ASTRONOMICAL ORIENTATIONS OF IZAPA SCULPTURES

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This Thesis, by V. Garth Norman, is accepted in its present form by the Department of Anthropology of Brigham Young University as satisfying the thesis requirement for the degree of Master of Science.

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To Cheryl

My help and companion through thick and thin.

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The Society for Early Historic Archaeology grace- ously provided travel expenses enabling me to conduct two archaeoastronomy field trips to Izapa, Mexico, in 1976 and 1978 for which I am most grateful. Ross T. Christensen was very helpful in expediting my first request on short notice in order for me to arrive at Izapa in time for the summer solstice.

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I express appreciation to Stephanie Bird for editor- ial and proofreading assistance during the final manuscript preparation. My wife, Cheryl, to whom this volume is grate- fully dedicated, assisted in countless ways throughout the entire study. She encouraged me to the end and typed the several drafts and final manuscript.

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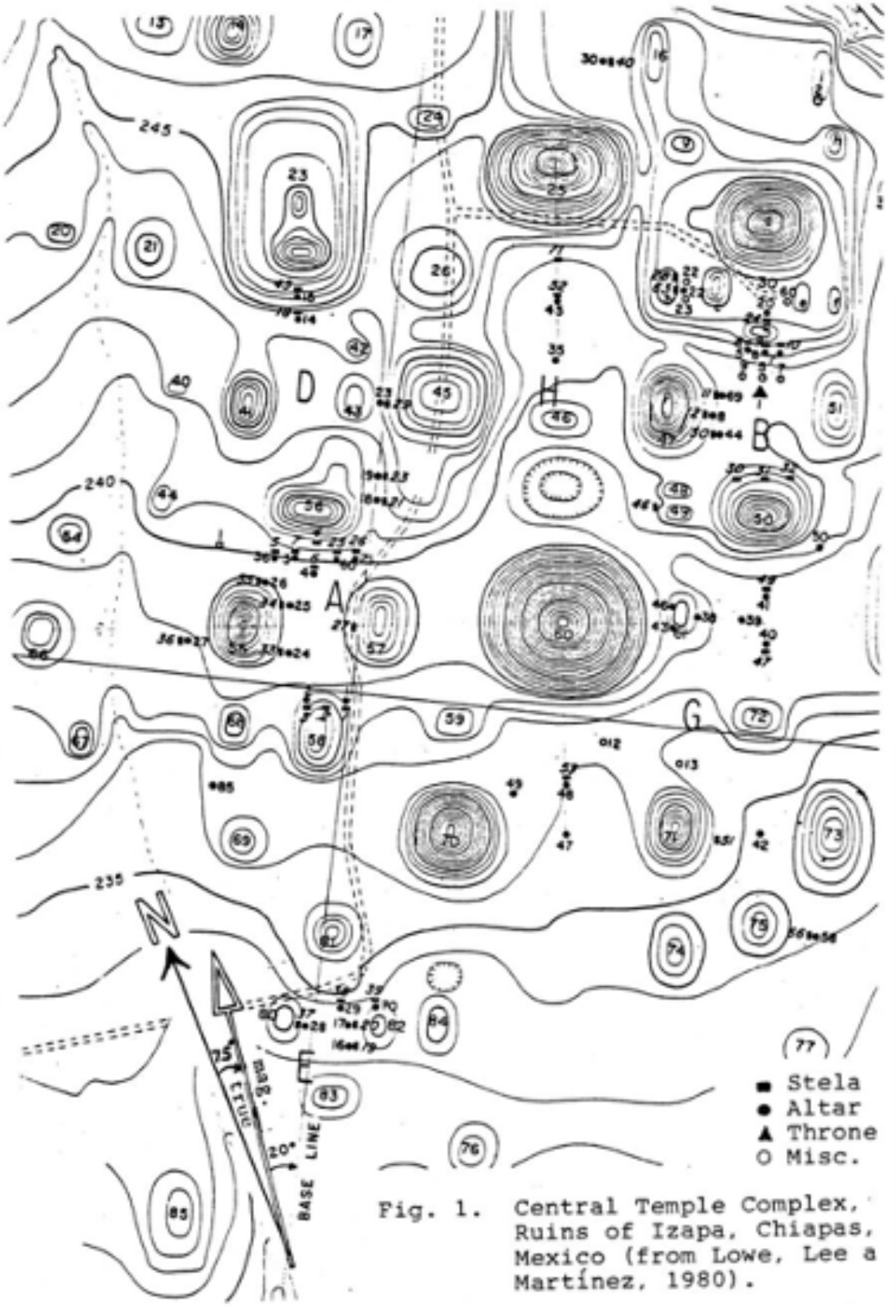

Fig. 1. Central Temple Complex, Ruins of Izapa, Chiapas, Mexico (from Lowe, Lee & Martínez, 1980).

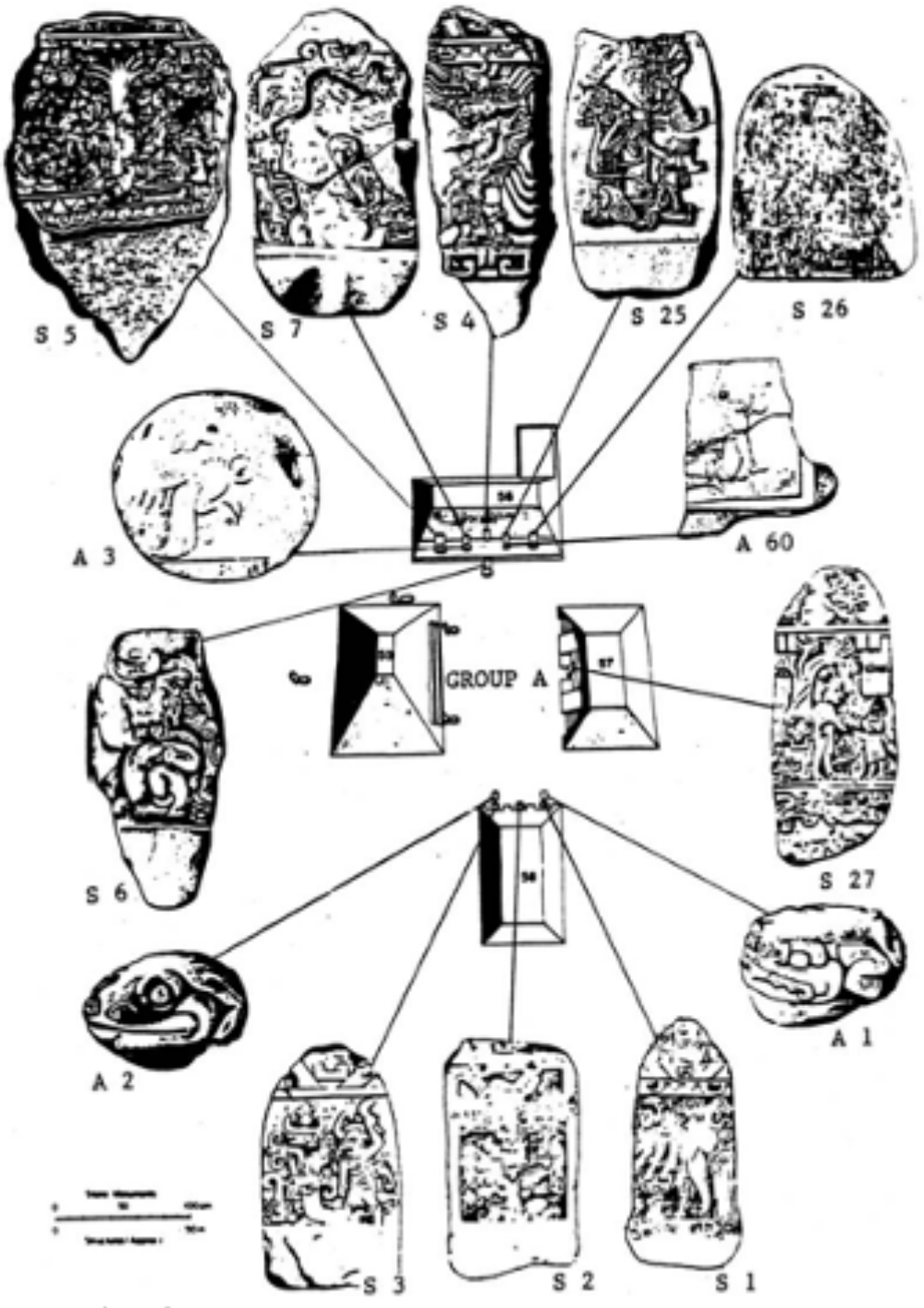

Fig. 2. Group A Monuments, Izapa
(from Lowe, Lee, and Martinez, 1980)

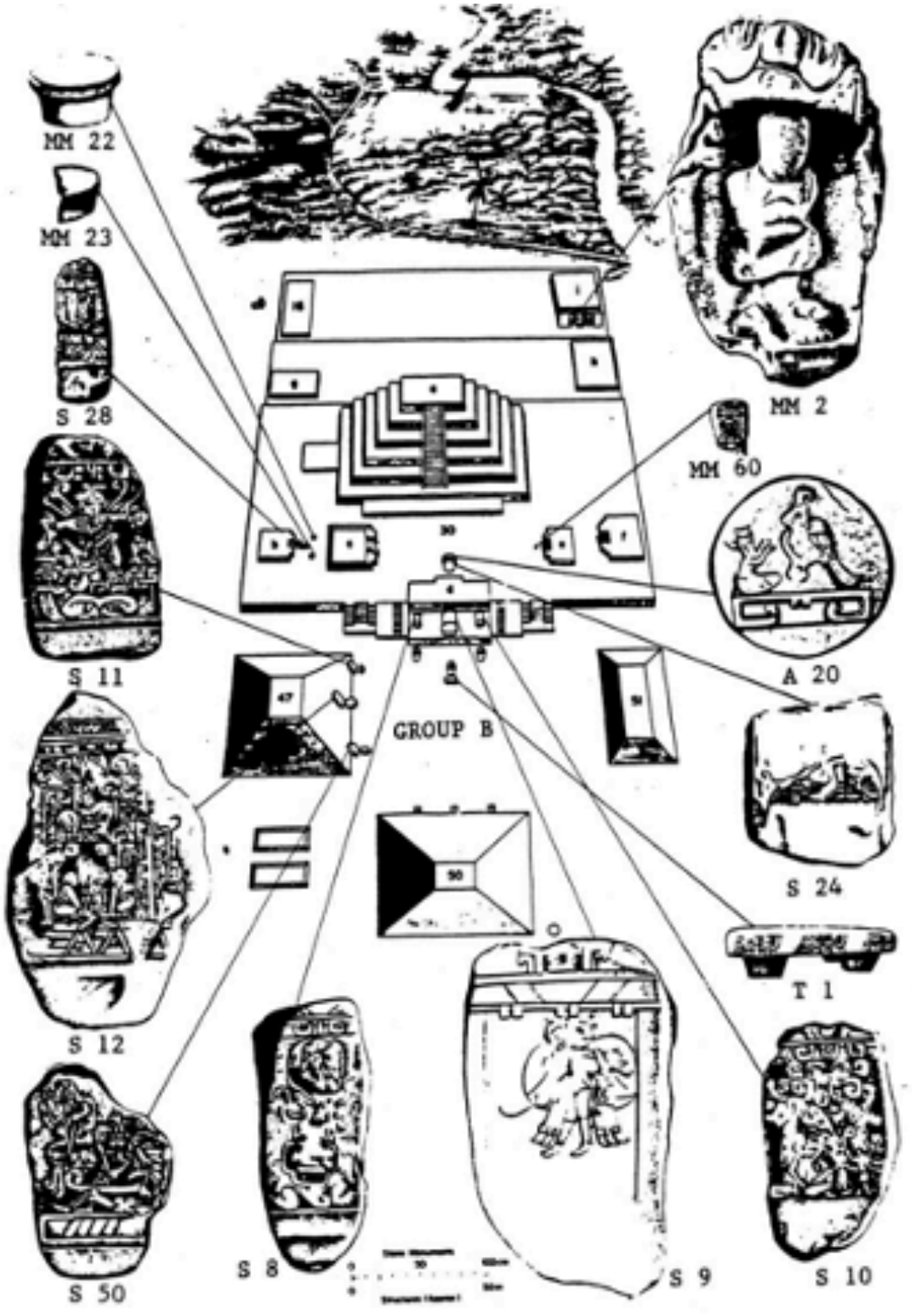

Fig. 3. Group B Monuments, Izapa
(from Lowe, Lee, and Martinez, 1980)
(Stela 89 is not illustrated.)

CHAPTER 1

THE PROBLEM AND ITS SETTING

Statement of the Problem

This research proposes to identify any astronomical basis in the layout of sculptures at Izapa which may have reference to iconographic themes and symbols.

The Preclassic archaeological site of Izapa located in the southern tip of Mexico near the Pacific Coast is characterized by a large number of eroded mounds arranged in plaza complexes with associated stone monuments (fig. 1). Izapa is best known for its unsurpassed array of sculptures within the temple complex, which are carved in a distinctive low-relief narrative style termed Izapan for this name site. The Izapan style represents a transitional cultural period spanning several hundred years between the earlier Olmec and the later Classic cultures. Fragmentary remains of Izapan style sculptures are found discarded at many other sites scattered throughout much of southern Mesoamerica. Only at Izapa are they found intact in their presumed original Pre-classic settings. Thus Izapa assumes great importance for the study of the Izapan cultural period of Mesoamerican civilization.

