

New investigations at Bonfire Shelter: a consideration of bison jumps and their implications for Paleoindian social organization

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Abstract

Bonfire Shelter (41VV218) is a nationally significant site in the Lower Pecos region of the West Texas borderlands that preserves evidence of what may be the oldest and southernmost “bison jump” in North America. At least two major episodes of bison hunting are evident at Bonfire Shelter, one associated with Paleoindian Plainview and Folsom projectile points, and another associated with Late Archaic Castroville and Montell points. The approximately 12,000-year-old layers comprising Bonebed 2 appear to represent a singular example of this hunting technique in these early time periods, and are the subject of recent debate. There is disagreement as to whether one or as many as three hunting events are represented in Bonebed 2, and as to whether or not they truly represent bison jumps. This paper reports the results of renewed field investigations into the timing, context, and cultural associations of both bone beds at Bonfire Shelter carried out by the Ancient Southwest Texas Project at Texas State University. The paper then considers the interpretation of these archaeofaunal deposits as bison jumps, and the implications of those interpretations for Late Pleistocene hunter-gatherer social organization in the Lower Pecos and the larger Southern Plains region.

Introduction

Bonfire shelter enjoys an almost iconic status among North American hunter gatherer archaeologists, and particularly those focused on Paleoindians. Located in the Lower Pecos Canyonlands of West Texas - about a mile from the border with Mexico – the inconspicuous shelter contains deep deposits reaching back into the Late Pleistocene. Excavations in 1963-1964 (Dibble and Lorrain 1968; Dibble 1970) and 1983-1984 (Bement 1986) established the significance of the site, and resulted in the identification of three layers rich in faunal remains. Two dense layers of bison bone were interpreted to

be the result of “bison jumps” carried out by prehistoric hunters. A third and older layer consisting of Pleistocene fauna was also suspected to be a result of human activity. The faunal layers were designated Bonebed 1 (Late Pleistocene), Bonebed 2 (Paleoindian period), and Bonebed 3 (Late Archaic period); each is widely separated by natural sediment with lesser amounts of archaeological material.



**New Investigations of
Bonfire Shelter**

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Implications for Paleoindian Social Organization

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TEXAS STATE
UNIVERSITY

Bonfire Shelter is remarkable in a number of ways, but there are two particular reasons that it looms large in the minds of Paleoindian archaeologists. First, it may preserve evidence of the oldest and southernmost “bison jump” in North America; however, there is disagreement as to whether the 12,000-year-old layer of bones (Bonebed 2) represents one or as many as three hunting events, and whether or not they truly represent bison jumps. If they do, it is an unprecedented adaptive strategy for North American Paleoindians. Second, a lower layer (Bonebed 1) includes remains of horse, mammoth, and other Pleistocene megafauna of ambiguous origin. Previous researchers (Dibble and Lorrain 1968; Bement 1986) have argued that these 14,600 year old remains also reflect human activity, but this has never been satisfactorily verified. If the lowest deposits are confirmed as human-related, the site will

rank among the earliest in America. If only for these two reasons, Bonfire Shelter has the potential to yield transformative information regarding the antiquity and adaptations of the earliest human occupants of the North America.

**Perhaps the oldest and southernmost
“bison jump” in North America**

- Dense layers of bison bone dated to around 12,000 BP
- Associated with Plainview and Folsom projectile points

**May contain a record of human
activity beyond the age of Clovis**

- Ice age megafauna dated to at least 14,600 BP
- Evidence for human activity is equivocal

