The Earliest rock art in Far Western North America

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Abstract

We have developed a suite of 67 chronometrically-dated rock engravings, based on 106 independent assays, from the Mojave Desert region of California, USA. These ages have recently been cross-checked, blind-tested, re-sampled and evaluated by two analysts using the VML and CR techniques. The most conservative interpretation, based on independently verified chronometric ages, is that the engraving sequence extends from 11,100 to 250 YBP; that is, from Paleoindian to protohistoric times. Less certain evidence suggests that the tradition minimally may be 15,100 years in age. Fully 18% of our dates are greater than 9,000 years old (the Paleoindian period), indicating that the Native American rock art tradition extends back to the Terminal Pleistocene. The earliest art assemblage includes a mix of geometric and representational motif forms, disproving claims for an evolution from abstract to iconic imagery in the region.

The chronometric dating of Great Basin rock engravings was first attempted by James Bard (1979; Bard *et al.* 1976), who used Neutron Activation and X-Ray Florescence Analyses to measure the accumulation of iron and manganese in the rock varnish that, over time, coats petroglyph grooves. Bard's assumption was that the mass of these elements would increase as a function of age. Although efforts to apply this approach periodically reappear (e.g., Lytle *et al*. 2002), it has been demonstrated to yield inaccurate results: manganese and iron concentrations have no relationship to age (e.g., Bard 1979; Dorn 2009). Bard himself, accordingly, has not pursued the technique that he pioneered in the 1970s.

Successful chronometric petroglyph dating only occurred with a better understanding of rock varnish formation processes and geochemistry. Chronometric use and application of this understanding has primarily been provided by Dorn (e.g., 1984, 1986, 1989, 1990, 1992, 1994a, 1994b, 1998a, 1998b, 2001), and Liu (1994; Liu & Dorn 1996; Liu & Broecker 1999, 2007, 2008a, 2008b; Liu *et al.* 2000; Broecker & Liu 2001) has extended and refined one of these, VML dating. Chronometric dating research has been undertaken in the Mojave Desert of eastern California including, especially, the Coso Range (Dorn & Whitley 1983, 1984; Whitley & Dorn 1987, 1988, 1993, 2010; Whitley *et al*. 1998, 1999a, 1999b; Whitley 2009), resulting in a large suite of direct ages for rock engravings.

The two primary techniques that they have successfully applied are Cation-Ratio (CR) and Varnish Micro-lamination (VML) dating. CR dating is based on the fact that the

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relatively mobile trace elements of calcium and potassium leach out of a rock varnish coating more rapidly than less mobile elements, specifically titanium. This rate of relative change can be calibrated to a temporal scale using independently dated control surfaces. Previously Potassium-argon-dated basalt flows in the Coso Range were used to calculate the first regional CR curve (Dorn & Whitley 1983). CR dating has been independently replicated by six laboratories worldwide (Bull 1991; Dragovich 1998; Glazovskiy 1985; Jacobson *et al.* 1989; Patyk-Kara *et al*. 1997; Pineda *et al*. 1988, 1989, 1990; Plakht *et al.* 2000; Whitley & Annegarn 1994; Whitney & Harrington 1993; Zhang *et al*. 1990), and has been successfully subjected to blind-tests (Loendorf 1991, 2008; Faris 1995; Francis & Loendorf 2002).

VML dating is a relative or correlative dating technique that is grossly analogous to tree-ring dating. It is based on the fact that varnish formation processes are influenced by major paleoclimatic shifts (wet versus dry periods). These are observable in micro-stratigraphic layers that develop, over time, in a rock varnish coating, and can be observed and identified in thin-sections. VML has also been replicated internationally (e.g., Cremaschi 1996; Dietzel 2008; Lee & Bland 2003; Zerboni 2008; Zhou *et al.* 2000) and has successfully been blind-tested (Liu 2003; Marston 2003; Phillips 2003). The best dating results, for rock engravings as well as for other kinds of chronometric research, are always obtained when multiple techniques are combined, however (Dorn 1994, 2001).

We have recently reassessed the chronometric petroglyph chronology for the Mojave Desert region (Whitley & Dorn 2010; Whitley 2009), with the assistance of Liu. This involved re-sampling previously dated petroglyphs, re-analyzing archived samples, additional petroglyph sampling, and blind-tests, including crosschecking the results of the two techniques and the two analysts. The result is a sample of 106 independent chronometric assays on 67 individual petroglyphs from six different localities. Twenty-seven of these petroglyphs are from the Coso Range; the remainder is from other localities within the Mojave Desert, including the Rodman Mountains, Cima, and Fort Irwin.

