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New silicoflagellate ultrastructures: Nanocones and solution cavities

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In the course of our studies on the microorganisms known as silicoflagellates, we have recorded two new silicoflagellate ultrastructures that have not yet been reported in the literature. These ultrastructures are known as nanocones and solution cavities.

Silicoflagellates can be useful in the determination of Cenozoic antarctic climates (Mandra, 1969). For example, a study of these microorganisms (Mandra and Mandra, 1970) indicated that some coastal areas of Antarctica were warm temperate during the Late Eocene. Subsequently, this study was extended to the Oamaru district of the South Island of New Zealand (Mandra, 1973) to provide a better understanding of the northern limits of the suggested pattern of antarctic climate. As our studies continued, it became apparent that more precision was needed in regard to the taxonomy and morphologic descriptions of these Protistids, so a study of silicoflagellate ultrastructure morphology was started using the scanning electron microscope. Our recent papers (Mandra, Brigger, and Mandra, 1975; Mandra et al., 1976) on *Hannaites* have introduced new nomenclature for such ultrastructures as nanopeaks, nanodivides, and nanovalleys. We have also determined that some *Distephanus* (0876) do not have ultrastructures.

Our most recent work has revealed that some radial spines of *Cannopilus* (0859) have small cone-like structures protruding from a smooth surface. These structures are called nanocones. A nanocone differs from a nanopeak in that the latter is formed by the intersection of two or more nanodivides, whereas the nanocone is on a surface that does not have nanodivides. The surface from which the nanocone protrudes is usually smooth, fine grained, and featureless. Commonly, nanocones are present in clusters on the distal half of a radial spine and also on the apical bridge system—both on the apical rings and on the lateral rods.

The nanocone is not thorn-shaped (a term much used in silicoflagellate literature). Rather, it has a shape such that the diameter of its base is frequently equal to the height of the cone. Its size is commonly about 0.1 micrometer.

In addition, some nanocones (0855, 0858) are on surfaces that are not smooth. These surfaces are usually featureless, except that they appear to be slightly pitted. Such a pit is approximately 0.05 micrometer wide.

The other new ultrastructures we have recorded occur only rarely. Some silicoflagellates have what appear to be solution cavities. As observed, the size of such a cavity is about 1 or 2 micrometers in diameter and about 0.5 micrometer in depth.

These new structures are found on the protuberances of *Hannaites* and on the basal ring and apical bridge system of *Hannaites* and other genera. We know that these solution cavities are not caused by our chemical preparation techniques, because no other specimen in our same sample has solution cavities. Also, more fragile specimens, including some very thin and delicate diatom structures, in the same sample show no evidence of chemical decomposition.

Our studies do indicate why the patterns on the protuberances of *Hannaites* and some radial spines of *Dictyocha* and *Distephanus* differ so markedly from the patterns on the basal rings of these specimens. This difference is caused by the multiple intersections of the two sets of nanodivides from each of the two intersecting basal ring rods. For example, if each basal ring rod has eight longitudinal nanodivides, then at least 64 intersections or nanopeaks will be formed at each protuberance or radial spine; however, given that there are also transverse nanodivides, there will actually be more than 64 nanopeaks.

Some nanopeaks may seem to have no intersecting nanodivides. Nevertheless, close examination will reveal either residual or immaturely formed nanodivides. Furthermore, in all cases observed, the nanopeaks are arranged linearly.

The ultrastructures of the abapical spines are such that the spines either may be completely smooth or may have any of the combinations mentioned above. Some of these spines have miniature spherical protuberances at their ends. The diameter of such a protuberance is slightly larger than the external diameter of the spine immediately under the protuberance.

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Seismic refraction measurements from sea ice in western McMurdo Sound

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Three reversed seismic refraction profiles were shot in western McMurdo Sound in late November–early December 1978 (figure 1). The profiles, shot out to six kilometers, were part of the McMurdo Sound Sediment and Tectonic Study (MSSTS) sponsored by the Antarctic Division of the New Zealand Department of Scientific and Industrial Research (DSIR).

Data were recorded with a portable SIE RS-4, 12-channel seismograph. Shots ranged in size from one to fifteen kilograms. Sea ice thickness ranged from 3 to 4 meters over water depths from 90 to 240 meters.

Map showing the location of three reversed seismic refraction profiles in western McMurdo Sound. Profiles are numbered S 78-79-1, etc. Numbered arrows indicate locations of Dry Valley Drilling Project boreholes. Fresh pore ice was found in sediments cored from hole 15. Mean ocean bottom temperature in McMurdo Sound is −1.8° C.