

Before the Maya:

How Time Began in America

by

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Chapter 1 – The Birth of a Hypothesis

The morning sun was already so hot that my students and I retreated into the shadow of the wall of El Caracol as we listened to our Mexican guide complete his briefing. The time was late January 1973; the place was Chichén Itzá, one of the largest and most impressive of archaeological sites in the whole of Mesoamerica -- the vast region that anthropologists define as the cradle of the highest cultures of prehistoric Mexico and Central America. As we lounged there, listening to him explain the equinoctial interplay of sunlight and shadow on El Castillo -- the giant pyramid which loomed over the jungle to the north of us -- my mind went fleeing back to a classroom at the University of Michigan almost thirty years earlier. On that occasion I had queried my anthropology professor as to how the strange 260-day sacred calendar of the Maya had come into being, and I remembered my disappointment at being told that nobody knew. It was an honest answer, of course, but for a curious university student, hardly a very satisfying one. In the subsequent decades, my academic career had taken me in very different directions, and other, seemingly more important questions had commanded the attention of my research. Now, suddenly, as I was leading my first student field trip to Mexico, that unanswered query from my own university days leapt out of the recesses of my mind. Only this time it was coupled with an idea, an idea born of the Mexican guide's description of how the Mayas used light and shadow to link their architectural masterpieces with the harmonies of the seasons. Might the 260-day sacred calendar have had its origins in the interval between vertical sun positions somewhere here in Mexico, I asked myself? After all, in the tropics the sun passes directly overhead on two days each

year -- once on its journey northward to the Tropic of Cancer at mid-summer and once on its southward retreat to the Tropic of Capricorn at mid-winter. I realized, of course, that there was no way I could readily answer this question in the field, but give me a few minutes with a solar ephemeris in my college library, and I would have my reply. Quite understandably, for me the drive between the Yucatán and Middlebury College seemed much longer going home than it did going down.



Figure 1. El Castillo, or the Temple of Kukulcan, at Chichen Itzá in the Mexican state of Yucatan, provided the clue that triggered the search for the birthplace of the 260-day Sacred Almanac, which was adopted throughout the entire realm of Mesoamerican high cultures as the region's first calendar.

It was a cold, crisp mid-February morning as I made my way across the snowy campus to the library, rummaged through the stacks to find the most recent copy of The

American Ephemeris and Nautical Almanac, and settled down in a quiet carrel to see what it could tell me about the annual movements of the sun. Very quickly it became apparent that, if the Mayas had measured a 260-day interval between vertical sun positions, they would have to have done so beginning with its southward passage. This is because their homeland -- the region bounded by El Salvador on the south and the Yucatán peninsula on the north, lies in the northern hemisphere, closer to the Tropic of Cancer than to the Equator. A northward-moving sun only takes half a year, or about 182 days, to go all the way from the Equator to the Tropic of Cancer and back again, so any place north of the Equator experiences an even shorter interval between zenithal sun positions. On the other hand, a southward-moving sun will take 182 days to move from the Equator to the Tropic of Capricorn plus an additional number of days to move back and forth between the Mayas' latitude and the Equator.

Even using a crude trial-and-error approach, I soon found that a 260-day interval between vertical sun positions could indeed be measured in Mesoamerica -- along a line just south of fifteen degrees north latitude. This was an exciting confirmation that my hypothesis for the origin of the sacred calendar was at least possible. But, what was almost more exciting was the realization that this 260-day interval began on August 13th, a day which I had learned from my earlier studies in anthropology had been the day on which the Mayas believed that time began. Certainly, this had to be more than a coincidence, I felt, for the odds against it were 365-to-1.

Pulling an atlas off the shelf, I quickly opened it to a large-scale map of Central America and began tracing my finger across the fifteenth parallel of north latitude. The line intersected the Pacific coastal plain of southernmost Mexico and then ran across the

entire width of Guatemala and Honduras before continuing out into the Caribbean Sea. About halfway across the Central American landmass, my fingertip brushed over the name of "Copán", a place heralded in the archaeological literature as one of the greatest astronomical centers of the Maya. Certainly, this too, could not be just another coincidence. Surely, the reason that Copán had been so important to the Mayas must have been because it was the place where they had first measured the 260-day interval between vertical sun positions, giving rise to their sacred almanac, and where the significance of August 13, as its beginning date, first became apparent to them. What a fantastic discovery to make, I thought -- and after only one casual field trip to Mexico and scarcely a half-hour spent in the library!

Although I had been trained as a geographer, conditioned to think about the location and significance of places, I couldn't imagine that an anthropologist or archaeologist hadn't at some time or other stumbled across the same clues and come to the same conclusion. It all seemed so obvious, so straightforward, so simple. Nevertheless, the elation that I felt about my discoveries that winter morning was soon replaced by a sense of incredulousness, disbelief, and suspicion. The solution to my thirty-year old question seemed altogether too simple, too obvious, too good to be true. Certainly, someone else must have long since come up with such an explanation, I felt, and if I made a search of the literature I would no doubt find that I had been anticipated by other researchers who puzzled over such problems as part of their every-day lives. Checking three or four books on the Maya out of the Library, I trudged back across the campus, got into my car, and drove home. There I curled up by the fireside to ponder why my first venture into the origins of Mayan calendrics had been so seductively easy.

* * * * *

Several days, and several books, later, I realized how close I had come to falling into what I since have termed "the Copán trap". It was quite apparent from my readings that Zelia Nuttall, a brilliant archaeologist who had spent virtually her entire professional life working in the Mesoamerican region, had "anticipated" my hypothesis as early as 1928. Indeed, she had argued that the 260-day ritual almanac did have an astronomical basis and that it stemmed from the interval between zenithal sun positions as measured at the great Mayan astronomical center of Copán. But, later writers, notably John Eric Sydney Thompson, acknowledged as the dean of Mayan archaeologists, had forcefully argued that this was an untenable theory. He had pointed out that, in some parts of the Mayan homeland, the interval between zenithal sun positions was as much as 311 days; so why, he asked, would they have adopted an astronomical measure that was valid only on its southern borders?

While at the same time he was discounting Nuttall's explanation for how the sacred almanac arose, Thompson was engaged in examining Mayan hieroglyphics to see if he could determine the starting date of the so-called "Long Count". Stelae, or carved monuments, that dated to the hey-day of the Maya (the "Classic Period", from 300-900 A.D.) invariably carried inscriptions in which numerals and day-names from both the 260-day sacred almanac and the 365-day secular calendar were included. Moreover, each such inscription bore five other numerals which summed up the number of days which had elapsed since the day that "time began", a date which the Maya referred to as 4 Ahau 8 Cumku. Because the Maya used a vigesimal counting system rather than a decimal system such as we do, each of these numerals recorded intervals that were 20 times

greater than the next smaller one. Because for the Maya the smallest interval of time was the individual day, or kin, this was the basic building block of their entire system. The second-largest unit was the uinal, which contained 20 days. Although for all other calculations the next larger unit had a value of 400 (20 x 20), for purposes of counting time the Maya used instead a unit called a tun. This unit, often called the "Vague Year" by Mayanists, was composed of 360 days, or 18 "months" of 20 days each. Thereafter, the next larger units resumed the 20-fold pattern of increase, with the katun having 7200 days (20 x 360) and the largest of their units, the baktun, having 144,000 days (20 x 7200).

In the late 1920's Thompson identified the theoretical beginning date of the Mayan calendar, i.e. 4 Ahau 8 Cumku, as August 13, 3114 B.C., a result which reinforced and confirmed earlier studies by the Mexican archaeologist, Martínez, and those of the American newspaper editor and friend of Mark Twain, Joseph Goodman, who was an amateur cryptologist and puzzle-buff. The coincidence of their three independent findings, each having arrived at a date within a day or two of the other, has prompted later researchers to credit all of them with the discovery of the Mayan calendar's starting date, their result being labeled the Goodman-Martínez-Thompson correlation, or GMT, for short.

In 1945, an American archaeologist named Merrill had tried to revive the Nuttall hypothesis by pointing out that the southward passage of the vertical sun over Copán took place on August 13, arguing that the GMT correlation now gave added support to her original argument, but Thompson himself dismissed this as being a pure coincidence. Indeed, in his major work on Mayan hieroglyphics published in 1950, Thompson strongly

denied any astronomical origin for the sacred calendar whatsoever, arguing instead that the 260-day interval represented either (1) an approximation of the human gestation period, or (2) a simple permutation of the two numbers, 13 and 20, both of which had a special magical significance to the Maya. With such a verdict having been handed down by the dean of Mayan archaeologists, no one in the anthropological fraternity had thereafter risked either his professional career or Thompson's displeasure to raise a counter-argument.

Of course, being a geographer rather than an anthropologist, I did not stand in sufficient professional awe of Sir John Eric Sydney -- he had subsequently been knighted by Queen Elizabeth II for his very considerable contributions to Mesoamerican archaeology! -- to be daunted by him, but neither did I find his arguments very compelling. If the 260-day sacred almanac did represent an approximation of the human gestation period, whose gestation was important enough to sanctify in the form of a calendar, I asked? Some king's or priest's? And how do you measure the beginning of a gestation period anyway? By the same token, even though the permutation idea is an attractive one, who knows which came first -- a 260-day interval divided by 13 to yield 20 or a 13-day interval multiplied by 20 to yield 260? In either case, calling the August 13 starting date a pure 'coincidence' overlooks the 365-to-1 odds I mentioned at the outset. In fact, even if one grants a two-day correction to the GMT (which Thompson called for in a later revision of the correlation), the odds would still be more than 120-to-1 that it would be a matter of chance for the date to fall between August 11 and August 13 -- a conclusion which statisticians could accept with a 99.178% level of confidence.

However, Thompson did raise one idea that appealed very much to my geographic sense of logic. He mentioned that a German naturalist by the name of Gadow, who traveled in Mesoamerica about the beginning of the 20th century, had made the observation that the sacred calendar of the Maya must have had its origin in a lowland, tropical region. Gadow came to this conclusion because the day-names of the almanac commemorate such lowland tropical species as the alligator, the monkey, and the iguana. Knowing that the Mayan astronomical center of Copán lay in the mountains of western Honduras at an elevation of 600 meters, surrounded by stands of pine and oak trees, I realized that the ecological niche described by Gadow certainly did not exist there; I would have to reject Copán as the birthplace for the sacred calendar for that reason alone.

The more reading I did, however, the more complex and involved the issue seemed to become. Sylvanus Morley, in one chapter of his work entitled The Ancient Maya, mentions that the sacred calendar almost certainly was in existence by the fourth century B.C. In a later chapter, writing in quite another context, he points out that the oldest dated stela from Copán goes back only to 426 A.D. Thus, in this one source -- if Morley's statements are correct -- I found an 800-900 year discrepancy between the time that the ritual almanac apparently came into use and the time that Copán, its supposed birthplace, had been founded. Therefore, Copán is not only in the wrong place geographically to have given rise to the sacred calendar, it is also about 900 years too late historically to have done so. Only its astronomy is correct -- but then, so too would it be for any place along the same parallel of latitude. Therefore, what I would have to do is

go back to the map and find a ceremonial center located just south of the 15th parallel that was situated in the lowlands and that was in existence by at least 400 B.C.

Fortunately, in 1972 the National Geographic Society had published an archaeological map of Mesoamerica showing all the major sites of the region, along with little illustrated vignettes describing some of the key places. Thanks to this map, my task of finding a ceremonial center where the astronomical, geographical, and historical clues converged was basically a simple one. Of course, the lowland tropical niche could be found either on the Pacific coast in the west -- where the 15th parallel just slices through the southernmost corner of Mexico -- or on the Caribbean coast of Honduras in the east. The latter region, drenched by almost continuous rains brought ashore by the Trade Winds, remains a sparsely inhabited tangle of rainforests and swamps even today -- hardly a place to look for the beginnings of anything, save mildew and mold.

However, on the narrow Pacific coastal plain of Mexico, immediately adjacent to the boundary of Guatemala, I found a place called Izapa -- a place I had never heard of before, and certainly one that was not in wide currency when I had studied the archaeology of the region. In the little illustrated vignette beside it, Izapa was described as "an important Late Preclassic site", which in the vernacular of the Mesoamericanist means it was founded before 300 B.C. Here, then, was a site where the southward moving sun passes overhead on August 13; where alligators, monkeys, and iguanas abound in the coastal marshes and forests; and where someone, sometime before the 4th or 5th century of the pre-Christian era, must have begun experimenting with a means of reckoning time that had eventually become the sacred almanac of the Maya. For that matter, the sacred almanac had become the very hallmark of civilization throughout the

Mesoamerican region, for every people in the area had employed the 260-day ritual count; indeed, it has been found to still be in use among some of the more remote villages of the Guatemalan highlands to the present day. Here, then, was an entirely new hypothesis, one that accorded with the facts of astronomy, geography, and history -- and one that avoided "the Copán trap" by arguing that the calendar gave rise to Copán rather than the other way around. In other words, the Maya had apparently founded their major astronomical center -- located well over 300 kilometers from the core of their settled area in the Petén region of northern Guatemala and southern Yucatán -- in order to calibrate and refine a time-keeping instrument which had already been in use for over a thousand years. So confident was I that I had stumbled onto a feasible explanation for the origin of the sacred almanac that I wrote an article describing my hypothesis and sent it off to Science, in whose pages it appeared the first week of September 1973.

* * * * *

Early autumn days in Vermont are often unforgettable mixtures of sparkling sunshine, intoxicating fresh air and brilliant color. However, one particular late-September afternoon turned out to be unforgettable for quite another reason, for among the various letters, journals, and advertising flyers in my office mailbox was an air-letter with an English postmark, from somewhere in Cambridgeshire. When I opened it, I found inside a terse little note signed "John Eric Sydney Thompson". It seems he had just received his copy of Science -- with my article in it, and he didn't like it. Citing the appropriate page references for me, he pointed out that if I had taken the trouble to read his book on Mayan hieroglyphics, I would have realized that he had laid the astronomical theory of the sacred almanac's origin to rest almost a quarter of a century ago.

Fortunately, I am not accustomed to receiving caustic reprimands in the post -- and the day that a Knight of the British Empire deigns to write me one is definitely a red-letter day, indeed. Of course, I had read the passage he referred to, but just in case I might have missed something, I went back and read it again. Finally, after mulling it over in my head a day or two, I decided to write back. I didn't really have much to say to Sir John except that I had read his book; that, on the basis of the argument he had presented in 1950, I would have thought him wrong then; and that I thought he was still wrong now. Needless to say, that was the end of our correspondence.

In the weeks that followed, Science forwarded to me several other responses from readers and promised that an exchange of letters would be published in a later issue. Apart from the scores of requests for reprints, most of which one assumes came from readers who were at least neutral rather than hostile, it was quickly apparent that my hypothesis was not about to be openly embraced by most archaeologists or anthropologists. Although I could not imagine how the logic of my arguments escaped them, I could imagine a number of other reasons why they might reject my hypothesis. One reason, quite conceivably, could be their loyalty to and/or their fear of Sir John Eric Sydney. Another reason, equally plausible, might be that they resented a mere geographer treading on their turf and coming forward with an answer that had for so long eluded their fraternity. But, for whatever reason or reasons they may have had, I now knew what I must do. I must visit both Izapa and Copán to see these places for myself, to see whether one or the other of them might hold a clue that had heretofore been missed. Although I was scheduled for a term of sabbatical leave in Rome working with the Food and Agricultural Organization of the United Nations during the spring, I realized that I

must take at least a few weeks and return to Mesoamerica. I had been led to Izapa solely by deduction; now I must go there in reality, for only after visiting it in person could I (1) reconcile myself to the fact that my hypothesis was implausible or (2) reassure myself that I was really on to something.



Figure 2. Although both Izapa and Copán are located at the identical latitude (14.8° N.), they differ markedly in their respective ages and geographies. The author's research has shown that Izapa dates to the 14th century BCE, while Copán first began erecting dated monuments in the 5th century CE.

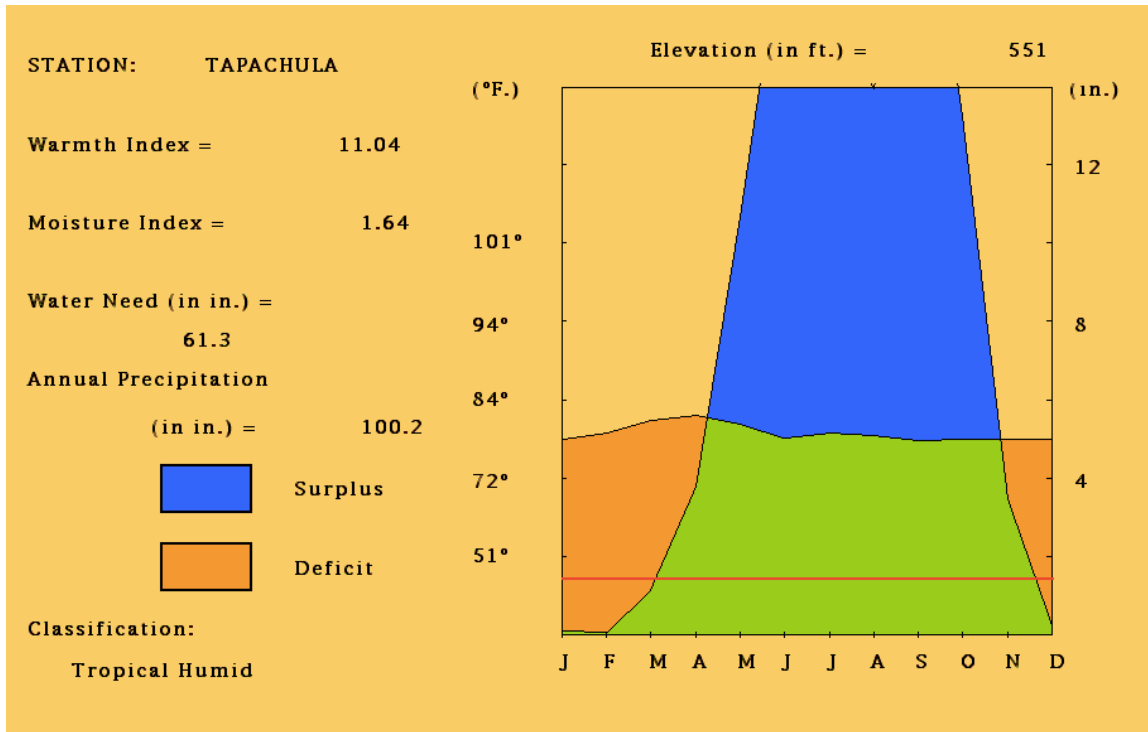


Figure 3. The closest weather station to Izapa is located in the city of Tapachula, in southernmost Mexico. With a Warmth Index of 11.04, its climate is clearly Tropical in nature, and its precipitation pattern is distinctly monsoonal, with the annual winter (i.e., low sun) drought more than being offset by the heavy rains of the summer, or high-sun, period. The local vegetation is dense rainforest and an important local crop is cacao, the source of chocolate.

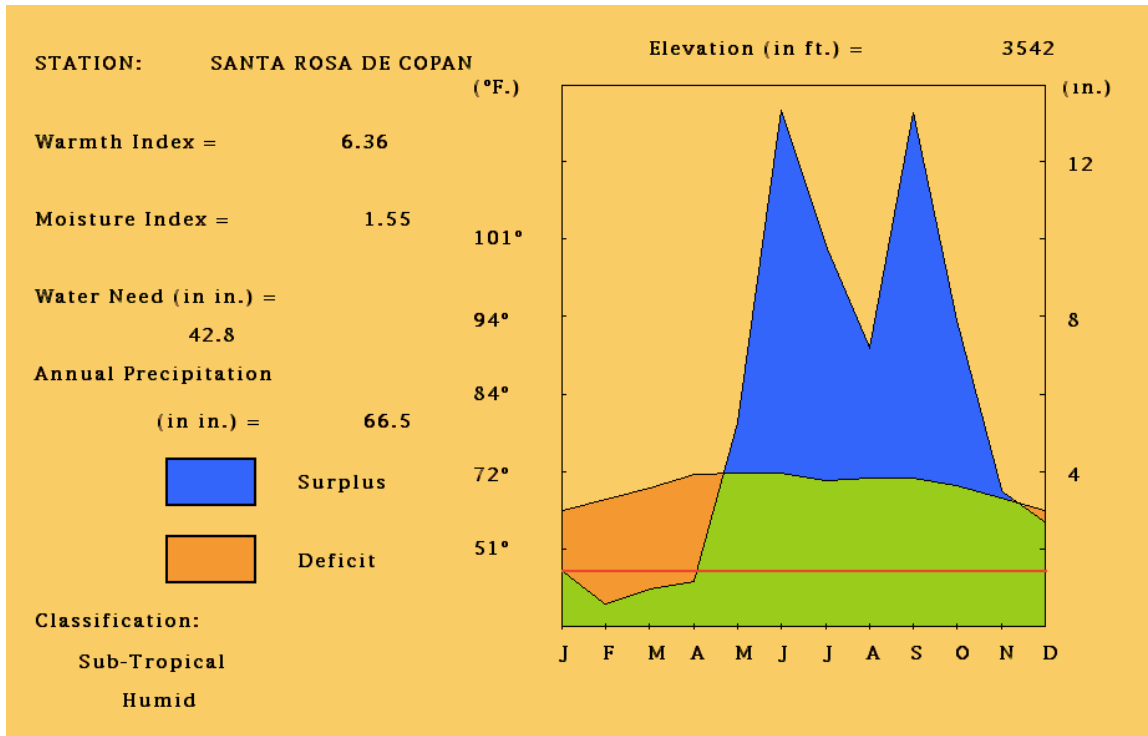


Figure 4. The nearest weather station to Copán, in the mountains of Honduras, is that at Santa Rosa de Copán. The cumulative warmth at this elevation is less than 60% of that received at Izapa, so the local climate here is sub-tropical rather than tropical. Although the monsoonal pattern of rainfall with winter drought and summer rains is still in evidence, in these inland locations it tends to follow the advance and retreat of the sun more closely, breaking into two separate peaks with a sharp decline in the month of August. The native vegetation of the surrounding mountains consists of oak and pine forests, which are certainly not the native habitat of such creatures as alligators, monkeys, and iguanas, which were all used as day-names in the sacred almanac.



Figure 5. The setting of Copán in the mountains of western Honduras. Although it is located on the same parallel of latitude as Izapa, it is not the abode of the tropical animals used as day-names in the 260-day sacred almanac, nor was it settled until at least a millennium after the almanac was created.

Chapter 2 – Discoveries at Izapa and Copán

Mexican Federal Highway 200 is a part of the Pan American Highway that winds its way from the Rio Grande in the north to the jungles of Darién, Panamá in the south. Scarcely five kilometers before it leaves Mexico and crosses the Rio Suchiate into Guatemala, it slices through the forest-covered ruins of Izapa, a sprawling site where archaeologists have mapped over 130 mounds. Even the casual tourist cannot miss it; a sign along the highway announces “Sitio Arqueológico Izapa”, you take a left-turn, and fifty meters off the road you’re there.

For this spontaneous expedition into the recesses of southernmost Mexico I had managed to recruit as my field assistant a young friend whose talents included a mastery of car mechanics and photography. Having likewise pressed my aging Fiat station wagon into service as our means of transportation, my choice of Aaron quickly proved to be an extremely felicitous one, for more than once on our long drive south, his expertise made all the difference between getting us there or not.

That mid-January morning as Aaron pulled the battered red Fiat to a stop in front of a collection of cobblestone pyramids, I must admit to a certain sense of disappointment and deflation. Perhaps I was expecting Izapa to be another Monte Albán or Chichen Itzá with grandiose structures of carved limestone or stucco bas-reliefs. Perhaps I had anticipated the same kind of dramatic introduction I had received a year earlier when I had come face to face with my first Mayan temple in the jungle at Chicanná—an elaborately carved edifice whose main entrance was through the gaping mouth of a grinning sky-god. In any case, for supposedly having been the birthplace of the sacred calendar, Izapa, at first glance, was something of a letdown.



Figure 6. The ramped pyramid near the entrance to zone F of the Izapa archaeological site, just off Mexican highway 200. At the left side of the photograph, a stairway also leads to the top of the pyramid.

However, once we started poking around a little, the discoveries began coming thick and fast. The well-rounded cobbles, with which all the structures were faced, were composed of basalt, a dark volcanic rock. This was hardly unexpected, because on the horizon to the north rose the cones of the highest volcanoes in Central America. In fact, the chain of which they are a part begins right at the border with Guatemala and continues southward as far as western Panamá.

The main pyramid—at least the largest immediately in front of us—was unlike anything else I had seen in Mesoamerica. In addition to having a staircase leading up its three-tiered face, it also had a large sloping ramp that led to its top. The latter was wide enough so that several persons could have mounted the pyramid abreast of one another.

At the base of the staircase stood an upright stone stela and what appeared to be a small stone altar. Certainly, the smooth, uncarved stela could have been used to calibrate the zenithal passages of the sun, I mused, for unlike this January morning, when it cast a long side-ways shadow, at noon on August 13 and April 30 it would have cast none.

Once on top of the pyramid we were afforded an overview of the entire site. (Actually, Izapa is so extensive that the archaeologists had divided it into different districts or zones, so what we were seeing was only that portion of zone F that had been uncovered.) From our vantage point on the mound, I quickly realized that all of the structures had been built according to a careful plan, for they all were oriented in the same direction. Getting out my surveyor's compass, I was about to take a reading on their alignment when I raised my head and caught sight of a giant mountain looming above the flowering golden-trumpet trees at the edge of the clearing. The compass suddenly became



Figure 7. It quickly became clear that the entire site of Izapa is oriented toward the volcano Tacaná, rising above the golden-trumpet tree on the northern horizon. At 13,428 feet, it is the second highest volcano in all of Central America.

redundant, because it was perfectly obvious that, whatever number of degrees it showed, the entire site of Izapa had been oriented toward the cone of the great volcano that stood on the northern horizon. (A few minutes later this orientation was reconfirmed even more dramatically. At the northern edge of the clearing I had noticed a peculiar upright stela, which on closer inspection turned out to be a shaft of granite with a carving on top of it. After studying the carving a few moments it became apparent that it had been broken, but that the fragment which remained clearly depicted a man in a breech-cloth, on his knees, worshipping the mountain.) What was that mountain, and, aside from its commanding



Figure 8. At the edge of the clearing, a granite pillar with a carving at its top seemed to be oriented to Tacaná as well. Only by studying the carving close-up did we understand its importance.

height, why had it been so important to the ancient Izapans that they had aligned their entire city to it? Again, my trusty National Geographic map came to the rescue. It identified the mountain just ahead of us as Tacaná, whose 13,428 foot (4,094 meter) cone

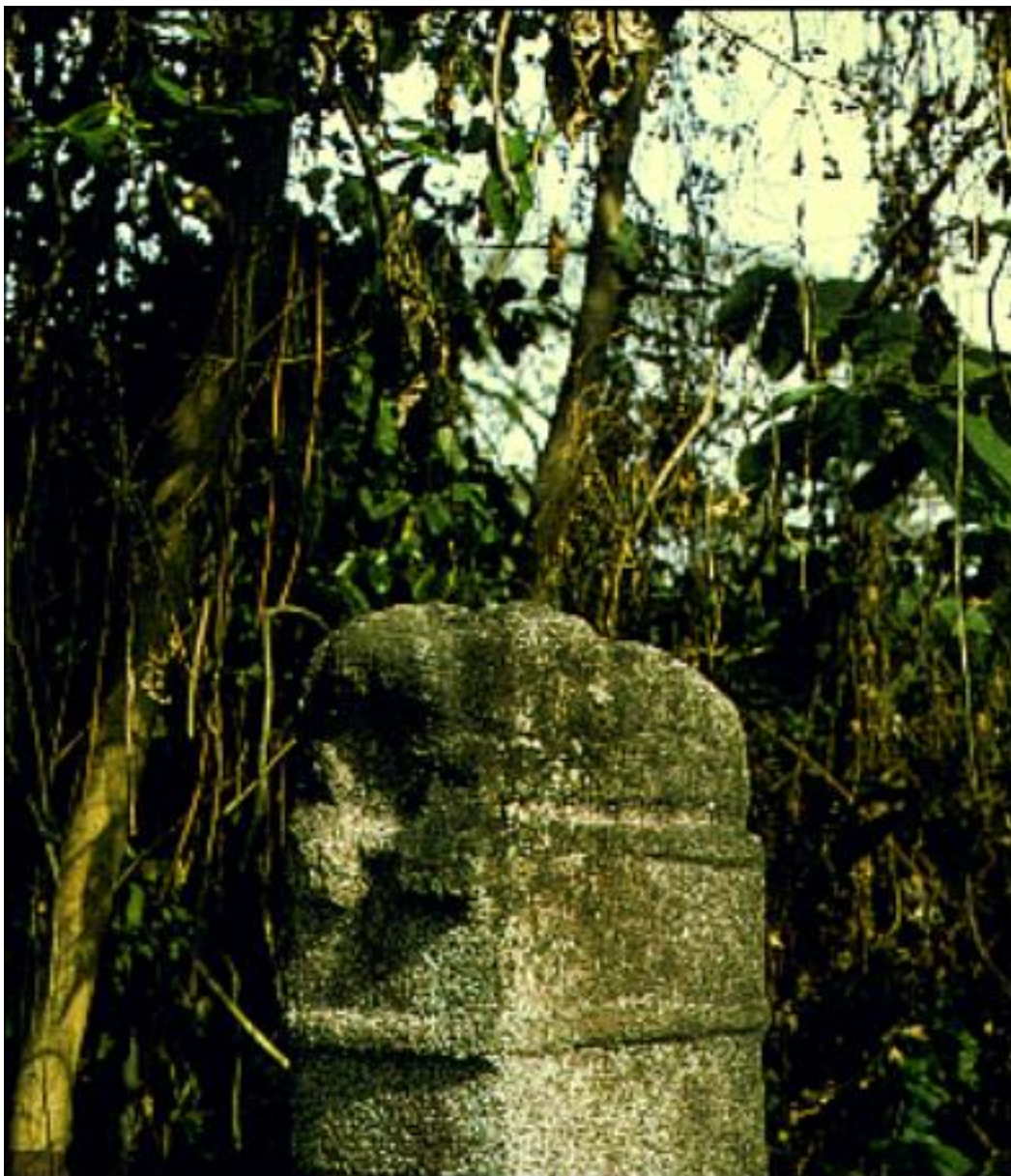


Figure 9. On closer inspection, we realized that the carving originally depicted a man on his knees worshipping the mountain. Unfortunately, the statue had been broken just above his hips, so only his legs and feet remain.

made it the second highest mountain in all of Central America. Yet, as I stood there looking off toward the great wall of volcanoes that lined the northern horizon, I realized that Tajumulco, which the map told me was 417 feet (127 m) higher than Tacaná, was likewise clearly visible a few kilometers farther to the northeast. Why, I asked myself, if I had been an ancient Izapan, would I have chosen to orient my city to the second highest mountain in view rather than to the highest? After all, for the Greeks, nothing short of Mount Olympus would do.

Taking a compass bearing on the cone of Tajumulco, I got an azimuth of 65 degrees, which, quite frankly, meant nothing to me. However, having determined never to be caught in the field again without the proper tools, I unlimbered my pocket calculator, plugged in the requisite formula, and a moment later the significance of that number suddenly became clear. The cone of Tajumulco, as seen from the site of Izapa, marked the horizon where the sun rose at the summer solstice.

Was this just another coincidence, I asked half aloud, as I sat down on the pyramid to check my calculations. If it wasn't, I said to Aaron, then Izapa may have been the birthplace of both the 260-day sacred almanac and the 365-day secular calendar, for it was the one place in all of the New World where both time-counts could have been calibrated—literally from the same pyramid. The 260-day interval could be accurately measured between shadowless noons at the passage of the vertical sun, whereas the true length of the year, 365 days, could be determined between successive sunrises over the

highest mountain in all of Central America. Perhaps there had indeed been a single astronomical genius—a “New World Hipparchus” Morley had called him—who had first designed the 260-day count but quickly discovered it did not accord with the cycle of the seasons and who soon thereafter recognized the more realistic 365-day rhythm of the heavens. In any event, I felt a certain tingle of excitement just imagining that I was now sitting on the pyramid where this nameless scholar had made his momentous discoveries well over two millennia earlier.



Figure 10. At an azimuth of 65° , or 25° north of east, the peak of Volcán Tajumulco, the highest mountain in all of Central America, marks the position of the summer solstice sunrise (June 22) as seen from Izapa. This means that Izapa is the only place in all of Mesoamerica where both the 260-day interval between zenithal sun passages and the 365-day interval between solstices can be measured – the first of which defined the creation of the Sacred Almanac and the second which established the true length of the solar year.

About 30 meters distant from the pyramid toward the northeast were the low, parallel walls of what I recognized as a ceremonial ball-court. Virtually every Mesoamerican ceremonial center has one, for the ritual ball game was as integral a part of the region's cultural life as the 260-day sacred calendar. To be sure, the ball court at Izapa was a far cry from those at such places as Xochicalco or Chichén Itzá, but what I was more and more coming to realize was that "that's the way it should be"; after all, if Izapa was the birthplace of civilization in the New World, it had a right to look unsophisticated and unfinished. If this is where it all began, I told myself, no wonder things looked less impressive than they did at Teotihuacán or Palenque, for example.



Figure 11. The ball court at Izapa is little more than 5 meters (16 feet) in width and about 20 meters (65 feet) in length and its principal axis runs east-west. In the middle of its lower north wall is a carving identified by the archaeologists as Stela 67, distinguishable in the photograph above by its lighter color.

The dimensions of the ball-court were decidedly modest, but what immediately caught my attention was a carved stone set into the middle of the structure's north wall. There, with a remarkable cleanness of line, a man standing in a boat was depicted. He appeared to be bearded and he was standing with his arms outstretched. In the waves beneath the boat one could see fish, and at either side of the boat were the profiles of long-nosed wind gods churning up the water by blowing on it. In the man's right hand there was the unmistakable outline of a cross.



Figure 12. Stela 67 shows a man standing in a boat with his arms outstretched, holding in his right hand what appears to be a cross. Although the Mormon archaeologists who uncovered it believed it to be a Christian religious symbol, it was more likely a cross-staff for measuring the heights of celestial bodies. Beneath the boat, we see not only waves, suggesting that the water body being portrayed is the Pacific Ocean, some twenty miles (30 kilometers to the south), but also fish swimming in a current being alternately blown by long-nosed wind gods, no doubt reflective of the fact that the offshore coastal current changes direction with the seasons, flowing north in summer and south in winter.

Apart from the latter element, where there is some temptation to look for religious symbolism, the features of the bas-relief told a very straightforward story. The people of Izapa must have been seafarers, for there are no navigable lakes or rivers anywhere along the Pacific coast of Mexico or Central America. The waves depicted on the carving had to be those of the open ocean, which lies scarcely 35 kilometers away to the south. The fact that there are two wind-gods depicted, each blowing from a different direction, could simply be a reflection of the fact that this portion of the coast is washed by one of the few currents in the world that seasonally reverses its flow—setting in from the south in summer and shifting to the north in winter. The beard which adorns the man’s chin—if that is indeed what it is—is somewhat unsettling because native Americans have very little facial hair and finding a moustache or a goatee among them is very rare. For this reason, one might be tempted to look farther afield, for un-American types who are able to grow beards. But, when you do, you end up by vaulting the Pacific to places as far distant as Japan, and this is definitely a “no-no” for most archaeologists. In the same way, it would be very easy to accept the cross the man is carrying as a Christian symbol, except for the fact that the carving on which it appears is most likely pre-Christian in origin. (It certainly is if the carving is in context with the remainder of the site, which as we have said has been dated to Late Preclassic times, i.e. 300 B.C. to 300 A.D.) On the other hand, the use of a cross-staff as a navigational instrument much pre-dates the Christian adoption of the symbol, and is a far more likely explanation of its appearance in this carving.

* * * * *

That afternoon, after we had completed taking our photographs and making our measurements, I suggested to Aaron that we go down to the coast, because it seemed quite apparent that Izapa must have had a strong association with the sea. Viewed from the long, black-sand beach that stretched as far as the eye could see, both to the northwest and southeast of the little Mexican shrimping port of Puerto Madero, there was no longer any doubt why the ancient Izapans had oriented their ceremonial center to Tacaná: when seen from the coast—the direction from which any seafarers would have come—Tacaná was unquestionably the highest mountain anywhere in sight. (Tajumulco's slight edge in actual elevation was offset by its greater distance inland, so, for all intents and purposes, Tacaná was 'visibly' the loftiest mountain in all of Central America.) In fact, a rapid calculation told me that one would not have had to have been all-that-good-a-navigator to find Izapa, for the cone of Tacaná was visible more than 245 km (155 mi.) out to sea! Indeed, the mountain may well have served as a 'fail-safe' beacon, guiding sailors into the great city at its base. That this scenario was scarcely a fanciful one emerged from my later readings on Izapa: Michael Coe's excavations at Ocós, at the mouth of the Suchiate river some 40 kilometers to the east of Puerto Madero, revealed that a lively trade had already developed between the Soconusco region—of which Izapa is the very heart—and South America as early as 1500 B.C. It would appear that even then Soconusco was prized for its specialty production of cacao, a plant native to the region which produces the raw material for chocolate, and for its quetzal feathers—the gorgeous meter-long emerald plumes of a bird native to the cloud forests of Guatemala and which today adorns that country's coat-of-arms.

Already I felt that my decision to make the long journey to Izapa had been vindicated. One day in the field had already taught me more than I could ever have learned from reading about the place second-hand. In fact, many of the observations Aaron and I had made, many of the clues we had stumbled upon, are not ever reported in the literature—oftentimes simply because they escape the notice of the archaeologist or anthropologist studying the site or are unappreciated as having any particular importance. I was already convinced that there was room for a geographer and his insights in the unraveling of the prehistory of Mesoamerica, because, if for no other reason, he would bring a spatial perspective into the entire equation. The archaeologist and anthropologist quite properly are the ones to do the excavations, to establish the stratigraphy, and work out the temporal associations. But, that doesn't mean that one shouldn't raise his sights out of the ground, beyond the fragments of ceramics, and look around him to see the broader environmental context in which the given people or culture lived or to attempt to relate their place in space to their surroundings. Already, in one day's visit to Izapa I had come to appreciate its special relationship to Tacaná, to Tajumulco, to the Pacific Ocean, and to the distant lands beyond it with which it maintained early commercial contacts. And each of these relationships was in addition to that most special one of all that had first guided me to Izapa—its astronomical relationship to the zenithal sun on August 13. Of course, facts or knowledge or truth are no more the exclusive domain of one academic discipline than they are of any other. If looking at the facts of Mesoamerican prehistory with the fresh eye of a geographer turned up as many suggestive leads as my first day in Izapa did, then I welcomed the challenge to continue my quest. Perhaps I had come no

closer to substantiating my hypothesis of calendrical origins, but neither had I found anything that argued against it.

Apart from sharing the identical latitude as Izapa, Copán is in every other way totally different from it. Whereas Izapa was easy to get to, whether from the sea or along

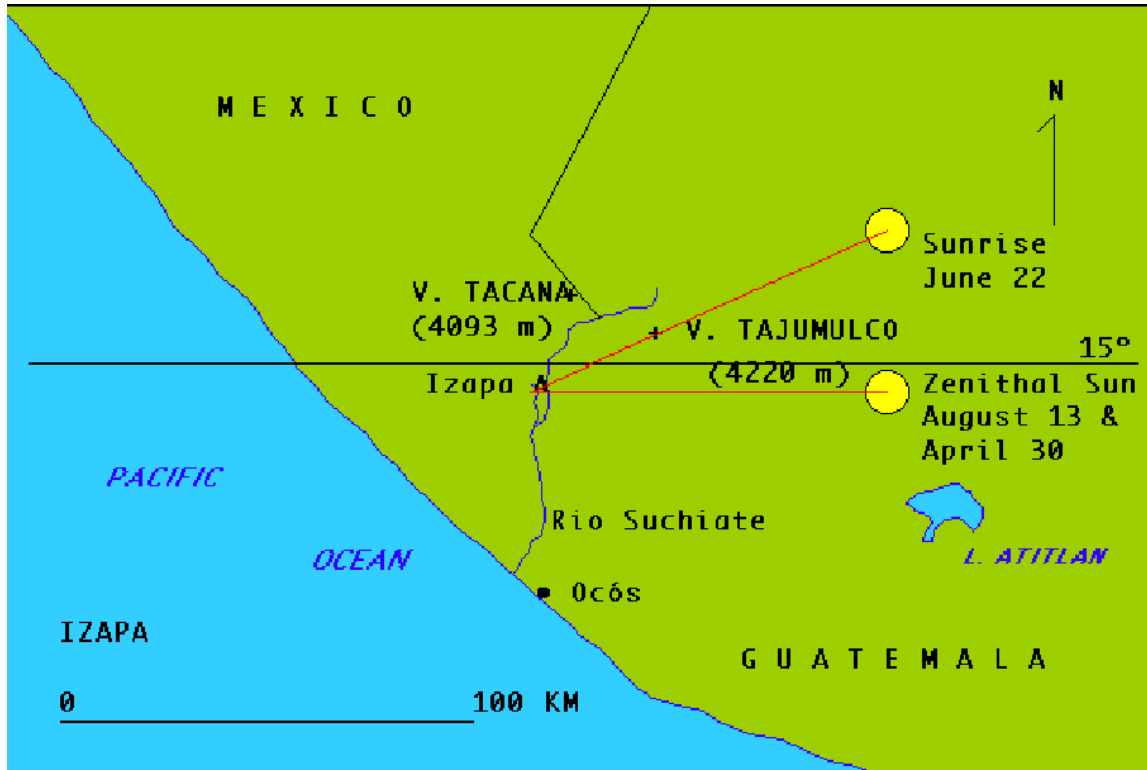


Figure 13. Not only was Izapa located at the only latitude in the northern hemisphere where a 260-day interval can be measured between zenithal passages of the sun – giving rise to the Sacred Almanac – but by being aligned to Tajumulco, the highest mountain in Central America at the summer solstice sunrise, it was also most likely the birthplace of the 365-day Mesoamerican secular calendar as well. Since they differ only 38 years in age, they were probably the creation of the same “Mesoamerican Hipparchus”, as Morley has termed him.

the coastal plain, reaching Copán was a real chore -- and probably no less for the ancient Maya than for us. The core of the Mayan homeland lay in the tropical rainforests of Petén, in what is today northern Guatemala, and in the adjacent areas of the Yucatán

peninsula. For the Maya to travel between their capital at Tikal and their astronomical center at Copán entailed a journey of some 300 kilometers (200 miles) and several days, walking first on forest paths through the pock-marked limestone country of Petén, then skirting the swamps around the Lago de Izabal and crossing the outliers of the Sierra de Las Minas into the valley of the Rio Motagua, ascending the latter into the ever-more-arid side valley of Zacapa with its cactus-covered hills and thorn-forest, and finally climbing into the cooler, moister upland valley of Copán with its stands of oak and pine. For me, the very fact that the Maya had traveled so far and had braved so many different environments to erect their astronomical center argued strongly for its location having been consciously sought, not just accidentally discovered. I could well imagine the Mayan elite, at the peak of their civilization's artistic and intellectual ferment, sending out an expedition to locate a place where the astronomer-priests could calibrate the sacred calendar with heretofore unknown precision. Seen in the context of such a scenario, Copán is probably as accessible a site as they could find, and certainly the dating of its earliest stela (426 A.D.) accords perfectly with the flowering of Classic Maya society.

Aaron and I left the paved highway just south of Zacapa and turned onto a narrow gravel road that wound upward toward the Honduran border along the Rio Copán. We had been told that there were paved roads almost the whole way to Copán if we were willing to take about a 200 km detour into El Salvador and then cross over to Honduras from there. That hardly seemed a viable alternative, however, because I also knew that the border between El Salvador and Honduras had been closed since 1969, following the short but bloody "Soccer War" between the two countries. For us, it was the back-door approach through Guatemala or none at all.

After we cleared the Guatemalan frontier post, the gravel road terminated and in its place we found a one-lane dirt track. As we passed a sign informing us that we were approaching the Honduras border and rounded a curve, even that seem to disappear. If a road-grader had ever gone past that point, it must have been several rainy seasons ago, because once we forded the border river we found ourselves trying to maneuver between massive boulders and ravines that even a burro would have found challenging. We quickly decided that, rather than ripping the bottom out of our trusty Fiat and never getting home again, we'd better turn around now while we still could. By the time we had gotten back to the Guatemalan frontier post, a local Honduran merchant in a beat-up Datsun truck was just clearing customs. We asked him if he intended to drive to Copán, and he allowed as he did. Some rapid negotiations ensued; our car was locked and left in the protection of the Guatemalan border-guards, and we piled our bags in the back of the Datsun for the 15 km drive to Copán. Just before sunset our brain-rattling ride ended as our merchant-friend delivered Aaron and me to the front door of a little hotel on the edge of town.

* * * * *

Because of its recognized importance in the context of Mayan civilization, Copán has been far more extensively researched and restored than Izapa. Its impressive ball-court, multitude of flamboyant carved stelae and altars, numerous ornate temples, Stairway of Inscriptions, and park-like setting all combine to make it truly one of the most elaborate, interesting, and beautiful of Mayan ruins. No one can fail to visit Copán and go away unmoved, for the entire ceremonial center is a testimonial to the grandeur of the Mayan world at its peak.

But, the very recognition that Mayan architecture, art, and science were nearing their zenith as Copán came into existence is to realize that it is not a place of beginnings, but rather one of completions and fulfillments. It could not have been the site of the first



Figure 14. The much-more sophisticated ball court at Copán, fashioned from carefully cut and fitted limestone blocks and surrounded on every side with elaborately carved stelae, many of them with an almost baroque-flair that boast Long Count dates, but none of which go farther back than to 426 CE.

faltering steps toward astronomy and time keeping in the New World. But, it was the locus of a science far more advanced and sophisticated than that of any other people in pre-Columbian America. The next day, as Aaron and I bounced back to the Guatemalan frontier in the cab of a Honduran beer-truck, I was glad to have visited both Izapa and

Copán. And, I was likewise pleased that my first research venture into Mesoamerica not only had left my hypothesis well intact, but perhaps even a little stronger than when I had begun.



Figure 15. Although Copán is situated on the same parallel of latitude as Izapa, its location in the mountains of western Honduras amidst forests of oak and pine is not the ecological niche in which animals such as alligators, monkeys, and iguanas are found, all of which are used as day-names in the 260-day sacred almanac. Moreover, whereas both the 260-day almanac and the 365-day secular calendar can be dated to the 14th century BCE, Copán boasts only Long Count dates which first came into use only after 235 BCE.

Chapter 3 – Getting Oriented

Rome is delightful at any time, but in the spring it is marvelous. From our apartment on the Aventine Hill, it was as easy a walk to the headquarters of the FAO, where I spent my working-days, as it was to the Forum, the market in Trastevere, or the Campo di Fiori where my wife and I often browsed in our leisure hours. The opera season was in full swing and on weekends the beach at Ostia beckoned, so my sabbatical term slipped by both rapidly and eventfully. More than once amidst the constant reminders of the lasting debt that Western civilization owed this great city, my mind went back to the yet more ancient civilization of Mesoamerica whose origins I had only just begun to explore. Was it not remarkable, I mused, that at the very time that the Julian calendar was bequeathed to the Western world by Rome, the Maya were already using a time-count whose accuracy was not equaled in our civilization until the Gregorian reform of 1582? Was it not incredible to realize that the Romans performed their arithmetic using letters, while the Maya, half a world away, had long since been the heirs of a well-developed numeric system that employed place notation and the concept of zero -- ideas that didn't even reach Europe until the Arabs brought them in from India sometime around the year 1000? If I stood in awe of ancient Rome—and assuredly I did, then what I was beginning to feel for the civilization of Mesoamerica bordered on reverence and wonder, and I could scarcely wait to resume my studies there.

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While I was in Rome, Science published the exchange of letters it had promised in response to my article. One of them pointed out that I had been “anticipated” in my

hypothesis by Nuttall—which was quite true with respect to the sacred calendar having had an astronomical basis, but not certainly in identifying Izapa as its birthplace; the other essentially reiterated the arguments of Thompson, dismissing an astronomical basis for the calendar altogether. I suspect, therefore, that anyone committed to the Thompson thesis was probably as unmoved by my defense as I was by their attack, so if anything came of the exchange, it was probably to cause both sides to dig in their heels.

In the months following the initial publication of my hypothesis and the basically cool reaction to it, I had much time to ponder not only the arguments which had been levied against it but also to consider what the motives for these arguments might be. Leaving the astronomical question aside for the moment, two other, very serious considerations remained, namely those of geography and history. The geographic problem stemmed from the fact that it had taken nearly a whole generation of research to establish that civilization in Mesoamerica had begun with the “Olmecs” and not the Mayas, a fact that such partisans as Morley and Thompson had accepted only with the greatest of reluctance. The “Olmec metropolitan area”, as Bernal and others came to call the cradle of this civilization, lay not in the Yucatán peninsula or the Petén region of Guatemala but along the Gulf Coast of Mexico in the rainforests of Veracruz and Tabasco states. Now I had come along with a hypothesis that argued for a Pacific coast birthplace, centered on the region of Soconusco, instead. If the calendar(s) had come from this area, then it is likely that the same was true of the mathematics and the hieroglyphics that made the priests’ record-keeping possible—not to speak of the astronomical knowledge which I argued was the foundation of it all. In other words, if my hypothesis were correct, most of the great intellectual innovations attributed to the

“Olmecs” would have arisen in quite another geographic realm than that currently identified as their core area.

The latter, if true, would also pose a serious historical problem. Painstaking stratigraphic and radio-carbon studies had pushed the dating of the “Olmecs” back to 800 BCE at Tres Zapotes, to 1000 BCE. at La Venta, and to 1200 BCE. at San Lorenzo. Naturally, my hypothesis implicitly suggested that Izapa must have been older still. Yet, in the archaeological literature, as I have indicated, it is identified as a “Late Pre-Classic” site, meaning that it was in existence between 300 BCE and 300 CE. Obviously, if the archaeologists were correct in their dating of Izapa, my hypothesis was in trouble, because I was something like a millennium too early. At the moment, the only evidence I had that something was going on in Soconusco as early as 1500 BCE was Coe’s discovery that a lively sea-trade was already in progress with South America at that time.

I was, therefore, not insensitive to the very real problems which my hypothesis posed to the prevailing scenario of cultural evolution in the New World. If I were correct, then forty years of laborious research and theory-building would have to be revised. Certainly, when I had published my article, it was not with the intent of upsetting any apple-carts, nor had I any special desire to play the role of l’enfante terrible or of a bull in a China shop. But, after visiting Izapa and realizing that there remained provocative clues that the archaeologists seem to have overlooked, I was anxious to follow them up at my earliest opportunity—which, because of my teaching schedule, would have to be during the next winter term when I had scheduled another student field trip to Mexico.