Recent in-depth analyses of Izapa iconography (Norman 1973, 1976) strongly suggest that Izapa sculptures are arranged in networks of astronomical alignments with iconographic reference to cyclic extreme declination points of planets on the horizons. Several factors in particular lead to this hypothesis. First, the monuments are in a setting of Preclassic earthen mounds which suggest that at least some carvings could retain their original locations. Archaeological excavations have not been able to determine precise dates when the monuments were set up (Lowe, personal communication) ,- nevertheless, they are predominently in a recognized Late Preclassic Izapan art style (Norman 1976).

A second factor is an abundance of carvings (49), that can be examined in the two main groups, A and B, which are the focus of this study. Group A (fig. 2) consists of 15 standing stelae and 12 altars. The Group B central plaza (fig. 3) consists of 14 standing stelae or monuments, 7 altars and a throne. The sculptures are arranged in rectangular plazas facing inward at the base of earthen mounds. The site axis of 21 degrees and low level mounds on the eastern side of both plazas, provide an open view toward the eastern horizon from these monument groups which accomodate the range of astronomical angles defined by

the cyclical extreme positions of planets on the horizon (see appendix A).

A third factor is a strong implication, by visual impression and also associated sculptural themes of Stelae 8, 9, and 10, as previously interpreted (Norman 1976), that the three adjacent pillar-ball monuments are planetary- symbols for the moon, sun, and possibly Venus, respectively As such the triangular positioning of the pillar-ball monuments and general directional orientations within a 30- degree deviation from the east-west axis is suggestive of potential astronomical alignments.

The Subproblems

The first subproblem. The first subproblem is to determine astronomical alignments of sculptures and their ' structural patterns. This problem iS investigated in chapter 3.

There is a high degree of probability for chance alignments in such a large grouping of mounds and monuments at Izapa, with a potential total of ten separate angles and twenty observation points for the sun, moon, and Venus, all within a 15-to-30-degree span from the east-west line, except for the equinox (table 1). Therefore, consistent structural orientation patterns must exist to confirm many astronomical alignments.

Prior to excavations initiated in 1962 by the BYU-New World Archaeological Foundation (hereafter NWAF), most monuments were fallen, An effort was made by the NWAF team to reset them in their calculated original positions. A few upright monuments partially or completely covered by erosion deposits were raised vertically to the present ground level. Many stelae were fallen, but original upright positions were closely approximated for most by their asso- ciated altars in situ. Determination of original positions for obtaining precision readings of many potential astro- nomical alignments is problematical. But such precision is not the only criterion for confirming orientations. If a consistent pattern of alignments should be found this would help resolve the question of original settings, especially if cosmic symbols on some sculptures should correspond to their planetary alignments.

Various possibilities for astronomical alignments of sculptures are (1) a sight line on two or more standing stones, (2) a line across a standing stone from a flat altar or throne as a sighting station, (3) a right angle to the sculpture face, or (4) parallel line with the sculpture face, and (5) two

standing stones bracketing the visible planet. Some sculptures could be oriented with architecture on astronomical alignments.

The meaning of a monument alignment might be read in several ways. It could apply to any monument in an alignment of several carvings. It might be applicable to the heel stone sighting station or to the distant sculpture on the sight line. An altar alignment could apply to the altar, to its accompanying stela, and/or to the distant sight-line sculpture. A monument alignment could apply to an associated stela as with the three pillar-ball monuments in Group B.

The second subproblem. The second subproblem is to determine if any potential alignment systems originated with Izapa builders and if similar systems are found in other areas as a validity test. This problem is investigated in chapter 4.

In the absence of datable archaeological remains associated with sculptures in situ, a comparison of the sculptural layout with the layout of mounds may help estab- lish contemporaneousness. Also, the existence of an Izapa sculptural alignment system elsewhere could help validate the Izapa system.

The third subproblem. The third subproblem, inves- tigated in chapter 5, is to analyze cosmic iconographic themes and symbols with respect to potential alignments.
If present, these relationships can logically be clues to the meanings of both mound and monument layouts. Further confirmation of alignment systems, and, most importantly, the meaning of such orientations, might be found in icono- graphic planetary symbols on sculptures that may correspond to astronomical alignments of monuments.

The Hypotheses

The research hypothesis is that Izapa sculptures are arranged in a network of astronomical alignments with icono- graphic reference to cyclic extreme declination points of planets on the horizons.

- The first subhypothesis is that astronomical align- ments of Izapa sculptures were created in structured patterns.

- The second subhypothesis is that astronomical alignments of sculptures originated with Izapa builders, not of later constructions, and that the system spread to other culturally related sites.

- The third subhypothesis is that cosmic iconographic themes and

symbols are codified to relate to the specific planetary alignments involved.

The Delimitations

This study considers astronomical alignments on the sun, moon, and Venus which are celestial symbols represented on the sculptures (Norman 1976). The study attempts to identify all potential alignments but analyzes in greater detail those that emerge into definable patterns. The two main sculptural groups, A and B, at Izapa, with a total of 49 monuments, are the focus of this study. The several other groups with more limited numbers are not considered.

Cosmic themes and symbols on the sculptures will not be examined in-detail for their indepth meanings with ref- erence to astronomical alignments, but will be analyzed principally for confirming alignments, assessing their significance, defining functional patterns, and formulating hypotheses for further research.

All possible alignments are not exhausted, but at- tention is focused upon visible sightings on the horizon.
Also, some potential alignments, undeterminable from-data limitations, are considered in instances where implications of iconographic cosmic ties exist.

Precision readings closer than about 30 minutes of arc cannot be expected with the number of monuments that had to be reset from their fallen positions, although errors could be slight in most instances. Alignments involving errors of up to two degrees might be resolvable. While a problem of precision limits some studies to features that must be exact, Hawkins (1975: 145) observed that a margin of two degrees off is not unusual and not noticeable for sightings involving alignments with two objects at short range.

Obviously, the meaning behind such an alignment must be a strong determining factor in considering its validity. The comparative investigation of related sites as confirmatory evidence of a sculptural alignments system is limited to library research of one site, Uaxactun, by consequence of limited knowledge of contemporary sites with stela/altar complexes in situ as at Izapa.

Assuming the sculptural layout is part of an overall site planning system, it can only be comprehended fully in terms of the whole through future

research. Site planning will be analyzed only when it is considered essential to defining sculptural orientations as a system.

Definition of Terms

Archaeoastronomy. Archaeoastronomy is a term applied to the study of astronomy as revealed in the archaeological record, and comes under the general category of the study of the history of astronomy. As an archaeological tool it is the application of astronomical knowledge and techniques for analysis of archaeological remains.

Ethnoastronomy. Ethnoastronomy is the study of cosmic knowledge among different cultures, which can be applied to analyzing the archaeological remains.

Cyclic declination. Cyclic declination is the azimuth of an extreme cyclic point of a planet on the horizon, such as sunrise at the winter solstice.

Assumptions

The first assumption is that Izapa, like other Meso- american archaeological sites, has an astronomical basis in its site planning. The second assumption is that the Izapa mound complexes of monuments are a structural part of the temple or ceremonial center. The third assumption is that Izapa is not unique, that it is typically Mesoamerican, so that discoveries at Izapa which appear to be unique are ultimately relatable to other Mesoamerican sites.

The Importance of the Study

Astronomical alignments of standing stone complexes as at Stonehenge and throughout the British Isles is virtually unknown in the Americas. Furthermore, the meanings of such standing stone alignments, beyond assumed calendrical functions, are problematical in the absence of associated iconographic and ethnographic interpretative data.

Assuming Izapa sculptures are astronomically oriented, they will stand in the forefront in importance for analyzing meaning in such alignments, because of their rich iconographic content.

Archaeologists have been slow to utilize the tool of astronomy in analyzing site planning. Consequently, astron- omers have taken the lead in the anthropological field with the new discipline of archaeoastronomy. This study proposes to develop a system of analysis

that can be a useful tool for archaeological field studies through utilizing precision mapping techniques.

Abbreviations

A number of abbreviations are employed, principally in reference to astronomical alignments of sculptures in tables. These are as follows:

Al	alignment		
SS	summer solstice		
ws	winter solstice		
Venus+	maximum cyclic delination		
moon+	maximum cyclic declination	moon-	minimum cyclic
declination			
Md.	mound		
A or a	altar		
S	stela		
MM or M	miscellaneous monument		
Th	throne		

CHAPTER 2

REVIEW OF RELATED LITERATURE

In recent years there has been a steadily growing interest in a new field of scientific investigation called archaeoastronomy which deals with the astronomy of prehistoric and non-industrial societies. It deals mainly with astronomical alignments of architecture and standing stones for calendrical determination of dates in the agricultural ' and ceremonial year. An allied field of ethnoastronomy re- constructs lifeways, astronomical techniques, and ritual through textual analysis, ethnology, and interpretation of ancient iconography (Baity 1973).

Studies of Stonehenge as an ancient observatory (Hawkins 1963, 1964) and other standing stones in the British Isles and France (Thom 1967, 1971) have been the main focus for this growing interest. In addition, we have known for many years that some ancient Maya structures were probably used as observatories, such as the Caracol at Chichen Itza and the Group E structures at Uaxactun (Morley and Brainard 1946: 287, fig. 32; 300, fig. 33). However, serious studies in this area are just beginning (e.g. Aveni 1975; Aveni et al. 1976). A recent comprehensive overview of archaeoastronomy by Baity (1973) as a viable research approach is a reflection of the current interest in such studies, particularly in the Americas.

Studies thus far in the Americas have focused almost exclusively upon architecture even though interest has grown principally from the studies of Hawkins at Stonehenge (1963, 1964) and Thom (1967, 1971) and others of standing stones throughout the British Isles and France.

Comparatively little has been done in the astronomical study of standing stones in the New World. In Peru, Posnansky (1942) and others have suggested strongly that astronomical orientations of Tiahuanaco megalithic monuments are based on an agricultural calendar, but these studies are disputed. Recently standing stones at Mystery Hill, New Hampshire have been shown to mark the four horizon points of the solstices (Fell 1976: 206).

On the Mesoamerican scene, we have known for many years of the standing Stelae 10 and 12 at Copan marking the horizons on opposite sides of the Copan Valley about four miles apart. They are on a sunset line on April 12 and are believed to mark an important date initiating the agricultural cycle with the burning of milpas (Morley and Brainerd 1946:

132, fig. 4). It seems surprising that such use of monuments has been little explored over the years in Mesoamerica.

Recently, a second isolated instance has been observed at Uxmal of an astronomical sighting from a Temple doorway across a standing stone. From the central doorway

of the Governor's Palace one can sight at a right angle from the building axis across a stone marker in the courtyard to the distant site of Nohpat on the horizon. The azimuth is that of the maximum southerly declination of the Venus rise around A.D. 750 (Aveni 1975: 184-89). At Piedras Negras an astronomical southern alignment from a temple doorway, across Altar 2, demonstrated in the site layout (Hartung 1975, fig. 2), is suggestive of possible undetermined orien- tations in other monuments as well.

Although most archaeoastronomy studies are involved with architectural or megalithic and other stone orientations, there are various, more specialized studies such as the massive network of lines on the Nazca plains of Peru which Hawkins (1975) demonstrates are not astronomically oriented. Hatch's (1971) disputed study of potential astronomical orientations of channels on the La Venta pyramid is another example. Most recently we have learned of calendrical function in the many stone "medicine wheels" constructed on hilltops by the Plains Indians (Eddy 1977).

Until recently, archaeoastronomical studies have been championed by astronomers who, by nature of their discipline have been principally concerned with discovering the degree of astronomical knowledge achieved by prehistoric peoples from celestial observations. Such studies have held limited interest for archaeologists who tend to see sociocultural rather than scientific significance in standing stones and other astronomical orientations (e.g., Atkinson 1960). Some astronomers are now succeeding in gaining the interest of archaeologists and anthropologists by taking a broader view through interdisciplinary approaches to understand the full meaning of astronomical observations revealed in archaeological remains and through ethnoastronomical studies.

Significant strides have been made in this interdisciplinary effort in the America's through three conferences: in 1973 at Mexico City; in 1975 at Colgate University (Aveni 1975 and 1977); and in Santa Fe, New Mexico, in 1979 (Williamson 1978: 1).

As a further interdisciplinary effort on a worldwide scale, Ray A. Williamson and John B. Carlson of the Astron- omy Program, University of Maryland, are editing and publishing the Archaeoastronomy Bulletin, now in its third year. It is already serving a valuable role in striving to keep abreast of all published information and current research in archaeoastronomy (including ethnoastronomy).

Needless to say, some studies involving stellar alignments require the mathematical skills of astronomers, but sun, moon, and Venus cycles which are most basic can be easily studied by archaeologists in the field with basic data provided beforehand on the cyclic extreme rise-set azimuths, and inclined paths of rising for celestial objects at given latitudes. This data can be obtained from Aveni's Significant strides have been made in this interdisciplinary effort in the America's through three conferences: in 1973 at Mexico City; in 1975 at Colgate University (Aveni 1975 and 1977); and in Santa Fe, New Mexico, in 1979 (Williamson 1978: 1).

