The Biblical Chronologist

WHAT HAS BEEN IS REMOTE AND EXCEEDINGLY MYSTERIOUS. WHO CAN DISCOVER IT?
(Ecclesiastes 7:24)

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Elk Lake Revisited

Prelude

From time to time I feel an urge to communicate some of my discoveries beyond the boundaries of the modest circulation of *The Biblical Chronologist*. I feel a sense of responsibility especially toward fellow scientists. My work is at the interface of science and the Bible, and discoveries at this interface can greatly impact one's worldview. I have always felt that if someone else were to make these discoveries, I would certainly want to be informed of them. A simple application of the Golden Rule says I should try to inform others.

But a bit of a sinking feeling always damps my enthusiasm when I undertake one of these communication projects. Experience has shown repeatedly that most individuals, scientist or otherwise, are not very receptive to discoveries which challenge their accustomed way of thinking. This observation extends far beyond my own experience. The pages of history are replete with instructive instances. Let me briefly review a few facts in relation to Galileo's struggles with fellow scientists, which I have previously discussed in greater detail.[1]

Galileo, having greatly improved the recently invented telescope, was the first to observe that the surface of the moon was cratered. Also by use of this improved instrument he was able to observe that moons orbited Jupiter.

Unfortunately, both of these observations were unthinkable at the time. Traditional wisdom of respectably ancient lineage held that the surfaces of all heavenly bodies were geometrically perfect spheres, and that all celestial objects orbited the earth.

[1]Gerald E. Aardsma, "Biblical Chronology 101," *The Biblical Chronologist* 2.4 (July/August 1996): 6–8.

The reception Galileo's discoveries received from fellow scientists is revealed in a letter from Martin Horkey, associate of internationally renowned astronomer Giovanni Antonio Magini, to the now famous astronomer Johannes Kepler.[2]

> Galileo Galilei, the mathematician of Padua, came to us in Bologna and he brought with him that spyglass through which he sees four fictitious planets [*i.e., moons of Jupiter*]. On the twenty-fourth and twenty-fifth of April I never slept, day and night, but tested that instrument of Galileo's in innumerable ways, in these lower [earthly] as well as the higher [realms]. On Earth it works miracles; in the heavens it deceives, for other fixed stars appear double. Thus, the following evening I observed with Galileo's spyglass the little star that is seen above the middle one of the three in the tail of the Great Bear, and I saw four very small stars nearby, just as Galileo observed about Jupiter. I have as witnesses most excellent men and most noble doctors, Antonio Roffeni, the most learned mathematician of the University of Bologna, and many others, who with me in a house observed the heavens on the same night of 25 April, with Galileo himself present. But all acknowledged that the instrument deceived. And Galileo became silent, and on the twenty-sixth, a Monday, dejected, he took his leave from Mr. Magini very early in the morning. And he gave no thanks for the favors

[2]Galileo Galilei, *Sidereus Nuncius*, translated with introduction, conclusion, and notes by Albert Van Helden (Chicago: The University of Chicago Press, 1989), 92–93. The italicized words in square brackets are mine, non-italicized words in square brackets are in the original.

> and the many thoughts, because, full of himself, he hawked a fable. Mr. Magini provided Galileo with distinguished company, both splendid and delightful. Thus the wretched Galileo left Bologna with his spyglass on the twenty-sixth.

Several years ago I submitted a paper to a secular scientific journal arguing, as I had previously done in *The Biblical Chronologist*, that the chronology of laminated sediments from Elk Lake, Minnesota had been misinterpreted.[3] The original researchers had interpreted a thick section of anomalous sediment as spanning a six hundred year interval. I pointed out that this interpretation encountered numerous contradictions from the Elk Lake data themselves. I argued that to avoid these contradictions it was necessary to interpret this anomalous section as due to a single brief episode of intense deposition. I suggested that careful radiocarbon measurements should be able to resolve the true chronology of the anomalous section, and I suggested that such a check should be carried out to settle the issue.

I would like to have added that the anomalous section dated to the time of Noah's Flood, implying that Noah's Flood was, in fact, the explanation of the anomalous section of sediment in question. But I knew that mention of Noah's Flood in a way which treated it as real history would almost certainly guarantee rejection of the paper by the journal editor prior even to the usual peer review process. Prudence demanded that I attempt this communication in two stages: 1. establish the fact that there was a big chunk of sediment at Elk Lake which was deposited in a single brief episode rather than 600 years, and, once that was accomplished, 2. point out that this single brief episode was synchronous with the date of Noah's Flood calculated by modern Biblical chronology, and suggest that Noah's Flood provided the only reasonable explanation of the anomalous sediments.

I heard back from the editor five months later. The paper had been rejected following peer review. But the editor cordially offered, "If you can make a strong case, based on further evidence or reasoning, that would refute the referees assessments, we would welcome hearing from you".

The referees—including the scientist who had interpreted the anomalous section of sediments in terms of 600 years of slow deposition to begin with—did not deny that there were problems with the 600 year interpretation. But to accept the idea that the anomalous section of sediments was deposited during a single brief episode, and allow the paper to be published, both referees felt, as the editor summarized, that "a reasoned explanation of the rapid accumulation of the layered sediments is required".

Well, they had me there. The chronology issues should have been able to be treated by themselves on the basis of chronological data alone. But the referees were demanding to see a physical model for rapid accumulation of layered sediments at Elk Lake before they would allow the chronological issues even to be surfaced. The only way I could begin to give a "reasoned explanation of the rapid accumulation of the layered sediments" at Elk Lake was to bring Noah's Flood into the picture. And I seriously doubted their ability to give that idea a fair hearing.

I pondered my dilemma off and on for a year, but I could find no solution. Eventually I decided I had no choice. I had to state in the paper that the anomalous section of sediment found reasonable explanation only within the context of a historical Flood. The alternative was to forget trying to communicate the implications of Elk Lake sediments to my scientific colleagues altogether—which was fine with me, I had several plates full of other interesting discoveries in progress which were more than enough to keep me occupied. But there was still the Golden Rule to reckon with. The door hadn't been entirely slammed in my face yet. Who could say but that the editor and referees might rise above history's norm in this one instance...? (I tend toward an overriding optimism about people. Life has been trying to beat this out of me, but still it persists.)