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The one clue that seemed as though it might have an applicability beyond Izapa was the idea of the solstitial orientation of ceremonial centers. If our “New World Hipparchus” had indeed discovered the accidental relationship between Izapa and the summer solstice sunrise over the cone of Tajumulco—or even if the initial site of Izapa had been located somewhere nearby in the coastal plain and the astronomer-priest had argued for its re-location so as to be able to use the mountain as a calendrical marker, perhaps he was setting a precedent which was emulated in the placement of later ceremonial centers in other parts of Mesoamerica. (Indeed, the geography of the “Olmecs” was one of the most puzzling things about them; nowhere in the archaeological literature does one find any discussion of what possessed them to build their great religious centers in the strange places that they did. Why, for example, were the remote sites of San Lorenzo, La Venta, and Tres Zapotes so special to them?) Could the very placement of a ceremonial center have been dictated by sun worship, I wondered? Might the early “Olmec” priests have argued for a form of city-planning based on religion, much as the ancient Chinese were always careful to locate their important structures in harmony with the laws of feng shui, or geomancy? Certainly, this was a notion that was testable, at least in a general way, through the use of large-scale maps, even before I could return to the field. On the other hand, the final verdict would still have to come from field observation and measurement, because only then would it be possible to confirm the hypothetical sight lines suggested by the map.

Before I got out my maps, however, I decided that I had to know what kind of alignments I was looking for. Because the region of Mesoamerica extends from El Salvador at latitude 13 ° N. in the south to the Tropic of Cancer at 23.5 ° N. in its northernmost reaches, I had to calculate what the range of solstitial azimuths would be

over such an expanse of territory. I was also curious what the azimuths would be for the date of August 13, which seems to have been so important in the zenithal sun passage at Izapa and Copán and as the “day that time began” for the Maya. With the help of my solar ephemeris and pocket calculator, the following table of values quickly emerged.

Azimuth of Sun						
	June 21		August 13		December 22	
Latitude	Sunrise	Sunset	Sunrise	Sunset	Sunrise	Sunset
13 N.	65.8	294.2	74.8	285.2	114.2	245.8
23.5 N.	64.2	295.8	73.8	286.2	115.8	244.2
(Average)	65.0	295.0	74.3	285.7	115.0	245.0

The interesting thing that the table revealed was that, despite a range of more than ten degrees of latitude across the region of Mesoamerica, critical sun angles within the area varied hardly more than a degree and a half, even at the extreme positions of the solstices. To test my hypothesis on the map, therefore, the key alignments I would check for would be the azimuths of 65° and 115° for solstitial sunrises and 245° and 295° for solstitial sunsets. And, if the August 13th alignment were to be found, it would very closely approximate an azimuth of 74.5° degrees at sunrise and 285.5° degrees at sunset.

Armed with these critical values and a protractor, I could now tackle my large-scale maps to see what turned-up. Of course, my greatest curiosity focused on the most ancient of “Olmec” sites, those whose geography was so peculiar in any case. Imagine my surprise—and delight, when I found that San Lorenzo, the 1200 BCE. ceremonial

center in the jungles of southern Veracruz, lined up perfectly with the highest mountain within sight (?), the 3396 meter (11,138 foot) Zempoaltepec at sunset on the winter solstice! In point of distance, my calculations told me that Zempoaltepec was indeed visible from San Lorenzo, but was it in actual fact? When Michael Coe excavated the site in 1965, he found that the entire ceremonial center had been constructed on top of a 50-meter (150 foot) man-made terrace, but he was at a loss to explain why this was so. Might it not have been to allow the astronomer-priests an unobstructed sight line to the mountain against which they calibrated their calendar? In any event, the real proof of this alignment would have to await an eventual test of it in the field—if and when I could ever get to San Lorenzo.

Laying the protractor over La Venta, a ceremonial center which Coe had called “a sanctuary in the swamps”, I let my eyes swing around its perimeter until they came to rest on the Tuxtlas, a series of relatively low volcanic cones located to the northwest of La Venta. Zeroing in on an azimuth of 295 degrees (the summer solstice sunset), I found that the sight line crossed the peak of Volcán San Martín, which, at 1402 meters (4600 feet), marked the highest summit in the group. It too, was theoretically well within the range of visibility from La Venta, a ceremonial center which boasted a 30-meter (100 foot) high clay-pyramid as its most commanding structure. At the time the site was excavated and the jungle was stripped off the mound, it was noticed that the pyramid had apparently been fluted to resemble a volcanic cone. Had this man-made replica of a volcano been constructed to provide a better line-of-sight to the real volcano that the priests employed as their calendrical marker? If it hadn't, then I had already logged my second “coincidence” of the day.

Inasmuch as most of what was known about the so-called “Olmec” civilization seemed to suggest that its earliest stages of development were largely concentrated in the eastern lowlands of Veracruz and Tabasco states in Mexico, such a reading of history overlooks the geographic realities of a cluster of sites located just to the south of Soconusco in what today are the countries of Guatemala and El Salvador. Here are at least four early population nodes, all of which duplicate the relationship of Izapa to Tajumulco on a very similar scale. For example, Abaj Takalik is oriented to the summer solstice sunrise over the Volcán Santa Maria at a distance just under 28 kilometers, Kaminaljuyu is oriented to the winter solstice sunset over the Volcán Fuego at a distance of 35 kilometers, El Baul is oriented to the summer solstice sunrise over the Volcán Agua at a distance of 33 kilometers, and the site of Tazumal is oriented to the Volcán Ilopango, some 38 kilometers away, at the winter solstice sunrise.



Figure 16. Interestingly, all the Central American orientations are to solstitial events – either sunrises or sunsets – shown by orange lines in the following figures, and none are to the August 13th sunset, depicted in red.

Throughout the autumn, whenever the opportunity arose, I would dig out my maps and protractor for another session of armchair exploration. And, time after time, the same solstitial relationship between ceremonial centers and prominent topographic features would repeat itself—so often, in fact, that by the time I was ready to return to Mexico in the winter, I had cataloged nearly two score of sites with such suggestive orientations. Of course, it remained to check out the actual lines-of-sight in the field, and for that exercise one could only hope for as clear weather as possible and the minimum of air pollution. In a country industrializing as rapidly as Mexico, the latter would be a real bonus. I knew only too well that even seeing the peaks of Popocatépetl and Ixtaccíhuatl from downtown Mexico City had become an increasingly infrequent thrill.

But even supposing that the sight lines could be proven in the field, there remained the gnawing realization that the relative ages of ceremonial centers still remained in dispute. Just because both Izapa and San Lorenzo may have been solstitially-oriented to the highest mountain within sight would not tell us which one had learned this “principle of location” from the other. My own immediate response to this question was that the principle must have arisen where the spatial relationship between the ceremonial center and the topographic feature was the closest, or the most obvious, and that it was later applied to features that were farther away and had more consciously to be sought after. To be sure, this interpretation favored Izapa, whose

calendrical marker was less than one-fourth the distance away that Zempoaltepec was from San Lorenzo; but, whether my argument was valid or not, only time would tell.

As my students and I began our sortie into Mexico in January 1975, the key concept on everybody's mind was alignments. Thus, as we all sat together at the top of the Pyramid of the Sun in Teotihuacán one morning, this was the theme of the field problem I tossed out to them. Assuming that the structure on which we were sitting was accurately named—and many archaeological ruins are not—then how was the Pyramid oriented?



Figure 17. The Pyramid of the Sun at Teotihuacán is literally a man-made mountain, so when the Aztecs arrived in the Valley of Mexico in the early 14th century, they were convinced that this immense ruined city must have been built by the gods themselves, hence the name they gave to the place – “The Home of the Gods”.

Glancing down the precipitous stairway we had just come up, the students ventured the thought that, because the steps mounted the western face of the pyramid, it must be aligned toward a sunset position. I verbally patted them on the heads and asked, toward what sunset position? Inasmuch as they had not been privy to my own table of calculations, they hauled out their surveyor's compasses and dutifully took their readings. They quickly reached a consensus of somewhere between 285 and 286 degrees, and I confirmed that the archaeologists who had excavated the site had found that the whole of the vast urbanized area—a city which had housed perhaps as many as 200,000 persons at the peak of its influence, had been meticulously oriented to an azimuth of 285.5 degrees. Then I asked again, to the sunset on which day does this azimuth correspond? There was a flurry of activity as their calculators came out and they ruffled through the pages of their pocket ephemerises. A few moments later the answer was announced: August 13th. I asked if that day meant anything to anyone, and the answer was “no”. In the short lecture that ensued, I made certain that everyone understood the magnitude of our discovery. For me, it had been one of those magical moments that one feels when he has just stumbled upon a revelation that had been lost for twenty centuries. I and my students now knew what the master plan of the greatest pre-Columbian metropolis in the New World had been -- a fundamental truth that no one, save the astronomer-priests who built it, seems to have been aware of.

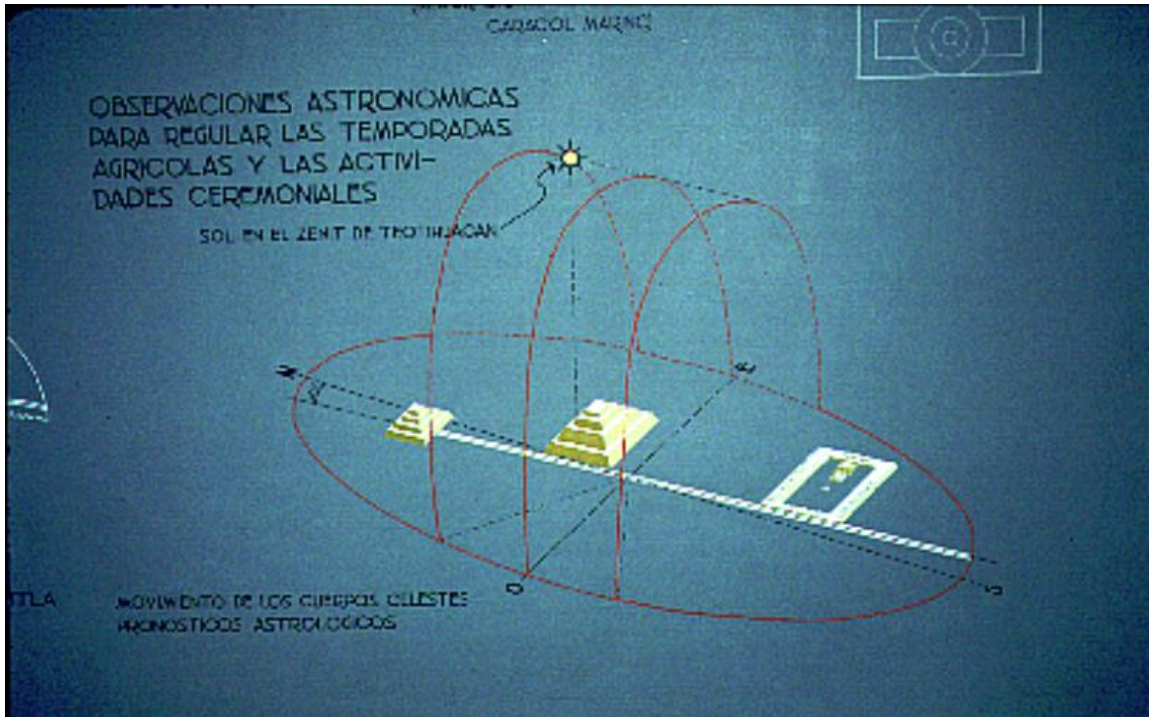


Figure 18. Hopefully, the inaccurate explanation of the layout of the Mesoamerica's greatest metropolis in the museum at Teotihuacán has long since been supplanted by the correct one, identifying the August 13th sunset as the origin of the city's master plan.

(For example, visitors to the museum at Teotihuacán are shown an exhibit which purports to explain the orientation of the metropolis, namely to the sunset position on the day the sun passes vertically overhead. Even my students were quick to realize that the sunset azimuth on that date would be 290.7 degrees, or more than five degrees in error.)

This great city, lying in the Valley of Mexico just 50 km (30 miles) to the northeast of the country's present capital and dating to the first or second centuries before Christ, had been oriented to the setting sun on the day the zenithal sun passes overhead at Izapa -- 1000 km (600 miles) to the south, and the same day that the Maya, 1000 km to the east, believed that "the world began." Surely, I believed, these three distant phenomena must be related, for to speak of yet another coincidence was

beginning to border on the ridiculous. To be sure, I couldn't explain how three different peoples and cultures, so widely separated in space, could all commemorate the same sacred event when the vertical sun, which seems to have been its trigger, can only be observed at Izapa on that day. But, now, for the first time, I had evidence that as early as 200 B.C., the Teotihuacán civilization on the plateau of Mexico had already come under the magico-religious influence of Izapa—and that was a truly momentous plus for my hypothesis.

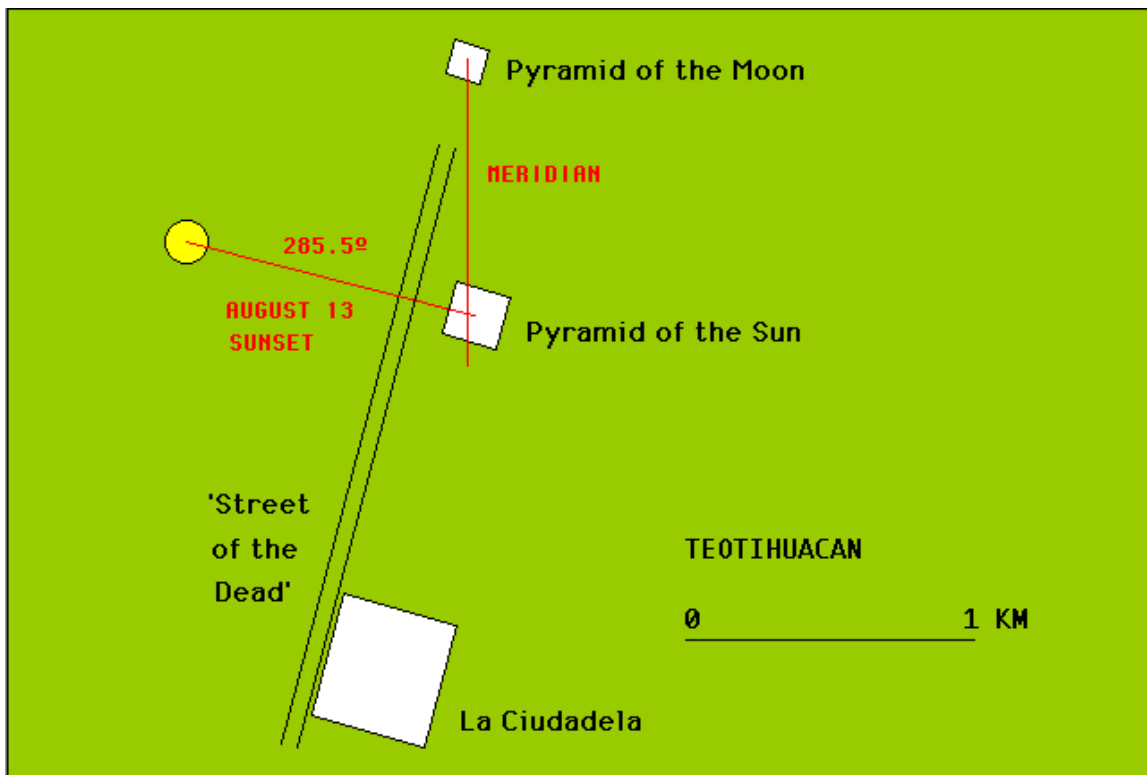


Figure 19. Although the Pyramid of the Moon marked the terminus of the great avenue called ‘the Street of the Dead’ by the Aztecs, it also defined the meridian of the city, which meant that both noon and midnight could be precisely determined as well. In addition, the construction of a ‘relay station’ on the intervening southeasterly ridge allowed the city to use the highest mountain in Mexico, Volcán Citlaltepec, (“the

Mountain of the Star”, or Orizaba (18,700 feet), to serve as its astronomical marker for the winter solstice sunrise.

As the field trip progressed, I had the satisfaction of confirming a few more of the solstitial alignments I had predicted from my map-studies but many more still had to be left in the category of “not proven”, thanks to cloudy weather, heat haze, and the pollution resulting from oil refineries and burning sugar cane fields. However, as we neared the end of our trip, I re-visited Izapa with my students because by now I had instilled in them an almost insatiable curiosity about the place. Whatever the students’ initial reactions were to the site, they were careful about offending me, and if any negative comments were heard, they invariably had reference to the oppressive heat and humidity that unfortunately seem to be hallmarks of “Olmec” ceremonial centers.



Figure 20. All three of central Mexico's highest mountains – Orizaba, Popocatepetl, and Ixtaccihuatl—served as horizon markers for solstitial events for some of the earliest agricultural settlements on the plateau.



Figure 21. In northern Veracruz, at least two of the lowland sites near the coast looked to the interior mountains as markers for the solstices, and Cerro de Las Mesas used Orizaba (Citlaltepetl) as its marker for the August 13th sunset.

One young lady, who was doing a research paper on the role of the serpent in Mesoamerican mythology, even went so far as to suggest that the carving of a snake's head that stood near the entrance to the site might possibly have some kind of an alignment, too. The basalt boulder that had been sculpted to resemble a rattlesnake's head stood about 30 meters from the main pyramid and was backed both by an uncarved stela and, a couple of meters farther behind, by another basalt boulder which appeared to represent a turtle's head. Although I told her that it was unlikely that the two sculptures had any special alignment, save to the main pyramid, it was a simple

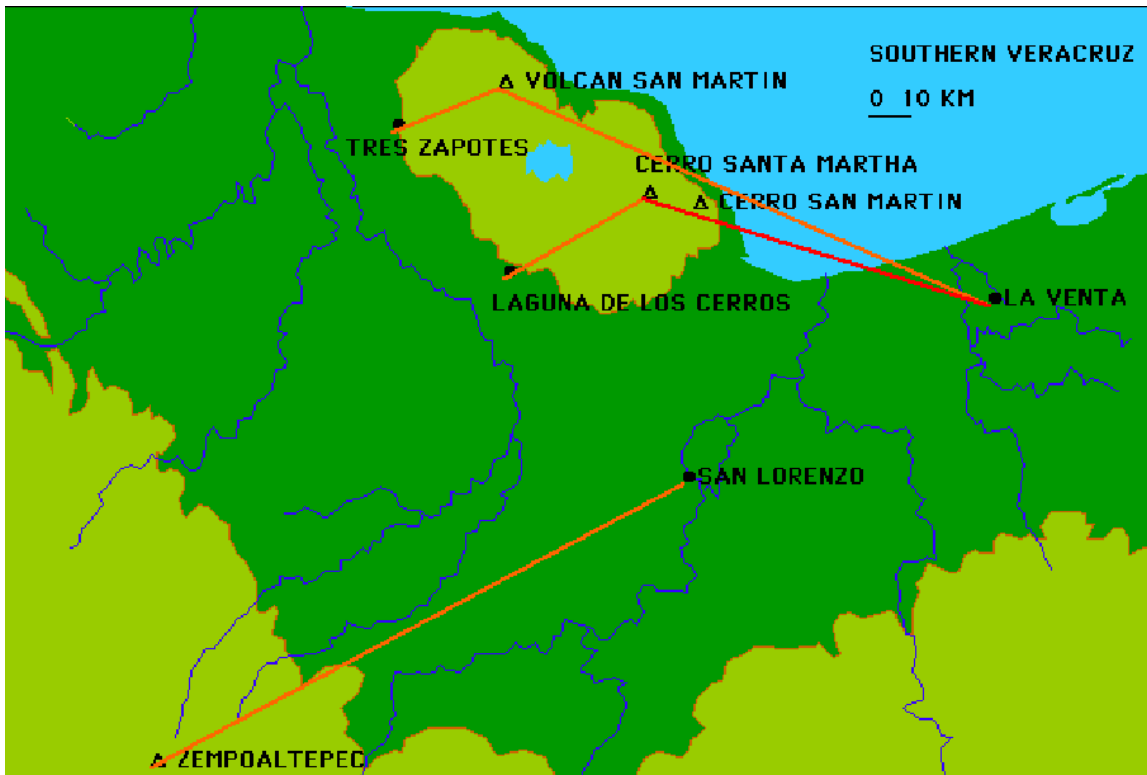


Figure 22. In southern Veracruz, the very heart of the “Olmec Metropolitan Area” as defined by Bernal, were the oldest of the urban centers that had been ascribed to the “Mother Civilization” of Mexico – San Lorenzo at 1200 BCE, La Venta at 1000 BCE, and Tres Zapotes at 800 BCE.



Figure 23. Because most of the classic Maya realm lay within the Yucatan Peninsula, there were no mountains in sight of any of their archaeological centers apart from Uaxactun and Tikal, both of which were located on the water-divide between the Caribbean Sea and the Gulf of Mexico. Of the two, Uaxactun was undoubtedly the older, having been built so that it aligned with the winter solstice sunrise over Baldy Beacon (1020 meters, or 3345 feet in height), which the Maya initially believed was the highest peak in the Maya Mountains of what today is the country of Belize. When they discovered in the 8th century CE that Victoria Peak was somewhat higher, (1120 meters, or 3670 feet) they felt impelled to “correct their impression” by building an entirely new city at Tikal with an identical winter solstice sunrise alignment to the higher peak, a fact which helps explain why two of their most important urban centers were spaced so closely together – a relationship that early archaeologists were at pains to understand.

matter to check them out with the surveyor’s compass, and so I proceeded to take a reading on the snout of the snake. As I had suspected, the snake’s head sculpture had an

azimuth about 60 degrees west of north, which in itself was meaningless. However, when I moved the compass back over the turtle's head, the needle gyrated wildly and came to rest pointing at the snout of the turtle. No matter where I moved the compass within a radius of a meter from the sculpture, the needle always pointed to the nose of the turtle! Indeed, it immediately became clear that the basaltic block was acting like a giant bar-magnet, because we could outline its lines of force in exactly the same way the typical high-school experiment with iron filings is carried out. It appeared that, because the lines of force came so precisely to a focus on the snout, whoever had carved the turtle's head must have been aware of its magnetic properties; otherwise, the lines of force might just as well have come out randomly through an eye or an ear instead. But, for anyone to have known about magnetism, it seems likely that the sculptor also must have known about iron—and there is no evidence of such knowledge pre-dating the Spanish in Mesoamerica!

Needless to say, that night I didn't sleep a wink. The mystery of the magnetic turtle's head kept me tossing and turning until dawn, when I hit upon a possible explanation. That morning at breakfast I told the students that I had a theory, and I invited as many as were willing to accompany me back to the site to check it out. Luckily about half of them did, and I immediately put them to work with their surveyor's compasses. I instructed them to test every exposed rock in the entire site for magnetism, because not until we knew whether this was a unique circumstance and not a commonplace occurrence would there be any reason to formulate a hypothesis to explain it. I told them that as soon as they came back to me with their results I would "lay my theory on them".



Figure 24. This carving at Izapa—that my students and I identified as a turtle head—proved to be strongly magnetic, with all the lines of force coming to a focus in its snout. Although its carver may have associated magnetism with the homing instinct of the turtle, the examination of similar carvings in nearby Guatemala by MIT scientists in 2015 established that many of the iron-rich basaltic boulders of this region had been struck by lightning, most likely over 2000 years ago, but have ever since retained the internal magnetic pattern that they received when they were hit.

While the students were making their observations, I strolled over to look more closely at two other sculptures that I had seen on my first visit to Izapa but had paid scant attention to. (As with so many other things, in fieldwork if you don't ask the "right" questions, you won't get the "right" answers; if your antennae are not tuned to the correct wavelength, you're likely to miss what might be valuable clues.) Now, inasmuch as

sculptures had suddenly become a possible source of information, I wanted to examine what seemed to be an up-turned bowl near the east side of the main, or ramped, pyramid and an altar at the western end of the ball-court.

A closer inspection of the bowl, which had been hollowed out of a single piece of basalt, revealed that it had an intricately carved edge with a concave notch at one end. During the rainy-season, it would obviously have filled with water and its similarity to a baptismal font was striking. Certainly, if the Spanish conquistadores had seen it, this is what they most likely would have been called it in the literature, just as they had also seen a “nunnery” at Uxmal and a “snail shell” at Chichén Itzá. In the same way, perhaps my own sudden preoccupation with turtles caused me to see the bowl as an up-turned turtle shell, with the notch being an indentation in the carapace for the creature’s head. In any event, I mused over what function this water-filled bowl might have fulfilled. Had the ancient Izapans known about magnetism, could this have been the frictionless surface on which a sliver of lodestone might have been floated on a leaf or a small twig? If it had, would it not have been a most impressive demonstration of the knowledge and power of the priest to watch the lodestone sliver turn and point to Tacaná—the great mountain that stood guard over the city on its northern horizon?

And what about the altar that stood a few meters farther north, at the western end of the ball-court? The Spanish had reported that when the ritual ball-game ended, the captain of one of the teams—there is some debate as to whether it was the winning or losing team—was beheaded. I wondered, not so much whether this altar was used for such a gory purpose, but rather why, on closer study, it now took on the configuration of a stylized turtle? The danger of reading one’s own preconceptions into the creations of

other peoples and cultures is a real one, so again I realized how careful one must be in such interpretations.

About half an hour later when the reports were all in and no additional examples of magnetic artifacts had been turned up, I put forth my “explanation”. Inasmuch as the ancient Izapans were a sea-faring people, I argued, they were undoubtedly familiar with the massive migrations of turtles that took place along the coast of Soconusco. Inasmuch as they had reserved the one and only magnetic sculpture in the entire site for the carving of a turtle’s head, perhaps they had associated magnetism with the homing instinct in the turtle—an uncanny ability which allows these creatures to literally zero in on the half-kilometer of beach where they had been hatched from an egg, even after a swim of some 2500 kilometers or more. This was not necessarily an unreasonable idea, but certainly one that couldn’t be readily substantiated either. In any case, on the long drive back to Vermont, I realized that my next weeks and months of library research would be concentrating on such unlikely topics as turtles and the properties of magnetism. And, if it turned out that the inventors of the sacred calendar had also been the first people in the world to discover magnetism, that would certainly be an exciting, even if somewhat tangential, finding in itself.

Chapter 4 – Computer Dating

In his exhaustive study of turtles titled So Excellent a Fishe, Archie Carr examines every conceivable mechanism they might employ for navigation, including magnetism, but in the end he concludes that he still doesn't know how they do it. However, he does make one observation that I found of particular interest, namely, that there is a distinctive species of black turtle that migrates between the coast of Guatemala (the Soconusco region) and the Galápagos Islands off the west coast of South America. This captured my attention because it meant that anyone familiar with the black turtle would, at the time of its migrations, find yet another "fail-safe beacon" (like Tacaná) that was capable of guiding them to Soconusco, only in this instance its range extends no less than 1600 km (1000 miles) out to sea. In other words, any sefarer intersecting its path had simply to take his bearing from the black turtle to find his way to Izapa.

Whether these musings of mine were pure conjecture or not, the fact that the sculptured turtle's head was magnetic was real enough, so I decided to submit a report on this topic to a professional journal. Ironically, just as I was about to send it off to Science, that magazine published as its lead article a seven-page review of the magnetic properties of a small piece of hematite found by Coe in his excavations at San Lorenzo in 1973. The article, authored by John Carlson, raised the question as to whether the Chinese or the Olmecs had been the first to discover magnetism -- a question that certainly had occurred to me as well when I stumbled onto the magnetic turtle at Izapa. Although my further readings on the subject had shed little light on the timing of the Chinese discovery -- most sources agreeing that it was known at least by the beginning of the Christian era -- what I did find titillating was the fact that the early Chinese often made their compasses in the shape of turtles. Whether this was just another of the many

"coincidences" I seemed to keep encountering or whether there was some functional relationship between the two I dared not speculate. Certainly, to have suggested the latter would have been heretical, for trans-Pacific diffusions of any kind are frowned upon by most archaeologists and anthropologists -- and especially at so early a period in time.

In any event, my paper went off to the British scientific journal, Nature, where it was published in early February 1976. Unlike my previous paper that presented a hypothesis, this one presented a fact, so the reaction to it was one of interest rather than hostility. Indeed, I was later to learn that the archaeologists who had originally excavated the sculpture at Izapa were so disbelieving that they went down the very next day to see if it truly was magnetic. In the same connection I learned that when the sculpture had been unearthed, it had been called a "frog's head". Can you imagine where my theory building would have led me if my students and I had perceived the sculpture as being a frog instead of a turtle! (If beauty lies in the eye of the beholder, so too, do perceptions. Depending on "where one is coming from", it is hardly surprising that some people see Viking ships on the walls of Mayan temples at Uxmal.)

In the correspondence which followed the article's publication, a couple of geophysicists assured me that it wasn't such a remarkable find after all; the stone had obviously been struck by lightning, and its magnetic alignment was due to that. Frogs! Lightning! Maybe. . . . But, enough of this distraction and back to the sacred calendar where the puzzle had all begun.

* * * * *

On January 1, 1976 -- just a month before my turtle article appeared in Nature -- I assumed a new position as Professor of Geography at Dartmouth College. This meant that I was unable to undertake another junket to Mexico during the winter field season of

1976, but I was afforded the exciting opportunity of putting Dartmouth's excellent computer facilities to work on my calendar problem. I decided to take the key facts that were known about the Mayan calendar and write a program that I could then run backwards in an attempt to find out when the secular and sacred counts had come into being. In other words, it was my hope to enlist the computer's aid in finding out just how old the calendars really were.

Of course, any computer program is only as good as the premises on which it is based. As hackers are quick to warn us, "Garbage in, garbage out", so in order to formulate my program, I had to review what it was that we actually knew -- or thought we knew -- about Mayan calendrics. Perhaps the most important single fact on which my computer program was predicated was that derived by Goodman, Martínez, and Thompson when they established that the "day that time began" was one which the Mayas called 4 Ahau 8 Cumku, and which equates to August 13, 3114 B.C. in our calendar. All researchers who have worked on the Mayan calendar are agreed that the year cited above is as fictitious as that ascribed, for example, to the traditional founding of Rome. What it seems to represent is a projection into the distant past of an event that took place much more recently, namely the creation of what the archaeologists call the "Long Count".

The Long Count is an ingenious invention in its own right, and a comparable mechanism for recording time did not emerge in the Western world until Joseph Scaliger proposed the so-called "Julian period" in 1582. (A Julian period has a duration of 7,980 years and represents the least common multiple of three cycles that were much used in Roman chronology: the Roman Indiction, the Solar Cycle, and the Lunar Cycle. The current Julian period had its beginning on January 1, 4713 B.C.) In essence, the Long Count was a fusion of the 260-day sacred almanac and the 365-day secular calendar that

produced a unique combination of numerals and names from each of the counts. Thus, the "day that time began" had a very specific designation: it was the 4th of the 13 numbered days of the ritual calendar and the 20th (Ahau) of the 20 named-days of the sacred almanac. It likewise fell on a day numbered 8 (in a monthly sequence of 20 days) in the "month" of Cumku, which was the last of the 18 regular months of the secular calendar. (The latter had 18 "months" of 20 days, followed by 5 "unlucky" days to round out the total of 365 days.) Such a combination of numerals and names could not recur in the two calendars until 52 years had elapsed.

Here I might digress a moment to point out just how artificial the "day that time began" really was. Imagine selecting as one's starting point in time a day numbered 4 which happened to be the last day of the "week" near the middle of the last month in the year! It would be as though the Gregorian calendar we presently use began on a Saturday about the middle of December on a day numbered 4. For what was supposed to have been a beginning, one wonders what happened to the first three numerals, and to the days from Sunday through Friday, and to the rest of the year up to the middle of December! Although such internal inconsistencies do not appear to have troubled the Maya, it is because of them that modern researchers feel the Long Count was a much later embellishment to their time-reckoning system, rather than an original or integral part of it.

My computer program was also predicated on a couple of other premises, the first of which was that the 260-day sacred almanac must be older than the 365-day secular count; if it weren't, why would someone who already knew the true length of the year come up with such a weird interval as that? Moreover, if the two calendars were begun at different times, it is reasonable to assume that they also had different starting dates. (Already my findings at Izapa had suggested that the secular calendar had been calibrated

to the summer solstice, which occurs on June 21-22 in the northern hemisphere, whereas one of the bases of my hypothesis regarding the sacred almanac was that it commenced on August 13.) Another premise, already alluded to, was that the Long Count had been devised considerably later than the two individual calendars of which it was composed. In this connection, it should be pointed out that the earliest Mayan dates that have ever been discovered go back to a period of time which they called "Baktun 7". A baktun was a measure of time representing 20 katun, each of which had 7200 days, and thus had a total of 144,000 days, or more than 394 years. In terms of our present calendar, Baktun 7 dates range from a couple of centuries before Christ until a couple of centuries after Christ -- precisely the period which the archaeologists call the "Late Preclassic". A further premise was that the major chronological 'building-block' of the "Olmecs" had been the katun, or 20 times the tun (360-day year). This did not seem an unreasonable premise, because such a practice was common among the Maya and probably had been inherited by them from the "Olmecs". A final fact that I plugged into my computer program was based on an observation of Bishop Landa, the third Spanish prelate of Mérida (the colonial capital of the Yucatán), namely that the Maya celebrated the beginning of their New Year on July 26.

Once the program had been completed and debugged for errors, I set the computer churning away to see what answers it would give me. One of the first results to emerge was that there were only three times in the entire span of Mayan history when a katun ended on the day 8 Cumku. The first time was in 1675 B.C. when the day 1 Ahau fell in that position, the second was in -236 B.C. when 11 Ahau fell on that date, and the third time was in 1202 A.D. when 8 Ahau coincided with that date. From what else is known of Mayan civilization, it was quickly apparent that the first date was too early and

the last date was too late for the Long Count to have come into being. Only the middle date, which corresponded to 18 September -235 (236 B.C.), was a feasible point of origin for the Long Count, and fell right into the Baktun 7 range characteristic of the oldest Mayan inscriptions. It appeared, therefore, that the astronomer-priests had selected this date from which to interpolate the two calendars backwards, finding that it would take 7 baktuns and 6 katuns (a grand total of 1,051,200 days) to reach a point that was respectably old enough for time to have begun. This was the day they called 4 Ahau 8 Cumku; the fact that they chose 13 August from the 365 days in the year available to them for this artificial beginning seems to reinforce once again the special importance that this date had for them.

I digress again solely to point out that an American researcher, John Teeple, whom Thompson had called a "brilliant mathematician", had reached the same conclusion, working from quite another direction, as early as 1930. Yet, Thompson had discounted Teeple's results, and, as we have seen earlier, had even dismissed his own finding of the August 13th beginning date and an astronomic origin of the sacred calendar as a pure coincidence. Already, with its first result, the computer had put me in the same company as a "brilliant mathematician", but seems to have estranged me even further from the dean of Mayan archaeologists.

As the computer kept churning, it soon became clear that a date such as 4 Ahau 8 Cumku would never have occurred if both the sacred and secular calendars had used the same starting day. This is because 4 Ahau is the 160th day of the 260-day ritual almanac, and, after its initial occurrence, it recurs, of course, every 260 days. However, because of the true length of the solar year, in the secular calendar it would recur only on days that were multiples of 5. Because the Maya numbered the days of their month from 0 to 19

instead of from 1 to 20, this means that the fifth, tenth, fifteenth, and twentieth days of the month were numbered 4, 9, 14, and 19, respectively. Thus, for 4 Ahau to have fallen on a day numbered 8 would have meant that the secular calendar had to have been set in motion independently of the sacred calendar, which is just what my findings in Izapa had suggested -- namely, an August 13th starting date for the ritual almanac, determined by the passage of the zenithal sun, and a June 21st starting date for the secular count, measured between successive sunrises over the highest mountain in Central America.

What I had programmed the computer to do was to run the calendars back until the first day of the secular count -- a day which the Maya called 0 Pop -- coincided with June 21. (Editor's note: Remember that at this time in history, the European world had no calendar, but if the Julian calendar -- invented by Julius Caesar -- had existed, its dates would have been 12 to 13 days behind the timing of astronomical events as we measure them today, or as desperately in error as it was ahead of them, when it was finally replaced with the Gregorian calendar in 1582. Thus, the summer solstice would have been taking place on July 3rd, and the zenithal passage of the sun over Izapa would have occurred on August 26th.) Imagine my surprise when the computer did not bring the two dates into correspondence with each other until the period between 1321 and 1318 BCE. (-1320 to -1317) (This four-year "dove-tailing" is due to the fact that our own calendar takes four years to add a one-day, or Leap Year, correction.) Thus, if my computer program was correct, the secular calendar appeared to be almost a thousand years older than other researchers, such as Morley, have previously suspected.

Of course, if the sacred calendar was older still -- as everyone had reason to believe -- then it was already running at the time that the secular calendar was initiated. Looking at my computer print out, I noticed that the dates of the ritual almanac on which

the summer solstice fell during those four years were 8 Manik, 9 Eb, 10 Caban, and 11 Ik, respectively. Thus, using any or all of these days as a starting point, I had the computer resume its run to determine when the first day of the ritual almanac (a day called 1 Imix) would coincide with August 13. This time the results were almost as surprising as the first, but in quite the opposite way. The computer cycled back only 38 years farther, to 1359 BCE, (or -1358) to find August 13 opposite 1 Imix! Thus, Morley's suggestion of a "New World Hipparchus" suddenly became all the more realistic; both time-counts might indeed have been the invention of one man, at one place. And the likelihood of that place having been Izapa in the fourteenth century BCE, seemed to me, at least, to be increasingly strong.

I take the liberty of jumping ahead here to recount an incident that took place in the headquarters of the New World Archaeological Foundation, the organization that had excavated Izapa, during the winter field season of 1977. The foundation's Director, Dr. Gareth Lowe, inquired of me why he hadn't seen me in Mexico during the 1976 season and I told him that I had not only changed positions but had also been working on a computerized reconstruction of the calendars' chronology. When he asked what my results had been and I replied, "the fourteenth century B.C.", he smiled and pulled his most recent research monograph off the shelf, opened it, and asked me to read a passage or two. In excavations carried out at a site about 40 km (25 mi.) west of Izapa, Lowe and his associates had uncovered literally hundreds of "small, nondescript pieces of obsidian" in the earliest horizons, but "sometime following 1400 B.C." they abruptly disappeared, only to be replaced by manos and metates (for grinding corn). Lowe believed that the bits of obsidian had been set into wooden boards and used for shredding a root crop known as manioc. However, sometime in the 14th century BCE he reasons that a radical change in

dietary patterns took place and that the much-more-nutritious maize took over from manioc. If he is correct, then perhaps we have the why for calendrical experimentation in the Izapa region, as well as a "back-handed" confirmation of when it occurred. After all, plus or minus 50 years in radiocarbon dating not only put me in the right ball-park; it also gave me a 'home-run'.

Needless to say, I found the 14th century BCE a very exciting ball park to be in, because it strongly supported my contention that Izapa must be older than San Lorenzo and the other "metropolitan" Olmec sites. It made my hypothesis of calendrical origins entirely consistent with a northward diffusion of civilization across the Isthmus of Tehuantepec into the Gulf coastal lowlands and not out of it, as the conventional archaeological wisdom suggested -- but it also put me increasingly at odds with both the Mayanist school represented by Thompson and the "Olmec" school which had arisen to challenge him.

Heartened by the computer's reinforcement of the temporal structure of my initial hypothesis, I decided to submit my results for publication in the Journal for the History of Astronomy published in Cambridge, England. When I mentioned to the editor that my study of the chronology of the Mayan calendar seemed to lend further support to my notion of solstitial orientation as well, he suggested that I combine both papers in one lengthier report. Thus, when my article titled "A Reconstruction of the Chronology of Mesoamerican Calendrical Systems" appeared in early 1978, it not only presented the results of my computer study but also my work on solstitial orientation and the explanation of the August 13th alignment of Teotihuacán. However, one result of my computer investigation appeared to be so contradictory that I decided to withhold it from

publication rather than stir up another hornet's nest. That had to do with a calendrical reform that the Mayas appear to have carried out sometime around 40 A.D.

Perhaps you will recall mention of Bishop Landa and his observation that the Maya celebrated July 26 as their New Year's Day. Although he was unaware as to why they had chosen this day, it occurred to me that there was the distinct possibility that the Maya of the 1st century A.D. might have been using the same technique to calibrate their calendar as I imagined their predecessors to have done in the 14th century B.C., namely by marking the southward passage of the vertical sun. (In this connection, I found it extremely puzzling that the dean of Mayanists had never linked this observation of a contemporary of the Mayas with an astronomical mechanism for calibrating time.) All I had to do was check my solar ephemeris to find at which latitude the zenithal sun stood at noon on July 26. The answer, 19.5 degrees N., lies just "where it should be" if it was to be of any real use to the Maya -- right over the middle of the Yucatán peninsula. Indeed, a better compromise between the city-states of the north and the south could hardly have been imagined. Yet, as I drew my finger across this parallel on the National Geographic's Archaeological Map, I encountered only one site where such a phenomenon could be observed -- a place called Edzná, whose little informational label identified it as a "Late Classic" ceremonial center. This meant that it had been dated to between 600 and 900 A.D., the period that represented the peak and the beginning of the end for the Classic Maya. Edzná, like Izapa, was not a place I had ever heard of, and certainly it did not figure very prominently in the archaeological literature of the Maya. Indeed, I found only one reference to it, by Thompson, who stated that the Mayan calendar seems to have undergone a one-day correction that began at Edzná in 671 CE and then was progressively adopted by other Mayan ceremonial centers throughout the Yucatán. This,

of course, suggested that the priests at Edzná wielded some kind of astronomical "clout" over the Maya that those in other ceremonial centers lacked, an idea that certainly conformed to my notion that it must have been the site of a major calendrical reform. My problem, however, lay in the fact that the computer's dating of that reform was around 40 A.D., which was supposedly six centuries before the city was founded! Being within 50 years of a major agricultural change in Izapa was one thing, but being 600 years off in a calendrical reform was quite another. Not until I could somehow explain that discrepancy could I dare publish my finding that the Mayas had revised their calendar during the first century of the Christian era.

Chapter 5 – Edzná and the Maya “Awakening”

Just after Christmas 1976 I headed southward once more, this time accompanied by a daughter interested in archaeology, a nephew seeking a new sense of direction in his personal life, a student who had majored with me when I taught at Middlebury, and another student who had become one of my first majors when I transferred to Dartmouth. As on my earlier field trips, I had no fixed idea of what we would be looking for, but I did outline a couple of goals for our group once we crossed the Rio Grande. Our principal mission would be to continue the search for ceremonial centers with solstitial orientations, but in the process I also hoped to delimit the geographic extent of the region in which the sacred calendar had been utilized. This meant that we would concentrate our attention on the more peripheral parts of Mesoamerica, examining the region's cultural boundaries, not only along the edges of the desert in the north, but also in the more remote sections of the Mexican plateau in the west and in the highlands of Guatemala, Honduras, and El Salvador in the south. New dimensions of inquiry had also been sparked by the discovery of the magnetic turtle, so I alerted my young assistants to be on the lookout both for turtle sculptures of any kind, as well as any artifacts that might be magnetic.

* * * * *

Chicomostoc is probably one of the most fascinating and enigmatic sites in Mexico, for almost everything about it is cloaked in mystery. Located about 60 km (35 miles) south of the Spanish silver-mining center of Zacatecas, it literally stands athwart an ancient physical and cultural boundary in the heart of the Mexican plateau. To its south lay the domain of the settled agriculturalists, the farmers whose irrigated fields provided the sustenance for the great civilizations of Mesoamerica. To its north lay the domain of

the hunters and gatherers, primitive nomadic bands who wandered back and forth through the semi-desert eking out their meager existence. Aztec legends spoke of Chicomostoc as one of the homelands of their people, a place whose name in Nahuatl means "seven caves". When the Spanish stumbled upon its ruins in the 16th century, they called the place La Quemada -- "the burned one", for it was apparent to them that it had been destroyed by fire sometime in the past.



Figure 25. Chicomostoc was truly an outlier of civilization, boasting one steep-sided pyramid and a large ball court, nestled at the base of a hillside fortress that guarded one of the major north-south routes of the Mexican plateau and marked the boundary between the nomadic hunters and gatherers of the north and the settled agriculturalists of the south.



Figure 26. The fortress walls at Chicomostoc enclosed the top of the hill and guard towers provided a 360° view of the surrounding countryside as far as the eye could see.

Whether a birthplace of the Aztecs or one of the victims of their depredations, Chicomostoc clearly served as a border fortress between the high cultures of central Mexico and the primitive Chichimecs, or "dog-people", of the northern desert. It had been built on a high hill overlooking one of the most strategic north-south pass-routes on the west of the plateau, and to enhance its natural site, great stone walls had been thrown up around the crest of the mountain and guard towers had been erected within their perimeter. On the southeastern flank of the hill stood one relatively crude, steep-sided pyramid overlooking a ball-court. Farther down the hillside toward the southeast stood the roofless ruins of a great palace or market-place and dimly outlined against the side of



Figure 27. The roofless palace or market place at Chicomostoc demonstrated an orientation to 285° , suggesting that the 'formula' for commemorating the birthplace of the calendar was known to its builders. The use of pillars was a favored architectural tool of the Toltecs, so the structure may well have been designed by them.

the valley to the east stood the dilapidated remnant of what the local guides called the 'temple of the moon'. Although a military function was its primary *raison d'être*, Chicomostoc had enough of the trappings of civilization to prove that it had served as a low-grade religious and/or commercial center as well.

As my young assistants and I recorded our observations regarding building alignments and key solstitial positions on the horizon, our discussion frequently came back to the questions of who might have erected the fortress-site and when. Not that we were trying to second-guess the archaeologists, but as cultural and historical geographers we were interested in the processes of spatial diffusion through time. We knew from the

very location of the site that it was "late" historically and that it represented a frontier of innovations which had emanated from somewhere to the south and east. The ball-court, the pyramid, the palace or market place with its massive stone columns, all revealed influences which, however dilute or impoverished they might have been, were hallmarks of the greater civilizations nearer the core of Mesoamerica. The fortified nature of the site suggested both the proximity and the constancy of the Chichimec threat, just as the lowland corridor over which it stood guard hinted at the importance of the routes of trade that must have passed this way in pre-Columbian times.

For us, however, the most intriguing aspect of Chicomostoc turned out to be the orientation of its many-columned palace or market place. Whoever this site's builders had been, and whenever they had erected their fortress-sanctuary, they had aligned the principal structure of the complex to an azimuth of 285 degrees -- the position of the setting sun on August 13. Was this just another coincidence -- or was it evidence of a "formula" known even on the remote northwestern frontiers of Mesoamerica? If the latter were true -- as seemed to be the case -- then certainly the sacred calendar, which had spawned this formula, had been in use as far north and west as at Chicomostoc, and most probably during Toltec times, i.e. about the 10th-12th centuries A.D.

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If Chicomostoc was a positive find, then places like Ixtlán del Rio, to the west of Guadalajara, and Tzintzuntzán, the capital of the Tarascan empire overlooking Lake Pátzcuaro, were negative ones. Indeed, although some suggestive solstitial orientations did turn up in central Mexico and in the highlands of Guatemala, by and large the 1977 field season provided little additional support for my hypotheses. (As mentioned earlier, it did, however, provide an opportunity to learn about the major shift in dietary patterns that

supposedly occurred in the Soconusco region about 1400 B.C., and in that respect I had received a backhanded confirmation of my computer dates for the calendars' origins.) But, even if few tangible results in my on-going quest were forthcoming, the 1977 field experience still deserves to be ranked as a success in its own right. My faltering nephew found a new commitment to academic life, returned to college, and completed his studies. My former student from Middlebury, with a renewed appreciation for interpretative field studies, went on to work in environmental protection for the State of Alaska. My then-student at Dartmouth, responding to the appalling social and health conditions of the areas we had visited, completed his work in Geography and then went on to medical school with the notion of one-day returning to the region as a physician. And my daughter, her appetite whetted for further travel and exploration and excited by the challenge of learning about new peoples and cultures, completed her degree in Geography and Chinese and went off to become a vice-president of a multi-national firm in Asia. As a researcher, my rewards that year had been modest, but as a teacher I look back with both pride and satisfaction at the personal triumphs of my young companions. I wish them all well in their professional careers -- even if none of them remembers to celebrate New Year's Day on the 13th of August!

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Dancing in the (Gregorian) New Year has become a time-honored custom in much of the Western world, and for my wife, daughters, and me, 1978 dawned to the throbbing melodies of a marimba band in "El Shrimp Bucket" nightclub in Mazatlán. The winter quarter was to be a teaching term for me in Puebla, so it seemed only fitting to have a family reunion in Mexico over the preceding holidays. Thus, after relaxing on the

golden beaches of the Pacific for a week, we drove across the plateau to Mexico's fourth largest city to meet my class early in January.

The foreign study program that I was directing was definitely a mixed bag, because it consisted primarily of language and sociology students and just a smattering of geographers. The former seemed quite content to meet their classes each day in a small room just off the patio of a colonial mansion that had been renovated as the city's "Casa de la Cultura", or "House of Culture". Nor were they dismayed by the prospect of returning each evening to their respective host families, all of whom had essentially been selected from the roster of one of the city's wealthiest social clubs. Having their breakfasts prepared by a cook and their rooms cleaned by a maid were as uncommon luxuries for the students as was the privilege of lolling around a swimming pool after classes -- but these experiences were scarcely representative of "life in Mexico", apart from that enjoyed by a very small minority. For my part, I could scarcely wait until I could get the students into the field to see the real Mexico and meet some of the common people who formed the overwhelming majority of that country's burgeoning population.

That opportunity finally arrived in late February when we started off in a chartered bus for the southern states of Oaxaca, Chiapas, and the Yucatán. Because this was a teaching term in contrast to a research term, I had no illusions that I would be able to accomplish anything of importance in my quest for calendrical origins. Therefore, it came as a total surprise and an unexpected bonus when the paths of my students and me crossed with that of Professor Ray Matheny in San Cristóbal de las Casas, the picturesque former-capital of the State of Chiapas.

It turned out that Professor Matheny was on his way back to Brigham Young University from a new site he was excavating in northern Guatemala when his light plane

developed engine trouble and forced him to lay-over a couple of days in San Cristóbal for repairs. Thus, on the morning that I was escorting my students through the headquarters of the New World Archaeological Foundation, he was on hand to serve as one of our hosts and guides. I had not met him before, but I knew of him because of his recent work at Edzná, a report on which had been published in Science in March 1977.

As we completed our tour of the Foundation's headquarters, I turned the conversation to the subject of Edzná as soon as I could politely do so. I mentioned to Professor Matheny that my computer studies had suggested that a major reform in the Mayan calendar had taken place at Edzná, but unfortunately it was such a "late" site that my results were obviously in error. He asked what date I had projected for such a reform, and I replied that it appeared to have happened around 40 A.D. His face lit up with a big smile and he retorted, "Well, that could hardly be a better time. Our radio-carbon dates showed us that Edzná was already a thriving city about 150 B.C., making it the earliest large city the Mayas ever built!" My jaw dropped in a combination of amazement and elation; another piece of the puzzle had suddenly and unexpectedly fallen into place. Earlier archaeological estimates of the age of Edzná had been grievously incorrect; instead of being 600 years younger than the calendar reform I had postulated, Edzná now turned out to be 200 years older than the event I had localized there!



