

# Inaugural address

## The concept of biostratigraphy: the viewpoint of a stratigrapher

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Colleagues, Ladies and Gentlemen

My presence here is due to accidental circumstances and I must confess that I feel a little embarrassed by the fact. Both your scientific quality and the worldwide acceptance of the results achieved by you in your research fields make me prudent and, to a certain extent, cautious.

On the other hand, as Dean, I am pleased to welcome you to this Faculty of Geology. Some of you have come a long way to be present here today in Barcelona. And this fact alone is a sign of the interest aroused by this Symposium on concept and method in Paleontology. The Secretary of the Symposium, Dr. Martinell, is a Professor of our Faculty and I should like to take this opportunity and openly voice my satisfaction for the hard work done, given our modest conditions, in organizing this symposium.

My satisfaction is also personal. My own research and teaching are closely related to some of the topics of the Symposium. I have some personal and effective ideas on the concept of Biostratigraphy as a science, resulting from my research and teaching practice.

I hope attending colleagues will be tolerant enough to bear with a short speech on the above mentioned topic, i.e. the concept and scope of Biostratigraphy as a science. The aim of my speech is to propose some elements of reflexion on this specific topic, announced as important in the first circular of this Symposium.

I do not hold with the usual restrictive interpretation of the concept and scope of Biostratigraphy. My opinion has been expressed several times (Reguant, 1975; De Renzi, et al. 1975). What I am asking you now is to examine my personal perspectives on a more logical and broad meaning of Biostratigraphy. This is only possible through a confrontation of different or dissenting views. The dialogue must be started and this dialogue must be scientifically correct, both from logical and pragmatic points of view. Those who have most to win from this discussion are stratigraphers and paleontologists, since a more complete knowledge of the scope of Biostratigraphy is very important for these two groups of scientists, often excessively disjointed.

### A BIASED CONCEPT OF BIOSTRATIGRAPHY

The concept of Biostratigraphy became impoverished by

the fact that the use of this word *Biostratigraphy* is linked in a restrictive manner to the zonation and correlation of strata. The extremely interesting book, edited in 1977 by Kauffmann and Hazel «Concepts and methods of Biostratigraphy» expressed in the preface this biased concept of Biostratigraphy «... in this book we are concerned with the principal purpose of biostratigraphy — zonal biostratigraphy, the zonation and correlation of strata...».

More recently, Guex (1979) in his paper «Terminologie et méthodes de la biostratigraphie moderne: commentaires critiques et propositions» seems to want to discuss the nomenclature and methods of biostratigraphy, but his discussion is restricted to biostratigraphic units. This procedure would be analogous to the professor or handbook of stratigraphy dealing only with stratigraphic units.

It is possible to find many other examples of this restrictive and all too frequent viewpoint. This opinion, however, is not universal. Hölder (1979) points out clearly that «The biostratigrapher is in the first instance only concerned with fossil series in general and not with evolutionary ones». This sentence presupposes a concept of biostratigraphy not linked exclusively to biozonation.

### THE TRUE CONCEPT OF BIOSTRATIGRAPHY

From a logical point of view, the concept of biostratigraphy is very simple. «Biostratigraphy (is) the element of stratigraphy that deals with the remains or evidences of former life in strata...» (Intern. Strat. Guide, p. 48).

The confusion and/or dissension about the biostratigraphy concept depend on confusion and/or dissension about the stratigraphy concept. Some very restrictive opinions on the stratigraphy concept accept that stratigraphy is only a pure time-classification of strata. If this definition is to be accepted then biostratigraphy is inexistent as a science or is reduced to some paleontological methods of stratigraphic classification.

This perspective is, in my opinion incorrect and evidently insufficient. Thus, I would like to avoid the discussion about stratigraphic classification and nomenclature (i.e. kinds of stratigraphic units and so on) and return to a classical definition of stratigraphy in modern words. Stratigraphy is the science of rock strata, i.e. science of *successionality* of materials in the Earth's crust. Thus, stratigraphy is concerned

with all aspects of rocks as *strata*, because each aspect shows us different elements for the recomposition of the origin, meaning and consequences of successional of rocks in a definite area, and in general allows us to discover the general laws of stratigraphy.

Thus, biostratigraphy is, in part or wholly, concerned with (cfr. Reguant, 1975):

1/ The texture and structure of rock strata, evidenced by fossil content.

2/ The active and/or passive influence of organisms or of their remains or products in the formation of rock strata.

3/ The successional characters of the stratigraphic sections inferred from the study of fossil content.

4/ The sedimentary environment as a result of paleontological analysis.

5/ The organization of strata into units based on their fossil content. Also inferences on stratigraphic correlation based on these units.

