

Non time-consuming method to reproduce Ammonoids sutures

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SUMMARY — *This is a description of a non time-consuming method to reproduce ammonites sutures by using acetyl cellulose films.*

This method is very useful in obtaining a large number of sutures in a very short time, offers a greater reliability than the « camera lucida » and renders advantageous the complex biometric methods of which we show some examples. This method is therefore of great assistance in biometry and can be of help to the traditional methods.

RIASSUNTO — *Viene descritto un metodo speditivo per riprodurre linee di sutura di ammoniti per mezzo di pellicole di acetil cellulosa.*

Il metodo risulta utilissimo per ricavare un gran numero di linee di sutura in breve tempo, offre una affidabilità maggiore della « camera lucida » e rende vantaggioso l'uso di metodi biometrici complessi di cui sono forniti alcuni esempi. Esso è quindi di estrema utilità nella biometria e può essere di aiuto ai metodi tradizionali.

KEY WORDS — *Biometry, Ammonoids, Sutures.*

INTRODUCTION

Within the framework of the « Rossi Ammonitici » programme the authors initiated the study of some ammonites faunas, mainly of the upper Lias (Toarcian) of the Central Apennines.

In the course of this study it was necessary to classify a very large number of ammonites and even fragments of them, for the study of the phylogenesis and ontogenesis of ammonites, in order to obtain a secure stratigraphic basis in the phylogenesis and ontogenesis of ammonites, in order to obtain a secure stratigraphic basis in the paleoenvironmental work and finally for correlating various outcrops.

At the same time, the abundance of the faunas we collected encouraged the traditional systematic study as well as the study based mainly on biometry, using the measurement of ammonites sutures taken on a very large number of specimens. This latter

method was applied on specimens of *Protetragonites* and *Lytoceras* with promising results (Kahn & Kant, 1975).

The examination of sutures in the studies of classic Paleontology as well as in biometric study, represents the first step and is often the most time-consuming. In order to be more precise, as well as to avoid the loss of time when using the « camera lucida » and also to avoid the great expense as in the case of photographs, we looked for a technique by which we could obtain sutures of ammonites without the traditional optical means, and still retain the reliability of precision and also have the possibility to make grand scale enlargements.

This could only be gained by using replicas of transparent plastic material which would permit the projection. We thought it best to adopt the peels technique, already known in the study of section of rocks and fossils and specifically in electron microscopy (Kay, 1956; Farinacci, 1964).

After many tests with films of different plastic material of various thickness, we got the best results by using acetyl cellulose films (Bioden R.F.A.) of 0.034 mm thickness and with a resolving power of

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about 100 Å which normally is used to make replicas for transmission electron microscopy (Magnan, 1961).

METHOD OF OPERATION

The following method must obviously vary according to the different lithologic types. The time, materials and techniques indicated here must be taken only as a guide and not as the optimum for each type of lithology and for each purpose.

We got the best results by following this procedure:

a) the specimen from which the suture is to be obtained, must first be cleaned by the usual methods. It should then be kept at least two or three minutes under ultrasound to remove small rock particles which, sticking to the peel, cause it to lose its transparency;

b) the ammonite is then dried because if the rock were wet, the evaporation of the solvent used to soften the film would occur very slowly and with difficulty and would cause some deformations on the same film;

c) while the specimen is drying, a strip of acetyl cellulose (normally sold in sheets of cm 15×10) is cut slightly larger than the area occupied by the suture;

d) the ammonite is thoroughly soaked in acetone and then placed firmly and flat on clay or plastiline. It must be kept damp at all times as the acetone tends to evaporate immediately. At the same time the Bioden strip also lightly dampened with acetone, is placed on the area to be examined, being very careful that there are no air bubbles between the film and the ammonite surface.

If there are any air bubbles, or in the case of ammonites with prominent ornamentations, as in the new genus *Rarenodia* (Venturi, 1975), the peel can be made to adhere perfectly to the specimen by

slight pressures with a soft brush dampened with acetone or by puncturing the bubbles with a needle. The preparation of the peels obviously differs for each type of ammonites: in the case of smooth ammonites with finely marked sutures (i.e. *Phylloceras*, *Calliphyloceras*, *Paroniceras*) we obviously get the best results. In the case of markedly ornamented ammonites or with prominent bulging, extra care must be taken in placing the peel surface on the ammonite. It is advisable in such case the use of a solution of distilled water and acetone with a different proportion for each case instead of pure acetone, because the process will necessarily have to be slower and the prolonged action of pure acetone might cause the acetyl cellulose film to dissolve completely;

e) we let it dry for less than a minute, for a period that varies for each rock and according to the amount of acetone used. The film is then peeled off being careful to apply an even tension in all directions. If the grade of curvature of the ammonite is very sharp, the film can be cut in sections to facilitate the stripping. As soon as it is removed, the peel is still relatively elastic and therefore should be placed immediately between glass slides or between slides of a microfilm projector to avoid the curving of the film edges.

