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Research Article

Parallel roads, solstice and sacred geography at the Gasco Site: a Chacoan ritual landscape

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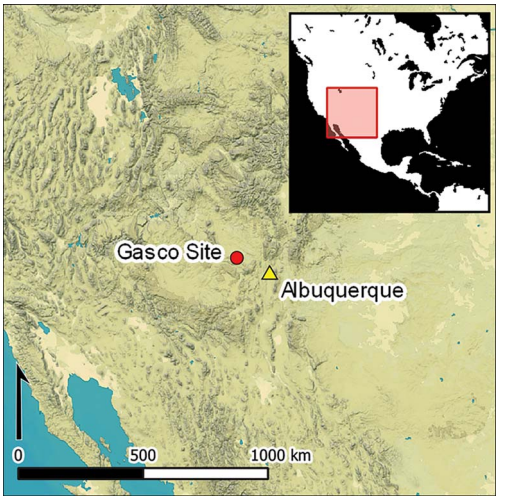

Monumental roads were constructed during the ninth to thirteenth centuries by the regional society centred on Chaco Canyon in the US Southwest. Here, the authors present new lidar and field documentation of parallel roads at the Gasco Site, which sits within a ritual landscape south of Chaco Canyon. Their findings reveal that the Gasco Road is substantially longer than previously believed and forms alignments between natural springs and towards the winter solstice sunrise over Mount Taylor, a mountain sacred among contemporary Indigenous peoples. These findings highlight the agency of landscapes and skyscapes in structuring ritual practices in ancient societies worldwide.

Keywords: North America, Chaco Canyon, Pueblo, Diné (Navajo), lidar, ritual landscape, roads

Introduction

The archaeological complex at Chaco Canyon (*c.* AD 850–1140) in north-western New Mexico, USA, is a UNESCO World Heritage Site and among the most-researched sites of the ancient Americas. The Chacoan culture is best known for its ninth- to twelfth-centuries AD fluorescence of monumental Great House architecture—multi-storeyed masonry buildings built to standardised templates that served religiopolitical purposes—and the regional distribution of these Great Houses across a 100 000km^2 region known as the Chaco World (Mills 2018). Multigenerational high-status burials at Pueblo Bonito in Chaco

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Canyon mark the first clear evidence of institutionalised inequality in the US Southwest (Plog & Heitman 2010; Kennett *et al.* 2017). The authority of Chacoan elites is demonstrated by their ability to acquire large quantities of construction timbers, pottery, turquoise, shell and maize from throughout the Southwest, along with macaws and cacao from 1800km away in Mesoamerica (Mills 2018: 856). Many researchers concur that a compelling religious tradition with associated ritual practices and architectural forms underlay this regional influence and the authority of Chacoan leaders (e.g. Renfrew 2001; Van Dyke 2007; Plog & Heitman 2010; Mills 2018: 860).

Scores, and perhaps hundreds (Friedman *pers. comm.*), of monumental roadways were constructed in Chaco Canyon and throughout its larger region (Roney 1992; Friedman *et al.* 2017). Chacoan roads were created by excavating 9m-wide linear channels—a width that exceeds practical necessity in a society without wheeled vehicles or pack animals—that incorporated rock-cut staircases, earthen ramps, earthen/stone berms and small architectural features (Kincaid 1983; Nials *et al.* 1987; Weiner 2023). Some Chacoan roads are regional-scale corridors that radiate up to 55km from Chaco Canyon, though most are shorter segments associated with Great Houses throughout the Chaco World (Roney 1992). The massive scale of Chacoan roads, the requisite labour organisation for their creation and their regional distribution underscore the relevance of these roads for global archaeological questions of complexity, inequality, monumentality and ritual landscapes in early societies.

Despite this potential, there has been little empirical investigation of Chacoan roads beyond a large-scale mapping effort by the Bureau of Land Management Chaco Roads Project (BLMCRP) in the 1980s (Kincaid 1983; Nials *et al.* 1987). In early interpretations, Chacoan roads were envisioned as connective infrastructure that facilitated the movement of trade goods and people throughout the Chaco World (e.g. Powers *et al.* 1983). Subsequent large-scale field documentation efforts by the BLMCRP and others have revealed that most roads are short spokes that rarely connect settlements, but instead often lead to landscape features and ritual architecture (Roney 1992; Kantner 1997; Marshall 1997; Van Dyke 2007; Hurst & Till 2009). The empirical record of Chacoan roads suggests that, in contrast to functionalist understandings, Chacoan avenues served to materialise a sacred geography on the landscape and structure ritual movements (Weiner 2023). Some roads may have facilitated the transport of timbers to Chaco Canyon for Great House construction, though even this 'utilitarian' act likely constituted a form of pilgrimage (Wilson *et al.* 2023: 5–6; Field 2024). Recently, Chacoan roads research has benefitted from the application of lidar technology, which has detected previously unknown roads (Friedman *et al.* 2017), along with the rise of interpretive frameworks that seek to enrich understanding of Chacoan roads through increased engagement with descendant Pueblo and Diné (Navajo) people and their cosmologies (Van Dyke & Heitman 2021; Weiner 2023). Investigation of Chacoan roads is time-sensitive given the rapid, ongoing deterioration of their archaeological traces through natural processes and increased human use of the landscape.

