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DIATOMS AND CHRYSOPHYTE CYSTS (CHRYSOMONADS): POWERFUL TOOLS FOR DETERMINING AGE AND PALEOENVIRONMENT OF THE HUEYATLACO EARLY MAN SITE, PUEBLA, MEXICO

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Abstract

No other archaeological site in the world is known to be associated with such highly significant age and environmentally diagnostic diatom/chrysophyte cyst evidence as Hueyatlaco. Diatoms and cysts have been found in 147 samples from 22 distinct stratigraphic units associated with the Hueyatlaco archaeological site. These samples have yielded 467 extant and 78 extinct diatom taxa and 44 extant and 39 extinct chrysophyte taxa, many of which are age diagnostic indicators designating a minimum (Sangamonian = *sensu lato* = 80,000 - ca. 220,000 yr BP) and a maximum (Illinoian = ca. 220,000 - 430,000 yr BP) age for the Hueyatlaco artifacts. Attempts have been made to discredit the Hueyatlaco early man artifacts and their *in situ* emplacement with such speculations as redeposition and an inset unconformably into an older section. The biostratigraphy and paleoecology of these numerous diatoms and cysts negate the likelihood of any redeposition, inset, or unconformity claims associated with artifact-bearing beds at Hueyatlaco. Those who insist on maintaining that humanity first arrived in North America during the Last Ice Age (Wisconsinan) or postglacial times are going to find it more and more difficult, if not impossible, to try to discredit the rapidly growing body of evidence supplied by diatom/cyst studies and by various investigations which have produced sophisticated and sustained lithostratigraphical, biostratigraphical, paleoecological, etc. data from the Valsequillo (Hueyatlaco) region, all of which are in essential agreement with a pre-Wisconsinan (>80,000 yr BP) age for the Hueyatlaco artifacts.

Introduction

This presentation was made possible through a grant from Chris Hardaker, the author of the book titled *The First American*, published in 2007.

The findings from diatom paleoecologic and biostratigraphic correlations in my presentations today thoroughly discredit the speculations concerning the inset and unconformity at the Hueyatlaco site alleged by Mike Waters and the Center for the Study of First Americans on its web site. As Hal Malde, I, and some others have previously indicated: there is no proof of such an unconformity, because all of the evidence has been eroded away. This alleged unconformity is simply a vacant hypothesis, because it cannot be proven.

The Hueyatlaco archaeological site is significant because age determinations by various means (including diatom and cyst fossils) on its artifacts have placed humanity in the Western Hemisphere at a time long before (ca. 8 to 40 times earlier than) that advocated by the current American archaeological establishment.

Diatoms and Chrysophytes

Diatoms are microscopical, one celled plants enclosed within delicate, intricately sculptured siliceous shells. They live in many environments - oceans, lakes, rivers, bogs, soils, sediments, caves, air, and even ice. The diatoms probably are the most important of all fossil groups from the standpoint of total number of well preserved individuals. Because of their abundance, wide distribution, small size (according to Elmore, 1898, more than 230 million average sized diatoms can be fitted into 1 cubic inch), and short life span, diatoms leave us with a good record of their environmental conditions when and where they were alive, as was shown by VanLandingham (2000, 2004 and 2006) in the Hueyatlaco region. The ubiquitous diatoms may represent the most universally distributed form of life; if this is not true today, it probably has been true in the fossil record at various times in the earths history (VanLandingham 1967). According to Lohman (1957, p. 731): Diatoms by virtue of their minute size and durability of their shells, achieve a wider geographic distribution in a shorter period of time than is possible with larger organisms. In addition to ocean [and water] currents, they are often carried great distances by wind, birds, and air. The resistant nature of their shells, coupled with their ability to withstand long periods of almost complete desiccation makes it possible for them to reproduce whenever they fall into a suitable environment. Chrysophytes are one celled golden-brown algae which produce resting spores (cysts) and are closely related to the diatoms: usually the silicified cysts are the only parts of these tiny organisms which are fossilized.

