

PALEODAYS 2021

ABSTRACT BOOK

XXI CONVEGNO DELLA SOCIETÀ PALEONTOLOGICA
ITALIANA

BOLOGNA (14)15-17 GIUGNO 2021

Live virtual edition



Edited by:

Rossi V., Fanti F., Barbieri G., Cavalazzi B. & Scarponi D.



XXI CONVEGNO DELLA SOCIETÀ PALEONTOLOGICA ITALIANA

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Evento organizzato da:

Dipartimento di Scienze Biologiche, Geologiche e Ambientali – Università degli Studi di Bologna
Sistema Museale di Ateneo – Università degli Studi di Bologna

Dipartimento di Scienze della Terra “Ardito Desio” – Università degli Studi di Milano

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Società Paleontologica Italiana

Con il patrocinio di:

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Società Paleontologica Italiana

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PALEODAYS 2021 - PROGRAM

Monday June 14, 2021			
Time	Presenting author	Title	Chair
10.00-10.15	Andrea Villa	Welcome Round Table - PaIP via ZOOM	
10.15-12.15	Filippo Bertozzo, Dawid A. Iurino, Andrea Musso, Fabio Manucci, Flavia Strani	Le meraviglie della paleontologia: incontro tra arte e scienza	Andrea Villa
12.15-13.30		Group discussion & final remarks	
13.30-14.30		Lunch	
14.30-14.40	Lucia Angiolini	Welcome Round Table – Tutela e conservazione dei beni paleontologici via ZOOM	
14.40-15.00	Valeria Acconcia & Federica Pitzalis	Il Gruppo di lavoro per la paleontologia del Ministero della Cultura	
15.00-15.20	Rossana Gabusi & Monica Miari	La tutela territoriale dei beni e dei giacimenti paleontologici: stato dell'arte e prospettive di sviluppo	
15.20-15.40	Gianluca Raineri	Beni paleontologici e Musei locali	Lucia Angiolini
15.40-16.00	Carlo Francou	Il patrimonio paleontologico in provincia di Piacenza: tutela e valorizzazione	
16.00-16.25	Stefano Rossi & Barbara Grassi	La tutela paleontologica in Lombardia Occidentale: problematiche e sfide	
16.25-16.45	Mirco Modolo	Problematiche inerenti la riproduzione del bene culturale pubblico	
16.45-17.05	Giuseppe De Gori	Il Comando Carabinieri Tutela Patrimonio Culturale nella prevenzione e repressione del traffico illecito di beni culturali	
17.05-17.30		Group discussion & final remarks	
18:00		<i>Paleoart exhibition</i>	Lucia Angiolini, Daniele Scarponi, Beniamino Mecozzi & Andrea Musso

Tuesday June 15, 2021			
Time	Presenting author	Title	Session/Chair
8.00-8.15		Welcome	Lucia Angiolini & Daniele Scarponi
8.15-8.45	Keynote Speaker: Paolo Albano	Conservation paleobiology uncovers massive biodiversity loss in the Eastern Mediterranean	Lucia Angiolini & Daniele Scarponi
8.45-9.00	Loredana Macaluso	Passato, presente e futuro di <i>Salamandrina</i> (Salamandridae, Urodela): l'utilizzo dell'Ecological Niche Modeling per investigarne passate estinzioni e prospettive future	
9.00-9.15	Claudia Deias	Morfologie di crescita e ruolo delle biocostruzioni a <i>Sabellaria alveolata</i> (Polychaeta) di aree costiere della Sicilia	Climate change
9.15-9.30	Angela Girone	Climate variability during MIS 19 from western to central Mediterranean basin	Daniele Scarponi
9.30-9.45	Silvia Danise	Change in richness, abundance, geographic range and habitat specialization in Plio-Pleistocene Mediterranean bivalves	
9.45-10.00	Francesca Bosellini	Reef development and coral diversity are positively correlated during the Late Oligocene warming (Castro Limestone, Salento Peninsula, Italy).	
10.00-10.05	Matteo Antonelli	A theropod-dominated ichnoassemblage from the Molfetta dinosaur tracksite (Early Cretaceous; Apulia, southern Italy)	
10.05-10.10	Giovanni Serafini	Revision of Cretaceous ichthyosaurs from the Northern Apennines: new insights on neurovascular anatomy, ecology and abyssal taphonomy	
10.10-10.15	Filippo Maria Rotatori	Re-evaluation of the holotype of <i>Draconyx loureiroi</i> (Dinosauria, Ornithomimidae) with report of new holotype material	
10.15-10.20	Lorenzo De Bortoli	Morphometric and 3D analyses of Middle Miocene oysters: A preliminary comparison between specimens from Moravian Outcrops of the Carpathian foredeep (Czech Republic) and from Roztocze Hills buildups (Poland)	
10.20-10.25	Alessio Iannucci	New perspectives on Suidae (Mammalia, Artiodactyla) at the Miocene-Pliocene transition	Cross disciplinary (Blitz)
10.25-10.30	Marco Merella	A second specimen of the archaic Mediterranean monodontid cetacean <i>Casatia thermophila</i> from the Zanclean deposits of Arcille (Tuscany, Italy)	Giulia Barbieri
10.30-10.35	Pierluigi Santagati	Taphonomy of an early Pliocene balaenopterid whale from southern Tuscany: a preliminary investigation	
10.35-10.40	Adriano Guido	Biological role and environmental control in the formation of carbonate biocostruzioni of confined marine settings ("Lu Lampiune" cave, Otranto Apulia)	
10.40-10.45	Beniamino Mecozzi	Large mammals from the lower complex of Grotta Romanelli (Apulia, southern Italy): between the rediscovery of the historical fossil collection and the study of new material	
10.45-10.50	Giulia Faucher	The strontium case in modern and past oceans: causal or casual relationships with coccolithophore growth rate and coccolith geometry.	
10.50-11.20		Mid-morning break/Question time Blitz session	
11.20-11.35	Saverio Bartolini Lucenti	Quando un "Tipo" è deformato: applicazioni di Paleontologia virtuale come nuove possibilità per la ricerca e la "terza missione"	
11.35-11.50	Dawid Adam Iurino	The canid remains from the Middle Pleistocene of Ponte Galeria (Rome, Italy)	
11.50-12.05	Marco Cherin	The <i>Dama</i> -like deer ' <i>Pseudodama nestii</i> ' (Mammalia, Cervidae) from Pantalla (Early Pleistocene)	3D reconstructions
12.05-12.20	Michelangelo Bisconti	New data about cetacean paleoneurology	Lorenzo Rook
12.20-12.35	Emanuele Peri	A new sperm whale occurrence from the Miocene of southern Italy: digital imaging and retrodeformation as tools for the systematic study of a basal physeteroid	
12.35-12.50	Giacinto De Vivo	3D modelling of the Cambrian Burgess Shale radiodont feeding appendages	

12.50-14.00		Lunch	
14.00-14.15	Giovanni Bianucci	A <i>Pseudorca</i> -like dolphin from the Pleistocene of Rhodes (Greece): toward the establishment of the extant delphinid stock (Cetacea, Odontoceti)	Extinction, radiation and morphological trends Raffaele Sardella
14.15-14.30	Emanuela Di Martino	Static and evolutionary allometry in multiple temporal populations of closely related cheilostome bryozoan species	
14.30-14.45	Sofia Holpin	The Rise of the Age of Mammals and the role of Early Paleocene 'Condylarth' <i>Tetraclaenodon</i> (Mammalia, Phenacodontidae) from the San Juan Basin of New Mexico, USA	
14.45-15.00	Giuseppa Forte	Amber from the Anisian (Middle Triassic) of Kühwiesenkopf/Monte Prà della Vacca	
15.00-15.15	Stefano Dominici	Growing up big: the largest known cowrie and the evolution of giant cypraeid gastropods	
15.15-15.30	Marco Romano	A brave new world: A review of the Early Triassic terrestrial tetrapod fauna	
15.30-15.45		Mid-afternoon break	
15.45-16.00	Giuseppe Marramà	Diversity, palaeoecology and palaeoenvironmental significance of the Eocene chondrichthyan assemblages of the Bolca Lagerstätte, Italy	Lagerstätten Paola Monegatti
16.00-16.15	Valentina Rossi	Skin patterning and internal anatomy of a 50 Ma moonfish from the Monte Bolca Lagerstätte	
16.15-16.30	Federico Fanti	There is more than meet the eyes: unfolding the diversity, age, and ecology of the Late Cretaceous Villaggio del Pescatore site (Trieste, Italy).	
16.30-16.45	Evelyn Kustatscher	Who is your father? Botanical affinities of spores and pollen from the Triassic of the Dolomites	
16.45-17.00		Mid-afternoon break	
17.00-17.15	Andrea Baucon	If the Universe is teeming with life... where are the Martian ichnofossils? Application of palaeontological predictive modelling for the search of extraterrestrial life	Tools in paleontology Annalisa Ferretti
17.15-17.30	Antonietta Rosso	Pleistocene lithobiont communities from Sicily	
17.30-17.45	Stefano Masini	UV light photography: unraveling the different applications in palaeontology	
17.45-18.00	Edoardo Martinetto	A possible way towards a comprehensive database of plant macrofossil records from the Cenozoic of Italy	
18.00-18.45		Poster session: 37 posters online (questions/answers via chat)	

Wednesday June 16, 2021			
Time	Presenting author	Title	Session/Chair
8.20-8.30	Welcome		Lucia Angiolini & Gaia Crippa
8.30-9.00	Keynote Speaker: Renato Posenato	Controllo ambientale e climatico sulla proliferazione dei bivalvi con conchiglia a bastone (club-like) del Mesozoico	
9.00-9.15	Omar Cirilli	<i>Equus stenorhis</i> Cocchi, 1867 (Perissodactyla, Mammalia). An updated review of the species with new remarks on the European Early Pleistocene <i>Equus</i> taxonomy and on the Old World <i>Equus</i> Evolution.	Taxonomy and phylogeny Giorgio Carnevale
9.15-9.30	Weronika Cieszyńska	<i>Oreopithecus bambolii</i> : does "molecular paleontology" can help us in better understanding such a peculiar fossil ape?	
9.30-9.45	Beatrice Azzarà	An overview of the African fossil record of <i>Hystrix makapanensis</i> (Mammalia, Rodentia)	
9.45-10.00	Alessio Fabbrini	Systematic Taxonomy of middle Miocene <i>Sphaeroidinellopsis</i> (planktonic foraminifera)	
10.00-10.15	Andrea Villa	An overview of the Miocene amphibians and reptiles from the Vallès-Penedès Basin (Catalonia, Iberian Peninsula)	
10.15-10.30	Marco Viaretti	Upper Permian brachiopods from the Abadeh section, Central Iran	
10.30-10.45	Annalisa Ferretti	Middle-Upper Ordovician conodonts from South Wales, United Kingdom	
10.45-11.15		Mid-morning break	
11.15-11.30	Marco Cacciari	Palaeoclimate teleconnections encompassing a mountain range: a case study from the Holocene of the Arno and Po delta plains (northern-central Italy)	Paleoenvironmental reconstructions Gaia Crippa
11.30-11.45	Donata Violanti	Presenza di <i>Amphistegina lessonii</i> d'Orbigny, 1826 nel "Tirreniano" (Tarentino, Pleistocene superiore) dell'isola di Favignana (Arcipelago delle Egadi, Sicilia).	
11.45-12.00	Leonardo Sorbelli	New results on the Early Pleistocene site of Ellera di Corciano (Italy)	
12.00-12.15	David Scaccia	Palaeoenvironmental evolution of the late Middle-Late Pleistocene Marano Equo Basin (Latium, central Apennines)	
12.15-12.30	Lisa Carrera	Palaeoenvironmental frame and landscape transitions during the Mid-Late Pleistocene inferred from the avian fossil assemblage of Grotta del Cavallo (Apulia, Southern Italy)	
12.30-12.45	Antonino Briguglio	Bartonian coastlines along the westernmost sector of Liguria: palaeoenvironmental interpretation with insights into the Middle Eocene Climatic Optimum (MECO)	
12.45-14.00		Lunch	
14.00-14.15	Edoardo Perri	Mineralization processes of organic matter in microbial communities: role of bacteria, extracellular polymeric substance and viruses	Biom mineralization and microstructure
14.15-14.30	Giulia Bosio	Ultrastructure, composition, and ⁸⁷ Sr/ ⁸⁶ Sr dating of shark teeth from early Miocene sediments of southwestern Peru	

14.30-14.45	Rossana Sanfilippo	Tube structure and taphonomic features of fossil cirratulids from the East Pisco Basin (Southern Peru)	Alessandro Cheli & Daniele Scarponi
14.45-15.00	Valentina Bracchi	Le ultrastrutture della parete cellulare in <i>Lithothamnion corallioides</i> : un segnale del controllo biologico della mineralizzazione?	
15.00-15.15	Martina Savioli	Bioapatite diagenesis and fossilization	
15.15-15.20	Giulia Piazza	An empirical study of the B/Ca proxy in calcareous red algae	Cross disciplinary (Blitz) Lisa Carrera & Veronica Rossi
15.20-15.25	Sahale Casebolt	Conservation Paleobiology Research Coordination Network	
15.25-15.30	Carmen Argenio	Ocean surface dynamic reconstruction at IODP Site U1313 since the Last Glacial Maximum	
15.30-15.35	Jacopo Amalfitano	Taxonomy and paleobiology of the Late Cretaceous shark <i>Cretodus crassidens</i> (Elasmobranchii; Lamniformes)	
15.35-15.40	Giulia Barbieri	The microfossil record of Holocene millennial-scale ecosystems shifts in a microtidal coastal system from the Po coastal plain	
15.40-15.45	Veronica Rossi	Benthic foraminiferal characterization of Holocene Prodelta successions from the Mediterranean record: Biotic and stratigraphic implications	
15.45-15.50	Samanta Trotta	Focus on sea surface water characteristics in the Gulf of Cadiz during Early Pleistocene: evidence from coccolithophores	
15.50-15.55	Andrea Panebianco	Analisi dei resti avifaunistici provenienti dai livelli Epigravettiani del sito di Riparo Tagliente (Stallavena di Grezzana, Verona)	
15.55-16.00	Alexander Wagensommer	Conservazione e valorizzazione delle collezioni storiche: la collezione paleontologica "Georg Gasser"	
16.00-16.05	Alessandro Cheli	Exploring shell variations dynamics of the bivalve <i>Chamelea gallina</i> on a millennial temporal scale: from the Holocene sub-fossil record to modern thanatocoenoses of the Northern Adriatic Sea	
16.05-16.35		Mid-afternoon break/Question time Blitz session	
16.35-16.50	Filomena Ornella Amore	Geo-paleontological heritage and regional planning as drivers of territorial challenges	Paleontological heritage Federico Fanti
16.50-17.05	Raffaele Sardella	Re-restoring bones: a new look at the Pleistocene large mammals stored at MUST Sapienza, University of Rome	
17.05-17.20	Fabio Bona	La paleontologia e la divulgazione nel XXI secolo: la Caverna Generosa e il progetto di Realtà Aumentata	
17.20-17.35	Stefano Claudio Vaiani	From <i>Ammonite</i> to <i>Ammonia</i> : an exhibition to celebrate the unique micropaleontological legacy of the Giovanni Capellini Geological Museum (University of Bologna, Italy)	
17.35-17.50	Enrico Sacco	Geothematic map and ichnological study of the Altamura dinosaur tracksite (early Campanian; Apulia, southern Italy)	
17.50-18.05	Luca Pandolfi	Rhinocerotidae from the lower Miocene of the Negev (Israel) and implications for the dispersal of early Neogene rhinoceroses	Paleobiogeography Lucia Angiolini & Daniele Scarponi
18.05-18.20	Andrea di Cencio	First record of the chitinophosphatic brachiopod <i>Glottidia</i> from the Mediterranean Basin, with some notes on the Neogene palaeobiogeography of lingulides	
18.20-18.30		Final remarks	

Thursday June 17, 2021		
Time	Title	Chair
10.00-12.00	Assemblea Annuale della Società Paleontologica , via ZOOM (link di partecipazione sarà inviato alla mailing list soci SPI)	Lucia Angiolini
12.00-12.45	Assemblea straordinaria modifiche Statuto SPI via ZOOM (link di partecipazione sarà inviato alla mailing list soci SPI)	Lucia Angiolini

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RIASSUNTI / ABSTRACTS

Comunicazioni orali

CONSERVATION PALEOBIOLOGY UNCOVERS MASSIVE BIODIVERSITY LOSS IN THE EASTERN MEDITERRANEAN

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Conservation paleobiology is an emerging discipline that provides high-resolution records of ecosystem change and variation spanning the whole of human history, enabling the reconstruction of ecological baselines and the trajectories of ecosystem states on timescales well beyond the limits of ecological monitoring. Indeed, there is now consensus amongst conservation biologists that to give proper context to modern day conditions we must include historical perspectives.

The eastern Mediterranean ecosystem is under multiple pressures such as biological invasions due to the opening of the Suez Canal, nutrient and sediment flow modification due to the damming of the Nile, resource extraction, pollution and accelerating anthropogenic climate warming. However, ecological monitoring has occurred only since the second half of the 20th century with many areas severely underexplored. Climate warming is causing the poleward shift of species distributions. In the Mediterranean Sea, this implies the northward retreat of their southern edges. This semi-enclosed basin, however, is not in natural contact with a suitable pool from which thermophilic species could replace the disappearing ones. The result is a net diversity loss, which cannot be quantified in the absence of baselines. We reconstructed such baselines on the Israeli shelf from shelly death assemblages and dated them with radiocarbon to put our results in a temporal context. We recorded only 12% and 5% of historically present native species on shallow subtidal soft and hard substrates, respectively. This is the largest documented climate-driven regional-scale diversity loss in the oceans. In contrast, assemblages in the intertidal, more tolerant to climatic extremes, and in the cooler mesophotic zone show ~50% of the historical native richness. Importantly, ~60% of the recorded shallow subtidal native species do not reach reproductive size, making the shallow shelf a demographic sink. The Suez Canal established an artificial connection between the Mediterranean and the Red Sea thermophilic species pool. These tropical non-indigenous species thrive in the Mediterranean, where they encounter environmental conditions not dissimilar from those in their native distribution, and counteract in terms of net diversity the collapse of native species. As the climate continues to warm, the native biodiversity collapse described here will intensify and expand geographically and local communities will become more and more dominated by Indo-Pacific species. These restructured assemblages, shaped by climate warming and biological invasions, are giving rise to a ‘novel ecosystem’ whose restoration to historical baselines is not achievable.

**TAXONOMY AND PALEOBIOLOGY OF THE LATE CRETACEOUS SHARK
CRETODUS CRASSIDENS (ELASMOBRANCHII; LAMNIFORMES)**

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Like many other extinct chondrichthyans, the shark *Cretodus* Sokolov, 1965, was primarily based on isolated teeth coming from ‘mid’ Cretaceous marine deposits worldwide (Cappetta, 2012). The genus includes five species: *C. semiplicatus*, *C. crassidens*, *C. longiplicatus*, *C. gigantea* and *C. houghtonorum*. *C. houghtonorum* is the only species originally based on a partial articulated skeleton. Here we discuss the specific attribution of another partial articulated skeleton of *Cretodus* from the Turonian of NE Italy, already described by Amalfitano et al. (2017), and some associated and poorly described *Cretodus* tooth sets from the Turonian of England. The Italian skeleton is remarkable, being associated with a pellet-like accumulation of turtle bones alongside the vertebral column of the shark, which was interpreted as the gastric content of the shark (Amalfitano et al., 2017). This specimen is known since 1997 and was attributed to *Cretodus* in a first draft of its description in 2015 evidencing strong affinities with *C. crassidens*. Amalfitano et al. (2017) later prudently attributed the specimen to *Cretodus* sp. focusing the attention only on the fossil association with the turtle remains. Shimada & Everhart (2019), describing the new species *C. houghtonorum* discussed the differences with other species and key specimens of the genus, proposing to attribute the Italian skeleton to *C. crassidens* (Dixon, 1850). The taxonomic attribution to *C. crassidens* is here finally confirmed and expanded. Some pathologies are identified and described in the tooth set. Further paleobiological remarks are discussed, such as body size, overall morphology and correlated paleoecology, age estimate and growth model.

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GEO-PALEONTOLOGICAL HERITAGE AND REGIONAL PLANNING AS DRIVERS OF TERRITORIAL CHALLENGES

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This work promotes and exploits the relation between geo-paleontological heritage and regional planning, highlighting that the knowledge of this heritage can act as a driver for the promotion of sustainable tourism and for the development of Italian marginal territories. The fossils are a key tool for understanding the evolution of our planet, but that still fails to obtain adequate attention. Numerous researches of previous decades have focused on the relevance of the geo-paleontological heritage (Amore et al., 2001; Ruggiero et al., 2003; Coccioni 2009; Amore & Ciarcia, 2016; Fistola et al., 2020; Santangelo & Valente, 2020). In 2000, the European Geopark Network (EGN) was founded underlining that the role of geological heritage can be significant to provide an economically sustainable future for the territory as a whole. In this regard, the responsibility to share and to safeguard this heritage must be a cultural target. Nevertheless, the scientific literature struggles to affirm new approaches based on a holistic vision to consider the revitalization processes as the integration of the territorial system. In this lack, the social, economic, and scientific dimensions of Earth Sciences are poorly appreciated outside protected areas. According to that, the principal goal of this study consists of individuating planning actions and responsibility levels that must be involved in a global design aimed at promoting these territorial areas and making them accessible to a wider range of users, both local (residents, students, administration, stakeholders) as well as external (tourists). To this end, integrated actions for the usability of these sites have to be activated at different levels: theoretical, policies, and promotional level. This study, basing on the conviction that the promotion of an integrated and shared knowledge allow to activate a real transition from a passive to an active use of these fragile and yet notable sites, set up the project of new use dealing with the startup of activities with experiential connotations, able to propose the story-telling of the formation of the site through the use of scientific videos and augmented and mixed reality. These activities are expected to encourage forms of sustainable and slow tourism by promoting historical routes and local economies (Papa & La Rocca, 2017). The interaction between geo-paleontological knowledge with territorial planning parameters contributes to the definition of innovative approaches to the use of paleontological heritage. In this vision the territorial context as a whole plays an active role contributing to the definition of strategies for development and it allows to transform the geo-paleontological site from an “island” into a “local magnet”, able of attracting external attention, activating positive effects on local economies, on the diffusion of scientific knowledge of specific cultural places, on the definition of integrated regional planning processes.

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A THEROPOD-DOMINATED ICHNOASSEMBLAGE FROM THE MOLFETTA DINOSAUR TRACKSITE (EARLY CRETACEOUS; APULIA, SOUTHERN ITALY)

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The track-bearing surface of the San Leonardo quarry (Molfetta, Apulia), late Aptian-early Albian in age, is characterised by more than 800 footprints, produced by both quadrupedal and bipedal dinosaurs. The tracksite has recently been the subject of an accurate mapping by using aerial-based photogrammetry (Petti et al., 2018). Six well-preserved bipedal trackways, composed by tridactyl footprints, are easily recognisable; they are attributed to medium- and large-sized theropod dinosaurs, as are at least other two clear isolated tracks. Only one clear but poorly preserved trackway and numerous isolated manus-pes couples have been attributed to quadrupedal dinosaurs. More than 20 tridactyl tracks, 8 isolated manus-pes sets and the whole quadrupedal trackway have been modelled by using close-range photogrammetry. The tridactyl ichnoassemblage is represented by large-sized, weakly mesaxonic (i.e., with low prominence of digit III in relation to digits II–IV) and robust tracks. The clear digital pad impressions on each digit reveal the typical phalangeal formula of theropods. Morphological comparison with Late Jurassic and Early Cretaceous theropod tracks from surrounding areas, supported by morphometric analyses, points out a highest affinity with the specimens from North Africa. Nevertheless, a set of unique characters appears to justify the establishment of a new ichnotaxon for the tridactyl tracks. They can be referred to as a theropod whose body length reaches about 6 m. The trackmaker's autopodium, reconstructed on the basis of characters identifiable on the 3D models, allows a reliable osteological match with the known hindlimbs of coeval theropods. The preliminary results (e.g., cluster analysis, PCA) suggest basal carcharodontosaurids as the most suitable trackmaker of the Molfetta tridactyl tracks. Additionally, the photogrammetric models of the quadrupedal trackway and four isolated manus pes sets suggest they belong to the same morphotype: pes is tetradactyl, wider than long and asymmetrical, with digits II and III forward oriented and digits I and IV slightly laterally directed; the highly digitigrade manus, tetra- or pentadactyl, also displays a similar pattern. These tracks share numerous morphological characters with both the ichnogenera *Tetrapodosaurus* and *Metatetrapodus*, and thus can possibly be attributed to a medium-sized ankylosaurian trackmaker.

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OCEAN SURFACE DYNAMIC RECONSTRUCTION AT IODP SITE U1313 SINCE THE LAST GLACIAL MAXIMUM

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The dramatic climate transitions that took place on Earth starting from the Last Glacial Maximum (LGM) are well recorded in the marine sedimentary sequences of the North Atlantic. In particular, many important advances in paleoceanography have been focused in this area since it is influenced by the northern part of the Atlantic Meridional Overturning Circulation, and thus it is a reference region for its response to the global climate variations. This study focuses on the reconstruction of global changes that occurred from the LGM to the Holocene (~25-6 kyr) in the North Atlantic and in detail at the Integrated Ocean Drilling Program (IODP) Site U1313 (41.00°N; 32.57°W). The climate variability interpretation at this site was achieved with high resolution paleoceanographic and paleoclimatic analyses focused on changes in coccolithophore structure assemblages. Coccolithophores, haptophyte algae living in the photic zone, are considered an excellent proxy to investigate paleoceanographic and paleoclimatic changes as well as the surface paleoproductivity fluctuations because of their biogeographic distributions and abundances as consequence of environmental changes (e.g., Abrantes and Moita, 1999; Flores and Sierro, 1997; Amore et al., 2012; Emanuele et al., 2015). The Site U1313 is located at the base of the upper western flank of the Mid-Atlantic Ridge in a water depth of 3426 m, ~240 miles northwest of the Azores Islands (Expedition 306 Scientists, 2006). Today, the Site is influenced by the surface waters of the North Atlantic Current (NAC) (Fratantoni, 2001; Naafs et al., 2013) and, at a water depth of 3426 m, by the North Atlantic Deep Water (NADW). The NAC flows from west to east into the North Atlantic and forms a transitional zone between the subpolar Front (Krauss, 1986), at north, and the North Atlantic Transitional Waters (NATW), at south. Furthermore, the region is characterised by high eddy activity favouring surface water productivity. The age model for the Site U1313 was calculated following Lang et al. (2016). Samples analysed for this study belong to holes C and D. For quantitative analyses, a minimum of 500 coccoliths have been counted per slide in different number of visual fields using a polarizing microscope at 1000x magnification. This allowed us to reach a 95% level of confidence for all species present in at least 1% abundance. Absolute abundances (coccoliths per gram of sediment) and nannofossil accumulation rates (NAR; coccoliths cm⁻² ka⁻¹) were estimated following Flores and Sierro (1997). Results highlight high values of the total NAR until ~17 ka which, together with paleoproductivity proxies and cold and warm water proxies have been used to provide the paleoceanographic reconstruction of sea-surface dynamics mainly related to variations of the NAC and NATW over the area.

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AN OVERVIEW OF THE AFRICAN FOSSIL RECORD OF *HYSTRIX MAKAPANENSIS* (MAMMALIA, RODENTIA)

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The rodent family Hystricidae includes three extant genera (*Atherurus*, *Trichys* and *Hystrix*) and eleven species, ranging from Asia to Africa, and to Italy. This family probably originated in Asia and dispersed in Europe and Africa from the middle-late Miocene. Several fossil species are reported from the middle Miocene to the early Holocene. Five species of the subfamily Hystricinae occurred in Africa in the late Pliocene and Pleistocene: the extinct *Hystrix leakeyi*, *Hystrix makapanensis*, and *Xenohystrix crassidens* and the still living *Hystrix africae australis* and *Hystrix cristata*. Among them, *H. leakeyi* from the late Pliocene of Laetoli (Tanzania) is the smallest species, followed by the similar-sized *H. africae australis* (reported at least since the late Pliocene of south-eastern Africa) and *H. cristata* (also reported since the late Pliocene of northern Africa and sub-Saharan Africa). The medium-sized *H. makapanensis* occurred in the latest Pliocene–Early Pleistocene in a wide geographical area ranging from East to South Africa. The “giant porcupine” *X. crassidens* had a distribution almost overlapping that of *H. makapanensis*, but occurred earlier (late Miocene–Pliocene). Although the overall morphology of the cheek teeth of these species is highly conservative (as in all porcupines), they exhibit a number of diagnostic characters which are useful for taxonomic purposes. For instance, *X. crassidens* can be distinguished from *Hystrix* for its relatively brachyodont cheek teeth with very “simple” occlusal pattern. Moreover, *H. makapanensis* differs from other *Hystrix* species in the robustness of the mandible and in the morphology of the lower fourth premolar: massive and squared with well-developed hypostriid and posterior mesostriid (that crosses the entire crown height). In this work, we describe a new porcupine mandible from the world-renowned paleontological and archaeological site of Olduvai Gorge (northern Tanzania). The specimen was collected in September 2015 by the THOR (Tanzanian Human Origins Research) team near Bed II surface (~1.8 Ma) at HWK West archaeological site (Geolocality 44). The morphological and biometric analysis of the specimen allows referral to *H. makapanensis*. The discovery of the new mandible triggered a comprehensive review of the entire hypodigm of *H. makapanensis*. In particular, we analyse all the South African (Makapansgat, Gondolin, Kromdraai, Swartkrans and Sterkfontein), Tanzanian (Olduvai and Laetoli), Ethiopian (Omo) and Kenyan (Koobi Fora) remains confidently referable to this species, and we propose an emended diagnosis that will serve as the basis for future systematic studies on African porcupines.

THE MICROFOSSIL RECORD OF HOLOCENE MILLENNIAL-SCALE ECOSYSTEMS SHIFTS IN A MICROTIDAL COASTAL SYSTEM FROM THE PO COASTAL PLAIN

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Microfossils are considered valuable indicators of past environmental changes, thanks to their sensitivity to ecological perturbations. Specifically, the abundance and complementary distribution of benthic foraminifers and ostracods from freshwater to marine settings make them excellent ecological indicators in a suite of aquatic habitats, including coastal ecosystems posed at risk by allogenic and autogenic forcings. In this context, the Holocene succession of the Po coastal plain (NE Italy) represents a valuable archive where microfossils can shed light on past ecosystem dynamics in relationship with major changes in Relative Sea Level, climate or river processes. We analyzed the paleobiological record (benthic foraminifers, ostracods and palynomorphs) of three cores located along a 35 km transect typifying a Holocene microtidal coastal ecosystem. Multivariate elaborations on microfossil groups and the combination with stratigraphic and chronologic data allowed to identify four main tipping points of paleoecological changes recorded throughout the study area. In response to the accelerating sea level rise at 8.2 kcal yr BP, low accumulation rates on the shelf and low confinement associated to high hydrodynamic regime in transitional settings are indicated by benthic foraminifers and ostracods, whereas pollens record an intense peatland growth inland. Then, benthic foraminifers record the shift towards increasing organic matter concentrations in the marine sector, linked to the incipient riverine inputs at the onset of highstand conditions ca. 7.0 kcal yr BP. In the transitional and inland sectors, microfossils indicate the persistence of a tidally-influenced bay surrounded by peatlands connected to the climate optimum stability. In correspondence to the third tipping point at 4.8 kcal yr BP, ostracods testify the closure of the bay and pollens indicate the development of a wooded peatland landward, as response to the increased sediment input connected to major climate variability. All the microfossil groups responded to the Ficarolo avulsion occurred at 0.8 kcal yr BP: benthic foraminifers and ostracods record water depth decrease in the marine realm, associated to flooding events and high disturbance landward as indicated by ostracods and pollens. This study reveals the powerfulness of an integrated paleobiological approach from continental to marine realms within a highly variable Holocene microtidal ecosystem. Benthic foraminifer assemblages reveal changes in organic matter and degree of confinement, whereas ostracods track shifts in water depth and salinity in the shelf and back-barrier sectors, respectively. Landward, palynomorphs trace environmental disturbance linked to oscillating water table and river regime.

