Predicting the "Shadowless Moment" at Monte Albán

by

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In a paper presented to the Mexican Society of Geography and Statistics in 1932, Zelia Nuttall called attention to the principle of zenithal sun observation among the civilizations of the New World and specifically suggested that the so-called Dupaix Monument at Monte Albán be investigated with this function in mind. (1) Though her suggestion seems never to have been acted upon -- possibly because of the advanced state of disrepair in which the Dupaix Monument was found -- a report on the so-called zenith tube identified in Mount P was initially published by Aveni and Hartung in 1975 and elaborated in detail in 1981. (2,3,4) The latter authors have argued for the orientation of Mound J (the 'observatory' at Monte Albán) to Mount P and more especially to the rising point of Capella as an indicator of the date on which the first zenithal passage of the sun occurs -- the heliacal rising of Capella having taken place on or about May 8 during the third century before Christ.

Without commenting on the merits of the Capella hypothesis, the present authors wish to report more fully on the 'slanted shaft' in Mound P whose presence Aveni and Hartung noted but which they considered to have been 'intended as a drain'. (5) We concur instead with the alternative explanation they offered, namely the 'remote possibility' of its having served as 'an observing device to channel solar light into the tube. (6)

The inclined tube consists of an opening approximately 15 cm square framed by carefully cut and fitted stones. The skyward opening of the tube lies 1.45 m to the east of the opening of the zenith tube and emerges in the top surface of Mound P, unlike the zenith tube itself which opens skyward in the third step down from the pyramid's surface. The inclined tube has an overall length of approximately 2.1 m and opens into the zenith tube some 0.83 m below its upper end. Although the inclined tube was clogged with dirt when found, the present authors were able to remove enough soil from it to make preliminary measurements of its horizontal orientation and its vertical angle. Taken with a surveyor's compass, the observations yielded an azimuth of 94º for the axis of the inclined tube (i.e. 4º south of east) and an angle of 38.8º from the horizon. (These readings may be subject to refinement once the tube is cleared of debris.)

Using these data as a point of departure, the authors calculated that at the latitude of Monte Alban (17º02' N.) the sun will intercept the opening of the inclined tube on those days of the year when it has a declination of approximately 7.5º north latitude, namely April 9-10 on its northward passage and September 3-4 on its southward passage. However, because the opening of the tube subtends an arc of at least 4º, the light of the sun will begin to appear in the tube as early as April 5 and continue through April 13 on its way northward and reappear on August 31 through September 8 on its way southward.

Through both of these nine-day periods, the image of the sun would be seen on the back-wall of the zenith tube each morning about 9:00 A.M. local time. (See Table 1 below.) Whether or not a mirror was employed to reflect light down the zenith tube (a possibility suggested by Aveni and Hartung), the inclined tube could have served to predict the 'shadowless moment' described by Zelia Nuttall a full thirty days in advance of the northward passage of the vertical sun and 20 days ahead of the 260-day cycle of the sacred almanac which ended on April 30. (7) If this, indeed, was its function can only be decisively demonstrated when and if the inclined tube is completely freed of debris and it is tested *in situ*.

References

1. Zelia Nuttall, "Communicación sobre un Monumento en Monte Albán de gran importancia", Boletín de la Sociedad Mexicana de Geografía y Estadística, Vol. XLIV, (1932), p. 24.

2. Anthony F. Aveni, "Possible Astronomical Orientations in Ancient Mesoamerica," Archaeoastronomy in Pre-Columbian America, Austin: Univ. of Texas Press, 1975, p. 173.

3. Horst Hartung, "A Scheme of Probable Astronomical Projections in Mesoamerican Architecture," Archaeoastronomy in Pre~Columbian America. Austin: Univ. of Texas Press, 1975, p. 201.

4. A. Aveni and H. Hartung, "The Observation of the Sun at the Time of Passage Through the Zenith in Mesoamerica," in Archaeoastronomy, No. 3 (JHA, xii (1981), S51-S70

5. Ibid., S66.

6. Ibid., S66.

7. For a discussion of the 260-day sacred almanac and its role at Monte Albán, see the senior author’s book, Cycles of the Sun, Mysteries of the Moon: The Calendar in Mesoamerican Civilization, Austin: University of Texas Press, 1997, pages 92-95.

TABLE 1.

ALTITUDE AND AZIMUTH OF THE SUN ON APRIL 9TH AT MONTE ALBÁN

(As calculated by the Astronomical Applications Department, U.S. Naval Observatory, Washington, D.C. 20392-5420)

LATITUDE = 17º 02’ N.
LONGITUDE = 96º 42’ W.