Many of the genera and species of diatoms and chrysophytes have evolved very rapidly and their distinctive first occurrences, extinctions, and dominance/subdominance associations make them excellent age indicators. Successfully correlating and dating rocks with microfossils (including diatoms and cysts) has been done since the time of the famous monograph *Mikrogeologie* by Ehrenberg (1854).

Not only do extinct diatom and cyst taxa far outnumber the extinct vertebrate and invertebrate species at Hueyatlaco, individual fossil specimens of diatoms and cysts probably are thousands of times more common than individual vertebrate and invertebrate specimens. Age and paleoecological evidence from the fossil diatoms (and cysts), because of its abundance, should predominate over all other fossil evidence from Hueyatlaco.

Results

Diatoms and cysts have been found in 147 samples from the Hueyatlaco region, most of which were collected by H. E. Malde. In addition to numerous extinct diatom and chrysophyte taxa (many of which are age diagnostic marker fossils), there are species and generic dominance/subdominance associations, earliest known first occurrences, and pennate to centric (P:C) diatom ratios. All of these criteria aided in fixing the ages (and environments) of deposition of the 22 distinct beds associated with the archaeological site. All of these 22 Holocene, Pleistocene, and upper Pliocene deposits in the Valsequillo region have at least one diatom/cyst-bearing sample which is age diagnostic. All Hueyatlaco artifacts are known to be above Unit J which contains Yarmouthian (430,000 - 500,000 yr BP) age diagnostic diatoms/cysts.

Diatoms have discredited the alleged unconformity at the Hueyatlaco site and some of the claims about the age, environments of deposition, and speculations about redeposition (VanLandingham 2006, 2008). Malde's samples from the TBM unit have 147 different fresh-water diatom taxa which indicate that the waters which deposited them were current in-different (without strong currents: redeposition very unlikely). Diatomaceous samples from artifact-bearing beds (Unit B, C, E, and I) indicate that they were not characterized by stream flow, but instead by relatively still waters. Irwin-Williams (1967, 1969) presented many excellent reasons for the *in situ* deposition of the artifacts at Hueyatlaco. At the present, apparently good evidence for an age less than 80,000 yr BP for the Hueyatlaco artifacts is specious, indirect, or without good substantiation. Why would so many archaeologists go out of their way to try to discount or ignore an abundance of diatom evidence for the great antiquity of the Hueyatlaco artifacts, if so many similar diatom correlation studies have proven useful to large corporations in their multimillion dollar searches for oil, to prosecutors as forensic evidence in murder cases, to geologists (e.g., in the Columbia Plateau) in determining the age relationships of rocks, etc.? I am still waiting for an answer!

Diatom/cyst paleoecology and biostratigraphy offer such good evidence that the Hueyatlaco region is probably the best spot on earth to refute the redeposition or reworking excuse which so many are so fond of invoking whenever the situation at hand does not fit their favored ideas. Such extensive redeposition and reworking in the Hueyatlaco region as advocated by the conjectures of those like Gonzalez et al. (2006) and Pichardo (1997) were not supported by the detailed diatom and cyst paleoecology from numerous samples from the region.

Conclusions

All of the proper indicative diatom/cyst fossils associated with the ancient artifacts at Hueyatlaco are present in the correct places (and absent from the places where they should not occur) to be consistent with a Sangamonian Interglacial or older (Illinoian Glacial) age.

Those who would wish to argue against the case for the great antiquity (prior to the Last Ice Age) of humanity in the New World by attacking the veracity of the compelling diatom and chrysophyte evidence have picked the wrong place to make such an argument at Hueyatlaco No other archaeological site in world is associated with such a variety of age diagnostic diatoms and chrysophytes and in such profusion. Moreover, the Valsequillo area has the most complicated non-marine diatomaceous sequence in the world: 22 beds compressed into less than 2 million years and into less than 30 m.

