UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

LATE PLEISTOCENE CHRYSOMONAD CYSTS FROM CORE 7, CLEAR LAKE, LAKE COUNTY, CALIFORNIA

by

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79-971

This report is preliminary and has not been edited or reviewed for conformity with Geological Survey standards or nomenclature

INTRODUCTION

Clear Lake, the largest lake in the Coast Ranges of California, lies at an elevation of about 400 meters some 120 km north of San Francisco (fig. 1). Eight sediment cores were recovered from the lake in 1973; their locations are shown in figure 1. This paper describes and illustrates numerous chrysomonad cysts that have been recovered from core 7.

SITE DESCRIPTION

Core 7 consists of 27.4 m of sediment that was recovered from beneath 13 m of water in the southern or Highlands arm of the lake. The sediments have been described and radiographed by Sims and Rymer (1975f). The upper 7.4 m of the core consist of open-water lake muds similar to those accumulating throughout Clear Lake at present. These sediments are fine-grained, and contain common bones and scales of large fish (Casteel, Adam, and Sims, 1977).

Below a depth of 7.4 m in the core, the sediments consist of interbedded shallow-water lake muds and peats; fish remains become much less common, and are almost all spines of the stickleback (Gasterosteus aculeatus), rather than the remains of larger fish which are found above 7.4 m. Macroscopic plant remains are common below 7.4 m, and include seeds of Potamogeton, Myriophyllum, Nuphar, Brasenia, and Zannichellia, all shallow-water aquatics.

Several radiocarbon dates are available from the middle of core 7 (table 1). These suggest that the base of the core is >40,000 years old, and that the transition from shallow to deep water occurred about 11,300 radiocarbon years ago.

Core 7 has been analysed for pollen; the major components of the arboreal pollen record are Quercus (oaks), Pinus (pines), and TCT (Taxodiaceae, Cupressaceae, and Taxaceae; mostly Calocedrus, Cupressus, Juniperus, and Sequoia). A pollen curve for oak is shown in figure 2, together with the stratigraphic positions of the chrysomonad samples. The diagram covers about the last 40,000 radiocarbon years; during that interval, the highest oak pollen frequencies correspond to the most interglacial conditions, and the lowest oak pollen frequencies to the most glacial conditions. Nearly all of the chrysomonad cysts reported here are from pre-Holocene sediments that represent shallow-water environments.

CYSTS

Scanning electron micrographs of 48 selected chrysomonad cysts from core 7 are shown in plates 1-4. It is of interest that the two Holocene samples (102 and 117), which represent open lake conditions, are devoid of cysts.

The cysts shown in the plates are designated here as types 1 through 44. The numbers have been assigned arbitrarily, and it is quite possible that more than one numbered type may represent a given species, because of either preservational or taxonomic variability. The taxonomy of these cysts is as yet poorly understood, particularly as it relates to the algae that produce them, and taxonomic problems are not addressed here.

No attempt is made to interpret the record of chrysomonad cysts from core 7. The photographs are presented as primary documentation of the occurrence of these forms in the Clear Lake sediments; interpretation must await a better knowledge of the environmental and geographic distributions of these cysts, as well as the identification of the algae that produce them.

We acknowledge with thanks the technical assistance of R. Oscarson, C. Throckmorton, and E. Griffin in the preparation of this report.

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:

