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DEPARTMENT OF DEFENSE-WIDE INVENTORY OF ROCK ART SITES AND ASSESSMENT OF MANAGEMENT PRACTICES

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TABLE OF CONTENTS

Chapter	Page
ACKNOWLEDGMENTS.....	vi
EXECUTIVE SUMMARY	vii
1. INTRODUCTION	1
TERMINOLOGY	5
DOCUMENT ORGANIZATION	6
2. DOCUMENTATION, NRHP EVALUATION AND TREATMENT	9
CHAPTER SUMMARY.....	9
DOCUMENTING ROCK ART SITES	10
Documentation Requirements and Techniques.....	10
NRHP ELIGIBILITY EVALUATIONS	13
Site Integrity.....	13
NRHP Eligibility Criteria.....	15
Treatment of Adverse Effects	17
3. MANAGEMENT PRINCIPLES AND CONCEPTS	21
CHAPTER SUMMARY.....	21
MANAGEMENT PLANNING PRINCIPLES.....	22
MODEL MANAGEMENT PLAN	26
Conservation Strategy	29
Visitor Strategy	30
Monitoring and Reassessment	32
Baseline Data	34
Documentation	34
Prioritization and Sampling.....	35
SUMMARY	35
4. ANALYTICAL APPROACHES TO ROCK ART	37
CHAPTER SUMMARY.....	37
CHRONOLOGY.....	38
Relative Dating Techniques	38
ETHNOGRAPHY AND ROCK ART.....	45
5. HISTORICAL CONTEXT OF NORTH AMERICAN AND HAWAI'IAN ROCK ART.....	49
CALIFORNIA	49
Literature	49
Description	51
Chronology and Period of Significance	53
GREAT BASIN	53
Literature	53

TABLE OF CONTENTS

Chapter	Page
Description	53
Chronology and Period of Significance	54
COLUMBIA PLATEAU	55
Literature	55
Description	55
Chronology and Period of Significance	57
PACIFIC NORTHWEST AND ARCTIC	58
Literature	58
Description	58
Chronology and Period of Significance	60
SOUTHWEST	60
Literature	60
Description	61
Chronology and Period of Significance	68
GREAT PLAINS	68
Literature	68
Description	69
Chronology and Period of Significance	72
EASTERN WOODLANDS	73
Literature	73
Description	74
Chronology and Period of Significance	77
NORTHERN WOODLANDS	78
Literature	78
Description	78
Chronology and Period of Significance	78
HAWAI'I	80
Literature	80
Description	80
Chronology and Period of Significance	82
6. ASSESSMENT OF DEPARTMENT OF DEFENSE ROCK ART RESOURCES AND MANAGEMENT	83
CHAPTER SUMMARY	83
ASSESSMENT METHODS	83
Facility Identification	84
Survey of Installations with Rock Art Sites	86
Case Studies	87
ASSESSMENT RESULTS	87
Identification Results	87
Survey Questionnaire	88
Case Studies	91

TABLE OF CONTENTS

Chapter	Page
7. SUMMARY AND RECOMMENDATIONS	99
STATUS OF DEPARTMENT OF DEFENSE ROCK ART SITES	99
DEPARTMENT OF DEFENSE FACILITY ROCK ART RECOMMENDATIONS ...	100
RECOMMENDATIONS FOR ROCK ART SITE MANAGEMENT.....	102
Site Documentation.....	103
Condition Assessment.....	104
REFERENCES	105
APPENDICES.....	133
APPENDIX A. CRM Questionnaire	

LIST OF FIGURES

	Page
Figure 1. Petroglyphs or rock engravings are typically made by pecking or incising designs into underlying rock panels. This example consists of bighorn sheep, from the Coso Range, California.	2
Figure 2. Pictographs are made by paintings or drawing on a rock surface. Head of Sinbad site, Utah.	2
Figure 3. Earth figures include rock alignments, shown here. Slate Range, California.	3
Figure 4. Intaglios, made by scraping away desert pavement coatings, are another type of earth figure. Blythe, California.	3
Figure 5. Flow chart of background studies and management plan strategies.	28
Figure 6. A superimpositional sequence for pictographs from the Carrizo Plain, California.	42
Figure 7. Horse and rider motifs indicate historical period production. This example is from the Coso Range, California.	43
Figure 8. Varnish microlamination thin-sections, both from Coso Range petroglyphs. Upper dates to 5900 BP; lower to 11,100 BP.	45
Figure 9. Culture areas of North America.	50
Figure 10. Pit and Groove Tradition boulder, northern California.	51
Figure 11. California Tradition pictograph: Painted Cave, Santa Barbara, California.	52
Figure 12. Columbia Plateau Tradition petroglyphs: “twin” anthropomorphs under rayed arcs.	56
Figure 13. Columbia Plateau Tradition petroglyph: “Spedis” Owl and anthropomorph.	56
Figure 14. Columbia Plateau Tradition petroglyph: “She Who Watches,” mythic being.	56
Figure 15. Pacific Northwest Tradition petroglyphs: mask faces and killer whales.	59
Figure 16. Gila (Hohokam) petroglyphs, Arizona, showing “lizard-like” anthropomorphs and geometrics.	61
Figure 17. Archaic anthropomorph pictographs, Barrier Canyon, Utah.	62
Figure 18. Pecos River Style Archaic anthropomorph pictographs, Texas.	62
Figure 19. Parrot petroglyph, Petroglyph National Monument, New Mexico.	63
Figure 20. Bear paw Hopi clans signs, Willow Springs, Arizona.	63
Figure 21. Navajo pictograph panel of a Ute raid, Canyon de Chelly, Arizona.	66
Figure 22. Northern Plains incised raiding scene, La Barge, Wyoming.	70
Figure 23. Plains shield petroglyphs, Castle Gardens, Wyoming.	70
Figure 24. Dinwoody style spirit figures and geometrics, Wyoming.	72
Figure 25. Thunderbird with heartline petroglyph, Jeffers site, Minnesota.	74
Figure 26. Mud scraper owl motif, Mud Glyph Cave, Tennessee.	75
Figure 27. Southeastern Pit and Groove Tradition, Judaculla Rock, Georgia.	75
Figure 28. Petroglyphs of horned anthropomorph, bird and geometrics, Leo site, Ohio. (Petroglyphs have been painted-in for visibility.)	77
Figure 29. Agawa pictograph site, Ontario, Canada (Northern Woodlands). Canoe with humans on left; mythic creature on right; snakes below.	79

LIST OF FIGURES

	Page
Figure 30. Incised geometric petroglyph, Bedford, Maine.	79
Figure 31. Anthropomorphic and geometric petroglyphs, Island of Hawai'i.	81
Figure 32. Cup and ring and circular petroglyph motifs, Island of Hawai'i.	81

