

ABSTRACTS

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## 2nd Workshop on Actualistic Taphonomy

Rio Grande do Sul, Brazil

19-21 July 2021 – Online

Centro de Estudos Costeiros, Limnológicos e Marinhos, CECLIMAR,  
UFRGS Litoral Norte

Edited by Matias N. Ritter, Fernando Erthal, Rodrigo S. Horodyski

ABSTRACTS VOLUME

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AN ONLINE EVENT HELD BY

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## VOLUME PRESENTATION

As announced during the First Workshop held in Montevideo (TAAS 2017; Figure below), we are organizing the second Workshop on Actualistic Taphonomy in South America. The idea of a small meeting (as a workshop *stricto sensu*) is to be continued, given the extraordinarily successful results of the first event. Covid-19 has been forcing institutional decisions that are affecting directly any type of people gathering and agglomerations. In this sense, we decided to postpone our 2nd TAAS to 2021.

The event is supported by the Centro de Estudos Costeiros, Limnológicos e Marinhos (CECLIMAR), Imbé, north coast of Rio Grande do Sul State, Brasil.

**Matias N. Ritter**  
General Chair of 2nd TAAS  
Imbé, July, 2021

## SCHEDULE

19/07/2021

09:00 – 09:30 – Welcome

09:30 – 10:00 – Aguiar et al. – MYTILIDAE SHELLS AS AN AVAILABLE SURFACE FOR SCLEROBIONTS COLONIZATION: IMPLICATIONS TO ECOLOGY AND PALEONTOLOGY

10:00 – 10:30 – Coffee break

10:30 – 11:00 – Archuby & Roche – TAPHONOMIC FIDELITY AND THE DETECTION OF ANTHROPIC IMPACTS IN SHALLOW WATER MARINE BENTHIC COMMUNITIES OF SAN ANTONIO BAY, NORTHERN PATAGONIA, ARGENTINA

11:00 – 11:30 – Assumpção et al. – CONSERVATION PALEOBIOLOGY THROUGH COMPOSITIONAL FIDELITY OF MOLLUSCS IN THE PATOS LAGOON ESTUARY

11:30 – 12:00 – Battista & Schultz – “SAMPLING BIAS” IN VERTEBRATE PALEONTOLOGY: STATE OF THE ART AND COMMENTS

12:00 – 14:00 – Lunch break

14:00 – 14:30 – Bavaresco et al. – TAPHONOMY OF SHELLY DEPOSITS FROM SÃO FRANCISCO DO SUL ESTUARY: PRELIMINARY APPROACH

14:30 – 15:00 – Fernandino & Ellif – ANTHROPOQUINAS: RECENTLY FORMED SEDIMENTARY ROCKS WITH TECHNOFOSSILS IN SOUTHERN BRAZIL

15:00 – 15:30 – Montalvo et al. – EFECTOS DE LA METEORIZACIÓN SOBRE MOLARIFORMES DE VIZCACHA (LAGOSTOMUS MAXIMUS, CHINCHILLIDAE, CAVIOMORPHA) Y SU APLICACIÓN AL REGISTRO FÓSIL

15:30 – 16:00 – Borrazzo – QUANTIFYING PSEUDOARTIFACTS IN THE ARCHAEOLOGICAL RECORD: AN ACTUALISTIC APPROACH IN LITHIC ARTIFACT TAPHONOMY

16:00 – 16:30 – Coffee break

16:30 – 17:00 – Ricardi-Branco et al. – EARLY DIAGENESIS OF SEEDS ASSOCIATED WITH LIMESTONES SOILS

17:00 – 17:30 – Casati et al. – CORRELAÇÃO FACIOLÓGICA E TAFONÔMICA ENTRE DEPÓSITOS CONCHÍFEROS HOLOCÊNICOS LAGUNARES E SAMBAQUIS, NA COSTA CENTRO SUL DE SANTA CATARINA, BRASIL

17:30 – 18:00 – Cenci & Horodyski – FERN-INSECT INTERACTIONS AS A RELATIVE PROXY TO CONTINENTAL PALEOCLIMATE

18:00 – 18:30 – Francesco & Hassan – DIFFERENTIAL PRESERVATION OF MOLLUSKS IN PAMPEAN SHALLOW LAKES: IMPLICATIONS FOR THE UNDERSTANDING OF THE PAMPEAN LACUSTRINE FOSSIL RECORD

20/07/2021

09:00 – 09:30 – L’Heureux et al. – SEDIMENTOS, GEOQUÍMICA Y HUESOS: TAFONOMÍA ACTUALÍSTICA EN EL INTERFLUVIO DE LOS RÍOS GALLEGOS Y CHICO, PATAGONIA, ARGENTINA

09:30 – 10:00 – Ghilardi et al. – DECADAL PERSPECTIVES ON BOUCHARDIA SHELL ACCUMULATIONS FROM THE NORTHERN COAST OF THE BRAZILIAN SHELF, SOUTH ATLANTIC

10:00 – 10:30 – Coffee break

10:30 – 11:00 – Gómez et al. – APROVECHAMIENTO DE UN EXPERIMENTO NATURAL EN TAFONOMÍA ACTUALISTA

11:00 – 11:30 – Hassan & Diaz – EXPERIMENTAL TAPHONOMY OF FRESHWATER DIATOMS: DISCRIMINATING BETWEEN CHEMICAL AND PHYSICAL CAUSES OF FRUSTULE FRAGMENTATION

11:30 – 12:00 – Hornung et al. – POSSÍVEL SELEÇÃO POR ONTOGENIA NA PREDACÃO DE GASTRÓPODES SOBRE A ESPÉCIE DE BIVALVE MARINHO GLYCYMERIS LONGIOR

12:00 – 14:00 – Lunch break

14:00 – 14:30 – Leoni et al. – ASPECTOS TAFONÔMICOS DE TAMANDUA TETRADACTYLA LINNAEUS, 1758, CAVERNA LAPA DO BODE, BAHIA

14:30 – 15:00 – Limeira Junior et al. – DIFFERENCES OF MICROTOPOGRAPHY IN MOLLUSCS DISSOLVED VALVES: TAPHONOMIC IMPLICATIONS

15:00 – 15:30 – Rodrigues et al. – DRILLING PREDATION RECORDED ON BOUCHARDIID SHELLS (BRACHIOPODA, RHYNCHONELLIFORMEA) IN THE CENOZOIC FOSSIL RECORD OF SOUTH AMERICA

15:30 – 16:00 – Schmidt-Neto et al. – THE HISTORY BEHIND PAGURIZED SHELLS

16:00 – 16:30 – Coffee break

16:30 – 17:00 – Lopes – DIFFERENTIAL PRESERVATION OF MODERN AND FOSSIL SHELLS OF THE BIVALVE ANOMALOCARDIA BRASILIANA (GMELIN, 1791) IN SOUTHERN BRAZIL

17:00 – 17:30 – Luz et al. – HOTSPOTS OF FIDELITY: LIVE-DEAD FAITHFULLY OF MARINE OSTRACODS SHED LIGHT ON THE STRUCTURE OF THE MICROFOSSIL RECORD

17:30 – 18:00 – Martínez – ASPECTO, EDAD, COMPOSICIÓN Y PRESERVACIÓN DE CONCHILLAS DE ACUMULACIONES MODERNAS EN UNA PLAYA DE URUGUAY

18:00 – 18:30 – Medeiros et al. – TRAÇOS MICROENDOLÍTICOS EM CONCHAS DE BIVALVES DE AMBIENTES MARINHOS SUBTROPICAIS E SEU POTENCIAL EM RECONSTRUÇÃO PALEOAMBIENTAL



21/07/2021

09:00 – 09:30 – Ozán et al. – ROCK ART TAPHONOMY: INORGANIC AND ORGANIC CHANGES OF EXPERIMENTAL PAINTINGS IN PATAGONIA

09:30 – 10:00 – Petró et al. – DISSOLUTION BIAS IN THE PLANKTONIC FORAMINIFERA ASSEMBLAGES FROM THE SOUTH ATLANTIC

10:00 – 10:30 – Coffee break

10:30 – 11:00 – Poptis et al. – PALAEOMETRY AND ACTUALISTIC TAPHONOMY: THE IMPORTANCE OF TESTING TECHNICAL LIMITATIONS AND PARAMETERS ON THE STUDY OF FOSSIL AND EXPERIMENTAL SAMPLES

11:00 – 11:30 – Ribeiro et al. – FATORES QUE CONTROLAM A OCORRÊNCIA DE MICROFÓSSEIS EM AMBIENTES MARINHOS ASSOCIADOS A ARCOS VULCÂNICOS (PENÍNSULA ANTÁRTICA)

11:30 – 12:00 – Ritter et al. – TO BE OR NOT TO BE A FOSSIL: A DILEMMA ON THE QUATERNARY PALEONTOLOGY

12:00 – 14:00 – Lunch break

14:00 – 14:30 – Lopes & Ferigolo – ARISTOTLE'S 'WHEEL PARADOX' AND THE TAPHONOMY OF THE CERITHID GASTROPOD CERITHIUM ATRATUM (BORN, 1778) FROM CONCEIÇÃO LAGOON, SOUTHERN BRAZIL

14:30 – 15:00 – Rojas et al. – TAFONOMÍA ACTUALISTA DE ENSAMBLES DE VALVAS EN PLAYAS DE LA COSTA URUGUAYA

15:00 – 15:30 – Saldanha et al. – MODERN TO PENNSYLVANIAN FJORDS: TAPHOFACIES AND SUBTLE VARIATIONS IN CIRCULATION AT THE LATE PALEOZOIC ICE AGE

15:30 – 16:00 – Santos et al. – PARASITIC LIKE-TRACES ON MARINE MOLLUSKS: NEW SOUNDS FROM SOUTHERN BRAZIL

16:00 – 16:30 – Coffee break

16:30 – 17:00 – Scarabino et al. – IMPLICANCIAS TAFONÓMICAS DE LA RELACIÓN AVES-MOLUSCOS ACUÁTICOS EN AMBIENTES COSTEROS URUGUAYOS Y RIOGRANDENSES

17:00 – 17:30 – Sierra et al. – TAFONOMÍA EXPERIMENTAL: INTERVENCIÓN DE MICROORGANISMOS EN LA PRESERVACIÓN DE INSECTOS ACUÁTICOS DE LOS RÍOS DE SAN LUIS, ARGENTINA

17:30 – 18:00 – Silva et al. – DRILLING PREDATION IN RECENT ECHINOIDS (CLYPEASTEROIDEA, MELLITIDAE) FROM THE NORTHERN COAST OF THE BRAZILIAN SHELF, SOUTH ATLANTIC

18:00 – 18:30 – Guidelines for PALAIOS special issue & Closure



## SUPPORT



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## MYTILIDAE SHELLS AS AN AVAILABLE SURFACE FOR SCLEROBIONTS COLONIZATION: IMPLICATIONS TO ECOLOGY AND PALEONTOLOGY

