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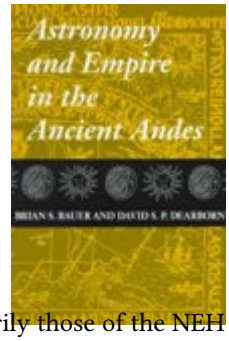
Brian S. Bauer, David S. P. Dearborn. *Astronomy and Empire in the Ancient Andes: The Cultural Origins of Inca Sky Watching.* Austin: University of Texas Press, 1995. xv + 220 pp. $37.50 (cloth), ISBN 978-0-292-70829-7; $14.95 (paper), ISBN 978-0-292-70837-2.



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This collaborative volume was written by an archaeologist, Brian Bauer (who holds a Ph.D. in anthropology from the University of Chicago), and an astrophysicist, David Dearborn (Senior Research Physicist, Lawrence Livermore National Laboratory, University of California, Berkeley).

The authors state that their book is designed for the use of astronomers, archaeologists, and historians, among others. Some Latin American scholars may decide that the book's title is a misnomer because it suggests a broad scope when, in reality, the perspective is narrower. This volume does concern ancient astronomy, specifically ethnoastronomy and archaeoastronomy, but its chronological and spatial parameters are confined, in the main, to the Inca and the immediate post-conquest period (ca. A.D. 1400-1610), and to the Cuzco Valley and sites within the Inca state (Tahuantinsuyu). Scholars will also note that the authors employ the term "Inca" in reference to the Inca Empire and its sites and culture, rather than using the currently in vogue and preferential spelling "Inka." I shall retain the authors' spelling and terminologies in my review.

The contents of the volume and the interpretations are based upon actual field work undertaken separately and together by the authors. Archaeological field work (survey and excavation) and analysis were supported by the Institute for New World Archaeology, the L. J. Skaggs and Mary C. Skaggs Foundation, the Guttman Foundation, the University of Chicago Housing System, the National Endowment for the Humanities, and the National Science Foundation. The astronomical work was supported by the Dudley Observatory and a Pollock/ Dudley grant; field work permissions for the project were granted by the Instituto Nacional de Cultura (Lima and Cuzco). In addition to archaeological and astronomical research, the authors also utilize late sixteenth- and early seventeenth-century historical documents, particularly accounts of Inca solar astronomy.

Among the individuals thanked by the authors for reading earlier drafts of the volume are Terence D'Altroy, Jeffrey Parsons, and Charles Stanish. Other assistance was provided by John Rowe and Tom Zuidema, and editorial expertise was rendered by Patricia Lyon. These anthropologists and their works will be familiar to most Latin American scholars. The involvement of these experts, either by providing consultation or conveying an imprimatur, heightened my anticipation of the volume's elucidation of Inca cosmology and social structure. As a long-time book reviewer, I tend to read the publisher's publicity statements and scholar- attributed quotations (the PR "blurbs") with reservation and a somewhat jaundiced eye, especially when these quotations are glowing and expansive.

However, upon reading the book, I must agree with my long-time friend, Jeffrey R. Parsons (Professor of Anthropology and Curator of Latin American Archaeology, University of Michigan, Ann Arbor), who has extensive field experience in Mexico and Peru, and who applauds this volume. The University of Texas's press release quotes Parsons as writing that Bauer and Dearborn's work is "a very significant and original study which will be of enduring importance....There is simply no other

place where a reader can find this quantity of high quality archaeological data so integrated with the more traditional historic sources bearing upon Inca astronomy." I concur totally with Jeff's assessment and I shall now characterize the book and attempt to document why I, too, find the volume to be compelling.

Bauer and Dearborn divide their book into seven chapters, supplemented with twenty-two black and-white photomechanically-reproduced illustrations, nine maps, fifteen figures (line drawings), and seven tables. There is a nine-page appendix, "Selected Star References from Early Colonial Sources" (containing eighty primary citations), and twenty-two pages of (end) notes on the text. A very useful and necessary eight-page glossary contains 181 terms (six Aymara, two Carib, forty English, twenty-four Spanish, and 111 Quechua). The English entries are, in the main, astronomical terms. A comprehensive thirteen-page bibliography (193 entries) and detailed eight-page index complement the book. The in-note system of citation is used and the references are in the style of the Society for American Archaeology's journals *American Antiquity* and *Latin American Antiquity*.