LIST OF TABLES

	Page
Table 1. Regulatory Context for Cultural Resources on Department of Defense Facilities.....	7
Table 2. Stakeholders and Significance Values	24
Table 3. Rock Art Management Plans	27
Table 4. Conservation Strategy	30
Table 5. Reassessment/Monitoring Strategy.....	33
Table 6. Southwestern Rock Art Styles	64
Table 7. Plains Rock Art Traditions.....	71
Table 8. Contacted DoD Facilities	85
Table 9. Returned CRM Questionnaires	88

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EXECUTIVE SUMMARY

Rock art sites include pictographs, petroglyphs and geoglyphs. These sites differ from other aspects of the archaeological record because of the nature of their remains, the archaeological approaches that are used to study them, and the problems they present for management and preservation. This document, funded by the DoD Legacy Resource Management Program as project #11-480, is intended as a guide to regulatory compliance related to rock art sites. Following a series of key definitions in the introduction, it starts with an overview of site documentation and treatment approaches. This chapter emphasizes that rock art data collection, eligibility determinations, and treatments often differ from the techniques employed for “dirt” archaeological sites. The next chapter outlines general heritage management principles, developed by the NPS, UNESCO and other organizations. It also provides a model rock art site management plan. This can be modified to suit the local conditions and requirements that may exist on any given DoD facility. Analytical techniques used to study rock art sites are then presented. The intent here is to provide a DoD CRM with an understanding of state-of-the-art analytical and interpretive approaches, to better assess any such work that may be conducted on a specific facility’s rock art sites. Chronology and ethnographic analysis are emphasized because these are both directly relevant to management concerns. Historical context studies are required for NRHP eligibility determinations, which are a major focus of NHPA Section 106 compliance. A historical context study for rock art sites in the 50 United States is accordingly presented, to assist in such efforts. This includes a summary listing of recent regional literature, the periods of significance and cultural historical framework for each region, and current interpretive theories. The current status of DoD rock art site management, based on a survey and interviews with selected facility CRMs, concludes the document. This provides an overview and summary of the rock art on DoD facilities within the 50 states. It identifies common facility management issues, and it makes recommendations to facilitate regulatory compliance with respect to this aspect of the archaeological record.

1. INTRODUCTION

A series of federal laws, regulations, orders, and policies, implemented on military lands through Department of Defense (DoD) directives and instructions, govern the treatment of cultural resources. These include archaeological districts, sites, artifacts, and remains; historical landscapes, structures, and buildings; heritage assets; and archival records and documents. These laws and policies also require consultation with Native American tribes; accommodation of their traditional religious practices and lifeways; protection of their sacred sites and traditional cultural properties; and the repatriation to them of burials and sacred/funerary objects. The general regulatory context for DoD cultural resource management is summarized in Table 1, which outlines these requirements and stipulations.

Included among the cultural resources considered by these laws, regulations and instructions are rock art sites and motifs. Rock art (Figures 1, 2, 3, 4) has been defined as:

landscape art [that] consists of pictures, motifs, and designs placed on natural surfaces such as cliff and boulder faces, cave walls and ceilings, and the ground surface ... the defining characteristic of rock art is its placement on natural rock surfaces, thereby distinguishing it from murals on constructed walls, paintings or carvings on canvas, wood, ceramics, or other surfaces, and free-standing sculptures.

Rock art includes *pictographs* (paintings and drawings), *petroglyphs* (engravings and carvings) and *earth figures* (intaglios, geoglyphs, or earthforms). Some researchers also include pecked pits-and-grooves, sometimes called cups-and-rings or cupules, as another form of rock art. Pictographs and petroglyphs are found on rock art *panels*. These are approximately flat surfaces that are the fracture or weathering planes of a natural rock outcrop [Whitley 2011:23, emphases added].

Many cultures have created and/or continue to create rock art, especially if graffiti on rock surfaces is included under this term. Only traditional Native American and Native Hawai'ian rock art, however, is considered in this document. This traditional rock art has a series of qualities that both distinguish it from other aspects of the archaeological record and make it difficult to manage:

- Unlike many other aspects of the archaeological record, rock art is typically above-ground and visible, making it easy to recognize.
- Because it is above-ground, rock art is often subject to greater natural (e.g., weathering) and cultural (e.g., vandalism) degradation than other kinds of sites. This is especially true for pictographs because painted motifs are often quite fragile.
- As an unusual aspect of the archaeological record, most archaeologists are not trained in rock art recording, analysis, or interpretation, and even fewer have a background in the specialized techniques required to manage and conserve these kinds of resources.

1. Introduction

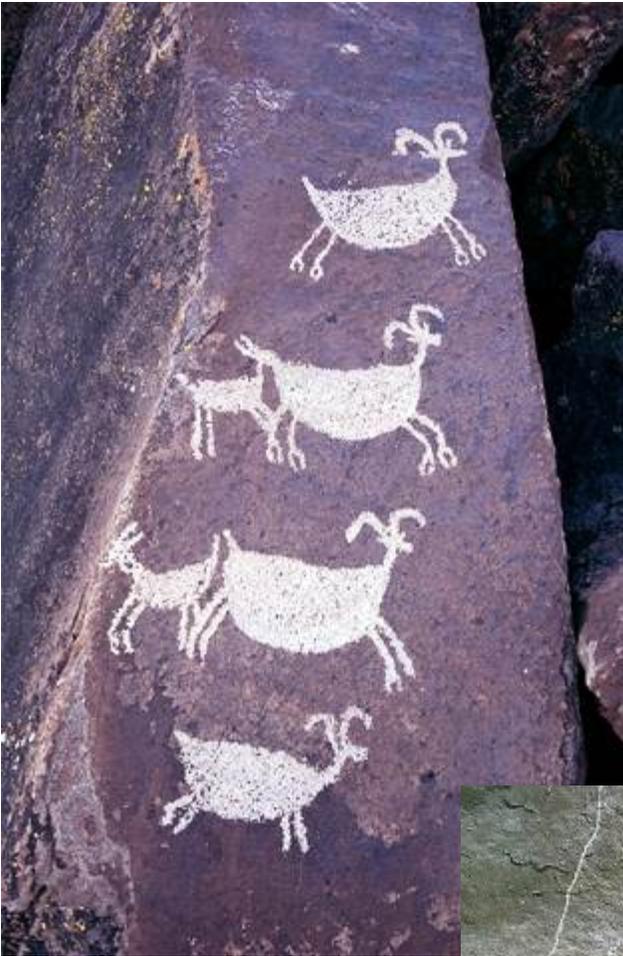


Figure 1. Petroglyphs or rock engravings are typically made by pecking or incising designs into underlying rock panels. This example consists of bighorn sheep, from the Coso Range, California.

