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forum

Taphonomy, a discovery for museology*

Over the last few years, the Science Museum of «la Caixa» Foundation, located in Barcelona, has been building up a collection of items especially chosen for their museological potential. In particular, the museum has paid attention to fossils, particularly those complex pieces which allow us to tell stories related to the fossilization process.

In this talk, we will analyse the museological potential of these types of pieces focusing particularly on taphonomic analysis and following the principles of the modern scientific museology.

Firstly, let's look at what these principles are:

- The content of the museums and exhibitions concentrates on the real object and on the three interactive levels:
  - Manual (or *Hands on* in museological jargon) which consists of the active participation of the visitor via an experiment.
  - Mental (*Minds on*) which consists of making the visitor ask him or herself questions, trying to find solutions or making analogies. Leaving the museum with more questions than you had when you came in is a success.
  - Emotional (*Hearts on*) which consists of the object or experiment exhibited connecting with the sensibility of the visitor.
- Secondly, the focus should always be interdisciplinary.
- Thirdly, the main aim is to stimulate and create scientific opinion.
- And fourthly, the best way to set up a good exhibition is to have done some background good research.

We will now go on to analyse the museological potential of palaeontology and in particular taphonomical analysis. Let's first define what the field of study of taphonomy is.

Taphonomy is the area of palaeontology which is involved in analysing what happens during the transit of organic remains from the biosphere to the lithosphere. This includes:

- How an organism dies and the processes which take place just after death. This part is called necrobiosis.
- What occurs from death until definitive burial. This is called biostratinomy.
- What changes happen during burial. This part is called fossildiagenesis.

When an organism dies, biological information can be lost because of the decay of soft parts, the breaking up of skeletal parts, and the change of the original mineralogy.

Furthermore, the fossil remains are a reduced and biased representation of the original communities: it may be that only organisms that have skeletal parts fossilize, and that the skeletal remains of a community may only consist of those which are most resistant, or of a certain size or mineralogy.

Therefore, fossilization processes bring about a loss of biological information, although it is important to note that they also mean an increase in taphonomic information.

The task of paleontologists is to reverse the process: they try to recover biological information lost during fossilization, and at the same time, obtain as much data as possible about the taphonomic processes. The paleo-taphonomist works like a detective, using clues to try to reconstruct the scene of the crime and the characters involved.

The tools that taphonomists use are multidisciplinary. They need the help of biology, geology, physics and chemistry to reconstruct the whole story which the fossil reveals.

All this makes taphonomy and extremely interesting science from the point of view of modern museology. By means of a fossil, we can make the visitor become a paleontological detective who tries to reconstruct what perhaps took place.

How can we put all these museological ideas into practice? We suggest the following ideas:

- First of all, by using the real object, one or perhaps several fossils, which allow us to explain their formation process. It is not the taxonomic criteria which lead us to choose one fossil or another, but the taphonomic interest involved.
- The next museographical element is the use of experiment.
  Through means of experiment, the visitor connects directly with nature. An example of this would be the observation of pieces of amber using:
  - Monocromatic light which make the discontinuities corresponding to distinct drops of resin visible. In this way, it is possible to see the internal structure of the piece and the position of the insects in relation to the layers of resin.
  - We can also use polarized light with which we can see the internal forces within the amber, such as tho-

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se produced by the insects struggling to escape from the sticky resin.

- This is accompanied by a text which generally brief and centres on guiding visitors towards details and clues which help them discover the story.
- And finally, we need to show the story which is enclosed within the fossil. There are various ways to do this. For example, in the case of insects in amber we use a drawing to show what we believed happened just before the moment that the insects became trapped in the resin. It is even clearer to show what occured via a sequence of drawings.
  An alternative method we have used has been dramatising the scientists' task. For instance, in a workshop called Micromania, two actor-scientists interact with the public showing them microscopic objects with lenses and microscopes.

We will now go on to present two examples of taphonomic analysis brought to museography, which are currently on display in our Museum.