Figure 28. Once Prof. Matheny had confirmed that the structure I had called the “Northwest Pyramid” (because of its offside location) was the same as that he had called “La Vieja” – “the Ancient One” (because its radio carbon date went back to -150 BCE), I realized that the date I had assigned to the Maya’s change of the New Year to 48 CE was likely to be accurate after all. The notorious Bishop Landa had claimed that the Maya celebrated the beginning of their New Year on what is July 26 in our present Gregorian calendar, although he didn’t know why, but I realized at once that Edzná was the only major Mayan site that lay on the parallel of 19.5° N, where the zenithal sun passes overhead on that date. The Maya were simply copying the Zoque notion of the zenithal passage of the sun over Izapa on August 13, but on a date that made more sense to them in the Yucatan.

Professor Matheny went on to tell us how he was led to excavate Edzná in the first place and about some of the intriguing discoveries he had made there. By sheer chance, he was flying over the western portion of the Yucatán at the end of the rainy season in October, 1973 when he saw -- probably for the first time in well over a thousand years -- the outlines of a gigantic canal system focused on the ruins of the five-story pyramid that forms the nucleus of the site of Edzná. Because most archaeologists

are earth-bound in the first place, they seldom have the advantage of an aerial perspective to appreciate the spatial dimensions of the sites they are studying. Moreover, few researchers venture into the field except during the winter dry season, so never would they have witnessed the extensive network of drainage ditches brimming with water. Circling the site several times to photograph what he was seeing, Matheny returned to Brigham Young, submitted a proposal for financial assistance to the National Geographic Society, and soon thereafter was investigating Edzná on the ground.

The work of Matheny and his associates quickly revealed the remarkable dimensions of the canal system -- a complex of waterways whose construction had probably entailed as much labor as the erection of the Pyramid of the Sun at Teotihuacán. From the extent of the built-up areas of the site and the cultivable districts accessible to it, Matheny concluded that in its hey-day Edzná probably supported in excess of 20,000 inhabitants. Just as remarkable as the truly urban character of the place, however, was the fact that it appears to have been constructed in the largest agricultural lowland of Yucatán, at just the same time that the metropolis of Teotihuacán was coming into being on the plateau of Mexico.

Everything that Professor Matheny recounted to us about Edzná only excited me more and I told him that we definitely planned to visit it a few days later to make some measurements of possible astronomical orientations. He strongly encouraged me to do so, saying that the same thought had occurred to him and for that reason he had invited an astronomer to accompany him to examine the alignments of the canals. As we parted, however, he said he didn't want to prejudge my results in any way, but he did confess that his astronomer-consultant had drawn a complete blank on the place.

From what I remembered of the map of the layout of the canals published with Matheny's article, I was not dismayed by the astronomer's negative results. The reason for this was that the alignments of all the principal canals lay within about 45 degrees of a north-south axis, whereas the most extreme positions of the sun -- the solstices -- all lay within 25 degrees of an east-west line. Therefore, if the canals were astronomically oriented in any way, they had to be to stars rather than to the sun or moon. And any time one postulates alignment to a star, there is always some stellar body that can be found to provide the requisite orientation, hence such arguments are as dangerous as they are meaningless. I knew, therefore, even before we parted company with Professor Matheny that, if there were indeed astronomical orientations to be found at Edzná, they would very unlikely to be associated with the canals and would have to be found elsewhere.

* * * * *

A couple of days later, having decided to "make everyone happy", I had deposited my sociology and literature students at the local market in the old, walled, seaport-town of Campeche so they could shop, while I and my die-hard geography and anthropology types had continued out to the site of Edzná to see what, if anything, it might offer in the way of discoveries. Once Amado, our Mexican driver had parked the bus, we headed immediately for the five-story pyramid that stood at the heart of the ceremonial center, duly armed with our surveyor's compasses, pocket calculators, and solar ephemerises.

This structure, known to the archaeologists by the unimaginative name of "Cinco Pisos" ("Five Stories"), stood atop a "terrace" which a 1968 University of Oregon expedition had decided was man-made and which Matheny had identified as "a high outcrop of rock". Whether its base was artificial or natural, the pyramid itself consisted of

five tapering layers of small rooms fashioned from limestone blocks and surmounted by a roof comb, a characteristic architectural device the Maya often added to their otherwise squat and dumpy structures to give them added height and flair. Altogether, the pyramid and its roof comb towered some 38 meters (125 feet) above the level of the "terrace" on which it was perched, and this added another good 7-8 meters (25 feet) to its overall elevation. As a result, "Cinco Pisos" could be seen across the flat Yucatecan landscape for many kilometers before one actually reached the site of Edzná itself.



Figure 29. The dominating structure at Edzná was the five-tiered pyramid that had led its discoverers to it, looming up out of the scrub of western Yucatán in the 1930's. In the foreground, we see the ingenious gnomon which the Mayas devised to determine the dates of the zenithal sun passages. The diameter of the stone disc atop its tapered 16 inch

shaft is precisely the same as that of the base of the shaft, ensuring that on the days of a vertical noontime sun the entire shaft is in shadow.

As my students and I mounted the broad staircase on the western front of the "terrace", the outlines of the ancient site soon revealed themselves to us. Below us was an elongated plaza some 120 meters in width and over 180 meters in length, bordered along its entire western side by a long, ridge-like platform. In the middle of the platform, directly opposite the entrance to the courtyard that surmounted the top of the "terrace", was a notch, and immediately behind that in turn rose a small pyramid. In fact, as we stood in the doorway of the courtyard of "Cinco Pisos", I realized that the ridge-like platform across the plaza had become an artificial horizon against the entire western skyline, broken only by the peak of the pyramid behind the notch. Here, with almost gun-sight precision, was a three-point alignment: doorway, notch, and pyramid.



Figure 30. The gateway to the courtyard of Cinco Pisos was oriented across the vast sunken terrace that defined its western edge, directly toward the gap that marked the midpoint of the ridge that served as an artificial horizon, and precisely toward the low pyramid that rose up behind it like a three-point gunsight. Its azimuth proved to be 285.5° , the sunset position at Izapa on August 13, over 500 km (300 miles) to the south—a very conscious acknowledgment by the Mayas of their indebtedness to the Zoques.

Pulling out the surveyor's compass, I pressed it against the side of the doorway and sighted toward the notch and the peak of the pyramid looming above it. Deducting the correction for magnetic declination, I almost trembled at the result I obtained: 285.5 degrees. Edzná, the earliest major urban center of the Maya, had been oriented with the same deliberate precision as Teotihuacán, its counterpart on the Mexican plateau 1000 kilometers to the west, to the setting sun on August 13th. This was no accident, and neither was it a coincidence. The Mayans, as well as the Teotihuacanos, had to have known the zenithal sun "formula" from Izapa -- but how? Certainly, there was no way they could have sent runners through the jungle, announcing "today's the day!" Somehow, long before the dawn of telecommunications, they had known with absolute precision the significance of an event that took place 500 kilometers away to the south, but not until I knew how they knew, would I ever piece this puzzle together. But, at least I had found one more intriguing clue to ponder over.

None of the students with me could have imagined how my pulse had quickened or how my thoughts had taken wing as I had confirmed the alignment of Edzná. Nor could I have guessed that even as I turned from the plaza toward the hulking mass of Cinco Pisos, I would literally stumble over another clue whose presence at Edzná I had virtually predicted. There, in the midst of the spacious courtyard that fronted the western face of Cinco Pisos, was a raised stone platform containing a beautifully fashioned

gnomon that was as simple in design as it was effective in operation. (Any upright pillar or post might be called a gnomon, for any object that casts a measurable shadow can be used for calculating sun-angles.) This was not just any upright pillar or post, however, but a carefully tapered stone shaft about 40 centimeters (16 inches) in height, surmounted by a stone disk whose diameter was identical to that of the base of the shaft. Thus, on the two days of the year when the sun passes vertically overhead at noon, the stone disk ensures that the entire shaft is in shadow; on all other days, as on that February morning, a stripe of sunlight will fall across the shaft. This ingenious device, restored to mint condition by the archaeologists, was proof-positive that the astronomer-priests of Edzná not only had an interest in the movements of the sun but also an absolutely precise gauge on the timing of its zenithal passage. Here, in what was the oldest and -- for its time -- the largest urban center of the Maya, was their equivalent of Greenwich -- a place, not where a new day began as measured by longitude, but rather a place where the new year began, as measured by latitude. Here was the very reason for the astronomical "clout" of Edzná that Thompson had alluded to, wondered about, and then dismissed. Here, sometime about the year 40 A.D., the priests, while perpetuating the "day that time began" (i.e., August 13) in the very orientation of the city itself, changed the New Year to conform to a zenithal passage of the sun that they themselves could calibrate on the spot -- July 26, a date whose commemoration was still taking place when Bishop Landa arrived in the Yucatán in the middle of the 16th century.

Exciting as these discoveries had been, there was at least one more very obvious question to which I had to have an answer: why, here on this flat limestone tableland of Yucatán, had the Maya felt impelled to build a five story pyramid that stuck up like a lightning-rod over the low scrub forest? Why such a "skyscraper" in such an open and

exposed setting? As I climbed the steeply sloping staircase up the western face of Cinco Pisos, each step higher seemed to widen my view. By the time I had reached its top and turned to catch my breath, a full 360-degree panorama of the horizon opened before me. It was as though I could see forever; in reality, my calculations told me that my line of sight reached out some 25 kilometers (15 miles), but that was far enough to encompass the entire aguada, or basin, which comprised the agricultural hinterland of Edzná and far enough to reach the rim of low hills which marked the distant but featureless skyline.



Figure 31. From the top of Cinco Pisos, it was clear that true horizon was unbroken save for one unrestored pyramid that rose out of the scrub to the northwest. When I took a reading on its azimuth, the fact that it measured 300° , or just 5° more than the sunset setting position at the summer solstice, told me that it marked the northern most still stand of the moon. Since Matheny had radiocarbon-dated the pyramid to 150 BCE, it proved that the Maya had set about trying to predict eclipses only a short time

after having received the Long Count from the Zoques, who had devised it scarcely 85 years earlier.

The entire circuit of the horizon was empty, except at one point. There, toward the northwest, the dilapidated remains of a second, lofty pyramid reared itself out of the scrub and etched its outline against the sky. Visible only from the summit of Cinco Pisos, what had this crumbling monument meant to mark against the vacant sky? Surely, it had been built high enough to intersect the horizon, but why? Out came the surveyor's compass once again. But this time the answer was even more surprising. With the correction for magnetic declination factored in, the azimuth of the Northwest Pyramid came to precisely 300 degrees -- five degrees beyond the farthest point the sun could ever reach. (Remember that at the summer solstice, its setting position averages 295° throughout Mesoamerica.) Clearly, this was not a solar marker of any kind, but having said that, what was it? Five degrees farther than the sun, I mused. A moment later, I burst into a grin that must have stretched from ear to ear. I couldn't resist "dropping" this one on my students, because there was no way I could contain my excitement any longer. Unless I was willing to entertain yet another coincidence, what we were looking at in the Northwest Pyramid of Edzná was the oldest lunar observatory in the New World! The orbit of the moon, which is just a shade over 5° off the orbit of the sun, brings it to its maximum northerly stillstand -- here in Mesoamerica to a azimuth of 300° -- once every 18.03 years. By being able to mark this position against an empty sky, the Mayan astronomer-priests could, after a sufficiently long period of observation, confidently predict the occurrence of eclipses -- one of the most frightening natural events that early man confronted. And, with such knowledge, their power and authority must have seemed unassailable. Here, at Edzná, the Maya had no doubt made some of their earliest and

greatest advances towards true science. And, although it now was too late to put back the missing paragraph in my article on the chronology of the Mayan calendars, I felt I had learned enough to write another whole article about a place which was not only the oldest, large city of this remarkable civilization but also most probably the very cradle of its astronomical science.

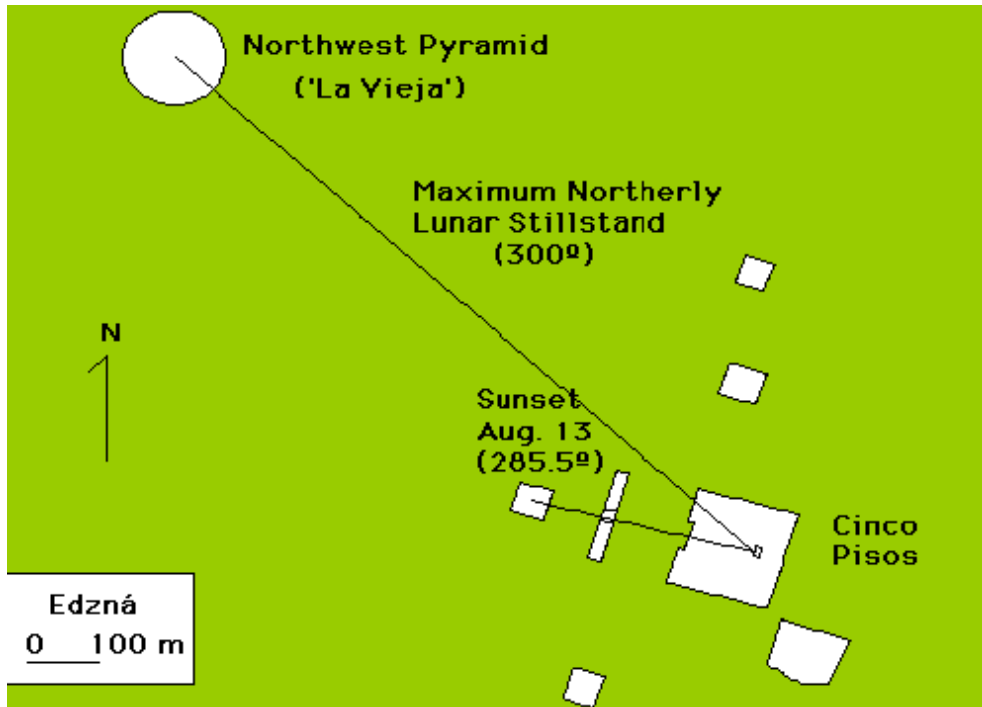


Figure 32. Map of Edzná, one of the earliest major urban centers of the Maya located near the largest aguada or agricultural lowland in the Yucatan, but showing the Maya's indebtedness to the Zoque by orienting the entire site to the azimuth of the sunset on August 13th, the day on which the 260-day Sacred Almanac had been created. By erecting the Northwest Pyramid at the moon's northernmost setting point about -150 BCE, they also reveal how early they began their attempt to predict lunar eclipses.

My identification of what I had called the "Northwest Pyramid" as a lunar marker (because of its location) and what Matheny had labeled "La Vieja" (because of its antiquity) convincingly demonstrated that the Maya's interest in predicting eclipses was as old as their adoption of the calendar itself. They had realized that, in order to chart the moon's erratic path across the heavens, they needed some fixed point from which to

calibrate its movements, and for them, its extreme northerly setting point provided just such a position. However, when they started their day-count, the Maya obviously had no notion of how long it would take, and during the lengthy and tedious process that ensued, they no doubt had to make numerous corrections before the entire 6585.3 day cycle was completed. Note that the extra third of a day is a critical part of the equation, because in that eight-hour span of time the moon crosses more than 120° of the sky. This means that no eclipse is visible from the same place for more than two cycles in a row, because by the third time it would have moved to the opposite side of the earth. However, after an absence of one cycle, there was every reason to expect its return for another two appearances, before it disappeared the next time.

Once I realized that the Maya had begun their attempt to predict lunar eclipses at the very time they had adopted the calendar, I decided I needed to examine as many dated Maya inscriptions as I could, to see if any of them matched actually recorded eclipse events. In doing this, of course, I was defying the advice of Sir John Eric Sydney Thompson who, after working out his correlation between the Maya and western calendars in 1927 and fixing the starting date of the former at August 13, changed his mind in 1935 and moved the starting date back to what Joseph Goodman had first proposed in 1905. He did so saying that he had concluded that the Maya were only astrologers, not astronomers and not to expect any of their dated inscriptions to accord with actual astronomical events. In any case, I found that Sylvanus Morley's book The Ancient Maya provided a very good starting point to accomplish my first goal, whereas the thorough eclipse compendium prepared by Oppolzer in 1887 would answer any need I had in regard to the second. (Although the Austrian count had compiled his monumental work without so much as an adding machine to tabulate his data, it remained the

indispensable source for any student of ancient astronomy right up until the appearance on the internet of the NASA Eclipse Website in 1996.)

It didn't take me long to discover that the most repeated Maya inscription of all time, recorded in eight places on six different altars and stelae at Copán, did indeed match a total lunar eclipse that Oppolzer recorded as happening just before sunset on the evening of June 29, 763 A.D. It also turns out that this eclipse has since been identified by Fred Espenak of NASA as the longest total lunar event of the entire eighth century, so the Maya had obviously « seen a very important one coming ». However, despite the fact that the priests at Edzná had announced its arrival with a lead-time of no less than four years and three months, it appears that only in Copán had any notice been taken of their warning. Not only did they exuberantly post multiple records of its occurrence, but if George Stuart – a student of Maya hieroglyphics is correct -- they also went to the trouble of « gilding the lily » by arranging to enthrone their newest ruler on this memorable occasion as well.

But this wasn't the only eclipse that I found to be firmly dated by the original Thompson correlation. My further research revealed that Yale archaeologist Floyd Lounsbury had noted that the original Thompson correlation appeared to match the three starting dates of the much-heralded “Dresden Codex”, but was obliged to conclude that all three of them must have been derived by calculation rather than observation, because none of them was visible from the Yucatan. (Even so, this would imply that by 755 the Maya had pretty well worked out the mathematics of the lunar cycle, but couldn't be sure whether the actual event would be seen from their vantage point or not.) Because the Dresden Codex dates were all within 30 days of each other, astronomer Maud Makemson

of Vassar made the further suggestion that they must represent two solar eclipses bracketing a lunar event.

When I re-examined the data, I found that the first event would indeed have been a solar eclipse and would have been visible from the Yucatan, had it not been off about 2.5 degrees in alignment and 8 minutes in timing. I found that the second definitely was a lunar eclipse but was only visible in that half of the world centered on India. The third was likewise another solar eclipse, but probably not a single soul in the world witnessed because it took place between South Africa and Antarctica! Thus, the much-vaunted Dresden Codex – no doubt the most beautiful hand-painted document to escape the bonfires of Bishop Landa -- turned out to be as close to science-fiction as the Maya ever came: beginning with one eclipse that didn't occur, and two that couldn't be seen!

Finally, a Maya inscription with one of the latest dates ever to be found describes a solar eclipse that was visible over Chiapas on July 16, 790, demonstrating that after more than 900 years they were still recording actual astronomical events. Certainly, had it not been for the fanaticism of the Spanish clerics, our legacy of the Maya contribution to indigenous science would have unquestionably been much richer. That we understand. But what is more difficult to understand is why someone in the archaeological fraternity didn't take the trouble a long time ago to examine the facts and set the record straight, as I just have done in the exercise above. So, let's admit that Thompson's original correlation is the only one that accords with the realities of the astronomical record and that his unfortunate revision has resulted in nearly a half century of fruitless 'wheel-spinning' and contention. Basta. Finito.

Chapter 6 – The South American Connection

For having been a teaching term without much promise, the 1978 winter quarter had produced a harvest of data that would take months to thoroughly evaluate and write up. Yet, the research term that I had scheduled for the spring quarter of 1978 was hardly the time to undertake such a project, for already the previous fall, one of my students had volunteered to accompany me to Ecuador and Peru to check out any possible South American connections my Izapan ‘birthplace’ might have. As a result, Bruce flew into Mérida in time for the farewell dinner with my winter term class; made the non-stop bus trip back to Puebla with Amado and me the next night and day; and then started south with me to Guatemala in my “valiant” Plymouth Valiant the morning after that.

We arrived in Guatemala City in time for a rattling earthquake that cut short our siestas and sent us scurrying out of the Hotel Centenario into the plaza. Although I had previously experienced earthquakes both in Iceland and -- yes, even in Vermont -- neither of them had been anything as violent as this temblor in the Guatemalan capital, so I advised Bruce that we had better stay out in the plaza awhile to see if there would be any aftershocks. After about a half an hour of uneasy quiet, we headed back into the lobby where I remarked to the desk clerk that “that had been quite an earthquake”. He shrugged his shoulders with a grin, and replied, "Regular".

The next day Bruce and I left our car with a friend and took a taxi out to the airport where we were to board a Pan Am flight bound for Panamá. As we brought our bags up to the check-in counter, I happened to glance out the window of the concourse and I nudged Bruce in the ribs. There, looming over the end of the runway was a volcano in full eruption. Thinking that the earthquake of the previous afternoon had triggered it off, I said as much to the airport attendant. The latter just smiled and shook his head.

"No, regular", he replied, implying that it was always in eruption. This time it was my turn to shrug my shoulders. For a country that had suffered over 20,000 killed in the massive earthquake of February 1976, I wondered just how much it took for something to happen that wasn't "regular". (Editor's note: Just how violent the 1976 earthquake had been became apparent to me when I visited the highlands of Guatemala a couple of years later. Along the Motagua valley, where three of the earth's plates come together, a highway and a soccer field had been physically shifted 11 feet (3.5 meters) to the west during the upheaval.)

On our way to Panamá, a forty-five minute stop in Managua was long enough to let us realize that the Nicaraguan capital was already under heavy siege and many of the outlying suburbs were in flames. More than forty years of the Somoza family dictatorship was nearing its end -- in the only way it could -- with violence and bloodshed. And, although our trip together had barely begun, already Bruce and I were skeptically looking at each other, silently wondering what we had let ourselves in for.

Stepping out of the plane in Panamá, we were almost overcome by the moist heaviness of the air. A missed connection and a full hotel obliged us to resort to our own devices -- Bruce curling up on a hard bench in the glaringly-lighted waiting room, I seeking refuge in a hammock next to the swimming pool where I listened all night to the myriads of insects being zapped by the eerie blue bug-lights scattered through the hotel gardens. We wanted to get to Ecuador, and it didn't much matter whether the next available flight took us to Quito or to Guayaquil. As it turned out, the one we got seats on landed in Quito, where, because of our lack of sleep and the city's 9300-foot elevation above sea level, we went to bed as soon as we arrived.

When we finally ventured out of our hotel in the old section of the city sometime toward noon, we found that the Ecuadorian capital was undergoing a student strike. Trucks packed with young army recruits toting rifles and armored cars were patrolling the streets. Since our primary motive in visiting Quito was to examine the holdings of the local museums, we quickly withdrew indoors again to the quiet respite of the pre-Columbian collections.

Back of my desire for visiting Andean South America was the understanding that already in the earliest days of Izapa's existence there had been a lively sea-trade with this region. From the literature, I was also aware that the earliest pottery in all of the New World had been identified at Valdivia, on the westernmost bulge of Ecuador. Dated to between 3800-3300 B.C., it was a type of ceramics which had no local antecedents in the Americas; its sophistication of style and finish clearly suggested that it had been introduced, full-blown, from somewhere else. Where that might have been had already been suggested by the American archaeologists Betty Meggers and her husband Clifford Evans, for in their studies of Valdivia pottery they found striking similarities in decorative patterns with the Jomon pottery of Japan. The latter's antecedents went back possibly as far as 5500 B.C., making it some of the oldest ceramic ware in the world. However, the fact that Japan lay a third of the world away from Ecuador across the Pacific had immediately directed the fire of the anthropological establishment at Meggers and Evans, for as trained Americanists, they both "should have known better" than to make such a suggestion. Oblivious and/or indifferent to this intra-disciplinary hassle among the professionals, the Ecuadorians had bravely gone ahead and painted a mural on one of their museum's walls showing how the ocean currents could have borne an unlucky boatload of fishermen quite easily and quite directly to the westernmost bulge of

South America. Indeed, they seemed quite content to accept the fact that, even though Valdivia pottery had not developed in situ, it was no affront to either their nationalism or hemispherism to admit that it most likely had come from Japan.

Although I had hoped to get to Valdivia to see this supposed bridgehead of Asian culture for myself, such was not to be. The evening that Bruce and I arrived in Guayaquil, Ecuador's major seaport and largest city, somehow, amidst the shuffling throngs of humanity milling through the streets, we became separated. Suddenly, the oppressiveness of the heat, the humidity, the noise, and the commotion of a strange city was infinitely compounded by the frantic realization of being totally lost. We had been heading for a hotel to which we had been directed, but Bruce never arrived. Having just been warned at another hotel not to turn right down the street because we would surely be mugged if we did, I knew we had both started out going left. But when fifteen minutes had passed and he still hadn't shown up, I decided to try to retrace my steps and find him.

By now, it had only become darker and the streets were more congested. Back to the first hotel I went, but no Bruce. Then down one side of the street, searching every face, every doorway I passed for someone or something I could recognize, and then down the other side of the street doing the same. Each passing moment it became darker and my desperation mounted. Suddenly, after what seemed an eternity, I spotted his curly blonde hair above the sea of brunettes. Calling to him amidst the tumult was hopeless, so I pressed my way through the throng toward him as rapidly as I could, trying always to keep him in sight. Finally, overtaking him, I tugged his sleeve and he turned. We almost embraced we were so happy to find each other. Even so, the trauma of our separation was enough to give us nightmares that night, so when morning came we both agreed that the quicker we got out of Guayaquil, the better. We abandoned our plans to try to get to

Valdivia and instead concentrated on what the collections in the local museum could tell us. Like those in Quito, they unabashedly reiterated the Meggers-Evans theme of trans-Pacific diffusion, even including some examples of Jomon pottery for comparison.

Our next stop was Cuenca, Ecuador's third largest city, located in the mountains to the southeast of Guayaquil. There were only two ways to get there: four hours on a bus over winding mountain roads or forty-five minutes by air. For the difference in price and convenience, we quickly decided to take the plane, but were somewhat surprised at the timetable of flights. It was then that we first learned the secret of flying in the Andes: you always do it as early in the morning as possible, because the later in the day, the stronger the convectional up- and down drafts become. Even by noon things are getting rather bumpy, and after 2 P.M., forget it. By then, the swirling cumulonimbus clouds are so thick and so high that even the 20,000 foot peaks of the Andes are totally lost to view. Now we understood why the president of Ecuador had recently been killed when his plane plowed into a mountain, and why it was not uncommon to lose one or more commercial airliners per year. Maybe, we mused, that's why our flight was operated by TAME, the Military Air Transport Command of Ecuador. Of course, the cumulonimbus weren't any kinder to them than to the commercial airlines, so we decided to take the 7 A.M. flight in any event.

Cuenca is a stately city of colonial origins with an impressive cathedral and flower-filled plazas. My reason for wanting to visit it can largely be summed up in one person: Padre Crespi. I had read about his museum and heard about the startling treasures it contained, so I thought it mandatory that Bruce and I make a special effort to visit it, now that we were so close. You can imagine our disappointment, then, in being told as

we arrived at the old Salesian monastery where his collection was housed, that the 'museum had been closed by the government'.

I asked the attendant why the museum had been closed, and he said the padre was too old and sick to guide people through it any longer. I said I understood that perhaps a personally guided tour was out of the question, but having come such a long way, we would be happy just to visit the museum on our own. When the attendant repeated that this would be impossible, it quickly became clear to Bruce and me that the padre's age and state of health had little to do with it. Changing my tack, I asked if the padre was well enough to receive visitors, and the attendant allowed as he was. In fact, he was then in the chapel praying, he said, and perhaps we could talk to him when he was ready to go back to his room.

On the strength of this possibility, Bruce and I settled down in the courtyard of the monastery to await the padre's appearance. About twenty minutes later, a large bearded man in a monk's garb tottered unevenly out of the chapel door and started across the patio. The attendant identified him with a wave of his hand, and we sprang up to intercept him near the middle of the courtyard. After introducing ourselves, I began by saying what a pity it was that his museum was closed.

The bright-eyed old father nodded and said, "Yes, he was too old and too sick to guide visitors through it any longer". He then told us that he had bronchitis and could hardly speak. However, the more we asked him about his museum and how it had come into being, the more he seemed to forget his "bronchitis" and for the next half hour, his voice failed him not at all. He told us how he had been educated at the University of Padua, and how he had traveled as a young priest throughout Italy and the eastern Mediterranean, and of his early interest in classical antiquities. In 1923, he said the Pope

had sent him to Ecuador, to Cuenca, and soon after he had arrived in the Andes he became aware of the many ancient artifacts to be found in this region, and, more surprisingly, of their striking similarity to things he had seen in the Mediterranean. Gradually, he began to collect them in a room in one wing of the monastery and to ask his parishioners to bring anything of special interest to his attention. In fact, he said he was so excited by what he and his flock had uncovered that he wrote to the Pope and asked that he be allowed to return to Rome to show them to the Holy Father. With a nostalgic smile, he said the Pope had told him to stay where he was and go on with his work, so he had never again been back to Italy.

Then, as if beginning a new chapter in his life, he took a deep breath and said that sometime later the government of Ecuador took notice of his collection and helped to fund his small museum. In fact, he said, they even set up a small purse so he could pay his parishioners for bringing in some of the more special artifacts they came across. Seeing that our interest in his work was genuine, he then bent toward us and in a low voice confided that just this past week one of his flocks had brought in two gold plates which he had found in a stream-bed a few kilometers outside the city. If we wanted to see them, he would go up to his room and fetch them. Of course, we wanted to see them, so off he tottered across the courtyard, returning about five minutes later clutching his artifacts under his cape. Opening his cape, he held out two resplendent discs, each about 20 cm (8 inches) in diameter. For having lain all these years in a stream bed, they seemed uncommonly bright and shiny we thought. On the other hand, we both knew that gold doesn't tarnish, so their condition was not a necessary indicator of their age.

Padre Crespi proudly explained what the two discs depicted. On one, there was the representation of a jackal-headed deity sitting on a throne; its Egyptian quality was

unmistakable. On the other, there was a muscular, curly-haired man in the act of demolishing two great pillars; you didn't have to be a Biblical scholar to recognize Samson in the Temple. Bruce and I looked at each other with a knowing nod. I asked the padre if we could take photographs of him and his "gold plates" and he willingly assented to my request. We thanked him for taking the time to tell us about his life and his work, and to show us his most recent acquisitions, and we started back to our hotel.

The "gold plates" had suddenly made everything crystal clear. In a country as poor as Ecuador, the government had made a fatal mistake in offering a reward to anyone who turned in an artifact, especially such unique finds as Egyptian and Palestinian objects d'art. Whatever the validity of his initial finds, Padre Crespi had unwittingly assembled a collection of such bogus character that his museum had become a national embarrassment to the government of Ecuador. As if the waters of archaeology aren't muddied enough, those of Andean archaeology have now become even murkier. And one lovable old man continues to cling to his dreams and nurses his "bronchitis".

* * * * *

In Peru, my primary mission was to visit Chavín de Huantar, the prototypical site of what the archaeologists identify as South America's most ancient culture. I wanted to see whether there were any affinities between this place and Izapa. However, long before Bruce and I set out for South America, I knew, as a geographer, there was something fundamentally "wrong" with Chavín as the birthplace of civilization in the Andes. It was located in absolutely the wrong place to have been the cradle of anything, and, for that reason alone, I was intrigued to visit it. However, before we made our pilgrimage to this remote interior site, I had promised Bruce "to do" the more typical tourist round by visiting Lima, Lake Titicaca, Cuzco, and Machu Picchu.

More than one-fifth of Peru's 16 million people live in the sprawling city of Lima. Located a few kilometers inland from its seaport-suburb of Callao, it had long since swallowed up the little oasis of the Rimac river on which it was founded and spilled over into the desert beyond. Its slums stretch into the naked dunes on all sides, and its slum-dwellers desperately try to hold the sand in check with fences of plaited reeds. Here, where the annual rainfall scarcely totals 25 mm (1 inch), water is often more expensive than milk or brandy.

For visitors, Lima has much of interest and beauty, for it was one of the prizes of the Spanish colonial realm -- majestic public buildings, great avenues and boulevards, fine restaurants and theaters, and museums with collections that rival those of Mexico in their wealth and grandeur. After a few days studying the artifacts of the Inca and pre-Inca cultures and indulging ourselves on Apfel strudel and other international specialties, we were off to the hinterland, flying first to the southern city of Arequipa. On the way, we had hoped to catch sight of the famous Nazca lines in the desert, but a local cloud cover unfortunately precluded that. In Arequipa, a local transport strike had disrupted the city a few days before our arrival, and so the "scab" taxi driver that picked us up at the airport didn't dare drive us closer than a block away from our hotel. Even so, there had been so much violence in the streets that we were obliged to crawl into the lobby through the half-lowered steel shutters that were meant to protect the hotel's plate-glass windows from bottles and bricks.

Once checked into the hotel, we were quickly informed that the state railways might go on strike the next day, so there was no guarantee we could continue on to Lake Titicaca and Cuzco. That evening at dinner we were approached by a man who offered to drive us to Puno, on the lake, the following day, but we had to be ready to leave at four in

the morning and agree to pay what seemed to be a staggering sum of money. Bruce and I talked it over, and thought it best to take our chances on the train. Luckily, it ran, as much on schedule as it usually did, and we got to Puno without serious incident or delay.

However, once in Puno we quickly gave up any ideas of visiting Tiahuanaco, the great pre-Columbian site just over the border in Bolivia. That benighted country appeared to be on the verge of its 197th revolution since Independence, so we decided to forego anything more than a local boat ride on the highest navigable lake in the world and head for Cuzco instead.

Situated at 3,500 m above sea level (11,480 feet), Cuzco is a place where gringos and other lowlanders move slowly. Just walking around the streets, looking at the Inca stonework that continues to form the foundations of many of the newer buildings is something of an effort in itself. And, in such a rarified atmosphere, the climb to the ruins of the Sacsahuamán fortress above the city turned into a real work out. One doesn't have to be in Cuzco very long before appreciating why the Spanish transferred their political nerve center from this remote and lofty Inca stronghold to a more accessible location near the coast -- or why many of the local hotels provide bottled oxygen to their short-winded guests.

The Incas are justly famous for their monumental stone construction that, even after five centuries of convulsive earthquakes, remains so tightly in place that a knife-blade cannot be inserted between adjoining blocks. And nowhere does one find a more awesome example of one of their "lost cities", virtually intact, as at Machu Picchu, unknown to the outside world until it was re-discovered by Hiram Bingham in 1911. Truly, the most unforgettable memory of my entire South American junket was standing on the parapets of Machu Picchu and feeling the soft, warm mist rising out of the

Amazon basin, up the vertical green walls of the Urubamba canyon, over this spectacular mountain-top sanctuary.

However, in my quest for the origins of New World civilization, I knew I would not find it among the Incas, because, like the Aztecs in Mexico, they were but the last of a long lineage of peoples that were heir to these ancient cultures. In Peru, that meant I would have to look to Chavín de Huantar, located in the north-central part of the country, so a couple of days later, Bruce and I flew back to Lima and then northward to Chimbote and up the valley of the Santa river to Huaráz.

Eight years earlier, in 1970, Huaráz and the entire valley in which it is located -- the so-called Callejón de Huaylas -- had been devastated by one of the most disastrous earthquakes ever to befall Peru. In the narrow, steep-sided valleys of the central Andes, whole mountainsides cascaded into the valley bottoms, burying scores of towns and villages. An estimated 70,000 persons lost their lives, many of whom were never even found. Huaráz, eight years after the tragedy, still had only been partially rebuilt, and many of its inhabitants lived in "temporary" housing that had been donated by relief organizations from around the world.

In Huaráz, Bruce and I managed to rent a car, in company with a Danish student, for the crossing to Chavín. As our driver coaxed his antiquated Chevrolet up over the narrow dirt road that led into the next valley, our Danish companion told us of having languished for months in an Argentine jail, the victim of a whimsical arrest by the military authorities and an attempted extortion. Only the insistent intervention of a West German consular official had won his freedom, along with that of half a dozen other foreigners likewise being held for ransom.

As the sturdy Chevrolet neared the crest of the mountains, I was tempted to take a photograph of a beautiful glacial lake, and I asked the driver to stop for a moment. Grabbing my camera, I ran up the adjacent slope and pointed it toward my intended subject, only to feel my head grow faint and my knees double under me. When I came to a moment later and finished taking my picture, I looked at my altimeter. It registered 4450 meters (14,600 feet), or 150 m (500 feet) higher than Pike's Peak. I had forgotten that nobody runs anywhere at that elevation -- and least of all, uphill.

A few kilometers farther along, the road steepened and it became apparent that there was no way it could cross the crest of the range. Instead, the Peruvians had blasted a kilometer-long tunnel through the remaining ridge, but it was unlike any other tunnel Bruce or I had ever seen. One-lane wide, it was neither lighted nor cemented, and water continually poured through its multi-fractured roof. Indeed, so much water had poured into the tunnel, that the entire middle portion of it consisted of lake that was well over half a meter in depth. Obviously, anyone using the tunnel hoped not only to avoid meeting another vehicle in the middle of it, but also to avoid stalling out in the subterranean lake as well. And, certainly in the back of both Bruce's mind and my own, if not in that of the local driver, there was the additional hope that we would get out of the tunnel before an earthquake occurred.

Once the road emerged from the tunnel, it dropped rapidly into a more lush and greener valley than the one through which we had approached the crest from the west. Now we were in a tributary valley of the Marañón, the main headwater source of the mighty Amazon River, and a few kilometers downstream, after breaching a series of almost vertical layers of sedimentary rock, we reached the site of Chavín. Although a

major portion of the structure had a tomb-like quality, being partially buried beneath the ground, it was the location of the site that intrigued me the most. Opening behind it to



Figure 33. Although a major portion of Chavin de Huantar is subterranean, its external portions are fashioned of carefully cut and polished sandstone, the predominant bedrock in this section of the valley. Dated to about 1700 BCE, it was clearly a major site of a culture that attached great importance to its remote, offside location. The latter can only be explained by its proximity to the coca-covered slopes of the Andes on the inner edges of the Amazon Basin.

the west was a narrow valley which ascended the main ridge of the Andes, skirted the edges of the glaciers mantling the slopes of Huascarán, the 6768 meter-high mountain (22,200 feet) that dominates the so-called Cordillera Blanca, or "White Range", and then dropped into the Santa river valley just above Huaráz. Still clearly etched against the side of this valley was the outline of an ancient track, once used by trains of llamas and human porters but today quite abandoned by all but alpine hikers because of its precipitous

gradient. It was clear to me that Chavín de Huantar represented the Amazon-valley terminus of the shortest ice-free route between the two sides of the continental divide of the South American continent. As such, it could not have been a major cultural center in



Figure 34. Farther down the valley of the Mosna river, a precipitous trail zig-zags its way up to the west, climbing first into the snow fields adjacent to Huascarán before descending to the coast along the Santa river valley to the site of Cerro Sechin. In the lower reaches of the Santa valley, the trail is flanked on each side by stonewalls, in an obvious attempt to protect the precious commodity that clearly was destined for the coast.

its own right, but it was rather an outpost or a way station between the great civilizations of the oases of the Pacific coast and the jungle regions of the Amazon. But what, I asked myself, could possibly have prompted the early city-states of coastal Peru to open a trade route between the glaciers of the high Andes into the rain-forests of the Amazon basin? A modern analogy provided the most likely answer: Chavín no doubt had been a major

collection and trans-shipment center for coca leaves during pre-Columbian times -- a commodity which must have figured as largely in the early trade between South America and Soconusco as did cacao and quetzal feathers in the opposite direction. Now that I had actually experienced its location at first hand, no more rational an explanation for its strange geography suggested itself. While this was hardly the answer I had expected when I set off for central Peru, I had by this time grown accustomed to surprises. If Izapa did in fact have a South American connection, at least part of that seems to have stemmed from a trade in drugs. More than that, I could not say at this time.



Figure 34. Although the site of Chanquillo, shown above, is described in the local travel literature as an “observatory”, none of the ports in its multiple walls has a clear opening to the sky, so that clearly is in error. It is a fortification whose function it was to guard the thirteen towers seen on the crest of the distant ridge. Set back from the coast a few kilometers, the presence of these towers would not be known to any casual coastal visitor, but for the locals inhabitants who were engaged in the drug trade, they were close enough to the point of export to facilitate the shipment of the coca that had been temporarily kept in storage there.

Chapter 7 – From Megaliths to the “52-Day Formula”

After a delightful summer quarter back on the Hanover campus, the fall term of 1978 saw me meet my classes in the venerable old university town of Lund, in southern Sweden. As the sole member of my department whose research background involved both Latin America and Scandinavia, I had been delegated to lead Dartmouth's Foreign Study Program in Geography and Environmental Studies in Sweden during the autumn quarter. For my Norwegian-born wife and me, returning to Scandinavia had something of a homecoming quality to it and we both looked forward to renewing our acquaintances, not only with the region but also with many old personal friends. In addition, my wife even managed to extract what, on the face of it, seemed to be a most modest promise from me: "not to go looking for any more stones or any more alignments".

As our field trips took us through the rolling lowlands of Skåne, Sweden's most productive agricultural region, I couldn't help but notice the scores of magnificent Megalithic dolmens and passage-graves we passed in the fields, nor the rows of great Bronze Age mounds that lined the commanding heights overlooking the Baltic Sea and the Öresund. More than once our weekend picnics just seemed to end up at some scenic spot that contained a Neolithic monument, a Bronze Age rock carving, or a Viking runestone. So it was on that fateful Saturday in early October that I drove my wife out to the little fishing port of Kåseberga on the southeastern coast of Skåne. I knew full well that on the wind-swept bluff behind the village lay one of the largest "ship-settings" in all of Scandinavia, a place known as Ales stenar, or "the stones of Ale". (In the literature, there was some debate over whether Ale was the name of some pre-historic personage or whether the term derived from the Old Norse word als meaning "sacred".)

Imagine her innocent delight, when, on reaching the top of the hill where I had suggested we stop for our picnic, she discovered two rows of huge red-granite boulders carefully arranged to emulate the outline of a ship some 67 meters (220 feet) in length. Ruth smiled at me knowingly, and remarked, "You've really got rocks in your head!" I grinned back, and chided her for not having let me bring my surveyor's compass along to Sweden. "I'm sure this thing is solstitially oriented," I said, striding off to capture the magic of the place on film. Spreading out the picnic cloth near the middle of the "ship", Ruth gave a pseudo-wistful shrug and replied, "Here we go again!"

When I returned to join her for lunch, I had all kinds of "thrilling" reports to give her. There were 59 stones in all, chiefly of red granite, most probably glacial erratics that had been hauled up from the foot of the wave-washed moraine some 30 meters (100 feet) below. The "bow", "stern", and "rudder" stones were different, being composed of a light cream-colored quartzite; they were also, by their very nature, smoother and more sharply angular, so that is probably why they had been used to define the ends of the "ship". Judging from their overall height and diameter, each of the stones must conservatively average about a half to 2 tons in weight, meaning that whoever had built this thing, had at the very minimum carted close to 100 tons of rock up to the top of this moraine. But why had they done it? Judging from the spectacular view of the Baltic Sea it commanded to the south and east and its sweeping vista of the plains of Skåne to the north and west, the site had, at least in part, been chosen for the full-circle view of the horizon it provided.

As we ate our sandwiches and drank our coffee, I half-jokingly remarked to Ruth how disappointed I was with the Swedes. She gave me a puzzled look, and asked what I meant. Well, considering that Gustav Vasa had decreed the protection of archaeological monuments as early as 1523, Sweden had perhaps the best record of its pre-history of

almost any country in the world. Yet, on the placard erected at the entrance to Ales stenar, the Swedish Antiquities Board had described the site as being late Iron Age in origin, that is, from the period 400 - 1050 A.D. That clearly had to be in error, I argued -- for a whole host of reasons. Just the size of the stones and the amount of labor involved to set them up gave the site a "Megalithic" feel, not unlike that which one experiences at Stonehenge in England or Carnac in Brittany. With abundant evidence of Megalithic settlement all over Skåne, this certainly was not a far-out idea. Moreover, anyone with even a rudimentary knowledge of Scandinavian history would realize that the "late Iron Age" was precisely the period of the great Germanic migrations -- the Völkerwanderungen that sent wild Nordic tribes high-tailing it across the North Sea into Britain and even around the end of the Pyrenees into Iberia. Certainly that was not the juncture in history for anyone to spend time hauling 100 tons of rock to the top of this hill. Nor was the Viking period which followed any more placid a time to devote to such construction. In fact, from the numerous examples I had seen of Viking workmanship, I had long since realized what a crude and lazy bunch they were. Sure, they'd build a "ship-setting" if the stones were lying at their feet, and if they weren't bigger than a couple of unemployed stevedores could man-handle into an upright position, but beyond that, forget it. Besides, the Vikings were like the Aztecs -- the last of a long line of peoples who had occupied the same region over time, and who had either forgotten or never understood the basic principles of what their forefathers had done before them. As a result, Viking ship-settings were small, puny, and irregular -- totally lacking in the grandeur of size and position that Ales stenar possessed. I concluded my little harangue by suggesting that Ruth and I return for another picnic tomorrow, and in the meantime I would borrow a surveyor's compass from

Lund's Geography Institute to see whether it was really solstitially oriented or not. Since it was such a lovely spot, Ruth didn't offer any objection.

The following day, Sunday, was in every way a repeat of Saturday. The sun was shining brightly, and a fresh breeze was blowing in off the sea as Ruth and I climbed up the hill with our picnic basket. Only this time I had a surveyor's compass with me, and as Ruth lay out the checkered blue-and-white cloth, the fried chicken, and white wine, I ran off to make my measurements. Standing at the "bow" of the "ship" and sighting on the "stern", I watched the compass needle pull around to 315°, and I nodded in satisfaction. Overnight, I had done my 'home work' and learned that at the latitude of Ales stenar my expected solstitial azimuths should be 45° at the June 21 sunrise position and 315° at sunset. In this connection, I was quick to realize that the specific latitudinal setting of Ales stenar insured that there was precisely a 90° difference between the rising and setting positions of the sun. I found this fact especially exciting because I already knew that, in my studies of the site of Stonehenge, it had been shown that its position marked exactly the same right-angular distance between maximal lunar rising and solar setting positions. Thus, if Stonehenge had been built by Megalithic peoples to commemorate a 90-degree angle between the rising and setting positions of sun and the moon, then there was a strong likelihood that Ales stenar had been built by the same culture to commemorate a similar relationship between the rising and setting points of the sun itself.

My home-work had also revealed that this part of Sweden lay right on the agonic line -- the line of zero magnetic declination, so there was no deflection of the compass needle to the left or right of true north. My 315 degree bearing needed no correction, and my compass clearly showed that the long axis of the "ship setting" aimed right over the "stern" to the sunset position on the summer solstice, while a sighting in the opposite

direction meant that the "bow" pointed toward the horizon where the sun rose at the winter solstice. In other words, Ales stenar could have served as a giant calendar by marking the two critical turning points of the solar year -- events that even today are vigorously celebrated by the sun-loving Scandinavians.

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Again, I was off and running. Enlisting the support of an economics major in need of extra course credit -- as it turned out, he was unable to pursue an independent study project with local Swedish economists because their participation in Dartmouth's program would push them into a higher income tax bracket! -- I resolved to use the autumn in Sweden for some research of my own into Megalithic archaeo-astronomy. Jay and I scoured the countryside of Skåne at every opportunity we could to see whether there were more 5,000 year-old mysteries lying undiscovered in the fields. And, one blustery late-October afternoon we found another one -- this time at a place called Klinta and a site known as Trollakistan ("The Troll's Chest"). It had no doubt received this name because it had the form of a massive table-like slab of stone that rested on three other uneven "legs" of stone.

Klinta lay at the top of a hill in the interior of Skåne, at least 35 km (20 miles) from the nearest shore. Because it was so far removed from the Megalithic graves that dotted the coastal lowlands of Skåne, Swedish archaeologists had paid it scant attention, even going so far as to suggest that it might have been a nomadic hunting site. However, a couple of years earlier it had finally been excavated and definite Megalithic associations were established for it. The archaeologist in charge concluded that it had been a dolmen, or single-grave, burial, and that the great table-like slab of stone had originally lain upside

down. In fact, he had even found some local farmers who claimed it had been up-ended to make it into a picnic table in the 1920's.

Even though I was privy to none of the foregoing history at the time of Jay's and my arrival at Klinta, I intuitively had the feel that the site must be Megalithic in origin. The size of the stones used in its construction was just too large for Vikings to have bothered with. Moreover, lying on a hill as it did, it seemed to have been positioned with some sense of alignment in mind -- something I never had found in the case of Viking structures. In fact, looking across the flat, triangular table top I noticed that on the southern edge of the site a single, isolated pointed-stone stuck up out of the grass. Taking a bearing with my compass from one apex of the triangle to the pointed stone, I got an azimuth which was surprisingly close to what a winter solstice sunrise position would have been. Moving around the table to the adjacent apex of the triangle, I sighted in on the bearing for the summer solstice sunrise and found my compass pointing straight into the trunk of a massive oak tree only two meters away. "Damn", I muttered. "That tree has grown up right in line with where the summer solstice marker should have been." Having taken scores of such "meaningless" sights, I chalked this up as just one more near miss, and proceeded to complete my examination of the site by walking around the tree. Imagine my surprise when I reached the other side of the oak and found an upright pointed stone clutched firmly in its roots!

Of course, two solstitially oriented sites -- or even one and a half -- will not rewrite the pre-history of Sweden, but my colleagues at the University of Lund encouraged me to draft an article of my findings for a Swedish scientific journal called Forskning och Framsteg, and so Jay and I wrote up our observations and enclosed a series of colored photographs to document our arguments. The article was eagerly accepted, and in the

resulting correspondence I was informed that a Swedish humorist had first suggested the possibility of Ales stenar being solstitially oriented some years earlier, but his notion had literally been "laughed off". More recently, a Swedish astronomer in Göteborg had determined that the individual stones of Ales stenar had been positioned with such precision that they formed two interlocking parabolae, and from these the actual day of the solstice could be predicted. Although our articles were jointly scheduled for publication the following autumn, in the interim one of my Swedish colleagues from the University of Lund engaged a professional photographer to test my hypothesis by actually recording the summer solstice sunset over Ales stenar. In a series of photos taken every four minutes, the sun was seen to set directly behind the "stern" stone, just as I had predicted.

My tangential foray into Swedish Megalithic archaeoastronomy was not over with the publication of Jay's and my article, however. Excited by the prospect of delving further into this topic, I applied for and received a grant from the Swedish Institute in Stockholm to continue my inquiry the following autumn, and Jay too, opted to return with me to the field, this time amply funded by a couple of grants from Dartmouth. Significantly, our follow-up examination of Megalithic sites throughout Sweden and Denmark did produce one further site of truly 'monumental' proportions in the west of Sweden known as Ranstena ("the stones of Rane"). Although this "ship setting" contains only 24 stones, each of them is about the size of an automobile and must conservatively weigh in the vicinity of 20 to 25 tons. The site lies at the northern end of Sweden's second-most densely settled "Megalithic" region, the West Gothic Plain, but it has likewise been erroneously identified by the Swedish Antiquities Board as being of Late Iron Age construction. It closely duplicates the Scottish site of Callanish in the Hebrides

in both latitude and orientation, Ranstena being aligned to Billingen, the highest 'mountain' in western Sweden, at the winter solstice sunset, just as Callanish is to Tirga Mor, one of the higher peaks on the Isle of Lewis. Subsequent research by the author has demonstrated that both Ranstena and Callanish also belong to that elite chain of Megalithic sites that commemorate right-angle relationships between the sun and the moon at their specific latitudes – the other three being Carnac in France, Stonehenge in England, and Ales Stenar, as already noted.