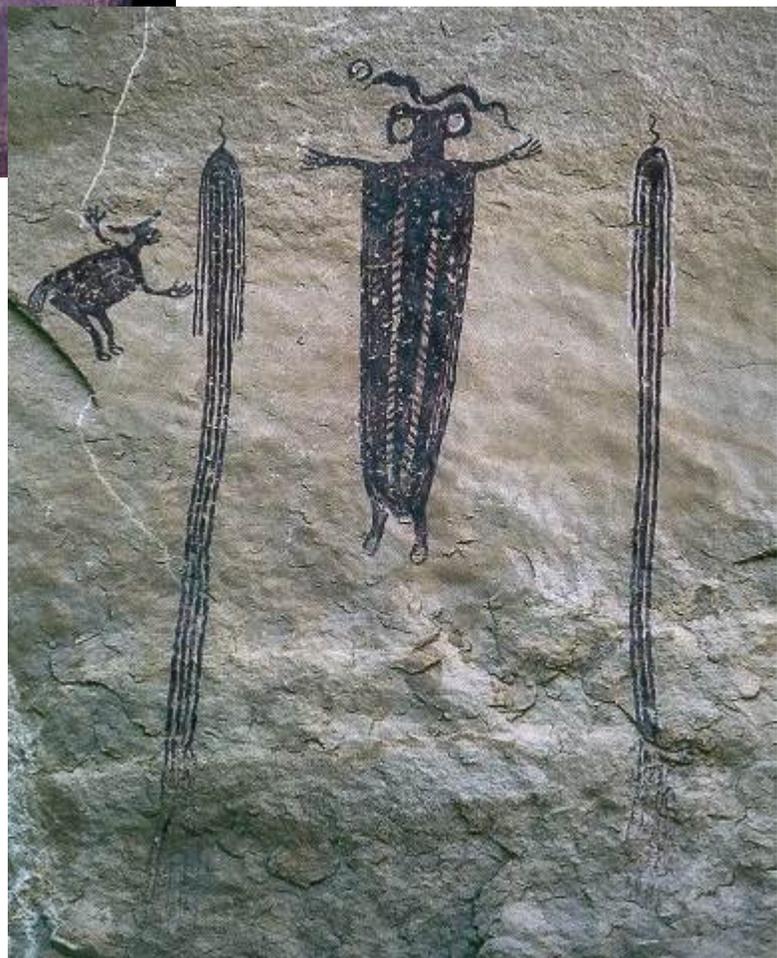


Figure 2. Pictographs are made by paintings or drawing on a rock surface. Head of Sinbad site, Utah.

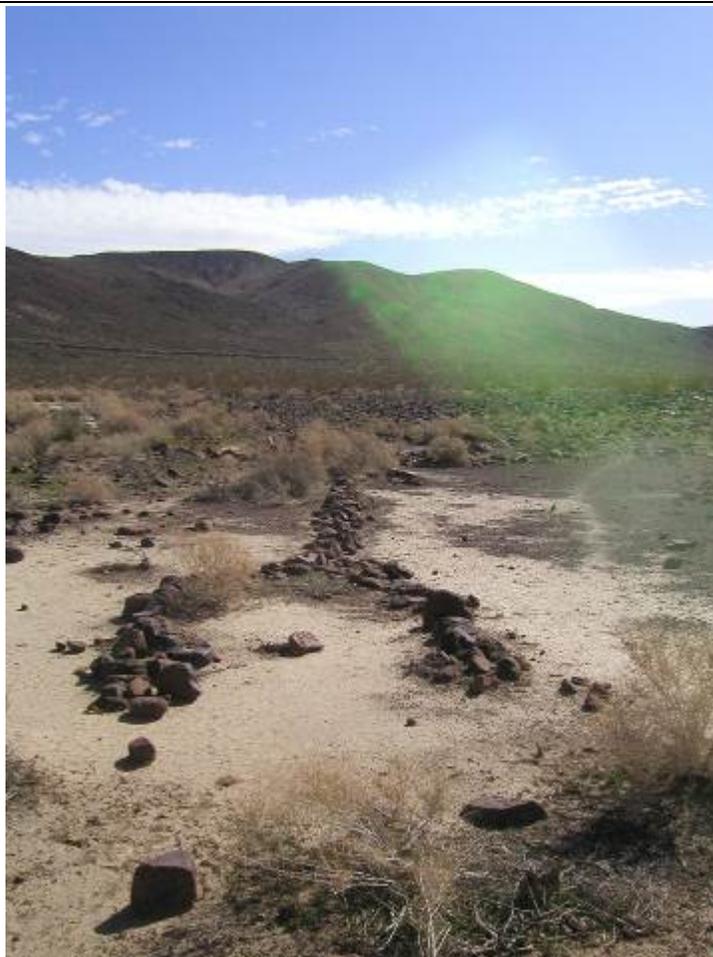


Figure 3. Earth figures include rock alignments, shown here. Slate Range, California.



Figure 4. Intaglios, made by scraping away desert pavement coatings, are another type of earth figure. Blythe, California.

- The visibility and aesthetic qualities of rock art sites can result in public interest in site visitation. In at least one DoD case, rock art tourism on a military facility has a significant impact on the local civilian economy.
- Though the origins and functions of Native American and Native Hawai'ian rock art varied during the ethnographic and prehistoric pasts, many indigenous peoples place special importance on rock art sites. Many groups claim that the sites were and continue to be important for spiritual/ceremonial purposes, the education of their children, and the perpetuation of their indigenous self-identity and social memory.
- Because of their potential aesthetic qualities, rock art sites may have NRHP eligibility for more than just their research value, unlike many other kinds of archaeological sites. Due to their connections with indigenous peoples, some rock art sites may also be NRHP-eligible as Traditional Cultural Properties (TCPs).
- Because of the relative rarity of rock art sites in many regions and their significant qualities, preservation-in-place is commonly the only acceptable management option. Yet because of the fragility of many sites, passive preservation may be inadequate for long-term resource sustainability, with active management and conservation treatments required.

This document, and the research upon which it is based, has been supported by the Department of Defense Legacy Resource Management Program, Project #11-480, under Agreement No. W9132T-11-2-018, and Purchase Request W81EWF-1077-4508. Its purpose is twofold. First, it provides background intended to assist DoD facility Cultural Resource Managers (CRMs) and Historic Preservation Officers (HPOs) in the inventory, assessment, and treatment of these resources, including their management and conservation. Included in this background are a number of elements:

- Guidelines for rock art documentation, NRHP evaluations, and treatments;
- Basic principles underlying a rock art management plan and a model for its development;
- Summary of analytical approaches to rock art study, intended to assist facility CRMs overseeing rock art contracts; and
- A historical context study useful for the preparation of NRHP evaluations or nominations.