In this article, we report on recent lidar and field documentation of Chacoan road segments at the Gasco Site, located 70km south of Chaco Canyon in the Red Mesa Valley near modern-day Grants, New Mexico. Earlier researchers noted the presence of a constructed road segment and *herradura* (Spanish for 'horseshoe', the term archaeologists use to describe crescent-shaped masonry features found along Chacoan roads) at this location

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via ground survey, but they could not trace the road beyond 75m and did not interpret the site's design or function (Gauthier & Stein 1977; Windes 1978: 61–62: 108, 123; Nials *et al.* 1987: 131–32). Here, we present lidar data showing that the Gasco Road extends for at least 6km and demonstrate the presence of a second, parallel road and a second herradura at the site. Both features are previously unknown and suggest aspects of how the Gasco Site materialised cosmological concepts and structured ritual movement practices. We also present documentation of the Gasco Roads' alignments towards two springs and the winter solstice sunrise above Mount Taylor, a mountain of great sanctity among contemporary Indigenous peoples of the region. The monumental roads of the Gasco Site foregrounded pre-existing affordances of place—namely, a view towards winter solstice sunrise over a sacred mountain—in crafting a compelling ritual environment used for ceremonial practices that affected the course of Chacoan history. In closing, we consider the Gasco Site alongside Stonehenge and the Emerald Acropolis near Cahokia, Illinois. The designs of these two premodern ritual complexes similarly highlight natural affordances of landscape and astronomy, supporting the broader point that the agencies structuring monumental religiopolitical landscapes in early societies worldwide frequently extend beyond the anthropic, thereby broadening the scope of historical actors implicated in past social transformation.

The Gasco Site

The Gasco Site is approximately 70km south of Chaco Canyon in the Red Mesa Valley. Research on the site began in 1976 during a cultural resource management survey for a New Mexico Gas Company (Gasco) pipeline, when archaeologists identified a massive crescentic feature of stacked stone (Gauthier & Stein 1977: 108, 123). Later, BLMCRP archaeologists identified a road segment adjacent to the Gasco Herradura, but they could not trace it beyond 75m to the north-west (Nials *et al.* 1987: 131–32, 148–50). A modest community of six Pueblo II (*c.* AD 900–1100) habitations is present to the south-east of the Gasco Herradura, along with two Great Houses and at least 115 residential sites within a 5km radius (Chaco Research Archive 2023; Weiner 2023: 381–82, fig. 8.52, tab. 8.10). Based on a rough estimate, assuming that every house in a community was occupied during its maximal occupation, with an average of five people per residential structure or Great House, communities within 5km of the Gasco Herradura could have included as many as 620 people.

The Gasco Site is located on a parcel of Navajo Nation land surrounded by Bureau of Land Management and private holdings, a complex land ownership situation that has precluded access to the site for many researchers. The Gasco Site has therefore rarely factored into discussions of the Chaco World and its roads. The authors received permission from all relevant landowning parties to document the site during a series of four visits between September 2021 and December 2022.

We renewed investigation of the Gasco Site by analysing 1m-resolution, pre-processed lidar digital elevation model data freely available via the US Geological Survey's National Map using ArcMap (Esri, v.10.8.1). We applied a hillshade filter positioning the light source at different simulated altitudes and azimuths and varying levels of vertical exaggeration to define linear anomalies on the ground surface. This process revealed clear evidence for two parallel Chacoan roadways, which we hereafter refer to as the Gasco North and South Parallel

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Roads (Figure 1 & online supplementary material (OSM) Figure S1). The distance between the parallel roads is irregular, ranging from 16m near where they converge in the south-east to 40m at their most separate. The Gasco South Parallel Road was not previously known, though parallel routes are present along numerous Chacoan roadways (Marshall 1997: 68–69).

The Gasco Herradura, the largest herradura known in the Chaco World, is the central feature at the Gasco Site (Figures 2 & 3; Nials *et al.* 1987: tab. 2). The formal similarity of Chacoan herraduras to historic and contemporary Pueblo shrines has led many archaeologists to identify herraduras as road-related shrines (e.g. Marshall 1997: 68), a perspective with which we concur. The Gasco Herradura is ovoid in shape, measuring 14m north to south by 10.7m east to west, with an opening flanked by 0.5m-tall sandstone blocks on its east-north-eastern side that articulates directly with the constructed roadway. While the BLMCRP reported the Gasco Herradura's maximum dimension as 9m, our mapping of the site shows its maximum dimension to be 14m. In comparison, the other herraduras documented by the BLMCRP rarely exceed a maximum dimension of 6.5m (Nials *et al.* 1987: tab. 2; see also Hurst & Till 2009: fig. 4.12).

Most of the stones forming the Gasco Herradura are fist-sized unshaped pieces of sandstone, though larger (e.g. 0.4 × 0.4m) sandstone clasts are also present in the architectural matrix. Bedrock is exposed in the interior of the herradura and near the opening on the

