

Late Pleistocene petroglyph traditions on the North American Plains

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Abstract

Three well defined petroglyph traditions are present on the northwestern North American Plains in the Late Pleistocene. Two traditions focus on pecked animal images and likely belong to related but geographically separated cultural entities. The third tradition, which may predate them by several thousand years, has abraded, incised, and pecked glyphs. The images include animals, bear paws, vulvas, and abraded grooves. The strong divergence between the third tradition and the pecked animal traditions suggests major cultural differences at the level of language families —essentially they likely reflect different cultural lineages. The antiquity of the petroglyphs was explored using experimental varnish dating methods. The most reliable method, varnish microlaminations, shows clearly that all three traditions were present at the end of the Pleistocene.

Three well defined petroglyph traditions are present in the Late Pleistocene on the northwestern North American Plains. Two traditions, Early Hunting and Outline Animals, focus on pecked animal images and likely belong to related, although geographically separate, cultural traditions. The third, the Hoofprint Tradition, predates them by several thousand years. It features completely different imagery made by abrading and incising, supplemented by some pecking. Although the latter tradition includes animal images, it also focuses on hoof prints, abraded grooves, vulvas, bear paws, and finely incised human heads shown in profile. The strong divergence between the Hoofprint tradition and the pecked animal traditions suggest that they belong to different cultural lineages or macro-traditions (Tratebas 2004).

The evidence that these petroglyph traditions date from the Late Pleistocene is based on analyses of rock coatings, including both varnish and oxalate deposits. Varnish microlaminations (VML) are particularly useful for dating because the method has been replicated and blind tested and accepted by geologists and geographers as a reliable method of establishing ages of varnish overlying rock surfaces (Liu 2003; Marston 2003). Other dating methods, such as oxalate AMS radiocarbon assays, can be checked against the VML results. The most extensive experimental dating research for these early petroglyph traditions is on Early Hunting petroglyphs for which we have run dating assays on over 100 samples, along with limited tests of the methodology (Tratebas *et al.* 2004; Dorn 2004).

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What are the rock properties that enabled open air petroglyphs to be preserved since the Late Pleistocene? The Early Hunting and Hoofprint traditions are on Late Cretaceous sandstone in the Black Hills, a Rocky Mountain outlier. Typically after joint cracks develop in the sandstone, silica skins form within the cracks and coat the rock surfaces. After exposure of joint blocks as cliffs, silica skins are still present and serve to harden the newly exposed rock surfaces (Tratebas *et al.* 2004). After aerial exposure, rock varnish forms and further strengthens the outer rock surfaces. Additional case hardening typifies these Cretaceous sandstones, the strongest being iron films. Iron films cement together the quartz grains in the sandstone, often directly beneath the silica and varnish. Sandstone surfaces in the Black Hills also have oxalate deposits. All of these processes protect the rock from eroding as well as provide materials used for dating.

Dating research on the Hoofprint tradition type site is still in progress, but the site shares the same sandstone and environment as the better researched Early Hunting sites. The fewer dating assays on the Hoofprint tradition allow less extensive assessment of whether the dating results make sense culturally, but in terms of the geology of the samples they add to the same dating corpus.

Two additional sites where pecked animal tradition glyphs have dating investigations (Liu & Dorn 1996:205; Francis & Loendorf 2002) are in western Wyoming, 400 kilometers from the Black Hills sites. Both sites are on sandstones that weather more rapidly than the sandstones in the Black Hills and fewer samples have been investigated for dating.

