

## = Chaco Culture National Historical Park =

Chaco Culture National Historical Park is a United States National Historical Park hosting the densest and most exceptional concentration of pueblos in the American Southwest . The park is located in northwestern New Mexico , between Albuquerque and Farmington , in a remote canyon cut by the Chaco Wash . Containing the most sweeping collection of ancient ruins north of Mexico , the park preserves one of the most important pre -Columbian cultural and historical areas in the United States .

Between AD 900 and 1150 , Chaco Canyon was a major center of culture for the Ancient Pueblo Peoples . Chacoans quarried sandstone blocks and hauled timber from great distances , assembling fifteen major complexes that remained the largest buildings in North America until the 19th century . Evidence of archaeoastronomy at Chaco has been proposed , with the " Sun Dagger " petroglyph at Fajada Butte a popular example . Many Chacoan buildings may have been aligned to capture the solar and lunar cycles , requiring generations of astronomical observations and centuries of skillfully coordinated construction . Climate change is thought to have led to the emigration of Chacoans and the eventual abandonment of the canyon , beginning with a fifty -year drought commencing in 1130 .

Comprising a UNESCO World Heritage Site located in the arid and sparsely populated Four Corners region , the Chacoan cultural sites are fragile ? concerns of erosion caused by tourists have led to the closure of Fajada Butte to the public . The sites are considered sacred ancestral homelands by the Hopi and Pueblo people , who maintain oral accounts of their historical migration from Chaco and their spiritual relationship to the land . Though park preservation efforts can conflict with native religious beliefs , tribal representatives work closely with the National Park Service to share their knowledge and respect the heritage of the Chacoan culture .

The park is on the Trails of the Ancients Byway , one of the designated New Mexico Scenic Byways .

## = = Geography = =

Chaco Canyon lies within the San Juan Basin , atop the vast Colorado Plateau , surrounded by the Chuska Mountains to the west , the San Juan Mountains to the north , and the San Pedro Mountains to the east . Ancient Chacoans drew upon dense forests of oak , piñon , ponderosa pine , and juniper to obtain timber and other resources . The canyon itself , located within lowlands circumscribed by dune fields , ridges , and mountains , is aligned along a roughly northwest -southeast axis and is rimmed by flat massifs known as mesas . Large gaps between the southwestern cliff faces ? side canyons known as rincons ? were critical in funneling rain -bearing storms into the canyon and boosting local precipitation levels . The principal Chacoan complexes , such as Pueblo Bonito , Nuevo Alto , and Kin Kletso , have elevations of 600 to 640 feet ( 180 to 190 m ) .

The alluvial canyon floor slopes downward to the northwest at a gentle grade of 30 feet ( 9 m ) per mile ( 6 meters per kilometer ) ; it is bisected by the Chaco Wash , an arroyo that rarely bears water . The canyon 's main aquifers were too deep to be of use to ancient Chacoans : only several smaller and shallower sources supported the small springs that sustained them . Today , aside from occasional storm runoff coursing through arroyos , substantial surface water ? springs , pools , wells ? is virtually nonexistent .

## = = Geology = =

After the Pangaeian supercontinent sundered during the Cretaceous period , the region became part of a shifting transition zone between a shallow inland sea ? the Western Interior Seaway ? and a band of plains and low hills to the west . A sandy and swampy coastline oscillated east and west , alternately submerging and uncovering the area atop the present Colorado Plateau that Chaco Canyon now occupies .

The Chaco Wash flowed across the upper strata of what is now the 400 @-@ foot ( 120 m ) Chacra Mesa , cutting into it and gouging out a broad canyon over the course of millions of years . The mesa comprises sandstone and shale formations dating from the Late Cretaceous , which are of the Mesa Verde formation . The canyon bottomlands were further eroded , exposing Menefee Shale bedrock ; this was subsequently buried under roughly 125 feet ( 38 m ) of sediment . The canyon and mesa lie within the " Chaco Core " ? which is distinct from the wider Chaco Plateau , a flat region of grassland with infrequent stands of timber . As the Continental Divide is only 15 @.@ 5 miles ( 25 km ) east of the canyon , geological characteristics and different patterns of drainage differentiate these two regions both from each other and from the nearby Chaco Slope , the Gobernador Slope , and the Chuska Valley .

