

EXTERNAL AND INTERNAL VIEWS OF THE SAME COCCOSPHERES: NOTES ON A NEW CRACKING TECHNIQUE

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Abstract: A novel cracking technique for coccospheres is briefly described and illustrated. This delicate method involves manual cracking of specimens with the help of a scalpel and thus enables us to obtain an internal view of some coccospheres. It is a particularly useful method for secondarily altered coccospheres, as the inner surface view frequently reveals well-preserved coccoliths. In the future, it may be a useful method for providing additional information on some enigmatic taxa.

Introduction

The investigation of calcareous dinoflagellates commonly requires the cracking of spheres in order to examine both wall structures and inner surfaces. We have successfully cracked many calcareous dinoflagellates (average size 30µm) and decided to apply a comparable technique to coccospheres. In doing so, we have been able to obtain an internal view of some coccospheres. In most cases, the internal view exhibits extremely well-preserved coccoliths, whereas the outer view often shows overgrowth or corrosion. Applying the method introduced here is particularly useful in scanning electron microscopy, if the outer view of a coccosphere reveals badly preserved, indeterminable coccoliths. Cracking of coccospheres additionally assists in identifying all external and internal features of a taxon observable under the scanning electron microscope (SEM). As we obtain both outer and inner views, it is thus possible to assign single coccoliths to a coccolithophore species, whatever side of a coccolith we perceive under the SEM. The cracking technique is, therefore, a helpful method in providing high-quality taxonomic information, as it is for calcareous dinoflagellates.

Method

The position of a detected coccosphere on a standard carbon SEM stub is documented by a set of video microprints ranging from low magnification (x20 or less, depending on your working distance) to approximately 6 000x magnification. At this high magnification, coccospheres of 8-14µm can be adequately viewed (Plate 1, Figures 1-4). The stub is then observed under a stereomicroscope, through the illumination of a cold light-source adjusted parallel to its surface. Using the set of video prints, the coccosphere is relocated on the stub and appears as a small, extremely bright spot (magnification x100 to x180).

The tip of a pointed scalpel with a straight cutting edge is then placed directly behind the coccosphere. By carefully reducing the angle between the scalpel and the stub-surface, in most cases the scalpel cracks the coccosphere. The stub is coated and reanalysed under the SEM. The cracked coccosphere is easily redetected as the scalpel produces an obvious track on the stub (Plate 2, Figure 2).

Recommendations

It is necessary to add some helpful recommendations for utilisers of the cracking method:

- Find coccospheres worth cracking, *e.g.* particularly specimens indeterminable in external view.
- Do not try to crack specimens < 8µm (you will never be successful).
- Mark the stub's rim in order to simplify relocating the coccosphere under the stereomicroscope.
- Use a carbon stub instead of aluminium or glass, as the scalpel can then be operated without slipping. Additionally, you can easily scratch a grid system into the carbon stub. Do not use a special SEM/TEM grid, because you cannot efficiently handle the scalpel.
- Keep your hands steady (not too much coffee, alcohol or nicotine the day before!).

Remark

In our case, the method has a success rate of 60%. Many coccospheres are too solid to be cracked or simply are lost due to trembling hands.