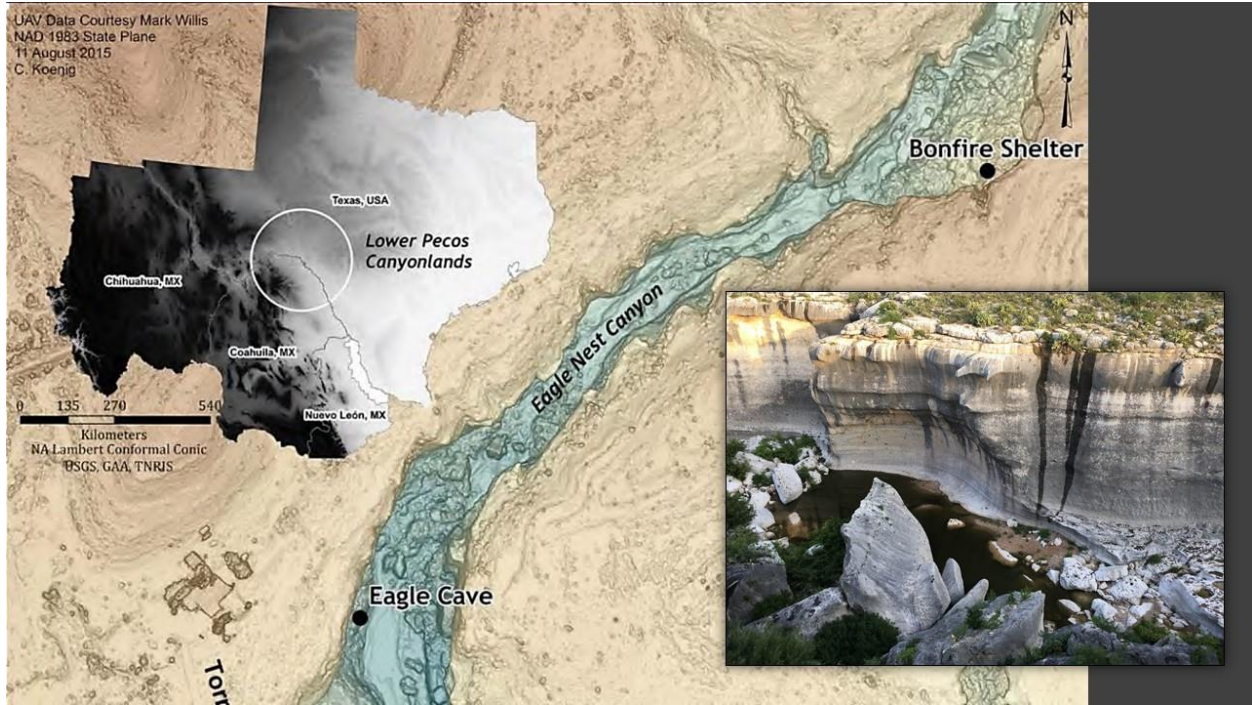


Over the course of the past year, the Ancient Southwest Texas project (ASWT) at Texas State has initiated new investigations at Bonfire Shelter aimed at addressing these two questions in particular. The purpose of this paper is to provide an overview of the site and its importance, with particular emphasis on the issues surrounding (Bone Bed 2). In a following paper in this symposium, Sean Farrell will go into more detail with regard to the investigation of the earliest deposits in the shelter.

Site Location and Description

Bonfire Shelter is one of several rock shelters formed in the Devils River Fm limestone along Eagle Nest Canyon. The canyon itself is a 20-30 m (70-100 ft) deep narrow gorge ending in a steep headcut about 1.5 km (one mile) north of its confluence with the Rio Grande, giving it its alternate name

of Mile Canyon. It is located about 300 boulder-strewn meters upstream from Eagle Cave, the largest shelter in the canyon.



Unlike Eagle Cave, made conspicuous by the yawning arch of its mouth, Bonfire Shelter is all but concealed by a vegetation-covered accumulation of talus derived from a massive collapse of its brow. By all indications, this collapse occurred long before any human occupation of the shelter (Dibble and Lorrain 1968). Protected behind this accumulation and behind the dripline of the current brow is approximately 1750 square m (19,000 square ft) of shelter interior, a 97 x 18 m (320 x 60 ft) crescent-shaped area oriented roughly N-S. The densest archaeological deposits occur in the southern half of the shelter, with Bonebed 1 concentrated in deep deposits toward the back wall.

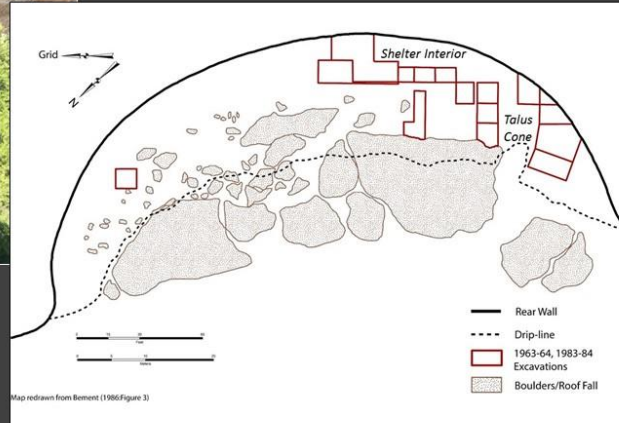
The locations of the densest concentrations of bison in Bonebeds 2 and 3 appear to be the result of the morphology of the shelter rim above. A sizeable notch has formed along the rim, with a short eroded channel creating a funnel for sediment transport from the uplands above. A debris cone – dubbed the talus cone – has accumulated below the notch on the floor of the southern end of the