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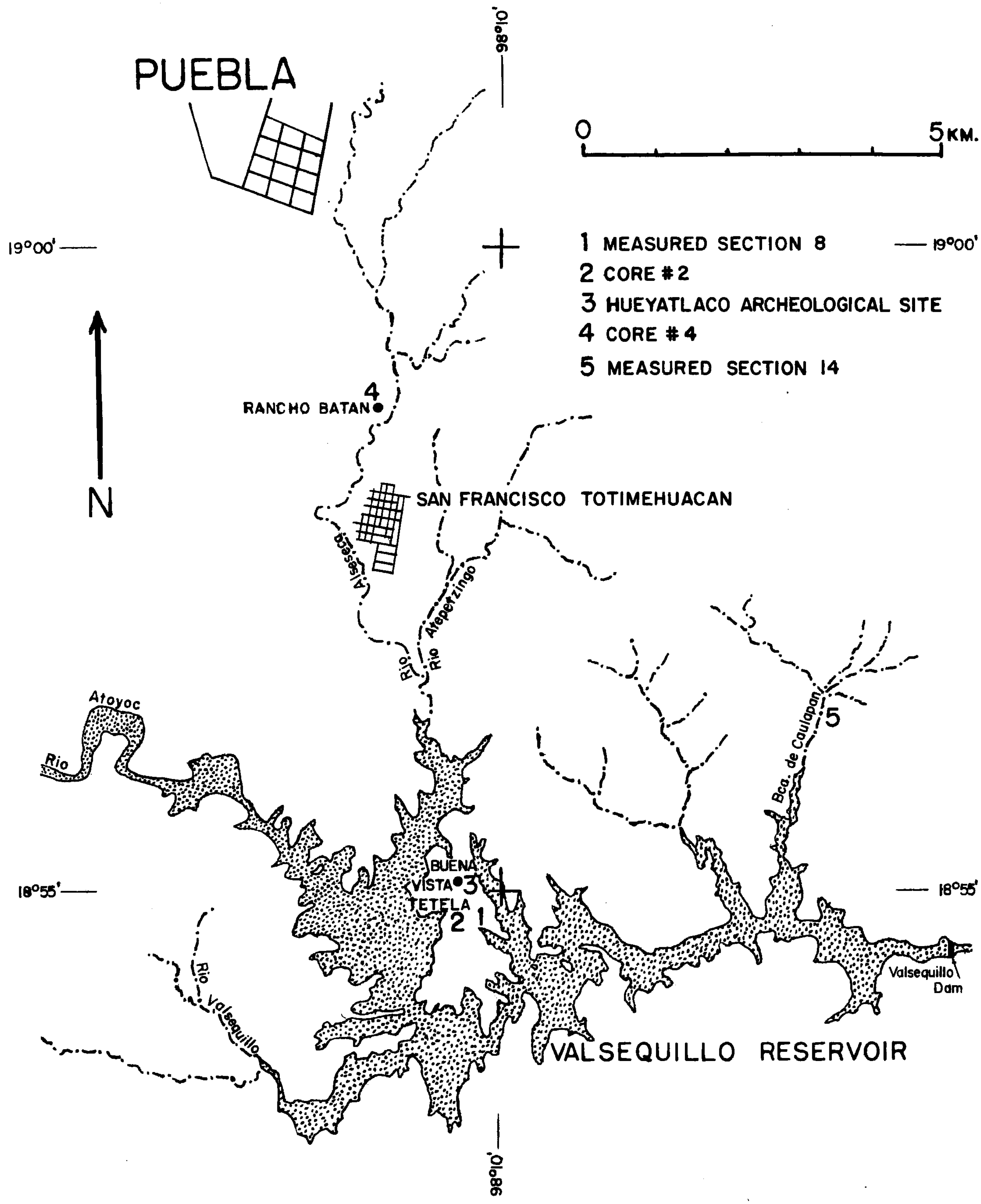

Figure 1. Map of Valsequillo Reservoir area south of Ciudad Puebla, Mexico, showing 5 main places where diatom/ cyst deposits were sampled.