The introductory chapter, "The Inca and the Sky," provides brief, salient background essays on the Inca Empire, the Cuzco ceque system, and the current status of research on Inca astronomy. The authors emphasize that the Inca Empire expanded rapidly from a minor polity located in the Cuzco region. This growth, the authors' contend, necessitated "an increasingly complex, hierarchical structure and the organization of an extensive ruling class" (p. 21). The ceque system includes a complex series of shrines and imaginary lines that radiated out from the center of Cuzco and had astronomical, calendric, and sacred connotations. This system provided the foundation for Zuidema's (1964, 1977) interpretation of the Inca calendar. Principal Inca ceremonies such as Inti Raymai and Capac Raymi are described. Bauer and Dearborn also review briefly their own archaeological and astronomical field work conducted in the Cuzco region. They conclude that "the study of Inca astronomy is not simply an investigation of indigenous interpretations of the native calendar, but a study of the social and religious organization of Cuzco and the processes by which elite kinship groups centralized authority in themselves" (p. 23).

Chapter 2, "Historical Accounts Concerning Inca Solar Astronomy and the Year," provides a chronological compilation of the more significant late sixteenth- and early seventeenth-century accounts of Inca solar astronomy. Wisely, the authors have considered the historic data separate from the archaeological and astronomical data surrounding these narratives so as not to confuse early historic accounts with the development of their own theoretical interpretations. Full citations to the eighty original documents are tabulated in the appendix; among these are works by Cieza de Leon, Cobo, Garcilaso de la Vega, Guayman Poma de Ayala, and the Anonymous Chronicler, and the Huarochiri manuscript. These sources contain numerous references to natural and artificial horizon pillars used to track the movement of the sun. Bauer and Dearborn discuss the numbers, sizes, and locations of these solar pillars and the use of gnomons. The Julian and Gregorian calendars, Incan calendrics, equinoctial passages, and shadow casting are also detailed. In addition, Bauer and Dearborn examine the practical aspects of making astronomical observations, noting that only some methods permitted public participation. The authors conclude that the horizon markers were most logically used in conjunction with large public ceremonies, whereas light and shadow casting were more likely affiliated with small, private activities.

In the subsequent chapter, "The Year," Bauer and Dearborn discuss the yancas, a "specialized class" who watched the sky–e.g. astronomer/astrologers. The authors cite in particular the Huarochiri manuscript, Carta Annua, and Guayman Poma de Ayala's accounts. They also elaborate the complexities of the twelve-month lunar and fixed twelve-month solar calendars, and the sideral calendar hypothesis advanced by Zuidema (1982). Lunar months consist of 345 days, eleven short of the solar year which has twelve months of thirty days (a total of 360 days). The commoners used the simple lunar calendar as well as independent stellar and solar observations to organize their year. The elite, however, in maintaining centralized authoritarian sociopolitical and religious control, established a new calendar system based upon calendar months fixed and determined by solar observations. The authors contend that the solar calendar, described in only the earliest colonial documents, fell into disuse as Spanish hegemony was established, and the Andean populations regressed to the lunar calendar.

The fourth chapter, "Seats of the Sun: The Solar Pillars of Cuzco," considers the author's efforts to characterize the Cuzco region's pillars and to compare the historical data from the colonial documents (in the main from Betanzos, Cobo, Garcilaso de la Vega, and the Anonymous Chronicler) with the authors' field observations. The general characteristics of the pillars, some of which remained for a century after the arrival of the Spanish,

are reported. Specific archaeological and archaeoastronomical details about the solar markers or towers on the hills of Picchu, Coricancha, Chinchincalla (related to the December solstice sunset), and Quiancalla (affilated with the June solstice sunset) which surround Cuzco are presented. Also described are sunrise observations and the zenith and antizenith passages of the sun. The information presented in this chapter is complex and requires careful reading in order to comprehend the authors' arguments about the monuments, the monitoring of the motion of the sun, and why those chroniclers who arrived later witnessed only the operation of the more ancient lunar calendar.