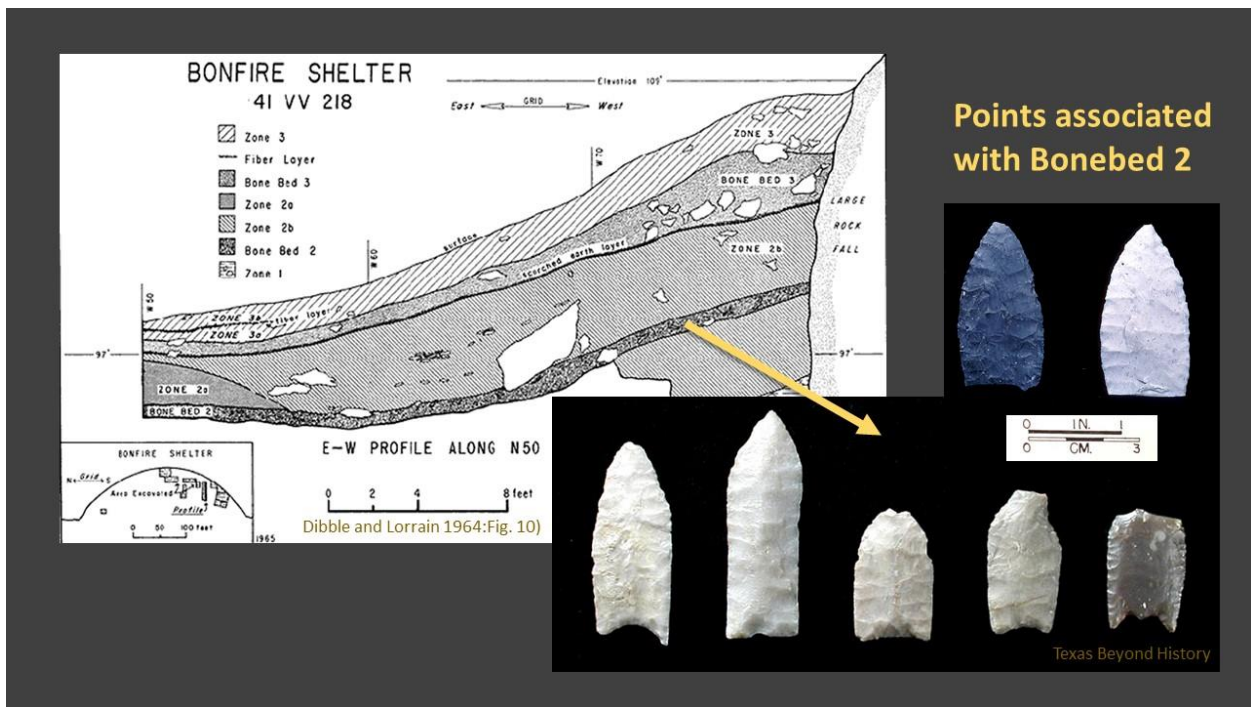
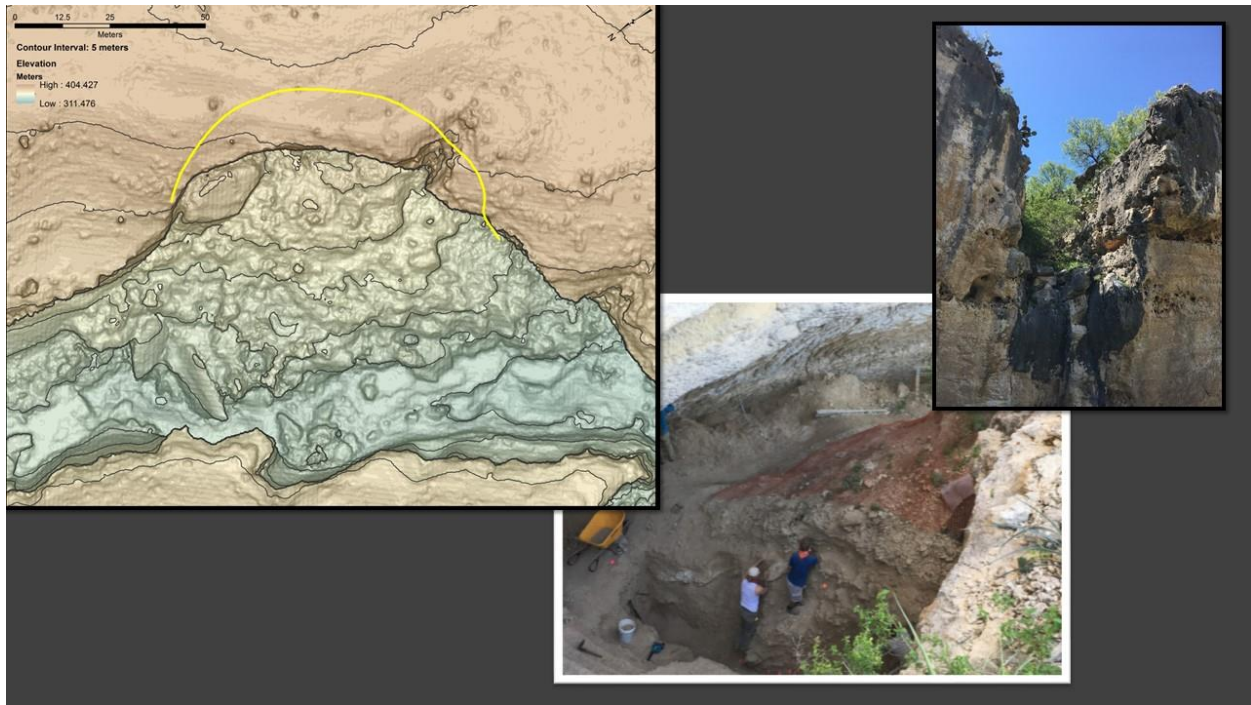
Limestone alcove bounded by debris from collapsed brow

1750 sq m/19,000 sq ft
(97 x 18 m/320 x 60 ft)

20 m/65 ft from rim to floor



shelter. Among the colluvium of the talus cone are multiple strata of dense bison bone, presumably also derived from the notch above. It appears that the notch was utilized as the focal point for a bison jump or jumps in the Late Archaic period. A layer of *Bison bison* up to 80 cm thick is associated with projectile points comparable to Castroville and Montell styles, and dated to around 2,500-2,000 BP (uncalibrated). These remains caught fire at some point after deposition, resulting in heavily calcined and distorted bone and burned and pottlidded artifacts, and giving the site its name. Below, and clearly stratigraphically separated from, Bonebed 3 lies Bonebed 2. Bonebed 2 consists of a relatively less dense accumulation of *Bison antiquus* or *occidentalis* remains associated with lanceolate points identified as Plainview and Folsom. Both Bonebed 2 and Bonebed 3 are thickest and densest in the talus cone, and thin out with regard to both stratum thickness and bone density toward the shelter interior. Questions regarding the origin, deposition, and human behavior associated with Bonebed 2 are the focus of the remainder of this paper.