= = Climate = =

An arid region of high xeric scrubland and desert steppe , the canyon and wider basin average 8 inches ( 200 mm ) of rainfall annually ; the park averages 9 @.@ 1 inches ( 230 mm ) . Chaco Canyon lies on the leeward side of extensive mountain ranges to the south and west , resulting in a rainshadow effect that fosters the prevailing lack of moisture in the region . The region sees four distinct seasons . Rainfall is most likely between July and September , while May and June are the driest months . Orographic precipitation , which results from moisture wrung out of storm systems ascending the mountain ranges around Chaco Canyon , is responsible for most of the summer and winter precipitation , and rainfall increases with higher elevation . Occasional aberrant northward excursions of the intertropical convergence zone may boost precipitation in some years .

Chaco endures remarkable climatic extremes : temperatures range between ? 38 to 102 ° F ( ? 39 to 39 ° C ) , and may swing 60 ° F ( 33 ° C ) in a single day . The region averages fewer than 150 frost @-@ free days per year , and the local climate swings wildly from years of plentiful rainfall to prolonged drought . The heavy influence of the El Niño @-@ Southern Oscillation contributes to the canyon 's fickle climate .

= = Flora and fauna = =

Chacoan flora typifies that of North American high deserts : sagebrush and several species of cactus are interspersed with dry scrub forests of piñon and juniper , the latter primarily on the mesa tops . The canyon is far drier than other parts of New Mexico located at similar latitudes and elevations , and it lacks the temperate coniferous forests plentiful to the east . The prevailing sparseness of plants and wildlife was echoed in ancient times , when overpopulation , expanding cultivation , overhunting , habitat destruction , and drought may have led the Chacoans to strip the canyon of wild plants and game . It has been suggested that even during wet periods the canyon was able to sustain only 2 @, @ 000 people .

Among Chacoan mammals are the plentiful coyote ( *Canis latrans* ) ; mule deer , elk , and pronghorn also live within the canyon , though they are rarely encountered by visitors . Important smaller carnivores include bobcats , badgers , foxes , and two species of skunk . The park hosts abundant populations of rodents , including several prairie dog towns . Small colonies of bats are present during the summer . The local shortage of water means that relatively few bird species are present ; these include roadrunners , large hawks ( such as Cooper 's hawks and American kestrels ) , owls , vultures , and ravens , though they are less abundant in the canyon than in the wetter mountain ranges to the east . Sizeable populations of smaller birds , including warblers , sparrows , and house finches , are also common . Three species of hummingbirds are present : one is the tiny but highly pugnacious rufous hummingbird , which compete intensely with the more mild @-@ tempered black @-@ chinned hummingbirds for breeding habitat in shrubs or trees located near water . Western ( prairie ) rattlesnakes are occasionally seen in the backcountry , though various lizards and skinks are far more abundant .

= = History = =

### == Archaic ? Early Basketmakers ==

The first people in the San Juan Basin were hunter @-@ gatherers : the Archaic ? Early Basketmaker people . These small bands descended from nomadic Clovis big @-@ game hunters who arrived in the Southwest around 10 @, @ 000 BC . More than 70 campsites from this period , carbon @-@ dated to the period 7000 ? 1500 BC and mostly consisting of stone chips and other leavings , were found in Atlatl Cave and elsewhere within Chaco Canyon , with at least one of the sites located on the canyon floor near an exposed arroyo . The Archaic ? Early Basketmaker people were nomadic or semi @-@ nomadic hunter @-@ gatherers who over time began making baskets to store gathered plants . By the end of the period , some people cultivated food . Excavation of their campsites and rock shelters has revealed that they made tools , gathered wild plants , and killed and processed game . Slab @-@ lined storage cists indicate a change from a wholly nomadic lifestyle .