"Stellar Observations," Chapter 5, is devoted to the celestial investigations made by the Inca. Initially documented are the historic accounts of Inca star watching, animal image associations (such as male and female llamas, and llama calf [called lamb later in the text]), and pan-Andean folk astronomy. Preeminent among the observed stars were the Pleiades, which were associated with maize cultivation, Orion's belt, and the planet Venus. Data and interpretations about five constellations, two dark cloud constellations, and the twenty brightest stars are also related. Various hypotheses are tested concerning the alignments of the ceques and shrines, including one which postulates that the ceques were astronomical sight lines (Zuidema 1982), another which states that individual shrines served as star fiducials or reference points, and a third which considers the relationship between the Coricancha and the rise of the Pleiades. The chapter concludes with the authors' speculations about the pre-Inca origins of Andean astronomy. Chapter 6, "Other Celestial Phenomena," considers the less common celestial events, including twenty-seven solar eclipses that occurred within the Inca Empire between 1440 and 1570, and the four comets appearing between August of 1526 and August of 1529.

Chapter 7, "An Overview of Inca Astronomy and Calendrics," contains an anthropological review of the Inca polity, folk astronomy, and associated beliefs, and characterizes astronomy as providing "an important focus for Inca imperial organization, and that their astronomical knowledge included elements for which direct historical or physical evidence no longer exists" (p. 153). The authors note that the Spanish accounts offer information on relatively few solar observations, but described, in particular, solstices. Bauer and Dearborn state that "our archaeological and astronomical work in the Cuzco region concluded with mixed results concerning the solar observations of the Inca" (p. 154). Nonetheless, their archival, ethnohistoric, and archaeological research on the four solar pillars on Picchu is significant, and their investigation of the pillars at Quiancalla confirms postulates by Aveni and Zuidema that these devices marked the June solstice. Bauer and Dearborn argue convincingly that the arrival of the Spanish shattered the foundations of Inca sun worship and sociopolitical structure, precipitating the elimination of the solar calendar. They also contend correctly that their work "provides a reference base for the major historical descriptions of Inca astronomical practices" (p. 157).

This is not a volume for the timid reader because of the multi-language vocabulary and technical astronomical terminology. In addition, the exceedingly well documented text requires the reader's close scrutiny in order to understand the authors' interpretations gleaned from primary and secondary source colonial documents and from extant and especially collected archaeological data, and to fully comprehend the conclusions they reach. The authors document credibly that solar observations played a major role in Inca religious ritual and civil ceremony, and they offer persuasive evidence that the Inca used a practical and uncomplicated calendrical system.

This book is definitely in the same scholarly category as Anthony Aveni's classic work on Mesoamerica, *Skywatchers of Ancient Mexico* (1980), also published by the University of Texas Press, and Ray Williamson's lesser-known edited volume entitled *Archaeoastronomy in the Americas* (1981). Aveni's edited volumes document Native American astronomy (1977), New World archaeoastronomy (1982), astronomy in prehistoric and contemporary tropical cultures in the Americas (Aveni and Urton, editors, 1982), and even in a global context, witness Aveni's *World Archaeoastronomy* (1988). Taken together, these works have advanced our understanding of the relationships existing between the sociopolitical and sacred-secular characteristics of prehistoric cultures, and celestrial observations. Bauer and Dearborn's well- written, detailed, and provocative volume joins these indispensable works and expands our understanding of Inca cosmology and the Cuzco ceque system and elucidates the interface between archaeoastronomy and ethnoastronomy, the latter seen in colonial archival sources. The authors are to be congratulated for their diligent archival research, their clear and precise explanations of astronomical phenomena, and for assiduously integrating archaeological data with astronomical evidence. This is a delightful book to read–much like Gerald Hawkins's *Beyond Stonehenge* (1989)–and for readers to cogitate about the authors' interpretations. The book is recommended

to advanced undergraduate students, graduate students, academic faculty, professional archaeologists, and astronomers.

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