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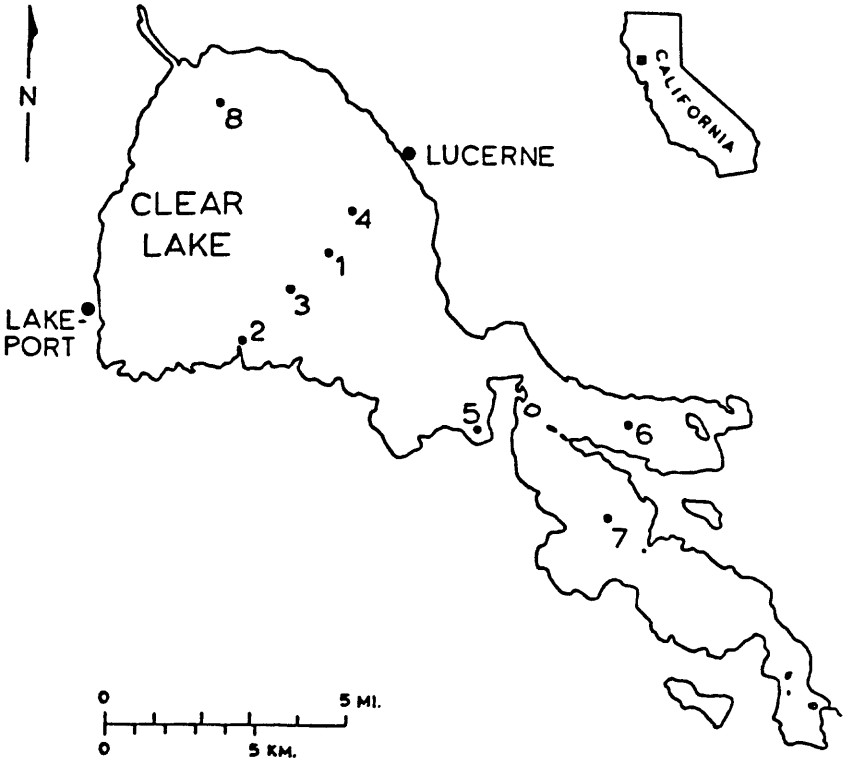

Figure 1.--Map showing location of core 7 in Clear Lake, California. Each numbered dot marks the location of a core; the lithology of each core has been described by Sims and Rymer (1975a-g, 1976). This map is also found in each of those reports.

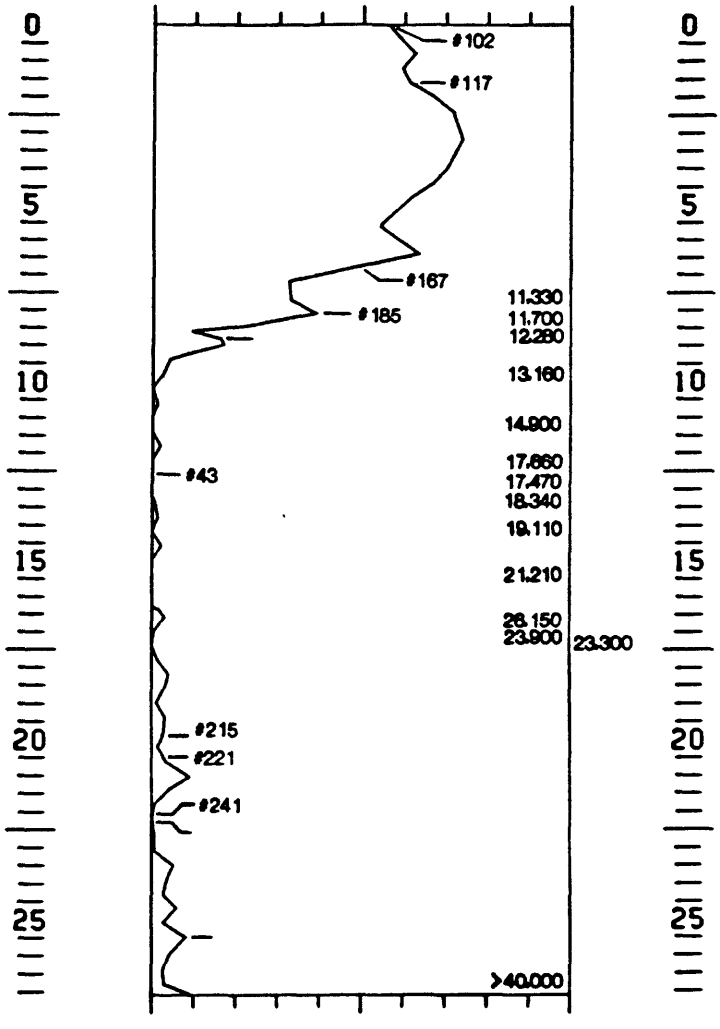

Figure 2.--Oak pollen frequency, expressed as oak/(oak+pine+TCT) x 100, plotted versus depth in meters for Clear Lake core 7. The box that includes the curve has a width of 100%. The positions of the samples examined for chrysomonad cysts are shown by the sample numbers plotted next to the curve; the positions and ages of the radiocarbon samples are shown along the right side of the box. For full details of the radiocarbon dates, refer to Table 1.

