231	0.0000341
15	0.70	0.0133	0.000	12.72	0.248	0.00454	0.00092	1.57	0.00099	0.000061	0.0000209
16	0.75	0.0011	0.000	14.09	1.097	0.00928	0.00536	1.60	0.00161	0.000092	0.0000141
17	0.80	0.0145	0.008	6.19	0.162	0.00080	0.00000	1.17	0.00050	0.000030	0.0000000
18	0.85	0.0122	0.031	8.42	2.201	0.00445	0.00000	1.32	0.00169	0.000062	0.0000100

Spot Number	Distance from the outer shell (mm)	P1B growth band transect L2 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0288	0.060	17.45	0.003	0.00747	0.00225	1.48	0.00083	0.000651	0.0000458
2	0.05	0.0347	0.015	12.85	0.012	0.00491	0.00000	1.45	0.00064	0.000418	0.0000386
3	0.10	0.0146	0.025	12.22	0.000	0.00102	0.00572	1.57	0.00079	0.000468	0.0000087
4	0.15	0.0026	0.020	12.17	0.000	0.00709	0.00000	1.28	0.00050	0.000057	0.0000285
5	0.20	0.0000	0.000	7.88	0.002	0.00456	0.00281	1.29	0.00042	0.000087	0.0000118
6	0.25	0.0138	0.025	7.58	0.000	0.00623	0.00356	1.36	0.00051	0.000249	0.0000220
7	0.30	0.0000	0.023	5.55	0.000	0.00389	0.00000	1.40	0.00034	0.000209	0.0000000
8	0.35	0.0147	0.006	5.14	0.000	0.00741	0.00514	1.30	0.00038	0.000283	0.0000391
9	0.40	0.0140	0.040	4.82	0.012	0.00409	0.00359	1.34	0.00070	0.000272	0.0000380
10	0.45	0.0000	0.014	4.38	0.015	0.00172	0.00264	1.33	0.00053	0.000301	0.0000054
11	0.50	0.0000	0.035	4.61	0.009	0.00000	0.00138	1.34	0.00042	0.000384	0.0000000
12	0.55	0.0000	0.000	4.33	0.000	0.00011	0.00487	1.30	0.00036	0.000228	0.0000000
13	0.60	0.0382	0.010	4.78	0.000	0.00365	0.00537	1.26	0.00042	0.000125	0.0000000
14	0.65	0.0275	0.002	5.10	0.000	0.00000	0.00133	1.19	0.00038	0.000093	0.0000199
15	0.70	0.0228	0.044	4.90	0.000	0.00185	0.00000	1.22	0.00036	0.000204	0.0000285
16	0.75	0.0354	0.000	5.31	0.035	0.00000	0.00263	1.15	0.00040	0.000196	0.0000036
17	0.80	0.0017	0.020	5.95	0.006	0.00000	0.00818	1.17	0.00030	0.000032	0.0000039
18	0.85	0.0000	0.000	5.79	0.000	0.00352	0.01002	1.16	0.00017	0.000255	0.0000251
19	0.90	0.0548	0.049	5.84	0.001	0.00806	0.00176	1.11	0.00045	0.000236	0.0000272

Spot Number	Distance from the outer shell (mm)	P1B growth band transect L3 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0262	0.024	13.08	0.494	0.01802	0.00292	1.47	0.00189	0.000363	0.0000326
2	0.05	0.0385	0.029	17.97	0.536	0.01334	0.00000	1.74	0.00243	0.000531	0.0000974
3	0.10	0.0116	0.026	5.56	0.000	0.00289	0.00578	1.20	0.00044	0.000358	0.0000055
4	0.15	0.0229	0.000	6.09	0.005	0.00550	0.00113	1.33	0.00047	0.000328	0.0000000
5	0.20	0.0059	0.001	5.14	0.000	0.01496	0.00081	1.37	0.00063	0.000318	0.0000468
6	0.25	0.0299	0.000	4.24	0.003	0.00000	0.00313	1.25	0.00035	0.000304	0.0000205
7	0.30	0.0242	0.030	3.59	0.000	0.00345	0.00000	1.14	0.00030	0.000175	0.0000000
8	0.35	0.0000	0.000	3.22	0.012	0.00197	0.00396	1.07	0.00024	0.000125	0.0000108
9	0.40	0.0166	0.006	5.21	0.023	0.00294	0.00137	1.13	0.00040	0.000252	0.0000272
10	0.45	0.0007	0.012	5.09	0.022	0.00364	0.00401	1.12	0.00036	0.000237	0.0000000
11	0.50	0.0192	0.012	5.03	0.006	0.00496	0.00059	1.12	0.00041	0.000109	0.0000245
12	0.55	0.0143	0.021	5.92	0.010	0.00251	0.00206	1.08	0.00035	0.000312	0.0000133
13	0.60	0.0071	0.002	5.72	0.000	0.00213	0.00360	1.15	0.00032	0.000158	0.0000000
14	0.65	0.0023	0.000	4.71	0.000	0.00000	0.00016	1.12	0.00042	0.000266	0.0000027
15	0.70	0.0015	0.014	5.85	0.014	0.00246	0.00432	1.05	0.00032	0.000163	0.0000219
16	0.75	0.0036	0.013	7.97	0.000	0.00246	0.00541	1.04	0.00026	0.000217	0.0000000
17	0.80	0.0000	0.008	8.66	0.000	0.01587	0.00617	1.21	0.00087	0.000169	0.0000000
18	0.85	0.0010	0.025	8.25	0.013	0.02022	0.00596	1.29	0.00062	0.000253	0.0000000
19	0.90	0.0000	0.003	7.56	0.000	0.03373	0.00386	1.13	0.00061	0.000108	0.0000000
20	0.95	0.0275	0.017	6.22	0.006	0.03521	0.00896	1.45	0.00152	0.000288	0.0000011

Spot Number	Distance from the outer shell (mm)	P1B growth band transect L4 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0936	1.133	9.46	21.865	0.45925	0.01400	10.49	0.02401	0.002213	0.0015296
2	0.05	0.0327	0.905	5.28	9.649	0.13286	0.01090	9.68	0.01646	0.002103	0.0015888
3	0.10	0.0009	0.079	1.34	0.000	0.00000	0.00203	4.19	0.00464	0.000248	0.0010896
4	0.15	0.0412	0.044	7.00	0.000	0.00075	0.00377	1.15	0.00089	0.000113	0.0000734
5	0.20	0.0127	0.000	7.69	0.000	0.00484	0.00000	1.10	0.00069	0.000189	0.0000000
6	0.25	0.0387	0.017	5.49	0.005	0.00319	0.00131	1.22	0.00070	0.000172	0.0000000
7	0.30	0.0306	0.000	3.54	0.000	0.00453	0.00000	1.15	0.00062	0.000107	0.0000000
8	0.35	0.0157	0.021	2.33	0.000	0.00481	0.00012	1.21	0.00081	0.000074	0.0000000
9	0.40	0.0152	0.000	2.29	0.000	0.01922	0.00044	1.20	0.00077	0.000256	0.0000175
10	0.45	0.0000	0.016	1.95	0.000	0.00811	0.00639	1.26	0.00087	0.000260	0.0000000
11	0.50	0.0671	0.018	2.78	0.532	0.00985	0.00562	1.30	0.00136	0.000138	0.0000027
12	0.55	0.0000	0.000	3.61	0.413	0.01631	0.00309	1.20	0.00120	0.000022	0.0000000
13	0.60	0.0324	0.019	5.17	5.499	0.04619	0.00166	1.25	0.00536	0.000083	0.0000000
14	0.65	0.0655	0.027	7.63	10.468	0.06504	0.00882	1.43	0.00933	0.000614	0.0000000
15	0.70	0.0024	0.059	9.34	3.387	0.03675	0.00577	1.59	0.00483	0.000300	0.0000647
16	0.75	0.0252	0.018	6.36	1.894	0.02647	0.00861	2.22	0.00397	0.000259	0.0001669
17	0.80	0.0296	0.144	6.31	10.529	0.02928	0.00745	3.99	0.01993	0.000409	0.0007536
18	0.85	0.0068	0.093	1.85	0.612	0.00891	0.00378	3.98	0.00672	0.000218	0.0006927
19	0.90	0.0000	0.084	10.09	0.141	0.01595	0.00218	3.79	0.00475	0.000254	0.0004947
20	0.95	0.0137	0.030	13.73	1.386	0.00401	0.00000	1.64	0.00543	0.000130	0.0000304
21	1.00	0.0239	0.014	6.40	0.607	0.00961	0.00000	1.29	0.00243	0.000055	0.0000081
22	1.05	0.0232	0.000	6.41	0.042	0.00254	0.00015	1.66	0.00256	0.000097	0.0000373
23	1.10	0.0500	0.029	6.84	4.200	0.09287	0.00514	1.59	0.00330	0.000090	0.0000343
24	1.15	0.0226	0.032	4.52	1.106	0.00523	0.00500	1.12	0.00222	0.000213	0.0000291
25	1.20	0.0000	0.000	3.04	0.037	0.00329	0.00136	1.28	0.00106	0.000160	0.0000000
26	1.25	0.0188	0.000	2.74	0.028	0.00286	0.00000	1.35	0.00108	0.000191	0.0000053
27	1.30	0.0000	0.000	3.37	0.005	0.00829	0.00053	1.23	0.00104	0.000198	0.0000016

