An Egyptian priest standing out under a crystal clear desert night sky at Gizeh in Egypt 4,500 years ago would have many signs to interpret. The moon, near full, is rising in the east. There is still a hint of twilight to the west. He notices the bright, unblinking white light of the planet Venus, the “Evening Star,” right beside the red eye of Mars—a close conjunction. If a modern astronomer were to look to the right, away from the north face of the Great Pyramid, he would see Polaris, the bright, white North Star, but the ancient priest sees a different sky. A wobbling movement in the earth’s rotation on its axis (precession) has changed the orientation of the earth toward the stars. The Egyptian has never seen Polaris here. Instead he finds Thuban, a pale yellow star astronomers call Alpha in the constellation Draco, the Dragon.

The recreation of ancient skies—a specific evening like the one described at Gizeh in the Old Kingdom or at any other time and place—is just part of the fascination of archaeoastronomy, a new “interdisciplinary” that benefits from the scholarship of the sciences and the humanities. Science, in the form of modern astronomy and astrophysics, can show us how that night sky would have appeared, in considerable detail. The planetarium is being used as a research tool for this purpose. But understanding how the priest interpreted those details is not a matter for science. Experiencing that unique evening through his eyes that see the sky alive with their powerful myths, portents, and pantheons requires the scholarship of the humanities.

In its broadest sense, archaeoastronomy is the study of the astronomical practices, sky lore, mythologies, religions, and cosmologies of ancient peoples and the surviving indigenous cultures of the world today. This latter category is often called ethnoastronomy where such topics as calendrical divination among the Highland Maya Indians or the star compass of the native navigators of Micronesia are explored. In these areas some of the best research has resulted from cooperative efforts. An anthropologist may team up with an astronomer or an art historian with an astrophysicist.

Archaeoastronomy requires that researchers have a willingness to develop a working acquaintance with the language and scholarship of other fields. Often, a cultural anthropologist working with a people will find that individuals in the native society know much more about the workings of the sky than he. The ethnologist then seeks out an astronomer or planetarium director for help. Or, an astronomer using an observatory in some distant part of the globe becomes fascinated with the temple architecture, urban design, or art of some ancient civilization. He may find an architect or art historian who has been approaching the same questions for years from another perspective. Barely twenty years ago, this process of synthesis was random, but now there exist several publications and organizations such as the Center for Archaeoastronomy that serve as clearinghouses for the field.

A rapidly growing “invisible college” aids this process of intellectual matchmaking. Since the early 1970s, an increasing number of conferences and symposia under a range of sponsors have been de-
voted to archaeoastronomy and ethnoastronomy in general and to specific cultures such as the Megalith Builders of Europe or the Maya of Mesoamerica. At one such event, "The First International Conference on Ethnoastronomy: Indigenous Astronomical and Cosmological Traditions of the World," participants from more than a dozen disciplines within the sciences, arts, and humanities were represented. Sponsored by the Center for Archaeoastronomy at the University of Maryland, the Smithsonian Institution National Air and Space Museum, and the Historical Astronomy Division of the American Astronomical Society and made possible by a grant from the National Endowment for the Humanities, this weeklong conference at the Smithsonian in September 1983, provided a forum for seventy presentations covering most of the major culture areas of the world.

Archaeoastronomy differs from the history of astronomy because it is a less restricted field devoted to broader questions about a broader range of data. In the history of astronomy the scholars tend to be historians dealing with textual sources. By and large, they have been interested only in the Western tradition: the "exact sciences" and mathematical astronomy of the Sumerian, Babylonian, Egyptian, Greco-Roman, Islamic, and Renaissance traditions that have led to modern Western science. The mathematics and astronomy of ancient China and India and the developments of, say, the Classic Maya civilization have been all but ignored because these scholars are usually historians of science and have been interested in indigenous classification schemes and divinatory practices such as astrology only in so far as they seem to lead to modern science.

