7TH INTERNATIONAL
SCLEROCHRONOLOGY
CONFERENCE

May 5–9, 2026

ST JOHN'S

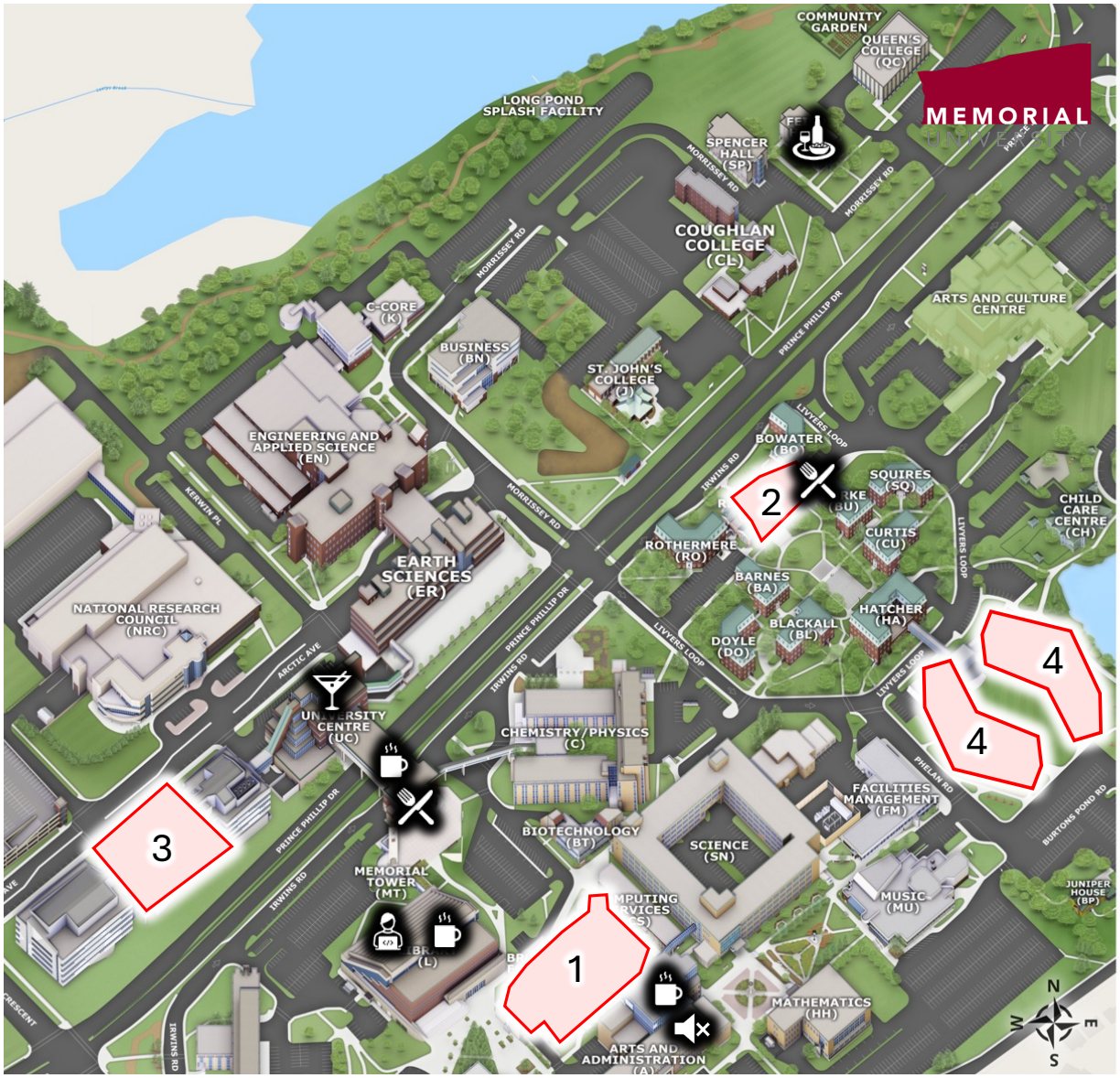
Newfoundland & Labrador

MEMORIAL UNIVERSITY

Land Acknowledgement

We acknowledge that the lands on which Memorial University's campuses are situated are in the traditional territories of diverse Indigenous groups, and we acknowledge with respect the diverse histories and cultures of the Beothuk, Mi'kmaq, Innu, and Inuit of this province.

Campus Map



1. Bruneau Centre for Research & Innovation (Room: 2001)
2. Gushue Hall (*Lunch Venue*)
3. Core Science Facility (*Poster Session & CREAIT Tours*)
4. McPhearson College (*Residences*)

QEII Library (*Quiet Workspace*)
Quick Coffee and Snacks
Food Services
Bar
Restaurant

Quiet Room (A 2071)
Follow the overpass from the Bruneau Centre on 2nd floor

Scientific & Local Committees

Alan Wanamaker
Iowa State University
United States

Amy Prendergast
University of Melbourne
Australia

Bernd Schöne
University of Mainz
Germany

David Gillikin
Union College
United States

Evan Edinger
Memorial University of Newfoundland
Canada

Julien Thébault
IUEM, Université de Bretagne Occidentale
France

Kotaro Shirai
University of Tokyo
Japan

Meghan Burchell
Memorial University of Newfoundland
Canada

Melita Peharda
Institute of Oceanography and Fisheries
Croatia

Natasha Leclerc
Memorial University of Newfoundland
Canada

Zoë Doubleday
University of South Australia
Australia

Megan McKinnon
Memorial University of Newfoundland
Canada

Musicians

Rory Graham (Reception)

Rory Graham is a multi-instrumentalist from Brandon, Manitoba that settled in Newfoundland. Rory holds two Master's of Music degrees from Memorial University in violin and has seen performances across the countries with orchestras and bands playing classical, jazz, folk, rock, country, pop, and more. Rory plays violin, guitar, bass, trumpet, and sings for a wide variety of bands in the St. John's area. When not playing music, Rory enjoys running and lifting, cooking, playing games, and spending time with his cat.

Evan AuCoin (Reception)

Evan AuCoin is a Newfoundland-born singer-songwriter known for his rich storytelling and genre-spanning sound. Hailing from Bay de Verde and now a fixture in the St. John’s music scene, AuCoin delivers a compelling blend of folk-rock, country, blues, and traditional Newfoundland music. Whether performing solo, with his folk-rock band Rugged Shores, or fronting his rock-country project Midnight Watch, his music resonates with raw emotion and authenticity. A multi-time MusicNL nominee, AuCoin has been praised for his evocative songwriting, drawing comparisons to the likes of Jason Isbell, Jeff Tweedy, and Taylor Goldsmith.

Yvette Favaro (Poster Session)

Originally from Cape Breton and proudly calling Newfoundland home for over three decades, Yvette balances a career as a Chemistry Lab Instructor at Memorial University with a lifelong passion for music. A talented pianist who has played primarily by ear for 50 years, she now performs at weddings and special events, frequently collaborating with fellow musicians across the St. John’s scene. Her favourite weekends include finding a local kitchen party and playing piano until the wee morning hours

MONDAY, MAY 4TH , 2026

UNESCO Fossil Site, Mistaken Point Excursion

09:00 Departure by bus for Mistaken Point Excursion
Location: ALT Hotel

12:00 Arrival at Mistaken Point
Lunches provided

15:30 Departure from Mistaken Point

18:00 Return to St. John's
Location: ALT Hotel

Drysuit SCUBA Course

08:30 Departure by carpool
Location: ALT Hotel

09:00 Arrival in Ocean Quest for material rental

12:00 Arrival in Conception Bay South for pool training

17:00 Return to St. John's
Location: ALT Hotel

TUESDAY, MAY 5TH , 2026

Diving Excursion

09:00 Diving Excursion departure by carpool
Location: ALT Hotel

15:00 Return to rental location from drop-off

16:00 Return to ALT Hotel

Reception

18:00 Beginning of reception
Location: Johnson Geo Centre

21:00 End of reception

WEDNESDAY, MAY 6TH , 2026

Presentation Sessions *Bruneau Centre for Research & Innovation (2001)*

08:30	Opening remarks
09:00	KEYNOTE: Elizabeth Harper
09:30	SESSION: Biomineralization & Kinetics
10:30	Coffee Break
10:45	SESSION: Biomineralization & Kinetics (continued)
11:00	KEYNOTE: Sujata Murty
11:30	SESSION: Paleoclimates & Paleoenvironments
12:00	LUNCH *Location: Gushue Hall*
13:15	SESSION: Paleoclimates & Paleoenvironments (continued)
14:45	Coffee break
15:00	KEYNOTE: Nina Whitney
15:30	SESSION: Paleoclimates & Paleoenvironments (continued)
16:30	End of day

THURSDAY, MAY 7TH , 2026

Presentation Sessions *Bruneau Centre for Research & Innovation (2001)*

08:30	Opening remarks
08:45	KEYNOTE: Niels de Winter
09:15	SESSION: Proxy Development
10:30	Coffee Break
10:45	SESSION: Proxy Development (cont.)
12:00	LUNCH *Location: Gushue Hall*
13:15	SESSION: Proxy Development (cont.)
13:30	KEYNOTE: James Scourse
14:00	SESSION: Impacts on Ecosystems & Pollution
15:00	Coffee break
15:15	SESSION: Impacts on Ecosystems & Pollution (cont.)
16:15	End of presentations

Poster Session: Core Science Facility (Whale Atrium – ground floor)

16:20	1st bus shuttle to ALT Hotel (bus circuit every 30 mins)
17:00	Start of poster session
17:30	CREAIT Lab tours (next tour at 18:30)
20:00	End of poster session

FRIDAY, MAY 8TH , 2026

Presentation Sessions *Bruneau Centre for Research & Innovation (2001)*

08:30	Opening remarks
08:45	SESSION: Impacts on Ecosystems & Pollution (cont.)
09:15	KEYNOTE: Vincent Raoult
09:45	SESSION: Fisheries Ecology, Management & Conservation
10:30	Coffee Break
10:45	SESSION: Fisheries Ecology, Management & Conservation (cont.)
12:00	LUNCH *Location: Gushue Hall*

Excursion: Manuels River Hike

13:30	Departure from Bruneau Centre for Research & Innovation
14:00	Drop off at Worsley Park
16:30	Depart from Interpretation Centre
17:00	Return to St. John's

Dinner: Bannerman Brewery

18:00	Start of event
21:00	End of event

SATURDAY, MAY 9TH , 2026

Presentation Sessions *Bruneau Centre for Research & Innovation (2001)*

08:30	Opening remarks
08:45	SESSION: Fisheries Ecology, Management & Conservation (cont.)
09:30	KEYNOTE: Gaia Crippa
10:00	SESSION: Sclerochronology in Deep Time
10:30	Coffee Break
10:45	SESSION: Sclerochronology in Deep Time (cont.)
12:00	LUNCH *Location: Gushue Hall*
13:15	SESSION: Sclerochronology in Deep Time (cont.)
13:30	KEYNOTE: Asier García-Escárzaga
14:00	SESSION: Archaeology
14:45	Coffee break
15:00	SESSION: Archaeology (cont.)
16:15	Awards announcement
16:30	Next ISC Pitches
16:45	Closing Remarks

SUNDAY, MAY 10TH , 2026

Excursion to Cape Spear

9:00 Departure for Cape Spear

12:00 Return to St. John's

ORAL PRESENTATIONS SCHEDULE

WEDNESDAY MAY 6TH , 2026

TIME	PRESENTER	TITLE
9:00	**Elizabeth Harper**	**KEYNOTE: BIOMINERALIZATION & KINETICS** ***Microstructure matters!***
9:30	Iris Arndt	Active ion transport drives daily elemental cycles in tridacna shells: Insights from culturing experiments
9:45	Mahiro Yumiba	Evaluating vital effects on stable oxygen isotope ratio of biogenic carbonates and its coupling with trace element concentrations
10:00	Theresa Kutzner	Otolith mineralogy in *Labeobarbus aeneus* (*Cyprinidae*) and implications for bulk and sclerochronological $\delta^{13}C$ and $\delta^{18}O$ interpretations of asterisci and lapilli
10:15	Karin Limburg	Where do those elements go in a fish's body, before ending up in otoliths? A speculation with some evidence?
10:45	Uwe Brand	Brachiopods: a sclerochronological enigma
11:00	**Sujata Murty**	**KEYNOTE: PALEOCLIMATES & PALEOENVIRONMENTS** ***Drivers of Indo-Pacific Oceanic Exchange: Insights from Corals and Ocean Models***
11:30	Logan Brenner	Well-replicated coral Ba/Ca records in the Gulf of Chiriquí, Panama reconstruct river discharge with implications for recording global climate teleconnections
11:45	Lauren T. Toth (ONLINE)	Centennial-scale influence of thermal variability on coral growth for a subtropical reef in the southwest Florida Keys
13:15	Zeyang Sun	Submarine groundwater discharge into the Plio-Pleistocene Florida Platform suggested by clumped isotope sclerochronology
13:30	Lucas Gomes	Testing the environmental drivers of extinction on the Plio-Pleistocene Florida Platform with clumped isotope (Δ_{47}) and trace elemental (Ba/Ca) sclerochronology
13:45	Brendan Oerlemans	Towards the limits of short-lived extreme weather event recognition in mollusc shells
14:00	Alan Wanamaker	Geochemical signatures in the long-lived marine bivalve *Arctica islandica* show intense warming in the down east coastal region of the Gulf of Maine
14:15	David P. Gillikin	Seasonal climate variability in Coastal North Carolina during the Roman Warm Period
14:30	Martin W. Miles	Four centuries of the Arctic–Atlantic climate reversals from sclerochronology and historical records
15:00	**Nina M. Whitney**	**KEYNOTE: PALEOCLIMATES & PALEOENVIRONMENTS** ***Utilizing a network of Arctica islandica records and model simulations to investigate past regional ocean dynamics in the rapidly warming western North Atlantic***
15:30	Shiono Miki	Paleoclimate variability recorded in shells of Stimpson's hard clam, *Mercenaria stimpsoni*, the longest-lived bivalve in Northwestern Pacific Ocean
15:45	Leila Rose Fischer	Three millennia of northeast Pacific sea surface temperatures from growth increments of the long-lived bivalve, Pacific geoduck
16:00	Nanyu Zhao (ONLINE)	Prehistoric shifts in tropical cyclone season in the South China sea: evidence from daily resolution records of giant clam shells
16:15	Xiulan Zong	Evaluating species-specific performance of land snail shell $\delta^{18}O$ as a seasonal hydroclimate proxy

ORAL PRESENTATIONS SCHEDULE

THURSDAY MAY 7TH , 2026

TIME	PRESENTER	TITLE
8:45	**Niels de Winter**	**KEYNOTE: PROXY DEVELOPMENT & OPTIMIZATION** ***Sclerochronology as a tool for high-resolution climate reconstructions***
9:15	Lukas Fröhlich	Extracting sub-annual geochemical information from bivalve shells – an approach to optimize sclerochronological methods on the example of the long-lived bivalve *Arctica islandica*
9:30	Mahsa Alidoostsalimi (ONLINE)	ENSO interannual variability in the Great Barrier Reef recorded by marine gastropod shells
9:45	Sílvia Pérez-Mayol	Quantifying trace elements in cephalopod beaks: A rigorous analytical strategy for LA-ICP/MS
10:00	Bohao Dong	Investigating seawater-shell relationships using tank experiments with living *Tridacna* to inform palaeoenvironmental reconstructions
10:15	Alexandra Fazekas-Németh	Absolutely dated *Glycymeris* increment $\Delta^{14}C$ records reveal post-bomb ventillation processes in the Subtropical East Atlantic
10:45	Qian Huang	Investigating the limits of amino acid nitrogen bivalve shells for biogeochemical and ecological reconstruction isotope composition in (sub-) fossil
11:00	Xizhi Huang	Compound-specific amino acids $\delta^{15}N$ values in mollusc shells: Extraction of intra-crystalline amino acids and evaluation as a proxy for palaeoenvironmental nitrogen baseline
11:15	Niklas Hausmann	The ups and downs of elemental analyses on mollusc shells
11:30	Christoph J. Gey	Applying QGIS to manage data in sclerochronology
11:45	Bernd R. Schöne	Equilibrium oxygen isotope fractionation and empirical paleothermometry equations: Critical assessment
13:15	Haotian Yang (ONLINE)	Potential interspecific differences in the indirect effect of light intensity on the sub-daily shell Sr/Ca and Mg/Ca ratios of two Tridacna species
13:30	**James Scourse**	**KEYNOTE: IMPACTS ON ECOSYSTEMS & POLLUTION** ***Ecosystem and biodiversity reconstructions from molluscan bivalve sclerochronologies***
14:00	Ethan L. Grossman	Temperature, discharge, and mussel growth during the last 150 years in the Brazos River, TX – A clumped isotope study
14:15	Andrew Graham	A 250+ year highly-resolved record of Hg in *Arctica islandica* shells from the Gulf of Maine
14:30	Maria Hussain	A lifetime of listening: mining related environmental contamination in fish otoliths across trophic levels
14:45	Matthew Mason	Sclerochronological evidence for recent benthic marine warming in the English Channel
15:15	Michael Cornish	Wavelet analyses reveal the scales of SST-driven synchrony in Pismo clam (*Tivela stultorum*) shell growth chronologies across their full latitudinal range
15:30	Max Castorani	Climate variability, not ecosystem state, drives long-term growth in seagrass-dwelling clams (*Mercenaria mercenaria*)
15:45	Jingzhuo Wang (ONLINE)	Assessing Environmental Stresses in Bivalve *Mercenaria mercenaria* from Tokyo Bay, Japan Using Shell Stable Isotope Records and Automated Growth Chronology Reconstruction
16:00	Ching-Tsun Chang (ONLINE)	Baleen Plates as High-Resolution Archives for Reconstructing Long-Term Nutrient Utilization in Large Vertebrates
17:00	**POSTER SESSION (until 20:00)**	

ORAL PRESENTATIONS SCHEDULE

FRIDAY MAY 8TH , 2026

TIME	PRESENTER	TITLE
		IMPACTS ON ECOSYSTEMS & POLLUTION (Continued)
8:45	Natasha Leclerc	Retracing food web shifts in Burrard Inlet (səl̓ilw̓ət, British Columbia, Canada) since industrialization with archaeological and modern clam (*Saxidomus gigantea and Leukomea staminea*) shell collections: A phytoplankton dynamics proxy evaluation
9:00	Anna-Cae Fuller	Investigating invader responses: Thermal niche insights from oxygen isotope sclerochronology of *P. maculata*
9:15	**Vincent Raoult**	**KEYNOTE: Fisheries Ecology, Management & Conservation**
9:30		***Soft skeletons, tough sclerochronology? Elasmobranch tissues for historical data***
9:45	Evan Edinger	Growth rates and carbonate production in two Northwest Atlantic calcareous large gorgonian octocorals
10:00	Wilder Greenman	Decadal variability in surface nutrient export recorded by deep-water corals in the Northwest Atlantic
10:15	Khady Diop (ONLINE)	Growth patterns and microchemical composition of the bloody cockle (*Senilia senilis*) shell along the gradient of the Sine-Saloum inverse estuary
10:45	Philip Jacobson	Assessing individual variation in habitat use of European eel along a unique salinity gradient using otolith microchemistry
11:00	Sanja Matić-Skoko	The microchemistry of European eel otoliths from different habitats in the Neretva estuary (Croatia) predicts/showed habitat variability due to anthropogenic activities
11:15	Tracey Loewen	Brackish water use of Burbot (*Lota Lota*) in the Western Canadian Arctic
11:30	Cerys Condran (ONLINE)	Age validation of Patagonian toothfish
11:45	Walter Rogers (ONLINE)	Validation of annual growth zone formation in gray triggerfish *Balistes capriscus* dorsal spines, vertebrae, and otoliths

ORAL PRESENTATIONS SCHEDULE

SATURDAY MAY 9TH , 2026

TIME	PRESENTER	TITLE
8:45	Steven E. Campana	Can otolith growth increments be used to reveal the age of sexual maturation in fish?
9:00	Lisa Spotowitz	Unlocking archival otoliths: Developing a non-destructive method to analyze museum otoliths for historical life-history reconstructions
9:15	Armagan Sabetian (ONLINE)	Unravelling baselines through time-series analysis of otolith chemistry
9:30	**Gaia Crippa**	**KEYNOTE: SCLEROCHRONOLOGY IN DEEP TIME** ***Shells through time: challenges and opportunities of the fossil bivalve archive***
10:00	Kirstin Brink	Chronology of colour banding in a Cretaceous-aged marine reptile tooth
10:15	Manja Hethke	Modern-like Asian monsoon in South China during the late Oligocene
10:45	Thomas Lechner	Sclerochronology of freshwater pearl mussels (*Margaritifera (pseudunio) flabellata*) from the early late Miocene hominid locality Hammerschmiede, Bavaria, Southern Germany
11:00	Andrew Johnson (ONLINE)	Intraformational changes in marine climate, water isotopic composition and bivalve community from combined $\delta^{18}O$ and Δ^{47} analysis of late Cenozoic shells from the UK and USA
11:15	Ennie Schulze	Seasonal variability during the Gelasian-Calabrian transition recorded by sclerochronological stable isotopes in lacustrine gastropods (Kos, Greece, Eastern Mediterranean)
11:30	Linda Ivany	Faster life histories for *Arctica islandica* during mid-Pliocene warmth in Iceland
11:45	Ellie Nelson	Advances in amino acid geochronology of bivalve shells: A complementary technique for sclerochronology
13:15	Zheng Fang	Tidal cycles echoed in oyster shell micro-growth increments: A method to calibrate seasonal paleotemperature reconstructions
13:30	**Asier García-Escárzaga**	**KEYNOTE: ARCHAEOLOGY** ***Sclerochronology in archaeology: Inferring seasonality of mollusc collection and past climate conditions***
14:00	Sadie Louise Weber (ONLINE)	Fluvial Sambaquis of Southwestern Amazonia: Indicators of Middle to Late Holocene climate dynamics
14:15	Julien Thébault	Fortnightly-resolved reconstruction of West African monsoon variability over the last two millennia from *Senilia senilis* shell middens
14:30	Chloe Stringer	Investigating shell-matrix deposits at the Neolithic site of Ginnerup (Denmark): Insights from zooarchaeological and sclerochronological analyses on mollusc remains
15:00	Jean-François Cudennec	Remarkable single-fishing event reveals exceptionally cold winter conditions during the Atlantic/Subboreal transition in Brittany, France
15:15	Amy Prendergast	A high-resolution stable isotope record of Holocene palaeoclimate and seasonality in the central Mediterranean
15:30	C. Fred T. Andrus	Exploring European flat oyster (*Ostrea edulis*) for season of capture analysis
15:45	Melita Peharda	Sclerochronological analysis of mussel shells from a Neolithic near-coastal cave site in the eastern Adriatic Sea
16:00	Meghan Burchell	The exploitation of the bivalve *Cerastoderma glaucum* in Hellenistic Epetion, Eastern Adriatic coast

POSTER PRESENTATIONS SCHEDULE

7TH INTERNATIONAL SCLEROCHRONOLOGY CONFERENCE 2026

THURSDAY MAY 7TH , 2026, 17:00 – 20:00 NST

PRESENTER	TITLE
BIOMINERAZITION & KINETICS	
Bohao Dong	Visualising and quantifying Mg/Ca and Sr/Ca heterogeneity in the isochronous growth increments of bivalve shells (*Tridacna*)
Montserrat Ramón Herrero	Disentangling the shell of the gastropod *Bolinus brandaris*: Inner structure and implications for the growth process
PALEOCLIMATES & PALEOENVIRONMENTS	
Gozde Degirmen	Stable oxygen ($\delta^{18}O$) and carbon ($\delta^{13}C$) isotope analysis of Late Cretaceous Oyster shells from Mooreville Chalk in the southern Western Interior Seaway (WIS) : Preliminary Paleoenvironmental Interpretations
Erin Kim	Observing Mio-Pliocene Gulf Stream Variability Using Δ^{47}-derived $\delta^{18}O_{water}$ Values and $\delta^{18}O$ Sclerochronology
Eric Waters	Investigating reproductive changes of Chione over a regional extinction using isotope and Ba/Ca sclerochronology
Bernd R. Schöne	Shells of *Littorina littorea* (*Gastropoda*) provide an archive for palaeoclimate and seasonal shellfish collection practices – an example from Orkney
Blake DePhillips	Reconstructing past marine climate variability in the Central Gulf of Maine (Isle au Haut) from growth increments and oxygen isotopes of the marine bivalve *Arctica islandica*
Carin Andersson	Constraining Arctic-Atlantic sea-ice variability using coralline algae archives: Insights from Svalbard
David Reynolds	Evaluating annually resolved marine variability in the North Sea over the last 500 years
David Reynolds	A multi-proxy evaluation of the spatiotemporal stability of the North Atlantic cold blob over the last five centuries
Alex Quizon	Late Pleistocene Atlantic Coastal Plain paleoclimate and paleoceanography reconstructions via molluscan traditional stable and 'clumped' isotope sclerochronology
Catherine Layfield	Exploring rhodolith growth habit variations in the Gulf of Mexico
Garrett Braniecki	Comparing low- and mid-latitude seasonal amplitudes using clumped isotopes as recorded in Plio-Pleistocene *Mercenaria* spp.
Tamara Trofimova	Evaluating annually resolved marine variability in the North Sea over the last 500 years
Diana Thatcher	Master shell chronology and multi-proxy geochemical records illustrate oceanographic variability in the mid-Atlantic Region (USA) since 1800 CE
Tessa Giacoppo	Deep-water gorgonian corals reveal decadal-scale variability in the composition of export productivity in the rapidly warming Northwest Atlantic margin

POSTER PRESENTATIONS SCHEDULE

THURSDAY MAY 7TH , 2026, 17:00 – 20:00 NST

PROXY DEVELOPMENT & OPTIMIZATION	
Yunhan Fang	Validating sampling and data-processing methods in high-resolution carbonate clumped isotope (Δ47) sclerochronology using Mercenaria mercenaria for reconstructing paleoseasonality
Alan Wanamaker	Sclerochronology on YouTube: Providing learning opportunities, broadening early career engagement, and developing community
Sudakshina Sinha	Assessment of Subantarctic crustose coralline algae as marine climate archives
Jacob P. Warner	*Helisoma (Planorbella) trivolvis*: A potential paleoclimate and paleo-weather archive for North America
Hunter Hughes	The TimeWarp Package: Obtaining robust geochemical timeseries from laser ablation mass spectrometry for paleoclimate applications
Lena Yuesha Li	Unlocking rhodoliths as paleoceanographic archives
Amanda Hauser	Evaluating SIMS-based oxygen isotopes from P. Generosa (geoducks) to monitor climate variability in the Northeast Pacific
Iza Pawlowski	Multi-site evaluation for the potential of lithium as a proxy in the coralline alga *Clathromorphum compactum* for high-latitude sea surface paleotemperature archiving
David Reynolds	Establishing a modular high-precision micro-sampling system
Daniel Thomas Vigelius	Simulating shell diagenesis: An In vitro approach
Madelyn Mette	Combined analysis of oyster shell carbon and oxygen isotope geochemistry along a salinity gradient in Tampa Bay, Florida
Barbara de Moura Neves	Trace element variations in sea pens (*Cnidaria: Octocorallia*): Potential indicators of environmental change

POSTER PRESENTATIONS SCHEDULE

THURSDAY MAY 7TH , 2026, 17:00 – 20:00 NST

PRESENTER	TITLE
IMPACTS ON ECOSYSTEMS & POLLUTION	
Maya Smith	Nitrogen isotopic records from modern and archaeological freshwater mussels in the Florida Everglades
Ashlee Vachon	The perks of opercula: Sclerochronological comparison of trace element composition in otoliths and opercula
Megan MacKinnon	The North Eastern Oyster: An isotopic study of oyster populations extended beyond their species range on the island of Newfoundland, Canada
FISHERIES ECOLOGY, MANAGEMENT & CONSERVATION	
Philip Jacobson	Making the invisible visible without preparation – using Micro-XRF for non-destructive analyzes of element composition and distribution of biological samples
Mišo Pavičić	Tracing adult *Sparus aurata* to nursery origins using elemental otolith fingerprints
Krista Greeley	Growth ring morphology, axial and radial growth rates in six species of Northwest Atlantic sea pens (*Cnidaria: Octocorallia*)
Melita Peharda	Isotopic records from the Variegated Scallop, *Mimachlamys varia*
Sílvia Pérez-Mayol	Disentangling the growth of *Bolinus brandaris* (*Gastropoda: Muricidae*) by means of an experimental calcein sequential
Logen Mikal Flem	Unvalidated age and longevity estimates lead to uncertainty of the true extinction risks of Chondrichthyans
SCLEROCHRONOLOGY IN DEEP TIME	
Yitao Huang	Tracing Late Cretaceous paleoclimate in the Mississippi Embayment through isotopic records from rudists
ARCHAEOLOGY	
Amy Prendergast	Sclerochronology partnership research with Aboriginal and Torres Strait Islander communities to aid Indigenous-led management of Sea Country
Freya Cordell	Growth analysis of *Saxidomus gigantea* as a proxy for seasonal sea ice extent
Sarah Kuehn	Increasing precision in SST reconstruction in British Columbia, Canada, using $\delta^{18}O$ and Sr/Ca of marine bivalves from archaeological sites
Chia-Cheng (Jason) Ku	Reconstructing seasonal upwelling and indigenous resource use using high-resolution pipi shells (*Plebidonax deltoides*)

BIOMINERALIZATION & KINETICS

Microstructure matters!

Dr. Elizabeth Harper
University of Cambridge

Sclerochronologists who use molluscan and brachiopod shells as targets rely on having an understanding on how these biocomposites form and also being able to access a common vocabulary of microstructural terms and landmarks in order to be able to compare data and interpretations. Detailed work has been going on for at least 60 years, but it is often mired in bewildering terms with a wide array of different microstructures described, with consequential uncertainties about homology between microstructures and layers within a shell.

In recent years much work has been invested in describing microstructures, using a battery of sophisticated techniques for example, SEM, TEM, EBSD, thermogravimetric analysis and histological studies, in a way that attempts to defines both the crystalline and the organic components, and to understand the similarities and 'genetic' relationships rather than describing everything as 'different'. It is clear that microstructural types and layer arrangements are reasonably distinct and conservative amongst different taxa (hence their value as phylogenetic markers) though with latitude for ecophenotypic or environmental variation in for example organic content or crystal unit size. It is possible to understand the evolution of particular microstructures on geological timescales along particular phylogenetic trajectories. However, it is equally clear that there is a broad spectrum of microstructural types from those which have a very strong biological control, characterised by highly order, hierarchical arrangements with a high organic matrix (inter and intra-crystalline) content and those where, organic content is either very low or non-existent, which are much more reminiscent of inorganic cements.

The classic text-book view suggests that molluscan and brachiopod (assuredly separate phylogenetic entities, and so convergently) secrete shell material by the mantle across a capacious fluid-filled extrapallial space on to the inner surface an organic periostracal sheet. But this view is now challenged on several fronts. For several described microstructures we can now see that mineralization begins within the periostracal sheet not on it, and that the extrapallial space in many of the more highly order molluscan and brachiopod microstructures is nanometric, with a very close association between mantle and forming cells. Furthermore, it is now clear for both molluscs and brachiopods that a single biomineral unit (such as a fibre or plate) may be secreted by the concerted action of more than cell and that a single cell may be simultaneously secreting both organic membranes and calcareous material. Successive shell layers of different microstructure are produced by a zoned mantle with sophisticated proteomic shifts in the basic biomineralization toolkit.

Where does this leave the sclerochronologist? I will attempt to review the relevant changes in our understanding and provide a clear rationale for recognising and describing microstructures and their topological relationships in a way that allows meaningful comparison of data.