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Mollusk shells may act as colonization surfaces for sclerobionts depending on the environmental exposure and their attributes. However, the main factors that can affect the establishment of an organism on hard substrates on modern and time-averaged shells remain uncertain. Using field approaches, we compared sclerobionts (bioerosion and biofouling) colonization patterns on Mytilidae empty shells collected from the Uruguayan coast (La Paloma-Rocha). Mytilids are/were critical components of Recent and Holocene hard bottom communities of temperate zones of the World ocean. These had the highest abundance of shells (*e.g.*, *Mytilus* sp. and *Brachidontes rodriguezii*) washed ashore, representing 89% of 629 shells gathered. We evaluated the influence of shell size, fragmentation, valve position (internal-external), and valve site (apex-center-base), ornamentation, and color. Most shells were disarticulated (98%), being found more left valves (38%) than right valves (36%). The average shell area recorded was 394mm<sup>2</sup> and most shells showed reduced color (35%). From Mytilidae shells, 31% and 37% showed bioerosion and biofouling, respectively. Canonical correspondence analysis, a multivariate statistical procedure that allows verifying the linear correlations between sets of variables, was used to assess what factors are associated with the occurrence of sclerobionts on Mytilidae shells. The sclerobionts community associated to bioerosion were composed mainly by Polychaeta, Bryozoa, Hydrozoa and Porifera. The most important factors that influenced the bioerosion coverage percentage was shell length, surface complexity and color (axes 1 and 2 explained 84% of the data ordination). Sclerobiont community associated to biofouling was composed mainly by Cirripedia, Bryozoan, Bivalvia and algae. The most important factors that influenced the biofouling coverage percentage was also shell length, surface complexity and color (axes 1 and 2 explained 73% of the data ordination). In this way, Mytilidae shells with higher length (>18mm), presence of internal and external ornamentation, and with natural color are more suitable to sclerobionts. The results indicate that both bioerosion and biofouling are more representative on recent shells, highlighting the relevance of current ecological relationships for paleontology of mytilids. Funding information: CNPq 422766/2018-6

## TAPHONOMIC FIDELITY AND THE DETECTION OF ANTHROPIC IMPACTS IN SHALLOW WATER MARINE BENTHIC COMMUNITIES OF SAN ANTONIO BAY, NORTHERN PATAGONIA, ARGENTINA

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In a recent paper we found a surprisingly high mollusc diversity recorded in the intertidal death assemblages of Punta Mejillón, in the atlantic coast of northern Patagonia, Argentina, that were close to figures found in studies based on living fauna across the whole San Matías Gulf (SMG). In this contribution we intend to provide the first evaluation the taphonomic fidelity of the death assemblages in the Gulf. For that sake, we sampled the living (LA) and dead (DA) mollusc assemblages of two channels affected by tides in San Antonio Bay (SAB), northwestern side of the SMG. The channels were sampled in three sites at different distances from the bay. The West Channel (WSACh) passes along San Antonio town where it receives organic content of sewage and industries that process the fish since the middle of the XX century. At its proximal sampling site there is a popular beach with high influx of tourists. The East Channel (ESACh), in turn, has a low charge of human impact. Distal ends of both channels are characterized by several hours of subaerial exposure per day, with high temperatures in summer, low temperatures in winter and strong winds. We expect lowered fidelity due to harsh climatic conditions, that destroy shells, and to human impacts. Human impact along the WSACh consists of pollution with high organic content that caused eutrophication since few decades ago. The proximal sampling site of WSACh is probably also impacted by tourism. Our data matrix consists of abundances per species of the six localities, divided by dead (n=12954) and alive (n= 56860). To test our hypothesis we used nMDS and permanova tests with BC distance on the sqrt transformed abundance matrix. Ordination axes were correlated with distance (1, proximal samples to 3, distal samples) with Spearman rank correlation index. Living communities showed a distal to proximal pattern that is mimicked by the death assemblages. In 2/3 cases of WSACh (polluted) LAs differ from DAs but in none of ESACh. Although not identical, DAs are appropriate proxies of benthic communities and proper tools to help identifying impacted communities. [The field work was supported by a Research Project of Universidad Nacional del Comahue UNCO-04P001. The attendance to the 2TAAS was possible due to a AUGM program Escala Docente 2020, supported by Universidad Nacional de La Plata and Universidade Federal do Rio Grande do Sul]

## CONSERVATION PALEOBIOLOGY THROUGH COMPOSITIONAL FIDELITY OF MOLLUSCS IN THE PATOS LAGOON ESTUARY

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The construction of ports and harbors in marine and estuarine areas is important to the development of human populations, however, they may bring severe damage to the environment and its inhabiting organisms. These man-made structures can cause changes in hydrodynamics and water turbidity, heavy metal release, introduction of exotic and invasive species, impossex in mollusks, death of individuals and thus, ecological changes. In this context, we questioned if these effects cause some taphonomy alteration in the geological record, which is accessed by the compositional fidelity method *i.e* the ecological metrics comparison between live and its counterpart dead assemblages. The study region is the Patos Lagoon Estuary (RS, Brazil), which is influenced by the Port of Rio Grande since its construction in 1847. The live association was sampled throughout six sampling points between 2010 and 2018, and the dead association between 2018 and 2019, using a Van Veen grab (19 x 41 cm). In this study we are comparing live and dead assemblages through the relative abundance of *Erodona mactroides* Bosc, 1801 and *Macra isabelleana* d'Orbigny, 1846, within and between species to establish the variation of this parameter over a much longer time series than the traditional ecological monitoring. Also, we will be dating a bunch of *M. isabelleana* individuals to test whether the higher abundance of this species would be correlated to elevated time-averaging since nowadays it is only found in dead assemblages inside the estuary. It is expected that there is a significant difference between live and dead assemblages for both species and that the abundance of *M. isabelleana* is correlated with time-averaging. This might show the port effects on the mollusk's assemblage, contributing to Conservation Paleobiology and guiding further studies in other ports along the coast of Rio Grande do Sul. [CNPq 422766/2018-6]

## “SAMPLING BIAS” IN VERTEBRATE PALEONTOLOGY: STATE OF THE ART AND COMMENTS

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“Sampling (or sample) bias” is a term widely used in several papers of different areas, such as Health, Ecology, Zoology, Sociology, although its origin is linked to statistical studies. The main problem regarding the “sampling bias” is related to the risk to misinterpretation of the data, generating artificial results. Also, in paleontological literature, it is possible to find this term, although substantially related to sampling in the context of fieldwork. In vertebrate paleontology this problem has been known for at least fifty years, and has been related to several factors that can generate bias. This includes two main groups defined as sullegic (method of collecting, point of view of researcher, personal biases, historic resampling, diagenetic differences) and trephic factors (sampling-transport-curatorial process). Another common phenomenon in vertebrate paleontology, which can also generate biases and consequently affect a paleontological collection has been named as the “Ugly Fossil Syndrome” (i.e., the choice of what to collect based on the degree of completeness or articulation of the specimens or even a taxonomic preference of the collector or researcher). Thus, sampling bias does not represent only the risk for an artificial result, but also a further loss of information. Considering the loss of (biological) information as due to the passage through various “filters” (decay of soft tissue, disarticulation, scattering, scavenging, deformation due to extreme permineralization), then we also would have to think about “sampling bias” as an additional taphonomic filter. Therefore, in vertebrate paleontology it seems that, sampling bias and the role and choices of the collector are frequently linked and almost indistinguishable. While in other study areas the topic is subject to evaluation and debate (equations have been developed to reduce and correct the statistical error), truly little has been discussed in the field of vertebrate paleontology, apparently. [CNPq]



## TAPHONOMY OF SHELLY DEPOSITS FROM SÃO FRANCISCO DO SUL ESTUARY: PRELIMINARY APPROACH

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Diverse studies have revealed that taphonomic damage is directly related to environmental and the sedimentary dynamics evolved in the genesis and final burial of bioclasts. In this sense, it is expected to observe a set of taphonomic signatures according to the depositional environment. The present work aims to compare Permian and Holocene estuarine shell deposits in order to verify their similarities and differences. For this purpose, data based on shells from fossil concentrations found in the Cambaí Grande outcrop (Lower Permian, Rio Grande do Sul), and collected at the mouth of the São Francisco do Sul estuary (Quaternary, Santa Catarina) were used. The comparisons were based on: a) kind of skeletons; b) the completeness of the original shape of the mollusk's valves (complete, moderately fragmented, and highly fragmented); c) signs of sclerobionts; d) taphonomic damage; e) body size. Despite both deposits are composed exclusively for bivalves, articulated specimens were observed only in the fossil record. In the Cambaí Grande outcrop complete valves represent 28%, moderately fragmented 25%, and highly fragmented 47%, while in the São Francisco do Sul estuary, they represent 85%, 9% and 6%, respectively. The frequency of bioerosion and abrasion is low for the deposits of the Cambaí Grande outcrop (<20%), but moderate to high for the S. Francisco do Sul estuary (> 50%). Dissolution is a common signature in two shell deposits. Regardless of variations in the body size is higher in the Cambaí Grande outcrop (5 to 50 mm) than in the S. Francisco do Sul estuary (20 to 40 mm) both areas show a close size average (15,3 mm for C. Grande outcrop; 26 mm for S. Francisco). Although has been possible to verify variations in taphonomic signatures between analogous environments, more comparative data such as chemical and physical aspects as well as influence of environmental events and time averaging are necessary for the next step of this research.

## WHERE *AMIAANTIS PURPURATA* RULES, *THE OTHERS* HAVE NO SWAY: TAPHOFACIES DEFINED BY THE PRESERVATION PROFILE OF THE DOMINANT SPECIES

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We are aware that in modern tropical carbonate environments taphofacies are defined by the preservation pattern of molluscan assemblages. Although dominant species show different magnitude of damage, they still show similar trends in preservation along environmental gradients. Moreover, differences in relative abundances do not bias the taphonomic profile of the defined taphofacies, probably favoured by high rates of cementation. Therefore, how much does relative abundance contribute to the definition of taphofacies in siliciclastic environments? The San Matías Gulf (SMG, Patagonia Argentina) is an ideal study area for testing due to the dynamic mosaic of environments that were recorded throughout the Late Quaternary by molluscan assemblages. Those assemblages are dominated by one species of bivalve, *Amiantis purpurata*; and based on its damage profile and the presence of certain molluscan fauna was possible to identify different taphofacies. In this study, we found that the preservation pattern of the dominant species, *A. purpurata*, is correlated to the second most abundant species, *Glycymeris longior*, both showing different gradients in preservation. However, the accompanying fauna showed no correlation with *A. purpurata*, they exhibited pristine preservation. This mollusc fauna, with very low abundance, was possible to be studied because of their good preservation which allowed to identify species 'characters. That gives us a clue that rare or exceptional fauna can be found because of their good or pristine preservation, and therefore, show a different pattern concerning the most abundant species. However, their very low abundance do not affect the taphonomic signal of the assemblage because it is defined by the very abundant species. On the other hand, Late Pleistocene and Holocene assemblages were possible to be discriminated in terms of the quality of preservation in internal glossiness, where late Pleistocene assemblages are affected by diagenetic processes. Finally, the most dominant species are the ones that worth to be analyzed and will define taphofacies in assemblages dominated by one or two species. Financial support for this study was provided by Agencia Nacional de Promoción Científica y Tecnológica (ANPCyT-FONCyT) PICT 2016-2951 awarded to S. Bayer. This is a contribution to PUE 2016 (CICTERRA – CONICET).