The renowned historian of science Otto Neugebauer was instrumental in encouraging broader studies, like those in archaeoastronomy through a criticism of the conservative father of the history of science, George Sarton. Neugebauer's classic note in the June 1951 Isis on "The Study of Wretched Subjects" responded to Sarton's review of a then recent publication of the Mandean "Book of the Zodiac" as "a wretched collection of omens, debased astrology and miscellaneous nonsense." In Neugebauer's words, "Because this factually correct statement does not tell the whole story, I want to amplify it by a few remarks to explain to the reader why a serious scholar might spend years on the study of wretched subjects like astrology."

He concludes his critique of Professor Sarton with the observation that, "When the recognized dean of the History of Science disposes of a whole field with the words 'the superstitious flotsam of the Near East,' he perhaps does not fully realize how much he is contributing to the destruction of the very foundations of our studies: the recovery and study of the texts as they are, regardless of our own tastes and prejudices." From the perspective of archaeoastronomers, Neugebauer was correct, but presents a narrower view than that represented by this emerging field. His interests were the pursuit of the textual sources of the history of the "exact sciences." Archaeoastronomy is the study of all such systems of astronomy and related practices in their cultural context, for all cultures, and using all types of available data.

by J.B. Carlson

Detail from the facade of the Palace of the Governor, Uxmal, shows a long-nosed rain god mask. The glyph for the planet Venus appears on the lower eyelids.
Even Western science is pursued by archaeoastronomers as part of culture to be understood as such. From the cultural perspective of archaeoastronomy, there are no "wretched" subjects, data, or cultures. To understand Babylonian astronomy one must seek the Babylonians themselves through their art, architecture, and the archaeological evidence as well the written record they have left. The history of science is only one part of the study of the history of culture, and the history of astronomy is a branch of what has come to be called archaeoastronomy.

The Venus cycle in the world of the Maya of ancient Middle America illustrates the methods and results of archaeoastronomy. During the first millennium A.D. largely in the lowland jungles of Mexico, Guatemala, Belize, and Honduras, Maya-speaking peoples created one of the brilliant civilizations of the New World. They developed a unique system of hieroglyphic writing, a sophisticated mathematics and astronomy, and perhaps the most elaborate ritual calendar the world has seen. Two of the most vital components in this system are a 260-day divinatory almanac (composed of two intermeshed cycles of 13 numbers and 20 named days) and an unadjusted 365-day "year" composed of 18 months of 20 days each and an epagomenal month of five days to complete the count.

The Maya were intensely interested in the appearances and disappearances of the planet Venus, a god whom they saw as a manifestation of the Plumed Serpent called Kukulkan. They were aware that it appeared in the east, rising ahead of the sun to become the morning star, only to disappear into the Maya underworld to transform into the evening star in the west. The full "synodic period", as astronomers call it, from the first appearance of Venus as morning star through its evening star manifestation, then back to morning star again takes almost exactly 584 days. This period was used by the Maya to create a complex almanac commemorating the 584-day Venus calendar with the 260-day and 365-day cycles. They gloried in the astronomical coincidence that five Venus cycles of 584 days exactly equaled eight years of 365 days giving a total of 2,920 days. They further compounded this with the 260-day almanac creating the Great Venus Round of 37,960 days, that is 65 Venus cycles, 146 260-day cycles, and 104 years. Now a modern astronomer can tell us that the synodic period of Venus is actually 583.92 days on the average, not 584. After the 104-year Great Venus Round, the almanac will be an average of 5.2 days off from astronomical reality. The Maya knew of this discrepancy and came to use a correction scheme that gave their tables a long-term accuracy of one day in 6,000 years!

How do we know this? Of only four Maya books that have survived the destructive forces of time and the Spanish Conquest, one, the Dresden Codex, contains the most elaborate version of the Maya Venus Almanac complete with correction table. Ernst Förstemann, the librarian of the Royal Public Library at Dresden, was the first to decipher the basics of the tables and published his results in 1886. Near the turn of the century, the great German Americanist Eduard Seler described three additional Venus almanacs found in other pre-Columbian books from Central Mexico elaborating the gods and rites associated with Venus. But the question still remained: For what purpose did the ancient Mesoamericans use these astronomically sophisticated Venus almanacs?

