ARTICLE

Cremations and Pyrotechnologies among the Prehispanic Inhabitants of Cerro de Trincheras, Northern Mexico

Jessica I. Cerezo-Román, Thomas R. Fenn, Carlos Cruz Guzmán, Silvia I. Nava Maldonado, Claudia León Romero, and Elisa Villalpando

Using data from several well-preserved pyres, which are rarely found well preserved in the southwestern United States and northern Mexico, we examine cremation customs and their associated pyrotechnologies at the site of Cerro de Trincheras in northern Sonora, Mexico, from AD 1300 to 1450/1500. We explore variations in pyre construction and use, thermal alterations of the deceased, the deceased individuals' biological profiles, the performance of mortuary rituals, and the sensorial experiences of both the mourners and the wider Cerro de Trincheras community. The residents of the site were masters of the pyrotechnologies associated with cremations, making efficient pyres for the deceased and maximizing their resources. The group also created transformative funeral rituals that may have facilitated and mediated a wide range of emotional responses toward their deceased.

Keywords: cremation, pyres, Cerro de Trincheras, southwestern United States, northwest Mexico

Mediante el análisis de piras funerarias, que rara vez se encuentran bien preservadas en el Suroeste de los Estados Unidos y Norte de Mexico, examinamos las prácticas fúnebres de la cremación y la pirotecnología del sitio arqueológico Cerro de Trincheras localizado en el norte de Sonora, México. Este sitio está fechado entre el 1300 y 1450/1500 dC. Específicamente investigamos las variaciones en la construcción y el uso de las piras, las alteraciones térmicas de los difuntos, los perfiles biológicos de las personas fallecidas, la realización de los rituales mortuorios y las experiencias sensoriales tanto de los dolientes como de la comunidad del Cerro de Trincheras. Los residentes del sitio fueron maestros de las pirotecnologías asociadas con las cremaciones; hicieron piras eficientes para los difuntos y maximizaron sus recursos. El grupo creó rituales funerarios transformadores que pueden haber facilitado y mediado una amplia gama de respuestas emocionales hacia sus difuntos.

Palabras clave: cremación, piras, Cerro de Trincheras, suroeste de los Estados Unidos, norte de México

Cremation rituals are poorly understood worldwide. In North America, several groups practiced cremation in antiquity; however, not much in-depth archaeological research has been conducted until recently. Typically, a pyre was constructed to contain the body, and usually this structure was almost completely destroyed by the fire. After the burning of the body, a pyre was often left uncovered. Over time, most archaeological evidence of what remained of these pyres was destroyed by taphonomic processes.

This study examines cremation pyres and pyrotechnologies—the use and control of heat and fire to modify organic or inorganic material—of cremation practices from AD 1300 to 1450/1500 at Cerro de Trincheras in northern Sonora, Mexico. We focus on two main questions: How

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were pyres constructed and used at the site, and what were the possible sensorial experiences of the mourners from a performative perspective?

By reconstructing the cremation rituals, the associated sensorial experiences, and their material manifestations in the archaeological record, we explore the pyres' construction, their variations, and how individuals were burned as part of funeral ceremonies. We build on performance theory to critically address and reconstruct sensorial experiences and the archaeological manifestations and social significance of cremation rituals.

Performance Theory and Ritual in Archaeology

Archaeologists have studied the performance of rituals in groups ranging from complex societies to hunters and gatherers (Hull 2014; Inomata and Coben, eds. 2006). These performances vary from informal daily activities to highly circumscribed and prescribed activities (Hymes 1975; Inomata and Coben 2006). A wide range of daily actions and performances can become ritualized (Bell 1992, 1997; Hull 2014; Inomata and Coben, eds. 2006). Performances and rituals usually are imbued with different political and social meanings (DeMarrais 2014).

Bell (1992, 1997) proposed incorporating ideas about performance into the study of rituals to better understand how they were generated, experienced, and performed. Earlier archaeological studies focused on rituals' symbolic meanings and emphasized the actors' thoughts during and about those rituals (Hull 2014). More recent research centers on deconstructing the dichotomy between mundane acts and formal performances, suggesting that daily actions can become ritualized and be used to explored how values, meaning, and identities were created, express, reinforced, and negotiated (Bell 1997). In addition, there is a move to explore *how* actions and rituals communicate, rather than *what* they communicate (Inomata and Coben 2006). This shift from meaning to action developed from an understanding that rituals could be variously understood and contested by both participants and performers (Damasio and Damasio 2006; Inomata and Coben 2006; Johnson 2006). Actions may involve both physical movements and sensorial experiences, engaging any of our five senses, which can be reconstructed using the archaeological record. Hull (2014) and Inomata and Coben (2006) suggest that ritual performances encompass a performer's bodily actions, the audience who witnesses or participates in the event, and the performance space. By considering these aspects of a ritual, archaeologists can reflect on its form, process, and context—from planning and setting up the event to the performance and its aftermath.

Mortuary rituals could involve multiple levels of interactions and intersections of cultural traditions, groups, and family preferences with political, emotional, and performance meanings.

Performance theory has been applied to their study both directly and indirectly, usually focusing on the collective expression of ideas at funerals. Price (2014), for example, explored Viking funerals in terms of their scale, complexity, and relationship to Norse drama. Boyd (2014) examined tomb architecture and content, focusing on funerals as spectacles informed by relational approaches and materiality. Dakouri-Hild and Boyd (2016) published an edited volume on Aegean funerary performance, architecture, and landscape. In the Americas, the broader social and political implications of burial rituals have been explored among the ancient Maya (McAnany 1995), the Aztecs (Chávez Balderas et al. 2022), and prehistoric groups in the United States (Brown 2003; Hall 2000; Hull 2014).

The use of performance theory to explore mortuary practices has also allowed researchers to examine mourners' sensorial experiences and emotional responses. Emotions surrounding the loss of a family member are contextual and specific to the individual. Indigenous communities in Mexico hold a wide range of attitudes about death, the afterlife, and the soul (Lerma Rodríguez 2013; Moctezuma Zamarrón 2012; Vigliani 2016). Mortuary archaeology allows us to contextualize the relationships between the living and deceased and examine how past peoples handled and disposed of dead individuals in a ritualized fashion (Nilsson Stutz 2016). As archaeologists, we need to consider the mourners'

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emotions and actions, who the deceased was in life, and his or her portrait in death.

Cremation and the Archaeology of Death

The practice of cremation, which comprises several stages during which the corpse is prepared, burned, and disposed of (Kuijt et al. 2014), brings about an intentional and relatively rapid transformation of the body (Cerezo-Román 2015; Cerezo-Román and Williams 2014; Williams 2004; Williams et al. 2017): the fire turns the body into bone fragments and ashes in a matter of hours or days (e.g., Fairgrieve 2008; Symes et al. 2015; Thompson 2015). This transformation also affects mourners and the community and the way they interact with the deceased (Cerezo-Román 2015; Cerezo-Román and Williams 2014; Kuijt et al. 2014; Williams 2004; Williams et al. 2017). Cremated bones are lightweight and can be transported relatively easily. Researchers, such as Kellaher and others (2005), have explored how memories were forged and sustained through the cremation process and the disposal of ashes.

