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Jim I. Mead

*Northern Arizona University, Flagstaff*

Saxon E. Sharpe

*Northern Arizona University, Flagstaff*

Larry D. Agenbroad

*Northern Arizona University, Flagstaff*

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## HOLOCENE BISON FROM ARCHES NATIONAL PARK, SOUTHEASTERN UTAH

Jim I. Mead<sup>1,2</sup>, Saxon E. Sharpe<sup>1</sup>, and Larry D. Agenbroad<sup>1,2</sup>

**ABSTRACT.**—An artifact constructed from a bison (*Bison bison*) hornsheath was recovered from the surface of a sandstone shelter also containing skeletal remains of bison and bighorn (*Ovis canadensis*). Radiocarbon dating of bison, bighorn, and the artifact indicate that all co-occurred on the central Colorado Plateau, southeastern Utah, either between A.D. 1405 and A.D. 1420, or between A.D. 1535 and A.D. 1605. Skeletal remains of the bison imply that the animal was of the local faunal community during the transition between Protohistoric and Historic time.

**Key words:** *bison*, *Bison*, *Holocene*, *bighorn*, *Ovis canadensis*, *Colorado Plateau*.

### BISON ALCOVE

Bison Alcove (our informal designation for locality 42GR538) is a large shelter located in the Entrada Sandstone in Arches National Park, Grand County, southeastern Utah (1317 m elevation). A sparse pinyon-juniper community occurs on the predominantly eolian sandy alluvium outside the south-facing entrance. The entrance to the dry rock shelter is approximately 10 m high and 22 m wide (Fig. 1). Much of the interior is choked with large roof spall boulders; however, one can easily proceed horizontally about 13 m into the shelter. Packrat (*Neotoma*) middens are common throughout the site. Initial analyses of seven of the indurated (cemented) middens, radiocarbon dating 12,400 to 20,000 years before present (yr B.P.) (S. Sharpe, in progress), indicate that Pleistocene-age materials (limber pine [*Pinus flexilis*], Douglas fir [*Pseudotsuga menziesii*], and numerous microfauna) occur at the site.

The entrance to the alcove is somewhat flattened and cleared of rubble in spots; higher up into the shelter many of the small boulders and larger packrat middens have been assembled to form one- or two-tier, dry-laid walls. Sand is deflating outside the alcove and uncovering lithic debitage. Pottery is rare. Two unindurated packrat stick middens occur in the shelter: one small nest at the east side of the entrance, and one large midden occupying the back of the shelter. In both

cases these middens contain numerous skeletal elements of large and small mammals. The dry environment outside the alcove and the protective nature of the shelter have permitted the preservation of various specimens of keratin tissue (horn and hoof) from herbivores. A vandal's pothole occurs near the midden at the entrance area. Just upslope from this hole, and under a boulder where packrat activity occurs, we recovered an artifact made from hornsheath.

We felt that the alcove and its deposit required additional analyses due to the remains of bighorn (*Ovis canadensis*) and bison (*Bison bison*), the excellent preservation of keratin, and the recovery of the horn artifact. Although bighorn lived in the region throughout the Holocene, they were reintroduced to the park in 1985. The chronological range of the bison is inadequately understood for the Colorado Plateau. Given the known occurrence of Pleistocene packrat middens, it was conceivable that the artifact was also of late glacial age. This is a report of the bighorn and bison remains and bison artifact recovered from Bison Alcove, Arches National Park.

### PACKRAT MIDDEN

Packrats typically collect plant, rock, animal (dung, hair, keratin, and skeletal), and artifactual material from within a range of 30–100 m of their den. These materials are placed over the nest mainly for protective

<sup>1</sup>Quaternary Studies Program, Box 5644, Northern Arizona University, Flagstaff, Arizona 86011-5644.

<sup>2</sup>Department of Geology, Box 6030, Northern Arizona University, Flagstaff, Arizona 86011-6030.