This broader concept of biostratigraphy is not necessarily linked with a specific broader concept of stratigraphy; the concept of stratigraphy adopted by the International Stratigraphic Guide (Hedberg 1976). Symmetrically, the restrictive (which I have called biased) concept of biostratigraphy is not necessarily linked with a specific restrictive concept of stratigraphy: the time-restricted stratigraphy.

Besides the actual relationships between concepts of stratigraphy and biostratigraphy I have above indicated, I want to point out this relative independence (perhaps not always logically understandable) of two concepts.

Hölder (1979), whom I have quoted above, belongs to the group of stratigraphers, that do not agree with the philosophy of International Stratigraphic Guide. He holds that, with the ISG «...stratigraphic terminology and the whole discipline of stratigraphy are split up in an unnecessarily strong manner» and that «according to European tradition, stratigraphy is understood there as a unified branch of geology whose principal aims is the chronological classification and correlation of rock bodies» However, Hölder points out that «biostratigraphy is not only serving geology and the main discipline of stratigraphy but is an extensive branch of research that reveals the abundance of the past life and the recurrent new combinations in chronologic order».

I should complete and summarize this sentence by pointing out that biostratigraphy is the science dealing with the remains and evidences of former life *in the successional* (chronological successional) of course, but not mainly chronological) of rock strata.

#### SOME EXAMPLES OF BIOSTRATIGRAPHIC RESEARCH, OUTSIDE RESTRICTED (BIASED) CONCEPT OF BIOSTRATIGRAPHY

My plea for a broader and more adequate concept of biostratigraphy is somewhat pedagogic. It becomes more and more evident that the information available from the remains and evidences of former life in rock strata is more subtle and richer than that available from results of pure physico-chemical processes, such as hydrodynamic ones in sedimentary structures, or chemical and mineralogical changes in edaphic processes. On the other hand, the fragility of organic structures leads unfortunately to a very incomplete fossil record. Thus, all information recorded within the rock strata though less refined than that available from fossil remains, is essential for stratigraphic knowledge.

I shall now attempt to present, very briefly, some examples of biostratigraphic evidences useful to solve stratigraphic problems, outside biozonation or zonal correlation.

1) Many colleagues surely know, the problems originated in the interpretation of the ochres of Apt (France) (Virgili, 1979). The fossil record always favoured a marine origin of these sediments. However the geochemical and mineralogical analysis seem to favour a continental origin. Recent work demonstrates the accuracy of biostratigraphic analysis. The mineralogical and geochemical evidences adduced above must be explained by a «continentalisation» after sedimentation.

2) Some years ago, we observed the cyclic nature of some calcareous sequences from Montsià (Tarragona, Spain) cretaceous sediments. The definition of different terms of an ideal cycle led us to a qualification of these terms in a relative marine or nonmarine position, chiefly based on fossil remains or evidences. Thus, we could propose a hypothesis on horizontal polarity of these rock strata against the accepted one based on classical criterion of sediments thickness. Unfortunately, the work was interrupted and the hypothesis remained exciting but unproved.

3) The marine upper oligocene of San Vicente de la Barquera (Santander, Spain) is rich in Bryozoa remains. This fact is enough to dissent from a pointview accepting turbiditic sedimentation, based on sedimentary evidences.

This brief explanation of three examples, referred to facies characterization, palaeogeographic reconstruction and type of sedimentation, constitutes an indication of possibilities of biostratigraphic contribution to a general stratigraphic analysis, outside biozonation or zonal correlation.

On the other hand, the restrictive, biased, concept of biostratigraphy can very easily mislead biostratigraphers.

My friend and colleague Dr. Martinell has often criticized the misuse of fossil content made by biostratigraphers only «heeding» the chronostratigraphic results of their own research. This wrong use issues from the restricted, biased, meaning of biostratigraphy and from the overlooking of related sciences such as, for example, taphonomy. In other words, this perspective is the result of overlooking the fact that fossils are inside the strata and must be understood within the strata and make the rock strata understandable.

The outcrop analysis, first step in any study of fossil content, is an element of biostratigraphic research, and only after this work has been done, is, the paleontologic study of fossils and the posterior applied work as the establishment of biozonations and correlation i.e. the biochronostratigraphy, possible. In conclusion, the reduction of biostratigraphy to biochronostratigraphy is, simply to take the word biostratigraphy, whose meaning includes scientific topics related closely both to paleontology and stratigraphy, as being equivalent to one element of the same science having a main pragmatic intentionality.

Dear colleagues, I have just presented you with a draft for a debate on the true concept and scope of biostratigraphy. It would be a great satisfaction to me if the discussions and communications of this symposium were to clarify this concept and all topics included in the symposium.

Thank you for your tolerance and I hope that your visit to Barcelona will be pleasant and satisfactory.

#### REFERENCES

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