Second, this document provides an assessment of the numbers of rock art resources and their management on DoD facilities in the United States. A goal of this assessment is to establish the nature and extent of rock art sites on DoD lands, to identify ongoing DoD rock art site management approaches, to determine if these are appropriate, to identify management issues that may be common to multiple DoD facilities, and to suggest more cost-effective ways to treat these kinds of resources. These represent standardized approaches that will improve the efficiency and cost-effectiveness of historic preservation efforts, as well as ultimately enhance the sustainability of these kinds of cultural resources. But heritage management standards and principles are not necessarily well understood or obvious. Because of this fact, it can be difficult to assess facility programs in these terms. The model rock art management plan, based on widely accepted and employed international guidelines, partly serves as a metric against which existing

programs can be evaluated. It also provides CRMs with ideas and approaches that can be applied to their specific facility programs.

TERMINOLOGY

The three primary types of rock art are defined above, but additional terminological detail is useful at this point, in order to clarify discussions throughout this document.

- ♦ *Abstract* motifs are (seemingly) nonrepresentational or nonfigurative images; often used synonymously with “geometric.”
- ♦ *Anthropomorphs* are human or human-like motifs.
- ♦ *Cupules* are shallow cups ground into a rock surface.
- ♦ *Geoglyphs* are rock alignments; that is, earth figures created by arranging cobbles or boulders into a pattern.
- ♦ *Iconic* motifs are figurative or representational images; that is, identifiable as real-world objects or entities.
- ♦ *Iconography* is the ordered set of connections between particular graphic forms and their meaning, including a corpus of such forms.
- ♦ *Intaglios* are earth figures made by scraping cleared areas, in a desired design, in a desert pavement surface.
- ♦ *Motif* is an individual rock art design, element, or figure.
- ♦ *Petroform* is a regional (Midwestern and Plains) term for geoglyphs.
- ♦ *Petroglyphs* include motifs made by pecking, incising, scratching, or abrading.
- ♦ *Pictographs* are drawn or painted motifs, using pigment or charcoal.
- ♦ *Pigment* used to make pictographs may have been applied wet (i.e., ground and mixed with a liquid, like water or blood) or dry, with a finger or brush. Common pigments include natural ocher (red), clays (white), and black (charcoal), but a variety of other color sources sometimes were employed. Brushes were commonly made from a small animal tail, or shredded plant fibers. Dry chunks of charcoal, clay, or ocher could also be used, unaltered, to draw on rock surfaces, analogous to drawing with chalk.
- ♦ *Rock varnish* is a paper-thin dark coating that develops, over time, on rock surfaces in arid environments. It is also sometimes called desert varnish or, incorrectly, “patina.” Petroglyphs are commonly created by pecking through a rock varnish coating to expose the lighter-colored heartrock below.
- ♦ *Substrates* are the natural rock surfaces (or “lithic supports”) upon which rock art was created.
- ♦ *Superimposition* (also sometimes called superpositioning) is the placement of one motif on top of another. Superimpositional studies can be useful for determining chronology.
- ♦ *Style* is a common classificatory scheme for rock art studies, derived from the more general concept of an “art style.” A common error in the rock art literature is the

confusion of “descriptive styles” for “cultural-historical styles” (Whitley 2011:69-73). Descriptive styles (e.g., geometric versus realistic) are necessary for data recording, but not all descriptive styles represent cultural-historical units (time periods or prehistoric cultures), as is frequently assumed.

- ♦ *Zoomorph* is an animal or animal-like motif.

DOCUMENT ORGANIZATION

The next chapter provides a summary of current professional rock art documentation and evaluation techniques, specifically directed at NRHP eligibility evaluations, and a brief discussion of site treatment. Chapter Three outlines the rationale and components of a model rock art site management plan. The intent is to illustrate how the various requirements of regulatory compliance and components of standard DoD cultural resource management fit into larger international heritage management standards and goals, and to provide guidance for long-term resource sustainability. This also provides an idealized standard against which existing management programs may be evaluated, or improved. Chapter Four is an overview of analytical approaches to rock art research, intended to assist facility CRMs oversee rock art studies conducted, by contractors, on DoD facilities. Chapter Five comprises a historical-context study intended for use in NRHP eligibility evaluations and/or nominations. Chapter Six consists of a DoD assessment, and includes a discussion of the evaluation techniques employed and the results of this analysis. It also includes suggestions to improve the efficiency of rock art management techniques, including an outline for cost-effective site documentation, and condition assessments. A summary concludes this document.

In order to facilitate the use of this document as a practical guide for DoD facility CRMs, the management/analytical chapters begin with a bulleted-summary of their key points. These summaries can be consulted to identify the main issues and topics of each chapter, with more details provided in the subsequent sections themselves.

Table 1. Regulatory Context for Cultural Resources on Department of Defense Facilities

National Environmental Policy Act (NEPA) – Requires federal agencies to “preserve important historic, cultural, and natural aspects of our national heritage” (42 USC 4331 (b)(4)), and is the overriding statutory basis for assessing potential impacts to the cultural environment, which includes archaeological sites, buildings, and traditional religious practices and lifeways.
National Historic Preservation Act (NHPA) – Requires federal agencies to responsibly manage federally owned or controlled cultural resources, following procedures outlined in Sections 106 and 110 of this act. <u>Section 106</u> defines cultural resources requiring management as those that are listed, determined eligible, or potentially eligible to the National Register of Historic Places (NRHP), based on a series of specific criteria. It also requires that the Advisory Council on Historic Preservation (ACHP) be allowed to comment on proposed federal actions and their potential effect on historical properties. <u>Section 110</u> requires federal agencies to establish preservation programs to identify, evaluate, and nominate cultural resources to the NRHP, and to preserve and protect these resources. It also calls for coordination and consultation with other agencies, Native American tribes, and other interested parties. Note that, while some federal actions are categorically exempt from NEPA, NEPA exemptions do not eliminate the requirement to comply with the NHPA.
Archaeological Resources Protection Act (ARPA) – Establishes civil and criminal penalties for theft or damage to cultural resources on federal land, and a permitting process for archaeological work that will excavate or remove archaeological remains from these lands. Also includes provisions for preserving archaeological collections and maintaining the confidentiality of archaeological site locational information. (DoD implementing regulations are given at 32 CFR 229.) Standards, procedures, and guidelines for curation are provided in 36 CFR 79.
Native American Graves Protection and Repatriation Act (NAGPRA) – Specifies procedures followed in the inadvertent discovery of Native American burial remains and sacred/funerary objects on federal lands; requires the inventory of all federal curatorial facilities to identify burial and funerary remains, and their repatriation to Native American descendants; and includes provisions for prosecuting those who knowingly sell, purchase, or transport such remains (see 43 CFR 10).
American Indian Religious Freedom Act (AIRFA) – Protects the rights of American Indians to conduct their traditional religious practices, including “access to sites (sacred places), possession of sacred objects, and the freedom to worship through ceremonies and traditional rites” (42 USC 1996). Also requires federal agencies to consider effects of their actions on traditional religious practices, and, following consultation with traditional religious leaders, to determine appropriate measures to protect Native American rites and practices.
DoD Directive 4710.1, Establishment of Policy, Procedures, and Responsibilities for the Management of Archaeological and Historical Resources under DoD Control, 21 June 1984 – Establishes, as DoD policy, the integration of archaeological and historic preservation with the planning and management of DoD activities, and assigns responsibilities and outlines procedures to achieve that integration for all branches of the department.
DoD Instruction 4715.3, Environmental Conservation Program, 3 May 1996 – Implements policy, assigns responsibilities, and prescribes procedures for the integrated management of natural and control resources under DoD control.

