International Fossil Coral and Reef Society

Third Early Career Researcher Symposium

Abstract Booklet

14 November 2024

Contents

Code of conduct

The International Fossil Coral and Reef Society (IFCRS) was created to connect individuals interested in fossil corals, sponges and reef ecosystems in the broadest sense. Researchers and students are the core of our Society, but general enthusiasts are also warmly encouraged to join our growing community. We strive to foster a safe, inclusive, and respectful community that values the diverse perspectives and experiences of all members. Harassment or disrespectful behaviour of any kind is not tolerated. By participating in IFCRS activities, you agree to adhere to the following code of conduct at all times. The IFCRS council will enforce this code as necessary to ensure that all participants feel welcome, and we reserve the right to remove those who are found to be negatively contributing to the society and its activities. The IFCRS is committed to diversity, inclusion, and accessibility for all, and expects members of the society to uphold these values, and treat all equally.

Members of the IFCRS and participants in its activities are expected to treat one another with respect and dignity regardless of gender, gender identity and expression, sexual orientation, marital or parental status, age, immigration status, disability, physical appearance, body size, race, ethnicity, nationality, religion (or lack thereof), socioeconomic background, educational background, career stage, career trajectory, or scientific opinions.

We believe all members of our society and participants in activities have:

- The right to be safe from harassment or discrimination in all its forms
- The right to fully engage in all the activities on offer
- The right to have any complaints or concerns investigated, regardless of career position

We ask everyone to help us maintain an inclusive and safe Society for all by agreeing to the common principles of our code of conduct:

- being courteous, respectful and professional towards others
- valuing the diversity of participants, their views and opinions

If you are being harassed, notice that someone else is being harassed, or have any other concerns, please contact the IFCRS council via fossilcoralreef@gmail.com

Ultimately, please remember why we are here: to network, diversify our knowledge, meet new people, and above all, to enjoy science!

Digital images and social media policy

During the symposium, do not photograph or record a talk without the author's express permission. While the default assumption is to allow open discussion of presentations on social media, attendees are expected to respect any request by an author not to disseminate the contents of their talk.

We request that authors indicate at the start of their talk whether they are happy for the presentation to be shared on social media or not.

Throughout the symposium, we will use the hashtag #IFCRS2024 to share updates about the symposium and presentations. You may also tweet us using our Twitter handle: @fossil_reef.

Joining the Symposium

The symposium will be conducted fully online. When registering via this link, you will receive an email with a link to join the symposium. Please note, this link will be sent to the email address you registered for the symposium. For the symposium, we will make use of the platform Zoom. If you are unfamiliar with Zoom, you may familiarise yourself via the following link: https://zoom.us.

Letter from the IFCRS president and secretary

Dear participants of the Third IFCRS Early Career Researcher Symposium,
Dear colleagues and friends,

In today's world, due to climate change, coral reefs are disappearing on a massive scale. Along with them, entire marine ecosystems are vanishing, and human environments across vast areas of the globe are undergoing radical, detrimental changes. Examining the dynamics of reef development, as well as the causes and consequences of reef crises or/and extinctions, from the perspective of millions of years of evolution in this group of organisms is also immensely important for modern societies. For this reason, we believe that our paleontological research has tremendous value, and the voice of our community should be increasingly well heard, including in the media.

While our work focuses primarily on fossil corals and reefs, discovering the overarching mechanisms governing the paleobiology of these organisms can increasingly inspire us to draw upon the rapidly growing knowledge of the biology, physiology, and molecular mechanisms of modern corals and reef organisms. In this way, two research communities/societies—those studying modern corals and reefs (ICRS) and those focusing on fossil corals and reefs (IFCRS)—will speak with one clear, strong voice. We hope this synergy between researchers of fossil and modern corals and reefs will be reflected at the upcoming 15th Symposium of the International Fossil Coral and Reef Society, which will be held in 2027 in Toulouse, France.