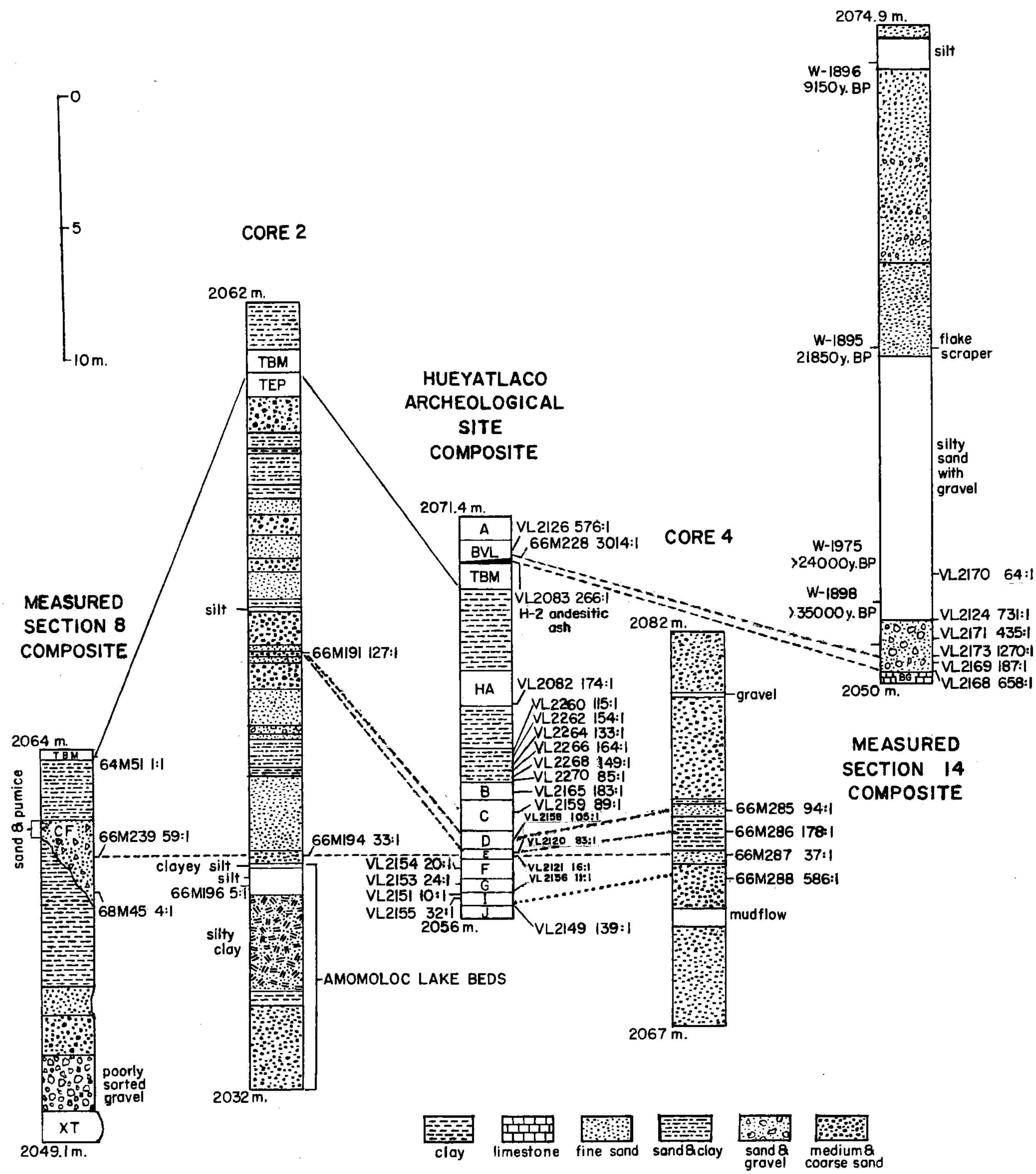

Figure 2. Sample numbers in stratigraphic sections and cores from the 5 main localities shown in figure 1. Dashed lines = diatom biostratigraphic correlations. Dotted lines = cyst biostratigraphic correlations. Long solid lines = lithostratigraphic correlations. Samples are described in previous publications by VanLandingham.