QUANDO UN “TIPO” È DEFORMATO: APPLICAZIONI DI PALEONTOLOGIA VIRTUALE COME NUOVE POSSIBILITÀ PER LA RICERCA E LA “TERZA MISSIONE”

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I processi tafonomici e diagenetici tendono a modificare i resti di organismi depositati anche durante la fossilizzazione, sia in modo fragile (fratturazioni, ecc.) che plastico (compressioni, distorsioni, ecc.). Di fatto, resti che già dopo i processi biostratinomici si trovano incompleti e sparsi rischiano di subire importanti modificazioni delle loro morfologie, che vanno ad aggiungersi, a mascherare o perfino a cancellare la naturale variabilità intraspecifica di quell'organismo fossile studiato, complicando le interpretazioni possibili per quel taxon. Recentemente è stata sviluppata una nuova metodologia di retrodeformazione di fossili diageneticamente deformati, chiamata “Target deformation”. Questo protocollo virtuale combina morfometria geometrica e modelli 3D. Una volta ottenuti modelli 3D dei campioni presi in esame tramite scansioni tridimensionali ad alta risoluzione, questo protocollo di retrodeformazione prevede l'utilizzo di un campione non deformato della stessa specie esaminata (un target, appunto) sul quale vengono presi dei landmark di riferimento che serviranno a guidare la retrodeformazione. Tale tecnica si presenta di particolare rilievo quando si prendono in considerazione specie i cui esemplari tipo siano particolarmente deformati e le cui morfologie, per quanto rilevanti scientificamente, siano oscure. Presentiamo qui i risultati preliminari della retrodeformazione di due esemplari tipo di alcuni carnivori iconici del Pleistocene inferiore italiano e europeo *Canis arnensis* Del Campana, 1913 e *Homotherium nestianum* Fabbrini, 1890 (= *H. latidens*). Questi due campioni sono contenuti all'interno delle collezioni del Museo di Storia Naturale di Firenze e sono entrambi stati raccolti intorno alla fine dell'800 nel Valdarno Superiore. Nonostante siano stati effettivamente selezionati come materiale tipo di queste specie entrambi presentano un alto grado di deformazione, in particolare in senso laterolaterale. I risultati preliminari di queste applicazioni forniscono dati nuovi e preziosi che potranno servire come base per future analisi volte a chiarire l'evoluzione e gli adattamenti di questi carnivori fossili. Infine, la potenzialità comunicativa di queste metodologie virtuali è tale da costituire un prezioso elemento in vari contesti educativi-divulgativi.

IF THE UNIVERSE IS TEEMING WITH LIFE... WHERE ARE THE MARTIAN ICHNOFOSSILS? APPLICATION OF PALAEOONTOLOGICAL PREDICTIVE MODELLING FOR THE SEARCH OF EXTRATERRESTRIAL LIFE

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Seeking signs of past life (biosignatures) in the geological record of Mars is one of the primary goals of the NASA Mars 2020 mission. To this aim, the Perseverance rover landed on February 18th, 2021 on Jezero Crater, an impact crater that is located in the NE region of Mars. The resolution of the Perseverance tools allows imaging of potential products of life-substrate interactions, such as burrows, borings, trails, stromatolites and microbial-induced sedimentary structures (MISS). Nevertheless, their study (ichnology) received little attention in the context of the Mars 2020 mission. This is surprising because ichnofossils are among the most abundant signatures of life on Earth, therefore, they may provide evidence of potential life that may have existed on Mars. The goal of this study is to evaluate the suitability of the Mars 2020 Landing Site for ichnofossils. Accordingly, we apply palaeontological predictive modelling, a technique used to forecast the location of fossil sites in uninvestigated areas on Earth. A geographic information system (GIS) of the landing site is developed. Each layer of the GIS maps the suitability for one or more ichnofossil types (bioturbation, bioerosion, biostratification structures) based on an assessment of a suitability factor of the Martian environment. Suitability criteria have been selected among the environmental attributes that control ichnofossil abundance and preservation in 18 reference sites on Earth, including Penha Garcia (Ordovician, Portugal), Bayanzag (Cretaceous, Mongolia), and the Ventimiglia Delta (Pliocene, Italy). Three predictive maps are delivered. These show which areas of the Mars 2020 Landing Site are more likely to preserve ichnofossils if any. Based on these maps, it is identified an ichnological strategy for the Perseverance rover, indicating (1) 10 sites on Mars with high suitability for bioturbation, bioerosion and biostratification ichnofossils, (2) the ichnofossil types, if any, that are more likely to be present at each site, (3) the most efficient observation strategy for detecting eventual ichnofossils. The predictive maps and the ichnological strategy can be easily integrated into the existing plans for the exploration of the Jezero crater, realizing benefits in life-search efficiency and cost- reduction.

**A *PSEUDORCA*-LIKE DOLPHIN FROM THE PLEISTOCENE OF RHODES
(GREECE): TOWARD THE ESTABLISHMENT OF THE EXTANT
DELPHINID STOCK (CETACEA, ODONTOCETI)**

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Oceanic dolphins (family Delphinidae) are the most speciose group of extant cetaceans, being represented by 19 genera and at least 37 species. Their high diversity correlates with a significant disparity that is clearly evident when considering their wide ranging in body size values (from 1.5 m up to 9 m total body length) and the shape of their skull and teeth. Variability of these characters is mainly due to the different trophic strategies carried out by dolphins, namely, suction, raptorial feeding, and grip-and-tear. Furthermore, dolphins are found throughout fluvial, coastal and open-sea environments, sometimes diving at great depths to feed. Molecular data suggest that the remarkable present-day diversity of delphinids is due to a very fast radiation that would have occurred in rather recent times, i.e., during the Pliocene and Pleistocene epochs. The fossil record of delphinids supports these molecular inferences. Indeed, most of the Pliocene delphinids were referred to extinct genera, and consequently, the rise of the modern delphinid stock seems to have occurred during the Quaternary; the latter does unfortunately feature a much fragmentary global record of fossil cetaceans. Here we report on a partial delphinid skeleton from the early Pleistocene clays of the Lindos Formation of Rhodes (Greece). This specimen, kept in the Museum of Mineralogy & Paleontology, Ialisos, Rhodes, consists of an almost complete cranium including the ear bones, both the mandibles, several teeth, a portion of the vertebral column including the atlas, several ribs and the sternum. Pending a more detailed analysis of this significant skeleton, our preliminary observations support a close affinities between the Rhodes dolphin and the extant *Pseudorca crassidens*, the so-called false killer whale, a large delphinid today reported as a visitor in the Mediterranean Sea. Indeed, the cranium of the Rhodes dolphin shares with *P. crassidens* i) a wide rostrum having most of its dorsal surface covered by the transversely wide premaxillae, ii) a dorsoventrally narrow supraorbital process, and iii) broadly similar ear bones. Moreover, similarly to *P. crassidens*, the Rhodes dolphin exhibits very large and cylindrical teeth and a small tooth count (nine teeth are present on each mandible). Interestingly, *Pseudorca crassidens* and the *Orcinus orca* (killer whale) are the two only extant cetaceans that feed via grip-and-tear, and they have an important role as macropredators in the modern marine trophic chains. This new discovery represents a crucial step for better understanding the last phases of the explosive radiation of oceanic dolphins as well as the establishment of the present-day marine ecosystems.

NEW DATA ABOUT CETACEAN PALEONEUROLOGY

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Cetaceans include the most encephalized mammals with the exclusion of mankind. The fossil record can help reconstructing aspects of cetacean brain evolution by means of natural endocasts and non-invasive analyses of fossil skulls. New data are presented about specimens from north-west Italy. These include a natural endocast of an early Miocene odontocete and the first virtual endocast of a Pliocene balaenopterid whale. In addition, new data from Miocene mysticetes from Belgium are reported showing the diversity of paleoneurological patterns evolved throughout mysticete evolution. This new information adds a wealth of new data about the patterns of variation of neurovascular characters such as paths and relative development of major endocranial vessels, relative size of brain, morphological variation of cerebral and cerebellar structures, filling in part a major gap about our understanding of cetacean brain evolution.

LA PALEONTOLOGIA E LA DIVULGAZIONE NEL XXI SECOLO: LA CAVERNA GENEROSA E IL PROGETTO DI REALTÀ AUMENTATA

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Il Turismo - Fin dal 1999, e quasi continuativamente per oltre venti anni, la Caverna Generosa, durante i mesi estivi, è stata aperta al pubblico con visite guidate. Il sostegno economico e il supporto logistico della Ferrovia Montegeneroso SA, del Comune di San Fedele Intelvi (oggi Centrovale Intelvi) e la Comunità Montana Lario-Intelvele hanno favorito il proseguimento ed il successo di questa attività per tutti questi anni. Oggi, nell’ambito di un progetto finanziato da INTERREG VA “SCOPRI” (al quale hanno partecipato per la parte svizzera il SUPSI e Mendrisiotto Turismo e per la parte italiana, oltre ad UniMI, il comune di Centrovale Intelvi e la Comunità Montana Lario-Intelvele), la Caverna Generosa si rinnova e diventa più sicura, affascinante e “tecnologica”. Oltre a diverse opere che permettono un agevole accesso alla grotta (tra cui un nuovo e sofisticato impianto di illuminazione), cambia anche il modo di divulgare la scienza: oltre alla visita guidata di tipo tradizionale sono stati predisposti per i visitatori degli occhialini a Realtà Aumentata che permetteranno una visita immersiva tra orsi, uomini di Neandertal ed altri contenuti mediatici molto suggestivi. Questo permetterà di rendere l’esperienza della visita ancora più spettacolare (a partire dalla prossima estate), mantenendo tuttavia un alto livello di comunicazione scientifica. **La grotta** - La Caverna Generosa (LO CO 2694) si apre sul versante orientale del Monte Generoso, in provincia di Como a pochi passi dal confine con la Svizzera. La Caverna Generosa è costituita da un cunicolo iniziale, lungo circa 25 metri, per mezzo del quale si accede ad una prima sala (denominata “Saletta”) dalla quale, attraverso un sifone, si passa in una sala più ampia (denominata “Sala Terminale”). **Gli scavi** - Il primo studio paleontologico è del 1989, ad opera del prof. Fusco di Unimi su materiale proveniente dalla superficie della “Sala Terminale”. Nel 1991 il prof. Tintori (UniMi) svolge la prima campagna di scavo in “Sala Terminale”, seguita da altre tre campagne (1993, 1994 e 1996). Un’importante svolta è avvenuta nel 1998 quando è stato realizzato lo scavo dei primi 40 metri di cunicolo per ampliare il passaggio ai fini dell’organizzazione di visite turistiche. L’ampliamento del cunicolo ha permesso un facile accesso alla grotta favorendone la continuità di intervento, anche scientifico, che dura ancora oggi. **Gli studi** - Gli scavi hanno permesso il recupero di migliaia di resti fossili databili ad un intervallo cronologico che copre buona parte del Pleistocene Superiore ed Olocene, definendone i cambiamenti paleoambientali e paleoclimatici. I fossili consistono, per lo più, di resti di macro e micromammiferi, dove l’orso delle caverne (*Ursus spelaeus*) è dominante. Molto importante è stato il rinvenimento di 9 schegge di selce musteriane opera dell’uomo di Neanderthal (*Homo neanderthalensis*) che testimoniano la frequentazione dell’area anche da parte di questa specie estinta di ominini.

REEF DEVELOPMENT AND CORAL DIVERSITY ARE POSITIVELY CORRELATED DURING THE LATE OLIGOCENE WARMING (CASTRO LIMESTONE, SALENTO PENINSULA, S ITALY)

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The Cenozoic record of coral reefs shows that high coral diversity is not strictly necessary for the growth and persistence of coral reefs and the Oligocene, well known as the apex of Cenozoic reef growth, is a crucial period of time to investigate the mutual relationship between these pivotal features and their link with palaeoclimate and palaeoenvironmental changes. Herein we provide a complete characterization of the upper Oligocene reef complex of the Castro Limestone (Salento Peninsula, S Italy), which is one of the best-preserved Oligocene coral reefs of the Mediterranean region. We combine facies analysis with results from taxonomic identification of coral collections at the genus and species level and from quantitative data obtained directly in the field. We show that the Castro Limestone has both a rich scleractinian coral fauna (25 genera and 41 species) and a large reef volume, and represents a luxuriant fringing reef formed within the euphotic zone in clear water conditions facing the open sea. The coral fauna differs both in its composition and in its proportions among reef palaeoenvironments, ranging from the shallow back reef to the fore-reef slope, and its stratigraphic and palaeogeographic distribution testifies to the persistence of a cosmopolitan Tethyan fauna in Oligocene time, with the Mediterranean and Indo-Pacific provinces being more closely connected than the Mediterranean and the Caribbean. The age of the Castro Limestone is here reassigned to the middle-late Chattian, which coincides with the Late Oligocene Warming (LOW) when atmospheric CO₂ values declined. We suggest that the strong reef-building capacity of the Castro Limestone, coupled with high coral diversity, was not hampered by warming conditions but most probably promoted by the reduced *p*CO₂ and a suitable local/regional physiographic setting. This study was funded by the Italian Ministry of Education and Research (MIUR), funds PRIN 2017: project “Biota resilience to global change: biomineralization of planktic and benthic calcifiers in the past, present and future” (prot. 2017RX9XXY).

ULTRASTRUCTURE, COMPOSITION, AND $^{87}\text{Sr}/^{86}\text{Sr}$ DATING OF SHARK TEETH FROM EARLY MIOCENE SEDIMENTS OF SOUTHWESTERN PERU

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As other marine minerals, phosphates - and in particular bioapatite - incorporate Sr from seawater during formation (Staudigel et al., 1985). Due to long-term variations in the relative abundance of Sr isotopes in the global ocean, $^{87}\text{Sr}/^{86}\text{Sr}$ values can be measured in minerals and compared to calibration curves for obtaining age estimates via Strontium Isotope Stratigraphy (SIS) (McArthur et al., 2020). Although hydroxyapatite is susceptible to alteration and Sr concentration in fish teeth can change during burial and diagenesis (Martin & Scher, 2004), fossil shark teeth have been successfully used for Sr-dating, especially when enameloid is analyzed (Schmitz et al., 1997; Harrell et al., 2016). In order to test the feasibility of this method in the fish tooth-rich marine sediments of the East Pisco Basin (Peru), and aiming to date some poorly-constrained strata of this region, we analyzed the ultrastructure and composition of fossil shark teeth from the Chilcatay Formation. This Miocene formation consists of massive sandstones and basement boulders overlain by bioclastic sandstones and diatomaceous and tuffaceous siltstones (Di Celma et al., 2019). It is characterized by an abundant marine vertebrate assemblage, among which elasmobranchs are present (Landini et al., 2019). Teeth of *Isurus* sp., *Cosmopolitodus hastalis*, *Isurus oxyrinchus*, *Megalolamna paradoxodon* and *Physogaleus contortus* were collected from Chilcatay beds at the localities of Zamaca, Media Luna and near Cerro Colorado. Teeth were investigated through an optical microscopy and SEM. After taphonomic observations, 11 teeth underwent ICP-OES and $^{87}\text{Sr}/^{86}\text{Sr}$ analyses. Shark teeth show a compact and non-porous outer enameloid layer that is distinctly separated from the more porous and heterogeneous inner core of dentine. Ultrastructure analysis shows that the enameloid is formed by highly-ordered bundles of fluoroapatite crystallites, which are often well-preserved, whereas the dentine displays a bone-like structure showing tubuli and crystalline artefacts from diagenesis (Lübke et al., 2015). SEM-EDS mapping shows differences in distribution of Ca, P, F, and S in the enameloid and dentine, and the shiny layer is compositionally recognizable (Enax et al., 2014). ICP-OES data show Sr contents that are comparable to those of recent lamniform teeth. $^{87}\text{Sr}/^{86}\text{Sr}$ results compared to the LOESS 6 calibrated on GTS2020 (McArthur et al., 2020) give ages between 19 and 18 Ma for the Chilcatay strata at the Ica Valley localities, in agreement with radioisotopic and biostratigraphic ages (Bosio et al., 2020). At Media Luna, a locality 25 km to the west of the Rio Ica, the Chilcatay strata have here been dated for the first time, resulting in a slightly older age ranging between 22 and 20 Ma. Not least, these results strengthen the notion that the Sr-ratio of shark teeth can be successfully used for obtaining reliable age estimates through SIS.

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LE ULTRASTRUTTURE DELLA PARETE CELLULARE IN *LITHOTHAMNION CORALLIOIDES*: UN SEGNALE DEL CONTROLLO BIOLOGICO DELLA MINERALIZZAZIONE?

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Le alghe calcaree sono importanti organismi calcificanti biocostruttori di fondi mobili (rodoliti) e duri diffuse in tutto il Cenozoico. Tra le rodoliti, il morfotipo a rami liberi (*maerl*) è presente sia in Atlantico che in Mediterraneo. *Lithothamnion corallioides* è una delle specie più abbondanti e diffuse nel *maerl*, tra 28°N e 58°N (Irvine and Chamberlain, 1994). Essa forma strutture ramificate, di colore da marrone a viola, spesso sterili, con diametro dei rami compreso tra 1-2 mm, e con apice a forma di pomello (Irvine and Chamberlain, 1994). In sezione longitudinale, i rami di *L. corallioides* mostrano un'alternanza di bande più chiare, legate allo sviluppo di cellule più allungate, e bande più scure, caratterizzate da cellule più tozze. Il *banding* è stato interpretato come la risposta della crescita variabile stagionale (Halfar et al., 2000), ma anche come l'alternanza tra cellule con ultrastrutture mineralizzate della parete differenti (Nash et al. 2019). Le pareti cellulari mostrano solitamente uno strato esterno con calcite aciculare tangenziale al plasmalemma, e uno più interno con calcite aciculare radiale (Giraud and Cabioch, 1976). La forma dei cristalli è stata interpretata come espressione fenotipica del genotipo, con risultati incoraggianti a livello di famiglia (Auer and Piller, 2020). Per valutare se le ultrastrutture subiscono modificazioni morfologiche nei diversi ambienti di vita della specie e a tassi di crescita diversi, sono stati studiati sei campioni di *L. corallioides* provenienti dall'Oceano Atlantico e dal Mar Mediterraneo da profondità variabili (12-66 m). A livello macroscopico, i campioni sono tutti morfotipi a ramo di colore bianco-rosa-lilla, lunghezza massima di 3 cm e diametro inferiore a 2,5 mm. Il campione di Morlaix (Francia, 12 m), dove studi genetici sulla biodiversità algale hanno escluso altre specie dello stesso genere (Carro et al. 2014), è stato identificato come *L. corallioides*. Su questo campione sono stati definiti gli elementi ultrastrutturali della parete cellulare, caratterizzata da un doppio strato: la parete primaria, più esterna, con cristalli di forma rettangolare molto allungati e appiattiti, simili ad aciculi tangenziali in sezione longitudinale; la parete secondaria, più interna, costituita da cristalli con forma di mattoncini tozzi e dai bordi arrotondati, solo apparentemente allungati e radiali al plasmalemma in sezione longitudinale. Sia il peritallo che l'epitallo mostra cellule con calcificazione primaria e secondaria con le stesse caratteristiche morfologiche. Il confronto degli altri campioni con questo, basandosi anche sulle ultrastrutture, ha permesso di identificarli come *L. corallioides*. Sebbene siano vissuti in ambienti molto diversi e abbiamo un tasso di crescita differente (Piazza et al., *under review*), le ultrastrutture della parete non subiscono deformazioni, il che permette di sostenere che il processo di mineralizzazione nelle coralline sia biologicamente controllato.

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**BARTONIAN COASTLINES ALONG THE WESTERNMOST SECTOR OF LIGURIA:
PALAEOENVIRONMENTAL INTERPRETATION WITH INSIGHTS INTO THE MIDDLE
EOCENE CLIMATIC OPTIMUM (MECO)**

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The sedimentary succession exposed in the westernmost part of Liguria is characterized by an extensively exposed unconformity where a deep marine globotruncanid-rich mudstone (Trucco Formation) is overlain by Cenozoic nummulitid-rich sediments. The uppermost Cretaceous layers just underneath the unconformity date to the Santonian due to the presence of *Dicarinella concavata*, *D. asymmetrica* and *Sigalia decoratissima*. The Cenozoic sequence ranges from a nummulitid-rich wackestone - packstone (Capo Mortola Formation) to globigerinid-rich marlstone (Olivetta San Michele Formation) and finally ends with a flyschoid unit (Ventimiglia Formation) thus displaying a characteristic deepening-upward sequence. This contribution focuses on the sedimentary conditions that characterized the very first layers above the unconformity, before the first appearance of the nummulitid tests. It seems that a variety of palaeoenvironments can be recognised among the exposures in the region just underneath the first appearance of the larger foraminifera. In some cases, a relatively thick succession (almost 30 meters) is made up by a *Microcodium* limestone followed by mostly sterile sandstones, whereas in other exposures a conglomeratic series is intercalated with well-sorted calcarenites/quartzarenites. In some places the large nummulitids are directly in contact with the Cretaceous substrate, with bioturbations mixing and reworking the material close to the unconformity. In one location only, a thick *Solenomeris* limestone is recorded. This variety of sedimentary conditions is reflected in significant differences in ichnofossil associations. Bioerosional ichnofossils mark the basal unconformity and indicate the colonization of a rocky shore during the earliest transgressive event. The overlying bioturbational ichnoassociations clearly indicate the establishment of softground seafloors. Such differences point to a rather complex coastline system, on one hand with rocky shores (where bioerosion occurred and nummulitid tests rest directly on the unconformity), high-energy shoreface conditions (with conglomerates, arenites and the iconic trace fossil *Nummipera*), or reefal settings with *Solenomeris*-dominated beds. On the other end there were low-energy fluvial to lagoon environments with mostly sterile beds and sporadically a *Microcodium* facies. The transgressive sequence records in its middle part, just below the boundary to the Olivetta San Michele Formation, the Middle Eocene Climatic Optimum (MECO). It has been recognized biostratigraphically by planktonic markers (both foraminifera and calcareous nannoplankton). The influence of this event on the benthic fauna (mostly characterized by abundant *Nummulites perforatus*) has shown similar response in all investigated section thus indicating quite stable and homogeneous environmental condition throughout the region fully established since the lower Bartonian.

**PALAEOCLIMATE TELECONNECTIONS ENCOMPASSING A MOUNTAIN RANGE: A
CASE STUDY FROM THE HOLOCENE OF THE ARNO AND PO DELTA PLAINS
(NORTHERN-CENTRAL ITALY)**

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The Mediterranean area is a vast region where climatic conditions are highly variable mainly because of orographic barriers (i.e., mountain ranges) and atmospheric circulation patterns (e.g., the North Atlantic Oscillation). In this context, the comparison between the palynological records of two delta plains of northern-central Italy can be effective in tracking the complex Holocene palaeoclimatic teleconnections in the central Mediterranean area. In this study two cored successions were analysed and compared focussing on their Holocene portions: core PA1 (Arno delta plain, Tuscany, central Italy), a ca. 18 m-long succession with a prominent 10 m-thick lagoonal interval, and core EM2 (Po delta plain, Emilia-Romagna, northern Italy), a ca. 25 m-long succession mainly consisting of a vertical alternation of swamps and crevasse splays. Backed by multi-proxy previous studies (Cacciari et al., 2019, 2020), the analysis of a total of fourteen additional samples allowed an enhanced comparison of palaeoclimate dynamics from a more holistic perspective. After a pollen-based statistical biomization of palaeovegetation (pollen-derived biomes -PDBs *sensu* Tarasov et al., 1998) of both areas, taxonomical comparison of PDBs, as well as variations in their relative abundances within-core and between-cores, allowed to better define the vegetation landscape and to compare palaeoclimate oscillations. A prolonged climate optimum, lasting for most of the Holocene, was identified in both areas by the spreading of an oak-alder lowland forest. Short-lived phases of climate deterioration punctuate the climate optimum. The most prominent is ascribed to the so-called 8.2-ka event, which in the Po delta lasts for a few centuries and shows highly differentiated vegetation phases, especially in their montane component, accompanied by an increase of river floods; by contrast, in the Arno delta its impact on palaeovegetation is scarce and no stratigraphic evidence is recorded. Differently, another period of climate deterioration lasting ca. 5.9-5 cal. ky BP is recorded at both locations and is testified to by an increase in montane pollen; it led to the disruption of the swamp-crevasse alternation in the Po delta and to the complete lagoon siltation in the Arno delta. Finally, Late Holocene vegetation degradation, mainly due to anthropisation, is recorded in both areas. To sum up, vegetational dynamics have shown many common features on the two sides of the Apennines during the Holocene. Nonetheless, the differing reactions to climate perturbations (with a degree of mediterraneity higher in the Arno- than in the Po delta plain) suggests that, during the Holocene, the present day distinction of a sub-Mediterranean climate north of the Apennines and a meso-Mediterranean climate to the south was already defined. This stresses the importance of vegetation in identifying palaeoclimate teleconnections at the regional scale.

PALAEOENVIRONMENTAL FRAME AND LANDSCAPE TRANSITIONS DURING THE MID-LATE PLEISTOCENE INFERRED FROM THE AVIAN FOSSIL ASSEMBLAGE OF GROTTA DEL CAVALLO (APULIA, SOUTHERN ITALY)

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Grotta del Cavallo, a cave which opens on the Ionic Apulian coast in Southern Italy (Nardò), preserves one of the best known Italian Middle Palaeolithic sequences, providing important evidence on Neanderthal lifeways from MIS 7 to MIS 3 (Mid-Late Pleistocene). In this work, we present the results of the taxonomic and taphonomic analysis of the avian fossil remains associated with *Homo neanderthalensis* occupation. The taxonomic analysis detected a very rich avian fossil assemblage, consisting of 1050 specimens grouped in 70 taxa and at least 35 species, that allowed palaeoenvironmental and palaeoclimatic reconstructions, further detailing the landscape surrounding the cave that was exploited by *H. neanderthalensis* throughout the last glacial-interglacial cycles. During MIS 7, 6 and 3 extensive grassland-steppes and shrublands dominated the landscape, with localised rocky outcrops and open woodlands. The abundance of water and wetland birds also suggests the presence of well-developed wetland systems near the cave, currently absent from the area. These wetlands were probably located in front of the cave, where a coastal plain, now the Apulian shelf, periodically emerged due to glacially driven sea-level drop. The further increase in water bird taxa and avian species richness in MIS 3 deposits is likely related to the expansion of wetland areas, linked to more humid conditions or to the shorter distance of the wetlands from the cave, compared to MIS 6. A few species also provided palaeoclimatic indications of climate conditions cooler than the present one, such as *Branta leucopsis* (Bechstein, 1803), an arctic breeder, and other species currently spread at higher altitudes. This work also recorded the first occurrence of *Larus genei* Breme, 1839, the first Italian occurrence of *Emberiza calandra* Linnaeus, 1758 the oldest Italian occurrence of *Podiceps nigricollis* C. L. Brehm, 1831, and the occurrence of *Sylvia communis* Latham, 1787 (a species rarely retrieved in the fossil record). Ordination analyses of the taphonomic data related to the bird assemblages allowed to identify physical sin- and post-depositional processes as the main drivers of fossil degradation, whereas the accumulation of the bird bones in the cave is mainly attributed to short-range physical processes of sediment accumulation and feeding activities of nocturnal raptors. We also detected anthropic traces on a few bones, related to butchering and cooking activities of bird carcasses. This attests to the consumption of birds as food by Neanderthals and represents the earliest Italian evidence of bird exploitation.

CONSERVATION PALEOBIOLOGY RESEARCH COORDINATION NETWORK

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The Conservation Paleobiology Network (CPN) is an initiative to transform the academic discipline of conservation paleobiology into an applied science that informs conservation and restoration efforts. The primary goal is to convert conservation paleobiology from a cluster of novel academic projects into an applied science that transfers geohistorical data to stakeholder groups and is responsive to stakeholder needs. We achieve this by bringing together scientists and stakeholders (communities, agencies, and industry) to ensure that historical archives effectively assist conservation efforts. The network centers on community-building activities, career development, and student education programs. So far, we have over 500 members from 43 countries, and continue to add new members weekly. The project aims for both internal integration (i.e., bringing together disparate efforts, establishing best practices, connecting efforts across regions, and coordinating training in best practices) and external integration (i.e., networking of scientists and stakeholders to make conservation paleobiology a translational science wherein new knowledge evolves via interactions between scientists and scientific data users). To achieve these goals, we are using grass-roots strategies to build an international Community of Practice which is currently in the process of developing (1) Working Groups that tackle key questions of conservation paleobiology; (2) System-Focused Field Courses that engage students, junior faculty, and stakeholders; (3) Webinars dedicated to training future conservation scientists/practitioners; and (4) Annual Symposium on Conservation Paleobiology. The network also has members dedicated specifically to the topics of Diversity, Equity, and Inclusion within the network and Student Resources. The Conservation Paleobiology Network is an international community-developed (grass-roots) initiative that is supported by a five year grant from the National Science Foundation (USA).

EXPLORING SHELL VARIATIONS DYNAMICS OF THE BIVALVE *CHAMELEA GALLINA* ON A MILLENNIAL TEMPORAL SCALE: FROM THE HOLOCENE SUB-FOSSIL RECORD TO MODERN THANATOCOENOSSES OF THE NORTHERN ADRIATIC SEA

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Marine calcifying organisms such as bivalves are expected to be severely impacted by the ongoing climate change. To design proper conservation and management strategies is critical to understand species' long term adaptive response to changing environments. In this light, investigation of the recent fossil record can give access to an archive of ecological responses to past climate-driven environmental transitions: mollusk shells biomineralization is in fact influenced by the environmental surroundings, reflected on geochemical properties, microstructure and growth rate of the shell. Here, skeletal parameters (micro-density and apparent porosity) and growth parameters (bulk density, linear extension and net calcification rates) of the bivalve *Chamelea gallina* were investigated in two different geomorphologic configuration of North Adriatic coastal systems along the Holocene (estuarine vs deltaic system). Four shoreface-related *C. gallina* horizons are being evaluated: two from the present-day Adriatic setting and two from the Middle Holocene sedimentary succession of the Adriatic-Po system, when the study area was characterized by barrier-lagoon-estuary depositional systems and higher regional temperature than today. Shells from past estuarine settings of the Holocene Climatic Optimum presented a denser exoskeleton than modern ones, possibly as a result of different mineralization rates driven by environmental parameters, especially temperature. The net calcification rates on the contrary are higher in modern specimens from deltaic/strandplain depositional system, as a result of a significant increase in linear extension rates. Modern specimens seem to promote faster growth rate, at the expense of a less dense shell. This approach should offer insights on the adaptive capacities of *C. gallina* to climate-driven environmental shifts and offers insights for assessing anthropogenic impacts on this economically relevant species.