A primary goal of our society is to support the scientific activities of early career scientists in the study of corals and reef ecosystems and to encourage those involved in this field to become active members of our society. For this reason, the one-day IFCRS Early Career Researcher (ECR) Symposia held online are important events. They serve as a bridge between the flagship IFCRS symposia held every four years and include a broader audience that might not otherwise attend our in-person meetings.

The success of past online ECR symposia in 2021 (Vigo, Spain, and Vienna, Austria) and 2022 (Erlangen, Germany) has solidified these forums as essential for intellectual exchange among early career researchers in our society. Therefore, we believe that the upcoming online ECR IFCRS Symposium in Chengdu and Nanjing in the fall of 2024 will also be an extremely successful gathering of early career scientists.

We would like to extend our sincere thanks to the organizers of this event Dr Xia Wang (Chengdu University of Technology, China) and Dr Le Yao (Nanjing Institute of Geology and Paleontology, China), for the time and effort they have put into its organization, and to Dr Danijela Dimitrijević (Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany). We hope you enjoy the day and have engaging and valuable exchanges with the various participants at this symposium. We also hope that many early career scientists will continue their research, and we look forward to seeing them at future Society events.

Jarosław Stolarski (IFCRS President)
Nadia Santodomingo (IFCRS Secretary)

A note from the organisers

Dear Delegates,

The IFCRS Early Career Researcher Symposium is back!

Time flies—it's been two years since our last symposium. We're thrilled to gather with you all again, and we want to extend a special thank you to each of our speakers who will share their exciting work. Your participation and enthusiasm make this event a great success!

The idea for the Early Career Researcher Symposium (ECR Symposium) was first implemented by Angelina Ivkić and Lewis Jones, with last year's event organized by Danijela Dimitrijević. The vision was to create a unique platform for early-career researchers to present their findings between the main meetings of the International Fossil Coral and Reef Society (IFCRS), which are held every four years. Thanks to their dedication and the involvement of so many talented researchers, previous ECR symposiums have brought together over 150 delegates, representing over 20 labs, and hosted 16 enriching talks.

At this third symposium, we have a fantastic lineup of six talks from early-career researchers, covering a wide range of topics on fossil reefs, corals, and sponges that span from the Ediacaran period to the present day. We're also honored to have two plenary speakers, Professor Stephen Kershaw from Brunel University and Professor Rowan Martindale from the University of Texas at Austin, who will share their insights on fossil sponges and the collapse and recovery of reefs in the Early Jurassic.

As we dive into these discussions, let's keep the atmosphere welcoming, positive, and respectful. We hope you enjoy this opportunity to connect, learn, and share ideas!

Thank you all once again for being in this event.

Life is short, let's stay reef.

Warm regards,
Xia Wang and Le Yao

Schedule

Thursday 14th November 2024 **(Time zone: Beijing CST = UTC +8)**
See the time chart on the next page for time zone guidance

17:00–17:10 Welcome address

Plenary talk 1

17:10–17:50 Stephen Kershaw

Hypercalcified sponges: making sense of a complex topic

Invited talks: Session 1

17:50–18:10 Ya-lan Li

Early Cambrian archaeocyath-dominated reefs in the Hannan-Micangshan area, South China

18:10–18:30 Alessandro Paolo Carniti

Brachiopod-rich mud mounds from the Mississippian of UK: an investigation on the factors controlling their growth

18:30–18:50 Xiao-peng Wang

A late Ediacaran hexactinellid sheds light on the early evolution of sponges

18:50–20:30 Dinner/Lunch Break

Invited talks: Session 2

20:30–20:50 Ling-zan Meng

Reef Quantitative Analysis with 3D Digital Outcrop Models: A Case Study of the Late Permian Jiantianba Quarry

20:50–21:10 Fayao Chen

The Permian giant bivalve alatoconchids: a gregarious taxon rather than reef builders

21:10–21:30 Tea and Coffee Break

21:30–21:50 Amanda Godbold

Ancient Frameworks as Modern Templates: Exploring Reef Rubble Stabilization in an Ancient Reef System