### == Ancestral Puebloans ==

By 900 BC , Archaic people lived at Atlatl Cave and like sites . They left little evidence of their presence in Chaco Canyon . By AD 490 , their descendants , of the Late Basketmaker II Era , farmed lands around Shabik 'eshchee Village and other pit @-@ house settlements at Chaco .

A small population of Basketmakers remained in the Chaco Canyon area . The broad arc of their cultural elaboration culminated around 800 , during the Pueblo I Era , when they were building crescent @-@ shaped stone complexes , each comprising four to five residential suites abutting subterranean kivas , large enclosed areas reserved for rites . Such structures characterize the Early Pueblo People . By 850 , the Ancient Pueblo population ? the " Anasazi " , from a Ute term adopted by the Navajo denoting the " ancient ones " or " enemy ancestors " ? had rapidly expanded : groups resided in larger , more densely populated pueblos . Strong evidence attests to a canyon @-@ wide turquoise processing and trading industry dating from the 10th century . Around then , the first section of Pueblo Bonito was built : a curved row of 50 rooms near its present north wall .

The cohesive Chacoan system began unravelling around 1140 , perhaps triggered by an extreme fifty @-@ year drought that began in 1130 ; chronic climatic instability , including a series of severe droughts , again struck the region between 1250 and 1450 . Poor water management led to arroyo cutting ; deforestation was extensive and economically devastating : timber for construction had to be hauled instead from outlying mountain ranges such as the Chuska mountains , which are more than 50 miles ( 80 km ) to the west . Outlying communities began to depopulate and , by the end of the century , the buildings in the central canyon had been neatly sealed and abandoned .

Some scholars suggest that violence and warfare , perhaps involving cannibalism , impelled the evacuations . Hints of such include dismembered bodies ? dating from Chacoan times ? found at two sites within the central canyon . Yet Chacoan complexes showed little evidence of being defended or defensively sited high on cliff faces or atop mesas . Only several minor sites at Chaco have evidence of the large @-@ scale burning that would suggest enemy raids . Archaeological and cultural evidence leads scientists to believe people from this region migrated south , east , and west into the valleys and drainages of the Little Colorado River , the Rio Puerco , and the Rio Grande . Anthropologist Joseph Tainter deals at length with the structure and decline of Chaco civilization in his 1988 study *The Collapse of Complex Societies* .

### == Athabaskan succession ==

Numic @-@ speaking peoples , such as the Ute and Shoshone , were present on the Colorado Plateau beginning in the 12th century . Nomadic Southern Athabaskan @-@ speaking peoples , such as the Apache and Navajo , succeeded the Pueblo people in this region by the 15th century . In the process , they acquired Chacoan customs and agricultural skills . Ute tribal groups also

frequented the region , primarily during hunting and raiding expeditions . The modern Navajo Nation lies west of Chaco Canyon , and many Navajo live in surrounding areas .

= = = Excavation and protection = = =

The first documented trip through Chaco Canyon was an 1823 expedition led by New Mexican governor José Antonio Vizcarra when the area was under Mexican rule . He noted several large ruins in the canyon . The American trader Josiah Gregg wrote about the ruins of Chaco Canyon , referring in 1832 to Pueblo Bonito as " built of fine @-@ grit sandstone " . In 1849 , a U.S. Army detachment passed through and surveyed the ruins , following United States acquisition of the Southwest with its victory in the Mexican War in 1848 . The canyon was so remote , however , that it was scarcely visited over the next 50 years . After brief reconnaissance work by Smithsonian scholars in the 1870s , formal archaeological work began in 1896 when a party from the American Museum of Natural History based in New York City ? the Hyde Exploring Expedition ? began excavating Pueblo Bonito . Spending five summers in the region , they sent over 60 @,@ 000 artifacts back to New York and operated a series of trading posts in the area .

In 1901 Richard Wetherill , who had worked for the Hyde expedition , claimed a homestead of 161 acres ( 65 ha ) that included Pueblo Bonito , Pueblo del Arroyo , and Chetro Ketl . While investigating Wetherill 's land claim , federal land agent Samuel J. Holsinger detailed the physical setting of the canyon and the sites , noted prehistoric road segments and stairways above Chetro Ketl , and documented prehistoric dams and irrigation systems . His report went unpublished and unheeded . It urged the creation of a national park to safeguard Chacoan sites .