APPENDIX 5.3d P04A growth band transect data

Spot Number	Distance from outer shell (mm)	P04A growth band transect L1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0045	0.0000	6.96	0.128	0.0000	0.00164	2.16	0.00263	0.000444	0.000150
2	0.05	0.0268	0.0000	6.81	0.944	0.0015	0.00000	2.44	0.00369	0.000528	0.000087
3	0.10	0.0156	0.1312	4.73	8.190	0.1763	0.02401	5.71	0.01839	0.000249	0.001450
4	0.15	0.0405	0.0000	3.16	2.589	0.0001	0.01961	3.93	0.00700	0.000325	0.000570
5	0.20	0.0257	0.0000	4.35	0.166	0.0000	0.02342	1.38	0.00000	0.000000	0.000208
6	0.25	0.0202	0.0000	3.10	0.648	0.0000	0.00386	1.93	0.00344	0.000768	0.000000
7	0.30	0.0000	0.0591	4.11	2.220	0.0054	0.00317	1.53	0.00137	0.000432	0.000000
8	0.35	0.0218	0.0000	7.53	1.136	0.0096	0.00320	1.48	0.00169	0.000000	0.000000
9	0.40	0.0114	0.0000	5.13	0.961	0.0000	0.00000	1.27	0.00073	0.000000	0.000060
10	0.45	0.0218	0.0931	3.11	0.002	0.0000	0.00180	1.34	0.00000	0.000000	0.000030
11	0.50	0.0025	0.0000	3.91	0.007	0.0000	0.00000	1.36	0.00045	0.000000	0.000078
12	0.55	0.0000	0.0885	3.63	0.000	0.0097	0.00000	1.23	0.00011	0.000000	0.000063
13	0.60	0.0318	0.0000	4.23	0.000	0.0043	0.00000	1.17	0.00013	0.000000	0.000012
14	0.65	0.0258	0.0556	5.34	1.975	0.0000	0.00575	1.28	0.00248	0.000920	0.000000
15	0.70	0.0067	0.0598	5.13	0.000	0.0059	0.00000	1.32	0.00056	0.000542	0.000000
16	0.75	0.0068	0.0150	5.04	0.141	0.0027	0.00229	1.42	0.00104	0.000000	0.000000
17	0.80	0.0327	0.1162	4.52	0.017	0.0006	0.00118	1.45	0.00060	0.000000	0.000411
18	0.85	0.0029	0.0802	5.01	0.032	0.0004	0.01001	1.46	0.00064	0.000100	0.000000
19	0.90	0.0126	0.0000	5.52	0.004	0.0146	0.00000	1.30	0.00122	0.000000	0.000000

Spot Number	Distance from outer shell (mm)	P04A growth band transect L2 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0721	0.0000	5.44	0.956	0.0231	0.00950	3.62	0.01082	0.000000	0.000329
2	0.05	0.0498	0.0768	4.24	4.167	0.0135	0.04413	3.39	0.01016	0.000271	0.000000
3	0.10	0.0161	0.0000	10.43	19.362	0.0132	0.00000	2.44	0.00436	0.000000	0.000267
4	0.15	0.0067	0.0632	17.86	2.067	0.0000	0.00000	1.42	0.00350	0.000633	0.000093
5	0.20	0.0320	0.0285	18.51	0.284	0.0000	0.02669	1.39	0.00058	0.000872	0.000656
6	0.25	0.0507	0.0000	11.07	0.042	0.0268	0.00000	1.16	0.00051	0.000606	0.000091
7	0.30	0.0317	0.1933	12.93	0.410	0.0126	0.00000	1.38	0.00099	0.000000	0.000000
8	0.35	0.0000	0.0000	11.58	0.097	0.0098	0.00000	1.23	0.00090	0.000046	0.000141
9	0.40	0.0312	0.0000	11.82	0.037	0.0000	0.00000	1.19	0.00031	0.000000	0.000840
10	0.45	0.0870	0.2999	12.55	0.120	0.0160	0.00000	1.03	0.00000	0.000000	0.000320
11	0.50	0.0332	0.0481	4.74	0.011	0.0000	0.00000	2.03	0.00094	0.000666	0.000000
12	0.55	0.0240	0.0522	0.53	0.056	0.0196	0.00000	2.73	0.00105	0.000000	0.000242
13	0.60	0.0127	0.1258	0.47	0.000	0.0166	0.00000	2.38	0.00033	0.000289	0.000059
14	0.65	0.0356	0.1421	0.38	0.000	0.0000	0.00000	2.17	0.00112	0.000000	0.000000
15	0.70	0.0000	0.0199	0.49	0.000	0.0000	0.00894	2.39	0.00030	0.000000	0.000000
16	0.75	0.0209	0.0860	0.37	0.005	0.0264	0.00287	2.07	0.00090	0.000000	0.000436
17	0.80	0.0000	0.0000	0.38	0.032	0.0078	0.04559	2.18	0.00302	0.000000	0.000227
18	0.85	0.0000	0.0000	0.70	0.013	0.0560	0.00000	2.11	0.00606	0.001572	0.001071

Spot Number	Distance from outer shell (mm)	P04A growth band transect L3 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0199	0.0696	3.76	0.108	0.0262	0.00000	1.48	0.00065	0.000177	0.000000
2	0.05	0.0000	0.0000	6.13	0.263	0.0179	0.00232	1.42	0.00092	0.000000	0.000000
3	0.10	0.0000	0.0000	4.62	0.000	0.0022	0.00000	1.37	0.00038	0.000575	0.000222
4	0.15	0.0290	0.0000	7.79	2.570	0.0188	0.02889	2.32	0.00556	0.000049	0.000151
5	0.20	0.0467	0.1331	10.03	8.375	0.0247	0.04021	3.10	0.02466	0.000349	0.000721
6	0.25	0.0161	0.0177	8.78	1.109	0.0086	0.00352	1.75	0.00242	0.001062	0.000000
7	0.30	0.0243	0.0572	5.54	0.059	0.0018	0.00000	1.37	0.00038	0.000444	0.000000
8	0.35	0.0161	0.0588	6.12	1.869	0.0077	0.02168	1.36	0.00397	0.000025	0.000000
9	0.40	0.0184	0.0000	8.02	0.026	0.0000	0.00655	1.34	0.00084	0.000288	0.000255
10	0.45	0.0132	0.0000	11.28	0.043	0.0073	0.01687	1.31	0.00027	0.000000	0.000000
11	0.50	0.0136	0.0179	10.56	0.000	0.0000	0.00000	1.19	0.00026	0.000640	0.000000
12	0.55	0.0126	0.0000	10.12	1.103	0.0202	0.03104	1.35	0.00154	0.000435	0.000162
13	0.60	0.0054	0.0913	8.49	0.029	0.0000	0.03130	1.88	0.00205	0.000492	0.000004
14	0.65	0.0061	0.0595	7.27	0.000	0.0000	0.00000	2.10	0.00106	0.000209	0.000429
15	0.70	0.0057	0.0000	9.32	0.227	0.0186	0.05144	1.51	0.00063	0.000000	0.000000
16	0.75	0.0436	0.0738	8.31	0.189	0.0222	0.00000	1.42	0.00147	0.000000	0.000071
17	0.80	0.0312	0.0000	6.95	0.003	0.0000	0.00000	1.44	0.00094	0.000139	0.000036
18	0.85	0.0000	0.0762	7.29	0.046	0.0342	0.00000	1.38	0.00042	0.000949	0.000294