## 42 GR 538, BISON ALCOVE Arches National Park, Utah (Schematic Plan Map)

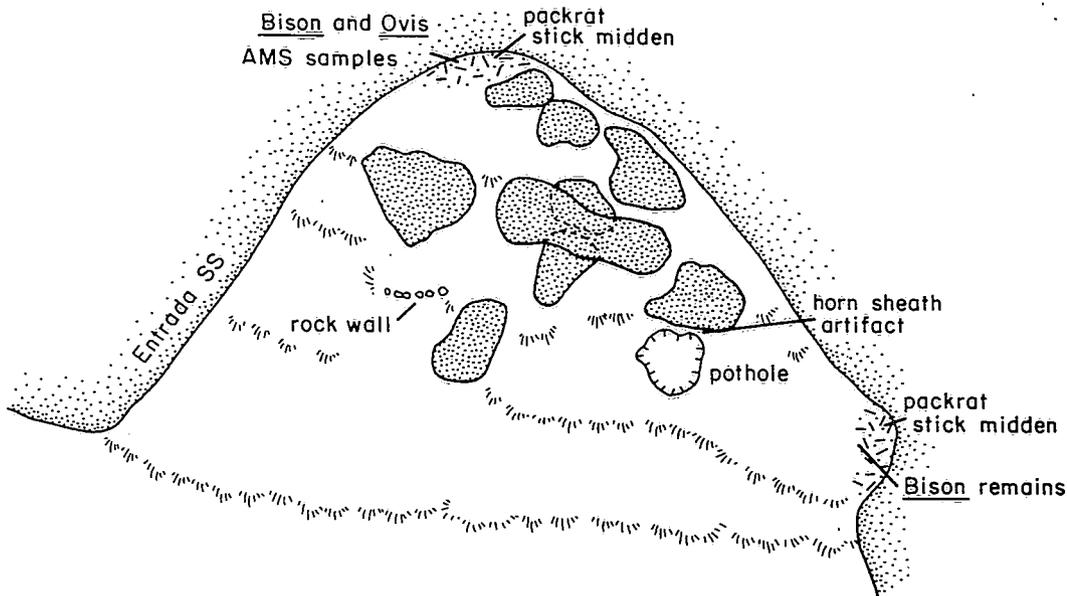


Fig. 1. Schematic plan map of Bison Alcove, Arches National Park.

construction. Often the packrat collects recently "living" materials, such as fresh plants, dung, and animal carcass remains. If the den construction is in a dry alcove in the hyperarid Southwest, the resulting midden will last as long as the shelter persists and represents the local biotic community at the time of collection (Betancourt et al. 1990). This same dry shelter may also preserve much older Pleistocene material, which the packrat may incorporate into a "recent" midden. Any item found loose in the dry alcove is "fair game" for a rummaging packrat.

The unindurated middens described above contained numerous bones of bighorn and bison. These materials could conceivably have been of late Pleistocene age, or they could be Holocene remains procured by local humans or packrats. The sample of large mammal bones was collected from the unindurated packrat midden in the back of the shelter; the artifact was collected from the surface near the front of the alcove. Due to the dry environment and continued preserva-

tion in the alcove spanning at least the past 20,000 years, precise age determination of the remains can occur only through direct radiocarbon dating.

### FAUNAL REMAINS

#### *Ovis canadensis*

Bighorn remains were the most numerous large mammal remains in Bison Alcove. The following skeletal elements were recovered: horncore with sheath ( $n = 1$ ) (Fig. 2A), axis (2; one burnt), thoracic vertebra (2), sacrum (2), scapula (1), tibia (1; distal fragment), metatarsal (1; distal fragment), and 2nd phalanx (1). Some of these remains exhibit tissue still adhering to the bone. Although no butchering marks are evident, the burning and the location of fragmentation could imply human usage. A minimum number of individuals (MNI) of two bighorn was represented, based on the sacrum.