Bonebed 2 at Bonfire Shelter: Competing Interpretations

Dibble and Lorrain (1968), along with Bement (1986; 2007), Prewitt (2007) and others interpret Bonebed 2 as multiple layers of bone from an estimated 120 Pleistocene bison representing at least

three distinct Paleoindian jump events. Though artifacts suggest a range of time periods is represented, only the upper layer has been dated (four dates cluster tightly around 12,025 calBP) and those dates are on charcoal only indirectly associated with bone. In this regard, Bonfire represents an anomaly. Although landform-assisted hunting can be traced into the Paleoindian Period, Bonfire represents the only known Paleoindian “bison jump” in which herd behavior is exploited to maneuver prey over a potentially lethal precipice. Furthermore, this hunting technique is primarily known from the Northern Plains, and even there the technique does not appear to have been common until several thousands of years later.

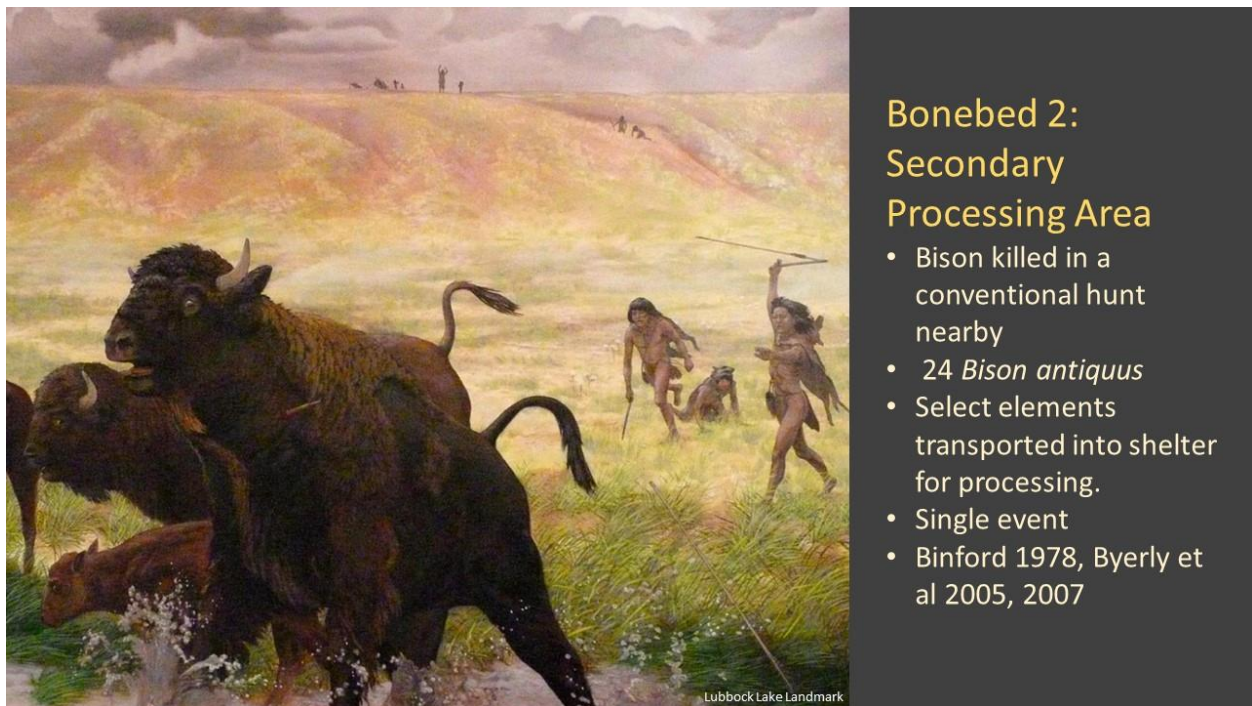
Bonebed 2: “Bison jump” hunting technique

- Bison driven over the rim at the notch and butchered in the shelter below.
- 120 *Bison antiquus*
- At least three separate events
- Youngest event dated to 12,025 BP
- Older event may be associated with Folsom
- Dibble and Lorrain 1968, Prewitt 2007



More recently, Byerly *et al.* (2005; 2007) argue that Bonebed 2 represents a single event involving fewer animals, and that natural processes have eroded and redeposited bones from that single event into three layers. Further, they cast doubt on the use of Bonfire Shelter as a bison jump, arguing (following Binford 1978) that the assemblage of skeletal elements is more consistent with a secondary butchering locality than a kill site. In their estimation, a more conventional bison hunt took place

somewhere nearby and Paleoindian hunters transported select portions of the carcasses into the shelter for processing. Resolving the issue is important because, if the original excavators' interpretation is correct, Bonfire Shelter contains the oldest example of this human behavior anywhere in the Americas by several thousand years, and the only example of hunting extinct Ice Age megafauna in this manner. Further, organized game drives require considerable planning, organization, and cooperation among hunters, and the use of this technique has significant implications for the social organization of Americas earliest hunter-gatherers.



Musings on the Implications of a Paleoindian Bison Jump

Large-scale bison hunting (defined here as kills that number from 50-100 or more individual animals) appears to be associated with several necessary social and natural conditions (Carlson and Bement 2012; Frison 1970, 2004; Zedeño et al. 2014). Bison drives and jumps require more than a single hunter-gatherer band, and thus are most likely associated with seasonal aggregations or other forms of cyclical nucleation. Both the bringing together of otherwise autonomous social groups and the planning

and organization of the hunt have implications for hierarchies of coordination and emergent, if expedient, social hierarchy (Carlson and Bement 2012). Though no remains are identified in association with Bonfire Shelter (Byerly et al. 2007), most bison jumps from later prehistory involve extensive infrastructure (e.g., drive lanes, walls, cairns, etc.), which requires additional labor and coordination investment. Historic accounts of bison drives describe people acting as decoys and as facets of the infrastructure as well. The logistics and organization of what can be reasonably expected to have been a fairly complex event would have required considerable coordination and a degree of hierarchical organization.