APPENDIX 5.3e SC2 growth band transect data

Spot Number	Distance from outer shell (mm)	SC2 growth band transect L1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0178	0.0159	11.90	0.00068	0.00000	0.00337	1.26	0.000307	0.0000000	0.0000000
2	0.05	0.0139	0.0002	11.13	0.00000	0.00000	0.00000	1.35	0.000469	0.0000000	0.0000000
3	0.10	0.0168	0.0079	7.46	0.00558	0.00000	0.00418	1.40	0.000384	0.0000000	0.0000000
4	0.15	0.0065	0.0202	8.31	0.00000	0.00000	0.00286	1.44	0.000495	0.0000334	0.0000071
5	0.20	0.0084	0.0123	5.43	0.00390	0.00027	0.00079	1.33	0.000387	0.0000392	0.0000000
6	0.25	0.0160	0.0000	5.54	0.00411	0.00058	0.00082	1.37	0.000430	0.0000286	0.0000092
7	0.30	0.0144	0.0000	5.25	0.00000	0.00076	0.00237	1.35	0.000333	0.0000419	0.0000000
8	0.35	0.0046	0.0000	4.47	0.00000	0.00230	0.00083	1.26	0.000420	0.0000158	0.0000000
9	0.40	0.0135	0.0275	4.89	0.02274	0.00197	0.00368	1.28	0.000436	0.0000310	0.0000238
10	0.45	0.0103	0.0043	5.26	0.00126	0.00294	0.00193	1.27	0.000424	0.0000410	0.0000090
11	0.50	0.0149	0.0160	5.47	0.01629	0.00056	0.00065	1.31	0.000421	0.0000000	0.0000000
12	0.55	0.0107	0.0000	4.75	0.00000	0.00137	0.00000	1.19	0.000332	0.0000000	0.0000029
13	0.60	0.0116	0.0049	4.99	0.00000	0.00313	0.00090	1.14	0.000294	0.0000568	0.0000099
14	0.65	0.0072	0.0110	5.18	0.00000	0.00276	0.00375	1.17	0.000294	0.0000000	0.0000000
15	0.70	0.0105	0.0294	5.18	0.00000	0.00419	0.00000	1.17	0.000266	0.0000384	0.0000047
16	0.75	0.0066	0.0076	5.28	0.00050	0.00033	0.00203	1.02	0.000335	0.0000041	0.0000000
17	0.80	0.0106	0.0137	5.83	0.00218	0.00129	0.00115	1.05	0.000263	0.0000398	0.0000110
18	0.85	0.0080	0.0000	6.06	0.00098	0.00000	0.00000	1.00	0.000279	0.0000105	0.0000000
19	0.90	0.0101	0.0217	7.94	0.00000	0.00037	0.00041	1.00	0.000242	0.0000627	0.0000000
20	0.95	0.0165	0.0000	7.47	0.00000	0.00004	0.00176	1.08	0.000304	0.0000240	0.0000056
21	1.00	0.0131	0.0136	7.03	0.00000	0.00494	0.00208	1.08	0.000264	0.0000000	0.0000000
22	1.05	0.0122	0.0136	7.31	0.00143	0.00087	0.00000	1.02	0.000244	0.0000000	0.0000191
23	1.10	0.0161	0.0467	7.77	0.00015	0.00279	0.00175	0.97	0.000224	0.0000320	0.0000000
24	1.15	0.0113	0.0000	8.29	0.00268	0.00029	0.00082	1.01	0.000227	0.0000000	0.0000000
25	1.20	0.0100	0.0000	8.57	0.00034	0.00326	0.00102	0.96	0.000282	0.0000725	0.0000120
26	1.25	0.0151	0.0080	10.36	0.00450	0.00321	0.00053	0.98	0.000278	0.0000092	0.0000000
27	1.30	0.0132	0.0105	7.75	0.00000	0.00272	0.00269	1.08	0.000270	0.0000372	0.0000000

Spot Number	Distance from outer shell (mm)	SC2 growth band transect L1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0300	0.0021	20.47		0.00000	0.00098	1.95	0.000848	0.0001253	0.0000149
2	0.05	0.0202	0.0000	15.61	0.01419	0.00000	0.00000	2.32	0.001248	0.0001351	0.0000910
3	0.10	0.0194	0.0000	12.38	0.07317	0.00000	0.00068	1.91	0.000743	0.0000000	0.0000376
4	0.15	0.0199	0.0000	12.19	0.00383	0.00000	0.00000	1.62	0.000892	0.0000000	0.0000732
5	0.20	0.0156	0.0000	7.81	0.00963	0.00243	0.00000	1.74	0.000926	0.0000193	0.0000379
6	0.25	0.0113	0.0014	7.14	0.00000	0.00000	0.00300	1.60	0.000471	0.0000438	0.0000000
7	0.30	0.0084	0.0027	5.61	0.00151	0.00177	0.00380	1.46	0.000654	0.0000685	0.0000126
8	0.35	0.0112	0.0000	6.42	0.02975	0.00000	0.00000	1.77	0.000597	0.0000296	0.0000267
9	0.40	0.0165	0.0000	4.67	0.00840	0.00002	0.00667	1.43	0.000449	0.0000000	0.0000000
10	0.45	0.0124	0.0169	8.31	0.00676	0.00000	0.00267	1.47	0.000514	0.0001286	0.0000000
11	0.50	0.0121	0.0000	10.34	0.00000	0.00078	0.00212	1.53	0.000626	0.0001179	0.0000568
12	0.55	0.0112	0.0000	7.04	0.00039	0.00020	0.00101	1.38	0.000520	0.0000250	0.0000000
13	0.60	0.0186	0.0038	8.76	0.00000	0.00352	0.00541	1.44	0.000600	0.0001931	0.0000276
14	0.65	0.0021	0.0295	8.24	0.00098	0.00000	0.00439	1.44	0.000607	0.0001026	0.0000096
15	0.70	0.0154	0.0191	8.64	0.00741	0.00114	0.00000	1.39	0.000429	0.0000181	0.0000586
16	0.75	0.0083	0.0000	8.62	0.00000	0.00161	0.00000	1.32	0.000419	0.0000000	0.0000000
17	0.80	0.0096	0.0000	9.42	0.00000	0.00101	0.00021	1.34	0.000576	0.0000000	0.0000098
18	0.85	0.0157	0.0002	10.11	0.00000	0.00416	0.00000	1.31	0.000448	0.0000244	0.0000000
19	0.90	0.0126	0.0026	9.30	0.00008	0.00252	0.00008	1.23	0.000418	0.0000003	0.0000000
20	0.95	0.0133	0.0013	10.06	0.00135	0.00186	0.00085	1.21	0.000455	0.0000092	0.0000000
21	1.00	0.0140	0.0063	10.96	0.00163	0.00286	0.00048	1.19	0.000400	0.0000000	0.0000000
22	1.05	0.0129	0.0066	11.37	0.00000	0.00235	0.00087	1.13	0.000335	0.0000096	0.0000056
23	1.10	0.0129	0.0066	11.37	0.00000	0.00235	0.00087	1.13	0.000335	0.0000096	0.0000056
24	1.15	0.0168	0.0000	11.65	0.00021	0.00364	0.00003	1.15	0.000354	0.0000000	0.0000000
25	1.20	0.0137	0.0008	13.87	0.00656	0.00000	0.00596	1.23	0.000296	0.0000000	0.0000063
26	1.25	0.0128	0.0246	16.88	0.00344	0.00146	0.00140	1.27	0.000422	0.0000940	0.0000165
27	1.30	0.0145	0.0179	17.68	0.00000	0.00464	0.00127	1.21	0.000323	0.0000304	0.0000203
28	1.35	0.0205	0.0174	18.90	0.00000	0.00436	0.00000	1.23	0.000475	0.0000111	0.0000000