So I enlarged the original paper to include an explanation of the anomalous sediments in terms of Noah's Flood. I showed that the secular date for this anomalous sediment from Elk Lake coincided with the Biblical date of Noah's Flood. And I summarized the archaeological and geophysical evidence for the historical reality of Noah's Flood

[3] Gerald E. Aardsma, "Noah's Flood at Elk Lake," *The Biblical Chronologist* 2.6 (November/December 1996): 1–13.

which I have discussed in previous issues of *The Biblical Chronologist*. The thrust of the original paper was retained (i.e., there is a chronological problem with the Elk Lake sediments which needs to be resolved). And most of the original discussion was retained. In short, it was the same paper with an added explanation of how the anomalous laminated sediments might have been rapidly deposited, to meet the demands of the referees.

Well, at least I didn't need to wait five months for a reply this time. A very definitive rejection was forthcoming in just six weeks. And this time the editor did not volunteer that I should write again with any further thoughts.

Since the editor had sent the original paper out for review, he had had little choice but to send the enlarged version out also—despite its reference to a historically real Noah's Flood. That is why it took all of six weeks for the reply. He chose a different set of two reviewers for the enlarged paper. Their comments were not models of scientific objectivity. I will spare you the full treatment; here is a sample:

> This paper is not science, not even pseudo-science. Its approach to varve analysis requires enormous faith and not any factual grasp of reality. I wouldn't even call this paper speculation. There is no evidence presented that can be used speculation. [That is how the preceding sentence appears in the original; I do not know how to emend it since I am not sure what it was meant to say. – G.E.A.] There appears to be such a rampant desire to show the existence of a catastrophic flood that the paper is blind to what can and cannot be substantiated or what is even realistic. There is NO support for any of the author's assumptions, which are necessary for any part of this house of cards to have credibility.

Well, as you can see, all it takes to demote a paper from serious science—demanding of a five month review process—to "not even pseudo-science" is reference to a historically real Noah's Flood.

Introduction

Elk Lake, in Minnesota, is a special lake for the scientific study of the past. In contrast to most lakes, it has well preserved laminated sediments. This results from the fact that Elk Lake is quite deep relative to its surface area, which makes it difficult for natural processes to supply the deepest parts of the lake with oxygen. As a result, macroscopic organisms which need oxygen to live—such as fish, worms, and clams—and which constantly mix the sediments at the bottom of most lakes, are unable to do so at the bottom of Elk Lake.

A lake's sediments are rich with certain kinds of information about its past. For example, pollen spores recovered from the sediments reveal the types of vegetation which surrounded the lake in the past. One can deduce past windiness in the vicinity of the lake by the amount and character of dust found within the lake's sediments. Other measurable parameters having distinct contributions to make to the story of the lake's past include, for example: types of diatoms which grew within the lake; elements and stable isotopes of sedimentary components, bulk magnetic properties, and fossil pigments.

Elk Lake's well preserved, laminated sediments greatly enhance its story of the past because they provide it with a simple chronological framework. At Elk Lake it is possible to deduce with some assurance not only *what* happened, but also *when* it happened.

Elk Lake is a particularly special lake for the science of Biblical chronology. It is special because its history intersects Bible history. The intersection point occurs at Noah's Flood.

The Bible informs us that a massive flood—Noah's Flood—happened in ancient history. Floods are ideal for making sediments. Elk Lake is a deep basin, ideal for catching and preserving sediments.

Modern Biblical chronology dates Noah's Flood to 3520±21 B.C. Elk Lake's layered sediment chronology reveals that the lake existed continuously from thousands of years prior to that date, down to the present time. Simply stated, Noah's Flood happened within the span of history recorded in Elk Lake's sediments.

Clearly, Elk Lake's sediments must have some-

thing to say about the nature of Noah's Flood. And its carefully preserved laminations provide us with the chronological framework we need to know where to look to discover what that something is.

Figure 1 shows the measured annual sedimentary layer thickness at Elk Lake, as the laminations are interpreted by Roger Y. Anderson *et al.*[4] Layer 1 in the figure corresponds to a layer of sediment near the top of the great depth of laminated sediments found at the bottom of Elk Lake. Layers are counted from the top to the bottom of the sedimentary column.

The history of the lake divides naturally into three stages as shown in Figure 1: 1. Post-glacial, 2. Prairie, and 3. Modern. During the first stage the climate in the vicinity of the lake was cold and moist. This resulted from the proximity of the lake to the slowly retreating glaciers which had formed the lake. The lake was surrounded by coniferous forests during this Post-glacial stage.

As the glaciers continued to retreat, air crossing the mountains from the Pacific was able to reach further to the north and east. This resulted in a drier, warmer climate at Elk Lake. The coniferous forest was replaced by dry prairie vegetation around the lake in response to this shift in local climate.

Moisture increased once again in the vicinity of the lake beginning about 3800 years ago according to the time scale of Figure 1. This appears to have resulted from an extension northward of the tropical airstream from the Gulf of Mexico. The result was displacement of prairie vegetation around the lake by mixed pine and hardwood forests.