ABSTRACTS
KEYNOTES

PALEOCLIMATES & PALEOENVIRONMENTS

Drivers of Indo-Pacific Oceanic Exchange: Insights from Corals and Ocean Models

Dr. Sujata Murty
University of Albany, SUNY

The Maritime Continent provides pathways for heat and freshwater transport from the Pacific to the Indian Ocean, serving as an important oceanic teleconnection for Indo-Pacific climate. Yet, the short length of robust observational datasets limits examination of past Maritime Continent and Indo-Pacific Warm Pool variability. Coral proxy records allow insights into variability on seasonal to multi-decadal timescales prior to the period of satellite and in situ observations. In this talk, I will present seasonally resolved coral proxy records (coral δ18O and Δ14C) and synthesize these records with in situ observations and ocean model simulations to explore drivers of seasonal to multi-decadal variations across the Indo Pacific Warm Pool (western Pacific, Maritime Continent and central Indian Ocean). I will discuss the role of key climate modes in driving upper ocean Indo-Pacific variability, including the Interdecadal Pacific Oscillation, El Niño Southern Oscillation and East Asian Monsoon. Such proxy-model comparison is critical for understanding future changes in global heat distribution and Indo-Pacific climate, highlighting the importance of records that resolve climate-ocean interactions beyond recent decades and provide important context for projecting future changes.

PALEOCLIMATES & PALEOENVIRONMENTS

Utilizing a network of Arctica islandica records and model simulations to investigate past regional ocean dynamics in the rapidly warming western North Atlantic

Dr. Nina M. Whitney
University of Albany, SUNY

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The complex changes occurring in modern day oceans require an understanding of long-term regional processes to contextualize current observations and guide future projections. As sclerochronology continues to grow in the field of paleoclimatology, the ability to build networks of shell-based, hydrographic reconstructions has become critical to understanding complex oceanic regions in the past. This comprehension is particularly critical in areas like the rapidly warming western North Atlantic, where the confluence of multiple major ocean currents and water masses create a complex hydrodynamic system. This presentation will discuss efforts to build a network of six shell-based hydrographic reconstructions on the continental shelf off the eastern coast of the United States, ranging from the southern Mid-Atlantic Bight to the northern Gulf of Maine. Reconstructions utilize annually- to decadally-resolved oxygen isotope records from Arctica islandica shells and vary in length from ~60 years to over 300 years. At some sites, radiocarbon and nitrogen isotope records have also been developed. Reconstructions reveal both coherent warming within the last ~50 years as well as deviations in variability between sites farther back in time, likely indicating multiple oceanographic processes affecting these different regions. Such variability was further investigated using a hierarchy of numerical model simulations, including a fully coupled, global climate model (Community Earth System Model – Last Millennium Ensemble) and a high-resolution ocean model (VIKING20X). Combining sclerochronological records with model simulations enables a more thorough investigation and interpretation of past regional oceanic changes in order to contextualize the rapid changes observed today.

ABSTRACTS
KEYNOTES

PROXY DEVELOPMENT & OPTIMIZATION

Utilizing a network of *Arctica islandica* records and model simulations to investigate past regional ocean dynamics in the rapidly warming western North Atlantic

Dr. Niels de Winter
Vrije Universiteit

Climate variability happens at a wide range of timescales but, due to the scarcity of suitable archives for hourly to decadal scale variability, we know very little about the behaviour of the climate system on these short timescales in the geological past. Mollusc shells present themselves as unique archives to fill this gap in our understanding, if we can read climate information them. In this presentation, I will expose some of the tools we use to understand how shell mineralization happens on short timescales. I will show how we can select the best-preserved fossil shell material to characterize ancient climates. I will discuss how information from those climates can teach us how Earth's climate changes in response to different forcings, and hold clues for our future climate. I will show some results of the high-resolution climate reconstructions we can do when we successfully decode the diaries of ancient molluscs. Finally, I will provide an outlook into an emerging application for sclerochronology: The reconstruction of paleo-weather patterns.

IMPACTS ON ECOSYSTEMS & POLLUTION

Ecosystem and biodiversity reconstructions from molluscan bivalve sclerochronologies

Dr. James Scourse
University of Exeter

Over the past 25 years, much of the motivation for research in molluscan bivalve sclerochronology has been in reconstructions of the ambient external physical environment. This motivation has been stimulated by 1. the need to provide enhanced understanding of the role of the ocean in climate change and 2. the realisation that the chronological precision, replication and fidelity of these annually-resolved timeseries from long-lived species such as *Arctica islandica* and *Glycymeris glycymeris* can reveal histories of toxicity and pollution that are consistent with the timescales of the human activity generating these impacts. When appropriately calibrated with instrumental data and crossdated, growth increment series, stable oxygen and carbon isotope, and radiocarbon, data enable reconstructions of seawater temperature and density, ocean circulation, and the marine Suess effect (Butler et al. 2009; Wanamaker et al. 2012; Reynolds et al. 2016). Annual resolution enables precise temporal correlation between series facilitating large spatial scale network analyses that reveal basin-scale modes of climate variability (Reynolds et al. 2018) and the identification of systemic tipping points (Arellano-Nava et al. 2025). These data provide long-term series that extend beyond the duration of instrumental series and even prior to significant human perturbation of the climate system; these records are therefore invaluable for assessing climate model ensembles and contribute to the identification of forcing mechanisms (Halloran et al. 2020).

It is now recognised that these molluscan sclerochronological series register changes in the ecological environment in addition to the physical system. Correlations between different annually resolved biological archives (bivalve, tree-ring, fish otolith; Black et al. 2014) that reveal large-scale ecosystem shifts, often in response to climate change, can be termed extrinsic reconstructions. Intrinsic reconstructions involve the interpretation of data from within bivalve growth increments that facilitate the interpretation of changes in the biodiversity and functioning of the ambient ecosystem. Examples of these intrinsic data include environmental DNA preserved in shell carbonate (der Sarkissian et al., 2017) enabling biodiversity assessment, the interpretation of changes to fish stocks via $\boldsymbol{\delta}^{13}C$ series (Estrella Martinez et al. 2019) and Ba trace element data revealing changes in primary productivity (Fröhlich et al., 2022). Stable bulk $\boldsymbol{\delta}^{13}C$ and $\boldsymbol{\delta}^{15}N$ analyses of the organic fraction of shell carbonate (Schöne & Huang 2021) are now being complemented by data revealed by novel technical developments in compound specific $\boldsymbol{\delta}^{13}C$ and $\boldsymbol{\delta}^{15}N$ (CSIA) analyses of amino acids in bound organic matter as part of the ERC SEACHANGE Project (Huang et al. 2023). For example, changes in baseline source amino acid, $\boldsymbol{\delta}^{15}N$ phenyalanine, in *Arctica* shell, a primary consumer, enable CSIA data of coeval higher trophic level fish bone to discriminate between environmental and human-induced changes (i.e. trophic cascade vs. feeding down forced by human exploitation of fish stocks).

The ability to reconstruct long parallel timeseries of both the physical and ecological system from the same material is invaluable since it facilitates the impact of the physical system on biodiversity and ecosystem changes, and the discrimination of human induced vs. external environmental/climatic forcings.

FISHERIES ECOLOGY, MANAGEMENT & CONSERVATION

Soft skeletons, tough sclerochronology? Elasmobranch tissues for historical data

Dr. Vincent Raoult
Griffith University

Sclerochronology is a staple of fisheries management for teleosts and bivalves. However, directly applying concepts used for those taxa to one of the other largest and most conservation-dependent groups in fisheries, elasmobranchs, can be problematic. While vertebrae, which are used to age elasmobranchs, appear analogous to fish otoliths, many studies including my own have challenged the validity of this concept. Here I will discuss the complexities of using elasmobranch tissues for sclerochronology, with a deep dive into vertebral formation, elemental profiling, growth interpretation, inter-specific differences and the use of other alternative tissues.

SCLEROCHRONOLOGY IN DEEP TIME

Shells through time: challenges and opportunities of the fossil bivalve archive

Dr. Gaia Crippa
Università degli Studi di Milano

Bivalve shells are excellent archives of environmental proxies, providing a rich source of information for reconstructing Earth's deep and recent past. Abundant in the benthic fossil record and spanning more than 500 million years of evolutionary history, they represent an invaluable archive for understanding their palaeobiology and reconstructing evolution and palaeoecology. Their accretionary shells record the physical and chemical conditions of the environment in which they lived, making them particularly suitable for sclerochronological and geochemical analyses.

Despite their great potential, the sclerochronological study of fossil bivalves presents a number of fundamental challenges. Diagenetic alteration can obscure original growth patterns and modify shell mineralogy, microstructure, and geochemical signals, requiring rigorous screening and preservation assessment prior to analysis.

Here, the main challenges associated with sclerochronological analyses of fossil bivalve shells are explored through case studies from different stratigraphic contexts, ranging from the Jurassic to the Holocene. Key issues encountered when using fossil biotic archives include: (a) the absence of modern analogues for extinct taxa, as exemplified by Lower Jurassic aberrant bivalves such as lithiotids from Italy; (b) uncertainties related to assumptions about ancient seawater $\delta^{18}O$ values and stable isotope interpretations in settings affected by salinity variations, as observed in Lower Pleistocene bivalves from the Arda section (Italy); and (c) species selection and thermal alteration induced by anthropogenic activities, as documented in Holocene bivalves from archaeological contexts in Oman.

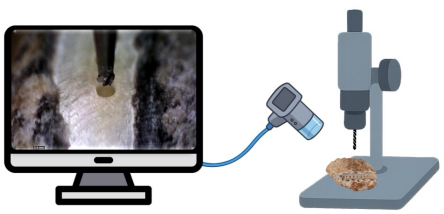
Despite these challenges, which must be carefully considered but can often be overcome, fossil bivalves remain among the most powerful archives for high-resolution reconstructions of past oceanic conditions, offering multiple opportunities to explore the Earth's past. Moreover, sclerochronological analyses of fossil shells also provide valuable insights into the growth rates, life spans and palaeobiology of extinct species, contributing to a better understanding of the evolution of marine ecosystems and organisms that inhabited our planet in the past.

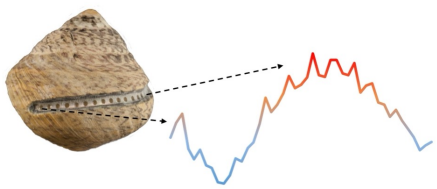
ARCHAEOLOGY

Sclerochronology in archaeology: Inferring seasonality of mollusc collection and past climate conditions

Dr. Asier García-Escárzaga
University of Burgos

The application of sclerochronological approaches in archaeology has notably increased over the last decades. Stable oxygen isotope (δ18O) and trace element ratio values from mollusc shell remains have become powerful tools for determining the season or seasons during which shellfish were harvested by past hominin populations, as well as for evaluating the role of intertidal resources in their annual subsistence strategies. Moreover, δ18O and element ratio values have frequently been used to infer past sea surface temperatures and to assess the impact of climate changes on human ecology. In this paper, three case studies from archaeological sites dated to the Mesolithic and Middle Palaeolithic in Europe, and pre-Columbian period in Bolivia are presented to highlight the insights gained from applying $\delta^{18}O$ analyses to marine and terrestrial gastropods. $\delta^{18}O$ values from Phorcus lineatus topshells recovered from the Mesolithic shell midden at El Mazo (N Spain) and Phorcus turbinatus species from the Middle Palaeolithic site of Los Aviones (S Spain) have shown that both anatomically modern humans (AMH) and Neanderthals inhabiting coastal areas of the Iberian Peninsula developed complex seasonal strategies for collecting marine molluscs, maximising meat yield from coastal resources while minimising health risks. Additionally, sclerochronological analyses of freshwater Pomacea spp. from the forest island of Los Chuchíos (Bolivia) have revealed, for the first time, how pre-Columbian populations adapted to the Amazonian savannah, which was seasonally inundated for several months each year.





ABSTRACTS
ORAL PRESENTATIONS

BIOMINERALIZATION & KINETICS

Time: **9:30 – 9:45 AM [Wednesday, May 6th, 2026]**

Title: **Active ion transport drives daily elemental cycles in tridacna shells: Insights from culturing experiments**

Authors: **Arndt, Iris** 1,2; Erez, Jonathan 3; Evans, David 4 ; Erhardt, Tobias 1,2 ; Levi, Adam 3 ; Müller, Wolfgang 1,2

Affiliations: 1 Institute of Geosciences, Goethe University Frankfurt, Frankfurt am Main, Germany; 2 Frankfurt Isotope and Element Research Center (FIERCE), Goethe University Frankfurt, Frankfurt am Main, Germany; 3 Fredy & Nadine Herrmann Institute of Earth Sciences, Hebrew University of Jerusalem, Jerusalem, Israel; 4 School of Ocean and Earth Science, University of Southampton, Southampton, United Kingdom

Tridacna shells are known as valuable archives of past environmental changes, as they feature daily to multidecadal variability in elemental ratios (El/Ca). However, the mechanisms behind the formation of daily elemental cycles and coupled growth bands remain unclear. In controlled experiments, we used ^{135}Ba-labelled seawater in alternating 12-hour intervals to distinguish day and night shell growth. Results showed calcification rates five times higher during the day than at night. Elements from the surrounding seawater are incorporated into the shell within tens of minutes, with a full replenishment of the extrapallial fluid composition likely occurring within one day. Most measured elemental ratios (B/Ca, Mg/Ca, Sr/Ca, Ba/Ca) decrease throughout the day but increased during the night, with Na/Ca showing the opposite pattern. El/Ca peaks occur in the early morning or evening, just before 7:30 AM and 7:30 PM, respectively. Daily El/Ca cycles are likely driven by active transport of Ca^{2+} and HCO_3^- to the calcification site, influenced by light, energy availability from photosymbionts and filter feeding, and possibly circadian rhythms – not just chemical fractionation. Light activated ion transport may also regulate daily growth rates, shell structure, and organic content.

Time: **9:45 – 10:00 AM [Wednesday, May 6th, 2026]**

Title: **Evaluating vital effects on stable oxygen isotope ratio of biogenic carbonates and its coupling with trace element concentrations**

Authors: **Yumiba, Mahiro** 1l Nakamura, Masahiro 2; Yoneda, Michio 2; Higuchi, Tomihiko 3; Ishimura, Toyoho 4 ; Nishida, Kozue 5 ; Ito, Shin-ichi 6; Shirai, Kotaro 6

Affiliations: 1 School of Science, The University of Tokyo, Tokyo, Japan; 2 Fisheries Technology Institute, Japan Fisheries Research and Education Agency, Imabari, Japan; 3 Graduate school of Agriculture, Ehime University, Matsuyama, Japan; 4 Graduate School of Human and Environmental Studies, Kyoto University, Kyoto, Japan; 5 School of Environment and Society, Institute of Science Tokyo, Tokyo, Japan; 6 Atmosphere and Ocean Research Institute, The University of Tokyo, Kashiwa, Japan

Vital effects that influence stable oxygen isotope ratio ($\delta^{18}O$) on biogenic carbonate creates the major uncertainties in paleotemperature reconstructions. However, it remains difficult to account for species-specific vital effects. Therefore, we aimed to quantify the impacts of these effects on $\delta^{18}O$ and establish potential trace element indicators for correcting vital effects. We employed an experimental design that excludes factors potentially induce variations in δ18O other than vital effect. We reared two species of bivalves (*Ruditapes philippinarum* and *Anadara broughtonii*) and one species of fish (*Engraulis japonicus*) in the same tank. We analyzed $\delta^{18}O$ and trace element compositions of their biogenic carbonates using identical analytical setups and protocols. The $\delta^{18}O$ values of A. broughtonii were up to 0.8‰ higher than those of R. philippinarum. The $\delta^{18}O$ values of the bivalves were up to 0.6‰ lower than those of E. japonicus. Although the organisms experienced the same environmental conditions and were analyzed using identical methods, their $\delta^{18}O$ values differed. Such offsets indicate that species-specific vital effects were responsible across different species and taxa. Trace element analyses showed that $\delta^{18}O$ deviations from isotopic equilibrium (Kim et al., 2017) had significant negative correlations with B/Ca, Sr/Ca, and Ba/Ca ratios. These results indicate that these elements can be used as chemical proxies for vital effects that alter $\delta^{18}O$. Moreover, δ18O value and B/Ca ratio of bivalves showed a significant negative correlation with metabolic carbon proportion (MC). This result indicates that common metabolic processes may influence both $\delta^{18}O$ and the B/Ca ratios in bivalve shells.

ABSTRACTS
ORAL PRESENTATIONS

BIOMINERALIZATION & KINETICS

Time: **10:00 – 10:15 AM [Wednesday, May 6th, 2026]**

Title: **Evaluating vital effects on stable oxygen isotope ratio of biogenic carbonates and its coupling with trace element concentrations**

Authors: **Kutzner, Theresa 1** Struck, Ulrich 1, 2; Rüdiger, Gina, 1; Riedel, Frank, 1

Affiliations: 1 Institut für Geologische Wissenschaften, Fachbereich Geowissenschaften, Freie Universität Berlin, D-12249 Berlin, Germany; 2 Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung, D-10115 Berlin, Germany

Sclerochronological stable isotope measurements ($\delta^{13}C$ and $\delta^{18}O$) in fish otoliths are essential for reconstructing ecological histories and past environmental conditions. Temperature reconstructions in particular rely on the temperature-dependent fractionation of ^{18}O between ambient water and otolith carbonate. However, otolith mineralogy is complex, and various $CaCO_3$ polymorphs (aragonite, calcite, vaterite) may occur depending on species and otolith type (asteriscus, sagitta, lapillus). Because these polymorphs differ in their fractionation behaviour, constraining otolith mineralogy is critical for reconstructing temperatures.This study examines how otolith mineralogy influences $\delta^{13}C$ and $\delta^{18}O$ values and the extent to which mineralogical variability may bias temperature reconstructions. We geochemically analysed 32 lapilli and 27 asterisci from 17 *Labeobarbus aeneus* specimens collected from the Katse Reservoir system, Lesotho. Our approach includes (1) age assessment, (2) qualitative mineralogical characterisation of lapilli and asterisci using Raman spectroscopy and (3) bulk and sclerochronological stable isotope analyses of otolith carbonates. Age estimates for the investigated specimens range from two to ten years. Raman spectroscopy revealed that *L. aeneus* lapilli are predominantly aragonitic, whereas asterisci are mainly vateritic, consistent with cyprinid otolith mineralogy. An offset of ≈0.25‰ in bulk carbonate $\delta^{18}O$ between aragonitic lapilli and vateritic asterisci implies that unaccounted mineralogical differences constrain the accuracy of absolute temperature reconstructions. Sclerochronological $\delta^{13}C$ and $\delta^{18}O$ patterns broadly covary at annual resolution, with $\delta^{13}C$ values increasing across the lifetime, reflecting a shift toward higher trophic levels and reduced metabolic rates. The $\delta^{18}O$ values rise during the first three years before stabilising, suggesting an age-related shift towards colder habitats.

Time: **10:15 – 10:30 AM [Wednesday, May 6th, 2026]**

Title: **Where do those elements go in a fish's body, before ending up in otoliths? A speculation with some evidence**

Authors: **Limburg, Karin E. 1, 2;** Heimbrand, Yvette 2

Affiliations: 1 Department of Environmental Biology, SUNY College of Environmental Science and Forestry, Syracuse, NY USA; 2 Department of Aquatic Resources, Swedish University of Agricultural Sciences, Uppsala

The term "vital effects" covers a range of phenomena that affect the incorporation of elements and their isotopes into calcified structures. Metabolic influences (e.g., temperature, pH, dissolved oxygen) can alter biomineralization rates. In the case of fish otoliths, delays in commonly measured elements such as strontium, barium, and manganese have been documented. But once taken up, whether by ingesting food or directly from water, might these elements be found? Using empirical observations and experimental studies, we speculate on plausible internal reservoirs. Specifically, we hypothesize that barium and strontium are stored in bones with rapid turnover, and manganese is stored in liver. Further, we hypothesize that magnesium has a much shorter time to incorporation, thus more directly reflecting metabolic activity. We suggest approaches for future study of these internal reservoir effects.

ABSTRACTS
ORAL PRESENTATIONS

BIOMINERALIZATION & KINETICS

Time: **10:00 – 10:15 AM [Wednesday, May 6th, 2026]**

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Authors: **Kutzner, Theresa 1** Struck, Ulrich 1, 2; Rüdiger, Gina, 1; Riedel, Frank, 1

Affiliations: 1 Institut für Geologische Wissenschaften, Fachbereich Geowissenschaften, Freie Universität Berlin, Berlin, Germany; 2 Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Berlin, Germany

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Time: **10:15 – 10:30 AM [Wednesday, May 6th, 2026]**

Title: **Where do those elements go in a fish's body, before ending up in otoliths? A speculation with some evidence**

Authors: **Limburg, Karin E. 1, 2;** Heimbrand, Yvette 2

Affiliations: 1 Department of Environmental Biology, SUNY College of Environmental Science and Forestry, Syracuse, NY USA; 2 Department of Aquatic Resources, Swedish University of Agricultural Sciences, Uppsala, Sweden

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ABSTRACTS
ORAL PRESENTATIONS

BIOMINERALIZATION & KINETICS

Time: **10:45 – 11:00 AM [Wednesday, May 6th, 2026]**

Title: **Active ion transport drives daily elemental cycles in tridacna shells: Insights from culturing experiments**

Authors: **Brand, Uwe** 1; Logan, Alan, 2; Bitner, M. Aleksandra 3; Gaspard, Daniele 4; Rollion-Bard, Claire 5; Lecuyer, Cristophe 6
Morrison, Audrey K. 1, 7

Affiliations: 1 Department of Earth Sciences, Brock University, St. Catharines Ontario L2S3A1 Canada ; 2 University of New Brunswick-in memorium; 3 Institute of Paleobiology, Polish Academy of Sciences, Twarda 51/55, 00-818 Warsaw, Poland; 4 Centre de Recherche en Paléontologie-Paris (CR2P), UMR 7207, MNHN-Sorbonne Université, 8 Rue Buffon (CP 38), 75005, Paris, France ; 5 Laboratoire des Sciences du Climat et de l'Environnement (LSCE), CNRS, CEA, UVSQ, Université Paris-Saclay, 91191 Gif-sur-Yvette, France ; 6 UMR 5125 CNRS-Campus -Doua, Paleoenironnements et Paleobiosphere, Universite Claude Bernard, Lyon 1, Bat 402, 27-43 Boulevard du 11 Novembre 1918, 69622 Villeurbanne Cedex, France; 7 Department of Earth Sciences, University of Western Ontario, London, ON Canada

Acquisition of high-resolution analyses of geochemical results archived within shells coupled with HD microstructures form the hierarchical temporal framework of brachiopod shells. This high-powered analytical combination gives us a clearer picture on their biomineralization and evolution. The so-called 'vital effect' has made the primary layer – a non-grata – configuration for additional geochemical investigations, while underlying problems persist with the secondary/tertiary layers. Thus, the potential for sclerochronological studies of brachiopod shells remains mostly unrealized and lags far behind studies of other carbonate accreting/secreting marine organisms. Despite their dominance during the Paleozoic and getting more recognition in the modern oceans, many problems remain regarding the temporal process marked by the various growth markings. Discovery of growth lines/bands in the primary layer (A) is highly important, especially when combined with the geochemical profile, because it records an exceptionally detailed seasonal trend within *Terebratalia transversa* (B). Ancient brachiopods, although made of diagenetically resistant low-Mg calcite, are prone to physical processes that may degrade their shell morphology and configuration and thus complicate sclerochronological investigations. We will provide an overview ranging from the early days of geochemistry on modern and ancient brachiopods and its progression to the current state of brachiopod sclerochronology. The primary layer calcite offers a strong case for sclerochronology in *T. transversa* and supports the von Bertalanffy growth conditions with increasing maturity. A re-visit of other modern and ancient brachiopods from intertidal and other zones makes scientific sense in re-evaluating their isotopic compositions and how it may contribute to better seasonal and growth interpretations.

ABSTRACTS
ORAL PRESENTATIONS

PALEOCLIMATES & PALEOENVIRONMENTS

Time: **11:30 – 11:45 AM [Wednesday, May 6th, 2026]**

Title: **Well-replicated coral Ba/Ca records in the Gulf of Chiriquí, Panama reconstruct river discharge with implications for recording global climate teleconnections**

Authors: **Brenner, Logan D. 1** ; Linsley, Braddock K. 2; Huang, Wei 2; Dunbar, Robert D. 3

Affiliations: 1 Department of Environmental Science, Barnard College, New York, NY, USA; 2 Division of Biology and Paleoenvironment, Lamont-Doherty Earth Observatory, Palisades, NY, USA; 3 Department of Earth System Science, Stanford University, Stanford, CA, USA

Along the Pacific Coast of Panama, stony corals growing in the Gulf of Chiriquí (GoC) can serve as successful proxies for the region's hydroclimate. Specifically, the Ba/Ca ratio in corals (Ba/Ca) function as a proxy for river discharge in the GoC. Here we present three near-monthly resolved Porites lobata Ba/Cacor time-series from different locations within the GoC to make conclusions regarding gulf-wide hydroclimate. Regardless of their different locations (near- and off-shore) the three Ba/Cacor records are well correlated (rmin=0.48, rmax=0.92) and replicate one another at monthly, annual average, annual amplitude, wet season average, and dry season average resolutions. A composite coral based on all records is statistically significantly correlated with river discharge, thus we extend the instrumental discharge data with a 300-year reconstruction (~2018-1716 CE). Our reconstructed river discharge record demonstrates a strong and consistent relationship between El Niño events and droughts in Panama with implications for understanding the functioning of the Panama Canal. Therefore, replicated Ba/Cacor records in the GoC are sensitive to regional hydroclimate and global climate teleconnections.

Time: **11:45 – 12:00 PM [Wednesday, May 6th, 2026]**

Title: **Centennial-scale influence of thermal variability on coral growth for a subtropical reef in the southwest Florida Keys**

Authors: **Toth, Lauren T. 1;** Bloomer, S. 1; Jacobs, Jessica A. 1; Stathakopoulos, Anastasios 1; Oberle, Ferdinand K.J. 2; Prouty, Nancy G.; 2 Richey, Julie N. 1; Flannery, Jennifer A. 1

Affiliations: 1 U.S. Geological Survey, St. Petersburg Coastal and Marine Science Center, St. Petersburg, FL, USA; 2 U.S. Geological Survey, Pacific Coastal and Marine Science Center, Santa Cruz, CA, USA

The persistence of coral reefs in a future, warmer world will largely depend on the capacity of corals to tolerate rapidly rising temperatures; however, fully quantifying the thermal limits and energetic trade-offs of coral acclimatization requires longer-term records than typically available from modern-day, ecological-scale studies. The extensive archive of centuries-long coral cores available in the U.S. Geological Survey St. Petersburg Coastal and Marine Science Center provides a unique opportunity to evaluate the influence of long-term marine temperature variability on coral growth. In this study, we used the CoralCT application to conduct a robust, multi-user analysis of computed tomography (CT) scans of 15 coral cores (5 *Orbicella* spp. and 10 *Siderastrea siderea*) from Dry Tortugas National Park in the southwest Florida Keys. We used the CT analyses to reconstruct how coral linear extension, skeletal density, and calcification rates have varied over the last ~200 years. We then compared the trends in coral growth with existing Sr/Ca-based records of past sea-surface temperature variability from those same cores. Our paired sclerochronological and paleoclimatological reconstruction will allow us to evaluate how coral growth was influenced by long-term climate warming as well as to both high and low temperature stress events in the past.

ABSTRACTS
ORAL PRESENTATIONS

PALEOCLIMATES & PALEOENVIRONMENTS

Time: **13:15 - 13:30 [Wednesday, May 6th, 2026]**

Title: **Submarine groundwater discharge into the Plio-Pleistocene Florida Platform suggested by clumped isotope sclerochronology**

Authors: **Sun, Zeyang 1;** Grossman, Ethan L.1

Affiliations: 1 Department of Geology and Geophysics, Texas A&M University, College Station, United States

The great diversity and density of marine molluscan fauna on the Florida Platform suggest a high marine biological productivity. However, it remains unclear whether this enhanced productivity was driven by upwelling or submarine groundwater discharge (SGD). Here, we applied clumped isotope thermometry (Δ^{47}) to Conus shells from two contrasting units of the Plio-Pleistocene Pinecrest Beds to reconstruct the seasonal temperatures ($T\Delta^{47}$) and oxygen isotopes of seawater ($\delta^{18}Ow$). The shell from Unit 7 (2.5 to 3.5 Ma), which contains a typical marine faunal assemblage, shows temperatures ranging from 18 to 27°C. The shell from Unit 4 (2.0 to 2.5 Ma), with its combination of marine and freshwater shells, shows weaker seasonality with $T\Delta^{47}$ between 18°C and 24°C. Reconstructed $\delta^{18}Ow$ values for Unit 7 vary from -1.25 to 1.08‰ VSMOW and correlate negatively with temperatures. In contrast, $\delta^{18}Ow$ values for Unit 4 are unusually high (-0.04 to 3.01‰). Comparison of our data with the seasonal patterns of temperature and seawater δ18O for the modern Florida Bay indicates that Unit 7 was deposited in an offshore marine environment whereas Unit 4 was deposited in a brackish-estuarine environment. The high $\delta^{18}Ow$ values correlating with summer temperatures point to the input of evaporative freshwater, rather than upwelling, into the Florida Platform through SGD during the summer rainy period. Further study of the clumped isotope sclerochronology of additional gastropod shells from Unit 7, Unit 4, and the Florida Bay will help understand the influence of SGD on the high productivity of the Plio-Pleistocene Florida Platform.

Time: **13:30 - 13:45 [Wednesday, May 6th, 2026]**

Title: **Testing the environmental drivers of extinction on the Plio-Pleistocene Florida Platform with clumped isotope (Δ47) and trace elemental (Ba/Ca) sclerochronology**

Authors: **Gomes, Lucas D. 1,2;** Waters, Eric 1,2; Petersen, Sierra V. 1,2

Affiliations: 1 Department of Earth and Environmental Sciences, University of Michigan, Ann Arbor, United States; 2 Museum of Paleontology, University of Michigan, Ann Arbor, United States

Over the past decade, methodological advancements in both trace elemental (Ba) and carbonate clumped isotope (Δ^{47}) sclerochronology have opened promising new frontiers for paleoecological and paleoceanographic research. High resolution Δ^{47}-sclerochronology resolves the historical "$\delta^{18}O_{water}$ problem" in paleoclimate studies because it enables direct reconstruction of absolute temperature seasonality as well as ancient $\delta^{18}O_{water}$ compositions, which can be further applied to constrain paleohydrological conditions in the deep geologic past. Independently, a growing number of studies indicate that barium content in mollusk shells (Ba/Ca) can be used as a quantitative paleoproductivity proxy, as transient peaks in modern shell Ba profiles have been linked to nearby blooms of phytoplankton. In this study, we apply these emergent techniques to investigate two longstanding hypotheses about the primary environmental driver of faunal turnover on the Plio-Pleistocene Florida Platform: cooling marine temperatures or declining primary productivity. Here we present paired isotopic and Ba/Ca analyses of fossil shells (n=30+) collected from each of the major Plio-Pleistocene formations of south Florida, with a focus on 4 stratigraphically-abundant bivalve genera (*Carolinapecten, Chione, Dinocardium, Mercenaria*). These independent records reveal substantial but asynchronous shifts in both regional marine climates and productivity over the course of the Plio-Pleistocene extinction interval. More broadly, this work also highlights several ways in which Δ^{47}-derived temperature and $\delta^{18}O_{water}$ profiles can strengthen interpretations of coupled Ba/Ca profiles in fossil mollusks, such as (i) detecting past freshwater influence that could also drive shell Ba variability and (ii) identifying the seasonal timing of past phytoplankton blooms.

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PALEOCLIMATES & PALEOENVIRONMENTS

Time: **13:45 – 14:00 [Wednesday, May 6th, 2026]**

Title: **Towards the limits of short-lived extreme weather event recognition in mollusc shells**

Authors: **Oerlemans, Brendan 1;** Bakas, Yauvani 1; Witbaard, Rob 2; Fakkel, Mignonne 2; Goudsmit-Harzevoort, Barbara 2,3; Borremans, Wim 4; Goderis, Steven 4; de Winter, Niels J. 1,4

Affiliations: 1 Department of Earth Sciences, Vrije Universiteit Amsterdam, Amsterdam, Netherlands; 2 Department of Estuarine and Delta Systems, Royal Netherlands Institute for Sea Research, Texel, Netherlands; 3 Department of Earth Sciences, Utrecht University, Utrecht, Netherlands; 4 Analytical, Environmental and Geochemistry Research Group, Vrije Universiteit Brussel, Brussels, Belgium

The frequency and severity of extreme weather events such as heatwaves, storms and floodings are linked to climate change. The capacity of bivalve mollusks to register chemical and physical environmental disturbances, caused by these events, on hourly to daily timescales and the potential for preservation of their carbonate shells makes them excellent archives for such disturbances in the geologic past. However, the timing and consistency of the biomineral registration in relation to the occurrence of these disturbances is yet not very well understood. In a pulse-chase experimental design, several common cockles (*Cerastoderma edule*) have been subjected to an artificial chemical disturbance – strontium enriched seawater – for varying durations and their last accreted carbonates were subsequently analysed by LA-ICPMS. Preliminary results show that the disturbances are reflected in the shell carbonate as soon as six hours after the start of the disturbance and can be traced back in 50 to 75% of the individuals. Further experiments will investigate interspecies consistency and success rates with more complex (multi-element) chemical disturbances.