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A number of basic guidelines have been offered by Aveni (1975) and Reyman (1975). Aveni has employed sun and star shots to determine alignment azimuths in all of his field studies of architectural orientations. He points out that very few existing site maps can be trusted for designation of true North and the correct magnetic declination (Aveni 1975: 164), although they may be useful for preliminary study of building orientations that suggest celestial reference. Reyman (1975: 205) observes that investigators often fall short from "the lack of a consistent, systematic procedure for conducting fieldwork, coupled with the all to frequent use of unsuitable field equipment." He also point out the importance of gaining sufficient control of relevant ethnohistoric, ethnographic, and especially archaeological data, and of having an adequate theoretical approach, to be able to formulate specific field problems, hypotheses, and test implications.

In this broader discipline, archaeoastronomy studies should seek to answer such questions as: What knowledge did the ancients possess; how did knowledge of astronomical events interact with other aspects of their culture; what planetary attributes are associated with deity and why; what instruments were utilized for astronomical observations? (Coe 1975: 3).

CHAPTER 3

ASTRONOMICAL ALIGNMENTS STUDY OF SCULPTURES

Field Study at Izapa

In a preliminary study of the NWAF site map of Izapa I found evidence for possible astronomical orientations in the site planning in both mound and monument orientations.

Because precision readings necessary to confirm astronomical orientations were lacking in existing maps, it was necessary to make readings in the field. This required additional field study.

I made two field trips to Izapa during solstice periods to obtain data for this study. The initial trip was principally a feasibility study made during the summer solstice of 1976 in order to observe firsthand any solar alignments of sculptures, and to confirm the positions of monuments on the NWAF grid map. On June 21 the sun set directly over Mound 55 on the west center of the Group A plaza as seen from Stela 27 positioned centrally on the east ern side of the plaza. On the following morning the sun rose on an alignment of Stela 9 and 12 positioned centrally on the western and northern sides of the Group B plaza. Azimuth readings of all monuments in Groups A and B were made with a theodolite, with the assistance of Eduardo Martinez E., cartographer for NWAF, to determine their positions or compass azimuths with respect to each other (tables 9 and 10). Compass azimuths and photos were taken of the sunrise and of the volcanic peaks of Tajumulco and Tacana to confirm the Izapa map orientation.

Following the field trip, analysis of compass azimuths demonstrated a significant number of potential alignments, but unfortunately these were horizontal orientations and did not take into account the prospect for elevation adjustments for sighting on the eastern mountainous horizon. Reconstructed maps showing where sculptures now exist based upon compass azimuths alone were significantly different from locations according to the original NWAF grid map. A few azimuth readings proved to be inconsistent, evidently due to magnetic interference. These limited results and certain other data gaps necessitated further field study. Even though the desired results were not attained, this mapping effort demonstrated with a high degree of probability that some sculptures could be aligned by chance within a complex like Group B.

I made a second trip to Izapa conducted in December of 1978. Data for producing a map of the eastern mountainous horizon were obtained by taking a series of photographs of the horizon for tracing and by taking compass azimuths and elevation readings of distinct features on the horizon. Compass azimuths and photos were taken of the winter solstice sunrise with respect to terrain and monument alignments along the northern and southern sides of Groups A and B. To complete a remapping of the sculptures in Groups A and B, the position of each monument was fixed by triangulation azimuths and distance readings on other monuments (tables 9-12). The two solstice positions with monument orientations were the only astronomical alignments determined in the field for the eastern horizon. The results appear in figures 4, 5, and 6.

Analysis of Data

Horizon map and sculptural alignments

The horizon map with extreme cyclic planetary rise azimuths (fig. 4) was produced from field data in the following systematic steps:

1. A composite tracing of the horizon was produced from a series of overlapping photographs of the horizon which included both solsticial sunrises.

2. A compass degree scale was constructed based upon azimuth and elevation readings taken on seven specific horizon features including both solstices (table 8). Although some elevation reading discrepancies exist, the averages still allowed fairly accurate reconstruction of the astronomical horizon line.
3. Cyclic positions of the sun, moon, and Venus on the visible horizon were next established on the degree scale from their cyclic extreme declination angles.

4. Elevation adjustments were projected from reference to the fixed position of the summer solstice on the horizon, and the summer solstice astronomical (level) horizon azimuth of 65.63 degrees which happens to lie on an exact vertical axis with the Tajumulco volcanic peak.

5. The planetary horizon azimuths interpreted on the degree scale (fig. 4) were superimposed over the sculpture maps to reveal the full range of potential alignments (figs. 5 and 6).

Discussion

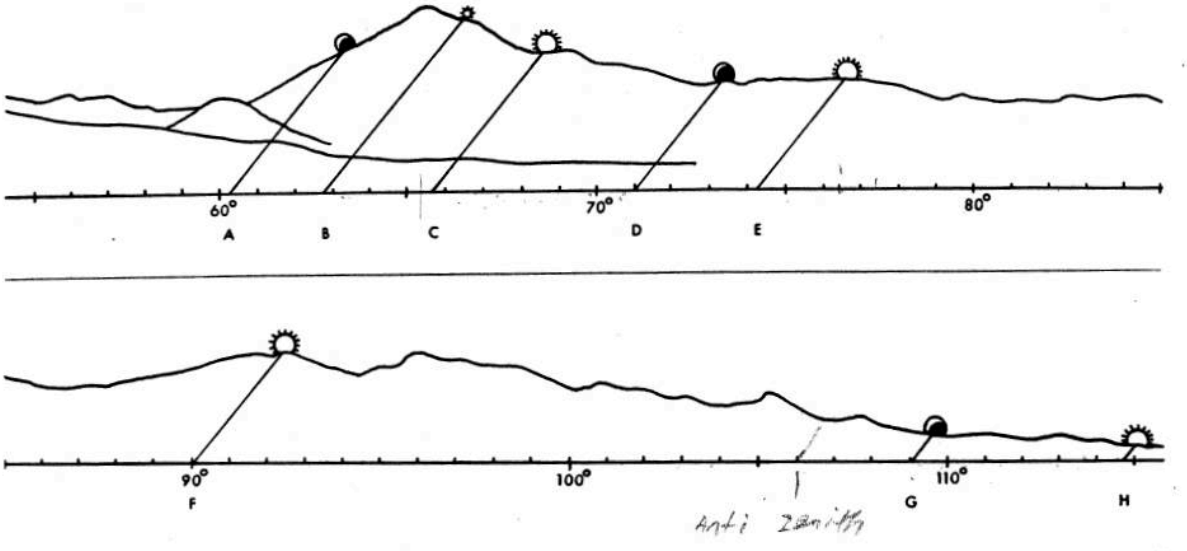
The monument maps (figs. 5 and 6) do not illustrate all potential alignments listed in tables 2 through 5. Those missing include alignments requiring further study and those which are considered to be questionable or, more probably, arbitrary. As noted previously, some potential alignments that cannot be confirmed from data limitations are still given priority if they harmonize with developed patterns. These will be clarified in the next chapter.

The maps clearly illustrate affirmative results from coordinating the horizon and monuments maps. Still the challenge remained to try and determine which alignments were intentional. First, consideration was given to original positioning of the monuments that had fallen and were reset upright by the NWAF excavation team. This was done by comparing the original positions, prior to resetting as indicated on the NWAF grid map, with the latest remapped positions. Differences in Group B were slight, but pronounced for some sculptures on the western side of the plaza. Nevertheless, the sculptures are from all evidences, in their original locations. Stelae 11 and 12 were excavated partially upright and were reset vertically in situ by NWAF. Although Stela 50 was removed to the Mexican National Museum of Anthropology, its position is still fixed by its altar which remains in situ.

The Group A map is problematic in a number of areas. Significant discrepancies were found on the western side of the plaza and in other areas due to removal of a number of sculptures from their original locations in Group A as shown on the NWAF grid map. Stelae 33 and 34, and their altars, and Stela 4 and Altar 2 have all been reset in relocated positions. Stela 1 and its altar, and Stelae 21, 23, and 25 have all been removed to museums. The proximity of grid stakes to sculptures on the western side strongly favors the original positions, and it is suspected that these carvings were relocated by local inhabitants to widen the plaza for a soccer field. Both the original and remapped positions are indicated on the Group A map for consideration. Consideration in chapter 5 of sculptural themes that relate to alignments may help resolve the question of original locations in dispute.

Table 1 gives azimuths of the full range of cyclical declinations for the sun, moon, and Venus with first gleam and full gleam positions on the eastern horizon plotted from the horizon map. Tables 2, 3, 4, and 5 show the full range of potential astronomical alignments with calculated positions revealing the degree of error by comparing alignment azimuths with first and full gleam positions listed in table 1.

A significant number of visible alignments, ten in Group A and at least nine in Group B, are within 0.5 degrees of first gleam azimuths. This fact leads me to conclude that Izapa builders in all likelihood made a conscious attempt to establish precise visual alignments.



A - Moon, Maximum, N
B - Venus, Maximum, N
C - Summer Solstice
D - Moon, Minimum, N
E - Sun Zenith
F - Equinox
G - Moon, Minimum, S
H - Winter Solstice

Fig. 4. Eastern Horizon Map, Izapa (with cyclical extreme rise points of the sun, moon, and Venus plotted on a degree scale). Southern extreme azimuth points for the moon and Venus, not shown, are on the same low level horizon as the winter solstice.

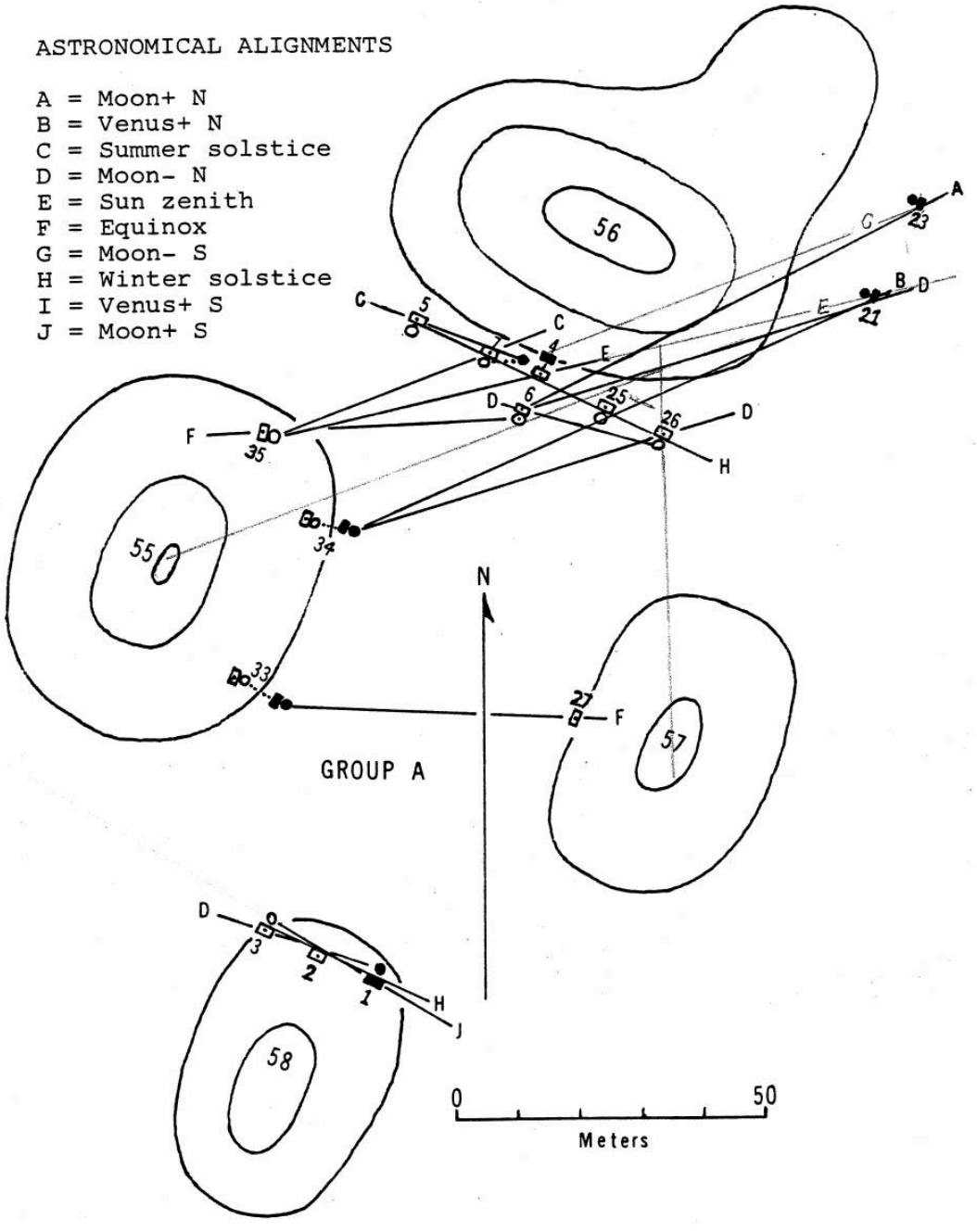


Fig. 5. Astronomical Alignments of Monuments, Group A, Izapa.
a o Positions from survey readings.
■ • Locations on original NWAF grid map.