THE DAMA-LIKE DEER '*PSEUDODAMA*' *NESTII* (MAMMALIA, CERVIDAE) FROM PANTALLA (EARLY PLEISTOCENE)

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Numerous exceptionally-preserved mammal remains, including some complete skulls, were discovered in the 1990s in Pantalla (Perugia, central Italy). The upper part of the stratigraphic section yielded a rich mammal assemblage composed by *Apodemus dominans*, *Canis etruscus*, *Vulpes* sp., *Lynx issiodorensis valdarnensis*, *Acinonyx pardinensis*, *Lutraeximia umbra*, *Leptobos merlai*, '*Pseudodama*' *nestii*, *Sus strozzii*, *Equus stenonis*, and *Mammuthus* cf. *meridionalis* (Cherin et al., 2021 and references therein). This contribution presents for the first time the outstanding sample of '*P.*' *nestii* from the site. During the Villafranchian, Epivillafranchian, and early Galerian, several *Dama*-like deer species occurred in Europe, but there is still much debate on their taxonomy and relationships. Azzaroli (1992) introduced the genus *Pseudodama* to accommodate all Villafranchian forms. Pending a comprehensive phylogenetic analysis, here we keep the conservative choice of considering '*Pseudodama*' as a valid genus but indicating it in inverted commas. The Pantalla sample is composed by two male skulls, a frontal fragment with basal part of the antler, several mandibles and maxillary fragments with teeth, and some postcranial elements including a partial articulated hindlimb. The first cranium belongs to an adult male with no antlers at the moment of death; the second preserves both antlers but the splanchnocranium is missing. The sample displays a combination of characters that allows an unambiguous attribution to '*P.*' *nestii*. CT-based comparisons of the inner and outer anatomy of skulls and antlers reveal that this species displays a mosaic of intermediate characters between *Dama* and *Cervus*, but also that the affinities with *Dama* are prevalent. Some *Cervus*-like features especially in cranial morphology can be interpreted as plesiomorphic characters supporting a basal position of '*Pseudodama*' in the evolutionary history of the Cervini. Most interestingly, several bone anomalies are observed in the two male crania from Pantalla. The first shows a drop-like spongy area on the right squamosal, which we interpret as a callus formed to heal a wound, presumably occurred during a fight with another male. The antlers of the second specimen show (1) on the left, a swelling above the first bifurcation corresponding to an anomalous change in orientation of the beam and (2) on the right, a supernumerary tine adjacent to the basal tine. We interpret the former as resulting from the traumatic fracture of the beam during its development and the latter as an anomalous development of the basal antler consequent to an early trauma of the burr.

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OREOPITHECUS BAMBOLII: DOES “MOLECULAR PALEONTOLOGY” CAN HELP US IN BETTER UNDERSTANDING SUCH A PECULIAR FOSSIL APE?

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Upper Miocene continental deposits in the northern Tyrrhenian area (Tuscany and Sardinia) are well known for the celebrated records of endemic fossil vertebrates. These faunal complexes are known as *Oreopithecus* Faunal Zones (OZFs) and are named from their most representative taxon, the fossil hominoid *Oreopithecus bambolii*. *Oreopithecus* evolved under insularity conditions on the Tusco-Sardinian palaeobioprovince, surviving there until 7.0–6.5 Ma and being the last European Miocene ape to become extinct. Since the time of its first description by P. Gervais (1872), the taxonomic and phylogenetic status of the large-bodied hominoid *O. bambolii* has represented some of the most controversial issues in palaeontology. Although *Oreopithecus* is today broadly accepted as a hominoid, its phylogenetic position is uncertain and debated). This taxon displays a unique mosaic of derived hominid features and apparently more primitive features, including evolutionary convergences with both bipedal hominins and cercopithecoid monkeys. Accordingly, *Oreopithecus* is still considered a somewhat “enigmatic anthropoid”, with some researchers arguing that it represents a derived great ape that originated from European dryopithecines, and others arguing that it is a late survivor of the African nyanzapithecine lineage. The paleobiology and phylogeny of *Oreopithecus* is under investigation by means of an emerging interdisciplinary research field, the Paleoproteomics. The latter is based on the analysis of ancient protein sequences preserved within fossil tissues using Mass Spectrometry. As proteins survive longer than DNA, Paleoproteomics can investigate specimens and taxa much deeper into the geologic time, and the method has been recently successfully utilized to typify fossil mammals towards the temporal limit of about 2My. Within the international ETN project PUSHH, the Florence University unit is contributing to setting up methodologies and techniques in order to refine the potential of this new approach toward the methodological threshold of 10My. The hopefully successful approach of this international collaborative multidisciplinary project will allow to retrieve a paleoproteomic signature from *Oreopithecus* (and associated fauna) fossils, thus helping us in clarifying the phylogenetic position of *O. bambolii* and its relations with the European Dryopithecinae.

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***EQUUS STENONIS* COCCHI, 1867 (PERISSODACTYLA, MAMMALIA).
AN UPDATED REVIEW OF THE SPECIES WITH NEW REMARKS ON THE
EUROPEAN EARLY PLEISTOCENE *EQUUS* TAXONOMY
AND ON THE OLD WORLD *EQUUS* EVOLUTION**

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Equus stenonis is one of the most iconic and important mammal species in the European Early Pleistocene, well known from several fossil localities spanning from 2.5 – 1.5 Ma. Nevertheless, in the last century, its taxonomy and evolutionary placement in the Old World *Equus* evolution have been extensively debated. Indeed, the European *E. stenonis* populations have been divided in several subspecies (*E. stenonis stenonis*, *E. stenonis vireti*, *E. stenonis guthi*, *E. stenonis senezensis*, *E. stenonis pueblensis*, *E. stenonis olivolanus*, *E. stenonis anguinus*, *E. stenonis pamirensis*, *E. stenonis mygdoniensis*), even if some of these subspecies were identified in the same sample (e.g. La Puebla de Valverde, Olivola and Senèze). *Equus stenonis*' disputed interpretations go well beyond debates concerned with its alpha taxonomy. An even more interesting and crucial controversial issue concerns *E. stenonis* role in the evolutionary history of the genus *Equus* and in the origin of modern zebras' evolutionary lineage. Indeed, some authors proposed to split the Old world *Equus* species into three different genera, *Plesippus*, *Allohippus* and *Equus*, including *E. stenonis* in the genus *Allohippus* and the North American *Equus simplicidens* in the genus *Plesippus*. Herein, we propose an update review of the *E. stenonis* subspecies by morphological, morphometrical and statistical comparisons, within a new phylogenetic analysis to test the validity of the genera *Plesippus*, *Allohippus* and *Equus*.

UV LIGHT PHOTOGRAPHY: UNRAVELING THE DIFFERENT APPLICATIONS IN PALAEOLOGY

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The analysis of fossil specimens under ultraviolet (UV) light represents a new field of research which only in the last twenty years has been explored as a powerful tool to be used in palaeontology. Up to now this technique has been applied mainly on mollusc shells, but the number of studies dealing with other taxa, like vertebrate specimens, is increasing. Despite this, the analysis of fossil specimens under UV light represents a technique still in evolution; the knowledge of the best procedure of sample preparation and photography still needs to be deeply examined and new data to better understand the real potential of this method are required. After testing different procedures of specimen preparation and different photographic techniques in order to define a methodological protocol for the analysis of fossil specimens under UV light, we explore the diverse uses of UV light technique in palaeontology analyzing fossil specimens coming from different stratigraphic contexts (from the Permian to the Holocene, from Oman to Italy), having a different mineralogy and belonging to different taxa (bivalves, gastropods, brachiopods, crustaceans and reptile); also, we use two different wavelengths: the commonly used 365 nm, and the 440 nm, a “borderline wavelength” here adopted for the first time. As previously observed, the main application of UV light is for systematic purposes. Residual colour patterns in mollusc shells are rarely observable under visible light but can be revealed under UV light, as formerly pigmented regions of the shell fluoresce. Also, this technique allows to differentiate between specimens and matrix; indeed, it improves the visualization of specimens that are, in visible light, difficult to distinguish in colour or texture from the surrounding matrix providing greater clarity of some details like soft anatomical tissues. Finally, the use of UV light provides an inexpensive method to detect man-made interventions in fossil specimens and thus fake fossils.

CHANGE IN RICHNESS, ABUNDANCE, GEOGRAPHIC RANGE AND HABITAT SPECIALIZATION IN PLIO-PLEISTOCENE MEDITERRANEAN BIVALVES

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Following the Mid Pliocene Warm Period (~3.0 million years ago, Ma), marine Mediterranean biodiversity experienced a sharp decline, which has been linked to the onset of the Northern Hemisphere Glaciation. Among bivalves, around 50% of Pliocene species became extinct, while the remaining 50% still lives in the Mediterranean Sea today. What factors drove the extinction of one species and success of another? How did climate change influence species survival? A species-level dataset of 1350 occurrences of three bivalve families (Pectinidae, Veneridae, Lucinidae), selected because of their different life habit (respectively, epifaunal suspension feeder, infaunal suspension feeder, infaunal chemosymbiotic), was assembled from literature data. Only occurrences with reliable chronostratigraphic information (stage-level or finer), information on geographic location and paleoenvironment were selected. Ages span from the Zanclean to the Calabrian (5.33-0.77 Ma); geographic range includes the Mediterranean Sea and the North Atlantic; based on lithology, paleoenvironments include brackish-water, shoreface, inner-outer shelf and slope-bathyal settings. We analyzed per-family changes in species richness through time, and using non parametric statistics, we tested whether abundance, habitat specialization, and geographic range, considered among the principal factors controlling extinction risk in ancient and modern seas, explained species survival or extinction. Richness was expressed as the number of species in shoreface and inner-outer shelf settings, in four-time bins of equal length; abundance as the number of species occurrences; habitat specialization as the number of environments in which each species was found; geographic range size as maximum convex hull area of each species. For all bivalve families, species loss in shoreface settings seems to predate changes at shelf depth, suggesting that shallower communities were the first to respond to climate perturbation. For all bivalve families, abundance is a good predictor of extinction, as extinct species were significantly rarer than extant species. For Veneridae and Lucinidae, extinct species occur in a lower number of environments, while habitat specialization seems not to play a role in Pectinidae species loss. Surprisingly, there is no statistical difference between geographic range size of extant and extinct species, which would suggest that broad geographic range did not play a role in species survival. This is in contradiction with evidence that most Pliocene species that still live in the Mediterranean are eurythermal, and today live both in the Mediterranean Sea and in the North Atlantic. This is probably due to the poorly documented Plio-Pleistocene fossil record in the North Atlantic, limited to occurrences in Portugal, the Azores and Canary Islands, United Kingdom and Belgium.

**MORPHOMETRIC AND 3D ANALYSES OF MIDDLE MIOCENE OYSTERS:
A PRELIMINARY COMPARISON BETWEEN SPECIMENS FROM MORAVIAN
OUTCROPS OF THE CARPATHIAN FOREDEEP (CZECH REPUBLIC)
AND FROM ROZTOCZE HILLS BUILDUPS (POLAND)**

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A preliminary study is here submitted about systematical, paleoecological and morphometrical analyses of Miocene oysters (Langhian-Serravalian \approx Badenian from Paratethys area). The purpose of the work is to present a comparison between the collected samples from Moravian part of Carpathian Foredeep (Czech Republic) and from Zdziechowice Pierwsze (Roztocze Hills, Poland), in relation to the observations of Studencka et al. (2019). In particular, the study will focus on Polish samples, as the Czech ones have been the subject of previous work and considerations, whereby the most common oyster species personally collected are represented by *Neopycnodonte navicularis* Brocchi 1814 and *Ostrea digitalina* Eichwald 1830, whose specimens are stored at the Institute of Paleobiology of Warsaw. From a geological point of view, three different types of Miocene reefs are described from the western Roztocze Hills, characterized by algal-vermetid buildups with rich micro and macrofaunal assemblages (Pisera, 1985). These reefs are typical of shallow waters, under high energy conditions and constituted by a diverse molluscan community, including concretions of oysters, showing the autochthonous character of bioconstruction (Pisera, 1985; Studencka et al., 2019). Some of the studied oyster specimens present moderate bioerosion and bioencrustation, caused typically by the activity of sponges, bryozoans, worms and bivalves; typically channel shaped and punctuate structures are presented, referable to the *Entobia* and *Gastrochaenolites* trace fossils. As for the Carpathian samples morphometric analyses were performed in order to measure oyster shell parameters: height (H), shell maximum length (W), hinge length (W1), distance between the resilifer area and the upper part of the muscle scar (H1), ventral length (W2), distance between lower part of the muscle scar and ventral margin (H2) and opening angle of the muscle scar (α). Using a regression analysis, calibrated on W/H, W1/H1 and W2/H2 ratios, we obtained a reference system to evaluate the morphometric trend of the single oyster valves, usefulness proxy in the determination of uncertain species. Furthermore, a 3D analysis of the oyster valves has been carried out, obtained from the morphological parameters of the *Neopycnodonte* specimens, in order to compare it with the samples of the Moravian Carpathian Foredeep. This research allowed to develop a “workflow” for the analysis of the oyster pattern morphospace, based on 3D models. These data permit to get a qualitative dataset, which is typical by species and by “paleoecological” area to which they belong, with common morphometric signature.

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3-D MODELLING OF THE CAMBRIAN BURGESS SHALE RADIODONT FEEDING APPENDAGES

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Radiodonts were the largest nektonic predators in the Cambrian. Radiodonts strongly differentiated during the Cambrian as shown by the different morphologies of their massive frontal appendages. Here to test the different radiodont feeding modes, their appendages have been 3-D reconstructed, and their movement explored. We investigated 4 radiodont species, *Anomalocaris canadensis*, *Hurdia victoria*, *Peytoia nathorsti* and *Amplectobelua stephenensis* from the Burgess Shale (Cambrian stage 4). Our results show that there was a significant functional and behavioural diversity among the different species with adaptations for feeding on differently sized prey (2 cm up to 10 cm). The limited dexterity and the lack of accessory feeding appendages suggest that feeding must have been inefficient, explaining their subsequent replacement by crown-group arthropods, cephalopods and jawed vertebrates.

MORFOLOGIE DI CRESCITA E RUOLO DELLE BIOCoSTRUZIONI A *SABELLARIA ALVEOLATA* (POLYCHAETA) DI AREE COSTIERE DELLA SICILIA

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Vengono discussi aspetti di diversi tipi morfologici delle biocostruzioni del polichete *Sabellaria alveolata*, interessanti per il ruolo nella dinamica costiera e i rapporti con gli organismi associati. La specie costruisce tubi agglutinati sabbiosi che si aggregano in fondali marini, incrostando substrati duri e successivamente fondi sabbiosi limitrofi. In Mediterraneo, *S. alveolata* vive dalla linea di costa fino a pochi metri di profondità, in siti con elevato idrodinamismo in cui le particelle di sedimento, necessarie per la costruzione dei tubi, vengono continuamente messe in sospensione (Sanfilippo et al., 2019). Le biocostruzioni a *Sabellaria* in studio sono state individuate in tre siti costieri della Sicilia, mappate e monitorate stagionalmente dal 2020: 1) Portopalo con biocostruzioni a crosta spesse circa 10 cm; 2) Oasi del Simeto con biocostruzioni a cuscino, alte alcuni dm, sviluppate su fondali ad elevata torbidità; 3) Falconara con una biocostruzione a banco alta circa 80 cm con massima estensione in estate, sviluppata all'interno di una cavità a tunnel lungo la costa in cui si incanalano correnti e moto ondoso. Interessante è comprendere cosa regola la formazione delle tipologie individuate e la loro variazione nel tempo. Ad oggi ciò sembrerebbe dipendere da locali cambiamenti di parametri ambientali come idrodinamismo e apporto sedimentario: a Portopalo le biocostruzioni si mantengono basse con tubi prostrati che si accrescono soprattutto lateralmente, piuttosto che in altezza; nell'Oasi del Simeto le biocostruzioni si sviluppano notevolmente anche in altezza con tubi subverticali, grazie all'apporto fluviale di una notevole quantità di sedimento; a Falconara i banchi presentano il maggiore sviluppo e continuità laterale per il costante rifornimento di sabbia sospesa dalle correnti costiere. Per la loro stessa natura, i reef a *S. alveolata* fungono da serbatoi di sedimento sabbioso che è temporaneamente sequestrato all'ambiente, fino alla sua parziale o completa re-immissione in conseguenza di eventi meteomarini particolarmente violenti e distruttivi. Questo ruolo chiave nella dinamica sedimentaria costiera finora pochissimo investigato merita di essere approfondito.

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**FIRST RECORD OF THE CHITINOPHOSPHATIC BRACHIOPOD *GLOTTIDIA*
FROM THE MEDITERRANEAN BASIN, WITH SOME NOTES ON THE NEOGENE
PALAEOBIOGEOGRAPHY OF LINGULIDES**

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New remains of lingulide brachiopods have been discovered in Pliocene outcrops of Tuscany (central Italy). Some relatively well preserved specimens are here reported from Castelfiorentino and Spicchio (both in Florence Province). At both localities, the exposed marine successions are characterised by alternation of greyish clayey sandstones and yellowish sandstones. The Spicchio lingulides have been found within grayish clayey sandstone besides abundant specimens of *Pelecypora*, *Callista*, *Procardium* and *Thetystrombus* (= *Persististrombus*). The Castelfiorentino lingulides come from a yellowish sand division that is typically rich in very well preserved crabs (*Eriphia cocchii*) and common shells of *Glycymeris*, *Pelecypora*, gastropods and barnacles. The septate nature of these new lingulide finds suggests to attribute the collected material to *Glottidia* rather than to *Lingula*. The presence of *Glottidia*-like specimens in the Tuscan Pliocene represents an entirely new occurrence datum for Italy as well as for the entire Mediterranean region. These lingulide fossils sum themselves to other recently described finds of *Lingula* from the nearby locality of La Serra (Pisa Province). Whereas *Lingula* is present in some Miocene brachiopod assemblages of the Mediterranean Sea and the connected Central Paratethys, the sole published records of the currently trans-Panamian genus *Glottidia* are from the Miocene and Pliocene deposits of the North Sea. Therefore, discovering that both *Lingula* and *Glottidia* occurred in closely locations of the central Mediterranean Basin during the Pliocene comes as a surprise that also stimulates to reconsider the palaeobiogeographic history and affinities of the late Neogene Euro-Mediterranean lingulides.

STATIC AND EVOLUTIONARY ALLOMETRY IN MULTIPLE TEMPORAL POPULATIONS OF CLOSELY RELATED CHEILOSTOME BRYOZOAN SPECIES

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The study of allometric relationships is key to understanding the mechanisms underlying the evolution of morphology. Empirical and theoretical studies on allometry are largely based on contemporary populations of solitary organisms. Studies based on the allometric relationships of species over evolutionary time scales, especially those based on fossil specimens, are more limited for solitary organisms, and in fact non-existent for colonial organisms. The modular nature of colonial organisms offers a unique opportunity to disentangle genetic effects along with various components of environmental effects on the observed variance in morphological traits. Here, we use cheilostome bryozoans, a phylum of calcified marine invertebrates commonly preserved in the fossil record, to investigate static (within species) and evolutionary (among species) allometry of different trait types over two million years. Specifically, using *c.* 500 colonies of six Pleistocene-to-Recent New Zealand species of the cheilostome genus *Microporella* we study the patterns of size covariation between autozooids (i.e., feeding modules) and (i) orifices (i.e., openings through which the feeding organ extends), (ii) ovicells (i.e., brooding structure), and (iii) avicularia (i.e., defensive polymorphs), within populations, species and across species. We hypothesize that phenotypic traits that directly bear on reproduction (i.e., size of ovicells) and/or are developmentally more tied to the autozoid bearing it (i.e., size of orifices) are both less variable within populations and more evolutionarily constrained than traits that may be induced by predators and/or are independently budded from the autozoid bearing it (i.e., size of avicularia). Preliminary results, controlling for within-colony and sample variation, show that the slopes of static allometry for the size of the six New Zealand *Microporella* species are similar to that of the evolutionary allometric relationship estimated from more than 80 described and undescribed *Microporella* species worldwide. Conversely, the slopes of static allometry for avicularia seem to be almost orthogonal to their equivalent evolutionary allometry, suggesting different types of phenotypic constraints for these two traits. We further hypothesize that static allometries will be similar in the same species across time but that some of the variation in slope and/or intercept can be attributed to palaeoclimatic change, as hinted at by our previous work on a single species of cheilostome bryozoans, *Antarctothoa tongima*, from the same marine basin/fossil assemblage. Our study demonstrates the importance of understanding population level, temporal and macroevolutionary variation in grasping the potential drivers of long-term evolutionary change.

**GROWING UP BIG: THE LARGEST KNOWN COWRIE
AND THE EVOLUTION OF GIANT CYPRAEID GASTROPODS**

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The cowries are the best-studied family of gastropods, with a global diversity distribution that parallels that of tropical corals, mangroves and seagrasses. The macroecological and macroevolutionary relationship between diversity and gigantism, two important ecological traits, has never been explored in this family (Cypraeidae). Here we introduce *Vicetia bizzottoi* sp. nov. based on a Priabonian fossil found in northeastern Italy, the largest documented cowrie found so far and the youngest of a lineage of Eocene Gisortiinae species. Their stratigraphic distribution in western Europe indicates that species selection favoured large size and increased ornamentation. Palaeoecology and the stratigraphic distribution of species richness of the Cypraeidae suggest that gigantism occurs in peripheral habitats with respect to diversity hotspots, where smaller species are favoured. The Eocene–Oligocene boundary was marked by a turnover that favoured small-sized species of clades other than Gisortiinae. Species selection leading to gigantism is again documented in Miocene lineages of *Zoila* and *Umbilia*, in the southern hemisphere, at the periphery of contemporaneous diversity hotspots. The decoupled relationship between size and diversity encountered in modern forms is thus a recurring pattern in the evolutionary history of cowries. Possible explanations include physiological and ecological phenomena, and life history constraints.

**SYSTEMATIC TAXONOMY OF MIDDLE MIOCENE *SPHAEROIDINELLOPSIS*
(PLANKTONIC FORAMINIFERA)**

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The taxonomy and phylogeny of the Miocene to Recent genera *Sphaeroidinellopsis* and *Sphaeroidinella* has been documented in previous studies, but the evolution of this lineage remains unclear. Some authors have debated on this genus in the past, choosing a variety of parameters to discriminate the morphospecies. Here we present new scanning electron microscope analyses on specimens from the Ocean Drilling Program (ODP) Site 925 (Ceara Rise, western equatorial Atlantic) and ODP Site 959 (Deep Ivorian Basin, eastern equatorial Atlantic). Our study reveals transitional individuals *Sphaeroidinellopsis disjuncta* – *Sphaeroidinellopsis kochi*, a speciation event never described in the previous literature. Those specimens are characterised by extreme morphological features such as elongated and sack-like final chambers, requiring amendments to the current classification and taxonomy of this genus. In this work, two possible hypotheses are presented and discussed, to assess these new observations within the evolutionary mosaic of *Sphaeroidinellopsis*.

THERE IS MORE THAN MEET THE EYES: UNFOLDING THE DIVERSITY, AGE, AND ECOLOGY OF THE LATE CRETACEOUS VILLAGGIO DEL PESCATORE SITE (TRIESTE, ITALY)

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The Late Cretaceous Mediterranean archipelago, its geodynamic history, ecological diversity, paleogeography and faunal composition stand as one of the most complex and debated topics related to the evolution of the Tethys Ocean and its continental margins. We conducted a pilot project started in 2019, generating novel and unforeseen outcomes related to one of the most important fossil localities of Europe: the Villaggio del Pescatore site (VdP, Duino-Aurisina, Trieste, Italy). Although this locality has achieved notoriety for the exquisite preservation of its dinosaur-dominated fossil assemblage, the organization of historically neglected and newly re-evaluated data into a unified framework set the ground for a renewed understanding of this site. With more than 450 identifiable fossils (including fish, crocodylian, dinosaurs, pterosaurs, crustaceans, plant remains, invertebrates), microfossils (foraminifera, pollens, ostracods, cyanobacteria), ~200 thin sections for biostratigraphic analyses, more than 100 still unprepared specimens and other still found *in situ*, the VdP offers a unique, high-resolution window for qualitative and quantitative analyses, including a detailed redefinition of its age. New prospecting activities and extractive processes resulted in additional observations. We here reevaluate data presented in the literature as referring exclusively to a very restricted area of approximately 300 square meters of the quarry and document that less than 40% of the site has been so far mapped and support a continuous extension of fossil beds outside the main, protected area. From a sedimentologic perspective, the uniqueness of VdP is represented by sharp *facies* variations from open marine, shallow-water limestones to organic-rich rhythmites, which interbed with breccias that accumulated as underwater bodies of breccia by subaqueous, density-driven, sedimentary flows. Rhythmites and breccias are folded by slumping and deformed by wet-sediment normal fault. Slumps also raise questions concerning the taphonomy (preservation of land vertebrates in dysoxic to anoxic bottom waters from marginal-marine settings) as well as the interaction between different depositional settings (terrestrial-paralic–shallow marine). The outstanding example of ‘Bruno’ – the second, sub-complete *Tethyshadros insularis* extracted from the quarry – shows how the mesoscale folding has interested the fossil body harmoniously but maintaining most of its skeletal connections. Based on inventory and new field surveys, we estimate seven articulated skeletons preserved at the VdP site and possibly eleven individuals of *T. insularis*. Originally described as an insular, pygmy hadrosauroid closely related to hadrosaurids, based on a single specimen. *T. insularis* is here revised on the basis of multiple individuals, including histological samples, documenting previously unexpected ontogenetic trends and morphological variation in this taxon.

**THE STRONTIUM CASE IN MODERN AND PAST OCEANS:
CAUSAL OR CASUAL RELATIONSHIPS WITH COCCOLITHOPHORE
GROWTH RATE AND COCCOLITH GEOMETRY**

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Coccolithophores are an important group of marine phytoplankton that contribute 1-10% of marine primary production and 50% to offshore CaCO₃ sedimentation. Calcareous nannoplankton display one of the most abundant and continuous fossil records of any phylum since their appearance dated as Triassic in age. For this reason, due to their abundance in pelagic (and hemipelagic) sediments and good preservation of the original community composition, nannofossils have been intensively used as paleoecological indicators. Indeed, the calcium carbonate produced by coccolithophores has been investigated for chemical and isotopic composition as tracers of paleoceanographic conditions and dynamics. One important proxy is the Sr/Ca ratio recorded in fossil coccoliths: several studies show the direct and proportional relationship between the Sr/Ca ratio of coccoliths and calcification rates. The calcification rate is a function of the growth rate and, therefore, of coccolithophore productivity: the faster is the coccolithophore growth the faster is the calcification and transport of ions via transmembrane pumps, and the higher is the coccolith Sr/Ca ratio. Therefore, the variations in coccolith Sr/Ca ratio were intensively used as a proxy for paleoclimatic reconstructions to indicate intervals of high and low productivity. The correlation works when changes in productivity are nutrient-induced while growth changes caused by light, temperature, and carbonate chemistry variations complicate the interpretation with respect to paleoenvironmental significance. Even the coccosphere geometry is influenced by environmental parameters with implications for coccolith sizes and shapes but also for the number of coccoliths produced per cell, which is, in turn, an important parameter in determining the total mass of calcite in the cell. In the fossil record, the estimate of relative abundances of taxa can be influenced by variations in the number of coccoliths produced per cell in response to altered environmental conditions. The significance of coccolithophore architecture in both the modern ocean and the geological record is, therefore, an important factor when exploring the impact of calcite production and carbonate export and burial. In our experiments, we exposed different coccolithophore species to variable seawater Sr/Ca ratios to address the following questions: Are changes in growth and coccosphere geometry comparable between different species? Is the coccolithophore architecture affected by Sr enrichment? and, ultimately, can potential effects of Sr concentrations on coccosphere geometry affect the interpretation of Sr/Ca in nannofossils? Our data suggest that increased availability of Sr stimulates the coccolithogenesis in terms of number of coccoliths (quantity) produced and could, therefore, contribute to the understanding of the biogeochemical role of coccolithophores under different ocean chemistry.

MIDDLE-UPPER ORDOVICIAN CONODONTS FROM SOUTH WALES, UNITED KINGDOM

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The conodont fauna of the reference succession of the regional British Llandeilian Stage of the Llanvirn Series was first described in a classical study by Rhodes (1953) more than 65 years ago using single element (form) taxonomy. Although several subsequent authors have recorded a substantial number of conodont taxa from the Llandeilo area, the present study is the first to present a modern taxonomic review of these late Darriwilian-early Sandbian faunas that include approximately 20 multielement species. Most prominent are representatives of *Amorphognathus*, *Baltoniodus*, *Eoplacognathus*, and *Plectodina*. The study faunas have their own biogeographic character. The distinctive genera *Complexodus*, *Protopanderodus*, and *Pygodus*, which are common in coeval Baltoscandic faunas, are not present, but the occurrence of *Amorphognathus*, *Baltoniodus*, and *Eoplacognathus* provides a link to age equivalent Baltoscandic faunas. The presence of abundant specimens of *Plectodina* and less common representatives of *Erismodus* and *Icriodella* are reminiscent of North American Midcontinent faunas. This type of faunal assemblage is in some respects similar to those of the early Caradoc Series of the Welsh Borderland. Biostratigraphically diagnostic species indicate that the Llandeilo study succession ranges from the *Eoplacognathus lindstroemi* Subzone of the *Pygodus serra* Zone to the *Baltoniodus variabilis* Subzone of the *Amorphognathus tvaerensis* Zone.