All of this is fairly easily read from the plentiful scientific data recovered from Elk Lake's sediments.[5]

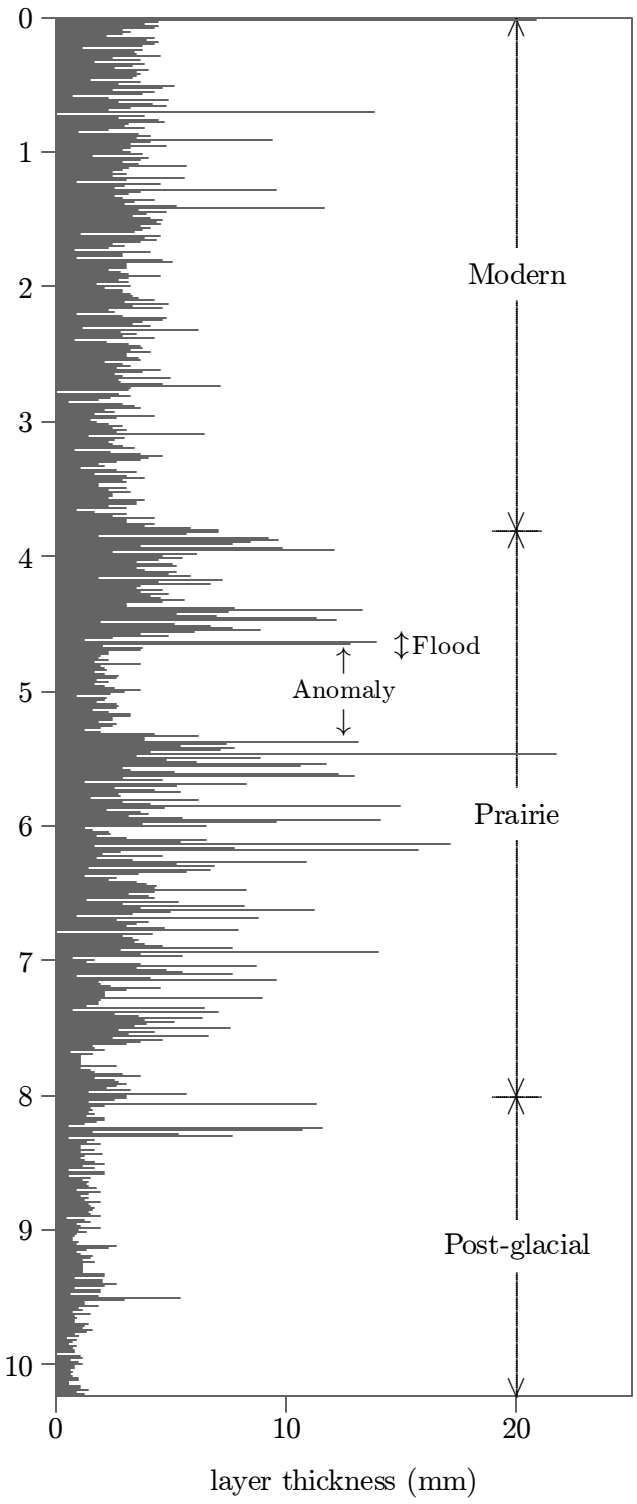

Figure 1: Elk Lake laminated sediment chronology as constructed by original researchers. (See text for reference.) For greatest visual clarity only the thickest and thinnest layers are plotted from each consecutive group of twelve layers. The layer number is given by the scale on the left in units of thousands.

[4]Roger Y. Anderson, J. Platt Bradbury, Walter E. Dean and Minze Stuiver, "Chronology of Elk Lake sediments: Coring, sampling, and time-series construction," *Elk Lake, Minnesota: Evidence for Rapid Climate Change in the North-Central United States*, ed. J. Platt Bradbury and Walter E. Dean (Boulder: The Geological Society of America, Inc., 1993), 37–43.; Roger Y. Anderson, "The varve chronometer in Elk Lake: Record of climatic variability and evidence for solar-geomagnetic-^{14}C-climate connection," *Elk Lake, Minnesota: Evidence for Rapid Climate Change in the North-Central United States*, ed. J. Platt Bradbury and Walter E. Dean (Boulder: The Geological Society of America, Inc., 1993), 45–67.

[5]J. Platt Bradbury and Walter E. Dean, ed., *Elk Lake,*

The only real curiosity is the section of layered sediments labeled "Anomaly" in the figure.

This is a section of 600 thin, uniform, striated laminations,[6] bordered on both sides by thick, variable laminations.

The thick, variable laminations are diagnostic of the Prairie lake stage. They result from wind-blown dust fertilizing the lake and settling to the bottom. Because of the dry and relatively open conditions during the Prairie stage, it was relatively easy for strong winds to blow near the surface of the ground, and for dust to be lofted into the air from dry soil.

Once this is understood it is natural to suppose that the 600 thin uniform layers must represent a period of temporarily increased moisture. This, in fact, is what the original researchers proffer as the explanation of this anomaly.

> The long-term changes in soil moisture that [hypothetically] at first increased and then lowered the threshold, shutting off and then turning on dust suspension, probably were more gradual than indicated by the event itself, occurring in an interval that was longer than 600 yr. This suspected longer interval must have been accompanied by a significant increase and later decrease in moisture in order to account for the event.[7]

In contrast to this "significant increase in moisture" theory, I have previously proposed that this entire anomalous section of thin, uniform laminations was deposited in a brief period of time as a result of Noah's Flood.[8] The laminated character of this anomalous section is attributed to physical processes active during the Flood, such as tidal phenomena, rather than to annual seasonality in this theory.

I advanced my theory on the strength of two considerations. First, Noah's Flood dates to the trailing edge of this anomalous interval, as shown in Figure 1. It seems improbable that the Flood, which has every reason to have produced unusual sedimentation at Elk Lake, should synchronize with the only anomaly in the entire series of roughly 10,000 annual layers at Elk Lake, and that anomaly have nothing in fact to do with the Flood. When the calendrical chronology of the sediments is calculated assuming the entire anomalous section is due to deposition within a single year, the remarkable chronology of layer thicknesses shown in Figure 3 results.[9]

Second, the significant-increase-in-moisture theory seems unable to provide a rational, cohesive explanation of much data from this anomalous interval.[10] As a single (previously discussed) example, a 600 year interval of significantly increased moisture should yield significant changes in the types of vegetation surrounding the lake. This was the case, for example, when moisture increased in the Elk Lake region roughly 3800 years ago (Figure 1). But pollen from the anomalous section fails to reveal any shift in the types of vegetation around the lake during this interval.[11]

Minnesota: Evidence for Rapid Climate Change in the North-Central United States (Boulder: The Geological Society of America Special Paper 276, 1993).