Time: **14:00 – 14:15 [Wednesday, May 6th, 2026]**

Title: **Geochemical signatures in the long-lived marine bivalve *Arctica islandica* show intense warming in the down east coastal region of the Gulf of Maine**

Authors: **Wanamaker, Alan D. 1**; Walton, Alexandra 1; Griffin, Shelly 1; Black, Bryan 2; Hauser, Amanda 1; Werhane, Lindsey 1; Whitney, Nina M. 3; Ummenhofer, Caroline C. 4; Remaili, Soraya S. 5; Biastoch, Arne 6; Martin, Torge 6; Thatcher, Diana L. 1

1 Iowa State University, Ames, IA, USA; 2 University of Arizona, Tucson, AZ, USA; 3 Western Washington University, Bellingham, WA, USA; 4 Woods Hole Oceanographic Institution, Woods Hole, MA, USA; 5 University of South Carolina, Columbia, SC, USA; 6 GEOMAR Helmholtz Centre for Ocean Research, Kiel, Germany

The Gulf of Maine (GoM) is undergoing rapid environmental changes, and this system is projected to become increasingly stressed in the coming decades. In this study, we used the growth and geochemical signatures from the long-lived marine bivalve *Arctica islandica* collected in 70 to 80 m water depth from the Down East coastal region in the GoM (Jonesport, ME, USA) to evaluate past climatic and hydrographic variability. The master shell growth chronology is precisely dated via crossdating methods and spans from 1953 to 2023 CE with shell growth variability being highly coherent among the population, indicating that environmental conditions are driving growth. The Jonesport stable oxygen isotope ($\delta^{18}O_{shell}$) series spans from 1956-2020 CE and demonstrates a secular decrease in $\delta^{18}O_{shell}$ values over time, indicating an increase in seawater temperature and/or freshening of waters over the past ~75 years. Radiocarbon dated shells and $\delta^{18}O_{shell}$ data from the 17th century provide a pre-industrial "floating" baseline context for the changes noted during the last 75 years. To further constrain the relative influences temperature and salinity (source water oxygen isotope values calculated) variations on the $\delta^{18}O_{shell}$ record since ~ 1970, output from the VIKING20X model (1/20° Atlantic configuration nested in 1/4° global ocean, forced by the 55-year Japanese Atmospheric Reanalysis product) is used. Although broadly consistent with other temperature records in the region, the $\delta^{18}O_{shell}$ series indicates that the warming since 1956 in the Down East coastal region of the GoM is large (> 3 °C) and will likely have negative ecological impacts.

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PALEOCLIMATES & PALEOENVIRONMENTS

Time: **14:15 – 14:30 [Wednesday, May 6th, 2026]**

Title: **Seasonal climate variability in Coastal North Carolina during the Roman Warm Period**

Authors: **Gillikin, David P. 1**; Luse, Miranda 1; Goodwin, David H. 2; Verheyden, Anouk 1; Wanamaker, Alan D. 3

Affiliations: 1 Geosciences, Union College, Schenectady NY USA; 2 Earth and Environmental Sciences, Denison University, Granville OH USA; 3 Earth, Atmosphere, and Climate, Iowa State University, Ames IA USA

The Gulf of Maine (GoM) is undergoing rapid environmental changes, and this system is projected to become increasingly stressed in the coming decades. In this study, we used the growth and geochemical signatures from the long-lived marine bivalve *Arctica islandica* collected in 70 to 80 m water depth from the Down East coastal region in the GoM (Jonesport, ME, USA) to evaluate past climatic and hydrographic variability. The master shell growth chronology is precisely dated via crossdating methods and spans from 1953 to 2023 CE with shell growth variability being highly coherent among the population, indicating that environmental conditions are driving growth. The Jonesport stable oxygen isotope (δ^{18}Oshell) series spans from 1956-2020 CE and demonstrates a secular decrease in $\delta^{18}O_{shell}$ values over time, indicating an increase in seawater temperature and/or freshening of waters over the past ~75 years. Radiocarbon dated shells and $\delta^{18}O_{shell}$ data from the 17th century provide a pre-industrial "floating" baseline context for the changes noted during the last 75 years. To further constrain the relative influences temperature and salinity (source water oxygen isotope values calculated) variations on the $\delta^{18}O_{shell}$ record since ~ 1970, output from the VIKING20X model (1/20° Atlantic configuration nested in 1/4° global ocean, forced by the 55-year Japanese Atmospheric Reanalysis product) is used. Although broadly consistent with other temperature records in the region, the $\delta^{18}O_{shell}$ series indicates that the warming since 1956 in the Down East coastal region of the GoM is large (> 3 °C) and will likely have negative ecological impacts.

Time: **14:30 – 14:45 [Wednesday, May 6th, 2026]**

Title: **Four centuries of the Arctic–Atlantic climate reversals from sclerochronology and historical records**

Authors: **Miles, Martin W. 1**; Andersson, Carin 2

Affiliations: 1 Institute of Arctic and Alpine Research, University of Colorado, Boulder, USA; 2 NORCE Norwegian Research Centre, Bjerknes Centre for Climate Research, Bergen, Norway

The Great Salinity Anomaly (GSA) of the 1960s–1970s resulted from an abrupt increase in the export of sea ice from the Arctic Ocean, transporting ice and polar waters toward the North Atlantic, with cascading effects downstream. There are indications of even larger climate reversals in the 1880s-1910s. However, this has never been constrained or explained, nor have earlier ocean climate reversals that may be apparent from ultra-high-resolution marine proxies and historical records. Here we investigate sea ice, ocean, and climate variations in the Atlantic Arctic since 1600 CE. We develop cross-disciplinary synergies using disparate data from sclerochronological records (marine bivalve *Arctica islandica*, and coralline alga *Clathromorphum compactum*), historical documentary records, and long instrumental records. The data analyzed are from Svalbard and the Greenland Sea, Iceland, Faroe Islands, Greenland, and northeast North America. The emphasis is on identifying and constraining GSA-like events (so-called "Great Sea-Ice Anomalies") through integration of independent evidence from the different archives. Since 1600, we find several periods of anomalously severe ocean-ice conditions: early 1600s, 1680s-1690s, early 1800s, and 1880s-1910s. The early 1880s climate reversal coincided with the great tilefish kill off northeastern North America and the last subsistence famine in Iceland. From the perspective of sea ice and marine climate, the Little Ice Age in the region persisted until its abrupt termination around 1920, at the onset of the Early 20th Century Warming.

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Time: **15:30 – 15:45 [Wednesday, May 6th, 2026]**

Title: **Paleoclimate variability recorded in shells of Stimpson's hard clam, *Mercenaria stimpsoni*, the longest-lived bivalve in Northwestern Pacific Ocean**

Authors: Miki, Shiono 1; Schöne, Bernd R. 2; Kubota, Kaoru 3; Tanabe, Kazushige 4; Shirai, Kotaro 1

Affiliations: 1 Atmosphere and Ocean Research Institute, The University of Tokyo, Japan; 2 Institute of Geosciences, University of Mainz, Germany; 3 The Japan Agency for Marine-Earth Science and Technology, Japan; 4 University Museum, The University of Tokyo, Japan

Paleoclimate signals recorded in biominerals such as corals, foraminifera and mollusks can provide valuable data for understanding past and future climate changes. In the mid- to high- latitude Atlantic Ocean, long-lived bivalves (e.g., *Arctica islandica, Glycymeris glycymeris*) have been extensively studied for paleoclimate reconstructions. In contrast, in the Northwestern Pacific Ocean, Stimpson's hard clam, *Mercenaria stimpsoni* has recently been identified as a bivalve with a lifespan exceeding a century. Their shells exhibit distinct growth patterns suitable to construct stacked chronologies. However, previous research has been limited to small numbers of specimens from few localities, underscoring the need for expanded sampling regions and sample sizes of long-lived specimens to fully realize the species' utility in paleoclimate studies. Here, we report continuous shell growth records of this species from Hokkaido, Japan. We collected over 50 shells of this species from four localities of Hokkaido (Abashiri, Enbetsu, Akkeshi and Hakodate, in order of proximity to the Arctic Ocean), Japan and applied sclerochronological techniques. The oldest specimen reached an age of 174 years. Changes in annual shell growth were linked to the PDO and/or the AMO. However, correlation varied among regions. Interestingly, the strength of the correlation to the AMO tended to decrease with increasing distance from the Arctic Ocean. In the future, by performing cross-dating of the dead shells, we will be able to extend the stacked chronology into the past.

Time: **15:45 – 16:00 [Wednesday, May 6th, 2026]**

Title: **Three millennia of northeast Pacific sea surface temperatures from growth increments of the long-lived bivalve, Pacific geoduck**

Authors: **Fischer, Leila R. 1**; Edge, David C. 2; Thompson, Diane M. 3; Lofverstrom, Marcus 3; Wanamaker, Alan D. 4; Thatcher, Diana L. 4; Hauser, Amanda E. 4; Black, Bryan A. 1

Affiliations: 1 Laboratory of Tree Ring Research, University of Arizona, Tucson, AZ, USA; 2 School of Earth and Sustainability, Northern Arizona University, Flagstaff, AZ, USA; 3 Department of Geosciences, University of Arizona, Tucson, AZ, USA; 4 Department of Earth, Atmosphere, and Climate, Iowa State University, Ames, IA, USA

Northeastern Pacific climate is characterized by interdecadal shifts between warm and cool temperature regimes superimposed on a recent warming trend that has culminated in a series of ecologically and economically disruptive marine heatwaves. Climate reconstructions from trees poorly agree with one another, causing considerable uncertainty as to whether observed variability and extremes are exceptional in the pre-industrial context. Annual growth-increment width of the long-lived bivalve Pacific geoduck (*Panopea generosa*) is strongly correlated to sea-surface temperature. A combination of living and dead-collected shells in the Tree Nob Islands, British Columbia, Canada, previously yielded a continuous, absolutely-dated history extending back to 1728 CE along with three crossdated sections "floating" in time. Here, that chronology is replicated and updated following two additional dead shell collections. The absolutely-dated portion is better replicated, and additional radiocarbon-dated segments are added to cover 2,084 years of the past three millennia. Regional curve standardization was applied to preserve low-frequency variability, highlighting a dramatic and consistent warming trend over the past century. Other equally warm years occurred during the mid-thirteenth and mid-fifteenth centuries, but these were short-duration events. The coldest period on record occurred between 1809 and 1811 CE following the unidentified volcanic eruption of 1809 CE. Wavelet analysis indicates pre-industrial time periods were dominated by variability in 3 to 16-year periodicities, consistent with the recent interval dominated by the warming trend. Integration with tree-ring and coral chronologies will allow for multi-proxy reconstructions and to assess linkages with the tropical Pacific.

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Time: **16:00 - 16:15 [Wednesday, May 6th, 2026]**

Title: **Prehistoric shifts in tropical cyclone season in the South China sea: evidence from daily resolution records of giant clam shells**

Authors: **Nanyu, Zhao 1**; Hong, Yan 1; Ge, Shi 2; Fan, Luo 2; Tao, Han 1; Chengcheng, Liu 2; John, Dodson 3

Affiliations: 1 State Key Laboratory of Loess and Science, Institute of Earth Environment, Chinese Academy of Sciences, Xi'an, Chinal; 2 Xi'an Institute for Innovative Earth Environment Research, Xi'an, China; 3 School of Biological, Earth and Environmental Sciences, University of New South Wales, Sydney, Australia

The impact of climate change on tropical cyclones (TCs) remains a critical concern, but understanding is limited by short instrumental records and low-resolution prehistoric data. Here, we present the first daily-resolution proxy data for investigating prehistoric TC activity, using a 12-year growth rate record of a fossil Tridacna shell (circa 3 ka BP) from the northern South China Sea (NSCS). By analyzing temporal patterns in the proxy data, we derived monthly TC frequency estimates. While modern TC frequency in the NSCS peaks in autumn (September–October), our results showed that TCs at 3 ka BP occurred more frequently in summer (June–July–August), with approximately 15% higher frequency than present. Combined with paleoclimate records, we suggested that this seasonal shift and increased frequency were likely linked to the relatively northward migration of the Intertropical Convergence Zone, which provided favourable conditions for TC formation and development. Our findings imply that future warming would contribute to earlier TC seasons and increased TC frequency in the NSCS.

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PALEOCLIMATES & PALEOENVIRONMENTS

Time: **16:30 – 16:45 [Wednesday, May 6th, 2026]**

Title: **Evaluating species-specific performance of land snail shell $\delta^{18}O$ as a seasonal hydroclimate proxy**

Authors: **Zong, Xiulan 1**; Dong, Jibao 1; Yan, Hong 1; Song, Yougui 1

Affiliations: 1 State Key Laboratory of Loess Science, Institute of Earth Environment, Chinese Academy of Sciences

Land snail shell $\delta^{18}O$ records have increasing potential as terrestrial proxies for reconstructing seasonal hydroclimate variability, particularly in loess-paleosol sequences. However, their reliability depends on species-specific growth behavior and the extent to which shell formation reflects environmental forcing. Here we evaluate the proxy performance of multiple coexisting land snail species from the Niefeng site on the Chinese Loess Plateau using high-resolution intra-shell $\delta^{18}O$ profiles. Shell $\delta^{18}O$ was measured at sub-millimeter resolution along the shell growth direction and compared with a daily theoretical $\delta^{18}O_{shell}$ record derived from instrumental temperature and precipitation isotope data. A flexible age-modeling strategy was applied to align shell growth sequences with the seasonal structure of the environmental signal while allowing for non-uniform and species-dependent growth rates. Individual shell age models were then combined to generate species-level mean seasonal trajectories. To assess proxy robustness, growth-rate uncertainty was explicitly propagated using Monte Carlo simulations, producing uncertainty envelopes around reconstructed seasonal patterns. Proxy fidelity was evaluated by examining the consistency with which shell $\delta^{18}O$ sequences reproduce the seasonal structure of the theoretical hydroclimate signal. Differences among species in coherence, temporal coverage, and uncertainty of reconstructed seasonal trajectories provide insight into their relative ability to record environmental seasonality. Our results reveal pronounced interspecific differences in proxy behavior. Some species exhibit consistent growth patterns and narrow uncertainty envelopes, indicating strong potential for seasonal climate reconstruction, whereas others show greater dispersion suggestive of physiological or ecological modulation of shell formation. This framework provides a quantitative basis for evaluating and optimizing land snail $\delta^{18}O$ proxies and offers guidance for species selection in high-resolution paleoclimate reconstructions from loess deposits.

PROXY DEVELOPMENT & OPTIMIZATION

Time: **9:15 – 9:30 [Thursday, May 7th, 2026]**

Title: **Extracting sub-annual geochemical information from bivalve shells – an approach to optimize sclerochronological methods on the example of the long-lived bivalve *Arctica islandica***

Authors: **Fröhlich, Lukas 1**; Huang, Qian 1; Schöne, Bernd R. 1

Affiliations: 1 Institute of Geosciences, University of Mainz, Germany

The analysis of geochemical properties in bivalve shells and their ecological contextualization is a fundamental concept of sclerochronological studies. Recent advances in analytical capabilities have substantially reduced the required sample volumes to reliably measure geochemical signals and thereby enable the extraction of highly resolved geochemical variations. Common practices for sampling shell material involve drilling or the use of powerful lasers to retrieve or ablate carbonate samples, leaving clearly visible marks on the sampled shell portions. Geochemical samples can then be accurately placed in a temporal context by geometrically contextualizing the position of the samples within their corresponding growth increments in combination with the shell growth patterns. Here we present a methodological framework aiming to optimize paleoenvironmental reconstructions from high-resolution geochemical samples taken on sub-annual scales. Specifically, we demonstrate how the sampling strategy and temporal alignment techniques may influence reconstruction accuracies. For instance, sample spots taken from different shell portions can contain geochemical information of contemporaneously formed shell carbonate, depending on the growth increment morphology as well as the relative position of individual samples. This can substantially bias obtained geochemical records and their environmental interpretations if not considered systematically. On the example of high-resolution geochemical data obtained from shells of the long-lived bivalve *Arctica islandica*, we present a potential application aiming for a more refined understanding of sub-annual geochemical variations.

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PROXY DEVELOPMENT & OPTIMIZATION

Time: **9:30 – 9:45 [Thursday, May 7th, 2026]**

Title: **ENSO interannual variability in the Great Barrier Reef recorded by marine gastropod shells**

Authors: **Alidoostsalimi, Mahsa 1,2;** Prendergast, Amy 1,2; Drysdale, Russell 1; Brown, Josephine 1; Fischer, Matthew 3
Ulm, Sean 4; Nguurruumungu Indigenous Corporation 5; Walmbaar Aboriginal Corporation RNTBC 6

Affiliations: 1 School of Geography, Earth and Atmospheric Sciences, University of Melbourne, Victoria, Australia; 2 ARC Centre of Excellence for Indigenous and Environmental Histories and Futures, University of Melbourne, Victoria, Australia; 3 Environment Research & Technology Group, ANSTO, Lucas Heights, Australia; 4 ARC Centre of Excellence for Indigenous and Environmental Histories and Futures, James Cook University, Cairns, Queensland, Australia; 5 PO Box 886, Cooktown, Queensland, Australia; 6 Walmbaar Aboriginal Corporation RNTBC, 24 Flierl Street, Hope Vale, Queensland, Australia

The El Niño-Southern Oscillation (ENSO) is the principal climatic system in the Pacific Ocean. The Great Barrier Reef (GBR), in the eastern tropical Pacific, is significantly affected by ENSO activity. In contrast to other research, for the first time, we investigated the potential of using a short-lived marine gastropod shells Rochia nilotica to reconstruct ENSO in the GBR. High-resolution marine archives are essential for understanding ENSO behavior at seasonal scales, yet suitable proxies from the Great Barrier Reef (GBR) remain limited to using corals. Here we present monthly-resolved $\delta^{18}O_{shell}$ and Sr/Ca records from a modern R. nilotica from the northern GBR. Our results show this species precipitates the carbonate shells in oxygen-isotope equilibrium with surrounding seawater, and $\delta^{18}O_{shell}$ at the shell edge reliably indicate the season of collection. Although monthly records capture local sea surface temperature (SST) variability, ENSO-related signals cannot be resolved at monthly or seasonal scales due to strong local SST and rainfall variability. At annual scales, however, shell geochemistry records the presence of El Niño events, with Sr/Ca providing a more robust SST proxy than $\delta^{18}O_{shell}$. These results identify this species as a new ENSO archive for the GBR, offering insights into Holocene SST variability along with providing a new opportunity to investigate human-ENSO interactions as this species is abundance in Holocene coastal archaeological contexts.

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Time: **9:45 – 10:00 [Thursday, May 7th, 2026]**

Title: **Quantifying trace elements in cephalopod beaks: A rigorous analytical strategy for LA-ICP/MS**

Authors: **Pérez-Mayol, Sílvia 1;** Terán-Baamonde, Javier 2; Escolar, Óscar 3; Fernández-Álvarez, Fernando Ángel 4; Vilarnau, Diego G. 3; Villanueva, Roger 3; Perales-Raya, Catalina 5

Affiliations: 1 Dpt. of Marine Resources, The Sclerochronology Service, IMEDEA (CSIC-UIB), Esporles (Balearic Islands), Spain; 2 Grupo Química Analítica Aplicada (QANAP), Instituto Universitario de Medio Ambiente (IUMA), Centro de Innovación Tecnológica en Edificación e Ingeniería Civil (CITEEC), Universidade da Coruña, A Coruña, Spain; 3 ICM (CSIC), Barcelona, Spain; 4 Centro Oceanográfico de Gijón, IEO-CSIC, Gijón, Spain; 5 Centro Oceanográfico de Canarias, IEO-CSIC, Santa Cruz de Tenerife, Spain

Trace element quantification in calcified structures is a well-established method, with LA-ICP/MS commonly used to relate water composition and age in order to track organismal movement. However, for growing tissues composed of non-carbonate materials –such as cephalopod beaks– the available literature is scarce, and analytical protocols for quantification are still limited. *Octopus vulgaris* beaks are primarily composed of the polysaccharide chitin, grow continuously throughout the animal's lifespan, and exhibit daily increments useful for ageing. Despite this potential, the study of their habitat and movements during its planktonic life (from hatching to settlement) remain poorly understood because obtaining settled juveniles is challenging. In this study, we developed a new, analytically rigorous LA-ICP/MS quantification method specifically tailored to trace-element determination in beaks of juvenile *O. vulgaris*. First, we produced a suite of ad-hoc matrix-matched chitin materials to serve as standards and quality-control samples, covering the range of elemental concentrations expected in these structures. Second, given the soft and thin nature of the smaller beaks, we evaluated a set of ablation parameters to identify conditions that allow optimal chitin ablation and accurate trace-element quantification. Our findings demonstrate that the chitin enrichment strategy is highly effective for producing homogeneous, matrix-matched standards across all elements and concentration levels, yielding calibration curves with analytical accuracy and precision. While the tested ablation conditions were suitable for larger beaks, they performed poorly on smaller ones due to their fragile morphology. Overall, this analytical strategy provides a robust and much-needed framework for quantifying trace elements in chitin-based biological structures.

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Time: **10:00 – 10:15 [Thursday, May 7th, 2026]**

Title: **Investigating seawater-shell relationships using tank experiments with living Tridacna to inform palaeoenvironmental reconstructions**

Authors: Dong, Bohao 1,2; Prendergast, Amy 1,2; Otter, Laura 3; Drysdale, Russell 1; Alidoostsalimi, Mahsa 1,2

Affiliations: 1 School of Geography, Earth and Atmospheric Science, University of Melbourne, Melbourne, Australia; 2 ARC Centre of Excellence for Indigenous and Environmental Histories and Futures, School of Geography, Earth and Atmospheric Sciences, University of Melbourne, Melbourne, Australia; 3 Research School of Earth Science, Australian National University, Canberra, Australia

High-resolution palaeoclimate reconstructions from marine biogenic carbonates offer critical baselines for understanding global environmental change and enhancing adaptation strategies for current and future climate variability. Giant clam shells (*Tridacnidae* spp.) are increasingly recognised as valuable archives due to their fast growth rates, longevity, and suitability for high-resolution geochemical analysis. Despite their potential, the precise relationships between environmental variables and the geochemical composition of giant clam shells remain insufficiently constrained. Most previous studies have relied on specimens from natural habitats and contemporaneous instrumental records to calibrate proxy-environment relationships. However, under natural conditions, environmental parameters such as sea surface temperature (SST), salinity (SSS), irradiance, and nutrient availability often co-vary, making it difficult to isolate the influence of individual factors on isotopic compositions. In this study, we conducted a controlled culturing experiment using three *Tridacna maxima* individuals over a three-month period, each reared in separate tanks with carefully regulated seawater conditions. We independently manipulated SST, SSS, light intensity, and nutrient concentrations to investigate their respective impacts on shell oxygen ($\delta^{18}O$) and carbon ($\delta^{13}C$) isotope compositions. The resulting data provide clearer constraints on the environmental drivers of isotopic variability in Tridacna shells. These findings contribute to improving the reliability of geochemical proxy interpretations and lay the foundation for more accurate reconstructions of past tropical marine environments.

Time: **10:15 – 10:30 [Thursday, May 7th, 2026]**

Title: **Absolutely dated Glycymeris increment $\Delta^{14}C$ records reveal post-bomb ventillation processes in the Subtropical East Atlantic**

Authors: **Németh, Alexandra 1;** Ustrzycka, Alicja 2; Piotrowska, Natalia 3

Affiliations: 1 no current affiliation/on a maternity leave, Budapest, Hungary; 2 Institute of Physics - Centre for Science and Education at the Silesian University of Technology, Gliwice, Poland; 3 Institute of Physics - Centre for Science and Education at the Silesian University of Technology, Gliwice, Poland

Radiocarbon analysis of annual shell increments provides valuable insights into the changing dynamics of the North Atlantic Subtropical Gyre during the latest anthropogenic warming. Studies focusing on anthropogenic influence on ocean-climate interactions often use the bomb-radiocarbon signal to anchor their data. The bomb signal, however, was proven to express a strong variation, especially in less-researched subtropical environments, depending on the depth of the sampling sites and processes such as stratification or vertical mixing. This study aims to provide a unique insight of the pre- and post-bomb ventilation processes of the subtropical East-Atlantic Ocean. A statistically robust Glycymeris chronology, anchored in 2013 from offshore Madeira, Portugal, was used to track changes in marine $\Delta^{14}C$ between 1934 and 2002. Additionally to this sample-set collected at 150 m depth, three other shells collected at approximately 30 m and 80 m depths were included for a vertical resolution. Thirty-three carbonate samples were manually drilled from annual shells increments and analysed using AMS technique. Due to the absolutely dated increment-chronology, it was possible to allocate calendar ages to the annually resolved $\Delta^{14}C$ results. This way an absolutely dated position of a flat bomb peak was identified at the lowest part of the mixing-zone. It became possible not only to track changes in the pre-bomb radiocarbon values (-60 to -40 $\Delta^{14}C$), but this dataset also gave a three-layered vertical insight into post-bomb mixing zone processes (127 to -59 $\Delta^{14}C$ from 30 m to 150 m depth) where sampled increments from the three sites overlap around 1980.

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Time: **10:45 – 11:00 [Thursday, May 7th, 2026]**

Title: **Investigating the limits of amino acid nitrogen bivalve shells for biogeochemical and ecological reconstruction isotope composition in (sub-) fossil**

Authors: **Huang, Qian 1**; Penkman, Kirsty E.H. 2; Nelson, Ellie 2; Vigelius, Daniel 1; Fröhlich, Lukas 1; Schöne, Bernd R. 1

Affiliations: 1 Institute of Geosciences, University of Mainz, Johann-Joachim-Becher-Weg 21, 55128 Mainz, Germany; 2 Department of Chemistry, University of York, Heslington, York, YO10 5DD, UK

Bivalve shells provide valuable long-term archives for reconstructing past environments and ecosystems. Their incrementally growing biomineralized structures record environmental changes as chemical properties, including stable nitrogen isotope ratios ($\delta^{15}N$). Compound-specific nitrogen isotope analysis of amino acids (CSIA-AA) enables more reliable estimations of biogeochemical processes and trophic dynamics compared to the bulk nitrogen isotope technique and has become a widely used tool across disciplines in the past decade. While recent applications on CSIA-AA nitrogen isotopes from biogenic archives primarily focus on material from the last millennia, extending this proxy into deeper time holds great potential for reconstructing past nitrogen cycles. Fossil and sub-fossil bivalve shells may provide a closed system that preserves amino acids and their isotopic composition on timescales of thousands to millions of years. Here, we evaluate the integrity of bulk and amino acid-specific nitrogen isotope compositions preserved in the shell organic matter of the long-lived bivalve *Arctica islandica*, a well-established geochemical archive in the North Atlantic. We analyzed live-collected and sub-fossil shells from the Holocene (Fladen Ground, North Sea) and fossil specimens from the Crag formation (Suffolk, UK) dating back to Pliocene–Pleistocene. Using a combination of spectroscopic (Fourier Transform Infrared Spectroscopy; FTIR), compositional (amino-acid composition) and isotopic (bulk and CSIA-AA) approaches, we assessed the preservation of the biomineral structure, shell organic chemistry and nitrogen isotope compositions in bulk organics and amino acids. Our results show the first attempt to push CSIA-AA reconstructions from bivalve shells deeper back in time.

Time: **11:00 – 11:15 [Thursday, May 7th, 2026]**

Title: **Compound-specific amino acids $\delta^{15}N$ values in mollusc shells: Extraction of intra-crystalline amino acids and evaluation as a proxy for palaeoenvironmental nitrogen baseline**

Authors: **Huang, Xizhi 1**; Ma, Xinying 2; Wu, Hao 3

Affiliations: 1 Institute of Earth Environment, Chinese Academy of Sciences, Xi'an, China; 2 College of the Environment and Ecology, Xiamen University, Fujian, China; 3 College of the Environment and Ecology, Xiamen University, Fujian, China

Compound-specific stable isotope analysis of amino acids (CSIA-AA) in bivalve shells is a powerful tool for investigating palaeoceanographic biogeochemistry and trophic dynamics. However, fossil materials are commonly affected by diagenetic alteration and contamination by exogenous organic matter, which complicates the extraction of primary amino acid signals and may compromise the data reliability. Thus, we conducted a time-series oxidation pretreatment experiment (1–10 days) using sodium hypochlorite (NaClO) on both modern and fossil *Paphies australis* shells collected from New Zealand, aiming to determine optimal conditions for isolating intra-crystalline amino acids. The results showed that amino acid concentrations in all shells decreased markedly during the initial 1–2 oxidation days and then stabilized, indicating that readily oxidizable extra-crystalline organic matter is basically removed during the early stages of oxidation. But NaClO oxidation does not significantly affect the nitrogen isotope ($\delta^{15}N$) values of individual amino acids in both modern and fossil shells throughout experimental periods. These results demonstrated that amino acids retained after oxidation predominantly represent intra-crystalline, indigenous shell organic matter, and that the amino acids within the mineral crystals of fossil shells were well encapsulated during burial and/or diagenesis. Lastly, using the optimised oxidation time, we compared $\delta^{15}N$ values of amino acid phenylalanine ($\delta^{15}NPhe$) in three bivalve species collected from the same locality. The results showed no significant interspecific differences in $\delta^{15}NPhe$ values, indicating minimal influence of species-specific trophic effects. Our study therefore supports $\delta^{15}NPhe$ as a robust proxy for reconstructing baseline nitrogen sources and long-term evolution of marine nitrogen cycling in the past.

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PROXY DEVELOPMENT & OPTIMIZATION

Time: **11:15 – 11:30 [Thursday, May 7th, 2026]**

Title: **The ups and downs of elemental analyses on mollusc shells**

Authors: **Hausmann, Niklas 1**

Affiliations: 1 Leibniz Zentrum für Archäologie (LEIZA), Mainz, Germany

Over the last ten years elemental analysis via laser induced breakdown spectroscopy (LIBS) has been applied in several studies, aiming to better understand the spatial distribution of elemental compositions of mollusc shells, with the aim of unlocking these ratios as an additional tool for palaeoclimatic and palaeoecological research. In this talk, I want to showcase some of these studies, their results, the setbacks, what we learned from it, and where I think we can take this research in the future. This includes general outcomes such as: (1) Mg/Ca ratios help to understand palaeotemperature in calcitic shells but not in aragonitic shells, (2) elemental ratios are not homogenous throughout growth increments, (3) elemental ratios are specimen specific, preventing general equations for e.g. absolute temperature reconstruction, (4) 2D mapping is essential for navigating the record. These are not hard and fast rules and desperately require more research to be fully understood and put to use. Nevertheless, knowing these restrictions, there is still a huge potential for in-situ elemental analyses, as they are faster than the study of milled/drilled carbonate samples via isotope analysis. Faster analyses directly translate into larger sample sizes, unlocking more robust assessments of climatic conditions or season-of-capture studies in archaeology.