Acknowledgements

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Plate 1

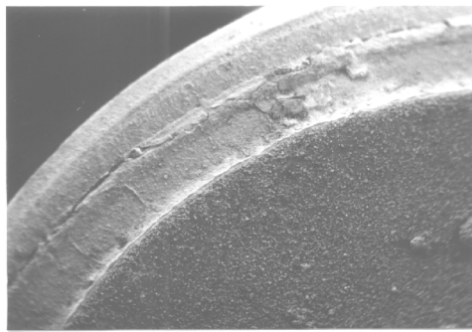


Fig. 1 1000 µm

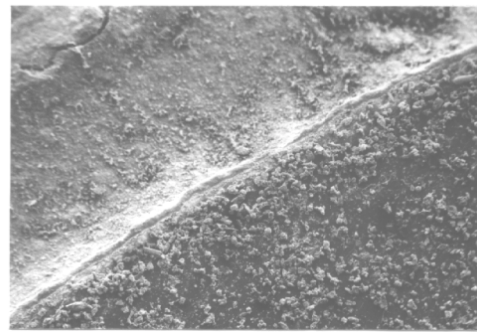


Fig. 2 300 µm

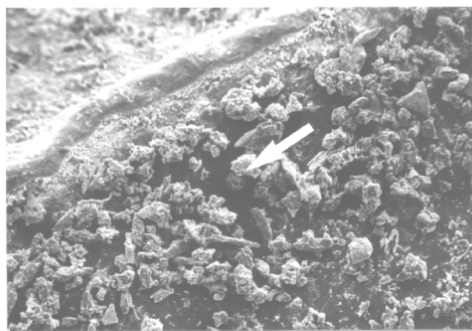


Fig. 3 100 µm

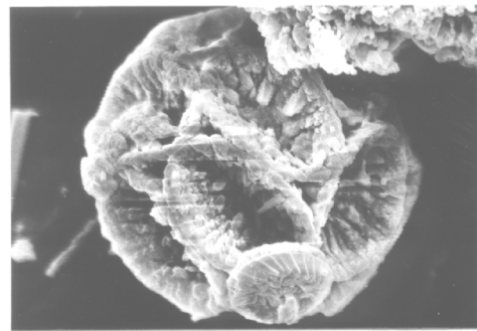


Fig. 4 3 µm

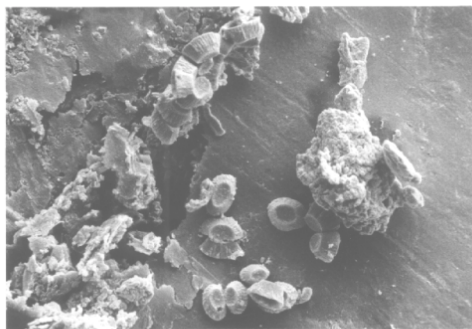


Fig. 5 10 µm

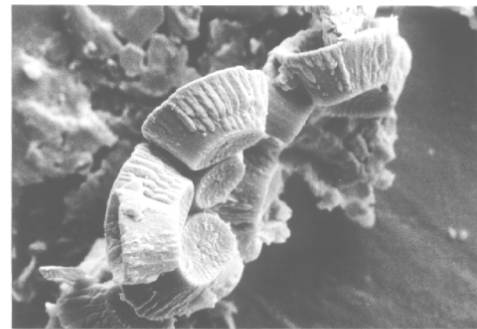


Fig. 6 3 µm

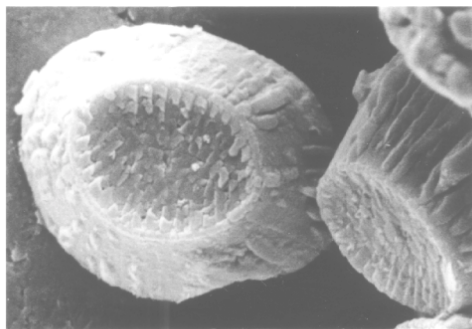


Fig. 7 1 µm

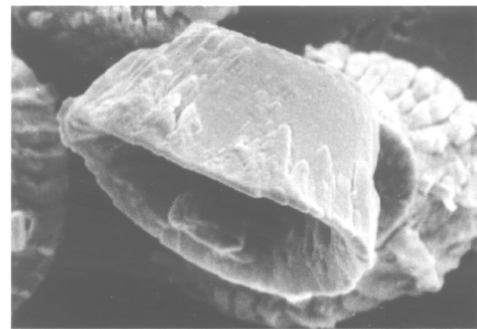


Fig. 8 1 µm

Plate 1: Material from Geulhemmerberg near Maastricht, The Netherlands (cave system, chimney). Sample GII7, ~0.5m above the Vroenhoven Horizon, Lower Paleocene, upper NP1. **Fig.1:** Coccosphere in centre; x20. Neg.# 894-1. **Fig.2:** Coccosphere in centre; x70. Neg.# 894-3. **Fig.3:** Arrow indicates coccosphere; x240. Neg.# 894-7. **Fig.4:** Uncracked *Crepidolithus?* sp. coccosphere. Neg.# 894-8. **Fig.5:** Cracked coccosphere of *Crepidolithus?* sp. Neg.# 894-11. **Fig.6:** Cracked coccosphere of *Crepidolithus?* sp. Neg.# 894-15. **Fig.7:** *Crepidolithus?* sp., proximal view. Neg.# 894-14. **Fig.8:** *Crepidolithus?* sp., side view. Neg.# 894-17.