[6]The nomenclature here is necessarily a bit clumsy. What one observes in a core of the sediments are individual horizontal bands of different shades and colors. The original researchers have bundled these together into what they assume to be annual groups and have called the bundles "varves". They claim 600 varves in the anomalous interval. I am deliberately avoiding use of the word "varves" because it implies annual cycles of deposition and I do not grant the claim that the anomalous section is due to 600 annual cycles of deposition.

[7]J. Platt Bradbury, Walter E. Dean, and Roger Y. Anderson, "Holocene climatic and limnologic history of the north-central United States as recorded in the varved sediments of Elk Lake, Minnesota: A synthesis," *Elk Lake, Minnesota: Evidence for Rapid Climate Change in the North-Central United States*, ed. J. Platt Bradbury and Walter E. Dean (Boulder: The Geological Society of America, Inc., 1993), 319.

[8]Gerald E. Aardsma, "Noah's Flood at Elk Lake," *The Biblical Chronologist* 2.6 (November/December 1996): 8.

[9]Gerald E. Aardsma, "Noah's Flood at Elk Lake," *The Biblical Chronologist* 2.6 (November/December 1996): Technical Appendix, 10–13.

[10]Gerald E. Aardsma, "Noah's Flood at Elk Lake," *The Biblical Chronologist* 2.6 (November/December 1996): 1–13.

[11]Cathy Whitlock, Patrick J. Bartlein, and William A. Watts, "Vegetation history of Elk Lake," *Elk Lake, Minnesota: Evidence for Rapid Climate Change in the North-Central United States*, ed. J. Platt Bradbury and Walter E. Dean (Boulder: The Geological Society of America, Inc., 1993), 258; J. Platt Bradbury, Walter E. Dean, and Roger Y. Anderson, "Holocene climatic and limnologic history of the north-central United States as recorded in the varved sediments of Elk Lake, Minnesota: A synthesis," *Elk Lake, Minnesota: Evidence for Rapid Climate Change in the North-Central United States*, ed. J. Platt Bradbury and Walter E. Dean (Boulder: The Geological Society of Amer-

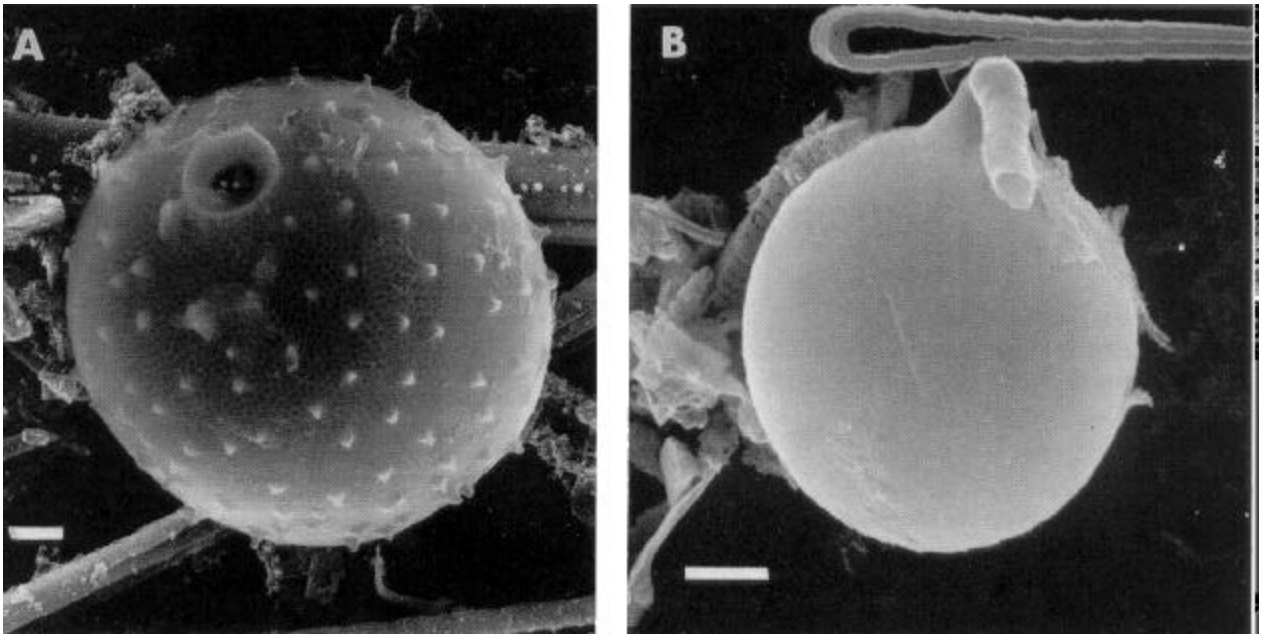

Figure 2: Examples of cysts obtained from Elk Lake sediments by Barbara Zeeb and John Smol. (See text for complete reference with additional examples.) Photos were obtained using a scanning electron microscope. The scale bars are 2 microns (79 millionths of an inch).

In the present issue I take us back to the Elk Lake sediments. My purpose is to show that additional analyses of data from Elk Lake continue to falsify the significant-increase-in-moisture theory and to corroborate the Flood theory of the origin of the anomalous 600 layers. The objects of interest to the present study are microscopic cysts found within the sediments of Elk Lake (Figure 2).[12]

Cysts at Elk Lake

A cyst consists of a thin "shell" made of silica (the major constituent of sand). Cysts are produced by certain types of algae (nonvascular and often single-celled plants). Different species of algae produce cysts which differ from one another in size and appearance. Cysts serve algae as a protective "house" in which to live for a period of time. Eventually the alga cell reemerges from the cyst through a small opening called a pore.

The importance of cysts to the present study lies in the fact that algae are sensitive to their environment. Species of algae differ in their respective tolerances to various environmental conditions. For example, some algae prefer cooler temperatures while others do better in warmer conditions. This selective sensitivity to environmental conditions immediately suggests the possibility of using cysts recovered from Elk Lake's ancient sediments to learn about conditions in the lake in the past.

Salinity

In the present context we are particularly interested in learning about the salinity of Elk Lake in the past. Our reason for this interest is somewhat obvious. Elk Lake is normally a freshwater lake. At the time of the Flood it was flooded by ocean water, according to the hemispherical Flood model. Since ocean water is salty, it has a higher density than fresh water. We confidently predict, therefore, that Elk Lake's fresh water was displaced by saline ocean water at the time of the Flood.