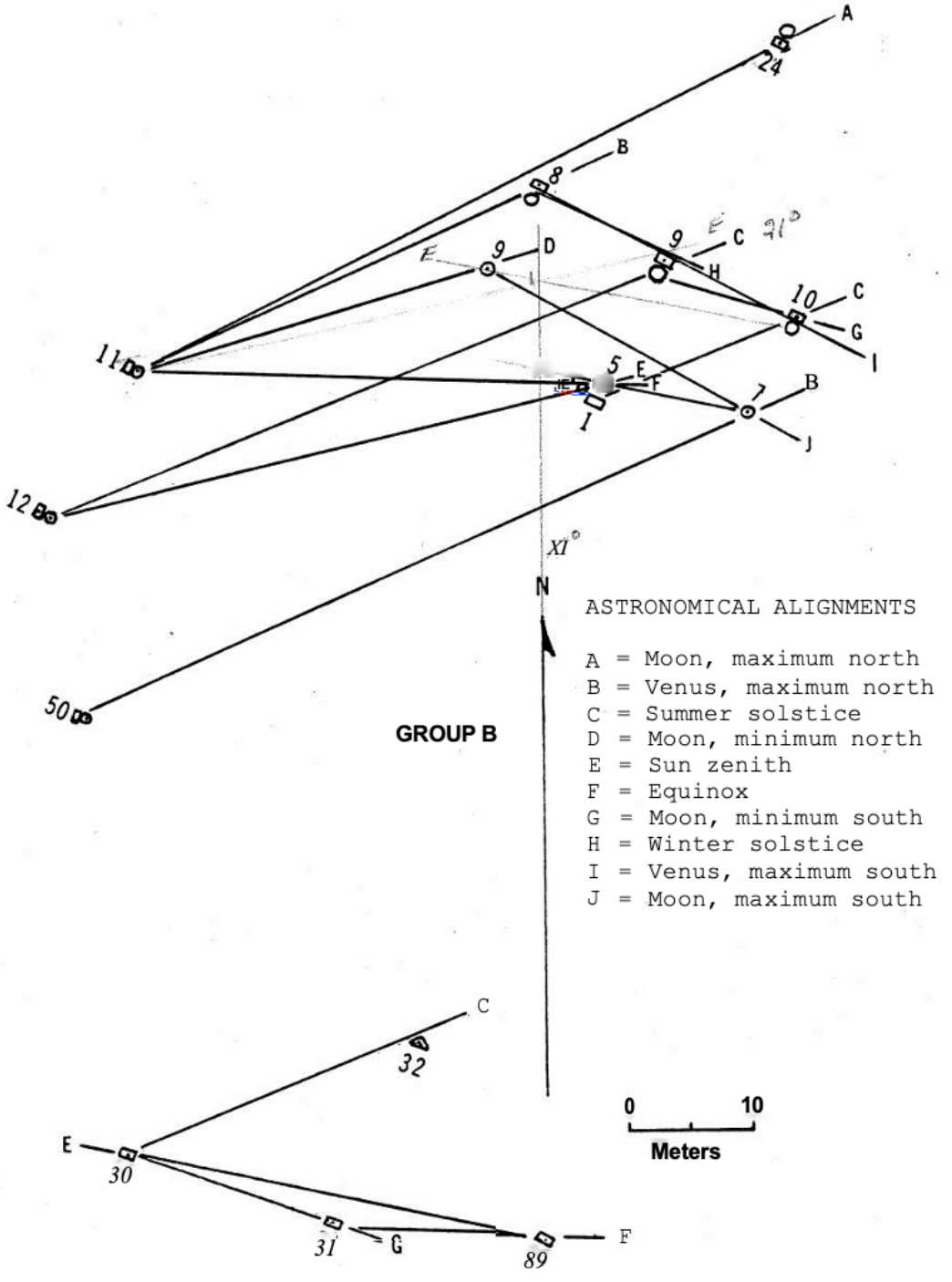


Fig. 6. Astronomical Alignments of Monuments, Group B, Izapa

Table 1: Sun, Moon, and Venus Cyclical Extreme Azimuths at Izapa (cf. fig 4)

Planet	Level Horizon Cyclical Extreme	Elevation Adjustment from Visible Horizon Map First Gleam/Full Gleam	
Rise Moon+	60.25°	62.4°	63.5°
Venus+	62.79°	66.5°	66.5°
Summer Solstice	65.63°	68.4°	68.7°
Moon-	70.99°	73.3°	73.6°
Sun Zenith	74.55°	76.8°	77.1°
Equinox	90.00°	92.5°	92.18°
Moon-	109.01°	109.7°	110.0°
Winter Solstice	114.37°	114.8°	115.1°
Venus+	117.21°	117.5°	117.5°
Moon+	119.75°	102.2°	120.5°
Set Moon+	240.25°	Undetermined: Western	
Venus+	242.79°	set azimuths could	
Winter Solstice	245.63°	range from near the	
Moon-	251.00°	level horizon to tree	
Equinox	270.00°	tops around 5 degrees	
Sun Zenith	285.45°	elevation.	
Moon-	289.00°		
Summer Solstice	294.37°		
Venus+	297.21°		
Moon+	299.75°		

Table 2

Monument Astronomical Alignments from 1976-1978 Surveys and Horizon Map, Group B, Izapa

From	To	Survey Azimuth	Astronomical Alignment	Calculated Position*
MM 9	MM 7	119.5°	Moon+ SE	0.7 before 1st gleam
S Ila	S 8	66.95°	Venus+ NE	0.45° after 1st gleam
S Ila	MM 9	75°	Moon- NE	1.4° after full gleam
S Ila	MM 5	92.2°	Equinox E	0.3° before 1st gleam
S 12a	S 9	68.5°	Summer Solstice NE	0.1° after 1st gleam
S 12a	MM 5	76.75°	Zenith NE	First gleam
S 50	MM 7	65.5°	Venus+ NE	1° before 1st gleam
S 8	S 9	120°	Moon+ SE	0.2° before 1st gleam
S 8	S 9	114.9°	Winter Solstice SE**	0.1° after 1st gleam
S 8	S 10	117.1°	Venus+ SE	0.4° before 1st gleam
S 9	S 10	113°	Winter Solstice	1.8° before 1st gleam
S 9a	S 10	108.5°	Moon- SE	1.2° before 1st gleam
S 30	S 31	110°	Moon- SE	Full gleam
S 11	S 24	64.28°	Moon+ NE	0.8° after full gleam

*ca. margin of error + .25°

**This sight line brackets the sun between Stela 8 (front) and Stela 9 (back).

Table 3

Possible Alignments Plotted From Monuments and Horizon Maps, Group B, Izapa

From	To	Azimuth	Astronomical Alignment	Calculated Position*
MM 9	S 12	242.5°	Venus+ SW, Md. 47 side	0.3° before last gleam
MM 5	S 50	238.5°	Moon+ SW, Md. 60 side	1.75° before last gleam
MM 5	S 10	72°	Moon-	1.3° before 1st gleam
MM 7	MM 5	281.43°	Zenith NW, ca. 283.5° at 4° elevation on side of Md. 47	2.° before last gleam
Th 1	S 10	68.5°	Summer Solstice Spatial adjustment with MM 5 from excavation photo	First gleam
S 89	S 30	283°	Zenith set, Md. 47 side	2.45° before last gleam
S 31	S 89	95°	Equinox rise	2.2 after last gleam
S 8a	S 11	248.5°	Moon- SW, Md. 47 side	3.6 before last gleam
S 9a	S 12	247.5°	Moon- SW, Md. 47 side	2.6° befpre ;ast g;eam
S 10a	S 50	242°	Venus (nonvisual, Md. 60)	1.9° before last gleam
S 9	MM 9	268°	Equinox set, ca. 2° adjustment on side of Md. 47	First gleam

*ca. margin of error in elevation adjustment + .25°
Elevation adjustments for visible planetary positions, undetermined for mound obstructions, approximate these angles.

Table 4

Monument Astronomical Alignments from 1976-1978 Surveys,
Group A, Izapa

From	To	Survey Azimuths	Astronomical Alignments	Calculated Position*
S 3	S 2	114.23°	Winter Solstice SE	0.6° before 1st gleam
S 35a	S 7	69.5°	Summer Solstice NE	0.8° after full gleam
S 35a	S 4**	78.2°	Zenith NE	1.1° after full gleam
S 6a	S 35	ca. 268°	Equinox W	Last full gleam
S 26a	S 6	286.42°	Zenith NW or Moon- NW	1.° after last gleam 1.78° before last full gleam
S 5	S 7, 25, 26	115.43°	Winter Solstice SE	0.3° after full gleam

*ca. margin of error in elevation adjustment + .25°
**Stela relocated from original mapped position

Table 5

Alignments Plotted from Monuments Map and Original
NWAF Grid Map, Group A, Izapa

From	To	Azimuth	Astronomical Alignment	Estimated Position
S 3a	S 1*	120°	Moon+ SE	First gleam
S 1a*	S 3	289°	Moon- NW	Last gleam
S 33a*	S 27	92.5°	Equinox E	First gleam
S 34*	S 26	73°	Moon- NE	First gleam
S 34a*	S 25	66.5°	Venus+ NE	First gleam
S 25a*	S 21*	66.5°	Venus+ NE	First gleam
S 6	S 21*	73°	Moon- NE	First gleam
S 6	S 23*	63°	Moon+ NE	First to full gleam
S 4*	S 5	286.5°	Zenith NW	1.° after last gleam
S 4a*	S 5	299.75°	Moon+ NW	Last gleam

*Monuments removed or relocated from original mapped positions (see map)

CHAPTER 4

EXTERNAL TEST OF THE SCULPTURAL ALIGNMENT SYSTEM

To test the validity of the Izapa sculptural alignment system, two approaches were utilized: (1) a study of Izapa site planning was made to determine if there is a related alignment system that can link a sculptural layout pattern to the original site planning; and (2) a study was conducted to determine if the Izapa sculptural alignment system exists at any other Mesoamerican site.

Izapa Site Planning and Sculptural Alignments Relationship

Comparing the Group B sculptural arrangement to the Izapa temple center layout, an apparent correspondence in directional and spacial groupings of numbers of mounds can be seen. The layout pattern of the three principle northern mounds, 23, 25, and 30a, corresponds to Stelae 8, 9, and 10 respectively. Mounds 54, 66, and 67, located centrally on the western periphery of the temple center, likewise correspond strikingly in relative spatial and directional arrangement to the pattern of Stelae 11, 12 and 50. The overall correspondence seems intentional. If similar astronomical alignments exist in these mounds, the layout of sculptures must be directly related to the original mounds layout.

The results of the astronomical alignments test are compiled in figure 7 for comparison to figure 6. As illustrated, the mounds scheme proves to have five alignments. The central solstice alignment is duplicated in the Group B sculptures. The upper and lower moon+ alignments differ only in the focal mound. The two zenithal sighting positions differ significantly, but in both cases the focal direction is eastward and on central mounds as in Group B. (The southern zenithal sighting, aligned on Mound 30a, focuses initially on Mound 55 which is positioned on the central EW axis of the temple center.)

The compelling question is whether this layout scheme is based on structural patterning for maintaining harmony and balance with corresponding meanings. The correspondences imply that the same world view in the arrangement of sculptures within the plaza structure may project into the layout of the temple center (see chapter 5).

The important question for exploring meaning in these correspondences through future research may be stated in a testable hypothesis, i.e., that cosmological world view patterns found in the sculptures are

projected into ceremonial functions of corresponding segments of the temple center.

Architecture in the Group E, Main Plaza at Uaxactun is generally accepted today (Ricketson and Ricketson 1937). The scheme involves establishing an arbitrary sighting station on the steps of Pyramid VII Sub behind Stela 20 where the summer and winter solstice sunrise sightings could be made across outside corners of temple structures I and III on the East Mound. Even more compelling evidence can now be shown for astronomical alignments of sculptures in Group E.

Evidence at Izapa, as analyzed in the preceding chapter, indicates that flat circular altars functioned as observation stations for sighting across distant stelae to cyclical extreme planetary positions on the horizon. The question naturally arises of whether or not we are viewing a unique system of altar-to-stelae astronomical alignments at Izapa. To examine this question it seemed that a logical place to look might be the stela-altar complex in the Main Plaza of Group E at Uaxactun where an Izapan style sculpture was found (Norman 1976, fig. 6-27).

As illustrated in figure 8, three stelae are located along the front of the East Mound (two with altars) and one west across the plaza at the base of Pyramid VII. Stelae
19 and 20 are opposite each other on the central EW Axis.

Stela 19 is situated in front and a little southward from the center point of the East Mound stairs so that it is positioned one degree south of the true east center line where Stela 20 is positioned. This slight difference may have accommodated a true equinox sighting from behind Stela

20 directly across Stela 19 at the sun as it would have appeared in its southward rising arc over Temple II. Stela 20 faces the equinox due east, but Stela 19 faces WNW. The angle as mapped (fig. 8) faces 23° north of west. If correctly mapped this is 1.7 degrees short of the 24.7 degree horizontal solstice line. But the north- ward arcing sunset would face Stela 19 directly at about 4 or 5 degrees elevation. Presumably this would compensate for visual obstructions.