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Plenary Talk 2

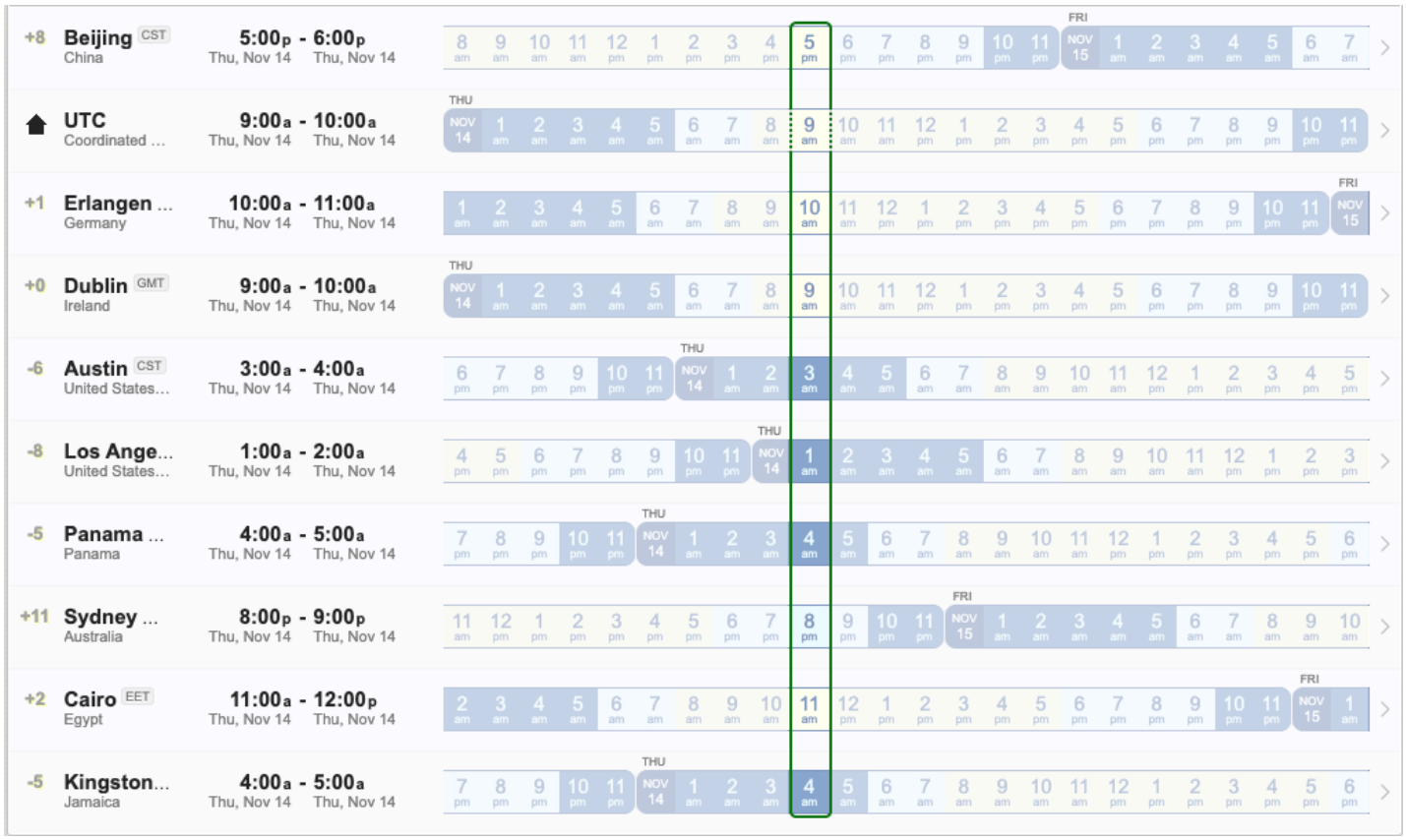
21:50–22:30 Rowan Martindale

A Tale of Two Crises: The collapse and recovery dynamics of Pliensbachian and Toarcian (Early Jurassic) reef ecosystems from the Central High Atlas of Morocco

22:30–22:40 Closing address

Time zone converter

Below, we provide a time zone converter for your convenience. If you have any queries about your specific time zone, please do let us know. The following is also a very useful resource: https://www.worldtimebuddy.com/