The horncore remain, although fragmented and removed from the skull, was from a young

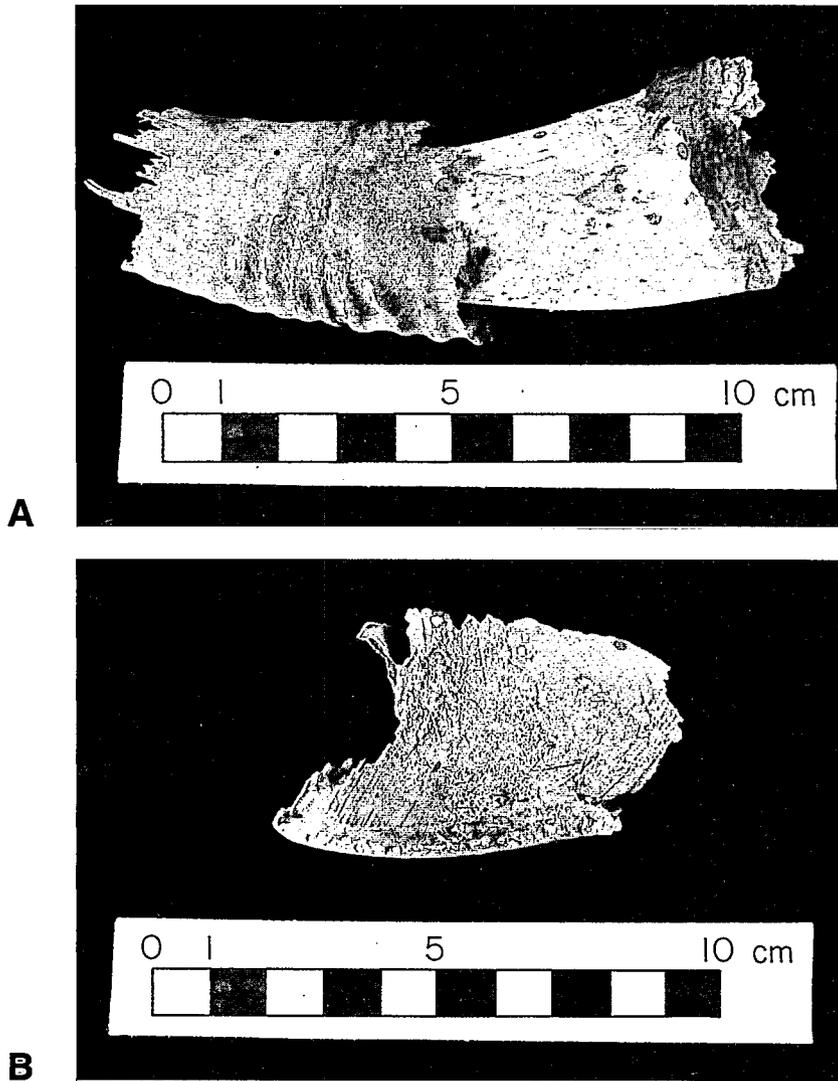


Fig. 2. Skeletal remains from the packrat midden: A, horncore and attached sheath of a young adult bighorn, *Ovis canadensis*; B, hoof remain of a young bison, *Bison bison*. Samples of keratinous tissue were removed from each specimen for AMS radiocarbon dating.

adult, possibly a female, based on the amount of internal core ossification and the length cross-section shape of the core and sheath. The unburned axis shows extreme degradation due to prolonged exposure to sun and possibly moisture. This bone was probably collected by the packrat from either outside the shelter or from the dripline area.

#### *Bison bison*

Bison remains were found throughout the shelter, but never in great quantity. The following skeletal elements were recovered

(Fig. 2B): hornsheath (1; fragment constructed into artifact), centrum plate (2), ulna (1; proximal fragment), 1st phalanx (1), 2nd phalanx (3), 3rd hoof phalanx (3), and keratin hoof (1). No butchering marks were observed on any of these bones, although evidence of rodent gnawing was common. There appears to be an MNI of one bison. The size of the terminal phalange, the unfused centrum vertebral plates, and the hollow length versus the diameter of the hornsheath suggest that the bison was a young adult.