**AMBER FROM THE ANISIAN (MIDDLE TRIASSIC) OF
KÜHWIESENKOPF/MONTE PRÀ DELLA VACCA**

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Paleontological research carried out during the last decades remarkably increased our knowledge on amber occurrences in the fossil record. The most ancient, quantitatively substantial amber deposit of the world comes from the Late Triassic (Carnian) Heiligkreuz and Rio del Lago formations (Dolomites and Julian Alps). However, more ancient amber occurrences have been found attached to two conifer specimens, respectively from the “*Voltzia* beds” (Anisian) of the Recoaro area and from the “Wengener Schichten” (Ladinian) of Wengen/La Valle. A case of serendipity led to the discovery of two new Italian amber localities. During the revision of the Middle Triassic (Anisian) fossil plant assemblages of Kühwiesenkopf/Monte Prà della Vacca (northern Dolomites), several tiny dispersed amber drops were discovered. The flora of Kühwiesenkopf/Monte Prà della Vacca is one of the most important witnesses of the recovery of the terrestrial ecosystems after the end-Permian mass extinction. The plant fossils were recovered from lens-shaped siltstone layers, which alternate with silty and marly limestone layers in the succession, in association with few marine fossils (bivalves, brachiopods, ammonoids and fishes). The discovery of amber drops from Kühwiesenkopf/Monte Prà della Vacca led to the re-study of other coeval plant fossil collections, including the one from Piz da Peres, and the discovery of additional dispersed amber drops, once even associated with a conifer shoot fragment of *Voltzia recubariensis*. This suggests that the amber was produced by *Voltzia recubariensis*, which is present in the three so far known Anisian amber-yielding localities of the Southern Alps (Kühwiesenkopf/Monte Prà della Vacca, Piz da Peres and Recoaro).

CLIMATE VARIABILITY DURING MIS 19 FROM WESTERN TO CENTRAL MEDITERRANEAN BASIN

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Marine Isotope Stage (MIS) 19 is the closest orbital analogue of the present interglacial and represents a valuable time window for documenting natural climate variability. In the last years we have investigated Mediterranean marine records integrating micropaleontological signals (calcareous plankton and pollen assemblage) with bio-geochemical proxies (isotope stratigraphy and biomarkers). The dataset derives from the Ocean Drilling Program sites 975 in the Balearic Basin and 976 in the Alboran Sea, from core KC01B from the Ionian Sea and from the onland Montalbano Jonico section in the southern Italy (Ionian Basin). These studies document the occurrence of a millennial and sub-millennial climate variability across Termination IX that can be traced in western and central Mediterranean basin reflecting North Atlantic climate perturbations. The succession and timing of these events have highlighted a strong similarity between Termination I and Termination IX. The comparison between calcareous plankton and pollen assemblages allowed to evaluate the effects of air-sea interactions on climate variations during MIS 19 that was characterized by high millennial-scale climate changes superimposed to glacial/interglacial and stadial/interstadial oscillations. The correlation of Mediterranean climate fluctuations with Iberian margin climate records confirm the persistent oceanic and atmospheric interconnections between Mediterranean and North Atlantic climate regime during latest MIS 20 and MIS 19.

**BIOLOGICAL ROLE AND ENVIRONMENTAL CONTROL IN THE FORMATION OF
CARBONATE BIOCONSTRUCTIONS OF CONFINED MARINE SETTINGS
("LU LAMPIÙNE" CAVE, OTRANTO, APULIA)**

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The dark and confined conditions of the innermost submarine cave sectors allow the development of cryptic bioconstructions, named "biostalactites" (BSTs). They resemble "buildup"-type ecosystems at smaller scale and are receiving increasing attention in the last years since they allow geobiological studies that could clarify the complex relationships between metazoan and bacteria in cryptic bioconstructions of the fossil record. The "lu Lampiùne" cave in Apulia, represents an example of these natural laboratories where the presence of bioconstructions locally enhance biodiversity. Micromorphological observations, UV-epifluorescence and micro-Raman spectroscopy analyses were applied to investigate the internal structures and growth pattern of the meter-long biostalactites, that project obliquely from the wall to the central part of the cave. Two type of "building engineers" were detected: sessile skeletonized organisms and microbialites. The serpulid tubes of the BST core offer the support for the colonization of other organisms. In turn, the decomposition of the organic matter, produced by this complex association, stimulates the development of heterotrophic bacteria that induce autochthonous micrite deposition contributing to the cementation of the structures. Further microbial biomineralization products are ferromanganesiferous crusts and Frutexites-like structures, induced by Fe–Mn autotrophic and chemoheterotrophic bacterial activity. Complex taphonomic and early diagenetic processes, recorded by bioerosion, micritization and dissolution of the skeletons, and early cement precipitation, suggest a variability of seawater chemistry. Phases of carbonate saturation, testified by the skeletal/microbialite growth and early cement precipitation, alternate with phases of carbonate instability, indicated by dissolution phenomena and precipitation of ferromanganesiferous structures.

**THE RISE OF THE AGE OF MAMMALS AND THE ROLE OF EARLY PALEOCENE
'CONDYLARTH' *TETRACLAENODON* (MAMMALIA, PHENACODONTIDAE) FROM
THE SAN JUAN BASIN OF NEW MEXICO, USA**

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With the dawn of the Paleocene, the mammalian survivors of the Cretaceous-Paleogene (K-Pg) mass extinction, 66 million years ago, found themselves in an open landscape. Within the first few million years of the bolide impact, placental mammals reached a diversity and abundance never seen during the Mesozoic. The Paleogene Mammal Working Group (PaM) is deciphering the initial stages of Early Cenozoic placental mammal evolution, with the aim of clarifying the as still uncertain phylogenetic relationships between Paleocene and Eocene mammals and the major groups of extant mammals. North American 'condylarths' were amongst the first to diversify following the K-Pg event and are often considered the ancestral 'stock' from which later euungulate groups evolved. Amongst these, Phenacodontidae are regularly regarded to lie at the base of the perissodactyl family tree, but their phylogenetic position, and that of other 'condylarths', remain contentious. *Tetraclaenodon* was a gracile, medium-sized (mean body mass ~10Kg), herbivorous phenacodontid, with a bunodont dentition, from the Torrejonian North American Land Mammal Age (~63.8 to ~62.4 Ma). This taxon is generally recognised as the oldest member of Phenacodontidae and is therefore instrumental for untangling the evolutionary relationships of 'condylarths'. Our research thus far reveals *Tetraclaenodon* underwent an increase in body mass and a shift in dental proportions that subsequently stabilized throughout the Torrejonian. A similar trend is seen in contemporary populations of the periptychid 'condylarth' *Periptychus*, suggesting that there were selective environmental pressures acting on these herbivorous species. Micro-CT scans of crania of *Tetraclaenodon* reveal that the brain endocast was relatively small, comparable to that of other Paleocene mammals. The petrosal lobules, which are involved in eye movement coordination, are small. The semi-circular canals associated with balance, provide an agility score of 3 indicating that *Tetraclaenodon* was moderately agile, similar to the extant raccoon dog or the aardwolf. Multivariate analyses of tarsal measurements, which indicate locomotor style, for a sample of Paleocene and extant mammals reveal that *Tetraclaenodon* was most suited to terrestrial locomotion, opposed to a more scansorial lifestyle as previously reported. Finally, a preliminary phylogenetic analysis of 171 taxa, including Mesozoic, Early Cenozoic and extant placental mammals, scored for 616 anatomical characters, confirms *Tetraclaenodon* as the basal most phenacodontid. The PaM research will ultimately produce the most comprehensive phylogenetic tree to date of the first Paleogene placentals, including enigmatic taxa such as taeniodonts, notoungulates and pantodonts, alongside Mesozoic and modern groups of mammals.

NEW PERSPECTIVES ON SUIDAE (MAMMALIA, ARTIODACTYLA) AT THE MIOCENE-PLIOCENE TRANSITION

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The Suidae are a family of artiodactyls that contains a diverse array of extinct and extant large mammals, including wild boars and warthogs, among others. They are and were a widely distributed group throughout the Old World. Part of their evolutionary success rests on a reproduction strategy that privileges a high number of offspring against a long-term effort in parental care, making them capable to adapt relatively faster than other mammals of comparable size to environmental fluctuations. This is reflected in a rich fossil record that provides valuable biochronological and paleoenvironmental insights. One of the most important events in the evolution of the family is the appearance of the genus *Sus* and the subsequent replacement of the other species previously inhabiting Eurasia during the Pliocene. The dispersal event of *Sus arvernensis* into Europe marks the beginning of the Ruscinian Mammal Age at the onset of the Pliocene, in a period of general reorganization of mammalian paleocommunities. Indeed, the Miocene-Pliocene transition records a return to more humid conditions after the trend of increasing aridity that took place in the late Miocene and it is paralleled by a marked faunal renewal. Here, by coupling the re-examination of historical collections with the analysis of new material a reappraisal of the replacement between *Propotamochoerus provincialis* and *S. arvernensis* is presented, in a comparative study with other Miocene, Pliocene, and Pleistocene species. The biochronological relevance of this event is underlined. *Sus arvernensis* occupies a key phylogenetic and chronological position for our comprehension of the subsequent evolutionary history of the Suidae. Indeed, fossils of *S. arvernensis* are known from several Ruscinian and Early Villafranchian localities of Europe, with other putative occurrences reported from Africa and Asia. Further implications resulting from a critical evaluation of part of these findings are discussed.

THE CANID REMAINS FROM THE MIDDLE PLEISTOCENE OF PONTE GALERIA (ROME, ITALY)

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Members of the genus *Canis* are among the most successful and widespread carnivorans across the Middle Pleistocene ecosystems of Europe, where two morphologically similar species are recognized, the Mosbach wolf (*Canis mosbachensis*) and the grey wolf (*Canis lupus*). The phyletic relationship between these two species is broadly accepted among scholars, as well as that the transition from *C. mosbachensis* to *C. lupus* occurred in Europe during the Middle Pleistocene, approximately 450-350 ka. The latest occurrence of the Mosbach wolf was attested during MIS 11, with a partial cranium from the Ostiense site (central Italy) (Mecozzi et al., 2020). The earliest record of the grey wolf was reported at the Lunel-Viel site (MIS 11, southern France), but recent works proposed a slightly younger age for the deposit (MIS 9-7) (Uzunidis-Boutillier, 2020). Doubts persisted on the taxonomical attribution of isolated dental and postcranial remains dated from MIS 12 to MIS 9 of a few European localities, due to the strong morphological affinity between these two canids. Therefore, the complete skull from La Polledrara di Cecanibbio (central Italy), dated at 340-320 ka (MIS 9) could represent one of the earliest evidence of *C. lupus* in Europe, but unfortunately a detailed study of this specimen is still lacking. In this contribution we present a partial neurocranium of a large-sized canid from the Middle Pleistocene of Ponte Galeria (Rome, Italy) whose dating at 419±6 ka perfectly falls at the strategic time of the *C. mosbachensis* - *C. lupus* transition. The specimen has been digitalized through CT methods and virtually restored to obtain a more complete model of the braincase and a partial brain endocast. Comparative analyses with extant and fossil canids, show that the specimen from Ponte Galeria shares several morphological and biometric features with extant *C. lupus*, representing one of the largest canids from MIS 11 and probably the earliest evidence of the grey wolf in Europe.

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WHO IS YOUR FATHER? BOTANICAL AFFINITIES OF SPORES AND POLLEN FROM THE TRIASSIC OF THE DOLOMITES

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Spores and pollen are produced in large numbers by plants and distributed by wind, water or animals up to thousands of kilometers away from the source area. Due to their high number (thousands in each sporangium), small size (20-200 µm) and high preservation potential (chemically resistant wall), they are particularly suitable to reconstruct past environments and climate. This works very well in relatively young sediments containing spores/pollen of still living plants or pollen of angiosperms. However, the older the rocks, the higher the percentage of spores and pollen originating from extinct plants, and therefore with unknown biological affinity. In order to reconstruct the botanical affinity, it is necessary to identify the original plant, and in particular the corresponding reproductive organs, whether cones or fertile leaves of various groups of ferns. Finally, not all organs were mature at the time of burial, and therefore do not always contain fully developed microspores. In the Dolomites, there are a number of fossiliferous localities (Kühwiesenkopf/Monte Prá della Vacca, Piz da Peres, Rifugio Dibona) with fossil plants from the Triassic in an exceptionally well-preserved state of conservation. Dozens of different species of horsetails, lycophytes, ferns, seed ferns, cycads and conifers were found, always containing vegetative organs (stems, branches, leaves) but often also with the presence of male and female reproductive organs. The detailed study of these reproductive organs permits to identify the palaeobotanical affinity of a considerable number of spores and pollen types previously known only dispersed in the sediment. These findings make it possible to reconstruct the various ontogenetic stages of microspores and to identify intraspecific variability within individual sporangia. An important aspect is also to verify the morphological variability developed in the same sporangium, as the increase of 'abnormal' (or 'mutated') forms is often related to stressed environments such as during mass extinctions.

PASSATO, PRESENTE E FUTURO DI SALAMANDRINA (SALAMANDRIDAE, URODELA): L'UTILIZZO DELL'ECOLOGICAL NICHE MODELING PER INVESTIGARE PASSATE ESTINZIONI E PROSPETTIVE FUTURE

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La penisola italiana è caratterizzata da un'elevata ricchezza specifica tra gli anfibi, soprattutto se paragonata alle altre penisole mediterranee d'Europa. Tra gli urodeli, il genere *Salamandrina* è l'unico rappresentante della sottofamiglia Salamandrininae, ed è caratterizzato da una combinazione unica di morfologia, ecologia e comportamento. *Salamandrina* è attualmente l'unico genere di vertebrato endemico del territorio italiano, sebbene la sua distribuzione passata sia stata molto più ampia, con fossili rinvenuti in diverse località europee in Germania, Ungheria, Spagna, e Grecia. Il presente lavoro si prefigge di utilizzare gli strumenti forniti dai metodi di Ecological Niche Modeling per indagare l'evoluzione dell'idoneità climatica di questo taxon, focalizzandosi su un intervallo di tempo che va dall'ultimo periodo interglaciale all'anno 2070. Si vuole, inoltre, investigare le radici dell'estirpazione di *Salamandrina* da tutta Europa a eccezione della penisola italiana. La nicchia climatica di questo taxon è stata determinata tramite MaxEnt, utilizzando i dati di presenza delle due specie attuali e 19 variabili bioclimatiche. Il modello è stato successivamente proiettato su scenari climatici differenti, che includono differenti intervalli climatici passati e futuri. Le analisi suggeriscono che il clima attuale della maggior parte d'Europa (a esclusione dell'Italia) non è adatto a *Salamandrina*, così come non lo era durante i passati 120-140 mila anni, suggerendo la potenziale influenza dei cambiamenti climatici pleistocenici quale causa responsabile dell'estirpazione di questa salamandra da diverse aree europee. Tuttavia, è importante sottolineare che questa ipotesi è da considerarsi soltanto teorica, visto che l'ultimo dato di presenza di questo genere al di fuori del territorio italiano risale al passaggio tra Miocene e Pliocene della Grecia (località di Maramena). È, infatti, probabile che alcuni eventi climatici del Pliocene abbiano influito considerevolmente sulla sua estirpazione. Le proiezioni future utilizzando diversi scenari di emissioni di CO₂ prevedono che anche il clima dell'Italia peninsulare sarà sempre meno adatto alle due specie di questa salamandra durante i prossimi 50 anni. Pertanto, i risultati delle analisi mostrano come il clima del passato abbia potenzialmente influito sulla biogeografia di *Salamandrina*, e come il cambiamento climatico globale potrebbe ulteriormente influenzarne la distribuzione futura. In assenza di corrette politiche di conservazione, la riduzione degli habitat adatti a questo urodelo e la sua conseguente possibile estinzione sembrano quindi essere inevitabili. Per le peculiari caratteristiche che contraddistinguono queste salamandre, la loro estinzione causerebbe una significativa perdita per la biodiversità italiana e globale, e la loro salvaguardia dovrebbe dunque essere considerata una priorità.

**DIVERSITY, PALAEOECOLOGY AND PALAEOENVIRONMENTAL SIGNIFICANCE
OF THE EOCENE CHONDRICHTHYAN ASSEMBLAGES OF THE BOLCA
LAGERSTÄTTE, ITALY**

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In the last few years, the anatomy, taxonomy and relationships of the cartilaginous fish taxa of the two main fossiliferous deposits of the Bolca Lagerstätte, the Pesciara and Monte Postale sites, have been extensively discussed in a series of papers, resulting in a complete systematic revision of this neglected component of the Eocene Tethyan ichthyofauna. Here, we present a comprehensive overview of the diversity, palaeoecology and palaeoenvironmental significance of the two chondrichthyan assemblages of the Pesciara and Monte Postale sites. Overall, the assemblages include 14 species-level taxa of sharks (Lamniformes and Carcharhiniformes) and batoids (Torpediniformes, Rhinopristiformes, Myliobatiformes, Platyrrhinidae, Zanobatidae), as well as of a single putative chimaeriform. Although the Pesciara and Monte Postale sites are characterized by eight chondrichthyan taxa each, the taxonomic compositions are distinctly different reflecting the dissimilarities in the overall composition of their fish assemblages. Palaeoecological interpretations and habitat preferences of the two chondrichthyan assemblages are consistent with the palaeoenvironmental settings that were previously hypothesized based on sedimentological, palaeontological and geochemical evidence. The two chondrichthyan associations appear to be constituted by ecologically vicariant taxa, being both characterized by a predominance of benthic species with durophagous/carcitrophic feeding mode (mostly batoids), followed by piscivores (especially selachians). A third group, the soft-prey feeders (e.g., torpediniforms) appear to be exclusive of the Monte Postale assemblage. There are no large opportunistic eurytrophic predators (diet mostly based on fishes and other vertebrates) or microphagous filter feeders (diet based mainly on plankton) in these assemblages, possibly because of the absence of specific food items or because the palaeoenvironmental conditions of the shallow water palaeobiotopes precluded the access to these groups. Based on the bathymetric distribution of extant chondrichthyan relatives, our analysis suggests that both the Pesciara and Monte Postale palaeobiotopes were likely characterized by depths reaching 40-50 meters, thereby supporting the assumption of a shallow water inner shelf scenario. In conclusion, taxonomic composition, habitat preferences and palaeobathymetric analyses support the hypothesis that both the assemblages occupied tropical marine shallow waters of the inner portion of the Lessini Shelf, which were surrounded by coral reefs.

A POSSIBLE WAY TOWARDS A COMPREHENSIVE DATABASE OF PLANT MACROFOSSIL RECORDS FROM THE CENOZOIC OF ITALY

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Plant macrofossils from the Cenozoic of Italy are studied at least since two centuries, but a comprehensive database of published records still does not exist, even if it could be useful for several purposes. Scientists eventually interested in such fossil records usually need to consult personally the few competent paleobotanists. These, however, do not have a complete database at hand, themselves, and are often forced to a time-consuming search for obscure or sparse literature sources, sometimes not yet digitized. Here, we propose to start a process of expansion and publication of an existing database, called CENOFITA. This is presently biased towards the Neogene/Quaternary records and towards specific plant parts, but constitutes, indeed, the largest list of plant macrofossil records presently available for the Cenozoic of Italy. Such database originated from the need of cataloguing and analyzing a growing number (up to millions) of specimens of a vast fruit and seed (palaeocarpological) collection, which was developed, and is still presently hosted at the Department of Earth Sciences of the University of Turin. Actually, the name CENOFITA was also applied to that collection, made up of thousands of centimeter-sized boxes which concentrate in only three sets of drawers a precious documentation of the distribution in Italy of entire genera and families of plants over the last six million years. The collection provides an ideal environment for the identification of new palaeocarpological material, by comparison with the existing one and with the associated extant samples. Under current conditions, the CENOFITA collection allows rapid observation, updating and taxonomic revision of materials representing entire systematic groups. This opportunity will be warranted also in the future if this will remain an "elastic collection", capable of continuous integration and expansion, and a collaboration with the Museo Regionale di Scienze Naturali of Turin was recently started in order to reach this goal. Of course, the CENOFITA database could be even more "elastic", through its decoupling from the CENOFITA collection and its implementation with as many records as possible of plant macrofossil material stored in other Italian collections. On the occasion of Paleodays 2021, the CENOFITA database will be opened to all the new entries concerning Italian plant macrofossil records from Palaeocene to Pleistocene. In order to facilitate and stimulate contributions, a new version of the Microsoft Excel file of the CENOFITA database will be freely released. Those who may be interested in contributing new data to the CENOFITA database will just need to check the structure of the existing Microsoft Excel sheet and provide similarly arranged records. The authors will take care to evaluate and appropriately filter the contributed data and finally release new, freely available versions of the database during the next few years.

LARGE MAMMALS FROM THE LOWER COMPLEX OF GROTTA ROMANELLI (APULIA, SOUTHERN ITALY): BETWEEN THE REDISCOVERY OF THE HISTORICAL FOSSIL COLLECTION AND THE STUDY OF NEW MATERIAL

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Grotta Romanelli is a coastal cave located in the administrative territory of the Castro municipality, within the Otranto-Santa Maria di Leuca Coast and Tricase Woods regional natural parks (Lecce, Apulia, southern Italy). The long sedimentary succession contains a rich palaeontological and archaeological heritage, revealing human frequentation since the Middle Pleistocene. The stratigraphical succession includes two main complexes separated by a speleothem (level F), U/Th dated at 40 ± 3 ky by Fornaca-Rinaldi and Radmilli (1968). The lower complex includes, from bottom to top, a conglomerate deposit (K), a bone breccia (I) covered by a stalagmitic layer (H) U/Th dated at <69 ky by Fornaca-Rinaldi and Radmilli (1968) and the so-called *terre rosse* (G), bearing Middle Palaeolithic artefacts and vertebrate fauna. The upper complex consists of the so-called *terre brune* (levels E-A), which include late Upper Palaeolithic artefacts and vertebrate fauna. Despite its key role for studies on the Mediterranean Quaternary, the age of the lower part of the sequence of Grotta Romanelli was repeatedly questioned in literature and thus new fieldwork activities started in 2015, focusing on its reassessment. The field activities are led by a team from Sapienza, University of Rome, in collaboration with IGAG CNR and other research institutions. The general stratigraphic scheme proposed by Blanc (1920, 1928) was confirmed, even though the new investigations revealed a more complex and differentiated succession of layers with different palaeoenvironmental significance. New radiometric dating for the lower complex indicates a deposition between MIS 11 and MIS 5. Available data on mammals from the lower complex are mainly based on a faunal list reported by Blanc (1920, 1928). A few exceptions are represented by the samples of canid and otter from level G, referred to *Canis lupus* (Sardella et al., 2014) and *Lutra lutra* (Mecozzi et al., 2021), respectively, and rhino remains, attributed to *Stephanorhinus hundsheimensis* (level K), *Coelodonta antiquitatis* and *Stephanorhinus* sp. (level I), and *Stephanorhinus hemitoechus* (level G) (Pandolfi & Tagliacozzo, 2013; Pandolfi et al., 2017, 2018).

The results of the taxonomic revision of the historical paleontological collections housed at Museo delle Civiltà (former Museo Preistorico Etnografico "Luigi Pigorini"), Istituto Italiano di Paleontologia Umana (IsIPU) and Museo di Geologia e Paleontologia, Sistema Museale di Ateneo, Università di Firenze, are here presented as well as the new fossils excavated during 2015-2019. This will add important information on the biochronological framework on Europe Mediterranean communities of the late Middle to early Late Pleistocene.

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**A SECOND SPECIMEN OF THE ARCHAIC MEDITERRANEAN MONODONTID
CETACEAN *CASATIA THERMOPHILA* FROM THE ZANCLEAN DEPOSITS OF
ARCILLE (TUSCANY, ITALY)**

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The white whale *Delphinapterus leucas* (also known as the beluga) and the narwhal *Monodon monoceros* are the only extant members of the family Monodontidae (Cetacea, Odontoceti, Delphinoidea). These two species are exclusive of Arctic and subarctic cold waters. They are well known as iconic cetaceans by virtue of a white skin color (in case of *D. leucas*) and a spiraled tusk (in case of *M. monoceros*). Differing from other groups of odontocetes cetaceans, the monodontids are known as fossils from just a handful of specimens. Only four species have been described in literature, all being known by the sole holotype, namely: *Bohaskaia monodontoides*, *Denebola brachycephala*, *Haborodelphis japonicus* and *Casatia thermophila*. In particular, *C. thermophila* is the only fossil monodontid to have ever been found in the whole Mediterranean basin. Here we describe a second specimen of *C. thermophila*, from its lower Pliocene type locality of Arcille (Grosseto Province, Tuscany, central Italy). The new find consists of three cervicals (including the axis) and two lumbar. This fossil resembles the holotype in terms of overall size and cranial morphology, and especially, by displaying a similarly depressed portion of the dorsal surface of the premaxillae anterior to the premaxillary sac fossae and medial to the anteromedial sulci. Our new find is thus assigned to *C. thermophila*, and significant anatomical parts that are missing in the holotype are described in order to improve the diagnosis of this monodontid species. Several dentigerous fragments of the maxillae hint at a homodont and polydont dentition, which in turn suggests a ram prey capture method that differs from the highly derived suction method that is proper of extant monodontids. This second specimen of *C. thermophila* from the warm-water Arcille palaeoenvironment lends further support to the hypothesis that monodontids once thrived in tropical and subtropical habitats.

**RHINOCEROTIDAE FROM THE LOWER MIOCENE OF THE NEGEV (ISRAEL)
AND IMPLICATIONS FOR THE DISPERSAL OF EARLY NEOGENE
RHINOCEROSSES**

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A revision of the rhinocerotid material from the Negev (Israel), dating back to the early Miocene (MN3 in the European Mammal Biochronology), highlights the presence of *Brachypotherium* and a taxon close to *Gaindatherium* in the Levantine Corridor. A juvenile mandible, investigated using CT, displays morphologically distinct characters consistent with *B. cf. snowi* rather than other Asian and European representatives of this genus. Some postcranial remains from the Negev, such as a humerus, display features that discriminate among Miocene taxa. We attribute these postcrania to *cf. Gaindatherium*, a taxon never recorded outside the Siwaliks until now. These taxa dispersed into the Levantine region during the late early Miocene following a pattern similar to other South Asian taxa. *Brachypotherium cf. snowi* probably dispersed via the Levantine region into Africa during the early Miocene, as its remains are known from slightly younger localities such as Moghara (Egypt) and Jebel Zelten (Libya). *Cf. Gaindatherium* represents a previously unrecorded range expansion out of Southeast Asia. These new records demonstrate the paleogeographic importance of the Levantine region and showcase the complex role of the Levantine corridor in intercontinental dispersals between Asia and Europe as well as Eurasia and Africa.

**ANALISI DEI RESTI AVIFAUNISTICI PROVENIENTI DAI LIVELLI
EPIGRAVETTIANI DEL SITO DI RIPARO TAGLIENTE (STALLAVENA
DI GREZZANA, VERONA)**

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In questo contributo viene presentato lo studio, l'analisi sistematica e tafonomica dei resti fossili avifaunistici rinvenuti all'interno del sito archeologico di Riparo Tagliente (Stallavena di Grezzana, Verona, Italia). L'area di provenienza dei reperti su cui si basa questo sito è situata sui monti Lessini, a nord-ovest di Verona, sul versante sinistro della Valpantena, alla base del monte Tregnago, sotto un riparo roccioso formato da calcari oolitici. Il confronto e la determinazione dei resti fossili sono avvenuti grazie alla collezione ornitologica di confronto conservata presso la Sezione di Scienze Preistoriche e Antropologiche del Dipartimento di Studi Umanistici dell'Università di Ferrara. Il campione avifaunistico analizzato proviene dalle campagne di scavo effettuate tra il 1983 e il 2010 ed assomma a 351 resti ossei (determinato e non). L'analisi tassonomica ha rilevato almeno 8 ordini e 12 specie, che indicano la presenza di un insieme di ambienti diversificati nelle immediate vicinanze. Si può evincere che la zona fosse costituita da aree aperte, foreste di conifere, praterie alpine con sporadici affioramenti rocciosi, aree erbose e probabilmente cespugliate e specchi d'acqua a debole intensità. L'analisi tafonomica ha rilevato alcune modificazioni antropiche, che attestano lo sfruttamento a scopo alimentare dell'avifauna da parte delle popolazioni epigravettiane. Tracce di combustione sono conservate su 3 reperti e cut-marks sono visibili su 18; ulteriori analisi hanno altresì evidenziato, all'interno del riparo, l'azione di piccoli carnivori, roditori e rapaci notturni come agenti di accumulo dei depositi. Infine si può affermare che le avifaune identificate a Riparo Tagliente rispecchiano le caratteristiche climatiche e paleoambientali ipotizzate fino a questo momento; l'alta presenza di Anseriformes è legata sicuramente all'habitat favorevole, caratterizzato anche dalla prossima vicinanza del fiume e delle probabili acque ristagnanti che dovevano trovarsi a pochi metri dal riparo; i Passeriformes si adattano facilmente agli ambienti e apprezzano le zone rocciose, ma richiedono anche la presenza di piante e abbondante vegetazione.

A NEW SPERM WHALE OCCURRENCE FROM THE MIOCENE OF SOUTHERN ITALY: DIGITAL IMAGING AND RETRODEFORMATION AS TOOLS FOR THE SYSTEMATIC STUDY OF A BASAL PHYSETEROID

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Here we report on the discovery of a new sperm whale (Cetacea: Odontoceti: Physeteroidea) specimen from the Pietra leccese, a Miocene calcareous formation exposed in Salento Peninsula (southern Italy) and widely known for its abundance of fossil marine vertebrates. This partial skeleton, kept at the Museo di Storia Naturale dell'Università di Pisa (MSNUP) with accession number MSNUP I-17604, was found inside six quarry slabs. It displays a significant degree of dorsoventral diagenetic compression; furthermore, it is still partially entombed within the host rock. These issues led us to pursue the imaging of this specimen via computed tomography (CT). Our main goal was to obtain a digital model of the fossil that could be retrodeformed for adequately serving the systematic study of this remarkable specimen. The CT-scan was performed at the Cisanello University Hospital (Pisa, Italy), and the resulting data were imported in the open-source platform 3D Slicer, where we manually segmented the fossil bones. In order to retrodeform the skull of MSNUP I-17604, we imported the mesh obtained from the CT-scan within the open-source platform Blender and we scaled the model to reverse the effects of diagenetic compression. As a proxy, we used the foramen magnum, which we assumed having a circular shape originally. We substantiated this assumption by measuring the height and transverse width of the foramen magnum in several extant and fossil specimens of toothed whales, including various members of Physeteroidea. The CT-scan revealed that MSNUP I-17604 includes an incomplete cranium, a partial mandibular ramus, two detached teeth and two vertebrae that are still embedded within the calcareous matrix, plus five detached and fully prepared teeth. Despite the presence of a hard entombing rock and conspicuous diagenetic deformation, we obtained a digital 3D model of the skull with a good level of detail. A preliminary analysis of the retrodeformed model allows for observing that MSNUP I-17604 is a longirostrine sperm whale that exhibits a highly asymmetrical skull. Asymmetry is particularly evident with respect to the supracranial basin, whose posterior margin is distinctly displaced posterolaterally on its left side. This highly idiosyncratic feature indicates that MSNUP I-17604 represents a new, still undescribed physeteroid taxon. The open pulp cavity of the teeth and the limited degree of apical erosion of the crown suggest that MSNUP I-17604 was a young individual at the time of death. Our cladistic phylogenetic analysis recovers MSNUP I-17604 as more related to extant *Physeter* than to living *Kogia*, and possibly as a stem physeterid. Taking its place besides *Zygophyseter varolai* and a recently described unnamed physeteroid, MSNUP I-17604 demonstrates that an unexpected diversity of sperm whales inhabited the central Mediterranean Sea during the time of deposition of the Pietra leccese formation.