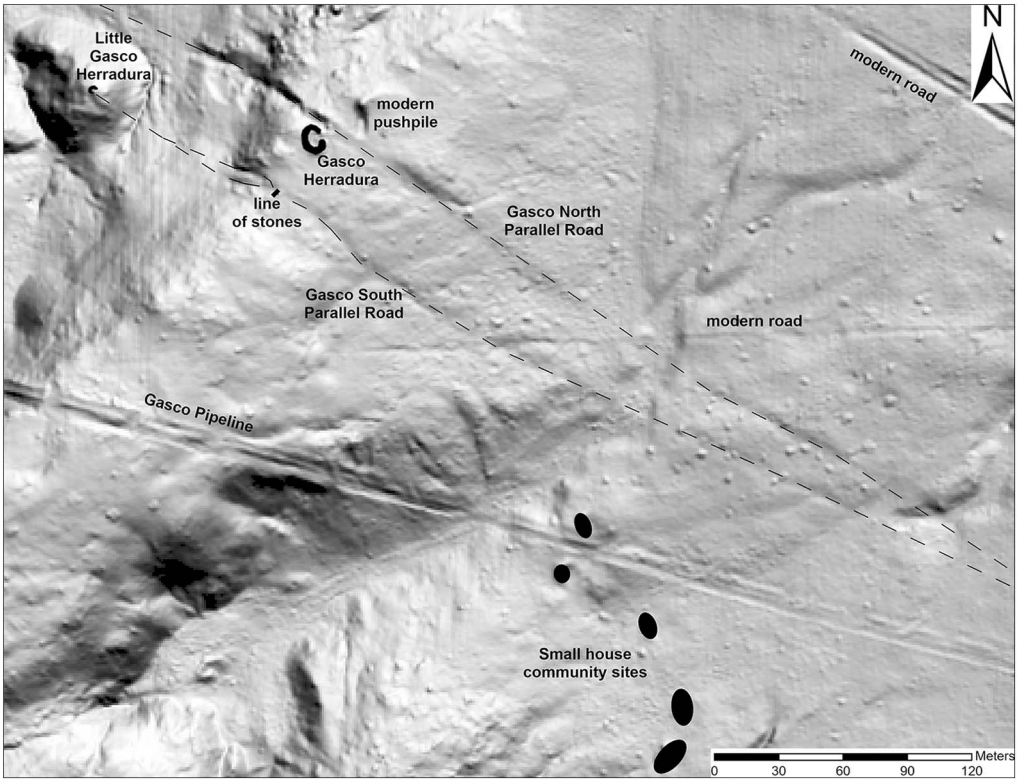

Figure 1. Lidar digital elevation model of the Gasco Site (figure by Robert S. Weiner).

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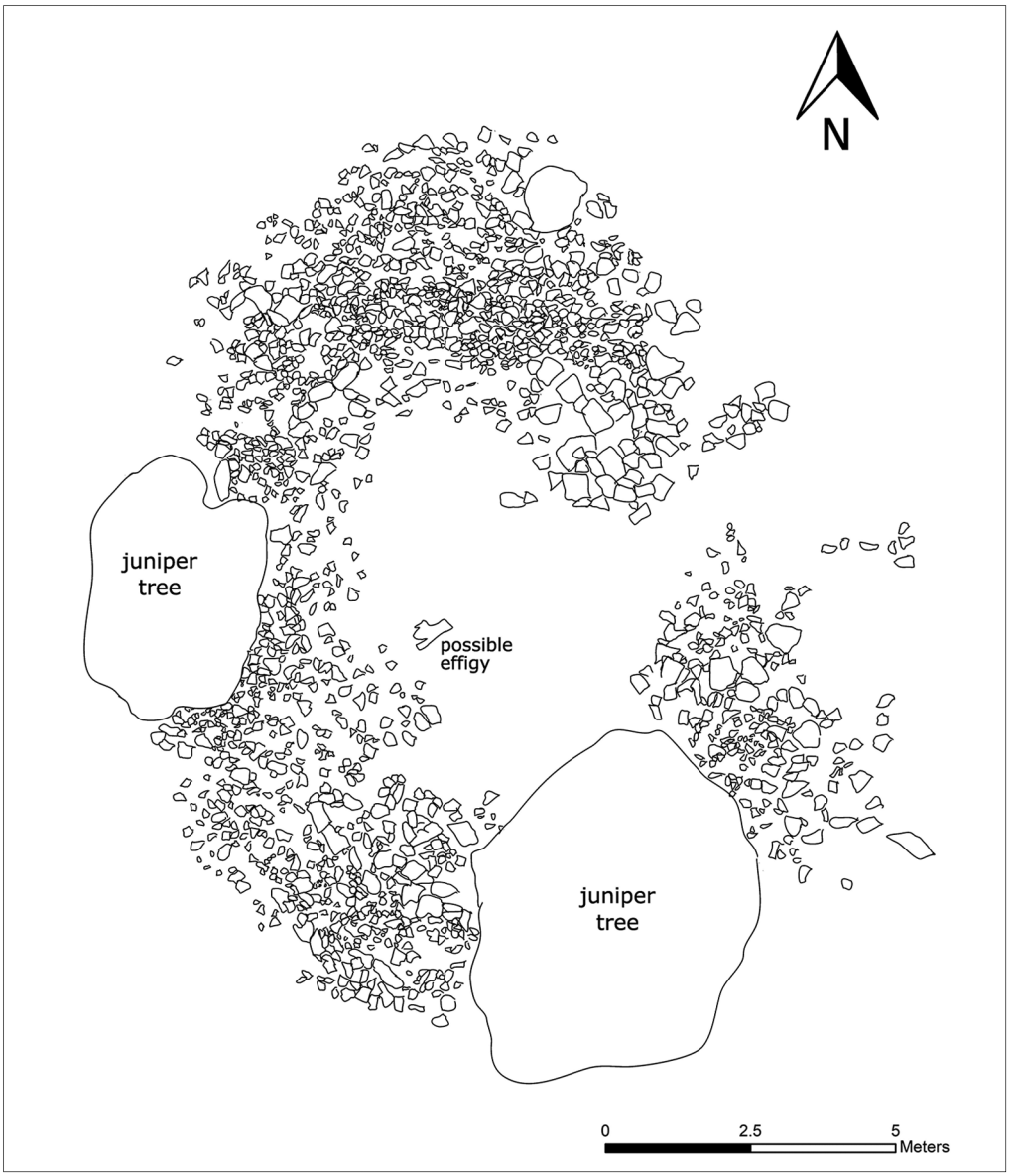