Time: **11:30 – 11:45 [Thursday, May 7th, 2026]**

Title: **The ups and downs of elemental analyses on mollusc shells**

Authors: **Gey, Christoph J. 1,** Fröhlich, Lukas 1, Schöne, Bernd R. 1

Affiliations: 1 Institute of Geosciences, University of Mainz, Mainz, Germany

A key challenge in sclerochronology is to contextualize datasets from different analytical techniques. Multiproxy approaches provide unprecedented insights from shell archives, but integrating high-resolution imaging (optical microscopy, SEM, XRF) with geochemical analyses (LA-ICP-MS, IRMS, SIMS) demands complex workflows that can quickly become difficult to manage. Preparations requiring staining or coating for imaging – which can interfere with subsequent chemical analyses – or invasive sampling such as micromilling often necessitate working on multiple transects of the same shell. Resulting datasets vary in spatial resolution, geometry and file format, yet must ultimately be precisely aligned to a common age model, a task that becomes complicated when the alignment is processed with different software lacking interoperability. Here, we demonstrate how Geographic Information Systems (GIS), specifically the open-source software QGIS, can be adapted for the analysis of micrometer-scale data from sclerochronological archives. Using Arctica islandica as a case study, we show how QGIS integrates ultrastructural imagery (light microscopy, SEM), elemental measurements (laser-ablation spots) and isotope data (micromilled powders) into a cohesive workflow that supports multiproxy reconstruction of North Sea environmental dynamics during the Holocene. QGIS efficiently handles large image datasets, supports a broad range of formats, provides intuitive tools accessible to users with minimal experience and includes a Python API for customized analyses. This workflow enables analysis, structured storage and data sharing while preserving the spatial reference of each measurement along the shell. By repurposing a GIS environment for microscale applications, QGIS provides a robust open-source solution that meets the increasingly data-driven demands of modern sclerochronology.

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PROXY DEVELOPMENT & OPTIMIZATION

Time: **11:45 – 12:00 [Thursday, May 7th, 2026]**

Title: **Equilibrium oxygen isotope fractionation and empirical paleothermometry equations: Critical assessment**

Authors: **Schöne, Bernd R. 1**

Affiliations: 1 Institute of Geosciences, University of Mainz, Mainz, Germany

Shells are precipitated close to thermodynamic equilibrium with respect to oxygen isotopes.' Such and similar statements can be found in many sclerochronological studies, although not entirely correct and typically unsupported by references. In fact, $^{18}O/^{16}O$ partitioning values of biogenic/synthetic aragonites are ca. 1.5 ‰ lower than such of extremely slow-growing subaquatic cave calcites (Devil's Hole, Larghetto Basso), considered to have attained thermodynamic equilibrium. Low-Mg calcites formed on Earth surface are even more enriched in ^{16}O than aragonites. Noteworthy, the true equilibrium $^{18}O/^{16}O$ fractionation factor (alpha) remains unknown and can only be numerically approximated. Some estimated/predicted alpha values closely resemble the fractionation relationships of empirical paleothermometry equations. The initial statement should thus read 'predicted thermodynamic equilibrium' (plus reference) or refer to empirical fractionation relationships. Furthermore, is it possible to constrain why some species precipitate their hard parts somewhat away from empirical or computed equilibrium? For instance, did environmental variables during shell formation fluctuate stronger than sporadic measurements imply? In view of variations of the rate of shell growth, changes of temperature and $\delta^{18}O_{water}$ over time would complicate calibration efforts. Are biological and/or kinetic effects at work? Can some of the discrepancies between observed and predicted $\delta^{18}O_{shell}$ values be explained by differences in shell micro/ultrastructure? Such a critical assessment could render some empirical paleothermometry equations superfluous. To understand mechanisms, it may be more effective to describe and apply observed offsets from established empirical or computed fractionation relationships rather than to introduce numerous species-specific paleothermometry equations.

Time: **13:15 – 13:30 [Thursday, May 7th, 2026]**

Title: **Potential interspecific differences in the indirect effect of light intensity on the sub-daily shell Sr/Ca and Mg/Ca ratios of two Tridacna species**

Authors: **Yang, Haotian 1;** Liu, Chengcheng 1; Yang, Yanan 2; Brosset, Cornélia 3; Li, Jun 4; Schöne, Bernd R. 3; Yan, Hong 1

Affiliations: 1 State Key Laboratory of Loess Science, Institute of Earth Environment, Chinese Academy of Sciences, Xi'an, China; 2 State Key Laboratory of Deep Earth Processes and Resources, Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, Guangzhou, China; 3 Institute of Geosciences, University of Mainz, Mainz, Germany; 4 South China Sea Institute of Oceanology, Chinese Academy of Sciences, Guangzhou, China

Tridacna spp., among the largest bivalves, rely on symbiotic zooxanthellae and are highly light-sensitive. However, whether light influences shell geochemistry remains unclear. To address this question, we cultured *T. squamosa* and *T. derasa* for 32 days under four light intensities (LI) and analyzed daytime shell growth rate (SGRday), Sr/Ca, and Mg/Ca ratios. Under low-medium light, *T. squamosa* maintained a stable SGRday, with no significant changes in Sr/Ca or Mg/Ca ratios. Conversely, *T. derasa* showed a significant SGRday increase with LI ($r = 0.99$, $p < 0.001$), while temperature-detrended Sr/Ca increases ($r = 0.46$, $p < 0.05$) and Mg/Ca decreases ($r = -0.70$, $p < 0.001$). The contrasting patterns suggest that species-specific light adaptation ranges and photosymbiotic responses affect the elemental incorporation of Sr and Mg into the shell. These results provide a foundation for calibrating *Tridacna*-based proxies in paleoenvironmental research.

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Time: **14:00 – 14:15 [Thursday, May 7th, 2026]**

Title: **Temperature, discharge, and mussel growth during the last 150 years in the Brazos River, TX – A clumped isotope study**

Authors: Grossman, Ethan L. 1; Brewer, Melanie A.1; Randklev, Charles R. 2

Affiliations: 1 Department of Geology and Geophysics, Texas A&M University, College Station, TX; 2 Texas A&M Natural Resources Institute, Dallas, TX

Warming climate and dam emplacement have brought major challenges to river environments, including hydrologic discontinuity, increased water temperature, and altered flow rates. These changes contribute to habitat disappearance for endangered freshwater mussels. In this study, we utilized high-resolution clumped isotope analyses (Δ47) of modern and historic freshwater mussels (*Amblema plicata*) collected in 1893, circa 1900, and 2013 to reconstruct modern and historic records of temperature (T(Δ47)), water δ18O (δ18Owater), and shell growth rate with monthly or better resolution. Modern and historic values for reconstructed T(Δ47) and growth rate show similar ranges across all shells and dam conditions, with values ranging from 16°C to 32°C and 0.2 to 2.6 mm per month, respectively. Calculated growth rates are highest in spring and summer for historic shells and extended into early fall in the modern shell, suggesting an extended growing season possibly due to dam release and warming climate. Annual bands in mussels generally correlate with the coldest T(Δ47) and slow growth, while sub-annual, or disturbance bands, correlate with rainfall and high streamflow events based on reconstructed $\delta^{18}O_{water}$. The T(Δ47) versus reconstructed $\delta^{18}O_{water}$ relationships are similar in modern and historical shells, and agree with that for the modern Brazos River, suggesting no major impact of damming on the overall water cycle. Overall, these data demonstrate the utility of clumped isotopes to reconstruct temperature and river water $\delta^{18}O_{water}$, crucial for understanding climate and river hydrologic during historic and prehistoric times, and provide insight into mussel sensitivity to climate change and anthropogenic impacts.

Time: **14:15 – 14:30 [Thursday, May 7th, 2026]**

Title: **A 250+ year highly-resolved record of Hg in *Arctica islandica* shells from the Gulf of Maine**

Authors: **Graham, Andrew M 1**; Thatcher, Diana L 2; Badgley, Penelope 3; Bvunyenge, Eustina 1; Fernandes Costa, Ana B 3; Roberts, Elizabeth 1; Hauser, Amanda 2; Wanamaker, Alan D 2

Affiliations: 1 Grinnell College, Department of Chemistry, Grinnell, IA, USA; 2 Iowa State University, Department of Earth, Atmosphere, and Climate, Ames, IA, USA; 3 Grinnell College, Department of Biology, Grinnell, IA, USA

Mercury (Hg) is a globally distributed pollutant that biomagnifies in food webs with negative health impacts for humans and wildlife. Predicting how Hg entry into food webs will change in response to changing climate and policy actions is challenging, in part, because biomonitoring records are extremely limited in spatiotemporal scope. Here, we report on the development of a novel sclerochronological Hg archive, using cross-dated shells of the long-lived clam *Arctica islandica*, that has potential to substantively increase the length of Hg biomonitoring records. We first validated shell Hg as a proxy of Hg biouptake in *A. islandica* by comparing tissue, shell, and periostracum Hg concentrations in two populations in the Gulf of Maine (GoM) and show that shells preserve differences in Hg exposure and biouptake by *A. islandica*. Following validation, we developed a 250+ year timeseries of Hg in shells from Seguin Island, in the central GoM. Major peaks in Hg occurred in the late-19th century and again in the mid-20th century, consistent with historical Hg emissions inventories for North America. Our record suggests appreciable Hg contamination of marine food webs by ~1800. Hg concentrations have remained unchanged since ~1990, at about one-third of late 19th and mid 20th century peaks. Hg concentrations in *A. islandica* shells are presently at their lowest levels since 1930-1945, and among the lowest levels since at least ~1770. Work is underway to extend our record to earlier periods to better constrain the onset of anthropogenic Hg contamination in the Gulf of Maine.

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Time: **14:30 – 14:45 [Thursday, May 7th, 2026]**

Title: **A lifetime of listening: mining related environmental contamination in fish otoliths across trophic levels**

Authors: **Hussain, Maria 1**; Schindler, Michael 1; Brink, Kirstin 1

Affiliations: 1 Department of Earth Sciences, University of Manitoba, Winnipeg, Manitoba, Canada

Flin Flon, a city in northern Manitoba, hosted nearly a century of base-metal mining and smelting that produced zinc (Zn) and copper (Cu), resulting in long-term contamination of nearby ecosystems. Although mining ceased in 2022, its environmental impacts persist. In 2024, the Government of Manitoba issued a selenium (Se) advisory for fish in Schist Lake after detecting elevated Se levels relative to previous years. Selenium is an essential trace element and a common byproduct of mining, but in excess it can be toxic to fish and humans. The temporal and trophic level history of Se exposure in Schist Lake fish remains unknown. To address this, we investigated how Se contamination varies through time and trophic levels and whether otolith chemistry can reconstruct this history. Contra muscle tissue, otoliths preserve a chronological, lifetime record of environmental exposure. We examined otoliths from three trophically distinct species collected in 2022 and 2025: Lake Cisco (mid-level planktivore), Yellow Perch (upper-level omnivore) and Northern Pike (top predator). Laser-ablation inductively coupled plasma mass spectrometry line transects were used to quantify Zn66 and Se77 concentrations across otolith growth increments. Zn66 profiles exhibited expected patterns, including enriched nuclei and cyclical annual signals. Most fish exhibited late-life Se77 peaks, suggesting movement into Se-enriched waters. Lake Cisco and Northern Pike exhibited the highest total Se77 (~10ppm), while Yellow Perch showed much lower total Se77 values (~1ppm). These differences suggest that trophic position influences the magnitude of trace element incorporation, and that species vary in their sensitivity to contamination.

Time: **15:00 – 15:15 [Thursday, May 7th, 2026]**

Title: **Sclerochronological evidence for recent benthic marine warming in the English Channel**

Authors: **Mason, Matthew J 1**; Reynolds, David J 1; Scourse, James D 1; Hall, Ian R 2; Ostle, Clare 3; Smyth, Tim 4; Nederbragt, Alexandra 2

Affiliaitions: 1 Department of Earth and Environmental Sciences, University of Exeter, Penryn, UK; 2 School of Earth and Environmental Sciences, Cardiff University, Cardiff, UK; 3 The Marine Biological Association (MBA), Plymouth, UK; 4 Plymouth Marine Laboratory, Plymouth, UK

Sea surface temperature (SST) is the most widely measured and analysed component of the marine climate system, while observations of bottom-water temperatures remain comparatively sparse due to sampling constraints. This observational bias limits our understanding of how recent climate change has affected benthic environments in shelf-seas, despite their ecological and biogeochemical importance. Sclerochronological archives provide a means of extending benthic climate records beyond the instrumental period. The English Channel hosts the Western Channel Observatory, one of the longest running oceanographic time-series in the world. However, geopolitical events and funding interruptions have resulted in significant gaps in the record, particularly for below-surface conditions. Here, we present an extended bivalve shell growth chronology, combined with stable oxygen isotope ($\delta^{18}O_{carbonate}$) measurements, from *Glycymeris glycymeris* growing in the English Channel spanning 1883–2024. Comparison with available instrumental records indicates that the chronology captures meaningful variability at the seabed. This is particularly relevant in the English Channel, where hydrography is influenced by seasonal stratification and tidal mixing and where benthic conditions may be decoupled from surface signals. Furthermore, a consistent long-term warming signal is apparent in both the shell-growth chronology and $\delta^{18}O_{carbonate}$ record over recent decades. By integrating growth increment width chronologies with $\delta^{18}O$-based temperature reconstructions, this study highlights the potential of sclerochronological archives to address gaps in benthic climate observations and to improve our understanding of recent marine warming beyond the sea surface.

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Time: **15:15 – 15:30 [Thursday, May 7th, 2026]**

Title: **Wavelet analyses reveal the scales of SST-driven synchrony in Pismo clam (*Tivela stultorum*) shell growth chronologies across their full latitudinal range**

Authors: **Cornish, Michael R. 1**; Emery, Kyle A. 1

Affiliations: 1 Marine Science Institute, University of California Santa Barbara, Santa Barbara, USA

The Pismo clam (*Tivela stultorum*) once supported a major commercial surf clam fishery spanning the Pacific coast from Baja California, Mexico, to Santa Cruz, California, USA. The U.S. fishery peaked at roughly $1.4M USD in 1945 (≈$25.7M in 2026) and was permanently closed in 1947 following a catastrophic population collapse widely attributed to overharvest. However, despite decades of protection the population remains well below historical levels. Although localized recoveries have been observed, a rapidly changing coastal ocean thermal regime and accelerating erosion and loss of soft sediment habitats may constrain long term recovery. To better understand the effects of oceanographic drivers on the productivity of these long lived (>50 yr) bivalves, we live-collected clams across the species' range and constructed site level growth chronologies from cross dated annual shell increment width time series extracted from sectioned valves. Then, we applied wavelet synchrony models to identify the key spatiotemporal scales on which sea surface temperature (SST) anomalies induced spatial synchrony among populations. Because annual growth rates were strongly related to SST anomalies—also reflecting El Niño–Southern Oscillation (ENSO) forcing—we used these chronologies to characterize SST-induced spatial autocorrelation of annual shell growth over >30 years across the species' latitudinal range, assessing whether productivity is synchronized coast-wide or buffered by spatial heterogeneity over space and time.

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Time: **15:30 – 15:45 [Thursday, May 7th, 2026]**

Title: **Climate variability, not ecosystem state, drives long-term growth in seagrass-dwelling clams (*Mercenaria mercenaria*)**

Authors: Cornish, Michael R. 1, 2; **Castorani, Max C.N. 1**

Affiliations: 1 Department of Environmental Sciences, University of Virginia; 2 Marine Science Institute, University of California, Santa Barbara

Ecosystem productivity emerges from drivers operating across multiple spatial and temporal scales, including broad-scale climatic forcing that unfolds over decades and local habitat structure and species interactions that act over meters and years. Disentangling these cross-scale influences is increasingly important in an era of rapid climate change coinciding with intensive habitat restoration. Long-lived accreting organisms provide natural archives capable of resolving these influences over organismal lifespans. Species–habitat associations and short-term experiments suggest that seagrass meadows enhance bivalve growth by modifying hydrodynamics, food availability, and sediment conditions. However, whether these local habitat effects persist over timescales relevant to organismal lifespans and population dynamics remains largely unresolved. We developed a 45-year (1976–2020) cross-dated annual shell-growth chronology from 51 hard clams (*Mercenaria mercenaria*) collected across a 20 km² chronosequence of restored seagrass expansion in a coastal lagoon in Virginia, USA—the largest successful seagrass restoration in the world. This system represents the largest seagrass restoration in the world, providing a rare opportunity to quantify long-term growth responses to both interannual climate variability and substantial changes in ecosystem state. Across sites and years, March–August sea surface temperature (SST) anomalies explained 50–57% of variation in standardized growth indices, with a +1 °C anomaly associated with a ~3–4% increase in annual shell deposition. In contrast, contemporaneous or lagged seagrass meadow area, annual change in meadow extent, and distance from the meadow edge did not meaningfully improve statistical models ($R2 < 1\%$). The SST–growth relationship was strongest prior to 1999 but remained significant despite sustained regional warming (~0.25 °C per decade). Nine site-level chronologies across the lagoon echoed this pattern: SST effects exceeded habitat effects by two to three orders of magnitude and revealed highly synchronous interannual growth, consistent with strong regional climatic forcing. Together, these results provide long-term empirical evidence that broad-scale climate variability can outweigh local habitat effects in structuring consumer growth—even in systems undergoing large-scale habitat restoration. More broadly, this study demonstrates how sclerochronology can resolve the relative influence of cross-scale processes on ecological dynamics in a rapidly changing world.

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Time: **15:45 – 16:00 [Thursday, May 7th, 2026]**

Title: **Assessing Environmental Stresses in Bivalve *Mercenaria mercenaria* from Tokyo Bay, Japan Using Shell Stable Isotope Records and Automated Growth Chronology Reconstruction**

Authors: **Wang, Jingzhuo 1**; Murakami-Sugihara, Naoko 2; Shirai, Kotaro 3; Tanaka, Kentaro 4; Sato, Kei 5; Ishimura, Toyoho 6; Yumiba, Mahiro 3; Nishida, Kozue 1

Affiliations: 1 Department of Transdisciplinary Science and Engineering, Institute of Science Tokyo, Tokyo, Japan; 2 Marine Environment Group, Central Research Institute, Marine Ecology Research Institute, Tokyo, Japan; 3 Division of Ocean Chemistry, Atmosphere and Ocean Research Institute, The University of Tokyo, Kashiwa, Japan; 4 Department of Natural Sciences, Faculty of Science and Engineering, Tokyo City University, Tokyo, Japan; 5 Institute of Liberal Arts and Science, Kanazawa University, Kanazawa, Japan; 6 Graduate School of Human and Environmental Studies, Kyoto University, Kyoto, Japan

Recurrent summertime warming, hypoxia, and eutrophication have imposed persistent stress on inner Tokyo Bay, contributing to severe declines in fishery resources. As one of Japan's most intensively utilized semi-enclosed embayments, Tokyo Bay has experienced substantial environmental changes over the past four decades of intensified human activities. This study focuses on the bivalve *Mercenaria mercenaria*, an introduced species that has become commercially important in the bay. To disentangle the effects of multiple environmental stressors on bivalve growth, we analyzed shell growth patterns together with stable carbon and oxygen isotopes ($\delta^{13}C$, $\delta^{18}O$) and reconstructed a high-resolution shell growth chronology. By integrating shell $\delta^{18}O$ records with real-time environmental monitoring data, the timing of growth cessation was aligned with seasonal variability in temperature and dissolved oxygen (DO), allowing identification of key environmental drivers. High-resolution $\delta^{18}O$ profiles captured seasonal temperature signals, while $\delta^{13}C$ variations reflected changes in ambient dissolved inorganic carbon and/or temperature-related metabolic effects. Growth cessations, expressed as dark lines or notches, frequently coincided with summer hypoxic periods. To improve efficiency and objectivity, we developed an automated chronology reconstruction framework based on a sliding-window approach, dynamic time warping, and dual-weight optimization, supplemented by a $\delta^{13}C$-$\delta^{18}O$ covariation scoring system for quality control. Automated results closely matched manual reconstructions, demonstrating robustness and reproducibility. The reconstructed chronology indicates that *M. mercenaria* growth is highly sensitive to summertime hypoxia, with temperature playing a secondary role. Overall, this study provides a quantitative and transferable framework for shell-based environmental stress assessment in modern coastal systems and future carbonate proxy research.

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Time: **16:00 – 16:15 [Thursday, May 7th, 2026]**

Title: **Baleen Plates as High-Resolution Archives for Reconstructing Long-Term Nutrient Utilization in Large Vertebrates**

Authors: **Chang, Ching-Tsun 1**; Clifton, Cody 2; West, Kristi 3; Wallsgrove, Natalie J. 4; Popp, Brian N. 5

Affiliations:1 Eastern Fishery Research Center, Fisheries Research Institute; 2 College of Tropical Agriculture and Human Resources, University of Hawai'i at Mānoa; 3 Hawai'i Institute of Marine Biology, University of Hawai'i at Mānoa; 4 Department of Earth Sciences, University of Hawai'i at Mānoa; 5 Department of Earth Sciences, University of Hawai'i at Mānoa

As global oceans undergo rapid change, biogenic archives offer a critical window into the physiological and ecological responses of long-lived marine vertebrates. Among these archives, whale baleen plates provide a high-resolution, chronological record of an individual's life history, capturing multi-year sequences of nutrient allocation. This study utilizes baleen-derived isotope analysis to reconstruct the nutritional and metabolic dynamics of humpback whales (*Megaptera novaeangliae*) across varying oceanographic regimes. Our results demonstrate that nutrient routing and protein turnover rates, recorded chronologically within the baleen structure, shift significantly in response to anomalous environmental conditions. These shifts indicate a transition in metabolic strategy, characterized by altered utilization of endogenous lipid stores and protein-derived nitrogen during periods of environmental stress. By establishing baleen as a reliable sclerochronological tool for monitoring metabolic flexibility, this work highlights the value of using structural archives to quantify the vulnerability of migratory species to a fluctuating marine environment. This study underscores the potential of isotopic sclerochronology to provide mechanistic insights into the life-history transitions of apex predators that are otherwise difficult to observe.

Time: **8:45 – 9:00 [Friday, May 8th, 2026]**

Title: **Retracing food web shifts in Burrard Inlet (səl̓ilw̓ət, British Columbia, Canada) since industrialization with archaeological and modern clam (*Saxidomus gigantea* and *Leukomea staminea*) shell collections: A phytoplankton dynamics proxy evaluation**

Authors: **Leclerc, Natasha 1**; Kuehn, Sarah D. 1; Kommescher, Sebastian 2; Prentise, Andrea 2; Taft, Spencer 3; Thébault, Julien 4; Covert, Paul 5; Meghan Burchell 1

Affiliations: 1 Department of Archaeology, Memorial University of Newfoundland, St. John's, Canada; 2 CREAIT (Core Research and Instrument Training Network) Micro Analysis Facility, Memorial University of Newfoundland, St. John's, Canada; 3 Treaty, Lands and Resources Department, Tsleil-Waututh Nation, North Vancouver, Canada; 4 Institut Universitaire Européen de la Mer, Université de Bretagne Occidentale, Plouzané, France; 5 Institute of Ocean Sciences, Fisheries and Oceans Canada, Sidney, Canada

Over the past few decades, the sclerochronological community has increasingly developed proxies to examine phytoplankton dynamics, motivated in part by their value for constraining carbon budgets and establishing historical baselines. Common among these proxies are stable nitrogen isotopes and barium-calcium ratios, with emerging proxies including molybdenum- and lithium-calcium proxies combined with growth increments. However, there are few studies that integrate data from archaeological materials to provide a long-term picture of how nutrients, phytoplankton and broader coastal food webs have shifted over time. Here, we present the results of isotopic (oxygen and carbon) and trace elemental (Ba/, Mo/, and Li/Ca) analyses on modern and archaeological clam shells (species: *Saxidomus gigantea* and *Leukomea staminea*). By comparing geochemistry and growth from modern shells to instrumental data from near-monthly CTD casts, and phytoplankton diversity and abundance surveys, we evaluate their ability to capture modern phytoplankton dynamics in Burrard Inlet (səl̓ilw̓ət), near Vancouver, British Columbia, Canada. Using archaeological shells, we also present long-term reconstructions of phytoplankton dynamics since 1700 cal. BP. This research is in collaboration with TWN but is not representative of TWN.

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Time: **9:00 – 9:15 [Friday, May 8th, 2026]**

Title: **Investigating invader responses: Thermal niche insights from oxygen isotope sclerochronology of *P. maculata***

Authors: **Fuller, Anna-Cae 1**; Andrus, C. Fred T. 2

Affiliations: 1 Department of Geological Sciences, University of Alabama, Tuscaloosa, United States; 2 Department of Geological Sciences, University of Alabama, Tuscaloosa, United States

The sequential and predictable shell growth of aquatic gastropods allows for organismal life history reconstruction using stable oxygen isotope sclerochronology. We apply this approach to estimate thermal limits and potential range expansion of *Pomacea maculata*, a globally invasive freshwater snail that threatens native biodiversity, agriculture, and human health. Because *P. maculata* is stenothermal and limited by cold tolerance, biogeographic range models rely on thermal thresholds derived from laboratory cold-stress exposure experiments. However, laboratory-based studies may not replicate natural environmental conditions or account for local adaptations and organismal survival mechanisms. We hypothesized that $\delta^{18}O$ analysis of *P. maculata* at the edge of their invasive range could circumvent these limitations and detect thermal tolerances of wild populations. We analyzed 21 *P. maculata* specimens from two localities near the Mobile-Tensaw Delta (Alabama, USA). During the year preceding collection, we monitored hourly water temperature and weekly water $\delta^{18}O$ to construct an idealized shell $\delta^{18}O$ time-series model assuming continuous growth. Sequential low-resolution sampling along the shell whorl of each specimen identified regions corresponding to seasonal temperature lows; these regions were milled to capture near-daily conditions then compared to the modeled $\delta^{18}O$ values. We expected the discrepancies between modeled and measured $\delta^{18}O$ to reveal temperatures at which *P. maculata* experiences cold stress approaching mortality. Time-series alignment, however, was complicated by a substantial decrease in shell growth during the summer. Nevertheless, our preliminary data suggest that shell growth ceases near 17°C, despite this species experiencing and recovering from temperatures lower than previously established physiological thresholds.

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FISHERIES ECOLOGY, MANAGEMENT & CONSERVATION

Time: **9:45 – 10:10 [Friday, May 8th, 2026]**

Title: **Growth rates and carbonate production in two Northwest Atlantic calcareous large gorgonian octocorals**

Authors: **Edinger, Evan N** 1,3,7; Piccirillo, Laura F. 2; Malayny, Chelsea J. 2; Boulard, Marion S. 3; Neves, Bárbara de Moura 4; Hayes, Vonda E Wareham 4; Sherwood, Owen A. 5; Shaomin Chen 5; Burchell, Meghan 6; Layne, Graham D. 7

Affiliations: 1 Geography Department, Memorial University, St John's, Canada; 2 Environmental Science Program, Memorial University, St John's, Canada; 3 Biology Department, Memorial University, St John's, Canada; 4 Fisheries and Oceans Canada, St. John's, Canada; 5 Department of Earth and Environmental Sciences, Dalhousie University, Halifax, Canada; 6 Archeology Department, Memorial University, St John's, Canada; 7 Earth Sciences Department, Memorial University, St. John's, Canada

Large "gorgonian" sea fans are large, long-lived structure-forming benthos along the continental margins of Atlantic Canada and the Eastern Canadian Arctic. Several of these species produce calcite-protein skeletons whose central axes exhibit annual or sub-annual growth rings, allowing measurements of growth rates, longevity, and calcium carbonate production. Axial and radial growth rates were measured in *Primnoa resedaeformis* and *Keratoisis flexibilis* from the Labrador Sea and Baffin Bay. Carbonate production rates were calculated applying growth rates, colony weights and carbonate contents, and colony abundances (n m^{-2}). Although *P. resedaeformis* can live for hundreds of years, the average age of this species at a cold seep site at NE Saglek Bank (Labrador Sea) was only 41 y. Very thin elongate colonies of *K. flexibilis* from SE Baffin Bay displayed both major and minor growth rings. AMS-^{14}C ages of basal and distal portions of the calcite skeletons of these corals indicated uncorrected radiocarbon ages of 103 ± 21 ^{14}C y near the base, and 39 ± 20 ^{14}C y near the tip. Colony ages based on minor ring counts best matched AMS-^{14}C ages and averaged 128 y among 12 samples. Slow radial growth rates in *K. flexibilis* from Baffin Bay matched previously documented relationships between radial growth and bottom water temperature in bamboo corals. Carbonate production by *P. resedaeformis* at NE Saglek Bank was only 0.4 g $CaCO_3$ m^{-2} y^{-1}, and 14 g $CaCO_3$ m^{-2} y^{-1} in Disko Fan *K. flexibilis* coral forests, 1–3 orders of magnitude below estimates from NE Atlantic cold-water scleractinian corals and reefs.

Time: **10:00 – 10:15 [Friday, May 8th, 2026]**

Title: **Decadal variability in surface nutrient export recorded by deep-water corals in the Northwest Atlantic**

Authors: **Greenman, Wilder 1**; Sherwood, Owen 1

Affiliations: 1 Department of Earth and Environmental Science, Dalhousie University, Halifax, Canada

Mechanisms linking large-scale climate variability to nutrient export in the North Atlantic remain poorly understood. Deep-water proteinaceous corals offer a unique archive, as their annually banded skeletons integrate geochemical records of sinking particles. Here, we use the long-lived gorgonian coral *Primnoa resedaeformis* to reconstruct decadal-scale variability in surface-derived nutrient export to the deep ocean. Large swings in the North Atlantic Oscillation (NAO) over the past ~70 years coincide with shifts in coral bulk nitrogen isotopes ($\delta^{15}N_{bulk}$), suggesting a link between atmospheric forcing and biogeochemical cycling in this region. Notably, a positive to negative swing in the NAO around 2000 coincides with a 1°C rise in upper-ocean temperatures and a 1 ‰ drop in $\delta^{15}N_{bulk}$ in corals spanning the Labrador shelf from the Makkovik Hanging Gardens to Hatton Basin (>600 km). To elucidate the causal mechanisms underlying this relationship, we investigate compound-specific nitrogen isotopes of amino acids ($\delta^{15}N_{AA}$). This approach allows us to attribute the observed isotopic variability to distinct processes, including changes in water-mass sourcing with differing baseline nitrogen isotope signatures, shifts in phytoplankton community composition, and potentially the contribution of sea-ice–associated primary production. By distinguishing between these factors, our study advances understanding of how climate variability propagates through marine ecosystems to the deep sea. These findings have direct relevance for ecosystem-based management and help inform conservation policy being developed by the Nunatsiavut Government under the Imappivut Marine Plan, supporting the protection of vulnerable coral habitats in a changing North Atlantic.

FISHERIES ECOLOGY, MANAGEMENT & CONSERVATION

Time: **10:15 – 10:30 [Friday, May 8th, 2026]**

Title: **Growth patterns and microchemical composition of the bloody cockle (*Senilia senilis*) shell along the gradient of the Sine-Saloum inverse estuary**

Authors: **Diop, Khady 1**; Sané, Babacar 2; Dewilde, Fabien 3; Thébault, Julien 4; Thomas, Yoann 4

Affiliations: 1 IRD, Univ Brest, Ifremer, CNRS, LEMAR, Centre ISRA/IRD de Bel-Air, Dakar, Sénégal; 2 Université Cheikh Anta Diop de Dakar, département de biologie animale, Dakar, Sénégal; 3 Univ Brest, CNRS, IRD, UMS3113, 29280 Plouzané, France; 4 Univ Brest, CNRS, IRD, Ifremer, LEMAR, 29280 Plouzané, France"

The bloody cockle (*Senilia senilis*) is a key species in West African coastal ecosystems. It supports a traditional fishing industry that dates back thousands of years, particularly in the Sine-Saloum Delta (Senegal), where women fish, process, and sell this mollusk. This delta is an inverse estuary charac-terized by increasing salinity from the mouth upstream, due to intense evaporation and limited rainfall during the monsoon season from July to November. In this habitat, *S. senilis* is therefore exposed to significant spatial and seasonal variations in salinity. Here, we present a study that uses sclerochronology and carbonate microchemistry to investigate variations in shell growth and isotopic composition of *S. senilis* along the salinity gradient of the estuary. Individuals were sampled at four sites along the gradient, between the estuary mouth and to the up-stream limit of the species' distribution. The results reveal optimal shell growth near the mouth and a marked slowdown during the monsoon at all sites. A spatial gradient of $\delta^{18}O$ is measured with lower values downstream and higher values upstream, and seasonality is marked by minima during the monsoon. A weaker spatial gradient is measured for $\delta^{13}C$, except downstream where values are higher. Seasonality of $\delta^{13}C$ mirrors that of $\delta^{18}O$, with minimum values observed during the monsoon. These data shed light on the species' sensitivity to environmental changes. They are fundamental to current regional studies of the species' response to bioclimatic gradients and provide a modern base-line for interpreting archaeological shells, used for reconstructing palaeoenvironmental conditions in West Africa.