During excavations at Uaxactun, a flat circular stone measuring about 70 cm. in diameter was uncovered near the center of the plaza at the confluence of the main excavation trenches. Ricketson judged this stone to be a possible altar, and it strikingly resembles Izapa altars. To test a hypothesis that it is an

astronomical sighting station like Izapa altars, the azimuth angles from this altar to standing stelae were measured. It was found that moon cyclic azimuths for the Uaxactun latitude align with both Stelae 18 and E-l. From this altar one can sight across Stela 18 between Temples I and II on the moon minimum angle of 19.26°; the sight line across Stela E-l between Temple II and III is on the moon maximum angle of 30.16°.

These four astronomical alignments demonstrate that stela-altar complexes as found at Izapa were utilized elsewhere and carried down into the Classic Period. Other Classic Maya sites such as Tikal, Quirigua, and Copan, with Izapan related iconography and with similar stelae-altar complexes, are prime prospects for similar alignments

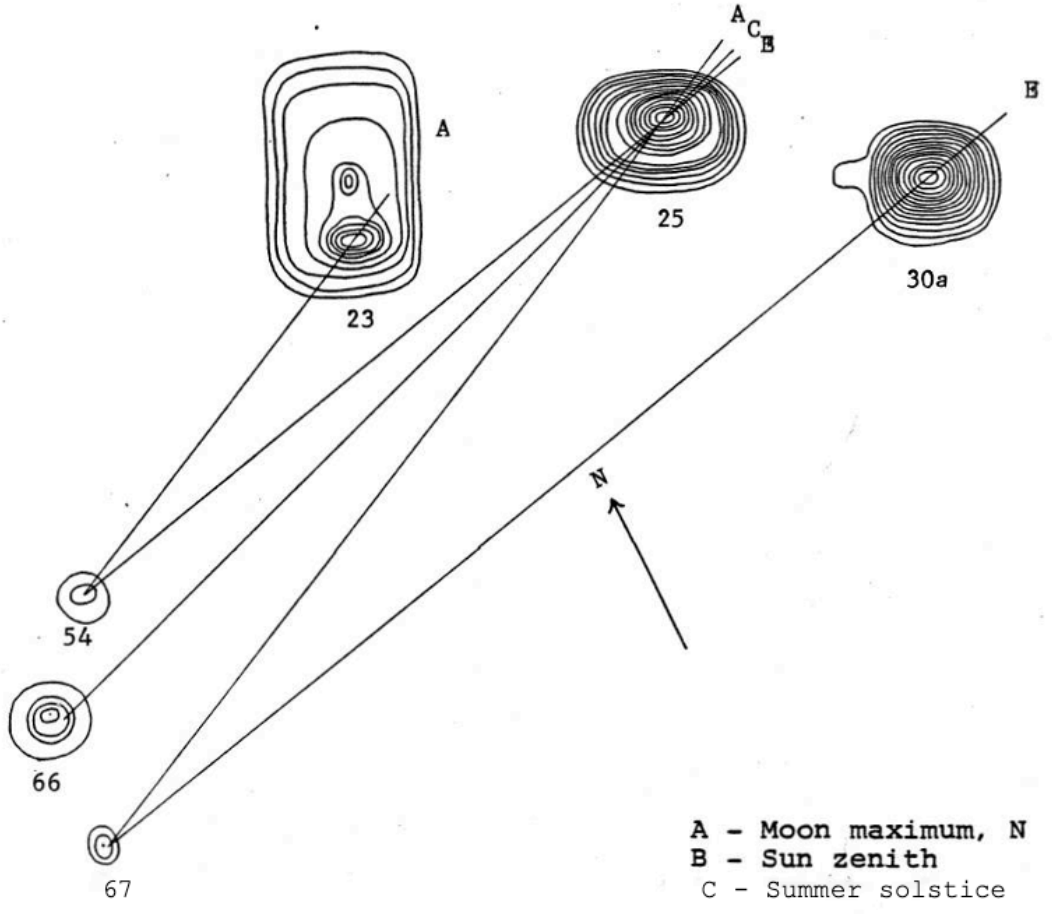


Fig. 7. Astronomical Alignments of the Three Western Mounds with the Three Northern Mounds of the Central Temple Complex at Izapa. (Elevation adjustments were plotted from the NWAF contour map.)

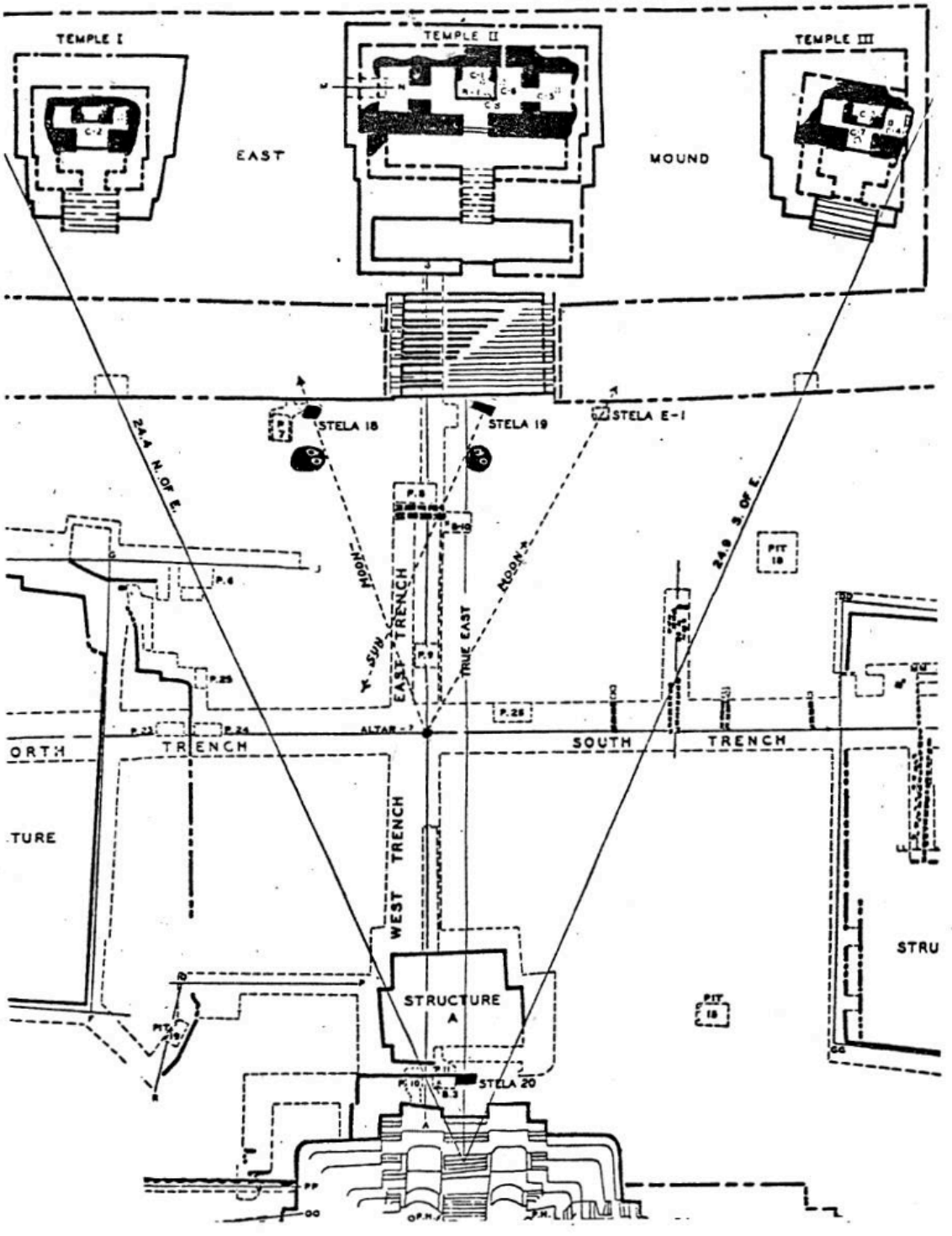


Fig- 8. Uaxactun, Group E, Main Plaza Astronomical Alignments (from Ricketson and Ricketson 1937) (Monument alignments added)

CHAPTER 5

RELATIONSHIP OF ALIGNMENTS TO SCULPTURAL THEMES AND SYMBOLS, AND DIRECTIONAL WORLD-VIEW ORIENTATIONS

This chapter examines iconography on Izapa carvings in terms of the sculptural alignments defined in the preceding chapter, and general world-view directional orientations. Tables 6 and 7 list by monument the astronomical alignments with corresponding cosmic symbols or themes. The tables serve as an overview for these relationships which are discussed in detail below. A total of18 out of 20 possible alignment references listed in table 6 for Group B have distinct reference to sculptural themes or symbols. In table 7 a total of 14 out of 24 possible alignment references for Group A relate to sculptural themes or symbols.

The identifications and arguments used below are concise because they are based on the large body of material published earlier (Norman, 1976). Full appreciation of a number of these interpretations could require consulting that source; however, there seems to be no reason to repeat what has been published before.

Table 6

Astronomical Alignments of Monuments and their Related Symbols or Themes, Group B, Izapa (cf. fig. 6)

Sighting Station	Sighting Point	Astronomical Alignment	Sighting Station Sculpture Symbol or Theme*	Sighting Point Sculpture Symbol or Theme*
S 11	MM 9	Moon- NE	U-moon Earth Monster	"Moon" ball by association with S 8 with Moon goddess fertility and death aspects
S 11a	MM 5	Equinox	Sun descent into underworld	Central "sun" pillar-ball by assoc. with S 9 & Th. 1
S 12a	S 9	Solstice NE	Jaguar underworld aspect of sun-god in death	Sun god carrying man into heaven
S 12a	MM 5	Sun Zenith NE	Jaguar sun aspect	Central "sun" pillar-ball
S 12a	MM 9	Moon+ NE	U-serpent with U-moon signs	"Moon" ball by assoc. with S 8
S 50a	S 10	Moon+ NE	Spirit rising at death in U-moon	Moon aspect in fertility and birth

Table 6 (Continued)

Sighting Station	Sighting Point	Astronomical Alignment	Sighting Station Sculpture Symbol or Theme*	Sighting Point Sculpture Symbol or Theme*
Th 1	S 10	Solstice NE	Throne of sun god with kin, sun glyph	None
MM 9	MM 7	Moon+ SE	Moon goddess fertility and death aspects by assoc, with S 8	Moon aspect in fertility and birth by assoc, with S 10
MM 7	MM 5	Zenith NW	None	Central "sun" pillar-ball

*As previously interpreted in Norman 1976

Table 7

Astronomical Alignments of Monuments and their Related Symbols or Themes, Group A, Izapa (cf. fig. 5)

Sighting Station	Sighting Point	Astronomical Alignment	Sighting Stations Sculpture Symbol or Theme*	Sighting Point Sculpture Symbol or Theme*
S 7a	S 3	Moon- NW	None	Man rising in U-moon
S 3a	S 1	Moon+ SE	Man rising in U-moon	None
S 3	S 2 & 1	Solstice SE	None	Sun god raises man from death
S 4a	S 5	Solstice NW	Sun god descends from heaven	Unknown
S 6	S 21	Moon- NE	Man rising in U-moon	Spirit of deceased carried to western land of death
S 6	S 23	Moon+ NE	Man rising in U-moon	Unknown
S 6a	S 35	Equinox	Rebirth in emergence of man from underworld	None

Table 7 (Continued)

Sighting Station	Sighting Point	Astronomical Alignment	Sighting Stations Sculpture Symbol or Theme*	Sighting Point Sculpture Symbol or Theme*
S 26a	S 6	Moon- NW	Man rising in U-moon	Man rising in U-moon
S 33a	S 27	Equinox	None	Sun god descending down trunk of world tree. Man led by jaguar
S 34a	A 60	Venus+ NE	None	Venus god rising on possible Venus glyph
S 34a	S 26	Moon- NE	None	Man rising in U-moon
S 35a	S 4**	Sun Zenith	None	Sun god descends to commune with man

*As previously interpreted in Norman 1976
**Position of Stela 4 is doubtful for this alignment from relocation since excavation

The Sun Cycle and World-View Orientations of Sculptures and Solstice and Equinox Alignments

Equinox, summer solstice, and winter solstice alignments are found in both Group A and Group B—six in each group. The sun cycle as the basis of Izapa world view is defined below through these alignments.

As we shall see, the Izapa temple center incorporates a cosmological world-view model consistent with that of the neighboring Maya. According to Tzotzil world view, the earth is a rectangular shape lying along an east-west axis with the four sides oriented to the four solstice points rather than the cardinal directions. Beyond the »” bounds of the rectangular world are the supernatural realms.

Ritual directions on an earthly plain follow the sun's path: the sun rises in the East, reaches its apex in the heavens in the North, descends in the West, and

goes into the underworld in the South (Gossen 1974: 31-34; see also Leon-Portilla 1973: 62, 81-82). This relates the east-west axis to the earth's surface. These relationships at Izapa are discussed below.
Cosmic mountain concepts at Izapa (discussed below) are an integral part of highland Maya cosmology. As at Izapa, the Tzotzil regard the mountaintop as the dwelling place of celestial and ancestral gods (Gossen 1972; Vogt 1969). Similarly, the Popol Vuh relates that gods of the Quiche dwelt upon mountains; the dawning of the first day- after the Quiche migration to Guatemala was observed through worship on top of the mountain Chi-Pixab (Recinos 1950:182) .