Cremation practices among various ancestral groups in the southwestern United States are the subject of many archaeological studies (Beck 2005; Brunson-Hadley 1994; Cerezo-Román 2014, 2015, 2020a, 2020b, 2021a; Creel 1989; Merbs 1967; Reinhard and Fink 1982, 1994; Reinhard and Shipman 1978; Robinson and Sprague 1965; Toulouse 1944). In northern Mexico, cremations were found at the site of La Playa in Sonora (Carpenter, Rohn, and Montero 2003; Carpenter, Sánchez, and Villalpando 2003; Carpenter et al. 2015). Cremations were found in Mesoamerica in Michoacán and Teotihuacan, and selected individuals were examined at Tenochtitlan (Chávez Balderas et al. 2022; Punzo Díaz et al. 2017; Sempowski and Spence 1994; see the several examples in Tiesler and Scherer 2018). Early examples of cremation were found in the Maya Lowlands (Nielsen and Helmke 2018; Tiesler 2018), and the practice also appears on the Gulf Coast, Oaxaca, the Sierras of eastern Chiapas, and the Maya Highland region during the Late Postclassic period (Duncan et al. 2008; see several examples in Tiesler 2022; Tiesler and Scherer 2018).

From an archaeological perspective, we can consider all the different stages of the cremation ritual that leave archaeological traces, including the gathering of fuel, food consumption, and placement of the remains in their final location. Inspired by performance theory (Inomata and Coben 2006; Schechner 1985; Turner 1982), we developed contextualized perspectives to critically address sensorial experiences and their material manifestations in cremation rituals that inform our reconstruction of the stages of mortuary practices at Cerro de Trincheras.

Cerro de Trincheras and the Trincheras Tradition

Cerro de Trincheras ("hill of trenches") is one of the most prominent archaeological sites in northern Mexico and is also the type-site of the Trincheras tradition, which clustered in the Altar, Concepcion, and Magdalena River Valleys (McGuire and Villalpando 2007, 2011, 2015; Villalpando and McGuire 2009; see Figure 1). The Trincheras tradition's agricultural populations made marine shell jewelry and lived in pithouses and households on hillside terraces (McGuire and Villalpando 2007, 2011, 2015; Villalpando and McGuire 2009). Terraced hill sites are found in the broader region, which was occupied for almost three millennia, from about 1250 BC to AD 1450 (Roney and Hard 2004). This broader region encompasses substantial portions of Chihuahua and Sonora in northern Mexico, as well as parts of New Mexico and Arizona in the southwestern United States (Fish et al. 2007), crosscutting several archaeological traditions, including the Hohokam, Casas Grandes, and Rio Sonora (McGuire and Villalpando 2011).

Cerro de Trincheras is 17 times larger and covers twice the combined area of all the other terraced hill sites in the region (McGuire and Villalpando 2011; Pailes 2017:394). Situated on a volcanic hill located along the Magdalena River (McGuire and Villalpando 2007, 2011, 2015; Villalpando and McGuire 2009), it was most densely occupied from approximately AD 1300 to 1450, making it contemporaneous with

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Figure 1. Cerro de Tricheras site (photo by Júpiter Martínez Ramírez).

similar terraced hill sites in northwest Mexico and the southwestern United States (Fish et al. 2007). The site has more than 900 terraces that supported habitation structures and areas for agricultural production, ritual activities, and social gatherings (McGuire and Villalpando 2007, 2011).

Cerro de Trincheras Mortuary Practices

Previous excavations on the hill at Cerro de Trincheras documented 10 inhumations adjacent to a terrace wall and one child cremation in the pithouse component on the southern part of the hill (McGuire and Villalpando 2011; Villalpando and McGuire 2009). An urnfield cemetery at the northeast base of the hill, called "La Loma de las Cremaciones," was documented and partially excavated when construction began on the archaeological site's visitor center (Figure 2; Cerezo-Román et al. 2018; Cruz Guzmán et al. 2017; Villalpando et al. 2009; Watson et al. 2015).

The urnfield sample consists of 137 features: one primary cremation, two secondary deposits of loose cremated bone, 131 secondary deposits of cremated bone in vessels, and three historic infant inhumations. Watson and others (2015) explored the cemetery's formation and its importance to the site's prehispanic inhabitants. Cerezo-Román and coworkers (2018) built on and expanded these early findings to investigate this cemetery's repurposing and transformation from the prehispanic to the historic period.

The Pyre Area: Los Crematorios

A few hundred meters from the northwest end of Cerro de Trincheras (Figures 1 and 2), Villalpando identified an area containing pyres and inhumations; she called it "Los Crematorios" (Villalpando 2019). The hill, urnfield, and pyre were contemporaneous and used by the same local population based on similarities in material culture, chronology (see Supplemental Table 1 for dates), and geographic proximity (Villalpando 2019). A pyre is defined as a feature containing burned human remains that has direct evidence of fire, implying that the body was deliberately placed and burned in situ. This does not necessarily mean that the remains were found articulated or that the deposits contained all the skeletal elements. As used here, the term "secondary deposit of cremated bone" includes secondary deposits with any recoverable bone. The findings from "Los Crematorios" are the focus of this article.

Samples and Methods

Thirty-nine pyres of various sizes (Figures 3, 4A, 4B, 4C, and 4D) and two inhumations

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Figure 2. Photo of site and location of pyre area and urnfield cemetery (photo modified from Google Earth 2022).