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1978 had turned out to be a most memorable, and most convoluted, year: What had begun in "El Shrimp Bucket" in Mazatlán, had continued through Edzná and Chavín and Ales stenar, had drawn to a close with Christmas in Houston. To be sure, the latter is hardly the place where those steeped in New England tradition or Scandinavian ancestry go to celebrate the Yuletide season, but having a daughter working there and being on my way back to Mexico for another round of field research, it seemed an acceptable, if not totally enjoyable, compromise. Unfortunately, in their haste to slap-up new condos, Texas builders sometimes lose sight of the continental extremes in climate to which their region is subject. Thus, when a "norther" comes through and plummets temperatures 50 degrees Fahrenheit over-night -- as it did just before Christmas of 1978, pipes freeze and burst and scores of apartment houses are turned into miniature mid-winter Niagaras, as water flows out under their doors and icicles form on their sun-decks and balconies. Of course, there was no reason that my daughter's apartment complex should be any more soundly built than the rest -- and it wasn't.

Just after New Year's (this time spent in the intimacy of Mickey Gilley's bar in Pasadena, all 3000 of us!), I met Paul, my new field assistant, at the Houston airport, and

the two of us headed south to Brownsville in my newly-acquired pick-up. After my return from Sweden, Paul and I had not only shopped around and bought a truck that both of us 6-footers could fit into comfortably, but we had also built it in as a full-fledged camping vehicle. For the first time I would be totally free of third-class Mexican hotels; now we'd be able to eat and sleep anywhere in the jungle or desert that we wanted to -- make that, dared to. Naturally, the "bandido" element still gave us some pause, so for the most part, we planned to stay pretty much in lighted and walled campgrounds -- at least wherever they existed. Our first night in Ciudad Victoria didn't quite turn out that way, but Paul was a good sport, and our expedition got off to a reasonably successful, even if somewhat delayed, start. (For some reason, the State of New Hampshire hadn't gotten around to issuing license plates for my new truck in time for our departure, so after killing a few days in Brownsville waiting for them to arrive, I had another idea. I called my daughter in Houston, asked her to take the front plate off her car, and send it to us on the local bus. Since one plate is legal in Texas, and virtually anything is legal in Mexico, we each drove for the next two months with no problems at all. Naturally, I did miss having the custom-made vanity plates marked "IZAPA" on my new truck, but at least they were awaiting me on my return.)

Paul and I headed as directly for Edzná as possible, because it was there that I hoped to once again pick up the thread of my Mesoamerican research. Standing on the steps of Cinco Pisos, I wanted to make sure that he not only understood the theory behind my study but that he could also replicate my alignments to his own complete satisfaction. Unless he, or any other observer, was convinced that the 285° and the 300° orientations actually existed, there was no case to be made for my hypothesis.

Having confirmed that the Edzná alignments were the same as I had recorded them, Paul and I then started up into the Yucatán to check out other Classic Maya sites. This low, limestone region -- the very core of the so-called Mayan Empire -- had never attracted me as a place to test alignments, for the simple reason that it had no mountains towards which any solstitial orientation was possible. But now that was not an issue. We had seen that at Edzná, the oldest major Mayan urban center, they had not only constructed their own artificial horizon -- the elongated ridge opposite Cinco Pisos, but also their own horizon-marker -- the Northwest Pyramid. Here, in a region where topography precluded such a solution, our goal would be to check if the Mayas had built their astronomical alignments into the buildings themselves.

In December 1978, while pipes were bursting all over Houston, Texas, the President of Mexico was dedicating a new stretch of paved highway leading to the Mayan sites of Sayil and Labná. Paul and I were among the first beneficiaries of this new road, and for a whole afternoon we clambered over the ornate rose-beige palaces and temples that graced these sites, taking our measurements and snapping photographs. At both of these ceremonial centers, the orientations of the principal structures again duplicated those of Edzná. Somehow, the builders of Sayil and Labná, just as those in Edzná, in Teotihuacán, and even in distant Chicomostoc too, seem to have known what the sunset position was on August 13. Until we figured out how they knew, I said to Paul, we would never unravel this puzzle. Therefore, it behooved us, then and there, to sit down and think this through, once and for all.

Thinking aloud, I began by recapitulating the obvious, so that we both had a common point of departure. The only fixed points in the year are, of course, the solstices - - "the places where the sun stands still", as the Romans expressed it. Even the Megalithic

peoples had ways of marking these, but what about dates in between, like the 13th of August? Perhaps the red-granite blocks along the gunwales of Ales stenar may have served that kind of function, but if they did, no one since has figured out how. What, after all, is the relationship of August 13 to the solstices? Well, it can hardly have any meaningful relationship with the winter solstice, because December obviously follows August; naturally, the only way you can predict when August 13 is coming is by reference to something that precedes it. If it has any relationship to a solstice, it must, therefore, be to the summer solstice. But, by how many days does it precede August 13? Well, count them and find out. There are 8 days after the summer solstice in June, 31 in the month of July, and another 13 in August. That makes 52 days. FIFTY - TWO! Where have I heard that number before? Weeks in a year? Cards in a deck? Years in a Mayan cycle? Yes, it took 52 years for the two calendars to come back into phase with each other. This is because it is the least common denominator of 260 and 365. Try it out -- 260 is divisible by 5 and yields 52, whereas 365 is divisible by 5 and yields 73. Put another way: $260 \times 365 = 94,900$, divided by 5 = 18,980. In that number of days, the ritual almanac will go through its full cycle 73 times, while the secular calendar will complete 52 of its rounds. When you reduce 52 to its least common denominators, it results in 4 times 13, and 13 was one of the numbers that intrigued the Maya the most. Coupled with their vigesimal counting system (i.e., counting both their fingers and toes), you had 13 times 20, which was one of the ways in which Thompson believed the sacred calendar might have arisen. In any case, 4 cycles each of 13 days following the summer solstice, and you will reach August 13. A priest didn't have to be too smart to remember that "formula". In fact, it was so moronically simple, I wondered why I hadn't sat down and thought it through long before this.

Now, the lights really began to flash. Continuing to think aloud, I told Paul that anybody who knew and used the sacred calendar certainly could also be expected to know the formula for determining when "time began" -- at least in the earliest days. Obviously, the farther removed a given people or culture was from the time and place of origin, the more vague their notions would be of how things began. That's why the Aztecs were such "dumb-bunnies" when it came to science and astronomy, or why the Vikings had no inkling that when they built "ship-settings", they were supposed to line them up astronomically. The earliest cultures, the ones that were responsible for developing the concepts, which were closest to where the ideas arose -- these were the peoples we should expect to understand the principles the best and employ them -- pardon the pun -- the most "religiously". The real test of the August 13th "formula" was still to come -- not necessarily in small ceremonial centers of secondary importance like Sayil and Labná, but rather at the major centers of power and learning such as Chichén Itzá, and especially at the Mayan capital of Tikal. If the formula didn't work there -- where it really counted -- then it might as well not work anywhere. Now our mission had taken on a whole new urgency and sense of excitement. At last I felt I had found the clue that would make or break my whole sacred calendar hypothesis.

Chapter 8 – Unraveling the Mysteries of the Mayas

Dotted across the Yucatán peninsula are the ruins of an estimated 3-4,000 Mayan ceremonial centers, most of them small and relatively insignificant but some of them of imposing size and impressive grandeur. It is the latter that have commanded the chief attention of the archaeologists, and also of the Mexican government, that has attempted to restore and maintain them as tourist attractions. Having been abandoned some 800 to 1000 years ago and subsequently overgrown by the jungle, the remnants of most Mayan structures are in such dilapidated condition that, as one seeks to find alignments in their architecture, one hopes to find original walls to work with rather than 20th century approximations of them. Fortunately, being a low-lying, stable platform of limestone, the Yucatán is not subject to earthquakes, and accordingly no dislocations of Mayan temples have occurred for that reason. By the same token, thanks to their geography, the Maya, alone amongst the peoples of Mesoamerica, lacked an earthquake deity.

However, being spared destruction by a shaking earth was small compensation for the other challenges posed by their environment. Imagine, for a moment, what problems the Maya had just finding water to drink, much less to irrigate their fields. This is because the limestone bedrock of the Yucatán is so porous any water falling on it quickly drains into the sub-soil, out of easy reach of both people and plants at the surface. As a result, nowhere in the entire peninsula is there a river or brook of running water. Collecting in subterranean pools, the ground water gradually dissolves away the limestone, forming massive caves and grottoes. Finally, when the roofs of these caves get so thin that they collapse, sink-holes are formed, leaving the landscape pocked by steep-walled cavities which the Maya called dzonot, and the Spanish approximated as cenotes. Because these "wells" intersected the water table, they became the principal sources of

water supply for Mayan settlements, the village women making a daily pilgrimage down the jagged lip of the sink-hole to fill their jugs. Over most of the Yucatán, water had to be hauled 20-25 meters (60-70 feet) to the surface in just this way, every day of the year.

Of course, the Maya also tried to conserve rainwater in special cisterns called chultunes. These were usually bottle-shaped cavities dug out of the limestone and plastered with clay. They likewise sought out natural depressions in the limestone where fine clays had washed down to make relatively impervious reservoirs of considerable size. These basins, called aguadas by the Spanish, not only retained water long after the rainy season was over, but also afforded the Maya with some of their choicest agricultural land. Indeed, as we have already noted, Edzná, sited on the largest aguada in all of the Yucatán, had become the Mayas' first great city, thanks to its extensive agricultural hinterland. Otherwise, the Maya struggled to plant their corn in fields that were more bare rock than they were soil.

The scarcity of water in the Yucatán was due, however, not only to the porosity of the limestone bedrock but also to the fact that nature had conspired to make the rainfall in the region capricious at best. Because Mexico lies in the trade wind belt, most of the moisture it receives is carried ashore by prevailing winds off the Caribbean Sea and Gulf of Mexico. The temperature of these tropical seas seldom drops below 25° C. (77° F.), so the air is always heavy with moisture as it comes ashore in the Yucatán, and the east coast does receive somewhat more rain as the air rises, cools, and condenses over the land. However, most of the year the sun beats down on Yucatán with such intensity that the air temperature there can rise well into the high 30's C. (90's F.), meaning that the air blowing in from the Caribbean becomes warmer the farther inland and to the west it moves. Of course, as air warms, its capacity to hold moisture increases, so instead of

releasing its moisture through condensation, it soaks up even more moisture through evaporation. Small wonder then, that Mayan priests could watch great towering clouds billow in from the east, only to literally dissolve before their eyes as the air passed overhead. Only when and if some local instability produced a violent updraft would a thunderstorm take place, and then the resultant rain might fall on one side of a village and leave the other completely dry. Under such haphazard conditions, where rainfall was so sporadic and undependable, it is easy to understand why the principal deity of the Maya was Chac, the hook-nosed rain-god. A more dramatic link between geography and religion can hardly be imagined!

Knowing even this much about the setting in which the Maya lived, one cannot but be impressed by their accomplishments. Beginning already a couple of centuries before the birth of Christ, they began building ceremonial centers like Edzná -- long thought to have been religious precincts, "empty" save for priests most of the year, but now known to have been true urban places with as many as 20,000 inhabitants. Indeed, at its peak, Tikal, the Mayan capital, appears to have had a population of 60-70,000 persons. For some 600 years -- between 300 and 900 A.D. -- their civilization flourished in the rainforests of northern Guatemala and southern Yucatán, and then it suddenly collapsed. For what reason, or reasons, no one knows for sure, but a variety of hypotheses have been proposed, including soil depletion, drought, internal strife, disease, and war. Whatever it was, the Maya seem to have made something of a comeback, at least in the drier parts of northern Yucatán, and what has been called the "New Empire" continued to struggle along from 900 to 1300 A.D. By then, however, their zenith had long since been passed, their cities had been abandoned, their buildings were falling into disrepair, and the refinements of their intellectual achievements had largely been forgotten. Even their

religion, with its elaborate pantheon of gods and goddesses had been replaced by a form of phallic worship, as Paul and I discovered from some of the crude carvings we stumbled over in the more remote sites we visited. Coming from a nation which had just celebrated its bicentennial, I couldn't help but wondering what the U.S. would be like after 600 years on its "first try" -- not to speak of after 400 more years, providing it has a second "go-around".

As we drove northward through the Yucatán, the next major site Paul and I reached was Kabah, a ceremonial center famous for its great "arch" which marked the beginning of one of the Mayas' mysterious paved highways. In reality, it was not an arch at all, because the Maya, despite all of their other masterful accomplishments, never hit upon the idea of the keystone. The best they could do to roof-over an open space was to add layer after layer of stones that projected farther and farther out until at last they touched. Of course, even with wooden lintels, the amount of masonry such a construction technique would support was decidedly limited, so Mayan rooms never could exceed much more than 4-5 meters (13-16 feet) in width before the walls started to buckle. The so-called arch of Kabah formed the entrance to a sacbe, or "white road", which slashed diagonally through the scrub forest to the ceremonial center of Uxmal, some 20 kilometers (12 miles) away. Lacking wheeled vehicles of any kind, the Maya appear to have built these carefully graded, 8-10 meter (25-30 feet) wide causeways solely for ceremonial purposes. However, it was not the highway, nor the arch, that primarily interested us, but rather the great palace known as the Codz Pop.

To be sure, we all have different ideas of what beauty is, and few of us in the western world probably find Chac, the hook-nosed rain-god, especially attractive. When his physiognomy is repeated about 200 times over to adorn the entire façade of a building,

there are those who would call it downright ugly. But, here, near the northwestern corner of the Yucatán, in the driest area of the Mayas' homeland, surely one must empathize enough with the builders of the Codz Pop to realize that this structure -- beautiful or not -- was an insistent entreaty for rain. Whatever this pink palace lacked in esthetics, it attempted to more than compensate for in its functionality. But, at the moment, what Paul and I found the most intriguing was that the Codz Pop was oriented squarely toward an azimuth of 285.5° , so we tallied up one more score for August 13th.

Uxmal is a far larger and more impressive site than any other Mayan center that Paul and I had previously visited, and because of its proximity to the modern city of Mérida, the Mexican government has expended considerable time and money in reconstructing it as a tourist attraction. In any event, its unique oval-shaped "Pyramid of the Magician" allowed no definitive alignments to be taken, and, although there were several suggestively close to the August 13th sunset position, Paul and I chose to ignore any but those we were totally convinced of. Thus, our next opportunity to test the hypothesis came in Chichén Itzá, the place where the entire quest had begun for me just six years earlier.

The most obvious place to look for astronomical alignments there, of course, was at El Caracol -- the snail-shaped building which had long since been identified as an observatory of sorts. Speaking of esthetics, as we were a moment ago, Sir John Eric Sydney Thompson reserved some of his most unflattering rhetoric for the structure we were now approaching. Allowing as how every society has made some -- pardon the pun! -- "monumental" blunders in what it considers beautiful, Thompson likened El Caracol to Grant's Tomb in Central Park and the Prince Albert Memorial in Hyde Park. Moreover, he chided the Maya for not having any two lines in the building parallel, and rather

indelicate described the entire creation as looking like "a wedding cake standing on the carton it came in".

Some relatively recent measurements made at El Caracol had suggested that a few of its alignments commemorated positions of Venus, whereas Paul and I quickly determined that the front staircase -- no doubt added by the Toltecs who moved in to conquer the Maya during the 10th century A.D. -- is oriented toward the summer solstice sunset. However, the most exciting discovery -- one later confirmed by photographic reconstructions carried out at the Griffiths Planetarium in Los Angeles -- was that the front door of El Caracol as well as the principal window of the structure located just above it were aimed squarely at the sunset position on August 13. What a sweet vindication this was, for the six years of time and the more than 50,000 miles of travel I

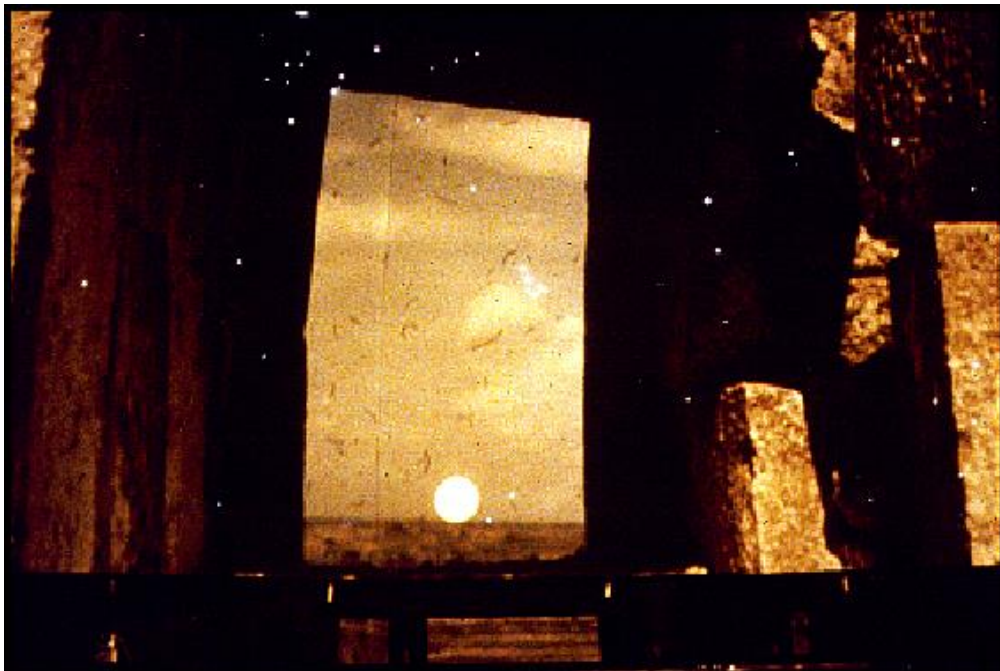


Figure 36. Dr. Edwin Krupp, Director of the Griffiths Planetarium of Los Angeles, kindly provided the above photograph of the August 13th sunset as it would have appeared superimposed over the window of El Caracol at Chichen Itzá. More eloquent proof of the Zoque 'New Year' can scarcely be imagined. About half way up the window, near its right side, the Pleiades may be seen, but are brighter in this reconstruction than

they are in reality, and of course continue shifting in their setting position as well, due to precession.

had spent in trying to piece the evidence of the sacred calendar together! Here, at the very site where the initial hypothesis presented itself, was some of the strongest support for it that I could find anywhere. Now, at least, I seemed to be asking the "right" questions. And now, more insistently than ever, it was imperative to test my hypothesis at the very core of the Mayan world -- at Tikal, their capital and largest city during the Classic Period. A few days later, after taking time out to snorkel in the crystal waters of Isla Mujeres, Paul and I started southward along the east coast of Yucatán, crossed into Belize, and finally entered the Petén region of Guatemala.

* * * * *

In the 400 kilometers (250 miles) we had driven southward, we had watched the vegetation change from scrub to ever taller and lushier rainforest. Now, camped on the shores of Lago Petén Itzá, the largest sink-hole lake in northern Guatemala, we found ourselves beneath an interlocking canopy of giant trees averaging 50-60 meters (160-180 feet) in height, laced with lianas and parasitic flowers. Colorful birds flitted in the shadows, adding their raucous cries to those of the chattering monkeys scrambling about above us as they foraged for food. Even though this was the dry season, the earth smelled of moistness and decay. Here, unlike parts of the northern Yucatán where the average annual precipitation totaled scarcely 750 mm (30 inches), in a typical year as much as 1650 mm (65 inches) of rain could be expected. Here too, the low-sun dry season was neither as short nor as marked as it was in the north. That fact we had ample opportunity to learn at first hand, because that night on the lake shore it rained a good 50 mm (2 inches).

The next morning, as Paul and I left our campsite and started into the national park that the Guatemalan government has created around the former Mayan capital, we quickly discovered what havoc the overnight thunderstorm had wreaked. The main road, which was in the process of reconstruction at the time, had been turned into a morass of slimy mud so deep that, with every meter we tried to force ourselves through it, the undercarriage of the truck became ever more thickly plastered with clay. Finally, when it seemed as though the truck could not carry another kilogram of the plastic clay with it, the back wheels slipped off the rutted track and we ended up sliding side-ways half off the road. Fortunately for us, a bulldozer working nearby was hastily pressed into service to loop a cable around our front bumper and pull us up onto the firmer ground of the old road, which despite its potholes and rock outcrops was still at least negotiable after the heavy and unexpected rain. Less fortunate were the two planeloads of gringo tourists who flew up for the day from Guatemala City. Every morning after the ground-fog clears at Tikal, Aviateca, the national airline of Guatemala, sends up a flight or two of tourists who otherwise would not have an opportunity to visit this fascinating site. On this particular occasion, the planes had successfully landed on the local dirt airstrip after their 45-minute flight from the Guatemalan capital, only to find that there would be no way to get up enough air speed to take off again in all that mud. As a result, Aviateca had to radio to the capital for buses to ferry the stranded passengers back to civilization -- a process which took the better part of the next three days.

As the largest urban agglomeration and the political nerve center of the Classical Maya, Tikal is a "must" for anyone who seeks to truly appreciate the accomplishments of this remarkable people. And, without question, the most dramatic architectural elements of this sprawling city are the five great skyscraper pyramids that thrust their roof-combs

out of the rainforest. One of them, the so-called Temple IV, is the tallest ancient structure in the New World, having a total height from base to summit of 67 meters (221 feet). How the Maya managed to construct the equivalent of modern 20-story buildings with a Stone Age technology is simply one more of the great mysteries of their civilization. And the question of why they did it has never been satisfactorily answered either. Of course, it is tempting to believe that in a rainforest whose canopy of interlocking limbs towers 50-60 meters above the forest floor, it was necessary to build structures that were even higher if they were to see the sky. But, the archaeologists tell us that, at the time of Tikal's greatness, the forest had long since been cleared and the surrounding countryside was a region of open cornfields. One wonders instead if such skyscrapers were necessary because of the nightly ground-fog that settles over tropical rain-forest areas like the Petén. Surely, this is one of the real hall-marks of the humid tropics which seldom is described in geography text books: the fact that the air is so moist, even the slight day-to-night drop in temperature is enough to make it condense and fill the low-lying clearings and hollows with wisps of fog. Only when the sun gets sufficiently high the following morning is the moisture re-absorbed back into the air and the fog burns off. But, in either scenario -- rainforest or ground-fog -- the underlying motivation for building such high structures seems to have been a need for seeing the sky -- in other words, astronomy.

The heart of Tikal is the area the archaeologists have called the Great Plaza, across which two of the towering pyramids -- Temple I, also known as the Temple of the Giant Jaguar and Temple II, sometimes called the Temple of the Masks -- almost face one another. Almost, but not quite, because it is clear as one climbs to the top of Temple I that its counterpart across the plaza has been slightly offset to the left, or south. Indeed, one soon realizes that Temple II is not only the smallest and the closest of the four outlying

pyramids but that it appears to have been constructed where it is simply as an esthetic counter-balance to Temple I; without it, the Great Plaza would be totally out of visual equilibrium.

On the other hand, the southward offset of Temple II has been carried out with deliberate care, because from Temple I there are unobstructed sight-lines to both Temple III (also known as the Temple of the Jaguar Priest), lying to the south of Temple II, and to Temple IV (sometimes known as the Temple of the Double-Headed Serpent), situated to its north. Standing in the middle of the doorway of Temple I and looking out toward the three great pyramids to the west, I brought the compass up to my eye and aligned it with the center of the doorway of Temple III. After a quick correction for the local magnetic declination, I suggested that Paul repeat the reading. He did, factor in the correction, and gave me his answer: 270 degrees, or due west. I asked what that meant to him, and he replied that a Mayan priest could have used the east-west axis between Temples I and III as a parallel of latitude, marking the places where the sun would rise and set at the equinoxes. I nodded in approval and gave him a big “thumbs up”.

I next took a sight on the center of the doorway of Temple IV. With the magnetic declination so fresh in mind, I merely grinned and handed the compass to Paul who proceeded to replicate my measurement. Turning back to me, Paul broke out in a broad smile and gave me a big “thumbs up” in return. The Maya had not let us down: they had constructed the highest pyramid in the Americas to commemorate their most sacred day -- August 13! What more fitting monument could they have erected to "the beginning of time" than the loftiest structure of which their engineering technology was capable?

Sitting on the top step of Temple I, Paul and I reveled in the knowledge that we had, in effect, been admitted to the innermost sanctum of the Maya astronomer-priests'

fraternity. Emerging, literally before our eyes, was the realization that the very center of centers -- the navel of the Mayan world -- had been planned as a huge astronomical matrix. The very geography of Tikal itself had been dictated by the religious-astronomical obsessions of this enigmatic people, and Paul and I felt a certain sense of excitement in realizing that we were first persons since the collapse of the Mayan Empire who were privy to that information. Even so, we had only begun our measurements, and we wondered what further alignments might lie hidden within the spatial fabric of the ruined city spread out below us.

Off to our south was the last of the outlying pyramids, Temple V, a structure whose sharp angular distance from the rest of the great temples immediately raised doubts in my mind concerning any astronomical function it might have had. Indeed, when Paul had confirmed my azimuth reading on it -- 195.5, or 15.5 degrees west of south -- it was obvious that it could have had neither a solar or lunar significance. However, what its relationship to Temple I did demonstrate was that the Mayas had constructed it at precisely 90 ° to the August 13th sunset position. This was an interesting revelation in itself, because Thompson -- perhaps due to his total disenchantment with El Caracol at Chichén Itzá -- is on record as saying that the Maya were quite incapable of delimiting a right angle, and here we had evidence that he was wrong. Nevertheless, I was quite convinced that an alignment 15.5 ° west of south could not have been of any astronomical utility to the Maya, least of all on August 13, and I suggested to Paul that perhaps we should be looking at its reciprocal instead. In other words, a back-sight from Temple V to Temple I might have resulted in the Maya priests zeroing in on some star which rose 15.5 degrees east of north, and, if it did so on August 13, it would have provided them with a doubly precise method for determining "the day that time began". Luckily, the pocket

ephemeris I was wont to carry contained the vital statistics on something more than two dozen of the brightest stars in the sky that conceivably might be of use to a surveyor. A quick check of these produced only one candidate -- Kochab, also known as Beta Ursae Minoris, located in "the little dipper". With a present declination of 74.3° , it lies within 0.2° of the roof-comb of Temple I as seen from Temple V -- a totally inconsequential difference in the naked-eye astronomy practiced by the Maya. However, when the position of Kochab is corrected for precession (the apparent motion of the stars which results from the slow wobble of the earth's axis), it is seen that in 700 CE, when Temples I and V were constructed, its declination was some 5 degrees higher, so it is clear that it could not have been used for any alignment between the two structures. Therefore, if there was a relationship other than a perpendicular to the August 13th alignment, it continued to elude us.

With three out of five of the great pyramids locked into a spatial pattern commemorating key astronomical sight lines, I suggested to Paul that our next order of business clearly was the ascent of Temple IV. From this highest of pre-Columbian edifices in the New World we would have an opportunity to re-assess the layout of Tikal from a yet loftier vantage point to see if there remained some still undisclosed mysteries. Our walk up along the so-called Tozzer Causeway happened to intersect a monkey "highway" in the branches above us, and as we passed by on the lower level, a troop of our primate cousins was crossing the arboreal bridge some 50 meters over our heads. I can't repeat what they said to us as we went by, but from the tone of voice in which they said it, it was obviously not very flattering.

Pulling our way to the top of Temple IV was a little trickier than usual, due to the rain of the preceding night, but once on its summit we were rewarded with a view of

unbroken rainforest stretching as far as the eye could see. Somewhere out there in the heat-haze, 132 kilometers (82 miles) away, was Victoria Peak, which at 1122 meters (3680 feet) was the highest pinnacle in the Maya Mountains. Suggested by my armchair map studies -- and later confirmed for me by the Defense Mapping Agency in Washington, D.C. -- was the fact that the site of Tikal was oriented to the rising sun at the winter solstice over Victoria Peak. Although Tikal was theoretically within the line-of-sight distance of the mountain, I wasn't certain whether the peak was actually visible from it, but in any case I aimed my compass at the horizon and turned until I brought the correct azimuth (i.e., 115 °) into line. Imagine my surprise when I found the sights of the compass perfectly bisecting the top of the roof-comb of Temple III. Whether Victoria Peak was visible or not, the Maya priests had ensured the accuracy of their observations by constructing Temple III with such care that its roof-comb just intersected the horizon. Here was the final link in their astronomical matrix, for viewed from Temple I, Temple III established the equinoxes, whereas viewed from Temple IV, and it commemorated the winter solstice. And, with Temples I and IV providing a check on August 13, the Maya astronomer-priests had become city-planners of a most exceptional kind, immortalizing the key events of time by their most grandiose constructions in space.

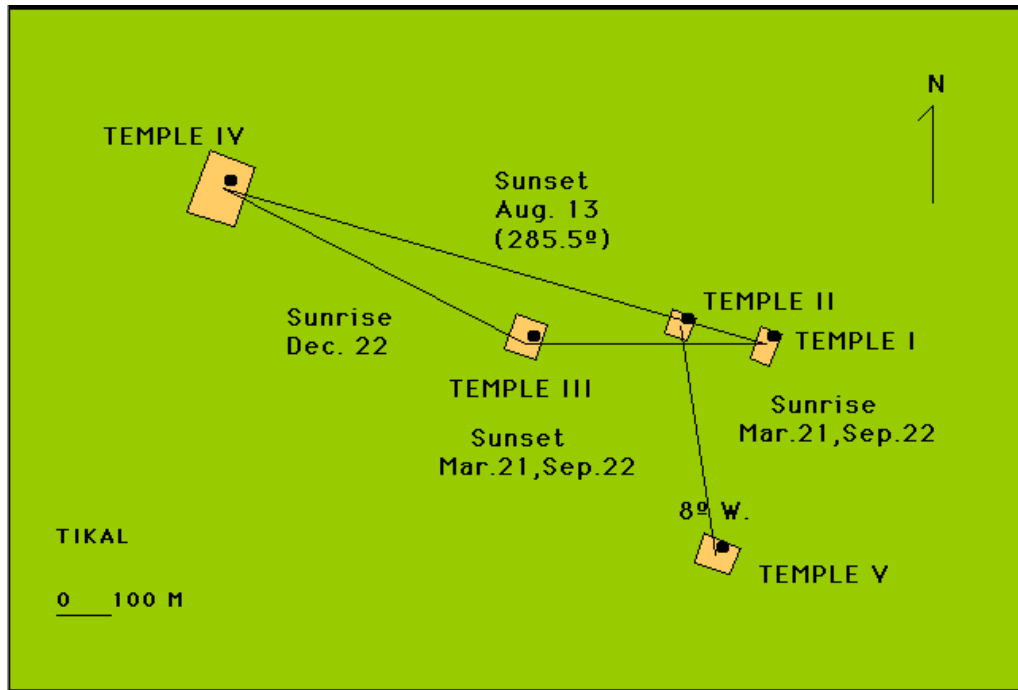


Figure 37. The astronomical matrix at Tikal is the most elaborate and complete of any in the Mesoamerican world, commemorating not only the equinoxes but also the winter solstice sunrise, the Zoque New Year, and what was then the closest asterism to the North Pole, Kochab, at 8° west of North.

Let me jump ahead here to recount one of the "spin-offs" of our discovery of the Tikal astronomical matrix. To me, the notion that the Maya were so obsessed with the importance of time that they incorporated it into the spatial design of their capital city was an exciting one, and one that I should share as quickly as possible with the readers of Science. Soon after my return from Mesoamerica, I dashed off an article, drafted a couple of maps to accompany it, and sent it along to the editor. As is customary, he forwarded it to 'expert' reviewers for their advice as to whether the article should be published or not. Imagine my surprise when the article was returned several weeks later with the following observation from an anonymous critic: "It is a pity that Malmstrom is not more familiar with the archaeology of Tikal. Had he been so, he would have realized that buried beneath Temple I is the wife of " -- such and such a chieftain. Naturally, when the editor

was confronted with such a damning indictment of my ignorance, what option had he but to reject my article! On the other hand, what relevance the burial site of the chieftain's wife had to do with the astronomical matrix of Tikal, my anonymous reviewer was never asked to explain. However, merely to raise such an irrelevant "red herring" in the face of an entirely new discovery, in this or any field of study, reveals not only the pettiness of the writer's supposed peer, but also casts serious doubts on the professional competence of the editor of the journal to which the paper was addressed. Unfortunately, facing both of these hazards are everyday realities in the life of most field researchers and surely of all original thinkers as well.

Chapter 9 – Filling in the “Doughnut Hole”

Some months before my planned return to Mesoamerica, I had received a letter from an author-naturalist who had been intrigued by my discovery of the magnetic turtlehead at Izapa. Not only did he make a last-minute revision to a manuscript of his own which was just about to go to press, but he also asked if he, his wife, and interpreter could accompany my field assistant and me on our next trek into the wilds. The motive for his request was a possible article in a popular magazine on how a geographer goes about his research. To be sure, I had my doubts that anyone -- including other geographers -- would find such an article very exciting, but I replied that he and his entourage were welcome 'to come along and look over our shoulders', as long as it did not impede our work in any way. Accordingly, we agreed to meet in Antigua, the colonial capital of Guatemala, toward the middle of February, thus permitting him an opportunity to accompany us to Izapa and see the magnetic turtle for himself.

Fresh from our discoveries in the Yucatán and Petén, Paul and I arrived in Antigua a couple days early -- a fact which allowed us to check out a few of the late, highland Maya sites such as Zacaleu and Iximché before they joined us. I had no expectation of anything of value coming from our highland jaunt, because, like the ‘Johnny-come-lately’ Aztecs, the highland Maya, apart from having preserved the sacred calendar to the present time, appear to have forgotten much of the basic rationale for it -- if, in fact, they had ever even known it. As it turned out, no orientations of any consequence showed up, but as we started back toward Antigua we caught sight of a distant plume of black smoke issuing from a mountain. Obviously, some volcano had begun spouting off -- no doubt just another "regular" eruption, but the closer and closer

we got to Antigua, the nearer to the city we realized it was. Indeed, Antigua itself had been the victim of both volcanic eruptions and earthquakes in the past, and there was scarcely a colonial structure in the city that did not show signs of massive cracks crisscrossing its façade. By the time we were back at our hotel, it was obvious that the volcano in eruption was Acatenango, just 20 km (12 miles) to the southwest of the city. Its towering plume of ash and dust by day and its spectacular fireworks display by night kept us amply entertained as we awaited our author-friend and his party.

We let Jack, Anne, and Nick (their interpreter) get one night's rest before we set out for the Pacific lowlands the following morning, our pick-up leading the way, followed by their Guatemalan rental-car. The only road from Antigua toward the coast lay around the flanks of Acatenango, and although we would ultimately pass within a couple kilometers of it, there seemed to be no special danger involved in doing so. In a previous eruption it had pulled an especially nasty trick, and belched out a nue ardente, or cloud of incandescent gas, which incinerated everything in its path almost down to the very road we would be driving, but as long as that didn't happen at the instant of our passing, we had nothing to fear. In any case, I was sure that the episode would provide a thrilling start for Jack's eventual article in Sports Illustrated -- or wherever.

Our first destination was the little lowland town of La Democracia, famous for the collection of statues that had been hauled in from the surrounding sugar plantations and set up in the town plaza. I had never seen the statues before and was curious about how they might fit into the origins of civilization scenario that I had been attempting to link with the sacred calendar. Ironically, the town had also been the birthplace of a disaffected Army captain who, in 1954 with the economic and military assistance of the

CIA, had nullified the only democratic election the nation of Guatemala ever had, and installed a military regime under which the country had lived ever since. Thus, in the very midst of all the crude pre-Columbian art works we had come to see was an atrocious gilded bust of this politically ambitious captain.

The statues I was interested in were those that the archaeologists had rather facetiously called the "Fat Boys". Whether "boys" or "girls", there was no way of telling, but "fat" they definitely were. They were in effect huge rounded boulders of dark basalt, into the surface of which only the most rudimentary of features had been scratched. On those that were supposed to represent human heads, the eyes, ears, noses and mouths had been etched with a bare minimum of effort, while on those that represented bodies, you could discern the outlines of arms and legs circling the boulder but little more. Indeed, most of the original boulder remained intact, giving the resultant sculptures a decidedly corpulent appearance. Both because of the striking crudity of their execution and the stratigraphic associations in which they were found, the "Fat Boys" were thought by archaeologists to date to somewhere between 2000 and 1500 B.C. Of course, if correct, this would have made them somewhat older or possibly synchronous with the origins of the calendars; hence my interest in them.

After examining each of the dozen-odd statues that stood in the plaza and taking photographs of several, I started toward the little municipal museum, accompanied by Paul and Jack, to see what items of interest it might contain. As we did so, Jack idly asked if any of the "Fat Boys" might be magnetic. I retorted that I doubted it very much, because they were "people" after all, not turtles, but I told Paul that he might just as well check them out while Jack and I were looking over the museum. About five minutes later

Paul came running in excitedly and gave us his report: "Those darn things are magnetic", he whispered, "but you'll never guess where!" With that kind of an admonition, I didn't even dare, but I hurried back out to the plaza with my compass and began moving it over the surface of the sculptures. If the statue happened to represent an entire body, the compass invariably did a flip-flop as I passed it near the navel. It was just as though a u-shaped bar magnet had been placed in the abdomen of each of the statues, with one pole attracting the needle to it and another, just 10 centimeters (4 inches) away, repelling it. On close examination, however, it was apparent that there was no inset of any kind, and, just as in the case of the magnetic turtle's head, the sculpture depended for its magnetism on the natural occurrence of a clump of magnetite within the stone. That this occurrence must have been known to the sculptor was obvious, otherwise there was no way that time after time he could have scratched out carvings whose "belly buttons" were magnetic. If the carving was of a head, the compass consistently did its flip-flop as I passed it near the right temple -- again one pole attracting the needle and another, about 10 centimeters away, repelling it. In all, we logged 11 statues in the plaza that deflected the compass in this manner, while in the twelfth we found one pole in the back of its neck but could not find the reverse pole at all. (Perhaps it was in the base of the statue where we could not reach it with the compass.) In any event, in one casual afternoon's work, Paul had increased the known total of magnetic sculptures on the North American continent from one to twelve -- leaving me as dumbfounded as I know Jack was. If every day of our trip ahead could deliver this kind of excitement, Jack was bound to have a cover story for Sports Illustrated!

The day was not over, however, because we had one other stop scheduled a few kilometers away. This was at the sugar plantation of El Baúl where an Izapan-style monument bearing a date equivalent to 36 A.D. had been found in the 1940's. Inasmuch as this Long Count date was nearly 300 years older than anything found anywhere in the lowland Maya region, and it was stylistically related to Izapa, I was especially eager to see and photograph it.

It was beginning to drizzle lightly as our two-vehicle caravan arrived in the parking area of the sugar plantation. The collection of sculptures which had been assembled from the surrounding countryside had been set up around the perimeter of the parking area for the benefit of tourists passing through, and over some of them roofs of sheet-metal had been erected to protect them from the rain. As Paul and I stepped out of our pick-up and looked around, it soon became apparent that the timing of our visit was very inopportune, because on one side of the parking lot stood the local management of the sugar mill, backed by a gum-chewing young man wielding a sub-machine gun, while on the opposite side stood a group of belligerent workers carrying clubs and bottles. In a moment, I realized that we had inadvertently driven into the midst of a labor-management dispute which was just about to be resolved with bullets and bricks. Neither the manager of the plantation nor his gun-twirling henchman said a word, nor the crowd of sullen field-hands just stood there glowering at us, obviously incredulous that five stupid gringos would drive right into the midst of such a confrontation. There was no way the matter could be settled until we were gone, for we had inadvertently placed ourselves right in the line of fire. Obviously Jack and his party had no inkling of what was up, and I whispered to Paul that we had better make this quick. Paul agreed, saying he didn't like

having that cocky young jerk standing behind him toying with a loaded sub-machine gun. We took our photos and checked the sculptures for magnetism -- hereafter to become standard procedure whether they were turtles or not! -- under a real sense of duress and then urged Jack and his friends to pile back in their car.

I regretted the tenseness of the moment, because one of the sculptures depicting two turban-clad individuals sitting cross-legged on a bench had no fewer than four magnetic poles on it: one each at the navels of the two men, and one more beneath the bench under each of the men. But, this was clearly not the time to stand there and speculate about anything so esoteric as magnetism, so Paul and I got back into the pick-up and led the way out of the parking lot. Just as we drove out of the entrance of the plantation, a station wagon arrived with management reinforcements, for in the back seat Paul and I spotted another man cradling a sub-machine gun in his arms. We never heard how the dispute came out, because such events seldom reached any edition of the censored press. In the same way, at breakfast a couple of days earlier, we had been told by an elderly American of how his wife had gone to an Indian village a few miles away from Antigua to take her weekly weaving lesson. As she was getting out of her car, she heard a volley of gunfire, only to see a group of Indians mowed down in the plaza by Army troops. Horrified by the spectacle and reluctant to be identified as a witness, the lady had quickly gotten back into her car and returned to Antigua. Needless to say, this "happening" had not been subsequently reported in the press either. But, now, having heard rumors for some time of how the Guatemalan military were stamping out "Communist-inspired" uprisings amongst the Indians, the workers, and the academics, and having this very afternoon literally stumbled into the crossfire of what could have

been a very ugly situation, I resolved that my research in Guatemala would cease. Selfish as my motives were, I could no longer stand to work in a country where the blood of innocent people was daily being spilled in the name of "anti-Communism", and the quicker I could return to the relative safety and sanity of Mexico, the better.

* * * * *

The next day, after a stop at the University of California's "dig" at Abaj Takalik, an ancient Pacific lowland site where both Olmec and Maya sculptures have been found superimposed on one another, Paul and I crossed into Mexico. Jack and his party were not so lucky, because it turned out that their Guatemalan rental car could not be driven outside the country. The only way out of this dilemma was for Jack to lock up his Guatemalan car, take a taxi across the border, rent a new car, and continue trailing along behind Paul and me, and then reverse the procedure when they returned this way about a week later.

After a visit to Izapa where Jack could inspect the magnetic turtle to his own satisfaction, we made a circuit of the highlands of Chiapas so I could show our companions the Indian market and Na Balom museum in San Cristóbal, the spectacular gorge of the Grijalva River at El Sumidero, and the ancient interior site of Chiapa del Corzo. Our primary goal, however, was the Pacific lowland town of Tonalá, near the entrance to the Tehuantepec Gap. In Tonalá, I had previously visited the little town museum on a couple of occasions and been impressed by the crudeness of the sculptures it contained. Like the "Fat Boys" of Guatemala, the sculptures of Pacific Mexico were definitely among the oldest (if judged by their extreme primitiveness) anywhere in Mesoamerica. Increasingly, the antiquity of the art forms showing up on the Pacific coast

of Mexico and Guatemala argued for this region having been a cultural hearth not only of the calendar but also of sculpture as well. However, for some years I had known about a ceremonial center located on a mountaintop above Tonalá that I wanted to see. I had attempted to reach it in 1977 but had failed to do so because I lacked a guide who could show me the way. Now, I wanted to try again, and local inquiry soon directed us to Oscar, who was reputed to be the best guide available.

Oscar was a wiry fellow who, despite a glossy-black head of hair, claimed to be 75 years old. He introduced us to his son Lorenzo, a handsome, bright-eyed lad hardly 14 years of age, who fetched a sombrero for his father and also a gourd filled with drinking water. Oscar had at first suggested that we go with him mañana, but, like the insistent gringos we were, we said we had to go today. We weren't smart enough to realize that what Oscar was trying to tell us was that 9:30 in the morning was too late to start, because the sun was already high in the sky and the climb would be difficult. Already in the first five hundred meters, Anne decided she couldn't make it, and Nick decided he'd stay behind and look after her. Poor Jack had no alternative but to continue, since he wanted "to look over our shoulders". After a couple of hours in the blistering heat, we reached a little rancho on the side of the mountain where another of Oscar's sons lived, this one about 30 years of age. After resting awhile in the shade of the veranda, Oscar saddled up two horses, taking one himself, and offering the other to one of us. There wasn't any contest as to who needed it most, so Paul and I continued to walk as Jack plodded along on the second mount.

In what must have been another hour and a half, we neared the summit, and the outlines of the abandoned ceremonial center began to appear in the scrub. Mounds of

debris revealed the redoubts of what had obviously been a fortified site. Soon we were passing through the narrow gate of the city, and ahead of us were the foundations of a massive temple or palace, the likes of which I had seen nowhere else in Mesoamerica. The front of the temple or palace I later learned was some 200 meters in length, but what intrigued me just as much as its colossal size was the manner in which it was constructed. It was fashioned of polished granite slabs, each over two meters long and more than a meter in width and fully 20 centimeters (8 inches) in thickness. I could scarcely imagine who would have climbed more than three and a half hours to the top of a mountain to build a fortified city of polished granite; certainly the style of construction was unlike anything that I had seen, except possibly in the Andes. Yet, interspersed among the polished granite structures were some of the most primitive sculptures I had ever seen -- among them a turtle. Oscar called the site Iglesia Vieja, or "old church", clearly a misnomer if I had ever heard one, but it was a truly intriguing place because of its mix of seemingly advanced construction techniques and extremely elementary artwork. The only thing that made any sense to me at all as a geographer was its strategic location,



Figure 38. The archaeological site on the mountain above the town of Tonalá, identified by our guide, Oscar, to the right in the photo above, as “Iglesia Vieja”, or “The Ancient Church”, was clearly a fortified bastion constructed of polished granite, some of whose blocks were twenty feet long, two feet in width, and some 8 inches in thickness. The only comparable workmanship I have personally observed in my research in the Americas was in the Andes of South America, both among the Tiahuanacoans of Bolivia and the Incas of Peru.

because it clearly commanded the approaches to Soconusco from the Tehuantepec Gap and the north. Whoever its builders had been, they must have been someone who feared attack from the north.

Regretfully, every one that goes up to Iglesia Vieja must also come down, and if the return trip was any shorter -- in point of time-- than was the ascent, it was only because Paul and I knew that awaiting us was an air-conditioned motel room, cool showers, and all the ice-cold Bohemia beer we could drink. Without creature comforts such as these to look forward to, I still can't imagine how the "Olmecs" -- or whomever it

was who built the place -- survived even a visit to Iglesia Vieja. All I know was there were three pretty hot and tired gringos that limped back to Tonalá that evening.

The next morning, Jack reported that he had had enough "looking over our shoulders" and he and his party headed back to Guatemala. Eventful as our trip together had been, this was not the stuff of which Sports Illustrated articles are made. On the other hand, it was already clear that the findings Paul and I had made would generate at least a couple more articles on the Tikal astronomical matrix and the magnetism of the "Fat Boys". But, as we headed into the mountains toward Oaxaca, I sketched out for Paul why the next couple of sites we would visit might still torpedo my basic hypothesis.

So far, the August 13th alignments had shown up on the Mexican plateau at Teotihuacán (and at a host of younger sites patterned after it), as well as on the far northern frontier of Mesoamerica at Chicomostoc. In the Yucatán it was at Edzná where I had first picked up the trail again, and, as we have seen, the Maya had faithfully incorporated the August 13th orientation into their major edifices from Chichén Itzá to Tikal. Geographically speaking, however, it was the middle of Mexico that was missing in this pattern, for I had never found any August 13th alignments at Monte Albán, for example, the major ceremonial center of the Zapotecs. In an area central to the diffusion of the sacred calendar, it seemed only natural to expect such alignments -- and at a very early date, besides. Without finding such supporting evidence, however, I would literally be left with "a hole in the doughnut", and much of my fundamental argument would be vitiated.

Monte Albán is one of the most impressive archaeological sites of Mesoamerica, situated on a mountain top 500 meters (1600 feet) above the modern city of Oaxaca.

Dating back to at least 600 B.C., it served as the capital of the Zapotec civilization until about the 8th or 9th centuries A.D. when the Mixtecs, a neighboring people to the north, gradually moved in and conquered the region. Because the earliest forms of calendrical hieroglyphs in Mesoamerica have been discovered here -- inscriptions that pre-date the development of the Long Count, the Mexican archaeologist Alfonso Caso believed the calendars themselves must have originated here as well.

On virtually every trip I had made to Mexico, I had always included a visit to Monte Albán, but I had always come away from the site "empty handed" with respect to evidence for astronomical alignments. To be sure, Building J, the arrow-shaped structure near the south end of the great plaza, has been identified as an astronomical observatory -- but chiefly on the basis of the fact that it is the only structure on the entire mountain-top that does not accord to the strict, essentially north-south, alignment of the other buildings. Otherwise, the most that can be said for it is that its front steps face an azimuth of 45 °, which is obviously too far north to have served as either a solar or lunar position. This leaves us with the rather uncomfortable prospect of linking its orientation to some bright star with a comparable declination. The star that has been suggested by archaeo-astronomer Anthony Aveni as the most likely 'candidate' is Capella, or Alpha Aurigae, the fifth brightest star in the heavens, which has a present declination just shy of 46°. However, as recently as the year 0 A.D., Capella had a declination of only 40.7 degrees, due to precession, and around 600 B.C. (when Monte Albán originally came into being) it stood at a hair over 38 °. Thus, faced with the fact that at the time the site was in use, Capella was from 5-7° out of line with the axis of Building J, I was forced to conclude that either the Zapotecs were "sloppy" or that Aveni was.

I have always been extremely reluctant to resort to stars as explanations for alignments, and on this occasion I was no more eager to embrace such an argument than I had been previously. But, after replicating a number of measurements and finding nothing, Paul and I took shelter from the blistering sun by retreating into the small air-conditioned snack bar that the Mexican authorities have thoughtfully provided for visitors near the far northeastern corner of the site. As on my earlier visits, Monte Albán seemed destined to remain an unsolved headache -- perhaps, I suggested to Paul, because the entire mountaintop had undergone a major urban renewal about 200 B.C. and evidence of the original alignments had been destroyed. Certainly, it was quite apparent that such reconstruction had taken place in Building J (the "observatory"), for unlike the other structures on the mountain top, it contained massive irregular blocks of stone, many of them bearing inscriptions, which had simply been up-ended and stuck into the wall wherever they would fit. In other words, the Zapotecs had reused portions of older buildings to erect Building J, so whatever their original orientations may have been, we would probably never know.

On such a pessimistic note, Paul and I finished our drinks and headed back to our pick-up. It was then, for the first time, that I happened to pay serious attention to Building Y, which lay just below the parking lot on a slightly lower ridge of the hill. Following our discussion of urban renewal and reused building materials, I suddenly realized that Building Y was composed of the same kind of massive, irregular blocks that had been incorporated into Building J, only in this instance they seem not to have been disturbed by any remodeling process. Lying just outside the main plaza precinct, Building Y and its nearest structures appeared to have escaped any face-lifting and might for that reason

have retained their original orientations. At any rate, from where we stood in the parking lot, it was quite apparent that the buildings below us had an entirely different alignment than those just behind us on the plaza, and for that reason alone they deserved our attention.

As we came up to the doorway of Building Y and looked out at the horizon it surveyed, we were surprised to discover that, despite being on a slightly lower ridge of the hill, it had a full view of the mountains to the northwest. Out came the surveyor's compasses as Paul and I both took our measurements along the face of the building and through its doorway. A nod and a smile was enough to confirm that the azimuth of 285° had again been identified, only this time in a structure and at a site that dated at least as far back as 600 B.C. The "hole in the doughnut" had suddenly grown a lot smaller. Moreover, the absence of the Long Count among the calendrical inscriptions of Monte Albán now made more sense as well. This is because, if the sacred almanac had been in use there as early as 600 B.C. -- as our alignments from Building Y suggested -- and the Long Count did not come into being until 236 B.C., as my computer reconstruction had indicated, then the version of the calendar adopted at Monte Albán naturally lacked this later refinement.