USE OF PEELS AND RESULTS

This method is easily applicable to all lithologic types having a minimum of porosity and can be put in operation after a very brief period of testing. It also gives very good results in quality as well as in quantity. Concerning the quality, the results are just as good as those obtained using traditional methods.

Regarding the number of sutures obtainable, we want to point out that, after a brief test period, the writers could reproduce and draw, in just a few hours, more than fifteen sutures of different types of

PLATE I

In the illustration we show three successive stages of the described method as applied to a specimen of *Calliphyloceras*, and the specimens and corresponding peels of various types of ammonites, all originating from the Toarcian « Rosso Ammonitico » of the series Umbro-marchigiano-sabina. The various ammonites were chosen in different state of preservation and of various types, to represent a more complete representative sample.

Figs. 1-3 - *Calliphyloceras nilssoni* (Hebert), abous x 1;

- 1) ammonite with peel in the acetone drying stage;
- 2) the peel is semi-detached and was cut to avoid curling;
- 3) peel almost completely removed.

Figs. 4-5 - *Calliphyloceras nilssoni* (Hebert), mineral waters spa, Valdorbis; 4) peel x 3; 5) x 1.

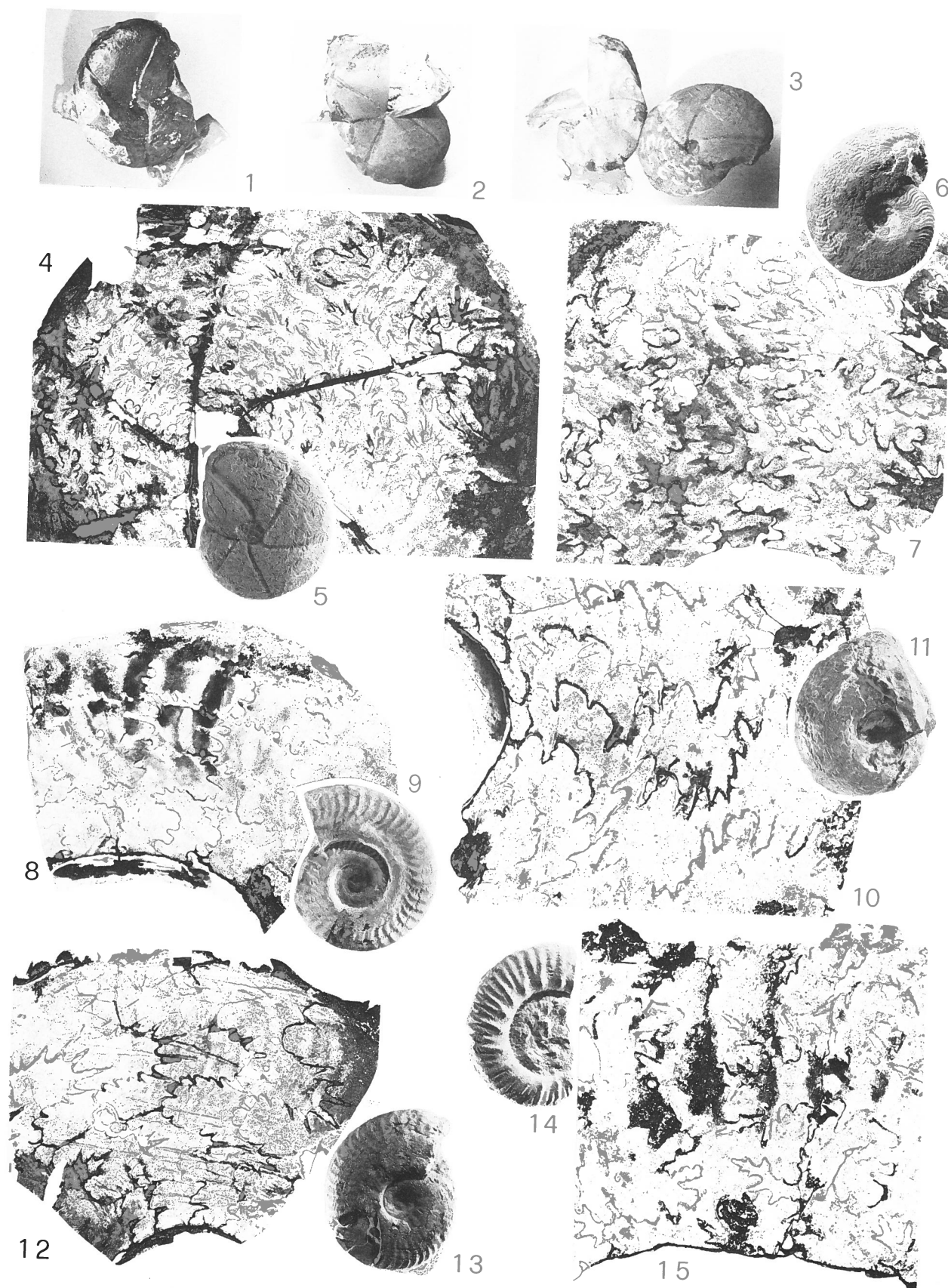
Figs. 6-7 - *Harpoceras exaratum* (Young & Bird) *subexaratum* (Bonarelli), Passo del Furlo; 6) x 1/3; 7) peel x 3.

