Arizona Archaeological Society
Prehistoric Sites -- Pueblo Grande

CONTRIBUTOR: Jim Britton - AAS Phoenix Chapter

LOCATION:
Pueblo Grande Ruin is located on the grounds of Pueblo Grande Museum and Cultural Park at 4619 East Washington in downtown Phoenix AZ.

PUBLIC VISITATION:
Museum and self-guided trail open to the public Monday -Saturday 9:00AM to 4:45PM and Sundays 1:00PM to 4:45PM.

SITE DESCRIPTION AND BACKGROUND:
[Most of the following data was taken from Archaeology of the Pueblo Grande Platform Mound and Surrounding Features, Vol. 1, 1993, Edited by Todd W. Bostwick and Christian E. Downum]

Pueblo Grande is a prehistoric Hohokam village preserved by the City of Phoenix as a cultural park and interpreted through a museum and outdoor trail. It has been designated as a National Historic Landmark. The cultural part contains the central, 100-acre portion of the original prehistoric village. By the late Classic period (ca. A.D. 1350), Pueblo Grande is believed to have covered an area one mile wide from east to west, and one mile or more long from south to north.

Pueblo Grande appears to have been settled sometime before A.D. 500. By about A.D. 750, Pueblo Grande had grown into a sizable village containing domestic pithouses, cemeteries, trash mounds and possibly a ballcourt. The Pueblo Grande canal system had been expanded considerably by this time, and irrigated thousands of acres of farmland on the north side of the Salt River. In the Sedentary Period (A.D. 900-1150), a small circular platform mound may have been built at the site. Apparently, two rectangular, vertical walled platform mounds were later constructed.

During the Classic Period (A.D. 1150-1450) the large platform mound was initially constructed incorporating the two small mounds, and then expanding on several occasions. The latest manifestation of the platform mound was approximately the size of a modern-day football field and at least 20 feet tall. Coursed-adobe houses arranged in at least 20 apartment-like compounds were built, replacing many of the previously occupied pithouses.

The population of Pueblo Grande probably reached its peak in the Classic Period, with as many as 1000 people living in the village. Large floods recorded for the Salt River in A.D. 1385 and 1380-1382 probably contributed to the collapse and/or restructuring of Hohokam society at Pueblo Grande and elsewhere during the 1400s (Taken from 1994 Pueblo Grande Museum Profiles No.14).

Alphonse Pinart, the first archaeologist of record to visit Pueblo Grande came in 1876. He was followed by Adolph Bandelier in 1883, Frank Hamilton Cushing in 1887, Joshua Miller in 1901, and Jesse Walter Fewkes in 1907.

In 1924 Thomas Armstrong, Jr., a local banker, purchased the platform mound and donated it to the City of Phoenix. The area of prehistoric canals south of the mound, called "Park of Four Waters," was

obtained by the City in 1929. Also in 1929, Odd S. Halseth was appointed Director of the newly formed Pueblo Grande monument. Extensive excavation took place in the 1030s by the CCC and WPA workers under the direction of Halseth and Julian Hayden.

In 1964, the National Park Service named the site a National Landmark. Today, Todd Bostwick, Phoenix City Archaeologist, is in charge of the archaeological component at the site, while Roger Lidman is the Museum Director.

PRESERVATION ISSUES AT PUEBLO GRANDE:
A preliminary study of the mound conducted in the early 1980s determined that erosion and other environmental factors were severely damaging the platform mound. Various room walls and portions of the mound perimeter wall had been exposed by excavation. The main forces causing room and mound deterioration include surface water movement, ground water infiltration or rising damp, burrowing insect and other animal intrusions, displacement of soil by plant roots, aircraft vibrations from Sky Harbor and Air National Guard, train vibrations, air pollution, and intentional/unintentional visitor activities. By far, the most serious damage is caused by direct precipitation . This involves the erosion of the tops and bases of the adobe/rock walls, resulting in wall sloughing and collapse.

STABILIZATION HISTORY

1918 Excavation and backfilling

1960 Backfilling and limited "patching" by museum maintenance staff.
1975

1982 Wirth Associates' did a platform mound stabilization study. This study clearly demonstrated
1984 that the Pueblo Grande platform mound was in dire need of preservation. They recommended using geotextiles and backfilling portions of the mound.

1988 National Park Service (T. Metzger, L. Nordby, and J. Trott) conducted a field assessment of the platform mound, adjacent compound area, and ballcourt. Various preservation problems were identified and plotted on a map. A preservation plan written and cost estimate given to the City.