Organization
Coordinated effort involving multiple bands.



Archaeological Society of Manitoba



Painted elk hide by Cadzi Cody (Shoshone) ca. 1900. The center is a camp scene with well-dressed warriors arriving. The perimeter depicts a bison hunt with hunters on horseback using rifles. Vignettes of skinning and butchering are also depicted, with heads, hides and hooves separated and piled. (Brooklyn Museum)

Though such an event requires significant investment, the payoff for a successful jump would have been staggering. Frison (1970) notes that successful jumps require minimum herd size of 50-100 animals which, given our understanding of changing herd dynamics from the Pliocene to the Holocene (Guthrie 1980), may play a limiting role in the timing of the emergence of this technique. A single mature *Bison antiquus* bull is estimated to weigh as much as 1,588 kg (3500 lb), about half of

which is edible mass. Assuming an average individual weight of 2,000 lbs in a cow/calf herd (and thus 1,000 lbs of meat), and a herd of around 100 animals (Dibble and Lorrain estimate 120 animals in Bonebed 2; Byerly and others' estimate is considerably lower), a kill the scale of that from Bonfire Shelter could be expected to yield as much as 100,000 lbs of edible mass. At 650 calories per pound of lean meat, the result is as much as 65 million calories. For a diet of ~3,000 cal/day, that's more than 20,000 person-days of energy from bison protein alone. If there were 50 people involved, each individual could potentially take away more than 12 months worth of energy (that's an annual salary). Of course this yield is limited by preservation and the logistics of transport -- assuming the meat was dried into jerky (~20% of wet weight), each person's share would have weighed 200-400 lbs. These figures and calculations are coarse, but they suggest that even a fractional harvest of available meat resulting from the kill would sustain a lot of people for a long time. The collection of hides, horns, and other collateral resources presumably added even more economic value to the endeavor.



The number of individual events represented in Bonebed 2 at Bonfire is debated, but it is clear that it does not represent a frequent or even annual phenomenon. The faunal remains represent between one and, at most, a small handful of kills (Dibble and Lorrain propose 3). Though the proposed bison jump (also debated) appears to be a rare behavior at best (perhaps reflecting the difficulty of coordination), similar forms of landform-assisted hunting are consistent with interpretations of other Paleoindian kills. Perhaps driving a herd off a cliff is a logical extension of utilizing topographical features such as arroyo traps. If bison were indeed driven through the notch on the rim of Bonfire Shelter, it can be seen as essentially an arroyo trap with a drop rather than a headcut. Despite the apparent rarity, the possibility remains that there were multiple jump sites in the region; there are many available cliffs in the Lower Pecos region and it may be that Bonfire is the one site we know of where this kind of behavior has been preserved.

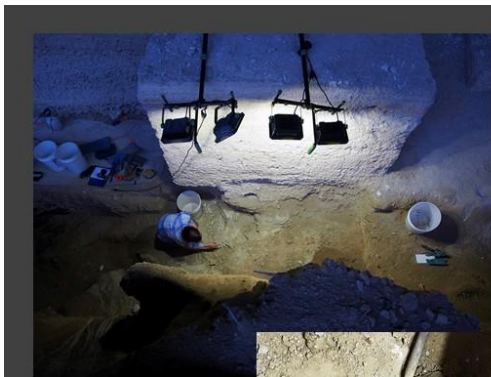
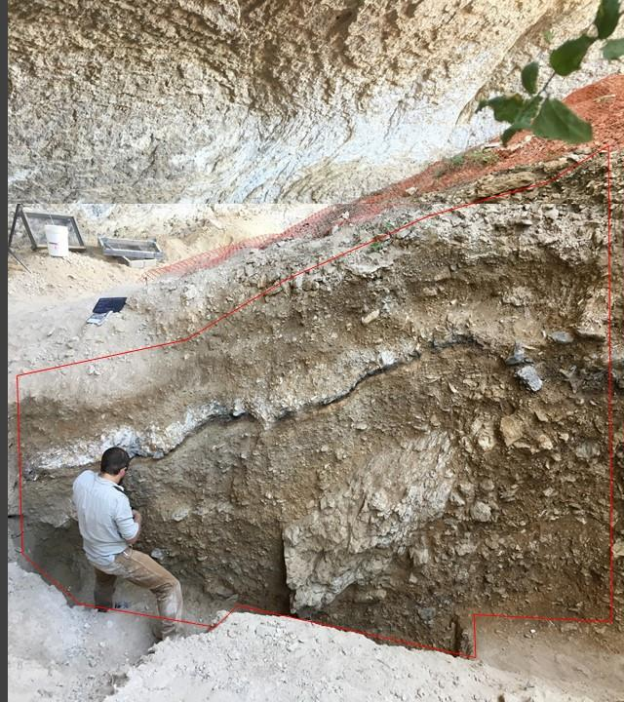
Renewed Investigations at Bonfire Shelter

The Ancient Southwest Texas Project (ASWT) at Texas State University initiated new fieldwork at Bonfire Shelter in 2017. Renewed investigations at Bonfire Shelter by ASWT are oriented toward four major research goals: (1) establishing a detailed chronostratigraphic sequence for the site deposits; (2) determining the origin and number of events associated with Bone Bed 2, specifically regarding it being a result of one or more drives or jumps from the rim above; (3) determining the origins of Bone Bed 1, specifically regarding whether or not some part of it is the result of human activity; and (4) preserving the site by stabilizing the surface and exposed deposits, including backfilling open excavation units and controlling surface runoff into and within the shelter.