BED	STRATIGRAPHIC DEPOSIT	TOTAL SAMPLES	MAIN SAMPLE	CYST/DIATOM AGE ASSESSMENT	MAIN SAMPLE EXTANT CYST TAXA	MAIN SAMPLE EXTINCT CYST TAXA	MAIN SAMPLE EXTANT DIATOM TAXA	MAIN SAMPLE EXTINCT DIATOM TAXA	MAIN SAMPLE P:C RATIO
1	Irwin-Williams Unit A (modern soil)	3	VL2084	Postglacial, Recent	8	0	14	0	13:1
2	Barranca de Caulapan, silty sand above Bed 3	1	VL2170	Wisconsinan Glacial	1	0	37	0	64:1
3	Barranca de Caulapan, brown gravelly sand grading down into gravel (up to ca. 2 m above Balsas Group limestone)	5	VL2173	Sangamonian Interglacial	2	0	57	6	1270:1
4	Buena Vista Lapilli (BVL)	5	66M228	Sangamonian Interglacial	8	2	56	7	3014:1
5	H-2 Andesitic Ash (base of BVL)	1	VL2083	Sangamonian Interglacial	15	8	35	5	266:1
6	Tetela Brown Mud (TBM)	3	64M45	Sangamonian Interglacial	3	2	120	15	1:1
7	Diatomite at La Mata in upper Qv alluvium unit of Valsequillo Gravels	5	65M259	Sangamonian Interglacial	1	0	39	4	13:1
8	Lahar member of Valsequillo Gravels	1	66M147	Sangamonian Interglacial	3	1	59	2	19:1
9	Hueyatlaco Ash (HA)	3	VL2082	Sangamonian Interglacial	6	2	27	10	174:1
10	Unnamed beds below HA (sand grading laterally into clay)	11	VL2268	Sangamonian Interglacial	2	0	75	7	249:1
11	Irwin-Williams Unit B*	4	VL2165	Sangamonian Interglacial	3	2	145	10	183:1
12	Irwin-Williams Unit C*	4	VL2159	Sangamonian Interglacial	2	0	30	2	89:1
13	Irwin-Williams Unit D	7	VL2158	Sangamonian Interglacial	2	0	107	8	235:1
14	Irwin-Williams Unit E (top)*	22	VL2120	Sangamonian Interglacial	5	3	120	17	83:1
15	Irwin-Williams Unit E (bottom)*	21	VL2121	Sangamonian Interglacial to Illinoian Glacial	4	1	101	11	16:1
16	Irwin-Williams Unit F	7	VL2154	Sangamonian Interglacial to Illinoian Glacial	1	0	72	6	20:1
17	Irwin-Williams Unit G	13	VL2153	Sangamonian Interglacial to Illinoian Glacial	2	1	69	1	24:1
18	Irwin-Williams Unit I*	17	VL2151	Sangamonian Interglacial to Illinoian Glacial	2	1	103	7	10:1
19	Irwin-Williams Unit J	6	VL2149	Yarmounthian Interglacial	19	3	142	5	139:1
20	Atoyatenco Lake Beds	3	65M260	Preglacial Pleistocene to Nebraskan Glacial	8	1	30	5	5:1
21	Detrital interbed within the Xalnene Tuff (XT)	1	VL2346	Preglacial Pleistocene ca. 1.3 m.y.	11	4	34	6	40:1
22	Amomoloc Lake Beds	4	66M196	Upper Pliocene to Preglacial Pleistocene	24	7	35	3	5:1
	TOTAL NUMBER OF CYST/DIATOM SAMPLES	147							

* = contains artifacts

Table 1.

Figure 3. Generalized composite chronology of the 22 diatom/cyst-bearing beds in the Valsequillo region. Beds are in sequence. Note: all diatom/cyst beds with early man artifacts are older than Wisconsinan Glacial (> 80,000 yr. BP) and are younger than Yarmouthian Interglacial (< 430,000 yr. BP).