Internal comparison of Izapa sculptures (Norman 1976: 327) revealed directional placement of life and death themes in rectangular plazas. Stelae along the eastern and northern sides of plaza Groups A and B have life themes in prominent water or tree motifs (Stelae 1, 10, 21, 23, 25, 26, 27), while in contrast stelae along the western and southern sides emphasize death (Stelae 8, 11, 12, 50).

These themes apparently relate directionally to a life-death dicholomy expressed in both the daily sun cycle and the
rain cycle.

The idea of the sun rising in birth and setting in death is widespread. At the Izapa location streams and rain originate from the eastern mountains. Accordingly, falling rain and descending movement—signifying origin of life from the heavens—consistently appear on the eastern- related, right-hand side of stelae (e.g., Stelae 1, 3, 5, 6, 10, 26, 50). Conversely, evaporation or ascending movement—signifying transition after death—are depicted on the left-hand side of stelae (e.g., Stelae 1, 3, 5, 6, 21, 50).

Exceptions to this right-east/left-west pattern are found in carvings that are centrally located on a generally north-south or east-west axis in Groups A and B. Carvings on the north-south axis (Stelae 2, 4, 24, 45; Altars 3, 20) have singular themes devoted to prominent centralized figures of bird or anthropomorphic sky gods in vertical movement. These sculptures conform to an east-west dichotomy in their placement within either Group B (east) or Group A (west). In keeping with the sun's daily cycle, deity figures are depicted in ascending form on the eastern Group B carvings (Stelae 9, 24; Altar 20), while those on the western Group A carvings are in de- scending, inverted motion (Stelae 2, 4). The northern direction relating conceptually to the heavens is also expressed in the upward orientation of central figures on all northern stelae aligned on Tacana (Stelae 4, 9, 24, 45).

Stela 27 on the east and Stela 12 on the west of plaza midpoints along the east-west axis relate to these directions in emphasizing life (east) and death (west), respectively. Like sculptures along the north-south axis, Stela 12 emphasizes vertical movement, in a centralized sacrificial jaguar. Stela 27 is more complex (see discussion below).

In Group A, a sequence of descending movement from the heavens is depicted toward the earth on Stela 4 and into the underworld on Stela 2 bringing fertility to the earth. In keeping with nature, germination takes place.

in darkness beneath the soil through the vivifying heat of the sun, as well as in the southern underworld realm of the winter solstice preceding the sun's northern ascension to the spring equinox bringing rain and the growing season.

Following the Stela 2 theme, the Stela 6 creature situated in between Stelae 2 and 4 evidently represents the ascension phase with Mother Earth giving birth to life.

These general world-view conceptions also relate to mountain alignments of sculptures. An additional cosmic aspect is expressed in the alignment of Stelae 2, 6, and 4 on the Tacana volcanic peak. Cross bands (Kin glyph) on the wings of the descending figures on Stelae 2 and 4 identify an anthropomorphic sun god, descending from the heavens, evidently by way of the Tacana peak. Thus, the world-view picture involves God's descent with the sun from the heavens on Stela 4, down the conceptual mountain of the west (Tacana), and into the underworld on Stela 2, bringing fertility to the earth so that it can in turn reproduce life as depicted on Stela 6.

The underworld orientation of Stela 2 may be astronomically illustrated in its alignment with other stelae before Mound 58 in line with the winter solstice sunrise. If so, we are also looking at a world view that is directionally oriented to the sun's annual cycle. Stelae 2 and 4 on opposite ends of Group A could relate to the winter and summer solstices respectively by both their alignments and relative directional settings. Stela 2 aligns with adjacent Stelae 1 and 3 on the winter solstice sunrise. On the north side, if Altar 3 were originally before Stela 4 as suspected (Norman 1976: 243), then this altar could have aligned with Stela 5 on the summer solstice sunset. We may be viewing astronomical alignments related to sculptural themes with the sun god descending from the heavens on Stela 4 at the summer solstice, when the sun, upon reaching its northern extreme reverses direction and begins its descending journey

southward toward the earth and underworld. At the winter solstice the sun is reborn, which is the central theme of Stela 2 and adjacent Stela 3.

Astronomical alignments of Stela 6 and its altar on the equinox are consistent with its placement in between the solstice alignments of Stelae 2 and 4. With the sol- stice alignments signifying the heavens and the underworld, respectively, as noted above, it appears then that in logical worldview order the equinox relates to the surface of the earth, already recognized as the realm of the Stela 6 Mother Earth creature.

As observed above, sequential phases of the sun's annual cycle are found in related sculptures in Group B. Notably, Group B lies both north and east of Group A. This directional relationship and the picture that has been reconstructed for Group A is consistent with Group B in emphasizing opposites of the life-death dichotomy, i.e., in sunrise, summer solstice, and zenithal rise orientations, and ascension of deity figures toward the heavens. Stela 9 corresponds to Stela 4 in its northern central plaza set- ting. We have observed the sun god descending on Stela 4 in conjunction with the summer solstice sunset. The converse is found on Stela 9.

During the summer solstice field study in 1976 a truly impressive spectacle was observed from the Stela 12 altar which aligned directly over Stela 9 with the sunrise on Tajumulco Volcano. [1]This alignment doubtless gives cosmic expression to the Stela 9 scene in which an anthropomorphic sun god carrying a man on his back ascends into heaven. Based on the Izapa latitude, astronomical, and compass survey data, an observer on the summit of Tajumulco on the solstice date of June 21 would have been able to project a straight line from the sunrise to Izapa, thus presenting a basis for the ceremonial center's siting.

Directional positioning of life-death themes and prior detailed interpretations at once suggest the four directions: east and west as is, north as up, and south as down, all in keeping with highland Maya world view. Rain and life emphasis along the east and north sides relate to the rainy and growing seasons (spring and summer).

Death and fertility renewal along the western and southern sides relate to the autumn and winter seasons of waning fertility. These directional relationships reveal that the four seasons are tied to the four quarters (directions) in an agricultural ritual cycle.

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[1] I made this observation in company with Brian Hayden of the University of British Columbia

The significance of the summer solstice alignment of Izapa on Volcano Tajumulco may be reconstructed in part from the sculptural solstice orientations. As previously interpreted, Stela 9 is a carving of an anthropomorphic sun god carrying a man on his back into heaven. [2]Directly in front of Stela 9, Throne 1, in its original proximity to MM 5 (see Norman 1976, fig. 5: 19), also aligns with Stela 10 on the summer solstice sunrise.

MM 5 is the focus for sun alignments on the equinox sunrise and sun zenith rise and set points (see below). Accordingly, we may surmise that at these crucial times of solar contact, the sun god comes into direct communication with the temple center, figuratively descending upon his throne (Throne 1). Descent of the sun god may be expressed in downward-gazing anthropomorphic deity masks on the sides of the throne. The masks include human and jaguar features, scrolls and diagonals, to symbolize the sun god and his cosmic realm.

The sun god is identifiable by his butterfly wings and fire burst headdress, and also by association with the Kin glyph with apparent sun rayed fringe on Throne 1, and the adjacent pillar-and-ball "sun" monument (MM 5-6), directly in front of Stela 9 (see Norman 1976: 107-8; fig. 5.33) of the throne. The masks include human and jaguar features, scrolls and diagonals, to symbolize the sun god and his cosmic realm.
A possible sun priest may have officiated on this throne as depicted on Stela 8, where a figure is seated on a like throne, and faces eastward holding what the author supposses to be offerings. The Ah Kin, priest of the Yucatec Maya solar cult, wore a jaguar mask and sat on a mat on the throne (Leon-Portilla 1973: 31; citing Barrera Vasquez 1948: 112). A plaited mat is sculptured on a possible throne at Izapa and supports a jaguar on Stela 12 (Norman 1976, figs. #3.12 and 5.17).

The cosmological act on Stela 9 expressing ascension into heaven through its alignment on Volcano Tajumulco, may be more fully comprehended with reference to other mountain orientations, and in its contextual relationship to the temple complex of monuments with their orientations and relative positions with respect to the full annual cycle of the sun. Stela 9 is also on an

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[2] The sun god is identifiable by his butterfly wings and fire burst headdress, and also by association with the Kin glyph with apparent sun rayed fringe on Throne 1, and the adjacent pillar-and-ball "sun" monument (MM 5-6), directly in front of Stela 9 (see Norman 1976: 107-8; fig.
5.33).

axis of sculptures in the center of Group B aligned on the eastern slope of Tacana. Curiously, the north-south axes of the three principal northern plazas, B (east), H (center), and D (west), parallel and adjacent to each other, have a one-to- two-degree westward progression (as mapped by NWAF and confirmed by this author from personal observations in the field). This visual progression is suggestive of ascent of the mountain along the sun's path, and we may presume that a like ceremonial progression occurred through these plazas. The final destination is only achieved on the northern end of the western sculptural alignment with reference to Stela 45 after a progressive westward ascent of the sun toward its noonday zenith. Stela 45 in the climax position, though extremely eroded, is readily recognized as a companion to Stela 9 in style, theme, and relative position. Their corresponding plaza positions on opposite sides of the temple center are as striking as their sculptural parallelism. The conclusion seems inescapable: the ascent of Tacana to heaven, initiated on Stela 9, culminates on Stela 45. What follows on Stela 4 and other carvings in counterclockwise order, already observed above, adds meaning and confirmation through a continuation in descending cyclic movement through Group A, initiated at the summer solstice sunset.

Other solar alignments in Group B can be examined in terms of the world view based upon the sun cycle. Stela 8 in Group B expresses descent of a great devouring insect over a Kan (sun) cross in natural order as it follows Stela 9 in a counterclockwise sequence. It was observed at the winter solstice, in 1978, that Stela 8 aligns at sunset with Stela 11. This may relate to Stela 8 in the descent toward earth, as on Stela 4, following the summer solstice commemoration on Stelae 9 and 45.

Next in sequence is Stela 11 and its altar on the western side of Group B, aligned with MM 5 on the equinox. The autumnal equinox is at the point of earth contact where entrance into the underworld realm occurs. The sculptured scene on Stela 11 as previously interpreted (Norman 1976), depicts descent of the sun god into the jaws of the Earth Monster. This scene is a graphic portrayal of the Yucatec Maya expression for the setting sun, Chi-Kin, meaning "sun in mouth" or "sun devoured" (Leon-Portilla 1973: 19).

Thus, the equinoxial alignment of Stela 11, in keeping with its western setting, implies descent of the sun in its annual as well as daily cycle, at the autumnal equinox, into the southern underworld realm. This being the case, we would expect the other two carvings—Stelae 12 and 50— adjacent and to the south of Stela 11, to also stress related sun/death themes, as they do in fact. Stela 12 deals with the sacrificial death of a jaguar—earth aspect of the sun—and Stela

50 depicts the rising of a human spirit at death from a skeleton with a sun Kan glyph on his headdress.

Stela 89, in the southeastern sector of Group B, though uninvolved in a solstitial alignment, depicts a man gazing toward the winter solstice sunrise who appears to rise from his captive bands of death with the rebirth of the sun (Norman 1976) . This carving is aligned with Stela 31 on the equinox sunrise which may also relate it to the spring equinox when emergence from the underworld realm culminates.

The most notable equinoxial alignment involves Stela 27 which follows Stela 89 in directional sequence. It commands a central and solitary placement before Mound 57 on the eastern side of Group A. The earth realm related to the equinox, as noted above, dominates the sculptured scene in the center of a three-tiered composition represent- ing the heavens, earth, and underworld. This sculpture aligned on the spring equinox sunrise presents an appro- priate antithetical theme to the death focus on Stela 11 and other carvings in the western sector of Group B by emphasizing life and ascent through the tree and celestial scene.

We have gone full circle in tracing a counter- clockwise movement of sculptures based on the sun cycle in sequence through the plazas and temple complex with some corresponding astronomical alignments. Figure 9 illus- trates these relationships. This movement is also expressed by the lefthand direction most figures face on the carvings, producing a visual impression of counterclockwise cyclic movement as the sculptures are viewed from plaza centers.

The principle exceptions to this movement are on central Stelae 2, 4, 9, 12, and 27, which stress centrality and vertical motion, although Stelae 4, 9, and 27 also have right-to-left motion. As we have seen, the vertical movement coincides with the central positions of these stelae on plaza sides, which relate to the solstices and equinoxes when the sun god descends or ascends in communion with the temple center.

North-south polarized directions in the plaza, tied to the solstices, and equinoxial orientations on the east- west sides, reveal a four-directional, four-seasonal dichotomy for plaza sides and associated sculptures in an agricultural ritual cycle. This has been born out by correspondences between sculptural life/death themes which coincide with newly discovered astronomical alignments.

Further research will probably reveal additional calendrical significance of specific carvings with respect to theme, relative position, and astronomical orientation.

Sun Zenith Alignments

One antizenith and six zenith alignments have been plotted: four in Group B, and two questionable ones in Group A. The two zenith passages of the sun—April 30 and August 13—are rare days when the sun, and presumably the sun god, come into direct communication with the Izapa temple in perfect centrality. As seen in figure 6, the central pillar-and-ball "sun" monument (MM 5-6) in Group B is a focal sighting point for both zenith rise and set alignments. This centrality of the sun zenith could hardly be more explicit. It is possible that the rise and set alignments mark the April 30 and August 13 zenith passage dates in the counterclockwise movement in the temple center of the sun through its annual cycle.