1989 NPS Stabilization Project - Before stabilization began, aerial photographs of the mound were
1991 taken by a radio-controlled model airplane mounted with a 35mm camera. Also an intensive seismic vibration study (Induced Ground-Vibration Study at Pueblo Grande, Phoenix, Arizona 1991) was conducted by Ken King of the U.S. Geological Survey to determine the effects of the various sources of vibrations on the mound. This study identified the types of equipment that could be used during the stabilization activities, as well as during other construction projects on or near the mound.

NPS Exhibit Specialist, Terry Morgart, supervised the stabilization work. A Bobcat and conveyor belt were used to move most of the more than 5000 cubic yards of dirt placed as backfill in and around selected portions of the mound. The reason for the NPS to do extensive backfilling was to protect whatever remains of the original walls. Remember, only the exposed walls are impacted by most agents of deterioration. If you buried the mound it would be protected from about all but burrowing animals. However, if you bury the entire mound there would be only a pile of dirt to look at. Exposing some walls makes the site more interesting for visitors and serves as an educational tool showing how the mound was constructed. As you walk around the mound you see most of the upper portions of the west and east walls. Three of the mound corners are exposed. It is these exposed wall areas that will require on-going maintenance.

Drainage boxes and pipes were installed in the backfilled areas to remove rainwater from the mound reducing the erosion caused by runoff. Microscopic color coded plastic particles call Microtagent were added to the mortar used to repair walls. This marker makes it possible to identify at some future date the area repaired by the NPS.

1993 NPS returned to do emergency stabilization work. The year of 1992 and Q1 of 1993 was an unusually wet period. Rainfall averaged 1 inch per month above normal. Due to these extreme wet conditions the mound and adjacent structures suffered heavy deterioration.

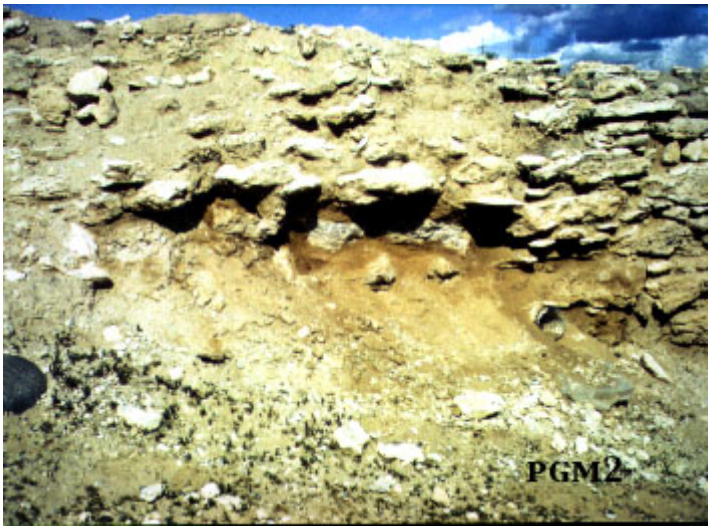
It became obvious that an on-going stabilization program was needed. However, the City of Phoenix was not funded to hire a contractor to do the repairs on an as needed basis. In March 1993, Terry Morgart held a one day stabilization workshop attended by Museum staff and 3 members of the Southwest Archaeology Team (SWAT).

1994 In January SWAT members volunteered to do the on-going maintenance repairs. This project consisted of two elements. First, one Saturday a month a volunteer crew, coordinated by Jim Britton, would monitor the erosion and repair damage to the mound. Second, George Butler, when available, would work weekdays recapping room walls on the mound top and adjacent structures. Most of the volunteer work done in 1994 involved repointing stones in wall faces and repairing basal erosion. The work involved walls near the north-east and south-east mound corners. The room walls on top of the mound were recapped using mud made by mixing soil and crushed granite gravel. The new mud serves as a sacrificial coat protecting the original wall matrix.

The south mound wall next to the SE corner demonstrates the type of basal erosion problem we have to contend with at Pueblo Grande. I will discuss the procedure used to stabilize this area. PGM1 shows the SE corner of the platform mound. The dark colored area (dark due to being wet from sprayer) is the eroded basal courses. The slope going up from where Chris is standing to the base of the wall is the backfill put in place by the National Park Service (NPS 1989-1991). You can see the backfill slope increases to the west (your left). The area to the west of this photo has backfill all the way to the top of the mound. You can see a close-up of this eroded area in Photo PGM2. This is a good example of basal erosion. It is caused by rising damp where moisture is drawn by capillary action up into the dry wall. As the moisture evaporates from the exposed basal courses the mortar breaks down and falls to the ground in the form of powdery soil. If the soil contains salt, the salt crystallizes and adds to the erosion process.

