

UNITED STATES DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

SCANNING ELECTRON MICROGRAPHS OF  
UPPER PLEISTOCENE CHRYSOMONAD CYSTS FROM  
FLAGPOLE PEAK, EL DORADO COUNTY, CALIFORNIA

by

David P. Adam

OPEN-FILE REPORT  
80-1239

This report is preliminary and has not  
been reviewed for conformity with  
U.S. Geological Survey editorial standards  
or stratigraphic nomenclature

## INTRODUCTION

This report is one of a series illustrating siliceous cysts from various localities. Although these cysts have been known for many years, they are so small that they cannot be observed in detail with optical microscopes. The recent development of the scanning electron microscope (SEM) has made possible much more detailed observations of the external features of these cysts, but as yet relatively few forms have been recorded in this way.

A major difficulty is taxonomic confusion. Many and perhaps all of these cysts are the resting stages of various algae of the phylum Chrysophyta; they will be referred to in the rest of this report as chryomonad cysts, although other groups in addition to the Chryomonadinae may be represented. Modern forms are found primarily in fresh water, and numerous authors have reported chryomonad cysts from Holocene sediments (for example, see Nygaard, 1956). Older fossils have been recovered mostly from marine deposits, and are known as archaeomonads; whether the two groups are as distinct as this terminology suggests is not clear.

For an introduction to the literature on chryomonad cysts and siliceous algal scales, the reader is referred to Adam and Mahood (1979a), a preliminary annotated bibliography on the subject.

The fossil archaeomonads have been described and named entirely on the basis of their cysts. This is not advisable with modern forms, because the cysts are the remains of one stage of the life cycle of algae that presumably already have legitimate taxonomic names. Proper cyst nomenclature therefore depends on establishing which cysts are produced by which algae. At the moment, we have only a very limited knowledge of the forms that exist, and almost no knowledge of the phylogenetic pedigrees of the various forms.

The present work is directed towards expanding our knowledge of the various cyst forms and their geographic and environmental distributions. Taxonomic problems are ignored, and the various cyst forms are simply given numbers, which have been assigned arbitrarily. These numbers are consistent throughout all reports in this series, and are being used to tabulate where the various forms occur. (A list of the previous reports in this series is given in Appendix A). The approach used has been that of "splitting", as opposed to "lumping"; it may well be desirable to lump together many of the forms described here when more is known about them.

The SEM photographs are the most important part of this paper, and no attempt has been made to reduce them to words. Supporting data have been placed in the

captions. Sample preparation techniques are generally the same as those used for preparing diatom samples; details may be found in Mahood and Adam (1979b).

The purpose of these initial reports is to provide primary documentation of the occurrence of particular cyst forms at particular localities, and to provide a means by which the SEM photographs of the cysts may be placed in a permanent depository. Counts of the relative abundance of the various forms and interpretations of their significance have not yet been attempted, but must await a more complete understanding of the range of cyst morphologies.

We have illustrated all of the distinctive cyst forms found in the sample, using the best available photographs. In some instances we have included more than one photograph of a given form, but we have not included all of the photographs we have taken.

Negatives of the plates for this report are on deposit at the USGS Photo Library, and prints can be obtained (at your expense) by writing to:

U. S. Geological Survey Library  
Photo Library  
Stop 914  
Box 25406, Denver Federal Center  
Denver, Colorado 80225

## SITE DESCRIPTION

The Flagpole Peak locality is located at an elevation of 2244 m (7360 feet) about 820 m (0.5 miles) due north of Flagpole Peak, about midway up the southwest wall of the Tahoe Graben (fig. 1). During Late Pleistocene time, a small glacier formed on the escarpment and descended to a minimum elevation of about 2210 m (7250 feet). The most recent of the Pleistocene glaciers left a well-defined moraine that encloses a swamp. Between the south side of this moraine and a somewhat older moraine slightly farther south there is a closed depression which is quite dry at present and appears to be drained internally. A pit was dug into the dry deposits in the depression in the hope of recovering datable organic material. A few flecks of disseminated charcoal were recovered, but most of the organic material had been oxidized away. It may be possible to date the small amount of charcoal available using new small-sample radiocarbon dating techniques.

The deposit is inferred to be of late Pleistocene age because under the present Holocene climate the basin is dry and well drained, whereas the cysts recovered from the sediment sample suggest that the depression must have been much wetter when the deposit was formed. Cyst types 160, 161, and 165 are common in a modern perched bog deposit at the lower end of

Haypress Meadows, about 4.2 km west of the Flagpole Peak site and about 300 m higher (Adam, 1980). The depression must have stayed wet through the summer, and was probably filled with a peaty deposit which has since been oxidized away by water percolating through it.