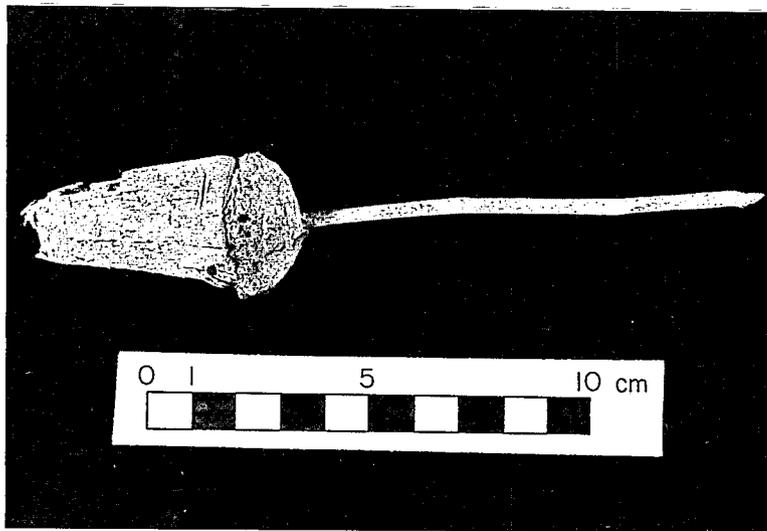


Fig. 3. Artifact made of bison hornsheath and pine pitch. Dermestid beetle chewing can be seen at the left end and top of the hornsheath. A knife cut mark is seen near the basal edge of the sheath adjacent to a circular groove used to cut the sheath from the horncore.

#### ARTIFACT DESCRIPTION

The artifact contains three parts: hornsheath, twig, and resin (Fig. 3). The total length is 163 mm, the hornsheath 50 mm, resin 16 mm, and protruding twig 97 mm. The hornsheath base is straight and contains a hollow center, indicating that it was cut from the burr and horncore of the bison skull. An isolated cut mark is seen above the base of the hornsheath (Fig. 3). The hornsheath now shows the burrowing damage of dermestid beetles; furrowing can be seen on the top edge of the sheath in Figure 3 and along the tip. It cannot be stated whether the tip of the horn was present when the artifact was constructed because it has since been consumed by beetles. Although it is possible that a human used an older, beetle-eaten hornsheath, the radiocarbon dates (see below) do not confirm this idea.

The resin is pine (*Pinus*) pitch; juniper (*Juniperus*) does not produce pitch in quantity. Most pitch exudes predominantly from a wound to the tree and stays malleable for approximately one to two years, after which it crystallizes (M. Wagner, Northern Arizona University). Pitch balls are preserved under trees in arid climate, such as in Arches National Park, and potentially can last for hundreds of years in the right environment.

A scenario of construction of the artifact follows: (1) The human procures a bison hornsheath. (2) Pine resin is pushed and molded into the base of the hollow (natural) hornsheath. (3) A twig of unknown identification is pushed into the soft resin before it hardens.

The function of this artifact is not understood; it would be pure speculation to identify this object as a "religious device," a tool, or a child's toy. A search through the Southwestern archaeological literature has failed to locate any examples of objects similar to this bison artifact. Morris (1980) illustrates a corn (maize) cob that contains a stick in one end and a feather inserted into the other end. The appearance is vaguely similar to our bison artifact. Morris (1980:139) states that these corn artifacts "may have been game darts, prayer sticks, or other ceremonial material" belonging to the Basketmaker people in the Prayer Rock district (tree-ring dating between A.D. 446 and A.D. 676), at the north end of the Lukachukai Mountains, Arizona.

#### RADIOCARBON DATING

Four samples were submitted for radiocarbon dating using the accelerator mass spectrometer (AMS) technique. All radiocarbon analyses were conducted by Beta Analytic Laboratories (Gainesville, Florida). A keratin

hornsheath of *Ovis canadensis* and the isolated keratin hoof of *Bison bison* were selected from the unindurated midden located in the back of the alcove to provide direct dates on these species. Milligrams of keratin of each species were used in the analyses.

The bison artifact was dated twice using two different segments of the specimen (hornsheath and resin). Initially it was assumed that the hornsheath could be of late Pleistocene age, based on other Pleistocene plant and animal remains preserved within the packrat middens and the alcove; but the artifact could have been manufactured at a much later time. We assumed that dating the sheath would provide a time for the species presence at the alcove, and the analysis of the resin would determine the age for the manufacture of the artifact.