This raises the prospect of astronomical plotting of the 260-day Tzolkin calendar at Izapa—the total number of days of the sun's southern passage between these two dates. These alignments give us some evidence for Malmstrom's (1978) argument that Izapa is the origin of the 260-day calendar. To test this hypothesis, future research must explore just what iconographic connections exist at Izapa between zenith alignments and the 260-day almanac.

The sunset alignment of 12 degrees along the MM 5- MM 7 axis is based on a calculated 7-degree elevation sighting (determined from the contour grid map) across the top of Mound 47 which is 10 meters high and 90 meters distant from the MM 7 sighting station. The same angle of 12 degrees is close to the S 4-S 5 axis as originally mapped by NWAF. Validity of this prospect must be explored in future research of possible zenithal symbolism on Stelae 4 and 5. (A 7° elevation azimuth for this alignment would have to focus on the sunset along treetops flanking the western side of the temple complex.)

Stela 30 is the focal point for a zenithal sunset alignment sighting from Stela 89. Stela 30 may also be the focal point for an antizenithal alignment from Stela 32. [3]It appears that Stela 32 (actually a pillar) is a positional counterpart to MM 5 across the plaza which is the principle zenithal marker. Thus, Stela 32

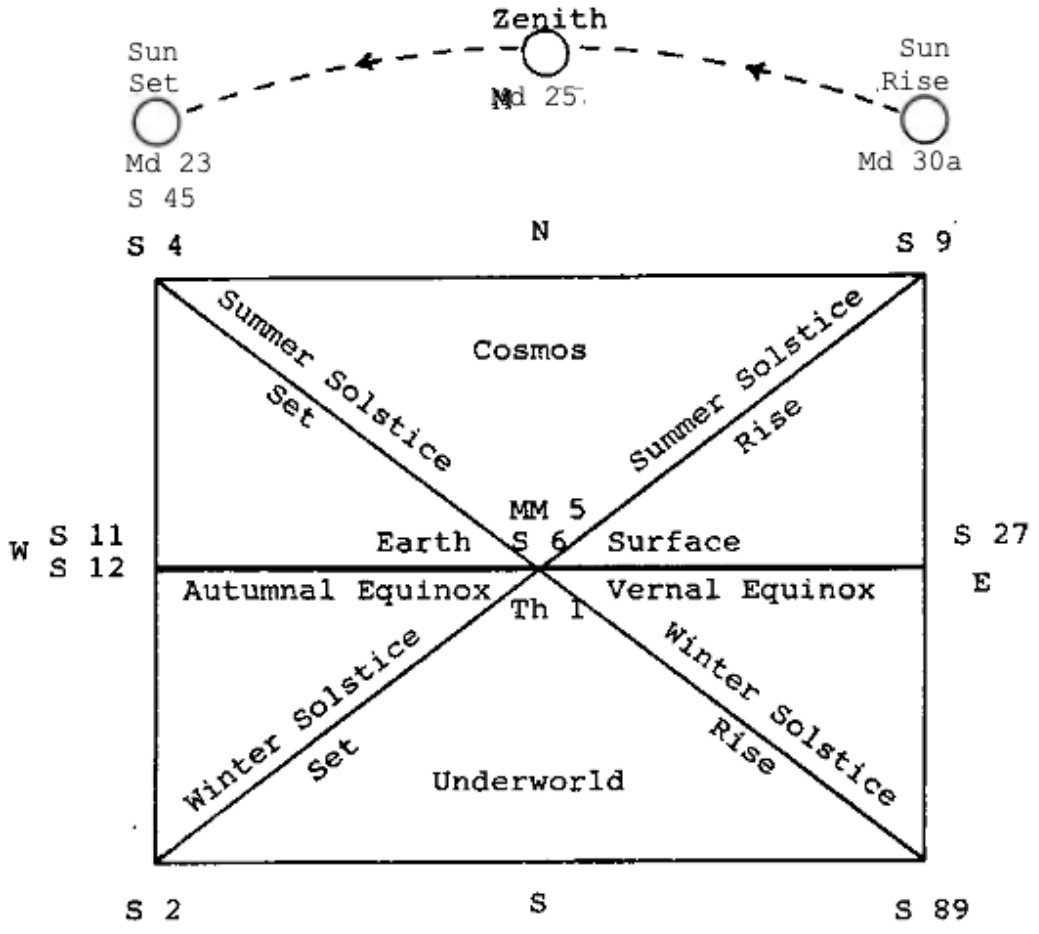
[3] This alignment is on a 250˚ azimuth with also aligns on the apex of the central Mound 60 at an elevation of 7˚ as plotted form the grid map. This 7˚elevation adjusts 4˚ southward from a horizontal azimuth of 254˚, or 16˚ south of west, which is within 0.5˚ of the antizenith angle. The Tajumulco summit elevation of 7˚10’ as mapped in figure 4 requires an azimuth adjustment of 4 degrees.

may actually be a mirror image or antizenithal alignment projected to the southern, underworld sphere.

Venus Alignments

Venus alignments are limited to four carvings with sculptured scenes—Stelae 8, 25, 50, and Altar 60. The most explicit Venus alignment is from the altar of Stela

This alignment is across MM 7 on the northern extreme rise of Venus. Because Venus as the Morning Star ushers in the day, the predawn Morning Star sighting could indicate that Stela 50 (like the sun at its northern extreme) represents the initial heavenly rising of the human spirit element, but from the nocturnal realm of death, the precise theme depicted on Stela 50.
As previously noted in a discussion of Stela 50 (Norman 1976), the Venus glyph on the pelvis of the skeleton is in a context relating it to man's inner wellspring of life. Relatedly, the reproductive region in women by analogy is associated in some contexts with the womb of Mother Earth through the cave entrance to the dark recesses of the underworld. This maternal aspect, also on Stela 50 and other carvings, ties to moon cyclic alignments discussed below.



June 21, set: Stela 4 - Sun god begins descent from heaven to commune with man.

Sept. 21, set: Stela 11 - Sun god descends into jaws of Earth Monster.

Sept. 21, set: Stela 12 - Jaguar (earth aspect of sun) sacrificed to begin underworld journey.

Dec. 20, set: Stela 2 - Sun god descends to depths of underworld to effect resurrection.

Dec. 21, rise: Stela 89 - Man resurrects in underworld with rebirth of sun at winter solstice.

Mar. 21, rise: Stela 27 - Resurrected man emerges from underworld.

Stela 6 - Mother Earth gives birth.

June 21, rise: Stela 9 - Resurrected man carried on back of sun god into heaven.

Stela 45 - Parallel to Stela 9.

Fig. 9. Solar Four-Directional World-View Scheme, Izapa (Based on sculptural themes, relative directional positions, solar cycle, astronomical alignments, and Maya world-view model; solstice directions are relative.)

The Altar 60 Venus alignment is hypothetical since this supposed altar (or stela) was discarded and buried near Stela 25 where it was excavated. Stela 25 is an evolved stylistic sculpture which presumably could have replaced Altar 60. The general location at least justifies consideration of this prospect. The sculptured theme of a Venus god rising in the East with a Morning Star glyph under his foot, as previously interpreted (Norman 1976), tends to confirm the hypothesis. In either case, both Stela 34 and its altar align across Stela 25 and its altar, Altar 60, with Venus+ NE. Stela 25 evidently relates to the same Venus alignment in the great bird which has a Venus glyph on its wing in the Maya style of Naranjo (Thompson 1960, fig. 22.52). Its long flowing tail feathers could be of the Quetzal bird, which represented Quetzalcoatl, god of Venus.

The Stella-S 8 alignment on Venus+ NE may be coincidental because prior investigations found no related symbols on either carving. Furthermore, these two stelae align on the winter solstice set azimuth (see above).

However, an inspection of the crossed bands glyph on Stela 11 monster reveals a Venus+ angle suggestive of the Venus monster of Maya tradition which had the head of a jaguar, as on Stela 11 (Thompson 1960: 77). This, however, is evidently only one aspect because the same glyph also forms a 30-degree moon+ angle in the Stela 10 manner (see discussion below).

Moon Alignments

Six potential moon cyclic alignments involve the three stelae in Group A which have a human figure in a U-moon symbol elevated in the upper lefthand corner (west)

(Norman 1976,	fig.	2.24).	The alignments are as follows:
Stela	3 :	Moon+	SE, Moon- NW
Stela	6 :	Moon+	NE, Moon- NW
Stela	26 :	Moon-	NE, Moon- NW

A common alignment of all three stelae is the moon- NW, in keeping with the western setting in Group A. Con- ceivably, this cyclic position was the cosmic axis of contact at death with the western heavenly realm of the moon goddess where descent into the underworld was initiated in line with the moon's cyclic directional movement. The cosmic pattern is a gradually increasing ascension from the new moon in the west through its monthly cycle, but descending in

the west in its daily cycle. Correspondingly, the moon- NW cyclic position is toward the heavens, but the cyclic movement at this point is southward into the underworld before eventually returning to the highest heavens at the moon+ cyclic extreme in the north—the focus of moon alignments in Group B (discussed below). Thus, human figures in U-moon boats express ascension in figurative rebirth through the medium of the moon goddess signified in the U symbol. This concept is graphically portrayed on Stelae 3 and 6 in conjunction with earth fertility signified in the creatures beneath the U boats. The moon goddess role is detailed in the Deity B figure on Stela 5 (Norman 1976 : 219). The moon+ SE alignment for Stela 3, and moon+ NE alignment for Stela 6 correspond to their respective south and nprth settings in the plaza, but neither have been confirmed since Stelae 1 and 23 have been removed from their excavated positions.

Six moon cyclic alignments in Group B are as follows :

Stela	9a	to	Stela	10:	Moon-	SE
Stela	11a	to	MM 9:		Moon-	NE
Stela	12a	to	MM 9 :		Moon+	NE
Stela	50	to	Stela	10:	Moon+	NE
MM 9		to	MM 7:		Moon+	SE
Stela	30	to	Stela	31 :	Moon-	SE

The common feature above is the moon+ NE alignment for all stelae involved with carved scenes except the S 9a- S 10 alignment, which is applicable to the Stela 10 theme, but probably not to Stela 9 which is devoted to the sun. In all likelihood, the meaning of the moon NE alignment is related to the summer solstice NE and Venus NE alignments as observed above, in terms of a heavenly paradise as the dwelling place of gods and the immortal spirits of men. The specific cosmic alignments of course relate to different aspects according to sculptural themes. Specific symbolism of the moon NE alignment would logically involve a celestial goddess fertility reference.

The application of specific moon alignments to given carvings is difficult to deduce, but the general meaning of moon symbolism is quite apparent. Moon alignments of stelae along the western side of Group B is in keeping with their moon symbols and the western setting of night and death implicit in the sculptured themes. An ascending figure in a U-shaped umbilicus on Stela 50 is conceptually related to the U-moon representations in Group A, noted above (see Norman 1976, fig. 2.24). This scene in its underworld context emphasizes

the concept of rebirth from death projected toward the heavens just as life springs up from the decaying seed buried in the earth. Stela 12 has a double-headed U-serpent with a U-moon aspect reiterated by U signs on its body. On Stela 11, seated in a double-headed U-serpent, is a devouring Earth Monster with Mother Earth and moon aspects. The meaning of MM 9 derives from its association with Stela 8 which has moon symbolism involving both earth fertility and death aspects.

Moon, Sun, and Venus Alignment Glyphs

Stela 10 moon symbolism is most explicit in terms of a possible heavenly reference to the moon+ NE alignment. As previously interpreted, on Stela 10 a spirit child is *-• portrayed descending from the heavens to enter the womb of an expectant mother about to deliver. According to both Mexican and Mayan beliefs the spirits of babies are sent to earth from the highest heaven by the primeval supreme parents of both gods and man (Nicholson 1971: 410-11; Recinos 1'950: 79, n. 4; 107, 226; see discussion in Norman 1976: 111). Directly above the child is a squared U with a diagonal inside. The diagonal proves to form an exact 30-degree angle with the baseline of the U which is the moon+ cyclic angle. Thus, we see glyphic confirmation of the moon+ NE alignment of Stela 10 and contextual reference to its symbolic projection into the heavenly realm or paradise of the supreme god and goddess. Herein is perfect harmony with the adjacent Stela 9 solstice alignment and its theme of ascension to heaven. This leads to the logical conclusion that the moon and Venus alignments, along with the sun alignment, focus equally upon Volcano Tajumulco for symbolic reference to the cosmic mountain discussed above for the solstice NE alignment. The whole arrangement seems to reflect a more ancient origin of a Popol Vuh tradition of the Quiche migration.to Guatemala, for upon arrival they worshipped on a mountaintop, contemplating the Morning Star as they awaited the dawning of the first sun (Recinos 1950: 173).

The kin glyph beneath the sun priest[1]s arm on Stela 4 is stylistically related to the kin glyph on Throne 1 which is dedicated to the sun. In the pattern of the moon+ cyclic glyph on Stela 10, the corresponding diagonal is the solstice angle of 24 degrees.

An inspection of the crossed bands glyph on Stela 11 reveals that the base of the forward diagonal projects to the base panel through an incised line crossing the serpent's body at the lower left forming a Venus+ angle of 27° (see Norman 1973, pl. 21). The upper line of the same diagonal forms a 30-degree moon+ angle, in the Stela 10 manner, with the inner top line of the cartouche.