Spot Number	Distance from outer shell (mm)	SC2 growth band transect L1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0128	0.0190	3.60	0.00000	0.00000	0.00026	1.09	0.000315	0.0000000	0.0000000
2	0.05	0.0093	0.0111	4.06	0.00000	0.00367	0.00000	0.82	0.000267	0.0000375	0.0001064
3	0.10	0.0127	0.0000	4.09	0.00000	0.00000	0.00173	0.89	0.000182	0.0000000	0.0000000
4	0.15	0.0084	0.0000	3.60	0.00621	0.00170	0.00412	0.95	0.000213	0.0000000	0.0000000
5	0.20	0.0070	0.0054	3.51	0.00000	0.00000	0.00000	1.01	0.000255	0.0000940	0.0000388
6	0.25	0.0098	0.0177	3.29	0.00000	0.00539	0.00000	0.95	0.000341	0.0000000	0.0000060
7	0.30	0.0118	0.0075	3.36	0.00000	0.00344	0.00196	0.97	0.000169	0.0000249	0.0000000
8	0.35	0.0059	0.0000	3.64	0.00278	0.00076	0.00624	0.99	0.000178	0.0000000	0.0000000
9	0.40	0.0117	0.0000	3.44	0.00000	0.00129	0.00167	1.09	0.000266	0.0000000	0.0000000
10	0.45	0.0159	0.0023	3.28	0.00000	0.00257	0.00000	1.00	0.000253	0.0001000	0.0000000
11	0.50	0.0069	0.0000	3.09	0.00660	0.00000	0.00390	1.08	0.000166	0.0000000	0.0000301
12	0.55	0.0104	0.0309	2.98	0.00175	0.00369	0.00000	1.10	0.000333	0.0000000	0.0000000
13	0.60	0.0155	0.0008	2.88	0.00307	0.00034	0.00780	1.12	0.000352	0.0000000	0.0000000
14	0.65	0.0091	0.0312	2.83	0.00590	0.00194	0.00432	1.15	0.000345	0.0001451	0.0000000
15	0.70	0.0103	0.0142	2.87	0.00303	0.00246	0.00597	1.19	0.000303	0.0000000	0.0000000
16	0.75	0.0093	0.0000	2.76	0.00644	0.00000	0.00720	1.19	0.000262	0.0001134	0.0000369
17	0.80	0.0054	0.0162	2.83	0.00088	0.00000	0.00000	1.21	0.000372	0.0000000	0.0000000
18	0.85	0.0092	0.0133	2.85	0.00000	0.00000	0.00000	1.20	0.000363	0.0000265	0.0000298
19	0.90	0.0085	0.0116	3.00	0.00021	0.00038	0.00000	1.32	0.000356	0.0000000	0.0000410
20	0.95	0.0070	0.0135	3.37	0.00000	0.00221	0.00423	1.32	0.000391	0.0000000	0.0000006
21	1.00	0.0181	0.0036	7.66	0.00602	0.00261	0.00000	1.44	0.000520	0.0000253	0.0000000
22	1.05	0.0102	0.0295	11.60	0.00305	0.00000	0.00366	1.47	0.000477	0.0000433	0.0000235
23	1.10	0.0146	0.0145	4.90	0.00000	0.00000	0.00120	1.34	0.000343	0.0000961	0.0000294
24	1.15	0.0142	0.0000	5.86	0.00776	0.00000	0.00299	1.25	0.000358	0.0000000	0.0000041
25	1.20	0.0174	0.0000	4.75	0.00075	0.00260	0.00928	1.32	0.000387	0.0000000	0.0000000
26	1.25	0.0145	0.0313	7.58	0.00000	0.00580	0.00705	1.22	0.000364	0.0000000	0.0000156
27	1.30	0.0073	0.0000	7.48	0.11099	0.00000	0.00000	1.17	0.000467	0.0000000	0.0000000
28	1.35	0.0226	0.0141	9.15	0.00649	0.00000	0.00766	1.18	0.000340	0.0001198	0.0000191

APPENDIX 5.3f SC1A growth band transect data

Spot Number	Distance from outer shell (mm)	SC1A growth band transect L1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.026	0.000	20.38	0.000	0.00794	0.0229	1.93	0.00053	0.000061	0.0000520
2	0.05	0.000	0.068	18.19	0.000	0.00000	0.0000	1.84	0.00166	0.000252	0.0000426
3	0.10	0.000	0.000	14.57	0.104	0.00502	0.0000	1.78	0.00126	0.000000	0.0000816
4	0.15	0.000	0.315	13.69	0.349	0.00585	0.0007	1.73	0.00120	0.000362	0.0000529
5	0.20	0.000	0.000	10.14	0.491	0.00000	0.0105	1.71	0.00111	0.000000	0.0000000
6	0.25	0.000	0.091	6.63	0.007	0.00000	0.0000	1.47	0.00056	0.000276	0.0000283
7	0.30	0.279	0.062	4.93	0.000	0.00129	0.0090	1.43	0.00098	0.000000	0.0000000
8	0.35	0.065	0.000	3.22	0.000	0.00876	0.0000	1.24	0.00000	0.000000	0.0000000
9	0.40	0.145	0.476	2.86	0.044	0.00546	0.0000	1.14	0.00043	0.000256	0.0000373
10	0.45	0.079	0.000	2.45	0.000	0.00857	0.0000	1.23	0.00059	0.000000	0.0000000
11	0.50	0.039	0.000	3.36	0.019	0.00139	0.0059	1.22	0.00047	0.000273	0.0000000
12	0.55	0.000	0.000	2.89	0.000	0.01047	0.0000	1.11	0.00015	0.000000	0.0000388
13	0.60	0.072	0.000	5.08	0.038	0.00483	0.0150	1.21	0.00114	0.000214	0.0000000
14	0.65	0.137	0.000	5.55	0.000	0.00000	0.0000	1.09	0.00047	0.000000	0.0000000
15	0.70	0.066	0.000	4.30	0.020	0.00000	0.0049	1.06	0.00039	0.000000	0.0001062
16	0.75	0.000	0.000	4.25	0.000	0.00000	0.0194	1.17	0.00027	0.000000	0.0000000
17	0.80	0.056	0.000	3.63	0.000	0.00348	0.0048	1.27	0.00019	0.000000	0.0000000
18	0.85	0.101	0.095	4.53	0.020	0.00464	0.0087	1.20	0.00040	0.000000	0.0000000
19	0.90	0.059	0.110	4.61	0.092	0.00000	0.0244	1.30	0.00024	0.000000	0.0000000
20	0.95	0.000	0.000	4.86	0.000	0.00000	0.0055	1.35	0.00000	0.000000	0.0000000
21	1.00	0.195	0.081	4.82	0.011	0.00000	0.0000	1.47	0.00065	0.000206	0.0000000
22	1.05	0.127	0.120	5.69	0.040	0.00325	0.0070	1.47	0.00000	0.000000	0.0000020
23	1.10	0.000	0.000	5.90	0.000	0.00000	0.0163	1.37	0.00122	0.000062	0.0000562
24	1.15	0.000	0.311	5.76	0.025	0.00000	0.0146	1.13	0.00000	0.000000	0.0000185

Spot Number	Distance from outer shell (mm)	SC1A growth band transect L2 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.057	0.045	4.88	0.000	0.00065	0.0000	1.13	0.00010	0.000000	0.0000000
2	0.05	0.024	0.000	4.97	0.000	0.00459	0.0000	1.24	0.00063	0.000183	0.0000000
3	0.10	0.000	0.000	3.07	0.000	0.00127	0.0023	1.01	0.00000	0.000154	0.0000041
4	0.15	0.000	0.081	3.51	0.042	0.00000	0.0028	1.15	0.00037	0.000222	0.0000007
5	0.20	0.000	0.174	3.50	0.015	0.00106	0.0108	1.08	0.00051	0.000158	0.0000099
6	0.25	0.000	0.000	3.36	0.030	0.00003	0.0020	1.03	0.00036	0.000199	0.0000302
7	0.30	0.000	0.000	4.40	0.000	0.00000	0.0008	1.15	0.00010	0.000102	0.0000066
8	0.35	0.000	0.078	3.98	0.000	0.00961	0.0000	1.13	0.00035	0.000140	0.0000000
9	0.40	0.000	0.018	4.62	0.000	0.00000	0.0114	1.07	0.00027	0.000056	0.0000374
10	0.45	0.000	0.000	4.94	0.020	0.00053	0.0000	1.02	0.00010	0.000109	0.0000000
11	0.50	0.000	0.202	5.91	0.037	0.00073	0.0037	1.15	0.00032	0.000031	0.0000038
12	0.55	0.006	0.109	5.20	0.032	0.00589	0.0083	1.00	0.00003	0.000115	0.0000009
13	0.60	0.000	0.000	4.48	0.000	0.00000	0.0000	1.12	0.00001	0.000000	0.0000000
14	0.65	0.006	0.000	5.20	0.000	0.00556	0.0000	0.95	0.00022	0.000091	0.0000000
15	0.70	0.077	0.000	5.60	0.000	0.00000	0.0000	0.93	0.00029	0.000122	0.0000184
16	0.75	0.006	0.000	6.25	0.000	0.00000	0.0000	0.95	0.00017	0.000000	0.0000085
17	0.80	0.068	0.211	6.55	0.000	0.00250	0.0084	0.97	0.00000	0.000000	0.0000058
18	0.85	0.000	0.000	6.38	0.000	0.00251	0.0000	0.93	0.00007	0.000000	0.0000000
19	0.90	0.027	0.000	6.87	0.029	0.00000	0.0000	0.99	0.00023	0.000000	0.0000000
20	0.95	0.038	0.281	7.22	0.013	0.00193	0.0000	0.97	0.00015	0.000070	0.0000429
21	1.00	0.000	0.019	7.38	0.064	0.00019	0.0088	0.90	0.00013	0.000125	0.0000106
22	1.05	0.000	0.000	8.56	0.012	0.00529	0.0007	0.84	0.00015	0.000115	0.0000000
23	1.10	0.054	0.000	9.20	0.051	0.00000	0.0044	0.91	0.00042	0.000265	0.0000000