Time	Altitude	Azimuth (E of N)
h m	0	0
06:00	-4.5	80.5
06:15	-0.9	81.7
06:30	2.9	82.7
06:45	6.3	83.8
07:00	9.9	84.9
07:15	13.4	85.9
07:30	17.0	86.9
07:45	20.6	88.0
08:00	24.1	89.0
08:15	27.7	90.1
08:30	31.3	91.2
08:45	34.9	92.4
09:00	------------ 38.5 -----------------	93.6
09:15	42.0	94.9
09:30	45.6	96.4
09:45	49.2	98.0
10:00	52.7	99.7
10:15	56.2	101.8
10:30	59.7	104.1
10:45	63.2	107.0
11:00	66.6	110.5
11:15	69.9	115.1
11:30	73.1	121.3
11:45	76.0	129.9
12:00	78.5	142.4
12.15	80.2	160.3
12:30	80.8	182.7
12:45	79.9	204.4
13:00	78.0	221.0

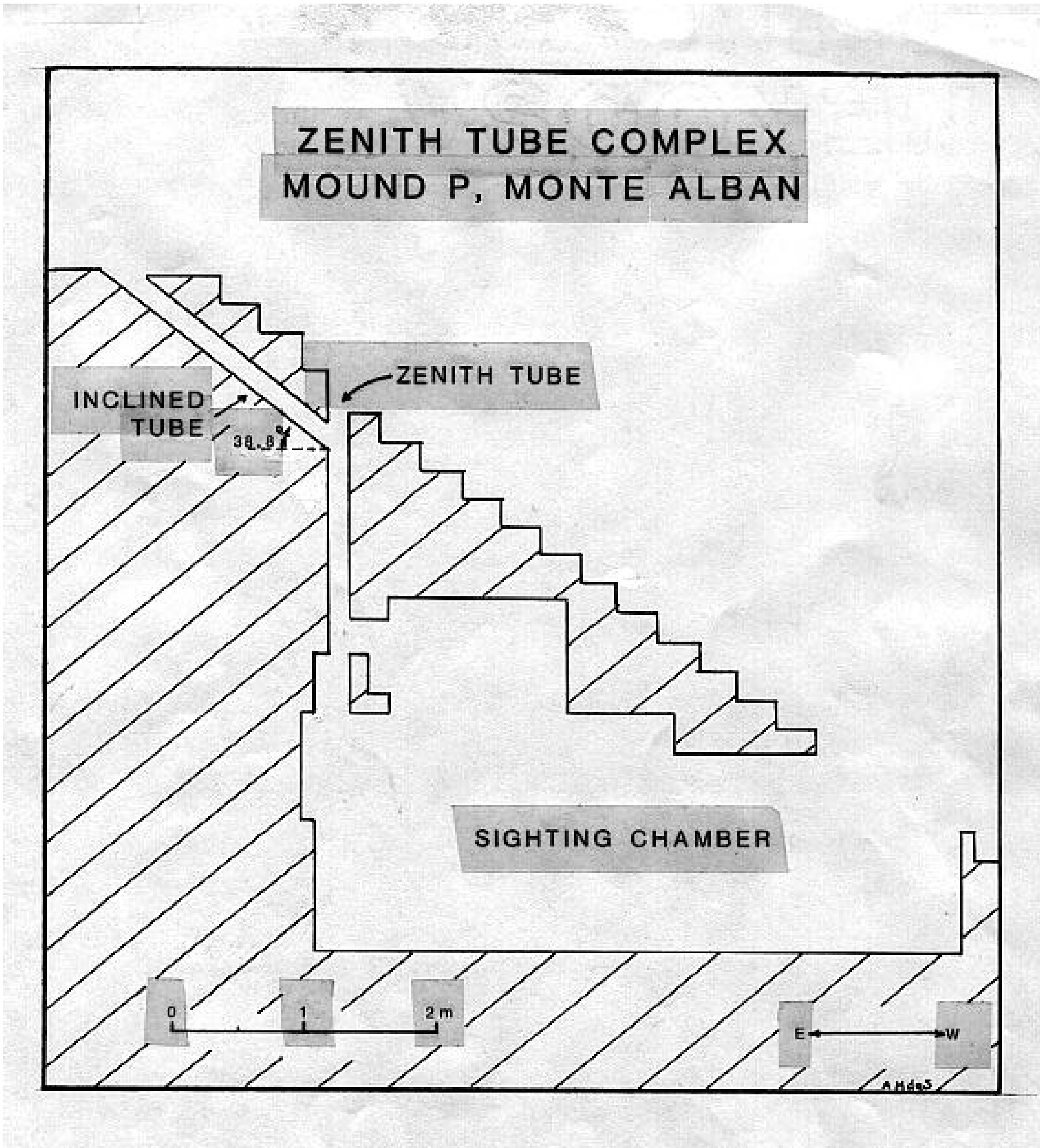
ZENITH TUBE COMPLEX
MOUND P, MONTE ALBAN
INCLINED TUBE
ZENITH TUBE
SIGHTING CHAMBER
0
1
2 m
E
W

Figure 1.

Figure 2. The opening of the inclined tube appears in the lower part of the picture, overgrown by grass and choked with dirt. It lies almost directly east of the zenith tube, whose opening is marked by the legs at the top of the picture.

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Figure 3. The intersection of the inclined tube with the zenith tube is marked by the carefully cut and fitted stones just behind (below) the small plant in the middle of the picture.

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