The erosion extended 3.2 meters to the west of the SE corner. It extended as far as 30cm into

the mound. The first step in stabilizing the area was to remove all soft mortar and loose or decomposing stone. Since the erosion went so deep into the mound, we needed to establish a base or foundation to set replacement stones on to fill the void. The next step is to mix the mud. We used a combination of two soils to get a color that closely matched the original color. To this we add crushed granite gravel to serve as a temper and a marker.



Before applying the mud, it is necessary to wet the original surface and any new stones. This wetting allows the new mud to adhere to the original surface and slows the drying process. Stones to be laid should be selected based on size that agrees with the original stones used. At Pueblo Grande we usually leave the stone face exposed so that the visitors can see that the wall was constructed of uncoursed stone (indurated caliche). The result of our stabilization work is shown in Photo PGM3 which was taken one month later.

1995 During this year the volunteer group concentrated on the west mound wall. The main project was to reconstruct a wall section referred to in the documentation notes as "The Gap". This gap was 2.4m long and began 33.7m north of the SW mound corner.This sloping area contained backfill which included a drain pipe from a drop box above. Since it was backfill we were able to excavate to establish a relatively solid base upon which the foundation stones could be laid.

As you can see in Photo PGM4, we used very large indurated caliche stones laid two wide for the foundation. At times a large "tie stone" would be placed to span the entire width of the wall, thus tying the two stones and forming a good solid wall to withstand the dead load force created by the differential fill. Above the foundation we used smaller stones that were more matched to the stone size on either side of the gap. Since a drop box was already in place above this area, once the wall reconstruction was complete we contoured the area behind the wall to direct the water runoff toward the drop box. This would prevent the water from flowing over the wall face and eroding the mortar. Due to the success in the "Gap" reconstruction, we were ask to do another mound wall section located between 78.5 and 80.5m north of the SW corner. This is near the NW mound corner. Runoff from the mound top flowed down the sloping side and made a large erosion cut which resulted in no visible wall above the NPS backfill. This can be seen in Photo PGM5.

As the wall was reconstructed the void behind the wall was backfilled. This section of wall was completed in January 1996.

1996 We continued reconstructing missing west wall segments, working our way toward the south. In March, we had to do an emergency stabilization repair. The term "Emergency" is used here to mean that the problem suddenly appeared and the wall or area involved was in imminent danger of further deterioration or collapse.

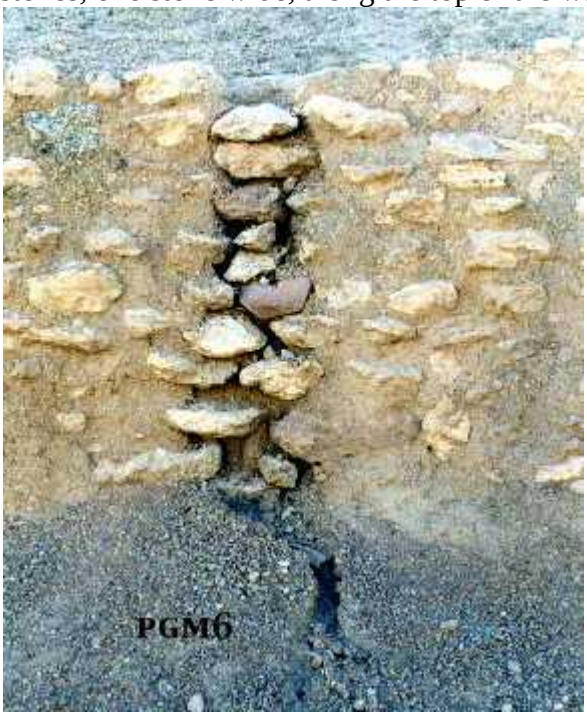
Repointing was done as needed on the south, east, and north walls. We repaired basal erosion on the south mound wall from the SE corner a distance of 3.8m to the west.

1997 At the beginning of this year, AAS Phoenix Chapter gets involved in the stabilization project. Jim Britton was ask to present a series of five stabilization workshops using slides

and hands-on training. There was an average of 12 participants per session. Big progress was made toward the completion of the the west wall reconstruction.