Abstracts

Plenary Talks

HYPERCALCIFIED SPONGES: MAKING SENSE OF A COMPLEX TOPIC

Stephen Kershaw[1]

[1]*Brunel University, UK*

Hypercalcified sponges began with the early Cambrian archaeocyaths, followed by well-known groups, including stromatoporoids, chaetetids, sphinctozoans, inozoans, and some others. They continue in present times with a small assemblage of living forms. This presentation makes an overview of the range of forms of hypercalcified sponges and considers their relationships, geological history and palaeoenvironmental aspects. It should provide a useful introduction to the topic and give some ideas to think about!

A TALE OF TWO CRISES: THE COLLAPSE AND RECOVERY DYNAMICS OF PLIENSBACHIAN AND TOARCIAN (EARLY JURASSIC) REEF ECOSYSTEMS FROM THE CENTRAL HIGH ATLAS OF MOROCCO

Rowan Martindale[1,2]

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[2]*Jackson School of Geoscience, University of Texas at Austin, Austin, Texas 78712, USA*

Reefs are key marine ecosystems but are currently threatened by various anthropogenic and natural threats. Reef crises and recoveries related to ancient environmental perturbations are important analogues for modern conservation. One of the most severe reef collapses of the Phanerozoic occurred during the Pliensbachian–Toarcian transition (Early Jurassic). Reefs composed of lithiotid bivalves, corals, sponges, and microbialites flourished in the Sinemurian and Pliensbachian Stages but were decimated by environmental changes associated with the Pliensbachian/Toarcian boundary event and Toarcian Oceanic Anoxic Event (T-OAE, ~183 million years ago).

Recent interdisciplinary research in the Central High Atlas Mountains of Morocco has identified a dynamic record of reef proliferation and collapse. During the Late Pliensbachian, reefs thrived in shallow water depositional environments. These reefs and biostromes were home to diverse communities with abundant macro and microfauna. Just after the Pliensbachian/Toarcian boundary, the climate regime shifted, resulting in a pulse of terrigenous clastic material and nutrients that poisoned carbonate ecosystems. Lithiotid bioherms and biostromes were extremely quick to return to shallow water settings and were often the first to colonize these settings. Conversely, corals, sponges, and foraminifera did not recover quickly, with large benthic foraminifera being absent from early Toarcian reefs and corals only occupying minor roles in lithiotid communities. It was not until just before the onset of the T-OAE that corals and sponges reappeared as reef builders, producing small patch reefs in several locations just before the onset of the event. Reef recovery was short-lived as the T-OAE wiped out the lithiotid bivalves and caused a second reef eclipse. Despite the severity of the T-OAE, coral and sponge reefs were quick to recover, albeit with an extremely depauperate foraminifera community and no lithiotids. This high-resolution record of multi-phased reef crisis and recovery is a rare and important analogue for modern reef ecosystems.

Invited Talks

BRACHIOPOD-RICH MUD MOUNDS FROM THE MISSISSIPPIAN OF UK: AN INVESTIGATION ON THE FACTORS CONTROLLING THEIR GROWTH

Alessandro Paolo Carniti[1]

[1]*Nanjing University*

The Mississippian record is characterized by the abundance of mud mounds, reefs characterized by abundant carbonate mud, and skeletal metazoans, but lacking a skeletal framework. The mud mounds found on the Derbyshire Carbonate Platform, England (UK), in the uppermost Visean (upper Brigantian), challenge traditional notions that link their formation predominantly to eutrophic conditions, typically associated with upwelling or siliciclastic influx.

A renewed investigation of the Derbyshire mud mounds reveals a massive core of carbonate mud with diverse textures. This diversity indicates various genetic processes, including microbial mediation, mechanical breakdown of skeletal remains, and current transport. The muds are rich in fibrous early-marine calcite cement and host a diverse assemblage of brachiopods, bryozoans, and siliceous sponge spicules. The inclined flank beds surrounding the mud mounds consist primarily of skeletal packstone dominated by brachiopods and crinoids.