The next year , Edgar Lee Hewett , president of New Mexico Normal University ( later renamed New Mexico Highlands University ) , mapped many Chacoan sites . Hewett and others helped enact the Federal Antiquities Act of 1906 , the first U.S. law to protect relics ; it was , in effect , a direct consequence of Wetherill 's controversial activities at Chaco . The Act also authorized the President to establish national monuments : on March 11 , 1907 , Theodore Roosevelt proclaimed Chaco Canyon National Monument . Wetherill relinquished his land claims .

In 1920 , the National Geographic Society began an archaeological examination of Chaco Canyon and appointed Neil Judd , then 32 , to head the project . After a reconnaissance trip that year , Judd proposed to excavate Pueblo Bonito , the largest ruin at Chaco . Beginning in 1921 , Judd spent seven field seasons at Chaco . Living and working conditions were spartan at best . In his memoirs , Judd noted dryly that " Chaco Canyon has its limitations as a summer resort " . By 1925 , Judd 's excavators had removed 100 @,@ 000 short tons of overburden , using a team of " 35 or more Indians , ten white men , and eight or nine horses " . Judd 's team found only 69 hearths in the ruin , a puzzling discovery as winters are cold at Chaco . Judd sent A. E. Douglass more than 90 specimens for tree @-@ ring dating , then in its infancy . At that time , Douglass had only a " floating " chronology. it was not until 1929 that a Judd @-@ led team found the " missing link " . Most of the beams used at Chaco were cut between 1033 and 1092 , the height of construction there .

In 1949 , the University of New Mexico deeded over adjoining lands to form an expanded Chaco Canyon National Monument . In return , the university maintained scientific research rights to the area . By 1959 , the National Park Service had constructed a park visitor center , staff housing , and campgrounds . As a historic property of the National Park Service , the National Monument was listed on the National Register of Historic Places on October 15 , 1966 . In 1971 , researchers Robert Lister and James Judge established the " Chaco Center , " a division for cultural research that functioned as a joint project between the University of New Mexico and the National Park Service . A number of multi @-@ disciplinary research projects , archaeological surveys , and limited excavations began during this time . The Chaco Center extensively surveyed the Chacoan roads , well @-@ constructed and strongly reinforced thoroughfares radiating from the central canyon .

The richness of the cultural remains at park sites led to the expansion of the small National Monument into the Chaco Culture National Historical Park on December 19 , 1980 , when an additional 13 @,@ 000 acres ( 5 @,@ 300 ha ) were added to the protected area . In 1987 , the

park was designated a World Heritage Site by UNESCO . To safeguard Chacoan sites on adjacent Bureau of Land Management and Navajo Nation lands , the Park Service developed the multi -agency Chaco Culture Archaeological Protection Site program . These initiatives have identified more than 2 , 400 archeological sites within the current park 's boundaries ; only a small percentage of these have been excavated .

= = Management = =

Chaco Culture National Historical Park is managed by the National Park Service , a federal agency within the Department of the Interior ; neighboring federal lands hosting Chacoan roads are controlled by the Bureau of Land Management . In the 2002 - 03 fiscal year , the park 's total annual operating budget was \$ 1 , 434 , 000 . The park has a visitor center , which features the " Chaco Collection Museum " , an information desk , a theater , a book store , and a gift shop . Prior to the 1980s , archeological excavations within current park boundaries were intensive : compound walls were dismantled or demolished , and thousands of artifacts were extracted . Starting in 1981 , a new approach , informed by traditional Hopi and Pueblo beliefs , stopped such intrusions . Remote sensing , anthropological study of Indian oral traditions , and dendrochronology - which left Chacoan relics undisturbed - were pursued . In this vein , the " Chaco American Indian Consultation Committee " was established in 1991 to give Navajo , Hopi , Pueblo , and other Indian representatives a voice in park oversight .

