

Against the Odds—Hottai Ki

... only a huge dun colored, almost shapeless mass, looming up strangely from the desolate plain. There is nothing architectural about the structure. It is, at best, but a mud house; though, as he examines it more closely, it seems more and more wonderful, and the mind is filled with conjecture as to the uses to which this great building may have been put, and why it stands so lonely and isolated.

J. Z. Stewart*

In 1879, geologist Professor George Cook participated in the first scientific examination of the earthen materials of the Casa Grande, then over 600 years old. His observations started a preservation process that continues today. In 1892, national interest in this earthen ruin led to the first federally funded stabilization project on an archeological site in America. By 1903, a shelter over the site had been constructed, after due consideration, even though surveys, historical commentary, and professional judgment indicated that some of the parapet top courses and wall surfaces were nearly as they were at construction. These walls built of puddled caliche-rich earth have withstood seasons of weathering, earthquakes, and the destructive forces of man for more than half a millennia. This remarkable history illustrates a perhaps never-ending story of engagement with the material and myth of one of America's most prominent earthen monuments. To consider its tenure one must approach the place with a measure of reverence and awe.

Jesuit priest Eusebio Kino first popularized Casa Grande when he was led by Native Americans to see the Hottai Ki (Great House, in native tongue) in 1694, and it became an attrac-

tion and destination for visitors thereafter. One may assume that natives of the area were well aware of the structure over the centuries since abandonment and had some use for and of it. Sketches, written descriptions, and the first photos taken in 1877 provide a wealth of information from which to discern conditions of the structure since Kino's first observations. The 1877 photographic record is a watershed in the process of documentation, which is essential to establish rate of change. Researchers draw on these documents now, as they did in the past, to discern gross changes.

Constructed of puddled earth in about 1250 by the Hohokam (whose name means "those who have gone") and used through 1400, the site appears to have been abandoned around 1450. The Hohokam, occupiers of the northern Sonoran desert, now south central Arizona, left no written record; they did, however, achieve technical mastery in earthen architecture and left treasures of artifacts and a major regional canal irrigation system. Oral tradition is held by their descendants, American native occupiers of the region today—the Pima Indians.

After abandonment, roof and floor timber were recycled into other uses and the natural processes of decay and the associated deterioration caused by human hand took a toll until the federal government intervened and officially took control of the site in 1892. Preservation started in 1891 when Cosmos Mindeleff, anthropologist for the Bureau of American Ethnology, managed the first stabilization effort. Several 19th-century anthropologists had preceded him to visit the site including Adolf Bandelier in 1883. Commentary, ideas, and proposals were developing and available. Under Mindeleff's general supervision, the site was cleared, braces were installed, and underpinning was added. The idea of a shelter was considered, disputed, and not resolved immediately. Photographic evidence indicates that the earthquake of 1887 (the last major seismic event recorded in the northern Sonoran desert) may have caused several major wall section collapses; and Mindeleff's work was clearly an attempt to re-establish the perceived lost stability. Records

* "Ancient Ruins in Arizona." *Juvenile Instructor* 12 (January 15, 1877): 21-22. Hanks, Henry Garber. "Casa Grande." *Californian* 2 (August 1880): 104. From "A Centennial History of the First Prehistoric Reserve: 1892-1992," A. Berle Clemensen, p. 23, Administrative History, United States Department of the Interior, National Park Service, 1992.

*West elevation,
The Great
House, Casa
Grande ruins.*

do not indicate that he consulted with an engineer; rather, it appears that the gestation of ideas developed during the previous decade was distilled into a plan of action. Contemporary technical evaluations of this 1891 work aside, the effort reversed the trend of neglect, turning the tide of “grave robbing” destruction that had been increasing on site since the railroad came in 1879 and 1880. The timber shelter with a sheet metal roof was finally built in 1903, also without the benefit of formal architectural or engineering services.

The original shelter was replaced with a designed and engineered steel frame shelter in 1932 (itself placed on the National Register). Current assessments indicate the efficacy and value of sheltering the site.

Current Program

In 1999 the effort is continuing. A review of the 20th-century activity reveals a history rich with proposal and treatment alternatives—cement stabilization, plans to infiltrate the soil with epoxy, geodesic dome covers, modern synthetic elasticized soil amendments, bricks and mortar underpinning, un-engineered stabilizing systems, wall monitors, material studies, documentation programs, test wall programs, surrounding terrain modification, technical scientific excursions, and many anthropologic studies. Each effort was well intentioned and of more or less value depending on viewpoint. After all that has occurred the structure retains a remarkable percentage of integrity. An astonishing recognition is that much of the remaining painted and unpainted interior surface plasters show little to



no degradation, appearing as they would have in the 1400s.