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Before leaving the Oaxaca region, there remained one last site I felt obliged to visit. It was a place called Huamelulpan, a former capital of the Mixtec peoples, which lay some 160 kilometers (100 miles) to the north and west of Monte Albán. There, in the little village museum, was a cigar-shaped sculpture that, according to an American art historian, was the ancestral prototype of Olmec art, and for that reason he had espoused a

theory tracing the origins of this early people and their artistic style to the Mixteca Alta region of western Oaxaca.

As luck would have it, the day that Paul and I arrived in the village to examine the sculpture, the custodian of the museum had taken the day off and gone to Oaxaca, taking the only key to the building with him. After our long journey over horrendous mountain roads, we were naturally disappointed at not being able to see what we had come for, and in this case we had no intention of returning mañana. We prolonged our stay by cooking up a little lunch in the plaza, hoping the custodian might return before we were finished, but when he did not, I asked a local boy if there were any pyramids nearby. He pointed around the hill behind us, so Paul and I collected our gear and hiked up to see what we could find.

What we discovered was a couple low mounds of earth and rubble on the side of the hill, the tops of which had literally been plowed into the ground by Indians trying to cultivate their upper slopes. In the thicket of brambles at their base, however, were some huge foundation stones a couple of meters in length and about a meter in thickness, still fitted neatly together. As we came up to them, we saw that they bore beautifully sharp calendrical carvings, similar to those at Monte Albán in that they were of the early form,



Figure 39. Apart from being broken, this carving on the side of a hill in Huamelulpan, the ancient capital of the Mixtecs, looked as though it was almost in 'mint condition'. However, it predates the creation of the Long Count, so this suggests that the Mixtecs must have adopted the calendar possibly as late as about 300 BCE.

pre-dating the Long Count. Because the archaeologists had dated Huamelulpan to 300 B.C., here we had another clue to the fact that the calendar had reached the Mixtecs fairly late -- and one more bit of evidence that the 236 B.C. date I had calculated for the origin of the Long Count was still solidly intact. Crouching along the foundation walls of the main pyramid, I took my compass-sight, corrected it for magnetic declination, and turning to Paul I said, "Here we go again!" A moment later he confirmed my reading. The "hole in the doughnut" had all but disappeared, for the Mixtecs had oriented their major pyramid to the August 13th sunset as well. A coherent spatial-temporal reconstruction of the origin and diffusion of the sacred calendar was now possible. At long last, the final

pieces of the puzzle were in place and the entire story could be told. Then and there Paul agreed to accompany me to a scheduled conference of archaeo-astronomers the following summer to report our results.

Chapter 10 – Looking to the Pacific – and Beyond

The campus of St. John's College in Santa Fe, New Mexico was the site of the June, 1979 symposium titled Archaeoastronomy in the Americas. Some months prior to my research in Sweden, I had submitted a paper to the conveners of the symposium presenting my thesis identifying Edzná as an early center of astronomical study amongst the Maya and it had been accepted for presentation. However, late in the spring of that year, when I realized that the editors of Science had been dissuaded from publishing my article on the astronomical matrix of Tikal, I got on the phone to Santa Fe and requested that I be allowed to substitute a more comprehensive paper on the diffusion of the sacred calendar to the forthcoming symposium, and my petition had been granted. Thus, when Paul and I arrived in Santa Fe, the paper that I was to present constituted a summary of six years of my research in Mesoamerica.

Titled "Architecture, Astronomy, and Calendrics in Pre-Columbian Mesoamerica", my paper began by pointing out that religion, astronomy, and architecture were so intertwined in Mesoamerican civilization that it was hardly surprising that many of the region's monumental structures commemorated such events as the equinoxes, solstices, and zenithal passages of the sun. However, one alignment that had been frequently encountered on the Mexican plateau (and elsewhere, as I proceeded to show) but inadequately explained was that oriented to an azimuth of 285° , or 15° north of west.

I then went on to discuss at some length the orientation of Teotihuacán, how the existing hypotheses for its alignment were untenable, and how the August 13 sunset was the only explanation which accorded with the evidence – a conclusion, by the way, which was to be seconded by two researchers from MIT in an article in the Journal for the History of Astronomy a year later. However, when the proponent of the primary existing

hypothesis was a professional astronomer, one of the foremost advocates of the interdisciplinary study of archaeo-astronomy, one of the conveners of the symposium, and was sitting in the audience at the time, this was not quite as simple as it may sound. This is because Dr. Tony Aveni of Colgate University has acquired something of the "Great White Father" image among archaeo-astronomers, just as Sir John Eric Sydney Thompson had among Mayan archaeologists. In any case, after pointing out the internal inconsistencies in his argument, I went on to present evidence for the existence of the 285° alignment throughout the Mayan realm and in the intervening Oaxaca and Gulf coast regions. Here I devoted several minutes to outlining the astronomical matrix at Tikal, presenting detailed maps – some of them prepared by Aveni himself – to illustrate the interrelationships between the various pyramids. In connection with Monte Albán, I touched only lightly on the Capella hypothesis put forward by Aveni and stressed instead the orientations of Building Y and the pyramid at Huamelulpan. At this point I also interjected a finding which my map research on the "Olmec" site at La Venta had produced, namely, that while the principal axis of the ceremonial center is oriented 8° west of north, an assemblage of structures known as the Stirling Acropolis and the Stirling Plaza all demonstrate alignments which are 15° off the cardinal points -- in other words, just as at Teotihuacán and all the other 285° sites.

I then proceeded to explain the meaning of the 285° orientation, pointing out that it represented the sunset position on the 13th of August and that the "formula" for finding it was simply to count 52 days from the summer solstice. I next cited the coincidence of this date with the "beginning of time" as defined by the Goodman-Martínez-Thompson correlation, and briefly discussed the different theories put forward to explain the 260-day sacred calendar. In this connection, I reiterated my arguments for why Izapa and not

Copán had to have been the birthplace of the ritual almanac, and I concluded with a cartographic reconstruction of how the sacred calendar had diffused throughout the Mesoamerican region.

Beginning from Izapa in the 14th century B.C., I showed it moving west and northward through the lowland Tehuantepec Gap from the Pacific coast region of Soconusco into the "Olmec metropolitan area" in the rainforests along the Gulf Coast. Although Coe thinks the calendar may have been present in San Lorenzo in 1200 B.C., he cites no tangible evidence, so I was obliged to pass over this site without comment, noting only that its geographic location would make the calendar's early introduction there extremely likely. However, I argued for its presence in La Venta by 1000 B.C., based on building orientations taken from the field notes of Stirling.

By 600 B.C. my map showed the sacred calendar having reached the Zapotecs at Monte Albán in the Oaxaca highlands, and 300 years later it had been adopted amongst the Mixtecs at Huamelulpan. Any progress it may have had in moving eastward among the Maya is not revealed until just before the birth of Christ when it shows up at Edzná. By the same time it has also been adopted at Teotihuacán and thereafter it remained firmly entrenched amongst the cultures of the eastern Mexican plateau. (The Tarascan people of the western plateau represent a very special situation, having apparently learned about the calendar only in Aztec times.) On the other hand, among the Maya the sacred calendar completed its conquest of Tikal by 300 A.D. and had spread through the remainder of the empire (including Copán) by the middle of the Classic period.

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To an historical geographer, the spatial-temporal pattern revealed by my final map was a perfect textbook example of the diffusion of a cultural innovation, in this

instance, the 260-day sacred calendar. To the assembled astronomers, archaeologists, and archaeo-astronomers, one can only guess what the map said – if anything. In any case, I don't really know what kind of a reaction I expected from my audience – either that audience present at the symposium, or the eventually greater audience of readers of the article published in the proceedings of the symposium. Naturally, one does not expect to be welcomed with open arms into the fraternity of archaeo-astronomers, any more than of archaeologists, especially when one takes issue with the one of the father figures of the discipline. Perhaps one straw in the wind was already discernible in the preface of the Proceedings where the editor chose to use Aveni's description of the so-called "17° family of alignments" rather than my more carefully defined 285° orientation. In any event, as far as I was concerned I had answered the question I had set for myself six years earlier -- at least to my own satisfaction – and if it took the archaeologists or the archaeo-astronomers another thirty years to get around to accepting it, I was not about to hold my breath.

As Paul and I left Santa Fe, first for a field excursion into the American Southwest to view a few of the pale reflections of Mesoamerica which are to be found among the native cultures there, and then back home, the sacred calendar was a closed book for me. To be sure, in my quest for its origin and paths of diffusion I had stumbled onto all sorts of other questions that still remained either unanswered or unreported. A case in point was Edzná, the paper that I had withdrawn in favor of our most recent findings. Then there was the matter of magnetism – the turtle's head at Izapa and the "Fat Boys" at La Democracia. (Ironically, a scholarly article on the latter had been inadvertently pre-empted by a news report on the science page of Time magazine on September 3, 1979. It turned out that the news director at Dartmouth College, in a casual exchange one morning on the local shuttle bus, asked about what I had found on my most

recent research trip to Mexico. When I told him about the "Fat Boys", he asked for more information and wrote up a little news-release which the science editor of Time grabbed off the wire. A telephone interview followed, a series of photos including a shot of Paul checking out the navel of one of the "Fat Boys" was dispatched, and the item was published. Although it attracted worldwide attention – even being followed up by an article in a German art magazine – it was no longer news as far as a scholarly article was concerned.) Yet, back to the calendar's origins and the related issues of astronomy, hieroglyphics, and mathematics, as well as of magnetism, there still lay the most haunting question of all: were these cultural innovations the products of the local people in Soconusco, or was Izapa the Mesoamerican bridge-head of some culture that had reached it from across the sea? The latter was the most intriguing, and – as I had already discovered from discussions with Native Americans in Santa Fe – the most “touchy” question in the entire equation. Without having meant to imply anything of the kind, the suggestion that the calendar and the knowledge of magnetism might have come from outside of the Americas was viewed as an argument that the Native Americans were incapable of making such discoveries on their own. Heaven only knows, I didn't want the Native Americans on my neck any more than I wanted the archaeologists or archaeo-astronomers after me!

At first glance, at least, it seemed that the one point on which both the Native Americans and most archaeologists could agree was that no trans-Pacific origins should be sought for the civilization of Mesoamerica. Rather than having been the product of some long-distance diffusion from another continent, it was, instead, an independent invention of the local Native Americans in Soconusco. Of course, most archaeologists would not be quite that restrictive, because we already knew that there were contacts with

South America by as early as 1500 B.C.; presumably, as long as the antecedents of Mesoamerican civilization stemmed from within the Western Hemisphere, they would not find such a scenario impossible to live with. Where the danger lay was in suggesting a contact with Asia, as Meggers and Evans had done, or even with the much nearer islands of Polynesia, small as they are.

The latter scenario, although involving distances less than half as great as those from Asia, was enough to give most archaeologists pause in it of itself. One of the greatest single mysteries of the Polynesian occupancy of the Pacific is that on virtually every island they settled they grew a root crop that they called kumara. To us, this crop is known as the sweet potato, and its botanical hearth has been identified as northern South America, where its local name was – of all things – kumara. Although all sorts of natural and/or supernatural agencies have been credited with its spread through the Polynesian islands, including drifting with ocean currents, seeds carried by migratory birds, etc., the fact remains that only human intervention could have been responsible for its introduction – especially because it is highly unlikely that the tubers which had been washed up on the beach or the seeds which had been carried by the birds bore little name tags identifying it as kumara. The inescapable fact of the matter is that either Native Americans from South America had to have transported it to Polynesia, perhaps on an involuntary, one-way voyage, or that Polynesians had reached South America and brought the sweet potato back to their islands, on what was quite probably a conscious, two-way voyage.

Of course, the Norwegian anthropologist Thor Heyerdahl had, as early as 1947, risked his life and that of his companions in a bold effort to demonstrate that South American contact with Polynesia was quite possible using the water-craft of the times. In fact, he had gone on to develop an entire hypothesis of American Indian settlement of

Polynesia, and in the process had fallen more and more into disrepute with his professional colleagues.

In the months following the Santa Fe symposium, I increasingly realized that my own research had come to something of a water-shed; if I believed that the sacred calendar and all the other intellectual innovations associated with it, together with the possible knowledge of magnetism, had been the products of the early people of Soconusco, then I must recognize Izapa, not only as the birthplace of the calendar, but also of most of the truly outstanding accomplishments of Mesoamerican civilization. Inevitably this made Izapa one of the great cultural hearths of the world, for few other places on our planet have been the wellspring for such a variety of intellectual achievements. Moreover, it made Izapa absolutely unique on our planet as the only center of cultural innovation to have sprung out of a tropical rain-forest environment! And, even if I happened to subscribe to this particular scenario of cultural evolution, I still had no clear idea of who the Izapans really were. Was it they who subsequently came to be misnamed as the "Olmecs," the "Mother Culture" of Mesoamerica?

Of course, the other alternative was to argue that the Izapans, or the "Olmecs," or whoever they were, were not the intellectual geniuses which such a scenario implies; that they were, in fact, nothing more than the heirs of a high civilization which had already been developed somewhere else and had been transplanted to Soconusco by sea. Of course, for such a scenario to make sense, we first must find a civilization that was already in existence by 1500 B.C., and that was capable of successfully navigating the Pacific by that date. There were very few possible candidates that met the first condition, and, most archaeologists would argue, almost none at all that met the second.

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The next time I returned to Mexico was in the winter term of 1981 when I again was responsible for leading Dartmouth's Geography Foreign Study Program there. Our newly revamped curriculum had been designed to provide advanced field training in both physical and cultural geography, as well as to provide each of the students with an opportunity to do an independent research project of their own design. Moreover, I had relocated the program to the west of Mexico, where our time could be divided between one base station at Colima in the lowlands and another at Uruapan in the highlands. My choice of western Mexico was a pre-meditated one, because it was the one major region of the country about which I knew the least from first-hand study, and also the one most likely to have been impacted by any trans-Pacific contacts. Thus, while my students were engaged in their independent research projects, I too, could at least make an initial reconnaissance of the region with my own ulterior motives in mind.

Thanks to the superb regional museum newly opened in the Casa de la Cultura in the city of Colima, I soon came to appreciate the very special role that the western region of Mexico played in the country's prehistory. Its peoples and cultures owed almost nothing to the high civilizations of the Mexican plateau, but they had their closest affinities with the cultures of northern South America instead. Perhaps the most dramatic example of this linkage was to be found in the strange shaft-tombs that occurred only in the western corner of Mexico, but were also common in Ecuador and Colombia.

When we later transferred our operations to the highlands of Michoacán, we found ourselves in the very heart of the Tarascan cultural realm. This enigmatic people spoke a language totally unrelated to any other in Mexico, and while they are an agricultural society today, they were known chiefly as hunters and fishermen as late as Aztec times. Interestingly, in their native tongue they called themselves purépecha,

meaning "visitors" or "late arrivals," but who they were or where they had come from no one really knew.

In the research term that followed, I had planned to make my first sortie into Polynesia with a visit to the Marquesas Islands, but, at the last minute, my plans fell through. Several months of background study had suggested to me that the Marquesas would be a key area to examine, for a variety of reasons. Geographically, despite being in the southern hemisphere, they lie a thousand miles closer to the coast of Mexico than they do to the coast of South America. If the latter region had been reached by Polynesian navigators – as the dissemination of the sweet potato strongly suggested – then it was even more probable that they had also reached Mexico. Despite being the easternmost archipelago in the Pacific, the Marquesas were apparently the first island group to be settled by voyagers coming from the Polynesian homeland in Samoa; indeed, linguistic studies suggested that it was from the Marquesas that the settlers came who later had peopled Easter Island, Tahiti, Hawaii, and New Zealand. There were, however, some serious problems of timing involved, for archaeological evidence suggested that the Marquesas had not been reached by the Polynesians before about 100 A.D. – and this, despite their having already been in Samoa sometime before 1500 B.C. Could or would the Polynesians have been sitting on their duffs for 1600 years without pushing farther eastward? Or was this simply another example of missing or faulty data in the chronological record? In any case, the Marquesas were also known for their tiki statues, photographs of which showed them to be strikingly similar to the "Fat Boys", for they were inevitably portrayed standing with their hands on their bellies. At the time of the French missionaries' arrival, they had found ramped and tiered pyramids fashioned from basaltic cobbles, the etchings of which looked like those in Izapa. And, the same

missionaries had reported a strange calendar in use on the islands, which they thought consisted of about ten lunar months, or 270 days. Naturally, all of these were suggestive-enough clues to whet my appetite, so when I had to scrap my plans for visiting the islands in the spring of 1981 I was sorely disappointed. The best I could do as a "consolation prize" was to check out some remote sites in the northern desert of Mexico, examine some seaside petroglyphs at Dimas north of Mazatlán, deliver a paper at the annual meetings of the professional geographers in Los Angeles (to fill in my colleagues as to what I had been doing for the past half-dozen years), and visit several of the major Mound Builder complexes in the Mississippi and Ohio river valleys on my way back to Hanover.

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As my research continued on the possible sources of contact with western Mexico, my attention was increasingly drawn back to South America. In the southern interior of Colombia was the strange San Agustín culture which archaeologists dated to 500 B.C. and which they compared artistically to the "Olmecs." Along the coast of Peru, the Cerro Sechín site had been dated to 2300 B.C. and its artistic motifs had also been likened to the "Olmecs" – especially to the carvings found at Monte Albán. Then there were the links suggested by Heyerdahl between the Andes and Easter Island. The more I delved into the literature, the more it seemed that my next foray into the field must combine both South America and Polynesia. And, as my plans began to take shape, it also became quite clear that my next field assistant would be a Panamanian student who, in his three years at Dartmouth, had come as close to becoming my protégé as any other I have ever worked with.

Juan Carlos had elected my freshman seminar on "The Origins of Civilization in the New World" the first term he was in residence, for as he explained, "being a citizen of the New World, he was curious about how it all began." He was quick to realize, however, that the "geography" he was being taught was not a body of detached facts to be memorized, but rather a systematic way of analyzing concepts and applying principles which could be employed in the "here and now" as well as in an historical context, and by his sophomore year he was already committed to becoming a Geography major. He had accompanied me to Mexico on the 1981 Foreign Study Program and become an acute observer of both the physical and cultural landscape. As his independent research project, he had done a very solid paper on the geographic factors affecting the development of Manzanillo, Mexico's most important Pacific seaport. When I hinted that if I were to make a trip into Polynesia I would need someone whose skills in French were better than my own, he immediately enrolled in an intensive French language course, including a term abroad in France. And, having Spanish as his native language, it goes without saying that he would make the best possible interpreter for the South American portion of the trip as well. Thus, as my plans began to shape up for this combined assault on western South America and eastern Polynesia there was no question at all but that Juan Carlos would be my field assistant. He would fly in from France and we'd meet in New York in the middle of March, and immediately head south – first stopping off in Washington where I had been invited to speak to the prestigious Cosmos Club about my Mesoamerican research, and then to Miami where the same presentation would be made before the Explorers' Club and the Institute of Maya Studies. With these obligations out of the way, we'd go on to Panamá for a few days of relaxation and then the expedition would begin.

Chapter 11 – San Agustín and Valdivia

Our early-evening departure from Miami International Airport brought us over Cuba just as the lights of Havana were beginning to come on, and, about half an hour later, we had reached our cruising elevation of 30,000 feet. The only other time I had been in Panamá was three years earlier when Bruce and I had stopped over briefly on our way to Ecuador. Juan said that in the interim a new airport had been constructed and that we would have a panoramic night-view of both the city and the canal as we made our final approach. That was still sometime away, however, so, seeing an old high-school friend across the aisle, Juan had gone over to visit with him.

At 30,000 feet over a darkened Caribbean there wasn't much to see except for the occasional flashes of lightning in a distant thunderstorm. All of a sudden, there was a loud "pop" and a rush of cold air through the cabin, and a moment later all of the oxygen masks tumbled out of the overhead compartments. One stewardess got to the inter-com and told everyone to extinguish their cigarettes and put on the masks, while a couple of other stewardesses started helping passengers slip the elastic bands over their heads. Babies began to cry and the pilot put the plane into a steep dive to bring us down to an elevation where we could breathe more normally. As I looked over at Juan Carlos, he made a gesture that was something between crossing himself and slitting his throat; either way, it was apparent that he was as scared as I was. In any case, there was no panoramic view of either the city or the canal, and the first lights I saw anywhere in the blackness were the red warning lights on the hills beside the runway. The pilot had been given clearance to make an emergency landing and come straight on in.

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Although this had hardly been an auspicious beginning for our trip, the bottom line still came down to "All's well that ends well." In the days that followed, I was royally wined and dined by Juan's family in Panamá City, at their country house, and at Contadora. Juan and I also managed to explore an intriguing pre-Columbian site to the west of the capital, as well as the Spanish trans-isthmian route and the forts that guarded both its Caribbean and Pacific ends. During our stay in Panamá, however, it became increasingly "obvious" to Juan that we could not visit Colombia unless we made a special effort to visit an uncle and aunt of his in Cali, so we changed our reservations for Bogotá to this city instead. As luck would have it, the only connection which looked even feasible was with a one-airplane Panamanian carrier which Juan assured me was a "very safe airline." With the memory of our first flight still vividly in mind, it was only with some reluctance that I agreed, especially because our arrival in Cali was scheduled for the middle of the afternoon.

Taking off from Panamá City in the early afternoon, I was afforded the full panoramic view of the capital and the canal that I had been denied the other evening. Indeed, the waters of the Gulf of Panamá were so clear and so shallow that one could easily spot schools of black-winged manta rays cavorting in the depths as we flew over the Pearl Islands. So, too the Pacific coast of Colombia was sharply outlined in the afternoon sunshine as we flew in over it and approached the westernmost range of the Andes. As any school geography of South America informs you, in Colombia the Andes break into three parallel ranges, so to reach Cali, which lies in the upper valley of the Cauca River, we had to cross over the western cordillera. And, as I had fully expected, great cumulonimbus clouds towered everywhere over the mountains, as mid-afternoon thunderstorms rumbled along their eastern slopes and lightning flashed on every side.

Leaving the clear, still air in the lee of the mountains behind us, the pilot dove into the middle of a boiling black cloud, and a moment later we were being tossed around like a log in a whirlpool. There was obviously no way he could see where he was going, and with the updrafts and downdrafts bouncing us around for what seemed hundreds of feet at a time, I hoped he knew what he was doing. After all, if he misjudged a mountaintop, his little one-airplane airline would be out of business – and so would we! (Editor’s note: Sad to say, about a year later, on exactly this same route, the plane disappeared. When it was found, the accident report stated that it appeared to be flying upside down at the time it crashed. Obviously, the pilot had run into some especially violent ‘thunderheads’ a good distance out in front of the mountains. All those aboard had been killed.)

After what were the longest three minutes in my life, we finally broke through the clouds and I could see below us the wide loops of the Cauca River curving across the flat, green floor of its valley. Tucked up against the rainy mountainside we had just crossed was the forest of skyscrapers that formed the central business district of Cali, Colombia's third largest and most rapidly growing city. In a few minutes more we were on the ground, had cleared customs, and had been bundled into Juan's aunt and uncle's car for the drive to their sumptuous suburban home.

Although I had not been in Colombia before, I was well aware of the fact that the country had been wracked for more than a decade by all-out war between the two principal political parties. Called locally La Violencia, this little-publicized struggle had taken over 200,000 lives and in the southern interior of the country guerrillas of the radical "M-19" group continued to harass the local populace with kidnappings and murders. In addition to the political unrest, high inflation and economic stagnation had brought many people to the brink of total desperation and crime was rampant. And linked

no doubt to both the political turmoil and the soaring crime rate was the lucrative narcotics trade that was generating far more wealth in the country than any of its legal exports.

Just on the ride between the airport and Juan's uncle's home we came to sense some of the apprehension and fear that the Colombians live under every day of their lives. As we were driving down the avenue, the car suddenly began to sputter and cough and then stopped altogether. Juan's uncle immediately diagnosed the problem as being the gasoline, which he claimed was so poorly refined that, in his words, "it was half mud." While he left his wife and the two of us to walk to a garage, Juan's aunt immediately took off and put away all her jewelry, because immobile in a public street, she was a tempting target for robbery – even in full daylight. When the mechanic finally got us going again, we continued on to their home, but not before taking a detour through an adjoining neighborhood. There, one palatial home literally outdid the next, not only in size and opulence but also in terms of their security arrangements. High walls and police dogs were standard, even in Juan's uncle's home, but in this section of the city there were armed guards at the garage entrances, surveillance towers on the corners of the property, also with armed guards and searchlights, and electrified fences. This neighborhood, they told us, was where the drug Mafia had recently moved in, and nobody trusted anybody. Children were sent to school with personal bodyguards, and even the presence of Juan's uncle's car was enough to put a carload of goons on our tail to see what we were doing in the area. Yet, despite all such precautions, where so much money is involved, allegiances are fickle. Only a couple of weeks earlier, in what rumor described as an "inside job," one of the Mafia dons had been machine-gunned in bed, after five of his bodyguards had been executed first.

Pleasant as Juan's relatives were, and gracious as was their hospitality, we spent only a couple of days in Cali before continuing on to San Agustín. Although we could have flown to an airport half a day's bus ride from our destination, I talked Juan into taking a bus the entire way, both so we could see some of the Colombian countryside en route and so we could avoid those hair-raising trans-Andean flights. As a result, we had a long detour northward along the Cauca valley, then over the central mountain range into the Magdalena valley, and southward again to the town of Neiva. What the journey lacked in speed and comfort, it more than made up for in scenery. On the other hand, if I had imagined that such a trip was necessarily any safer, I had another "thing" coming. Crawling up over 20,000-foot mountains on rain-drenched, one-lane gravel roads with 8,000-foot drop-offs, first on one side, then on the other, didn't make for any less anxiety, but it certainly prolonged it.

That evening we stopped in a fairly comfortable hacienda-like hotel on the edge of Neiva, and likewise had a very good dinner in the terrace dining room. The only sobering note of the evening was the waiter's admonition not to leave the hotel grounds, because a local landlord had just been kidnapped and killed and army patrols were all over the countryside.

Early the next morning we hopped a local bus to take us to San Agustín, which lay near the very headwaters of the Magdalena River. We arrived without incident about noon, stowed our gear in a motel near the site, and immediately climbed up into the little side valley where the strange collection of sculptures, locally known as "idols", had been discovered.

Dotted over the thickly forested mountainside were scores of statues, the one more grotesque than the other. Although most of them appeared to be "humanoid", there were

also representations of jungle birds and monkeys. The "people" depicted were either warriors carrying clubs or men holding gourds from which they appeared to be imbibing through straws or tubes, strongly reminiscent of the continuing use of bombillas for drinking mate throughout southern South America. However, since San Agustín is so far removed from where mate is grown, most archaeologists believe that what is represented is the use of coca tea, instead. In any case, one is tempted to wonder whether the hideous carvings depicted how the people felt after imbibing or if these are the images they hallucinated about while imbibing. Certainly, anyone familiar with "Olmec" art would immediately discount any but the most tangential influences on San Agustín. Perhaps the latter had been fashioned with a more "sophisticated" and "finished" carving technique, but, with at least one exception, they were infinitely less "realistic" and diverse in what they attempted to portray. (San Agustín artists did not hesitate to depict the male genitals, that is something "Olmec" artists very seldom did!) I must confess that I found nothing in San Agustín art that truly excited my interest or evoked any particular aesthetic reaction. For me the difference between what the "Olmecs" had created and what this culture had produced was the difference between art and caricature. When Juan and I completed making our measurements and taking our photographs, we left the "Height of the Idols" with a feeling of having endured a bad dream.

That night in the motel we put together the "pieces" of San Agustín as best we could. Now, having visited the site, I understood why it lay in this remote interior region of Colombia – a fact that never emerges in the archaeological literature on the subject. Thanks to its geographic location, San Agustín occupied something of a transport node in pre-Columbian times, with valleys breaking across the narrow backbone of the Andes, both to the Amazon in the east and to the Pacific on the west. Moreover, the Magdalena

valley led straight down to the Caribbean coast on the north and other transverse valleys opened southward along the Andes. Of the corridors likely to have been used for trade in earlier days, certainly that between the Amazon and the Pacific appears to have been the most important, and perhaps for much the same reason as at Chavín de Huantar in Peru. Indeed, if San Agustín had any special advantage in this regard, it was that it had provided a "short cut" to the source of coca supply for anyone coming from Mesoamerica.

Otherwise, Juan and I found no evidence of either astronomical alignments or calendrical knowledge. Despite having lived nearly two millennia after the "Olmecs" of Soconusco, the people of the San Agustín culture were scarcely more intellectually advanced than their hunting and gathering neighbors a few score kilometers to the east. Indeed, as we assessed the geography of this culture in greater depth, it was apparent that the people of San Agustín neither had a need for a calendar nor did they have much reason or opportunity for studying the heavens. Here, in the upper headwaters of the Magdalena, it rained almost every day of the year, and the vegetation and soils were almost constantly dripping with moisture. By the same token, the warm air continually billowing up out of the Amazon basin made a clear sky a highly infrequent "luxury", thereby precluding any more than a passing interest in things celestial.

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The next morning at 6 we were back on a local bus headed up over the mountains to Popayán. Up as early as we were, the army was up even earlier, and about 20 kilometers down the valley we were stopped by a detachment of soldiers armed with automatic rifles. All male passengers were herded off the bus and forced to spread-eagle against the vehicle as we were searched for weapons. Although they quickly concluded that Juan and I were carrying no arms, one soldier pointed to Juan's boots, a second

nodded, and Juan was led away to a little house in the woods to be interrogated. As luck would have it, Juan had bought some army surplus boots in Boston especially for our trip, but the military nature of his footwear suddenly made him suspect to the Colombian army – either of being an army deserter or a guerrilla who was wearing stolen army boots. Juan later told me that he had been forced to strip – ostensibly to see whether he had any scars from bullet wounds. It seems the captain doing the interrogating was not necessarily convinced that his Panamanian passport was valid, and they wanted to hold him for further questioning. When I learned this, I protested as vehemently as I could – in the face of their guns – saying that I was a North American professor and that Juan was my student-assistant and we had just come from visiting San Agustín. I told them it was ridiculous for them to think that just because he had military boots, he was a guerrilla, but as I started to explain about the army surplus store, I suddenly realized how improbable such a concept must be, anywhere but in the United States. Imagine, an army having so much equipment that it literally sold it off to the public at cut-rate stores! Who in the world would believe such a story? So I just shut-up and let them ponder what to think and do about his boots. Just to be "on the safe side", they eventually decided to let Juan go, but without his boots, so about 10 minutes later he came plodding down the rain-soaked road in his stocking feet, and our bus could finally continue on its way.

The half-hour delay that the army had occasioned us was only one of four that we encountered on our way to Popayán, the other three being the result of break downs of the bus. It seemed that the road was such a washboard that the electrical system was repeatedly being shorted out by all the bumping around. First one thing wouldn't function, then something else. As we finally limped into Popayán, it was down a fog-mantled mountainside, replete with its 8000-foot drop-offs, after dark, and without lights.

The next day was Palm Sunday and since our bus for the Ecuadorean border did not leave until early afternoon, Juan and I had a leisurely breakfast and then idled around the plaza to watch some of the religious pageantry. My most poignant memory of that morning was the man who obviously recognized me as a gringo and came out of the crowd to speak a few words of English with me. His one faltering sentence to me: "Colombia is a very sad country." I nodded, confident in the expectation that I would be leaving it in just a few hours.

Psychologically, it was as though a great burden had been removed from us as Juan and I crossed into Ecuador at the little border town of Tulcán. There was almost a *joie de vivre* in the air that you could feel amongst the people, compared to the oppressive and fearful atmosphere we had just left. Rampant entrepreneurial capitalism immediately enveloped us, as half a dozen youths, each representing a different "colectivo", or collective taxi, attempted to extol the advantages of his particular firm. Apart from an almost non-existent difference in prices, what we discovered, once we were on our way, was that the real competition existed in how fast they could traverse the mountain road between Tulcán and Quito. As we careened down the Pan American Highway, passing and being passed by one competitor after another, Juan and I were both reminded of the reputed motto of Flecha Roja, Mexico's most notorious bus line: "Better dead than late!"

This time Quito was just a way station on our way to Valdivia and Peru, so as soon as we could secure seats on the autoferro to Guayaquil, we did. This bus-chassis mounted on railway wheels provides the only through service on the spectacular railway linking Ecuador's two major cities and its forty seats are usually booked many days in advance. But, we were lucky to get seats for the following day, and at 6 in the morning we were once again on our way.

That the rainy season was still very much in force was apparent from the day we spent in Quito. Local newspapers told of three little boys having been washed away by torrents that swept down the steep ravines as downpours pelted the denuded mountainsides above the city. That morning as the autoferro climbed toward the pass at Urbina, ominous clouds clung to the peaks, both to our east and to our west. As I looked out at the racing mountain stream alongside the track, I could literally see the water rising in it, minute for minute, and I called it to Juan's attention. Soon it was as though the entire gorge was filled with rushing water, and still it was climbing higher. As we turned a curve, the narrow stream became a broad river, with water spilling everywhere in its headlong dash down the naked mountainside. Suddenly the carcass of a large bull went catapulting by and the driver of the autoferro slammed on his brakes. Ahead of us 500 meters of the rail-line was under water, with anywhere from a quarter to half a meter of water pouring over it in a constantly accelerating current. The question was: were there still any tracks under the water, or had they been washed away? Could he gun the autoferro through the torrent and reach the other side, or would it derail in all the sand and debris? If the track had been seriously weakened, the car might tip over, and even if we weren't washed away, that would be the end of the trip in any case.

No doubt this was not the first such incident the driver had encountered, so he just stopped the train and waited for the effects of the distant cloud burst to subside. After about fifteen minutes or so, the main violence of the torrent seemed spent and the waters gradually began to drop. When it became clear that the track still seemed to be intact, even though it was filled with sand and strewn with bushes, he decided to chance a crossing, and giving the car full power, he ground his way through the mud and slime to

the higher ground on the opposite side of the ravine, to the applause of his much-relieved passengers.

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In Guayaquil, Juan and I managed to rent a car and driver to take us out to Valdivia and back. Our route took us first directly west to Punta Salinas, across lowland that became progressively drier with every kilometer we drove. We watched the lush tropical rainforest of the Guayas valley change first to tall deciduous scrub, then shorter thorn forest, and by the time we arrived at Valdivia, we were virtually in a desert. Due to the combination of the Andes and their rain-shadow effect blocking most of the moisture blowing across the South American continent from the east, and the Peru Current – the intensely cold mass of Antarctic water that bathes the entire west coast of South America up to Punta Salinas, where it curves westward out into the Pacific – much of the west coast of the continent receives so little precipitation that it forms part of the Atacama Desert. The latter embraces the northern third of Chile, the entire coast of Peru, and finally tapers out in Ecuador within a few kilometers of Valdivia. Indeed, as one continues north along the coast from Valdivia, the landscape rapidly becomes green again, as the cold Peru Current veers out to sea and the warmer waters of the north Ecuadorean and Colombian coasts once more provide moisture for the occasional on-shore breezes.

Valdivia today is a dismal collection of poor fishermen's houses, and, with the exception of a few electric light poles, a handful of cars, and the corrugated iron roofs, it probably looks not too unlike what it did 5000 years ago when a hapless bunch of Japanese castaways supposedly made their landfall here. Certainly, in and of itself Valdivia could never have been the birthplace of ceramics manufacture in the New

World, and, had the Japanese not been so happy to finally get out of their boat(s) after nearly 12,000 kilometers (over 7000 miles) of drifting, it probably never would have been their conscious choice as a place to land either. The point is that its geography totally precludes the first scenario, and strongly argues for the second. The collection of pottery in the little local museum was relatively small but strikingly imaginative and beautiful in its rendition, and quite out of character with the otherwise austere nature of the place's setting. Excited as I was to see the splendid vessels on display, I was both surprised and dismayed to learn that the museum's custodian had a lively business going on the side -- selling the precious artifacts to foreign visitors!

Returning to Guayaquil that evening, Juan and I next made arrangements for the long bus trip through the coastal desert of Peru to Lima. The first two goals of our journey had been completed: San Agustín having demonstrated no demonstrable links with Mesoamerica, and Valdivia having made us consider the possibility of trans-Pacific connections all the more real. A yet more critical test of cultural affinities between Meso- and South America lay just ahead, for the only civilizations in the New World that were antecedent to that of the Olmecs were those of the coastal oases of Peru. If the calendar, and the astronomy, and the mathematics, and the hieroglyphics associated with it, did not have its origin in Soconusco, then the only place in the Americas where it conceivably could have come from was the area we were about to enter.

Chapter 12 – Forays into the Atacama and the Altiplano

The Atacama is without question one of the driest deserts in the world, and unlike those in the American Southwest or central Australia, it is almost totally lacking in vegetation. For more than 2800 kilometers (1800 miles), the west coast of South America is a landscape of shattered rock fragments and shifting sand dunes, broken only infrequently by a narrow ribbon of green along an exotic river valley. Were it not for these little oases, of which there are about 40 within Peru, there would be no means of sustaining life from the land at all. By contrast, the frigid waters of the Peru Current just offshore are teeming with plankton and other marine life, and it is on this that the myriads of sea-birds that nest along the rocky headlands and small offshore islands depend for their subsistence. So, too, did early man look to the sea for the livelihood that the land denied him. Thus, unlike their pre-Columbian neighbors, both to the north and to the south, whose environments presented them with other options for survival, the coastal dwellers of the Atacama have, of necessity, been fishermen and sea-farers since the beginning of time. This strong maritime attachment is clearly seen in their art, whether it be in their ceramics, weaving, or the stucco murals of their buildings.

But, the world provides us with no example of a higher civilization that has sprung solely from a maritime base. Only where one had the means of generating a surplus food supply and the means of collecting it in a central place could a truly urban life-style evolve, and this meant first developing a fairly intensive form of agriculture. In coastal Peru this was possible, of course, only in the small alluvial valleys where the presence of water coincided with fertile soil, and where the sub-tropical climate provided long-hours of brilliant sunshine and no risk of frost. Here, by the careful control and application of water, i.e. irrigation, heavy yields of crops such as corn, sweet potatoes,

peppers, squash, peanuts, and tomatoes provided the basis of a diversified diet that could support relatively high densities of population – a diet whose protein came in large part from the marine resources offshore and from guinea pigs, the sole domesticated animal the coastal Peruvians possessed.

After crossing into Peru the day before Easter, Juan and I continued south to the town of Chiclayo before making our first foray out into the Atacama. Chiclayo is a modern Peruvian counterpart of a pre-Columbian ceremonial center in the sense that it is situated in the midst of a compound alluvial fan, and hence can draw its sustenance from two or three exotic river valleys that flow together there. On the northern edge of its oasis lies the smaller town of Lambayeque, whose very name suggests affinities to Central America for some archaeologists. Hiring a car and driver in Chiclayo, we first visited the little regional museum in Lambayeque and then continued up the valley of the Rio de la Leche to the site of Batán Grande. Even a cursory examination of its ruins told us that, despite its strategic location for the control of irrigation-water, its position quite precluded any use of the solstitial orientation principle. The first ranges of the Andes, naked and barren, rose jaggedly just behind the site, but certainly there was no distinct peak that commanded one's attention. Indeed, the mountain-wall was so high and abrupt that there was no systematic way that anyone could have utilized the horizon to mark the rising positions of the sun or moon. Furthermore, if the western horizon had been visible – and that was dubious, because of the low coastal fog that lies almost continuously over the cold waters of the Peru Current, there would be no way to establish fixed points for sunset and moonset positions against the backdrop of the open ocean. Thus, on even our initial examination of a Peruvian coastal oasis, Juan and I realized that, just because this type of setting was repeated forty times over, there would be little or no likelihood of

identifying one of the principal kinds of clues that had proven so useful in Mesoamerica. By the same token, this was strong indirect evidence that the "principle of solstitial orientation" had evolved in the latter region, because it certainly seemed doubtful that it could have had any antecedents here.

As we drove back to Chiclayo through the verdant alluvial delta, another thought occurred to me that I bounced off of Juan. Since you really can't establish with any precision when the solstices take place here, I said, then you have little means of finding out how long the year is, or when the seasons will change. If the measurement of time becomes so imprecise, how could you ever develop a calendar, I asked? Of course, the obvious answer is that you don't, but if you don't, so what? Who needs a calendar here anyway? What changes, apart from the sun being a little higher in the sky or a little lower in the sky, a little farther north or a little farther south, distinguish one time of the year from another here in the Atacama? Is there a marked difference in temperature, so one can speak of "winter" or "summer"? In a coastal oasis only seven degrees from the Equator, the answer to that question was decidedly no. Or, is there a marked seasonal difference in precipitation, so we can speak of a rainy season versus a dry season, as in Mesoamerica? Again, the answer is no, because here in coastal Peru it almost never rains – ever. The proverbial Atacama climatic station receives an average of about one millimeter of rain annually (one twentieth of an inch), but this does not mean it rains one millimeter a year; it means only that it may rain 20 millimeters in one year and not rain again for 19 years. There is no time-keeping system on earth that can predict such irregular phenomena. In fact, it is only very recently that climatologists have begun to understand the mechanisms of the drastic oscillations in water temperature and precipitation that follow in the wake of El Niño, the warm-water current that spills

southward along the Peruvian coast on sporadic occasions. When these outbursts take place, the plankton are rapidly killed off, the schools of fish that feed on the plankton retreat southward or themselves die off, and the sea-birds that prey on the fish lose their sustenance as well, resulting in an ecological chain-reaction of disastrous proportions. (For example, the fish catch of Peru can drop from more than 10 million tons in an average year to less than one-third that figure in an El Niño year.) The way it affects global weather is still not totally clear, but in the one month of October 1967, for instance, it rained over 500 millimeters (20 inches) in northern Chile, which is as much precipitation as had fallen there since the Spanish arrived over 400 years ago!

However, with one's water supply assured by an exotic river, the only cyclic or seasonal element in the climate of coastal Peru is the flow of the river itself. If the seasonal changes in water levels were as drastic as those of the Tigris and Euphrates, or the Nile, then some kind of predictive scheme would be desirable. If not, the sheer uniformity – one might say, monotony – of the annual regimen would make a calendar as unnecessary here in the desert as it was in the rainforest at San Agustín.

If the physical geography of coastal Peru was inimical to both the principle of solstitial orientation and the seasonal rhythms that are the prerequisites of a calendar, we discovered from our visits to the local museums that the history of the region was a negative factor as well. The sites surrounding Chiclayo and Trujillo, our next stop to the south, had chiefly been constructed by the Moche culture, which reached its peak in the period 150-700 A.D. Thus, even if there had been any evidence of solstitial orientation and/or the use of a calendar, it would have been far too late to have served as the antecedents of those traits in Mesoamerica. Furthermore, if sea-borne contact existed between Soconusco and Peru as early as Coe's work suggests, then certainly the sacred

calendar and its cultural appurtenances had never won a foothold on the South American continent. Even if they had been introduced, one wonders what applicability they could have possibly had.

The oasis of Trujillo lies on the alluvial fan of the Rio Moche, and it was here that both the Moche civilization and the later Chimú Empire, which dates from about 900 A.D. until its conquest by the Incas in 1465, had their centers. The accounts of the legendary beginnings of the Chimú civilization I found of more than passing interest, because they told of a moon-worshipping race of giants who arrived from across the sea, without women of their own. The reference to the sea-invaders' stature certainly rules out the Japanese, but it does make the large-framed Polynesians prime suspects in this drama – an idea which at least one reputable archaeologist has dared to suggest. R. J. Suggs observes that the Marquesans spoke of a land to the east, Te Fiti, whose name meant "Land of Ridges," hardly an inappropriate description of Peru.

In the Trujillo oasis, Juan and I made our first field trip out to Chan Chan, the vast adobe capital of the Chimú. Its discovery in the early 1920's was one of the first triumphs of aerial archaeology, for it had for so long been covered with drifting sand that its outlines were all but indiscernible from the ground. Once it had been seen from the air, however, archaeologists immediately set about cleaning away five centuries of wind-blown dust, uncovering in the process the outlines of a huge city laid out according to a well-ordered plan. Ironically, the year following the city's disinterment, a freak rain-storm – no doubt caused by El Niño – deluged the area and literally dissolved many of the city's mud-brick walls as the archaeologists looked on in horror.

Naturally, I was curious as to whether the single-minded alignment of Chan Chan's walls, palaces, and temples might commemorate some date of astronomical

importance. What our measurements suggested was the possibility of a sunrise azimuth on the two days of the year when the sun passes vertically overhead, which here at 8° South latitude occurs on March 1 and October 14. However, in the absence of any other evidence of an interest in astronomy or calendrics, we concluded that the Chimú empire was probably no more concerned with these matters than the earlier Moche culture seem to have been.

The following morning when Juan and I left on our field trip to the Moche pyramids, it was with the full confidence that if anything astronomical was going to show up in Peru, it would most likely be here and now, for the very structures themselves were called the Huaca del Sol and the Huaca de la Luna (Temple of the Sun and Temple of the Moon). Our measurements did suggest the possibility of a June 22 sunset alignment from the Pyramid of the Moon to the Pyramid of the Sun, and of a December 22 sunset alignment from a smaller pyramid on the adjacent hill sighting across the Moon pyramid, but again there was nothing dramatic or conclusive. Our failure to get to another site known as Huaca de los Reyes (Temple of the Kings) was something of a disappointment, if for no other reason, because of its reputed antiquity (supposedly 1500 B.C.), but studies of its general setting on the map suggested that there was little we would have learned from it. So, later that afternoon we continued by bus down the coast to Chimbote, from which we would make our next incursions into the desert.

The following morning we took a local bus to the town of Casma, where we found a friendly colectivo driver in the plaza and negotiated for a trip out to Cerro Sechín. Dating to sometime between 2300 and 1800 B.C., this was the one site we had planned to visit which definitely was older than anything comparable in Mesoamerica. Archaeologists had classified this as belonging to the Chavín culture, but the fact Cerro

Sechín was well over a millennium older than the place whose name had come to be the hallmark of its civilization clearly suggested that they had gotten the cart before the horse. As my earlier visit to Chavín had shown me, it was highly unlikely that it could have been the center of a great civilization in its own right, but only its outlier. Cerro Sechín had probably been that center, for the little valley leading back up into the Andes behind it was the most direct route to Huaráz, the main town in the upper reaches of the Santa valley, and from which the trans-montane route continued past the ice-fields and down into Chavín. However, the most direct route was not necessarily the easiest, for certainly the latter would have led down along the Santa river, which breaks across the lowest gap in the Cordillera Negra (the westernmost range of the Andes) and debouches into the alluvial fan just north of the present city of Chimbote.

As our 1952 Chevrolet sputtered to a stop in front of the main pyramid, I could see at a glance why the archaeologists had likened Cerro Sechín to Monte Albán. (One group of carvings at the latter site – the so-called Danzantes, or "Dancers" – have been identified as depicting sexually mutilated chieftains rather than terpsichoreans, according to a more recent interpretation.) The entire façade of the main pyramid was covered by large, polished granite slabs decorated with bas-reliefs of warriors and dismembered bodies. As Juan and I moved from one carving to the next, it was like getting a four thousand year old lesson in anatomy. Clearly, the inhabitants of Cerro Sechín had been militaristic and warlike, because their idea of art definitely had "blood and guts" as its principal motifs. They had squarely aligned their main pyramid with the cardinal points, but beyond that we found nothing that suggested any preoccupation with the more intellectual aspects of life, such as astronomy and calendrics. A hike over to the base of Sechín Alto, a nearby mountain top site, promised little reward for a climb to its summit

in the mid-day heat, and a particularly ferocious dog helped convince us that we would forego that adventure. Instead, we hailed a car back to Casma and a colectivo back to Chimbote, where we showered, wrote up our field notes, and had an early dinner. At Juan's suggestion, we decided to relax a little and take in a movie at the town's sole bijou. That evening the offering was a 20th-century American epic in full living color, but its theme was absolutely identical to that of Cerro Sechín. Its title was "The Texas Chain-Saw Murders."

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Earlier in the afternoon, as I had perused the local travel literature describing Chimbote and its surroundings, I was intrigued to find mention of a site called Chanquillo which the archaeologists had identified as an astronomical observatory. I convinced Juan that we could not leave the region without making a pilgrimage out to this site, so the next morning we again hopped the local bus to Casma, and in the plaza we found the same friendly colectivo driver with the 1952 Chevrolet. Always glad for a lot more soles – the Peruvian equivalent of dollars – our accommodating driver literally forced his trusty vehicle along what he said was a road but looked and felt a lot more like a series of abandoned irrigation ditches, past green fields of peanuts and sweet potatoes, to the base of a low rocky mountain sticking up out of the sand. He pointed to the top and said that that was where we would find Chanquillo. Perhaps we were somewhat daunted by the prospect of getting up to it, but if Juan was, he never let on, and certainly I was not about to be turned back now. So, off we plodded, but not before reminding the driver that today he was to wait for us – not just drop us off and disappear as he had yesterday. To insure his compliance, we didn't give him any soles at all, and so up the mountain we went in the blistering sunshine.

An hour and a quarter later, Juan and I entered the first of three oval walls encircling the top of the shattered-granite mountain. Once inside the oval ring, we clambered up onto the wall for a look around. From our vantage point it was clear that it was quite impossible to directly enter any of the ports, or doorways, that breached the ring; to get through them, one had to make two right-angle turns. By the same token, anyone inside the ring could not look out through the port, so any idea that it had been designed as an astronomical observatory was patently absurd. The same convoluted entryways provided us access to the second and third oval rings, and inside the final one, at the very summit of the mountain, we found two more-circular walls of the same design, again with offset entryways.

There was no doubt in either of our minds that we were inside a fortress, but what had it been intended to protect? Looking out across the valley we could see, sharply outlined against the wide expanse of shifting sand, a row of 13 stone towers lined up along the brow of a low hill. Back of them again, the valley of the Rio Casma curved upward into the barren mountains. This was the "short-cut" to Chavín; had this been the route over which the coca leaves from the interior had found their way to the sea and then into export? Or had this lucrative trade been threatened by the neighbors of Cerro Sechín, which had taken this means of trying to protect it? Such a possibility could scarcely be ruled out, because along the lower valley of the Santa (the "easy" way to the sea) archaeologists had identified stonewalls some 65 kilometers (40 miles) in length along each side of the river. Ironically, these had initially been identified as military fortifications (which certainly seems in keeping with the scenario we have just sketched out), but more recently they have been reinterpreted as "an ethnic boundary." (While they may well have become that once they were in place, it is difficult to imagine that the

walls were originally constructed to keep two different language groups or cultures apart – especially when there is a pair of them, one on each side of the valley.) In any event, though no ready explanation of the fortress and the towers was at hand, I couldn't help but being reminded of Iglesia Vieja, the mountain-top fortress-site that Paul and I had visited three years earlier. That too, had commanded a strategic trade route, but there in Soconusco the prized commodity had been cacao, rather than coca. As Juan and I picked our way downward, first through the gold-flecked fragments of gray granite, and then through the sea of hard-packed sand, we did so with the same dissatisfaction as Paul and I had come off the mountain at Tonalá: at least we knew it wasn't an astronomical observatory. But the mystery of what it really was and how it had functioned probably lies hidden beneath the same drifting sands that even now barely conceal the outlines of walls and abandoned fields stretching across the valley floor. (We subsequently learned that a sample from one of the carob-wood lintels at Chanquillo has yielded a radiocarbon date from the middle of the third century B.C., a fact that lends considerable support to the early trade route scenario we had deduced above.)

