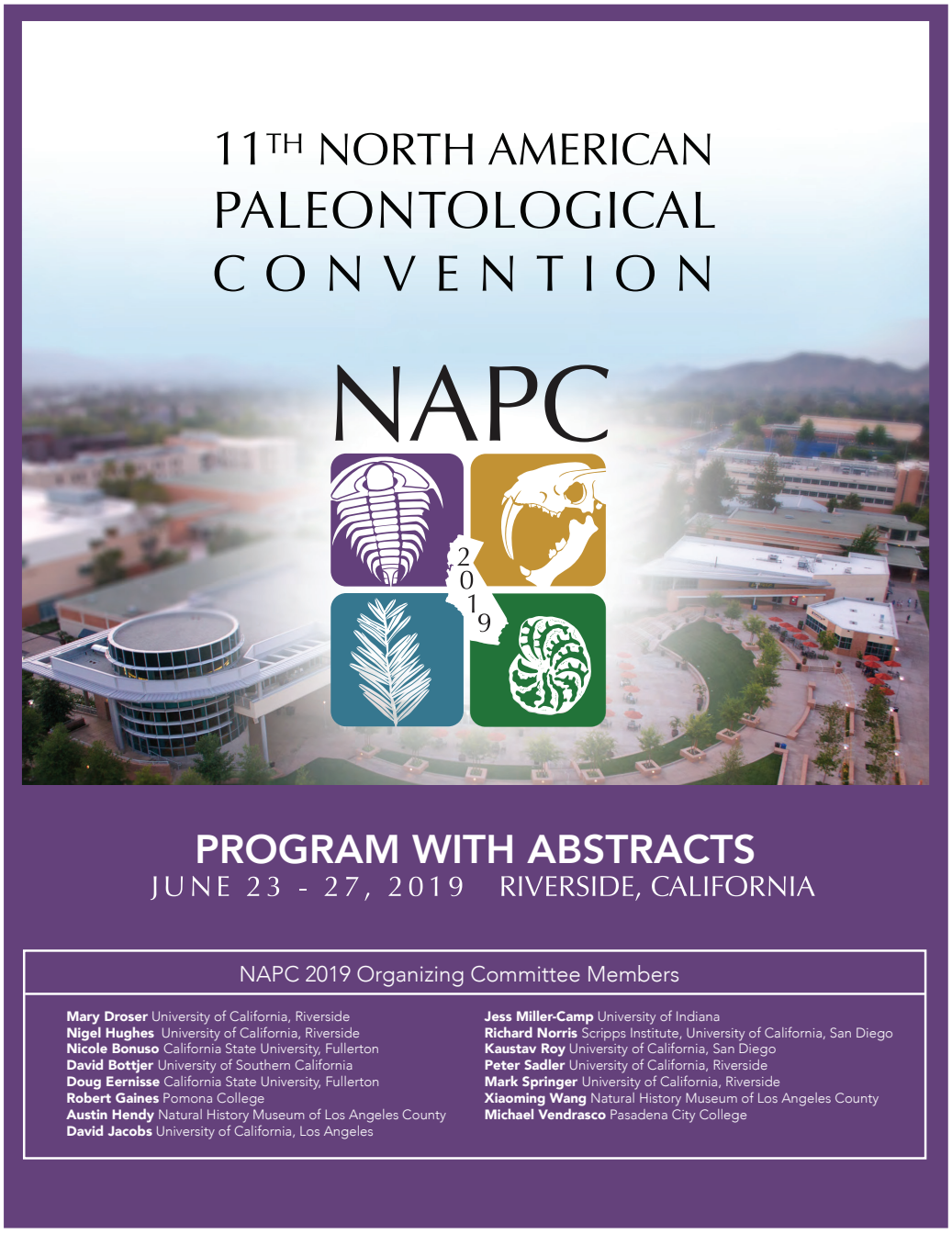
PaleoBios 36 (Supplement 1): 1–389, June 19, 2019