Due to recent rainfall an emergency repair had to be made between 26.5m and 28.1m on the west mound wall. The rain had dislodged several small (fist size) to medium size stones and the upper wall was threatening to collapse. This was a challenging stabilization job. In order to establish a good solid base, the loose soil (old mortar) and stones had to be removed without causing the upper wall to collapse. As the loose material was removed, the void created was immediately filled with replacement stones and mud. This process was repeated, until the entire damaged area was stabilized. A section of the south mound wall approximately 8m long was stabilized and where stone was missing reconstructed.

1998 The runoff from the sloping mound sides would flow over the 20m length of reconstructed and stabilized wall face. After each rain, there would be small erosion cuts along the entire length of wall. It was a maintenance headache. It was decided to focus the runoff to five points along this wall section. A diversion berm was constructed using small (1 to 2 fist size) stones, one stone wide, along the top of the wall face.



An opening approximately 50cm wide was left at 5 points where any runoff would tend to flow. The berm would direct the runoff to the drain opening. This isolated the erosion to only the five drain opening, thus cutting repointing time dramatically. This is illustrated in Photo PGM6. During the first nine month of this year the wall face below the five runoff openings were repointed 3 times. In September we reduced the openings from 5 to 3. This further reduced maintenance time after each rain. A major stabilization of the north mound wall was started and completed this year. This wall section was located between the NE mound corner and the backfill buttress. The concave area of this wall was stabilized by reinforcing the basal courses with additional stone and mud. The concave area was filled to make the wall straighter and more vertical. This was done to prevent possible collapse of the top portion of wall. A water runoff diversion berm was constructed above the east and north walls at the NE mound corner. This berm directed the runoff to one drain opening near the backfill buttress. This, like the 3 drain openings along the west wall, focused the erosion and decreased maintenance effort.

1999 The main project for this year was the stabilization of the south mound wall by reconstructing a wall face 4.35m in length beginning 12.0m east of the SW mound corner. The condition before work on this wall can be seen in Photo PGM7. To the right of this photo is the NPS backfill buttress that extends to the top of the mound.

Photo PGM8 shows two of the "PGM Mudslingers" in action.

The completed stabilized/reconstructed wall face is seen in Photo PGM9. The volunteer

maintenance project at Pueblo Grande completed 6 years at the end of 1999. The Saturday work crew is now made up of members of SWAT, AAS, PGM Auxiliary, and the general public. This group is now called the "PGM Mudslingers". During the first 6 years (1994-1999), there have been 3839 volunteer hours contributed to the preservation of this unique cultural resource.

2000 During the first five months of year 2000, work has concentrated on the west wall of the mound. The wall section between 46.0m and 57.0m north of the southwest mound corner has eroded to form a dished shaped slope from the mound top to the top of the NPS backfill slope (See photos). Discussion between Bostwick (Phx. City Archaeologist) and Britton resulted in a decision to reconstruct this wall section.

The erosion in this area is due to water runoff from the sloping side of the mound, not from the mound top. Rain hitting the top of the mound in this area flows into a drop-box and down a PVC pipe to current ground level. It was decided to install a drop-box just behind the

proposed reconstructed wall face. Since erosion had removed the original outer mound wall in this area, there would be no adverse impact to any original mound matrix to install the drop-box and pipe. The drain pipe from the new drop-box was connected using a "T" to the existing pipe which drains the mound top.

After the new drain pipe was attached we began laying a footing using large indurated caliche stones. Where possible the wall face was made two stones wide. To avoid impacting original mound matrix we, at times, were only able to lay one stone wide. As the wall increased in height each workday, we would backfill behind it. We backfilled each workday to assure that if it rained before our next workday, water would not be trapped behind the new wall. The wall height is determined by the location of the drop-box. Photo PGM10 shows the wall being reconstructed with the drop box in place. You can see in this photo the dished-out area on the mound slope that will flow into this drop box. The wall must to be slightly higher than the top of the drop-box. As you can see in this photo, wall needs several more layers of stone to build it up to the height required by the box location. The backfill behind the wall will be contoured so that runoff would flow toward the box and away from the wall face. There should be no runoff over the wall face. The only damage to this wall face will be from direct rain hitting it.