Current park policy mandates partial restoration of excavated sites . " Backfilling " , or re -burying excavated sites with sand , is one such means . Other measures attempt to safeguard the area 's ancient ambiance and mystique , such as the " Chaco Night Sky Program " , which seeks to eliminate the effect of light pollution on the park 's acclaimed night skies ; under the program , some 14 , 000 visitors make use of the Chaco Observatory ( inaugurated in 1998 ) , park telescopes , and astronomy -related programs . The park was named a Gold -tier Dark Sky Park by the International Dark -Sky Association in 2013 . Chacoan relics outside the current park 's boundaries have been threatened by development : an example was the proposed competitive leasing of federal lands in the San Juan Basin for surface coal mining beginning in 1983 . As ample coal deposits abut the park , this strip mining threatened the web of ancient Chacoan roads . The year -long " Chaco Roads Project " thus documented the roads , which were later protected from mining .

= = Sites = =

The Chacoans built their complexes along a 9 -mile ( 14 km ) stretch of canyon floor , with the walls of some structures aligned cardinally and others aligned with the 18 . 6 -year cycle of minimum and maximum moonrise and moonset .

= = Central canyon = =

The central portion of the canyon contains the largest Chacoan complexes . The most studied is Pueblo Bonito . Covering almost 2 acres ( 0 . 81 ha ) and comprising at least 650 rooms , it is the largest great house ; in parts of the complex , the structure was four stories high . The builders ' use of core - and -veneer architecture and multi -story construction necessitated massive masonry walls up to 3 feet ( 91 cm ) thick . Pueblo Bonito is divided into two sections by a wall precisely aligned to run north -south , bisecting the central plaza . A great kiva was placed on either side of the wall , creating a symmetrical pattern common to many Chacoan great houses . The scale of the complex , upon completion , rivaled that of the Colosseum . Nearby is Pueblo del Arroyo , which was founded between AD 1050 and 1075 and completed in the early 12th century ; it sits at a drainage outlet known as South Gap .

Casa Rinconada , isolated from the other central sites , sits to the south side of Chaco Wash , adjacent to a Chacoan road leading to a set of steep stairs that reached the top of Chacra Mesa . Its

sole kiva stands alone , with no residential or support structures whatsoever ; it did once have a 39 @-@ foot ( 12 m ) passageway leading from the underground kiva to several above @-@ ground levels . Chetro Ketl , located near Pueblo Bonito , bears the typical ' D ' -shape of many other central complexes . Begun between 1020 and 1050 , its 450 ? 550 rooms shared one great kiva . Experts estimate that it took 29 @,@ 135 man @-@ hours to erect Chetro Ketl alone ; Hewett estimated that it took the wood of 5 @,@ 000 trees and 50 million stone blocks .

Kin Kletso ( " Yellow House " ) was a medium @-@ sized complex located 0 @.@ 5 miles ( 800 m ) west of Pueblo Bonito . It shows strong evidence of construction and occupation by Pueblo peoples from the northern San Juan Basin . Its rectangular shape and design is related to the Pueblo II cultural group , rather than the Pueblo III style or its Chacoan variant . It contains 55 rooms , four ground @-@ floor kivas , and a two @-@ story cylindrical tower that may have functioned as a kiva or religious center . Evidence of an obsidian @-@ processing industry was discovered near the village , which was erected between 1125 and 1130 .

Pueblo Alto is a great house of 89 rooms located on a mesa top near the middle of Chaco Canyon , 0 @.@ 6 miles ( 1 km ) from Pueblo Bonito ; it was begun between AD 1020 and 1050 during a wider building boom throughout the canyon . Its location made the community visible to most of the inhabitants of the San Juan Basin ; indeed , it was only 2 @.@ 3 miles ( 3 @.@ 7 km ) north of Tsin Kletzin , on the opposite side of the canyon . The community was the center of a bead- and turquoise @-@ processing industry that influenced the development of all villages in the canyon ; chert tool production was common . Research at the site conducted by archaeologist Tom Windes suggests only a handful of families , perhaps as few as five to twenty , lived in the complex ; this may imply that Pueblo Alto served a primarily non @-@ residential role . Another great house , Nuevo Alto , was built on the north mesa near Pueblo Alto ; it was founded in the late 12th century , a time when the Chacoan population was declining .