2. DOCUMENTATION, NRHP EVALUATION AND TREATMENT

CHAPTER SUMMARY

- Rock art data collection techniques differ from other archaeological techniques
 - Site *documentation* differs from site *recording*
 - Documentation requires a complete and permanent record of motifs and context
 - NRHP eligibility determinations
 - Site integrity is not necessarily the same as site condition
 - Sites may be eligible under Criteria C and D, sometimes under A, rarely under B
 - Sites may also constitute TCPs
 - Treating adverse effects
 - Data recovery is rarely appropriate
 - Preservation and protection in place is generally preferable
-

Rock art differs from many other aspects of the archaeological record because it is entirely surficial in nature. It is also permanently affixed to the landscape and cannot normally be collected, moved or archived, like artifacts. It is graphic/aesthetic in form and nature, thereby requiring different descriptive, analytical, and interpretive approaches than might be employed, for example, for lithic tools or ceramics. These unusual circumstances are compounded by the fact that rock art documentation, analysis, and interpretation are relatively new topics in professional North American archaeology. One result is that few archaeologists are trained or have experience in rock art documentation, analysis, conservation, or management. Another is that, while there are a large number of amateur rock art enthusiasts in the country who sometimes promote themselves as rock art professionals, they do not meet the qualifications required by the Secretary of the Interior's *Standards and Guidelines*, and are not familiar with compliance issues and procedures. This document is partly oriented towards assisting DoD facilities manage their rock art resources, starting in this chapter with documentation, assessment, and treatment.

NHPA Sections 106 and 110 require federal agencies to conduct site inventories and assessments, and determine the effect of actions. This chapter is intended to provide an overview of rock art recording, documentation, NRHP evaluations, and, when appropriate, treatment of adverse effects, directed at assisting facility CRMs to satisfy their regulatory requirements. More detailed discussions of field documentation and analytical techniques are provided in Loendorf (2001), Whitley and Loendorf (2005), and Whitley (2001a, 2001b, 2011).

DOCUMENTING ROCK ART SITES

Rock art sites commonly are components or features of larger archaeological sites. They should be recorded following a given facility's standards and protocols for recording all cultural resources. The term "recording" is used here in a specific sense. It refers to the mapping and completion of standard site record forms during cultural resource inventories. It is important that the rock art component of any given larger site be included in the site records and maps, to ensure that the component is fully integrated into the cultural resources database as a whole. Site recording is, then, a step, following resource identification, in the inventory process.

"Documentation" means something different. Documentation typically occurs subsequent to site recording and inventories. It requires the collection of a more detailed and systematic graphic, locational, and descriptive record of a rock art site. In much of the older (and especially amateur/avocationalist) literature, rock art documentation is referred to as "recording." For regulatory compliance purposes, "recording" and "documentation" are better understood as distinct procedures, involving varying levels of detail, intended for different management (or research) purposes. Rock art documentation as employed here is analogous to site evaluations. Documentation normally is necessary for NRHP eligibility assessments. It also provides the required baseline data for site monitoring and conservation, as well as an archival record of a potentially ephemeral aspect of the archaeological record.

An empirical example emphasizes this last point. Two small pictograph sites in rockshelters were recorded (in the sense used here) in 1987, in the Simi Hills of southern California. Both sites were located on private property, in very rugged terrain. Due to their inaccessibility, the sites were not revisited by archaeologists for two decades. Although both rockshelters were re-located during the second visit, no trace of the paintings at either site could be found, even with the use of digital photographic enhancement. Although the original site recorder had taken a few quick snapshots of the pictographs, no formal or complete documentation had occurred. (The 1987 photographs are now the only record of this art.) In this case, the corpus of rock art at these two sites was effectively lost in 20 years, entirely due to natural weathering processes. Because similar kinds of weathering processes occur at many rock art sites and can be rapid, documentation should be completed at the first opportunity.

As the American Rock Art Research Association (ARARA) emphasizes:

[I]t is the first responsibility of site management to fully survey and document these cultural resources. Documentation should begin with the most vulnerable resources, but should also include a complete inventory, mapping and descriptive record of the remaining sites [ARARA 2001:4].

Documentation is, then, the first step in rock art site management (Mazel 2012:520).

Documentation Requirements and Techniques

NRHP evaluations and basic management needs result in a set of *minimum* requirements for rock art site documentation. This is intended to serve as a dated baseline record of the art at a site and its condition. These requirements are:

- : A systematic graphic record of each rock art panel, ideally including information on each panel's condition;
- : A systematic record of existing site vandalism, including all vandalism (such as graffiti, looter's pits, and trash) that is present at the site, even if not on a rock art panel;
- : Mapped locations of the panels, vandalism, and other site features;
- : Descriptive notes or summaries that describe and clarify the documented graphic imagery, site condition, and mapping data; and
- : A final report that outlines field methods, data collected, and management and compliance implications and recommendations.

It is important to emphasize that documentation should be conceptualized as an *analytical* process; that is, it involves systematic sampling, structured with respect to the kinds of data it collects, and results in data that are immediately usable for management purposes (Whitley 2011). A box (or file) of photographs, even if systematically taken, is unprocessed and unanalyzed, and does not constitute professional rock art documentation.

A variety of techniques have been employed to obtain the graphic imagery required for rock art site documentation. Given the current pace of technological change, it is likely that new, more efficient and accurate techniques will be developed. Appropriate (or best) techniques may also vary regionally, depending upon the nature of the rock art and its frequency in the local archaeological record. Regardless of approach or circumstance, the basic data collection unit for rock art documentation is the rock art panel, analogous to an excavation unit or a surface collection unit in dirt archaeological studies. The most common professional techniques used to document panels, and their advantages and disadvantages, are listed below (cf. GRAPP 1993; Loendorf 2001; Whitley 2011; Whitley and Loendorf 2005).