PaleoBios

OFFICIAL PUBLICATION OF THE UNIVERSITY OF CALIFORNIA MUSEUM OF PALEONTOLOGY



Citation: Droser, M., N. Hughes, N. Bonuso, D. Bottjer, D. Eernisse, R. Gaines, A. Hendy, D. Jacobs, J. Miller-Camp, R. Norris, K. Roy, P. Sadler, M. Springer, X. Wang, and M. Vendrasco (eds.). 2019. 11th North American Paleontological Conference Program with Abstracts. *PaleoBios* 36 (Supplement 1), ucmp_paleobios_44177.
Permalink: https://escholarship.org/uc/item/6r18f8wn

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Sequence stratigraphic control on fossil diversity patterns has been supported by theoretical models, numerical simulations and empirical studies, but the relative importance of eco-environmental versus taphonomic processes in driving this relationship remains poorly understood. We address this question using mollusk assemblages from a series of cores drilled throughout the Holocene transgressive-regressive succession of the Po coastal plain. We analyze changes in rarefied sample-level diversity, species turnover and regional diversity within and across systems tracts, and link these patterns to lateral and stratigraphic variation in depositional environments and magnitude of time averaging estimated based on geochronological dating on individual mollusk shells.

For data pooled across the cores, sample-level diversity and evenness are considerably higher in the late transgressive systems tract (TST) and maximun flooding zone (MFZ) compared to the early highstan systems tract (HST), and decrease even further in th late HST. However, between-sample turnover at the regional scale do not vary significantly between systems tracts. This result contrasts with the higher turnover in the HST previously documented in the Po basin based on the analysis of distal cores. What is more, within individuals cores the relationship between the stratigraphic position and sample-level diversity depends on the location along the depositional profile: strong up-section decrease in diversity typical for the distal cores, is missing from the proximal, back-barrier settings.

The results suggest that highly uneven representation of different depositional environments across systems tracts combined with 1) onshore-offshore gradient in the diversity of benthic communities, and 2) downdip increase in the scale of time averaging in transgressive deposits and MFZ, are the primary drivers of the observed stratigraphic patterns in diversity. The limited turnover within TST and MFZ observed along single cores is compensated on the regional scale by a greater lateral variation in facies and thus stronger faunal turnover along the depositional dip. Moreover, the two most species-rich facies associations – transgressive sand sheet and offshore transition – recording millennial-scale condensation and maximum water depths in the studied succession, are unique to the TST and MFZ and spatially restricted to the distal part of the study area. Their exclusion from the analyses eliminates most of the differences in sample-level diversity between the TST, MFZ and early HST.

Our study underscores the importance of collecting and interpreting fossil data within a well-defined time-environmental framework. However, in spite of exceptional sampling efforts, most of the environments could not be traced continuously thought the depositional sequence. The nature of the stratigraphic record thus severely limits the resolution of paleoecological studies addressing within-habitat diversity trends.

ANIMAL-PLANT INTERACTIONS IN THE MARINE REALM: ECHINOID-CORALLINE ALGAL DOMINATED ECOSYSTEMS IN THE MIOCENE OF SARDINIA

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Well preserved echinoids and coralline algae from the Miocene of Sardinia allow not only for assessing paleoecology, but also for analyzing complex, trophic interactions. Grazing on coralline algae by echinoids has been discussed with respect to key developments in both tooth morphologies among regular sea urchins as well as biotic interactions with potential algal prey. Both echinoids and coralline algae are especially appropriate for paleoenvironmental reconstruction due to functional morphological aspects and actualistic comparisons of their close association in modern shelf environments.

In Miocene sublittoral sedimentary successions of Sardinia (Proto Torres and Santa Caterina di Pittinuri), two substrates types containing exceptionally preserved biotic components are often juxtaposed: 1) highly bioturbated, echinoid-rich, fine grained sediments, within which 2) rhodolith pavements, containing non-geniculate coralline algae, various regular echinoid associations as well as spatangoids and clypeasteroids. This study concentrates on the later which are found in different localities with varying faunal and floral associations allowing for the relationship of sea urchins and algae to be analyzed.