== = Outliers == =

Another cluster of great houses lies in Chaco 's northern reaches ; among the largest is Casa Chiquita ( " Small House " ) , a village built in the 1080s , when , in a period of ample rainfall , Chacoan culture was expanding . Its layout featured a smaller , squarer profile ; it also lacked the open plazas and separate kivas of its predecessors . Larger , squarer blocks of stone were used in the masonry ; kivas were designed in the northern Mesa Verdean tradition . Two miles down the canyon is Peñasco Blanco ( " White Bluff " ) , an arc @-@ shaped compound built atop the canyon 's southern rim in five distinct stages between 900 and 1125 . A nearby cliff painting ( the " Supernova Platograph " ) may record the sighting of the SN 1054 supernova on July 5 , 1054 .

Hungo Pavi , located 1 mi ( 1 @.@ 6 km ) from Una Vida , measured 872 feet ( 266 m ) in circumference . Initial probes revealed 72 ground @-@ level rooms , with structures reaching four stories in height ; one large circular kiva has been identified . Kin Nahasbas , built in either the 9th or 10th century , is sited slightly north of Una Vida , positioned at the foot of the north mesa . Limited excavation of it has taken place . Tsin Kletzin ( " Charcoal Place " ) , a compound located on the Chacra Mesa and positioned above Casa Rinconada , is 2 @.@ 3 miles ( 3 @.@ 7 km ) due south of Pueblo Alto , on the opposite side of the canyon . Nearby is Weritos Dam , a massive earthen structure that scientists believe provided Tsin Kletzin with all of its domestic water . The dam worked by retaining stormwater runoff in a reservoir . Massive amounts of silt accumulated during flash floods would have forced the residents to regularly rebuild the dam and dredge the catchment area .

Deeper in the canyon , Una Vida ( " One Life " ) is one of the three oldest great houses ; construction began around 900 . Comprising at least two stories and 124 rooms , it shares an arc or " D " -shaped design with its contemporaries , Peñasco Blanco and Pueblo Bonito , but has a unique " dog leg " addition made necessary by topography . It is located in one of the canyon 's major side drainages , near Gallo Wash , and was massively expanded after 930 . Wijiji ( " black greasewood " ) , comprising just over one hundred rooms , is the smallest of the great houses . Built between 1110 and 1115 , it was the last Chacoan great house to be constructed . Somewhat isolated within the

narrow wash , it is positioned 1 mi ( 1 @. @ 6 km ) from neighboring Una Vida . Directly north are communities even more remote : Salmon Ruins and Aztec Ruins , sited on the San Juan and Animas Rivers near Farmington , were built during a thirty @- @ year wet period commencing in 1100 . Some 60 miles ( 97 km ) directly south of Chaco Canyon , on the Great South Road , lies another cluster of outlying communities . The largest , Kin Nizhoni , stands atop a 7 @, @ 000 @- @ foot ( 2 @, @ 100 m ) mesa surrounded by marshy bottomlands .

Casamero Pueblo is located on McKinley County Road 19 , near Tecolote Mesa , a red sandstone mesa . It was connected to its nearby outlier , Andrews Ranch , by a Chacoan road . Chaco Canyon , Aztec Ruins , Salmon Ruins , and Casamero Pueblo are on the Trail of the Ancients Scenic Byway .

= = Ruins = =

= = = Great houses = = =

Immense complexes known as " great houses " embodied worship at Chaco . The Chacoans used masonry techniques unique for their time , and their building constructions lasted decades and even centuries . As architectural forms evolved and centuries passed , the houses kept several core traits . Most apparent is their sheer bulk ; complexes averaged more than 200 rooms each , and some enclosed up to 700 rooms . Individual rooms were substantial in size , with higher ceilings than Anasazi works of preceding periods . They were well @- @ planned : vast sections or wings erected were finished in a single stage , rather than in increments . Houses generally faced the south , and plaza areas were almost always girt with edifices of sealed @- @ off rooms or high walls . Houses often stood four or five stories tall , with single @- @ story rooms facing the plaza ; room blocks were terraced to allow the tallest sections to compose the pueblo 's rear edifice . Rooms were often organized into suites , with front rooms larger than rear , interior , and storage rooms or areas .