Figure 4 provides the radiocarbon age plus two standard deviations for each of the AMS dates. Uncorrected ages span a time, at two standard deviations of the mean, from A.D. 1180 to A.D. 1715 (720 to 235 yr B.P.). The radiocarbon ages illustrated in Figure 4 indicate that three of the dates are statistically the same age at one standard deviation of the mean (*Ovis* hornsheath, *Bison* hoof, and the *Bison* hornsheath). The resin in the artifact is older than the other three, but it is within a single grouping at two standard deviations. There are two scenarios for the use of the radiocarbon dates: (1) Group all four dates together at two standard deviations and determine the co-occurrence age. (2) The resin is actually an "old pitch ball" (see above) by a hundred years or so, and therefore the actual age of the remains is best determined by omitting the resin date and calculating the co-occurrence age at one standard deviation of the mean for the three youngest dates.

All dates can be considered a single event in time (at two sigmas), having occurred between A.D. 1425 and A.D. 1490 (stippled area in figure; scenario 1). Holocene radiocarbon dates should be calibrated because of temporal variations in the radiocarbon content of atmospheric carbon dioxide. Numerous calibration techniques occur (including Ralph and Michael 1970, Stuiver and Reimer 1986). At the 95% confidence level using the calibration technique of Klein et al. (1982), our four dates fall within a time span of A.D. 1280 to A.D. 1650. A grouped overlap area within

this calibration implies a possible single co-occurrence between A.D. 1405 and A.D. 1420 (Fig. 4). A high-precision calibration of the radiocarbon dates and a grouped overlap of corrected ages still implies a time of procurement and manufacture within the A.D. 1400s (Stuiver and Pearson 1986).

Scenario 2 is also depicted in Figure 4. By omitting the resin date, the co-occurrence age at one standard deviation is from A.D. 1535 to A.D. 1605, providing the implication that the bison, bighorn, and artifact were all utilized during the early historic period. Either scenario is reasonable to pursue.

#### DISCUSSION AND CONCLUSIONS

The question arises as to whether or not the bison remains were locally procured, either by humans or packrats, or brought to the alcove as a traded or long-distant-hunted carcass; i.e., were bison present in Arches National Park in A.D. 1400 to A.D. 1600? One way to attempt to answer the question is to examine the represented bison bones. Wheat (1972:101) states that

... virtually all sources, both historic and ethnographic, concur in listing the choicest parts of the bison as the tongue, hump ribs with meat, marrow bones, and ribs, in about that order.

It is implied that if only these bones are recovered from a site, it can be assumed that the bison was brought into the area by trade for "choicest" meat parts (Wheat 1972, Driver 1990). Had the carcasses been locally procured, more of the animal (e.g., phalanges, pelvic region, etc.) would be recovered.

The list of bison bones presented here is biased in two ways. First the sample of bones is a grab sample of the bones we saw in the unindurated packrat midden. We did not systematically sample all the bones from the midden. Second, the bones represented in the midden are of the size that can be carried by a packrat. A bighorn radius, metapodial, or single mandible is about the maximum size and weight of bones observed to be carried by the largest packrat species (bushy-tailed packrat, *Neotoma cinerea*); this packrat presently inhabits the alcove. Marrow-containing bones (humerus, tibia, femur), if present in Bison Alcove, most likely would not have been incorporated into the midden by the packrat due to their large size.