Four Primary Goals of ASWT Investigations at Bonfire Shelter

1. Establishing a detailed chronostratigraphic sequence for the site deposits.
2. Determining the origin and number of events associated with Bone Bed 2, specifically regarding it being a result of one or more drives or jumps from the rim above.
3. Determining the origins of Bone Bed 1, specifically regarding whether or not some part of it is the result of human activity.
4. Preserving the site by backfilling, stabilizing the surface and exposed deposits.

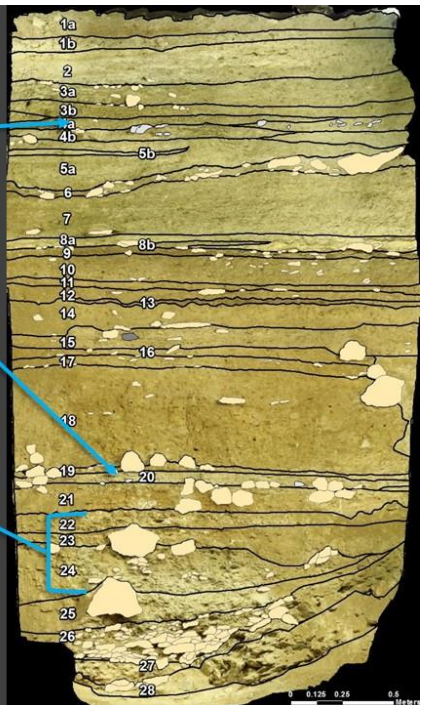
New research activity is focused primarily on two areas of the site: the talus cone (the stratified mound of colluvium and archaeofaunal remains derived from a notch in the rim of the shelter above that lies near the southern end of the shelter); and the open shelter interior (the deeply stratified deposits of internally and externally derived sediment and archaeological remains that exist in the south-central portion of the shelter and along the back wall). We removed wall slump and debris from the interior of the shelter, and removed approximately 30 cubic meters of backfill from 1964 excavation units along the north side of the talus cone. Clearing the old excavation trenches in the shelter interior revealed exposures of all three bonebeds. We identified 23 discrete strata, representing variation in depositional processes within the rockshelter over the past 15,000 years. Excavation into Bonebed 1 revealed remains of mammoth and Pleistocene horse. Sean Farrell presents a review of our approach to Bone Bed 1 in this same symposium.