Ceremonial structures known as kivas were built in proportion to the number of rooms in a pueblo . One small kiva was built for roughly every 29 rooms . Nine complexes each hosted an oversized great kiva , each up to 63 feet ( 19 m ) in diameter . " T " -shaped doorways and stone lintels marked all Chacoan kivas . Though simple and compound walls were often used , great houses were primarily constructed of core @- @ and @- @ veneer walls : two parallel load @- @ bearing walls comprising dressed , flat sandstone blocks bound in clay mortar were erected . Gaps between walls were packed with rubble , forming the wall 's core . Walls were then covered in a veneer of small sandstone pieces , which were pressed into a layer of binding mud . These surfacing stones were often placed in distinctive patterns . The Chacoan structures altogether required the wood of 200 @, @ 000 coniferous trees , mostly hauled ? on foot ? from mountain ranges up to 70 miles ( 110 km ) away .

= = = Uses = = =

The meticulously designed buildings composing the larger Chacoan complexes did not emerge until around AD 1030 . The Chacoans melded pre @- @ planned architectural designs , astronomical alignments , geometry , landscaping , and engineering into ancient urban centers of unique public architecture . Researchers have concluded that the complex may have had a relatively small residential population , with larger groups assembling only temporarily for annual ceremonies . Smaller sites , apparently more residential in character , are scattered near the great houses in and around Chaco . The canyon itself runs along one of the lunar alignment lines , suggesting the location was originally chosen for its astronomical significance . If nothing else , this allowed alignment with several other key structures in the canyon .

Turquoise was very important to the people of Chaco . Around 200 @, @ 000 pieces of turquoise have been excavated from the ruins at Chaco Canyon , and workshops for local manufacture of turquoise beads have been found . The turquoise was used locally for grave goods , burials and

ceremonial offerings . Over 15 @,@ 000 turquoise beads and pendants accompanied two burials at Pueblo Bonito .

Around this time , the extended Ancestral Puebloan ( Anasazi ) community experienced a population and construction boom . Throughout the 10th century , Chacoan building techniques spread from the canyon to neighboring regions . By AD 1115 at least 70 outlying pueblos of Chacoan provenance had been built within the 25 @,@ 000 square miles ( 65 @,@ 000 km<sup>2</sup> ) composing the San Juan Basin . Experts speculate the function of these compounds , some large enough to be considered great houses in their own right . Some suggest they may have been more than agricultural communities , perhaps functioning as trading posts or ceremonial sites .

Thirty such outliers spread across 65 @,@ 000 square miles ( 170 @,@ 000 km<sup>2</sup> ) are connected to the central canyon and to one another by an enigmatic web of six Chacoan road systems . Extending up to 60 miles ( 97 km ) in generally straight routes , they appear to have been extensively surveyed and engineered . Their depressed and scraped caliche beds reach 30 feet ( 9 @.@ 1 m ) wide ; earthen berms or rocks , at times composing low walls , delimit their edges . When necessary , the roads deploy steep stone stairways and rock ramps to surmount cliffs and other obstacles . Though their purpose may never be certain , archaeologist Harold Gladwin noted that nearby Navajo believe that the Anasazi built the roads to transport timber ; archaeologist Neil Judd offered a similar hypothesis .

= = Archaeoastronomy = =

= = = Sun Dagger = = =

Two whorl @-@ shaped etchings near the top of Fajada Butte compose the " Sun Dagger " petroglyph , itself tucked behind the eponymous rock panels of the " Three @-@ Slab Site " . They are symbolically focal .