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The next day the Expreso Sudamericano picked us up in the plaza about 9:30, and a little over six hours later deposited us in the center of downtown Lima. After the many privations of our long overland journey from Cali, I thought it only proper to introduce Juan to a variety of the urban amenities that the Peruvian capital afforded, including its excellent restaurants with international cuisine and its numerous movie theaters. Trips to a couple of local pre-Columbian sites were tucked in between arranging air tickets for our further trip to Cuzco, on catching up on our correspondence, and in a fruitless attempt to have our laundry done. Neither Pachacamac, a major seaside pilgrimage center with a

sun temple, nor Punuchuco, a little Inca site nestled in a river valley, produced anything of interest. Indeed, I had no expectations about finding any clues in either Cuzco or Machu Picchu, having examined both sites previously, but I did not want Juan to miss seeing the Inca capital or the fantastic mountain-top refuge of the Virgins of the Sun.

However, even when Juan and I did discover a solstitial alignment in the great Inca fortress at Sacsahuaman on the heights above Cuzco, I was inclined to dismiss it as a truly striking coincidence. From the Inca's throne, which had been hewn out of the living rock in the center of the fortress, it was possible to see only one snow-capped mountain -- the 6,364 meter-high (20,874 ft.) Ausangate. It was visible only because the axis of the valley below Cuzco opened southeastwards toward it. Hence, the fact that the sun rose over the peak of Ausangate at the summer solstice (December 22 in the southern hemisphere) as seen from Sacsahuaman, along the axis of the valley, was purely an accident. Man could have had no role in aligning any one of these three natural features, yet only man could have appreciated the very special spatial relationship that existed between the mountain and the fortress-site. That the Inca had indeed discovered this relationship and employed it in their great annual festival to the sun, Inti Raymi, I later confirmed in the literature. However, it was only as late as the 15th century that they constructed special solar towers on the ridges around Cuzco to calibrate their ceremonies more precisely, so they were not only late-comers to empire in the Andes but also to the intricacies of horizon-based astronomy which the Mesoamericans had already been using for three thousand years. However accidental or fortuitous their use of Ausangate as a calendrical marker had been, it was at least clear that the idea of solstitial orientation was not totally foreign to the peoples of the Andes.

Two days later, after our pilgrimage to Machu Picchu and another all-day train-ride to Puno on the shore of Lake Titicaca, Juan and I were poised to make our entry into Bolivia. There our goal was to be the ancient ceremonial center of Tiahuanaco, which as early as 800 B.C. had emerged as one of the great cultural hearths of Andean America. Our introduction to Bolivia was accomplished by taxi with a guide in the company of a fellow American from San Francisco, our destination being the lakeside town of Copacabana, whence we continued on to La Paz by local bus.

The cloudless sky and thin air made the sunlight at 3800 meters (12,500 feet) incredibly intense and the lake itself a deep cobalt blue. The straw-colored totora reeds growing on the lake's shallower margins and the fields of purple quinoa – a coarse grain native to the high Andes – spreading back from the lake added touches of color to the open, somewhat austere, and generally arid-brown landscape of the Altiplano that stretched as far as the eye could see. On some of the mountain slopes, the abandoned terraces of pre-Columbian potato patches gave witness to the much higher densities of settlement that prevailed in the region then. As elsewhere in the Americas, the arrival of the white man had had catastrophic repercussions on the local populations, by dint of warfare, disease, and enslavement. Even so, as I looked at the coppery-skinned descendants of the proud Quechua and Aymará peoples around me in the market place at Copacabana, I might have wished to turn the clock back for them to the days of the Inca Empire. Then, at least, they had been assured of food distributed from the emperor's own storehouses in times of need, whereas the five centuries of colonialism that had been their lot since the arrival of the Conquistadores had only inured them to crushing economic poverty and total political apathy.

Snow-capped Illimani (6462 m, or 21,195 ft.) formed an awesome backdrop to the Bolivian capital as we approached it at sunset. Dropping off the Altiplano into the narrow valley where La Paz is tucked, we found a city that seemed surprisingly quiet for a Saturday night. On the other hand, La Paz after sundown (elevation 3600 m, or 11,800 feet) gets pretty chilly, so we had no way of knowing whether the fact that it wasn't "hopping" this particular weekend was due to the added chill of an impending coup d'etat or whether this was the normal state of affairs.

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Tiahuanaco lies in a broad valley of the Altiplano some 50 km (30 miles) west of La Paz. Although today it is some 23 km (14 miles) from the shore of Lake Titicaca, supposedly at the time of its founding about 800 B.C., the lake stood only 2 km away, which suggests a major desiccation in climate since that time. Tiahuanaco apparently reached the peak of its power and glory between 450 and 900 A.D., after which time – like the cities of the Mayan world – it was suddenly abandoned and by the time the Incas appeared on the scene, it was a long-forgotten ruin. As archaeologists have gone about excavating and restoring it, they have found suggestions that Tiahuanaco owes some of its artistic connections to the earlier Chavín culture. What interested me most, however, were the associations the place was claimed to have had with the Sun-God, for the Lake Titicaca region was believed to be the birthplace of this element of Andean religion.

The site of Tiahuanaco was relatively undistinguished, for low ridges of hills cut off all view of the distant horizon to the east and west and one had no inkling that a major body of water lay anywhere in the vicinity. A sunken fore court with three carved stelae standing side by side in a line seemed to promise some sort of alignment but Juan and I quickly ruled out that possibility. A two-tiered walled enclosure formed the nucleus of the

site and at its back, or north side, stood the famous Gateway of the Sun. The architects of Tiahuanaco had oriented the entire complex to the cardinal points, but the only even-suggestive solstitial alignment we found was between the Gateway of the Sun and a stela known as Monolith 8, or the Ponce. With such flimsy evidence to go on, I could never have made a case for Tiahuanaco having played so decisive a role in the sun-cult as it reputedly did. Although most of the structures at the site were faced with reddish sandstone, a row of block-like stones along the eastern edge of the main enclosure were obviously basaltic, so Juan and I checked them out for magnetism. A couple of them deflected the compass needle quite sharply, but the fact that nothing had been done with the stones, apart from cutting them into upright posts, meant that the builders of Tiahuanaco were quite unaware of their magnetic properties. Casual a finding as this was, at least it argued for the uniqueness of the knowledge of magnetism in Soconusco.

Apart from our overall disappointment with not having established a stronger solar link at Tiahuanaco, Juan and I felt that we did not come away from the place "empty-handed." What we did learn from our visit to the site was that the distinctive interlocking stonework that the Incas were later to make the hallmark of their monumental constructions clearly had had its antecedents here. Indeed, from the lowest and oldest tier of the structure to the more recently added higher parts of the main enclosure, it was possible to see a marked progression in the sophistication of building technique. Whereas the earliest construction had almost a "field-stone" quality about it, inasmuch as somewhat rounded slabs of sandstone had been employed, in the second tier more carefully cut and polished blocks had been fitted into place. If a third step in the progression might be discerned, it was possibly in the fact that the builders seemed capable of moving and shaping ever-larger blocks of stone to their needs. Of course, by

the time the Incas had added their refinements, such as at Sacsahuaman, 25 and 30-ton blocks were being levered into place and polished with such perfection as to give them a third-dimensional or embossed quality.

Yes, Tiahuanaco had been a letdown, not because it wasn't intriguing in its own right, but because it certainly had fallen far short of whatever inflated expectations Juan and I may have had for it. It was only sometime after we had returned from our expedition that, in reviewing the literature of the Titicaca region, the idea occurred to me we had probably looked in the wrong place. Juan's and my investigation should have taken us to a couple of islands in the middle of Lake Titicaca instead. Though most modern maps identify the islands as Isla Titicaca and Isla Challa, the names by which they came to be known to the Spanish were as the Isla del Sol and the Isla de la Luna (the Islands of the Sun and Moon, respectively). It was on the former that the Colla people believed that the sun had made its first appearance in the world, sent by the creator god Cons, or Ticci Viracocha, to dispel forever the chaos of darkness. Aside from having been garbled, consciously or otherwise, by the Incas, the early creation myths of the Titicaca region may have reflected something of the same serendipity that they later recognized in the alignment of their Sacsahuaman fortress with Mount Ausangate at the summer solstice. From my examination of large-scale maps of the Lake Titicaca region, the definite possibility emerged that the Island of the Sun is so fortuitously situated that the summer solstice sunrise takes place over Illimani ("The Resplendent One" in the Aymará language), while the winter solstice sunrise may be calibrated over the snowy summit of Illampu (6485 m, or 21270 ft.), thus having provided the local peoples, quite by accident, the means of demarcating the limits of the annual solar migration. By an even stranger quirk of fate, the Island of the Moon has a situation that steepens the angle to each of the

same mountains by about 5°. In effect this means that the same peaks essentially mark the maximum still stands of the moon, both to the north and to the south, as seen from the second island. However, there is no evidence whatsoever, apart from the name of the island itself that the Collas, Tiahuanacoans, or Incas were sophisticated enough to appreciate the latter fact. Thus, in the New World, the full credit for the discovery of lunar cycles would definitely appear to belong to the Maya at Edzná.

Chapter 13 – Easter Island

As the LAN-Chile jet lifted off the runway at the Santiago airport and turned westward out over the Pacific, my thoughts went back to a cold, rainy evening in the late autumn of 1950. Since Midsummer of that year I had been a Fulbright student in Norway carrying out the field research for my doctoral dissertation. On the particular evening in question, I was sitting in the audience in the Aula of the University of Oslo, watching as His Royal Highness, King Haakon VII of Norway, bestowed the Medal of the Order of Saint Olaf on a young Norwegian adventurer for a daring exploit he had completed a couple of years earlier. The recipient of this honor was Thor Heyerdahl, and his accomplishment had been to demonstrate that it was possible to sail from South America to Polynesia on a balsa raft. If anyone in that audience had suggested that something over three decades later I would be following in the wake of Kon-Tiki conducting my own research, I suspect I would have laughed in his face.

In subsequent expeditions, Heyerdahl had made an exhaustive study of Easter Island and, in support of his hypothesis that American Indians had settled the Pacific, had drawn attention to, among other things, the presence of the same totora reeds in the volcanic lakes of the island as grow in Lake Titicaca, and to the striking similarity in stone-construction work between the Altiplano and this Polynesian outlier. However, there was so much stronger and conflicting evidence to argue for the region having been settled from the west, that most archaeologists had dismissed Heyerdahl's arguments as quite unfounded.

My intent in visiting Easter Island was simply to see for myself what the island might offer in the way of clues to my quest for calendrical origins. To be sure, its geographic location is such that one is tempted to wonder how anybody found it at all, for

it lies 3700 kilometers (2300 miles) off the coast of South America and the same distance to the southeast of the Marquesas. The first time that Europeans are known to have reached the island was on Easter Day in 1722 when a ship under the command of the Dutch sea captain, Jacob Roggeveen, anchored there. What Roggeveen found was a barren, treeless island whose handful of people had no inkling of what the giant statues littered around its shores were supposed to commemorate or who had carved them.

From what the archaeologists have been able to reconstruct of the island's prehistory, sometime around 1680 the custom of carving and erecting the colossal monuments for which Easter Island is so famous, terminated abruptly. For what reason, it is not known, but Heyerdahl argues for an internecine struggle between the two different ethnic groups that he believes had inhabited the island up until then. One of these groups, the "Long Ears", so called for reason of their using large spools in their earlobes, Heyerdahl believes were the earlier settlers and traced their origins to South America, while the other group, the "Short Ears", represented the later-arriving Polynesians. (Other sources speak of a "thin people" inhabiting the island first, and of a "fat people" moving in later. However, such terms are not inconsistent with Indians in the former instance and Polynesians in the latter.) The population of the island at that time may have been as great as 20,000; by the middle of the last century, following the raids of slavers rounding up labor for the Peruvian nitrate mines, the number of inhabitants had dropped to 111.

The airstrip for Easter Island lies in the far southwestern corner of the island, tucked in between the crater of the great extinct volcano Rano Kau and the island's one village, Hanga Roa. Most of the island's two thousand present-day inhabitants live in and near Hanga Roa, and while not everyone in town was out at the airport to see the plane arrive, it was clear that this was one of the major events of the week. We quickly came to

appreciate that with only one ship a year from the mainland, bringing such bulk commodities as construction materials and equipment, the bi-weekly LAN-Chile flight was the principal link this place had with the outside world. Besides its handful of passengers and tourists, it brought in such perishables as foodstuffs and newspapers. Indeed, Alberto Edmunds, who was meeting us, was the owner and operator of the island's only television station, and he depended on the plane for ever-renewing his supply of video tapes for the local audience. Very quickly Juan and I came to appreciate the special feeling that the geography of Easter Island imposes on its residents. Today, thanks to the airplane and to television, they know that an outside world exists, but for most of them it is totally inaccessible. Most of them realize that they will never get off the 166 sq. km. (64 sq. mi.) hunk of volcanic rock (air fares are expensive), and that they will probably never see or meet more than the same 2000 people with whom they share the island and/or the few hundreds of tourists or government officials who pass through in the course of a lifetime. Is it something you resign yourself to, like being in prison? Is that why everyone seems to be on his or her best behavior – because there's no place to go if you can't get along with your neighbors?

Alberto drove us over to the bungalow of Inés Paoa where he had arranged board and room for us during our stay on the island. He told us that the next morning our tour guide, Georgina, would pick us up in her Land Rover so we could see as much of the island as possible in the four days we had at our disposal. After a delicious dinner of fresh tuna steak and local vegetables, Juan and I turned in, because it was already well past 11 P.M. mainland Chile time and we wanted to get as much out of the morrow as we could.

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The next morning, Georgina picked up Juan and me, a Brazilian mother and daughter, also staying with Inés, and a Canadian couple, and we headed east along the southern coast road. Our destination was the crater of the long-extinct volcano Rano Raraku, for as Georgina explained, this was where the great stone monuments were quarried. As we turned in toward the foot of the vestigial volcano, we could see scores of the half-finished carvings dotted across the lower slopes of the mountain and lying along the trail that led back westward across the island. In all, she said that there were some 276 of the monuments clustered around the quarries and along the trail, 193 of them essentially finished and ready to be freighted off to the ahu, or coastal temples, where they were to be erected. Another 83, she said, were in the beginning stages of carving. One of these, the largest of them all, hadn't been freed from the bedrock when the work had stopped. As we climbed to the lip of the dead volcano and peered down into its water-and-reed-filled crater, Georgina pointed out the rings that had been carved into the rock which outcropped at the mountain top – loops that she explained were used to tie the ropes that hoisted the carvings out of the crater and lowered them down the outside wall.

As the others in our party clambered around the mountainside taking pictures, Juan and I retreated to the lower flanks of the volcano to examine the half-finished sculptures more closely. As Juan tested some of them for magnetic properties – without result, I might add – I pondered the possible cause of the abrupt work stoppage in the quarries and along the trail leading to the coast. It was just as if the workers had broken for lunch, or the 5 o'clock whistle had blown, and everything was dropped where it was, never to be resumed. Could the outbreak of a war have been so sudden and its results so devastating that a centuries-old tradition would have been terminated in a matter of hours or even days? If Heyerdahl's scenario was accurate and two different ethnic groups had

been sharing the island for several hundreds of years, then the violence that erupted between them must have done so with almost explosive spontaneity. By the same token, the struggle must have been so bloody that about ninety percent of the island's population was exterminated, for hardly two generations later when Roggeveen arrived the island apparently had fewer inhabitants than it does today.

Gazing up into the sightless eyes of the great stone face beside me, I wondered what stories this would-be ancestral god of the island could have told me if he could have spoken. As I looked at him quizzically, I thought at first my eyes were playing tricks on me, so then I moved over to contemplate another of the great heads, and then yet another. Finally, I called Juan over to ask whether he noticed anything "special" or "different" or "peculiar" about some of the monoliths that had been left abandoned here on the volcano's flank. After having examined four or five of the heads in the immediate vicinity, he reported that he noticed that they seemed to be "somewhat eroded", in that they had pits, or pock marks, in their noses, cheeks, foreheads, and necks. I smiled, because that's what I thought I was seeing too, only I suggested to Juan that the pits or pock-marks, as he called them, appeared to have been the result of random chiseling or hammering, rather than of erosion. Heyerdahl's reconstruction of events had argued that many of the great heads were flung down and cracked as a result of the violence. Yet, here at the very quarry site, many of them were still standing, apparently untouched apart from an occasional chip here and there in their physiognomies. I asked Juan, half rhetorically, whether he thought the stone masons might be trying to tell us something, and then it dawned on him what I had been thinking. "You mean, small pox," he blurted out. I nodded, knowing that my idea was purely speculative. After all, I explained, it had taken only one ship with contagion to land in Genoa in June, 1347 to bring the Black

Death to Europe, and before it had run its course, between half and two-thirds of the population was dead. In the same way, small pox introduced by the Spanish into Panamá in 1514 had spread through the Inca Empire and decimated large parts of it before Pizarro ever confronted Atahualpa. Here, on Easter Island, such a scenario was not totally impossible, because by the 1680's Spanish ships had been plying the waters of the eastern Pacific for over a century and a half, and wave after wave of epidemics had spread through their dominions. It would only have taken one ship blown off course with a few infected sailors to have altered the island's destiny, just as one shipload of virus had totally transformed the history of Europe. Because the crew had expired along with the islanders, the official "discovery" of the island remained for Roggeveen to record some forty years later.

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The next goal of our excursion with Georgina was the north-coast beach of Anakena, the reported landing site and residence of the King Hotu Matua. It was he who had initiated the Polynesian settlement of the island, some say as early as the 5th century CE, but certainly within two or three hundred years of that time in any case. For an island that meets the sea virtually everywhere in jagged lava flows and precipitous crags, the protected harbor and sandy beach of Anakena made it absolutely unique as a landing site – a fact that no one could have appreciated more than the sea-faring Polynesians.

Quite different was Ahu Tongariki near the eastern end of the island, which fronted on the sea with some low lava cliffs. Here, Georgina pointed out the primitive carvings of turtles and sea birds, but what gave the site its own special claim to fame was once again its geography. It overlooked an eastward-facing embayment, and in 1960, the largest earthquake ever recorded with modern instruments – a 9.6 temblor on the Richter

scale – rift the floor of the Pacific off the mainland of Chile and sent a tsunami (often erroneously called a "tidal wave") racing westward. The twenty-meter (65 foot) wall of water that crashed into this embayment funneled up onto the shore and strewn the 30-ton stone heads of the temple scores of meters over the surface of the adjacent valley. Fortunately, this blow to the island was extremely localized and there was no loss of life because of it.

The following morning Georgina again picked us up about 9:30 and on this occasion our itinerary took us to sites on the southwestern corner and in the western interior of the island. Our first stop was at Vinapú, which had been identified as the oldest ahu, or temple, on the island. Its radio-carbon date was a somewhat ambiguous 757 CE +/- 200 years, but as we walked up toward it through tall tufts of wind-blown grass, I could see at a glance that its geographic location was unlike that of any of the earlier temples we had visited. Instead of lying immediately on the coast, it lay near the coast – about 110 meters (360 ft.) inland. Moreover, it lacked easy access to the sea, so that was obviously not a factor in its location, whereas most other ahu are in immediate proximity to the shore. As we drew near to the temple structures, Juan's eyes lit up with a sign of recognition and he turned to me with a wink. We had seen this kind of stonework before – in the Andes. It was not what I had called the "embossed" kind of stone work characteristic of the Incas, but rather the finely cut and fitted flat work of the Tiahuanaco culture. I told Juan that we would have to score two points for Heyerdahl, because now, with our own eyes, we had seen the same totora reeds in the lake at Rano Raraku that we saw in Titicaca and here in front of us was what looked to be the same careful kind of stone construction work that we had seen in the Andes. (Already we had gotten a pretty good feel for the rather "sloppy" stonework the Polynesians were responsible for in their

constructions. Just looking at the solidity and precision of the workmanship at Vinapú I knew intuitively that this had been the product of a very different culture.)



Figure 40. Although Easter Island was the first area of Polynesian settlement we had visited, it was already clear from our prior observations that this meticulously cut and fitted stonework was no product of theirs. The nearest antecedent of such workmanship was obviously to be found in the Andes, and most probably at Tiahuanaco.

William Mulloy, one of the members of Heyerdahl's 1955-56 expedition to the island, had suggested that the two ahus at Vinapú may have been oriented to the December 22 solstice and the equinoxes. If they did have such orientations, these dates could only have been calibrated against the empty horizon of the sea, which probably accounts for the fact that neither of them was closer than 2° to the azimuths Mulloy was arguing for. However, the one solar alignment missing from the architecture of Vinapú is the winter solstice sunrise (June 21), and as Juan and I checked this azimuth against the

horizon, we found that it coincided precisely with the peak of Pua Katiki, the highest mountain on the eastern end of the island. Indeed, it looked as though this relationship – the solstitial alignment with the mountain – had been instrumental in determining Vinapú's more inland, more elevated, and less water-oriented location initially, and whether Mulloy's arguments were correct or not, the site certainly had an astronomical importance – but one that he had never suspected.

Vinapú is one of those kinds of places that restores one's faith in human nature. It had produced the most solid convergence of clues we had found on our entire trip so far – a solstitial orientation to a mountain, coupled with a structure whose building style and antiquity had direct links with the Andean highlands. Throw in the totora reeds – which didn't arrive on the island with bird seeds – and you have a case for contact with the mainland of South America, at least by the 8th century CE.

It was with a certain exaltation that Juan and I piled back into Georgina's Land Rover and she headed up the flank of Rano Kau, the largest of the volcanic craters on the island. Driving as far as we could, we then hiked the rest of the way up to the site of Orongo, a ceremonial center located on the western brink of the crater and overlooking the crashing waves of the open ocean some 400 meters (1300 feet) below. It was here that the famous Bird Man ceremony took place each spring, Georgina explained. Youths representing each of the island's great chiefs would dive off the cliff below and swim out several hundred meters through shark-infested waters to the little offshore islands where sea birds came back to nest. Picking their way up onto the rocks, the youths were to find a newly laid bird's egg and then return with it intact to their sponsoring chieftain, carrying it in a little basket fastened to their foreheads. The chieftain who had sponsored the winning

contestant was then named Tangata-Manu, or "Bird-Man", for the coming year, with all the honors and emoluments associated therewith.

Impressed as we were, both with the spectacular grandeur of the site itself and with the heroic athletic contests that had gone on here, our primary interest in Orongo was in its reputed calendrical connections. Edwin Ferdon Jr., another member of the Heyerdahl expedition, had identified four holes cut in the rock at the lip of the crater as having been used as "a sun observation device" to mark the solstices and the equinoxes. Three of the four holes averaged 3-6 cm in diameter (1.5 to 2.5 inches), whereas the most critical one – that supposed to cast the shadow on the December 22 solstice and the equinoxes – had a diameter of 40 cm (15.5 inches). This would hardly have been a very "refined" shadow in any case, but even using the centerlines of the detailed drawings he included in his report, we determined that his azimuths were between 9 and 11° off. Moreover, he seems to further weaken his argument when he admits later in his report that "the deviation must be caused by such *landscape interference* (italics mine) as Structure 1 and the eastern rim of the Rano Kau crater."

Of course, there in a nutshell was the difference in my approach as a geographer, and his as an archaeologist. He was intrigued with holes in the ground, and I was obsessed with "landscape interference."

Looking into the yawning crater of Rano Kau, we could see yet another fresh-water lake, again almost overgrown with totora reeds, and on the sheltered inner sides of the crater, Georgina pointed out the patches of pineapple, sugar cane and other fruits and vegetables being cultivated there. What I found even more interesting, however, was the fact that over the northeastern lip of the crater the peak of Pua Katiki was once again visible against the horizon. When I took a bearing on it with my surveyor's compass, I

could confirm what my first impression had intimated: Orongo, the island's principal ceremonial center from about 1420 CE onward, had exactly the same solstitial orientation as did Vinapú, the island's oldest ceremonial center – to the sunrise position on the winter solstice (here, of course, June 21).

Swinging my compass to the south, I zeroed in on the azimuth of the summer solstice, and what I found was a sharp break in the volcano's rim etched against the skyline – again, a markedly distinct fixed-point against which to calibrate the sun's southernmost rising position. Of course, half way between the two extremes should be the sunrise position at the equinoxes, so I sighted against the far lip of the crater at an azimuth of 90°. As I did so, I found that the vertical hair in my compass sight was aimed directly at a pile of rocks on the horizon. Juan replicated my measurements, and concurred. It appeared that from Orongo all of the critical calendrical dates of the year could have been defined: one by a distant volcanic peak, another by the seaward edge of the Rano Kau crater itself, and the third by what appeared to have at one time been a cairn.

Not until I had returned to Dartmouth and examined the literature more closely did I come across the studies of Thomas Barthel, a German scholar, on the place names of Easter Island. He was intrigued to find, for example, a correspondence between local place names as one moves clockwise around the island and the months of the Polynesian year. Thus, the year "began" on the north coast at the beach of Anakena at the summer solstice (December 22) and "ended" on the south coast at Vinapú on the winter solstice (June 21). The "turning point" of the year he identified as the "high plateau" named Poike at the eastern end of the island – a name that he translated as "height," "to be just seen above the horizon, to rise in connection with stars". He found it "amazing" that the names

of mountains on his list coincided with the months during which the summer solstice and the fall equinox occur, and he ventured the comment that "perhaps from these mountains the other landmarks of the passing year were observed". From Juan's and my observations, it was just the other way around, for both Vinapú and Orongo are oriented to the cone of the ancient volcano which surmounts the "plateau" of Poike, the mountain called Pua Katiki. The latter name, Barthel tells us, translates as "flowery aura," which is a fittingly poetic description of a place where the first rays of the sun appear.

Apart from adding the support of Barthel's place names study to our observations, my examination of the literature also turned up a couple of other interesting references from the archaeologists. It seems that Carlyle Smith of the Heyerdahl expedition had suggested that a west coast temple known as Ahu Tepeu – identified for me by a National Park warden at the local museum in Hanga Roa as having the finest stone work of any ahu on the island – had seaward walls whose perpendiculars would approximate the azimuth of the sunrise position on December 22. Although Juan and I were unable to visit Ahu Tepeu ourselves, a subsequent examination of its location on a large scale map revealed that it lines up precisely with the December 22 sunrise over the peak of the highest mountain on the island, another dead volcano called Maunga Tere Vaka.

Smith also mentions another Early Period ahu on the north coast whose finely finished stonework meant that it had likewise been constructed by the builders of Vinapú and Ahu Tepeu. This was a temple called Ahu Te-pito-te-kura, whose name means "the navel of light." In addition to having been the site of the largest stone head ever sculpted on the island, a monster that measured 9.8 meters (32 feet) in height and weighed an estimated 82 tons, Smith felt that Ahu Te-pito-te-kura must have played a rather special role in the island's ceremonial prehistory, but he couldn't identify what it was. As I poured

over my large-scale map of the island, the answer to his question seemed to jump right out at me. Drawing a sightline for the December 22 sunrise from the temple toward the southeast, I found that it crossed directly over the top of Pua Katiki once again. And, as I traced the line backward in the other direction, it crossed right over another Early Period temple – Maunga Hau Epa – whose "terraced mountain" had suggested to Smith that it was a sacred place of great importance as well, but once more he couldn't guess why. Interestingly enough, as the sight line intersected the coast, it did so precisely at the beach of Anakena, the place where Barthel had learned that the Polynesians began their year. Thus, archaeological evidence, reinforced with place name studies, and coupled with astronomical alignments all pointed at the solstitial orientation principle being employed on all three of Easter Island's coasts – and in the Early Period of the island's prehistory, before the Polynesians arrived.

Whatever else Heyerdahl may have argued, I was now totally convinced in my own mind that on one score he was absolutely correct: Andean peoples had reached and were living on Easter Island when the Polynesians moved in from the Marquesas. Remote and offside as this tiny fleck of basalt is, two peoples, coming from opposite directions, had both reached the island and settled down to live together upon it. Whether that co-habitation had finally erupted into an internecine war after ten centuries or more of joint occupancy of the island or if the population had suddenly been decimated by the unrecorded arrival of a pestilential ship, we will probably never know for sure.

I leap ahead of my story for another short footnote. As in the instance of the discovery of the astronomical matrix at Tikal, I felt that the Easter Island clues that Juan and I had pulled together should be of interest to at least the archaeo-astronomical crowd, so on my return I put together the documentation for an article and submitted it to the

Bulletin of Archaeoastronomy. In due course, the article was returned with a note from the editor informing me that the "final referees' reports were quite negative regarding both the substance of the article and the fact that (it) apparently adds little to previously published work." What I had forgotten, of course, was that in the interim I had been asked to do a review of a new book edited by a prominent archaeo-astronomer, and which, with considerable reluctance, I had had to give quite an unflattering assessment. In the academic world, where the safest advice to follow in such matters is "you pat my back and I'll pat yours," I had committed the unpardonable sin of being too forthright. Numerous subsequent submissions to the same journal only tested the editor's ingenuity to come up with new reasons for not accepting my articles, but the unspoken bottom line inevitably came down to "tit for tat."

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Bengt Danielsson had been one of Thor Heyerdahl's five companions on the Kon-Tiki raft expedition in 1947. A Swedish ethnologist fresh from an expedition in the Amazon basin, he had emerged one day in Lima, Peru as the raft was being readied, and asked if he could accompany Heyerdahl. To paraphrase Heyerdahl, "any Swede who could put up with five Norwegians couldn't be all bad," so he was invited to come along for the ride. In Danielsson's case, he fell in love in and with Polynesia and settled down to continue his research in Papeete, Tahiti. It was there that Juan and I interviewed him one morning early in May 1982. Even coming unannounced as we did, we were graciously received in his beachfront study and settled down for an hour's discussion of the merits of our plan for a reconnaissance of the Marquesas. It soon emerged that the logistics of getting back and forth to the islands on anything like the kind of time-table we had in mind was quite impossible; had we been willing and able to devote a month or two,

taking a copra-collecting boat between the islands, that would have been one thing. Trying to guarantee seats back and forth on the little weekly airplane was very chancy to say the least, because he pointed out that one could always be "bumped" at the last minute by some French administrative officer and find himself stranded another week or two. Apart from the sheer logistics of just getting there and back, Danielsson said that the sorts of things that we would be looking for simply didn't exist any longer. The French missionaries had been very thorough in toppling statues and leveling pyramids, so the images I had of tiered, cobble-faced structures similar to those at Izapa could only be found in the etchings of the early explorers. Dismayed as we were to learn that any venture into this key area of Polynesia could only prove costly in time and money and very unprofitable in terms of the kinds of research rewards we were seeking, Juan and I reluctantly decided to terminate our jaunt into the Pacific. We rearranged our plans so we could fly back to Los Angeles together – but not before we could enjoy a few days soaking up some of the local flavor of Tahiti and Moorea.

Chapter 14 – Armchair Navigation

Following my abbreviated foray into the South Pacific with Juan, I continued to be obsessed by several unanswered questions. For example, if the Polynesians had managed to discover and settle virtually every habitable isle in the Pacific, how was it possible that they could have missed the coast of the Americas in the process, especially since it formed a continuous, 20,000 mile-long backdrop to the arena that they were exploring? The odds against this *not* having happened, not even once in one isolated locale, much less being repeated several times in numerous places, are staggering. On the other hand, the likelihood that the Polynesians might have found either a sweet-potato tuber washed up on a tropical beach somewhere in mid-Pacific or deposited as a seed by some constipated seabird, three thousand miles from the shore of Peru, accompanied by a little name tag identifying either one of them as « kumara, » is both astronomically inconceivable and patently ridiculous. Yet, at the time of Juan's and my venture to Easter Island and Tahiti, something very close to such a scenario is what the archaeologists would have had us believe. The only credible alternative would have been a face-to-face confrontation between a Polynesian and an Ecuadorean or Peruvian Indian, allowing the former to have asked what it was, and the latter to have given him a spoken answer in return.

Moreover, my readings had told me that the Polynesians had reached the Samoan Island group by 1500 BCE.; thereafter, we find no evidence of their whereabouts until 1600 years later – about 100 CE. – when they suddenly appear in the Marquesas, about the farthest-east archipelago in all of the Pacific. What were they doing in the interim? Sitting on their duffs, paralyzed by the fear of tackling the vast stretches of sea that

opened before them, now that the short and relatively easy gaps between the islands were all behind them to the west? Or were they still out there giving it the ‘old college try’, launching voyage after voyage, only to have them simply disappear, never to be heard from again?

Naturally Juan and I were quite disappointed not to have been able to visit the Marquesas, because, following their original discovery and settlement, it seems that subsequent Pacific exploration had chiefly continued to emanate from there. From the descriptions of these islands provided by later visitors, it was quite apparent that they were not exactly « tropical paradises. » They were extremely jagged topographically, making it very difficult to even maintain contact between opposite sides of an individual island. Local groups of people, isolated from one another, quickly found their native language fragmenting into dialects, each peculiar to its own isolated valley, and helping to set apart their neighbors from adjacent valleys as ‘strangers’ or ‘intruders’. With so divisive a terrain, it is small wonder that the Marquesans soon found themselves fighting over the limited resources that their new homeland had to offer. Moreover, because the islands lay directly in the path of the South Equatorial Current, a continuation of the cold Peru Current that angled itself across the Pacific at just this latitude, the prevalence of frequent droughts only heightened the likelihood of periodic famines, which in turn served to trigger the forced migration of any islanders who were unable to secure their tenuous hold on the land by the force of arms.

In the late ‘60’s, I had read about an experiment conducted by a team of geographers at the University of Minnesota who had devised a computer program to test what they called ‘drift voyages’ in the Pacific Ocean. The idea behind this experiment

was to simulate the launching of two vessels every day, throughout the year from a multitude of places scattered across this vast expanse of water, and have the computer track where they would end up, solely by drifting. In effect, the program was attempting to substantiate the notion, advanced a few years earlier by a New Zealand archaeologist, Andrew Sharp, that the Polynesian settlement of the Pacific had essentially been accomplished by drifting with the prevailing currents, rather than by undertaking voyages that were consciously intended to reach some given destination. The latter he argued, were quite impossible, because the Polynesians had no way of knowing where it was that they were going.

Of course, the world had already been given a vivid example of such a voyage in 1947, when the Norwegian adventurer, Thor Heyerdahl, and his companions drifted with the « Kon-Tiki » raft from Peru to the mid-Pacific, covering a distance of some 4,300 miles in a total of 101 days. However, unlike a typical Polynesian voyage, it was itself a carefully planned ‘experiment’ based on a thorough knowledge of the direction and strength of the current involved, as well as a fairly good notion of where it would take them. The greatest « unknown » in the whole under-taking was how seaworthy and durable their modern copy of a primitive balsa raft would be, but, in the event that either of these factors were ever called into question, adequate precautions had also been put into place – a ‘security back-up’ that no Polynesians ever enjoyed. Even so, the experiment ended in a near-tragedy when the balsa raft finally smashed into a reef at Raroira in the Tuamotu Islands.

However, after about 100,000 iterations of the University of Minnesota computer program, suffice it to say that the experiment could not account for more than a small

fraction of the islands of the Pacific having been settled by accident ; therefore, conversely, it strongly suggested that human intelligence and daring must have been responsible for the impressively thorough distribution of Stone Age man across the world's largest ocean!

As a result, shortly after my return in 1982 from Easter Island and Tahiti, I was emboldened to write a computer program that would allow me to test how the Polynesians might have consciously chosen where they wanted to go, and then devised a means for getting there. By designing the program in the form of a game that could be used in one of my classes, I hoped to acquaint my students with the kinds of challenges that would have confronted a Polynesian navigator about to set off on a new voyage into the unknown; as it turned out, the game also later became a favorite learning experience for my grandsons.

As luck would have it, during the Fall Term of that year, when I learned that the Anthropology Department of Dartmouth College was hosting guest lectures by both Ben Finney and his wife from the University of Hawaii (rather appropriately on Columbus Day), I was presumptuous enough to direct a special request to them. I asked, if Prof. Finney could find the time, might he be able to make a short visit over to me in Geography, and they replied that he would be happy to come by.

Inasmuch as I knew he had been actively engaged in the « Hokulea » Project of outfitting a modern Polynesian canoe and attempting the re-creation of a long distance voyage between Tahiti and Hawaii, I was interested in having him « play my game » to learn his reaction to it. He very obligingly did so and obviously found it intriguing enough to suggest that I send a copy of it to the Bishop Museum in Honolulu. Although I

subsequently received a letter from the Museum confirming his request, I declined to send one, feeling that they would find it too amateurish to be of any real value to them. Yet, on a return visit to Prof. Finney in Hawaii in 1985, I learned that the Museum had managed to get their own similar program up and running so that its visitors could likewise try their hand at arm-chair navigating, and I was happy that my idea, at least, had diffused back out into the Pacific, whence the inspiration for it had first come.

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Because the Polynesians were known to have navigated primarily by reference to the stars, at the start of my game, the would-be navigator was first introduced to the choice of asterisms available at the time of year corresponding to his or her departure. The Polynesians recognized two main seasons, one that they called the Rua Poto (« the Short Hole »), and the other the Rua Maro (« the Long Hole »). The first season ran from March to September, corresponding to the summer-half year in the Northern Hemisphere, and the second, to the summer-half year in the Southern Hemisphere. I quickly realized that the number of bright stars, that were available for them to steer by, was noticeably greater during the « Short Hole », when no fewer than fourteen were available, compared to the « Long Hole », when only half that number were visible. (Editor's note: In actuality, the Polynesians are known to have used chains of stars to fix a given rising or setting point, and some of their navigators, or « star-chiefs, » were credited with having memorized up to 200 asterisms in all; the limitation of only 21 for use in our experimental game obviously represented a considerable contraction of reality. On the other hand, since it was the brightest stars that served as their fundamental guide-posts,

most of the fainter stars were viewed as lesser ‘companions’ that were intended to help hold the rising and setting points of the principal star in memory.)

In creating my computer program, the first step had been to compartmentalize the Pacific into a number of spatial blocks or regions according to the physical conditions prevailing in each. Within each block, the physical conditions that I included in my data bank were (a) the prevailing direction of the ocean current, (b) the prevailing direction of the wind, and (c) the relative water temperature. Each of these conditions was continuously made known to the navigator every night that the voyage continued. Each night the navigator was also presented with three options: 1 = to continue on the current course, 2 = to check the stars, and 3 = to alter the course. If the second option was chosen, the navigator was given a current view of the night sky, and any time a guide-star was directly overhead, its zenithal height was announced. As the voyage proceeded, if a landfall was made on an atoll, a fourth choice became to stop and restock the vessel’s larder of coconuts, whereas if a sighting of a « high-island » occurred instead, i.e., one suitable for habitation, the fourth option was to stop and settle.

Weather conditions were generated randomly from one night to the next, and ranged from calm, clear nights to stormy, cloud-covered ones, interspersed with occasional storms of a gale-like or hurricane intensity. Any time the stars were obscured, the sails were dropped and the canoe was permitted to drift, until the weather once again cleared. Naturally, the directions of the currents and winds and the state of the weather were all factors that affected the forward speed of the vessel, and therefore influenced the distance made good each day that it was at sea. Although the navigator never knew at any

time where he or she was, the ‘computer’ was continuously mapping the course, as the voyage proceeded.

Once the navigator had made his or her choice of the « guide star » to be followed, the program had initially offered an additional option of deciding how to stock the vessel’s larder, so as to ensure that there was enough food for a lengthy voyage. However, early experience with this option soon caused it to be revised, because the larger the size of the crew that had been chosen, the less space there was for foodstuffs, and vice versa. Tests quickly revealed that if the number of passengers was too large, then the food ran out too soon; thus, if the voyage was to have any reasonable chance for success, their number should preferably be restricted to no more than 30. This limitation was explained by the computer as having been « a decree by the island’s principal chief indicating the maximum number of warriors he could spare for the voyage, » whereas in reality, it was designed to prevent disaster from overtaking the fledgling land-lubber navigator before he or she had become comfortably accustomed to the responsibility of his or her new undertaking.

Once a voyage was underway – in my class, following the election of one of the class members to serve as the navigator – he or she remained under continuous peer pressure for the duration of the entire trip, a situation that would never have been allowed to arise in real-life (where second-guessing the captain is strictly forbidden). Thus, the neophyte navigator was constantly being forced to weigh his or her own judgment against that of the consensus of ‘passengers’ looking over his or her shoulder, which was certainly not an enviable position. As the voyage dragged on, with no land being sighted, and the larder constantly continuing to shrink, the sense of anxiety steadily became more

palpable. Each night, new and more radical advice was being offered by the fearful ‘passengers’, some of it clearly bordering on mutinous sentiments. Even though the popularly elected navigator was obviously doing the ‘best’ that he or she could, there was little reason to suppose that anyone else would be able to do any ‘better,’ so the tension steadily escalated.

Nevertheless, short of a voyage that abruptly ended in tragedy, such as capsizing in a hurricane, « as long as there was life, there was hope. » The more occasions the experiment was run – i.e., the more often the game was played – the more I and the class (and later my grandsons) learned from the experience we were gaining. One of the very first lessons we learned was to avoid sailing during the « Long Hole, » if at all possible. That, of course, was easier said than done, because if your clan has been driven down to the shore by an army of raging cannibals, you couldn’t stop to ponder what season of the year it was. You just had to clamber aboard the canoe and put out to sea as fast as you could.

On the other hand, once you were well out at sea and were following a given guide-star, if no one from your island had ever successfully reached land before or had not been able to return to tell you about it, you still really had no idea where you were going; you were literally « flying blind ». But, at least if you were leaving from your home island, there were a couple of observations that were definitely worth making, especially in the event you ever should find it advisable or necessary to return; one was that Sirius, the brightest star in the sky, passes directly overhead on your home island, so that fact should at least help guide you back to its correct latitude. Nevertheless, it would still, of course, be up to you to determine whether you were up-wind of your home-island

(i.e., to the east), or down-wind of it (i.e., to the west). Also, as you were departing your home-island, it would be very helpful to take a backsight on it as well; that way, at least you would know which star would be the most useful in guiding you safely back, should the need arise.

Finally, there was another thing to keep in mind, no matter where you're departing from, and that was to remember you're not going to be welcome landing on any island where people already lived. That is because they are definitely not looking for any more mouths to feed on their « tight little island, » except their own. Thus, it is probable that many Polynesian landfalls ended in a big « luau » or « cook-out » right on the beach, with the newcomers providing the dinner! Indeed, poor Captain Cook ended up in just such a cooking-pot himself!

Once the voyage is underway, unless you are pretty sure of where you are headed, don't be tempted to change course. If you do, it's highly unlikely that you'll ever find your way back to any place that you're familiar with. If you should sight land, you can only hope that nobody has gotten there before you. In fact, this lesson may have been one of those the Polynesians were learning – the hard way – during the 1600 plus years that they disappeared off the radar screen. The desperation that resulted in their early departure from Samoa and their late arrival in the Marquesas may well have resulted as often from coming ashore on an island that was already inhabited as from a long litany of vessels being simply lost at sea.

On a more positive note, I can also report that I did learn something from repeated tests of the game that I did not share with either my students or my grandsons; I knew that if I did, I would take much of the realism out of their own experiences and cause

them to chalk up many more successes than any Polynesian was likely to have done. Of course, if either my students or my grandsons had had the opportunity to continue testing the game, as I did, they too, would no doubt have happened upon this discovery as well. I felt therefore, that my experience would indeed be replicable, which, after all, is one of the critical prerequisites of scientific testing. Indeed, it was such a « comforting » discovery, that I assumed it must be simply a by-product of my ‘amateurish, unsophisticated’ game, rather than anything that might actually correspond to reality, so I did not take it as seriously as perhaps I should have.

However, now that I am secure in the knowledge that the reader is safe in his or her own armchair, I am prepared to finally divulge what my « comforting » discovery was. For whatever value it may continue to have, I learned that anyone departing from Samoa and holding a steady course on the rising point of Aldebaran, the 12th brightest star in the heavens, would have a very good chance of making a safe and successful journey to a new homeland! However, holding such a course requires sailing against both the wind and current during the entire voyage – something that Heyerdahl maintained was not really possible. As a result, the « timing » suggested by my game may well be in error, so naturally I can not vouch for its accuracy. In any case, the game suggested that about 8 to 12 days after their departure, our hypothetical sailors would have sighted a series of high islands. Because they lay so close to the « home island », the likelihood of them being already inhabited would be great enough so they were by-passed without any intention of stopping.

After about 20 days out – still according to the game’s timing – a flurry of atolls would be sighted, so even one stop among them would serve to replenish the larder of

coconuts for an additional score of days at sea. Naturally, a total re-supply of the canoe's larder at this juncture obviously added a welcome measure of security to the venture that otherwise would be lacking, so making such a stop was definitely in their interests to do. The next 20 days would likely pass without event, apart from possible storms at sea, but shortly after reaching the 40th day, they would find that the temperature of the seawater turned noticeably colder. (Unknown to our imaginary « exiles », they had now entered the South Equatorial Current.) Of course, because they had never made such a voyage before, they would have had no understanding of what this portended, but to one who has had this experience before – like yours truly – it meant that within the next two or three days, there would be a very high probability of sighting land. Thus, despite the fact that our Samoan 'emigrés' were completely ignorant of where they were, they would have successfully reached their new homeland – for, surprisingly enough, they would have found themselves in the very midst of the Marquesas Islands!

Naturally, there was good reason for me to want to test this result as soon as I could, because although my game brought me successfully to what appears to have been the first island group settled after Samoa, thereby confirming the historical record, the question remained as to what azimuth such a voyage would have required in reality, and how closely was it approximated by that recorded on the unseen Mercator map being generated by the computer as the voyage proceeded. (Editor's note: The chief merit of the Mercator projection is that it enables a given compass bearing to be mapped as a straight line; as a result, ever since it was devised in 1569, it has been much appreciated by navigators.) Using an independent computer navigation program, I found that the distance between the origin of the voyage (Samoa) and its destination (the Marquesas Islands)

measured 2050 statute miles, or 4025 kilometers, and that the azimuth of the compass bearing of the intervening course was 80°, or ten degrees to the north of east. The clandestine Mercator map produced by the game confirmed the latter perfectly, but there was no way for me to know whether a realistic time-frame for such a voyage would have averaged something in the range of 43 to 45 days or not. However, since we know that Kon-Tiki's progress, drifting with the current and wind, averaged about 40 statute miles per day, the value suggested by my game, against the current and wind, would appear to be somewhat too high. When I checked some of the computations made for similar voyages recorded in Polynesians in America, an average of 40 miles per day also appeared to be a good approximation of the distance covered against the current and wind, so a more accurate timing for the length of my hypothetical voyage between Samoa and the Marquesas should probably have been about 51 days. However, with the supplemental supply of food acquired en route, this should still have been quite possible.

Incidentally, my 'discovery' that navigating by Aldebaran would almost without fail get you safely to the Marquesas also had some other interesting consequences. For example, I found that, if a canoe by chance missed the Marquesas but still continued on course, its eventual landfall would very likely be in the Guayas estuary of southern Ecuador. A more fortuitous place to land can hardly be imagined, because it represents the last patch of green vegetation on the Pacific Coast of South America for almost 2000 miles (3000 km). Beyond it to the south, the Atacama Desert stretches along the entire length of what today is Peru and for more than one-third of northern Chile. Had the Polynesians come ashore anywhere in this vast expanse of wasteland – and local legends

in northern Peru record that they did – they no doubt would have described the area as the « One Nui » (OHnay Newee) – «The Big Sand ».

Memories of Juan's and my experience with the El Niño of 1982 led to me realize that the forceful torrents of rain that had swept away the little boys in Quito and had nearly washed away the railway leading down to the coast could only have been produced by an airflow off of the Pacific, from the west, that was so strong that it periodically nullified the effect of the prevailing easterly winds. Checking the rainfall pattern for Guayaquil, I found that the city's 'rainy season' started in the month of December – coinciding with the return of «the Christ Child » about Christmas time – and continued to the month of May; the rest of the year is essentially dry. This means that the backflow of water that we call the Equatorial Counter-Current is obviously accompanied by air currents aloft that bring moisture to coastal Ecuador and Peru – not necessarily every year but, as the data reveals, at least on a fairly regular cycle of every 6 to 7 years. Suspecting that the first inkling of such an event would have been observed out in the Galápagos Islands, 600 miles (1000 km) to the west, I checked the climatic data for the station of San Cristobal and found that this was indeed the case. A further examination of coastal stations ranging from central Ecuador to central Peru revealed that strong periodic pulses in rainfall occurred every six to seven years over this entire region. This means that, had Polynesian navigators been at sea during any of these wind-reversing events – (the odds of this happening would have been at least as high as one time in six) – then they would not only have been able to reach the Guayas Estuary, but they also would have done so blessed with tail winds.

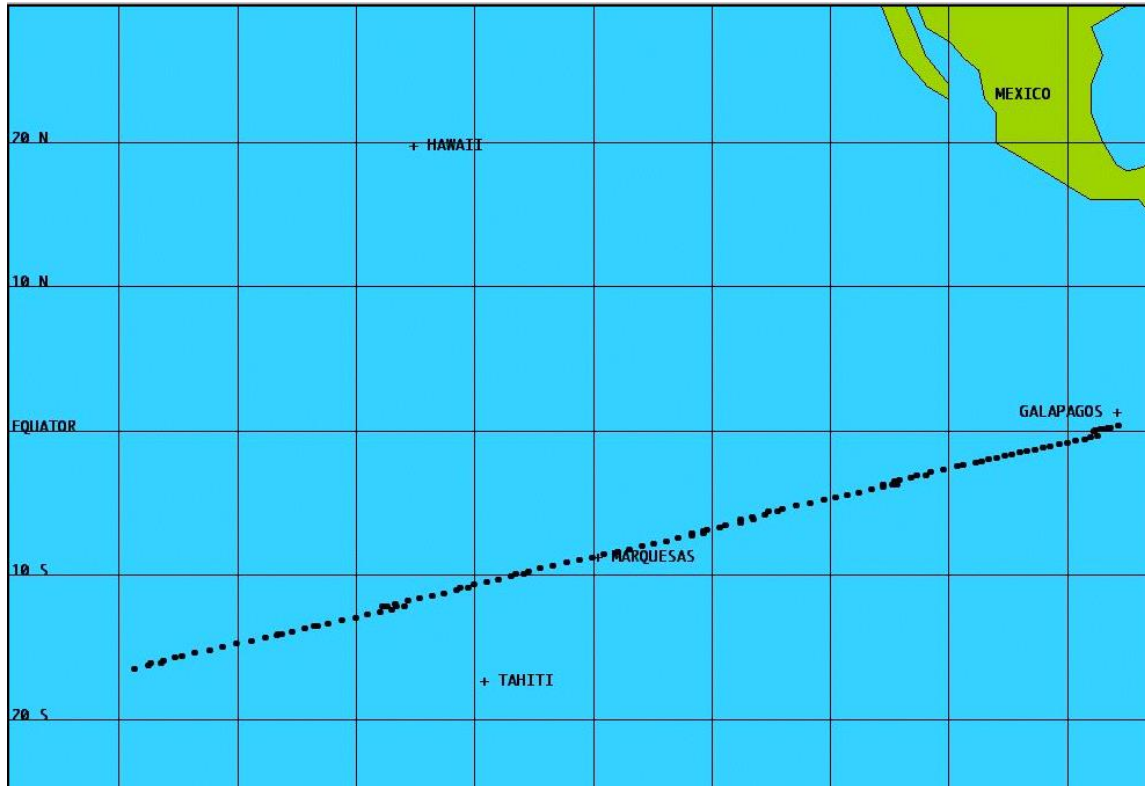


Figure 41. Using the rising point of Aldebaran to set its course, a voyage commencing in Samoa would be following an azimuth of 80°, as shown on this Mercator map of the Pacific generated by the author’s computer game. If it happened that the Marquesas Islands were bypassed, the next landfalls were likely to have been the Galápagos Islands and the Guayas estuary of Ecuador, the latter being the source of the sweet potato.