Figure 2. Plan of the Gasco Herradura (figure by Robert S. Weiner & Richard A. Friedman).

east side. An irregularly shaped sandstone block measuring 0.6 × 0.4m (previously noted by Gauthier & Stein 1977; Windes 1978) is present atop this bedrock exposure (Figure 4). The block appears to have been intentionally placed as a focal element within the interior of the herradura—it is set apart from wall fall rubble, close to the centre of the herradura, in line with the formalised opening and it is conspicuous within the otherwise cleared interior of the feature. Given its zoomorphic form with an angular head, eye socket, torso and forelimbs, one possible interpretation of the stone is that it is an effigy.

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Figure 3. Ground view of the Gasco Herradura (photograph by Robert S. Weiner).

A modest artefact assemblage of ceramics and lithics is present within a 25m radius of the Gasco Herradura (see Tables S1–S3). One concentration of artefacts is in direct spatial association with the herradura, and a second is distributed along the hillslope north of the herradura. The painted ceramics in the assemblage include Gallup Black-on-white, Escavada Black-on-white, Red Mesa Black-on-white and Wingate Black-on-red, all of which date to the Chaco Era (*c.* AD 875–1140) (Tables S1 & S2; Nials *et al.* 1987: 148; Weiner 2023: tab. 8.13). Artefacts in direct spatial association with the herradura are sparse and include two Wingate Black-on-red bowl sherds, two flakes of Grants Ridge obsidian, a Narbona Pass chert flake, a pink (non-Narbona Pass) chert flake, a mineralised quartz river cobble and a smooth quartz pebble. Modest assemblages of ceramic sherds are frequently found in association with herraduras throughout the Chaco World. These are not midden deposits, and the artefacts are widely interpreted as offerings (Nials *et al.* 1987; Friedman *et al.* 2017).

The Gasco North Parallel Road runs directly alongside the Gasco Herradura, extending towards the north-west and south-east. The road is 6.3m wide and 0.5m deep and was excavated directly into the sandstone bedrock for at least 75m, lined along its northern side by a 0.5m-tall, 4.2m-wide berm of fist-sized sandstone clasts and earth. The stones that were used to create the berm and herradura likely derived from the excavation of the roadbed. Both the excavation of the roadway into bedrock and construction of a massive rubble berm evince a significant labour investment that required the removal of approximately 187.5m^3 of

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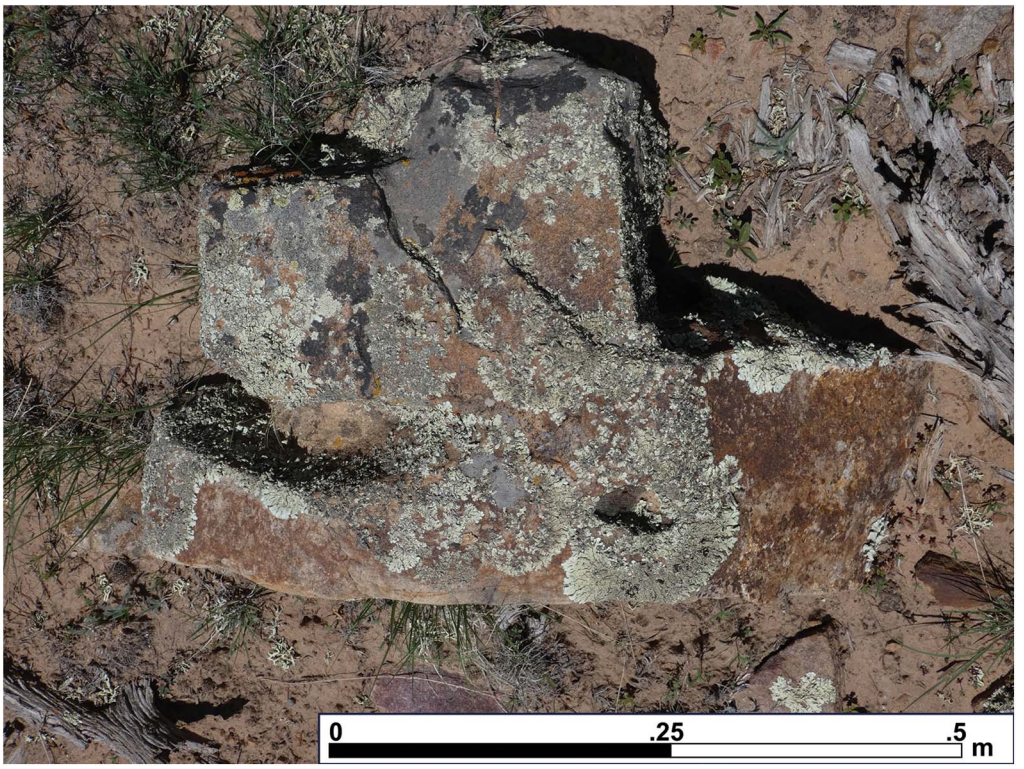

Figure 4. Photograph of the possible stone effigy within the Gasco Herradura (photograph by Robert S. Weiner).

bedrock. The Gasco North Parallel Road continues downhill from the Gasco Herradura in a north-westerly direction along a highly eroded corridor before entering the valley flats below, where its surface signature soon disappears from both ground visibility and lidar data.