## THE CRAZY CLAM DEPOSIT: A MODEL FOR TIME-AVERAGED MOLLUSKS IN PATAGONIA ARGENTINA

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The North-western coast of the San Matías Gulf (SMG) shows a spectacular shell deposit above the intertidal zone. This shell bed, located at La Almeja Loca Beach, consists of 2.5 meters thick deposit mostly composed by valves of *Amiantis purpurata* (Bivalvia) from the Late Holocene. The accumulation is a multievent deposit, characterized by a lateral continuity of hundreds of meters. Some reworked Foraminifera species has been found showing low abundance. Although this shell deposit could be the result of the evolution of an *A. purpurata* bank through time, some storms could be responsible for the accumulation of this shell bed. The knowledge of the origin, as well as age's ranges of the shell bed, will allow us to generate a time-averaging model for this kind of accumulation. In order to shed light to the origin of this accumulation, we are going to (1) characterize this deposit in terms of stratigraphic, taphonomic and faunistic composition; (2) interpret the origin of the deposit, (3) analyse of ages ranges and inter-quartile values to understand its time-averaging, (4) correlate it with other similar deposits from the San Matías Gulf, (5) propose a model of formation for molluscan deposits in littoral environments that could be also useful for older deposits (Paleozoic, Mesozoic, Cenozoic deposits).

## QUANTIFYING PSEUDOARTIFACTS IN THE ARCHAEOLOGICAL RECORD: AN ACTUALISTIC APPROACH IN LITHIC ARTIFACT TAPHONOMY

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Several studies showed that the presence of pseudoartifacts in the lithic archaeological record is not rare, especially within contexts where lithic raw material of good flaking quality is locally available. Water transport, rock fall and trampling are among the taphonomic processes that modify lithics by pressure and percussion in a manner that may mimic human flint knapping. Therefore, once we recognize that taphonomic process/es and raw material are in place within any archaeological context under study, the necessary next step in the research is to assess the contribution of pseudoartifact to the lithic assemblage. This was the case at Casa de Piedra de Roselló (Chubut, Argentina), a rock shelter from central Patagonia in which we conducted actualistic research in order to 1) test if pseudoartifact production was feasible, and 2) to characterize morphometric properties of the by-products resulting from the interaction of local taphonomic processes and lithic raw material. We reported the data obtained from this first stage of the taphonomic investigation in the 1<sup>st</sup> TAAS edited volume. Here we present the subsequent naturalistic and experimental studies carried out to estimate the contribution of the lithic taphonomic background noise to Casa de Piedra de Roselló lithic assemblage. They included *in situ* rock fall experiments, surface and stratigraphic sampling of clasts, and the techno-morphological analysis of both experimental pseudoartifacts and the lithic artefacts recovered from the archaeological excavation. Funding information: This work was supported by Agencia Nacional de Promoción Científica y Tecnológica (ANPCyT-FONCyT, PICT2015-2141) and CONICET.

## CORRELAÇÃO FACIOLÓGICA E TAFONÔMICA ENTRE DEPÓSITOS CONCHÍFEROS HOLOCÊNICOS LAGUNARES E SAMBAQUIS, NA COSTA CENTRO SUL DE SANTA CATARINA, BRASIL

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No litoral centro-sul de Santa Catarina, Sul do Brasil, encontram-se dois tipos de depósitos conchíferos formados entre cerca de 8 ka e 1,5 ka cal AP: os depósitos naturais ou paleolagunares, cujo topo hoje se situa cerca de 80 cm abaixo da superfície, e os sambaquis, sítios arqueológicos monticulares com até dezenas de metros de espessura, intencionalmente construídos e compostos predominantemente por conchas de *Anomalocardia brasiliiana* oriundas das lagunas adjacentes. Neste trabalho, a área de estudo foi delimitada entre os municípios de Imbituba e Jaguaruna. Foram coletados cerca de 2 kg de sedimento bioclástico em cada uma das 26 fácies de nove sambaquis e em 11 fácies de cinco depósitos paleolagunares próximos. O sedimento de cada fácies foi analisado granulometricamente em classes de 1 phi; na fração maior que 8 mm, foi analisada a composição faunística e feita sua caracterização tafonômica. As assinaturas tafonômicas determinadas incluíram graus de fragmentação, dissolução, “oxidação”, ou alteração da cor, e precipitação. As associações de fácies levantadas nos depósitos lagunares incluem, da base para o topo: (a) cascalho clasto-suportado de conchas predominantemente inteiras; (b) lama arenosa com conchas inteiras, frequentemente preservadas em posição de vida; (c) cascalho clasto-suportado de conchas inteiras e quebradas; (d) areia com cascalho conchífero fragmentado; (e) lama arenosa com menos de 5 % de conchas. Nos sambaquis, foram reconhecidas quatro associações de fácies: (1) com ostras inteiras; (2) com cascalho de conchas (outros moluscos, sobretudo *A. brasiliiana*) inteiras; (3) cascalhosa de conchas quebradas, com conchas e ossos moídos; (4) areno-lamosa de ossos moídos. A distribuição no tempo destas associações apresenta variação: em ambos os depósitos, associações de fácies dominadas por conchas inteiras são mais comuns nos estratos mais antigos, sobretudo anteriores a 3 ka, de que nos mais novos. A menor disponibilidade de conchas inteiras no sistema lagunar refletiu nos sambaquis, com aumento progressivo de conchas quebradas na estratigrafia, antes do abandono quase completo desse recurso como material construtivo. Isto reflete a queda de disponibilidade de *A. brasiliiana*, bem como o encolhimento dos bancos de moluscos, seja pelo progressivo assoreamento do sistema lagunar, com redução da área submersa, seja pelo desenvolvimento de condições ecológicas desfavoráveis, como queda de salinidade e aumento no material em suspensão. [CNPq]

## FERN-INSECT INTERACTIONS AS A RELATIVE PROXY TO CONTINENTAL PALEOCLIMATE

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Plant-insect interactions are sensitive to climate changes and latitudinal gradients. The responses of herbivore insect are on the diversity and abundance of damage types (DTs) that presents trends among fossil localities. Plant-insect interactions represent a new field without comparisons of fossil data with modern different guilds of herbivore insects. For the fossil record, possible climatic responses are reported by variance of herbivory indexes in Cenozoic paleofloras. Ferns present primitive morphological characteristics of vascular plants, also bearing a broad temporal range in the fossil record (Devonian-Recent). The geographic distribution of ferns in humid tropical and subtropical climates demonstrate the potential of these plant groups for understanding ancient behavior of herbivore insects. The fern-insect interactions data will explore taphonomic bias and paleobiological trends among the groups studied. Thereof, the results will integrate a relative proxy for paleoenvironmental inferences with paleofloras in which ferns are dominant. The proposal is to study fern-insect interaction in the geographic distribution of an altitude spectrum from 2500 to 100m and in the middle latitudes (20-30°). In addition, the sampling of soil in the transects will be collected in conservation units. The local climate of Atlantic forests areas studied will be used as the climatic parameter for comparisons with fossil record. The analysis and description of fern-insect interactions will be based on the fossil damage types guide. Besides, fern-insect interaction indexes (diversity, density and intensity) will be compared with fossil localities. The preliminary results from the high montane of Atlantic forest (ranging from 900 to 600m) shows 45 individual ferns with at least 30 DTs in eleven fern spp. The difference in the composition of damage types is comprised by 15 new DTs (50 %), being 12 DTs that are found in the fossil record, and 3 DTs are *Incertae sedis*. The external foliage feeding (EFF) is represented by 40 % of herbivorized leaves from all leaf organs studied (n=618). The EFF value is high when compared with the 10-12% of herbivorized leaves found in current tropical forests showing difference in fern-insect interactions. [UNISINOS-Fluig-18625; CNPq; FAPERGS/CAPES]

## ANTHROPOQUINAS: RECENTLY FORMED SEDIMENTARY ROCKS WITH TECHNOFOSSILS IN SOUTHERN BRAZIL

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Technofossils are preserved human artifacts that range from near-continental (urban settlements), small (e.g. bottles, pens) to microscopic (fly ash particles). Though more common in terrestrial environments, they also currently have wide distribution in marine environments. Litter, especially plastic, can be found in virtually any environment. This material has been described in the literature as an anthropogenic component of marine and continental sediments and, therefore, it is expected that future sedimentary rocks present human artifacts – technofossils – which may be used to characterize human behavior. There are few examples of technofossils described in association with geological material. In southern Brazil, the recently described anthropoquinas are an example of technofossils cemented with bioclasts and sediment. The objective herein was to describe these anthropoquinas considering their technofossils. Six samples of anthropoquinas were collected from the southern coast of the state of Rio Grande do Sul, Brazil. They presented different technofossils (metal bottle caps, ship nail, plastic earring and plastic fragment) and composition (lithic and biogenic fragments). All anthropoquinas presented bioclasts, including a well-abraded fragment of *Glycymeris longior* and a well-preserved shell of *Macra isabelleana*. Energy Dispersive X-ray Spectroscopy (EDS) analyses were conducted in two samples showing different types of cement (calcium-rich and iron-rich), reflecting two possible origins for the cement: seawater and the samples themselves. The type and state of preservation of the technofossils found suggest these anthropoquinas were probably formed during the past decades. These rocks are concerning and reflect how deeply human behavior influences natural compartments. Moreover, this shows that technofossils may be preserved over geological time and used to correlate and characterize deposits as technostratigraphical markers of human behavior and influence. Short-term (decades/centuries) preservable items may help current scientists to characterize Anthropocene deposits, while those preservable over geological time scales may contribute to the far-future signal of this epoch.



## DIFFERENTIAL PRESERVATION OF MOLLUSKS IN PAMPEAN SHALLOW LAKES: IMPLICATIONS FOR THE UNDERSTANDING OF THE PAMPEAN LACUSTRINE FOSSIL RECORD

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Premortem and postmortem processes significantly influence the formation of the molluscan fossil record in freshwater environments. Despite their importance for paleoenvironmental studies, they remain poorly understood. In Pampean shallow lakes, Holocene shell deposits of the euryhaline snail *Heleobia parchappii* show a relation with salinity, as preservation seems to be favored by brackish-saline water conditions. To explore if this pattern may respond to ecological (i.e., differential survival and reproduction) or taphonomic processes acting differently in freshwater and brackish-saline environments, we conducted a field-based study comparing premortem (abundance, length, width/length ratio and crushing resistance in living and dead shells) and postmortem (fragmentation, fine-scale surface alteration and loss of periostracum of dead shells) attributes along a modern lacustrine salinity gradient (0.5-40 ppt) in the Pampa plain of Argentina. Snails from saline lakes were smaller and more rotund than those from freshwater lakes, exhibiting higher abundances and resistances in death assemblages. They showed the highest fidelity in shell length and the best states of preservation, which were similar to values recorded in fossil shells. We concluded that shells deposited in saline lakes are better preserved than those deposited in freshwater lakes, giving rise to highly abundant shell concentrations, analogues to those shell-rich fossil levels recorded in Pampean lakes. Such abundance does not reflect the natural abundances of living snails, but is the result of the combined influence that less destructive environments and better shell intrinsic properties have on preservation.