Bonebed 3

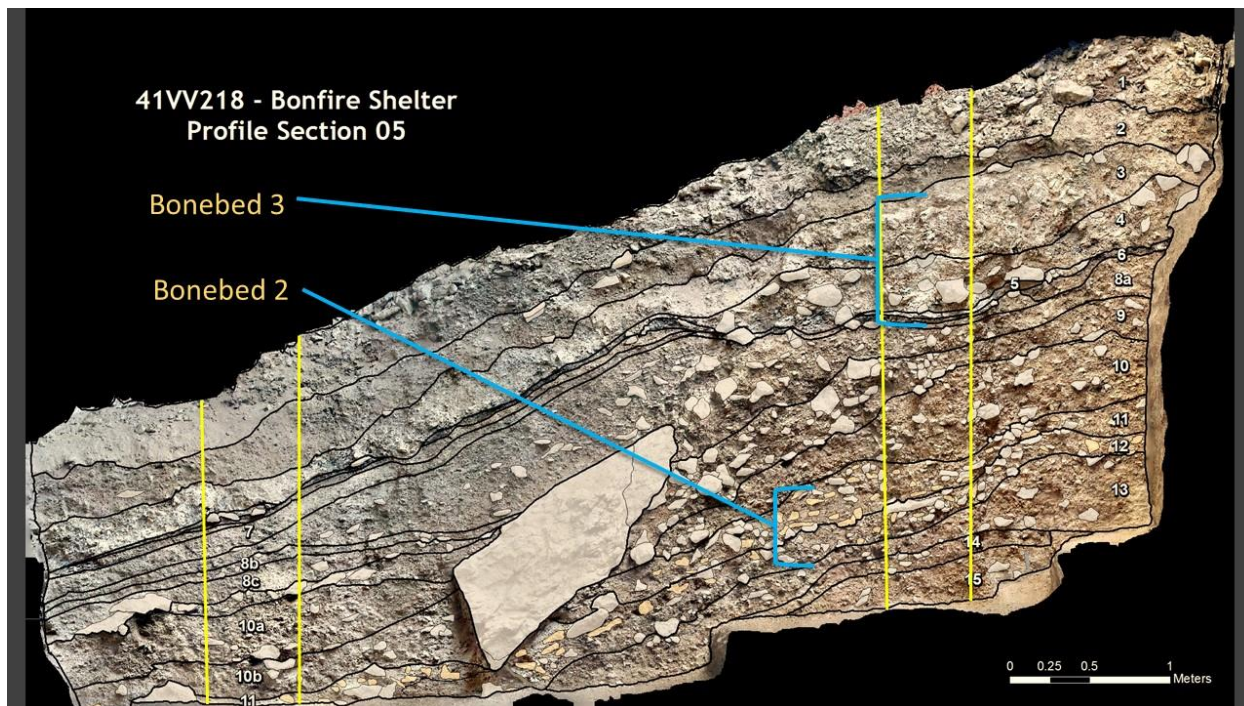
Bonebed 2

Bonebed 1



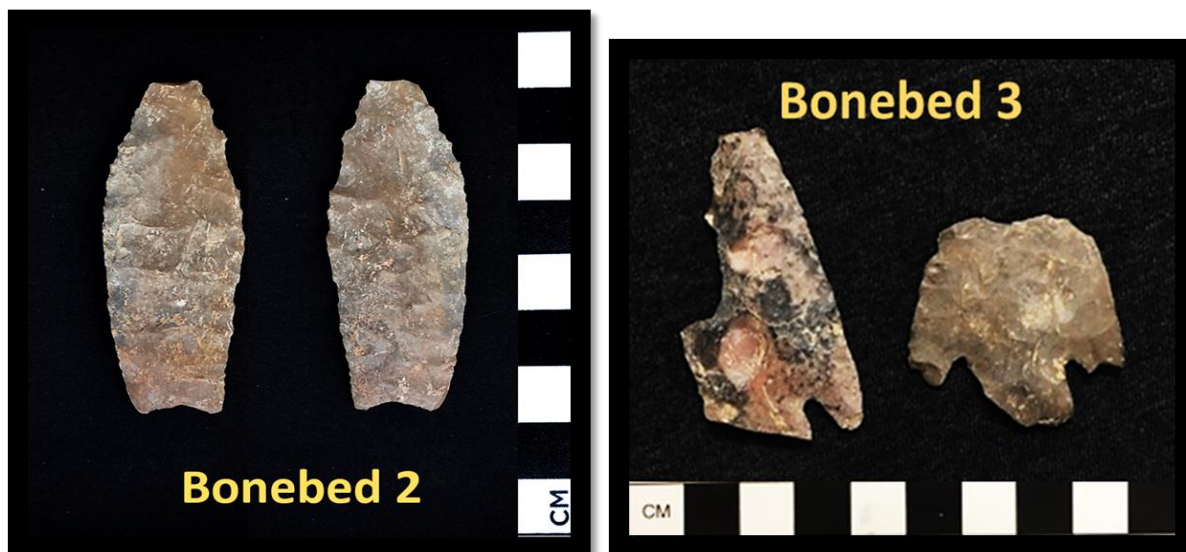
Exposure of the North side of the Talus Cone revealed a stratigraphic sequence that includes Bone Bed 2 and Bone Bed 3 as well as the underlying, intervening, and overlying deposits. Stratigraphy was recorded in detail and mapped using Structure from Motion (SfM) 3D photomodeling software

(Koenig et al. 2017; Willis et al. 2016). We identified a total of 15 strata here, reflecting pulses of sediment deposition ranging from accumulation of fine sediments originating from the notch above, along with catastrophic collapse events that impacted the underlying deposits. We were able to correlate our stratigraphic units with those identified by previous excavators.



We excavated two 50 x 50 cm column samples to collect samples of the bone, rocks, and debris (including dateable samples) that will help us reconstruct the geologic history of the deposits. In the process, we recovered four new stone tools, including a newly discovered and nearly complete lanceolate Plainview-like point, along with another point tip from Bone Bed 2, and two Castroville point fragments from Bone Bed 3, both subjected to intense heat.

In contrast to previous researchers, our observations of the bone beds in the talus cone suggest that Bone Bed 3 might represent a single event, while Bone Bed 2 appears to represent multiple events. Detailed analysis of the samples and data collected will allow us to evaluate these initial perceptions. Specifically, radiocarbon dating and granulometric analysis of sediments should aid in determining the



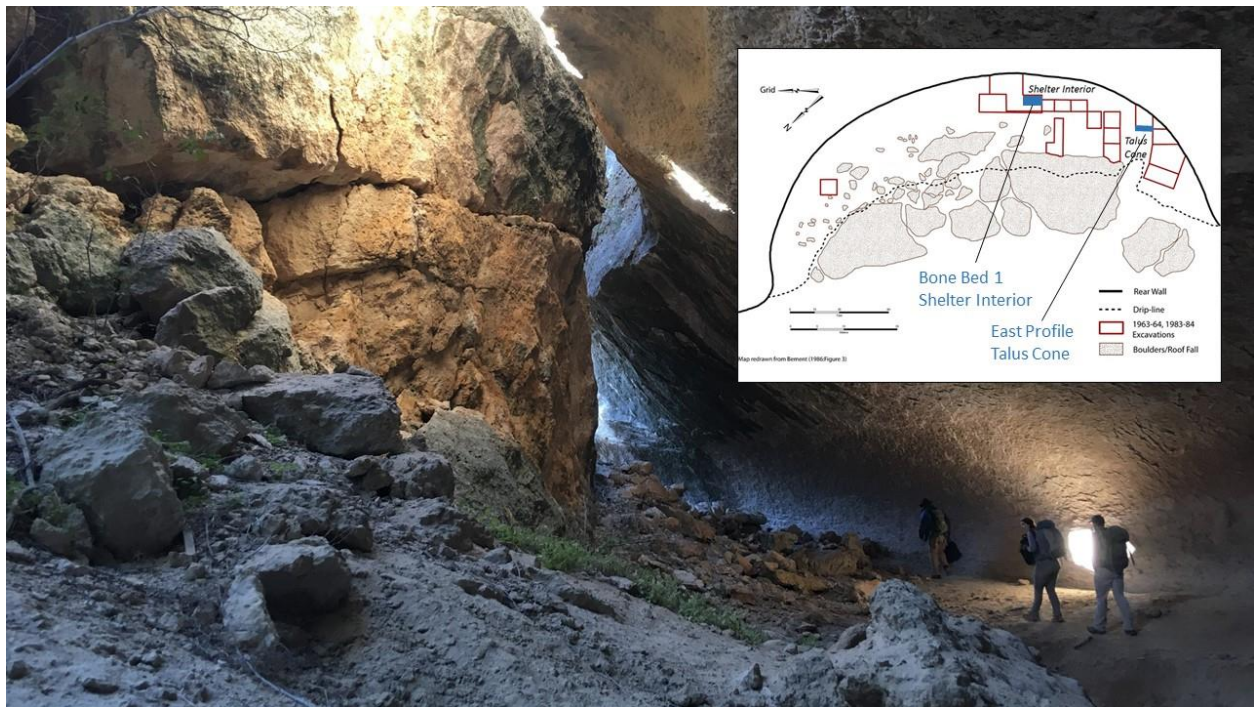
number of events. Zooarchaeological and spatial analysis will help determine if the faunal remains represent a catastrophic assemblage derived from the notch above, or a secondary butchering area for animals killed elsewhere. Of course, we are just getting started, and interpretations will surely evolve as we collect more data.