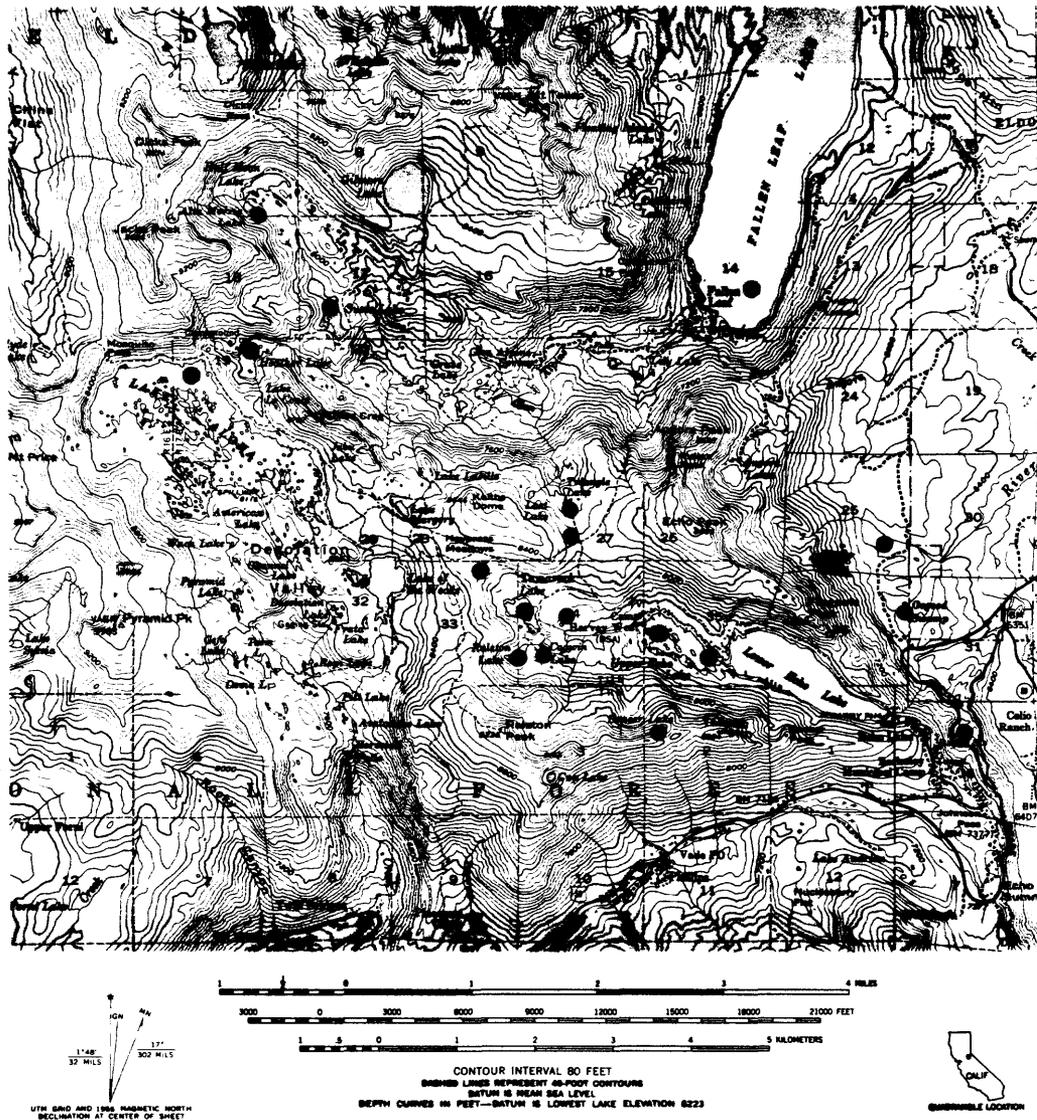


Figure 1.--Map showing the location of the Flagpole Peak locality (arrow). Dots mark the locations of other sites where we have observed chrysomonad cysts. Map is reduced from part of the USGS Fallen Leaf Lake 15-minute quadrangle.

#### REFERENCES CITED

- Adam, David P., 1980, Scanning electron micrographs of modern chrysomonad cysts from Haypress Meadows, Eldorado County, California: U. S. Geological Survey Open-File Report No. 80-1235, 15 p., including 3 plates.
- Adam, David P., and Mahood, Albert M., 1979b, A preliminary working bibliography on siliceous algal cysts and scales. U. S. Geological Survey Open-File Report No. 79-1215, 34 p.
- Nygaard, Gunnar, 1956, Ancient and Recent flora of diatoms and Chrysophyceae in Lake Gribssø, in Berg, Kaj, and Petersen, I. C., eds., Studies on the Humic acid Lake Gribssø: Folia Limnologia Scandinavica, No. 3, p. 32-94, 12 plates.