Sample number	Depth (cm)	Type of sediment	Age (years)
I-7719	763-771	peat	11,330±330
W-3071	820-830	peaty mud	11,700±250
W-3072	870-880	peat	12,280±250
W-3073	980-1010	silty peat	13,160±300
W-3063	1120-1130	clayey peat	14,900±300
I-7756	1225-1229	peaty mud	17,660±340
W-3064	1276-1280	peaty mud	17,470±300
W-3066	1320-1330	peat	18,340±300
W-3068	1410-1420	peaty mud	19,110±300
W-3069	1530-1540	peat	21,210±400
W-3070	1670-1676	peat	26,150±600
I-7928	1715-1720	carbonaceous mud	23,900±640
I-7932	1727-1733	carbonaceous mud	23,300±600
I-7718	2731-2737	peat	>40,000

Table 1.--Radiocarbon dates from core 7 (from Sims, 1976).

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Plate I.--Chrysomonad cysts, types 1-11.
Each scale bar represents 3 micrometers.

1 - Type 1, Clear Lake sample 43
Length = 13.3 μm, width = 10.0 μm

2 - Type 1, Clear Lake Sample 43
length = 10.3 μm, width = 9.6 μm,
pore diameter = 0.95 μm

3 - Type 2, Clear Lake Sample 43
length = 15.4 μm, width = 13.6 μm

4 - Type 3, Clear Lake Sample 241
length = 13.5 μm

5 - Type 4, Clear Lake Sample 215
length = 11.2 μm, width = 8.8 μm

6 - Type 5, Clear Lake Sample 43
width = 7.9 μm

7 - Type 6, Clear Lake Sample 241
length = 13.1 μm

8 - Type 7, Clear Lake Sample 43
length = 10.0 μm, pore diameter = 1.3 μm

9 - Type 8, Clear Lake Sample 215
length = 10.7 μm, pore diameter = 1.2 μm

10 - Type 9, Clear Lake Sample 43
length = 9.7 μm, pore diameter = 0.8 μm

11 - Type 10, Clear Lake Sample 43
length = 14.2 μm, pore diameter =1.3 μm

12 - Type 11, Clear Lake Sample 241
length = 13.8 μm

Plate I

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Plate II.--Chrysomonad cysts, types 12-22.
Each scale bar represents 3 micrometers.