Figs. 8-9 - *Hildoceras bifrons* (Bruguiere) f. *graeca* Renz, Polino; 8) peel x 5; 9) x 3/4.

Figs. 10-11 - *Paroniceras substernale* Pinna, Passo del Furlo; 10) peel x 3; 11) x 1/2.

Figs. 12-13 - *Brodieia gradata* (Merla), Passo del Furlo; 12) peel x 2; 13) x 1/2.

Figs. 14-15 - *Rarenodia* gr. *planulata* Venturi, Polino; 14) x 1/3; 15) peel x 3.



ammonites. The replicas obtained, inserted in a normal microfilm-reader, can be used for the systematic traditional study because the suture tracing can be quickly done and, in the case of not well preserved specimens, the extrapolation of a suture from various incomplete specimen stubs is also possible.

Inserting the peels in a slide and projecting them on a screen, one can measure the greatly enlarged suture by a curvimeter which only at these higher magnifications can measure even the tightest curvatures of the drawing and obtain a reliable measurement.

The above mentioned study of Kahn & Kant (1975) concerns the ontogenetic variations in particular and shows interesting results, but the method used is quite limited because the measurements have been taken on drawings done using the « camera lucida ». By using a rapid method as we propose, the biometric study will lead to a stratigraphy based on a variation of quantitative indexes in a time period, applied even on forms usually quite frequent, but neglected up to now because of practical difficulties as the *Phylloceratids* or the *Lytoceratids*. One of the writers (F. Schiavinotto) is in fact preparing a study concerning the variation in a time period of a new numerical index of papulation of *Phylloceras* and *Calliphyloceras* of the Toarcian of the series umbro-marchigiano-sabina. For the time being, we will show some experimental data in order to give an evaluation of the described method: we used the measurement of the real length of the suture, enlarged 50 x, divided by the height of the chamber were this same suture was measured, thus obtaining a quantitative index of the sutures deviation in respect to their hypothetical straight line pattern.

This preliminary observation made on single specimens belonging to a limited number of genera, gave the following values of the above mentioned index:

<i>Calliphyloceras</i>	6.2
<i>Harpoceras</i>	5.8
<i>Paroniceras</i>	2.9
<i>Hildoceras</i>	3.6
<i>Brodieia</i>	2.7
<i>Rarenodia</i>	8.7

This data are still very limited but give not only a demonstration of the method usefulness, but offer interesting new area of studies, especially in regards to the distinction of the genera, quantitatively and qualitatively.

Our method shows better results than the « camera lucida » also because it avoids the error due to the flat drawing of a curved surface. In fact the

peels, due to the Bioten plasticity, permit the placing of the suture that covers the curved surface of the fossil on a plane with a minimum of error, but, if done by « camera lucida » it would entails approximate eye appraisals or many repeated tests.

Besides our method is quicker than that exposed by Mattei (1966) who requires greater operative difficulties in order to obtain suture prints and to take a photograph of them in skimming light.

To avoid stretching the film and thus distorting the suture, especially in the case of ammonites with prominent convex sides, it is better to cut radially the film, to eliminate the problem. One of the advantage of this method is the possibility to compare, by overlapping, the sutures of typical forms of the literatures to the sutures obtained from the specimens being examined, by using at the same time two projectors and a series of suture slides previously obtained from the literature.

An other advantage concerns the study of ontogenetic variation of sutures, because it is possible to make an immediate comparison between successive sutures of the same specimen, in one peel if possible, or in the case of large specimens with few peels, and thus have available all the visible sutures of a specimen.

We also want to record our great satisfaction, at the end of the experimental period, in recognizing the great didactic value of illustrating peels of ammonites at higher magnification, comparing them with the original specimen, with no waste of time and with extreme clearness.

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