Time: **10:45 – 11:00 [Friday, May 8th, 2026]**

Title: **Assessing individual variation in habitat use of European eel along a unique salinity gradient using otolith microchemistry**

Authors: **Jacobson, Philip 1**; Heimbrand, Yvette 2; Sundin, Josefin 1; Myrenås, Elin 1; van Gemert, Rob 1; Spotowitz, Lisa 1

Affiliations: 1 Swedish University of Agricultural Sciences, Department of Aquatic Resources, Institute of Freshwater Research; 2 Swedish University of Agricultural Sciences, Department of Aquatic Resources, Institute of Coastal

Knowledge regarding variation in habitat utilization among individuals is pivotal for fish management and conservation measures. For migratory fish species such as the critically endangered European eel (*Anguilla anguilla*), which depends on multiple interconnected habitats to complete its life cycle, such knowledge is key for prioritizing management and conservation measures. Here, we analyzed the chemical composition of otoliths from more than 3000 individuals to assess individual variation in habitat use of eel along a unique salinity gradient, ranging from almost full marine to freshwater including the brackish Baltic Sea in the northern Europe, using ratios of strontium to calcium (Sr:Ca) and barium to calcium (Ba:Ca). We show high variation in habitat use among individuals, including resident coastal and resident freshwater eel and inter habitat shifters utilizing both coastal and freshwater habitats to grow large. Our findings are important for future development of management and conservation measures towards the recovery of the critically endangered European eel.

ABSTRACTS
ORAL PRESENTATIONS

FISHERIES ECOLOGY, MANAGEMENT & CONSERVATION

Time: **11:00 – 11:15 [Friday, May 8th, 2026]**

Title: **The microchemistry of European eel otoliths from different habitats in the Neretva estuary (Croatia) predicts/showed habitat variability due to anthropogenic activities**

Authors: Matić-Skoko, Sanja 1; Kennedy, Brian 2; Bašić, Sanja 1; Glamuzina, Branko 3; Kresonja, Matija 4; Glamuzina, Luka 3; Pavičić, Mišo 1; Ugrin, Nika1

Affiliations: 1 Institute of Oceanography and Fisheries, Split, Croatia; 2 University of Idaho, Dept Fish & Wildlife Sci & Dept Biol Sci, Moscow, Idaho, USA; 3 University of Dubrovnik, Department of Applied Ecology, Dubrovnik, Croatia; 4 Oikon- Institute of Applied Ecology, Zagreb, Croatia

Spatial and temporal variability in otolith microchemistry of European eel (*Anguilla anguilla*) from the Neretva River were studied to address: (1) whether freshwater and marine signatures are consistent across habitats; (2) which geochemical factors drive observed variability; (3) whether otolith tracers can identify and quantify transitional periods; and (4) whether distinct settlement areas correspond to specific behavioral patterns. Eels were collected from three representative habitats—transitional lagoon, shallow wetland, and river channel—between September 2023 and July 2024. Otoliths were analyzed for $^{87}Sr/^{86}Sr$ ratios and trace elements using LA-ICP-MS with a Laser Ablation Split Stream (LASS) protocol at the University of Idaho. Wetland eels showed low otolith Sr concentrations consistent with low salinity and freshwater aquifer inputs, but highly variable Sr isotope values indicate fluctuating source waters, reflecting complex karst hydrology rather than a single freshwater signature. Across individuals, baseline oceanic signals were followed by variable freshwater influences, with low Sr/Ca ratios indicative of freshwater residency. Of the 3 source sites, river individuals displayed the lowest Sr concentrations and the greatest variability, suggesting diverse early-life conditions. In contrast, lagoon residents exhibited consistently elevated Sr concentrations and stable isotope ratios, indicating persistent marine influence. Seasonal oscillations in Sr/Ca ratios aligned with age estimates and reflected strong annual temperature cycles. Although eels are well studied, the combined effects of climate change and altered catchment connectivity—key drivers of recolonization success—remain underrepresented in predictions of future distributions. Our findings reveal habitat-specific chemical patterns and raise questions about whether these reflect pre-settlement habitat selection or post-settlement survival dynamics.

Time: **11:15 – 11:30 [Friday, May 8th, 2026]**

Title: **Brackish water use of Burbot (*Lota Lota*) in the Western Canadian Arctic**

Authors: **Loewen, Tracey N. 1;** Amos, Amy 1; Cott , Peter A. 2

Affiliations: 1 Fisheries and Oceans Canada, Freshwater Institute, Winnipeg, Canada; 2 Cott Environmental, Yellowknife, Canada

Burbot (*Lota lota*) are known to be a freshwater fish that is distributed throughout the Mackenzie River Delta, Canada and associated rivers and lakes. On the North Slope of the Yukon, Canada community fishers capture Burbot in brackish water conditions in summer fishing camps. The objective of our study was to examine the occurrence of brackish water use of Burbot throughout the species range in the region. LA-ICP-MS was used to examine Sr concentrations in community collected Burbot otoliths from various communities along the Mackenzie River, NWT. The study results indicate that a large proportion of Burbot from the Aklavik, Tsiigehtchic, and Inuvik regions, Northwest Territories migratory patterns into brackish water. Burbot from southern locations such as Great Slave Lake, NWT were purely in freshwater habitats and did not exhibit brackish water use. This study demonstrates new life history patterns for Burbot in the Western Canadian Arctic.

ABSTRACTS
ORAL PRESENTATIONS

FISHERIES ECOLOGY, MANAGEMENT & CONSERVATION

Time: **11:30 – 11:45 [Friday, May 8th, 2026]**

Title: **Age validation of Patagonian toothfish**

Authors: **Condran, Cerys 1**; Hollyman, Phil 1; Le Luherne, Emilie 2

Affiliations: 1 School of Ocean Sciences, Bangor University, Askew Street, Menai Bridge LL59 5AB, UK; 2 Fisheries Department, Directorate of Natural Resources, Falkland Islands Government, Bypass Road, Stanley FIQQ 1ZZ, Falkland Islands

Patagonian toothfish (*Dissostichus eleginoides*) have been routinely aged for stock assessment by assuming annual periodicity of otolith growth increment deposition. Indirect evidence of annual increments has been provided for this species using bomb radiocarbon and lead-radium dating, as well as marginal increment analysis. However, these methods have limitations in terms of application and resulting age resolution. This study attempts to validate the annual increments using oxytetracycline (OTC) marked otoliths, one of the best methods available for validating the periodicity of growth increment formation. From 2016 to 2018, 1755 Patagonian toothfish were injected with OTC on release across the Falkland Islands longlining fishing area. By 2025, 9% of the OTC-marked toothfish had been recaptured, with a time at liberty between 1 and 7 years. A total of 149 otoliths were processed and read by three independent readers. We found a 1:1 relationship between the number of growth increments beyond the OTC mark and the known time at liberty, allowing us to validate the annual periodicity of increment deposition on Patagonian toothfish otoliths. Furthermore, estimated age-at-length at tagging aligned with Falkland Islands population data from 2016 to 2024 ageing program. Comparison between predicted and estimated age-at-length at recapture revealed a reduction in toothfish growth after tagging. Population age estimations are keystone information for stock assessments of this slow-growing species. It was therefore crucial to validate annual otolith increment deposition to improve the confidence in age estimates and confirm the reliability of stock assessments, essential for sustainable management and conservation of the species.

Time: **11:45 – 12:00 [Friday, May 8th, 2026]**

Title: **Validation of annual growth zone formation in gray triggerfish *Balistes capriscus* dorsal spines, vertebrae, and otoliths**

Authors: **Rogers, Walter D. 1**; Potts, Jennifer C. 2; Rezek, Troy C. 3; Rezek, Amanda R. 4

Affiliations: 1 Cooperative Institute for Marine and Atmospheric Studies, University of Miami, in support of NOAA Fisheries Southeast Fisheries Science Center, Beaufort, NC, USA; 2 NOAA Fisheries Southeast Fisheries Science Center Beaufort, NC, USA; 3 CSS-Inc., Under Contract to NOAA National Centers for Coastal Ocean Science, Beaufort, NC, USA; 4 NOAA Fisheries Southeast Fisheries Science Center, Beaufort Laboratory, , Beaufort, NC, USA

Uncertainty in age estimates from dorsal spines has been a persistent issue in stock assessments of gray triggerfish, *Balistes capriscus*. This study sought to validate the annual deposition of growth zones on dorsal spines, vertebrae, and otoliths of gray triggerfish through chemical marking. Fish (n = 101) were collected from offshore habitats and held in an aquaculture facility. 74 adult fish were chemically marked with a 50 mg/kg body weight injection of calcein and reared for an average of 527 days post-marking. At intervals, fish were sacrificed and first dorsal spines, vertebrae, and otoliths were extracted and sectioned. Annuli, were enumerated for spines (n = 96), vertebrae (n = 94), and otoliths (n = 48) and ranged from 0 to 11 annuli for spines and vertebrae, and 1–12 annuli for otoliths. Age bias plots showed strong agreement between spine and vertebra annuli counts for all observed ages, while counts from spines and vertebrae appeared to underage beginning at age 5 when compared to otolith annuli counts. Tests of symmetry indicated that the annuli counts between paired age structures were not biased ($p > 0.05$). Analysis of growth zones observed distal to calcein marks in all of the age structures confirmed that these zones were deposited annually, and the expected number of these zones, or annuli, were observed in 91% of spine, 90% of vertebrae, and 100% of otolith sections. Marginal increment analysis of ageing structures indicated that annuli form during summer months. Percentages of annuli deposited on the margins peaked in June for spines (58%) and otoliths (29%), and August for vertebrae (30%). Results from this study validate the annual deposition of growth zones but further consideration needs to be taken when ageing older than age-4.

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FISHERIES ECOLOGY, MANAGEMENT & CONSERVATION

Time: **8:45 – 9:00 [Saturday, May 9th, 2026]**

Title: **Can otolith growth increments be used to reveal the age of sexual maturation in fish?**

Authors: **Campana, Steven E. 1**; Black, Bryan A. 2; Morrongiello, John R. 3; Smolinski, Szymon 4

Affiliations: 1 Life and Environmental Sciences, University of Iceland, Reykjavik, Iceland; 2 Laboratory of Tree-Ring Research, University of Arizona, Tuscon, Arizona, USA; 3 School of BioSciences, University of Melbourne, Melbourne, Victoria, Australia; 4 National Marine Fisheries Research Institute, Gdynia, Poland

Otoliths are routinely used to determine the age, size and growth rate of long-dead fishes, with more recent innovations allowing the reconstruction of historic mortality rates. Only a reconstructed recruitment rate is missing from the quest to reconstruct most of the population dynamics of past fish populations. Can the pattern of declining otolith growth increment widths long noted by otolith age readers be objectively linked to the age of onset of sexual maturation, which in turn is a proxy for spawning and recruitment? Or is the otolith growth pattern too variable across individuals and species to provide useful information? Let's find out, shall we?

Time: **9:00 – 9:15 [Saturday, May 9th, 2026]**

Title: **Unlocking archival otoliths: Developing a non-destructive method to analyze museum otoliths for historical life-history reconstructions**

Authors: **Spotowitz, Lisa 1**; Heimbrand, Yvette 2; Sundin, Josefin 1; Jacobson, Philip 1

Affiliations: 1 Department of Aquatic Resources (SLU Aqua), Swedish University of Agricultural Sciences, Drottningholm, Sweden; 2 Department of Aquatic Resources (SLU Aqua), Swedish University of Agricultural Sciences, Öregrund, Sweden

Museum collections provide unique archives for reconstructing historical life-history variation in fishes through otolith analyses. However, given the historical value of museum curated old specimens, non-destructive or minimally invasive sampling and analytical approaches are required. Using X-ray radiography and CT scanning to localize otoliths, we developed a novel and precise extraction method that minimizes damage to museum-curated specimens. We analyzed 100 otoliths from European eels (*Anguilla anguilla*) collected between 1845 and 1920 to evaluate their suitability for microchemical analysis and life-history reconstructions. We further assessed the applicability of non-destructive micro-X-ray fluorescence (μXRF) for determining otolith chemical composition and compared it with data of the more traditional and invasive laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) analysis.
The developed method for extracting and analyzing otoliths from museum collections with reduced negative impacts on the specimens and the otolith show great potential for utilizing museum collections for assessing historical life-history and habitat use in fish. The first results highlight both the opportunities and constraints of working with archival material and underscore the importance of museums as repositories of long-term ecological information for species of conservation concern, supporting their use in sclerochronological and microchemical analyses. Such archival material is particularly valuable for the critically endangered European eel, given the species' dramatic decline and the scarcity of pre-industrial baseline data.

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FISHERIES ECOLOGY, MANAGEMENT & CONSERVATION

Time: **9:15 – 9:30 [Saturday, May 9th, 2026]**

Title: **Unravelling baselines through time-series analysis of otolith chemistry**

Authors: **Sabetian, Armagan 1**; Zhang, Jingjing 2; Hegg, Jens 3; Campbell, Matthew 4; Walter, Richard 5; Lilkendey, Julian 1

Affiliations: 1 School of Science, Auckland University of Technology, Auckland, New Zealand; 2 The New Zealand Institute for Bioeconomy Science Limited, Auckland, New Zealand; 3 Department of Biology, Gonzaga University, Spokane (Washington), USA; 4 Anthropology Department, University of Auckland, New Zealand; 5 Southern Pacific Archaeological Research, School of Social Sciences, University of Otago, Dunedin, New Zealand

Effective fisheries and coastal ecosystem management necessitate understanding the large-scale movements of fish species. Traditional analytical techniques do not usually provide high-resolution information from continuous movement profiles. In this study, we applied time series analysis techniques - Behavioural Change Point Analysis (BCPA) and Dynamic Time Warping (DTW) - to otolith element profiles of New Zealand snapper (*Chrysophrys auratus*) collected from archaeological, 20th century, and contemporary specimens. Our innovative methodology helped uncover significant differences in snapper movement patterns pre- and post-industrial times and draw inferences about residency, migration, and coastal habitat clustering. We identified distinct cluster groups mainly characterized by samples from different periods. As a result, we gained key insights into the long-term impacts of anthropogenic environmental changes on snapper movements and habitat use. Our research integrates time series analyses with movement analysis, proposing a novel ecological indicator for ecosystem health assessment and conservation. The results underscore the importance of understanding habitat use and fish population resilience amidst anthropogenic disturbances and environmental changes.

SCLEROCHRONOLOGY IN DEEP TIME

Time: **10:00 – 10:15 [Saturday, May 9th, 2026]**

Title: **Chronology of colour banding in a Cretaceous-aged marine reptile tooth**

Authors: **Brink, Kirstin S. 1**; Gold, Virginia K. 1

Affiliations: 1 Department of Earth Sciences, University of Manitoba, Winnipeg, Canada

Banding and other colouration patterns in the dentine and enamel of fossilized teeth are relatively common in vertebrate non-mammalian carnivores. However, it is unknown if these colourations are due to the fossilization process (i.e., diagenesis) or if they formed during tooth development. In mammals, colour changes associated with other defects (e.g. enamel hypoplasia) have biological significance, marking life history events or periods of stress, however, this has not been demonstrated in reptiles. In this study, we examined teeth with banded dentine from extinct Cretaceous-aged marine reptiles, mosasaurs, to determine if they formed through fossilization or before the death of the animal and have biological significance. To do so, transmitted light microscopy, electron probe microanalysis, scanning electron microscopy, and transmission electron microscopy analyses were used to determine chemical, morphological, and textural features of normal and banded dentine. Results show that the banded dentine is translucent in thin section, has infilled dentine tubules with a similar elemental composition to the surrounding intertubular dentine, and has smaller intratubular crystals than the surrounding intertubular dentine. Counts of von Ebner Lines suggest the banded dentine formed over 30 days. We interpret this band as sclerotic dentine, formed during the life of the animal. However, the aetiology of this patterned dentine remains unknown, as no similar occurrences have been described for humans or other animals. This study emphasizes the use of the fossil record to understand the deep homologies of modern tooth tissues and the diversity of occurrences in vertebrates.

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SCLEROCHRONOLOGY IN DEEP TIME

Time: **10:15 – 10:30 [Saturday, May 9th, 2026]**

Title: **Modern-like Asian monsoon in South China during the late Oligocene**

Authors: **Hethke, Manja 1,2**; Struck, Ulrich 2,3; Hoelzmann, Philipp 4; Busche, Marleen 2; Li, Huayong 2,5; Wiese, Robert 2; Wiechert, Uwe 2 Zhang, Hucai 6; Riedel, Frank 2,6

Affiliations: 1 LWL-Museum für Naturkunde, Westfälisches Landesmuseum mit Planetarium, Referat Paläontologie, D-48161 Münster, Germany; 2 Institut für Geologische Wissenschaften, Freie Universität Berlin, D-12249 Berlin, Germany; 3 Museum für Naturkunde, Berlin, Leibniz-Institut für Evolutions- und Biodiversitätsforschung, D-10115 Berlin, Germany; 4 Institut für Geographische Wissenschaften, Freie Universität Berlin, D-12249 Berlin, Germany; 5 School of Resource Environment and Tourism, Anyang Normal University, Anyang 455000, China; 6 Institute for Ecological Research and Pollution Control of Plateau Lakes, School of Ecology and Environmental Science, Yunnan University, Kunming 650500, China

The onset of the modern Asian Monsoon is debated, with previous studies pointing to monsoonal conditions as early as the mid-Eocene in present-day South China and an Oligocene to Neogene age for the onset of the East and South Asian Monsoon subsystems. A key to recognizing monsoonal circulations in deep time is to resolve seasonal precipitation cycles and to look for dry and wet phases. Here, we compare late Oligocene gastropod sclerochronological patterns ($\delta^{13}C$, $\delta^{18}O$) from lake deposits of South China with (1) a mid-Holocene pattern and with (2) annual cycles of present-day precipitation in the region. We find that the late Oligocene annual precipitation pattern was similar to the modern East Asian Monsoon precipitation pattern, in yielding a multi-phased onset with extended wet and drier phases and a stepwise monsoon withdrawal, indicating a modern-like Asian Monsoon during the late Oligocene in terms of rainfall seasonality. However, late Oligocene monsoon intensity was distinctly higher than in the mid-Holocene.

Time: **10:45 – 11:00 [Saturday, May 9th, 2026]**

Title: **Sclerochronology of freshwater pearl mussels (*Margaritifera* (*pseudunio*) *flabellata*) from the early late Miocene hominid locality Hammerschmiede, Bavaria, Southern Germany**

Authors: Lechner, Thomas 1; Glotzbach Christoph 1; Böhme Madelaine 1,2

Affiliations: 1 Eberhard Karls University of Tübingen, Department of Geoscience, Tübingen, Germany; 2 Senckenberg Centre for Human Evolution and Palaeoenvironment (HEP), Eberhard Karls Universität, Tübingen, Germany

The Early Late Miocene locality of Hammerschmiede (Bavaria, Southern Germany) is one of Europe's most important Miocene vertebrate sites, yielding over 150 vertebrate species and famously the early great apes *Danuvius guggenmosi* and *Buronius manfredschmidi*. Systematic excavations by the University of Tübingen have applied advanced documentation techniques, enabling high-resolution taphonomic and biostratinomic analyses. The fossiliferous strata belong to the Upper Series of the Inclined Foreland Molasse and comprise two key fluvial deposits: HAM5 (11.62 Ma), representing a stable, small rivulet, and the younger HAM4 (11.58 Ma), deposited by a dynamic, meandering river system. The site preserves dense accumulations of freshwater pearl mussels (*Margaritifera* (*Pseudunio*) *flabellata*), often in layers of thousands of individuals. Preliminary sclerochronological data indicate that individual mussels commonly exceeded 100 years in age. Sedimentological observations reveal a fine-grained depositional environment dominated by sand and clay, contrasting with the coarse-grained substrates typically preferred by extant freshwater pearl mussels. The exceptional preservation of primary aragonite provides an excellent basis for high-resolution sclerochronological analyses. This combination allows for a nuanced reconstruction of the paleoecology of *M. flabellata* and its role within the fluvial depositional system, with the potential to provide a high-resolution hydroclimatic time series for the continental Miocene. Future work aims to cross-calibrate individual shells to reconstruct the full depositional history of the Hammerschmiede fluvial system. Layered mussel accumulations provide opportunities to correlate discrete events and count annual growth increments. Geochemical analyses are expected to yield additional insights into paleo-hydrology, seasonal variability, water chemistry, and paleotemperature. Collectively, sclerochronology of *M. flabellata* offers a high-resolution temporal framework for understanding the depositional dynamics of this key hominid locality.

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SCLEROCHRONOLOGY IN DEEP TIME

Time: **11:00 – 11:15 [Saturday, May 9th, 2026]**

Title: **Intraformational changes in marine climate, water isotopic composition and bivalve community from combined $\delta^{18}O$ and Δ^{47} analysis of late Cenozoic shells from the UK and USA**

Authors: Johnson, Andrew L.A. 1; Cudennec, Jean-François 2; Schöne, Bernd R. 3; Leng, Melanie J. 4; Petersen, Sierra V. 5; Harper, Elizabeth M. 6

Affiliations: 1 School of Science, University of Derby, Derby, UK; 2 European Institute for Marine Studies, University of Western Brittany, Plouzané, France; 3 Institute of Geosciences, Johannes Gutenberg University, Mainz, Germany; 4 National Environmental Isotope Facility, British Geological Survey, Keyworth, UK; 5 Department of Earth and Environmental Science, University of Michigan, Ann Arbor, USA; 6 Department of Earth Sciences, University of Cambridge, Cambridge, UK

Palaeoenvironmental and palaeoecological interpretations are sometimes based on aggregated data from different specific locations and horizons. The mean states inferred might, however, be fleeting circumstances between modal states. Bimodality of marine climate and bivalve community is suggested by the higher seasonal shell $\delta^{18}O$ values from Arctica compared to Centrocardita and Glycymeris from the early Pliocene Coralline Crag Formation (UK). The seasonal differences cannot be fully explained by time-averaging, growth breaks or vital effects but might be due to changes in water $\delta^{18}O$ rather than temperature. Water $\delta^{18}O$ values back-calculated from shell $\delta^{18}O$ data and Δ^{47}-temperatures from co-occurring Aequipecten span a fairly large range: –1.2‰ to +0.1‰. Seasonal temperatures calculated using the highest value (identical to a modelled value) and shell $\delta^{18}O$ data from Arctica are closely comparable to $\delta^{18}O/\Delta^{47}$-based temperatures from Aequipecten. However, this water value yields seasonal temperatures about 2°C higher from Centrocardita and Glycymeris. Water $\delta^{18}O$ values similarly back-calculated from Carolinapecten data from the early Pleistocene James City Formation (eastern USA) also span a fairly large range: +0.5‰ to +2.2‰. Use of both the highest and lowest values in conjunction with shell $\delta^{18}O$ data from co-occurring Glycymeris yields summer temperatures that are comparable to those obtained from Carolinapecten. However, winter temperatures from Glycymeris are about 10°C higher. Thus, in this case the data point towards intraformational climate variation, whereas in the case of the Coralline Crag either or both of variation in climate or water $\delta^{18}O$ may be represented. In both cases, however, bimodal community compositions are evinced.

ABSTRACTS
ORAL PRESENTATIONS

SCLEROCHRONOLOGY IN DEEP TIME

Time: **11:15 – 11:30 [Saturday, May 9th, 2026]**

Title: **Seasonal variability during the Gelasian-Calabrian transition recorded by sclerochronological stable isotopes in lacustrine gastropods (Kos, Greece, Eastern Mediterranean)**

Authors: **Schulze, Ennie 1**; Bellas, Spyridon 2; Busekrus, Sophie 3; Hartmann, Kai 1; Hethke, Manja 1, 4 ; Struck, Ulrich 5; Zieger, Johannes 6; Riedel, Frank 1

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The Early Quaternary marks the onset of intensifying Northern Hemisphere glaciation, dominated by obliquity-driven (41–ka) cycles, with longer 100–ka cycles emerging toward the Middle Pleistocene. Marine records robustly document these changes at millennial timescales. However, how such large-scale climate reorganizations were expressed in the continental hydroclimate at seasonal to sub–seasonal resolution remains poorly explored. We present sclerochronological $\delta^{18}O$ and $\delta^{13}C$ records from *Viviparus* shells recovered from six stratigraphically successive lacustrine layers of palaeolake Kos (Eastern Mediterranean), spanning approximately 2–1.5 Ma. The shells preserve consecutive intra–annual isotope cycles, enabling the reconstruction of seasonal hydroclimatic variability across the Gelasian–Calabrian interval. Seasonal isotope amplitudes vary systematically across the section, with a pronounced mid–section maximum. Notably, intra–annual isotope amplitudes change prior to shifts in mean isotope values, suggesting that seasonal variability responded earlier than the average climate conditions. Seasonal patterns broadly show alignment with marine isotope stages, consistent with a coupling between Eastern Mediterranean continental seasonality and global ice–volume changes during this period.

Time: **11:30 – 11:45 [Saturday, May 9th, 2026]**

Title: **Faster life histories for *Arctica islandica* during mid-Pliocene warmth in Iceland**

Authors: Ivany, Linda C. 1; Duati, Bella 1; Bromonsky, Skylin 2; Weinzapfel, Benjamin H. 1; Nirenberg, Jared 3; Bhattacharya, Tripti 1; Butler, Paul 4; Moss, David K. 2,5

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The ocean quahog, or kúfskel, *Arctica islandica*, is the slowest growing and longest-lived bivalve known today. A North Atlantic cold-water taxon, populations around Iceland regularly produce individuals of 200+ years of age. Bivalves from higher latitudes today tend to be longer lived and slower growing than lower latitude representatives, a relationship likely driven in part by temperature and light/food availability. To the degree that temperature plays a role in life history, we predict that Arctica living during warmer intervals of the past should exhibit faster growth and shorter lifespans than those today from the same place, yet few data exist from the fossil record. We collected fossil Arctica from the Pliocene Tjörnes Beds of NE Iceland to compare their life histories and paleotemperatures with those directly offshore today. Serially collected δ18O values yield Pliocene paleotemperatures averaging ~7-9 °C with a 6 °C seasonal range. Alkenones in associated sediment yield UK'37-derived summer SSTs of 14 °C. All are significantly warmer than historical temperatures, averaging <2 °C. Growth parameters from 34 fossil shells reveal short lifespans (7-78 years; mean = 24.3) and fast growth (k values of 0.06 to 0.38; mean = 0.15) in comparison to data from 27 modern shells (45-505 yrs, mean = 199; k values 0.004 to 0.05, mean = 0.02). Results confirm a 'faster' life history for Pliocene Arctica and reinforce a role for temperature in driving the latitudinal life-history gradient. Summer water temperatures in the region today are approaching those of the Pliocene. Can modern populations adapt?

ABSTRACTS
ORAL PRESENTATIONS

SCLEROCHRONOLOGY IN DEEP TIME

Time: **11:45 – 12:00 [Saturday, May 9th, 2026]**

Title: **Advances in amino acid geochronology of bivalve shells: A complementary technique for sclerochronology**

Authors: **Nelson, Ellie F. 1**; Conti, Martina ; Butler, Paul G. 2; Reynolds, David J. 2; Trofimova, Tamara 2; Robson, Harry K. 3; Milner, Nicky 3; Meng, Stefan 4; Reuter, Markus 4; Hausmann, Niklas 3, 5; Scourse, James D. 2; Penkman, Kirsty E.H. 1

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Amino acid geochronology (AAG) is a relative dating technique that can support the construction of sclerochronologies by providing range-finding age estimates for marine bivalve shells. Recent work has demonstrated that a time signal for the whole Quaternary period (last ~2.6 Ma) can be generated from the inner portion of the outer shell of *Arctica islandica* using the intra-crystalline protein decomposition (IcPD) approach to AAG. This method targets closed system proteins within the intra-crystalline fraction of the shell, where protein decomposition is solely time and temperature-dependent. Temporal resolution has been achieved for shells attributed to the Holocene to the Early Pleistocene from northern European seas. The extent of IcPD has been defined for sub-stages of the Holocene to constrain the age of shells collected from the Fladen Ground (North Sea) and North Icelandic Shelf for building regional sclerochronologies. The resolution of this approach has been improved by the development of an age calibration model to estimate a numerical age from the multi-variant data produced by IcPD analysis. The IcPD method has also been used to determine chronostratigraphic attribution of *Arctica islandica* from Baltic Sea Middle and Late Pleistocene deposits, demonstrating that this approach can be used to correlate shells with interglacial stages associated with this period for northern Europe. In addition, other species of bivalves (oysters, *Mya* & *Macoma*) are now being tested for IcPD AAG. Expanding the use of this technique to other taxa will increase the diversity of marine deposits that can be dated using this approach.

Time: **13:15 – 13:30 [Saturday, May 9th, 2026]**

Title: **Tidal cycles echoed in oyster shell micro-growth increments: A method to calibrate seasonal paleotemperature reconstructions**

Authors: **Zheng Fang 1**; Matthias Alberti 2; Yanhong Pan 1

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Seasonal patterns are shifting under ongoing global warming, manifesting as earlier, longer and hotter summers. Reconstructions of seasonality during past warm periods — derived from seasonally resolved biogenic archives such as bivalve fossil shells — provide valuable insights that serve as analogs for future conditions. However, existing age models for these reconstructions often rely on unstable increment timing or oversimplified environmental assumptions. In this study, we employ spectral analysis to detect tidal rhythm from micro-growth increment widths. This approach achieves precise dating (bias <10%) in two modern oyster shells with known temporal markers. Further application to a mid-Holocene fossil oyster indicates slightly cooler sea surface temperatures in summers and warmer in winters near Yangtze River Delta, consistent with model simulations.

ABSTRACTS
ORAL PRESENTATIONS

ARCHAEOLOGY

Time: **14:00 – 14:15 [Saturday, May 9th, 2026]**

Title: **Fluvial Sambaquis of Southwestern Amazonia: Indicators of Middle to Late Holocene climate dynamics**

Authors: **Weber, Sadie L. 1**; Pugliese, Francisco 2; Neves, Eduardo G. 1; Hermenegildo, Tiago 3; Prestes-Carneiro, Gabriela 4; Watling, Jennifer G. 1; Shock, Myrtle P. 5; Brandão, Kelly 6.; Cruz, Francisco W. 7

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We carried out a detailed reconstruction of the climate for the past 6000 years on the Guaporé River on the border between Brazil and Bolivia in southwestern Amazonia. The Amazon basin is home to a deep Indigenous history of unique settlement and landscape management systems that resulted in the culturally and biologically diverse biome we know today. We apply a program of intensive stable isotope analysis of *Pomacea* sp. shells at the Monte Castelo, a 6.5 m fluvial shell mound that is currently flooded seasonally. Excavations at Monte Castelo have yielded evidence for in situ domestication of rice as well as early development of ceramic technologies. We assess the changes that have taken place since the initial occupations at Monte Castelo during Middle Holocene through its various phases of reoccupation and abandonment through the Late Holocene. We integrate these data with ongoing research on subsistence and human-landscape interactions to understand how Monte Castelo's builders and occupants interacted with their dynamic surroundings.