Productide brachiopods are particularly abundant and larger than other brachiopods in the mud mounds, a possible indicator of low and scattered food resources. The analysis of the depositional context indicates that the mud mounds thrived below the fair-weather wave base after a transgressive phase, but no substantial siliciclastic input began until the cessation of mud mound growth. These data suggest that the mud mounds developed under mesotrophic conditions rather than in highly nutrient-rich environments after deepening of the depositional setting on the Derbyshire Carbonate Platform.

A LATE EDIACARAN HEXACTINELLID SHEDS LIGHT ON THE EARLY EVOLUTION OF SPONGES

Xiaopeng Wang[1,2], Alexander G. Liu[2], Zhe Chen[1], Chengxi Wu[1], Yarong Liu[1], Bin Wan[1], Ke Pang[1], Chuanming Zhou[1], Xunlai Yuan[1], Shuhai Xiao[3]

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[2]*Department of Earth Sciences, University of Cambridge, Downing Street, Cambridge, CB2 3EQ, United Kingdom*

[3]*Department of Geosciences, Virginia Tech, Blacksburg, VA 24061, USA*

Sponges are considered the most primitive animals. While molecular clock analyses suggest that sponges diverged during the Neoproterozoic, the fossil record does not provide definitive evidence of their presence until the Cambrian period. This discrepancy may be due to the absence of biomineralized skeletons in Precambrian sponges. In this study, we report *Helicolocellus cantori* gen. et sp. nov., a newly discovered late-Ediacaran fossil from the Dengying Formation in South China, dated to approximately 551–539 million years ago. This fossil exhibits a stemmed conical body with a complex body wall structure featuring a self-similar grid pattern that recalls a Cantor dust fractal. The hierarchical organization of this pattern is interpreted as an organic skeleton composed of cruciform elements arranged orthogonally, closely resembling the skeletal architecture of some fossil hexactinellid sponges. Unlike hexactinellid sponges, however, this structure lacks biomineralized spicules, suggesting it was formed from non-mineralized material. Phylogenetic analysis also aligns *H. cantori* with Hexactinellida, reinforcing the hypothesis that sponges diverged prior to the Cambrian as non-biomineralizing organisms. The discovery of *H. cantori* supports the idea that sponges diverged before the Cambrian as non-biomineralizing organisms with organic skeletons. Given that siliceous spicules may have evolved independently across different sponge lineages, the reliance on biomineralized spicules as a definitive marker for identifying Precambrian sponge fossils should be reconsidered.

EARLY CAMBRIAN ARCHAEOCYATH-DOMINATED REEFS IN THE HANNAN-MICANGSHAN AREA, SOUTH CHINA

Ya-lan Li[1]

[1]*School of Geoscience and Technology, Southwest Petroleum University, Chengdu, China*

The widespread emergence of hypercalcified archaeocyath sponges as dominant reef-builders in the early Cambrian marks a significant milestone in the evolutionary history of reef systems. This event signifies the development of more complex and higher-order ecosystems in shallow marine environments, offering crucial insights into the co-evolution of organisms and their contemporaneous environment. While archaeocyath sponges have been documented in depositional successions of Cambrian Stage 3 globally as important reef-building organisms, well-documented examples from South China remain limited. Furthermore, previous studies suggested that archaeocyaths did not play a constructive role in reef formation within the Hannan-Micangshan area. This study presents new evidence from a previously undocumented section in the Hannan-Micangshan area of South China, demonstrating that archaeocyath sponges served as primary reef-builders during the Cambrian Age 3. We investigated the composition, characteristics, and depositional sequences of these bioherms, which are distinctively constructed by branching archaeocyaths. Through analysis of reef characteristics across multiple sections in the study area, we evaluate the environmental conditions and distribution patterns of archaeocyath-dominated reefs in the northwestern part of the South China Block.