MINERALIZATION PROCESSES OF ORGANIC MATTER IN MICROBIAL COMMUNITIES: ROLE OF BACTERIA, EXTRACELLULAR POLYMERIC SUBSTANCE AND VIRUSES

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The nanostructure and composition of two modern lithifying microbial communities were studied and compared, with the aim to understand the processes of mineralization of the organic matter. One consists of a thick, stromatolite forming, microbial mat from a marine hypersaline sabkha environment, and one consists of a microbial biofilm in a fluvial tufa-forming freshwater setting. Despite the very different environmental conditions and the diverse species of microorganisms present, the mechanisms of mineralization of the organic substrates and the mineral products show many similarities. A variety of microorganisms dominated by cyanobacteria, heterotrophic bacteria and viruses (bacteriophages) compose both the communities; microbial-produced vesicles are also present. Extracellular polymer substance (EPS) produced by most of the bacterial forms, is widespread. The EPS is the unique place where the mineralization takes place, as inside this organic structure bacterial cell walls, viruses, and vesicles can be initial sites of mineral nucleation and successively completely replaced by the mineral. EPS itself can also mineralize, as mineral nanocrystals develop randomly within the polymers replacing their filamentous structure. In both microbial consortiums, the mineralization of the organic substrates starts with the accumulation in the bacterial EPS, of an amorphous mineral compound rich of Ca, Si, Al, S and Mg with various proportions. This could have played a fundamental role in the subsequent formation of two types of proto-crystals less than 10 nm in size: nanoparticles (irregular to sub-spherical) and nanofibers (elongated), respectively Ca and Si-Al-Mg rich. The growth of proto-crystals carries to the formation of two mineral species: Ca-carbonate and Mg-silicate crystals with different habitus. The Ca-carbonate continues its growth forming most of the deposit, whereas the silicate, probably for the much less availability of Si and Al ions, the remain. The presence of several bacterial forms implies several metabolic processes acting within the microbial communities; among these heterotrophic bacteria (mainly sulphate and nitrate reducing) are probably the main responsible for the mediation of mineral formation thanks to their degradation activity of the EPS. In fact, the highly hydrated nature of much EPS represents an environment where ions can accumulate to reach higher concentrations. The successive microbial degradation of EPS increases the alkalinity and reduces the quantity of cation binding sites, releasing the cations that can be attracted by negatively charged substrates such as virus, vesicles, bacterial walls, and EPS itself, that act as nucleation sites for initiating the mineralization process.

AN EMPIRICAL STUDY OF THE B/CA PROXY IN CALCAREOUS RED ALGAEGiulia PIAZZA^{1*}, Valentina Alice BRACCHI¹, Antonio LANGONE² & Daniela BASSO¹¹ Department of Earth and Environmental Sciences, University of Milano-Bicocca, Milano, Italy.² CNR – Institute of Geosciences and Earth Resources, Pavia, Italy.* Presenting author; e-mail: g.piazza15@campus.unimib.it

Calcareous red algae have a long and rich fossil record (Basso et al., 2007; Bracchi et al., 2014), and a widely recognized importance as paleoclimate archives (Halfar et al., 2008; McCoy and Kamenos, 2015). Their geochemical composition is used to infer past seawater temperature (Fietzke et al., 2015; Ragazzola et al., 2020), salinity (Kamenos et al., 2012), and pH (Anagnostou et al., 2019). The B/Ca ratio in benthic foraminifera has been used as a proxy for past CO₃²⁻ concentrations (Yu and Elderfield, 2007; Rae et al., 2011), but scarce data exist on B/Ca in coralline algae, and its driving factors. Recent experiments on cultured *Neogoniolithon* sp. showed an inverse relationship between seawater dissolved inorganic carbon (DIC) and B/Ca (Donald et al., 2017). B and Ca contents were measured by laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) in the maerl species *Lithothamnion corallioides* (P. Crouan & H. Crouan) P. Crouan & H. Crouan 1867, which has a wide geographic distribution in European waters. Samples were collected in the Mediterranean Sea (Pontian Islands, 66 m depth; Elba, 45 m depth and Aegadian Islands, 40 m depth), and in the NE Atlantic Ocean (Morlaix Bay, 12 m depth). DIC data from the sampling sites have been extracted by CMEMS (E.U. Copernicus Marine Service Information) products, and the Kruskal-Wallis test was run in R 3.6.3 software to evaluate B/Ca differences among samples. The B/Ca ratio showed significant differences among samples ($p < 0.01$). The mean DIC was lower in the Atlantic Ocean, where the alga registered high B/Ca values. In Pontian Isl., the deepest site, the B/Ca was significantly lower than the other Mediterranean sites ($p < 0.01$), despite very similar DIC. The measurements on growth rates resulted in a lower rate in Pontian Isl. (0.10 mm/yr), compared to the other samples (~0.13 mm/yr), likely related to the variations in light availability with depth (Halfar et al., 2011). In general, the differences in growth rates among samples explained the shifts between DIC results and the expected B/Ca (Donald et al., 2017). In the light of this evidence, we suggest a growth rate influence on the B incorporation in this alga. As known for other geochemical signals, the B/Ca is therefore subject to algal growth patterns which should be carefully investigated in the attempt to reconstruct the paleoclimate.

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CONTROLLO AMBIENTALE E CLIMATICO SULLA PROLIFERAZIONE DEI BIVALVI CON CONCHIGLIA A BASTONE (CLUB-LIKE SHELL) DEL MESOZOICO

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Il Mesozoico registra la diffusione di bivalvi a forma di bastone (*club-like shell*, CLS) con conchiglie allungate in direzione dorso-ventrale, una ridotta cavità palleale, margini ventrali flessibili e senza cerniera. I CLS rappresentano un processo di convergenza adattativa tra generi di famiglie diverse (Plicatostylidae, Plicatulidae, Ostreidae) che derivano da progenitori sessili di substrati duri. Data l'assenza di un piede funzionale, i CLS rappresentano un adattamento secondario a substrati mobili con alti tassi di sedimentazione, stabilizzandosi passivamente nel fondale con la conchiglia che agisce da ancora (*mud-sticking bottom stabilization*). Alcuni di essi hanno avuto un rilevante ruolo nella produzione di rocce sedimentarie. Recenti ricerche hanno messo in evidenza il controllo climatico sulla loro diffusione ed estinzione. I plicatostylidi sono rappresentati da tre generi monospecifici chiamati informalmente lithiotidi i quali possedevano conchiglie essenzialmente aragonitiche con microstrutture fibroso-prismatiche e madreperlacee. Essi mostrano una distribuzione geografica globale, ma una breve durata temporale (Pliensbachiano-Toarciano inf.). La diffusione è avvenuta nella fase di miglioramento climatico successiva alle fluttuazioni negative del $\delta^{13}\text{C}$ registrate dal *Sinemurian-Pliensbachian Event*. L'estinzione è invece imputabile agli effetti letali (riscaldamento, acidificazione, eutrofizzazione, etc.) prodotti dall'evento anossico del Toarciano inferiore (Posenato et al. 2018). I CLS del Cretaceo sono rappresentati dall'ostreide *Konbostrea* e dal plicatulide *Chondrodonta*. Il primo genere è ristretto al Turoniano-Coniaciano del Giappone; il secondo mostra invece un'estensione areale e temporale molto più ampia essendo presente in tutta la Tetide dal Barremiano al Turoniano. *Chondrodonta* mostra una spiccata variabilità ecomorfica, tipica dei bivalvi adattati secondariamente a substrati mobili, con stili di vita che variano da pleurotetici, con conchiglie a coppa, ad ortotetici con conchiglie a bastone. La conchiglia presenta uno strato esterno di calcite foliata ed uno interno aragonitico, spesso affetto da dissoluzione diagenetica precoce. Le valve sono strettamente agganciate da un lungo condroforo per cui si rinvengono quasi sempre articolate. Nel Cretaceo Inferiore è comune *C. glabra* con piccole conchiglie (ca 10-15 cm di altezza), moderatamente allungate e tendenzialmente lisce. Questa specie ha prodotto accumuli biogenici paucispecifici prossimi all'evento anossico dell'Aptiano inferiore (OAE1a, Livello Selli). Nei calcari a rudiste del Cenomaniano superiore, prossimi all'evento anossico OAE2, sono comuni gli accumuli di *C. joannae*, una specie con grandi conchiglie (> 50 cm), spesso con vistosi ornamenti radiali e con morfotipi di CLS (Posenato et al. 2020). Analisi bio-cronostratigrafiche, tafonomiche e geochemiche suggeriscono che le proliferazioni di *Chondrodonta* possano costituire un bioevento indicatore di instabilità ambientale (p.e., bassa ossigenazione ed incremento dei nutrienti) che precede gli eventi anossici del Cretaceo (del Viscio et al. in press).

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A BRAVE NEW WORLD: A REVIEW OF THE EARLY TRIASSIC TERRESTRIAL TETRAPOD FAUNA

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The Permian-Triassic mass extinction (PTME, ca. 252 Mya) eliminated > 90% of marine and terrestrial species and thus can be considered as one of the most severe biotic crises of the entire Phanerozoic. The Early and Middle Triassic represented a long period of recovery with a real ‘revolution’ in the structure of both terrestrial and marine ecosystems. Entire new clades emerged after the mass extinction, including decapods and marine reptiles in the oceans and new tetrapods on land, leading in the long term to the new ecosystem structures of the Mesozoic and Cenozoic. The recovery has been interpreted as stepwise and slow in both marine and terrestrial ecosystems, due to a complex combination of continuing environmental perturbations and complex multilevel interaction between species in the new environments as ecosystems reconstructed themselves. In this contribution we present a review of Early Triassic geological formations, and terrestrial tetrapod faunas around the world, and we perform a semi-quantitative analysis of a large data set of Early Triassic terrestrial tetrapods. The analysis highlights a consistent regionalization of Early Triassic terrestrial tetrapods, with palaeolatitudinal belts influencing ecosystems in terms of both taxonomic composition and relative abundance. We thus reject the alleged uniformity (‘cosmopolitanism’) of faunas around Pangaea suggested in the literature as a result of the hot-house climate. The study also shows that the “tetrapod gap” of terrestrial life in the Early Triassic was restricted to palaeolatitudes between 15°N and about 31°S, in contrast to the earlier suggestion of a total absence of tetrapod taxa between 30°N and 40°S. The cluster analysis performed on the taxon presence-absence matrix stresses strong provincialism following the PTME, entirely consistent with Early Triassic palaeobiogeography. An interesting and unexpected finding is an overall pattern for Early Triassic terrestrial tetrapod faunas that largely reflects that of the Late Permian, suggesting that the recovery faunas in the Early Triassic retained some imprint of tetrapod distributions according to palaeogeography and palaeoclimate, despite the near-total extinction of life through the PTME.

SKIN PATTERNING AND INTERNAL ANATOMY OF A 50 MA MOONFISH FROM THE MONTE BOLCA LAGERSTÄTTE

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The Monte Bolca Lagerstätte (50 Ma, Veneto, Italy) includes abundant teleost fish that preserve soft tissues and integumentary colour patterns in the form of stripes and spots. A recently excavated specimen of the moonfish *Mene rhombea* (Volta, 1796) from the Pesciara site provides a timely opportunity to investigate the preservation of the soft tissues. The specimen preserves several features defined by dark carbonaceous films: striking longitudinal stripes in the epaxial region, an eyespot and discrete patches in the abdomen. Scanning electron microscopy reveals that all of these features comprise layers of melanosomes – melanin-bearing organelles – and thus the abdominal dark patches represent degraded internal organs. As with other vertebrate fossils, melanosomes from the skin and internal organs differ in geometry; melanosomes from two different regions in the abdomen exhibit different geometry, suggesting that the latter derive from two separate organs, likely to be the kidneys and liver based on the anatomical location. Raman spectra of all melanosome-rich soft tissues are consistent with eumelanin. The longitudinal striping suggests open water lifestyles and/or cooperative shoaling or other mutualistic interactions.

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**BENTHIC FORAMINIFERAL CHARACTERIZATION OF HOLOCENE PRODELTA
SUCCESSIONS FROM THE MEDITERRANEAN RECORD:
BIOTIC AND STRATIGRAPHIC IMPLICATIONS**

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At a basin scale, subaqueous deltas embody a crucial step of the sediment routing from a source-to-sink perspective and they represent a key architectural element of platforms worldwide. Onshore, the tens m-thick prodelta muds buried beneath modern delta plains are valuable sedimentary archives as well, recording the Holocene phases of delta upbuilding since about 8000-7000 cal yr BP when highstand relative sea level conditions established across the Mediterranean Sea. The high accumulation rates (up to cm/yr) and the fine-grained character of these shallow-marine deposits allow investigating past environmental dynamics and processes at a high-frequency scale, through the application of a stratigraphic-based multivariate approach on cored successions. We quantitatively analysed and compared the benthic foraminiferal content of Holocene prodelta successions belonging to three Mediterranean deltas, which currently show different morphologies (from lobate to cusped) and fluvial discharges: Po Delta (N Adriatic Sea), Rhône Delta (Gulf of Lions) and Arno Delta (Ligurian Sea). Six recurring groups of taxa were highlighted by the R-mode cluster analysis applied on the final matrix including a total of 69 samples (31 from the Po Delta, 21 from the Arno Delta and 17 from the Rhône Delta). These groups reflect foraminiferal associations thriving prodelta (palaeo)environments characterised by specific substrate features, including organic matter availability and hydrodynamic conditions. The vertical stacking pattern of the identified foraminiferal associations and the integration with nMDS (non-Metric Multidimensional Scaling) results allowed: *i*) the visualization of the (palaeo)community changes through time within each prodelta setting and *ii*) the identification of similarities and differences in the evolution trajectories of the selected deltas, revealing past river plume-longshore currents interactions at the shelf bottom.

PLEISTOCENE LITHOBIONT COMMUNITIES FROM SICILY

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Lithobiont communities consist of a variety of taxa that are able to live inside (borers) and on (sessile epibionts with diversified fixing behaviours and structures) rocky surfaces including extensive outcrops as well as boulders and cobbles. Such communities mostly develop along rocky shores showing remarkable differences between exposed and sheltered to cryptic habitats and subordinately in deep (circalittoral to bathyal) settings where hard lithic substrata are available or locally form due to early diagenesis cementation. The under-representation of colonizable hard-surfaces in relation to soft bottoms and their prevalent location in high energy settings, joined with the composition of lithobiont communities usually dominated by soft-bodied organisms (such as soft algae and sponges), affect their preservation and recovery. Consequently, lithobiont communities are usually rare or exceptional in the fossil record including trace fossils (essentially *domichnia* and *fixichnia*) and cemented skeletonized organisms including molluscs, scleractinians, brachiopods, serpulids and bryozoans with the last two taxonomic groups often playing a relevant role. Records from southern Italy, especially Sicily, are growing in the last decades. Besides widespread documentation about very shallow lithobiont communities often associated with morphological markers of past sea levels, sparse information is now available for different settings including palaeocommunities from infralittoral cobbles and pebbles, shallow-water completely dark submarine caves, deep circalittoral and bathyal scarps and large blocks associated to active faulting. A short overview of the serpulid and bryozoan biodiversity associated with these habitats will be provided together with preliminary information about a new finding (Vallone Loddiero, Militello in Val di Catania, Sicily) of a pioneer community encrusting the free surfaces offered by just ejected submarine volcanic products.

RE-EVALUATION OF THE HOLOTYPE OF *DRACONYX LOUREIROI* (DINOSAURIA, ORNITHOPODA) WITH REPORT OF NEW HOLOTYPE MATERIAL

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The Upper Jurassic Lourinhã Formation is a siliciclastic continental unit, which yielded a diverse vertebrate fauna, dated from upper-most Kimmeridgian to lower-most Tithonian. Among dinosaurians, extremely diverse and abundant were saurischians, while ornithischians are extremely rare. In 1991, Museu da Lourinhã excavated a specimen of a medium-sized iguanodontian, the holotype of *Draconyx loureiroi* (ML 357). However, beside its original description, specialists in many systematic and taxonomic revision of the clade Iguanodontia have neglected this specimen. Moreover, the original discoverer of the holotype, Mr. Carlos Anunciação, provided us with new material belonging to the holotype specimen and collected during the original dig in 1991, including partially articulated phalanges and carpal bones. This new material, new lab preparation, and new CT-scanning data, allowed us to re-appraise ML 357 and perform phylogenetic and morphometric analyses. We confirmed that *Draconyx loureiroi* is a valid taxon, providing a revised diagnosis for this species. It can be distinguished by other iguanodontians in possessing the following unique combination of characters: an unfused and unpacked carpus, cnemial crest of the tibia cranio-laterally deflected, fibular condyle caudo-laterally deflected, presence of a vestigial splinter-like metatarsal-I. Phylogenetic analyses were carried out employing both Maximum Parsimony and Bayesian approaches. Both analyses found *D. loureiroi* nested at the base of Styracosterna. Further, we estimated with both Maximum Parsimony and Bayesian inference evolutionary rates across the consensus topologies obtained and found accelerated rates of evolution across the Jurassic-Cretaceous transition. The linear morphometric analysis indicated that *D. loureiroi* is a specimen of approximately 3 to 4 meters, suggesting that the base of Styracosterna is characterized by medium-sized species, and only later in their evolution styracosternans attained larger body sizes. This increase in evolutionary rates is contemporary to a global geological crisis and the subsequent remodelling of terrestrial ecosystems. Further research is needed to elucidate if this crisis sped-up the evolution of this clade of dinosaurs.

GEOTHEMATIC MAP AND ICHNOLOGICAL STUDY OF THE ALTAMURA DINOSAUR TRACKSITE (EARLY CAMPANIAN; APULIA, SOUTHERN ITALY)

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In 2019 a multidisciplinary study of the Altamura dinosaur tracksite (Late Cretaceous, early Campanian; Apulia, southern Italy) was carried out to document its palaeontological and geological features. The goal was to pave the way to projects aimed both at long-term conservation of the geo-palaeontological heritage and at its valorisation, developing a virtuous and sustainable geotourism. For this purpose, a 3D mapping of the whole track-bearing surface was performed, to produce the first geothematic 1:50 scale map of the ichnosite. During the field activities, the surface was subdivided into sectors. For each sector, the work started with the accurate manual and mechanical (industrial vacuum cleaner) sweeping. The ichnological survey was carried out using standard methods (interpretative drawings with chalks to highlight outline and main morphological features of each track). This approach was supported with close-range photogrammetry to obtain 3D models of the best-preserved specimens. Finally, each sector was surveyed through aerial-based photogrammetry by means of UAV (Unmanned Aerial Vehicle), and DGPS/RTK on fixed ground targets. Aerial survey allowed to gain high-resolution and georeferenced orthophotos processed with Agisoft Photoscan[®] (now Agisoft Metashape[®]). The field ichnological drawings occurring on each orthophoto were then accurately traced and vectorized. The final step was to merge each digitized sector obtaining the map of the whole tracksite. Output (geo-thematic map and 3D models of dinosaur tracks) shows the extraordinary richness of the Altamura tracksite (about 26,000 footprints and 12 distinct trackways), confirming the high impact of new methodologies (close-range and aerial-based photogrammetry) as useful tools for both ichnological studies and future activities of public fruition of the geosite. The sedimentological and lithostratigraphic study allowed to attribute the succession hosting the track-bearing surface to peritidal facies characterized by periodic exposures. The ichnological study, supported by the analysis of almost 4,000 morphometric measurements and by the photogrammetric models, led to the identification of two different morphotypes. The first, attributed to ornithopods, includes specimens characterised by tridactyl pes, with lobe-shaped digit marks, and smallest manus with three subcircular pad impressions: this group includes the ichnospecies *Apulosauripus federicianus*, typified by the trackway ACDL99/3 (Nicosia et al., 2000), but numerous footprints can be also morphologically assigned to the ichnogenus *Caririchnium* Leonardi, 1984. The second morphotype, attributed to ankylosaurs, is represented by a broad tetradactyl pes and a slightly smaller manus, with four or five poorly distinct digit marks: this morphotype closely matches the ichnogenus *Tetrapodosaurus*.

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TUBE STRUCTURE AND TAPHONOMIC FEATURES OF FOSSIL CIRRATULIDS FROM THE EAST PISCO BASIN (SOUTHERN PERU)

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Among the tube-dwelling polychaete worms in the family Cirratulidae, some species produce calcareous tubes preservable as fossils. Recent calcareous cirratulids are distributed in temperate and tropical environments, where they aggregate to form small reefs in shallow waters with normal salinity. Fossil records of cirratulid aggregates are however rare. Here we analyse the tube structure and taphonomic features of the cirratulid *Diplochaetetes mexicanus* (Wilson, 1986), reported from the Miocene of Peru, in the East Pisco Basin. There, the species forms dm-sized tube aggregates with pillow-, mushroom-, dome-like and tabular growth morphologies. Aggregates are formed by subparallel tubes adhering to each other. Tubes do not increase in diameter during growth and have a circular lumen with an average width of 1.3 mm. Transverse, concave upwards, double-layered septa occur inside some tubes. Optical and electron microscopy (SEM) analyses, coupled with epifluorescence observations, allow for detecting the tube biomineralization style. Tube wall is ca. 0.2 mm thick and is formed by a layer of very thin irregular micro-laminae. Sediment particles can be visible between tubes, cemented by biomicrites. Both the laminated wall and biomicrites in between show high fluorescence, reflecting their bio-mediated origin. The tubes exhibit different degrees of preservation. They vary from exquisitely preserved specimens, showing remain of the prismatic-like ultrastructure of the laminae and micrite-size crystals (finer than 4 microns) of the agglutinating biocement, to deeply diagenized specimens, showing rhomboedric dolomite crystals, growing on the original laminae and biomicrite. The present work aims at depicting the microstructure of the *D. mexicanus* and providing comparisons with the results obtained in previous studies.

TAPHONOMY OF AN EARLY PLIOCENE BALAENOPTERID WHALE FROM SOUTHERN TUSCANY: A PRELIMINARY INVESTIGATION

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A balaenopterid skeleton from the early Pliocene of Montalcino was found in 2007 and prepared in 2016-2019. After its complete preparation, a preliminary investigation about its taphonomy was performed that resulted in the reconstruction of the map of the bone dispersion, an analysis of fracture types, part of the associated fauna and a new stratigraphic study to constrain the age of the specimen. This Zanclean whale is represented by an associated skeleton (about 50% complete) that is completely disarticulated. Bones are scattered and removed from the original axis of the whale with the exception of part of the cervical vertebrae and the transition between lumbar and caudal vertebrae. The bones show load fractures and a limited number of impact fractures suggesting that the environment where the decay occurred was characterized by high energy water flow. Presence of fully grown balanid barnacles on some of the bones suggests that the carcass remained over the seafloor for *c.* 1 year before being buried. Application of biostratigraphic procedures allowed the reconstruction of part of the taphonomic history of the specimen.

RE-RESTAURING BONES: A NEW LOOK AT THE PLEISTOCENE LARGE MAMMALS STORED AT MUST SAPIENZA, UNIVERSITY OF ROME

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Since 2017 the MUST (University Museum of Earth Sciences of Sapienza) is the new museum of the Department of Earth Sciences of Sapienza University of Rome, part of the museal system (Polo museale) of the university. MUST represents the unification of the existing and independent departmental museums of Geology, Mineralogy and Paleontology. The vertebrate paleontological collection currently hosts thousands of specimens, including many Quaternary mammals from central Italy and the Mediterranean Islands, in exhibition since the beginning of '70s. During the renewal of the Vertebrate Paleontology hall, the restoration of nearly complete crania and skeletons of Rhinocerotidae, Hippopotamidae, Bovidae and Cervidae was started. This project has a twofold meaning: the preservation of this material from a museal viewpoint and the preparation for new paleontological research. In particular, all previously applied materials (gypsum, glue, resin, paint) were removed, exposing the bone tissue. This allowed to observe original features of these fossils and to acquire reliable biometric and morphological data. Finally, new consolidating was applied and new supports were realized in order to better preserve this paleontological heritage. During the reorganization of the Vertebrate Paleontology hall, new technologies are also applied and, especially, 3D models of most significant specimens are realized using CT-scans and photogrammetry. This represents a first step towards the digitization of the Museum and the realization of a virtual catalogue of the Vertebrate fossils stored at MUST.

BIOAPATITE DIAGENESIS AND FOSSILIZATION

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Bioapatite has triggered the evolution of living organisms for over five hundred million years. In utilizing calcium phosphate minerals, animals learnt how to construct new body architectures with a rigid skeletal frame, to shelter soft body parts from predation within a shell, to defend themselves from attack with menacing weapons, and to process food with teeth. By the use of efficient structural designs that optimized mechanical properties through a combination of evolutionary processes and functional adaptations, bioapatite has enabled vertebrates to acquire large body sizes in the sea, on land and in the air. Despite such a remarkable biological success, the crystallography of bioapatite and the eventual modification of lattice parameters over a wide range of geologic time have in contrast been scarcely investigated. In our study we analyzed living, dead and fossil remains of apatite biomineralizing organisms, both vertebrates and invertebrates, ranging from the Cambrian to the Recent, a time-lapse spanning over 500 million years. We detected the bioapatite crystal features of the major phosphatic phyla (Brachiopoda, Arthropoda, Bryozoa, and Chordata: the latter including conodonts, cartilaginous and bony fishes, amphibians, reptiles, birds and mammals). Groups were investigated using either fossil or recent material (dead and alive, the latter referring to material extracted from living organisms). Our data reveals that living and dead organisms, and their fossil remains, have a distinct geometric signature in terms of bioapatite lattice cell parameters mirroring atom re-arrangements within the crystal lattice which drive to a general reduction of the cell volume (i.e., the volume of the hexagonal crystalline cell frame) over time. These changes initiate at the death of the organism, and attain overall stability only in the ultimate stages of fossilization.

PALEOENVIRONMENTAL EVOLUTION OF THE LATE MIDDLE-LATE PLEISTOCENE MARANO EQUO BASIN (LATIUM, CENTRAL APENNINES)

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The Marano Equo area is part of the valley of Aniene, a river draining the western flank of the Apennines chain (Latium, central Italy). The bedrock is made up of the Meso-Cenozoic units of the Latium - Abruzzi carbonate platform, of the Miocene units characterized by facies transitional from the carbonate platform to the basin (Sabina domain), and of the syn-orogenic turbiditic siliciclastic deposits (upper Tortonian). In the Marano Equo area the Aniene R. valley is filled by a sedimentary succession more than 150 m thick. The sediments and the paleontological content of the cores of eight continuous boreholes have been analyzed to decipher the paleoenvironmental and palaeoclimatic changes occurred in the area. The results indicate that the sedimentary succession is referred to a braided plain where conglomerates, sands and clays speak for a varying fluvial energy and, at some levels, for the strong influence of springs. It is noteworthy that calcareous tufa and calcareous sands are present in several cores. Seven samples of these latter have been dated by the disequilibrium method in the Uranium series. Two datings gave an age >350 ka, whereas the others span from 259 +61/-43 ka to 100 ± 7 ka. These results allow to refer the sediments of the cores to at least the Middle Upper Pleistocene. Molluscs and ostracods from three sediment cores were studied. Among molluscs, the most abundant were terrestrial species, adapted to dry or humid open environments (*Vallonia pulchella*, *Vertigo pygmaea*, *Vitrea contracta*, *Vertigo angustior*, *Carychium minimum* and *Oxyloma elegans*). The few recorded freshwater species (such as *Lymnaea truncatula* frequently associated to *Pisidium personatum*, at some core levels), point to marshy grasslands or ephemeral ponds. Among ostracods, nineteen species were identified, scattered in the sediment cores, that, in a large part, inhabit preferentially different spring system habitats (nine species i.e. *Eucypris pigra*, *Herpetocypris brevicaudata*, *Heterocypris reptans*, *Ilyocypris bradyi*, *Ilyocypris inermis*, *Paralimnocythere messanai*, *Potamocypris zschokkei*, *Psychrodromus olivaceous* and *Scottia pseudobrowniana*) or occur commonly in springs (five species i.e. *Candonopsis scourfieldi*, *Darwinula stevensoni*, *Heterocypris incongruens*, *Neglecandona neglecta*, and *Pseudocandona albicans*). The results obtained by the application of multivariate analyses (Cluster Analysis and Principal Component Analysis) on the ostracod assemblages showed that the Marano Equo braided plain was partially occupied by ponds fed by groundwater, floods, and springs in which it was possible to recognize different limnocene, helocene and rheocene habitats. The Mutual Ostracod Temperature Range method indicates that the spring systems and the ponds were active during cool periods, when summer air temperatures were 3-5°C cooler than present. These periods could be referred to the cool intervals of the late MIS 5, according to the calcareous tufa ages.

REVISION OF CRETACEOUS ICHTHYOSAURS FROM THE NORTHERN APENNINES: NEW INSIGHTS ON NEUROVASCULAR ANATOMY, ECOLOGY AND ABYSSAL TAPHONOMY

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A new ichthyosaur rostrum fragment (251372) was found in 2016 near Gombola (Modena province). This new find enriches the record of Cretaceous ichthyosaur remains from the same locality, dating back to the late 1800s. Two other rostral fragments from Gombola (IPUM 30139, IPUM 30140), previously referred to *Platypterygius* sp., were also re-examined. All specimens come from parts of the rostrum anterior to the narial openings, and CT scans allowed the observation of their internal anatomy. All three specimens can be confidently assigned to the ophthalmosaurid subfamily Platypterygiinae, based on the strongly quadrangular shape of the tooth roots. The robust shape of the teeth and the coarse longitudinal ridges on the crowns are indicative of an apex-predator ecomorphotype. The CT scan of 251372 revealed maxillary and mandibular ramification of the trigeminal nerve (V); each channel is branching from the main body at the base of the alveolar grooves and connects with the respective fossa dentalis/premaxillaris. All three specimens share similar taphonomic characteristics, e.g. displacement along the symphyseal axis due to lateral compression. 251372 shows also evidence of scavenging, among which the tip of a shark tooth embedded in the proximal end of the fragment. Similar to other marine reptiles found in the Northern Apennines, all fragments present signs of a common taphonomic history: bones and teeth are highly dense, black in colour and barely permeable by X-rays. These features seem to be related to the particular deep-sea environment, where iron-manganese oxides and carbonates (rhodochrosite) encrust the skeletal tissues, encasing and protecting the remains. This study has been financed by the University of Modena and Reggio Emilia, FAR 2020 Project (Remitti, Papazzoni, Vescogni).

