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APPLIED MARINE PALEOECOLOGY: THE HOW AND WHY

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Several actuopaleontological investigations on the taphonomy and absolute dating of marine biogenic accumulations occurring on present-day seafloors have provided evidence that they represent multisecular archives of the marine associations that followed each other. Beside a variable degree of bias introduced by erosion or lateral transport and time-averaging of multiple generations, these accumulations of shells tend to have a continuous age structure and thus represent a long-term, high-resolution record of environmental history of coastal and shelf regions (Kowalewski, 2003). The reliability of such record has been estimated via quantitative comparison of live and dead assemblages in modern environments. Strong evidence supports the conclusion that marine death assemblages mirror the original "source" association by retaining species' original rank orders (Kidwell, 2001). Benthic paleoecology integrates data from fossil biota and embedding sediments with the aim to describe a paleoenvironment, through the identification of its most important descriptors: the (paleo)ecological factors. The strategies of benthic paleoecologists can be schematized into the following steps: 1) quantitative description of death assemblages and embedding sediment; 2) taphonomic analyses of death assemblages (the so-called thanatocoenoses) (Basso & Corselli, in press); 3) definition of the ecological compatibility of each species with the rest of the association and the embedding sediments; multivariate statistics based on raw or filtered data to circumscribe/recognize discrete ecological association; reconstruction of their relationships in space and time; absolute dating. Further insights on short-term variation of selected ecological variables (temperature, salinity, productivity) can be obtained from specific geochemical investigations (element ratios, stable isotopes, trace element) possibly associated to microsampling (i.e. laser-ablation techniques). This well-tested paleoecological approach can be usefully applied to Holocene death assemblages, providing ecologists with longer temporal perspectives on association composition, which typically are measured in decades to centuries. If we consider that the human impact on marine ecosystems can be traced back to few decades up to some millennia, depending on the study area, the potential to disclose the evolution of Holocene pre-human environments seems highly valuable when trying to discriminate natural and anthropogenic environmental changes. Few decades are the longest time scale approached by conventional ecologic studies by means of time-series data collection, that necessarily concentrate on selected sites or very limited areas. Ecological investigations can reveal inter-annual or seasonal variations in benthic associations, providing details on recruitment processes, population dynamics etc. Conversely, paleontology more often focuses on basin-scale changes, with a temporal resolution that seldom goes below the millennia. Applied marine paleoecology can be considered as a bridge between conventional ecology and paleontology, from the point of view of the considered time scale and potential resolution of the results. Its field of application covers the artificial gap between the biological and the paleontological approaches to the common topic of environmental change, providing a new kind of data for the implementation of forecast and modelling.

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