The real picture of Venus in the Mesoamerican world has begun to emerge only in the last decade or so, and the discoveries depend on the type of interdisciplinary cooperation called archaeoastronomy. Three major developments have taken place. First, in the early 1970s astronomer Anthony Aveni began a long professional collaboration with Mexican architect and urban planner Horst Hartung to explore and measure the alignments of buildings and site plans of ancient centers. Among the most intriguing of their discoveries were buildings aligned to the extreme rise or set positions of Venus on the horizon. The spectacular Palace of the Governor at Uxmal is the most impressive example.

Uxmal was a Late Classic Maya city that flourished in northern Yucatan during the latter half of the first millennium A.D. The Palace of the Governor is perhaps the greatest Maya edifice extant with the tallest corbel vaulted arches known. The facade is decorated with elaborate masonry mosaics that include numerous masks of the long-nosed Maya rain god, "Chac." These masks routinely adorn the temples of Maya buildings throughout this area in Yucatan, but Eduard Seler long ago noted that the rain god faces on the Palace of the Governor all had Venus hieroglyphs on their lower eyelids. This was the same glyph found for the planet by Förstemann in the Dresden Codex Venus tables. We now know that this is the only appearance, with one exception also at Uxmal, of the Venus glyphs in conjunction with such Chac masks.

The Palace of the Governor faces to the southeast and this structure as well as the massive artificial platform on which it is built are skewed in orientation 19 degrees clockwise from the common axis of most of the other buildings at the site. Aveni and Hartung were intrigued with this and have carefully measured the line looking perpendicular to the facade at some 28 degrees south of east on the flat Yucatecan horizon. They found that precisely on the line
there is a bump on the horizon. This is a 25-meter-high temple pyramid six miles away at another site named Nohpat—almost certainly located there in this relation to the Palace of the Governor by design. Not only does the line from the central doorway of the Palace point to the principal pyramid of Nohpat, but it also indicates the position where Venus would have risen at its maximum southern excursion about A.D. 800 when the structure was erected. We may remember that the five Venus cycle/eight-year period was important to the Maya as demonstrated in the Dresden and other tables and in carved inscriptions on monumental architecture.

Recently art historian Jeff Kowalski, who has studied the Palace of the Governor, made the significant discovery that the ruler of Uxmal who made this his residence had the same name glyph as that used in the Maya codices for the rain god, Chac. There are a great many detailed arguments in Kowalski's careful analysis of the hieroglyphic inscriptions and early colonial documents that attest to ancient rulers of Uxmal with Chac in their names such as Hun Uitzil Chac. It does now seem convincing that a great Maya lord who took the name of the powerful rain deity for his own constructed a palace with a significant Venus alignment and decorated it with more than 350 masks of Chac with the Venus glyph inscribed on each of the lower eyelids. But, what was the significance of Venus for the Maya?

The second major development in the unveiling of the Maya Venus involves a diverse group of scholars working on seemingly separate problems. Maya epigraphers such as anthropologists David Kelley, Berthold Riese, and Peter Mathews had identified a verb in the hieroglyphic inscriptions that functioned as a battle, raid, or war event. Captives were often taken for later sacrifice. This hieroglyph, in several different forms is usually called the “shell/star event” because the Venus glyph is part of its composition. Why? Kelley and mathematician Michael Closs had come close to solving the puzzle, but anthropologist/linguist Floyd Lounsbury made the breakthrough with the stimulation of questions posed by an art historian.

Mary Miller was researching the famous polychrome murals found in the 1980s at the Maya site of Bonampak. Her analysis of scenes suggested that they record an heir designation event, which involved an astrologically timed ritual battle and the final celebration of the victors. More specifically, she found evidence in the imagery and inscriptions to suggest that the great battle event had something to do with Venus. She collaborated with Lounsbury to determine that the battle event most likely took place on A.D. August 2, 792, which was both a rather special “inferior conjunction” date for Venus (it would likely first appear as morning star the next day) and it was also solar zenith passage day—the day the sun would pass directly overhead.