## DECADAL PERSPECTIVES ON *BOUCHARDIA* SHELL ACCUMULATIONS FROM THE NORTHERN COAST OF THE BRAZILIAN SHELF, SOUTH ATLANTIC

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Rhynchonelliform brachiopods (*Bouchardia rosea*, Bouchardiidae) are relatively well investigated in modern death assemblages from the northern coast of the State of São Paulo, southeastern Brazil, especially considering the pioneering investigations carried out by a team of Brazilian, European and North American researchers, during the first decade of this millennium. Taphonomic, paleoecologic and historical ecology approaches were investigated based on bulk samples collected in the Ubatuba (5 to 35 meters of depth) and Picinguaba bays (5 to 45 meters of depth), southeastern Brazil. Sampling program during 2001 to 2003 target *B. rosea* shell accumulations. Over the last two decades, the team gathered about 6,000 dead shells and only 6 living specimens of *B. rosea*. This brachiopod is endemic, abundant and patchily distributed on siliciclastic bottoms. Surprisingly, previous results of an ongoing sampling program (2019 to 2021) at the same localities on Ubatuba bay indicate a decline both in the number of living specimens and also in the amount of available dead shells in the sediments. In a first field sampling, a total of only 15 shells were collected (1 alive and 14 dead). This incipient data lead us to some insights: (1) does the decline of living *B. rosea* shells - as widely discussed – affected the shell input and may contribute to the soft bottom alteration; (2) does the Ubatuba bay recently experience natural environmental changes, that control the brachiopod occurrences with shifts in shell rich localities (sampling sites). Revisiting the brachiopod shell accumulations is key to our understandings on the historical ecology and environmental changes, such as bottom current direction and intensity, bottom water temperature, nutrient availability, sedimentation rates, and even pollution. [CNPq and FAPESP]

## APROVECHAMIENTO DE UN EXPERIMENTO NATURAL EN TAFONOMÍA ACTUALISTA

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El gasterópodo *Rapana venosa* es una especie invasora en el estuario del Río de la Plata y el establecimiento de las primeras poblaciones hace aproximadamente 20 años se encuentra bien documentado. Tomando ventaja de la introducción accidental de este molusco, se consiguió restringir el *time averaging* para el estudio de los procesos y patrones tafonómicos considerados, a un tiempo máximo de un par de décadas. Con el fin de comparar los rasgos tafonómicos que se generan en distintos ambientes, se realizaron muestreos en grupos de playas que difieren principalmente en la constitución del sustrato y la energía del oleaje, también se tomaron réplicas en el tiempo. Las comparaciones fueron testeadas a través de una prueba de Chi<sup>2</sup>, y se realizaron tafogramas ternarios para visualizar el arreglo de las muestras según los atributos considerados. Se encontró que las playas con tendencia a ser reflectivas y con presencia de sustratos rocosos presentaron similitudes en la intensa corrosión y bioerosión, además del predominio de ejemplares fragmentados y de tallas grandes. Así mismo, las playas con características intermedias, de cantos rodados y sedimento tenaz, se asemejaron en la escasa bioerosión y bioincrustación, con la mayoría de las conchas más enteras. Por otro lado, se evidenciaron diferencias significativas en todos los atributos tafonómicos entre las playas de ambientes diferentes en el sentido antes mencionado. En cuanto a las réplicas tomadas con diferencia de meses o años, se obtuvo que la mayoría de los rasgos tafonómicos que caracterizaron cada entorno se mantuvieron. Gracias al conocimiento del *time averaging* máximo de solo 20 años, se lograron caracterizar las alteraciones tafonómicas en condiciones naturales generadas en este tiempo, las cuales, podrían ser comparables a las de asociaciones fósiles de contextos ambientales similares. La presente investigación fue financiada por la Agencia Nacional de Investigación e Innovación (ANII) y PEDECIBA.

## EXPERIMENTAL TAPHONOMY OF FRESHWATER DIATOMS: DISCRIMINATING BETWEEN CHEMICAL AND PHYSICAL CAUSES OF FRUSTULE FRAGMENTATION

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Frustule fragmentation is one of the major taphonomic factors affecting diatom preservation in Pampean shallow lakes. This has been demonstrated both by contemporary and fossil taphonomic studies, although little is known about the causes of frustule breakage and its environmental significance. Field studies along modern environmental gradients showed a low but significant correlation between dissolution and fragmentation, suggesting that debilitation of the frustule by silica dissolution can be the cause of diatom fragmentation. Reworking of sediments by wind action have also be suggested as a possible explanation for the observed fragmentation patterns. To evaluate the relative importance of chemical and physical causes of diatom fragmentation, three laboratory experiments were conducted to test for 1) the effect of physical agitation, 2) the effect of chemical dissolution, and 3) the joint effect of both variables on diatom fragmentation. Physical agitation was simulated by subjecting diatom samples to lineal shaking at 250 rpm during 30 days. Chemical dissolution was tested by mixing diatom assemblages with solutions of different concentrations of NaCl and NaHCO<sub>3</sub>, and pH 10 during 20 days. The joint effect of both processes was tested by diluting diatom assemblages in salt solutions and subjecting them to agitation during 20 days at 250 rpm. In all cases, aliquots of each assemblage were sampled at initial and final experimental times and taphonomically analyzed through the application of fragmentation and dissolution indices. Significant differences in fragmentation indices were observed both in dissolution alone and combined experiments, but no differences were found in the agitation alone essay. In all cases, dissolution and fragmentation indices were correlated, suggesting a causal relationship among them. Overall, our results suggest that the debilitation of the diatom frustule by chemical dissolution may be the main cause of the observed fragmentation patterns in surface sediments of Pampean shallow lakes.

## POSSÍVEL SELEÇÃO POR ONTOGENIA NA PREDACÃO DE GASTRÓPODES SOBRE A ESPÉCIE DE BIVALVE MARINHO *GLYCYMERIS LONGIOR*

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Os estudos que avaliam interações ecológicas têm se concentrado nas relações entre predadores e presas e sua importância evolutiva e ecológica no decorrer do tempo geológico. Os predadores, desempenham um papel fundamental na estruturação dos ecossistemas atuais em termos de pressão seletiva. Os traços de predação nas conchas de bivalves marinhos e demais invertebrados constituem a maior evidência desta interação predador presa, auxiliam nas reconstruções paleoecológicas, tendências evolutivas e comportamento dos predadores. Devido a isso, o objetivo do trabalho é testar a hipótese preliminar de seleção por ontogenia na predação de gastrópodes (famílias Muricidae e Naticidae), através de análises de seus traços de predação (*Oichnus simplex* e *O. paraboloides*) na espécie de bivalve *Glycymeris longior*. Foram mensurados o comprimento, altura e a espessura das valvas de todos os espécimes, verificando a ocorrência dos traços de predação. A partir da altura e do comprimento das valvas foi estimado o tamanho corporal, com base na média geométrica. Para cada traço foi determinado sua morfologia (completos e incompletos), posição na valva, e diâmetros (externo e interno). Para tal, dezoito amostras padronizadas de sedimento praial foram coletadas, utilizando quadrantes de (0,17 m<sup>3</sup>), ao longo da faixa praial de La Paloma (distrito de Rocha, Uruguai), em dois setores: Playa Del Faro e Laguna de Rocha. No total, 1217 valvas foram obtidas. A partir da altura e do comprimento das valvas foi estimado o tamanho corporal, com base na média geométrica. Desse total, ~25 % (n=309) apresentavam pelo menos um traço de predação. O tamanho corporal dos indivíduos predados mostrou-se relativamente menor ( $\bar{x} = 12.1$ ,  $\sigma = 2.99$ ) do que aqueles não predados ( $\bar{x} = 16.4$ ,  $\sigma = 5.82$ ). Com base no teste *t* foi possível rejeitar a hipótese nula de não diferença entre as médias ( $p < 0.01$ ) entre o tamanho corporal das conchas predadas daquelas não predadas, mesmo após reajustar o tamanho amostral díspar entre esses dois grupos. Embora os resultados ainda sejam preliminares, a maior frequência de predação parece estar associada a estados ontogenéticos mais juvenis de *G. longior*. Tais resultados podem ter implicações paleoecológicas na assimetria do tamanho das conchas no registro fóssil, devido a maior adição de conchas pequenas, as quais tem menor potencial relativo de preservação. [FAPERGS 21/2551-0000674-9]

## ASPECTOS TAFONÔMICOS DE *TAMANDUA TETRADACTYLA* LINNAEUS, 1758, CAVERNA LAPA DO BODE, BAHIA

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Neste trabalho, descrevemos aspectos tafonômicos do *Tamandua tetradactyla* coletado na caverna Lapa do Bode, Ituaçu, Bahia. As feições bioestratinômicas observadas foram: (I) grau de articulação, (II) grau de fragmentação, (III) abrasão, (IV) transportabilidade e (V) marcas de predação. O material faz parte do acervo científico do Laboratório de Ecologia e Geociências, UFBA, Vitória da Conquista, Bahia. Considerando o grau de articulação a maior parte do material foi categorizado como “desarticulado e associado”. Algumas peças foram encontradas articuladas: duas vértebras cervicais, a tíbia direita e a epífise distal da fíbula, falanges mediais e distais. Sobre os sinais de fragmentação, à grande maioria foi atribuído o estado de danificado. Tratando-se sobre a abrasão, ossos longos como o fêmur direito, úmero esquerdo, tíbia esquerda, tíbia direita apresentaram sinais de transporte, no entanto a morfologia óssea característica foi preservada. Utilizando os grupos de Voorhies chegamos à interpretação de que os elementos não foram transportados do seu local original. Quebras foram observadas nos seguintes elementos: crânio, fíbula, ulna esquerda, fragmento da escápula direita e costelas. As quebras ocorreram nas extremidades dos ossos. No padrão observado, as quebras são perpendiculares ao maior eixo do osso e, em alguns casos, pode-se observar que suas bordas são arredondadas, sem vestígio de angulosidade, descartando a possibilidades de ocorrência na coleta. Sinais de predação ou necrofagia foram encontrados em cinco elementos do esqueleto: tíbia, fíbula, ulna, fragmento de costela e crânio. As feições encontradas são majoritariamente distribuídas na diáfise dos ossos, com perfurações e escavações. A coloração das marcas se assemelha ao resto dos elementos, indicando que foram decorrentes de processos bioestratinômicos. Devido a presença da maioria dos elementos esqueléticos, de ossos associados e pouco dispersos, sugere-se que não houve transporte por predadores, necrófagos ou hidráulicos após o período de necrólise. [CAPES/CNPq 308122/2016-0]

## HUESOS, TAFONOMÍA Y CIENCIA DE LA TIERRA: UN CASO DE ESTUDIO EN EL INTERFLUVIO DE LOS RÍOS GALLEGOS Y CHICO, PATAGONIA, ARGENTINA