The newly detected Gasco South Parallel Road is located 35m south-west and uphill from the North Parallel Road. It is 6.2m wide but lacks any visible berms and does not show evidence of having been excavated into bedrock. Our ground survey revealed a 2m-long line of sandstone clasts that is perpendicular to the sides of the South Parallel Road south-west of the Gasco Herradura (Figure 5). Such lines of stones are common aspects of road-related architecture in the Chaco World that may have prescribed movement patterns and/or marked formal closures of roadways (Weiner 2023: 662–67). We also identified a fork in the South Parallel Road just north-west of this line of stones, where the road forks into a southern branch that descends off the low mesatop via a constructed cut-and-fill segment and a northern branch that proceeds through a narrow, naturally occurring passageway in a sandstone outcrop (Figure 6). After descending, the two branches of the Gasco South Parallel Road presumably rejoin, but this section of the road is not visible on the ground nor in lidar data.

One hundred metres beyond the fork to the north-west, the Gasco South Parallel Road is well defined as it ascends a low hill as a 12.5m-long, 2.5m-wide excavated corridor flanked by berms of fist-sized sandstone rubble (Figure 7). Atop this low hill, our survey revealed a previously unknown 4.5 × 3.5m herradura, which we call the Little Gasco Herradura (Figure 8).

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Figure 5. The newly identified line of stones (arrows) across the Gasco South Parallel Road. Note the road's alignment towards Mount Taylor on the horizon (figure by Robert S. Weiner).

An assemblage of 18 Chaco Era ceramic sherds, including Red Mesa Black-on-white, Gallup Black-on-white and Wingate Black-on-red (Table S4), as well as a miniscule chip of turquoise and a smoothed, black river pebble were found in direct spatial association with the herradura (Figure 8). There is no physical trace of the South Parallel Road beyond the Little Gasco Herradura, suggesting it ends there.

Our documentation of Chacoan roads at the Gasco Site also offered new insights into the roads' connections with features on the landscape—specifically, watery places. Running north-west from the Gasco Herradura, the Gasco North Parallel Road is traceable for 284m in the flats as a moderate swale, both in lidar data and on the ground, after which the Chacoan road merges with historic/contemporary roads and its signature disappears. Projection of the North Parallel Road's trajectory, running north-west (approximately 282°) after it descends off the mesa, leads to the Blue J Site 2.4km away (Figure 9). Blue J is a Chaco Era community consisting of approximately 60 residential structures that cluster around a spring emanating from the red-hued sandstone cliffs (Kantner & Kintigh 2006: 160–61). The BLMCRP documented a 50m-long ground-visible swale approaching one of the houses at Blue J at an azimuth of 295°—the general direction of the Gasco Herradura (Nials *et al.* 1987: 150). Rock art imagery on the red sandstone cliffs behind Blue J may also provide support for there having been a Chacoan road at the site (John Kantner, *pers. comm.* 3 September

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Figure 6. Fork on the Gasco South Parallel Road. The left fork passes through a natural gap in a sandstone outcrop, and the right fork is a constructed cut-and-fill segment (figure by Robert S. Weiner).

2024). Two petroglyphs of sandals, a motif that accompanies Chacoan roadways in south-eastern Utah (Bellorado 2020: 287–300), are found near the spring, and it is possible that a long, anomalous, undulating, pecked line that articulates with water-related zoomorphs (a turtle, ducks and possible fish) may represent a Chacoan road associated with water and springs. There is currently no evidence that the Gasco North Parallel Road physically connected with Blue J and/or the spring around which the community is clustered, though the Blue J area has been significantly altered by modern activity, including the creation of a dirt road providing access to the various ranches and landholdings in the vicinity and a nearby mining operation. Traces of the Chaco Era road may have been destroyed by these activities. Whether or not the road once connected the Gasco Herradura to Blue J, it undeniably forms a visual alignment with the site and therefore physically reinforces a relationship between the herradura and the spring.

Heading south-east from the Gasco and Little Gasco Herraduras, the Gasco Parallel Roads converge near a highly eroded masonry feature 480m south-east of the herraduras (discussed in Weiner 2023: 393–95) and then proceed south-east as a single, albeit discontinuous, swale for 6.1km (Figure 9). This south-eastern extent of the road was not previously recorded, but is clearly visible in lidar data and on the ground. The last visible trace of the road runs to the head of a canyon informally referred to as Two Fault Canyon, where

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Figure 7. Well-defined road segment where the Gasco South Parallel Road ascends the low hill atop which the Little Gasco Herradura is located (figure by Robert S. Weiner).

a spring is present and water seasonally pools into a small, ephemeral pond. Chacoan roads at the Gasco Site therefore mark relationships with watery places in both directions from the herraduras.