REEF QUANTITATIVE ANALYSIS WITH 3D DIGITAL OUTCROP MODELS: A CASE STUDY OF THE LATE PERMIAN JIANTIANBA QUARRY

Ling-zan Meng[1], Xia Wang [1,2,3,4*],Qijian Li[5*],Hanting Zhong[1,2,3],Zongqi Lin[1]

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During the Late Permian Changhsingian period, numerous reefs dominated by sponges occurred worldwide, constituting a distinctive shallow-water marine ecosystem within the Phanerozoic eon. Among these, sphinctozoans played a pivotal role as primary framework-builders, showcasing remarkable diversity and abundance in reef environments throughout the Permian-Triassic transition. Consequently, the paleoecology and biogeographic distribution of sphinctozoans within these reefs have garnered significant attention over the last half-century. With recent advancements in photogrammetry by commercial Unmanned Aerial Vehicle (UAV), researchers can now conduct precise centimeter-scale analyses of three-dimensional digital outcrop models. Based on 3D digital outcrop models, we conducted a comprehensive quantitative analysis of sponge communities within the Jiantianba Quarry reef. We also quantified the framework density and main constructional biota by line transects across the outcrop surfaces. Each transect spanned four to five meters and consisted of forty to fifty points, capturing detailed data on the vertical distribution of reef-building sphinctozoans. Genera such as *Amblysiphonella, Colospongia, Lichuanospongia, Sollasia, Uvanella, Tebagathalamia, Neoguadalupia and Cystothalamia* were identified. As the predominant reef builder, *Lichuanospongia* creates the primary framework in our case here. *Colospongia*, *Sollasia* and *Tebagathalamia* are also important components. Synsedimentary cementation processes further bolstered framework stability by encasing the majority of macrofossil skeletons. There is strong heterogeneity within the reef and the sponges community succession occurs.

THE PERMIAN GIANT BIVALVE ALATOCONCHIDS: A GREGARIOUS TAXON RATHER THAN REEF BUILDERS

Fayao Chen[1]

[1]*School of Earth Sciences, China University of Geosciences, Wuhan 430074, China*

The Alatoconchidae from the Permian is the largest known bivalve family in the Palaeozoic, with the shell lengths reaching about 100 cm. Apart from the giant body size, alatoconchids are also characterized by their unusual shell form with wing-like flanges and coarse prismatic outer layer of the shell wall. The clams are palaeogeographically restricted to low-latitude Tethyan and Panthalassan domains, and considered as one of the most typical representatives of the Permian tropical carbonate environments. As these bivalves occur commonly in great abundance, they were once considered as reef builders by some authors. This presentation will introduce widely distributed alatoconchid occurrences from South China, which have been misidentified as phylloid algae in the past forty years. Furthermore, based on detailed lithological and microfacies observation at more than ten fossil localities, combining stratigraphical and palaeogeographical summary of the occurrences in South China, we suggest the great abundance of the alatoconchid shells results from a gregarious lifestyle, and they never formed reefs nor bioherms. Judging from the lithological successions and skeletal grain associations, these giant clams lived in the environment of normal marine salinity and warm water, with the optimal position in the lower part of the photic zone.

ANCIENT FRAMEWORKS AS MODERN TEMPLATES: EXPLORING REEF RUBBLE STABILIZATION IN AN ANCIENT REEF SYSTEM

Amanda Godbold[1]

[1]*Smithsonian Tropical Research Institute, Panama*

Both natural and human-induced stressors cause reef erosion, resulting in reef rubble formation. This rubble, when consolidated, can facilitate reef recovery, sparking interest in rubble stabilization as a method for reef restoration. However, our understanding of the natural processes governing coral reef regeneration within rubble beds is limited. This study examines the regeneration processes within ancient rubble frameworks in a Late Triassic carbonate platform. Results show that these Late Triassic rubble environments exhibit successional trajectories similar to those of contemporary rubble environments. Key organisms such as sponges, calcareous red algae, bryozoans, microbes, and scleractinian corals, which are instrumental in the stabilization of modern reef rubble, appear to have played comparable roles during the Late Triassic. The similarities between Late Triassic and modern reef rubble stabilization highlight enduring ecological mechanisms important for reef regeneration. This study deepens our understanding of reef dynamics and offers valuable insights for improving current reef restoration strategies grounded in time-tested natural processes.