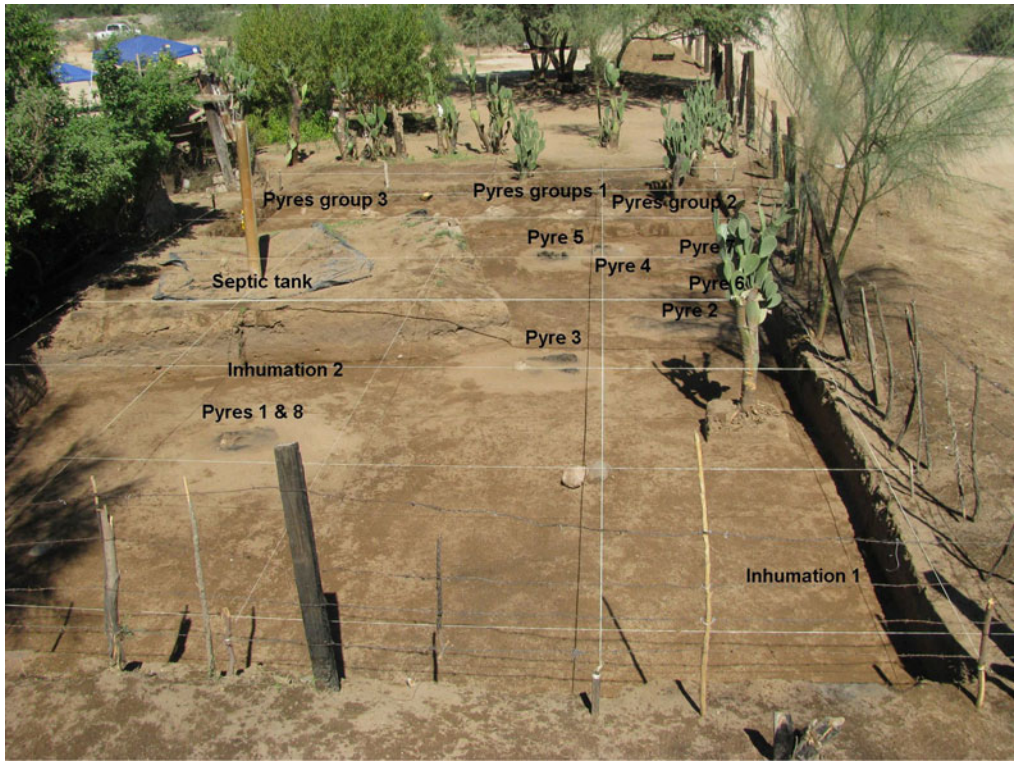

Figure 3. Location of some of the pyres (photo by Carlos Cruz Guzmán).

were identified during fieldwork in the 8 × 14 m excavation area. Some were isolated pyres, whereas others seem to have been clustered within three groups (Figure 4B, 4C, and 4D; Cruz Guzmán et al. 2017; Villalpando et al. 2012b).

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Figure 4. Example of different pyres and deposited ceramics. (A) Example rock pile associated with pyre; (B) pyres group 2; (C) pyres groups 1, 2, and 3; (D) pyres group D (photos by Carlos Cruz Guzmán).

Biological Profile of the Cremated Human Remains

Protocols for determining biological profile estimates were based primarily on those of Buikstra and Ubelaker (1994), revisions to some of their methods (Scheuer and Black 2000), and the protocols of the Bioarchaeology Laboratory of the Arizona State Museum (2018). We conducted a detailed skeletal inventory of each burial in which we determined body completeness and the number of individuals represented in each deposit. Second, we estimated age at death, within established error ranges, and biological sex following standard protocols. The degree of fragmentation observed in cremated bone necessarily limited specific analytical observations, but estimations were attempted when possible.

Posthumous Treatment of the Remains and Archaeological Context

Posthumous treatment of the body was inferred through observations of the human skeletal remains and the contextual data generated from archaeological fieldnotes, reports, and published analyses. Thermal alteration and postfire body treatment were documented to produce a detailed reconstruction of the posthumous treatment for remains from pyres and secondary deposits. Following data collection protocols proposed by Cerezo-Román (2014; 2021b), we recorded bone weights and the color, degree, and type of shrinkage and fractures caused by fire to evaluate how the remains of an individual were treated after being burned. A typical cremated adult's bones are expected to weigh more than 1,500 g; adult bone weights less than this would imply that not all the remains were present (Bass and Jantz 2004; Trotter and Hixon 1974). Bone weight can vary for many reasons, including differential funeral treatment, postdepositional disturbances, archaeological excavation, and analysis procedures; only deposits that did not exhibit major postdepositional disturbances were selected for this study. We examined cremation deposit type—pyres, secondary, or

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mixed pyre/secondary—and analyzed dimensions and construction methods of the pyres and the presence of associated items, flora, and fauna in the deposits. We estimated the dates for the remains based on radiocarbon rates, archaeological fieldnotes, and reports. These variables were integrated with osteological information, intersite comparisons, and reconstructions of posthumous treatments and then analyzed using statistical software programs such as SPSS Statistics 19 and Excel 2016.

Results

Forty-two features were analyzed in detail: two inhumations, 39 pyres, and one feature that had both an inhumation and cremated bone. Twenty-five pyres contained one individual, and the remaining 14 had more than one individual (Figure 5).

Of the pyres that contained one individual, it was not possible to estimate the age at death for six individuals. Of the individuals whose ages at death could be estimated, two were infants (<2 years at death), five were children (2–12 years at death), and 12 were more than 12 years old; this last group included adults (Figure 6). Of those 12 individuals, two were females, but it was not possible to estimate the sex in the other 10 individuals. The two inhumations were both adult females.

The features that had more than one individual presented several combinations of ages. There were four cases of an infant and an adult; six cases of a child and an adult; two cases of an infant, a child, and an adult; one case of one adult and indeterminate remains; and one case of multiple adults (Figure 7). Three females were found in pyres with more than one individual (two cases of one female and a child, and one case of one female and an infant).

The dimensions (north–south and east–west) and depth could be determined for 23 pyres (Table 1). The sizes of the pyres varied according to the age of the individuals. For example, infants were placed in smaller features, whereas children

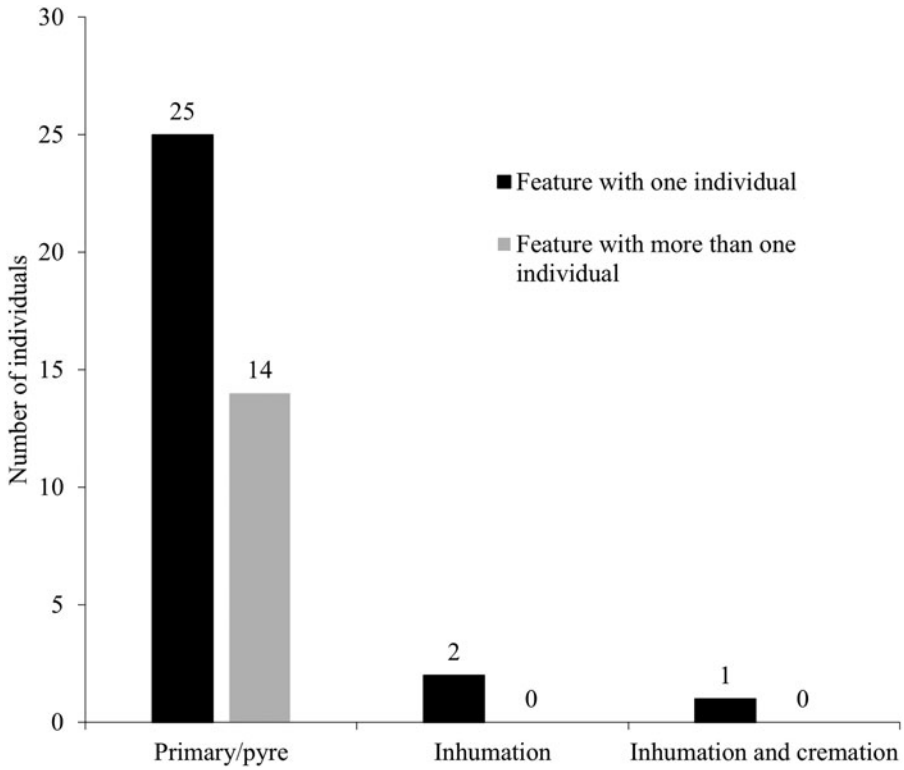

Figure 5. Feature types and number of individuals.