13 - Type 12, Clear Lake Sample 215
length = 12.0 μm, pore diameter = 0.6 μm

14 - Type 12, Clear Lake Sample 215
length = 15.7 μm

15 - Type 13, Clear Lake Sample 215
length = 7.4 μm

16 - Type 14, Clear Lake Sample 241
length = 10.4 μm

17 - Type 15, Clear Lake Sample 241
length = 10.1 μm

18 - Type 16, Clear Lake Sample 241
length = 12.5 μm

19 - Type 17, Clear Lake Sample 185
length = 6.6 μm

20 - Type 18, Clear Lake Sample 241
length = 13.8 μm

21 - Type 19, Clear Lake Sample 241
length = 10.1 μm

22 - Type 20, Clear Lake Sample 241
length = 13.8 μm

23 - Type 21, Clear Lake Sample 43
length = 17.4 μm

24 - Type 22, Clear Lake Sample 241
length =14.4 μm, pore diameter = 0.75 μm

Plate II

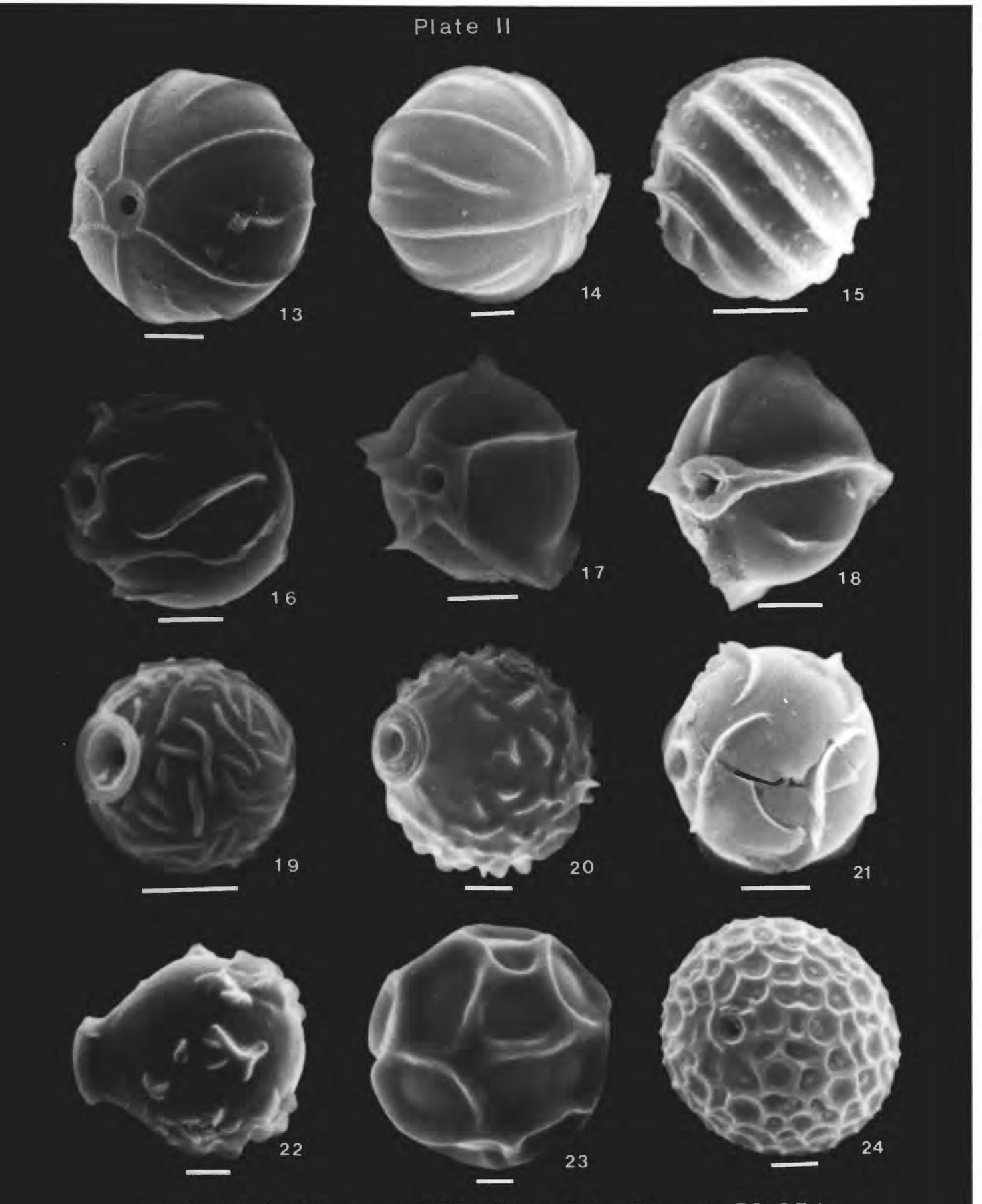

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Plate III.--Chrysomonad cysts, types 23-32.
Each scale bar represents 3 micrometers.