This discovery of an astrologically timed battle involving the planet Venus started Lounsbury on the track of a major discovery that has demonstrated that the “shell/star event,” the war event of the classic inscriptions, contained the Venus glyph because such events were timed for significant stages in the Venus cycle. A picture of the astrology of Classic
Maya ritual warfare had emerged with Venus as the chief protagonist. In this research Lounsbury had solved, to most scholars' satisfaction, the old problem of the correct correlation of the Maya calendar with our own. He also found a new glyph for Venus, a toothy skull, which usually functioned in the context of Venus as evening star.

The third chapter in the Venus warfare story involves the comparatively recent discovery of the fourth known Maya book which has come to be called the Grolier Codex. This fragment of a screenfold Mesoamerican Codex book composed of stuccoed, painted bark paper was apparently found in a dry cave in Mexico in the 1960s and acquired by a Mexican collector of antiquities. Anthropologist Michael Coe saw the Codex, decided it was genuine, and arranged to have it exhibited in 1971 in New York at the Grolier Club exhibition on Maya art and writing. It immediately created a sensation that polarized the scholarly community. Was the Codex genuine or a modern forgery? The paper was radiocarbon dated and found to derive from the thirteenth century A.D., but some claimed it was a modern forgery on ancient paper.

The Grolier Codex was easily recognizable as a fragment of a Maya Venus almanac resembling the calendrics of the Dresden Codex. However, it differed stylistically, reflecting a hybrid of non-Maya influences that were common at the time it was composed. It depicts an array of Venus gods, manifestations presiding over all of the stations of the eight-year Venus cycle. Quite the opposite to Venus in the Western world—the Ishtar of the Babylonian cultures or Aphrodite-Venus in the Greco-Roman tradition—Mesoamerican Venus gods were hostile, death-dealing entities that speared or decapitated their victims, particularly at first or last appearances in the cycle. Venus is essentially the “Mars” or war god of ancient Mesoamerica. This realization and its implications have only recently become apparent.

While studying the Grolier Codex and other Venus almanacs, I made discoveries that authenticated the Codex as a genuine pre-Columbian book and extend the implications of Venus as a god involved with the astrology of ritual warfare in broader Mesoamerican contexts. Essentially, I was able to show that the Grolier contained information that could not have been known to an alleged fabricator in the 1960s. It is genuine. Fragments of what were thought to be two pages (10 and 11) were shown conclusively to be portions of the same page. The resulting figure of a skeletal Venus god presiding over first appearance of Venus as evening star then fit into a pattern of such skeletal evening star gods discovered the previous year by Lounsbury. This and additional evidence weave for us a more complete picture of the Venus almanacs. Their structure had been known but their purpose was a mystery. They are now seen as the almanacs governing ritual warfare, sacrifice, and related activities for a broader spectrum of Mesoamerican cultures. For additional reasons, it now seems likely, though unproved, that the “flowery wars” of the Aztecs of Central Mexico, battles arranged in advance so warriors could prove their prowess and obtain captives for sacrifice, were timed according to the cycles of Venus by calendar priests using these and related almanacs.

The promise of archaeoastronomy as a new venture in interdisciplinary scholarship is to show us the ancient skies—not merely the sky of Uxmal in A.D. 800 projected on a planetarium dome, not even the celestial realm of the Maya calendar-priest astronomer with his astronomical observations, planetary tables, and “exact sciences.” We would stand beneath the skies of Lord “Chac” of Uxmal and experience with his court and the people of his kingdom the cosmos through the eyes of their culture. Neither the physical sciences nor the humanities can approach such problems alone. It is the union of the two that will give us these ancient skies, and I believe, the skies of the future as well.

—John B. Carlson
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