Winter solstice alignment of the Gasco Roads

From the vicinity of the Gasco Herradura and the stone line across the South Parallel Road, both roads form clear visual trajectories towards Mount Taylor to the south-east, an eminently sacred mountain among contemporary Pueblo and Diné people living in the Four Corners region who are descendants of the Chacoans (Pueblo of Acoma *et al.* 2009). We also note that both roads run at azimuths of approximately 120°, corresponding with the position of the winter solstice sunrise at the latitude of the Gasco Site. Suspecting that the sun would rise over Mount Taylor in alignment with the roads on the morning of the winter solstice, we visited the Gasco Site to witness and document the alignment on 21 December 2022. As anticipated, the sun rose dramatically behind Mount Taylor in alignment with the road corridors when viewed from the centre of the roadbeds adjacent to the Gasco Herradura and the line of stones (Figure 10). Many Chacoan Great Houses and roads incorporate alignments towards prominent features of the landscape and astronomical events including

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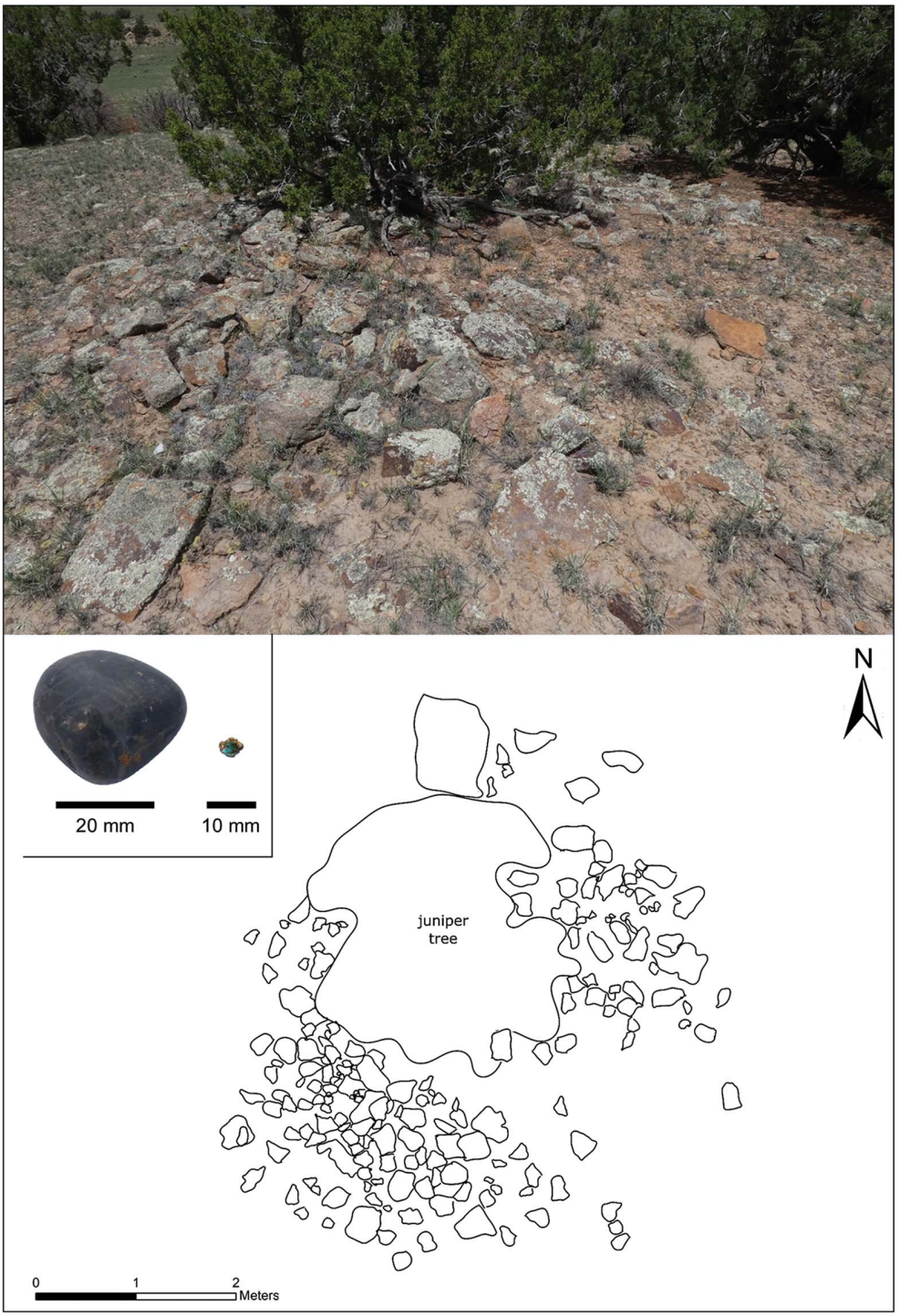

Figure 8. Ground view (top half) and plan of the Little Gasco Herradura (lower half); inset shows the turquoise chip and water-worn pebble found at the herradura (figure by Robert S. Weiner).