Time: **14:30 – 14:45 [Saturday, May 9th, 2026]**

Title: **Fortnightly-resolved reconstruction of West African monsoon variability over the last two millennia from *Senilia senilis* shell middens**

Authors: **Thébault, Julien 1**; Thomas, Yoann 1; Blanchard, Nolwenn 1; Dewilde, Fabien 2; Diop, Khady 3; Kerhervé, Malika 1; Sardenne, Fany 1; Carré, Matthieu 4,5

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Shell middens formed by past shellfishing activities are valuable archives of long-term socio-cultural and environmental change. In West Africa, they are widespread along the Mauritanian and Senegalese coasts, with particularly high densities in the Sine-Saloum Delta (~100 sites). These middens are dominated by the bloody cockle *Senilia senilis*. Although the oldest mounds date to ~6000 BP, sustained occupation mainly occurs after ~2000 BP, coincident with geomorphological changes from beach-ridge systems to a mangrove-dominated delta. We analysed 17 *S. senilis* shells from four shell middens in the delta. Radiocarbon dating indicates harvesting between 294 CE and 1917 CE. Sclerochronological analysis revealed clear fortnightly increments expressed as alternating dark and light bands. One carbonate sample was drilled per increment, yielding two- to six-year growth records per shell, and oxygen and carbon isotope ratios were measured. Within individual shells, seasonal $\delta^{18}O$ and $\delta^{13}C$ patterns are highly reproducible, while substantial variability exists among shells from different periods. All specimens show an annual isotopic decrease associated with the onset of the monsoon and freshwater input into the delta. However, the amplitude, timing, and duration of this shift vary markedly over the past 2000 years. In some intervals, monsoon onset appears abrupt, with sharp $\delta^{18}O$ decreases over two fortnightly increments, whereas in others it is more progressive, with gradual isotopic change over several weeks. These results demonstrate the potential of *S. senilis* shell middens as high-resolution archives of past climate variability in West Africa.

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ARCHAEOLOGY

Time: **15:00 – 15:15 [Saturday, May 9th, 2026]**

Title: **Investigating shell-matrix deposits at the Neolithic site of Ginnerup (Denmark): Insights from zooarchaeological and sclerochronological analyses on mollusc remains**

Authors: **Stringer, Chloe A. 1**; Schöne, Bernd R. 2; Olsen,Jesper 3; Ramussen, Uffe 4; Maring, Rikke 1,5; Klassen, Lutz 5; Johannsen, Niels N. 1; Mannino, Marcello A. 1

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During the Middle Neolithic (c. 3000 BCE), the northeastern coastal areas of Denmark witnessed a transition from a farming economy, introduced by the Funnel Beaker culture, to a mixed economy associated with the Pitted Ware Culture, in which hunting and gathering again rose to prominence. While this change has been recorded at several sites, Ginnerup, a shell-matrix site in central-eastern Jutland, is unique for its strata which span the time intervals before and during this transition. The site, therefore, provides an opportunity to better understand the environmental context under which these changes occurred. Thanks in part to the shell-rich sediments, the cultural remains of Ginnerup show excellent preservation; now, our project brings the shells themselves under the spotlight! This presentation will detail how we are using archaeomalacology, sclerochronology and radiocarbon dating to investigate the environmental context of the cultural transition and answer important questions about site formation and use. *Littorina littorea*, *Cerastoderma* sp. and *Ostrea edulis* were selected for isotope analysis ($\delta^{18}O$, $\delta^{13}C$) with the aim to understand how these taxa may provide differing environmental information given their specific habitats. *L. littorea* and *Cerastoderma* specimens were selected for further analyses to investigate season of death. Archaeomalacological analyses focus on taxonomic identification and quantification, but also variations in taphonomy to understand why shells were deposited at the site. Using a multi-pronged approach, this research will inform us on how human-mollusc-environment relationships changed at Ginnerup through time, and should contribute to our understanding of this complex period of Danish history.

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ORAL PRESENTATIONS

ARCHAEOLOGY

Time: **15:30 - 15:45 [Saturday, May 9th, 2026]**

Title: **Remarkable single-fishing event reveals exceptionally cold winter conditions during the Atlantic/Subboreal transition in Brittany, France**

Authors: **Cudennec, Jean-François 1**; Robinet, Zoé 2; Siebert, Valentin 2; Dewilde, Fabien 3; Thébault, Julien 2; Pailler, Yvan 1

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Marine molluscs shells are widely used as high-resolution palaeothermometers for reconstructing past climatic conditions through the analysis of their stable oxygen isotope composition ($\delta^{18}O$). Prehistoric shell middens are particularly valuable archives, preserving well-dated assemblages of shells that record sea-surface temperatures at sub-seasonal to interannual timescales. This study focuses on a batch of *Pecten maximus* shells recovered from a single Late Neolithic pit on Quéménès Island (Iroise Sea, Brittany, France), dated to 5065-4890 cal. BP. Oxygen isotope analyses along the shell growth margins indicate a narrow collection period in late summer to early autumn for all analysed shells, matching equinoctial spring tides, which is consistent with the tidal accessibility required for hand collection of this species. Under the hypothesis that these shells were collected simultaneously, their isotopic records represent different replicates of the final years before the scallop's collection, enhancing the reliability of the palaeo-environmental reconstructions. These contemporaneous specimens offer a unique opportunity to investigate the seawater temperature of this period at very high resolution (as *Pecten maximus* produces daily growth increments) and high level of confidence. Assuming a conservative salinity value of 34.5, the reconstructed SST reveal exceptionally cold winters (5.5°C, down to 3.9°C) and cool summers (11.5°C), with modern values being 9/10°C in winter and 16/17°C in summer and markedly exceeding previously documented variations for the region at that time. While a broader cold event is known across parts of Europe during the Atlantic/Subboreal transition, the magnitude observed here points to a pronounced, regionally constrained climatic anomaly.

Time: **15:45 – 16:00 [Saturday, May 9th, 2026]**

Title: **A high-resolution stable isotope record of Holocene palaeoclimate and seasonality in the central Mediterranean**

Authors: Prendergast, Amy 1; Groucutt, Huw 2; Blinkhorn, James 3; Vella, Nicholas 2; Lindauer, Susanne 4; Alidoostsalimi, Mahsa 1; Scerri, Eleanor 2

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While the spectacular archaeological remains of the Maltese islands, such as the Neolithic megalithic 'temples', have been widely discussed, much remains to be understood about the context of the human past in Malta. Here we report a study to elucidate how regional climate has changed over the past twelve thousand years, and to explore the seasonal character of the earliest human presence in Malta. To address these topics we have directly radiocarbon dated a large number of *Phorcus turbinatus* marine gastropods from archaeological sites in Malta. We then conducted stable isotope analysis on these shells, which gives a high-resolution record of climate change as their isotope values have previously been shown to strongly correlate with sea surface temperature. Furthermore, by studying the final growth phases of these shells we are able to determine the season of collection. This allows us to test models for the earliest inhabitants of Malta and distinguish between seasonal visits and longer-term occupations. Our results highlight the dynamic climate of the central Mediterranean and suggest that the earliest inhabitants of Malta were present year-round.

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ORAL PRESENTATIONS

ARCHAEOLOGY

Time: **16:00 – 16:15 [Saturday, May 9th, 2026]**

Title: **Exploring European flat oyster (*Ostrea edulis*) for season of capture analysis**

Authors: **Andrus, C. Fred T. 1**; Dominguez, Teresa 1; Mihanović, Hrvoje 2; Janeković, Ivica 3; Peharda, Melita 2

Affiliations: 1 Department of Geological Sciences, The University of Alabama, Tuscaloosa, Alabama, USA; 2 Laboratory for Fisheries Science, Institute of Oceanography and Fisheries, Split, Croatia; 3 School of Engineering, The University of Western Australia, Perth, Australia

The European flat oyster (*Ostrea edulis*) is one of the most abundant and important mollusks found in shell-bearing archaeological sites along the Atlantic and Mediterranean coasts, from Norway on the north to many Mediterranean sites on the south. Despite its occurrence in excavations spanning paleolithic to historic times, sclerochronological research on this species remains limited. Here, we report a validation study of season of capture estimates, using stable oxygen isotope analysis of modern shells. We analyzed aquaculture-grown shells from Mali Ston Bay, Croatia and natural oysters from the open Adriatic. Oxygen isotope profiles derived from micromilling the hinge in cross section yielded sinusoidal patterns indicative of seasonal variation. These shell data were compared to modeled oxygen isotope profiles based on local water temperature and salinity data, revealing intervals of reduced or halted shell growth. The slow growth periods were not synchronous among individuals but tended to be more frequent during summer and winter temperature extremes and during periods of decreased salinity. No pattern relating oxygen isotope oscillations to chalky vs foliated increments was evident, nor were annual growth lines detected, suggesting visual analysis of season of capture may not be possible, at least in this region. Overall, our findings indicate that only coarse seasonal estimates, such as distinguishing warm from cold season of capture, may be feasible. These results may be improved with finer scale micromilling than is typically used on other oyster species such as *Crassostrea virginica*. Further validation studies across the range of *O. edulis*' are recommended.

ABSTRACTS
ORAL PRESENTATIONS

ARCHAEOLOGY

Time: **16:15 – 16:30 [Saturday, May 9th, 2026]**

Title: **Sclerochronological analysis of mussel shells from a Neolithic near-coastal cave site in the eastern Adriatic Sea**

Authors: **Peharda, Melita 1**; Bodružić, Mario 2; Buchnell, Meghan 3; Bujas, Niko 1; Gillikin, David P. 4; Hajdas, Irka 5; Harper, Elizabeth 6; Schöne, Bernd R. 7; Uvanović, Hana 1; Verheyden, Anouk 4; Vujević, Dario 2; de Winter, Niels J. 8

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During the past decades, archaeological excavations along the eastern Adriatic coastline have uncovered several sites with remains of various mollusc species. Among them, Ždrilo Cave is especially interesting due to a high abundance of mussel (*Mytilus galloprovincialis*) and oyster (*Ostrea edulis*) shells, some partially fragmented but many well preserved. Shell deposits made a significant proportion of the layers that can otherwise be interpreted as fumier deposits (associated with the burning of vegetation and/or animal excrement) and are associated with the seasonal use of the cave for the purpose of herding sheep and/or goats. In the framework of the research project BivalveSPEECH, archaeological specimens of *M. galloprovincialis* (n=9) from three different stratigraphic layers were analysed. This includes the analysis of radiocarbon (^{14}C; one sample per shell) as well as stable oxygen ($\delta^{18}O$) isotopes (30 – 73 samples per shell). The age of the studied specimens ranged from 7521 (layer 2.6) to 6169 yr BP (layer 2.2). Results confirm that the analysed shells were deposited during the Early and Middle Neolithic. Stable oxygen isotope values ranged from -4.4 to 2.3 ‰, indicating freshwater input into the area. Values obtained from the shell margin suggest year-round collection, which implies year-round site occupation. Our data and interpretation provide new insights into the settlement patterns, mobility, and subsistence strategies of Neolithic populations occupying the Middle Dalmatian coastal zones. In addition, the archaeological shells could provide information on changing freshwater inputs into the coastal zone.

Time: **16:45 – 16:45 [Saturday, May 9th, 2026]**

Title: **The exploitation of the bivalve *Cerastoderma glaucum* in Hellenistic Epetion, Eastern Adriatic coast**

Authors: **Burchell, Meghan 1**; Belliere, Evacilie 2,3; Barbir, Antonela 4; Ugarković, Marina 4; Peharda, Melita 2

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The archaeological excavation of ancient Epetion (modern Stobreč, Dalmatia, eastern Adriatic coastline) revealed the presence of mollusc remains, dated from prehistoric to modern times, and *Cerastoderma glaucuum* was one of the most common species found. Within the framework of the BivalveSPEECH project, we analysed *C. glaucum* shells from the Hellenistic settlement period with the objectives to validate periodicity and seasonality of growth line formation, examine age and growth patterns, and evaluate seasonality of collection. Four *C. glaucum* shells were selected for stable isotope analysis, with a total of 90 carbonate samples micro-drilled from shell cross-sections. Stable oxygen isotope analysis showed seasonal cycles with values ranging from -3.29 to -0.29‰, with their highest values (winter signal) coinciding with growth lines. For growth analysis, the exterior shell growth lines were measured using digital callipers (N=250). In addition, 40 specimens were embedded in epoxy resin and sectioned along the major growth axis to enable analysis of internal growth lines. The age of the analysed shells ranged from less than one year to over eight years, and the majority were two to three years old. Distances between the last deposited growth rings on the external shell surface and shell margin reveal that the majority of the collection occurred during the warmer part of the year. The results are promising for future studies which will incorporate samples from different time periods and areas within the site to understand shellfish harvesting in the Dalmantian coastal zone.

ABSTRACTS
POSTER PRESENTATIONS

BIOMINERALIZATION & KINETICS

Title: **Visualising and quantifying Mg/Ca and Sr/Ca heterogeneity in the isochronous growth increments of bivalve shells (*Tridacna*)**

Authors: **Dong, Bohao 1,2**; Hausmann, Niklas 3; Otter, Laura M. 4; Drysdale, Russell N. 1; Prendergast, Amy L. 1,2

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Ultra-high (hourly to daily) and high (annual) resolution paleoenvironmental proxies derived from geological and archaeological sclerochronology archives provide us with a window into ancient times. As one of the most common and well-developed archives, bivalve shells play a very important role in reconstructing past environments and connecting palaeo-environmental records with past human behaviours. However, we still lack a basic understanding of whether bivalve shells have evenly distributed trace element abundances in shell portions that grew at the same time (i.e., isochronous growth increments). In this study, we present the first published application of laser-induced breakdown spectroscopy (LIBS) for qualitative two-dimensional elemental mapping of Tridacna shells. To complement the qualitative results, we also employed laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) and wet-chemistry trace element analyses to acquire quantitative composition of Mg/Ca and Sr/Ca in Tridacna maxima shells, addressing the question of spatial heterogeneity in shell geochemistry. Our results reveal significant spatial heterogeneity in Mg/Ca and Sr/Ca ratios within contemporaneous increments, which could lead to a ± 4.3 to 5.5 °C variance in palaeo sea surface temperature reconstructions. This heterogeneous distribution may result from varying environmental exposure in different areas of a shell influencing the sensitivity and efficiency of minor and trace element incorporation in the different regions of the shell's epithelium tissue. By better understanding the natural heterogeneity of trace element uptake across isochronous growth increments, this study makes a fundamental step forward in assessing the reliability of sea surface temperature reconstructions and guiding future data acquisition strategies.

Title: **Disentangling the shell of the gastropod *Bolinus brandaris*: Inner structure and implications for the growth process**

Authors: **Ramón, M.** 1; Checa, A.G. 2; Mir-Arguimbau, J. 1; Pérez-Mayol, S. 3; Fortuño, J.M. 1, Fernández-Manteca, M.G. 4,5; Morales-Nin, B. 3

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Bolinus brandaris (Linnaeus, 1758) is a common muricid in the Mediterranean Sea and in the Atlantic waters off Portugal and Morocco, harvested since ancient times. The lack of detailed studies on the structure and composition of *B. brandaris* shells prevents the determination of relevant life history parameters, such as age and growth, which are required to implement science-based fisheries management. To this end, we characterized the inner structure and mineralogical composition of its shell using X-ray diffraction, Raman and scanning electron microscopy. We also characterized how the shell growth process is reflected in the internal structure of the shell. We find that the shell is composed mainly of three–four crossed-lamellar layers of aragonite. The last whorl contains varices, its associated spines and the growth zones (intervarix area), whereas previous whorls bear these ornaments only in the areas not overlapped by new whorls. In sections transverse to the coiling axis, the inner whorls are characterized by the presence of a discontinuity between shell layers that runs inside the shell because of the dissolution of the ornaments and part of the outer layer previously laid down. New shell material is subsequently secreted onto the discontinuity by the columellar mantle. The shell varices are formed by the thickening of the middle layer, and the spines by the outer and the middle shell layers extension. Our study provides insights into the shell structure and growth of a poorly known species, providing a model for the development of the shell and ornamentations during growth.

ABSTRACTS
POSTER PRESENTATIONS

PALEOCLIMATES & PALEOENVIRONMENTS

Title: **Stable oxygen ($\delta^{18}O$) and carbon ($\delta^{13}C$) isotope analysis of Late Cretaceous Oyster shells from Mooreville Chalk in the southern Western Interior Seaway (WIS) : Preliminary paleoenvironmental interpretations**

Authors: **Degirmen, Gozde 1**; Andrus, Fred C T 2

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Oysters (family *Ostreidae*) are valuable archives for paleoclimate and paleoenvironmental reconstruction owing to their extensive stratigraphic range, widespread distribution, and resistance to diagenetic alteration. As sessile bivalves inhabiting shallow marine environments, oyster shells record local environmental conditions with high temporal fidelity through their seasonally controlled calcitic (CaCO3) shell accretion. This study focuses on *Ostrea plumosa*, a Late Cretaceous oyster species abundant within the Gulf Coastal Plain but rarely analyzed for their sclerochemistry. Twenty-three (23) specimens, housed at the Alabama Museum of Natural History, were collected from the Lower Campanian Mooreville Chalk in Alabama, representing the Mississippi Embayment near the southern extent of the Western Interior Seaway (WIS). The majority of specimens were micro-milled along ontogenetic growth axes to obtain high-resolution stable isotope profiles while a minority of them were analyzed via bulk sampling due to their fragility. Oxygen ($\delta^{18}O$) and carbon ($\delta^{13}C$) isotope analyses were conducted to reconstruct sub-annual variations in paleotemperature, salinity, and dissolved inorganic carbon (DIC) composition. Shell microstructure and preservation were assessed using scanning electron microscopy (SEM) and electron backscatter diffraction (EBSD) to confirm the retention of primary isotopic signals. To clarify paleoenvironmental interpretations, these new data are compared with previously published $\delta^{18}O$ and $\delta^{13}C$ records from ammonite aptychi collected from the same stratigraphic interval and locality. The integration of oyster and ammonite isotopic datasets enables the reconstruction of both benthic and pelagic conditions within the southern WIS, providing insights into temperature gradients, salinity variations, and water-column structure during the Late Cretaceous. "

Title: **Observing Mio-Pliocene Gulf Stream variability using Δ^{47}-derived $\delta^{18}O_{water}$ values and $\delta^{18}O$ sclerochronology**

Authors: **Kim, Erin 1, 2**; Petersen, Sierra V. 1, 2; Dowsett, Harry J. 3

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Beyond changes in global climate, coastal climates are highly dependent on the position and strength of coastal ocean currents, the properties of which are difficult to reconstruct in the past. In this study, we use clumped isotope paleothermometry (Δ^{47}) and $\delta^{18}O_c$ sclerochronology to reconstruct ocean temperatures, $\delta^{18}O_{water}$ values, and inter-shell $\delta^{18}O$ variability from the Miocene and Pliocene of southeastern Virginia (U.S. Mid-Atlantic Coastal Plain). This is a key region near the breaking-off point of the modern Gulf Stream Current. Gaining insight into how this current has shifted in the past will allow us to better understand how it may fluctuate under higher sea levels with anthropogenic climate change. Data was obtained from the scallops *Chesapecten jeffersonius* and *Chesapecten madisonius*, as well as clams *Glycymeris americana*, *Panopea* sp., *Mulinia* sp., *Dosinia* sp., and *Mercenaria* sp.. Life-averaged Δ47-derived temperature and d18Ow are combined with subannual $\delta^{18}O$ profiles to assess seasonal-scale temperature changes. These three lines of evidence are combined and interpreted in the context of Gulf Stream changes and known global climate change. Using these proxies allows us to track shifts in currents through Earth history. This will improve our understanding of one of the main drivers of coastal climate change, one that directly impacts molluscan life and other biota that support our modern society.

ABSTRACTS
POSTER PRESENTATIONS

PALEOCLIMATES & PALEOENVIRONMENTS

Title: **Investigating reproductive changes of *Chione* over a regional extinction using isotope and Ba/Ca sclerochronology**

Authors: **Waters, Eric R. 1,2**; Petersen, Sierra V. 1,2; Gomes, Lucas 1,2

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Isotope sclerochronology of bivalves has seen frequent use in the field of archaeology to identify season of death, indicating timing of harvesting by ancient humans. A lesser explored concept is identifying the season of juvenile growth (SJG) associated with the youngest portion of ontogeny, which, if identified could be associated with reproductive timing. Reproductive timing is a key component of an organism's behavior, as it dictates the ability of gene flow. The regional molluscan extinction event of the Plio-Pleistocene in Florida offers an opportunity to investigate reproductive changes under major ecological perturbations. Here we use isotope and trace element sclerochronology to track reproductive timing and phytoplankton abundance associated with the transition between *Chione erosa* and *Chione elevata* populations of Florida. Profiles of $\delta^{18}O_{shell}$ were drilled with two approaches: 1) entire life history, and 2) juvenile-targeted – only sampling the most dorsalward 5-10 mm. In addition to producing typical paleoclimate records of $\delta^{18}O$ extrema through time, this combined approach can determine typical SJGs for each population. $\delta^{18}O$ data reveal a shift in SJG from spring/early summer to late summer/fall during the Early-Middle Pleistocene. Ba/Ca sclerochronology indicate a gradual decrease in magnitude of phytoplankton productivity from the Pliocene to Present. Taken together, this data suggests *Chione* shifted its reproductive timing to coincide with peak phytoplankton concentrations in an otherwise low-nutrient environment. This unique perspective on use of $\delta^{18}O$ profiles, in conjunction with the Ba/Ca sclerochronology, offers new insights into the mechanisms driving the turnover and for understanding reproductive behavior in the geologic record.

Title: **Shells of *Littorina littorea* (*Gastropoda*) provide an archive for palaeoclimate and seasonal shellfish collection practices – an example from Orkney**

Authors: **Schöne, Bernd R.** 1; Holly Young 2; Hubert Vonhof 3; Jennifer Harland 4

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The common periwinkle, *Littorina littorea* is a biogeographically widely distributed gastropod that occurs frequently in archaeological shell middens along the European Atlantic coast. Yet, its potential use as a recorder of paleoclimate and the season-of-collection has not been rigorously assessed. Here, gaps of knowledge are addressed with a comprehensive dataset of 78 specimens collected from Skaill Farm, a Medieval and Post-medieval archaeological site on the island of Rousay, Orkney, UK, and the adjacent intertidal zone, and more than 3000 shell oxygen isotope data. Shell stable oxygen isotope-based coastal summer water temperature deviated by only +0.2°C from the 1992/93 – 2022 average, but winter temperatures were overestimated by 2 – 5°C, provided proper sampling was applied. Modern summers are 0.7°C warmer than during the final centuries of the late Little Ice Age, but statistically indistinguishable from such during two Medieval intervals (14^{th} – 15^{th} century). As the timing and rate of seasonal shell growth remains unchanged through the lifetime, the season of harvest can be faithfully determined from apertural $\delta^{18}O$ profiles. During studied time intervals of the past, snails were predominantly collected in early spring and possibly functioned as a starvation food. Findings of this study may encourage future shell midden archaeological studies at sites where the common periwinkle occurs.

ABSTRACTS
POSTER PRESENTATIONS

PALEOCLIMATES & PALEOENVIRONMENTS

Title: **Constraining Arctic-Atlantic sea-ice variability using coralline algae archives: Insights from Svalbard**

Authors: **Andersson, Carin 1**; Trofimova, Tamara 1; Miles, Martin 1; Scurci, Alessio 2; Halfar, Jochen 2

Affiliations: 1 NORCE Norwegian Research Centre, Bjerknes Centre for Climate Research, Bergen, Norway; 2 Department of Chemical and Physical Science, University of Toronto at Mississauga, Mississauga, Canada

The crustose coralline alga *Clathromorphum compactum* is a unique archive of Arctic-Subarctic marine climate and sea-ice variability. In high-latitude environments, the growth of *C. compactum* is strongly influenced by the duration of seasonal sea-ice cover, which blocks sunlight essential for algal growth. This relationship provides a robust basis for using coralline algal growth records as proxies for past sea-ice variability. Here, we present a sclerochronological record from the coast of northern Svalbard (80°28′N, 19°54′E), a key location for reconstructing Arctic sea-ice dynamics. Oceanographic conditions in this region are controlled by the inflow of warm Atlantic water via the West Spitsbergen Current, a major driver of sea-ice variability. Using Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) and sclerochronological analysis, we examine three specimens of C. compactum and reveal continuous growth for up to 270 years (1741–2019 AD). Growth increments and geochemical proxies (Mg/Ca ratios) correlate significantly with observational data on winter sea-ice concentration and capture the recent decline in sea-ice cover. These findings demonstrate the potential of coralline algal archives to extend sea-ice reconstructions beyond the instrumental period, offering insights into multi-decadal variability and Atlantic inflow dynamics. By bridging observational gaps, this work highlights the value of sclerochronology for improving coupled climate–sea-ice models and understanding long-term Arctic change.

Title: **Evaluating annually resolved marine variability in the North Sea over the last 500 years**

Authors: **Northey, Emma 1**; Reynolds, David 1; Genelt-Yanovskiy, Evgeny 1; Genelt-Yanovskaya, Anna 1; Butler, Paul 1; Trofimova, Tamara 1; Huang, Qian 2; Schone, Bernd R 2; Conti, Martina 3; Nelson, Ellie 3; Scourse James 1; Penkman, Kirsty 3

Affiliations: 1 Department of Earth and Environmental Science, University of Exeter, UK; 2 Institut für Geowissenschaften, Universität Mainz, Germany; 3 Department of Chemistry, University of York, UK

The North Sea, situated on the northwest European continental shelf, is a dynamic marine environment. Variability across the region is shaped by the interplay between local hydrography, regional oceanographic processes (e.g., inflow of North Atlantic water), and atmospheric circulation (e.g., the North Atlantic Oscillation and atmospheric blocking). These processes influence nutrient supply, water mass mixing, stratification, and ultimately biological productivity. However, understanding of these linkages remains constrained by the limited length and spatial coverage of direct marine observations. Given the socioeconomic importance of the North Sea, there is a clear need to better quantify the amplitude, rate, and frequency of marine variability, the drivers of change, and the associated ecosystem impacts. Here we investigate spatial and temporal variability in the North Sea over the past 500 years using growth increment width sclerochronologies derived from the long-lived bivalve *Arctica islandica*. Two multi-centennial chronologies were developed from *A. islandica* shells (live- and dead-collected) from stations 40 km apart within the Fladen Ground (northern North Sea). These records were statistically compared with observational datasets of local and regional physical and biological variability. Analyses revealed significant relationships between *A. islandica* growth and sea surface productivity, subsurface seawater temperature, and sea surface salinity. Point correlation analyses further demonstrated significant covariation with regional seawater temperature in the northeast North Atlantic, suggesting that *A. islandica* growth is sensitive to variability in Atlantic inflow to the North Sea. These findings highlight the potential of *A. islandica* sclerochronologies, in combination with complementary datasets, to provide novel insights into the interplay between regional marine dynamics and atmospheric circulation patterns in the North Sea.

ABSTRACTS
POSTER PRESENTATIONS

PALEOCLIMATES & PALEOENVIRONMENTS

Title: **A multi-proxy evaluation of the spatiotemporal stability of the North Atlantic cold blob over the last five centuries**

Authors: **Reynolds, David 1**; Scourse, James 1; Genelt-Yanovskiy, Evgeny 1; Genelt-Yanovskaya, Anna 1; Northey, Emma 1; Trofimova, Tamara 1;; Mason, Matthew 1; Butler, Paul 1; Arellano Nava, Beatriz 2; Halloran Paul 2

Affiliations: 1 Department of Earth and Environmental Science, University of Exeter, UK; 2 Geography, University of Exeter, UK

The subpolar North Atlantic plays a key role in regulating the global climate system through its influence on ocean heat transport and the sequestration of atmospheric CO_2 into the deep ocean. Despite a clear warming trend in mean global sea surface temperature, the subpolar North Atlantic has exhibited a cooling pattern commonly referred to as the North Atlantic "cold blob." Numerous studies have investigated the potential significance of this feature, particularly in relation to a possible slowdown of the Atlantic Meridional Overturning Circulation. However, substantial uncertainties remain regarding the response of this key oceanographic region to climate forcings and its influence on future climate trajectories. Here we present a multi-proxy reconstruction of spatiotemporal variability in subpolar North Atlantic seawater temperatures spanning the last 500–1000 years. Our reconstruction integrates annually resolved marine (bivalve molluscs, coralline algae, and corals) and terrestrial (tree rings and ice cores) proxy records. These data indicate that the modern cold blob likely represents an unprecedented shift in the spatial distribution of sea surface temperatures over the subpolar North Atlantic Ocean. Spatial fingerprinting analysis highlights the role that coupled ocean-atmosphere feedbacks are likely playing in driving decadal scale sea surface temperature variability over the last 500 years. However, analysis of the temporal stability of reconstructed temperatures within the cold blob provides additional evidence that recent variability is without precedent in the context of the last five centuries. These data therefore suggest that North Atlantic Ocean circulation patterns are likely changing in response to anthropogenic forcings.

Title: **Late Pleistocene Atlantic Coastal Plain paleoclimate and paleoceanography reconstructions via molluscan traditional stable and 'clumped' isotope sclerochronology**

Authors: **Quizon, Alex A. 1**; Petersen, Sierra V. 1,2; Winkelstern, Ian Z. 3

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Oxygen isotope sclerochronology ($\delta^{18}O$) has been commonly applied to marine carbonates to reconstruct seasonal-scale ocean paleotemperatures. However, these calculations rely on assumptions about how the oxygen isotope composition of seawater (**δ**18Ow) varied in the past. 'Clumped' isotope thermometry (Δ^{47}) produces temperature estimates independent of $\delta^{18}O_w$. Recent efforts to utilize Δ^{47} sclerochronology to improve accuracy of paleoseasonality reconstructions have been promising. Furthermore, combining Δ^{47} and $\delta^{18}O$ measurements allows for paleo-$\delta^{18}O_w$ reconstructions, opening up possibilities for paleohydrological and paleoceanographic interpretations (e.g., paleo-circulation changes). In this study, we apply multiple different $\delta^{18}O$ and Δ^{47} sampling techniques (i.e., sclerochronology vs. bulk sampling) to fossil *Mercenaria* sp. (quahogs) collected from 8 sites along the Atlantic Coastal Plain, dating to the late Pleistocene. The "Last Interglacial" (LIG, or MIS 5e) is the most recent time in Earth's history when temperatures were as warm as they are today. Peak warmth is thought to have occurred during substage MIS 5e (~130-115 kya), while substage MIS 5a (~80 kya) represents an intermediate subglacial episode during which sea level fell and ice volume increased. Paleoenvironmental reconstructions from both intervals can provide insights into the larger-scale processes driving climate variability. We find that MIS 5e paleotemperatures generally fall within modern instrumental temperature ranges, while MIS 5a paleotemperatures are cooler than modern. MIS 5e and 5a paleo- $\delta^{18}O_w$ estimates regionally align with modern Labrador Current and Gulf Stream $\delta^{18}O_w$ values, effectively capturing ocean circulation patterns at the time and demonstrating the insight that can be gained from this additional environmental variable.

ABSTRACTS
POSTER PRESENTATIONS

PALEOCLIMATES & PALEOENVIRONMENTS

Title: **Exploring rhodolith growth habit variations in the Gulf of Mexico**

Authors: **Layfield, Catherine H. 1**; Andrus, C. Fred T. 1

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The Flower Garden Banks National Marine Sanctuary (FGBNMS), Gulf of Mexico, USA, is a subtropical reef system habitat with a wide variety of calcareous coralline red algae (CRA). Millions of free living CRA nodules, known as rhodoliths, lie within extensive beds throughout the FGBNMS. Previous mesophotic, ~150m, research discovered the oldest rhodoliths ever recorded in the FGBNMS at ~14,000 y/o. All collected rhodolith samples from the mesophotic zone had boxwork morphologies. Due to the slow growing nature and debris pockets throughout boxwork rhodoliths, detailed growth rates could not be determined. In October 2025, a large rhodolith sample set was collected between 50-65m from Bright Bank, Bouma Bank, Sidner Bank, and McGrail Bank to investigate rhodolith growth habits in depths with greater light availability. The 2025 rhodoliths are mostly small, fast-growing praline rhodoliths and branched nodules. A small number of boxworks were collected from this region. We explore using micro-XRF imaging to create 2D elemental maps of CRA rhodolith sections. These images are compared to LA-ICP-MS transects for Mg:Ca and growth increment length measurements. Mg:Ca concentrations throughout CRA growth increments could reveal a relationship between growth increment size and known ~10°C seasonal temperature variations in the FGBNMS. Oscillating Mg concentrations in praline growth increments are expected. Boxwork CRA are expected to have frequent debris pocket interruptions and erratic Mg concentration patterns around those interruptions. Understanding growth habits and behaviors of one of Earth's most prolific reef builders will aid in reef management, fundamental reef development, and recovery science.