It seems likely that Elk Lake would have remained unusually salty for a long time following the Flood. To rid the lake of excess salt requires

ica, Inc., 1993), 318.

[12]Barbara A. Zeeb and John P. Smol, "Postglacial chrysophycean cyst record from Elk Lake, Minnesota," *Elk Lake, Minnesota: Evidence for Rapid Climate Change in the North-Central United States*, ed. J. Platt Bradbury and Walter E. Dean (Boulder: The Geological Society of America, Inc., 1993), 239–249.

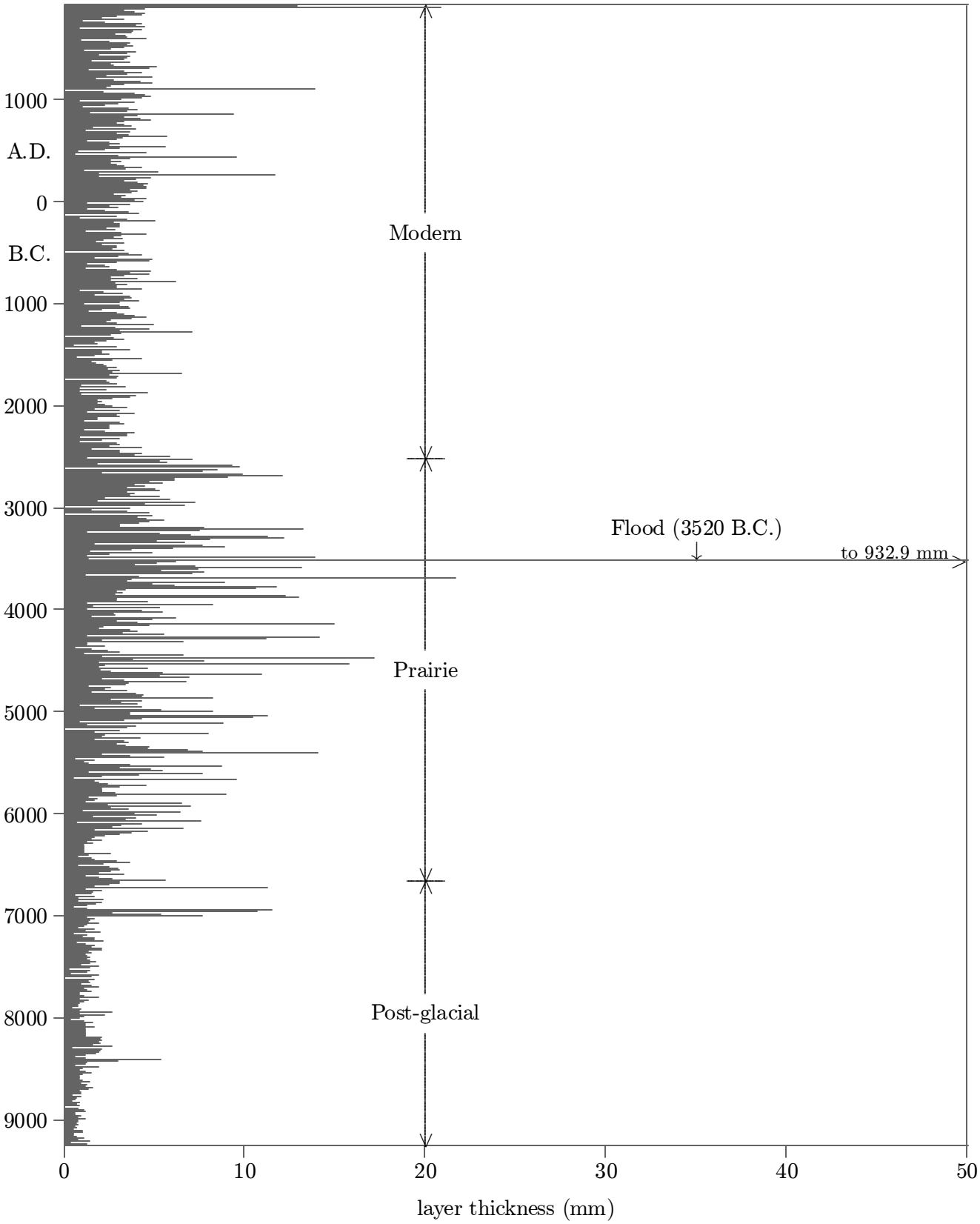

Figure 3: Elk Lake laminated sediment chronology as constructed by Aardsma. (See text for reference.) For greatest visual clarity only the thickest and thinnest layers are plotted from each consecutive group of twelve layers.

dilution and flushing with fresh water. But the lake experienced a dry prairie climate for a millennium following the Flood (Figure 3), so the fresh water contribution to the lake back at that time was probably limited. Furthermore, since salt water is denser than fresh water, stratification of the lake following the Flood is probable. Cold, salty water would naturally tend to settle into the deepest portions of the lake. Mixing of these deep saline waters with overlying fresh water would not have been easily accomplished.

In summary, the Flood thesis predicts a sudden influx of salt water to the Elk Lake basin synchronous with the anomalous 600 layers, and persistent elevated saltiness for a significant length of time following the anomalous layers.

A very different prediction follows from the significant-increase-in-moisture theory. Increasing moisture through change in climate is expected to *decrease* the salinity of the lake. There are only two ways to increase soil moisture (so dust stops blowing into the lake): 1. increase precipitation, or 2. decrease evaporation. In either case lakes in the region should become less salty.

Temperature

The past temperature of the lake is also of some interest. The significant-increase-in-moisture theory makes no prediction regarding temperature during the anomalous 600 layers, but the Flood theory predicts that the lake water should become very cold. This results from the fact that, while the top few meters of the oceans may be quite warm, most of the water of the oceans is deep ocean water, and deep ocean water is only a few degrees above freezing (typically 1–4°C).[13]

Might the selective sensitivity of algae to environmental conditions be exploited to test these two theories? Might the record of the number density of various types of cysts in Elk Lake's laminated sediments reveal what really happened at Elk Lake at the time of the Flood? Though here, as in many areas of Biblical chronology research, we necessarily labor at the frontier of a scientific discipline, the work of Barbara Zeeb and John Smol suggests that the answer to both of these questions is yes.