Petroglyphs in all three petroglyph traditions have varnish microlaminations that show Late Pleistocene varnish layers. For the Early Hunting tradition dating research, we examined two thin sections of the varnish overlying several petroglyphs to check for consistency in laminations between subsamples (Dorn 2004). A wapiti image and a quadruped with large cloven hooves have the same lamination patterns on both subsamples, which show layers of orange varnish beneath a black layer that was deposited during the Younger Dryas. Another glyph, interpreted as a caribou because the antlers branch only at the tips, shows rapid varnish formation during the Late Pleistocene. In the thin section we can even see the brief drying episode in the middle of the Younger Dryas ice advance as a thin orange layer. AMS radiocarbon dates on oxalates are consistent with the microlaminations. An oxalate AMS assay for the wapiti is between 10,000 and 11,000 radiocarbon years ago and for the cloven hoofed animal is over 11,000 years ago. The caribou image produced an oxalate radiocarbon age over 12,000 years ago. Caribou retreated north at the end of the Pleistocene, consequently are extra-local in this region today. None of the Early Hunting tradition glyphs identified by varnish microlaminations or experimental dating methods as Late Pleistocene depict extinct animals. The consistencies between microlaminations and oxalate radiocarbon assays are encouraging, considering that there are many unanswered questions concerning oxalate dating, including, what is the time delay before it forms? Does it form episodically or regularly through time? What processes deposit it? We also have consistency between cation-ratio and varnish microlamination ages. Unlike dating research in the Far West, however, the cation-ratio curve relies primarily on oxalate radiocarbon ages. Consequently, cation-ratio ages should be considered experimental. We need more testing of cation-ratio dating in this region, while oxalate dating as a method has yet to be thoroughly tested anywhere.

Early Hunting petroglyphs are solid pecked and the oldest images in the rock art tradition focus primarily on animals, especially wapiti (Fig. 1) and bighorn sheep (Tratebas 1993, 1999). Rare human glyphs are stick figures or have stick arms and legs and a solid pecked body. They also have large hands with fingers that are held out to either side. The glyphs which date from the Late Pleistocene are the earliest in a long tradition that continued for 9,000 or 10,000 years, with gradual change through time in both motifs and style details. The theme of Early Hunting petroglyphs appears to focus on animal procurement or control and in Holocene panels becomes less symbolic and more narrative in depicting hunting situations and ceremonies.



Fig. 1. Early Hunting tradition large pecked wapiti (image width 85cm). (Photo Alice M. Tratebas.)

The Outline Pecked animal tradition also may begin near the end of the Pleistocene. Dating research on this tradition shows varnish microlaminations and other experimental dating evidence that places these petroglyphs in time (Walker *et al.* 2010, and this CD). Although some researchers have assumed that the Outline Pecked glyphs belong to the Early Hunting tradition, there are differences in the imagery (Tratebas 1999, 2004). The two traditions are also geographically separated. Outline pecked animals are concentrated in western Wyoming, while Early Hunting petroglyphs are in extreme eastern Wyoming and adjacent South Dakota. Both

traditions are absent in the middle of Wyoming. Unlike the rounded fully pecked bodies of Early Hunting animals, the oldest outline pecked animals tend to be more angular. Legs are either thin lines of pecking or are wider in the upper leg and taper to thin lines, unlike the broad band of Early Hunting quadruped legs. The few humans depicted are outline pecked and lack the large hands with fingers typical of the oldest Early Hunting humans. The Outline Pecked tradition may also last for thousands of years with changes through time. Glyphs that likely belong to younger horizons of the tradition have experimental dating estimates from the early middle Holocene. A statistical comparison between Early Hunting and Outline Pecked glyphs shows no overlap in a Discriminant Analysis (Tratebas 2009). The statistics are based on a Principal Components analysis of attributes from the combined sample of petroglyph panels, followed by running the component scores in Discriminant Analysis. Key attributes that the statistics rely on to separate the two traditions are outline versus solid pecking, straight legs on Early Hunting versus bent legs on Outline Pecked animals, and bighorn sheep horns depicted in frontal view in Early Hunting versus in profile view for the Outline Pecked tradition. Even so there are similarities –such as the focus on animals and details like round ball feet on cervids (even though they differ in being outlined versus solid pecked).