Title: **Comparing low- and mid-latitude seasonal amplitudes using clumped isotopes as recorded in Plio-Pleistocene *Mercenaria* spp.**

Authors: **Braniecki, Garrett F.N. 1**; Surge, Donna M. 2; Hyland, Ethan G. 3

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Seasonal sea surface temperature (SST) reconstructions from deep-time archives offer a critical window into climate dynamics during major climate transitions, such as the Mid-Piacenzian Warm Interval (MPWI) and early Pleistocene cooling. Traditional oxygen isotope ($\delta^{18}O$) measurements in biogenic carbonates have been the dominant seawater (sw) temperature proxy in marine archives but can be complicated by assumptions made to constrain $\delta^{18}O_{sw}$ values. Clumped isotope geochemistry (Δ^{47}) is a novel paleothermometer, as it does not rely on constraining the $\delta^{18}O_{sw}$ value. Here, we compare seasonal SSTs from the MPWI, early Pleistocene, and today using $\delta^{18}O_{shell}$ values and Δ^{47} -based temperatures from low-latitude Florida (FL). We further evaluate changes in seasonal amplitude by comparing FL records to those from mid-latitude North Carolina (NC). We then test the accuracy of previously published $\delta^{18}O_{sw}$ values during these time intervals using the Δ^{47} proxy in combination with $\delta^{18}O_{shell}$ values. Local maxima and minima within the $\delta^{18}O_{shell}$ timeseries were targeted to collect 1.5-2mg of carbonate powder for Δ^{47} analysis to capture seasonal amplitude of SST. Forthcoming clumped isotope data will allow us to test the hypothesis that: (1) Δ^{47} -derived SST (SST Δ^{47}) are similar to $\delta^{18}O$-derived temperatures; (2) SST Δ^{47} -derived $\delta^{18}O_{sw}$ values are indistinguishable from previously published methods using the $\delta^{18}O_{sw}$-salinity relationship; (3) *Mercenaria* shells from the MPWI record warmer summers and winters compared to the early Pleistocene and today; and (4) shells from low-latitudes record reduced seasonal amplitudes compared to those from mid-latitudes.

ABSTRACTS
POSTER PRESENTATIONS

PALEOCLIMATES & PALEOENVIRONMENTS

Title: **Evaluating annually resolved marine variability in the North Sea over the last 500 years**

Authors: **Trofimova, Tamara 1**; Butler, Paul G 1; Reynolds, David 1; Scourse, James 1

Affiliations: 1 Centre for Geography and Environmental Science, University of Exeter, Penryn, UK

Exceptional lifespan and synchronous growth make *Arctica islandica* shells one of the key environmental archives in sclerochronology. Shell growth chronologies and their corresponding geochemical records provide a source of climate information with the potential to bridge the gap between short instrumental datasets and longer-term proxy reconstructions. However, existing shell-based reconstructions often do not exceed timescales of a few centuries, which limits our ability to observe longer-term changes and to make comparisons with lower-resolution sedimental archives. The work presented here forms part of the ERC project SEACHANGE (seachange-erc.eu), which focuses on the impact of human activities on marine ecosystems. The project aims to investigate how marine ecosystems have changed across major cultural transitions in history, thereby establishing baselines that can inform future management. Within this framework, our study examines changes in marine climate at the north Icelandic shelf prior to, across the first human settlement in Iceland, and up to the present day. Building on previous research that produced the first millennium-long *A. islandica* shell growth chronology, we revisited the study site, renewed the collection, and updated the shell proxy records. Here, we present the results of this updated work, focusing on shell growth and geochemical composition of *A. islandica* shells. Specifically, we highlight improvements in the length and replication of both growth chronologies and stable isotope records. We also discuss the advantages of chronology building based on *A. islandica* and challenges of accurately identifying annual increments in shells from this location, which is critical for constructing reliable chronologies.

Title: **Master shell chronology and multi-proxy geochemical records illustrate oceanographic variability in the mid-Atlantic Region (USA) since 1800 CE**

Authors: Thatcher, Diana L. 1; Sun, Heeyeon 2; Wanamaker, Alan D. 1; Whitney, Nina M. 3; Jarosinski, Lindsey 1; Stewart, Joseph A. 4; Williams, Branwen 5; LaVigne, Michèle 6; Ummenhofer, Caroline C. 7; Remaili, Soraya S. 8; Biastoch, Arne 9; Martin, Torge 9

Affiliations: 1 Iowa State University, Ames, IA, USA; 2 University of Massachusetts Amherst, Amherst, MA, USA; 3 Western Washington University, Bellingham, WA, USA; 4 University of Bristol, Bristol, UK; 5 Claremont McKenna College, Claremont, CA, USA; 6 Bowdoin College, Brunswick, ME, USA; 7 Woods Hole Oceanographic Institution, Woods Hole, MA, USA; 8 University of South Carolina, Columbia, SC, USA; 9 GEOMAR Helmholtz Centre for Ocean Research, Kiel, Germany

Instrumental data from the Atlantic Ocean along the U.S. and Canada coast indicate warming and salinity variability in recent decades, potentially associated with changes in the strength of the Atlantic Meridional Overturning Circulation (AMOC). However, observational time series of hydrographic conditions from buoys and moorings, especially at depth, are short. Additional information spanning multiple decades to centuries is needed to place recent hydrographic conditions in context and to better understand past oceanographic changes.
To provide this context, we constructed a continuous master shell growth chronology spanning the last two centuries and provided geochemical records (stable oxygen and nitrogen isotopes and radiocarbon) from the Mid-Atlantic shelf region using shells of the marine bivalve *Arctica islandica*. Shells were collected on the outer shelf region near Ocean City, Maryland, at approximately 60 m water depth. The multiproxy records from shells from this site, located midway between the RAPID (26° N) and the OSNAP (52–60° N) instrumental arrays, provide context for present and future variability in AMOC. Output from the VIKING20X simulations (1/20° Atlantic configuration nested in ¼° global ocean, forced by the 55-year Japanese Atmospheric Reanalysis product) are used to infer the relative contributions of source water oxygen isotope (from salinity) and temperature variations on the shell oxygen isotope record since ~1970 CE, helping to understand oceanographic variability in this region. The shell oxygen isotope record ($\delta^{18}O_{shell}$) is strongly inversely correlated with the RAPID array which, although relatively short in duration, estimates AMOC strength, providing evidence that this location is sensitive to large-scale ocean dynamics.

ABSTRACTS
POSTER PRESENTATIONS

PALEOCLIMATES & PALEOENVIRONMENTS

Title: **Deep-water gorgonian corals reveal decadal-scale variability in the composition of export productivity in the rapidly warming Northwest Atlantic margin**

Authors: **Giacoppo, Tessa 1**; Greenman, Wilder 1; Neves, Bárbara de Moura 2; Sherwood, Owen 1

Affiliations: 1 Department of Earth and Environmental Science, Dalhousie University, Halifax, NS, Canada; 2 Northwest Atlantic Fisheries Center, Fisheries and Oceans Canada, St. John's, NL, Canada

Deep-water gorgonian corals provide continuous, high-resolution archives of biogeochemical variability in their tree-like skeletons, yet their potential for reconstructing past changes in the composition and quality of marine export productivity over decadal and longer timescales remains underexplored. We analyzed bulk and compound-specific nitrogen (N) isotopes in multi-decadal skeletal records from two proteinaceous coral species (*Primnoa resedaeformis* and *Keratoisis grayi*) from the upper continental slope off Nova Scotia, a region experiencing among the most rapid ocean-warming trends globally. Amino acid-specific N isotope patterns reveal consistent differences in trophic status between species, with *P. resedaeformis* feeding at a lower trophic position and *K. grayi* feeding at a higher trophic position on zooplankton or their fecal pellets. These species-specific feeding strategies produce distinct signatures. *Primnoa resedaeformis* exhibits greater temporal variability in both bulk and amino acid $\delta^{15}N$, reflecting sensitivity to fluctuations in microbial reworking and the quality of sinking organic matter. In contrast, *K. grayi* records more stable temporal variability, suggesting that animal-mediated export may attenuate long-term, climate-driven changes in pelagic–benthic coupling. Together, these coral proxy records demonstrate that species ecology and nitrogen-cycling pathways influence how export-productivity signals are incorporated into coral skeletons. This work highlights the importance of gorgonian corals as a sclerochronological record and underscores their value as archives for reconstructing pelagic–benthic coupling and environmental change in the Northwest Atlantic.

Title: **Reconstructing past marine climate variability in the Central Gulf of Maine (Isle au Haut) from growth increments and oxygen isotopes of the marine bivalve *Arctica islandica***

Authors: **DePhillips, Blake 1**; Martin, Brielle 2; Thatcher, Diana 3; LaVigne, Michèle 4; Wanamaker, Alan 5

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The Gulf of Maine (GoM) region is facing significant and rapid environmental challenges due to climate change. Many aspects of the GoM ecosystem are undergoing changes that are expected to continue in the future, perhaps at an increasing rate. Despite ongoing environmental changes, records that depict the past behavior of the GoM system are spatially and temporally limited. Thus, additional high-resolution records from the GoM are needed to provide context for current and future changes. To address these data gaps, we investigated the growth increments and geochemical signals in the marine bivalve, *Arctica islandica*, which were collected alive from the Isle au Haut (southeast of Acadia National Park) in 31 to 37 m water depth. The Isle au Haut (IAH) site strategically bridges the gap between eastern and western master shell chronologies in the GoM. The IAH master shell growth chronology spans from 1907–2010 CE and was precisely dated via crossdating methods. Coherent variability in the master shell growth chronology indicates that environmental conditions drive shell growth. The IAH stable oxygen isotope ($\delta^{18}O_{shell}$) series currently spans from 1951–2010 CE and shows an overall lowering of $\delta^{18}O_{shell}$ values, indicative of warming/freshening which is in agreement with the two other GoM sites—Jonesport (eastern GoM) and Seguin Island (western GoM). Current work includes extending the oxygen isotope time series with dead-collected and radiocarbon-dated shells from the IAH site.

ABSTRACTS
POSTER PRESENTATIONS

PROXY DEVELOPMENT & OPTIMIZATION

Title: **Validating sampling and data-processing methods in high-resolution carbonate clumped isotope (Δ^{47}) sclerochronology using *Mercenaria mercenaria* for reconstructing paleoseasonality**

Authors: **Fang, Yunhan 1**; Petersen, Sierra V. 1,2; Gomes, Lucas D. 1

Affiliations: 1 Department of Earth and Environmental Sciences, University of Michigan, Ann Arbor, USA; 2 Museum of Paleontology, University of Michigan, Ann Arbor, USA

Paleoseasonality records are of great interest in unravelling short-term oceanic and environmental shifts to reconstruct past climate. Sclerochronological profiles measuring oxygen isotope composition in shell carbonate ($\delta^{18}O_{carb}$) have been extensively used to assess subannual variations in temperature, both in the recent and deep past. However, $\delta^{18}O_{carb}$ combines the effects of formation temperature and the oxygen isotope composition of ambient seawater ($\delta^{18}O_w$); interpretations of $\delta^{18}O_{carb}$ therefore depend on estimated $\delta^{18}O_w$ values, introducing uncertainty into the temperature values derived. Carbonate clumped isotope paleothermometry (Δ_{47}) provides $\delta^{18}O_w$-independent temperatures, but applying Δ_{47} at high resolution has been limited by large sample-size requirements and time-intensive analysis. In this study, we present high-resolution, Δ_{47}-derived sclerochronological profiles of temperature and $\delta^{18}O_w$ using the clam *Mercenaria mercenaria*, collected from aquaculture farms with monitored growth conditions along the U.S. Atlantic and Gulf coasts (Trenton, ME; Mashpee, MA; two sites in Cedar Key, FL). We compare (i) Δ_{47}-derived temperatures with instrumental seawater temperatures and (ii) Δ_{47}-derived $\delta^{18}O_w$ values with empirically derived $\delta^{18}O_w$ based on salinity. We demonstrate that high-resolution Δ_{47} sclerochronology is possible on large taxa like *Mercenaria* and can identify subannual changes in temperature and $\delta^{18}O_w$, as well as growth shutoff temperatures. Modern calibration studies give us confidence in applying these methods to fossil shells and help identify the limitations of the method (e.g., inability to capture wintertime temperatures due to growth shutoffs). Our findings highlight the need to consider biological factors in Δ_{47} sclerochronology for paleoseasonality reconstructions and provide a framework for future investigations.

Title: **Sclerochronology on YouTube: Providing learning opportunities, broadening early career engagement, and developing community**

Authors: **Wanamaker, Alan D. 1**; Thatcher, Diana L. 1; Hauser, Amanda 1

Affiliations: 1 Department of the Earth, Atmosphere, and Climate, Iowa State University, Ames, Iowa, USA

There is a growing international demand for training in sclerochronology. To address this need, a YouTube sclerochronology channel has been developed. This YouTube channel is a way to share preparation and sampling techniques freely to increase access and to broaden participation globally in the field of sclerochronology to study past, present, and future climatic and environmental variability. Featured laboratory techniques for preparation of shell- or otolith-based materials include sectioning, imaging, measuring, micromilling, and hand-sampling. Future content will include crossdating, the fundamental tenet of chronology construction, using sclerochronology-specific examples, and showcase the applicability of existing dendrochronology software for sclerochronology projects. Going forward, we seek input from the sclerochronology community by providing content and ideas about how *Sclerochronology on YouTube* can best serve the community.

ABSTRACTS
POSTER PRESENTATIONS

PROXY DEVELOPMENT & OPTIMIZATION

Title: **Assessment of Subantarctic crustose coralline algae as marine climate archives**

Authors: **Sinha, Sudakshina 1**; Halfar, Jochen 1; Leclerc, Natasha 2; Hetzinger, Steffen 3; Tsay, Alexandra 4; Le Gall, Line 5; Savoie, Amanda 6; Gabrielson, Paul W. 7; Mansilla, Andres O. 8,9; López-Farrán, Zambra 10

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Southern Hemisphere crustose coralline algae (CCA) remain underutilized climate archives largely due to a lack of knowledge of coralline algal taxonomy and their distribution. Here, we present the first assessment of Subantarctic thick-crust-forming CCA (*Lithophyllum* sp.) as climate archives using seven specimens from historical museum collections of southern Chile, southern Argentina, and the Falkland Islands origin. These samples provide environmental time series for the early-to-mid 20th century and are compared to recently collected samples from the Strait of Magellan, southern Chile. These regions extend towards Antarctica, with the Strait of Magellan acting as a key oceanographic gateway between the Pacific and Atlantic Oceans. As such, CCA specimens from this region can fill significant knowledge gaps in Subantarctic marine climate variability. Similar to the better-known *Clathromorphum compactum* species used for Arctic paleoenvironmental reconstruction, Subantarctic *Lithophyllum* sp. contains annual growth increments and pronounced seasonal variability in skeletal Mg/Ca ratios. Seasonal Mg/Ca cycles in the Subantarctic CCA specimens correlate with available instrumental SST records, supporting their utility as SST recorders. This study establishes a critical foundation for developing long-term SST reconstructions in understudied high-latitude Southern Hemisphere regions where pre-satellite era instrumental observations are sparse and high-resolution proxy information is limited.

Title: ***Helisoma* (*Planorbella*) *trivolvis*: A potential paleoclimate and paleo-weather archive for North America**

Authors: **Warner, Jacob P. 1**; Thirumalai, Kaustubh 2; Vetter, Lael 3

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Few archives for freshwater hydroclimate span tropical to polar latitudes. *Helisoma trivolvis*, a short-lived pulmonate freshwater aquatic snail, may be an exception. *H. trivolvis* inhabit lentic freshwater systems from Mexico to Alaska, USA, from the Pacific to the Atlantic, and elevations ranging from sea level to thousands of meters. Wild and aquarium studies suggest *H. trivolvis* typically live 1–3 years, with some specimens living 5 years. Typically, individuals hibernate in water temperatures <~8°C, biasing growth to warmer seasons. Specimens span the Quaternary, indicating potential for paleoclimate reconstruction. We recovered live *H. trivolvis* specimens from Rose Canyon Lake, a reservoir near Tucson, AZ, USA (2115 masl) and deceased specimens from Agua Caliente Park, a spring-fed pond system in Tucson (825 masl) in October 2023. External growth structures broadly confirm size-based age estimates. Most specimens lived <5 months, and all lived ≤10 months. Preliminary analysis of $\delta^{18}O_{shell}$ (−5.03 ± 0.81‰) from 28 live specimens indicates a potential correlation with modeled April–September $\delta^{18}Ow_{ater}$ (−5.49 ± 1.94‰), which is primarily driven by precipitation–evaporation balance in southern Arizona. We suggest that *H. trivolvis* likely hibernate November to March in southern Arizona, making spring–fall hydroclimate the likely driver of *H. trivolvis* $\delta^{18}O_{shell}$. We plan subsampling of *H. trivolvis* guided by external growth structures to verify the growing season and assess the relationship between $\delta^{18}O_{shell}$ and environment. Additional specimens collected in New York, USA in 2024 and planned for North Carolina, USA in spring 2025 are being analyzed to assess the influence of geographic and ecological factors on *H. trivolvis* as a hydroclimate archive.

ABSTRACTS
POSTER PRESENTATIONS

PROXY DEVELOPMENT & OPTIMIZATION

Title: **The TimeWarp Package: Obtaining robust geochemical timeseries from laser ablation mass spectrometry for paleoclimate applications**

Authors: **Hughes, Hunter P. 1**; Arney, Thomas 2; Foster, Gavin L. 2

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Geochemical proxies of sea surface temperature (SST) preserved in scleractinian coral skeletons provide critical records of climate variability from seasonal to centennial timescales. Laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) offers a high-speed, high-resolution, and cost-efficient method for measuring geochemical variations in coral skeletal material. However, previous applications of LA-ICP-MS in coral-based paleoclimate studies are often limited by analytical uncertainty, precluding robust investigations of interannual climate variability. Here, we present "TimeWarp", a software package enabling robust processing of element-to-calcium ratios in coral skeletons for paleoclimate studies. The software first collapses two-dimensional geochemical "maps" into one-dimensional data series using a dynamic time warping algorithm to account for uneven growth banding and variable skeletal accretion rates. The entire coral dataset (B/Ca, Li/Ca, Mg/Ca, Sr/Ca, U/Ca, and Li/Mg) is then age modeled followed by calibration to SST. Applying this LA-ICP-MS framework to *Porites astreoides* corals from Bermuda, initial comparisons with local temperature estimates using the Scleractinian Multivariate Isotope and Trace Element (SMITE) method show high validation correlations ($r > 0.8$) and root-mean-square errors (< 1.5°C) substantially smaller than the local annual SST cycle (9°C). Using the same geochemical dataset, we will evaluate the performance of alternative SST reconstruction approaches during the observational period (e.g., Sr/Ca, Li/Mg, UMTECS) to fully contextualize multivariate versus univariate approaches. Finally, we will use this framework to investigate climatic drivers of SST variability near Bermuda throughout the 20th century using multiple *P. astreoides* corals.

Title: **Unlocking rhodoliths as paleoceanographic archives**

Authors: **Li, Lena Y. 1,6**; Bernal-Tamayo, Juan P. 2; Hetzinger, Steffen 3; Halfar, Jochen 4; Johnson, Maggie D. 5; Vonhof, Hubert 6; Schiebel, Ralf 6; Schöne, Bernd R. 1

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Long-term, high-frequency temperature records are essential for assessing the vulnerability of marine ecosystems to ocean warming. Most established marine climate archives are geographically restricted and increasingly threatened by accelerating environmental change. Rhodoliths, free-living coralline algal nodules with global distribution, are a resilient but underutilized alternative. However, their application has been limited by complex branching morphologies which fragment their growth histories. Here, a new workflow is introduced that integrates vital stain calibration, microCT-based semi-automated increment width detection, and dynamic time warping to assemble a continuous chronology using multiple branches (March–July). Applied to a central Red Sea rhodolith, this approach yields the first composite, daily resolved temperature reconstruction from a rhodolith. Coupling growth-increment analysis with a novel, multi-element temperature proxy resolves longstanding discontinuity and improves reconstruction fidelity, with single-branch records explaining less than 45% of modeled in-situ temperature variance and compiled multi-branch chronologies approaching 90%. These findings demonstrate that rhodoliths preserve highly accurate thermal variability records, establishing them as a high-resolution, globally accessible paleoceanographic archive, and provide a novel temperature proxy for the Red Sea.

ABSTRACTS
POSTER PRESENTATIONS

PROXY DEVELOPMENT & OPTIMIZATION

Title: **Evaluating SIMS-based oxygen isotopes from *P. Generosa* (geoducks) to monitor climate variability in the Northeast Pacific**

Authors: **Hauser, Amanda E. 1**; Thatcher, Diana L. 1; Wanamaker, Alan D. 1; Black, Bryan A. 2; Fischer, Leila 2; Thompson, Diane M. 2; Lofverstrom, Marcus 2; Spicuzza, Michael J. 3; Zhang, Mingming 3

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Climate variability in the Northeast Pacific Ocean has significant implications for fisheries as well as the socioeconomic and environmental landscape, including accelerated warming, marine heatwaves, and climate-related disasters such as flooding and forest fires. Northeast Pacific climate variability before 1900 CE and the long-term context regarding how hydrographic changes occurred are poorly constrained. Currently, few long-term, annually resolved marine records are available to address past, current, and future marine climate variability. To further evaluate oxygen isotope ratios ($\delta^{18}O$) in the shells of *Panopea generosa* (geoduck) as a proxy for seawater temperature and source water changes (i.e., oxygen isotopic composition of seawater—related to local salinity), we used dead and live collected material from the Tree Nob Islands (western British Columbia, Canada). We utilized Secondary Ion Mass Spectrometry (SIMS) due to the presence of small (<40 µm) increments in the geoduck hinge. The shell $\delta^{18}O$ record spans the instrumental period (1942–2012 CE) and is compared to monthly mean sea surface temperature (SST) and salinity (SSS) data from the nearby Langara Lighthouse. Sub-annually resolved $\delta^{18}O$ from the geoduck shells, coupled with local SST and SSS data, allows us to assess the contributions of temperature and salinity to shell $\delta^{18}O$ variability and inform us about the seasonality of geoducks in the Northeast Pacific and the fidelity of $\delta^{18}O$ in geoducks as a high-resolution proxy for local seawater conditions. Initial results indicate that geoduck shell $\delta^{18}O$ variability is largely driven by changes in salinity and may be a promising salinity proxy in the region.

ABSTRACTS
POSTER PRESENTATIONS

PROXY DEVELOPMENT & OPTIMIZATION

Title: **Multi-site evaluation for the potential of lithium as a proxy in the coralline alga *Clathromorphum compactum* for high-latitude sea surface paleotemperature archiving**

Authors: **Pawlowski, Iza 1**; Halfar, Jochen 1; Hetzinger, Steffen 2; Leclerc, Natasha 3; Dias, Minoli 1; Sinha, Sudakshina 1; Tsay, Alexandra 4; Adey, Walter 5

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Lithium-based elemental ratios in layered calcifying marine organisms are emerging as promising sea surface temperature (SST) proxies. Dividing Mg by Li is thought to reduce secondary impacts of calcification rate on the elemental relationship with temperature, and recent work suggests that Mg/Li may be a more reliable SST proxy for *Clathromorphum compactum* than Mg/Ca alone. However, these conclusions are based on a limited number of laboratory-reared samples grown under controlled pH and temperature conditions. Here, we evaluate the effectiveness of lithium-based proxies in high-latitude environments by correlating time series of annual growth increment widths, Li-based elemental ratios, and Mg/Ca ratios from *C. compactum* with satellite-derived SSTs. These relationships are examined across four climatically diverse sites that span large gradients in sea-ice duration and light availability: Aasiaat (Greenland), Beechey Island (Nunavut, Canada), Eastern Kingitok Island (Labrador, Canada), and Mosselbukta, Svalbard (Norway). Time series of Li/Mg and Mg/Li were developed using a Mg/Ca cycle-based age model spanning 1950–2023. In addition, several decadal time series from an ice-free Gulf of Maine site were compared against in situ temperature records to assess inter-specimen reproducibility. This multi-site comparison provides the first broad-scale evaluation of lithium proxies in *C. compactum* and offers new insights into their reliability for reconstructing SST in seasonally ice-influenced marine environments.

Title: **Establishing a modular high-precision micro-sampling system**

Authors: **Reynolds, David 1**; Genelt-Yanovskiy, Evgeny 1; Genelt-Yanovskaya, Anna 1; Scourse, James 1

Affiliations: 1 Department of Earth and Environmental Science, University of Exeter, UK

Powdered samples drilled or milled from precisely dated positions within calcium carbonate structures (such as shells, corals, or speleothems) underpin a wide range of geochemical analyses, including oxygen and carbon isotope measurements central to palaeoclimate and palaeoceanographic research. Although molluscan shell growth lines can often be visualised using acetate peels or Mutvei's staining, they are frequently faint or absent when viewed under the reflected-light microscopy typically employed by commercial micro-sampling systems. This hampers sampling speed and ultimately reduces temporal precision. Current commercial micro-sampling devices are often expensive and rely on proprietary hardware and software and therefore offer limited scope for customisation. To overcome these constraints, we have developed a relatively low-cost, modular, high-precision micro-sampling system built from off-the-shelf and 3D-printed components combined with bespoke control software. The hardware is designed for ease of assembly, future upgrades, and user-driven modification, while maintaining the fine-scale stage control required for high-resolution geochemical sampling. Although the new system still uses a reflected light microscope, the software enables high-resolution imagery, captured using optimised approaches, to be overlaid directly onto the live camera feed. By integrating the micro-sampling control software with our in-house image analysis tool (*Ring Measurer*), we can accurately project growth-ring positions onto the sample surface, allowing precise sampling of specimens that would otherwise be impractical. To facilitate the final development of the micro-sampling system we are interested in getting community feedback about the wider challenges experienced with sample preparation and analysis, and approaches that are being taken to tackle them.

ABSTRACTS
POSTER PRESENTATIONS

PROXY DEVELOPMENT & OPTIMIZATION

Title: **Simulating shell diagenesis: An In vitro approach**

Authors: **Vigelius, Daniel T. 1**; Schöne, Bernd R. 1; Vonhof, Hubert 2; Geisler-Wierwille, Thorsten 3; Tütken, Thomas 1

Affiliations: 1 Institute of Geosciences, University of Mainz, Mainz, Germany; 2 Max Planck Institute for Chemistry, Mainz, Germany; 3 Institute of Geosciences, University of Bonn, Bonn, Germany

Mollusc shells are valuable archives of past environmental conditions. However, diagenesis can alter the proxies recorded in shell biominerals, biasing paleoenvironmental or paleoclimatic reconstructions. It remains unclear whether chemical proxy information can be altered without affecting shell mineralogy or microstructure in low-temperature aquatic burial settings. Here we investigate the stability of environmental proxies in shell biominerals by simulating low-temperature diagenesis through in vitro experiments. Bivalve shell powders from *Arctica islandica* and *Pecten maximus* were placed into sealed Teflon vials filled with seawater or freshwater and heated at 30, 60, or 90 °C for hours to months. Solutions were spiked with isotopes (^{18}O, ^{26}Mg, ^{44}Ca, ^{86}Sr) to trace element and isotopic exchange with the carbonate. Shell powders and solutions were analyzed before and after the experiments. Oxygen isotopes were measured by CF-IRMS to assess whether biomineralization temperatures are preserved. Elemental chemistry was characterized by ICP-OES and TQ-ICP-MS. Phase transformations were investigated by XRD, Raman, and FT-IR, while SEM was used to study microstructural modifications. Shell $\delta^{18}O$ values increased rapidly (<1 day at 60 °C and 90 °C), with stronger changes in freshwater than in seawater experiments. Element chemistry changed in both aragonite and calcite, with alteration degree depending on solution composition and crystallographic properties. No phase transformations were detected. However, SEM revealed overgrowth of idiomorphic abiogenic aragonite (~2–3 µm) on aragonitic grains, while calcitic grains remained unaffected. These findings suggest chemical alterations in shell carbonate can occur without mineralogical or microstructural changes, impacting the reliability of shell-based paleoenvironmental reconstructions.

Title: **Combined analysis of oyster shell carbon and oxygen isotope geochemistry along a salinity gradient in Tampa Bay, Florida**

Authors: **Mette, Madelyn** J. 1; Herbert, Gregory S. 2; Hardin, Alizé 2; Rogers, Jaime 2; Jackson, Kendal 3; Pluckhahn, Thomas 2

Affiliations: 1 U.S. Geological Survey, St. Petersburg Coastal and Marine Science Center, Florida, USA; 2 University of South Florida–Tampa, Florida, USA; 3 University of Tampa, Florida, USA

Oxygen and carbon isotope ratios of shells from archaeological middens are commonly used paleoenvironmental proxies. Interpretation of these proxies in estuarine environments is complicated, however, by the variable nature of temperature, salinity, nutrient, and tidal dynamics. To support interpretation of isotope profiles from archaeological shells in the region, we studied modern oysters (*Crassostrea virginica*) collected along a salinity gradient of the Manatee River estuary of Tampa Bay, Florida. We compared measured shell stable carbon and oxygen isotope ratios to expected values determined through application of traditional paleotemperature equations and regionally specific equations relating salinity to water oxygen isotope ratios and to carbon isotope ratios of dissolved inorganic carbon. We show that shell carbon isotope ratios reliably record reef position along a salinity gradient, despite a seasonal bias in shell growth and challenges in accurately modeling oxygen isotope ratios from available environmental records. The combined use of oxygen and carbon isotopes provides promise for improving temperature reconstructions via shell geochemistry in estuarine environments; however, further proxy development is required to reduce uncertainty estimates.

ABSTRACTS
POSTER PRESENTATIONS

PROXY DEVELOPMENT & OPTIMIZATION

Title: **Trace element variations in sea pens (Cnidaria: Octocorallia): Potential indicators of environmental change**

Authors: **de Moura Neves, Bárbara 1**; Murray, Kathryn 1, 2; Piercey; Glenn 3; Kommescher, Sebastian 3; Layne, Graham D. 4; Edinger, Evan 4,5,6

Affiliations: 1 Northwest Atlantic Fisheries Centre, Department of Fisheries and Oceans, St. John's, Canada; 2 Department of Ocean Sciences, Dalhousie University, Halifax, Canada; 3 MicroAnalysis Facility, CREAIT, Memorial University, St. John's, Canada; 4 Department of Earth Sciences, Memorial University, St. John's, Canada; 6 Department of Geography, Memorial University, St. John's, Canada; 7 Department of Biology, Memorial University, St. John's, Canada

Sea pens are octocorals of worldwide distribution, found from the Arctic to Antarctica, from coastal to deep-sea environments. Most sea pen species have an internal skeleton (axis) composed of calcite. This axis has been shown to store environmental information, but their potential to store human-induced environmental changes has not yet been assessed. In this study, the sea pen *Pennatula aculeata* was collected from two areas, one coastal (Bay d'Espoir, south coast of Newfoundland), and one offshore at the Laurentian Channel Marine Protected Area (MPA), Eastern Canada. Bay d'Espoir has been home to open net aquaculture, while the offshore location has not been subject to targeted activities outside of fishing and vessel traffic. We used Secondary Ion Mass Spectrometry (SIMS) and Inductively Coupled Plasma Mass Spectrometry (LA ICP-MS) to examine the trace element variations in traverses across the skeleton of *P. aculeata* samples. Results reveal consistently elevated levels of Cu, Fe, Mn, Pb, and Zn in the coastal samples in relation to offshore samples. The source of these patterns is still elusive , given that factors other than aquaculture could be at play at the coastal location. Our study calls for further systematic investigation on their potential utility in monitoring the biology, fitness, and ecology of sea pens and other fauna living in areas exposed to human-induced activities.