Spot Number	Distance from outer shell (mm)	SC1A growth band transect L3 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.008	0.000	6.76	0.000	0.00229	0.0000	1.68	0.00017	0.000000	0.0000000
2	0.05	0.024	0.161	6.18	0.000	0.00241	0.0031	1.76	0.00076	0.000105	0.0000743
3	0.10	0.123	0.000	5.44	0.000	0.00523	0.0000	1.67	0.00056	0.000178	0.0000000
4	0.15	0.008	0.096	5.00	0.000	0.00134	0.0000	1.68	0.00051	0.000185	0.0000238
5	0.20	0.060	0.000	3.69	0.012	0.00210	0.0000	1.54	0.00041	0.000285	0.0000040
6	0.25	0.049	0.093	3.10	0.052	0.00502	0.0068	1.62	0.00021	0.000066	0.0000000
7	0.30	0.040	0.066	3.44	0.013	0.00381	0.0076	1.66	0.00031	0.000076	0.0000268
8	0.35	0.000	0.000	3.72	0.045	0.00000	0.0085	1.69	0.00056	0.000159	0.0000000
9	0.40	0.015	0.020	3.52	0.017	0.00000	0.0031	1.58	0.00026	0.000201	0.0000000
10	0.45	0.037	0.000	4.68	0.000	0.00058	0.0000	1.61	0.00036	0.000136	0.0000206
11	0.50	0.000	0.125	4.34	0.000	0.00000	0.0000	1.61	0.00041	0.000076	0.0000000
12	0.55	0.000	0.038	3.60	0.005	0.00000	0.0047	1.51	0.00060	0.000199	0.0000000
13	0.60	0.000	0.019	3.46	0.000	0.00000	0.0080	1.50	0.00019	0.000000	0.0000000
14	0.65	0.000	0.113	3.32	0.000	0.00362	0.0005	1.44	0.00038	0.000079	0.0000049
15	0.70	0.036	0.000	3.89	0.000	0.00142	0.0035	1.37	0.00034	0.000127	0.0000000
16	0.75	0.098	0.122	4.34	0.000	0.00075	0.0117	1.39	0.00053	0.000000	0.0000000
17	0.80	0.007	0.119	4.27	0.034	0.00264	0.0000	1.34	0.00054	0.000110	0.0000039
18	0.85	0.000	0.019	5.28	0.000	0.00250	0.0004	1.31	0.00004	0.000140	0.0000049

APPENDIX 5.3g MP02A growth band transect data

Spot Number	Distance from outer shell (mm)	MP02A growth band transect L1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0047	0.0105	15.26	1.338	0.0020	0.0058	1.36	0.00092	0.000000	0.0000000
2	0.05	0.0295	0.0000	13.34	0.811	0.0200	0.0082	1.35	0.00128	0.000135	0.0000000
3	0.10	0.0555	0.0340	14.94	4.665	0.0676	0.0232	1.34	0.00148	0.000068	0.0000566
4	0.15	0.0527	0.0356	16.78	14.517	0.1082	0.0223	1.36	0.01591	0.000201	0.0000011
5	0.20	0.0066	0.0316	12.56	4.394	0.0300	0.0057	1.23	0.00726	0.000397	0.0000519
6	0.25	0.0000	0.0000	9.78	0.204	0.0009	0.0025	1.24	0.00109	0.000142	0.0000085
7	0.30	0.0116	0.0114	10.72	0.044	0.0020	0.0000	1.25	0.00025	0.000000	0.0000000
8	0.35	0.0281	0.0116	9.96	0.000	0.0012	0.0000	1.19	0.00037	0.000000	0.0000000
9	0.40	0.0501	0.0005	9.81	0.006	0.0050	0.0025	1.09	0.00025	0.000000	0.0000004
10	0.45	0.0000	0.0000	10.41	0.023	0.0043	0.0059	0.97	0.00037	0.000000	0.0000000
11	0.50	0.0109	0.0175	6.83	0.007	0.0016	0.0009	1.10	0.00040	0.000000	0.0000003
12	0.55	0.0026	0.0000	5.03	0.000	0.0022	0.0021	0.97	0.00028	0.000003	0.0000000

APPENDIX 5.3h KD1B growth band transect data

Spot Number	Distance from outer shell (mm)	KD1B growth band transect L1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0000	0.0084	7.66	0.1171	0.00892	0.00000	1.24	0.00114	0.0001139	0.0000000
2	0.05	0.0519	0.0101	7.68	0.8466	0.00683	0.00234	1.52	0.00160	0.0000276	0.0000429
3	0.10	0.0000	0.0406	10.75	0.0272	0.00601	0.00703	1.38	0.00091	0.0000848	0.0000000
4	0.15	0.0363	0.0233	10.69	0.0756	0.00559	0.00000	1.43	0.00124	0.0001125	0.0000000
5	0.20	0.0335	0.0135	12.16	1.0243	0.00645	0.00028	1.55	0.00141	0.0000212	0.0000444
6	0.25	0.0000	0.0039	8.91	0.0110	0.00538	0.00000	1.41	0.00085	0.0000000	0.0000153
7	0.30	0.0006	0.0026	6.88	0.0320	0.00298	0.00485	1.25	0.00062	0.0000000	0.0000323
8	0.35	0.0029	0.0147	6.52	0.0148	0.00166	0.00748	1.25	0.00053	0.0000000	0.0000000
9	0.40	0.0000	0.0000	4.69	0.0000	0.00084	0.00928	1.21	0.00048	0.0000291	0.0000034
10	0.45	0.0067	0.0000	4.63	0.0169	0.00050	0.00170	1.27	0.00054	0.0000005	0.0000000
11	0.50	0.0036	0.0198	4.32	0.0284	0.00308	0.00447	1.30	0.00054	0.0001289	0.0000000
12	0.55	0.0048	0.0000	4.35	0.0000	0.00240	0.00862	1.23	0.00052	0.0000304	0.0000000
13	0.60	0.0371	0.0000	6.02	0.0412	0.00020	0.00000	1.34	0.00069	0.0000000	0.0000000
14	0.65	0.0041	0.0257	10.76	0.1082	0.00258	0.00730	1.38	0.00113	0.0000000	0.0000172
15	0.70	0.0065	0.0666	10.15	0.0894	0.00000	0.01056	1.23	0.00062	0.0000000	0.0000063
16	0.75	0.0434	0.0000	7.51	0.0056	0.00072	0.00250	1.16	0.00034	0.0000361	0.0000000
17	0.80	0.0030	0.0040	7.36	0.0263	0.01111	0.00901	1.22	0.00051	0.0000653	0.0000000
18	0.85	0.0023	0.0000	6.47	0.0000	0.00000	0.00108	1.16	0.00047	0.0000000	0.0000000
19	0.90	0.0178	0.0034	6.21	0.0000	0.00676	0.00871	1.22	0.00066	0.0000438	0.0000000
20	0.95	0.0172	0.0000	5.45	0.0226	0.00007	0.00261	1.18	0.00055	0.0000000	0.0000000
21	1.00	0.0080	0.0000	5.22	0.0113	0.00309	0.00366	1.25	0.00053	0.0000000	0.0000000
22	1.05	0.0098	0.0221	4.97	0.0000	0.00341	0.00815	1.25	0.00053	0.0000288	0.0000244
23	1.10	0.0306	0.0067	4.45	0.0027	0.00000	0.00712	1.22	0.00050	0.0000000	0.0000028

APPENDIX 5.3i K3A growth band data

Spot Number	Distance from outer shell (mm)	K3A growth band transect L1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0060	0.1324	4.97	0.043	0.00392	0.00157	5.52	0.005120	0.000149	0.001612
2	0.05	0.0009	0.1102	5.14	0.044	0.00570	0.00591	4.61	0.004493	0.000165	0.001152
3	0.10	0.0175	0.1296	4.73	0.016	0.00576	0.00712	3.47	0.003237	0.000332	0.000655
4	0.15	0.0107	0.1083	4.08	0.059	0.00495	0.00419	3.29	0.003242	0.000197	0.000477
5	0.20	0.0000	0.1005	3.35	0.209	0.00170	0.00315	2.56	0.001793	0.000144	0.000429
6	0.25	0.0197	0.0956	2.55	0.014	0.00104	0.00413	2.38	0.001581	0.000065	0.000304
7	0.30	0.0000	0.0854	2.09	0.000	0.00132	0.00337	2.53	0.001508	0.000000	0.000233
8	0.35	0.0000	0.0482	2.16	0.030	0.00021	0.00476	2.70	0.001557	0.000078	0.000113
9	0.40	0.0041	0.0646	1.76	0.032	0.00303	0.00428	2.60	0.001323	0.000028	0.000088
10	0.45	0.0152	0.0593	1.58	0.052	0.00203	0.00498	2.58	0.001193	0.000059	0.000081
11	0.50	0.0015	0.0525	1.39	0.014	0.00147	0.00100	2.60	0.001027	0.000036	0.000071
12	0.55	0.0199	0.0836	1.27	0.004	0.00329	0.00330	3.12	0.001188	0.000030	0.000035
13	0.60	0.0240	0.0783	1.57	0.001	0.00000	0.00347	3.35	0.001251	0.000168	0.000055
14	0.65	0.0000	0.0290	6.66	0.316	0.00345	0.00451	2.15	0.000977	0.000052	0.000020
15	0.70	0.0156	0.0049	12.88	0.008	0.00466	0.00589	1.32	0.000491	0.000146	0.000004
16	0.75	0.0310	0.0350	14.37	0.191	0.00320	0.00540	1.60	0.000750	0.000098	0.000000
17	0.80	0.0000	0.0151	16.23	0.013	0.00282	0.00241	1.74	0.000712	0.000162	0.000017
18	0.85	0.0258	0.0215	18.32	0.000	0.00634	0.01737	1.62	0.000857	0.000184	0.000000