[13]George L. Pickard and William J. Emery, *Descriptive Physical Oceanography: an Introduction*, 4th (SI) enlarged edition (New York: Pergamon Press, 1982), 41–42.

Experimental

Zeeb and Smol have painstakingly counted and categorized well over 30,000 cysts from 105 sediment levels at Elk Lake.[14] They have analyzed their numerical data using a statistical method known as "principle components analysis" (PCA). This method separates out independent causes of observed (colinear) variablity in a dataset.

Zeeb's and Smol's PCA diagram for the interval from 10,400 laminated sediment years ago to 3100 laminated sediment years ago is shown in Figure 4. Zeeb and Smol caution that, due to the newness of the whole field of cyst analysis, they cannot be certain which environmental variable is responsible for the variations of their dataset which the PCA analysis has separated out and they have plotted as "PCA axis 1" and "PCA axis 2". Nonetheless, by comparing their PCA analysis with what is know of the climatic history of Elk Lake, they suggest that PCA axis 1 corresponds to temperature and PCA axis 2 corresponds to salinity, as shown in Figure 4.

PCA axis 2 is labeled "wet" and "dry" in conformity with Zeeb's and Smol's original figure. This refers to climate around the lake, not conditions in the lake itself. The algae, which live in the lake, are always wet, of course. They are not sensitive to wet and dry climate directly, but rather to salinity of the water in which they live, which increases when the climate is dry and decreases when it is wet. When referring to the lake itself, rather than climate, PCA axis 2 should be labeled "saline" in place of dry, and "fresh" in place of wet. I have added these labels to the right hand axis of Zeeb's and Smol's original figure for ease of reference in the present discussion.

Results

Figure 4 starts the lake out (double square in PCA diagram) in a cold, fresh condition 10.4 ky (10,400 years) ago. This is as expected. Cold, fresh water is expected within the newly formed lake following retreat of the glaciers toward the north and east.

[14]Barbara A. Zeeb and John P. Smol, "Postglacial chrysophycean cyst record from Elk Lake, Minnesota," *Elk Lake, Minnesota: Evidence for Rapid Climate Change in the North-Central United States*, ed. J. Platt Bradbury and Walter E. Dean (Boulder: The Geological Society of America, Inc., 1993), 239–249.

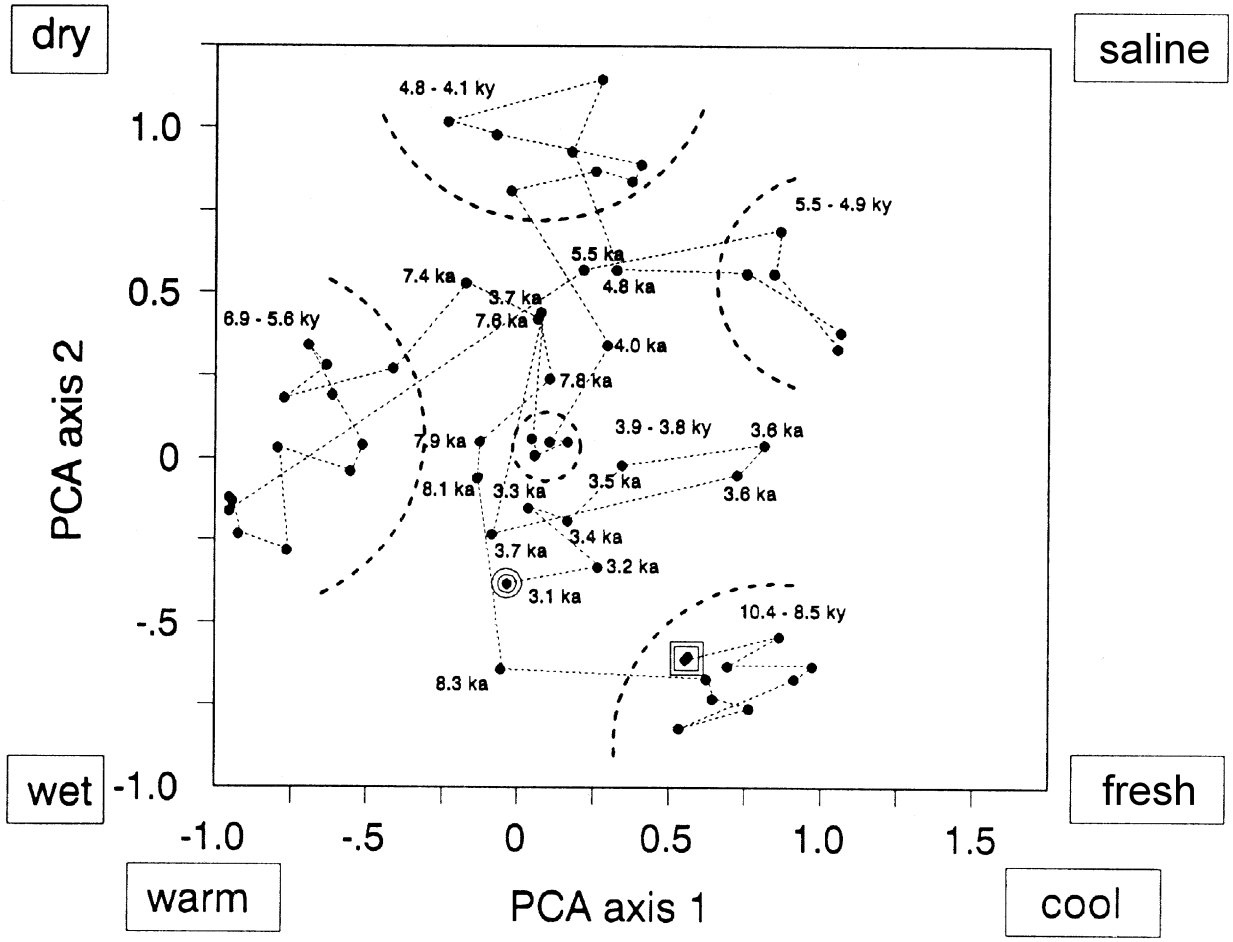

Figure 4: PCA diagram for cyst data obtained from Elk Lake sediments. (After Barbara Zeeb and John Smol; see text for complete reference.) PCA axis 1 explains 40% and PCA axis 2 explains 18% of the total variance. Each plotted point corresponds to a cyst assemblage at a unique depth in Elk Lake's sediments. The development of the lake in terms of temperature and salinity can be traced in time by following the dashed lines from point to point. Time references are given for many points, based on counts of sedimentary layers. The heavy dashed arcs separate out combinations of temperature and salinity which persisted through a significant depth of sediment.