Thus, when we learned, as we did in 2007 from the linguistic studies of Kaufman and Berlin, (*Polynesians in America*, p. 190.) that the word kumar was the name for the sweet potato in the Cañari language, originally spoken on the islands of the Guayas Estuary and all along its south shore, it was just as though a long-missing piece of a puzzle had finally fallen into place: the Guayas valley was not only the southernmost limit of where this important sub-tropical food crop could be grown without irrigation, but it also lay only a short distance from the temperature boundary that precluded its successful cultivation anywhere farther south on the entire western side of South America.

It is appropriate here that we also take notice of at least one other Polynesian voyage that appears to have « overshoot » its intended destination. Judging from where it finally intersected the South American mainland, it seems to have been an attempt to reach Rapa Nui (Easter Island) from the Marquesas by using the rising point of Adhara as its guide-post. Fortunately, it too, ended up in a « green patch of coast » – at the very southern end of the Atacama Desert. There, on the Arenal Peninsula, near the Chilean city of Concepción, the discovery in 2005 of a deposit of chicken bones confirmed that the Polynesians had likewise managed to reach that region sometime about 600 years ago. (Polynesians in America, p. 209.)

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Following a year's sabbatical in 1985-86, during which my wife Ruth and I « filled in some of the blank spots » on my mental map of the world, our travels took us to Hawaii, New Zealand, Australia, Indonesia, the People's Republic of China, the Republic of China (Taiwan), Thailand, and India, as well as to Brazil, Uruguay, Argentina, and Chile in South America, and ended with our return to Scandinavia. The conclusion of our world circumnavigation in Sweden closely coincided with the passing of one of my last relatives in that country and our subsequent purchase of the little red cottage in Småland that had been my grandfather's gift to his last remaining sister in « the Old Country ». For the next fifteen years, our springs and our summers were divided between my lecturing on cruise ships, literally in all parts of the world, and becoming familiar with the roots of my ancestry in the picturesque and historic South Swedish Highland. Several of the voyages served not only to expand my acquaintance with many more of the islands of the Pacific, but also to renew an earlier passion I had for the

Megalithic culture of Western Europe. But, central to it all was a continuing search for additional clues to the early astronomical knowledge of man, in each part of the globe we were privileged to visit.

Chapter 15 – Late Arrivals and Early Movers

For me, one of the greatest joys of teaching is the continuing opportunity to learn – to learn, not only from the constant flow of new discoveries reported in the literature or from my own findings gained from field research, but also from the interaction with bright and curious young minds in the classroom. I can't count the times that, during a lecture or a seminar, a question from a student has forced me to clarify my own thinking on a matter, obliged me to look for a new or different example to explain some principle, or caused me to combine an old idea with a new one, producing in the process a whole new insight into a topic on which I previously thought I had a comfortable, if not total, grasp. This constant challenge and renewal is the very elixir of my existence, and when students tell me horror stories of other professors using the same lecture notes or exams for years on end, I can't help but commiserate with both the students and instructor. Surely, for me all the fun would go out of teaching if I couldn't feel the same excitement of discovery that I hoped to awaken in the young men and women who sat before me in the lecture hall or seminar room.

As I tried to put into perspective what it was that Juan and I had learned from our expedition to South America and Easter Island, I felt that it was now safe to conclude that the elaborate time-reckoning systems of Mesoamerica had no antecedents in either area, nor conversely, did its highly developed sacred almanac or secular calendar ever win acceptance in either of the other regions. Nevertheless, a number of cultural traits, including such things as ceramics and shaft tombs, have been identified by the archaeologists that indicated an early, lively, and continued contact existed between Mesoamerica and South America. Likewise, I no longer had any reason to doubt that contact, perhaps more tenuous and sporadic, had also existed between Polynesia and South America in pre-Columbian times,

and that the early presence of Andean peoples in the eastern Pacific was a very definite possibility. That similar contacts had existed between the Marquesas and Hawaii on the one hand and Mesoamerica on the other, seemed extremely likely as well, for the distances involved were at least 1500 kilometers (1000 miles) less than they were to mainland South America. But, as I had always known, the Polynesians were far too late and too primitive to



Figure 42. The so-called Menehune Ditch on Kauai, the northernmost of the Hawaiian group, likewise has stonework that is quite uncharacteristic of what the Polynesians produced elsewhere throughout the Pacific. One of the early Supreme Court judges of the Kingdom of Hawaii (1886-87) was a Swede named Abraham Fornander, whose interviews with elderly natives revealed that in times of famine on the islands, voyages were made to the mainland following the constellation of the Pleiades to replenish their larders. Voyages on such a course would inevitably have landed in western Mexico.

have contributed anything of cultural significance to the civilizations of Mesoamerica. Thus, with South America and Polynesia excluded as possible donors to the advanced societies of Mesoamerica, the only remaining sources of cultural diffusion of sufficient antiquity lay in East and Southeast Asia. Clearly, I now had to either cast my lot with the European and Latin American scholars who found no difficulty in espousing theories of trans-Pacific contact prior to the beginning of the Christian era and add myself to that intrepid handful of American pariahs like Meggers and Evans who had dared embrace such anathematic ideas, or I would have to join the thalassophobic establishment of American scholars who insisted on independent invention within Mesoamerica itself.

Before irrevocably committing myself to either camp, however, I decided that what was needed was some unified theory which would tie all the disparate clues and bits of evidence together. Although I had satisfied myself that I had worked out the origins and diffusion of the sacred calendar from Izapa, and linked with it such intellectual innovations as the astronomy on which it was based and the mathematics and hieroglyphics with which it was recorded, I wondered if other, more customary trace elements used by the archaeologist and ethnographer would provide supporting or contradictory evidence. What about stylistic patterns in art, as represented by ceramics and sculpture, or about linguistic patterns in southern Mexico? What light might such items shed on the people who had invented the calendars and where and how they had diffused through the Mesoamerican cultural realm? Surely, if evidence of Mesoamerican influence could be found in the religion and ceramics of South America where the calendars had not been adopted, then wasn't it likely that the same kinds of evidence might prove useful in tracing the paths of the calendars' diffusion into the regions where they had become an integral part of the peoples' lives?

For the field season of 1983, my readings and research would focus primarily on linguistics, because language is one of the most conservative trace elements there is. A people give up their language only with the greatest of reluctance. Hence, my reasoning was that if I could find out who the people were that lived in Soconusco in 1500 B.C., we might figure out not only where they came from but also where they may have moved as the calendars diffused. In the process, maybe I would have an answer to the question that had so long stumped the Mesoamericanists – who were the "Olmecs"?

My first acquaintance with the name of Morris Swadesh had come at the very outset of my research in Mesoamerica. A linguist at the University of Chicago, he had pioneered the field of glottochronology – the dating of linguistic changes through time. It was he, for example, who claimed that the degree of differentiation between the Maya and Huasteca languages, both spoken in the Gulf coastal plain of Mexico, indicated that they had become separated about 3200 years ago, i.e. about 1300 B.C. This one fact alone had intrigued me, since it corresponded so closely to the time of the calendars' origins.

Swadesh' fascination with the indigenous languages of Mexico must have prompted him to accept a position at the Universidad Autónoma de México, because his later literary citations all stem from UNAM. Among his contributions to the field was a diagnostic list of 100 carefully chosen words to expedite the comparison of one language with another, so, armed with this tool and a tape recorder, my plan was to go into the field and test it out. I was under no illusions about pretending to be a linguist, but I did want to acquaint myself with the spoken sounds of several of the languages of southern Mexico, if only because seeing them transcribed into a page of print using a Spanish alphabet left a lot to be desired. The languages I was interested in were those of preliterate peoples, who had no tangible way of

recording how a word should be pronounced or spelled. Moreover, as quickly became clear once I began my fieldwork, they were also dying languages, because they were being abandoned, especially by the younger generations, for Spanish instead. But, before I could venture into the field again on my own quest, I had a field program to teach during the winter term of 1983.

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As in our 1981 program, we concentrated our attention in western Mexico, first at a lowland base in Colima, and later at a highland station which this time we based in the charming old Indian town of Pátzcuaro. While the students busied themselves with their independent study projects, I availed myself of the fine local libraries to dig more deeply into the history and language of the native people – a mysterious tribe that called itself Purépecha, meaning "the late-comers" or "the recent arrivals". (Editor's note: They were known to the Spanish as the Tarascans, a term that is not only erroneous, as explained below, but also derogatory as well. As they began their conquest of Michoacán, the sex-starved Spanish soldiers set about raping as many of the local women as they could, while at the same time their accompanying friars were attempting to convert the Indians to Christianity. The poor, bewildered Purépecha could only understand this disgusting behavior as the white man's way of consummating marriage, so they attempted to "bless" the marriage by acknowledging the rapists as their "sons in law", and therefore greeted them with the word "tarhaskua", a 'favor' the Spanish then returned in addressing their new "fathers in law".)

In many ways, the Purépecha were "backward" compared to other of their Indian neighbors, for they had a counting system based on five, and their version of the calendar was a garbled replica of what they had belatedly picked up from the Aztecs. They had

originally counted time by the moon and their principal deity was the god of fire. Indeed, one of the most sacred of celestial objects to them was the constellation of the Southern Cross, but whether it was this or the star-group known as the Hyades, which they likened to a firedrill, is not totally clear. The people themselves also both looked and dressed differently than all of their neighbors, the men shaving their heads and wearing knee-length cloaks, and their women, to the horror of the puritanical Aztecs, going both barefoot and bare-breasted. In terms of their economy, they were hunters and fishermen of wide repute, and collections of their weapons in local museums included star-headed maces, similar to those Juan and I had seen in both South America and Polynesia. In only one respect were the Purépecha more advanced than the other peoples of Mesoamerica, and that was in metallurgy. The knowledge of smelting, casting, and fashioning metals was a cultural trait which appeared very late in Mesoamerica – most archaeologists placing the date somewhere around 800 CE – so if the Purépecha were indeed "late comers", perhaps it was they who brought the knowledge of metal working with them.

In his original study of the Purépecha language, Swadesh had concluded that, although it bore no relation to any other existing tongue in Mexico, it may have split off from Quechua in the Andean highlands as long as 50 centuries ago. However, in a more recent study completed by one of his students, Velazquez Gallardo, who is both a native Purépecha and a social anthropologist, any connection with a New World language was totally ruled out; indeed, he claimed that its nearest affinities were to be found with certain tongues in Eastern Asia instead.

The mystery of who the Purépecha were and where they had come from also piqued the curiosity of Spanish clerics, as soon as the excesses of the Conquest were over.

Interrogating those elders of the tribe who could be enticed into divulging the oral history of their people, the Spanish found the same difficulties in communicating with a preliterate people that I was about to encounter in my own research. One can almost imagine how the question and answer session went, the “white men of God” asking for information which the humble Indian was intent on providing in as solicitous a manner as possible.

Unfortunately, what emerged was as unlikely and garbled a narrative as can possibly be imagined. When asked where their ancestors had come from, the response was “far to the left”. At least by this time the Spanish had come to realize that, for the Indians, directions were determined by the path of the sun; since it crossed the sky each day from east to west, this meant that their original home lay far to the south. Further questioning revealed that their homeland was also “mountainous”, which the Spanish immediately assumed had to have been Peru. From there, a journey of “many moons” had brought their forefathers to a large river that the Spanish interrogator may have first confused with the Amazon. However, since that river lay chiefly in “Portuguese territory”, he ventured that they must mean the Orinoco instead, a suggestion that their informant happily seconded. When next asked how they got from the coast of Venezuela to Mexico, the reply was “on the backs of turtles”. At this point the cleric had no alternative but to assign such a response to the realm of ‘poetic license’, take a deep breath, and continue. When asked where they had landed on their arrival in Mexico, his informant may again have been at a loss for an answer, but another quick suggestion from the interrogator seems to have produced an acceptable reply: Veracruz, the same place where Cortez came ashore. But, if this were true, it raised another serious problem for the questioner. In order for the Purépecha to have traveled from Veracruz to their present home in the state of Michoacán, in the west of Mexico, they would have had to pass

directly through the territory of the Aztecs, who were known to be their mortal enemies. To the Spanish cleric, the only possible way they could have done that, was to have made their crossing before the Aztecs ever arrived, which, in turn, had to have been “pretty early”. On the other hand, because such a notion totally contradicted the very name the tribe used to describe themselves, the bewildered cleric must have realized that his interview wasn’t producing very convincing results and he decided to pursue another tack. Because the Purépecha lacked any form of writing, but were known to be masterful weavers, he suggested that they forget the oral history approach and preserve the story of their people's migration in a picture weaving instead, which he commissioned them to do. The remnant of this imaginative but beautifully woven tapestry, called the Lienzo de Jucutácato, still hangs in the State Museum of Michoacán, in its capital city of Morelia.

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Among the several field trips I escorted my students on in and around Michoacán was one to the old Purépecha capital of Tzintzuntzán, overlooking Lake Pátzcuaro. Here are the best preserved and most impressive structures of the Purépecha, that, once again, resemble nothing else in all of Mesoamerica. The largest structure has an elongated rectangular form, along the front of which, five half-circular protuberances called yacatas bulge out. Although I had first visited Tzintzuntzán in 1977, and again in 1979 and 1981, as I approached this commanding edifice this time, I noticed something which I had never paid attention to earlier: the yacatas were faced with the same kind of carefully cut and fitted stone that Juan and I had seen both at Tiahuanaco and at Vinapú. Locally called xanamus by the Purépecha, it definitely had both the appearance and the



Figure 43. The facing of the major Purépecha structures at Tzintzuntzan consists of finely cut and fitted stone slabs reminiscent of the façades of temples we had earlier seen both in Bolivia at Tiahuanaco and in Peru at Cuzco and Machu Picchu. Their distinctive language and early acquaintance with metallurgy also strongly supports a possible South American origin.

"feel" of the Andean stonework. Coupled with their worship of the Southern Cross and their proficiency in metallurgy – one of the few cultural innovations known to have been imported into Mesoamerica from South America – perhaps their origins and time of departure as recorded in the Lienzo de Jucutácato were not as far off as our hypothetical cleric came to conclude. Certainly,

their supposed route between the Andes and Michoacán was about as circuitous and unlikely as any geographic ignoramus could make it, but that didn't mean that, in reality, it couldn't have led them northward to the estuary of the Guayas, the largest river on the Pacific versant of South America, and then from there directly by sea to the west coast of Mexico. (We have already mentioned the massive migrations of turtles that take place between the Galápagos Islands and western Mexico, so invoking them in the history of the Purépecha no longer seemed so far-fetched.) Indeed, all the known minerals of Michoacán are likewise located in the basin of the Pacific-flowing Balsas river, so anyone who had a knowledge of their presence must at one time or another have had more than a passing familiarity with the Balsas Depression. The only piece that doesn't fit into this puzzle very neatly is the "second thought" that the linguists now have about what the origin of the Purépecha language may be. Who is correct: Swadesh, the professor, or Gallardo, his student?

Having safely delivered my students back to San Antonio at the conclusion of our winter term program in western Mexico, I retrieved my faithful pick-up from storage and set off for a few days of relaxation on the Texas coast with my new field assistant. Like Juan before him, Alex had first enrolled in my freshman seminar, had been converted to the "true faith" and become a Geography major, and had accompanied me on the Mexico field program just completed. Now he was looking forward to probing into the recesses of southern Mexico to see if he could help me answer the 64-dollar question: who were the "Olmecs"?

When Alex and I started into the field to collect our data on linguistics, we first got out a map showing the distribution of Indian languages in present-day Mexico. Our goal was to pinpoint the municipios, or communes, in which the dominant language in the first instance was Popoluca, in the

second Zoque, and in the third, Mixe. As an aside, I also wanted to make a detour into the coastal area of Tehuantepec where Huave was spoken, because the fact that it was reputed to be so different from the languages around it had piqued my curiosity.

To interview speakers of the Popoluca language we decided that the most representative municipio would be one called Soteapan, despite the fact that its very name was Nahuatl rather than Zoquean. Having taken refuge on the eastern slopes of the Tuxtlas, the Popolucas promised to be the easiest of the three tribes to reach, since this was the least rugged of the upland areas into which they had been pressed. From our overnight stop at Acayucan, it was a fairly short drive into the foothills and, once off the main highway, the local dirt road was in reasonably good condition. As it turned out, the Popolucas were also the most flattered by our interest in their language and the most eager to assist us in completing our Swadesh-inspired diagnostic glossary.

Our linguistic map revealed that the heart of the Zoque speaking area of Mexico lay in the rugged northwestern corner of Chiapas state, where the quiescent volcano El Chichón had suddenly come to life scarcely over a year earlier. So unexpected and violent had been its eruption that more than 2,000 persons had been killed in the initial explosion, and its continuing outpouring of cinders and ash had wreaked havoc over a wide area of southern Mexico. Moreover, it belched so many contaminants into the atmosphere that scientists reported that their effect could be discerned in climate changes around the world. The municipio that demonstrated the largest number of Zoque-speakers was Copainalá, which entailed a 60-mile drive over one mountain range, a descent into the canyon of the Grijalva River, and a climb into a second mountain range close to the slopes of El Chichón. Understandably, the road itself had been damaged by the ash-fall, and as we neared the town of Copainalá itself, we found that much of it looked like a war-zone, for the roofs of many houses and of the village church itself had caved in under the weight of the volcanic debris.

Inquiries as to who might assist us in our language study soon led us to octogenarian Castulo García Hernández and his wife, who graciously received us into their home. Only two years earlier, when the Summer Institute of Linguistics was preparing a Zoque dictionary, it was Sr. García who had served as their primary source. Quite naturally, most of the local young people are abandoning Zoque in favor of Spanish and, as a result, Sr. García and his wife represent some of the last native-speakers of this language. Even so, when Sr. García found his memory failing and called upon his wife for assistance, one realized how tenuous an existence this ancient tongue currently retains.

More remote still are the Mixe, who inhabit the mountains of northeastern Oaxaca state. Alex and I determined that the most accessible center of Mixe-speakers was to be found in the municipio of Ayutla, so we made that the third goal of our linguistic research. However, in arriving at the offices of the Presidente of the Municipio about noon, we found that the “presidente” himself and an associate, to whom he seemed to defer on all decision-making matters, were not only suspicious of our interest in their language but totally unwilling to cooperate in our study. After half an hour of unsuccessfully trying to assure them that we were not devious gringos with something more malicious in mind, I told Alex to watch my change of tactics. With that, I proceeded to take out the notebook in which we had recorded the Popoluca and Zoque glossaries, and I said to the Presidente that, because they refused to cooperate with us, I would not “include them in our book”. He asked “What book?” and I pointed to the notebook, and opened it to a page of the glossary. Glancing at it a moment, he looked up at me and asked, “Where did you get our language?” I smiled and replied, “It’s not your language. It’s Popoluca language, and a couple of pages farther on, it’s Zoque language.” He glanced back at the page, and then looked at me again. “Those are our words,” he insisted, but I shook my head. “I said no, there are other tribes who speak like the Mixe do, but if you don’t want to help us, you won’t be in our book.” A quick consultation with his advisor settled

the issue, and from then on the two of them were eager to make sure that the Mixe language was “in our book” as well. Once back in our hotel in Oaxaca, Alex and I were quick to begin our analysis of how many of the 100 diagnostic words of Swadesh’s list we could recognize as being similar. Between the Popoluca and the Zoque, we found that two-thirds were close enough to identify, whereas with the more isolated Mixe, only about half of the words had survived intact. To be sure, the exact statistics were not as important to us as the knowledge that the Zoquean peoples still retained a recognizable identity in each of their respective mountain refuges, more than 3000 years after their initial dispersal!

Chapter 16 – The “Olmec” Incarnation

Apart from being a far more central question to my research than finding out who the Purépecha were, the "Olmec" question was also far more complicated. The Spanish, for instance, had never had an opportunity to talk to the elders of the "Olmec" tribe or to interrogate them about their origins. In fact, the Spaniards had never even heard of the "Olmecs", as they are presently defined. Indeed, nobody was aware that such people even existed until as recently as 1862.

Mexico in 1862 was a nation in convulsion. The bloody War of the Reform was still going on, for although Liberal troops had occupied the capital and Juárez had been elected President, groups of die-hard Conservatives were continuing their fight in several outlying districts. In other areas, uncontrolled by either faction, gangs of bandits terrorized the countryside. And, in the midst of this chaos, French troops had landed in Veracruz and began marching toward Mexico City, intent on crushing the government of Juárez and installing in its place the Archduke Maximilian of Austria, would-be Emperor of Mexico.

Unmindful of these tumultuous events in the life of his country, a gentleman traveler by the name of José Melgar was journeying through the steamy lowlands of Veracruz in that very year. He was, no doubt, equally unmindful that he was about to open a new chapter in Mexican history in his own right.

As he was traveling in the vicinity of San Andreas Tuxtla, he was told of a strange stone sculpture that had been unearthed a few years earlier, as a nearby patch of forestland was being cleared to make way for a sugar plantation. At first the peon who discovered it thought it was a large iron kettle, for only a portion of its rounded surface projected above

the ground. He reported his find to the plantation owner, who promptly ordered its excavation. Far from being a kettle, however, it turned out to be a gigantic stone head, measuring almost two meters (6 feet) in height. When Melgar, in the company of the plantation owner, went to view the head, he was, in his own words, "struck with surprise: as a work of art, it is without exaggeration a magnificent sculpture". But Melgar's surprise did not end there, for the features of the face were unlike those of any sculpture yet seen in Mexico. Its thick lips and flat nose seemed to be those of a typical Negroid physiognomy, and in his report to the Mexican Society of Geography and Statistics published in 1869, Melgar could not resist speculating that "there had undoubtedly been Negroes in this country, and that this had been in the first epoch of the world".

Without realizing it, Melgar had not only provided the scientific community with its first report of an "Olmec" artifact, but he had also initiated what was to become a long and heated debate as to the origins of this mysterious people. The "Olmec problem", as it has been called, has kept the archaeologists embroiled in almost constant controversy as new finds have been made and new theories to explain them have been advanced at an accelerating rate with each passing decade. But, before we can hope to understand why the cultural historians of the New World have been so preoccupied with the problem of the "Olmecs", we must recapitulate a bit on how the mystery of these ancient people has unfolded.

Melgar's African hypothesis found staunch support in the writings of Alfredo Chavero, a renowned jurist, political administrator, poet, and playwright who was also Mexico's leading authority on prehistory at the time. In his ambitious volume entitled "Mexico Through the Centuries" published in 1887, Chavero not only included an

etching of Melgar's Colossal Head but he also illustrated a carved axe upon which a face strikingly similar to that on Melgar's sculpture was shown. Thus, it was Chavero who first realized that the artifacts that were coming to light in the jungles of eastern Mexico were not just isolated phenomena but part of a larger cultural complex, as yet unnamed.

It remained for a Frenchman, M. Alfonse Pinart, writing in the Journal of the Geographical Society of Paris in 1885 to provide a name for the culture, albeit an extremely poor, misleading, and totally inaccurate one. In his article entitled "Opinion on the Subject of the Olmecs", he described the Tepehua Indians on the eastern slopes of the Sierra Madre Oriental (to the south and west of the city of Veracruz) as speaking a language that they called "Ulmeca". Apparently this was the same group of people who were living in this same region of eastern Mexico when they were described as "Olmecs" in the 16th century chronicles of Father Bernardino de Sahagún. The sheer fact of their presence in the same geographic area where these strange archaeological finds were being made had led Pinart to assume that it was the "Olmecs", or Tepehuas, who had been responsible for them. Little did he seem to realize that what had been true in the three hundred years since Sahagún, was probably totally false in the two thousand years preceding Sahagún. Nevertheless, despite the valiant efforts of subsequent researchers to disassociate America's most ancient civilization from this Johnny-come-lately tribe of Tepehuas, the appellation "Olmec" has stuck. Thanks to Monsieur Pinart, the name of this completely undistinguished tribe has undeservedly become the trademark of the New World's most sophisticated early culture.

The next scholar on the scene was a German named Eduard Seler who visited the Veracruz region with his wife in 1905. In addition to photographing the Colossal Head

and a subsequently discovered stone box covered with elaborate carvings (now known as Monument C from Tres Zapotes), Selser called attention to sixteenth-century sources that indicated that the "Olmecs" had originally come from the highlands to the west and hence were quite unlikely to have been the artisans responsible for these ancient and mysterious artifacts. However, in Frau Selser's account of the trip (1906), no attempt was made to suggest an alternative explanation for their origin.

A year later another exciting discovery was reported to the scientific community. The then-curator of the Smithsonian Institution in Washington, W.H. Holmes, published a description of a weird little jade statuette that had been unearthed some years earlier as a farmer was plowing his field near San Andres Tuxtla. The 17 centimeter (6.5 inch) tall figurine depicted some kind of a winged creature with a duck's bill, but most significantly, its sides and back were covered with hieroglyphic writing, some of which bore an unmistakable resemblance to Mayan numbers. When these numbers were deciphered, they revealed a Long Count date that equated to 162 A.D. -- older by more than a century than anything discovered in the Mayan region itself.

Needless to say, this came as very unsettling news for most Mayanists, for here was an artifact that used the same kind of numerals as the Maya, that was found far outside of the traditional Maya homeland, and that recorded a date considerably older than anything the Maya themselves had inscribed. Unthinkable as it might seem, could there have been somebody before the Mayas? Somebody who might have been sophisticated enough to devise a calendar and a system of hieroglyphic writing to record their observations? No -- for most Mayanists, it was pure heresy to even suggest such a possibility! Surely the Tuxtla Statuette had been carved by the Mayas and carried to

Veracruz -- certainly it was small enough to have been readily transported. Or, maybe the "somebody" else who copied the Maya numbers and calendar system used a different starting date when they reckoned time, so that the statuette wasn't really as old as it seemed to be. Whatever the explanation might be, it was disconcerting to realize that recognized "Mayan" cultural innovations such as calendrics and hieroglyphics were turning up in the "wrong" places geographically, within the "wrong" time-frame as well.

But the Tuxtla Statuette was only the first of many rude jolts that the archaeological fraternity was to receive from the misnamed "Olmecs". In 1924 an even earlier Long Count date showed up in an even "weirder" geographic location. The place was a coffee plantation called El Baul in the foothills of the Pacific coastal plain of Guatemala, and the researcher was an American by the name of T. T. Waterman. Yet, it was a German named Walter Lehmann who, in reading Waterman's paper and studying the photographs it contained, realized that one column of hieroglyphics contained a date, which when deciphered could be equated to 36 A.D. (Actually, Lehmann originally calculated the date as equivalent to 28 A.D., but it was subsequently corrected by Michael Coe.) Not only did the El Baul stela push "Maya" calendrics and hieroglyphics back by more than another century, it also had them appearing in another region as remote from the Mayan heartland to the south as Veracruz was to the west. Besides, the El Baul stela had obviously not been transported from anywhere else, as the Tuxtla Statuette might have been.

In 1925, under the auspices of Tulane University, the Danish-born archaeologist Frans Blom and his young American assistant, Oliver LaFarge, began a two-man expedition to explore the Gulf coast region of Mexico. Although they discovered a

handsome idol executed in the purest "Olmec" style on the flanks of the volcano San Martín Pajapan in the Tuxtlas, it was so different from anything with which they were familiar that they dared "not venture to ascribe it definitely to any culture". However, when they later discovered the great "Olmec" site of La Venta on the banks of the Rio Tonalá, – including what they termed "the most amazing monument of them all", a second Colossal Head – they "were inclined to ascribe these ruins to the Maya culture". To Blom and LaFarge, La Venta was "a place of many puzzles", but neither of them had the slightest inkling that what they had stumbled upon was one of the largest and oldest ceremonial centers ever constructed by the "Olmecs". On the other hand, after reading a review of their findings, a German scholar by the name of Hermann Beyer was prompted to comment that the idol which they had found on the slopes of the Tuxtla volcano and a figurine which had formerly been in his possession were so similar that they both must have been the product of the same "Olmecan or Totonacan civilization".

Two American museum curators who had been working with the steadily increasing number of strange artifacts to come out of eastern Mexico were coming to the same conclusion. Marshall H. Saville of the Museum of the American Indian in New York City, writing in 1929, stated that the artifacts he had examined could be "safely assigned to the ancient Olmecan culture". Three years later, George C. Vaillant of the American Museum of Natural History espoused essentially the same view when he concluded, "the Olmec fulfill very well the requirements for the peculiar art styles we have been discussing". He spoke of the geographical distribution of the "Olmecs" (Pinart's Tepehua peoples), of their skill in working jade and turquoise, and their supposed familiarity with the use of rubber and how their position appeared to coincide

with the distribution of "tiger-face" and "baby-face" sculptures which had in effect become their very trade-marks. If Pinart had been guilty of applying a misnomer to the "Olmecs", Vaillant, more than anyone else, deserves the credit (?) for solidifying the term in popular usage. He did recognize the need for more intensive field work in the area, however, and later the same year (1932) the Smithsonian Institution's Bureau of American Ethnology set up a program to investigate some of the regions peripheral to the Maya heartland.

About the same time, a young Mexican woman archaeologist was conducting some of her own research in one of these peripheral regions. In March 1934, Eulalia Guzmán visited the awesome trio of ancient volcanic plugs that rise out of the floor of an arid mountain basin in eastern Morelos state. There, high up on the side of the vertical rock face of the middle peak, she found a series of carvings done in the characteristic "Olmec" style. One of these shows a person seated inside what appears to be a cave, while phallic-shaped raindrops fall from puffy cumulus clouds above. On adjacent rocks a variety of growing plants are depicted. Another scene portrays what is no doubt a human sacrifice. A naked male, bound at the wrists, reclines against a jaguar-masked idol while two men in ornate jaguar masks carrying spears or maces advance on him and a third holds aloft a stalk of corn. Although Ms. Guzmán brought the so-called Chalcatzingo reliefs to the world's attention, she failed to recognize them as being "Olmec" in origin, attributing them instead to "the Teotihuacanos, or the Archaics".

The depression years of the 1930's were hardly the time for the Smithsonian Institution to look to Congress for any appropriations to finance expeditions into the jungles of Mexico. However, early in 1938, the director of its Bureau of Ethnology,

Matthew W. Stirling, came up with a "brain-storm" that not only reactivated American research in the "Olmec" area but also greatly accelerated it. Journeying down to southern Veracruz, he located the Colossal Head first described by Melgar and photographed it extensively. Then, returning to Washington, he used the photographs to convince the Board of Directors of the National Geographic Society that the time had come for them to help underwrite this modern epic of exploration. If they would provide the funds, he would provide the "copy" which promised to keep millions of American readers spellbound in the decade to come. Indeed, for most Americans, including yours truly, Stirling's popularly written, lavishly illustrated articles in the National Geographic magazine were their first real introduction to the "Olmec problem".

Early in January, 1939 Stirling was back in Tres Zapotes, his first priority being to totally excavate Melgar's Colossal Head. Thereafter, in short order, he uncovered the ornately carved box first described by the Selers and a large stela that bore the signs of having been intentionally smashed. His most exciting discovery came just two weeks after he arrived in Tres Zapotes – a piece of a stela containing a typical "Olmec" jaguar-mask on one side and a typical "Mayan" calendrical inscription on the other. Although no baktun number was in evidence (i.e., the first number in any sequence describing a Long Count date), from the context of the remaining digits it seemed apparent that only a reading of "7" would make any sense at all. According to the recently formulated Goodman-Martínez-Thompson correlation, Stirling worked out a date equivalent to 31 B.C., which meant that the so-called Stela C of Tres Zapotes had now become the oldest dated artifact in the New World. However, for some reason, when the National Geographic published Stirling's first article, they chose to use the generally discredited

correlation of Herbert Spinden instead. (The Spinden correlation made all Long Count dates some 260 years older than the Goodman-Martínez-Thompson correlation.) The editors no doubt reasoned that the magazine's readers would be even more impressed by Stirling's Stela C if it had been carved in 291 B.C.! Be that as it may, Stirling himself considered the find nothing short of a miracle, for, as he said, "If three inches more had been broken off either the top or the bottom of the monument, the date never could have been determined!"

It is safe to say that some of the Mayanists may have preferred it that way, for Stela C was even more unsettling than either the Tuxtla Statuette or the El Baul stela had been. Our old friend, J. Eric S. Thompson, the foremost of these authorities, had attributed both the invention of the Mesoamerican calendar and numerical system to the Maya, so he was especially quick to attack Stirling's transcription of Stela C. Sylvanus G. Morley, the other great partisan of the Maya, was tardier in his response but no less critical than Thompson had been. (It is interesting to note that only after radiocarbon dating had firmly established Stela C within the time-frame of Baktun 7 did Thompson get around to conceding that Stirling might have been correct in his reading after all. Probably even more miraculously, the missing fragment of Stela C with the baktun digit was later found, and it was a number "7"!)

With a successful first season behind him, Stirling returned to the field in 1940 with renewed National Geographic backing. This time he headed for La Venta to find the Colossal Head first reported by Blom and LaFarge. Again, the fates smiled on him, for he not only located the monument they had described, but three other Colossal Heads as well, together with five other previously known sculptures and fourteen entirely new

monuments – all within ten days time. He then moved over to the Cerro de Las Mesas site where his crews turned up twelve additional stelae and eight further monuments.

So encouraged was he at Cerro de Las Mesas that Stirling resolved to continue digging there during the 1941 field season. This time there were some more routine discoveries, but not until the last day in the field did he hit the "jackpot" – a cache containing 782 pieces of jade. Since he was running short of time, Stirling had the entire assortment dug out and packaged for shipment within half an hour!

The following year he was back at La Venta again, trying to pin down the chronology of the site with some precision. His big finds of this field season were a basalt burial chamber replete with more jade and another jaguar mask. By this time, however, the "Olmec problem" was engendering such acrimonious debate that the Mexican Anthropological Society decided to sponsor a "round table discussion" to see if some sort of consensus could be welded out of the strongly conflicting views.

The meetings were convened at Tuxtla Gutiérrez, the capital of Chiapas state, late in the summer of 1942. Very quickly the two opposing camps were identified: Mexican archaeologists such as Alfonso Caso and Miguel Covarrubias argued that the "Olmecs" constituted a "mother culture" which had preceded the Mayan and the other classic cultures of Mesoamerica. The American faction led by Thompson and Stirling held that the "Olmecs" were contemporaries of the Maya. Although the round table did not succeed in reconciling these widely divergent views, it did help to promote a clearer understanding of who the "Olmecs" really were and what was distinctive about their art forms. These contributions were largely the product of Mexican initiative, the former

being summarized by the historian Wigberto Jiménez Moreno in a paper entitled "The Enigma of the Olmecs" and the latter defined by the talented and versatile Covarrubias.

In Stirling's 1943 field season at La Venta, he unearthed two large mosaic floors, each composed of tons of serpentine slabs and each depicting a huge jaguar mask. Since he still believed that the "Olmecs" and the Mayas were contemporaries, Stirling devoted the following year's field work to exploring what he considered to be the interface between the two cultures – the region along the lower reaches of the Grijalva river, but without producing any noteworthy results. A short visit to the Pacific coastal plain and highland areas of Chiapas in 1945 confirmed for Stirling the presence in these regions of "Olmec-like" artifacts, but his most intriguing find of the season once again came from the Gulf coast area. There, near a branch of the Rio Coatzacoalcos, he was shown a collection of local antiquities by the village schoolmaster, among which was an unmistakable "Olmec" monolith. Though severely defaced, the monolith clearly depicted a male-jaguar having sexual intercourse with a woman. Here, for the first time was physical evidence of what most other "Olmec" art seemed to imply, namely that these ancient people conceived of themselves as having had jaguar forbearers.

In the jungle nearby, Stirling was led to a site even larger and more impressive than La Venta -- a place called San Lorenzo. Here, gazing up at the sky from its resting place in the bottom of a deep ravine was the largest Colossal Head Stirling had ever seen, nearly three meters (9 feet) tall. In rapid succession, several other discoveries were made, including a La Venta type altar, a figure holding an infant, and a seated anthropomorphic jaguar. Small wonder that Stirling returned to San Lorenzo for the field season of 1946, and this time he unearthed four more Colossal Heads, all apparently rolled into the same

ravine where he encountered the first huge head the year before. From another nearby site he recovered a second erotic sculpture of a jaguar copulating with a woman, as well as an altar and two other major monuments. Thus, Stirling terminated his seventh and last season in the field, having brought to light more "Olmec" artifacts than any single researcher before or since. And yet, despite all of his discoveries – or indeed, perhaps because of them – the "Olmec problem" only seemed murkier than ever. There was still no way of knowing which school of thought was right – the American which saw the "Olmecs" as just one more Classic culture alongside the Maya, or the Mexican which still maintained that what had been uncovered was nothing less than a highly sophisticated civilization ancestral to all the others.



Figure 44. The author at San Lorenzo in 1983, the oldest Olmec site in eastern Mexico.

Chapter 17 – The Maya Imperilment

Stirling's retirement coincided with the end of one era and the dawn of another, for all of his work had been done before the advent of radiocarbon dating. His principal field assistant on several of these expeditions had been Philip Drucker, and to the latter had fallen the task of trying to establish the time-frame into which Stirling's many discoveries should be placed. Like Stirling himself, Drucker continued to believe that what they had been unearthing in the jungles of Veracruz and Tabasco was essentially contemporary with the earliest stages of Classic Mayan development in the Petén region of northern Guatemala.

By 1948 the technique of determining the age of organic specimens through radiocarbon dating was beginning to be applied to archaeological remains, and among the earliest samples tested from Mexico were several from Preclassic agricultural villages near present-day Mexico City. The results that came back from the laboratories took all but the most radical protagonists of "Olmec" antecedence by surprise, for they yielded dates as early as -1500 BCE.

One such site was Tlatilco that lay on the northern edge of the Mexican capital. Now a center for making bricks, Tlatilco's clay pits regularly gave up a variety of figurines and pottery vessels, some of which were clearly "Olmec" in design. In 1947 Miguel Covarrubias finally succeeded in winning support for a scientific investigation of the site and in 1950 an ancient cemetery containing no fewer than 203 graves was discovered. This find turned out to be extremely important in understanding the role played by the "Olmecs", for side by side in the same strata lay the humble grave offerings of the peasant masses and the sumptuous and sophisticated wares of an elitist minority. The latter pieces

showed no evidence of having evolved in situ, but rather the many stylistic traits they shared with Gulf Coast artifacts suggested a sudden introduction from that quarter. Covarrubias could now speak with renewed assurance that an advanced "Olmec" elite had moved in from the east and come to dominate an already existing but obviously more backward agrarian society.

While Stirling had been concentrating his attention on the Gulf coast region of Mexico, other researchers were turning up artifacts in the "Olmec" style farther and farther afield. In fact, rather than be accused of seeing "Olmecs" in such widely divergent geographic areas as Guatemala, El Salvador, northern Veracruz, and the western state of Guerrero, many researchers found the use of the term "Olmecoid" to be especially congenial. It meant that they could call an artifact "Olmec-like" without necessarily arguing that the "Olmecs" themselves had produced it.

In 1955 Drucker led a new expedition to La Venta, still determined to learn where in the time-scale of Mesoamerican cultural history this important site should be placed. This time he was accompanied by Robert Heizer of the University of California, a meticulous stratigrapher who was sensitive to the subtlest changes in soil color and texture. Through careful excavation and mapping they were able to provide the first accurate description of the site itself. From their work it emerged that La Venta was a carefully planned ceremonial complex whose dominant feature was its 31-meter (100 foot) clay pyramid. To its north lay a plaza flanked by two long, low mounds, all symmetrically positioned along an axis oriented 8° west of true north. Realizing for the first time that the principle of symmetry had been used in the layout of La Venta, Drucker and Heizer not only managed to uncover the two mosaic floors found by Stirling but they also located a

third of which he had had no inkling. Incredible as it may seem, the jaguar-faced mosaics were made from an estimated 1200 tons of serpentine, the nearest source of which lies more than 160 kilometers (100 miles) to the south on the Pacific slope of the Isthmus of Tehuantepec.

In their first report, issued in 1956, Drucker and Heizer guessed that the oldest phase of occupation at La Venta stemmed from about the time of Christ, while the last of four stages that they could identify might be dated about five hundred years later. Surely, no one was more surprised than they were when the radiocarbon results came back with dates ranging from 800 to 400 B.C., nearly a millennium earlier than their estimates. At last the evidence was in hand and an answer could be given to the question which had prompted the ill-fated "round table" discussion more than a decade earlier: the Mexican faction in the great "Olmec" debate had been right, and the American group, so stubbornly wedded to their idea of Mayan pre-eminence, had been wrong. Unfortunately, the artist Covarrubias, one of the leading protagonists of the "mother culture" school, did not live to see his viewpoint vindicated.

Significantly, the next major "Olmec" discovery was of a hitherto unknown site located about halfway between Tres Zapotes and San Lorenzo. Known as Laguna de los Cerros, it was excavated by the Mexican archaeologist Alfonso Medellin Zenil in 1960 and proved comparable in size and importance to both San Lorenzo and La Venta. In all, Medellin uncovered twenty-seven monuments and mapped some ninety-five mounds.

In 1965, Medellin tracked down a rumor that another Colossal Head had been discovered at San Lorenzo. Arriving at the site, he found that a sixth monstrous "Olmec" head lay half-exposed in the side of a ravine. Similarly, a few months later, a couple of

children living farther up the valley near Jesus Carranza decided that they would take home with them a shiny, green rounded rock that they had found sticking up out of the bright red soil. When they finally got it uncovered, they saw that it was the statue of an ornately tattooed man sitting cross-legged and holding a baby in his arms. Today this masterpiece of "Olmec" art reposes in the State Museum at Jalapa, Veracruz.

American interest in the "Olmec" question was vigorously revived in 1966 with the beginning of three seasons of careful excavation carried out at San Lorenzo under the leadership of Michael Coe of Yale and supported by the National Science Foundation. Thanks to his meticulous stratigraphic control, Coe was able to demonstrate that the monuments of San Lorenzo had not been hurriedly smashed and toppled into the adjacent ravines, as Stirling's first reports had suggested; they had, to be sure, been deliberately broken but then had been painstakingly interred as if in some form of ritual burial. By carefully mapping the site of San Lorenzo, Coe was also able to demonstrate that this important ceremonial center had been constructed on top of an extensive man-made terrace some 50 meters (160 feet) in height. The ceramics that Coe uncovered showed strong affinities with types from the Pacific coastal lowland of Guatemala whose radiocarbon dates averaged between 1000 and 800 BCE.; of the charcoal samples that Coe found, five out of six ranged between 1200 and 850 BCE. Thus, San Lorenzo seemed to fit into the "Olmec" chronological scale somewhere about the same time as the Pacific coast sites, but just ahead of La Venta.

Just as Coe was beginning his work at San Lorenzo, one of the most exciting discoveries of the "Olmec" world was reported from the rugged state of Guerrero in the west of Mexico. There, a retired Italian steel company executive, Carlo Gay, whose

fascination with "Olmec" art had led him to roam the mountains of central and western Mexico in an almost quixotic quest for new finds, came upon the Mesoamerican equivalent of Altamira or Lascaux. Hidden more than a kilometer within the dank recesses of the great Juxtlahuaca cave were the oldest paintings yet discovered in the New World, done in typical "Olmec" style. One depicts a large standing figure wearing a plumed headdress and jaguar skins and holding a smaller, kneeling figure on a rope as if he were a captive. Another painting seems to show a crouching jaguar and a rampant serpent about to do battle. In all, the three line-drawings and three polychrome paintings constitute a subterranean gallery of "Olmec" pictorial art, hidden from the light of day and tucked into one of the most remote and isolated mountain regions in all of Mesoamerica. Though they constitute a unique addition to our appreciation of these ancient people, the Juxtlahuaca murals likewise heighten the mystery surrounding the "Olmecs". What stories were they meant to tell? Why were they painted in the innermost bowels of the Earth? How did the "Olmecs" find their way into this wild mountain fastness, so distant from their main area of settlement? What clues, if any, might they provide to the ultimate origins of this strangely sophisticated, yet dimly known civilization?

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More than a century of research and exploration had gone on between Melgar's first fortuitous encounter with the Colossal Head of Tres Zapotes and Gay's discovery of the Juxtlahuaca paintings. Yet, there were still no answers as to who the "Olmecs" were or where they had come from. Thanks to radiocarbon dating, at least one major problem in the "Olmec" debate had been definitely resolved: the "Olmecs" were the antecedents of the Mayas and not their contemporaries. Beyond that, however, few other positive

statements could be made about them. A belief in their descent from the jaguar unquestionably colored their religious lives. Their consummate skill in carving and polishing jade testified to a level of technology more sophisticated than their early appearance would have hinted at. Similarly, the Colossal stone heads, the great buried jaguar-mask mosaics, the huge man-made terrace at San Lorenzo and the clay pyramid at La Venta all bespoke a highly organized society which could command tremendous inputs of labor from the masses – a society undoubtedly dominated by an elite of chieftain-priests who wielded a life and death grip over their subjects. Moreover, it was a society capable of generating the surpluses of food necessary for the support of the priestly caste and for the great urban/ceremonial centers which constituted the physical expressions of their spiritual and temporal authority. And, what was perhaps the most surprising, it was a society capable of producing such surpluses under some of the most difficult ecological conditions in the world – the tropical rainforest.

Agreement on these points was general, but on little else as it turned out. Even these "facts" left a lot of doubt in the scholars' minds. How could the "Olmecs" have become such accomplished artisans and administrators without a lengthy process of evolution? What were the antecedents that could be cited for their growth and development? Certainly, no civilization springs full-blown into existence -- above all, not in the midst of tropical jungles and swamps. Where should one look for the origins of the "Olmecs"? And, if there was doubt as to how early the "Olmec" civilization had appeared, then there was just as much doubt as to when their sway over Mesoamerica had come to an end.

Obviously, the question of "Olmec" origins was probably the most important, because if it could be established where the civilization had developed, perhaps answers would begin to fall into place with respect to some of the other questions as well. Michael Coe, writing in 1965, argued that the "Olmec" culture originated in the "heartland" of southern Veracruz and northern Tabasco, most probably at San Lorenzo because the earliest radiocarbon dates stem from there. However, he conceded that their original home may have been in the Tuxtla Mountains, since this is where most of their building stone came from and it was probably one of the many volcanoes in this region which served as an inspiration for the fluted-cone pyramid at La Venta; if such were the case, their origins may lie forever buried beneath deep layers of lava and ash -- which would certainly account for no antecedents having ever been found.

Alfonso Caso tended to agree in part at least, contending that the "Olmec" civilization, like those of the Near East, was the product of the great alluvial valleys that one finds so prominently in evidence on the Gulf coastal plain of Mexico. It was their fertile soils, he argued, that made possible the food surpluses that in turn gave rise to the great urban developments of the "Olmecs". Of course, Caso made no distinction between the environments through which their respective rivers flowed, those in the Old World being deserts and that in the New World being a rainforest. To him, the "hydraulic" parallel was close enough.

William Sanders, an American archaeologist from the University of Pennsylvania, disagreed, pointing out that all the Old World civilizations were based on irrigation techniques developed in arid lands; therefore, the urban origins of the "Olmecs", if they paralleled those of virtually every other known civilization – and there was no good

reason to believe that they didn't – must have been in the semi-arid basins of the Mexican plateau. In short, it was quite inconceivable to Sanders that the "Olmecs" should have been such an exception to the "rule" that they could have developed the necessary agricultural surpluses in a tropical rainforest environment, when no other culture in the world appeared to have been able to do so.

Roman Piña Chan, the Mexican archaeologist, agreed in part with Sanders, suggesting the likelihood that, because of the relatively numerous "Olmec" finds which have been encountered in and around the state of Morelos, this area must have been the cradle of their civilization. Using much the same line of argument, but stressing a stylistic progression, the artist Covarrubias believed it was on the Pacific slopes of the states of Oaxaca and especially Guerrero that we should seek the origins of the "Olmec" culture; it was in the latter areas, he said, that "its most archaic forms appear". Charles Wicke, an American anthropologist, essentially seconded Covarrubias' motion, specifically zeroing in on the Mixteca Alta region of western Oaxaca where a particularly primitive monument had been discovered at the village of San Martín Huamelulpan. Edwin Ferdon used much the same rationale to argue for the primacy of the Tehuantepec region, having discovered a fairly early representative of "Olmec" sculpture at Tonalá, whereas S.W. Miles would push the "Olmec" heartland even farther south into the Pacific coastal plain of Chiapas and Guatemala, likewise on the basis of "archaic" sculptures.

Despite the diversity of these opinions, they in no way exhaust the list of alternatives that have been suggested. While no one gave serious consideration to José Melgar's original thesis of an African birthplace for the "Olmecs", this has not stopped reputable archaeologists like Gordon Ekholm, Director of the American Museum of

Natural History, and the German, Robert Heine-Geldern, from suggesting "Olmec" ties to Shang Dynasty China. Michael Coe himself, while not looking to overseas impulses for the "Olmecs", has not hesitated to suggest that they were the precursors of the Chavín culture in Peru.

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This was essentially the status of the "Olmec problem" when Ignacio Bernal, then Director of the Museum of Anthropology and History in Mexico City, wrote his volume entitled The Olmec World in 1969. Here, in a handsome work numbering less than 200 pages of text, is an eloquent synthesis of virtually everything of importance that had been learned – and/or deduced – about America's oldest civilization. To be sure, the picture that emerges is fragmentary at best but, on the basis on this evidence, such as it is, Bernal boldly formulates a number of hypotheses. While the critical reader may not find the latter totally consistent or convincing, Bernal has nevertheless done an effective job of drawing together in a single volume what might be called "the best thinking" on the subject up to that time.