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El sitio Alero Clark 1 se ubica en una región de estepa fría de Patagonia meridional, en el interfluvio de los ríos Gallego y Chico, provincia de Santa Cruz, Argentina. Se emplaza en la ladera norte de un afloramiento basáltico (147 m.s.n.m.), que actualmente es refugio frecuente de ganado ovino. En este sitio (fechado en *ca.* 314–470 cal BP) se realizaron muestreos de superficie y una exploración subsuperficial de 1 m<sup>2</sup> hasta la roca base, a 65 cm de profundidad. Este alero registra la mayor densidad de artefactos líticos en superficie y en estratigráfica de todo el interfluvio (~2000 km<sup>2</sup>), y una muy baja frecuencia de especímenes óseos, los cuales se encuentran en un estado regular de preservación. Esta situación contrasta considerablemente con lo observado en el resto de los sitios del área, donde la frecuencia de restos arqueofaunísticos (representados mayormente por especímenes de *Lama guanicoe* en buen estado con trazas de procesamiento) es elevada, y los artefactos líticos poseen una frecuencia inferior al registro óseo. En este marco, el objetivo de este trabajo es generar desde las Ciencias de la Tierra información actual y pasada relevante que aporte al modelado de la historia tafonómica de los conjuntos óseos recuperados en el área de estudio. Para evaluar la incidencia de propiedades de la matriz sedimentaria en la integridad del registro óseo se analizó la frecuencia relativa de materia orgánica y carbonatos de calcio (por *Loss-on-Ignition*), conductividad, pH y susceptibilidad magnética, entre otras propiedades macroscópicas. Esta información fue procesada tanto para los sedimentos de la unidad arqueológica, como para aquellos ubicados fuera del sitio, como control del ruido de fondo. Estos datos son cruzados con la distribución vertical del registro óseo (NSP), grados de meteorización, especímenes con óxido de manganeso, exfoliación, trazas de raíces y otras variables antropogénicas. Este trabajo se desarrolla en el marco de los PICT-ANPCyT 2014-2061 y 2019-02106



## DIFFERENCES OF MICROTOPOGRAPHY IN MOLLUSCS DISSOLVED VALVES: TAPHONOMIC IMPLICATIONS

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Dissolution is the result of calcium carbonate imbalance between the marine environment and the mollusk's valve. The CaCO<sub>3</sub> grains are gradually removed from the shell crystals in the form of component ions removing the skeletal material. The process leaves the surface of the valve with a granular appearance that is used as a parameter to evaluate the dissolution of calcareous shell organisms. The rate of the inner shell layers dissolution is controlled by the characteristics and organization of the grains that form it. However, there are few papers that present differences in chemically degraded microrelief between taxa. Therefore, we compared SEM images of the dissolved surface of two gastropod species, *Olivancillaria urceus* and *Strombus pugilis*, collected at Ubatuba Cove, SP, in the bathymetric range of 10 - 15 m. The specimen of *O. urceus* (aragonite) presented a granular texture conventionally found in actuopaleontology articles. *S. pugilis* (aragonite), however, exposed a relief marked by regions of microboring and partially detached layers of the shell body, which differed from that found in the literature. Since the specimens were collected at the same point and were subjected to the same biostratinomic processes, this difference is related to the intrinsic characteristics of each species. *O. urceus* is characterized by the absence of periostrachium, while *S. pugilis*, besides presenting the structure, seems to exhibit foliations of organic matrix parallel to the surface and interspersed with calcareous layers. With its necrolysis, the foliations give way to microboring structure that increases the contact surface and facilitates dissolution, resulting in the shedding of calcareous plates that overlapping them. Thus, it is possible that the amount of organic matrix in the valves is related to their taphonomic success and representativeness in the fossil record. [FAPESP]

# ARISTOTLE'S 'WHEEL PARADOX' AND THE TAPHONOMY OF THE CERITHID GASTROPOD *CERITHIUM ATRATUM* (BORN, 1778) FROM CONCEIÇÃO LAGOON, SOUTHERN BRAZIL

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In the book *Mechanical Problems* attributed to Aristotle, the author addresses the fact that larger pebbles and shell fragments subject to wave action in beaches become more worn and rounded than small ones, a pattern confirmed by further observations and experiments. According to that author, that phenomenon, which became known as ‘Aristotle's Wheel Paradox’, is caused by the greater radius and circumference of the larger particles, which make them to hit the substrate and other particles with stronger force than the small ones. This phenomenon seems to be responsible for the pattern of taphonomic modification observed in modern shells of *Cerithium atratum* found in Conceição Lagoon, in the state of Santa Catarina. Dead shells of that species deposited on the bottom at shallow (<30 cm) depths, associated with pavements of empty shells of the bivalve *Anomalocardia brasiliiana* Gmelin, 1791, are constantly subject to oscillatory movement produced by bi-directional (back and forth) wave motion. As a result of that movement, the elongated, turritiform shells rotate around the central axis describing arc segments that increase in length from the apex to the last (body) whorl. According to the paradox described above, the wider distal whorls would be more prone to wear and breakage than the narrower proximal whorls. This seems consistent with the pattern observed in the studied specimens, which exhibit a sequential loss of the shell wall that begins in the body whorl and progresses toward the apex, culminating with total loss of the shell wall and exposure of the columella. As this process is caused by a combination of the turritiform shape and bi-directional wave motion, the recognition of similar features in fossil shells with similar shape can provide information on the local hydrodynamics and relative time-averaging of the death assemblage, considering that different degrees of wearing among shells from the same depositional environment may indicate individuals that died at distinct times.

# DIFFERENTIAL PRESERVATION OF MODERN AND FOSSIL SHELLS OF THE BIVALVE *ANOMALOCARDIA BRASILIANA* (GMELIN, 1791) IN SOUTHERN BRAZIL

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The venerid bivalve *Anomalocardia brasiliiana* (Gmelin, 1791) occur in sheltered coasts and estuaries of South America up to southern Brazil (28°S). A comparison between modern and fossil shells of this species found on different areas could show variations in preservation features related to the depositional environments. In the polyhaline Conceição Lagoon (27°S), on the central-western Island of Santa Catarina, that species is dominant in shallow (<50 cm) areas of fine sandy bottom, especially close to the outlet of the 2.8 km-long channel that connects the lagoon to the ocean. Dead shells accumulated on the shore by fairweather waves form pavements of concave-down valves. Of the 150 shells from the lake shore analyzed, 52.7% are broken along the margin, 81.3% are unabraded, 92% are corroded, 47.3% exhibit color, and 14% exhibit periostracum; another 4 specimens are impregnated by iron oxide, and 2 specimens harbor encrusted oysters. These were compared with shells found in two oceanic beaches along a Holocene sand barrier adjacent to the channel inlet. The specimens collected closer to the inlet (Barra da Lagoa Beach) exhibit similar proportion of broken and complete shells, but are less corroded and abraded, more exhibit traces of color and iron oxide, and only 2 exhibit vestiges of periostracum. The shells from the adjacent Moçambique Beach exhibit no corrosion or periostracum, most exhibit traces of color, are abraded and broken, and a few exhibit iron oxide. The most striking difference in the specimens from the two beaches is the presence of encrusting organisms (Serpulidae, Ostreidae and Bryozoa) and marine bioerosion traces (*Entobia*, *Caulostrepsis*, *Oichnus*, *Maeandropolydora* and *Gastrochaenolites*). The specimens found along the beaches are probably fossil/subfossil shells preserved in lagoon deposits that are being exposed on the shoreface-foreshore by erosive processes affecting the barrier. The preservation of Holocene and Pleistocene *A. brasiliiana* in deposits of the coastal plain of the state of Rio Grande do Sul (~33°S), where this species is extinct, is more similar to those from Conceição Lagoon, indicating they were deposited in lagoon settings formed by sea-level highstands, although a few Pleistocene shells exhibit bioerosion traces *Caulostrepsis*, *Iramena* and *Radulichnus*.

## HOTSPOTS OF FIDELITY: LIVE-DEAD FAITHFULLY OF MARINE OSTRACODS SHED LIGHT ON THE STRUCTURE OF THE MICROFOSSIL RECORD

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Death assemblages provide excellent data on the species composition and structure of communities in diverse settings, even though temporally coarse. Their assessment is essential to determine the trustworthiness of the fossil record as biological evidence. We present herein comparisons of species assemblages in living and dead ostracods from the Vitória-Trindade Chain, encompassing Trindade Island and four seamounts (Vitória, Jaseur, Davis, and Dogaressa). The faunal analysis resulted in 2,577 specimens distributed in 54 species. All the species found are benthic forms, belonging to the orders Podocopida, Platycopida, and Halocypridida, the last one present only in the seamounts. The seamounts were richest, though less abundant than the island. Rank abundance tests have shown that life and death assemblages differ substantially in the composition of their dominant species, both on the island and in the seamounts. The live-dead agreement is higher in Trindade, mainly in samples of beach, cove, and islet. The live-dead mismatch in the seamounts may be related to the greater number of juveniles in the life assemblage. This situation possibly arises from the rapid destruction of fragile juveniles' carapaces by post-mortem changes. [CNPq and SECIRM/Marinha do Brasil]

## ASPECTO, EDAD, COMPOSICIÓN Y PRESERVACIÓN DE CONCHILLAS DE ACUMULACIONES MODERNAS EN UNA PLAYA DE URUGUAY

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En la Playa Brava de Punta del Este (Uruguay) se depositan actualmente acumulaciones de conchillas de numerosas especies. Algunas de éstas son especialmente abundantes, como las pertenecientes al género *Macra*, y presentan diferentes coloraciones, siendo fundamentalmente blancas, amarillo-anaranjadas o grises. A los efectos de observar si estas coloraciones corresponden a diferentes edades o procesos tafonómicos, las estoy estudiando desde diversos puntos de vista. Por el momento dispongo de resultados de composición elemental (obtenida a través de EDS), microestructura (SEM) y edad radiocarbónica (AMS), para valvas de *M. isabelleana* y *M. guidoi* con las tres coloraciones. Para cada color fue datado un ejemplar de *M. isabelleana* y dos de *M. guidoi*. Excepto en el caso del de *M. isabelleana* blanco que es posterior a 1950, las conchillas de ambas especies tienen una edad entre 2000 y 3000 años radiocarbónicos. La composición no cambia sustancialmente en ningún caso, correspondiendo a carbonato de calcio con pequeñas impurezas que tampoco presentan mayores variaciones. Al SEM se observan alteraciones en todos los casos, siendo más evidentes en las de las valvas de coloración amarilla. [Financiado por CSIC-UdelaR y PEDECIBA]

## TRAÇOS MICROENDOLÍTICOS EM CONCHAS DE BIVALVES DE AMBIENTES MARINHOS SUBTROPICAIS E SEU POTENCIAL EM RECONSTRUÇÃO PALEOAMBIENTAL

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Interpretar as assinaturas tafonômicas em seus ambientes atuais permite detalhar o quanto as acumulações de bioclastos ainda não soterradas são afetadas por fatores ambientais. Até agora há um número limitado de estudos sobre danos tafonômicos de origem biogênica em conchas de plataformas continentais de regiões subtropicais. Neste estudo, o objetivo é identificar e quantificar os traços de bioerosão presentes em conchas oriundos de depósitos bioclásticos da plataforma continental do sul do Brasil (PSB), e verificar a relação desses traços com alguns fatores ambientais. Foram selecionadas 13 amostras de sedimentos superficiais da PSB em diversas profundidades (12 a 200 metros) entre as latitudes ~28°S e ~34°S, coletadas durante as expedições GEOMAR e REVIZEE. Os traços foram visualizados utilizando estereomicroscópio binocular e M.E.V, com as seguintes características analisadas: fragmentação, alteração de cor; e tipos de marcas de bioerosão (traços de fungos, cianobactérias, esponjas, briozoários, poliquetos, além de traços com produtores indeterminados). Em grande parte do material foi realizada, quando possível, a identificação taxonômica dos bioclastos até gênero. Foram analisados 2800 bioclastos chegando a mais de 30 gêneros de moluscos bivalves. Os traços de bioerosão mais frequentes foram, respectivamente: *Phormidium* isp., *Phytophthora* isp., *Entobia* isp., *Iramena* isp. e *Scolesia filosa*. O restante dos traços de bioerosão apresentou uma baixa frequência, inferior a 5%. Os traços microendolíticos como *Orthogonum lineare*, *Phytophthora* isp. e *Sarcomorpha* isp. aparecem mais relacionados com variação na latitude, os danos *Scolesia filosa* e *Fascichnus* isp. estão relacionados com a profundidade. Outros danos tiveram alta correlação com o tipo de substrato, por exemplo, *Pinnaceoclidichnus* isp., *Iramena* isp. e *Entobia* isp. tiveram mais correlação com cascalho e areia. *Phormidium* isp. e foraminíferos indeterminados tiveram uma correlação com áreas mais ricas em carbonato de cálcio. Com a utilização da Análise Canônica de Proximidades e a Correlação de Spearman foi possível relacionar estas assinaturas tafonômicas de origem biológica com algumas características ambientais, tornando possível a utilização desse tipo de informação em interpretações paleoambientais de rochas sedimentares fossilíferas mais antigas, depositadas em condições ambientais (marinhas rasas subtropicais) equivalentes aos atuais.