25 - Type 23, Clear Lake Sample 241
length = 16.2 μm, pore diameter = 1.5 μm

26 - Type 23, Clear Lake Sample 221
length = 13.9 μm

27 - Type 24, Clear Lake Sample 241
length = 16.3 μm

28 - Type 25, Clear Lake Sample 215
pore diameter = 0.8 μm

29 - Type 26, Clear Lake Sample 241
length = 8.8 μm, width = 8.3 μm

30 - Type 27, Clear Lake Sample 215
length = 11.8 μm

31 - Type 28, Clear Lake Sample 43
length = 13.6 μm, pore diameter = 0.5 μm

32 - Type 28, Clear Lake Sample 43
length = 8.8 μm, pore diameter = 0.5 μm

33 - Type 29, Clear Lake Sample 241
length = 10.6 μm

34 - Type 30, Clear Lake Sample 43
length = 8.8 μm

35 - Type 31, Clear Lake Sample 241
length = 10.6 μm

36 - Type 32, Clear Lake Sample 167
length = 13.0 μm, width = 11.3 μm

Plate III

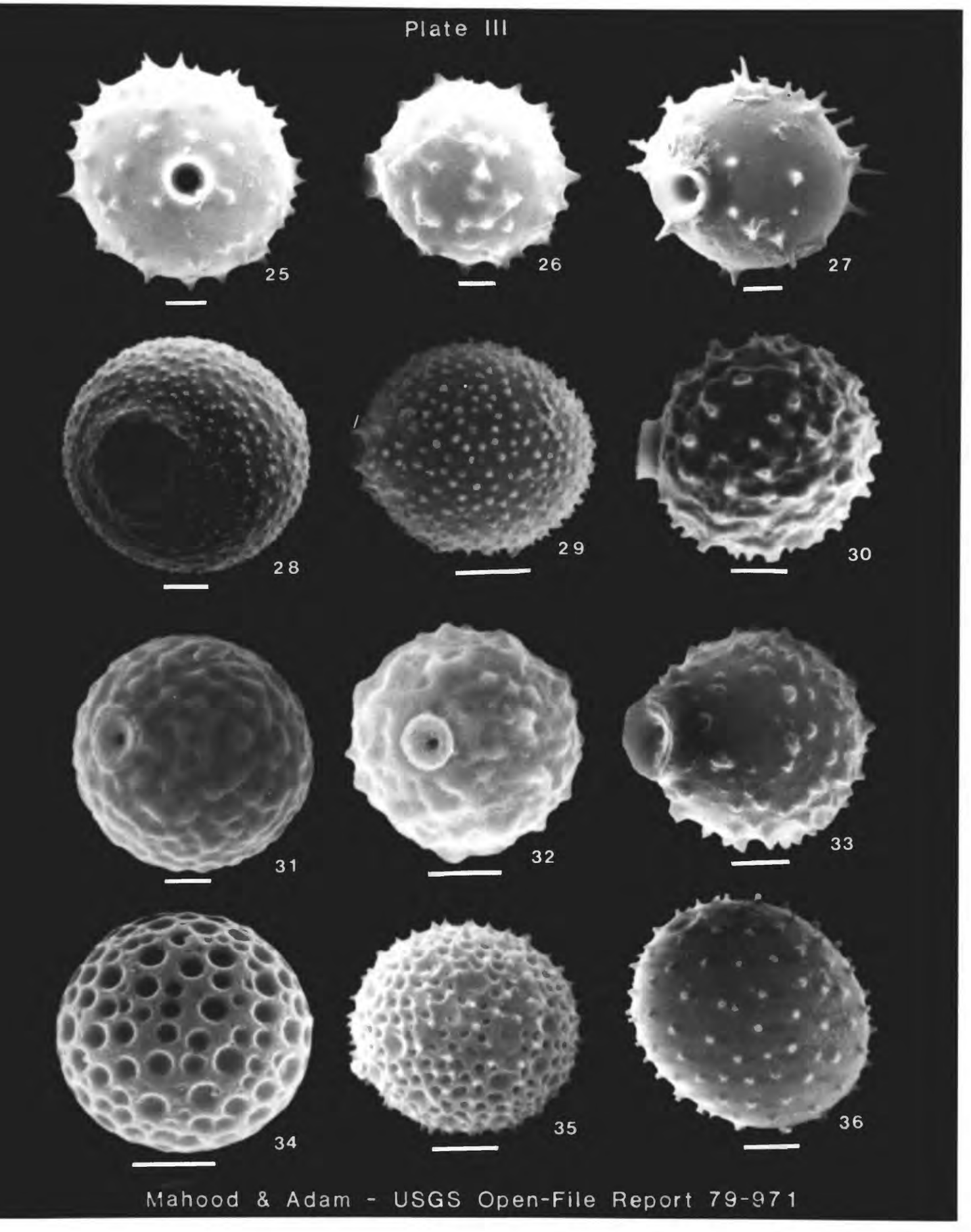

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Plate IV.--Chrysomonad cysts, types 33-44.
Each scale bar represents 3 micrometers.