«Jorge Caridad»

The first example deals with the museography developed around an exceptional piece of amber which forms part of the Science Museum's collection

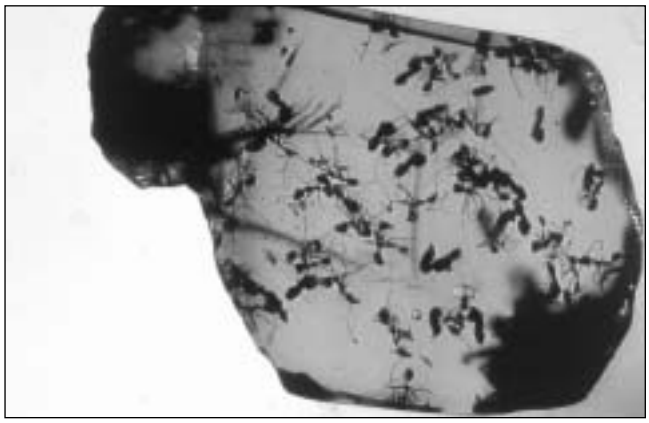
This piece was found in 1995 in the Palo Quemado mine, in the Dominican Republic. It is called «Jorge Caridad» in honour of its discoverer and it is 20 million years old (Miocene). Despite its small dimensions (3 by 2 cm) its inside houses a complicated scene in which 98 perfectly preserved characters participate. They are clearly visible thanks to lack of bubbles and debris.

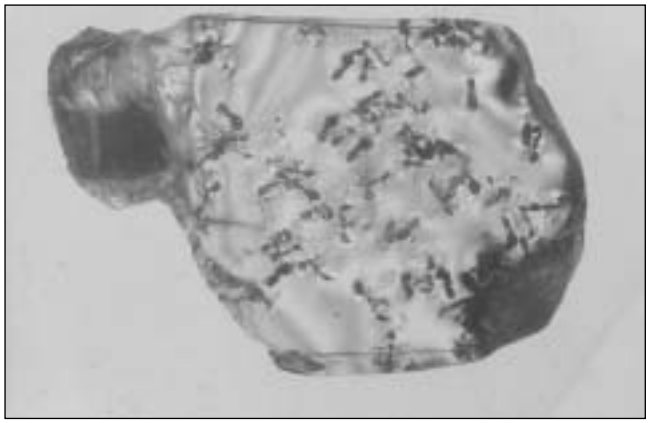
The great majority of actors in this scene are ants belonging to the same species (*Technomyrmex caritatis*). But the real interest is that all stages of development are present: adult workers, pupae, eggs clusters and larvae.

Observing the piece, it quickly becomes evident that a bond can be established between adults and their young: adults are found holding on to a larva, a pupa or an egg cluster. Looking closely, we can also see that the adults are clutching the young very tightly with their jaws. It seems that the colony was perhaps experiencing a very tense or stressful situation.

How is it possible to exhibit this tiny piece of amber to the public?

- In our museum it's displayed in a case equipped with a hands-on video camera which visitors can control from outside. In this way visitors can explore this amazing world, zooming in and out with the blown-up images displayed on a monitor.
- The text alongside helps the visitor observe and identify the distinct stages of development of the ants and the relationships between them.





- These are backed-up with monochromatic and polarized photos which highlight the internal structure.
- A drawing reveals that the antennae didn't seem to be pointing in any particular direction. This would reasonably indicate that the ants were not dragged by the resin, but were engulfed by a single drop from above. It also seems that the ants were moving in two distinct directions.
- And finally, an artists interpretation which shows the moment immediately before the 98 ants were encased by the resin. In this picture, we can see, how the two columns of ants carrying their young, were forced out of the nest, which was being flooded by resin.

Big and small

The second example is about an exhibition entitled «Big and Small» which tells the stories behind particularly spectacular fossils. Each case has the same common factor: two or more characters of different sizes.

The exhibition uses the famous fictional detective characters Sherlock Holmes and Dr. Watson to investigate the fossilization process.

The museographical elements of Big and Small are:

- Fossils:
  - Some fish with smaller fish in their stomachs from the mid-Cretaceous from Lebanon.

  - A fish with a another half-swallowed fish in its mouth from the Eocene from Wyoming.
  - Three cave bear skeletons in different stages of development: adult, juvenile and new-born.
- Text:
  - This consists on a dialogue between Sherlock Holmes and Dr. Watson.
- Theatre:
  - In this exhibit, the story behind each fossil is performed by two actors playing the parts of Holmes and Watson.

Conclusions

To sum up:

- Taphonomy, as well as being an extremely useful tool for palaeontologists also has a great museological potential.
- Using fossil exhibits, texts, experiments and other ways of bringing the fossilization process to life, we can develop a modern museology which actively involves the visitor.
  Let's not forget that the three interactive levels (hands-on, minds-on and hearts-on) should all be brought into play.
- Above all, the ultimate goal is to turn the visitor on to science, and especially to the scientific method.