Spot Number	Distance from outer shell (mm)	K3A growth band transect L2 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0154	0.1610	2.98	0.108	0.00340	0.01854	4.63	0.005964	0.000000	0.000905
2	0.05	0.0000	0.1340	11.50	0.322	0.01747	0.01057	4.52	0.005360	0.000141	0.000644
3	0.10	0.0283	0.1121	5.39	0.619	0.00170	0.00725	4.07	0.005384	0.000065	0.000349
4	0.15	0.0000	0.0917	10.18	0.355	0.00391	0.00901	3.48	0.003381	0.000001	0.000160
5	0.20	0.0319	0.0273	21.44	0.096	0.00578	0.01204	2.25	0.001459	0.000144	0.000068
6	0.25	0.0460	0.0128	14.44	0.000	0.00157	0.00368	1.76	0.000910	0.000026	0.000016
7	0.30	0.0164	0.0131	16.94	0.005	0.00329	0.00488	1.87	0.000706	0.000000	0.000000
8	0.35	0.0241	0.0000	10.74	0.003	0.00287	0.00449	1.65	0.000710	0.000003	0.000011
9	0.40	0.0253	0.0139	8.61	0.014	0.00362	0.00313	1.51	0.000591	0.000000	0.000022
10	0.45	0.0344	0.0230	6.99	0.002	0.00361	0.00972	1.43	0.000452	0.000000	0.000005
11	0.50	0.0291	0.0117	8.14	0.000	0.00000	0.00000	1.33	0.000461	0.000068	0.000027
12	0.55	0.0271	0.0042	12.80	0.001	0.00000	0.00979	1.38	0.000490	0.000072	0.000000
13	0.60	0.0070	0.0000	19.25	0.005	0.00319	0.00501	1.27	0.000283	0.000000	0.000008
14	0.65	0.0167	0.0000	21.28	0.000	0.00000	0.00450	1.24	0.000483	0.000046	0.000000
15	0.70	0.0204	0.0000	24.23	0.000	0.00443	0.00189	1.15	0.000462	0.000054	0.000023
16	0.75	0.0226	0.0081	21.37	0.019	0.00321	0.00697	1.21	0.000569	0.000072	0.000000
17	0.80	0.0073	0.0174	3.41	0.000	0.00000	0.00642	2.76	0.001292	0.000000	0.000039

Spot Number	Distance from outer shell (mm)	K3A growth band transect L3 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0249	0.0115	12.91	0.000	0.00167	0.01033	2.18	0.001364	0.000336	0.000024
2	0.05	0.0034	0.0000	10.28	0.018	0.00475	0.00832	1.80	0.000680	0.000241	0.000000
3	0.10	0.0237	0.0245	7.51	0.000	0.00279	0.00703	1.75	0.000595	0.000186	0.000000
4	0.15	0.0031	0.0171	6.14	0.023	0.00094	0.00611	1.71	0.000595	0.000187	0.000023
5	0.20	0.0000	0.0119	5.29	1.127	0.00078	0.00412	1.83	0.004048	0.000039	0.000000
6	0.25	0.0000	0.0062	4.82	0.000	0.00226	0.00642	1.71	0.000653	0.000131	0.000010
7	0.30	0.0114	0.0106	4.26	0.023	0.00137	0.00053	1.65	0.000354	0.000000	0.000000
8	0.35	0.0070	0.0000	4.38	0.043	0.00081	0.00040	1.64	0.000632	0.000015	0.000018
9	0.40	0.0219	0.0028	3.98	0.008	0.00361	0.00808	1.67	0.000509	0.000157	0.000009
10	0.45	0.0022	0.0194	3.36	0.000	0.00228	0.00260	1.56	0.000624	0.000118	0.000000
11	0.50	0.0267	0.0300	3.36	0.010	0.00486	0.00322	1.55	0.000475	0.000035	0.000000
12	0.55	0.0000	0.0064	3.19	0.000	0.00500	0.00199	1.45	0.000479	0.000034	0.000000
13	0.60	0.0012	0.0000	3.58	0.007	0.00539	0.00174	1.32	0.000370	0.000057	0.000000
14	0.65	0.0331	0.0062	3.85	0.012	0.00834	0.00273	1.21	0.000449	0.000097	0.000000
15	0.70	0.0116	0.0108	7.37	0.009	0.00000	0.00509	1.12	0.000375	0.000054	0.000028
16	0.75	0.0292	0.0200	15.41	0.008	0.00771	0.00116	1.27	0.000449	0.000048	0.000006
17	0.80	0.0172	0.0394	17.61	0.000	0.00629	0.00569	2.05	0.001139	0.000110	0.000024

APPENDIX 5.3j K1A1 growth band transect data

Spot Number	Distance from outer shell (mm)	K1A1 growth band transect L1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0000	0.0230	11.99	0.0000	0.00741	0.00000	1.17	0.0005084	0.0003047	0.0000042
2	0.05	0.0522	0.0000	11.90	0.0093	0.00707	0.00485	1.07	0.0004545	0.0003084	0.0000214
3	0.10	0.0216	0.0000	9.99	0.0000	0.00683	0.00000	1.23	0.000456	0.0003888	0.0000068
4	0.15	0.0470	0.0000	9.29	0.0000	0.00735	0.00448	1.29	0.0005331	0.0002594	0.0000000
5	0.20	0.0317	0.0110	8.69	0.0000	0.00486	0.00198	1.34	0.0004846	0.0003118	0.0000000
6	0.25	0.0000	0.0000	7.53	0.0266	0.00300	0.00000	1.37	0.0004745	0.0002398	0.0000000
7	0.30	0.0256	0.0000	6.55	0.0054	0.00609	0.00449	1.39	0.0006375	0.0002322	0.0000000
8	0.35	0.0088	0.0084	6.73	0.0000	0.00816	0.00000	1.48	0.0006547	0.0003885	0.0000000
9	0.40	0.0097	0.0000	6.40	0.0017	0.01116	0.00918	1.49	0.0006535	0.0002442	0.0000639
10	0.45	0.0000	0.0265	7.39	0.0120	0.00757	0.00738	1.53	0.0006565	0.0003046	0.0000000
11	0.50	0.0000	0.0326	8.47	0.0171	0.00205	0.00000	1.56	0.0006249	0.0001483	0.0000354
12	0.55	0.0291	0.0000	9.74	0.0326	0.01165	0.01385	1.67	0.0008855	0.0004596	0.0000015
13	0.60	0.0000	0.0000	9.24	0.0102	0.00248	0.00000	1.75	0.0009199	0.0001907	0.0000000
14	0.65	0.0000	0.0000	11.63	0.0289	0.00293	0.00158	1.88	0.0008039	0.0002439	0.0000200
15	0.70	0.0120	0.0033	9.54	0.0000	0.00293	0.00000	1.89	0.0007248	0.0001882	0.0000541
16	0.75	0.0341	0.0102	13.85	0.0000	0.00000	0.00490	1.86	0.0006934	0.000304	0.0000000
17	0.80	0.0037	0.0384	13.87	0.0000	0.00283	0.00115	1.80	0.0006949	0.0003117	0.0000299
18	0.85	0.0000	0.0242	15.48	0.0000	0.01002	0.00209	2.34	0.0014282	0.0004084	0.0000801
19	0.90	0.0149	0.0054	18.28	0.0000	0.03607	0.01671	2.05	0.0013426	0.0004052	0.0001105
20	0.95	0.0481	0.0325	19.19	1.7931	0.02739	0.01202	2.22	0.002051	0.0003656	0.0000000
21	1.00	0.0441	0.0463	20.41	1.4172	0.03438	0.02178	2.02	0.003642	0.0003618	0.0000000