In December, Jim Britton experimented with an amendment that when added to the mud would make the dried mortar more resistant to erosion. He made three small adobe bricks, each with a different ratio of amendment (SoilShield) to water. A fourth brick contained no amendment. Once dry, these bricks were subjected to equal water spray and the deterioration monitored. Based on this experiment he decided to mix 1 part SoilShield to 35 parts water. This solution was then used to mix the mud to be used below the mound runoff openings. These seven opening were located along the west, north, and south walls. Nails were inserted into the mud, with only the nail head showing, in order to monitor any erosion.

2001 Britton made a condition assessment of the amended runoff points in January. A total of 1.85 inches of rain had fallen since the amended mud had been used a month earlier. No erosion was seen, the nail heads were still flush with the mud surface. However, one very interesting characteristic was noted. The amended mud surface had re-emulsified, i.e. it had softened slightly, but had not eroded. When it dried out, it hardened again. Britton feels this is important since it seems likely that any moisture behind the amended surface would have an opportunity to escape as the amendment dries. This is unlike the Rhoplex used by the NPS in 1990-1991, which is extremely hard and remains hard when wet.

During the five months from February to June the goal was to repoint all wall stones and repair all basal erosion. This goal was completed in June when we had 27 volunteers, the

largest crew in the history of the PGM Mudslingers.

2002 The official rainfall recorded at nearby Sky Harbor Airport was only 2.82 inches for the year. Little rain means little erosion. The mound looked great all year with little effort from the "Mudslingers". We only worked on the mound in February and September doing minor maintenance including emptying drop boxes.

2003 The coursed adobe room walls in the northwest corner of the compound had vertical slumping in some areas. These walls were repaired using unamended mud. All 47 of the drop boxes were emptied over a two month period.

In September amended mud was used to cap the runoff diversion berm that runs along the top of the west mound wall and the berm above the north east mound corner. Prior to this the only amended mud used by the "PGM Mudslingers" had been the narrow runoff points below the seven runoff openings. Using amended mud should reduce future erosion of these berms.

2004 This year all four perimeter walls of the platform mound required some maintenance. We used unamended mud to repair basal erosion and to repoint eroded mortar between wall stones. In previous years, the Mudslingers concentrated on the perimeter walls of the platform mound, while George Butler reconstructed and maintained the room walls located on the mound top and in the north west room block of the compound.

Room JH7 Mixing Mud 16 Oct 2004

This year, however, the Mudslingers began to maintain these rooms in addition to the mound walls. We repointed the east and west interior walls of Room 4M located near the south east corner of the mound top. This room is in the area of Miller's Tunnel. At Todd Bostwick's (City of Phoenix archaeologist) request we recapped the walls of Room JH57, located in the north west room block. The walls of this room had been reconstructed by Butler several years ago. We used SoilShield-LS as a mud amender. SoilShield is a Polyvinyl Acetate-Acrylic Polymer designed to construct walking trails and driveways. A thin coat of liquid mud (slurry) was applied over the recap after it had dried to seal any shrink cracks that had formed. After completing Room JH57 we began recapping the walls of Room JH11 located

on the mound top. This room is known as the “Solstice Room”. The west wall and a portion of the south wall were completed this year.

2005 The last three months of 2004 and the first three month of this year recorded 8.39 inches of rain at Pueblo Grande. This is about the average rainfall for an entire year. Because of this extreme wet period we had to do some platform mound maintenance.

Walt Lesko & Donna Beng repairing local erosion with Soil Shield-Ls amended mud.

All four perimeter walls of the platform mound needed some spot repairs due to basal erosion and eroded mortar joints. After a heavy rain or wet period, the moisture in the ground is pulled up into the dry walls by capillary action. The bottom or basal areas of the walls become moist causing a mechanical breakdown of the clay molecules. As the wall dries a void is formed as dirt particles fall from the wall. If not repaired the wall could eventually collapse. We completed recapping Room JH11 that had been started last year. We then recapped and slurry coated Room JH10 located on top of the mound across the walking trail from Room 11.

2006 This year we continued recapping walls with 1.5 to 2 inches of amended mud. This recapping serves as a sacrificial coat protecting the wall material below. Walls on the mound top recapped this year included those involving Rooms JH24, C2, and JH30. We then began work on the room block located in the north west corner of the compound. Walls recapped here included those involving Rooms JH50, JH53, JH54, JH55, and JH62. The volunteers known as the PGM Mudslingers have now completed 13 years of maintaining the prehistoric components at Pueblo Grande. During these years 197 people have worked a total of 6246 hours.