Ethnographic Relationships

We have evidenced a sun-centered worldview at Izapa consistent with highland Maya world view of the Quiche and Tzotzil. The following additional ethnographic data from the Lacandon and Quiche relate to directional orientations and astronomical alignments of the moon and Venus as well as the sun. Data from the Classic Maya sites of Tikal and Palenque are also considered.

In a comparative study of Lacandon and Quiche Maya cosmology, Robert Bruce (1976-77, map facing p. 208) illustrates how various deities associated with the sun, moon, and Venus are tied to these heavenly objects. His map of Maya cosmology illustrates a vertical reference with the direction up, and life associated with the cosmic deities and their opposites on astronomical lines projected into the underworld realm of night and death. To this may be added the Maya conception of cyclic time regulated by the sun and tied to the four quarters.

Although Bruce apparently had no intention of illustrating relative directional alignments (diagonals), other than up and down, in his astronomical lines, the vertical and diagonal lines pattern coincidentally resembles the Izapa alignments system. The vertical sun reference to the upper and lower worlds, as at Izapa, is apparent. By switching Bruce's moon and Venus diagonal lines, the correspondence to Izapa is completed, appropriately placing Venus as the Morning Star in the eastern sky, and the moon in the western night sky. The upper Venus line corresponds to Venus alignments of Izapa Stela 25 and Altar 60 in their northern setting in Group A. Conversely, the Venus underworld setting of Stela 50 in the southern sector of Group B fits its Venus alignment.

The heavenly and underworld opposites of the two stelae are apparent in the great bird on Stela 25 and the death god on Stela 50. Opposites of various moon alignments are not so apparent, but the four elevated, U-moon boats do compare. Those on Stelae 6 and 26 in the northern sector of Group A are in sculptural scenes with falling rain, an aspect of the upper world (illustrated by Bruce). In contrast, Stela 50, just noted for its south- ern death reference, has a U-moon boat symbol and moon alignment, as does Stela 3 in the southern sector of Group A, which is associated with underworld earth fertility, an aspect of moon symbolism (Norman 1976: 97, 105).

These apparent ethnographic connections with Izapa should be found in similar correspondences with Classic Maya temple planning, to bridge the time gap. The Izapan system of sculptural alignments at Uaxactun, observed above, hints

at other relationships. Studies of Maya cosmology in temple planning are just beginning. Guillemin general observations at Tikal (1968: 8-10) suggest that the Izapa system may be basic to later Mesoamerican temple planning. He has speculated that the Tikal orientations plan may have originated from Kaminaljuyu or Izapa, or some other Pacific Coastal site. He observed that Tikal is oriented symbolically to the four directions, and speculated that the great East and West temples were dedicated to the rising and setting sun respectively, and that the North temple was dedicated to the northern sun with a combined cult of rain and possibly other weather deities. The northern sun/rain relationship relates to the northward-moving sun bringing the rainy season.

Cohodas (1975: 79-81) has analyzed a comparable cosmological system at Palenque involving the panels of the Sun, Cross, and Foliated Cross as sequential in the sun's cyclic movement for agricultural ritual purposes. The panels also have directional associations with the equinoxes and solstices.

CHAPTER 6

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Viability of the mapping technique developed in this study for examining large numbers of potential astro- nomical alignments has been demonstrated. Although the horizon positions of the summer and winter solstices were established visually with photos for this study, these points can also be plotted from astronomical data. Thereby, the full field data gathering process can be accomplished any time in a single effort. Success depends principally upon precision control in taking azimuth readings utilizing reliable equipment. Because magnetic interference is
always a concern, ideally, mapping of networks of align- ments should be done in the field so that any inconsisten- cies that might arise in azimuth readings can be resolved.
Rather precise astronomical alignments have been demonstrated in a number of instances with networks involving all sculptures in Groups A and B. The question of whether the sculptural alignments are an intentional part of the original site planning at Izapa is confirmed in part by discovery of an alignment system in the layout of mounds in a pattern very close to one found in Group B monuments (fig. 7). Further confirmation and the spread of the Izapa alignment system to other Mesoamerican sites is demonstrated in discovery of the same system of altar- to-stela astronomical alignments at Uaxactun (fig. 8).

Examination of the full range of potential alignments (tables 2, 3, 4, and 5) revealed that 46 percent are within 0.5 degrees of first gleam azimuths. The greatest number of alignments are from altars, with a total of 19 out of 41, for 46 percent. Stela-to-stela alignments constitute 34 percent, and the remaining 20 percent involve Miscellaneous Monuments and Throne 1.

The following test criteria were established to weigh credibility of alignments in forming conclusions:

Degree of precision in a visible alignment.
Multiple alignments of a sculpture.
Corresponding sculptural themes to alignments.
World-view order consistent with the sculptural theme and alignment.

Correspondences between Izapa solar alignments and Izapa world view, cosmology, sculptural themes and symbols, calendrical functions, and ethnographic data are a homogenous body of expanding material both for confirming the alignments and interpreting their meanings.

An alignment is confirmed if the sculptural theme is singular and corresponds to a precise alignment in a world-view order, as with the Stela 9 summer solstice alignment, for instance. Multiple alignments of a sculpture which meet these criteria add further confirmation.

While most themes are not singular, multiple themes are often applicable to multiple alignments, and an alignment is still confirmed if it is relatively precise.
Examples are sculptures along the western side of Group B which have sun- and moon-related themes.

The most significant results of this research are in the relationships between sculptural themes or symbols and their astronomical alignments. Tables 6 and 7 provide an overview as well as summary of these relationships. At least 21 (over 50 percent) of the total alignments plotted correspond iconographically. These alignments involve a total of 44 potential references, 32 of which relate for a
73 percent correspondence.

A significant number of alignments correspond dramatically to prominent sculptural themes in an interrelated world view which is consistent with Maya world view and cosmology. While the above criteria tends to

relate to solar alignments, to a lesser degree lunar and Venus alignments are confirmed and interpreted as well.

Where potential alignments and other relationships lack precision, future research must consider the prospect of alternative alignments that could result from errors in resetting sculptures.

APPENDIX A

RELATIONSHIP BETWEEN SITE AXIS AND SCULPTURAL ALIGNMENTS

The 21-degree axis of the site and placement of mounds is not itself astronomical but could be astronomically based in that the angle may have been determined because it accommodates most of the astronomical alignments of sculptures on the eastern horizon. Data in figure 4 reveal that the mean of the full range of NE horizontal alignments between the moon= and zenith azimuths is 22.6 degrees. The mean between the NE visible horizon points is 19.8 degrees. The average between these two mean figures is 21.1-degrees.

Although monument alignments relate symbolically to sculptured themes, with a few exceptions all plotted alignments eastward can be observed on the horizon (excluding vegetation obstruction), so that calendrical observations were probably involved as well. The great majority of alignments in both Groups A and B are plotted to the eastern horizon. In Group B, low-level Mound 5J eastward and the Mound 30 platform northward provide an unobstructed view of most sculptural alignments toward the eastern horizon. Moreover, eastern alignments predominate in Group A as well, even though it is on the western side of the temple complex. Similarly, in Group A a visible equinoxial sunrise alignment passes eastward across the low Mound 57.

Also, the full range of sun, moon, and Venus cyclic extreme alignments are visible on the eastern horizon because of the 21-degree axis.

APPENDIX B

Tables 8 through 12 contain the field survey-data from Izapa obtained in 1976 and 1978 for mapping the eastern horizon (fig. 4), and for mapping sculptures in Group A (fig. 5) and Group B (fig. 6).

Table 8

Eastern Horizon Mapping Data at Izapa*

Azimuth	Elevation	Feature
65° 30'	7° 10'	Tacana peak
68° 30'	5° 50'	Tacana bench and summer solstice
92° 40'	4° 30'	peak
96°	4° 25'	peak
101° 30'	3° 30'	peak
105° 30'	2° 40'	peak
115°	1°	winter solstice

horizontal scale fix: 494 mm. between winter solstice and summer solstice

Horizontal scale: 98 mm. per 10 degrees

Vertical scale: 4.2 mm. per 1 degree elevation

Table 9

Group B Survey Azimuths from 1976 and 1978 Field Trips

From	To	Azimuth
S 12	S 11	34° 30'
MM 9	MM 7	110° 30'
MM 5	MM 7	101°
MM 9	MM 5	136°
S 8	S 9	120° 40' (front line)
S 8	S 10	109° 31'
S 9	S 10	113°
S 8a	S 11	246.5°
S 8a	S 12	240°
S 9a	S 12	251°
S 11a	MM 7	94° 30'
S 11a	MM 9	75°
S 11a	MM 5	92° 20'
S 11a	S 8	66° 40'
S 11a	S 9	79° 20'
S 11a	S 10	86°
S 11a	S 24	63°
S 12	MM 5	76° 45'
S 12a	MM 7	81° 10'
S 12a	S 8	56° 30'
S 12a	S 9	67° 30'
S 12a	S 10	75°

Table 9 (Continued)

From	To	Azimuth
S 12a	S 11	29°
S 12a	MM 9	61° 10'
MM 7	S 10	27° 30'
MM 5	S 9	27° 20'
MM 9	S 8	32°
S 50	MM 7	65° 30'
S 50	S 12	12°
S 11a	MM 5	92°
S 11a	S 10	86°
S 8a	S 11	246.5° 5°15' elevation
S 8a	S 12	240°
S 9a	S 12	251°
Th1	MM 7	93.6° (relocated)
S 30	S 50	6°
S 30	S 32	7°
S 30	S 31	110°
S 31	S 89	95°
S 31	S 32	25°
S 89	S 32	328.5°

Table 10

Group A Azimuths from 1976 and 1978 Field Trips

From	To	Azimuth
S 35a	S 6	62° 6'
S 35a	S 26	74° 51'
S 34a	S 26	53° 36'
S 6a	S 26	90° 16'
S 26a	S 6	278° 42'
S 3a	S 27	47° 51'
S 6a	S 35	242° 30'
S 34a	S 6	68°
S 34a	S 25	72° 55'
S 34a	S 26	79° 35'
S 34a	S 27	50° 37'
S 6a	S 25	86° 28'
S 6a	S 26a	81° 25'
Md. 56 altars		65° 34'
S 6a	S 27	171°
S 6a	S 2	68° 35' (Tacana)
S 6a	S 33	48° 55'
S 6a	S 34	69° 45'
S 26a	S 34	72° 15'
S 26a	S 33	61° 24'
S 26a	S 6	73° 43'
S 5a	S 6	[illegible]°

Table 10 (Continued)

Group A Sculptural Azimuths;
December 1978

From	To	Azimuth
S 35a	S 5	50°
S 35a	S 7	69.5°
S 35a	S 4	78.2°
S 6	S 35	271°
S 35a	S 26	91°
S 26a	S 35	274.5°
S 35a	S 27	133°
S 33	S 34	358.5°
S 2, 6, 4		20° 45'
S 3	S 33	345°
S 27	S 33	278.5°
S 27	S 34	309.5°
S 27	S 5	339.5°
S 27	S 7	347.5°
S 27	S 6	350.5°
S 27	S 4	354.25°
S 27	S 25	5.4°
S 27	S 26	16.5°
S 21	S 26	233°
S 1, 2, 3		115°
S 3a	S 2	125.5°

Table 11

Group B Measurements Between Center Points of Sculptures

From	To	Distance
S 11	S 8	36 m.
S 8	MM 9	7.8 m.
S 8	S 24	22.2 m.
S 11	MM 9	30.6 m.
S 12	S 11	12.8 m.
S 12	MM 9	40 m.
S 9	S 24	19.9 m.
S 8	S 9	11.7 m.
S 9	S 10	11.6 m.
S 8	MM 5	16.6 m.
MM 9	MM 5	13 m.
MM 5	MM 7	12 m.
MM 5	S 9	11 m.
MM 7	S 10	8.3 m.
S 12	MM 5	46.3 m.
S 12	S 50	16.8 m.
S 50	S 30	35.4 m.
S 30	S 31	17.7 m.
S 30	S 32	24.7 m.
S 31	S 89	16.9 m.
S 89	S 32	18.9 m.
S 31	S 32	15 m.

Table 12

Group A Measurements Between Center Points of Sculptures

From	To	Distance
S 35	S 5	50 m.
S 34	S 5	37.3 m.
S 5	S 7	13.1 m.
S 7	S 4	22 m.
S 4	S 25	34 m.
S 6	S 4	7.1 m.
S 34	S 35	15.4 m.
S 34	S 33	29.4 m.
S 33	S 3	43 m.
S 3	S 2	9.8 m.
S 2	S 27	156.6 m.
S 27	S 26	48.7 m.

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ASTRONOMICAL ORIENTATIONS

OF IZAPA SCULPTURES

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ABSTRACT

At the archaeological site of Izapa, Mexico, a total of 49 sculptures are examined for astronomical orientations. Cyclic extreme declination azimuths on the horizon of sun, moon, and Venus alignments, and their meanings, are determined through analyzing the degree of precision, and by identifying both patterned systems of alignments and their iconographic relationships.

Valid alignments and their Preclassic origin are tested through identifying a comparable alignment system in the layout of mounds at Izapa, and also by identifying comparable orientation systems from ethnographic data. Maya architecture and world view, and calendrical function of alignments are considered in analyzing an interrelated world-view setting of sculptures based upon the sun cycle.

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