It is important to recognize the different strategies used to sample the engraving localities to fully understand the results. Sampling in the Coso Range was primarily directed towards identifying the oldest motifs, hence the Coso ages are skewed towards the earlier end of the chronological sequence. Sampling at Fort Irwin, another of our study localities, in contrast, was structured to yield a representative understanding of the entire sequence, not just the early end (Whitley *et al.* 1996; Whitley & Dorn 2010). The data set as a whole provides a reasonable estimate for the longevity of the engraving tradition although again, the earlier end of the sequence is over-emphasized in the distribution of ages.

The most conservative consideration of the suite of 67 dated engravings (based on engravings with multiple overlapping age estimates using the two independent techniques, and full concurrence from both analysts) indicates that the sequence extends minimally from 11,100 to 250 YBP. Less certain results push the initial ages back into Pre-Clovis times (i.e., >12,000 YBP), perhaps as early as 15,100 YBP. But 18% of the ages are greater than 9,000 years, providing firm support for Paleoindian rock art production. At the other end of the time scale, 45% of the ages are less than 3,000 years old, and 13% fall within the last 700 years, during the Numic phase (AD 1300–1850).

Given the differing sampling emphases used in the studied localities, the Coso ages are weighted towards the earlier portion of the Mojave sequence. The most conservative interpretation of the Coso ages, based on multiple overlapping results using the two independent techniques, and full concordance between analysts, is a petroglyph tradition that minimally runs from at least 11,100 to 1,300 years ago. Bighorn motifs are securely dated as early as 5,900 years old, but appear to be as much as 11,200 years in age.

The results for motif R96ST13 warrant special mention, as they provide plausible support for Pre-Clovis rock engravings. A blind-test identification of this motif, by a paleontologist specializing in Mojave Desert Pleistocene fauna, suggested that it is an extinct species of North American llama, thereby indicating that it should be early Holocene or earlier in age (Whitley 1999, 2000, 2009). The CR age on this engraving, 13,400 ± 2000 yrs cal BP, is consistent with the VML date (17,150 yrs cal BP) at two standard deviations, though one analyst qualified the VML readings as requiring additional sampling for full verification. An experimental AMS ^{14}C age was obtained on a calcium oxalate layer inter-bedded in the rock varnish. This yielded an age of 11,860 ± 60 yrs cal BP (Beta 90197). It provides stratigraphic and chronological concordance to the minimum-limiting VML layer and age, and the CR results. Although additional sampling is required to verify this age with confidence, four lines of evidence support the possibility that it represents a Pre-Clovis aged petroglyph.

An additional comment is warranted concerning possible Pleistocene faunal depictions in the corpus. The second oldest CR dated representational image has an age of 11,700 ± 1000 yrs cal BP (Cima 2-5). It is a snake engraving. The third oldest, at 11,200 ± 1200 yrs cal BP (CM-7), is a bighorn sheep petroglyph. Although this species is commonly depicted in later art across almost the entirety of western North America, the bighorn has been present on the landscape since the Late Pleistocene, as have been snakes. All three of the Pleistocene-dated representational petroglyphs in the corpus, in other words, depict species that were present during that early time period.

The chronometric results, whether taken for the Mojave Desert as a whole or just in terms of the Coso Range, provide no support for Heizer and Baumhoff's (1962) stylistic chronology, or the calendar ages they linked to it. The chronometric results, on the other hand, support Grant's (1968) contention that representational and geometric motifs co-occur throughout the sequence, but the ages do not match the dates he assigned to his two phases, or the three temporal phases he proposed.

Note again that 13% of the total suite of ages date to the Numic Period, supporting the continuity of the rock art tradition into recent times, contrary to the positions of Heizer and Baumhoff (1962) and Grant (1968). Numic rock art production is independently confirmed by the historical motifs and ethnographic commentary. Further, with 45% of the motifs dating to the last 3,000 years, some degree of ritual intensification appears to have occurred during the later portions of Mojave Desert prehistory.

Regardless of this last point, the Mojave Desert CR and VML ages provide strong support for the hypothesis that rock art production occurred in the Americas during the Terminal Pleistocene, and that it was likely a cultural tradition brought into the continent by its earliest settlers.

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