Like Caso and Coe, Bernal subscribes to the theory that "Olmec" civilization was born in the tropical rainforests of the Gulf coastal plain. Here, in a region plagued more by an excess of precipitation than by a scarcity of it, the "Olmec" response to the challenge of the environment (a la Toynbee) took the form of cutting back the luxuriant tree-growth and fighting off the swirling floodwaters of the great rivers that converge in this part of Mexico. Indeed, here, where the jungles are all but impenetrable and vast areas are poorly drained swamps, only the rivers afforded any ease of movement. Not too surprisingly, the "Olmecs" were heavily dependent on aquatic fauna for their livelihood, including fish,

shellfish, turtles, and waterfowl. Yet, no civilization could be based on the hunting and gathering of such creatures alone, no matter how abundant they were, so the "Olmecs" were also settled agriculturalists who grew the standard triad of Mesoamerican staples: maize, beans and squash. In the lush rainforests of eastern Mexico it was possible for them to grow two crops a year – the first and largest, the so-called milpa del año, being harvested between mid-November and mid-December, and the second and usually somewhat smaller crop, the so-called tonamil, coming due the following April or May. Yet, despite the bountiful surpluses that this dual harvest yielded each year, the soil fertility was rapidly depleted in this hot and humid region. As a consequence, for every acre that was actually being used to produce food, there were at least five other acres that were of necessity lying fallow at any given time. Nevertheless, it was these food surpluses that made possible the rise of what Bernal has termed the "dispersed cities" of the "Olmecs", for he concedes that true urbanism did not appear until Teotihuacán and its irrigated agriculture, well over a thousand years later. Thanks to the success of "Olmec" agricultural practices, the Gulf coast region of Mexico was probably the most densely settled area in Mesoamerica by the end of the first millennium of the pre-Christian era. While he can neither confirm nor deny his estimate, Bernal thinks that as many 350,000 people may have resided in the eastern jungles at this time. Yet, he is also cognizant of the low "carrying capacity" of this swampy rainforest region and contends that the strong demographic pressures that were generated here soon were responsible for an extensive wave of colonization that moved into adjacent areas of Mesoamerica.

Missing from Bernal's scenario is any attempt to explain the "antecedents" of the "Olmecs" in the Gulf coastal plain. Rather than implying that they were "just there",

Bernal suggests that the arrival of the "Olmecs" in eastern Mexico may have been responsible for driving a wedge between the Maya and the Huasteca people, both of whom spoke the same language some 3200 years ago according to Swadesh. Although he finds the coincidence in timing (roughly 1300 B.C.) very intriguing, he doesn't carry his speculation any farther by telling us where the "Olmecs" may have come from when they supposedly drove their wedge into the Maya-speaking coastal plain. He is content to observe that the "Olmec physical type" may be observed among older Indian groups in the south of Mexico and let's it go at that.

But what is the "Olmec physical type" and how might it be recognized when we see it? Bernal tells us that the primary characteristics are low stature, bodies tending toward obesity, slanted puffy eyes with an epicanthic fold, a short wide nose, a mouth with thick lips and down-turned corners, a prominent jaw, and a short heavy neck. Some carvings like Melgar's Colossal Head are unmistakably Negroid, yet they likewise have the improbable addition of a Mongoloid trait, the epicanthic fold. Still another type seems to show up later – a fine nosed, thin-lipped, taller type individual such as the personage referred to as "Uncle Sam" on Stela 3 from La Venta. So out of character is he with other "Olmecs" that Covarrubias considered him to have been a "visitor".

Despite the fact that "Olmec" statuary depicts a variety of "physical types", Bernal feels that their resemblance to other races is "only accidental", and was the result of an "aesthetic ideal". Obviously, what was aesthetically pleasing to the "Olmecs" might seem rather "weird" by contemporary standards, for they also appear to have favored deforming the skulls of their children by binding a tight band around their foreheads shortly after birth. Furthermore, their idea of handsome teeth included filing them to points and

insetting them with bits of colored stone such as jade or hematite. They likewise seem to have had a morbid fascination with pathologic individuals, for many "Olmec" sculptures depict dwarfs, hunchbacks, and what appear to be lepers, cretins, and other unfortunate persons. Especially strange are their many depictions of nude or semi-nude males, all of whom are missing their genitals. Bernal does not think this results from any sense of modesty on the "Olmecs" part, but that they may represent eunuchs instead. If such was the case, the resemblance can scarcely be "accidental".

"Olmec" society, insofar as Bernal has been able to reconstruct it, appears to have consisted of a small religious-political elite, a somewhat larger group of specialized artisans, and a great mass of peasant farmers. It was the latter, of course, that provided the society's sustenance, but it was the former who established the community's objectives and directed its energies. Indeed, all temporal and spiritual authority would seem to have been vested in the sophisticated clique of chieftain-priests at the apex of the "Olmec" hierarchy. It was they who dictated what the skilled jade workers and stone carvers should produce and how the great pyramids and terraces should be constructed. It was only they that possessed the requisite knowledge of astronomy to orient their great ceremonial centers and to calibrate their calendars. It was only they who had been schooled in the hieroglyphic writing that recorded the notable events and significant dates in the history of their people. And, it was only they who could interpret the will of the gods for the common people.

Perhaps to enhance the aura of awe which surrounded them, the "Olmec" priests not only built their religion around the cult of the jaguar, the largest and most frightening beast of the Mesoamerican jungles, but they also sought to establish their own descent

from him. Their "myth of creation" seems to have been embodied in such sculptures as those discovered by Stirling – a lineage that traced itself back to a jaguar-father and a human mother. Perhaps they believed that by establishing a kinship with him, they might be able to appease him in some manner. Yet, the jaguar deity apparently was not satiated, for, as Bernal points out, human sacrifice – possibly of infants – may have played an integral role in "Olmec" religion.

The most characteristic trait of Mesoamerican civilization, Bernal maintains, was ceremonialism that he defines as the vast importance given to rites and to religion in general. This, after all, was the very *raison d'être* for the ceremonial centers that the priests designed and ordered built. This likewise seems to have been at the root of the sacred ball game and the justification for much of their art. Bernal suggests that "the priests rose to a dominant position in an agricultural society when they became, among other things, experts on the calendar". Yet, no calendrical inscriptions have been found at either San Lorenzo or La Venta and the only dated monument from Tres Zapotes is Stela C that bears a Long Count date equated to 31 B.C. Though it was first considered to be "too old", now Stela C would seem to be "too late", though Bernal emphatically states that "It is almost a positive fact that the first inscriptions were carved in wood and therefore have disappeared". Use of the Long Count system for recording dates is based on positional notation and therefore implies knowledge of the concept of zero -- an idea it appears that the "Olmecs" hit upon well before the Hindus, who were responsible for bequeathing it to western civilization. In any event, the knowledge of astronomy, of the calendar, of hieroglyphic writing and of the numerical system was all intimately bound up with the power of the priestly elite and was no doubt jealously guarded by them. Indeed, Bernal

speculates that the ultimate cause for the downfall of "Olmec" civilization may have been a peasant revolt against the priesthood that not only removed the ruling caste but, in the process, also destroyed the very fountainhead of their intellectual strength.

Beneath the priests in the "Olmec" hierarchy were the specialized artisans -- "the lapidaries of great virtuosity who worked the jade and the first-rate artists who carved the stone monuments". Bernal goes so far as to say that "The Olmecs were not only the first and finest sculptors in Mexico; they were also the first to work jade and indubitably were the greatest in this medium". He quotes Stirling as saying that "Olmec jades rival the finest Chinese pieces" while he himself credits the "Olmecs" with having "practically discovered the secret of carving jade and worked it to a perfection which no other people would achieve in the history of Mesoamerica". That the "Olmecs" should have been capable of such an achievement is all the more impressive when one realizes that there is no jade -- or any other stone for that matter -- in the jungles of eastern Mexico. The jade used by the "Olmecs" was jadeite, a stone which is harder, more lustrous, of brighter colors, and of rarer occurrence than the nephrite used by the ancient Chinese. Its source appears to have been in the southern Sierra Madre, most likely from the central portion of Guerrero state. As a consequence, Bernal believes that jade was an important item of trade for the "Olmecs" and that the quest for this precious material may have triggered their later diffusion into the Mexican highlands.

(Editor's note: In 1983, about the same time that Alex and I were conducting our linguistic survey among the Zoquean peoples, a Mexican woman archaeologist by the name of Dra. Guadalupe Martínez Donjuán was beginning the excavation of a site she had recently discovered in the Balsas River valley of Guerrero state. Inasmuch as this was

precisely the area that Covarrubias had suggested was likely to have been one of the earliest areas of Olmec occupation in Mexico, it was only fitting that Dra. Martínez not only quickly established that it was definitely Olmec in origin but also one of their oldest sites as well, dating to at least 1000 BCE. Moreover, despite the fact that a recently published American study had just concluded that the earliest use of dot-and-bar numerals in Mesoamerica came from Monte Albán, she was able to demonstrate that these had already been in use 400 years earlier at this new-found site, and that it also boasted one of the earliest irrigation projects ever identified in Mexico, built by the way, to almost exactly the same gradient as modern irrigation projects utilize. She concluded that the reason the Olmecs had come into this area at so early a date was to exploit a local jade deposit in the Balsas valley, whose identity was subsequently lost during the Spanish colonial period, because the Spanish interest in minerals was limited almost entirely to silver and gold. She named the site “Teopantecuanitlán”, meaning “Place of the Temple of the Jaguar-God”, after one of its principal structures.)

In addition to jade, the "Olmec" lapidaries worked serpentine, obsidian, amber, and amethyst, all of which likewise had to be imported from the mountains to the west and south. Many of these stones were fashioned into the nose and earplugs, necklaces and pendants worn by the priests or into the votive axes and celts used in their rituals. One example of "Olmec" precision stone working for which Bernal can deduce no function, save perhaps personal adornment, are the mirrors of magnetite, a black iron ore which seems to have come from the Pacific side of the Isthmus of Tehuantepec. "Their polish", he states, "is so extraordinary that it reaches the limit of possible perfection"; these magnetite mirrors constitute "one of the most notable technical advances of the Olmecs".

Their precision-ground concave shape has been shown to have too long a focal length to concentrate the rays of the sun for generating fire, and the fact that they all have small holes drilled on their upper edges suggests that they may have served as very resplendent pendants hung around the necks of the priests.

Not unlike their fellow lapidaries, "Olmec" sculptors and stone carvers were also obliged to work with materials imported from great distances. Most of the basalt used in the Colossal Heads and in the great altars of San Lorenzo and La Venta had to be quarried in the Tuxtla Mountains and rafted along the coast and up the rivers to the sites in which they were finally set in place. Because in some instances this involved the transport of individual blocks of stone weighing in excess of ten tons, it is most likely that it was accomplished with the aid of canoes decked over with logs. Certainly this would have afforded the most stable and commodious type of watercraft available to them. Even so, the movement of any given block from the quarry to the seaside or from the river bank to the site on which it was ultimately erected would have involved the labor of scores if not hundreds of men in each instance. For this purpose, of course, the masses of peasant farmers were periodically enlisted, just as they were to move the thousands of tons of colored clays used to construct the ritual burials of the jaguar masks and the pyramid at La Venta and the great artificial terrace identified by Coe at San Lorenzo. Phenomenal as the number of man-days of labor must have been in the production of such works, it is likely that the clays at least were derived fairly close at hand. However, it was quite another matter with the serpentine slabs used to construct the buried jaguar mosaics at La Venta, for in this instance an overland movement of some 1200 tons of stone from quarries some

160 kilometers (100 miles) to the south seems to have been involved – no doubt, a few slabs at a time on the back of each man.

Thus, it fell to the peasant masses in "Olmec" society not only to grow the crops that sustained themselves, the artisan class, and the priestly aristocracy, but also, on command of the latter, to devote their labor to the grandiose construction projects that the priests ordained. Bernal suggests that such projects were not only carried out once at a given site, but that there may be evidence of a periodic reconstruction of La Venta about once a century during the four hundred years of its occupance. The cyclical meshing of the sacred and secular calendars used by the "Olmecs" occurred only every 52 years, and in later Mesoamerican civilizations such as the Maya and the Aztec, major renovations or rebuildings of earlier edifices were carried out at such an interval, whereas double cycles of 104 years (when the planet Venus also came back into phase with the two calendars) were apparently marked by even more special projects of renewal. Bernal, among others, suggests that the peasant masses may finally have rebelled against being pressed into service for such repetitive purposes, for in the name of religion they were literally required to ritually bury their entire ceremonial center every 52 or 104 years within a new "layer" of construction. Whether it was this or some other cause for disenchantment, Coe's discoveries of what appear to have been the purposeful desecration and burial of monuments at San Lorenzo about 900 B.C. seems to support the theory of unrest among the masses. Yet, such unrest could not have been fatal to the whole of "Olmec" society, for even though San Lorenzo was eclipsed at this time, La Venta and Tres Zapotes were just beginning to flourish.

This fact inevitably raised another question to which Bernal devotes some time. Was there such a thing as a unified "Olmec" empire, or did the individual ceremonial centers such as San Lorenzo, La Venta, and Tres Zapotes function as separate city-states? Bernal definitely favors the former, citing an observation of Stirling who noted "the very direct and close communication between different Olmec sites, which seems to point to close bonds and therefore to one government for all of them, although (he conceded) the similarity could be explained in other ways". Bernal states that "There are good reasons to suppose that La Venta was a capital, in spite of the fact that its geographic position is unspectacular and isolated. It is the only Olmec site where what might be called "royal tombs" are to be found. From La Venta come the greatest number and the best jade pieces so far discovered. Furthermore, it is by far the most elaborately planned city, the one with the largest pyramid, carefully preserved and improved during at least four hundred years". Thus, in summarizing the political structure of the "Olmec" state, Bernal calls it "a military theocracy with an extremely important religious basis".

If such, indeed, was the personality of "the Olmec world", its characteristics were most strongly developed in what Bernal calls the "metropolitan area" of the Gulf coastal plain. From their cultural hearth in this region, he believes that the "Olmecs" sent out traders, missionaries, and perhaps soldiers into adjacent areas, owing to increasing demographic pressures within their homeland. Where such "Olmec" migrants took up residence and managed to retain their culture essentially intact, Bernal has referred to these places as "Colonial Olmec" sites; Tlatilco, on the outskirts of Mexico City, is an example. On the other hand, in those areas where a fusion of "Olmec" cultural traits with those of the local indigenous groups seems to have taken place, Bernal uses the term

"Olmecoid" to describe the resultant blend. Among the more important sites to which he attaches this label are Monte Albán and Izapa.

If, up to now, Bernal has written with a certain sense of confidence and authority, it is because he has not required the reader to make great leaps of faith between the facts as revealed in the field and the conclusions that may be drawn from them. However, it is when Bernal starts to discuss these outlying "Olmecoid" centers that he really begins to "waffle". Monte Albán, in particular, he finds both highly significant and intriguingly enigmatic. The oldest phase of Monte Albán, he says, was contemporaneous with the second phase of "Olmec" development in the metropolitan zone, but was not derived from it. He maintains that "This explains why Monte Albán was more advanced in some aspects but behind in others compared with the Olmec". Among the traits in which Monte Albán showed precocity, Bernal lists calendrical knowledge, hieroglyphic writing, the emergence of a religious pantheon, and the development of pottery. Speaking of the latter, Bernal observes that "the Olmecs were not great potters nor did they dedicate their interest and talent to this minor art". He goes on to say, "It is curious that the finest and most beautiful ceramic ware is found at the sites belonging to the Colonial Olmecs and the Olmecoids and not in the Metropolitan Area". He concludes his discussion of Monte Albán with the observation that "It was a culture which did not diffuse, and whose products, style and knowledge rarely left its confines. I cannot claim to understand the reasons for this but archaeology indicates clearly that it is so. It may be supposed therefore that much was imported from outside and that Monte Albán is only an extraordinarily distinguished heir".

This latter statement of Bernal is especially curious because it seems to contradict some of the principal ideas he had put forth earlier. Although he had made the point that

the oldest phase of Monte Albán was contemporaneous with the second period of "Olmec" development in the Metropolitan Zone, he argues that its culture was not derived from that area; later he states that Monte Albán imported much of its culture from outside, so we are left wondering where these imports came from if they did not emanate from the "Olmec metropolitan region". Bernal likewise stresses the point that the culture of Monte Albán did not diffuse; yet, somehow the "Olmecs" of the metropolitan region seem to have learned about the calendar, the hieroglyphics, and the numerical system, all of which supposedly developed first at Monte Albán.

When Bernal examines the "Olmecoid" cultures of the Pacific coast region of Chiapas and Guatemala (i.e., Soconusco), he raises several other intriguing questions. Among the most notable remains of the Pacific coastal plan are some Colossal Heads, similar to those of the metropolitan zone, found chiefly in and around Monte Alto in Guatemala. There are also several representations of seated figures that he says are almost identical to those in the metropolitan area. Bernal goes on to say that "This does not necessarily mean that all are contemporaneous; it seems more probably that some are older, since they range from an extremely coarse art to another style which is reminiscent of the "Wrestler" from Uxpanapa". The same strong similarities are found in the bas-reliefs at Chalchuapa, El Salvador, for as Bernal observes, "Curiously -- in view of its great distance from the Metropolitan zone -- the style is one of the most characteristically Olmec in the entire Pacific watershed". He then goes on to cite Coe's observation that the pottery from the Conchas period at Ocos on the Guatemalan coast is identical to that at La Venta, while likewise noting that the ceramic period at nearby Izapa corresponds precisely to that at Chiapa de Corzo in the central valley of Chiapas. Bernal does admit, however,

that "Some difficulties arise in correlating with precision the periods at Chiapa de Corzo with Olmec II, since Chiapa I would seem earlier". Thus, we are left with the impression that Pacific coast artifacts of the "Olmecoid" style are virtually identical with those of the metropolitan region, but may indeed be "older" than those from which they were supposedly derived.

"Waffles" of these kinds are indeed "food for thought".

Chapter 18 – The Final Judgment

In my freshman seminar on the origins of civilization in the New World, I always had my students first explore the literature on the "Olmecs" in depth, because only if they understood what is known and unknown about this enigmatic people would they have a framework into which they could fit my own research findings. Thus, when Alex and I started into the field in the spring of 1983, he was well versed in the "establishment" view of the "Olmec problem", but as eager as I was to test whether the "unified theory" approach that I had been evolving through the years would really stand up.

There were a number of different threads that would have to be woven together before the whole cloth of a finished fabric would emerge. As far as I was concerned, the warp was already in place. The spatial-temporal patterns of the origin and diffusion of the sacred calendar, its astronomical base and its hieroglyphic expression, were both clear and consistent. From a cultural hearth in Soconusco in the 14th century B.C. they had spread across the Isthmus of Tehuantepec to the Gulf coast of Mexico where they bifurcated, one arm reaching east to embrace the Maya and the other west to enfold Teotihuacán. What remained was to lock in the weft -- any and all cross-threads which would complete the overall design. These threads I would draw from the basic physical geography of southern Mesoamerica; from the evolution of the art forms of the region, especially of sculpture and ceramics as far as they were known; and from the linguistic patterns of the region.

In the half-dozen years I had spent probing the jungles and deserts of Mesoamerica for clues relating to the sacred calendar, I had come to acquire a considerable familiarity with the physical geography of the region. Far from having been a passive stage on which the drama of the "Olmecs" was acted out, southern Mexico was a region whose

diversity in landforms, bedrock, minerals, climate, vegetation, and soils played a critical role in influencing where and why the major events of the story occurred as they did.

That part of Mesoamerica that Bernal termed the "Olmec metropolitan area" is centered in the Gulf coastal plain of southern Veracruz and adjacent Tabasco. It is in this region that the most extensive alluvial lowlands of Mesoamerica are found, the latter being the result of the heaviest concentration of precipitation anywhere in Mexico. Moisture-laden winds blowing in off the Gulf meet the steep walls of the uplands fewer than 100 km (60 miles) inland and, as a consequence, this east-facing mountain-front receives more than 2000 mm (80 inches) of rainfall per year. The low latitude of this region, combined with its low elevation and heavy precipitation, insure that its vegetation is in most parts high tropical forest of the broadleaf evergreen variety. Even so, there is a marked seasonal variation in rainfall within the region, so that the volume of water carried by the rivers may vary by as much as tenfold between May (at the end of the dry season) and September (at the peak of the rainy season). Indeed, changes in river levels of the magnitude of 10 meters (33 feet) are not uncommon, and, in this region of minimal relief, widespread flooding results in the creation of extensive swamps. It is, in short, a region of high temperatures, high humidity, and rampant vegetation growth. Its soils are riverine deposits of silt and alluvium -- a region totally devoid of bedrock. Its climate ranges from tropical-humid to super-humid in the windward uplands.

Rising out of the Gulf coastal plain in southern Veracruz and almost entirely encircled by it is the volcanic massif known as the Tuxtlas -- a cluster of cinder cones and small stratovolcanoes, none of which exceeds 1500 meters (4900 ft.) in height. Opening southward from the Gulf coastal plain is the structural lowland known as the Tehuantepec

Gap – the only place in Mesoamerica where it is possible to cross between the two oceans at an elevation of scarcely 300 meters (1000 ft.) Indeed, apart from the low hills that form the continental divide near the southern side of the Isthmus, the Gulf coastal plain is virtually continuous with that bordering the Pacific. The latter, however, is quickly pinched out to the west by the Sierra Madre del Sur in Oaxaca but continues as a narrow fringe along the Pacific margin of Chiapas on into Guatemala, where it broadens out to a width of some 50 km (30 miles).

Although topographically an extension of the Gulf coastal plain, the Pacific lowland may be divided into two quite distinct climatic and vegetation regions. Once the height of land is crossed from the Gulf, the dense rainforest of the north quickly gives way to low scrub forests on the south. Here, in the lee of the main mountain barrier of Mesoamerica, the dry season becomes so pronounced that the entire isthmian area warrants a tropical sub-humid designation. However, from Tonalá southward along the coast, the rainfall increases rapidly once again, resulting in a dense tropical rainforest throughout southern Chiapas and adjacent Guatemala. It is this region that was known in pre-Columbian times as Soconusco, prized among the ancients as the source of cacao, rubber, and quetzal feathers. Thus, while it is climatically very similar to the Gulf coastal plain, Soconusco had a special importance, thanks to its wealth of exotic trade items. Moreover, lying as it does on the flanks of both ancient crystalline and younger volcanic mountains – the dividing line between the two formation occurs almost precisely along the present political boundary between Mexico and Guatemala – Soconusco was likewise blessed with an abundance of stone that was used both for construction and artistic purposes.

Rugged mountain massifs rise on either side of the Tehuantepec Gap, the one to the west culminating in Zempoaltepec (3395 m, 11,135 ft.) near the northeastern corner of Oaxaca, and the one to the east rising in ever-higher ridges into the heart of Chiapas. In both mountain areas, patterns of climate and vegetation change dramatically with elevation and exposure, varying from cool, moist uplands covered with oak and pine forests to sub-humid interior valleys where both steppe grasses and prickly pear cactus are prevalent. In both mountain areas there is likewise a striking transition in geologic age and complexity from north to south, with the younger, least-disturbed sedimentary formations nearer the Gulf coast and the older, more jumbled crystalline outcrops in close proximity to the Pacific. Thus, in contrast to the essential simplicity of the physical patterns of the lowlands of southern and eastern Mesoamerica, the mountain areas of the region are characterized by great local diversity.

Given the character of the physical setting of southern Mesoamerica, it is easy to appreciate that the movement of people, goods, and ideas within the region has usually taken the path of least resistance, that is, along the Gulf and Pacific coastal plains and through the Tehuantepec Gap between them. Despite the fact that the largest rivers of the region all flow toward the Gulf and that the continental divide lies far closer to the Pacific than it does to the Gulf, there are no easy approaches from the Gulf to the highlands, either of Oaxaca on the west or of Chiapas in the east. This is because the rivers of the region are antecedent streams that have breached the uplifted mountain massifs in spectacular canyons. The Grijalva River, for example, has incised to a depth of more than 1200 meters (4000 feet). Thus, approaches to the interior mountain areas are actually easier from the Pacific side, with the valley of the Tehuantepec River affording a route of penetration to within 20 km of the great interior

valley of Oaxaca, while a couple of passes break through the lower western ridges of the Sierra Madre into the central depression of Chiapas.

Now, how might these facts of physical geography have influenced the patterns of cultural diffusion in the region? Judging from the character of Bernal's metropolitan area, the "Olmecs" were a people thoroughly at home in a humid tropical environment. Had they wanted to expand their settlement into areas with similar physical conditions, they might have done so either by moving westward along the Gulf coast into central Veracruz or eastward into Tabasco and Campeche. However, even the most cursory reconnaissance southward across the Tehuantepec Gap would have brought them face to face with the sub-humid, scrub-forest environment of the Pacific coastal plain of Oaxaca – an area quite unlike that in which their civilization supposedly took root. The incentive for undertaking such a radical move would have had to be compelling at the very least. (This is not to suggest that "Olmec" influences did not penetrate into regions of very dissimilar physical geography, for they are found, for example, in such sub-humid areas as the central valley of Oaxaca at Monte Albán and in the highlands of Morelos at Chalcatzingo. However, no evidence of "Olmec" settlement has ever been found in the scrub-forest regions of southern Tehuantepec.)

For the sake of argument, were we to postulate a scenario that has the "Olmecs" originating in the humid tropical environment of Soconusco and adjacent Guatemala and then spreading out from there, we would find the extent of suitable land far more restricted, both for reasons of topography and climate. Indeed, as a result, population pressures would more quickly have convinced them of the need for seeking out other humid tropical niches of the kind with which they were familiar. On the Pacific coastal plain, this type of environment

extends from northwestern Nicaragua across present-day El Salvador and Guatemala into southern Mexico, as far as the entrance to the Tehuantepec Gap. There, as we mentioned earlier, the climate becomes markedly drier and the vegetation becomes scrub, but, ironically, not without the promise of more attractive lands beyond: anyone who reaches the entrance to the Tehuantepec Gap from the south cannot miss seeing the towering build-up of cumulus clouds across the Gap to the north. Anyone responding to this invitation and venturing through the Gap would find himself in the midst of a verdant lowland far more extensive than anything he had yet encountered. Whether this scenario is valid or not, it is an interesting geographic fact that the earliest identifiable "Olmec" ceremonial center is that at San Lorenzo, near the northern entrance to the Gap, whereas later centers such as La Venta and Tres Zapotes are both located farther to the east and west, respectively, in the Gulf coastal plain proper.

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Thus, if we accept Bernal's argument of population pressure as the mechanism for migration, it can easily be seen that it would have had a lot more force – and temporal consistency – if we turn his arrows around and point them from Soconusco to the "metropolitan zone" instead of in the opposite direction.

Although archaeologists may pay scant attention to arguments of physical geography, they do set considerable stock in the comparative study of pottery types as diagnostic tools in determining relationships between culture areas. It was only fitting, therefore, that we examine the evidence relating to this critical trace-element, so one of Alex' and my stops was in San Cristóbal de las Casas to visit the field station of the New World

Archaeological Foundation. There we could interview professionals who had worked in this region for over a quarter of a century.

According to Dr. Thomas Lee, Associate Director of the Foundation, the earliest pottery found at San Lorenzo has unquestioned antecedents in the Ocós phase found along the Pacific coast of Soconusco. Moreover, Lee pointed out that the white-rimmed black pottery common to both areas has come (quite belatedly, he confessed) to be recognized as characteristic of the Zoque peoples who currently inhabit the northwestern sector of Chiapas. Interestingly, Pierre Agrinier, also of the NWAFF, notes that the earliest pottery from the Ocós phase is by all odds the most sophisticated found anywhere in southern Mesoamerica, while that from San Lorenzo represents a rather less carefully made imitation. (It was Coe who had established that Ocós pottery is identical with the Chorrera phase in Ecuador, and in his work on the "Olmecs" published in 1980, he goes so far as to call the pottery found at San Lorenzo "a country version of the far more sophisticated Ocós phase of Guatemalan Soconusco".) Thus, even if the people responsible for making the pottery did not themselves move from the Pacific coastal lowland to the "Olmec metropolitan area", there is clear evidence that their knowledge of pottery styles and techniques diffused in that direction.

Another diagnostic of cultural diffusion cited by archaeologists such as Ferdon and Miles is the evolution of stone sculpture within Mesoamerica. Unlike pottery, carved stones cannot be reliably dated. Although the so-called "Fat Boys" of the Pacific coastal plain may not be as ancient as the 2000 B.C. date John Graham of the University of California has suggested for them, there is little question but that the most primitive examples of the sculptor's art all stem from the Pacific side of Mesoamerica, and especially Soconusco. As I mentioned earlier, it was in this region that the raw materials, including both granite and

basalt, were readily available for carving, unlike the "metropolitan area" where stone had to be fetched from the Tuxtlas some 60 to 80 km (35-50 miles) away. In fact, it is very likely that the famous serpentine jaguar mosaics at La Venta were fashioned from stone quarried on the Pacific coastal plain near Niltepec, more than 200 km (120 miles) to the south, and that as much as 1200 tons of the green rock was transported across the Isthmus for their construction. All along the Pacific foothills of the Sierra Madre from Arriaga in the north to the Guatemalan border in the south one finds large, round, exfoliated granite boulders that may have served as an inspiration for the Colossal Heads so typical of the Gulf coast "metropolitan area". At Iglesia Vieja near Tonalá, for example, are some of the most primitive carved statues in Mesoamerica, yet at the same site is found some of the most impressive stone construction work. Clearly, the Pacific coastal plain of southern Mesoamerica not only provided the raw materials but was also an ideal training ground for developing a tradition of stone working, unlike the "metropolitan area", where, because of the lack of stone, it is difficult to imagine any such skill having arisen without outside influence.

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An old adage reminds us that "People who live in glass houses shouldn't throw stones". By the same token, the moral of our story is that "people who live in alluvial coastal plains can't carve stones" – unless, of course, they learned how somewhere else. It is possible, though rather unlikely, that the idea of stone sculpture could have diffused from Soconusco to the "Olmec metropolitan area" without involving any major movements of people. So, if we are to establish that not just goods and ideas moved between the two areas but that people, too, were involved, we must turn to a trace element characteristic of the

actual human beings themselves. Here, one of the most reliable "tools" has been the language they speak, because, as suggested earlier, it is only with the greatest of reluctance that one usually abandons the vehicle of communication he or she grows up with.

Most linguists have accepted the idea that Mayan languages were spoken along the entire Gulf coast region of Mexico since the earliest Formative times (ca. 1500 B.C.) Thus, many archaeologists, among them Jiménez Moreno, Thompson, Coe, and Bernal, believed that the "Olmecs" spoke a Mayan tongue. Lee observes, however, that there is not a single linguist who thinks the "Olmecs" spoke Mayan. In this connection, we are reminded of Swadesh and his contention that a split occurred among the Maya-speaking peoples living along the Gulf coastal plain around 1300 B.C. – a separation that accords very closely to the rise of San Lorenzo in southern Veracruz. At that time it appears that a wedge was driven into the midst of the Maya language area, forcing some of the peoples to the west and northwest to become the Huastecas and the remainder to the east to become the Yucatecas, or Lowland Maya. (Although Bernal also suggested the idea of a linguistic "wedge", he did not venture to tell us where it came from.) For such a wedge to have effectively separated a relatively densely settled people suggests that it was far more likely to have been the result of a sustained overland movement from the south (through the Tehuantepec Gap) than it was of a sea borne invasion from the north. Moreover, for some time linguists have recognized the similarity of four languages in southern Mesoamerica, but their current geographic separation has complicated the reconstruction of pre-Columbian language patterns within the region. One of the four – Tapachulteco, once spoken in the mountains of Soconusco behind Izapa and the present-day city of Tapachula – is now extinct; the other three, while in active retreat before the intensified Hispanization that is going on as a result of Mexico's economic

modernization, are still spoken by approximately 60,000 persons. Of these, the largest group – slightly more than half of the total – are Mixe speakers residing in the rugged mountains of northeastern Oaxaca. The second-largest group – comprising about one-third of the total – is the Zoques, who today reside in the mountains of northwestern Chiapas. The final group, the Popoluca, who constitute scarcely one-sixth of the members of the combined Mixe-Zoque-Popoluca language family, inhabit the eastern slopes and foothill region of the Tuxtla Mountains in southern Veracruz.

That the four groups at one time formed a contiguous or continuous geographic pattern is as apparent as the original contiguity of the Maya and Huasteca; however, to link the four groups in any convincing geographic manner would involve a connection along the Pacific coastal and through the Tehuantepec Gap – along precisely the arteries of movement suggested by the diffusion of pottery-making and the postulated diffusion of stone sculpture. That the four peoples came to be so isolated one from the other is easily explained by the subsequent movement of other linguistic groups into or through the same lowland corridors. Perhaps the earliest of these pressures was felt in the 7th century A.D. when Chiapanecs, moving out of the central plateau as Nahua-speaking Toltecs pushed southward, spread into west-central Chiapas. Apart from giving their name to the state as a whole and providing many local place names, the Chiapanecs appear to have been culturally assimilated by the Zoques in the succeeding centuries. About the same time, or perhaps even earlier, Maya-speaking peoples began pressing into the highlands of Chiapas from the northeast, while on the west it is likely that the Zapotecs posed an increasing threat after the 8th century when their Mixtec neighbors became more restive. It remained, however, for the militant Aztecs to reshape the linguistic map of southern Mesoamerica most thoroughly, impressing their

Nahua-tongue on subjugated peoples all along the Gulf coastal plain down to the Tehuantepec Gap, across the latter and down the Pacific coast into Soconusco during the 15th and early 16th centuries. The latter region was a primary goal of their trading expeditions and, when combined Zapotec-Mixtec resistance closed the southern end of the Tehuantepec Gap in the late 15th century, the Aztecs were obliged to open a more difficult alternative route to Soconusco through the interior of Chiapas and over the Motozintla pass to the Pacific. As a result, anyone caught in the path of these military and commercial advances had little recourse but to retire into refuge areas in the adjacent mountains if they sought to preserve either their economic or cultural independence. Thus, the Popoluca withdrew into the eastern Tuxtlas, where they remained the most vulnerable of the three extant groups and suffered the greatest inroads into their numbers. The Zoque retreated into the mountains of northwestern Chiapas, a rugged area of little commercial interest to the Aztecs, hence of little subsequent cultural disturbance. Such too, was the fate of the Mixe who, from a tropical lowland environment in the San Lorenzo region, found themselves pushed up into the oak-and-pine forested uplands (2000 meters, 6500 ft. high) of northeastern Oaxaca, an area that not even the highland Zapotec seem to have coveted. It is they, then, who are the most numerous, the most aloof, and the most culturally impoverished of the original Mixe-Zoque family. (Researchers like Foster had commented on the cultural "crudity" of the Mixe, a result no doubt of their having had to give up much of their material culture, including even some of their staple crops, when they were forced up into the mountains. Alex and I were told that today "mountain beans" constitute one of the principal items in their diet.) Their early separation and long-continued isolation from the rest of their linguistic brethren is seen in the fact that scarcely half of the words they use have

recognizable equivalents in Zoque and Popoluca, whereas the latter two groups share about two-thirds of their vocabularies in common.

Although Jiménez Moreno commented on the correspondence between the distribution of the Zoquean language and "Olmec" settlement patterns forty years ago, substantial support for any hypothesis linking the two has appeared only in the past decade. Thanks to the convincing linguistic studies of Campbell and Kaufman, and more recently of Stross, there now seems little doubt that the "Olmecs" were people of Zoquean speech, a conclusion that Gareth Lowe, Director of the New World Archaeological Foundation, likewise came to after extensive study in the Chiapas region. Geographically, there is a strong correlation between the distribution of the Zoquean language on the one hand and the demonstrated diffusion of pottery styles and techniques, the postulated diffusion of stone-working traditions, and the reconstructed scenario of the expansion of "Olmec" settlement on the other. Each of the latter trace elements in turn argues more strongly for a movement emanating from the Soconusco region of the Pacific coastal plain and spreading northward through the Tehuantepec Gap into the "Olmec metropolitan area" than in the opposite direction. That this is the same pattern of movement that I hypothesized earlier for the diffusion of the calendar from Izapa comes, therefore, as no "surprise" to me, but rather as convincing support for the idea that the "Olmecs" were in fact people of Zoquean speech who originally resided in Soconusco and for reason of the population pressures generated in that limited area of tropical rainforest, began moving across the Isthmus of Tehuantepec into the middle of the Mayan area as early as 1300 B.C.

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When such disparate pieces of the puzzle as ceramics, stone-working techniques, linguistics and glottochronology all fit together in a spatial and temporal pattern as snugly and coherently as these, the geographer feels most confident in speaking of a process of "cultural diffusion" having been at work. That these traits should have diffused from a region whose unique geographic circumstances – latitude and lowland tropical ecology – produced a highly original mechanism for keeping time – the sacred almanac – and at a time when the archaeological evidence testifies to a major shift in agricultural land use (from manioc to maize), merely reinforces the importance of Soconusco, and especially Izapa, as the major cultural hearth of pre-Columbian North America. I was curious, therefore, to discuss with Dr. Lowe what, if any, progress had been made in further work at Izapa, for it was he and his team that excavated the site and has been publishing the results of their findings in a sporadic series of monographs ever since.

The first thing he mentioned was that, although the earliest reports issued in 1973 and 1976, saw little or no evidence of any calendrical inscriptions at Izapa, he had subsequently (that is, after my hypothesis on the calendar's origin at Izapa had been published in Science in 1973) re-interpreted the inscriptions and concluded that they are largely calendrical in nature. (I could accept this as a belated and back-handed way of admitting that my basic calendrical hypothesis was correct -- but not so fast.) Lowe then said he had consulted with an astronomer to determine with what astronomical events and period the glyphs would best correlate. Their results suggested a first century A.D. time-frame he said, which would date them near the end of Izapa's existence rather than toward its beginning, as my hypothesis argued. (I was curious as to his choice of astronomer-consultant, because the latter was an individual who does not even accept the Goodman-Martínez-

Thompson correlation that is so widely favored in archaeology, but prefers a correlation of his own devising. After I learned that he was also a member of the Mormon church, I can only leave it to the reader to deduce why such a consultant was chosen.) However, when I indicated to Lowe that the glyphs at Izapa would describe the same astronomical events one Sothic cycle earlier, on reflection he conceded that they would correlate "precisely". (A Sothic cycle is a measure of time discovered by the Egyptians and measures 1461 years. Since the Egyptians measured time by using the star Sirius instead of the sun, they found that its rising "slipped ahead" by four minutes each day. After 1461 years of such "slippage" the stars and the sun were once more back in phase with each other.) This meant that a 14th century B.C. interpretation of the glyphs at Izapa would be fully as accurate as a 1st century A.D. reading. Of course, it was the former time frame that my computer studies had pointed to, and which Lowe himself had first "correlated" so closely with the shift in dietary patterns in the Soconusco region from manioc to maize. (Again, I must leave it to the reader to deduce why Lowe preferred the 1st century A.D. interpretation). In any case, I now had the satisfaction of knowing that not only was Izapa 'full of calendrical inscriptions', but that they likewise described astronomical phenomena that could very well have been taking place in the 14th century B.C.

Finally, I asked if anything exciting had turned up in the excavation of El Mirador, a major Maya ceremonial center which had been discovered only a few years earlier in the jungles of northern Guatemala, and with which the NWAFF was involved through Dr. Ray Matheny. Alex and I were shown a site plan of it, and told that radiocarbon dates had pinned it down to about the beginning of the Christian era, making it some 300 years older than Tikal. One glance at the site-plan and I got out my protractor and ruler and checked the

orientation of the largest pyramid at the ceremonial center, a monstrous structure called "El Tigre". The 285° alignment told me that once again the major edifice in a Mayan ceremonial center – in this instance, one that had just been uncovered – was oriented to the setting sun on August 13. For the Mayans to have appreciated this fact and built their largest pyramid with this orientation in the year 0 A.D. – at a time when the Izapans supposedly hadn't even formulated their calendar yet – revealed how the significance of this critical clue had continued to elude the archaeologists – right up to the present time!

I smiled to Alex as we left the Foundation, realizing how painfully slow the process of education really was. It had taken my hypothesis in Science to suggest the possibility that Izapa was a center of calendrical innovation and when the glyphs were re-examined, sure enough, it was. (Yet, even this hypothesis Lowe was unwilling to credit to me in his 1982 report on Izapa, stating that "Malmstrom makes no recognition of this same thesis by other authors much earlier (see Girard 1948, 1966 above, for example." However, when the first of these citations is examined, Lowe states that "Although Izapa is not mentioned, it is in the center of the zone in which the 260-day tzolkin was invented, according to Girard." About the second Girard citation, Lowe says, "Has a map showing zone in which the 260-day calendar was invented: Izapa is within the zone. Izapa is also mentioned infrequently in the text." Notice how careful he is *not* to say that Girard linked the calendar's origin with Izapa! Indeed, in his discussion of the 260-day sacred almanac, Lowe explicitly states that Girard "fails to press the Izapa ruins as a possible source apparently because he wishes to see all beginnings somewhere within Guatemala".)

Likewise, although the NAAF had excavated Izapa, they had not realized the turtle (or "frog"?) was magnetic until I reported it in Nature; the day after the journal was

received, by their own admission, they had dashed down to Izapa to see if it was true, and sure enough, it was. (Interestingly, when Lowe cited this discovery of mine in his 1982 report, it was cautiously described in the following terms: "A remotely possible sea-turtle head sculpture at Izapa may be both magnetic and of Late Formative carving" (Italics mine.) Obviously, he was not about to concede anything!)

Later, Lowe finds that the astronomical events described in the Izapan glyphs correlate best with the 1st century A.D. (best for reasons which only he himself appears to understand), even though his own field work had revealed a striking contemporaneousness in what he postulated as a dietary change and my 14th century B.C. computer results. (You will remember that it was Lowe who first called my attention to the possible shift from manioc to maize at Izapa in the 14th century B.C. and yet in his later report he seeks to discount the possible link in timing with what he condescendingly calls my "highly disputed "computer-based" calculations.") In the dietary-shift hypothesis we had what might have been a possible rationale for calendrical experimentation at the beginning of Izapa's existence and not in its twilight hours of existence; on the other hand, Lowe makes no attempt to tell us what prompted the Izapans to start experimenting with a calendar as their proud city was nearing its demise.

Moreover, Lowe's report did not even begin to wrestle with the internal inconsistencies posed by a calendar that supposedly evolved many centuries after the Izapa-defined date of August 13th was being calibrated throughout Mesoamerica. If his conclusions are correct, the orientation of Teotihuacán and dozens of other ceremonial centers will have to be re-explained according to some other hypothesis – and hopefully not ascribed to being

just more "coincidences", as some of our leading archaeologists and archaeoastronomers are wont to do.

Furthermore, if it has really taken a quarter of a century for the NAAF to realize that the pottery they had been working with during this entire time was diagnostic of the Zoques, then it is small wonder that things move so slowly in some disciplines. It would appear that the archaeologists were so busy examining the "pieces" that they had lost sight of the "big picture"!

Moreover, most of them were so intent on preserving a half-century old Anglo-American vision of a Maya civilization that had been the very alpha and omega of indigenous Mesoamerica that they were very reluctant – one could say, downright unwilling – to accept the continuing barrage of findings that their Mexican colleagues had been raising in opposition. But, the final indignity would be having to concede that the findings of a Swedish-American geographer not only reinforced the latter's contentions, but also clearly demonstrated that the Maya had virtually nothing to do with the ancient calendars that lay at the heart of the region's intellectual flowering.

As it turns out, geography was all important, not only to the initial inspiration for the sacred almanac at Izapa, but also for the Mayas establishing their own first center of astronomical studies at Edzná. That the two time-counts could possibly have been devised and utilized by an unknown people for over 1200 years before being combined into the elaborate "Long Count", for whose development the Maya have been erroneously credited, may be an unthinkable revelation for a "Mayanista" partisan, but once the Maya had adopted it – about the beginning of the Common Era – the only further contribution they made to the calendar's evolution was to change the beginning of the year from August 13th – which only

had real meaning at Izapa – to July 26th, which made more sense to the Maya farmers in the middle of the Yucatán.

However, the Maya's belated adoption of the calendar took place without any understanding that, in so doing, they would be launching a commercial scam amidst an ill-informed public some two millennia later. For them, when the day 13.0.0.0.0 arrived on December 23rd, 2012, the sole consequence it had was the dawning of – our Christmas Eve – on the following day – 13.0.0.0.1! Yes, that's it; it had all the excitement and accompanying hoop-la that our own calendar had in reaching Y2K !

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As Alex and I climbed back into my trusty pick-up truck, proudly bearing its "IZAPA" license plates, and headed north, it was with the satisfaction of knowing that somehow, the whole puzzle had come together. It all made sense to me, as a geographer, but if it took the archaeologists another generation to come around to recognizing the reality of Izapa and its role in the cultural evolution of Mesoamerica, so be it. For me, at least, the enigmatic "Olmecs" were no more. They were the Zoques!

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Thankfully, the note on which I ended my research in 1983 was unduly pessimistic. If there was a misunderstanding between the archaeologists of the New World Archaeological Foundation and myself, it was only due to a lack of communication rather than to any professional hostility. Once I was able to present my collected papers to them – including my summary statement titled "The Origins of Civilization in Mesoamerica: A Geographic Perspective", published in the 1985 Yearbook of the Conference of Latin Americanist Geographers – they could more fully

appreciate the cogency and force of my arguments. Indeed, Tom Lee, the Associate Director of the NWAF, candidly remarked "We should have had these twenty years ago!", and then kindly had my article translated into Spanish and republished by the University of Chiapas for the benefit of the Mexicans. Dr. John E. Clark of Brigham Young University, who took over as Director of the NWAF on Lowe's retirement in 1987, wrote to say that he was delighted to read my work and that he "agreed with most of my conclusions", and sent along a copy of the survey he had just completed on coastal sites in Chiapas that confirmed that an agriculturally based society with a chieftaincy form of government was already in existence in the Izapa region by 1700 B.C., making this without question the oldest true civilization in all of Mesamerica!

The upshot of my work at Izapa, combined with that of Drs. Lee and Clark, proved to be exactly what Dr. Lowe had obviously feared from the outset. If Izapa was indeed a creation of the 14th century B.C., as my calendar studies had shown, then the man standing in the boat carrying a cross depicted on the stela in the Ball Court certainly could not have been the prophet Moroni arriving to convert the Indians. This meant that the Church of the Latter Day Saints of Jesus Christ could no longer justify underwriting such an endeavor as the New World Archaeological Foundation because its very *raison d'etre*, as least as far as the Church was concerned, had disappeared. All of the artifacts that had been collected over the years were carefully put into storage in a guarded warehouse in San Cristobal de Las Casas and all further operations of the Foundation were suspended.)

A couple of years later, my own research also took a new and exciting turn. In 1985-86, Dartmouth College granted me a year's sabbatical, which I immediately put to

good use by making an aerial circumnavigation of the globe with my wife. Because its primary goal was to fill in some of the remaining blanks in my mental map of the world, it was punctuated by prolonged study stops in those areas whose physical and cultural environments intrigued me the most. These included following the Silk Route into the innermost reaches of Asia, broadening my familiarity with the islands of Oceania and Indonesia, visiting the earliest astronomical centers of China, India, and Egypt, and probing such diverse regions of Latin America as the Pantanal and Amazon Basin of Brazil and the extremities of Patagonia. But once again, our global circuit ended in Scandinavia, where I not only continued my exploration of the Megalithic impact on western and northern Europe but also could delve more deeply into the origins of each of our Nordic ancestries.

Though my research naturally took on a broader compass, it did not distract me – at least for very long – from my continuing focus on Mesoamerica. Besides turning out several new research papers on the area, on a frigid February morning in 1993 I also managed to confirm the presence of the “relay station” on the mountain ridge between Teotihuacán and Orizaba, which I had first hypothesized back in 1975 – proving that the largest urban center of the ancient New World had been consciously oriented to the winter solstice sunrise over the highest volcano in all of Mexico – and thereby promised the return of the sun yet again to the lands and peoples of the North.

Two years later in 1995, in the company of Dra. Guadalupe Martínez Donjuan, the discoverer of Teopantecuanitlan, an “Olmec” site in the interior of Guerrero state dating to ca. 1000 BCE, I was also able to confirm that site’s orientation to the August 13th sunset more than eight centuries before the founding of Teotihuacán.

This meant, of course, that the ‘52-day formula was already known to the “Olmecs”, well over a millennium before the creation of the Long Count, once again proving how rapid and widespread the diffusion of the Mesoamerican calendars had been.

An even greater challenge came a few months later when Shannon Davies of the University of Texas Press suggested that I summarize my Mesoamerican research in book form, and ultimately resulted in the publication in 1997 of my volume titled “Cycles of the Sun, Mysteries of the Moon: The Calendar in Mesoamerican Civilization”. Because the first edition of my book sold out so rapidly, I felt impelled to offset the numerous inquiries I began to receive from those who couldn’t acquire it in “hard copy” to place a digital version of my book online on my personal website (www.dartmouth.edu/~izapa). This proved so effective that I soon decided to post all of my earlier writings there as well, most of which had already been published in a variety of other venues.

But, the ‘final judgment’ on what has really been accomplished by my seventy-year intrigue with the “Mayan calendar” comes not from a geographer — for none has ever either cited or reviewed my magnum opus – but from the present Dean of Meso-americanists, Dr. Michael Coe, Emeritus Professor of Anthropology at Yale University. Speaking at a Symposium in Riverside, California in 2012, he is quoted as having said that my book ranks as “possibly the most important work of the (20th) century on Mesoamerica”. Certainly this is the most gracious complement than anyone could ever receive from so eminent a scholar in a sister discipline – and proof that at least someone has indeed been listening to a “VOX CLAMANTIS IN DESERTO”!

In the meantime, at the end of the rainy season in 2011, when a one-ton carving of a jaguar – again shown copulating with a woman, a clear sign of its “Olmec”

origins – began protruding from the river bank at Izapa – it pushed the date of human occupance at the site back a further three centuries to 2000 BCE, making Izapa clearly one of the earliest centers of advanced civilization in all of North America. While this remarkable find should ensure Izapa’s importance in Mesoamerican cultural history once and for all, even that distinction is now in jeopardy, thanks to a ‘front organization’ calling itself “The Maya Conservancy”. This motley group of ill-informed individuals derives its ‘science’ from an individual who knows so little about the ‘calendar’ that he continues to base his calculations on the totally discredited 1935 revision of the Thompson correlation coefficient, and who further claims that the Maya were able to ‘discover the galactic center’ when they didn’t even recognize that the Earth was round! (When I realized as early as 1993 that he was preparing to capitalize on his mistaken notions to promote a book heralding ‘the end of the world in 2012’, I published an advisory on my website that unfortunately only SLATE magazine picked up on.) Now, under his continued tutelage, the Maya Conservancy has taken over the site of Izapa with the aim of creating a museum and public information program that smacks of a “Hollywood Sideshow”. For example, its premier “Sound and Light” presentation is titled “The Evening of Creation”, despite the fact that the 260-day sacred almanac can only have been calibrated by the zenithal passage of the sun at high noon over Izapa! Indeed, their attribution of the origin of the Mesoamerican calendars to the Maya, who had nothing to do with their development at all and who adopted them full blown from their Zoque neighbors some twelve centuries after their creation, reveals how poorly informed they are. In contrast to the honesty of the Mormon Church, that realized it had grievously misinterpreted a monument in the Izapa ball court depicting a man holding a

cross, and withdrew in a totally correct and dignified manner, these imposters should be sent packing immediately for their complete distortion of Izapa's key role in Mesoamerican history and geography. Ironically, the Mayas themselves were far more intellectually honest than these would-be entrepreneurs, because whenever and wherever they founded a new site of their own, they always made sure to dedicate at least one of its major structures to the August 13th sunset at Izapa – a clear admission of their indebtedness to the Zoques!