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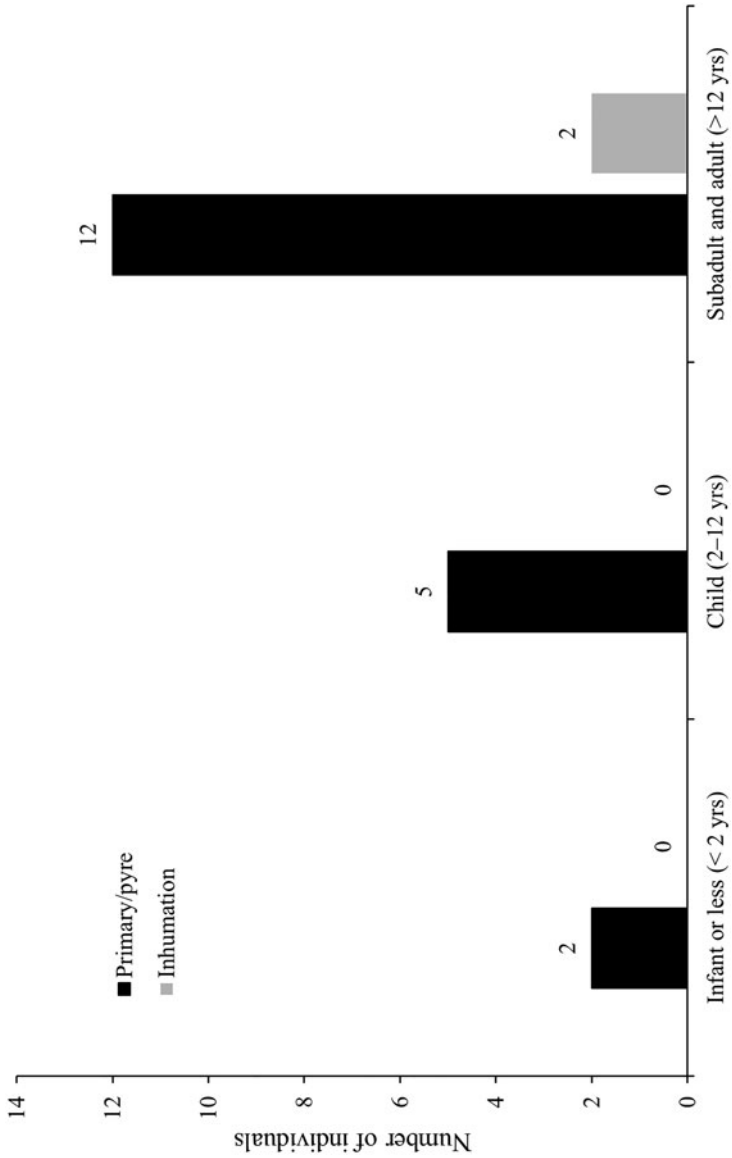

Figure 6. Pyres and MNI = 1.

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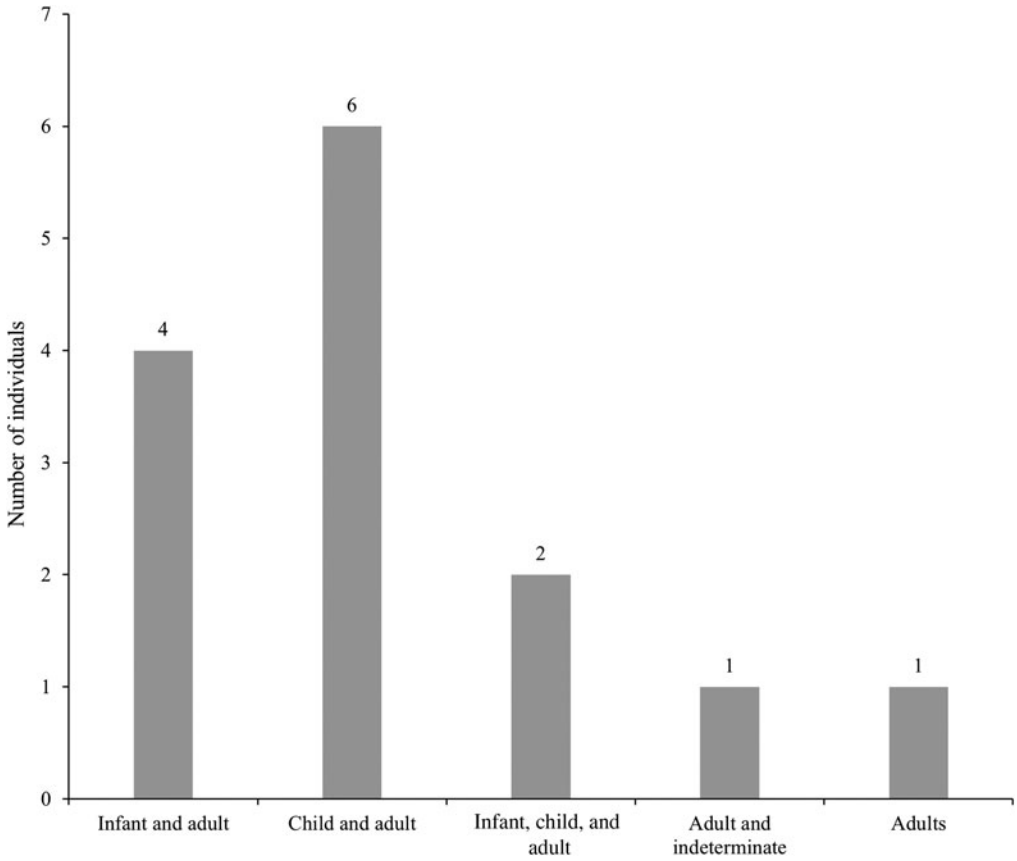

Figure 7. Age group and MNI >1.

were generally found in pyres with physical X–Y dimensions that were larger than adult features. In those cases where more than one individual was found, there was considerable variation in feature size (Table 1).

In some cases, rocks had been placed in the bottom and around the pyres. Rocks were also present in one inhumation. In the cases of an individual child and an individual subadult/adult, rock alignments were placed atop the pyres after the cremation ritual (Table 2; Figure 4A). Features with more than one individual also had rocks associated with the remains. However, seven pyres overlapped with other pyres, and one pyre overlapped with one of the inhumations. Overlapping features made it challenging to assess the features' boundaries.