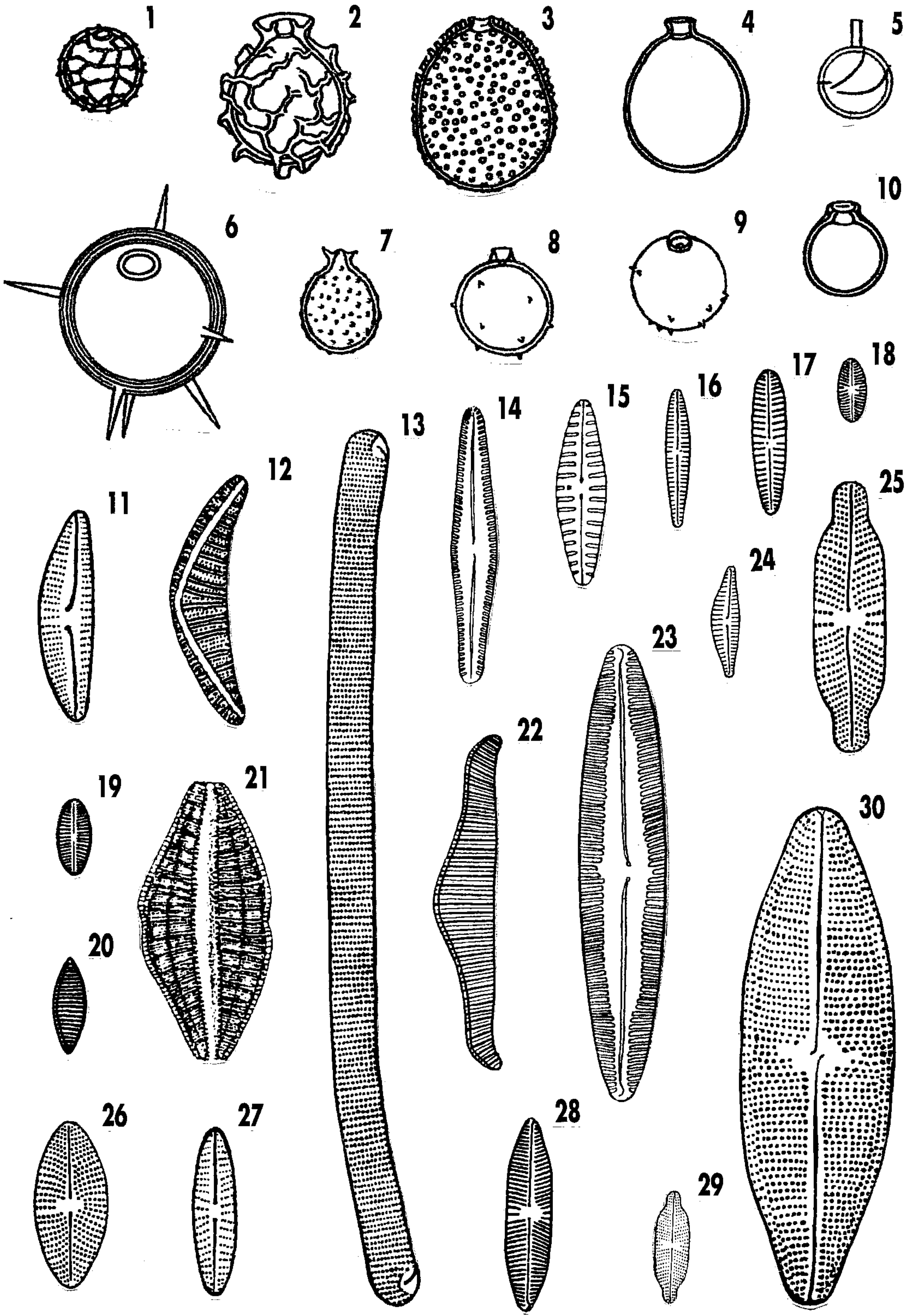

Figure 4. Age diagnostic cysts and diatoms from the Hueyatlaco site and surrounding area. Most of these were extinct by the end of the Sangamonian Interglacial.