- ♦ *Numerical tabulations*: In the older literature, sites were sometimes documented using motif counts following a standardized motif typology. This is a very quick technique that yields easily stored and manipulated data. But for a variety of reasons, tabulations have been found to be inaccurate, sometimes remarkably inaccurate. Tabulations are also inadequate for management purposes. They may be useful, however, for general site recording (rather than documentation) during inventory, or for a focused research project (e.g., one interested in the distribution of a particular motif type).
- ♦ *Rubbings*: Rubbings on paper or film have sometimes been used to document petroglyphs, especially in the Pacific Northwest where the motifs are often wide but shallow and difficult to see. Rubbings are considered potentially damaging to the panel face, they result in data that are difficult to store and manipulate. Rubbings are no longer used as a professional documentation technique.
- ♦ *Tracing*: Plastic sheeting and fine-point marking pens are often used to trace the motifs on individual panels. Although tracing skills vary between individuals, this technique typically is very accurate and only moderately time-consuming in the field. It risks damaging rock art, however, especially pictographs, although it is generally safe for petroglyphs. Tracings can include information on panel condition (e.g., by illustrating the extent of lichen growth). Storing and reducing the tracings to a manageable and usable size can be time-consuming and difficult.

- ♦ *Scaled drawings*: Scaled line drawings made using a string grid and graph paper have sometimes been employed for site documentation. Although this approach avoids any damage to the art, it is very time-consuming in the field, inaccurate, and data-poor: motif drawings lack many of the kinds of information needed for management purposes, such as panel condition, and invariably represent generalizations of the motifs. Scaled drawings also result in data that are difficult to store and manipulate, as with direct tracings.
- ♦ *Photography*: Most of the above techniques are typically combined with photography. Digital photography (including a graphic scale) has dramatically changed rock art documentation techniques, partly because it is accurate, fast, and inexpensive. It is also data-rich in the sense that photos include visible information on panel condition. Images, furthermore, can be manipulated using common software packages to improve visibility. This may reveal aspects of the art that are not apparent to the “naked” eye. The data are also easy to store. Although discussed in more detail in the final chapter, when combined with detailed field notes and accurate mapping techniques, systematic digital photography is currently the most efficient, cost-effective means for site documentation.

More sophisticated, digitally based techniques also exist, including 3-D laser scanning and 3-D photogrammetry (e.g., Barnett et al. 2005; Simpson et al. 2004; Waslewicz et al. 2005). Both are highly accurate and may yield three-dimensional imagery not just of panels and motifs, but of the site surface as a whole. 3-D laser-scanning is currently expensive, and requires substantial amounts of post-field computer processing. It is also only applicable to petroglyphs and earth figures for motif documentation. The equipment is very sensitive to light and heat, and can be difficult to deploy in field conditions. Digital imagery that can be used in 3-D photogrammetry is quick and easy to collect, creating a very detailed archival record of rock art sites and panels. It simply requires systematic overlapping photography at set distances apart and spacing from the panel faces. To date, the data richness of the 3-D imagery is only just beginning to be used analytically in management studies, and its practical utility has not yet been fully explored. That said, its value in providing baseline data that can be easily archived is clear.

It is important to always remember the human/interpretive aspect of rock art documentation. This starts with determining what requires documentation. This issue is well illustrated by the differences between tabulations (typological counts), scaled line drawings (impressionistic graphic details), and tracings (accurate graphic details). Each of these approaches has potential value, especially with respect to specific possible research as opposed to management needs. But each also reflects a commitment to a certain level and amount of data collection. Good digital photography can obviate the data deficiencies of each of these techniques by including information useful for management purposes, especially the visible condition of rock art panels. Knowing what to include in the photographic record is also critical. This record should provide imagery not just the panels and their motifs, but aspects of condition and setting that may subsequently prove critical for management purposes. As in most things, professional archaeologists who understand regulatory requirements and are knowledgeable about rock art research, management, and conservation will provide the most useful site documentations.

This last point has been emphasized by Copeland (2008), based on his experiences overseeing a series of rock art projects contracted by a federal agency. He notes with respect to site recording and documentation that:

Most seasoned field archeologists are well versed in identifying and recording more common types of sites such as artifacts scatters and habitation features. Many do not have similar experience on identifying rock art and the numerous, sometimes subtle distinctions evident in petroglyph and pictograph imagery. They are not bad archeologists, just often not well experienced in the special skill of rock art survey and documentation.... Many archaeological projects rely on specialists for the analysis and reporting of specialized materials such as botanical samples or lithic sourcing; rock art should ... be no different [Copeland 2008:77].

A subtext of the above discussion is that rock art documentation, especially for management purposes, ideally is completed in conjunction with a condition assessment, discussed in detail below.

NRHP ELIGIBILITY EVALUATIONS

The NHPA requires federal agencies to determine whether their cultural resources are eligible for inclusion in the NRHP and, if so, to nominate the historical properties for listing. The criteria for NRHP eligibility are defined at 36 CFR §60.4 and, in addition to a minimum age of 50 years, include:

The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and that:

- (a) are associated with events that have made a significant contribution to the broad patterns of our history; or
- (b) are associated with the lives of persons significant in our past; or
- (c) embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- (d) have yielded or may be likely to yield, information important in prehistory or history.

Two issues concerning the NRHP eligibility of rock art sites warrant discussion: site integrity, and the eligibility criteria themselves.

Site Integrity

“Integrity” is an important quality with respect to the NRHP eligibility of rock art sites, due to the sites’ exposure to the natural weathering and potential vandalism, and resulting inherent fragility. The integrity (or lack thereof) of a site must be carefully considered during the

eligibility evaluation process. But integrity, especially for rock art, is a more complex quality than may be initially apparent. Two empirical examples illustrate this point.

Carrizo Painted Rock

Located within the Carrizo Plain National Monument, California, Painted Rock is the largest pictograph site in North America. Arguably it was also one of the most spectacular, and it has been described as the “Sistine Chapel” of American rock art. Due to its recognized prominence, the National Park Service (NPS) considered listing it as a National Historic Landmark (NHL) in the 1960s. But the site had suffered substantial vandalism during the first half of the twentieth century, including an infamous incident when drunken oil field workers used the main paintings for target practice. The NPS decided that it lacked integrity, and it was not NHL-listed at that time.

This determination, notably, occurred prior to any formal site documentation. Although it is clear from initial impressions that the site is badly vandalized, the relative degree of destruction did not become apparent until systematic site documentation occurred in the 1990s and 2000s. Partly based on this documentation, the NPS listed Painted Rock as part of a 24-site NRHP district in 2004, at the National level of significance. In 2012, it was listed as the central component of the 100-site Carrizo Plain NHL Archeological District.

This circumstance raises an obvious question: Why did the NPS list a site as an NHL when it had previously been determined to lack integrity? Two arguments were presented in the nominations to support its listing. Both arguments highlight some of the issues involved in evaluating integrity.

The first concerned the results of the site documentation. This showed that the main pictograph panels had been substantially (and obviously) destroyed. But numerous smaller, less conspicuous panels and motifs existed that still retained integrity. These retained research and aesthetic values adequate to support the continuing significance of the site. Although initial appearances suggested otherwise, systematic documentation revealed a very substantial corpus of intact rock art.