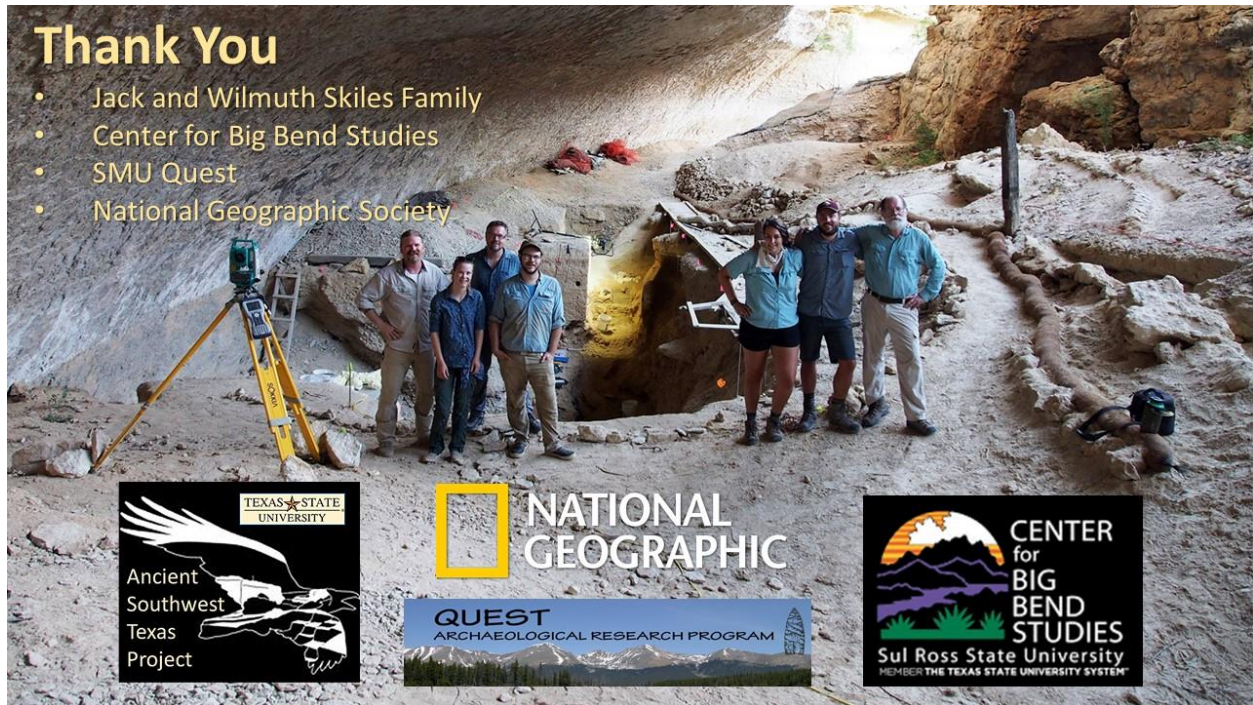
Conclusion and Future Research

The ASWT summer 2017 field season, along with a brief winter field season, represents a successful initiation of new research at Bonfire Shelter. Critically, we got a handle on the complicated stratigraphy of the site and were able to associate the layers we see with those identified by previous researchers. We successfully cleared existing exposures of Bone Beds 2 and 3, and exposed new deposits in Bone Bed 1, recording them in a level of detail that is unprecedented for the site and collecting archaeological, geological, and environmental samples that will shed new light on the deposits.

We see the 2017 work as the first season of an ongoing research program aimed at understanding the deposits of Bonfire Shelter and their significance for understanding the prehistory of region. This initial research was supported by ASWT, SMU Quest, and the Center for Big Bend Studies,

and has provided the foundation for a National Geographic Research and Exploration grant awarded in 2018 to continue research at the site. Our plan for the second full season of fieldwork is to expose a profile along the eastern edge of the Talus Cone in an attempt to identify the three discrete strata within Bonebed 2 that were reported by Dibble and Lorrain, and to open up another series of new excavation units into Bonebed 1. Restoration and stabilization efforts will continue as new research progresses and culminate with the backfilling of all excavation units to protect Bonfire Shelter for posterity.





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