37 - Type 33, Clear Lake Sample 43
length = 10.2 μm, pore diameter = 0.5 μm

38 - Type 34, Clear Lake Sample 43
length = 11.1 μm, pore diameter = 0.79 μm

39 - Type 35, Clear Lake Sample 215
length = 12.1 μm, pore diameter = 0.86 μm

40 - Type 36, Clear Lake Sample 43
length = 10.0 μm, pore diameter = 0.77 μm

41 - Type 37, Clear Lake Sample 43
length = 8.2 μm, pore diameter = 0.58 μm

42 - Type 38, Clear Lake Sample 43
length = 7.8 μm, width = 7.5 μm

43 - Type 39, Clear Lake Sample 43
length = 10.0 μm, width = 8.6 μm

44 - Type 40, Clear Lake Sample 241
length = 11.9 μm, width = 7.9 μm

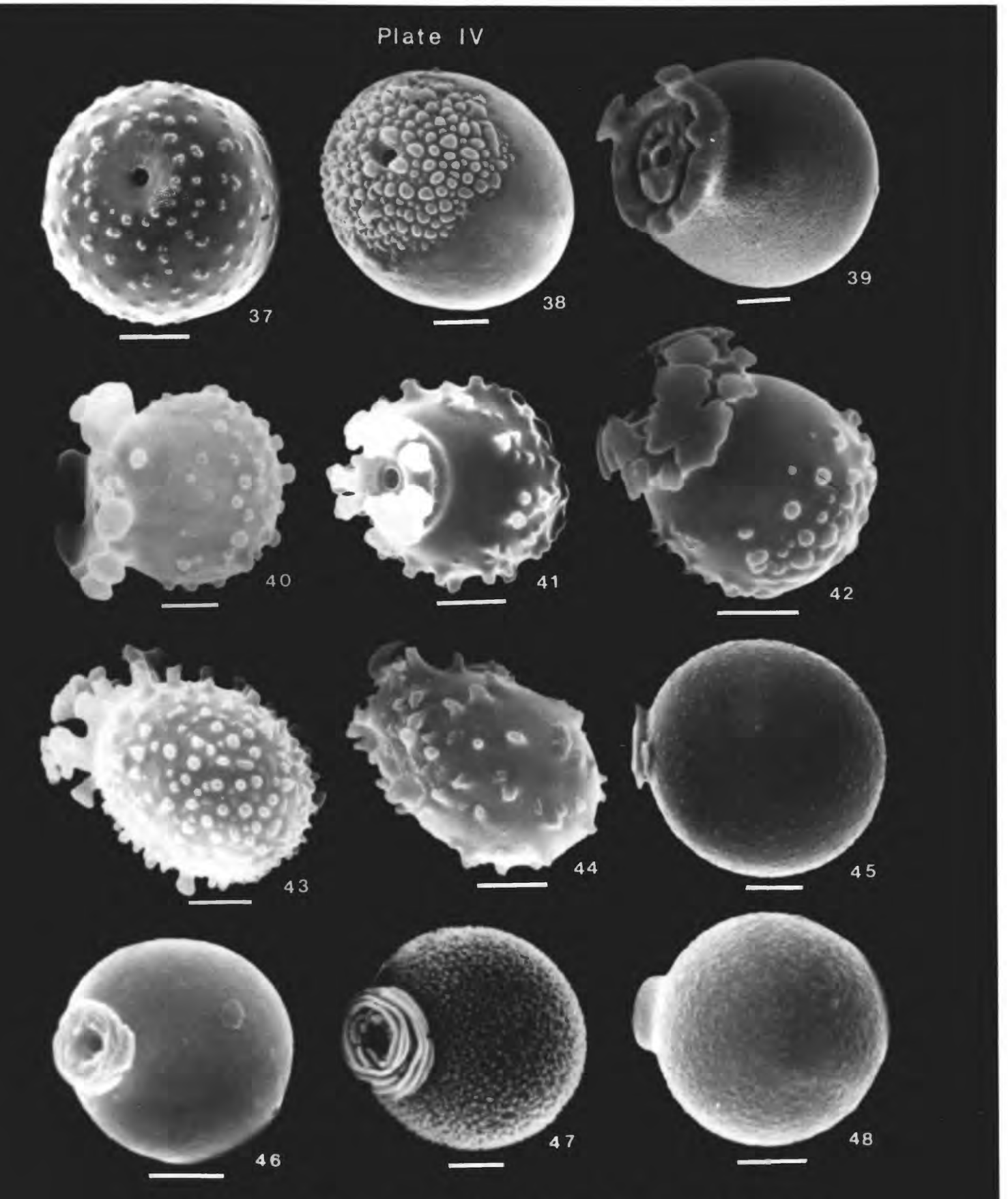
45 - Type 41, Clear Lake Sample 43
length = 11.7 μm

46 - Type 42, Clear Lake Sample 43
length = 9.1 μm, pore diameter = 0.6 μm

47 - Type 43, Clear Lake Sample 43
length = 11.5 μm, pore diameter = 1.3 μm

48 - Type 44, Clear Lake Sample 43
length =9.6 μm, pore diameter = 3.0 μm

Plate IV



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