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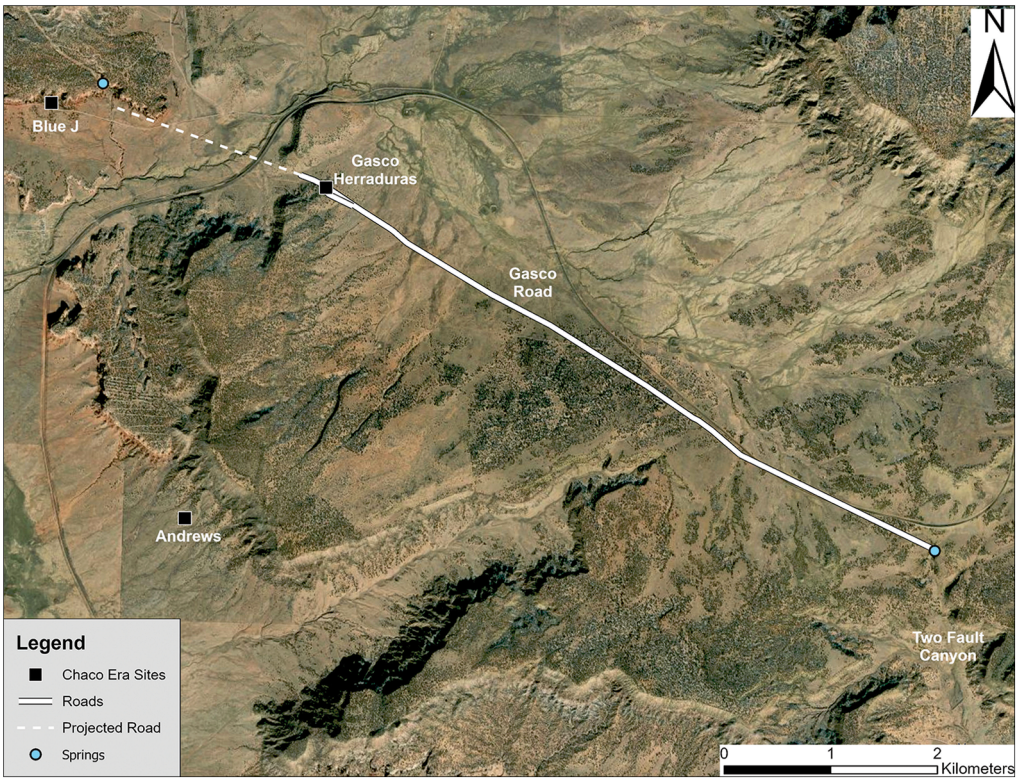

Figure 9. Map showing the relationship of the Gasco Road with springs in both directions from the Gasco Site (figure by Robert S. Weiner).

solstices, equinoxes and lunar standstills (Kantner 1997; Marshall 1997; Sofaer 2007; Van Dyke 2007; Weiner 2023).

Reading the Gasco ritual landscape: dualism and water

In interpreting the cosmological principles and associated ritual practices materialised in the Gasco ritual landscape, we rely on multiple years of partnership with Diné and Pueblo colleagues, reviews of the ethnographic literature and comparison with previously documented Chacoan sites. Mountains are among the pre-eminent sacred places for contemporary Pueblo and Diné people, and Mount Taylor, in particular, is a sacred mountain for the Diné and the Pueblos of Acoma, Laguna, Hopi and Zuni (Pueblo of Acoma *et al.* 2009). During the Chaco Era, spruce and fir trees from Mount Taylor were felled and carried the 95km back to Chaco Canyon by foot for use as timbers to roof the monumental Great House structures (Guiterman *et al.* 2016). Mount Taylor was also a major obsidian source for the inhabitants of the Chaco World (Moss *et al.* 2023). Flakes of Grants Ridge obsidian procured from the flanks of Mount Taylor are present among the lithic assemblage at the Gasco Herradura (Table S3), perhaps deposited as "pieces of place" (Bradley 2000: 81–96) that further connected the Gasco Herradura with that specific mountain. For the people of Zuni Pueblo

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Figure 10. Sunrise over Mount Taylor on the winter solstice (21 December 2022) viewed from the centre of the Gasco North Parallel Road adjacent to the Gasco Herradura (figure by Robert S. Weiner).

today, Mount Taylor is "a tangible record of ancestral migrations, a living being, a pilgrimage site, a referent in religious prayers, a spiritual source of rain, and a collecting place for spring water, animals, minerals, and plants" (Colwell & Ferguson 2014: 234). Similar associations hold for the Diné and other Pueblos for whom Mount Taylor is a sacred place. To construct a road aligning towards Mount Taylor was therefore to link the Gasco Site—and, by extension, the people who conducted ceremonies there—with a locus of great meaning and power.

The Gasco Roads also evince associations with water, a scarce resource crucial to the sustenance of life and the focus of much Pueblo and Diné ceremonialism. Most prominently, the Gasco Roads connect the Gasco Herraduras with watery places: a spring in the cliffs behind Blue J and the head of Two Fault Canyon. The deposition of water-worn pebbles at both herraduras and of a blue-green turquoise chip at the Little Gasco Herradura likely express relationships with water. The alignment towards Mount Taylor is also relevant, as mountains are strongly connected with water among Pueblo and Diné people (Reichard 1977; Parsons 1996). As elsewhere, mountain peaks in the US Southwest alter the movement of winds, causing clouds to condense above their summits, and the headwaters of rivers originate in the mountains. For Pueblo people, ancestral cloud beings dwelling in the mountains are the bringers of rain (Parsons 1996: 175–76). Numerous previously documented Chacoan roads terminate at watery places (Marshall 1997: 66–67) and contemporary Diné and Pueblo

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ritual practices frequently involve visiting springs and lakes to make offerings and collect water (White 1962: 234; Parsons 1996:184–85; Largo 2012).

The Gasco Roads and associated herradura shrines also marked the moment of the winter solstice sunrise over Mount Taylor. As the shortest day of the year, the longest night of the year and the point at which the sun reaches the most southerly position in its annual cycle, the winter solstice marks the fullness of one half of balanced dualities between winter and summer, night and day, and cold and heat. Given the solstice relationship at the Gasco Site, it seems reasonable to suggest that one road was associated with summer, and the other winter, each with a corresponding herradura shrine. Some Pueblo groups undertake ritual races at the winter solstice as a means of invigorating the 'weak' winter sun to return north, bringing longer, warmer days, the return of life and the advent of the agricultural cycle (Parsons 1996: 200–1, 212). Solstice races are one instance of the prominent place running holds in the ceremonial life of Pueblo and Diné peoples (Nabokov 1981). Pueblo races often take place early in the morning (i.e. close to sunrise) on constructed tracks that, while less grandiose, offer compelling analogues to Chacoan roadways. Given these traditions among descendant cultures, ceremonial races timed to coincide with the solstice may have been a focus of ritual practice at the Gasco Site, perhaps drawing participants from the different Great House communities surrounding the herraduras.