The second argument involved the important, but often overlooked, distinction between site *condition* versus *integrity*. Condition strictly concerns current physical status. And the condition of Painted Rock, on average, is poor, due to its history of vandalism and the age (over 2,000 years old) of some of its art. Integrity, in contrast, involves “location, design, setting, materials, workmanship, feeling, and association,” as the regulations explicitly state, but not necessarily condition. A site in this sense can be in poor condition overall, but potentially still retain its integrity, as in the case with Painted Rock.

This last circumstance reflects a subtle point about rock art and the distinction between integrity and condition. Many (but not all) rock art sites include panels and motifs of different age and therefore relative condition, and it should be expected that these would vary in completeness, brightness, visibility, and other factors. But because the motifs and panels may have accreted over long periods of time, this kind of internal variability may also have existed prehistorically,

when the latest motifs were made. Variability in condition, in this sense, can potentially be understood as an aspect of a site's integrity, and not necessarily a sign of its absence.

Newberry Cave

The second example is an Archaic cave located in the central Mojave Desert, California (Davis and Smith 1981). It has played an important role in regional archaeological research, partly because it included an unusual assemblage of ceremonial objects. These included preserved split-twig figurines, uncovered during the complete excavation of the cave deposit. This deposit dated to a narrow time-frame, from 3,800 to 3,000 years before present (YBP). The site was nominated to the NRHP in the 1990s based on its research importance. But it was not listed at that time, due to the fact that the entirety of the cave deposit had been excavated in the 1950s, resulting in a lack of site integrity. (Although the regulations at 36 CFR §60.4, criterion (d), state that a historical property must "have yielded or may be likely to yield, information...", the implication is that integrity must also be retained.) The federal agency managing the site nonetheless felt that, due to its significance to local research, an NRHP listing for Newberry Cave was justified.

As in the case with many such sites, Newberry Cave also contains a significant but somewhat overlooked corpus of pictographs. These are unusual for two reasons. They were painted with a rare green pigment (likely derived from the processing of a copper mineral). And paint palettes with this same distinctive green paint were recovered in the excavation, directly linking the art to the dated deposit, and providing excellent chronological placement for the pictographs. This last fact alone is significant, due to the difficulties in dating rock art, combined with the fact that this doubled the assumed age of Mojave Desert pictographs. Newberry Cave was re-nominated to, and listed in, the NRHP in 2000. The listing was based on the integrity of its rock art, the aesthetic importance of this pictograph corpus, and the previously established research significance of the site as a whole.

NRHP integrity, then, is a more complicated concept than often appreciated. Current physical condition is a component of integrity, and complete physical destruction can result in loss of integrity. But integrity is not a function of condition alone. And even though potentially very ancient (like the Newberry Cave paintings), rock art often retains its integrity, sometimes when the integrity of other aspects of the archaeological record has been destroyed.

NRHP Eligibility Criteria

Archaeological sites (as opposed, for example, to historical structures) are almost invariably evaluated for NRHP eligibility exclusively in terms of criterion (d), research potential. Although almost all rock art sites have research potential, most archaeologists recognize that they are also commonly eligible under criterion (c), as works of art, examples of master artists, and/or embodiments of distinctive types. In addition, some rock art sites may also be eligible under criteria (a), (b), and/or as TCPs. A brief discussion of the potential applicability of each of these NRHP criteria is then warranted.

Criterion (a): Association with Significant Events in the Broad Patterns of History

Rock art may signal significant major historical patterns, and be NRHP-eligible under the first criterion. This results from the fact that it is a traditional form of social communication that

necessarily reflects and was associated with these same broad trends. Proto-historical and historical period art, as illustrated at some sites by European-introduced objects (e.g., horses, weaponry, or ships), for example, is exemplary of the contact era and its impact on indigenous peoples (e.g., Keyser 2004). In such cases, this involved a broad historical trend that was global, not simply national, in nature: the spread of European civilization across the world, from about A.D. 1450 to 1900, and its impact on indigenous cultures. The relatively short-lived appearance of Fremont style rock art in central Utah (discussed in Chapter 4), as another example, reflects the expansion of farming into the Great Basin and its ultimate retraction. It was one manifestation of the widespread social, adaptive, and demographic changes that occurred across wide expanses of western North America during the Medieval Climatic Anomaly, ca. A.D. 800-1300 (cf. Jones et al. 1999). These and other similar possibilities demonstrate the point that, if properly contextualized, some rock art sites may be eligible under criterion (a) as exemplary of important historical trends.

Criterion (b): Association with the Lives of Significant Historical Individuals

Although much rarer, occasionally rock art sites are associated with known, historically significant individuals, and may be eligible under criterion (b). Deer Medicine Rocks, a petroglyph site in Montana, was listed as an NHL in 2012, partly because the famous Sioux Chief Sitting Bull conducted his vision quest here before the 1876 Battle of Little Bighorn.

Traditional Cultural Properties

Rock art sites potentially may be NRHP-eligible as TCPs associated with traditional Native American practices (see *National Register Bulletin 38*; Parker and King 1998). Two points are important to emphasize in this regard. The first concerns the fact that rock art may have been created originally for a number of purposes, by a variety of age, social, or gender groups in a society. On the Columbia Plateau, for example, rock art was made by shamans during their acquisition of supernatural power; by boys and girls during individual puberty vision quests; and by adults experiencing “life-crises,” such as the death of a spouse (Whitley 2000). Prehistoric rock art may also predate the historic or contemporary tribal occupants of a region. But a rock art site may be a legitimate TCP regardless of that site’s specific age, origin, and initial purpose.

This results because Native Americans widely recognize the cross-cultural significance of rock art sites. Sundstrom (1996), for example, has demonstrated this point on the Northern Plains. Although a series of historical changes occurred in tribal distributions in that region, preexisting sites were recognized and adopted into the cultural practices of incoming groups. The Carrizo Plain NHL Archaeological District, similarly, falls within ethnographic Chumash territory. Yet its rock art suggests that the pictographs were created by both Chumash and Yokuts tribal members, not the Chumash alone (Whitley et al. 2007). To this day, both groups identify the sites as an important part of their cultural heritage.

Regardless of the age, origin, and primary intent of the makers of any specific motif or panel, rock art also typically has “secondary” functions or purposes. These too may be commonly recognized across many tribal groups (Whitley 2011). They include education of younger generations concerning traditional beliefs and practices, the maintenance of self and group identity, and social memory (Whitley and Whitley 2012). Many rock art sites, in a more general fashion, are used for prayer and personal ceremonies. Each of these may constitute a traditional

practice in the sense that it has been ongoing for multiple generations. A particular site may then be much more ancient than the ethnographic or current tribal occupants of a given region, and may have been created for different reasons, but still may be used for traditional practices. Tribal consultation, of course, is necessary to determine such potential uses.

Second, as emphasized by Parker and King (1998), although religious properties are generally excluded from NRHP designation, this circumstance may not pertain to TCPs. This is due to the fact that many Native American tribes make no distinction between religious versus traditional cultural beliefs and practices (Walker 1991). Use of a site for a traditional religious ceremony, in this sense, is a traditional cultural practice. It may make the site NRHP eligible as a TCP.