Spot Number	Distance from outer shell (mm)	K1A1 growth band transect L2 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0253	0.0112	6.44	0.0123	0.00512	0.00785	1.67	0.0013469	0.0001308	0.0000000
2	0.05	0.0752	0.0271	7.11	0.0000	0.00000	0.00549	1.21	0.0005405	0.0001599	0.0000199
3	0.10	0.0009	0.0184	6.94	0.0000	0.00000	0.01169	1.39	0.0004664	0.0001895	0.0000461
4	0.15	0.0000	0.0079	5.72	0.0000	0.00417	0.00888	1.48	0.0006087	8.412E-05	0.0000147
5	0.20	0.0037	0.0000	5.54	0.0127	0.00644	0.00817	1.43	0.0006415	0.0002719	0.0000000
6	0.25	0.0339	0.0019	5.82	0.0000	0.00000	0.00291	1.55	0.0006378	0.0001859	0.0000311
7	0.30	0.0055	0.0000	6.36	0.0000	0.00113	0.00441	1.77	0.0008806	0.0002769	0.0000000
8	0.35	0.0024	0.0186	7.06	0.0036	0.00476	0.01202	1.73	0.0008706	0.0001772	0.0000117
9	0.40	0.0000	0.0000	9.52	0.0085	0.00239	0.00893	1.80	0.000991	8.931E-05	0.0000000
10	0.45	0.0000	0.0000	9.90	0.0000	0.00031	0.00458	1.88	0.0010049	0.0002838	0.0000149
11	0.50	0.0109	0.0261	8.70	0.0719	0.00331	0.00374	1.74	0.0009156	0.0003613	0.0000000
12	0.55	0.0154	0.0000	8.49	0.0000	0.00013	0.01654	1.79	0.0007909	0.0006827	0.0000000
13	0.60	0.0148	0.0599	10.05	0.0154	0.00349	0.00921	1.79	0.0009872	0.0003473	0.0000000
14	0.65	0.0422	0.0148	13.10	0.0205	0.00627	0.00662	1.85	0.0010123	0.0004058	0.0000000
15	0.70	0.0000	0.0146	9.97	0.0308	0.00729	0.00193	2.02	0.0012665	0.0004219	0.0000000
16	0.75	0.0867	0.0197	14.10	0.1021	0.00988	0.00435	1.80	0.0011952	0.0005403	0.0000438
17	0.80	0.0000	0.0171	11.21	0.1848	0.00606	0.01260	2.69	0.0023177	0.0005121	0.0001475
18	0.85	0.0491	0.0186	12.90	0.4604	0.01458	0.00000	2.10	0.0017372	0.0004021	0.0000659
19	0.90	0.0167	0.0035	17.28	0.1813	0.02159	0.00685	2.08	0.0027224	0.0003811	0.0000000
20	0.95	0.0563	0.0384	22.73	0.0219	0.01695	0.00458	2.34	0.0016945	0.000561	0.0000627
21	1.00	0.0000	0.0546	18.47	0.1940	0.01617	0.00899	2.19	0.0023422	0.0003898	0.0000974

APPENDIX 5.3k AR1 growth band data

Spot Number	Distance from inner shell (mm)	AR1 growth band transect L1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0171	0.0374	16.65	0.00850	0.00000	0.01447	1.36	0.001050	0.0001430	0.0000000
2	0.05	0.0000	0.0020	22.09	0.05814	0.00056	0.01356	1.51	0.001767	0.0000717	0.0000058
3	0.10	0.0000	0.0021	14.24	0.00399	0.00232	0.00765	1.28	0.000510	0.0000412	0.0000000
4	0.15	0.0141	0.0000	11.81	0.00911	0.00369	0.00000	1.17	0.000641	0.0001260	0.0000291
5	0.20	0.0000	0.0000	15.86	0.00782	0.00570	0.00867	1.02	0.000500	0.0001575	0.0000400
6	0.25	0.0000	0.0638	20.76	0.00722	0.00000	0.00603	1.12	0.000885	0.0000000	0.0000088
7	0.30	0.0200	0.0160	23.09	0.00000	0.00042	0.00000	1.10	0.000587	0.0001615	0.0000366
8	0.35	0.0336	0.0264	21.63	0.00000	0.00043	0.00906	1.22	0.000682	0.0000987	0.0000166
9	0.40	0.0189	0.0000	21.10	0.01669	0.00000	0.00441	1.18	0.000859	0.0001886	0.0000022
10	0.45	0.0369	0.0032	22.20	0.00795	0.00439	0.00802	1.28	0.000713	0.0000000	0.0000382
11	0.50	0.0356	0.0575	16.86	0.02632	0.00297	0.00519	1.27	0.000797	0.0001090	0.0000376
12	0.55	0.0147	0.0127	18.81	0.00000	0.00456	0.01180	1.23	0.000880	0.0000438	0.0000048
13	0.60	0.0000	0.0072	21.43	0.00000	0.00399	0.00614	1.38	0.000780	0.0000968	0.0000098
14	0.65	0.0211	0.0054	20.11	0.00000	0.00000	0.00529	1.27	0.000652	0.0000024	0.0000164
15	0.70	0.0267	0.0000	18.23	0.00000	0.00632	0.00732	1.17	0.000543	0.0000000	0.0000125
16	0.75	0.0317	0.0271	18.76	0.01918	0.00149	0.00155	1.11	0.000500	0.0000728	0.0000352
17	0.80	0.0364	0.0142	18.56	0.00000	0.00007	0.00899	1.08	0.000456	0.0000417	0.0000000
18	0.85	0.0000	0.0095	16.88	0.03422	0.00115	0.00149	1.05	0.000351	0.0000803	0.0000061
19	0.90	0.0007	0.0076	16.94	0.01144	0.00171	0.00490	1.02	0.000301	0.0000717	0.0000377
20	0.95	0.0000	0.0453	18.00	0.01191	0.00237	0.00897	1.10	0.000409	0.0000000	0.0000408
21	1.00	0.0000	0.0207	17.68	0.03484	0.00592	0.00832	1.11	0.000414	0.0001285	0.0000000
22	1.05	0.0036	0.0000	19.00	0.00000	0.00378	0.00243	0.96	0.000385	0.0001137	0.0000169
23	1.10	0.0456	0.0366	19.50	0.03319	0.00508	0.00410	1.03	0.000342	0.0000977	0.0000000
24	1.15	0.0000	0.0288	18.71	0.00979	0.00557	0.00982	0.95	0.000456	0.0001172	0.0000087

APPENDIX 5.3l MR2 growth band data

Spot Number	Distance from outer shell (mm)	MR2 growth band transect L1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0076	0.552	19.17	0.0000	0.00000	0.0112	1.27	0.000756	0.000000	0.0000000
2	0.05	0.0000	0.702	14.63	0.0000	0.00000	0.0292	1.27	0.000956	0.000148	0.0000000
3	0.10	0.0405	0.522	10.06	0.0000	0.00000	0.0259	1.28	0.000686	0.000134	0.0001452
4	0.15	0.0000	0.656	8.27	0.0000	0.00260	0.0031	1.32	0.000596	0.000081	0.0000389
5	0.20	0.0081	0.316	6.94	0.0282	0.00219	0.0120	1.25	0.000614	0.000133	0.0000000
6	0.25	0.0000	0.004	7.92	0.0208	0.00070	0.0017	1.28	0.000521	0.000000	0.0000000
7	0.30	0.0195	0.155	6.82	0.0000	0.00000	0.0177	1.21	0.000550	0.000268	0.0000592
8	0.35	0.0022	0.000	6.61	0.0168	0.00000	0.0154	1.23	0.000574	0.000100	0.0000471
9	0.40	0.0000	0.000	6.92	0.0126	0.00132	0.0111	1.23	0.000693	0.000000	0.0000000
10	0.45	0.0000	0.073	7.56	0.0108	0.00201	0.0198	1.20	0.000557	0.000137	0.0000269
11	0.50	0.0002	0.080	7.95	0.0000	0.00110	0.0163	1.08	0.000709	0.000000	0.0000000
12	0.55	0.0000	0.441	8.42	0.0193	0.00000	0.0073	1.05	0.000141	0.000000	0.0000721
13	0.60	0.0060	0.000	7.27	0.0000	0.00000	0.0186	1.02	0.000716	0.000000	0.0000510
14	0.65	0.0288	0.000	7.61	0.0377	0.00589	0.0147	1.00	0.000431	0.000000	0.0000000
15	0.70	0.0160	0.152	7.96	0.0491	0.00864	0.0000	1.04	0.000464	0.000000	0.0000648
16	0.75	0.0475	0.210	8.08	0.0000	0.00943	0.0000	1.04	0.000635	0.000000	0.0000460
17	0.80	0.0510	0.129	6.87	0.0026	0.00231	0.0063	1.09	0.000451	0.000000	0.0000145
18	0.85	0.0505	0.000	7.95	0.0054	0.00048	0.0000	1.05	0.000431	0.000000	0.0000000
19	0.90	0.0072	0.052	9.47	0.0116	0.00000	0.0049	1.00	0.000750	0.000161	0.0000816
20	0.95	0.0021	0.000	8.73	0.0109	0.00000	0.0155	0.85	0.000340	0.000000	0.0000137
21	1.00	0.0133	0.280	1.23	0.0000	0.00000	0.0000	2.88	0.003394	0.000000	0.0000189
22	1.05	0.0288	0.337	12.71	0.0003	0.00000	0.0160	1.15	0.001160	0.000307	0.0000000
23	1.10	0.0000	0.538	10.80	0.0119	0.00000	0.0044	1.80	0.001522	0.000000	0.0000085