Paleobotanical analyses were conducted by coauthor León Romero (Villalpando 2019), showing that a variety of taxa in the pyres survived the fire (Supplemental Table 2). There was less variety in the paleobotanical remains associated with children than with older individuals (Table 2). Pyres that had more than one individual, regardless of ages, had a similar number of identified taxa as subadults and older individuals.

We also evaluated the types of objects placed in the fire and recovered archaeologically from both single- and multiple-individual features (Supplemental Table 3). These objects could have been used in the ritual, placed with an individual as offerings, or, in the case of ornaments, worn as jewelry or attached to the clothing of the individual. For single-individual cremations, infants had the fewest objects present, consisting only of ceramic vessels, beads, and unworked animal bone. Children had more objects than infants but less than subadults and adults; those objects included ceramic vessels, sherds,

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Table 1. Pyres Characteristics, MNI = 1 and MNI >1.

		Infant or Less (<2 yrs)			Child (2–12 yrs)			Subadult and Adult (>12 yrs)			Features with MNI > 1 Individuals		
		E-W (cm)	N-S (cm)	Depth (cm)	E-W (cm)	N-S (cm)	Depth (cm)	E-W (cm)	N-S (cm)	Depth (cm)	E-W (cm)	N-S (cm)	Depth (cm)
N	Valid	2	2	2	5	5	5	12	12	12	14	14	14
	Missing	—	—	—	—	—	—	2	2	2	—	—	
Mean		77.000	56.500	22.000	98.800	116.000	38.000	91.750	113.670	45.750	103.571400	79.285710	35.571430
Std. Error of Mean		8.000	1.500	9.000	18.733	6.782	6.442	12.838	18.087	10.789	18.98603	9.610222	4.691252
Std. Deviation		11.314	2.121	12.728	41.889	15.166	14.405	44.471	62.655	37.376	71.03922	35.95816	17.55306
Variance		128.000	4.500	162.000	1,754.700	230.000	207.500	1,977.659	3,925.697	1,396.932	5,046.57100	1,292.98900	308.10990
Minimum		69	55	13	50	100	18	20	32	9	20	34	17
Maximum		85	58	31	160	140	56	155	210	118	300	155	77

unworked animal bone, awls, beads, lithics, and pyrite. Subadults and older individuals were found with the highest number of objects, including ceramic vessels, sherds, awls, unworked animal bone, ochre, unworked and worked shell (including shell bracelets), beads, lithics (polishing stones), ground stone (such as manos and metates), mica, quartz, and pyrite. In multiple-individual features, there were ceramic vessels, sherds, unworked animal bone, worked and unworked shell, beads, and lithics similar to those found with subadults or older individuals (Supplemental Table 3). The unworked animal bone included the remains of snakes, such as *Crotalus* sp., tortoise carapaces, deer metapodials, bones of *Sylvilagus floridanus* and *Lepus* sp., and remains of indeterminate small and medium-sized mammals. Several recovered bones of Muridae and Rodentia were probably intrusive and not part of the mortuary rituals.

Decorated ceramics were found at the pyres and the urnfield cemetery in low quantities, but more were found in the pyre areas than in the cemetery. Ceramic types included Ramos Polychrome (one vessel), Villa Ahumada Polychrome (two vessels), Carretas Polychrome (two vessels), Babocomari Polychrome (one partial vessel; Hunter M. Claypatch, personal communication 2022), and Tonto Polychrome (one partial vessel)—all at the pyre area. Trincheras Purple-on-Brown and Purple-on-Red decorated sherds were found in larger quantities at the pyres than the urnfield cemetery.

Bone color is a proxy for the fire's temperature and the duration of exposure to heat. As the length of time and heat increase, bone usually goes from a natural color to brown, black, gray, blue, and white (Symes et al. 2015; Thompson 2015). Although there was variation in the color of the remains, no clear pattern was found in relationship to the age of the individuals (Figure 8). The predominant color was white, suggesting very high levels of combustion and calcination both for single- and multiple-individual deposits.

The expectations for bone lengths in pyres would be that the older the individual, the longer (and stronger) the original bones, and therefore the minimum, maximum, and mean bone lengths should be shorter for the youngest individuals

Table 2. Rocks Associated with Pyre and Total Identified Taxa of Paleobotanical Remains.

	Rocks on the Bottom of the Pit	Rocks on Top	Rock Alignment on the Sides	Total number of Taxa Identified Paleobotanical Remains
Infant (<2 yrs)	—	—	—	—
Children (2–12 yrs)	2	1	1	9
Subadult and adult (>12 yrs)	—	1	1	16
Features with MNI >1	4	2	3	16

and larger for the older individuals. These patterns are seen in the remains from Cerro de Trincheras (Table 3). The child and subadult/adult categories show strong similarities in bone length metrics, and both show higher expected values than in infants and younger individuals. Of interest here are the generally higher values and greater variance in bone length measurements among individuals from features with more than one individual, suggesting a different treatment during the firing event in these instances. The maximum length of the bone fragments seemed to vary by age of the individual (Table 3). The mean length for infants was smaller than that of children and subadults or the maximum length of older individuals. The maximum length of bone fragments in child cremations was smaller than that of subadult or older individuals; however, the standard deviation and variance also increased with age.

The weight of bones in the deposits also varied (Table 3) but increased with age. Infants had the lowest bone weights, whereas subadult and adult individuals had higher bone weights. The expectations for bone weights in pyres, prior to removal for secondary deposition, would be that the older the individual, the more bone present, and therefore the minimum, maximum, and mean bone weights should be lower for the youngest individuals and higher for the older individuals. However, our examinations occurred after bone removal in antiquity, and the amount of bone remaining in pyres would depend on the behaviors of and decisions made by

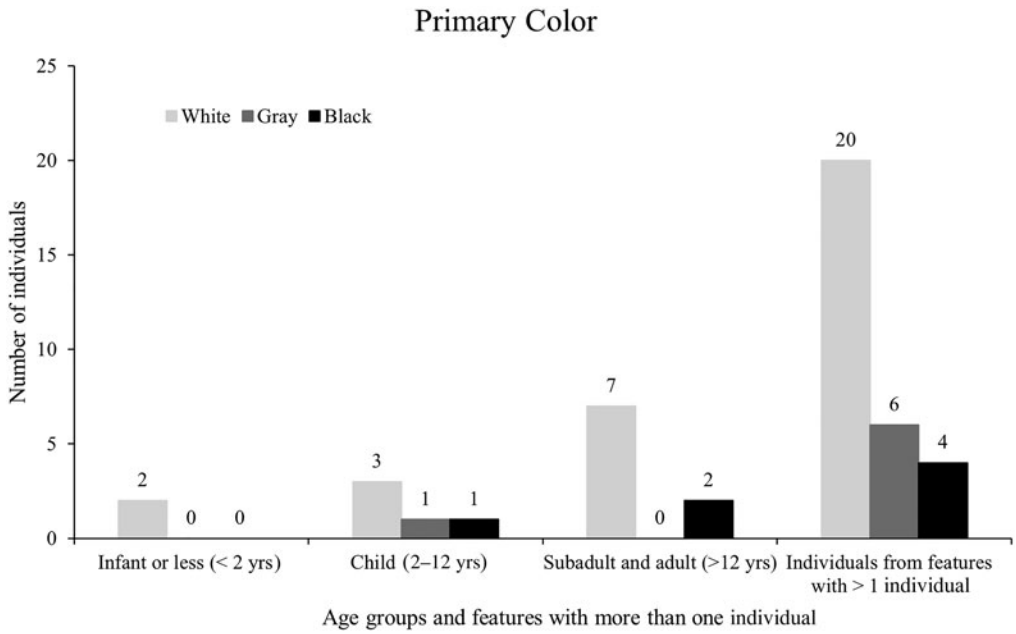

Figure 8. Primary bone color of individuals.