Preliminary results show a wide range or rhodolith sizes, generally spheroidal to subspheroidal in shape. Various components are present in the core including

corals, encrusting acervulinid foraminifera as well as bryozoans and barnacles also contribute. Different coralline algal taxa are present, growth forms range from densely encrusting thalli to highly protuberant. Rhodolith associated echinoids from Porto Torres (northern Sardinia) consist of spines and test fragments of the cidaroids *Prionocidaris* and *Eucidaris*; along with the remains of *Schizechinus* and trigonocidarids, while those from Santa Caterina di Pittinuri (central-western Sardinia) include co-occurrence of the diadematid (*Diadema*) and toxopneustid (*Tripneustes* and *Schizechinus*) echinoids. The size and complexity of the rhodoliths including extensive encrustation sequences and intense bioturbation indicated long surface residence times within the photic zone. The sea urchins found among the beds represent epibenthic grazing regular echinoids and it is discussed to what extent the rhodoliths or other epiphytic organisms served as a source of food.

THE ECHINOID SKELETON. AN EXEMPLARY SOURCE OF ADAPTATIONS AND THEIR POTENTIAL USEFULNESS IN TECHNICAL APPLICATIONS

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The multi-plated echinoid skeleton is a welcome object for studying adaptations and their evolution. Structures of the echinoid skeleton have been interpreted with respect to self-support structures; modular, thin-shelled vaults emulating monolithic shells, multi-plated amalgamates and so on. This is especially relevant for the clypeasteroid test which has evolved complex plate boundaries and internal support systems enabling these animals to colonize high energy shallow water environments in both siliciclastic and carbonate settings.

This presentation will review the state of the art and present new research with respect to the stability of clypeasteroid echinoid skeletons, and showcase some models derived from cooperation with civil engineers and architects. Methods have included high-resolution X-ray micro-computed tomography, finite-element analysis and physical crushing experiments. Various internal support systems are present among different clades with plate boundaries and internal support systems showing high material accumulations. The importance of skeletal stability for preservation and taphonomic filters is discussed. These analyses also consider tracking of traits among evolutionary pathways.

When shells are regarded, biologist and paleontologist can profit not only from direct studies concerning the morphology of skeletal elements and their functional interpretations with respect to ambient environmental factors, but also from the methodology and insights applied by engineering including modelling and visualization techniques. This is especially the case for the planning and construction of double-curved, shell constructions. Finally, the potential for biomimetic research as a whole based on fossil and recent shells will be reviewed.

PHYLOGENY OF AN ENIGMATIC AND DISTINCT CLADE OF CAMBRO-ORDOVICIAN TRILOBITES FROM LAURENTIA WITH NEW AND REVISED SPECIES OF *CLELANDIA*

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Clelandia Cossman, 1902, is a poorly understood group of 12 currently named species of trilobites. These species range from the late Cambrian (Furongian; Jiangshanian; Sunwaptan) to the Early Ordovician (Tremadocian; Skullrockian) of Laurentia. No phylogenetic work has previously been carried out and the family affinity of the group is uncertain. Species of *Clelandia* have reduced morphology and effaced sclerites which limit the morphological data available for analysis. Compounding this is the quality of published images, which are frequently of poor resolution and few in number.

Field-based study of Skullrockian faunas from the Great Basin of the western United States has produced material representing four new species of *Clelandia*. Detailed study of trilobite sclerites is possible in three dimensions due to preservation through secondary silicification. Species are represented by material free of matrix with multiple representative sclerites and growth stages. These new species are diagnosed by several cranidial features. None exhibit glabellar furrows or the extended glabellar-occipital spine structure seen in other members of the genus. Two of these species have greatly reduced furrow definition and lack an occipital spine, traits rarely seen in other members of the genus.

With fresh, high-quality images of the new and previously described taxa, morphological data are sufficient to propose a species-level phylogeny. The Marjuman *Brachyaspidion* was used as an outgroup.