Title: **Reconstructing historical sub-annual primary producer dynamics in coastal Baffin Bay with high-resolution sclerochronology**

Authors: **Leclerc, Natasha 1;** Archambault, Philippe 2; Deslauriers, David 3; Teichert, Sebastian 4; Thébault, Julien 5; **Baqué, David 6**; Halfar, Jochen 7; Hetzinger, Steffen 8

Affiliations: 1 Department of Archaeology, Memorial University of Newfoundland, St. John's, Canada; 2 Département de Biologie, Takuvik, Québec-Océan, Université Laval, Quebec City, Canada; 3 Institut des sciences de la mer de Rimouski, Université du Québec à Rimouski, Rimouski, Canada; 3 GeoZentrumNordbayern, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Erlangen, Germany; 5 Institut Universitaire Européen de la Mer, Université de Bretagne Occidentale, Plouzané, France; 6 Centre national de la recherche scientifique, Takuvik, Université Laval, Quebec City, Canada; 7 Department of Chemical and Physical Science, University of Toronto at Mississauga, Mississauga, Canada; 8 Christian-Albrechts-Universität zu Kiel, Institut für Geowissenschaften, Kiel, Germany

The Arctic has experienced rapid warming and sea-ice loss over the past 50 years, profoundly altering marine ecosystems and biogeochemistry. Phytoplankton abundances and diversity have shifted affecting biogeochemical cycles, yet their long-term variability remains poorly understood, especially in coastal zones. This project develops sclerochronological proxies of phytoplankton dynamics using trace elemental, isotopic, and growth data from Arctic coralline algae and clam shells. Starting summer of 2026, we will collect coralline algae, analyze already collected geochemical and growth data from clam shells, and install a 1-year coralline algae monitoring platform with near monthly collection. Leveraging the Qikiqtarjuaq research station's monitoring programs, local infrastructure and cold-water diving experience, this work will generate multi-centennial proxy records for Baffin Bay and clarify producer–consumer dynamics and coastal biogeochemical change.

ABSTRACTS
POSTER PRESENTATIONS

PROXY DEVELOPMENT & OPTIMIZATION

Title: **Trace element variations in sea pens (Cnidaria: Octocorallia): Potential indicators of environmental change**

Authors: **de Moura Neves, Bárbara 1**; Murray, Kathryn 1, 2; Piercey; Glenn 3; Kommescher, Sebastian 3; Layne, Graham D. 4; Edinger, Evan 4,5,6

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Sea pens are octocorals of worldwide distribution, found from the Arctic to Antarctica, from coastal to deep-sea environments. Most sea pen species have an internal skeleton (axis) composed of calcite. This axis has been shown to store environmental information, but their potential to store human-induced environmental changes has not yet been assessed. In this study, the sea pen *Pennatula aculeata* was collected from two areas, one coastal (Bay d'Espoir, south coast of Newfoundland), and one offshore at the Laurentian Channel Marine Protected Area (MPA), Eastern Canada. Bay d'Espoir has been home to open net aquaculture, while the offshore location has not been subject to targeted activities outside of fishing and vessel traffic. We used Secondary Ion Mass Spectrometry (SIMS) and Inductively Coupled Plasma Mass Spectrometry (LA ICP-MS) to examine the trace element variations in traverses across the skeleton of *P. aculeata* samples. Results reveal consistently elevated levels of Cu, Fe, Mn, Pb, and Zn in the coastal samples in relation to offshore samples. The source of these patterns is still elusive , given that factors other than aquaculture could be at play at the coastal location. Our study calls for further systematic investigation on their potential utility in monitoring the biology, fitness, and ecology of sea pens and other fauna living in areas exposed to human-induced activities.

ABSTRACTS
POSTER PRESENTATIONS

IMPACTS ON ECOSYSTEMS & POLLUTION

Title: **Nitrogen isotopic records from modern and archaeological freshwater mussels in the Florida Everglades**

Authors: **Smith, Maya 1**; Andrus, Fred 2

Affiliations: 1 Department of Geological Science, University of Alabama, Tuscaloosa, United States; 2 Department of Geological Science, University of Alabama, Tuscaloosa, United States

Nitrogen pollution is an increasing concern in the Florida Everglades, where land use change, fertilizer runoff, and altered hydrology have disrupted natural biogeochemical cycles. However, consistent water quality records in the region only date back to the 1960s, leaving a gap in our understanding of nitrogen dynamics prior to modern monitoring. This project explores the use of *Elliptio jayensis* freshwater mussel shells as bioarchives to reconstruct past nitrogen levels in the Everglades ecosystem. Mussels incorporate environmental nitrogen into their shell's organic matrix during growth. This study analyzes stable nitrogen isotope ratios ($\delta^{15}N$) in both modern and archaeological specimens collected from the northern Everglades adjacent to Lake Okeechobee to assess long-term changes in nitrogen sources. We hypothesize that modern shells will reflect higher $\delta^{15}N$ values, indicative of increased anthropogenic nitrogen inputs such as fertilizer and wastewater runoff, compared to pre-disturbance archaeological shells. Shell organic matter was extracted from powdered whole shell samples and will be analyzed using isotope ratio mass spectrometry. This approach offers a promising method to fill historical data gaps and evaluate how human activities have shaped nutrient levels in the Everglades over time. The use of freshwater mussels as geochemical archives may also provide a valuable tool for other long-term paleoenvironmental reconstructions in wetland systems.

Title: **The perks of opercula: Sclerochronological comparison of trace element composition in otoliths and opercula**

Authors: **Vachon, Ashlee 1**; Hussain, Maria 2; Brink, Kirstin 2

Affiliations: 1 Department of Environment and Geography, University of Manitoba, Winnipeg, Canada; 2 Department of Earth Sciences, University of Manitoba, Winnipeg, Canada

Otoliths are metabolically inert calcium carbonate ear stones that develop incrementally, creating a chronological record of trace elements useful for environmental reconstruction. For example, selenium levels are often elevated at the edge of otoliths in contaminated environments, making selenium a useful proxy for environmental reconstruction. This study investigated whether opercula, calcium phosphate bones that cover the gills, could serve as reliable alternatives to otoliths for assessing trace elements. Both structures are frequently used in age estimation and grow by adding seasonal layers and incorporating various trace elements. The objective of this study was to provide a direct comparison between trace elements and growth marks in opercula and otoliths from the same fish. Data analysis was performed on otoliths and opercula from a pike and a perch from Schist Lake, Manitoba, known for increased selenium levels due to mining contamination, and a walleye and a goldeye from Lake Winnipeg, Manitoba, which is assumed to be unaffected. Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) line scans were used to generate trace element concentration profiles from the nucleus to the edge of each structure. Results showed that selenium peaked at the edge of opercula from the contaminated lake, and that seasonal peaks of trace elements in opercula correspond to annuli, demonstrating the potential of elemental sclerochronology in opercula as an alternative to otoliths for certain elements. Ultimately, differences in environmental conditions, growth mechanisms, metabolic pathways, and chemical composition may influence the incorporation of trace elements between calcium carbonate (otoliths) and calcium phosphate (bone).

ABSTRACTS
POSTER PRESENTATIONS

IMPACTS ON ECOSYSTEMS & POLLUTION

Title: **The North Eastern Oyster: An isotopic study of oyster populations extended beyond their species range on the island of Newfoundland, Canada**

Authors: **MacKinnon, Megan 1**; Dufour, Suzanne 2; Burchell, Meghan 3

Affiliations: 1 Interdisciplinary PhD Program, MUN, St. John's, Canada; 2 Biology, MUN, St. John's, Canada; 3 Archaeology, MUN, St. John's, Canada

The eastern oyster (*Crassostrea virginica*) has been translocated beyond its natural northern range from the Gulf of Mexico to the Gulf of St. Lawrence, yet little is known about how high-latitude environmental conditions influence oyster growth, survival, and shell integrity. The island of Newfoundland represents a high-latitude environment marked by pronounced seasonal cycles and a history of both experimental transplantation and commercial oyster cultivation. Two Guts Pond, a barachois system on the west coast of Newfoundland, received Prince Edward Island seed oysters in 1965, and the site was monitored into the 1970's. Oyster valves collected at this site by the Department of Fisheries and Oceans in 2009 indicate continued survival, whereas dead shells collected in 2025 suggest a recent population decline. Merasheen Bay, located in southwest Newfoundland, hosts the province's first commercial oyster aquaculture operation (established 2019), with floating cage culture in a deep, open-bay environment. This study asks: (1) How do temperature–salinity patterns recorded in oyster shell $\delta^{18}O$ differ between environments in Newfoundland? (2) How do shell structure and growth patterns vary spatially and temporally between transplanted and cultured oysters? (3) What implications do these environmental and dietary differences have for oyster growth, valve density, and aquaculture viability beyond the range of this species? By comparing historical and modern oysters across contrasting environments, this study aims to assess the environmental constraints on oyster survival and shell quality at the northern edge of *C. virginica*'s range and to inform aquaculture development.

FISHERIES ECOLOGY, MANAGEMENT & CONSERVATION

Title: **Making the invisible visible without preparation – using Micro-XRF for non-destructive analyzes of element composition and distribution of biological samples**

Authors: **Jacobson, Philip 1**; Spotowitz, Lisa 1; Heimbrand, Yvette 2

Affiliations: 1 Swedish University of Agricultural Sciences, Department of Aquatic Resources, Institute of Freshwater Research; 2 Swedish University of Agricultural Sciences, Department of Aquatic Resources, Institute of Coastal Research

Micro X-ray fluorescence (μXRF) is a method used to determine the chemical composition of materials. The X-ray beam can be focused to micrometer-scale resolution, allowing detailed mapping of elemental variations within very small regions of a sample. Because μXRF is a non-destructive method, sensitive and unique materials can be analyzed without physical alteration. We developed novel ecological applications using the μXRF technique for rapid mapping of the elemental distribution in whole fish otoliths, allowing assessment of migration patterns and chemical marking. In addition, we successfully mapped elemental compositions in a wide range of biological samples, including brachiopod fossils, whole isopods (*Saduria entomon*), whole fish, fish larvae, leaves, flowers, plants, fish bones, teeth from marine mammals, and mussels. This technique shows great potential for cost-efficient and non-destructive analyses of elemental composition and distribution in biological samples without the need for sample preparation.

ABSTRACTS
POSTER PRESENTATIONS

FISHERIES ECOLOGY, MANAGEMENT & CONSERVATION

Title: **Tracing adult *Sparus aurata* to nursery origins using elemental otolith fingerprints**

Authors: **Pavičić, Mišo 1**; Matić-Skoko, Sanja 1; Bašić, Sanja 1; Ugrin, Nika 1; Vrdoljak, Dario 1; Madunić, Lea 1; Uvanović, Hana 1; Markulin, Krešimir 1; Mertz-Kraus, Regina 2

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This study aims to determine if otolith chemistry can differentiate nurseries and if it can effectively reassign *Sparus aurata* adults from nearby stocks to adjacent nurseries. Juveniles and young adults were collected in May–June 2021 and 2024, respectively, within ten nurseries (N1–N10) and two channel areas (A1, A2) along the middle eastern Adriatic coast. Laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) was used to quantify the concentrations of 12 chemical elements in the specific otolith region corresponding to the juvenile nursery stage. Elemental concentrations differed significantly between nursery areas, with N2 (Jadro) showing the most distinct profile. Analysis revealed a relatively compact cluster for N2, while other nurseries exhibited broad overlap with no clear separation. Several nurseries show a wide range of dispersion, while N1 (Prosika) shows a narrow range of dispersion. Statistical analysis confirmed significant differences between N2 and the other nurseries, with varying levels of significance for differences among other nurseries. Most adult individuals were assigned to the cluster that also includes nursery N2, despite overlapping cluster structures in the plot. Assignment tendencies differed by adult sampling area. Individuals from A1 were more frequently assigned to N2 and showed more classified individuals than those from A2. Although the proximity of the nurseries likely contributes to a higher percentage of recruits to the nearest surrounding area, it is important to recognize that local stocks are replenished from several other nurseries as well, which contributes to and ensures population stability in a given area.

Title: **Growth ring morphology, axial and radial growth rates in six species of Northwest Atlantic sea pens (*Cnidaria*: *Octocorallia*)**

Authors: **Greeley, Krista 1**; Edinger, Evan 2,3,5; Neves, Bárbara de Moura 4; Hayes, Vonda Wareham 4; Layne, Graham D. 5

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Sea pens are the most diverse group of octocorals occurring along the continental margins of Atlantic Canada and the eastern Canadian Arctic. Most sea pen species produce calcified central axes with growth rings, but their composition and frequency of formation are not well understood. Structure and chemical composition of growth rings, and axial and radial growth rates, were measured in six sea pen species collected from the Laurentian Channel Marine Protected Area (NW Atlantic) from depths ranging between 400–600 m. Species examined included *Anthoptilum grandiflorum* and *A. murrayi*, *Pennatula aculeata*, *Funiculina quadrangularis*, *Protoptilum carpenteri*, and *Kophobelemnon stelliferum*. Structure and composition of rings were examined visually using scanning electron microscopy (SEM) of transverse sections of the central axes. Elemental ratios Mg/Ca, Sr/Ca, Ba/Ca, and Na/Ca were compared for light and dark growth rings using SEM-EDX. For most species these were almost identical in composition, except for slightly higher Mg/Ca ratios in light rings than in dark rings. Dark portions of growth rings were more porous than light portions. All species showed both major and minor growth rings, with major rings indicating annual growth increments, and possibly linked to seasonal variation in food availability. Sea pen axial growth patterns were generally logistic–logarithmic, best approximated by a Gompertz growth curve. Maximum ring widths among the sea pens were observed in the middle of the radial growth series. Axial growth asymptotically approached a maximal height in most species, suggesting that age can be inferred from colony length only up to a species-specific threshold size.

ABSTRACTS
POSTER PRESENTATIONS

FISHERIES ECOLOGY, MANAGEMENT & CONSERVATION

Title: **Isotopic records from the Variegated Scallop, *Mimachlamys varia***

Authors: **Peharda, Melita 1**; de Winter, Niels J. 2; Schöne, Bernd R. 3; Uvanović, Hana 1; van der Lubbe, Jeroen 2; Bujas, Niko 1; Stanić, Rino 1; Janeković, Ivica 4

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The variegated scallop, *Mimachlamys varia*, is a relatively small-sized scallop whose growth patterns are not well studied. It occurs as fossils in sedimentary deposits and is of potential commercial interest. In this study, we aim to test the environmental utility of oxygen ($\delta^{18}O_{shell}$) and carbon ($\delta^{13}C_{shell}$) stable isotope values of *M. varia* specimens collected from two locations in the Adriatic Sea. Specimens were obtained from their natural habitat in the northern Adriatic Sea using a commercial fishing vessel (November 2024) and from the aquaculture net at the bluefin tuna farm near the island of Brač, middle Adriatic Sea (February 2025). A total of six *M. varia* specimens were analysed, three from each site. Carbonate powder samples for stable isotope analysis were manually micro-drilled from the external shell surface. Temperature and salinity values were obtained from the ROMS numerical model and were used to compute predicted $\delta^{18}O_{shell}$ values. Measured $\delta^{18}O_{shell}$ data were manually aligned along the predicted $\delta^{18}O_{shell}$ curve, enabling the reconstruction of the seasonal timing and rate of shell growth. Results indicate differences in isotopic signatures between these two sites, with shells from Brač having lower $\delta^{18}O_{shell}$ and $\delta^{13}C_{shell}$ values. According to the alignment, shells from the northern Adriatic slowed their growth both during the winter and summer, while those from Brač only slowed their growth during the cold season. Results were compared to previously published data for other scallop species from the Adriatic Sea, including *Aequipecten opercularis*, *Pecten jacobaeus*, and *Flexopecten glaber*.

Title: **Disentangling the growth of *Bolinus brandaris* (*Gastropoda*: *Muricidae*) by means of an experimental calcein sequential**

Authors: **Pérez-Mayol, Sílvia 1**; Mir-Arguimbau, Joan 2; Morales-Nin, Beatriz 1; Ramón, Montserrat 2

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The purple dye murex (*Bolinus brandaris*) is a gastropod inhabiting sandy–muddy and detrital bottoms at depths up to 100 m in the Mediterranean and northeastern Atlantic. Despite its local relevance for small-scale fisheries and signs of overexploitation, the lack of knowledge on its age and growth impedes the implementation of effective fishery management and conservation measures.
Therefore, a calcein sequential marking experiment was performed on individuals collected in Catalan (NW Mediterranean) waters and kept in captivity under natural photoperiod and temperature conditions. Individuals (N = 98) were marked five times by immersion in 60 mg·L^{-1} calcein for 3 h. After 13 months, the individuals were sacrificed, shells were cleaned, embedded in epoxy resin, and processed to obtain thin slices at the last whorl level. In order to visualize the growing inner structures and the calcein marks, digital microphotograph images and mosaics under both brightfield and fluorescent light were obtained. Shell growth and the growth increments (GI) deposited between marks were determined from the images to estimate growth rates and assess GI periodicity. Our results indicate that *B. brandaris* exhibits episodic growth independent of season and water temperature, as observed in other muricid species. Additionally, two groups of individuals were identified: those presenting high growth rates throughout the experimental period (N = 52) and another group with low or minimal growth rates (N = 46). Due to the variability in growth, increment identification was only possible for individuals presenting intense growth between marks because of optical microscopic resolution limits.

ABSTRACTS
POSTER PRESENTATIONS

FISHERIES ECOLOGY, MANAGEMENT & CONSERVATION

Title: **Unvalidated age and longevity estimates lead to uncertainty of the true extinction risks of Chondrichthyans**

Authors: **Flem, Logen M. 1**

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There is increasing awareness of the widespread extinction risk of chondrichthyan fishes, with almost 40% of species categorized as threatened (i.e., Vulnerable, Endangered, or Critically Endangered) in current IUCN Red List assessments. These assessments rely on the best available information to determine a species' threatened status, including biological life-history traits. Key traits incorporated into assessments include age and longevity estimates traditionally derived from calcified structures, such as vertebral centra and dorsal spines. However, the periodicity and formation of growth increments remain insufficiently validated. Further, many species lack life history information, resulting in assessments inferring information from congeners. These forms of questionable or sub-optimal life history information are carried into the extinction risk analyses, introducing the potential to erroneously estimate a given species' extinction risk and increasing the likelihood of misrepresentation of true extinction concern for chondrichthyans. To demonstrate this issue, Red List risk assessment methods will be summarized, incorporating scenarios using both known and borrowed life history information. These examples illustrate that for species already designated as threatened their extinction risk may be misstated, and concern should be maintained for many species not yet determined as threatened. Resolving life history knowledge gaps, particularly the need for improved methods in age and growth analysis and validation, is therefore urgent. Similarly important, life history information should be pursued for species across the taxonomy of chondrichthyans to minimize error in future extinction risk assessments.

SCLEROCHRONOLOGY IN DEEP TIME

Title: **Tracing Late Cretaceous paleoclimate in the Mississippi Embayment through isotopic records from rudists**

Authors: **Huang, Yitao 1**; Andrus, Fred 1

Affiliations: 1 Department of Geological Science, University of Alabama, Tuscaloosa, Alabama, USA

We apply stable oxygen ($\delta^{18}O$) and carbon ($\delta^{13}C$) isotope analysis to fossil rudist bivalves (*Sauvagesia* sp.) to investigate and reconstruct the paleoclimate and paleoenvironment of the Mississippi Embayment, a coastal formation in the southeastern United States formed during the Cretaceous period. Rudist bivalves are important and unique archives for paleoenvironmental reconstructions in the greenhouse world of the Cretaceous. *Sauvagesia* sp., a genus of rudists that were very abundant dwellers on shallow marine carbonate platforms during the Cretaceous, can be used as a paleoenvironmental archive because it preserves seasonal signals in both shell growth structures and isotope records. The rudist samples (*Sauvagesia* sp.) analyzed in our study were previously collected from Harrel Station, Alabama, USA, in the Upper Cretaceous Mooreville Chalk and are housed at the Alabama Museum of Natural History. Prior to isotopic analysis, these fossils were examined to assess preservation by investigating their microstructure using scanning electron microscopy (SEM). Sequential isotopic analysis was performed by microsampling using a computer-controlled micromill. These time-series data may provide insight into the possible periodicity of the apparent growth structures and environmental conditions in the Cretaceous Mississippi Embayment. Data measured thus far are consistent with previously published research on the Mooreville Chalk, and our time-series data suggest the possibility of seasonal water temperature variation. Our findings contribute to a better understanding of coastal environmental dynamics and paleoclimate evolution in the Cretaceous Mississippi Embayment.

ABSTRACTS
POSTER PRESENTATIONS

SCLEROCHRONOLOGY IN DEEP TIME

Title: **Resolving Life Histories of Paleozoic Brachiopods for a Test of 'Seafood through Time**

Authors: **Dempsey, Caitlyn 1;** Ivany, Linda C. 1; Limburg, Karin 2

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Brachiopods are one of the most abundant fossils in the Paleozoic, and they persist into the modern. While their diversity, morphology, and ecology have been extensively studied, we know surprisingly little about their life histories. Life history, specifically lifespan, can inform ecological context because of the connection to organism metabolism and environmental energetics, where slower growth and a longer lifespan generally imply a slower metabolism, and vice versa. Brachiopod life history data could therefore offer a means by which to test Bambach's 'Seafood Through Time' hypothesis suggesting that the energetics of marine ecosystems have increased over the Phanerozoic. Despite being accretionary, resolving annual growth increments in brachiopod shells has proven difficult in both the Modern and ancient. Here, we use micro X-ray fluorescence (microXRF) and laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) to explore the distribution of elements in Devonian brachiopod hinge areas in an effort to resolve seasonal variation in temperature and growth rate and produce growth curves. Work thus far demonstrates that element maps from the microXRF can spatially resolve growth banding, and that transects across bands with LA-ICP-MS pick up the variation seen in microXRF maps. Dark bands (low concentrations) in the μXRF Sr plot correspond to Sr lows and Mg peaks in LA-ICP-MS data, suggesting that growth slowdowns in this case correspond to warm temperatures. Discriminating what are (presumably) annual peaks from background noise involves ambiguity and patterns are not always clear, but our data suggest a lifespan of at least 10 years for *Spinocyrtia*.

ARCHAEOLOGY

Title: **Sclerochronology partnership research with Aboriginal and Torres Strait Islander communities to aid Indigenous-led management of Sea Country**

Authors: **Prendergast, Amy 1**

Affiliations:1 School of Geography, Earth and Atmospheric Sciences, The University of Melbourne, Australia

The application of mollusc shell sclerochronology to studies of past climate and environment, seasonal foraging reconstructions, and human–environment interaction has been steadily increasing over the past few decades in many regions of the world. However, in Australia, even with some pioneering early studies, its application has until recently been underutilised. This is despite Australia's extensive network of coastlines and river systems which support abundant molluscan fauna and its rich archaeological record of middens containing abundant marine, terrestrial, and freshwater shells. Here we present an overview of the latest mollusc shell sclerochronology research from the Australian region. This includes modern calibration studies applying stable isotope and trace element analyses to marine bivalves and gastropods from northeastern, southeastern, and western Australia, as well as the Torres Strait, and complementary analyses of Holocene archaeological assemblages from these regions in collaboration with Aboriginal and Torres Strait Islander Traditional Owners. Each project has been co-designed with local Indigenous partner organisations as part of the Australian Research Council-funded Centre of Excellence for Indigenous and Environmental Histories and Futures. These studies aim to provide long-term reconstructions of marine shellfish use and high-resolution pre-colonial environmental baseline records. These records will enable the strengthening of Indigenous-led management of Sea Country through the provision of new scientific baselines for sustainable fisheries and reef conservation. Furthermore, they are paving the way for the further application of sclerochronology to Australia's rich archaeological record.

ABSTRACTS
POSTER PRESENTATIONS

ARCHAEOLOGY

Title: **Growth analysis of *Saxidomus gigantea* as a proxy for seasonal sea ice extent**

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The discovery of vertebrate zooarchaeological remains of ice-dependent species in the Aleutian Islands has provoked arguments that seasonal sea ice reached the southern Bering Sea during the late Holocene. However, this is significantly farther south than sea ice has been documented to occur. This project utilizes sclerochronological analyses of ancient and modern samples of butter clam (*Saxidomus gigantea*) from Dutch Harbor, Unalaska Island, Alaska, USA, to estimate past growth season durations and assess the possibility of late-Holocene sea ice. This species displays growth increments bracketed by lines indicating cessation that occur when sea-surface temperature (SST) is below ~5 °C. Oxygen isotope analysis confirms that these cessations occurred due to winter SSTs rather than other factors, and measuring the distance between winter cessation lines of modern and ancient samples allows comparison of growth season duration. Shell samples excavated from three Holocene sites were compared to nearby modern clams. Seasonal sea ice would presumably be associated with shorter archaeological growing seasons than modern growing seasons in ice-free periods. However, data indicate that late Holocene samples have similar or longer growth seasons compared to modern samples. These results suggest the necessity for alternative interpretations to reconcile the appearance of ice-dependent species in these archaeological sites. Lunar-daily microincrement counts, performed with machine learning, will further test that conclusion or suggest other reasons for the unexpected visual growth season results. The synthesis of paleoclimate data such as these is useful for understanding historical baseline sea ice extent and for contextualizing how anthropogenic warming is contributing to sea ice loss.

Title: **Increasing precision in SST reconstruction in British Columbia, Canada, using $\delta^{18}O$ and Sr/Ca of marine bivalves from archaeological sites**

Authors: **Kuehn, Sarah, D. 1**; Leclerc, Natasha 1; Morin, Jesse, 2, 3; Taft, Spencer 4; Burchell, Meghan 1

Affiliations: 1 Department of Archaeology, Memorial University of Newfoundland, St. John's, Canada; 2 Institute for the Oceans and Fisheries, University of British Columbia, Vancouver, Canada; 3 Department of Archaeology, Simon Fraser University, Burnaby, Canada; 4 Tsleil-Waututh Nation, North Vancouver, Canada

Since European contact in 1792 CE, water quality and shellfish harvestability in Burrard Inlet, British Columbia, have declined. Consequently, a shellfish harvesting ban since 1972, due in part to warming sea surface temperatures (SST) intensifying harmful algal blooms and E. coli cell division, has threatened the access to traditional foods for its longstanding inhabitants, Tsleil-Waututh Nation (TWN). A historical SST baseline would help evaluate how climate change has affected shellfish harvestability over time. However, significant annual freshwater inflows prevent accurate SST reconstruction using stable oxygen isotopes ($\delta^{18}O$) alone. This study combined $\delta^{18}O$, Sr/Ca ratios, and sclerochronology of live-collected clam shells (*Saxidomus gigantea* and *Leukoma staminea*) to model modern instrumental SST before reconstructing a historical SST baseline using archaeological shells. Measured water temperature and salinity collected between 2019-2024 ranged from 6.2°C -16.9 °C and 8.8 - 27.3 PSU, respectively. Modelled SST based on $\delta^{18}O$ ranged from 2.0 - 20.7°C, while Sr/Ca better isolated the instrumental range (4.9 - 19.3°C). When examined separately, S. gigantea captured higher temperatures more accurately, while L. staminea was more suited to record lower temperatures, suggesting that using both species may be important to document the full annual SST range. The inclusion of Sr/Ca and the combined use of both S. gigantea and L. staminea will enable more precise SST calculations from archaeological shells obtained from nearby 500-1000 years old shell midden sites. This research is in collaboration with TWN but is not representative of TWN.

ABSTRACTS
POSTER PRESENTATIONS

ARCHAEOLOGY

Title: **Reconstructing seasonal upwelling and indigenous resource use using high-resolution pipi shells (*Plebidonax deltoides*)**

Authors: **Chia-Cheng (Jason) Ku 1,2 , Amy Prendergast 1,2**

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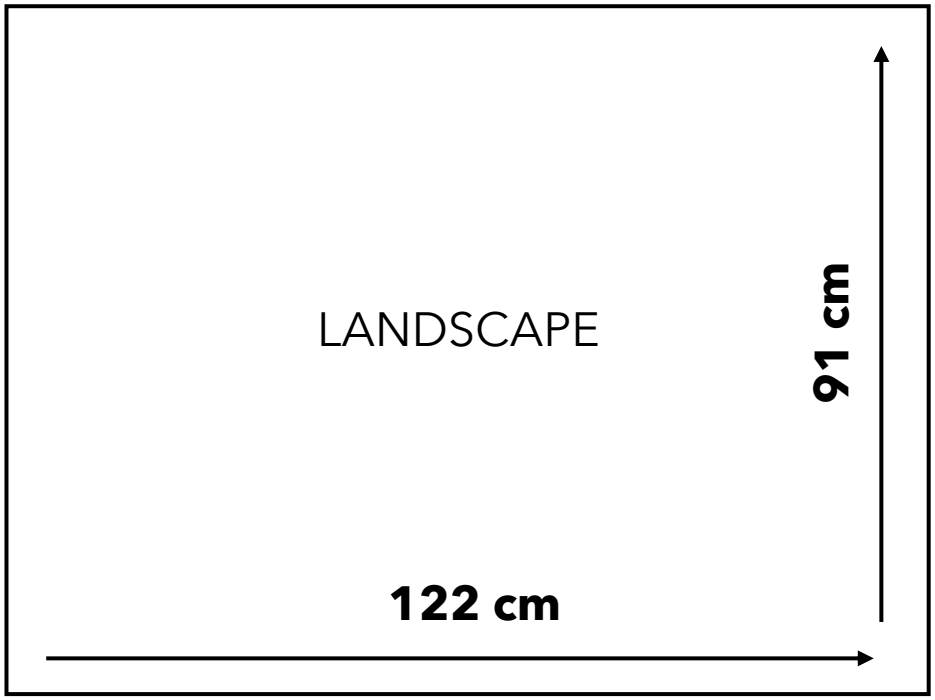
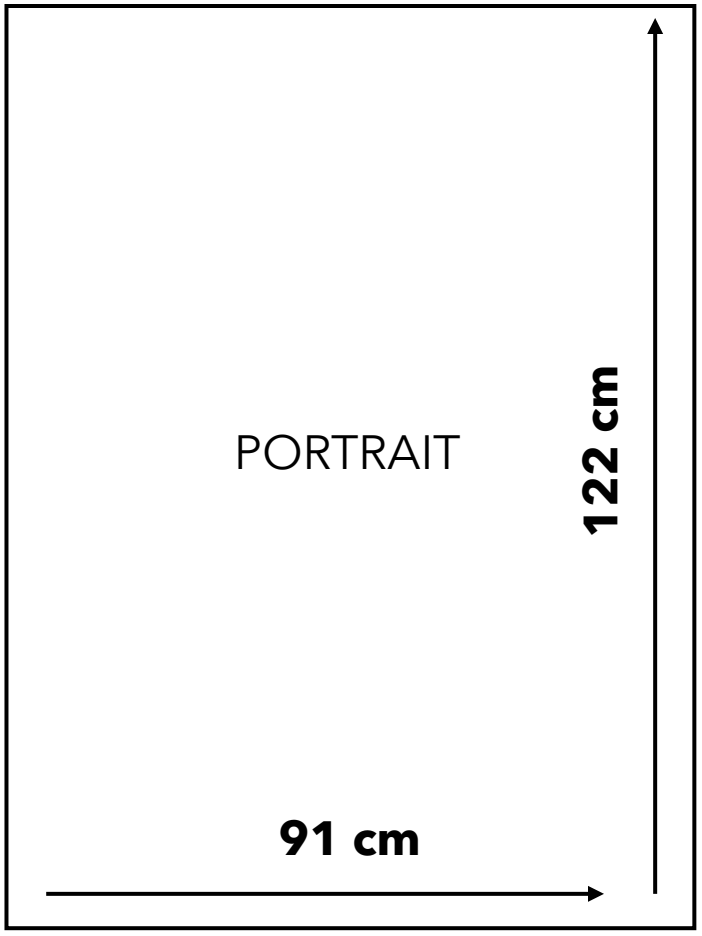
Understanding past climate variability at seasonal scales is critical for revealing how human populations historically adapted to environmental changes, particularly in upwelling-influenced regions. Along the southern shelf of Australia, the seasonal Bonny upwelling (December–April) delivers nutrient-rich waters that significantly enhance marine productivity and available resources, such as pipi shells (*Plebidonax deltoides*). This study aims to establish a high-resolution paleoenvironmental archive using the geochemistry of pipi shells, such as trace elements (Ba/Ca, Cd/Ca, Mg/Ca, Sr/Ca), and stable isotopes. In collaboration with the Gunditj Mirring Traditional Owners Aboriginal Corporation, this framework is further applied to archaeological shell middens in coastal Western Victoria. Our expected results are that geochemistry will reveal high-resolution (approximately fortnightly) records of intensity and timing of the upwelling events. As a multiproxy framework to resolve the timing and intensity of past upwelling dynamics, biogenic remains in archeological sites can be analysed to better understand past upwelling dynamics connected to human activities. The results will provide high-resolution insights into human-environment interactions and help refine regional climate models for future projections.

POSTER REQUIREMENTS





Thank you!

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