Plate 2

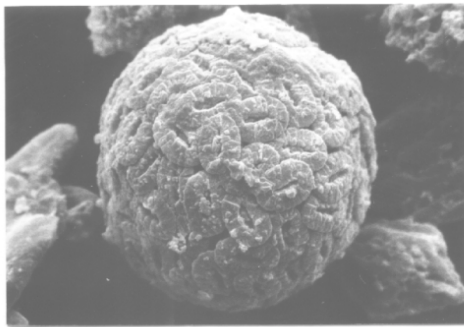


Fig. 1

3 µm

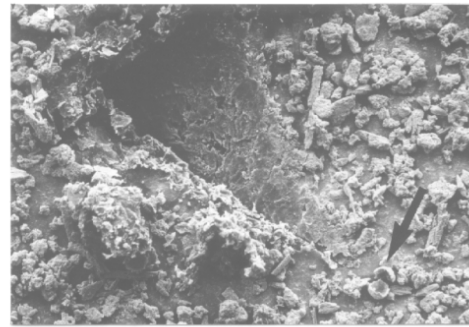


Fig. 2

100 µm

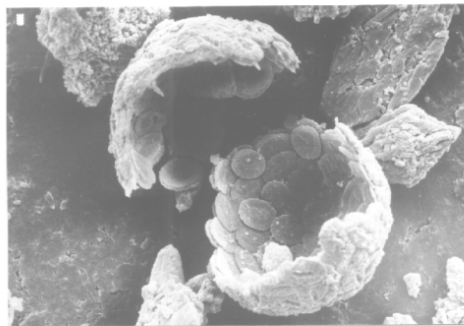


Fig. 3

10 µm

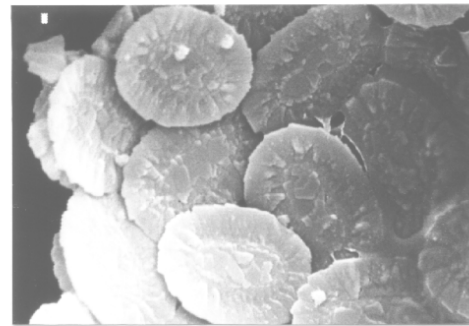


Fig. 4

1 µm



Fig. 5

3 µm



Fig. 6

3 µm

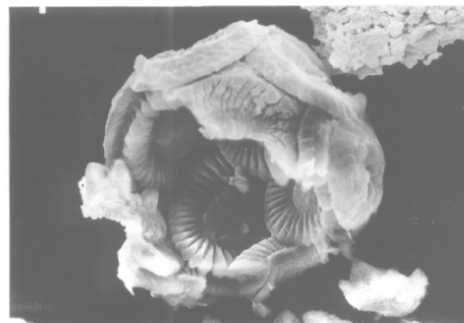


Fig. 7

3 µm



Fig. 8

3 µm

Plate 2: Material from Geulhemmerberg near Maastricht, The Netherlands (cave system, chimney). Sample GII7, ~0.5m above the Vroenhoven Horizon, Lower Paleocene, upper NP1. **Fig.1:** *Neobiscutum?* sp. Neg.# 895-5. **Fig.2:** Scalpel track at x240. Arrow indicates cracked *Neobiscutum?* sp. coccosphere. Neg.# 895-12. **Fig.3:** Cracked coccosphere of *Neobiscutum?* sp. Neg.# 895-13. **Fig.4:** *Neobiscutum?* sp., proximal view. Neg.# 895-14. **Fig.5:** *Watznaueria coronata* (Gartner, 1968) Bukry, 1969 coccosphere. Neg.# 895-24. **Fig.6:** Cracked coccosphere of *Watznaueria coronata*. Neg.# 895-30. **Fig.7:** Cracked coccosphere of *Watznaueria coronata*, rotated and tilted. Neg.# 895-32. **Fig.8:** *Watznaueria coronata*, proximal view. Neg.# 895-34.