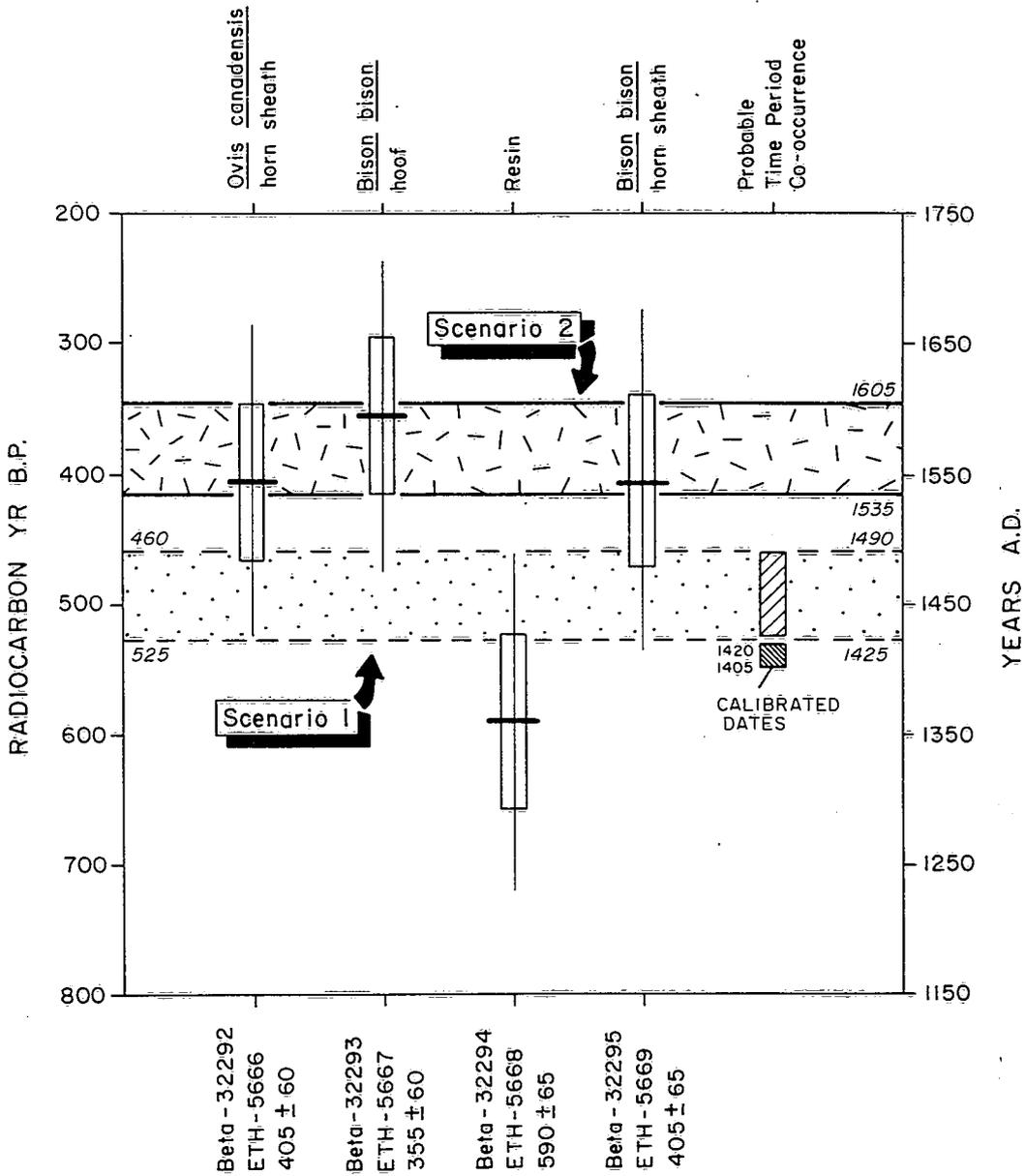


Fig. 4. Graph of the AMS radiocarbon dates from the bighorn and bison skeletal and artifact remains. Laboratory numbers and actual radiocarbon date are at the bottom. Material dated is at the top. One (box) and two (vertical line) standard deviations of the date (horizontal line) are shown for each date. See text for discussion.

These biases should not affect our determination of whether or not the bison was locally procured. We did recover some leg elements (phalange and ulna), some vertebral elements (unfused centrum plates), and a fragment representing the skull. Although the horns sheath could have been traded, the other elements

are not from the "choicest parts." We therefore feel that the young bison must have been a local community inhabitant.

It is possible that bison, albeit rarely to occasionally, roamed through Arches National Park during A.D. 1400s to A.D. 1600s. One could have died near Bison Alcove, and

only the packrat-size portions were collected by *Neotoma* and carried back to the shelter. What appears more likely, given the construction of the bison horns sheath artifact, is that a bison was procured (scavanged or hunted) near the alcove by humans. The bison carcass was rendered outside the alcove, and the "choicest parts" were either carried away from the site for later consumption or consumed at the site, with the larger bones later scattered by carnivores. The small-element bones were taken by the packrat and placed into its midden at the back of the alcove.

Bison are well documented as having lived in a wide variety of habitats on the Colorado Plateau during the late Pleistocene (Lindsay and Tessman 1974, McDonald 1981, Mead and Agenbroad 1989). The Holocene record of *Bison* on the Colorado Plateau is less well understood, but they were present at least rarely during protohistoric times.

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