Both of these animal-focused traditions differ in motifs from the third Late Pleistocene tradition which predates them. Varnish microlaminations from a deeply abraded groove at a Hoofprint tradition site at the north end of the Black Hills reveal two black laminations representing the last two ice advances, underlain by an orange layer. Date of varnish inception would be after the second black layer formed at 14,000 years ago and before the preceding ice advance ended about 17,000 years ago. There does not appear to be any way that the varnish laminations could be in error. Extensive research by Tanzhou Liu to develop this method has shown that ultrathin sections of 5-10 μ m show Pleistocene varnish stratigraphy, while thicker sections (10-15 μ m) are needed to reveal laminations that show Holocene climatic change (Liu & Broecker 2007). Like any scientific result, this VML age for a Hoofprint tradition glyph appears to be accurate unless proven faulty by future research. It appears likely that Native Americans were making rock art south of the continental ice sheet at around the time of or just after the last glacial maximum.

Although pecked images are present, abrading and incising are the dominant manufacturing methods for Hoofprint glyphs (Buckles 1964; Tratebas 1999). A major theme focuses on abraded grooves, animal hoof prints, and vulvas. Some vulvas are so elaborate that Bill Buckles (1964), who researched the site in the 1960s, called them ground intricate designs. Some look floral –sort of like Georgia O'Keefe paintings. If control or procurement of animal resources or fertility and increase is the theme, depiction of the theme is radically different from how it is depicted in the pecked animal traditions. Hunting situations and methods appear in Early Hunting petroglyphs, while Outline Pecked glyphs show ranks of animals with few clues to symbolic meanings. The Hoofprint site in the Black Hills fits well the ethnographic concept of Algonquian and Siouan tribes concerning places where animal spirits residing in the underworld emerge to replenish life on earth and sustain human life. The type site is a narrow sandstone crack that has petroglyphs covering both walls. In addition to non-representational glyphs, the site imagery includes naturalistic images. The front half of a large (2 meter tall) wapiti emerges from the sandstone crack as if coming to life on the earth surface. A tall incised human figure superimposes it. Incising on the wapiti and human images is comparatively deep and wide.

Underlying the wapiti antlers is a finely incised profile of a human head with a long nose and an eye. Superimposed images are frequent at the site, in contrast to pecked animal tradition panels. Fine incised images in particular are so superimposed that it is difficult to sort out individual images. This is an interesting parallel with some European Paleolithic incised images. Another unusual characteristic of this site is bas-relief. An elaborate raised relief bear paw has a fine line incised profile human head over it and a hoof print deeply ground on top (Fig. 2). A bas-relief human female has a series of fine line incised images superimposed on the chest and head. In terms of relative chronology, these two raised relief images are the oldest. Both are outstanding images that catch the eye.



Fig. 2. Hoofprint tradition raised relief bear claw image superimposed by finely incised human head and abraded hoofprint. (Photo Alice M. Tratebas.)

Petroglyphs inside the sandstone crack lack varnish or oxalate coatings and cannot be dated by these methods. All of the images on the exterior surfaces have heavy black rock coatings. Some images high on the wall inside the crack compare with more recent petroglyphs in the region (for example, a turtle and a shield bearing

figure) and would be much younger than the Pleistocene images. More dating research is needed to develop a better understanding of the age and longevity of the petroglyphs at the site and changes through time.

The Hoofprint tradition is the oldest rock art known for the study region. Later, it likely overlapped in time with the pecked animal traditions. The Hoofprint study site in the Black Hills is on the margin of the distribution of abraded hoof prints, which occur mainly to the north and east (Tratebas 1999). Early Hunting petroglyphs are concentrated in the southern Black Hills. The two traditions are separated geographically, but are in adjacent territories. Hoofprint imagery is so different from the pecked animal traditions that it must derive from a completely different cultural lineage. Post-Pleistocene sites with hoof prints are distributed widely within the historic territory of Algonquian and Siouan speaking tribes. Buckles' (1964) detailed analysis of the imagery at the site demonstrates eastern connections for other images as well, including abraded water birds depicted in profile and the zigzag style of 'weeping eye' motif on profile human heads. In general the techniques of incising and abrading are more frequent to the east and north. In contrast, the pecked animal traditions resemble most closely rock art produced by Uto-Aztecan speakers who used solid pecking and often depicted animals and hunting situations.

Not only do we have Late Pleistocene rock art on the northwestern Plains, but we have rock art likely made by different lineages of people. Clearly, multiple cultural traditions were already established in various regions of North America at the end of the Pleistocene.

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