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Table 3. Maximum Length of Bones and Bone Weight Frequencies.

		Infant or Less (<2 yrs)	Child (2–12 yrs)	Subadult and Adult (>12 yrs)	Individuals from Features with >1 Individual
Maximum Length of Bones					
N	Valid	2	5	8	24
Mean		12.04	23.29	32.60	34.44
Std. Error of Mean		1.93	6.34	5.45	8.04
Std. Deviation		2.73	14.17	15.41	39.39
Minimum		10	15	13	6
Maximum		14	48	48	198
Bone Weight (g)					
N	Valid	2	5	8	26
	Missing	—	—	6	9
Mean		0.3	5.9	25.4	131
Std. Error of Mean		0.0	3.9	9.0	90.7
Std. Deviation		0.0	8.7	25.4	462.7
Minimum		0.3	0.2	<0.1	0.0
Maximum		0.3	20.2	59.8	2,321.1

individuals in charge of the pyres. Following these parameters and presumptions, bone weight metrics follow expectations and appear proportionally across the three age categories. Again, of interest here is the generally greater variance in the weight metrics for individuals from features with more than one individual, although the overall numbers in this category are heavily influenced by data from two features. Individuals found in deposits with more than one individual also had higher bone weights in general. Overall, those deposits that contained infant individuals presented total bone weights of <1 g, compared to deposits with children, which weighed between <1 and 50 g. Deposits of subadults or older individuals presented total bone weights from <1 to 100 g (Figure 9). In deposits with more than one individual, infants and children weighed between <1 and 50 g, whereas subadults and older individuals weighed between ≥ 1 and >1,500 g.

Mortuary Rituals as Performance

Using performance theory as an analytical framework, we can reconstruct activities surrounding pyrotechnologies and cremation rituals and evaluate the various stages of cremation practices at the Cerro de Trincheras pyre area. A cremation funeral contains a complex set of procedures in which the burning of the body is but one element. Cremation involves preparing the deceased's body, transporting the body to the area where it will be burned, burning the body, usually collecting the burned remains, placing them in another burial deposit, and participating in subsequent mourning ceremonies. We focused on finding patterns and looking for deviations from the norm to develop critical perspectives on sensorial experiences, emotional reactions, and material manifestations of treatment of bodies and mortuary practices.

The Trincheras community was a middle-range society that may have had elites or leaders but lacked marked social stratification. McGuire (1989), Minnis and Whalen (2015), and Pailes (2017) suggest that elites gained and maintained their sociopolitical status by manipulating the exchange of high-value items, mainly objects that could be acquired only through external trade (McGuire 1986:251). High-value items such as foreign ceramic vessels were used in funeral rituals and in the pyre areas, along with other objects. Public spaces such as plazas and ballcourts are integral to the political processes involved in the naturalization and contestation of power by different groups (Inomata and Tsukamoto 2014; Lefebvre 1991). At Cerro de Trincheras, the pyre area and the urnfield cemetery can be considered public spaces where important rituals and events, such as cremation funerals, could be arenas of power, social

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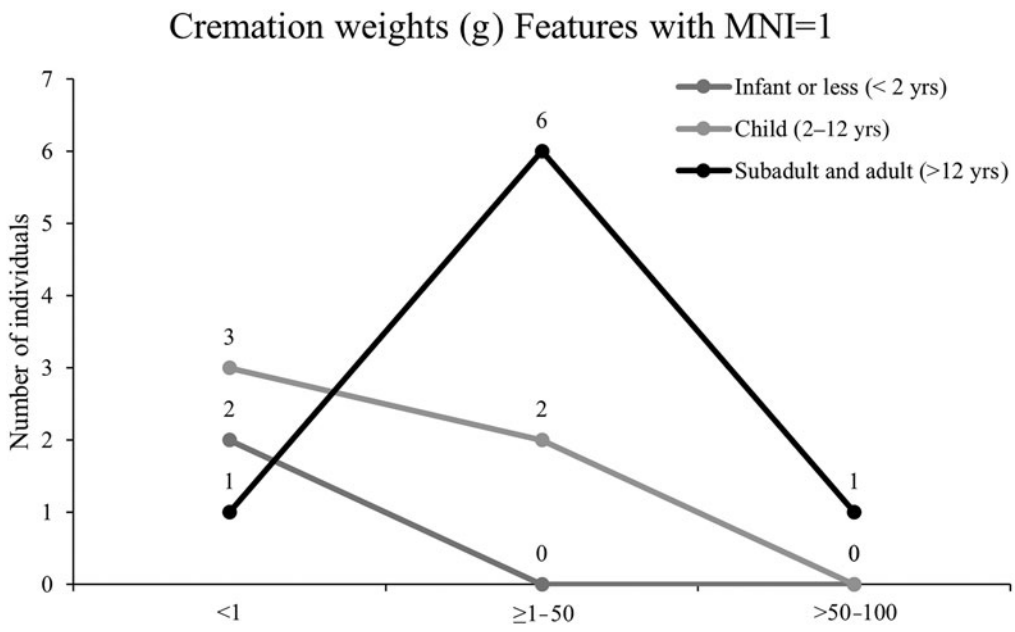

Figure 9. Bone weight distribution and MNI = 1.

negotiation, and contestation. A cremation funeral could offer the participants the opportunity to re-create and transform meanings and memories associated with that ritual or cemetery space.

As commemorative ceremonies, funerals not only have a formal performative element but also a strong emotional component. Nilsson Stutz (2016) argues that the disposal of the dead is a ritualized and routinized event that serves to reduce anxiety by controlling chaos through prescribed, formalized, and invariant ritual practices. She also suggests that by studying these ritualized events and viewing them both as structuring patterns and a way for mourners to deal with their emotions, it is possible to find archaeological traces of emotional reactions. Archaeologists also can find evidence for practices in the funeral ritual that can relate to structural practices (Nilsson Stutz 2016). Conversely, observing practices that deviate from the norm can indicate unique situations.