## EFECTOS DE LA METEORIZACIÓN SOBRE MOLARIFORMES DE VIZCACHA (*LAGOSTOMUS MAXIMUS*, CHINCHILLIDAE, CAVIOMORPHA) Y SU APLICACIÓN AL REGISTRO FÓSIL

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La vizcacha actual, *Lagostomus maximus*, es un roedor de hábitos subterráneos que vive en ambientes abiertos de América del Sur austral. Diferentes especies de *Lagostomus* se registran en Argentina desde el Mioceno tardío. Sin considerar los registros arqueológicos asociados a sesgos por aprovechamiento humano, los restos óseos de este roedor suelen estar incompletos. Se destaca que los dientes aparecen sin ningún tipo de alteración tafonómica aparente que pueda asociarse a la etapa pre-enterramiento. Esto es de particular interés ya que observaciones actualísticas de restos recuperados en la región Pampeana reflejan que sus dientes se destruyen rápidamente cuando quedan expuestos a condiciones atmosféricas. A fin de interpretar la respuesta tafonómica de estos elementos frente a la meteorización, se realizaron experimentaciones en contextos naturales (ambientes abiertos en las provincias de Buenos Aires y La Pampa) y en el Laboratorio de Ensayos Tafonómicos (Museo Nacional de Ciencias Naturales-CSIC, Madrid) simulando parámetros atmosféricos concretos con condiciones controladas aceleradas, y análisis de registros paleontológicos y arqueológicos asociados a diferentes contextos preservacionales, que se describirán en esta presentación. Las experimentaciones demostraron que los dientes están sujetos a una rápida degradación desde los primeros días de exposición, incluyendo agrietamiento y descamación de la dentina y, posteriormente, del esmalte, hasta que, finalmente, se produce su rotura y ocasionalmente su pérdida. Si bien la velocidad e intensidad de los cambios varía de acuerdo a las condiciones climáticas (y época del año), en la mayoría de los casos los dientes son totalmente destruidos antes de los seis meses. Debido a que los registros fósiles de este taxón también aparecen vinculados a ambientes abiertos de Argentina, se plantea que los dientes sin modificaciones que habitualmente se recuperan en los sitios arqueológicos y paleontológicos habrían sido rápidamente enterrados en el interior de sus propias cuevas, donde el microambiente presenta condiciones estables.



## ROCK ART TAPHONOMY: INORGANIC AND ORGANIC CHANGES OF EXPERIMENTAL PAINTINGS IN PATAGONIA

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Only a few actualistic studies concerning rock art taphonomy combined with robust analytical data have been carried out so far worldwide. In this sense, the present work aims to analyze compositional and mechanical changes of a set of experimental paintings specimens at three different localities in central and southern Argentina, in order to obtain information to discuss the potential archaeological bias related to the abundance, diversity and distribution of rock art paintings in the Patagonian region. Based on ethnographical and archaeological data, and using Patagonian raw materials, fifteen combinations of pigments (hematite with different pre-treatments, gypsum and charcoal), binders (*Lama guanicoe* fat, urine, blood and saliva) and additives (blood and gypsum) were manufactured, resulting in red, white and black paintings. They were all applied by fingers on basalt fragments, a ubiquitous rock art support in the Patagonian region. Raman spectroscopy was carried out on each raw material, painting combination and support to get the “time 0” spectra. Qualitative macroscopic characterization of the painting was also done to evaluate color, adherence capacity, painting thickness and roughness among others. After analysis, resulting paintings were installed at three different localities: Buenos Aires (34°S 58°W), Bariloche (41° S 71°W) and Rio Gallegos (51°S 69°W), in order to evaluate weathering rates and degrees of both organic and inorganic components of the paintings, associated with different physico-chemical and biological conditions (i.e., isolation, temperature, humidity, wind action, bioactivity). Raman spectra to contrast with the “time 0” ones will be carried out on each painting combination after a certain period of time, along with a macroscopic characterization focused on changes in the painting color (i.e., hue, chroma, value) and quality (e.g., fissures, stains, loss of painting surface and among others). This work is funded by PINCID Research. Authors expect to submit a full version in due time.

## DISSOLUTION BIAS IN THE PLANKTONIC FORAMINIFERA ASSEMBLAGES FROM THE SOUTH ATLANTIC

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For half a century since the CLIMAP Project, modern planktonic foraminifera assemblages have been used in the calibration of transfer functions to obtain paleo-SST estimates. A basic assumption is that assemblages included in the calibration datasets faithfully reflect modern assemblages from specific environmental conditions. SST changes results not only in changes in planktonic foraminifera assemblage composition but also in subtle compositional changes (different Mg content) between the calcitic carapaces which, in turn, imply different susceptibilities to dissolution. After death, foraminifera may undergo taphonomic alteration, mainly caused by dissolution, therefore modifying the original assemblages when incorporated into the sediments. To avoid the potential taphonomic bias resulting from differential dissolution of species, only samples above the lysocline are included in the calibration datasets. However, as recently documented for the Pelotas Basin, the dissolution bias of planktonic foraminifera may affect samples well above the modern lysocline. The aim of this study is to investigate eventual biases in the planktonic foraminifera composition of sediment assemblages caused by dissolution. Data on the species composition of planktonic foraminifera assemblages from South Atlantic sediments and oceanographic data (temperature, salinity, dissolved oxygen, and oxygen saturation, from surface and bottom waters) were analyzed using Non-Metric Multidimensional Scaling (NMDS) and Canonical Analysis of Proximities (CAP). Since SST is the main controlling factor over planktonic foraminifera species distribution, we assumed that similar SST should generate similar assemblages, and, grouping areas/samples with similar SST, differences in planktonic foraminifera sediment assemblages can be attributed to changes in bottom waters conditions. The clustering of foraminifera according to temperature range occurrences showed greater inertia coefficient in the CAP of the tropical and polar zones, highlighting resistant species *Neogloboquadrina pachyderma*, *Globigerina bulloides*, *Globoconella inflata* and *Globigerinoides ruber* (white). The results indicated a high relation with SST, but dissolution-susceptible planktonic foraminifera also responded significantly to surface dissolved oxygen, bottom salinity (indirectly) and bottom dissolved oxygen. The areas with greater bias were associated to the presence of more corrosive bottom water masses of southern origin. Therefore, such fidelity bias needs to be considered in the calibration databases used in paleotemperature reconstructions based on planktonic foraminifera census counts. [Projeto FAPERGS nº 1982-2551/13-7; CAPES Processo 88887.091727/2014-01]

## PALAEOMETRY AND ACTUALISTIC TAPHONOMY: THE IMPORTANCE OF TESTING TECHNICAL LIMITATIONS AND PARAMETERS ON THE STUDY OF FOSSIL AND EXPERIMENTAL SAMPLES

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Actualistic taphonomy aims to communicate experimentation and observation, enriching the deductions on the fossil record. Paleometry is an interdisciplinary area for improvement of new methods for accessing paleobiological information which can move in parallel with experimental approaches. Scanning electron microscopy with energy dispersion spectroscopy (SEM-EDS) is an effective way to investigate textures and morphologies, as well as chemical elements on different types of geological samples. However, the lack of specific knowledge about the limitations and possibilities of this technique can skew the results of analytical and experimental studies. We are testing parameters and limitations on SEM/EDS, so as other complementary techniques, on the study of fossils and different sediments in order to improve protocols for experimental and observational paleontology. Here we present some results from the analysis of pure sand and illite, under the following parameters: (1) gold/palladium coated and not coated samples; (2) under tensions of 3, 5, 10, 15 and 20 keV. In the case of uncoated sediments, under lower tensions (3 and 5 keV), only sand showed detectable elements (C, O, Al and Si). Once coated, clay started to show detectable intensities for some elements, since 3 keV (C, O, Mg, Al and Si). Under higher tensions (20 keV), coated and uncoated clay presented almost the same potential of detectable elemental intensities when compared to coated and uncoated sand. However, under 20 keV, coated clay revealed considerable intensities of Sr, at the same time that coated sand showed detectable Ti and Sr. In this sense, low tensions and gold coating may be useful for the detection of lighter elements related to thinner organic films on fossils (as the carbon remain of some microbial mats, extracellular polymeric substance - EPS, and invertebrate organic teguments). Higher

tensions and gold coating are better for the detection of trace elements related to diagenesis (such as Sr and rare earth elements - REEs). For this reason, we propose and reinforce that the application of analytical techniques with well-known limitations, as well as the use of the same forms of data analysis, will make interpretations and hypothesis tests more reliable in paleontology. [kickante crowdfunding, FAPESP, CNPq, CAPES]

## FATORES QUE CONTROLAM A OCORRÊNCIA DE MICROFÓSSEIS EM AMBIENTES MARINHOS ASSOCIADOS A ARCOS VULCÂNICOS (PENÍNSULA ANTÁRTICA)

