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THE INFORMATION POTENTIAL OF A PALAEOBIOCENOSIS. THE MALACOLOGICAL REMAINS USE AS A PALAEOENVIRONMENT DATA SOURCE

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Abstract

From a qualitative point of view shells represent the most significant animal remains in many stratigraphic contexts, and sometimes also the most quantitatively substantial; therefore they constitute a rich, and often underestimated, palaeoeconomic and palaeoecological source of data. The palaeoeconomic information obtainable through the analysis of malacological finds may relate to the collection, use and trade of molluscs for food, the processing of molluscs and their shells to obtain raw materials used in more complex production processes (e.g. purple and byssus extraction), or still the processing and use of shells as jewelry or tools of various kinds. The palaeo-environmental data obtainable by studying ancient malacological remains can often be even more relevant, though archaeomalacology has shown many practical and theoretical limits when dealing with this kind of speculations. In the article we will be briefly present the discipline and analyze some of its major criticalities.

Keywords: *archaeomalacology, malacological finds, palaeoenvironment, history of ecosystems*

Introduction

The study of malacocenosis recovered from a stratigraphic deposit, allows the acquisition important information about the paleoenvironment, specifically regarding the close proximity of the investigated area.

Although many scholars started dealing with this discipline as early as the middle of the 19th Century, realizing its informative potential, there would be few archaeologists who would approach it in the following decades, and even during the course of the 20th Century archaeomalacology remained a very small branch of study.

As of today theoretical and methodological contributions, especially outside the English sphere, remain scarce: the main reference is still a book published over forty years ago (EVANS, 1972).

This delay in the development of the discipline is responsible, at least in part, for the lack of attention paid to the recovery of malacological remains, which are often inappropriately collected and almost never the subject of appropriate studies.

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Materials and methods for collecting, determining and counting malacological finds

Shells remains can be retrieved in two different ways:
- on-site collection during the documentation and excavation of a store;
- flotation and sieving of substrate samples, to sort malacological finds from residue.

As it is easy to imagine, the most accurate recovery strategy involves the integration of the two above mentioned modes: limiting collection to the remains identifiable by sight means selecting only the most easily recognizable finds (the whole and larger ones), with the complete exclusion of small or fragmentary shells, often of considerable diagnostic value (Sparks 1961; Evans 1972).

Following this first stage, the finds are analyzed in laboratory, and for each storage assembly considered, the minimum number of specimens of each species found is established, with criteria selected according to the quantity and the state of preservation of the examined material.

A common practice is the counting of non-repeatable elements of a shell (protoconch, mouth, columella). Alternatively, in the case of extremely abundant and/or fragmentary finds, a numerical estimate of the specimens may be based on the total weight of the remains.

Finally, counting the number of fragments identified by species can be useful in obtaining information on the taphonomic processes affecting the shells remains of the various species (Mannino, 2010).

Requirements needed for data analysis

Assuming the actualistic principle can be applied to animal species (Girod, 2005), the more we deepen our knowledge of the ecological and ethological characteristics of the single species found, the more palaeo-environmental information we will be able to extrapolate from malacological remains relevant to the archaeological – or more generically depositional – contexts.

This knowledge should be supplemented by studies on the composition of current species associations and the resulting thanatocoenosis to acquire important ecological and taphonomic data; the lack of these data could easily lead to interpretative errors related to the over-representation or under-representation of the different species pertinent to the same assembly.

Equally fundamental to the analysis in question is the acquisition of palaeoclimatic data concerning the period considered, since it is well known that many animal species - particularly if characterized by high or medium-high ecological valence - can cope with the change in the climatic characteristics of a territory by occupying very different habitats, and thus guaranteeing themselves the most suitable environmental parameters (Cameron, 1970).

Finally, it is necessary to carefully consider the type of stratification from which the remains have been recovered, since only by the correct interpretation of their

formation dynamics we will be able to hypothesize to what extent all of the said remains are representative of a real palaeobiocenosis.
In other words, it is necessary to evaluate which and how many potential vectors of malacological remains may have contributed to the formation of a specific deposit bringing shells from contexts more or less close to the investigated area (Bobrowsky, 1984).
For example, the remains of molluscs in deposits caused by a slow deposition of sediments represent the most reliable source of information regarding the paleo-environmental reconstruction, since the thanatocoenosis considered is usually constituted by a high percentage of indigenous elements. In cases like these the main difficulties in interpreting the data are that every stratigraphy of this kind results from processes that have taken place in a very variable time span, and cannot usually be measured with accuracy.
On the other side the palaeoecological interpretation of the remains of molluscs dispersed in carryover soils can be even more problematic, because these substrates, together with the malacological finds contained therein, may have been taken at more or less great distances and/or depths, and may consequently have been part of heterogeneous contexts, both from a typological and chronological point of view.