NEW RESULTS ON THE EARLY PLEISTOCENE SITE OF ELLERA DI CORCIANO (ITALY)

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The “Quasar” fossiliferous site at Ellera di Corciano (Perugia, Italy) was discovered in 2011 during an archaeological survey by the “Soprintendenza Archeologia, Belle Arti e Paesaggio dell'Umbria”, in the building site of a mall. The site is located within the Ellera basin, a small intermontane sedimentary basin adjacent to the larger Tiberino Basin. The Quasar stratigraphic section has a thickness of more than 16 meters, and is characterized by an alternation of calcareous tufa, sandy clay and silty clay affected by advanced pedogenesis. Most of the vertebrate fossils (about 300 remains) were found within four different layers: the lowermost layer, in which a hippo partial skeleton was found, among other remains; the second layer, from which most of the collection of isolated bones come; the third layer, in which a mammoth partial skeleton was discovered; the uppermost layer, from which a second mammoth partial skeleton was retrieved. The complete faunal list includes: *Anura* indet., *Testudinoidea* indet., *Mammuthus* cf. *meridionalis*, *Soricidae* indet., *Arvicolidae* indet., *Canis* sp., *Hyaenidae*, *Hippopotamus antiquus*, ‘*Pseudodama*’ *farnetensis*, *Praemegaceros verticornis*, cf. *Bison* (*Eobison*), and *Equus* sp. Especially noteworthy are the remains of *H. antiquus*, among which a partial skeleton with nearly complete cranium stands out. This large mammal, more adapted to aquatic environments as compared with his extant relative, shows in Ellera quite advanced morphologies especially in the cranium, similar to what is observed in the specimens from the Incarcial Complex (ca. 1 Ma; NE Iberian Peninsula). Micropaleontological studies allow the recognition of two ostracod assemblages: the first dominated by the genus *Cyprideis* (in the lowermost and second layers), and the second by *Ilyocypris* and *Candona* (in the third layer), testifying shallow oligohaline waterbody and freshwater permanent waterbody, respectively. These results, together with sedimentological and geotechnical data, suggest the presence of two main depositional environments: a periodically flooded alluvial plain (clays, silty and sandy clays, paleosols) and a lacustrine/palustrine environment (calcareous tufa). A phytoclastic sandy layer very rich in Characeae remains at about 11 m is indicative of the presence of a still and clear freshwater body. From a biochronological point of view, probably the most interesting taxon is *P. verticornis*, whose first occurrence has been chosen as the bioevent marking the beginning of the Galerian Land Mammal Age (now corresponding to the beginning of the Epivillafranchian) in the Italian biochronological scheme. The occurrence of this cervid in Ellera suggests an attribution to a time span between 1.2 and at least 0.65 Ma. However, the presence of a small sized *Bison*-like bovid with primitive features would indicate an earlier age (Late Villafranchian, ca. 1.5–1.2 Ma) for the assemblage.

FOCUS ON SEA SURFACE WATER CHARACTERISTICS IN THE GULF OF CADIZ DURING EARLY PLEISTOCENE: EVIDENCE FROM COCCOLITHOPHORES

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Quantitative analyses have been carried out on coccolithophores from sediments of Site U1387 recovered in the Gulf of Cadiz, with a 0.3ky temporal resolution, according to the age model of Voelker et al. (2016). The study interval from MIS 48 to MIS 46 (1468.41 ka-1411.83 ka) focuses on Early Pleistocene climate variability (“41 ka world”) and supports the research of the QUIGS (QUaternary Inter GlacialS) and PAGES (Past Global Changes) projects. The Nannofossil Accumulation Rate ranges from 1316 to 46517 coccoliths/cm²kyr and its pattern through time doesn’t show a particular correlation with the glacial-interglacial phases displayed by the oxygen isotope record of Voelker et al. (2016). Gephyrocapsids are the dominant group of the coccolith assemblage with percentages up to 80%. The reworked coccoliths and the lithic or mineral elements (> 10 µm) have been also counted to monitor variability in terrigenous supply. The abundance fluctuations of key taxa, such as *Gephyrocapsa caribbeanica*, *Coccolithus pelagicus* ssp. *pelagicus*, warm water taxa, large *Gephyrocapsa* (> 5.5 µm), as well as of the reworked and lithic elements, allow the recognition of glacial (MIS 48 and 46) and interglacial (MIS 47) phases, in agreement with δ¹⁸O_{G.bulloides} pattern. The peculiar higher abundance of large *Gephyrocapsa* during glacial periods clearly evidences, for the first time, a preference of this morphotype for colder surface waters. The principal component analysis (PCA) performed on the assemblages shows that temperature (Factor 1) was the primary parameter that influenced coccolithophore assemblage composition, although productivity (Factor 2) also played a role. Factor 2 shows a high correlation index (r= +0,83) with the paleoproductivity index of Flores et al. (2000). The major increase of coccolithophore productivity is recorded during the selected interval of both glacial and interglacial phases. This pattern is linked to greater availability of nutrients in surface waters, a condition that at the core location is usually connected to a greater land-derived input, and/or to upwelling phenomena depending on the changes in the atmospheric process and oceanographic dynamics along the coast.

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**FROM AMMONITE TO AMMONIA: AN EXHIBITION TO CELEBRATE THE UNIQUE
MICROPALEONTOLOGICAL LEGACY OF THE GIOVANNI CAPELLINI
GEOLOGICAL MUSEUM (UNIVERSITY OF BOLOGNA, ITALY)**

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The Giovanni Capellini Museum houses one of the most important fossil collections in Europe in a substantially unaltered layout of the late 19th Century. This exhibition allows visitors a journey into the history of foraminiferal micropaleontology, from the discovery of the first microfossils, in the early 18th Century, to the first half of the 20th Century, when micropaleontology reached a leading role in Earth Sciences.

The itinerary of the exhibition is organized in six showcases. The first one documents the birth of micropaleontology through the original materials of Jacopo Bartolomeo Beccari. As reported in a manuscript (1711) and in a published paper (1731), Beccari described and interpreted for the first time a foraminiferal assemblage collected from Pleistocene strata south of Bologna. In this showcase some Beccari's *Ammonia* are exposed next to the volume of Plancus (1739) with the illustration of specimens later used by Linnaeus for establishing his *Nautilus beccarii* (1758). It also hosts an ancient microscope attributed to Giuseppe Campani (1635-1715) and traditionally regarded as the Beccari's microscope. The second showcase is devoted to Alcide d'Orbigny and shows a collection of his foraminiferal models (2nd edition, 1842), the plates of the "*Tableau méthodique de la classe des Céphalopodes*" (1826), and a manuscript version of this volume, the "*Tableau Berthelin-Fornasini*". In this volume, Georges Berthelin traced foraminiferal sketches from d'Orbigny's unpublished plates. Berthelin then bequeathed this unique volume to Carlo Fornasini, who described and published many d'Orbigny species by these sketches. The third showcase includes part of the foraminiferal collection of Carlo Fornasini, the leading Italian micropaleontologist of the late 19th Century. This collection consists of hundreds of glass tubes and high-quality micropaleontological slides – "*the red slides of Fornasini*". The fourth showcase is devoted to the foraminiferal iconography during the 18th and 19th Centuries, with the exhibition of Soldani's (1780) and Brady's (1884) masterpieces. An original slide by Brady is shown for a comparison between the foraminifera specimens preserved there and the illustration of the same species in one of Brady's famous plates. The fifth showcase includes the nummulites of the "Hantken Collection", consisting of more than 100 species, carefully arranged within beautiful green slides, donated to the Museum in 1881. The last showcase is dedicated to the micropaleontology of the first half of the 20th Century, focusing on the relationships between industry and academy. A selection of research and educational materials is exposed, such as a set of foraminiferal models by Brooks Ellis (1950). Hundreds of foraminiferal specimens, models and volumes of great historical and scientific value are still preserved in Museum's repository, such as for instance, the 19th Century foraminiferal slides by Brady, Goës, Karrer, Millett and Sherborn, or the more recent ones by Bermudez, Bolli, Heron-Allen, Jenkins, Kennett, Parker, and others.

UPPER PERMIAN BRACHIOPODS FROM THE ABADEH SECTION, CENTRAL IRAN

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The Abadeh section, Central Iran, is one of the most important Permian-Triassic section because it consists of a continuous marine succession spanning the Late Permian to Early Triassic time interval. The succession comprises the Surmaq Fm., the Abadeh Fm., the Hambast Fm. and the Elikah Fm., the latter recording the Permian-Triassic boundary at its base. Although extensively studied, the position of the Permian-Triassic Boundary is still highly debated (e.g. Horacek et al. 2021) and the issue is complicated by the laterally discontinuous microbialites at the boundary transition (Taraz et al., 1981) and by problems in conodont taxonomy. The brachiopods here presented were collected by an Italian-Chinese-Iranian research team in Central Iran, along two sections, about 100-m far apart. The collected material consists of 559 specimens, of which 427 have been described as brachiopods, while the remaining specimens are solitary corals, crinoids, bryozoans, various mollusk fragments and an hybodontoid tooth assigned to the genus *Acrodus*. Among the brachiopods, 13 genera and 29 species have been identified in the Wuchiapingian part of the Hambast Fm. The taxa described in this study are: *Spinomarginifera helica*, *S. iranica*, *S. pygmaea*, *S. spinosocostata*, *S. sp. ind.*, *Araxilevis intermedius*, *Tschernyschewia typica*, *Leptodus* cf. *L. richtofeni*, *L. nobilis*, *L. sp. ind.*, *Permianella* sp. ind., *Orthotetina persica*, *O. sp. ind.*, *Perigeyerella* aff. *P. costellata*, *P. aff. P. tricola*, *P. sp. ind.*, *Araxathyris abichi*, *A. bruntoni*, *A. felina*, *A. quadrilobata*, *A. sp. ind.*, *?Rectambitus* sp. ind., *Gruntallina* sp. ind., *?Spirigerella* sp. ind., *Transcaucasathyris araxensis*, *T. kandevani*, *T. lata*, *T. sp. ind.* and *?Permophricodothyris* sp. ind. The fauna also comprises undetermined species belonging to the orders Productida and Athyridida. The stratigraphic distribution of the specimens in the two sections at Abadeh has been analyzed using the Unitary Association (UA) method, from which three main UAs were obtained and used to correlate the two sections. The base of the Hambast Fm. is well correlated between the two sections, as well as their upper part. A correlation with the Julfa section (NW Iran) has also been attempted showing that the brachiopod assemblages of Abadeh are correlatable to those of the Lower Julfa Beds and part of the Upper Julfa Beds. Also in both sections the topmost part of the Paratirolites Limestone is characterized by the occurrence of *Paracrurithyris pygmaea*.

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AN OVERVIEW OF THE MIOCENE AMPHIBIANS AND REPTILES FROM THE VALLÈS-PENEDÈS BASIN (CATALONIA, IBERIAN PENINSULA)

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First reports of fossil amphibians and reptiles from the Vallès-Penedès Basin (VPB) in Catalonia date back to the early-mid 20th Century pioneering works of scholars such as Bergounioux, Bataller, Crusafont, Villalta, and Hoffstetter. Since then, new material from new excavations was added to the record, and now more than one hundred sites within the basin have yielded palaeoherpetological remains. This includes sites that span in age from the early (MN3) to the late Miocene (MN12). The large amount of remains and the well-dated, chronostratigraphic framework in a well-delimited area triggered a renewed interest on the palaeoherpetological assemblages from the VPB in the last two decades, with a series of articles published by researchers linked to the Institut Català de Paleontologia Miquel Crusafont. We present an overview of the amphibians and reptiles from the VPB, including both published and unpublished material. This overview will act as a benchmark and starting point for future studies focused on specific groups and/or specimens, highlighting knowledge gaps or promising research topics. Amphibians from the VPB include urodeles and anurans. The former are represented only by two salamandrids, whereas the latter are more diverse, with discoglossine alytids, bufonids, pelobatids, and ranids. A larger number of reptile taxa were identified, belonging to chelonians, crocodylians, and squamates. Chelonians include members of the Geoemydidae, Testudinidae, and Trionychidae. *Diplocynodon* is the only crocodylian genus recovered up to now. Among squamates, we report the presence of gekkotan, lacertid, scincid, anguid, and varanid lizards. Amphisbaenians are represented only by blinids. Snakes include scolecophidians, erycine boids, “colubrines”, elapids, and viperids. Most of the remains from the VPB could be identified only at higher taxonomic ranks based on the current knowledge, even though further investigation will likely be of help in refining the identification of at least some of the groups. Nevertheless, specific identification was possible for a few taxa, including species with a wide distribution in Europe (*Latonia seyfriedi*, *Varanus marathonensis*) and others currently known only from the VPB (i.e., *Testudo catalaunica*, *Blanus mendezi*). Further new taxa are currently under study. Some of the specimens referred to these species, as well as some of those still being investigated, are particularly well preserved, thus offering significant opportunities to study their phylogenetic relationships and the evolution of their respective clades in the Neogene. Thus, the palaeoherpetological record of the VPB is a very important resource towards a better understanding of the Cenozoic evolutionary history of amphibians and reptiles not only at a local scale, but also for Europe and the Mediterranean region as a whole.

**PRESENZA DI *AMPHISTEGINA LESSONII* D'ORBIGNY, 1826 NEL "TIRRENIANO"
(TARENTIANO, PLEISTOCENE SUPERIORE) DELL'ISOLA DI FAVIGNANA
(ARCIPELAGO DELLE EGADI, SICILIA)**

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L'isola di Favignana conserva tracce di depositi riccamente fossiliferi del "Tirreniano", intervallo corrispondente alla base del piano Tarentiano (Pleistocene superiore) e all'episodio di clima caldo dello Stadio isotopico MIS 5.5. Il recente studio di conchiglie fossili del gasteropode *Thetystrombus latus* (= *Persististrombus latus*, = *Strombus bubonius*) (Repetto et al., 2020) ha permesso di mappare una porzione residua di tipica "spiaggia a *Strombus*", di proporre una ricostruzione paleoambientale e una valutazione del tasso di sollevamento dell'isola dal "Tirreniano" ad oggi. Lo studio stratigrafico e malacologico, integrato con l'analisi delle associazioni a foraminiferi, ha portato al ritrovamento di comuni esemplari di *Amphistegina lessonii* nel livello sommitale di spiaggia fossile, corrispondente al picco termico dello stadio isotopico, e nel riempimento di conchiglie di *T. latus*. *A. lessonii* è un macroforaminifero a parete calcarea, tipico di scogliere coralline, di aree tropicali e subtropicali, presente in Mediterraneo nel Miocene, Pliocene e negli intervalli più caldi del Gelasiano e Calabriano (Bizzarri et al., 2015; Baio & Violanti, 2021). Finora la specie non risulta segnalata nel Pleistocene superiore italiano. Tuttavia la sua diffusione in associazione con ospiti senegalesi, quali *T. latus*, nel Tirreniano sembra ecologicamente plausibile. Infatti il genere *Amphistegina* è, tra i macroforaminiferi, quello con più ampia diffusione, per la sua distribuzione limitata dall'isoterma invernale di 14° C. A Favignana gli esemplari di *Amphistegina* sono generalmente abrasati, poco ricristallizzati e con dimensioni comprese tra 700-2000 µm. Sono accompagnati da comuni frammenti di alghe corallinacee (*pralines*), e da microforaminiferi (miliolidi e forme sessili). Gli autori si sono proposti di proseguire le ricerche con lo studio dei foraminiferi in altri siti a *T. latus*, finora studiati solo per il contenuto macropaleontologico, per verificare l'eventuale presenza del genere *Amphistegina*. Pertanto, sperano che il progetto, interrotto dalla pandemia, possa continuare.

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CONSERVAZIONE E VALORIZZAZIONE DELLE COLLEZIONI STORICHE: LA COLLEZIONE PALEONTOLOGICA “GEORG GASSER”

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A cavallo fra la fine dell'Ottocento e i primi del Novecento, Georg Gasser, naturalista autodidatta, si dedicò alla creazione di quella che a livello storico è certamente una delle più importanti collezioni naturalistiche presenti in Alto Adige. Realizzata all'interno della sua casa secondo il tipico allestimento delle “Wunderkammer”, la raccolta di esemplari di interesse naturalistico divenne un'attrazione pubblica, tanto da comparire nelle guide di viaggio dell'epoca, che ne suggerivano la visita. La collezione Gasser è costituita da reperti di carattere botanico, zoologico, archeologico, mineralogico e paleontologico di varia provenienza, sia italiana che estera. La sezione che raggiunse maggiore notorietà è quella mineralogica, allestita e curata metodicamente con criteri che per l'epoca possono essere considerati esemplari. Alla morte di Gasser, parte della sua raccolta venne acquisita dall'Istituto Mineralogico dell'Università di Padova, mentre altri reperti furono venduti privatamente. La maggior parte dei reperti botanici, zoologici ed archeologici andarono dispersi. Ciò che rimase della collezione fu donato dagli eredi, nell'ottica di realizzare un museo di storia naturale nella città di Bolzano. Da questo nucleo originale si sviluppò e venne fondato, poi, il Museo di Scienze Naturali dell'Alto Adige. Poca attenzione è stata finora dedicata alla sezione paleontologica della collezione Gasser. Un recente progetto di ricerca promosso dal Museo di Scienze Naturali dell'Alto Adige prevede ora la pulizia, la documentazione fotografica, l'inventariazione e la catalogazione dei beni paleontologici della collezione, inclusa la digitalizzazione delle informazioni relative. Completa il percorso la revisione scientifica e tassonomica in atto. Il progetto persegue il duplice scopo di favorire la conservazione dei reperti e la loro valorizzazione, e di ricostruire dal punto di vista storico le finalità e gli interessi perseguiti da Gasser. Un interessante nucleo della collezione Gasser è rappresentato dai reperti provenienti dalle regioni alpine, sia italiane che austriache, che costituiscono circa il 30% della collezione complessiva, focalizzando soprattutto sul Triassico e sull'Eocene. Il restante 70% della collezione può essere inquadrato come raccolta didattico-divulgativa, intesa a fornire al visitatore del museo una panoramica dei principali gruppi tassonomici nonché delle diverse epoche geologiche, con un'attenzione particolare ai siti “classici” particolarmente in auge a cavallo fra Otto e Novecento: Bolca, Solnhofen, i bacini carboniferi dell'Europa centrale, il Terziario della Francia e della Bassa Austria. Va notato che fatta eccezione per pochi pezzi raccolti da Gasser personalmente, la quasi totalità della collezione fu composta negli anni attraverso acquisizioni avvenute con modalità ancora da chiarire, almeno in parte acquisti mirati presso commercianti di fossili dell'epoca.

RIASSUNTI / ABSTRACTS

Posters

PARTICLE SELECTION PROCESSES AND MINERALOGICAL DIVERSITY IN AN AGGLUTINATED TEXTULARIID FORAMINIFER FROM A DELTAIC SEDIMENT: MRAMAN SPECTROSCOPY MEETS FORAMS PHYSIOLOGY

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During summer 2019, four shallow cores have been collected by scuba diving along a depth transect just in front of the estuary of the Entella River in the Tigullio Gulf (Ligurian Sea, NW Italy) at the depths ranging from 10 to 40 meters with 10-m interval. The aim of the project is to reconstruct the sedimentary conditions preserved in the historical records registered in the cores.

The cores have been immediately sliced every 2-cm directly on the University research vessel "Veliger". The two uppermost slices (0-2 cm and 2-4 cm) have been immediately immersed into a Bengal Rose solution for staining. The rest of the slices have been analyzed (some still under process) for chemical composition, foraminiferal abundance and diversity, microplastic abundance and have all been dated by organic ¹⁴C method. Within this large project, we show here only a specific analysis that we performed to verify whether a quantification of the mineralogical diversity between the agglutinated minerals in the shell of textulariid foraminifers was possible. For this goal, we have selected a quite "large" specimen of *Textularia* cf. *agglutinans* picked from the slice 4-6 cm belonging to the deepest core, drilled at 40 meters water depth. This foraminifer was analyzed by micro-RAMAN (μ RAMAN) spectroscopy for almost 15 hours to record, with a 10- μ m point-by-point analysis, all mineral species along a specific path that meandered through all foraminifer's chambers. In total 1331 points were analyzed and, surprisingly, only three mineral species were identified for all points. The minerals identified are coal, anatase and quartz. It can definitely be stated that the foraminifer had only these three mineral species along its entire test as no other mineral has been detected despite more than 1000 measuring points. From the analyzes performed with μ RAMAN, quartz and coal appear to be common constituent of the seafloor sediment in the investigated area and were therefore expected to be present and abundant as agglutinated particles, but anatase has not been revealed by XRD analyses. Nonetheless, anatase has been found in the observation for microplastics μ RAMAN. Such observations were performed on filters prepared starting from the sediment mixed in super salted water and left to decant. The supernatant was then collected and filtered. The filters show mineralogical compositions that are somehow comparable with the mineralogical composition of the foraminifer's test but quartz, anatase and coal only reach up to 50% of the entire mineralogical diversity of the analyzed particles present on the filters. Additionally, filters have revealed a large amount of exobiogenic material that has not been recovered on the foraminiferal shell. It is therefore interesting to check for differences between XRD data and μ RAMAN spectra on filters and the actual mineral selection of the protists on the seafloor. Agglutinated foraminifera are long known to be able to critically select the particles they aggregate for their test and anatase has already been reported as a key element that get used in deltaic foraminifera, but it seems there is more to add on this regard. Further analyses should check to what extent XRD results can be considered indicative to estimate mineral diversity among the grains agglutinated on a foraminifer test and a careful methodology shall be implemented to correlate mineralogical diversity on agglutinated foraminifera as a proxy to estimate seafloor composition. The potential impact of such research might shed light on resilience of specific benthic taxa and their capacity to select specific mineral species even in stressed or anthropogenic influenced environments.

REAPPRAISAL OF LOWER CRETACEOUS CLUPEOMORPH FISHES FROM VERNASSO (FRIULI-VENEZIA GIULIA, NE ITALY)

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The Italcementi Quarry of Vernasso (near San Pietro al Natisone, Udine) is renowned as paleontological site since 1888 when an Upper Cretaceous flora associated with mollusks was discovered in a carbonate olistolith contained in the giant megabed 11 of the upper Paleocene-lower Eocene Grivò Flysch. The megabeds of Grivò Flysch record repeated catastrophic submarine landslides events in which large sectors of the Friuli carbonate platform collapsed and redeposited in an elongate foredeep basin system (Friuli Basin; Ogata et al. 2014). The blocks contained in the megabed 11 cropping out at Vernasso are made up of different lithologies of different age, spanning from Lower Cretaceous to Paleocene (Tunis & Venturini, 1992). Two groups of Cretaceous blocks were detected in the yielding two distinct ichthyofaunas, one mostly represented by pycnodonts, and the other mostly including exquisitely preserved clupeomorphs. Both ichthyofaunas are object of an ongoing investigation project. The blocks yielding the clupeomorphs have been referred to the Hauterivian-Barremian (Muscio & Venturini, 1990) and consists of finely laminated brownish, greyish to whitish limestones. The fossil assemblage also includes gastropods, bivalves, decapod crustaceans and ophiuroids (Dalla Vecchia, 2008). The clupeomorphs of Vernasso are possibly among the oldest known worldwide and were preliminarily studied by Sirna in his master thesis in 1991 and referred to the clupeiform subfamily Pellonulinae (Sirna et al. 1994). However, the diagnostic characters evidenced are rather vague (Dalla Vecchia, 2008) and such fauna is therefore in need of a reappraisal comparing the specimens with the clupeomorph record from other Lower Cretaceous localities.

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DIGITALIZZAZIONE DEL PATRIMONIO PALEONTOLOGICO DEL MUSEO DI GEOLOGIA E PALEONTOLOGIA DI FIRENZE

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La Paleontologia virtuale si sta imponendo sempre di più come un elemento comune nell'indagine paleontologica: negli ultimi vent'anni, differenti ricercatori indipendenti e istituti di ricerca si sono affidati a tecnologie di acquisizione tridimensionale (sia di tipo tomografico che di scansione superficiale) per ottenere dati preziosi per i propri studi, forti anche della relativa semplicità e accessibilità dei mezzi di digitalizzazione ad oggi disponibili. Allo stesso modo, anche istituzioni museali hanno progressivamente iniziato a sfruttare l'alto potenziale di queste tecnologie per la conservazione e la valorizzazione dei propri reperti. In Italia, tuttavia, rimangono ancora poche le esperienze di musei scientifici che le adottino in maniera sistematica, e praticamente nessuna in ambito paleontologico. Lo scorso anno, grazie ad uno specifico finanziamento erogato dalla Regione Toscana nell'ambito del progetto POR FSE 2014-2020 Asse A denominato "Assegni di ricerca in ambito culturale (Bando per progetti congiunti di alta formazione attraverso l'attivazione di assegni di ricerca)" ha preso il via un progetto di digitalizzazione e valorizzazione di reperti del Museo di Geologia e Paleontologia dell'Università degli Studi di Firenze. Questo Museo costituisce a tutti gli effetti un caso particolarmente privilegiato per tale obiettivo, in quanto riferimento nazionale e internazionale per le proprie estese e diversificate collezioni, note per la loro rilevanza scientifica fin dall'inizio dell'Ottocento, soprattutto, ma non solo, per i reperti del Neogene e Quaternario. Inoltre, il Museo è sede della "Collezione Centrale Italiana di Paleontologia", istituita nel 1861, e che conserva ancora oggi più di 200.000 esemplari. Si descrivono qui le metodologie e gli avanzamenti del progetto di digitalizzazione e disseminazione delle collezioni del Museo, quale primo caso di digitalizzazione sistematica in Italia in un contesto prettamente paleontologico.

PALAEONTOLOGY OUTREACH 2.0: VIDEO AND PHOTO BLOGGING ABOUT THE ICHNOLOGICAL HERITAGE OF LIGURIA, ITALY

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Science communication has traditionally been dominated by professional communicators employed directly or indirectly by the mainstream media. With the emergence of Web 2.0, platforms such as blogs, wikis, social media and video sharing websites have redefined the mediascape. Science communication is now conducted not only by professional communicators through television documentaries but also by scientists across numerous video (e.g., YouTube, Vimeo) and photo (e.g., Instagram) sharing platforms. Video blogging is the most significant example of this revolution in science communication. It consists of maintaining a video blog (vlog), that is, a website or a social media account where a person regularly publishes short videos. By serving more than 2 billion videos per day, YouTube is the most popular online platform that delivers science vlogs. Science vlogging now compete for views with large well-funded corporations like the BBC and the Discovery Channel. There is no denying that YouTube vlogs and Instagram feeds are the science communication content of the moment. However, there is no vlog about ichnology. This is surprising, especially because many successful science vlogs are discipline-specific, e.g. BrainCraft (neurosciences), Numberphile (mathematics) and Dr. Becky (astrophysics). In this study, we present our first attempt to fill this gap: the ICHNO-VLOG, the first video blog about ichnology and its companion Instagram channel. The video and photo blogs take the viewer on a thrilling journey through ichnology — from bioturbation to bioerosion, from ichnofacies to ichnofabrics, and ultimately to actualistic comparisons with our world today. Palaeontological themes are explained using a location-specific communication strategy, i.e., each video/photo post presents a palaeontology concept by exploring a specific fossil site in Liguria. As such, the ICHNO-VLOG introduces the viewer to 10 of the most significant and enthralling ichnological sites in Liguria, providing both in-depth looks at the sites themselves and an insider's view of the concepts, science, and technology of ichnology. We monitored the video performance using YouTube Analytics, a free tool aimed at reporting video performance metrics: (1) Views (How many views do the vlog have?); (2) Watch time (How long are people watching the vlog?); (3) Audience retention (How consistently are people watching the videos?). We followed a similar approach for the Instagram channel, measuring (1) audience demographics, (2) online time and (3) subjects of engagement (which ichnological subject earn most likes/comments?). In addition, we monitored post insights to get information about how people found ichnological posts. Preliminary results show that either the video or the photo blog has the potential of raising awareness of ichnology in outdoor enthusiasts and inspire a new generation of ichnologists.

**UPPER YPRESIAN-LOWER LUTETIAN LARGER FORAMINIFERA FROM RUSSIZ
AND ROSAZZO (EASTERN FRIULI, NORTHERN ITALY)**

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The aim of this work is to present some diverse larger foraminiferal assemblages from the Ypresian-Lutetian Flysch di Cormons cropping out in the eastern Friuli. The investigated matrix-free specimens were sectioned along the equatorial (nummulitids) or axial (alveolinids) plane to analyse their inner morphology. Beside well-known taxa originally described from Rosazzo, i.e., *Alveolina violae* and *Nummulites friulanus*, we document very diversified assemblages consisting of 30 species of *Nummulites*, 17 *Assilina*, and 6 *Alveolina*, whereas radial foraminifera are very rare or absent in most samples. The assemblages point to a upper Cuisian (SBZ12) to lowermost Lutetian (SBZ13) assignment for the investigated samples. This study was funded by the Italian Ministry of Education and Research (MIUR), funds PRIN 2017: project “Biota resilience to global change: biomineralization of planktic and benthic calcifiers in the past, present and future” (prot. 2017RX9XXY).

FIRST *CYMBOSPONDYLUS* FROM BESANO (MIDDLE TRIASSIC, MONTE SAN GIORGIO UNESCO WHL)

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An unpublished specimen, recently recovered in the collections of the Museo di Storia Naturale di Milano (MSNM V926) and here preliminarily described, represents the first Italian occurrence of *Cymbospondylus* from the Middle Triassic of the Besano Formation. The Besano Fm. is the most fossiliferous unit of the Middle Triassic succession of the Monte San Giorgio site (Italy/Switzerland; UNESCO WHL), which has provided one of the best-preserved records of marine life in the Triassic period, including the holotype and only known specimen of the medium-large ichthyosaur *Cymbospondylus buchseri* (Sander, 1989). Nevertheless, no *Cymbospondylus* remains from the Italian side of Monte San Giorgio have been described yet. In Italy, *Cymbospondylus* is represented by few fragmentary specimens scattered across the Alps (Pian delle Streghe, Val Brembana, Seceda, and Clap di Val; Balini & Renesto, 2012). *Cymbospondylus* represents one of the most basal Ichthyosauria: it is more basal than Mixosauridae (the most common ichthyosaurs of the Besano Fm.) and *Besanosaurus leptorhynchus*, a second large ichthyosaur taxon from Monte San Giorgio (Dal Sasso & Pinna, 1996; Bindellini et al. 2021). The specimen MSNM V926 was collected in the 1950s from the waste material of the Piodelle-Selva Bella mines, near Besano (Varese). It can be dated to the uppermost *R. reizti* or *N. secedensis* zone (about 242 MA) since the profiles of two ammonoids are visible through CT scans. MSNM V926 is a dark-grey dolomite slab bearing three complete semi-articulated vertebrae exposed in right lateral view and 10 dorsal ribs exposed in medial view, lacking their mesiodistal ends. These vertebrae can be distinguished from *B. leptorhynchus* based on the morphology of the diapophyses and the relative length of the ribs. The characters identified allow us to assign this specimen to *Cymbospondylus* cfr. *buchseri*. Following Sander (1989) description, the three vertebrae should have occupied the 38th, 39th and 40th position. Notably, in the cranialmost region of the specimen some soft tissue is preserved. Further analysis (UV, SEM, and detailed microscopy) of this tissue will follow, to better define and describe it. The rediscovery of such a nice specimen in the MSNM collections gives hope for further findings in the historical collections around Italy.

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**THE CATALOGUE OF THE FOSSIL CETACEANS FROM PIEDMONT:
A WORK IN PROGRESS**

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The paleocetological collections of Piedmont include more than 200 specimens of fossil whales. These specimens have been collected over more than two centuries by important Italian students and represent a major source of data about cetacean taxonomy, paleoecology and evolution. Currently, the collections of the Museo Regionale di Storia Naturale of the University of Torino (MGPT-UT) and of the Museo Paleontologico Territoriale dell’Astigiano (MPTA) are housed at MPTA and comprise several holotypes including *Astadelphis gastaldii*, *Septidelphis morii*, *Eschrichtioides gastaldii* and *Atlantictetus lavei*. A new catalogue of this collection is actually under development that will provide students with an updated photographic atlas of the specimens, relevant literature and data about updated stratigraphic ages, taphonomy and taxonomy. It is expected that this new catalogue will be of help in comparative studies of cetacean osteology and phylogeny.