Ethnohistoric and ethnographic accounts from the Akimel O'odham (Pima), the Tohono O'odham, and Yuman-speaking groups suggest that the cremation sequence began in the house of the dying individual, when the shaman and orator prepared the individual and family for the person's imminent death and departure. This initial stage of a funeral, in which the body is prepared, can be reconstructed by looking at particular objects found in the pyres at Cerro de Trincheras; specifically, objects associated with clothing or ornaments such as beads, rings, and bracelets. Once placed with the individual, these objects could be viewed only by mourners and other nearby funeral participants. Gamble and others (2001) note that the Chumash of California placed beaded strings as offerings on chiefs and selected community members during the funeral.

McGuire and Villalpando (2011) find that Trincheras artisans made numerous beads, rings, bracelets, and other worked shell objects, primarily for local consumption. At Cerro de Trincheras, beads (of various raw materials, including shell) were found on pyres and in urns and were not associated with individuals of all age groups. Similarly, worked shell—usually in the form of *Gycymeris* bracelets or *Conus* rings—was found only in pyres with subadult or older individuals or in those with more than one individual. This suggests that rings and bracelets were not associated with children and perhaps were used only by selected society members

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for their mortuary rituals. Cerezo-Román (2014, 2020a) noted a similar pattern among the Hohokam, where shell bracelets were found more often with individuals older than 15 years, suggesting that shell jewelry may have been associated with becoming adults.

Males, females, and individuals of all age groups were found in the Cerro de Trincheras urnfield cemetery near the pyre area (Cerezo-Román et al. 2018; Villalpando et al. 2009; Watson et al. 2015). At the pyre area, it was possible to estimate sex for only four individuals (all females) because of the high degree of bone fragmentation and the small number of fragments. The human remains found at the pyre area suggest that the individuals were burned as whole bodies with intact flesh. This was indicated by horizontal and concentric fractures in the bone caused by exposure to fire, which is consistent with the thermal alterations found at the urnfield cemetery (Watson et al. 2015). However, two individuals were not burned but only inhumed, whereas in Cerro de Trincheras itself, 10 inhumations were found on the terraces.

In many societies worldwide, cremation and inhumation were practiced simultaneously. Among the Preclassic and Classic Hohokam, for example, the co-occurrence of cremation and inhumation was common. Hohokam Classic period inhumations, more so than cremations, seem to have been an opportunity to display different social and economic relationships (see Cerezo-Román 2020a). At Cerro de Trincheras and the pyre area, this was also the case, even though cremation was the leading burial custom and inhumation was practiced very infrequently. There could be multiple reasons and meanings for not cremating individuals. Cerezo-Román (2021a) argues that the locations of the inhumations on the hill and in the pyre area could be a way to socially differentiate these individuals from community members buried in the urnfield cemetery. Other possibilities could be adverse weather conditions and the lack of social cooperation. However, none can be excluded because there are no large comparative samples from other Trincheras sites.

To achieve the high temperatures needed to burn human bodies and transform them into fragments, the Trinchereños mastered high-temperature fires and then the pyrotechnology of cremation. Burning an individual in a pyre is a labor-intensive, time-consuming, and complicated process (Cerezo-Román 2014; McKinley 1997; Williams 2014). Experimental work by McKinley (1993, 1997) and Marshall (2011) suggests that a crib of wood is usually required. Experimental work and forensic cases suggest that burning a body requires specialized knowledge about pyre construction to maintain a steady source of heat and oxygen (Marshall 2011; McKinley 1993, 1997), particularly when the deceased does not have much body fat that can serve as fuel. As part of the ritual, the remains may have to be stirred as the body burned. This action likely occurred because remains of several individuals did not present any anatomic articulation based on archaeological fieldwork observations.

The pyres at Cerro de Trincheras were constructed in various ways. In general, a pit was excavated, rocks in some cases were placed on the bottom of the pit (Table 3; Figure 4A), and wood of different sizes was placed on top, allowing proper airflow during firing. Some pyres only had evidence for wood of different sizes on the bottom of the feature and no associated rocks. Hardwoods, such as desert ironwood and mesquite, which produce hotter and longer fires, were identified in the pyres (Figure 4). The Trinchereños constructed pyres based on the body sizes of the deceased, showing that they maximized their resources (Table 1). The mean length and width of pyres for both children and subadults or older individuals were similar, although standard deviation and variance were larger for the subadults/older individuals. This suggests that the pyres of children were larger than they needed to be to accommodate their bones; this increased size may be related to other social aspects and not to maximizing resources.

Once the pyre was constructed and the body placed in it, there were several more steps in the process. Archaeologically, we were able to reconstruct that vessels, beads, and unworked animal bone were placed with individuals two years of age or younger (Supplemental Table 3). Items such as ceramic vessels, sherds, beads, lithics, and pyrite were placed with

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children aged 2–12. By comparison, a wide range of objects were placed with subadults or individuals older than 12: they included all the objects previously mentioned, as well as ochre, shell (worked and unworked), ground stone, quartz, and mica (Supplemental Table 3). Botanical remains were also placed with the individuals following the same pattern associated with age; the older the individual, the greater the variability represented. At least four vessels from the Casas Grandes tradition at Paquimé, a few hundred kilometers east of Cerro de Trincheras, were documented with children and adults (Villalpando et al. 2012a, 2012b). It is possible that some of the mourners had a connection with Paquimé, used the items to display their social status, or both. As with the ornaments, only mourners and participants close to the pyre saw the type and quantity of objects burned in the ritual performance.

Ethnohistoric accounts from the Akimel O'odham, the Tohono O'odham, and Yuman-speaking groups suggest that, at the funerary pyre, a tribal orator, an official funeral orator, a fire tender (or *aume'va*), relatives, community members, and guests from other tribes were all assembled (Brew and Huckell 1987; Russell 1908; Underhill 1939, 1954; Wyllys 1931). Among the Maricopa, an orator, singers, and dancers performed, and food was made available to guests while the body was burning. Objects and blankets were piled on or thrown over the fire by relatives or guests (Schaefer 2000; Spier 1933).

McGuire (1992, 2001), in his study of Preclassic Hohokam cremation practices, suggested that mourners also destroyed the deceased's belongings in the pyre or in a subsequent mourning ceremony. Families' unequal wealth and status were displayed as the items were placed in the fire. However, as the fire destroyed those belongings, it also reduced the disparity between families and limited accumulation across generations (McGuire 1992, 2001). As with the Hohokam (McGuire 1992, 2001), the associated objects in the pyres at Cerro de Trincheras could have been used to highlight social differences between individuals. It appears that the older the individual, the more items and objects were placed in the pyre and burned, creating a more elaborate cremation ritual performance.