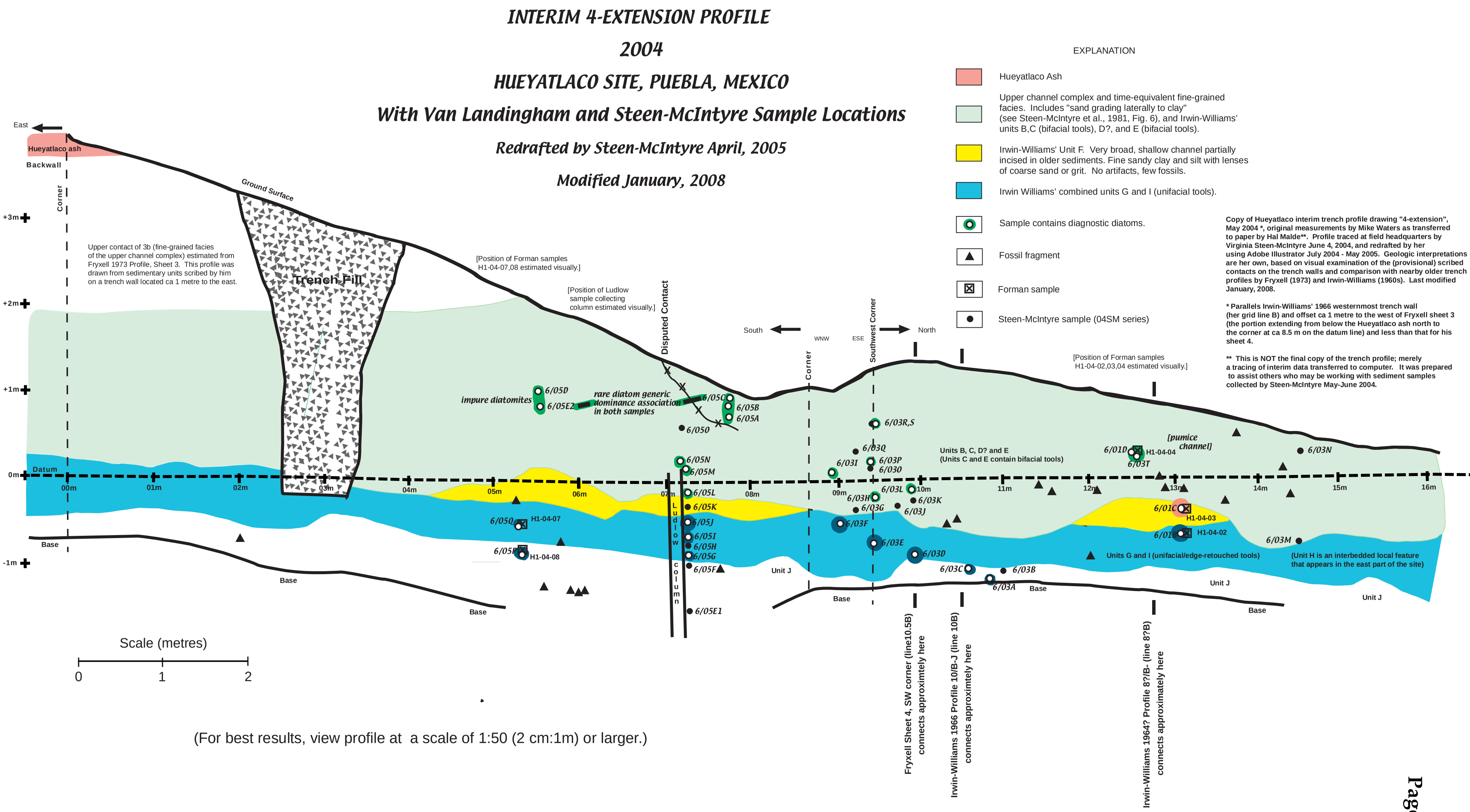

Figure 5. Profile of 2004 excavations at Hueyatlaco. Diatoms and cysts from five samples (6/05D, 6/05E2, 6/05C, 6/05B, and 6/05A) correlate across and through the disputed contact (unconformity) of Mike Waters. Note: the distance between these samples is < 2.2 m., i.e., an unconformity is very unlikely.