**BIOSEDIMENTARY AND PALAEOECOLOGICAL CHARACTERIZATION OF
LATE TRIASSIC BIOCONSTRUCTIONS
(WESTERN TETHYS, NORTH CALABRIA, ITALY)**

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The Monte Cocuzzo tectonic window, located in the central part of the Catena Costiera Calabria (Calabria - South Italy), hosts a thick Norian-Rhaetian carbonate succession characterized by three different depositional units representing three successive carbonate platform systems of the western Tethys realm: early-middle Norian Lower Complex, middle-late Norian Intermediate Complex and late Norian-Rhaetian Upper Complex. The Lower Complex platform system is characterized by spread and isolated bio-constructed bodies showing an oligotypic community with a primary framework composed by sponges, red algae and corals; and a secondary framework by microbialites, foraminifera and serpulids. Globose clusters of sponges (*Olangocoeliidae*), encrusting red algae (*Solenopora*) and microbial crusts, represent the start-phase of the reef construction. In the successive frame-building phase, sponges and red algae progressively decrease in favor of pennulate isolate (*Distichophyllia* sp.) and colonial (*Retiophyllia* sp.) corals, the latter forming dendroid fun-shaped tufts (50-60 cm thick). Coral skeletons are encrusted by microbial laminae, serpulids and red algae and are immersed into bioclastic detritus composed by echinoid fragments, bivalves and gastropods tests and rare bryozoans. The primary framework is composed by 41% sponges, 35% red algae and 24% corals, whereas the secondary framework by 41% foraminifera, 35% microbialites and 24% serpulids. The accessory organisms are 19% echinoids, 8% bivalves and 6% gastropods and the rest of the volume is represented by non-bioclastic sediments (39%) and primary cements (28%). The bioconstructions are commonly overlapped by bioclastic packstone grainstones enriched into dasycladacean algae and foraminifera indicating a relatively shallow water environment, probably characterized by disphotic and eutrophic waters as testified by the presence of pennulate corals. These bioconstructions can represent patch reefs located along the carbonate platform margins directly facing an internal restricted basin generally characterized by stressed environmental conditions. In fact, during the whole Norian, syn-depositional down-faulting pulses, accompanied by gradual eustatic sea-level drops, induced repeated episodes of basin restrictions with a consequent limited water circulation and stressed conditions affecting the late Triassic Western Tethyan general carbonate platform domain.

LATE OLIGOCENE WARMING EVENT (LOWE) POSSIBLY PRESERVED ON TOP OF A REEF DROWNING SEQUENCE IN NW ITALY: INSIGHTS FROM AN INTEGRATED STRATIGRAPHIC APPROACH

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The Oligo-Miocene Transition (OMT) is one of the most important climatic transitions of younger earth history. This short period of climate warming coincides with a few biotic turnovers. OMT follows the Late Oligocene Warming Event which marks the last warming pulse of a generally cool interval and represents a time frame that could potentially fit well with modern climate change predictions. The Case Cné section located within the Tertiary Piedmont Basin (TPB) and nearby the village of Dego (SV) represents a gradual transgressive event, which shows the drowning of a locally developed reef complex and a development of a constantly deeper marine sedimentary setting influenced by gravity flow mechanics. Larger foraminifera associations indicate a late Oligocene (SBZ23) time for the entire succession and this seems confirmed by Sr isotopes data. The stratigraphic section starts within the Molare Formation and continues into the bottom part of the Rocchetta-Monesiglio Formation. By usage of sedimentological, semi-quantitative microfacies and geochemical analysis the sedimentary history of the section could be reconstructed and divided into four major phases. 1) The growth and establishment of the reef directly on the metamorphic substrate, 2) its development over the basement and the construction of a modest reefal body, 3) the slow drowning of the reef complex due to enhanced prograding fluvial activity and finally 4) the onset of gravity flows passing to turbiditic influence which cap the transgression and that continue regionally throughout into the Miocene. The benthic fauna seems to register the warming period by change in biodiversity and abundance. Below the warming event, larger foraminifera are rather sparse over the section and the benthic community seems dominated by suspension feeders. Toward the top of the section, where the LOWE seems to occur, the gravity flows transport a very large amount of operculinid foraminifera that are well adapted to warm and eutrophic conditions as the ones that possibly characterized the LOWE time span in this tectonically active region.

A BRACHIOPOD-RICH MUD MOUND COMPLEX FROM THE MISSISSIPPIAN OF DERBYSHIRE, ENGLAND

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Mud mounds from the upper Visean of the Derbyshire Carbonate Platform in the UK host a rich brachiopod fauna. Though several palaeontologists and bio-stratigraphers have extensively studied Mississippian brachiopods in the British Isles since the late XVIII century, no systematic study of this fauna has ever been attempted. In the Derbyshire platform, brachiopods were thought to be a minor constituent of the mound facies, mostly confined to dm-sized “pockets” scoured by storm currents in an inner ramp environment (Gutteridge, 1990). New outcrop investigation, facies analysis and palaeontological studies on the mound complex of Ricklow Quarry, near Monyash, have shown that it developed in a deeper middle ramp environment; no trace of storm scouring was found. Brachiopods are widespread in the mounds, being the major skeletal constituents alongside fenestellid bryozoans. The collected assemblages are interpreted as life to neighbourhood ones based on the dominance of articulated specimens with no signs of abrasion or fragmentation, some in life position. The fauna is rather diversified: systematic study of the collected specimens led to the recognition of 47 brachiopod species, representing 33 genera of seven orders. The substrate relationships of the brachiopod fauna have been investigated: seminafaunal productides are dominant (mainly *Quasiavonia aculeata*, *Breileenia radiata*, *Antiquatonia hindi*, *Antiquatonia insculpta* and *Echinoconchus punctatus*) and associated with pedicle attached rhynchonellides (e.g. *Pleropugnoides pleurodon*), spiriferides (mainly species of *Phricodothyris*) and terebratulides (e.g. *Hartella oakleyi*). Orthides, orthotetides and Linguliformea are also rarely found. Facies composing Ricklow mud mounds show a diversity of carbonate muds: allomicrite of detrital origin including bioclastic debris and structure-less leiolitic/clotted peloidal automicrite derived from *in-situ* microbially-mediated precipitation. Substrate variety supported the rich diversity of the brachiopod fauna: soft substrates (detrital allomicrite) were colonised by seminafaunal productides while firm (*in situ* precipitated automicrite) to restricted hard substrates (large brachiopod shells and fenestellid bryozoan fronds) were colonised by pedicle attached brachiopods. The reconstructed food chain for the mound complex palaeocommunity is dominated by suspension feeders (brachiopods, bryozoans, ostracods) sustained by particulate organic matter and microbial mats covering the mound surface. The larger size of productides with respect to other brachiopod taxa and their dominance in terms of biovolume in the assemblages suggest that they efficiently exploited environmental resources. This may be indicative of a mesotrophic environment with scattered food resources.

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**A TOOTHED WHALE VERTEBRA FROM THE LATEST MIOCENE OF VIGOLENO
(WESTERN EMILIA, NORTHERN ITALY)**

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The mixed carbonate-silicoclastic succession of Vigoleno (western Emilia, northern Italy) is well-known on account of its latest Tortonian-Early Messinian mollusk assemblage and coral-algal reef. We report the first reliable occurrence of a vertebrate fossil from Vigoleno: an incomplete caudal vertebra of a marine mammal. Size and morphology show that it belonged to a toothed whale, most likely a small-sized delphinid or kentriodontid. However, it is not possible to further assess the systematic placement of the specimen due to its fragmentary state. The Mediterranean Basin has yielded abundant Miocene cetaceans, but Messinian records are remarkably rarer and poorly studied. Only two mysticete skeletons are known, whereas odontocetes are represented by indeterminate or fragmentary material. No specimens are presently known from Italy, but two odontocete fossils originating from Sardinia and Sicily are respectively dated as Tortonian-Early Messinian and Late Tortonian-Early Messinian. Hence, the Vigoleno specimen expands significantly northward the known distribution of toothed whales in the Mediterranean Basin in this time range. This paucity of findings has largely resulted from the stepwise environmental disruption eventually leading to the onset and development of the Messinian Salinity Crisis.

MECHANICAL CHARACTERIZATION OF TIBIAL BONE MATERIAL OF AN OSTRICH

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Ostriches are praised for their feathers and running abilities since ancient times, arousing interest to breed these animals in farms. In recent years many studies have been focused on ostrich biomechanics, driven by the accessibility of these animals and their peculiar adaptation for running abilities and leg musculature. Ostrich bones are hollowed arousing interest in their mechanical properties. The study of bone material has been faced in the past in several studies, but many presented results about the whole bone structure rather than the material itself. Here we present the first results from a broad review of the mechanical properties of ostrich bones, mainly focusing on the tibial bone, with the aim to characterize the material at its best. Two samples were obtained, an adult ostrich tibia of unknown age and a young specimen of 9 - 15 months of age, purchased from a butcher serving the food industry, under veterinary supervision. The bones have been sectioned with a circular saw in order to obtain samples of appropriate dimensions. Tensile strength tests have been performed on samples from the central portion of the diaphysis of tibial bones, while compression tests have been done on the extremities of the diaphyseal shaft. Results from the tests have evidenced that the condition of the bone deeply affects the mechanical tests. The adult tibia was completely dried and kept at unknown conditions for years at the time when received by the authors. It has been preserved at environmental conditions and only part of the samples has been kept overnight immersed in water before testing. The young bones have been preserved in a freezer at -18° up to the moment of processing. The results have evidenced that the old dried bone performs as elastic-fragile material reaching a top yield stress of 80MPa, with a maximum strain of around 0.5%, while wetting it makes it assume a more elastic mechanical behavior, closer to the young bone values, with a maximum yield strength of around 100MPa and a maximum strain value of 1%. The young bone has evidenced the ability to sustain a higher yield stress value, up to 120MPa with a strain value of 1.3%, and a ductile behavior before breaking at up to 140MPa with a strain value of 1.6%. The compression tests have evidenced a safe value of stress of 70MPa, with a sample able to sustain stresses with values higher than 150MPa with a strain value of around 2%.

I FOSSIL-LAGERSTÄTTEN E ALTRO DELLA COLLEZIONE OLPHIN DEL MUSEO GEOLOGICO G.G. GEMMELLARO

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Lo svolgimento di una tesi di laurea triennale è stata l'occasione di catalogare ed intervenire sul tema della valorizzazione e del recupero di alcune collezioni di reperti fossili di nuova acquisizione da parte del Museo Gemmellaro tramite un database organizzato che permetta il facile reperimento di determinati reperti ritenuti più idonei a far parte sia di mostre temporanee che permanenti. Nello specifico trattasi di una ricca collezione di fossili vertebrati, invertebrati e vegetali provenienti anche da famosi giacimenti fossiliferi italiani ed esteri e rappresentativi di tutte le Ere del Tempo Geologico. Questa collezione fu raccolta dal Prof. Graham Olphin, un docente di lingua inglese appassionato di Paleontologia residente a Palermo in un arco temporale di circa quarant'anni, ed è costituita da una serie di reperti fossili raccolti o acquistati nel corso degli anni dal professore durante una serie di viaggi in diverse parti del mondo. Alla sua morte la collezione è stata donata al Museo Geologico G.G. Gemmellaro dagli eredi, esaudendo in questo modo il desiderio del suo autore di renderla fruibile al pubblico. I fossili della collezione qui esaminata, costituiscono la sezione degli invertebrati e dei vegetali che risulta essere costituita da 124 esemplari. In particolare sono presenti reperti di gasteropodi, lamellibranchi, cefalopodi, scafopodi, celenterati, insetti, crostacei, trilobiti, echinodermi, brachiopodi, foraminiferi, reperti di vegetali e reperti di taxa rimasti indeterminati. I reperti provengono da importanti siti fossiliferi di grande rilievo scientifico molto noti per ricchezza di esemplari, per ottimale conservazione delle forme ed anche per il valore che i fossili dei suddetti giacimenti hanno assunto per la ricostruzione della storia della vita sulla Terra e della sua evoluzione. Alcuni di essi, in particolare, provengono da "giacimenti fossiliferi eccezionali", i cosiddetti "Fossil-Lagerstätten" di Solnhofen in Germania (Giurassico Superiore/Cretacico inferiore), "Wheeler Shale" in Utah (Cambriano Medio), Ediacara in Australia (Proterozoico Superiore) e Latham Shale in Nevada (Cambriano Medio). Trattandosi di reperti non molto comuni la loro acquisizione ha implementato le risorse didattico – educative del museo e numerosi di essi sono stati scelti ed organizzati in risposta a specifiche finalità espositive in sale tematiche del Museo Gemmellaro.

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“ANOTHER BRICK IN THE WALL”? GEOHERITAGE AND EDUCATIONAL POTENTIAL OF THE "WALL OF DEEP-SEA LIFE" (SAN CASCIANO VAL DI PESA, ITALY) IN THE TIME OF COVID-19

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Most of the ornamental stones used to decorate the city walls of the town San Casciano Val di Pesa (=SCVP, Tuscany, Italy) belongs to the Macigno Formation that is comprised of turbiditic, brownish to grayish, Eocene-to-Miocene clayey sandstone. This sedimentary unit features a plethora of exquisitely preserved sedimentary structures and trace fossils. Many of these ichnofossils and sedimentary structures are exposed along the SCVP city walls. This project aims to explore the educational resourceability of this stone wall heritage, with particular regard to the present-day pandemic situation, during which museums, cultural events and exhibitions are strongly limited. The exposition in streets allows to observe the architecture of several ichnofossils and their interactions with the deep-sea substrate where they were formed, and consequently interpret several correlated paleoenvironments. Trace fossils thus become like paleobiological sculptures in what we may consider as an open-air art gallery, where every limitation such as social distance or regrouping of people can be accomplished. Interpretative panels on-site must be considered to identify the “Wall of Deep-sea Life” main sites and adjust communication according to school curricula levels. In a period when our daily life has been drastically changed, cultural proposals must also change. In 2021, during the current COVID-19 pandemic, it is necessary to re-think the educational system in its whole, also passing by figuring out new educational resources, such as our proposal of the “Wall of Deep-sea Life”.

NUOVI STUDI SUI RINOCERONTI DEL VALDARNO SUPERIORE (TOSCANA, ITALIA)

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Il bacino del Valdarno Superiore, situato a sud-est di Firenze, rappresenta una delle più importanti aree fossilifere villafranchiane d'Europa i cui fossili sono stati raccolti, collezionati e studiati fin dal Rinascimento (Rook et al., 2013). I rinoceronti sono un elemento comune della fauna villafranchiana del Valdarno Superiore, e sono presenti con due diverse specie, entrambe appartenenti al genere *Stephanorhinus*: *S. jeanvireti* e *S. etruscus*. *S. jeanvireti* è documentato nelle località i cui depositi sono riferiti al primo ciclo deposizionale del bacino del Valdarno Superiore (sintema di Castelnuovo dei Sabbioni), come Santa Barbara. I resti di questa specie sono relativamente scarsi e non permettono di indagare la sua variabilità morfometrica e morfologica nell'area in studio. La specie *S. etruscus*, istituita da Falconer (1868), è ben documentata in più località del Villafranchiano superiore del Valdarno, tutte incluse nel Sintema di Montevarchi (e.g., come Figline, Matassino e Terranova), e rappresenta uno degli elementi caratteristici del Villafranchiano superiore d'Europa (Rook et al., 2013). Gli esemplari di *S. etruscus* del Valdarno Superiore presentano un'ampia variabilità dimensionale, comparabile a quella nota per gli esemplari del Villafranchiano europeo. Il terzo metatarso di questa specie presenta una significativa correlazione lineare tra lunghezza massima e diametro trasversale della diafisi mentre l'astragalo mostra una significativa correlazione tra l'altezza massima e il diametro trasversale massimo. La viabilità morfologica, in particolare dei carpali, tarsali e metapodiali, si mostra relativamente ampia per alcune superfici articolari, suggerendo un certo grado di incertezza nella determinazione di resti isolati o poco completi.

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**CONIFER DIVERSITY IN THE PELSONIAN (ANISIAN, MIDDLE TRIASSIC)
FOSSILLAGERSTÄTTE KÜHWIESENKOPF/MONTE PRÀ DELLA VACCA
IN THE DOLOMITES (NE ITALY)**

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The Triassic is considered a pivotal time for the radiation of modern plant families and the rapid diversification of gymnosperms. Among them, the conifers represent one of the major groups that evolved and diversified, becoming ecologically dominant during the Mesozoic era. The voltzian conifers, mainly restricted to Euramerica during the late Paleozoic, spread out to the northern latitudes and the Southern Hemisphere during the early Mesozoic and diversified in several genera (e.g., *Voltzia*, *Albertia*, *Pelourdea*) characterized by needle-like to broad leaf shapes. Although the voltzian conifers represent an important group, their diversification pattern is still obscure, because of the incompleteness of their Early–Middle Triassic fossil record. In this respect, the plant assemblage of the Anisian Kühwiesenkopf/Monte Prà della Vacca is important, because it represents the acme of the biotic recovery after the end-Permian mass extinction, but also because of its richness of taxa, among which conifers revealed a great diversity. Based on micro- and macromorphology, at least six species were identified in the Kühwiesenkopf/Monte Prà della Vacca flora (i.e., *Pelourdea vogesiaca*, *Albertia* cf. *latifolia*, *Voltzia heterophylla*, *V. edithae*, *V. walchiaeformis*, *V. recubariensis*). These species represent a wide range of forms, ranging from needle-like to broad, parallel-veined leaf species and from shrub-like (e.g., *Pelourdea vogesiaca* and *Albertia* cf. *latifolia*) to probably trees (e.g., *Voltzia recubariensis*, *V. edithae*, *V. walchiaeformis* and *V. heterophylla*). The occurrence of *Voltzia heterophylla* in the Kühwiesenkopf/Monte Prà della Vacca flora extends the geographic range of this species to the Alpine Realm. The description of well-preserved material and of cuticle fragments allowed us to propose an amended diagnosis for *V. walchiaeformis*. Moreover, some morphological characters observed on the new species *Voltzia edithae* resemble both the late Permian *Majonica alpina* and the Middle–Late Triassic *Voltzia foetterlei*, suggesting that transitional forms survived the end-Permian crisis and persisted until the Middle Triassic. The study of conifer shoots from Kühwiesenkopf/Monte Prà della Vacca allowed us to obtain a more complete view of the flora composition, and, moreover, the comparison of the taxa with other Permian and Middle Triassic European species improve our knowledge of the conifer diversity during the Middle Triassic.

THE HIGHER ECOLOGICAL TIERS OF THE ROTZO FORMATION: FIRST CLUES ON A FORGOTTEN VERTEBRATE FAUNA

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The Rotzo Formation, a shallow water carbonate succession outcropping in several portions of the Trentino Alto Adige Region, belongs to the Calcari Grigi Group, an important unit of the Trento Platform. This formation is best known for its invertebrate fauna (e.g., the *Lithiotis* beds) and for the exceptionally preserved flora. It is interpreted as a ramp lagoon environment and it is dated to the Pliensbachian (Early Jurassic) via biostratigraphy and carbon-isotope analysis. Vertebrate fossils are rare, with the exception of numerous dinosaurian ichnoassociations documented in several beds throughout the whole Calcari Grigi Group. In a recent study, included in a master thesis, a collection of vertebrate remains from the Rotzo Formation, gathered in the last twenty years, has been described. This collection, housed at MUSE-Museo delle Scienze of Trento, proved the presence of two well differentiated faunas in the lower part of the Rotzo Formation. In the first unit, representing the lowermost part of the Rotzo Formation and interpreted as a brackish-marginal marine setting with eutrophic conditions, were identified fragmentary remains of Ginglymodi and Pycnodontiformes (Actinopterygii) and Thalattosuchia (Reptilia). In the second unit, younger than the previous one, interpreted as a mesotrophic sea, were identified remains of Ginglymodi and Pachycormiformes (Actinopterygii), Hybodontiformes (Chondrichthyes), Chimaeriformes (Holocephalii) and Thalattosuchia (Reptilia). The identified faunas, coherent with the depositional interpretation of the units in which they were found, support the previously proposed general affinity of Lower Jurassic Southern Alps ecosystems with ecosystems from central and northern Europe. Moreover, the Rotzo Formation fauna presents what is probably the oldest global evidence for Pachycormidae and Thalattosuchia, previously known only from the Toarcian and younger Jurassic stages. The complete lack of neoselachians, if not due to collection biases, calls for an explanation: this notable and extremely interesting feature of the studied collection seems to anticipate an ecological shift that present-day models date to the Toarcian. Although the paucity of specimens does not allow a definitive reconstruction of the composition of the vertebrate fauna of the Rotzo Formation, and sampling bias prevents full comparison with other coeval associations, this study provides a first glimpse into the higher ecological tiers of an extremely complex Early Jurassic marine ecosystem, where tidal flats and lagoons, domain of fishes and marine reptiles, developed along with vegetated islands populated by terrestrial vertebrates.

STRATIGRAPHIC DISTRIBUTION OF PLIO-PLEISTOCENE CETACEANS IN THE MEDITERRANEAN BASIN

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Recent studies on the stratigraphic distribution of Mediterranean cetaceans have allowed to recognize a particular biological richness during the Pliocene (Collareta et al., 2019; Bianucci et al., 2019) with a peak of richness in fossils specimens and biological diversity between 3.2 - 3.0 Ma (Dominici et al., 2018; Freschi et al., 2019). An extinction event of marine megafauna has been identified in the late Pliocene (3.8 - 2.6 Ma), which has been related to enhanced climatic variability, higher-amplitude sea-level oscillations and loss of productive coastal habitats (Pimiento et al., 2017). A taphonomic imprinting would at least in part explain the overall paucity characterizing the Pleistocene record (Dominici et al., 2020). To clarify the evolution of cetaceans during the Plio-Pleistocene time at Mediterranean scale, we have built an accurate chronostratigraphic dataset based on quantitative data (124 specimens from 73 sections) from the Italian (in particular Piedmont, Emilia, Tuscany regions) and Iberian areas. For each fossil, lithological and paleoenvironmental information are provided; furthermore, an average age has been assigned that allows to distribute them into 11 Plio-Pleistocene time-intervals, each spanning ~500 ka. Our results show: 1) a lower abundance in the Zanclean (35 specimens, 28%); 2) a higher abundance in the Piacenzian (80 specimens, 64%) with a progressive increase up to a peak value (53 specimens, 42.7%) at ~3.2 Ma; 3) a drastic reduction starting from 2.7 Ma which leads to only 9 specimens between Gelasian and Calabrian; 4) a strong positive correlation between the time-distribution of cetacean and the paleoclimatic and oceanographic events of the Northern hemisphere and Mediterranean Basin, in particular with phases of increased marine primary production and climatic changes. Studying diversity changes over time is fundamental to understand the most recent phases of the evolution and spread of marine mammals within the Mediterranean basin.

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LA SPI NEL RICONOSCIMENTO DELL'ECCELLENZA NELLA PALEONTOLOGIA ITALIANA

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Il progresso della paleontologia avviene attraverso il pensiero, la dedizione e l'ostinazione di persone, scienziati, che hanno saputo avere uno sguardo differente verso il mondo che li circondava, consci che l'immagine dipinta dal sapere corrente sarebbe potuta essere ancora più nitida, maggiormente a fuoco. Le loro personali domande hanno spesso portato a risposte rivolte ad intere generazioni di ricercatori, contemporanei e prossimi. Il loro lascito scientifico, amalgama di cognizioni, scoperte e innovazioni, rappresenta un patrimonio tangibile ed inestimabile di informazioni su cui dar fondamento alla conoscenza del domani. Eppure, nonostante l'entità delle loro opere e azioni sia innegabile, spesso la memoria di queste persone, esseri umani, tende a scolorirsi nel tempo e non rende onore alla rilevanza e all'eccellenza del loro lavoro. Da sempre il panorama scientifico italiano è costellato di numerosi esempi illustri che si sono distinti nelle diverse discipline della ricerca scientifica, e nell'ambito circoscritto dalla materia paleontologica potremmo ricordare i nomi di alcuni personaggi quali Agostino Scilla, Giovanni Merla e Luigi Torri. Agostino Scilla (1629-1700), pittore, numismatico e scienziato, viene considerato fra i fondatori della paleontologia moderna. Ipotizzò l'origine organica dei fossili come ex-vivi grazie ad un'attenta osservazione al di là delle inutili speculazioni filosofiche. Giovanni Merla (1906-1984) ricoprì la prima cattedra di paleontologia italiana. Scrisse importanti monografie sulle faune paleozoiche e mesozoiche dell'Italia centro-settentrionale e del Karakorum. Compì studi stratigrafici in Africa Orientale e ricerche sulla geo-tettonica dell'Appennino Settentrionale. Luigi Torri (1904-1996), collezionista di fossili, contribuì in modo rilevante alla conoscenza paleontologica del monte Albenza, ritenuto una zona sterile prima dei suoi studi. Citato in numerose pubblicazioni, gli venne dedicato un museo e diverse sono le specie fossili che portano il suo nome. E con il proposito di onorare queste tre importanti personalità, la Società Paleontologica Italiana ha inteso istituire altrettante medaglie onorifiche in loro memoria, per il riconoscimento dell'eccellenza di chi ha saputo distinguersi nella promozione e progresso delle discipline paleontologiche. Pertanto, l'assegnazione della Medaglia Agostino Scilla è conferita a paleontologi con 20 - 35 anni di esperienza che si siano distinti per una produzione scientifica rilevante ed una partecipazione attiva nella comunità paleontologica italiana. Ai giovani paleontologi, la cui esperienza maturata non sia superiore ai 20 anni ed i cui studi abbiano avuto un ruolo di rilievo per il progresso a favore della disciplina è invece invece dedicato il premio Giovanni Merla. Infine, a chi non è impiegato professionalmente nell'ambito della paleontologia, ma il cui contributo è stato significativo, attraverso la cura e la conservazione di collezioni museali, studi pubblicati su riviste scientifiche ed altre attività di supporto per la comunità scientifica è riservato il titolo onorifico della Medaglia Luigi Torri.

BRAIN MORPHOLOGY IN THE GENUS *CANIS*: CASES STUDY OF THE PLEISTOCENE CANIDS FROM GROTTA ROMANELLI AND PONTE GALERIA

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Paleoneurology deals with the study of the brains of fossil vertebrates obtained through the production of physical and digital casts named “endocasts”. In recent years, the support of CT-scans together with the advanced medical imaging software, allowed to explore the external brain anatomy as well as its morpho-functional aspects and relative volumes, increasing our knowledge on the evolution of the central nervous system in vertebrates, autoecology and phylogenetic relationships of many species. Among carnivorans, large canids often play the role of top predators, displaying a wide range of behaviours, vocalization, and hunting strategies, which make them of special interest in paleoneurological studies. In the last decades great attention was led to the evolution of canid brain, nevertheless, several aspects about the sulcal variability in genus *Canis*, one of the most successful and widespread groups, can be deepened. In this contribution, we present the preliminary results of the paleoneurological analysis performed on two fossil canids from Italy, the Middle Pleistocene specimen from Ponte Galeria (Rome) and the Late Pleistocene specimen from Grotta Romanelli (Castro). Comparisons with extant large to medium-sized canids, led us to recognize three groups within the genus *Canis*: a jackal-like, a coyote-like and a wolf-like group, where the latter shows the most complex cortical arrangement. The specimen from Grotta Romanelli attributed to *Canis lupus*, shows the same relative brain size and morphology of the extant grey wolf, instead, the canid from Ponte Galeria is characterized by a mosaic of characters, with a complex sulcal pattern of the rostral pole, typical of the wolf-like group, and a relative less developed prefrontal area. Regarding the Ponte Galeria specimen, our results suggest the asserting of a wolf-like group yet in MIS11. Furthermore, the brain morphology of the canid from Grotta Romanelli, shows no differences in morphology and relative brain size among Late Pleistocene and extant wolves. Further data in these paleoneurological analysis, will better clarify the evolution of brains among the genus *Canis*.

SPORES OF *ASTEROTHECA MERIANII*: MORPHOLOGICAL VARIATION AND EFFECTS OF PREPARATION

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Spores and pollens can vary substantially in morphology and size, both within a single reproductive organ and within the same plant or species. This has given rise to the phenomenon that spores and pollen produced by the same biological plant or species were assigned to different species and sometimes even genera if found dispersed in the sediment. It is still unclear to what extent this variation is influenced by the random development of certain characteristics among individual sporomorphs, by different ontogenetic stages within the fertile structures, by environmental parameters or even by different maceration protocols followed. *Asterotheca merianii* is a fern belonging to the family Marattiaceae that is very common in fossil plant associations in the Carnian of Europe. Its fertile fronds contain numerous large sori, usually comprised of four sporangia. One of its most famous occurrences is in the Lunz flora of Austria; an exceptionally well-preserved flora, where *in situ* spores of *Asterotheca merianii* have already been reported. Several spore extraction analyses were carried out following slight variations of the standard technique for macerating *in situ* spores (using Schulze's reagent, i.e., HNO₃ + KClO₃, and KOH) on sporangia of *Asterotheca merianii* in order to detect any effects due to the treatment. The preparation protocol with the Schulze reagent was modified in terms of duration, concentration of nitric acid and the amount of potassium chlorate added. These parameters changed the rate at which the originally opaque material became translucent, but appear to have limited effects on the final state of the samples after bleaching. More significant are the differences between individual spores within the same sporangium. The spores can be weakly ornamented to smooth and vary also noticeably in size. Above all, the size varies greatly even within a single sporangium. In particular, some spores were observed to be much smaller than normal, which could represent malformations.

MICROFACIES ANALYSIS IN LIMESTONE COMPONENTS OF THE POSIDONIA SHALE FORMATION (SURROUNDINGS OF HOLZMADEN, GERMANY)

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This study integrates field-based and microfacies analyses of the limestone strata that top the Posidonia Shale Formation outcropping in the Schieferbruch Ralf Kromer, a large quarry near the town of Holzmaden (Baden Württemberg). This Toarcian formation was deposited in the epicontinental sea that included the southwestern Germany during the Lower Jurassic. The Posidonia Shale Formation is worldwide known as an excellent source of Early Jurassic fossils, mainly marine animals and terrestrial plants. The study focused on a 2.70 meters thick succession outcropping in the eastern edge of the quarry, where on top of nearly 2 meters-thick dark and finely laminated shales, characterized by a high abundance of pyritized ammonites (*Dactylioceras* Hyatt, 1867; *Harpoceras* Waagen 1869; and *Hildoceras* Hyatt, 1867) and shells of *Bositra* De Gregorio 1886 (the former *Posidonia* of authors), three limestone strata alternate with the shale deposition. The limestones are massive, cream-colored, bounded by erosional contacts, and rich in marine fossil remains (mainly fragments of belemnites and ammonites). Field-based observations and microfacies analyses performed on petrographic thin sections enabled stratigraphic insights aimed at understanding the meaning of this deposition of limestones. In terms of facies association, a lower (A) layer characterized by thin lamination, high concentration of pyrites and organic matter, on top of which *Chondrites* trace fossils abound, and suggest a marine platform facies formed in low energy and bottom oxygenation conditions. The overlying layers B and C are typified by abundant and diverse fossil assemblages (belemnites, foraminifera, corals, ammonites, bivalves and gastropods), suggesting that the marine platform facies switches to higher energy and higher bottom oxygenation conditions. Together with their biotic component, the remarkable erosional contacts of the upper two layers enable their interpretation as the result of marine storms that have reworked the sediment deposited in this epicontinental sea.

