petrographic, taphonomic and paleoecologic attributes, at least five microstratigraphic units (MUs) were recognized, each one separated by thin layers of silty shale with irregular boundaries. Each individual MU records increasing energy levels upwards. Development of the bakevelliid shell concentration started (MU-1) with interbedded wackestones, packstones, and grainstones with fragmented and chaotically-oriented shells (few bakevelliids, cassiopids, epitoniids, and undetermined remains). These are overlain by lime mudstones and gastropod-bearing wackestones with chaotically arranged and highly fragmented shells (MU-2). This is succeeded by fine interbeds of packstones, mudstones and shell concentrations with highly fragmented undetermined bivalve shells and few large-size gastropods (cassiopids and undetermined ones) (MU-3). Up in the succession, packstones occur with wackestones, mudstones and grainstones, characterized by abundant terrigenous material and by highly fragmented bivalve shells (MU-4). At the top of MU-4, bivalves with closed articulated valves are also recorded. At the very top of the concentration, a 15-cm-thick succession of shell concentrations interbedded with bivalve-rich packstones is present (MU-5). Thisunit is dominated by predominantly disarticulated, non-fragmented bakevelliid shells, oriented parallel to bedding (shell pavement). Immediately above, closed articulated bakevelliids are preserved in growth position, recording a mainly physically-driven in situ taphonomic feedback. The in situ shells are covered by sandstones with hummocky cross-stratification, indicating that living bakevelliids were abruptly buried by rapidly deposited sand, probably by storm-induced processes.

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EVALUATION OF THE ECOSYSTEMS OF THE WESTERN MEDITERRANEAN THROUGH PALEOECOLOGICAL STUDIES

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Over time, the plant landscape has changed as a result of the numerous events on a global and local scale that have happened. This is the case of the Mediterranean ecosystems (one of the most complex and rich in endemisms on the planet), subjected to anthropic pressures from the beginning of civilizations. The intervention in these systems together with climate changes, has led to changes in diversity, tree cover, shrub, and ultimately in the structure and functioning of these ecosystems.

Paleopalinology is used as a tool for analyzing pollen and non-pollen microfossils preserved in the flooded grasslands of the Middle Atlas (Morocco). This allows reconstructing the evolution of vegetation and climate, as well as providing data and reasoning to different ecological, cultural and historical processes. Although climatic and anthropic events are well documented in Europe, they are not so well documented in North Africa, which gives added value to the study area.

The results obtained serve to predict the behavior and evolution of Mediterranean mountain ecosystems during the Holocene, their response to future changes, resilience and recovery from climatic and anthropic disturbances. In the stratigraphic series analyzed, nine major events were detected, eight of which appeared to be of climatic and anthropic origin, and one unexpected, related to volcanic activity.

THE EMERGENCE AND ECOLOGICAL STABILITY OF GEOLOGICALLY PERSISTENT PALEOCOMMUNITIES

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The emergence of an ecological community in evolutionary time is the result of species evolution and coevolution. In species rich and functionally diverse communities, there are a multitude of alternative pathways along which emergence could proceed. Nevertheless, analysis of alternative pathways for paleocommunities spanning more than 13 million years of the Permian-Triassic of the Karoo Basin of South Africa, suggests that pathways actually taken represent a small subset of the total available. This leads to a narrow representation of the total number of communities possible given a specific number of species and level of functional diversity. Furthermore, the paleocommunities were always superior to structural alternatives of equal complexity, in terms of community global stability (the number of species that can coexist stably and indefinitely). Such optimization could indicate a selective process during the formation of types of communities, or simply be emergent from the

coevolutionary framework. Here we present ongoing work to support an emergent process by which many alternative types of communities may form constantly on ecological timescales, but where few are stable and persistent on longer timescales. This leads to the compositional stability of paleoecological units often noted in the fossil record, and the apparent incumbency of long-lasting lineages. The aftermath of mass extinctions present opportunities to test this hypothesis, because previously persistent communities are replaced by newly emergent ones, and the emergence process itself can be extended to geological timescales because of ongoing environmental instability, and the time required for the reformation of coevolutionary relationships and functional structures. Such is the case in the aftermath of the Permian-Triassic mass extinction, when Early Triassic paleocommunities in the Karoo Basin were sub-optimal compared to alternative, hypothetical histories.

Understanding long-term ecological persistence is crucial to our understanding of the modern anthropogenically-driven environmental crisis. Modern ecosystems are the documented products of geological and evolutionary history. Species acclimatization and adaptation to ongoing changes are not necessarily guarantees of the future persistence of the resulting reorganized systems. It will become critical to determine if the biosphere has already turned down new ecological and evolutionary pathways, or is still operating in the capacity of the pre-Anthropocene system.

MORPHOLOGICAL ANALYSIS OF ENIGMATIC ARTHROPODS OF THE SILURIAN WAUKESHA LAGERSTÄTTE, WI

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The Waukesha Lagerstätte is an early Silurian fossil deposit found in the Brandon Bridge Formation, which may be found in Wisconsin and Illinois, although exceptional fossils are known only from Waukesha and Milwaukee, WI. Samples come from a finely laminated mudstone and dolomite in the lower portion of the formation. Fossiliferous bedding planes are thought to be large accumulations of arthropod molts within sediment traps. Despite the abundance and quality of the fossils of the Waukesha biota, there is still much worked needed to classify the array of taxa. Among these are a group of enigmatic arthropods that resemble Marrellamorpha—at least superficially. Marrellamorpha, named after its original member *Marrella splendens* Walcott, 1912, from the Cambrian-age Burgess Shale Lagerstätte, is a small class of Paleozoic arthropods including *Furca bohemica* Fritsch, 1908 (Ordovician), *Mimetaster hexagonalis* Gürich, 1931 (Devonian), *Vachonisia rogeri* Lehmann, 1955 (Devonian), and *Xylokorys chledophilia* Siveter et al., 2007 (Silurian). To better determine the taxonomic placement of these Waukesha arthropods, samples were photographed using varying light angles and features were traced using Affinity Photo and Affinity Designer. The defining characters of Marrellamorpha from Rak et al. (2013) were used to evaluate if these sample are marrellamorphs. These characters include longer cephalic exopods, the possession of rounded endopod endites, multisegmented trunk exopods, a truck with more than 25 segments, and medially-directed, filamentous exopod setae on each podomere. Our investigations have revealed an organism with one pair of short, stout antennae, and a 9-11 segmented trunk, with most trunk somites bearing short pleurites and a short pair of legs with setae. Thus, the taxon likely does not belong to the Marellamorpha, and alternate taxonomic placements are considered.

VIRTUAL FIELDWORK EXPERIENCES FOR ON-LINE EXPLORATION OF CENOZOIC PACIFIC COAST FOSSIL LOCALITIES FOR THE EPICC PROJECT

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Virtual fieldwork experiences (VFEs) are being created for four important paleontological sites along the western coast of the US as part of the educational outreach associated with EPICC (Eastern Pacific Invertebrate Communities of the Cenozoic) project. Virtual fieldwork experiences allow visual exploration of sites for those who cannot visit physically, engaging audiences in the physical features of an area through the eyes of a geoscientist. They can also be of scientific and educational value for those documenting sites. VFEs generally offer some combination of gigapixel-resolution images, panoramas, 3D imagery, and video taken at the site, and may also integrate research collections and microscope images, together with other data. They integrate imagery and data at the sites with other data such as maps and models.

Example imagery in a typical EPICC VFE includes identifying large structural features at continental,