The parallel roads at the Gasco Site recall at least five other known examples of paired Chacoan roads (Marshall 1997: 68–69). Paired roads could mark architectural expressions of moiety organisation or other social structures (e.g. Whiteley 2015). Parallel roads are also evoked in various Pueblo oral traditions. Zuni histories of creation describe four parallel roads leading forth from the origin place (Bunzel 1933: 717), and Alfonso Ortiz (1969: 57) writes that, "at the beginning of life there is a single road for all Tewa … it divides into two parallel paths and continues in that way until the end of life. At death the paths rejoin again and become one." More broadly, dual pairings are central elements of Diné and Pueblo cosmologies—for example, the principle of complementary male and female forms (*Bika'ii dóó Ba'áadi*) integral to Diné sandpaintings (Reichard 1977; Parsons 1996; Williams *et al.* 2006). Overall, the parallel roads, paired shrines and solstice relationship at the Gasco Site combine to create an integrated religious complex organised around principles of balanced dualism, as well as sacred landforms, water and astronomy (cf. Van Dyke 2007).

Discussion and conclusion

While previous research has shown that Great House communities in the Red Mesa Valley rarely traded ceramics with one another (Kantner & Kintigh 2006), the presence of a large herradura central to a cluster of Great Houses suggests these communities may have been connected through shared engagement with the ritual landscape at the Gasco Site. Specifically, the centring of the Gasco Herradura among 11 Great Houses within a 15km radius and its larger-than-normal size suggest it may have served as a regional shrine for the Red Mesa Valley. Interaction between Great House communities in the Chaco World may therefore have hinged on multicommunity ritual practices at places such as the Gasco Site in tandem with larger ceremonial events at the regional centre of Chaco Canyon (Van Dyke 2007; Mills 2018: 863).

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The evidence outlined above suggests that the landscape affordances inherent to the Gasco locale—the view towards the winter solstice sunrise over Mount Taylor and the situation between two life-giving springs—compelled Chacoan people to construct monumental roads and a large herradura shrine there. Sanctity, or religious potency, was inherent in this place given the relationships it afforded between the sun, mountains and water. To create roads and construct herraduras at the Gasco Site was therefore not to endow it with some external sanctity, but rather to entangle human political and social action with powers that had already converged there.

The Chacoans were not alone in monumentalising special places on the landscape that bundled land, water and sky. Two strikingly parallel examples of ritual roadways leading to ceremonial complexes elsewhere in the ancient world have previously been reported in this journal: the Stonehenge Avenue of third-millennium BC Neolithic Britain (Allen *et al.* 2016) and the Emerald Acropolis of eleventh-century AD Mississippian society in the US Southeast (Pauketat *et al.* 2017). Around 2420–2285 cal BC at Stonehenge, ancient peoples constructed a berm-lined avenue along naturally occurring glacial striations in the bedrock that fortuitously align with the summer solstice sunrise, which is also commemorated with the renowned trilithon architecture of the henge (Allen *et al.* 2016). Assuming "the striations were already visible in the landscape and were seen to be aligned upon the setting winter solstice sun, then this would surely have been a powerful affirmation of cosmic harmony" (Allen *et al.* 2016: 998–99). Furthermore, the south-eastern terminus of the Stonehenge Avenue is a watery place: the River Avon.

Similarly, the Emerald Acropolis, a ceremonial complex connected to the Mississippian city of Cahokia (*c.* AD 1050–1350) via a processional roadway, was constructed atop a hill whose ridgeline naturally aligned north-east to south-west with a central axis of 53°, corresponding to the northern major standstill moonrise and southern major standstill moonset (when the moon rises in its most northerly extent and sets in its most southerly extent) (Pauketat *et al.* 2017). Cahokian builders, recognising this alignment, modified the topography of the hill through excavation to accentuate its cosmic orientation. Digging into the sediments of the Emerald Acropolis would have led Cahokians to encounter water bubbling forth from beneath the surface, as a spring is located on the Emerald ridgetop and water occasionally seeps out as a consequence of the hill's perched water table (Pauketat *et al.* 2017: 217).

Solstice-aligned glacial striations, a lunar-oriented hill seeping water and roads towards solstice sunrise over a sacred mountain were catalytic powers that affected the histories of Neolithic British, Cahokian and Chacoan societies. Understanding the role of monumental ritual landscapes in the emergence of inequality, the development of regional polities and the rise of complexity is therefore entangled with the affordant qualities of places such as the Gasco Site, where humans, sunrises, mountains and waters converged to create religious atmospheres. Embodied ritual practices at such places of heightened affect would have served as arenas in which societal messages, ranging from the cosmic sanctioning of political leaders' authority to forging pan-regional social bonds, could be performed and contested. Understood in this way, Mount Taylor, the solstice sun, springs and ritual roads take on an agentive significance in Chacoan history, a recognition in keeping with the ontological perspectives of contemporary Indigenous descendants for whom the land and sky are relatives fundamentally implicated in the course of how and why history unfolds.

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Online supplementary material (OSM)

To view supplementary material for this article, please visit https://doi.org/10.15184/aqy.2025.4 and select the supplementary materials tab.

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