A cremation pyre is a highly sensorial event. As archaeologists, we can visualize the pyres of the past: archaeological data from the site allow us to reconstruct performative aspects of the cremations. The area where the pyres were found was large enough to allow for a group of people to gather directly around them; this area at Cerro de Trincheras enabled a group to gather round and for anyone near the pyre to see the fire, possibly smell it, and feel its heat: when the body is burning, it generates odors, produces heat, and is visually and auditorily powerful. The pyre also transformed and destroyed objects and botanical remains. The smells, sounds, heat, and illumination from the pyre would have profoundly affected the witnesses, particularly those watching the larger pyres associated with adults (Larsson and Nilsson Stutz 2014; Williams 2004:271–276, 2014). Most pyres at Cerro de Trincheras burned for a long time and/or at a very high temperature based on the white color of the remains and the types of wood used. Watson and others (2015) and Cerezo-Román and colleagues (2018) found that the human remains at the urnfield cemetery at Cerro de Trincheras also were predominantly white.

After the Fire: Collection of the Remains and Closing Ceremonies

Ritual closing of structures and unique ways to dispose of objects are relatively common among Indigenous groups of the American Southwest (Brew and Huckell 1987; Cerezo-Román 2014; Russell 1908; Underhill 1939, 1954; Wyllys 1931) and Mesoamerica (Tiesler and Scherer 2018). Termination rituals are powerful statements of the impact of death and the destruction or transformation of a social persona (Cerezo-Román 2014; Field Murray and Mills 2013).

After the fire burned out, some of the dead individuals' bones were left on the pyre; only one deposit represented a complete individual. These bones varied in length but were generally short (Table 3). The mean maximum length for infants was 12.04 mm; for children, 23.29 mm; and for older individuals, 32.60 mm. The mean weight of the remains was reasonably low as well. A complete adult cremation regardless of sex, weighs more than 1,500 g; the deposits at

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the pyre area at Cerro de Trincheras weighed far less than 1,500 g (Figure 9). The older the individual, the larger the amount of bone that was left. This age pattern was also found with the remains found in the urnfield cemetery, where the majority of the individuals were represented by most of the body's anatomical areas and the mean bone weights were relatively high (Cerezo-Román et al. 2018; Watson et al. 2015).

Some of the pyres had been covered and marked by piles of rocks (Figure 4A). It was unclear whether these piles of rock were used in the construction of the pyres or as markers; their placement may also have been part of a closing ritual that visually marked the termination of the burning event (Table 2). Perhaps the mourners recognized that some bone fragments left in the pyre held the personhood of the deceased, and after the fire was out, they placed vessels and rocks, as part of a closing ceremony, to mark or cover it.

At least four overlapping pyres were documented during archaeological excavations (Nava Maldonado et al. 2012; Villalpando et al. 2009, 2012a, 2012b; Villalpando and McGuire 2009). It is unclear whether the pyres were placed so as to intentionally overlap each other, but likely their placement was not related to closing rituals. Three of these overlapping pyres consisted of single individuals, based on osteological and archaeological data. Deposits that had more than one individual were challenging to reconstruct, because the extent of overlapping of the pyres was not clear. In one case, there was a mix of burned and unburned bone; perhaps this was done intentionally, because there was little postdepositional disturbance.

Based on the archaeological and osteological evidence, we present two possible scenarios for these overlapping pyres. The first is that an existing pyre was sometimes reused, and a second individual was burned in a separate cremation ritual. It is also possible that the commingling of individuals from two different burning episodes occurred. This could have been the case for at least four pyre features based on osteological and archaeological data.

The second scenario is that occasionally two or more individuals were burned together. Eleven pyre features with more than one individual are good candidates for this practice. There were two cases at the urnfield area where two similarly burned individuals were placed in a single urn. However, we suggest that, if this practice was performed, it was done rarely, because most of the urns (109 urns) in the urnfield area represent single individuals (Cerezo-Román et al. 2018; Watson et al. 2015).

Pyre areas, particularly at Cerro de Trincheras, offered community members a space to negotiate social relationships, grieve, and commemorate the decease. Some aspects of the cremation ritual were standardized and normative, particularly the selection of the place where the individuals were burned and the use of cremation, regardless of the age of the deceased. However, based on current evidence, the mourners had a degree of freedom and personal expression in how they performed the burning of their loved ones and remembered them. These rituals may even have displayed power and social differences, based on the types and age-group distribution of associated items found in the pyre and urns.

After the fire, the remains were collected and likely taken to the Cerro de Trincheras urnfield cemetery a few hundred meters away. Most remains found there lacked any taphonomic changes indicative of exposure, suggesting that the time between the burning and final interment was not long.

The cremation ritual and ideas about death at Cerro de Trincheras may have been associated with the concept of tranformation. The final stage of the mortuary practices reimagined the individuals as more general ancestors for the entire community (for a detailed discussion, see Cerezo-Román 2021a; Cerezo-Román et al. 2018). The transformation of the individuals into a more generalized ancestor is not unique to this setting and has been observed in other parts of the world under different circumstances (Graeber 1995). The performative aspect of the pyrotechnology, sensorial experiences, and the ritual's transformative nature likely facilitated and mediated a wide range of emotional responses among mourners and the final transformation of their loved ones.

Conclusion

This article offered an innovative and critical way to explore the different stages of the

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cremation ritual, starting from the preparations of the pyres to aspects that were visually striking and full of sensorial stimulation to termination events. We explored variation associated with these contexts, including the individuals' thermal alterations and biological profiles, to develop critical perspectives on sensorial experiences and their material manifestations in cremation practices at Cerro de Trincheras.

As we showed, the residents of the site were masters of the pyrotechnology of cremation. They were efficient, knew how to maximize their resources, and created customized pyres for the deceased. Cremations were performative acts full of sensorial stimuli for the funeral participants and other community members. Although the location of the pyres and the burning of individuals of all ages were reasonably standardized in the cremation ritual, other aspects were not, such as the objects placed in the pyre and the closing ceremonies. This allowed participants more flexibility in their practices. After the remains were collected from the pyres, they were placed in vessels and likely buried at the urnfield at the bottom of the hill; some pyres were ritually closed. Over time, the deceased lost their individuality and instead became part of the mourners' ancestral collective memory.

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Data Availability Statement. All osteological inventories and fieldnotes for this study are stored in the Bioarchaeology Laboratory, Department of Anthropology, University of Oklahoma, Norman; Centro INAH, Sonora, Mexico; and the Bioarchaeology Laboratory, ASM, Tucson, Arizona. All data are available on request from the authors.

Supplemental Material. For supplemental material accompanying this article, visit https://doi.org/10.1017/laq.2022.64.

Supplemental Table 1. Samples and Radiocarbon Dating Results from Los Crematorios, Cerro de Trincheras (SON: F:10:151).

Supplemental Table 2. Identified Paleobotanical Remains.

Supplemental Table 3. Number of Individuals and Burial Objects from both the Pyre Area and the Urnfield Cemetery.

Competing Interests. The authors declare none.

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