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DESCRIZIONE E CLASSIFICAZIONE DI UN AMIIDAE FOSSILE APPARTENENTE AL GENERE *CALAMOPLEURUS*

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È stato descritto e classificato un reperto fossile del periodo Cretacico proveniente dai giacimenti fossiliferi del Brasile. Il reperto è composto da un nodulo che presenta ossa fossili inglobate all'interno di un sedimento sabbioso di colore giallastro e, per la forma e la geometria delle ossa, si ritiene che possano appartenere ad un singolo individuo. Il reperto è costituito dalla regione cranica, dove sono osservabili la maggior parte degli elementi ossei, e la parte prossimale dello scheletro assiale, rappresentato da una serie di 9 vertebre articolate. Innanzitutto, si è proceduto con il riconoscimento tassonomico del reperto a livello di genere. L'insieme delle caratteristiche craniali suggeriscono di assegnare il reperto al genere *Calamopleurus* (famiglia Amiidae). Questo genere estinto presenta tre specie: la primitiva *Calamopleurus mawsoni*, e le forme più derivate *Calamopleurus cylindricus* e *Calamopleurus africanus*. Per il riconoscimento tassonomico a livello specifico, oltre ai dati di letteratura, si è utilizzato l'unico Amiidae attualmente esistente, *Amia calva*, considerate le numerose caratteristiche comuni tra di esso ed i calamopleurini fossili. Il confronto morfologico ha permesso di ascrivere il reperto a *C. cylindricus*. Grazie a questa attribuzione ci permette di ipotizzare i possibili luoghi di provenienza del reperto: considerando la distribuzione della specie *C. cylindricus*, il campione qui descritto potrebbe derivare da due diverse formazioni cretache brasiliane, dalla formazione Crato oppure dalla formazione Romualdo, rispettivamente datate Aptiano e Albiano. Futuri studi sedimentologici e mineralogici sul sedimento inglobante potrebbero contribuire a risolvere questa incertezza.

ROTAIIIDS BIODIVERSITY IN THE PALEOCENE-EOCENE OF NEOTETHYS

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This contribution is a part of ongoing research aimed to analyse the diversity of shallow water benthic foraminiferal assemblages of the Neotethys. Rotaliids are one of the groups of larger foraminifera (LF) that recolonize faster the shallow-water environments after the mass extinction at the end of the Cretaceous. Their stratigraphical distribution has been revised in the light of the updated papers published in the last decade. Our work focused on the Paleocene and Eocene epochs, being the fossil record about rotaliids discontinuous from the upper Eocene upward. Our data suggest that their differentiation at genus level was very rapid and reached its maximum in the upper Danian SBZ2. Specific diversification, instead, culminated in the upper Thanetian SBZ4, with a second peak during the Cuisian (=upper Ypresian). Successively, the rotaliid diversity definitely declined, whereas other groups of larger foraminifera, and especially *Alveolina* and *Nummulites*, became more widespread and flourished with a large amount of species, up to the lower Bartonian SBZ17, when a final drop in rotaliid diversity is recorded. Climate plays a pivotal role in the rotaliids biodiversity, since the above major changes appear strictly linked to warming climate events such as Late Danian Event (LDE, generic diversification of rotaliids), Paleocene Eocene Thermal Maximum (PETM, faunal turnover followed by abrupt decrease in both generic and specific diversity), Early Eocene Climatic Optimum (EECO, increase in number of K-strategists under oligotrophic conditions) and Middle Eocene Climatic Optimum (MECO, ultimate drop in diversity and competition with other larger foraminifera). This study was funded by the Italian Ministry of Education and Research (MIUR), funds PRIN 2017: project “Biota resilience to global change: biomineralization of planktic and benthic calcifiers in the past, present and future” (prot. 2017RX9XXY).

**PRELIMINARY TAXONOMIC AND ISOTOPIC RESULTS ON MAMMAL REMAINS
FROM GROTTA POLESINI (TIVOLI, CENTRAL ITALY)**

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The archaeological and paleontological site of Grotta Polesini is part of the “Grotte Lucane” Cave System, located near Tivoli (Latium, central Italy). Although the cave system was already known since the XIX century, the possibility that it could contain paleontological or archaeological remains was initially considered unlikely, as the caves open at level of the floodplain of the Aniene River. Indeed, the first exploration and systematic excavations of Grotta Polesini were carried out only in the 1950s. These campaigns resulted in the recovery of lithic artifacts and mobiliary art belonging to the Upper Paleolithic, Neolithic and Copper Age, and ceramic fragments from the Iron Age. This work aims at the paleontological study of a collection of unpublished remains recovered from Grotta Polesini in the 1970s. 565 fossil remains belonging to twelve mammal species have been identified, measured and cataloged. The faunal list includes *Canis lupus*, *Vulpes vulpes*, *Gulo gulo*, *Lutra lutra*, *Sus scrofa*, *Capra ibex*, *Capreolus capreolus*, *Cervus elaphus*, *Bos primigenius*, *Equus ferus* and *Equus hydruntinus*. Moreover, the occurrence of *Homo sapiens* at Grotta Polesini is directly attested in our sample by a juvenile radio. Additionally, after the taxonomic characterization of the fauna, 25 remains of herbivore species were selected, and their dental enamel sampled for carbon and oxygen isotopic analyses. Once the results of the isotopic analyses will be elaborated and studied, they will provide new environmental clues on the recent past of the Campagna Romana.

**LA COLLEZIONE DI MAMMIFERI DEL MIOCENE SUPERIORE DI PIKERMI
CONSERVATA PRESSO IL MUSEO REGIONALE DI SCIENZE NATURALI,
TORINO**

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La collezione di mammiferi del Miocene superiore (7-8 Ma) di Pikermi (Attica, Grecia) costituisce una delle raccolte paleontologiche di maggior rilievo storico e scientifico tra quelle conservate presso il Museo Regionale di Scienze Naturali di Torino. La collezione giunse a Torino nel 1853, in dono ai Savoia da parte di un diplomatico greco, ed è costituita da più di 270 reperti alla cui identificazione contribuì anche il celebre paleontologo francese Jean Albert Gaudry. L'intera collezione è stata recentemente riesaminata, ogni reperto è stato fotografato e misurato e la posizione tassonomica verificata. Un terzo dei reperti appartengono a *Hipparion mediterraneum*, tra i quali spiccano varie ossa di arti e un bel cranio ancora nella matrice originale; il secondo gruppo più rappresentato è quello dei bovidi con resti di *Palaeoreas lindereyeri*, *Palaeoryx pallasi*, *Gazella brevicornis* e *Tragoportax* sp.; sono presenti resti di due specie di rinoceronte, ossia *Dihoplus schleiermachersi* e *Ceratotherium neumayri*; degni di nota sono anche reperti ben conservati di *Adcrocuta eximia*, *Hystrix primigenia*, *Promeles palaeattica* e *Mesopithecus pentelicus*.

FIRST REPORT OF LAMNIFORM VERTEBRAE FROM THE APTIAN-ALBIAN MARNE A FUCOIDI OF THE UMBRIA-MARCHE DOMAIN (CENTRAL ITALY)

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In the present contribution we describe elasmobranch remains from the Aptian–Albian Marne a Fucoidi cropping out at Mt Nerone (Umbria-Marche Ridge, Northern Apennines, Italy), representing the first occurrence of lamniform vertebrae from the Cretaceous of the Umbria- Marche Domain (Central Italy). Due to high fossilization potential of the hard dental components, the fossil record of chondrichthyans is essentially represented by isolated teeth, whereas cartilaginous skeletal elements, even though mineralized, are less prone to survive to biostratinomic and diagenetic processes. However, fossil vertebrae can provide useful information about taphonomy, paleoecology, individual total length, age and ontogenetic stage. The material described herein is represented by ten vertebrae (four found semi-articulated), characterized by well-calcified, amphicoelous, and slightly dorso-ventrally compressed centra showing notochordal spaces constricted and reduced to intervertebral lenses. All of these characters confidently support their attribution to the group of lamniform sharks. In this contribution we provide a possible age for the individual and an estimate of the minimum total length for the entire body, along with taphonomic considerations. The overall morphology of the centra, their size and annual growth bands, indicate a small-medium sized fusiform and pelagic lamniform shark, with a body length reaching not less than 1.59 m. The individual likely was characterized by an approximately sub-circular trunk area, and a moderately fast swimming and consistent maneuverability. Taking into account the relatively poor record of shark vertebral remains worldwide, the material described herein represents a valuable source of information for the paleobiology of the Umbria-Marche Domain of Central Italy during the Cretaceous period.

THE RETURN OF *TRIDENTINOSAURUS*: NEW ANALYSES OF THE “SOFT TISSUES”

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Tridentinosaurus antiquus Leonardi 1959 is a nearly complete reptile-like tetrapod exhibiting evidence of soft tissues, discovered in 1931 in the Early Permian volcanic succession of the “Gruppo vulcanico atesino” near Stramaiole (Trentino Alto Adige, Italy). Since its discovery, few studies have focused on the description of the specimen for phylogenetic purposes, but the taphonomy of the soft tissues has been so far overlooked. The characterization of the soft tissues will assist in the interpretation of the depositional environment to pinpoint the stratigraphic position of this important vertebrate fossil within the successions of the “Gruppo vulcanico atesino”. The specimen shows a defined dark coloured body outline that appears mostly opaque under natural light, alluding that most of the soft tissues are organically preserved. In the proximity of the shoulder and pelvic girdle, three-dimensionally preserved integumentary scales are evident; these are relatively small (ca. 1 x 2 mm) rhomboidal in shape with a layer of varnish on top. We used scanning electron microscopy (SEM) coupled with energy dispersive X-ray (EDX) analyses and micro X-ray diffraction analysis (micro-XRD) to investigate the mode preservation, ultrastructure and chemistry of the fossilized soft tissues of *T. antiquus*. Our study reveals that the scales are composed of apatite with a pitted texture; no ultrastructure of the integument is preserved. The composition and texture of the supposed integumentary scales indicate that these are osteoderms (i.e., dermal scales). The body outline and the abdomen, despite what the dark colouration might suggest, is formed by relatively large anhedral crystals of apatite. There is no evidence of carbonaceous matter in any of the samples analysed. We suggest that the body outline and the abdomen have been covered with a layer of black paint similar to those produced via carbonization of bones (e.g., Bone Black paint), commonly used in paintings. We report that there are no soft tissues preserved in *T. antiquus* but the identification of small rhomboidal osteoderms uncovers new aspects of the dermal skeleton of this ancient tetrapod.

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CARBONIFEROUS PLANT FOSSILS FROM THE SAN LORENZO SCHISTS (PISANI MOUNTAINS, TUSCANY, ITALY): A PRELIMINARY STUDY OF THE PALAEOBOTANICAL COLLECTION OF THE MUSEO NATURALISTICO ARCHEOLOGICO DELL'APPENNINO PISTOIESE

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The Museo Naturalistico Archeologico dell'Appennino Pistoiese (MUNAP) hosts one of the most abundant and diverse collections of Late Palaeozoic plant fossils from the San Lorenzo Schists of the Pisani Mountains. More than 1200 rock slabs yielding plant fossils were collected from six different outcrops in Guappero Valley in the San Lorenzo a Vaccoli area (NE of the Pisani Mountains, near Lucca), the type-locality of the formation. The present study concerns two outcrops at Via Pari that are characterized by a wide range of plant fossils (20 taxa) belonging to the lycopsids (*Stigmaria*), sphenopsids (*Calamites*, *Asterophyllites*, *Calamostachys*, *Sphenophyllum*, *Bowmanites*), ferns (*Acitheca*, *Diplazites*, *Cyathocarpus*), seed ferns (*Alethopteris*, ?*Autunia*, gen. indet.), cordaites (*Cordaites*) and seeds (*Carpolithes*). This first description of the plant fossil collection and the revision of its stratigraphical context with respect to the surrounding famous fossiliferous sections of the Guappero Valley refine the stratigraphic and palaeoenvironmental framework of the Late Palaeozoic successions of the Pisani Mts. and more generally of the Apennine chain. The qualitative and quantitative analyses show significant environmental variations between neighbouring outcrops in the Via Pari area – i.e., more humid conditions in 'Via Pari Buca' than in 'Via Pari Smottamento' – and suggest a latest Carboniferous (Gzhelian) instead of an early Permian age as proposed by previous authors. Moreover, the differences in composition between the plant assemblages of the Via Pari sections with the historical assemblage of the nearby Monte Vignale outcrop (containing typical Permian and more xerophytic elements) in the De Stefani Collection of the Florence Natural History Museum is explained by a younger age (early Permian) of the latter.

PALEOCLIMATIC IMPLICATIONS OF A PALEOECOLOGICAL STUDY ON A TYRRHENIAN CALCARENITE (MAR PICCOLO, TARANTO, SOUTHERN ITALY)

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This work shows the preliminary results of a study conducted on two bulk-samples from the Mar Piccolo of Taranto, collected in 1976 from a weakly cemented Tyrrhenian calcarenite, from P.ta della Penna (sample T13) and south of Masseria S. Pietro (sample T5). The study focuses on molluscan species with >1% dominance (representing about the 79% of the association in T13 and the 82% in T5). Autoecological data indicate a lower infralittoral location for both paleocommunities. According to this relatively shallow settlement, the biocoenosis of Fine Well Sorted Sands (SFBC) dominates, associated with those related to vegetated bottoms [biocoenoses of Photophilous Algae (AP) and of Posidonia Meadows (HP)]; representatives of the Heterogeneous Community (PE) are present as well, suggesting moderate instability conditions. In both samples, percentages of endofauna and epifauna are comparable and sand-related species are dominant, followed by those requiring a mixed substrate. The major differences between the two samples are: 1) the presence in T13 of species related to the biocoenosis of Coarse Sands under Bottom Currents (SGCF) along with taxa inhabiting the intermatte channels, denotes a relatively high energy level of the environment, whereas a small percentage of taxa exclusive of the biocoenosis of Superficial Muddy Sands in Sheltered Areas (SVMC), present only in T5, points toward a more protected area for this paleocommunity; 2) in addition to sand-related species which are dominant in both samples, in T13 gravel-related taxa are present whereas in T5 mud-related ones are detected; 3) suspension-feeders are dominant in T13 and detritus-feeders are prevalent in T5. It is also of note the presence in T13, even if < 1% of dominance value, of species referable to the so called "Senegalese fauna", such as *Thetystromubus latus* (= *Strombus bubonius*), *Conus ermineus* and *Cardita rufescens*, which are not detected in T5. In conclusion, both samples are indicative of a similar paleoenvironmental frame, i.e. an infralittoral sandy bottom, locally vegetated, characterized by a lateral transition from a relatively high-energy setting (T13) to more sheltered bottom conditions (T5). The subtropical to eurythermal character of all the identified bivalves, along with the presence of Senegalese taxa, suggests for the considered Tyrrhenian calcarenite a climate relatively warmer than the present one: in fact, the mean sea-water temperature required by *T. latus* is about 25 °C, whereas the one yearly measured during the time span 1918-2004 ranges from 17,3 to 19°C; geochemical studies on key-species skeletons are underway to better define this aspect.

LATE PALAEOZOIC FLORA OF MONTARBU BASIN (CENTRAL SARDINIA)

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Even though late Palaeozoic studies on plant macro-remains of Sardinia started in the second half of the XIX century, detailed systematic studies about macro-floras using modern keys are few, and they often report only floral taxa lists. Except for the San Giorgio macro- and micro-flora and the Tuppia Niedda micro-flora (Iglesiente, South-West) which is dated to the Moscovian, all the others are younger (late Carboniferous-early Permian). The study of new material collected in the Montarbu locality (Seui-Seulo basin, central Sardinia) and specimens already stored in the Geological and Paleontological University Museum of Cagliari has been carried out, providing useful quantitative analyses to ascribe the age of these associations. The analysed flora is well-preserved, with 24 taxa belonging to 18 genera, among which conifers and cordaitanthaleans are dominant elements in terms of quantity, while pteridosperms are common, and ferns and rare sphenophytes are present as well. Seed-ferns are the most diversified (8 taxa), followed by conifers (7), ferns (4), cordaitanthaleans (2) and sphenophytes (1). This assemblage reflects a C/P flora and probably a late Ghzelian age can be assumed. The presence of typical taxa of “Stephanian affinity” (e.g., *Callipteridium pteridium* (Schlotheim) Zeiller in Renault et Zeiller) and the abundance of *Acitheca*, along with peltasperms and conifers, justify this attribution. The systematic study of our flora has paved the way for a comparison with other paleogeographically close continental basins. Applying the IS (= Index of Similarity), a strong similarity has resulted between the Montarbu and the Igornay flora (Autun Basin, Massif Central, France). These analogies mirror close paleogeographical conditions that enable the presence of similar sets of vegetation. The Montarbu flora is also strictly comparable with the Weissig Basin flora (Germany) and those of the Czech basins, farther into the Variscides. It is therefore assumed that at that time there were no (or weak) geographical barriers between Sardinia and those areas. It is also arguable the possibility to include the Montarbu flora among the Autunian floras since *Autunia conferta* is considered one of the key species for the attribution to the Autunian (recently dated late Ghzelian/early Sakmarian). As a consequence, it should be also necessary to re-evaluate the floras from other Sardinian outcrops, which could be slightly older.

PARASITISM AND HOST BEHAVIOR IN THE CONTEXT OF A CHANGING ENVIRONMENT: THE HOLOCENE RECORD OF THE COMMERCIALY IMPORTANT BIVALVE *CHAMELEA GALLINA*, NORTHERN ITALY

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Global warming is predicted to be major driving forces in shaping ecosystems in the near future and the effect of long term climate change on parasite dynamics is complex and unresolved. We target sub-fossil traces of digenean trematodes on their bivalve hosts to infer parasite host-dynamics through time and space. Previous work has demonstrated a consistent association between sea level rise and increasing prevalence of trematode traces. Here we examine the relationships of host size, shape, and functional morphology with parasite prevalence and abundance. The main goals are to shed lights on how parasites are distributed across hosts, and how all of these relationships vary through time, using the bivalve *Chamelea gallina* from a Holocene shallow marine succession of the Po-Adriatic system. Trematode prevalence increased and decreased in association with the transition from a wave-influenced estuarine system to a wave-dominated deltaic setting. Prevalence and abundance of trematode pits are associated with large host body size, reflecting ontogenetic accumulation of parasites, but temporal trends in median host size do not explain prevalence trends. Ongoing work will test the roles of temperature, salinity, and nutrient availability on trematode parasitism. Parasitized bivalves in one sample were shallower burrowers than their non-parasitized counterparts, suggesting that hosts of trematodes can be more susceptible to their predators, though the effect is ephemeral. Like in living parasite-host systems, trematode-induced malformations are strongly aggregated among hosts, wherein most host individuals harbor very few parasites while a few hosts have many. We interpret trace aggregation to support the assumption that traces are a reliable proxy for trematode parasitism in the fossil record.

A NEW MIDDLE-JURASSIC CRINOID-RICH ASSEMBLAGE IN THE PELAGIC CARBONATE DEPOSITS OF THE CONCESIO GROUP AT MT. COVOLO (BRESCIA PREALPS, SOUTHERN ALPS, ITALY)

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Mt. Covolo is an isolated relief of the Brescian Prealps (Italy), located in Villanuova sul Clisi village, just in front of the foothills from which it is separated by the Chiese river. The backbone of the relief is characterized by a complete deepening Jurassic sequence, belonging to the sedimentary cover of the Southalpine domain of the Alps. It starts with the thick beds of the Hettangian Corna carbonate platform up to the well-stratified Titonian pelagic limestone of the Maiolica Fm. At the beginning of Jurassic this area underwent a paroxysmal rifting stage preceding the upcoming opening of Neo-Tethys, leading to the block-faulting and subsequent stepwise drowning of the Hettangian-Sinemurian carbonate platform. A very articulated submarine paleogeography characterized by structural highs and troughs of limited extension was generated in this part of the eastern border of the wide Lombardian Basin, bounded by the Trento Plateau to the east. The succession of Mt. Covolo represents the easternmost outcropping part of the wide west-east trending Jurassic Botticino High, close to an east-west fault, which borders it to the north, where a confined basinal sector developed. It shows similarities with the sequence observable at the western edge of the Botticino High, immediately to the east of Brescia: the occurrence of the reduced sequence of 'Corso' Group above the Corna Fm. and the reduction/absence of the basinal deposits of the overlying Medolo Group in the Early Jurassic. Moreover, at Mt. Covolo a reduced thickness of the pelagic limestones of the Concesio Group is also found. Therefore the above-mentioned reduced sequence attests that the Covolo block continuously remained in conditions of relative submarine pelagic high in Early-Middle Jurassic times. This contribution focuses on a recently mapped particular lithofacies, 3 metres thick, showing mass flow deposits interbedded to pink sometimes nodular marly limestones, included in the upper lithozone of the Calcari Medoloidi Fm. (upper Fm. of the Concesio Group), 16 metres below the boundary to the radiolarites of the Selcifero Lombardo Group. Crinoidal calciturbidites are coupled with debris flow deposits supported by a matrix macroscopically rich in crinoids, associated to echinoid spines, belemnites, aptichi and pelagic bivalves. In particular, we are able to recognize fragments of disarticulated cyrtocrinid crinoid cups (*Ninocrinus* and *Eugeniocrinites*) and columnals of isocrinids, probably referable to the Bajocian. In fact, *Ninocrinus* is a genus up to today found only in the Bajocian of the Umbria-Marche Central-Appenninic domain (Castellana et al., 1990). In conclusion, the study of this new crinoid-rich thanatocoenosis allows the recognition of Bajocian beds included in the upper lithozone of the Calcari Medoloidi Fm. in the easternmost Botticino High.

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INTEGRATED CALCAREOUS PLANKTON BIOSTRATIGRAPHY AND STABLE CARBON ISOTOPE STRATIGRAPHY FROM THE UPPER CRETACEOUS TETHYAN BREONIO AND QUERO SECTIONS

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The late Cenomanian-Coniacian interval is characterized by major changes in the global carbon cycle, identified by stable carbon isotope excursions and associated to climatic variations. These changes are linked to significant palaeoceanographic modifications and impacted calcareous plankton assemblages, inducing extinctions and evolutionary radiations. A reliable biostratigraphy is an essential tool to correlate environmental and biotic changes globally. Calcareous nannofossils and planktic foraminifera are well recognized as extremely useful palaeoecological and biostratigraphic markers. However, the Cenomanian-Coniacian calcareous nannofossil biohorizons are at present poorly constrained because the nannofossil assemblages suffered of marked provincialism. In order to improve the calcareous nannofossil biostratigraphic scheme of the late Cenomanian-Coniacian interval, we present new data from the Breonio section (NE Italy), in the southwestern part of the Trento Plateau, and from the Quero section, located in the western Belluno Basin (central-western Tethys). The analysis of calcareous nannofossils assemblages integrated with that from planktic foraminifera are associated to the $\delta^{13}\text{C}$ curve that highlights several positive global stable carbon isotope shifts (e.g., Oceanic Anoxic Event 2, Holywell, Round down, Pewsey, and Late Turonian Events 1, 2, 3) in both sections. The stratigraphic position of biohorizons with respect to the globally recognized $\delta^{13}\text{C}$ excursions can provide a valuable means to evaluate their potential synchronism/diachronism. Our preliminary data show a good correspondence with the recent calcareous nannofossil-planktic foraminiferal integrated scheme (Geologic Time scale 2020; Gale et al. 2020) in the late Cenomanian-Turonian interval, even though some calcareous nannofossil markers were not recorded. Interestingly, some standard and additional calcareous nannofossil events seem to occur close to the Late Turonian Events 1 and 2.

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THE CEPHALOPODS OF THE “GEORG GASSER” COLLECTION

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The restoration and digitization of the paleontological collection of Georg Gasser (1857-1931) is part of a research project at the Museum of Nature South Tyrol. This historical collection of the self-taught naturalist, one of the most important historical collections in South Tyrol, includes representative specimens from the various fields of biology and geology. The paleontological collection, formerly exhibited in Georg Gasser's “Wunderkammer”, shows an attempt at a scientific classification of the fossils on the historical labels. Currently, the paleontological portion of the heritage is composed of about 1500 fossils of which slightly more than 75% are fossils of animals, and of these 80% are invertebrates. Mollusks are the dominant group in the collection. Cephalopod inner molds, impressions and skeletal remains constitute 42% of the total number of mollusks. Ammonoidea, Coleoidea, Orthoceratoidea, Nautiloidea and Bactritoidea are the groups represented. Ammonoidea, in particular, are well documented with a good variety of genera and species. A preliminary revision was carried out by a former volunteer at the museum (Helmuth Buratti) some ten years ago. Unfortunately, about 40% of the specimens lack information related to their geographic, litho- and chronostratigraphic origin. The biggest portion of the cephalopod collection comes from Central Europe with the main areas of origin being Germany and the territories of the former Austro-Hungarian Empire. The historical *Fossilagerstätten* and famous fossiliferous lithostratigraphic groups like the Muschelkalk and Solnhofener Plattenkalke of the German regions of Baden-Württemberg and Bavaria, are well represented by ammonoids, nautiloids and coleoids. The oldest specimens date back to the Silurian and Devonian and come from the German regions Sauerland (North Rhine Westfalia) and Hessen, as well as from Poland or from the historical region of Bohemia (now part of the Czech Republic). The youngest specimens document the Cretaceous and belong to *Belemnitella mucronata* from the island Rügen (Germany). Other rare samples also come from the Gault formation of England. Peculiar is the fact that the ammonoids from Northern Italy, and especially the Trentino-South Tyrol, are relatively rare in the collection. They seem to be more linked to casual findings from local collectors or Georg Gasser himself, rather than to a systematic mining or collecting activity. The area is represented, e.g. by some Triassic ammonoids from San Cassiano (Dolomites; Bozen/Bolzano Province).

THE PLANT FOSSILS OF THE “GEORG GASSER” COLLECTION

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The restoration and digitization of the paleontological collection of Georg Gasser (1857-1931) is part of a research project at the Museum of Nature South Tyrol. This historical collection of the self-taught naturalist includes representative specimens from the various fields of biology and geology. The paleontological collection, formerly exhibited in Georg Gasser's "Wunderkammer", shows an attempt at a scientific classification of the fossils on the historical labels, with references to locality and chronostratigraphic position. Unfortunately, the collection suffered various relocations after Gasser's death. Thus, its preservation is far from pristine, and in several cases labels are missing, displaced or faded. This caused a noticeable loss of information over time. Currently, the paleontological portion of the heritage is composed of about 1500 fossils. Less than 300 specimens contain plant remains; in some cases, these are rather "lithological" samples since they include lignite, coal or other, unidentified organic remains. Only 150 specimens are determinable at least on group level. It does not surprise that the biggest part of the entire collection come from the Carboniferous of Germany and the Czech Republic. Even among the specimens without a label, Carboniferous plant remains are easily identified. The Carboniferous specimens include stem fragments belonging to the lycophytes, numerous frond fragments of ferns or seed ferns, and horsetail stem fragments. Cordaitaleans are rare. Also the Paleogene is well represented, especially with samples from the floras of Bad Häring and Bad Gleichenberg (Austria). The Neogene is much less common in the assemblage and mostly represented by Miocene plant remains from Münzenberg (Germany). Triassic specimens come from the Late Triassic Keuper of Zirl in Austria and from the Middle Triassic Wengen Formation in the Dolomites. Permian specimens come from Mölten/Meltina (South Tyrol) and in the case of one specimen from the famous Zechstein of Ilmenau (Germany). The plant fossil assemblage of the Gasser collection is thus a mixture of typical Carboniferous remains from the most famous Central European mining areas, the most important floras of the Austrian-Hungarian Empire and a few specimens from the Dolomites and Mölten/Meltina. It does not contain any typical Middle and Upper Keuper (Triassic) plant remains from Southern and Central Germany, contrarily to the animals in the collection, among which these areas are well represented. On the other hand, eastern Central Europe is much better represented. England is completely missing from the collection, even though the famous Jurassic Yorkshire flora would be expected to be present. Older, and rarer time periods such as the Silurian and Devonian are completely absent.

THE VERTEBRATES OF THE “GEORG GASSER” COLLECTION

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The restoration and digitization of the paleontological collection of Georg Gasser (1857-1931) is part of a research project at the Museum of Nature South Tyrol. This historical collection of the self-taught naturalist includes representative specimens from the various fields of biology and geology. The paleontological collection, formerly exhibited in Georg Gasser's "Wunderkammer", shows a primitive attempt at scientific classification of the fossils on the historical labels. Unfortunately, the collection suffered various relocations after Gasser's death, that led to a loss of information. Currently, the paleontological portion of the heritage is composed of about 1500 fossils. More than 200 fossils belong to the vertebrates: 17% of the total amount of paleozoological specimens. Fishes, reptiles, and mammals are the taxonomic categories represented. A preliminary revision in 2020 by Silvio Renesto (University of Insubria) and Cristina Lombardo (University of Milan) gave origin to a first classification, confirming, rectifying, or adding more information to the historical labels. Only few samples are unidentified at class level due to the partial state of conservation and/or the absence of more specific references. The vertebrates mainly come from Germany, with samples originating from Italy, Austria, England, Spain, USA, and the Czech Republic. About 41% of the vertebrates are represented by mammals, mainly from Quaternary sites, with some exceptions from the Neogene and Paleogene. The primary source areas are two Länder in Germany, i.e. Baden-Württemberg (Bietigheim, Bad Cannstatt, Engelswies, Goldberg) and North Rhine-Westphalia (Warstein, Dingden). Fish remains amount to 44% of the entire collection. Well represented are some well-known Fossilagerstätten such as Mansfeld (Permian), Solnhofen (Jurassic), Bolca (Eocene), and Ulm (Miocene). The rarest among the vertebrates are the reptiles (10%). They are focused mainly on Mesozoic findings, including teeth and osteoderms from the Triassic of Aixheim and *Dakosaurus maximus* from the Jurassic of Sigmaringen. One tooth of placodonts comes from Trento. The composition of the vertebrate collection allows to postulate some theories about Gasser's contacts and the ways of acquisition of the specimens. The value of the specimens is not always linked to their state of conservation, but sometimes to their rarity, to the fame of the source area or the unusual origin and preservation. . One specimen interpreted as a vertebra of *Zeuglodon*, object of a special donation from the prince of Salm-Salm. Archival research allowed us to reconstruct the main steps that led to this gift providing a glimpse on the network of relationships that Gasser had and how he constructed it.



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