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Pesquisas realizadas para avaliação do potencial de fossilização em ambientes marinhos atuais associados a arcos vulcânicos sugerem uma tendência de maior dissolução das carapaças carbonáticas, em ambientes de salinidade constante, com o aumento gradativo da pressão de CO<sub>2</sub>, e consequente acidificação dos oceanos. Neste contexto, o presente trabalho visa obter uma melhor compreensão de como a deposição de sedimentos vulcanoclásticos podem favorecer a fossilização e preservação de microfósseis em uma escala temporal maior. O Membro Lachmann Crag da Formação Santa Marta (Ilha de James Ross, na Antártica) possui um dos registros marinhos mais completos do intervalo Santoniano-Campaniano em altas latitudes no Hemisfério Sul. De modo geral, a ocorrência de microfósseis está associada a litologias pelíticas. Entretanto, recentes estudos micropaleontológicos apontaram a preservação preferencial de microfósseis, tais como nanofósseis calcários, foraminíferos, ostracodes e radiolários, em níveis de arenitos siliciclásticos tufáceos, do Membro Lachmann Crag. O objetivo deste estudo é de caracterizar as condições de deposição e diagênese que podem ter influenciado a preservação de microfósseis na Formação Santa Marta, com base em análises de fluorescência de raios-X (FRX). Razões elementares sugerem que: (i) há uma influência hidrotermal relevante ao longo da sucessão estratigráfica, sugerida por valores >15 da razão (Fe+Mn)/Ti; (ii) o ambiente apresenta salinidade variável, como indicado por oscilações da razão Sr/Ba; (iii) aporte de cinzas vulcânicas em determinados níveis arenosos é demonstrado por elevados valores da razão Zr/Ti, conferindo-lhes a característica tufácea. Para o futuro desenvolvimento da pesquisa, está prevista a análise integrada dos dados geoquímicos com as ocorrências de microfósseis. [Projeto PROANTAR: 88887.314454/2019-00]

## EARLY DIAGENESIS OF SEEDS ASSOCIATED WITH LIMESTONES SOILS

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The early diagenesis of fossil plants, especially reproductive structures as seeds, provides significant information about the evolution of the group. The present research describes the morphology and the fossilization of isolated eudicot seeds derived from Toninha outcrop limestone soils, Romualdo Formation, Araripe Basin, Brazil. The seeds are three-dimensionally preserved with volume ranging from 10.16 to 18.57 mm<sup>3</sup>. They were studied by using scanning electron microscopy, X-ray microtomography, and laser ablation-inductively coupled plasma mass spectrometry in the imaging mode. The morphology and anatomy were described, and the specimens were identified as Fabidae seeds. It is known that Fabidae arose in the mid late Cretaceous, so the seeds were considered diachronic to the paleobiota from Romualdo Formation, not belonging to this stratigraphy. Based on the spectrometric intensities of the mapped elements such as C, Fe, Si, and Cu, images of distribution were elaborated to these elements on the surface and inside the seeds. The maps indicated intensities for C, Fe, Si, and Cu in the tissues of the seeds, higher than those presented by modern seeds, suggesting an early stage of diagenesis. The high intensity of Si in the inner portion of the seeds allowed the preservation of the endosperm, cotyledons, and radicle. The calcareous sandstones of the Romualdo Formation may have provided the charged ions that were carried by groundwater, and they later precipitated in the organic tissues. [FAPESP grant No 2016/07384-7, CNPq131216/2013-9, 407148/2010-3 and 201716/2010-0 and CAPES]

## TO BE OR NOT TO BE A FOSSIL: A DILEMMA ON THE QUATERNARY PALEONTOLOGY

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Sympatric empty shells and mollusk live assemblages are commonly lying on modern shelves around the world. These ubiquitous components, biodiversity (the variety of living nature), and geodiversity (non-living geological nature) are acting as a non-linear route. It is especially true for living nature formed by calcified skeletons or structures, like mollusks, brachiopods, coral reefs, rodolithos, among others. These organisms, after death, as part of the geodiversity component, still interact with their counterpart biodiversity, acting as baselines for sclerobionts, for example. Without dating all empty shelly remains we are not able to assign for what temporal momentum within a bio or a geosystem those remains belong to, or which law should be applied to them (biological or geological laws). The Schrödinger's dilemma, as we have analogically called that duality, has several implications when both paleontologists and neontologists are dealing with Quaternary sediments, especially those sediments that are contiguous between past and modern environments. In our study, based on more than 400 individually dated biological remains, we demonstrated that in shallow marine sediments, the probability of a shell be a fossil is roughly 16 %, while on deeper areas these values increase up to six-fold. The identical pattern is also reached in dry Mollusca zoological collections museums, proving that the geochronological fossil definition is a duality mismatch to both the zoologic and paleontological world. Thus, we suggest that fossil definition may be clear, as follows: fossil is any biological element that represents an individual or its activity that despite the age is not accurately known, being potentially a paleontological object of study [CNPq 422766/2018-6].



## DRILLING PREDATION RECORDED ON BOUCHARDIID SHELLS (BRACHIOPODA, RHYNCHONELLIFORMEA) IN THE CENOZOIC FOSSIL RECORD OF SOUTH AMERICA

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The evolutionary history of drilling predation on the Phanerozoic rhynchonelliform brachiopods is a key issue in macroevolutionary and paleoecological studies. However, the post-Paleozoic fossil record of drilling predation in brachiopods is still poorly documented. We evaluate the history of drilling in an austral clade of Cenozoic brachiopods (bouchardiids) and mollusk bivalves co-occurring in the same fossil assemblages. Combined field, museum, and literature data encompass samples from polar to subtropical shallow shelf environments. Drilling frequencies (DF) and the standardized hole disparity (SHD) were calculated for 5485 bouchardiids [Paleocene (*B. conspicua*, n=29), Eocene (*B. antarctica*, n=27), Oligocene (*B. zitteli*, n=88), Miocene (*B. transplatina*, n=37) and Holocene (*B. rosea*, n=5204)], and 9431 bivalves from the Eocene to Holocene. Within each time interval (except the Holocene), comparable DFs are observed for both groups, with generally low frequencies (except the Oligocene): (1) Bouchardiids: Paleocene/Eocene=0%; Oligocene=25%, Miocene=2.9%, and Holocene=0.4%; and (2) Bivalves: Eocene=3.7%; Oligocene=23.5%; Miocene=2.5%; and Holocene=5.6%. Also, a similar range of SHD values is observed for both groups: from 0.4 to 1 for brachiopods, and from 0.3 to 1.2 for bivalves. The anomalously high Oligocene DFs and concurrent low SHDs observed for both groups coincide with the appearance and diversification of muricids (*Trophon*). All in all, comparable DFs and SHDs for both groups are inconsistent with the predictions of the Secondary Evolutionary Escalation Hypothesis postulated previously for brachiopods, and originally based primarily on the Paleozoic fossil record of drilling predation. Brachiopods were attacked at comparable rates to bivalves through most of the studied time interval and did not produce holes more variable in shape comparing with bivalve drillers. These conflicting results may suggest that either the Cenozoic and Paleozoic brachiopod-driller interactions differed fundamentally from one another or the secondary escalation hypothesis is of a limited general validity. Cases of intense drilling predation on Cenozoic brachiopods seem to have been restricted geographically and stratigraphically. In this case study, the intensification of predator-prey interactions appears to have been linked to the appearance and diversification of predator lineages, that resulted, at least initially, to drilling frequencies that were comparably high to those observed in post-Paleozoic mollusks.[CNPq and FAPESP]

## TAFONOMÍA ACTUALISTA DE ENSAMBLES DE VALVAS EN PLAYAS DE LA COSTA URUGUAYA

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Los ensambles de valvas recientes proveen valiosa información tafonómica y ecológica que puede ser contrastada tanto con las comunidades actuales como con las asociaciones fósiles en un área dada. La presente contribución representa el inicio de una línea de investigación sobre la composición taxonómica, diversidad, ecología y tafonomía de acumulaciones de valvas de moluscos en playas de la costa uruguaya. Mediante la colecta de muestras en diferentes playas, subambientes (rocoso, arenoso) y distancia a la zona de rompiente se pretende abordar interrogantes tales como: a) qué especies de moluscos predominan y cuáles son sus atributos tafonómicos, b) varían estos en diferentes subambientes y sectores geográficos de la costa, c) cuán antiguas son las valvas que componen los ensambles, d) son estos representativos de las comunidades de moluscos vivientes de las áreas adyacentes, e) son fieles las reconstrucciones ecológicas y de parámetros ambientales a partir de las especies de dichas acumulaciones, f) qué aprendizajes podemos obtener al comparar los resultados obtenidos con las inferencias provenientes de asociaciones de moluscos cuaternarios del área de estudio. Al momento se han colectado unas 20 muestras de unos 5 l cada una en varias playas del departamento de Maldonado en Uruguay, desde Bella Vista hasta José Ignacio (distantes unos 85 km). Los resultados preliminares disponibles corresponden a muestras de Bella Vista 3 (DABV3), Punta Ballena 1 (DAPB1) y El Chorro (DAECH1 y DAECH2). La riqueza de las muestras oscila entre 30 y 43 especies, siendo las más diversas aquellas situadas hacia el E. En DABV3 predominan los géneros *Brachidontes*, *Mactra* y *Ostrea*, en DAPB1 abundan *Glycymeris*, *Mactra*, *Mytilus* y *Ostrea* mientras que en DAECH predominan *Mactra* y *Glycymeris*. Es interesante que en las muestras de El Chorro se detectó la presencia de la especie extralitoral *Anomalocardia flexuosa*, frecuente en las asociaciones de moluscos cuaternarios y en Bella Vista y Punta Ballena se registró a la especie invasora *Rapana venosa*. Tal como ocurre con la riqueza específica, parece haber una mayor incidencia de bioerosión en los ensambles situados más al E. Esta es una contribución a PEDECIBA Geociencias.

## MODERN TO PENNSYLVANIAN FJORDS: TAPHOFACIES AND SUBTLE VARIATIONS IN CIRCULATION AT THE LATE PALEOZOIC ICE AGE

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Over the centuries, uniformitarianism has been widely used to understand sedimentary paleoenvironments, helping to diagnose complex circulation and deposition patterns as well as taphonomic processes. Recent studies have yielded the importance of understanding current fjords, like Puyuhuapi Fjord, Chile, to reconstruct and identified mid-latitude paleofjords as the Pennsylvanian Lontras Fjordbay. This worldwide known site, located at Mafra, Santa Catarina State, Brazil, is a relevant fossil site (being suggest as Lagerstätte) from the Itararé Group, Paraná Basin. The Lontras Shale Macrofossiliferous Interval comprises a 1.1 m black shale related to the final deglaciation moment and formed by a well-preserved and diverse fauna. Considering the sedimentological and geochemical data, and its complex patterns, we sought to identify and describe taphofacies for LSMI, to shed light on possible subtle variations in depositional settings. Then, we have selected holometabolous larval cases and sponges, the two most abundant benthic fossils, to recognize autochthony and different fragmentation grades. Classified as complete and fragmented fossils, sponge's root tufts, loose spicules, and free insects silk stripes, the association of these through the shale layers have led to four different taphofacies (T1-T4): T1) formed by rare free spicules; T2) which comprises more intact cases and free spicules, probably a good moment for the holometabolous; T3) fragmented taphofacies with loose spicules, strips and fragmented sponge bodies, possible evidence of untraceable bottom streams; and T4) less fragmented moment with sponge bodies, root tufts and also complete and fragmented cases, setting best moment for Porifera. Furthermore, using the sublevel division applied on LSMI, we have observed that the taphofacies alternate upward as T1-T1-T2-T3-T2-T4-T2-T4-T2-T4-T3. Comparing our results with the current fjords circulation patterns, we may suggest a cyclicity on LSMI water circulation and different sources of streams. Thus, in a moment with continental inflows, we may have a better environment for insects (T2), while in other times a non-clear but relevant bottom current led to T3, and in the paralic system have improved the sponge proliferation (T4). Despite further approach that should be applied on the deciphering paleodepositional settings of LSMI, these taphofacies can help to shed light on subtle paleoenvironmental changes, once modern fjords have strong stratification, seasonality and rapid evolution.