It consists of two spirals : one principal and one ancillary . The latter left @-@ hand spiral captured both spring and fall equinoxes ; its artifice was revealed by a descending spear of light , itself filtered through the slabs , that shined upon it and split it in two . The former and larger whorl to its right was lit by the titular " sun dagger " , which bisected it through another interplay of slab and sun . It struck it , brilliantly , as the summer sun attains its solstice midday peak . The Chacoans were said to be marking , as artist , " Sun Dagger " discoverer , and leading proponent Anna Sofaer puts it , " the middle of time " . Each turn of the 9 @.@ 25 @-@ turn large spiral was found to mark one year in the 18 @.@ 6 @-@ year " lunar excursion cycle " of the rising mid @-@ winter full moon . This record is kept by a slab @-@ cast lunar shadow whose edge strikes in succession each ring . As the full " minimum moon " closest to the winter solstice rises , the shadow 's edge precisely strikes the center of the larger spiral ; it steps outward year by year , ring by ring , until it strikes the outermost edge of it during the full " maximum moon " , again in mid @-@ winter .

Fajada Butte bears five other petroglyphs ? including a carving of a " rattlesnake " , other spirals , and a rectangle ? that are conspicuously lit by contrasts between sunbeams and shadows during equinoxes or solstices . Public access to the butte was curtailed when , in 1989 , erosion from modern foot traffic was found to be responsible for one of the three screening slabs at the " Sun Dagger " site shifting out of its ancient position ; the assemblage of stones has thus lost some of its former spatial and temporal precision as a solar and lunar calendar . In 1990 the screens were stabilized and placed under observation , but the wayward slab was not moved back into its original orientation .

= = = Alignments = = =

Some parties have advanced the theory that at least 12 of the 14 principal Chacoan complexes were sited and aligned in coordination , and that each was oriented along axes that mirrored the passing of the Sun and Moon at visually pivotal times . The first great house known to evince



fastidious proportioning and alignment was Casa Rinconada : the twinned " T " -shaped portals of its 10 @-@ metre ( 33 ft ) radius great kiva were north @-@ south collinear , and axes joining opposing windows passed within 10 centimetres ( 4 in ) of its center . The great houses of Pueblo Bonito and Chetro Ketl were found by the " Solstice Project " and the U.S. National Geodetic Survey to be sited along a precisely east @-@ west line , an axis that captures the passage of the equinox sun . The lines perpendicularly bisecting their principal walls are aligned north @-@ south , implying a possible intent to mirror the equinox midday . Pueblo Alto and Tsin Kletsin are also north @-@ south aligned . These two axes form an inverted cross when viewed from above ; its northbound reach is extended another 35 miles ( 56 km ) past Pueblo Alto by the ramrod @-@ straight Great North Road , a pilgrimage route that modern @-@ day Pueblo Indians believe to be an allusion to myths surrounding their arrival from the distant north .

Two shared @-@ latitude but diametrically opposed complexes , Pueblo Pintado and Kin Bineola , are located some 15 miles ( 24 km ) from the core buildings of the central canyon . Each lie on a path from the central canyon that is collinear with the passage and setting of the full mid @-@ winter " minimum moon " , which recurs every 18 @-@ 6 years . Two other complexes that are less distant from Pueblo Bonito , Una Vida and Peñasco Blanco , share an axis collinear with the passage of the full " maximum moon " . The terms " minimum " and " maximum " refer to the azimuthal extreme points in the lunar excursion cycle , or the swings in direction relative to true north that the setting full moon exhibits . It takes roughly 9 @-@ 25 years for the rising or setting full moon nearest to winter solstice to proceed from its maximum azimuthal north , or " maximum extremum " , to its southernmost azimuth , known as " minimum extremum " .

Reasons for the alignments have been offered :

As these people would view the heavens ... there was an order of things up there . What you had here ... contrasted to that . Some years it was too dry , too hot ... too windy , too cold . If there was a way to transfer the orderly nature of the cosmos down onto what seems to be chaos that exists here , then you begin to then integrate at this place both heaven and earth . And this would be ... the center place .

= = Photo gallery = =