This condition persisted, according to the PCA diagram (Figure 4), until about 8,500 years ago. This was the Post-glacial lake stage. It is set off by the dashed arc at lower right in the PCA diagram.

The lake then warmed, and began to increase in salinity. This is in agreement with conditions expected of the dry Prairie stage, which the climate around the lake had now entered.

The lake then slowly reduced salinity while continuing to warm, from about 7400 to 5600 years ago. This is the regime set off by the dashed arc at the left of the PCA diagram.

The net trend from the inception of the lake to this point in time was significant warming and moderate increase in salinity.

At this point, in approximate synchronization with the anomalous section of sediment, the lake suddenly transitioned out of the warm, moderate salinity regime and into a cold, saline regime, set off by the dashed arc at upper right in the PCA diagram. This transition is in accord with the predictions of the Flood explanation of the anomalous section of sediment.

Chronological Hitch

A small hitch—which we must now pause to deal with—is that the transition to the cold saline regime shown in the PCA diagram appears to predate the onset of the anomalous 600 layers by 200 years. The anomaly runs from 5300 to 4700 laminated sediment years ago (Figure 1). The PCA diagram shows the cold saline regime lasting from 5500 to 4900 years ago—a 200 year offset.

While it may be possible to accommodate such an offset within the Flood theory, it seems more probable to me at present that this 200 years is artifactual only, resulting from chronological error in the PCA diagram.

A chronological offset of 100 years is found almost everywhere in connection with discussion of the boundaries of this 600 "year" anomaly within the GSA volume devoted to Elk Lake in which Zeeb's and Smol's paper is found.[15] It is most often referred to as beginning 5400 and ending 4800 years ago, though the closest century boundaries of the anomalous section in the laminated sediment chronology (Figure 1) are clearly 5300 and 4700 respectively. (See Figure 6 of Bradbury *et al.*[16] for an expanded view.) Anderson *et al.* claim the laminated sediment chronology is used throughout the GSA volume:

> For all chapters in this volume, the following conventions are used for time designations: ka (for kilo annum) = thousands of varve years ago, T_0 = A.D. 1927 (the beginning of Elk Lake varve chronology);[17]

but this is evidently not the case, at least in regard to this anomalous section.

Zeeb and Smol explicitly state that beginning 5300 and lasting to 4800 years ago "dominant cysts indicate a striking return to early postglacial conditions".[18] This seems in obvious contradiction to their PCA diagram (Figure 4) which shows the dramatic shift back to cold conditions running between 5500 and 4900 years ago.

Zeeb and Smol mix "ka" and "ky" as the unit meaning "thousands of years ago" in the PCA diagram. One wonders whether they intended a different origin of coordinates in the two cases, possibly explaining the apparent chronological offset of the PCA diagram. But they also mix these units throughout the body of their paper, and there they appear to be used synonymously.

To further compound the puzzles with the detailed chronology of this paper, their Figure 3

[15] J. Platt Bradbury and Walter E. Dean, ed., *Elk Lake, Minnesota: Evidence for Rapid Climate Change in the North-Central United States* (Boulder: The Geological Society of America Special Paper 276, 1993).

[16] J. Platt Bradbury, Walter E. Dean, and Roger Y. Anderson, "Holocene climatic and limnologic history of the north-central United States as recorded in the varved sediments of Elk Lake, Minnesota: A synthesis," *Elk Lake, Minnesota: Evidence for Rapid Climate Change in the North-Central United States*, ed. J. Platt Bradbury and Walter E. Dean (Boulder: The Geological Society of America, Inc., 1993), 319.

[17] Roger Y. Anderson, J. Platt Bradbury, Walter E. Dean and Minze Stuiver, "Chronology of Elk Lake sediments: Coring, sampling, and time-series construction," *Elk Lake, Minnesota: Evidence for Rapid Climate Change in the North-Central United States*, ed. J. Platt Bradbury and Walter E. Dean (Boulder: The Geological Society of America, Inc., 1993), 40.

[18] Barbara A. Zeeb and John P. Smol, "Postglacial chrysophycean cyst record from Elk Lake, Minnesota," *Elk Lake, Minnesota: Evidence for Rapid Climate Change in the North-Central United States*, ed. J. Platt Bradbury and Walter E. Dean (Boulder: The Geological Society of America, Inc., 1993), 247.