Methodologies of analysis

Once the qualitative and quantitative information on the detected malacological remains has been systematized, its critical analysis can be carried out. In general, as is obvious, it is the speculative part of a study of any kind to present the most critical issues, being the one most influenced by the various possible theoretical orientations: the acquisition of paleoenvironmental data based on the analysis of the malacological remains is strongly influenced by different speculative guidelines.
From the rigid and substantially autoecological approach to which the first authors involved in the discipline adhered to, it is now widely wished to consider a malacocoenosis more comprehensively: as each single shell has a certain information potential, in fact, it is from the critical analysis of the associations of species present in the same depositional context that the paleoenvironmental reconstructions are obtained, and that is why the correct retrieval of the malacological finds, according to the methods mentioned above, is often an essential condition to the study in question.
In particular, by using a synecological approach, we will be able to better develop the information potential offered by the euryoecious species, which lose much of their diagnostic value when extrapolated from their relative biocenosis.
In any case, regardless of the choice between the autoecological or the synecological approach, one cannot ignore a common problem factor in critical data analysis, determined by the choice of categories by which the specimens of the different species are subdivided.
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Particularly fortunate was the proposal advanced by English geomorphologist and archaeomalacologist Bruce Wilfred Sparks at the beginning of the 1960s (Sparks, 1961). According to him terrestrial malacofauna could be grouped in just four orders:
- wetland species;
- woodland/shade loving species;
- catholic species;
- open country/xerophil species.

This subdivision, while ensuring a great agility in processing and reading data, is overly schematic, trivializing the complex interaction between biotic and abiotic factors, which defines the characteristics of a particular habitat.
In addition, these factors are considered asistemically: the *wetland species* category, for example, is based on a single environmental factor (presence of water), while the category *woodland/shade loving species* is defined only by vegetation cover.
It is better then to evaluate the ecological requirements of the species in relation to individual environmental factors, selected each time depending on the information we can or intend to acquire.
Among these, still considering terrestrial habitats only, the most important are:
- vegetation coverage, which is usually the most influential biotic factor, which can affect many environmental factors such as moisture, brightness or chemical and physical characteristics of the soil;
- the average moisture content of a biotope, which is dependent on both vegetation coverage and geomorphological and climatic conditions;
- the physical and chemical characteristics of the substrate, which have a significant influence on the development of much of the malacological biocenosis.

Archaeomalacology in an interdisciplinary context

As we said, the comparison with paleoclimatic data is often useful, if not outright necessary, to a proper palaeo-environmental analysis based on malacological remains. But palaeoclimatology is not the only discipline that archaeomalacologist can deal with: a palaeo-environmental reconstruction should benefit from the integration of all available data on the biocenosis of the context under study, as well as data on any other aspect of its abiotic environmental factors.
For example, it is of extreme interest to have an integrated analysis between the study of the malacological remains and the pollen analysis, when both types of finds are preserved. This is because, while a study of pollens can provide environmental data on the medium and large scale, archaeomalacology can provide extremely precise small-scale palaeoenvironmental information when applied to a single site (and can be less effective in a more comprehensive analysis).
Likewise, significant paleoenvironmental studies could be produced based on the totality of archeozoological and/or archaeobotanic data available.
The hope is that such interdisciplinary approaches and the scientific results to which they lead will induce both archaeologists and scholars of natural sciences to

adopt the necessary change of course that the respective branches of study must undertake as a sign of an ever-greater and structured synergy, dictated by the common awareness that they are all part of what we might call *history of ecosystems*, of which man is but one of many factors, and from which *human sciences* should not believe themselves to be separate.

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IL POTENZIALE INFORMATIVO DI UNA PALEOBIOCENOSI. L'USO DEI RESTI MALACOLOGICI COME FONTE DI DATI SUL PALEOAMBIENTE

Riassunto

In molti contesti stratigrafici, le conchiglie rappresentano i resti animali più significativi dal punto di vista qualitativo, e talvolta anche i più sostanziali dal punto di vista quantitativo, costituendo una ricca e spesso sottovalutata fonte di dati sia paleoeconomici che paleoecologici. Le informazioni paleoeconomiche ottenibili attraverso l'analisi dei reperti malacologici possono riguardare la raccolta, l'uso e il commercio di molluschi per il cibo, la lavorazione di molluschi e delle loro conchiglie per ottenere materie prime utilizzate in processi produttivi più complessi (ad esempio l'estrazione della porpora e del bisso), o ancora la lavorazione e l'uso di conchiglie come gioielli o strumenti di vario genere. Spesso ancor più rilevanti sono i dati paleoambientali che potrebbero essere ottenuti studiando antichi resti malacologici, anche se molti sono i limiti pratici e teorici mostrati dall'archeomalacologia nell'affrontare questo ambito di ricerca. Nell'articolo sarà brevemente presentata la disciplina, e verranno analizzate alcune delle sue principali criticità.