APPENDIX 5.3m MD1 growth band data

Spot Number	Distance from outer shell (mm)	MD1 growth band transect L1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0000	0.0000	21.49	0.0000	0.00000	0.0281	1.26	0.001330	0.000035	0.0000138
2	0.05	0.0023	0.0000	20.42	4.1944	0.01906	0.0108	1.88	0.013390	0.001104	0.0001527
3	0.10	0.0278	0.0000	17.06	0.0243	0.00000	0.0018	1.25	0.000619	0.000250	0.0000386
4	0.15	0.0096	0.0000	12.72	0.1655	0.00000	0.0180	1.25	0.001362	0.000014	0.0000000
5	0.20	0.0450	0.0000	10.35	0.0000	0.00000	0.0000	1.26	0.000691	0.000000	0.0000240
6	0.25	0.0441	0.0000	9.90	0.0000	0.00135	0.0035	1.20	0.000401	0.000000	0.0000000
7	0.30	0.0141	0.0000	7.25	0.0362	0.00257	0.0044	1.14	0.000496	0.000000	0.0000011
8	0.35	0.0318	0.0000	8.14	0.0320	0.00138	0.0051	1.05	0.000586	0.000085	0.0000632
9	0.40	0.0291	0.0233	13.33	0.0074	0.00000	0.0000	1.02	0.000371	0.000000	0.0000015
10	0.45	0.0281	0.0000	22.05	0.0000	0.00010	0.0103	1.04	0.000202	0.000164	0.0000615
11	0.50	0.0314	0.0000	24.32	0.0000	0.00647	0.0072	1.38	0.000735	0.000000	0.0000000
12	0.55	0.0112	0.0000	19.14	0.0369	0.00000	0.0024	1.60	0.000846	0.000242	0.0000151
13	0.60	0.0183	0.2787	14.02	0.0000	0.00000	0.0000	1.54	0.000621	0.000000	0.0000000
14	0.65	0.0153	0.1288	10.01	0.0261	0.00000	0.0040	1.39	0.000604	0.000000	0.0000450
15	0.70	0.0332	0.1185	9.98	0.0000	0.00170	0.0174	1.31	0.000643	0.000100	0.0001196
16	0.75	0.0000	0.0000	10.18	0.0250	0.00042	0.0071	1.19	0.000309	0.000070	0.0000000
17	0.80	0.0000	0.0887	10.81	0.0000	0.00140	0.0181	1.18	0.000370	0.000088	0.0000063
18	0.85	0.0281	0.0000	11.49	0.0028	0.00230	0.0091	1.14	0.000396	0.000105	0.0000063
19	0.90	0.0099	0.1738	13.65	0.0000	0.00001	0.0143	1.09	0.000367	0.000000	0.0000264
20	0.95	0.0346	0.6620	15.06	0.0131	0.00000	0.0100	1.02	0.000267	0.000000	0.0000082
21	1.00	0.0381	0.0000	16.83	0.0155	0.00000	0.0016	1.00	0.000654	0.000055	0.0000000
22	1.05	0.0476	0.2495	18.08	0.0054	0.00217	0.0003	0.95	0.000570	0.000080	0.0000488
23	1.10	0.0197	0.2612	18.17	0.0000	0.00252	0.0000	0.94	0.000310	0.000139	0.0000000
24	1.15	0.0795	0.0000	22.67	0.0030	0.00297	0.0000	0.91	0.000523	0.000193	0.0000411

APPENDIX 5.3n MD3 growth band data

Spot Number	Distance from outer shell (mm)	MD3 growth band transect L1 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0217	0.1026	6.44	0.062	0.00514	0.0000	4.79	0.00407	0.0000805	0.0005034
2	0.05	0.0242	0.0970	8.93	0.333	0.00752	0.0175	3.74	0.00397	0.0001746	0.0002628
3	0.10	0.0058	0.0064	10.28	0.553	0.00361	0.0088	2.30	0.00162	0.0001038	0.0000657
4	0.15	0.0000	0.0430	6.52	0.000	0.00000	0.0187	1.38	0.00038	0.0000256	0.0000467
5	0.20	0.0199	0.0411	4.99	0.000	0.00512	0.0163	1.37	0.00056	0.0001144	0.0000000
6	0.25	0.0302	0.0000	6.18	0.070	0.00670	0.0187	1.34	0.00050	0.0000000	0.0000099
7	0.30	0.0048	0.0505	4.94	0.266	0.00000	0.0122	1.36	0.00061	0.0000640	0.0000000
8	0.35	0.0036	0.0151	3.83	0.000	0.00092	0.0143	1.44	0.00045	0.0000086	0.0000183
9	0.40	0.0007	0.0000	3.35	0.013	0.00000	0.0065	1.33	0.00044	0.0000591	0.0000000
10	0.45	0.0223	0.0000	2.99	0.000	0.00000	0.0105	1.24	0.00042	0.0000234	0.0000144
11	0.50	0.0008	0.0137	3.32	0.058	0.00202	0.0080	1.25	0.00053	0.0000881	0.0000000
12	0.55	0.0117	0.0000	3.41	0.004	0.00223	0.0000	1.22	0.00049	0.0000546	0.0000370
13	0.60	0.0113	0.0542	3.38	0.013	0.00117	0.0049	1.21	0.00039	0.0000460	0.0000000
14	0.65	0.0000	0.0227	3.98	0.000	0.00235	0.0080	1.12	0.00043	0.0000000	0.0000185
15	0.70	0.0120	0.0158	4.16	0.000	0.00366	0.0042	1.09	0.00037	0.0000000	0.0000163

Spot Number	Distance from outer shell (mm)	MD3 growth band transect L2 corrected data (mmol/mol)									
		Li/Ca	B/Ca	Mg/Ca	Al/Ca	Mn/Ca	Zn/Ca	Sr88/Ca	Ba/Ca	Pb/Ca	U/Ca
1	0.00	0.0043	0.0294	17.46	0.254	0.00702	0.0135	1.60	0.00171	0.0000547	0.0000943
2	0.05	0.0215	0.0648	24.52	3.698	0.01777	0.0079	1.82	0.00524	0.0002306	0.0000817
3	0.10	0.0536	0.1404	49.56	5.435	0.03563	0.0052	2.89	0.00685	0.0002503	0.0001766
4	0.15	0.0429	0.0651	24.25	1.865	0.01023	0.0077	2.94	0.00378	0.0002493	0.0001240
5	0.20	0.0420	0.0296	19.91	0.794	0.00677	0.0108	1.56	0.00220	0.0001510	0.0000492
6	0.25	0.0058	0.0003	9.92	0.006	0.00422	0.0099	1.44	0.00081	0.0000268	0.0000342
7	0.30	0.0067	0.0099	4.87	0.001	0.00205	0.0097	1.51	0.00064	0.0000570	0.0000043
8	0.35	0.0474	0.0272	4.43	0.053	0.00215	0.0012	1.44	0.00064	0.0000000	0.0000093
9	0.40	0.0239	0.0000	3.85	0.000	0.00142	0.0067	1.46	0.00063	0.0000539	0.0000000
10	0.45	0.0056	0.0163	3.79	0.004	0.00449	0.0058	1.25	0.00043	0.0000100	0.0000148
11	0.50	0.0121	0.0000	3.81	0.000	0.00277	0.0043	1.15	0.00042	0.0000645	0.0000139
12	0.55	0.0148	0.0176	4.48	0.009	0.00197	0.0122	1.02	0.00039	0.0000646	0.0000000
13	0.60	0.0276	0.0014	5.59	0.002	0.00047	0.0004	1.15	0.00046	0.0000000	0.0000171
14	0.65	0.0193	0.0168	7.39	0.006	0.00322	0.0046	1.25	0.00045	0.0000227	0.0000176
15	0.70	0.0189	0.0000	5.83	0.000	0.00670	0.0072	0.99	0.00030	0.0000926	0.0000000
16	0.75	0.0000	0.0000	5.88	0.013	0.00567	0.0064	1.06	0.00038	0.0000433	0.0000011
17	0.80	0.0320	0.0250	7.29	0.005	0.00818	0.0058	0.95	0.00044	0.0000895	0.0000159
18	0.85	0.0262	0.0441	7.47	0.006	0.00545	0.0041	1.24	0.00093	0.0000260	0.0000000