As of 1996, the Western Archeological Center (of the National Park Service in Tuscon, Arizona) bibliographic references on this subject exceeded 100 documents, books, and reports, indicating a wealth of studies and information. Little of this material sheds light on an understanding of the physical changes of the structure—the rate of change, the causes for change, and the fundamental structural capability as originally conceived and as it is today. The current program was initiated following the 1995 collapse of a 6-cubic-foot piece. Since the late 1980s, hands-on routine type preservation had been suspended. The routine preservation maintenance actions would probably not have prevented the failure of 1995; and over the years several such sectional collapses are recorded. The current effort seeks to consider all previous work, sift through evaluations, assess treatments, and review as many points of view as possible. Perhaps most important is a re-examination of the structure that takes into account the builders' original intent. What was there, what is there, and why are changes taking place?

In 1996 work began with a partnership planning team made up of the Arizona State Historic Preservation Officer, the Architectural Conservation Laboratory in the Graduate Program of Historic Preservation at the University of Pennsylvania, and National Park Service staff. The University of Pennsylvania has for eight years partnered with parks in the Southwest to answer difficult research questions, develop pilot preservation programs, and assist with training activities through the cooperative

*East elevation,
The Great
House, Casa
Grande ruins.*





University of
Pennsylvania
1998 Field
School survey-
ing interior walls.

agreement process. Many of these activities have focused on earthen architectural issues, which for some time now have not had the attention of other more responsive architectural fabrics.

At Casa Grande two concurrent winter field schools documented, surveyed, and assessed conditions evident from surface observations. Students mapped details of conditions across the surfaces, a complete 100%-coverage photo-documentation was accomplished, and an engineering assessment was made. Throughout these campaigns the Arizona State Historic Preservation Officer and staff participated in planning. Analysis sessions were periodically held at the park and at the University; during these forums, participants stood in front of scaled digitized color annotated elevations considering patterns, clues, and other information pertinent to the ruin's condition. Two graduate students undertook thesis topics that involved researching fundamental questions about material, architecture, and deterioration mechanisms. Engineers simultaneously engaged in assessing the structure. In addition, seismic evaluations of the structure in relation to potential earth tremors were made.

Results are coming in. Materials research findings have suggested a theoretical concept that appears astonishingly simple, yet of lasting and profound implication relevant to our considerations. Laboratory testing of samples taken from the 1995 collapsed piece showed a migration of calcium carbonates from the substrates to the surface in the form a kind of case hardening of the surface. One master's thesis defines and characterizes this phenomenon in detail. This factor could explain the resistance of the surface to direct water abrasion and the accompanying phenomenon of detachment of sections resulting

Photos courtesy the author.

from weakening substrates and strengthening surfaces. Most of this action probably occurred before the structure was sheltered.

Engineering work clarified the viability of the original architecture. A model of the structure, which included the diaphragm floor and ceiling systems, performed even while any single component could not withstand even dead loads. A rather sophisticated understanding of architectural requirements emerges presumably resulting from empirical knowledge by the builders. Without the original structural fabric in place, the remaining walls are compromised and performance is marginal. The seismic data combined to inform the team of real concerns regarding the viability of Casa Grande in a contemporary earthquake. Continuing engineering work is envisioned and plans for revised monitoring are in the works. Difficult decisions for management lie ahead, and no ready-made methodology is anticipated.

Continued monitoring, stabilization, and preservation programs are taking place at Casa Grande. New findings offer information for interpretive agendas. On the one hand, reassurance of the test of time leads to limited objectives; on the other hand, localized and continuing deterioration begs for attention and action. Regardless of approach, the sustaining preservation principle at this stage should be to maintain a graceful, long, and dignified old age for the deserving Hottai Ki.

Bibliography

- Clemensen, A. Berle. *A Centennial History of the First Prehistoric Reserve: 1892-1992*, March 1992, Administrative History. Casa Grande Ruins National Monument, United States Department of the Interior, National Park Service, 1992.
- Matero, Frank. *Documentation and Assessment of Wall Conditions. The Casa Grande, Casa Grande Ruins National Monument*. Unpublished Report for National Park Service, 1999.
- Del Bono, Elisa M. *Characterization and Analysis of the Caliche Walls of the Great House, Casa Grande Ruins National Monument*. Master's thesis in Historic Preservation, University of Pennsylvania, 1999.
- Gift, Andrea, and G. Eric Johansen. *Casa Grande, A Preliminary Structural Review*. Unpublished Report for the National Park Service. Department of Engineering, University of Pennsylvania, 1998.

Jake Barrow is Senior Exhibit Specialist in the Architectural Conservation Projects Program, Intermountain Region, Santa Fe Support Office, National Park Service.