## PARASITIC LIKE-TRACES ON MARINE MOLLUSKS: NEW SOUNDS FROM SOUTHERN BRAZIL

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Parasite traces on invertebrate fossil remains are relatively uncommon, despite its high biological information value regarding ecological interactions. Although these traces are not properly preservable, parasites are ubiquitous in the biosphere and their diversity and abundance is higher rather than predators. However, there is a vast unknowledge about the spatial and environmental variation of parasitic traces derived from the fossil record so far. The digenean trematode, for example, has a complex life cycle with three hosts, infesting mollusks bivalves in the second stage, being an intermediate host. Despite parasites be formed by a soft-bodied, they can produce diagnostic traces and preservable on bivalves, in the inner of the valves thus inducing de growth of oval-shapes modifying locally the shell geochemical composition. It has been observed that these deformities present in the structures, indicate that they were made when the host was still alive. This work aims to evaluate the prevalence of parasite like-traces caused by Digenean trematodes in bivalves' mollusks. To this purpose, 27 standardized samples of 0.05 m<sup>3</sup> of sedimentary material and mollusks shells were gathered, along about 135 km of coast, between the counties of Torres and Palmares do Sul, southern Brazil, simulating retrograding and prograding settings in the Quaternary fossil record. Twelve species of mollusks were identified, while the genus *Donax* displayed a frequency of 88.49 %, the most abundant species being the only one that displayed parasite like-traces. Prevalence values were significantly similar (Mann-Whitney-Wilcoxon test after sine arc transformation,  $p=0.956$ ) in samples associated with retrograding (0.55) and prograding settings (0.59). The pattern found for studies carried out in the Mediterranean Sea — high prevalence of trematodes infesting bivalve in retrograding sectors —, was not identified here for the Southern Brazilian coast, which highlights the importance of carrying out more studies on the subject. [CNPq 422766/2018-6]

## IMPLICANCIAS TAFONÓMICAS DE LA RELACIÓN AVES-MOLUSCOS ACUÁTICOS EN AMBIENTES COSTEROS URUGUAYOS Y RIOGRANDENSES

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Las relaciones depredador-presa entre aves y moluscos son variadas y sumamente informativas. Por su tamaño y presencia de estructuras duras perdurables, los moluscos son ideales para investigar relaciones ecológicas que muestren, e.g. relaciones tróficas o adaptaciones evolutivas a través de marcas de depredación en conchillas o eventuales adaptaciones en las formas del pico. Sin embargo, el abordaje morfo-funcional de estas estrategias implica varias preguntas biomecánicas y evolutivas aun no resueltas. Abordajes ecológicos y menos aún tafonómicos de esta relación han sido poco explorados y difundidos a nivel regional. En base a revisión bibliográfica, a miles de horas de observación y de análisis de contenidos estomacales de la costa uruguaya y riograndense (RS, Brasil), sintetizamos aspectos que merecen mayor atención. Por la abundancia de moluscos y aves en ambientes acuáticos/costeros allí, son comunes algunas relaciones tróficas. Se destacan las siguientes aves especialistas: el gavilán caracolero (*Rostrhamus sociabilis*) y el carao (*Aramus guarauna*) en ambientes límnicos, así como el ostrero común (*Haematopus palliatus*) en ambientes estuarinos y marinos, este último alimentándose tanto de moluscos varados como *in situ*. Estas especies dejan marcas y/o acumulaciones características, con potencial paleoindicador. La gaviota cangrejera (*Larus atlanticus*) es también malacófaga, aspecto poco conocido o reconocido. Se destaca el aporte fundamental de los bivalvos de playas arenosas (*Donax hanleyanus* y *Amarilladesma mactroides*) a la alimentación de los chorlos y playeros (*Calidris* spp., *Charadrius* spp. y *Pluvialis* spp.); el playero rojizo *Calidris canutus rufa* está particularmente especializado en consumir moluscos. Más de 20 especies se alimentan principalmente en ambientes dulceacuícolas e incluyen moluscos en su dieta, abarcando garzas, mirasoles, bandurrias, cuervillos, patos, gallinetas, pollas de agua y al macá común. También se destacan como malacófagos los generalistas como el benteveo (*Pitangus sulphuratus*), la gallineta grande (*Aramides ypecaha*) y la gaviota cocinera (*Larus dominicanus*). El gran interés por las aves permite instancias de ciencia ciudadana, ayudando a caracterizar las características tafonómicas de las eventuales acumulaciones, marcas en conchillas y los fragmentos de estas presentes en regurgitaciones y fecas de estas especies.

## THE HISTORY BEHIND PAGURIZED SHELLS

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Despite most dead shelly assemblages gathered from the Southernmost sector of the Brazilian coast (Rio Grande do Sul) are infaunal, fouled shells of gastropods are likely common on these concentrations. The importance of hermit crabs in holding shells in the sediment-water interface is already well known. Taphonomy can be employed to record the occurrence of traces related to the pagurized gastropod shells in shelly assemblages. In this sense, the purpose of this work is to understand how hermit crabs affected the shells available in the marine environments and the development of fouling communities. A total of 843 gastropod shells were collected through 150 km of the study area. The gastropod shells were divided in three zones: A = spire and abarptural exterior of the last whorl; B = spire and adapertural exterior of the last whorl; and C = aperture interior (columella, siphonal canal, outer lip, and apertural notch). The fouling organisms were identified and their occurrences for shell zone quantified. The body size of gastropod shells was measured using the geometric mean ( $\text{Length} \times \text{Height}^{1/2}$ ). Fouling organisms were observed in 115 shells. The highest frequency was observed in *Olivancillaria urceus* (68%, n= 78). Bryozoans represented 78% of fouling occurrences (n= 107). Serpulids (10%, n= 14), bivalves (6%, n= 9), and balanomorphs (6%, n=8) represented subordinate occurrences. The occurrence of fouling organisms was higher in Zone C (62%), which is lower in zone A (30%), and B (8%), respectively. Balanomorphs were the unique fouling organisms observed preferentially in zone A. Etchings classified as *Pennatichnus* isp. were observed preferentially in zone C too. Borings corresponded to sponges (*Entobia* isp.), worms (*Caulostrepsis* and *Maendropolydora*), and bivalves (*Gastrochaenolites*). The highest occurrence of fouling organisms in zone C is a strong indicative of their occupation by hermit crabs. The higher frequency of fouling organisms in the internal zones indicates the importance of crabs as food sources and safety house for filter-feeds. Finally, the higher abundance of fouled shells measuring between 26 cm and 33 cm would demonstrate indirectly an average size to the crabs. [PNPD/CAPES]



## “TAFONOMÍA EXPERIMENTAL: INTERVENCIÓN DE MICROORGANISMOS EN LA PRESERVACIÓN DE INSECTOS ACUÁTICOS DE LOS RÍOS DE SAN LUIS, ARGENTINA”

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Este estudio fue realizado como Trabajo final, para la obtención del título de grado de Licenciado en Ciencias Biológicas en la Universidad Nacional de San Luis. El objetivo del mismo fue evaluar la posible intervención de los microorganismos en la etapa bioestratinómica, para luego determinar si estos, podrían haber favorecido la preservación de restos de insectos favoreciendo posteriormente su fosilización. Para ello se realizó un experimento tafonómico con insectos de la especie *Belostoma bifoveolatum* (Heteroptera). El experimento mismo consistió en colocar los cadáveres de insectos (muertos por congelación) sumergidos en un volumen conocido de agua colectada del mismo cuerpo de agua (Rio El Volcán) donde se realizó la captura de los especímenes. En cada caso se le adicionó, además, combinaciones de distintas sustancias (alguicida, fungicida, antibiótico) para incrementar o inhibir el crecimiento de distintos tipos de microorganismos, dando así lugar a un diseño de observación cualitativa de cinco tratamientos con seis réplicas cada uno. La duración total del experimento fue de 35 días. A partir de las 48 horas de su inicio, cada cierto día establecido, se procedió a la toma de muestras de los cadáveres en los que se realizaron observaciones de varias características. Una de las más importantes, fue la formación de una película microbiana recubriendo los restos de insectos en los distintos tratamientos utilizados. En una etapa posterior, se realizó la identificación de los microorganismos constituyentes de estas películas a través de distintas técnicas, como el MEB y medios de cultivos selectivos. La identificaron preliminar de microorganismos pertenecientes a Fungi (*Aspergillus niger* y Zygomycota), “Algas” (Bacillariophyceae: *Cocconeis* sp. y Zygnematales) y Eubacteria (Staphylococcaceae y Enterobacteriaceae). A partir del experimento se realizaron inferencias acerca de los procesos tafonómicos sufridos por insectos fósiles de la Formación La Cantera (Cretácico Inferior, Sierra del Gigante, San Luis), depositados en la Colección Paleontológica de UNSL. Se corroboró la hipótesis, ya propuesta por otros autores, de que los microorganismos protegerían los restos orgánicos de la degradación natural, en los ambientes acuáticos formando rápidamente una biopelícula microbiana, que contribuiría a incrementar el potencial de fosilización de los restos. [Financiamiento Proyecto PROICO UNSL 2- 0618, Directora Arcucci A]



## DRILLING PREDATION IN RECENT ECHINOIDS (CLYPEASTEROIDEA, MELLITIDAE) FROM THE NORTHERN COAST OF THE BRAZILIAN SHELF, SOUTH ATLANTIC

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Drilling predation on mollusks-brachiopods is relatively well investigated in modern benthic death assemblages from the northern coast of the state of São Paulo, Brazil. However, drilling predation on echinoids, which are also common in those death assemblages, was not investigated previously. Here, specimens of *Mellita* sp. (Mellitidae), a slow-moving semi- to shallow-infaunal detritivore clypeasteroid, were examined for drilling predation. Specimens were collected along the Fazenda Beach, Picinguaba Bay, a nearly flat, sandy, dissipative beach. Dead individuals were collected as encountered by walking on the beach parallel to shore, during 2004-2005. Out of 329 tests, 304 (92.4%) specimens were drilled, 30 (9.9%) of which with multiple holes. Most drill holes were complete (96.3%), variable in shape and with irregular or regular outlines. The oval, beveled ones, were observed in thicker, less porous test regions suggesting that drill-hole morphology may vary as a function of the test robustness and thickness. Complete drill holes were mainly observed on the porous and fragile petaloids on the aboral side of the tests (99.7% of drilled specimens), especially at posterior regions V and I. The non-random distribution of drill holes suggests stereotypy, with the petaloid regions preferably drilled compared to the interambulacral regions. The drilling frequencies in *Mellita* (92.4%) are remarkably high, and much higher than those typically reported for sympatric molluscs (>5.6%) and brachiopods (>0.4%), suggesting either much higher intensity of drilling predation on echinoids or a strong taphonomic bias (either preferential preservation or selective onshore transport of drilled tests). Gastropods (cassids) that occur in shell accumulations on the beach are the most likely candidates for being the drilling culprits. [CNPq 401039/2014-5].