Flagpole Peak, Plate A  
scale bar = 3 micrometers

- 1 - Type 161  
(with adhering debris)
- 2 - Type 166  
(with adhering debris)
- 3 - Type 165  
(with adhering debris)
- 4 - Type 165  
(with adhering debris)
- 5 - Type 161  
(with adhering debris)
- 6 - Type 165  
(with adhering debris)
- 7 - Type 161  
(with adhering debris)
- 8 - Type 161  
(with adhering debris)
- 9 - Type 161  
(with adhering debris)

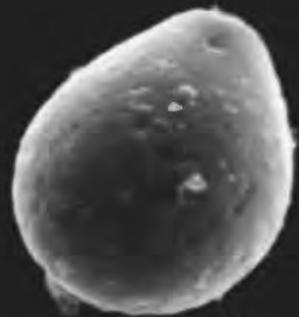
Flagpole - Plate A



1



2



3



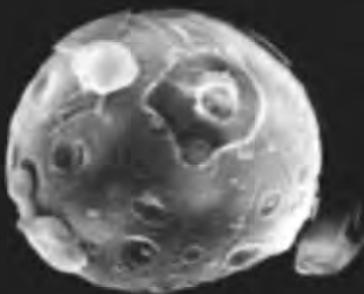
4



5



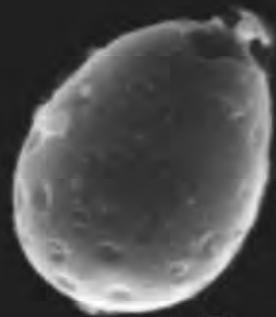
6



7



8



9

Flagpole Peak, Plate 3  
scale bar = 3 micrometers

1 - Type 160

2 - Type 160

3 - Type 285

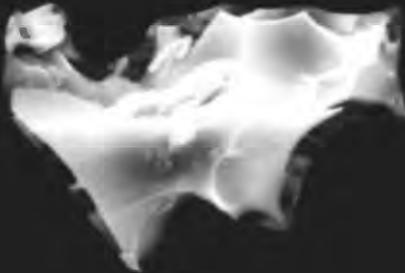
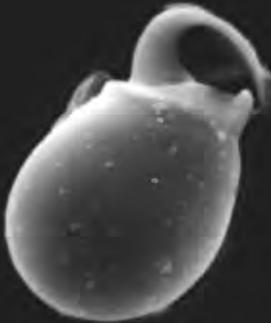
(with adhering debris; aperture is at top  
right)

4 - Type 165(?)

(aperture not visible)

5 - Volcanic ash shard

Flagpole - Plate B



## APPENDIX A

### PREVIOUS REPORTS IN THIS SERIES

- Mahood, Albert D., and Adam, David P., 1979a, Late Pleistocene chrysomonad cysts from core 7, Clear Lake, Lake County, California: U. S. Geological Survey Open-file Report Number 79-971, 11 p., 4 plates. Defines types 1 through 44.
- Adam, David P., and Mahood, Albert D., 1979a, A preliminary annotated bibliography on siliceous algal cysts and scales: U. S. Geological Survey Open-file Report Number 79-1215, 34 p.
- Mahood, Albert D., and Adam, David P., 1979b, Techniques used for the cleaning, concentration, and observation of chrysomonad cysts from sediments: U. S. Geological Survey Open-file Report Number 79-1431, 5 p.
- Adam, David P., and Mahood, Albert D., 1979b, Chrysomonad cysts from Upper Echo Lake, Eldorado County, California: U. S. Geological Survey Open-file Report Number 79-1461, 21 p. + 12 plates.
- Adam, David P., and Mehringer, Peter J., Jr., 1980, Modern and Holocene chrysomonad cysts from Lost Trail Pass Bog, Montana: U. S. Geological Survey Open-file Report Number 80-797, 13 p. + 5 plates.
- Adam, David P., and Mahood, Albert D., 1980, Modern chrysomonad cysts from Fallen Leaf Lake, Eldorado County, California: U. S. Geological Survey Open-file Report Number 80-798, 9 p. + 2 plates.
- Adam, David P., and Mahood, Albert D., 1980, Modern chrysomonad cysts from Alta Morris Lake, Eldorado County, California: U. S. Geological Survey Open-file Report Number 80-822, 11 p. + 4 plates.
- Adam, David P., and Mehringer, Peter J., Jr., 1980, Scanning electron micrographs of modern chrysomonad cysts from Castor Pond, Jemez Mountains, New Mexico: U. S. Geological Survey Open-File Report Number 80-1231, 18 p., including 5 plates.
- Adam, David P., 1980, Scanning electron micrographs of modern chrysomonad cysts from Haypress Meadows, El Dorado County, California: U. S. Geological Survey Open-File Report Number 80-1235, 15 p., including 3 plates.