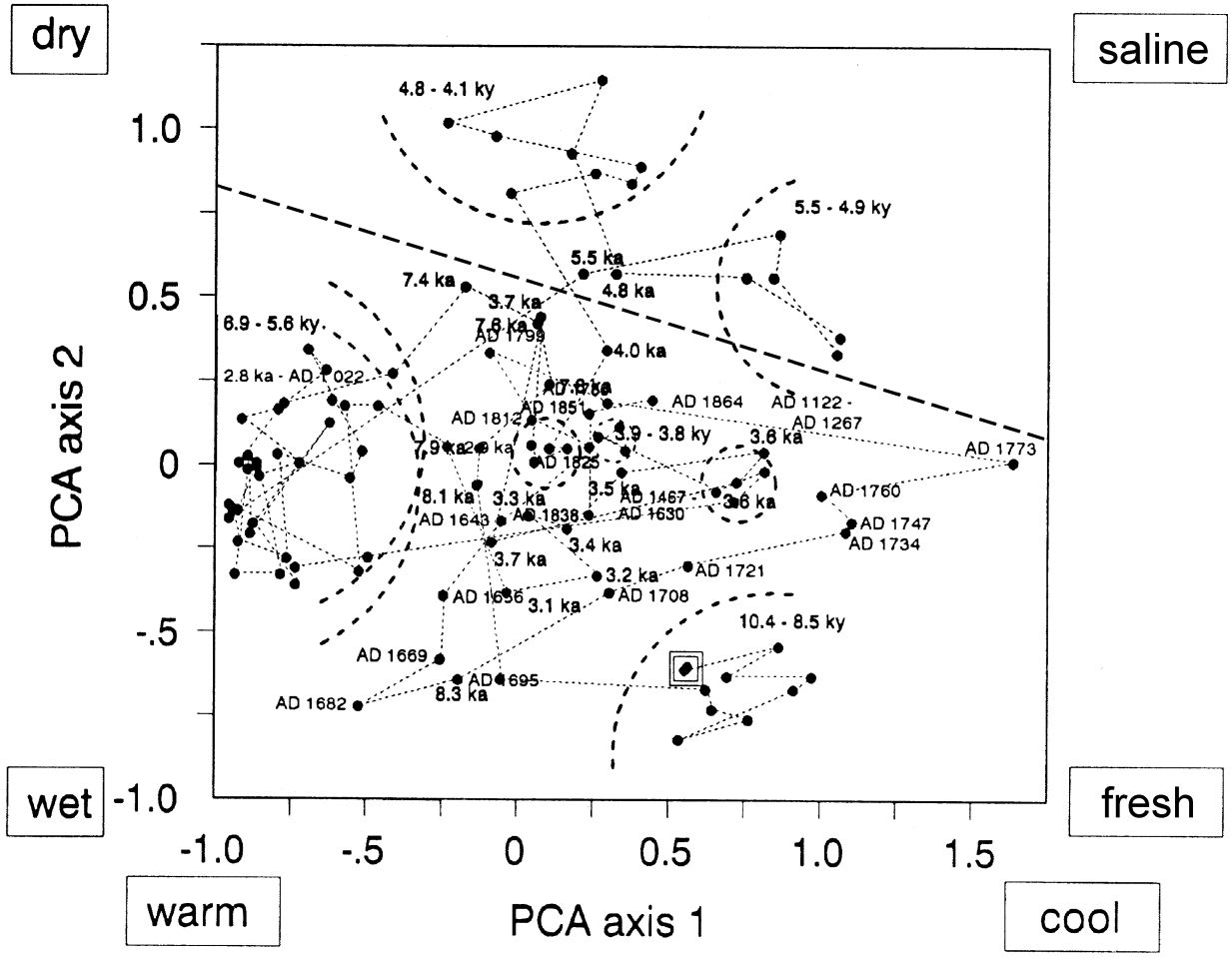

Figure 5: Composite PCA diagram for entire cyst dataset obtained from Elk Lake sediments by Barbara Zeeb and John Smol. (See text for complete reference.)

shows a curious nonlinearity in its timescale between 5500 and 5000 years ago.

My best guess is that the figures for Zeeb's and Smol's paper were drafted before fine tuning of the laminated sediment chronology was complete. Subsequent editing updated some of the text, but failed to make all the changes which were needed.

Significant-Increase-In-Moisture Theory

Be that as it may, what is absolutely clear is that the prediction of the significant-increase-in-moisture theory (that the climate was more moist during the anomalous sediments interval) fails entirely. The PCA diagram shows an unequivocal transition to drier (more saline) conditions during this anomaly, in exact contradiction to the significant-increase-in-moisture theory.

Something highly unusual happened at Elk Lake during this anomaly, sending it into an unprecedented temperature - salinity regime. This is most easily seen in Figure 5, which includes all of Zeeb's and Smol's data from the birth of the lake to relatively modern times. The heavy dashed line in the figure shows that the data points between 5.5 ka and 4.1 ka are in a separate region unto themselves. In Zeeb and Smol's words: "It is interesting that cyst assemblages from 5.5 to 4.1 ky are unique, and have no other analogues during the lake's history".[19] It is clear that the lake experienced something far more unusual than a simple increase in moisture at this time.

Flood Theory

While the PCA results are in blatant contradiction to the significant-increase-in-moisture theory, they strongly corroborate the Flood theory for the origin of the anomalous sediments. The lake not only became suddenly very saline, it also became suddenly very cold at the time of the anomaly—both of which are necessary if deep ocean water flooded Elk Lake basin as the Flood theory predicts. Following the anomalous sediments interval (i.e., following the Flood) the PCA diagram shows that the lake quickly warmed to normal temperatures again, as one would expect. And, as anticipated in the discussion above, high salinity persisted in the lake for an extended time. Only with the coming of the Modern lake stage, when all indicators point to enhanced moisture in the overall climate at Elk Lake, did the lake begin to receive a sufficient supply of fresh water to return it to normal salinity.

In short, Zeeb's and Smol's cyst data seem to show that Elk Lake became suddenly very cold and very salty within dating uncertainties of Noah's Flood. Their data contradict the significant-increase-in-moisture theory, and strongly corroborate the Flood theory for the origin of the anomalous 600 striated laminations at Elk Lake.

Postlude

Galileo's scientific critics accused him of arrogance and ingratitude. Mine accuse me of a self-delusion bordering on imbecility. But my belief is that the logical mind, eschewing *ad hominem* and embracing available data, must ultimately conclude that the moon's terrain is indeed rugged, Jupiter does indeed have orbiting moons, and Noah's Flood did indeed happen, 3520±21 B.C. ◇

[19] Barbara A. Zeeb and John P. Smol, "Postglacial chrysophycean cyst record from Elk Lake, Minnesota," *Elk Lake, Minnesota: Evidence for Rapid Climate Change in the North-Central United States*, ed. J. Platt Bradbury and Walter E. Dean (Boulder: The Geological Society of America, Inc., 1993), 245.

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