Treatment of Adverse Effects

The management of rock art sites typically emphasizes preservation. This is because of the unusual artistic and aesthetic values of most sites, their relative rarity in the archaeological record, and their importance to indigenous groups. But rock art site preservation may be more difficult than is apparent. This is especially true relative to the so-called “dirt” archaeological record, where passive preservation is the norm. Despite the fact that rock art is best left in its original setting (discussed below), natural environmental factors progressively degrade the art. Sometimes this occurs very rapidly, as the Simi Hills pictograph sites example, described above, illustrates. These processes can include the spalling or flaking of the panel face, the growth of salt encrustations, water staining, wind and vegetation abrasion, and lichen growth, to name just a few.

This circumstance has important regulatory implications because “Adverse effects on historic properties include, but are not limited to...(4) Neglect of a property resulting in its deterioration or destruction” (36 CFR 800.9[b]).

Proactive management and conservation, rather than passive preservation, are typically required to ensure the long-term sustainability of rock art resources and to achieve regulatory compliance. But in light of the mission of many DoD facilities, in-situ preservation of any kind may be difficult to achieve in all cases. A brief discussion of potential treatment approaches is hence warranted, emphasizing two key points.

The first is that it is *theoretically* possible to remove and relocate rock art panels (e.g., to a museum), but this should only occur in extreme cases. The removal process itself is dangerous, and may result in damage to the art. Removal also destroys the integrity of the site as a whole. Equally importantly, rock art in its “natural” setting has typically achieved a kind of complex environmental equilibrium that may be significantly changed by a new setting. Although it might appear that the removal of a panel to the seeming safety of a museum or the construction of a roof over it would enhance the potential to preserve the art, the opposite instead sometimes occurs, with the decay of the art accelerating rather than declining. Removal, in this sense, is a risky gamble, because it is very difficult, if not impossible, to predict the reaction of a panel to a new environment.

This circumstance emphasizes a key fact: the natural factors that may affect rock art are very complex. Although this issue is discussed in the next chapter, any alteration of a rock art site’s

environment should only be attempted in consultation with a trained archaeological conservator. But even then, it may be difficult to predict the results.

The complexity of the relationship of rock art to its environmental setting is illustrated by a world-renowned case: Lascaux Cave, France. This site is 17,000-18,000 years old and is widely acknowledged as one of the world's greatest masterpieces of prehistoric art. In the early 1960s, French authorities recognized that human respiration resulting from tourism had changed the internal atmosphere of this cave site. This resulted in fungus on the walls that was imperiling the paintings. The visitor program was stopped, the cave was hermetically sealed, and a system for complete control of the atmosphere was installed, stabilizing the cave and saving the art. Eventually, a full-scale replica of the site, "Lascaux II," was created to safely accommodate tourists.

In the late 1990s, the French authorities recognized that the atmospheric control infrastructure in the original cave was approaching a half-century in age, and potentially could fail. They initiated a multiyear process to remove the old infrastructure, including walkways and stairs, and air circulation and humidity control systems. Under the supervision of a team of experienced and highly trained rock art conservators, they replaced them with the latest and best, state-of-the-art control systems then available. Despite taking every precaution imaginable, a more serious outbreak of fungal growth developed shortly after the new system was operationalized. Ten years later, conservators are still working to eradicate the fungus, determine what went wrong, and ensure the preservation of the art. At this point, this is still not guaranteed.

Lascaux certainly is an extreme case, both in terms of its global importance as a UNESCO World Heritage Site and the danger of the circumstance that has developed there. It dramatically illustrates, however, the potential dangers that may result from altering the environment of a rock art site or its panel, despite the best of intentions and the greatest care.

The second point is that, in extremely rare occasions, "data recovery" has been conducted at rock art sites. This has only occurred when the site's destruction is otherwise completely unavoidable. This is not generally recommended as a treatment option unless there is no other prudent or feasible alternative. The consultation requirements for such a treatment plan alone are a hurdle, and could involve local tribes, the SHPO, ACHP, and regional and national rock art organizations. But in the event that this is the sole and only option, three minimum data requirements should be recognized as necessary to mitigate adverse affects:

- The collection of sufficient data at the site to result in the exhaustion of its research potential. This would include a complete documentation and analysis of the graphic imagery, as well as the collection and analyses of material samples of the art for chronometric dating (e.g., Dorn 2001; Rowe 2001a; Whitley 2011), and other analytical studies, such as pigment characterization (Rowe 2001b). It would also include excavation immediately in front of the panel face(s) to identify associations with other archaeological remains, if present, and/or to recover archaeological evidence of rock art production processes (e.g., buried paint flecks or petroglyph flaking chips that may provide evidence on site age).

- The collection and archival preservation and storage of additional material samples of the art for future use with improved or different chronometric and analytical techniques.
- A complete, digital 3-D reconstruction of the site, using 3-D laser scanning or photogrammetry, or other similar techniques, as they become available.

Ethnographic studies of regional rock art traditions, the compilation of indigenous oral histories, and a variety of other measures might also be considered as potential “off-site” mitigation, where appropriate.

In the vast majority of cases, however, the management of rock art sites will involve site preservation. But because passive preservation alone never guarantees the long-term sustainability of these kinds of resources, proactive management measures are commonly required. These should be undertaken within the framework a rock art management plan, as outlined in the next chapter.

3. MANAGEMENT PRINCIPLES AND CONCEPTS

CHAPTER SUMMARY

- Site management
 - Differences exist between regulatory compliance and adequate site management techniques
 - Natural and cultural factors may degrade rock art sites
 - Proactive conservation and management are usually necessary to preserve sites
 - Heritage management principles
 - Goal is site preservation, not reconstruction, using most conservative approaches
 - Identifying stakeholders' significance values is important first step
 - Stakeholders' significance values differ from Section 106 criterion
 - e.g., DoD facility defense mission needs is an important stakeholder value
 - Site conditions assessments are required for any management plan
 - Management plans
 - Comply with laws and regulations
 - Accommodate stakeholders' significance values
 - Involve minimal and reversible conservation actions
 - Have three main components
 - Conservation strategy
 - Visitor strategy
 - Reassessment/monitoring strategy
-

The long-term integrity and preservation of rock art sites and motifs are never guaranteed, even with preservation as the implemented management procedure (Pope 2000, 2001; Dorn et al. 2008; Mazel 2012). Preservation is instead promoted with proactive management. This is based on inventories; assessments of values and conditions; strategies for care, protection and use; and processes for re-evaluation and adaptation to changing circumstances (Lee 1991; Loubser 2001; Swadley 2009). Long-term preservation, in other words, requires more than just regulatory compliance alone.

Put another way, federal laws, regulations, and policies require agencies to manage and protect cultural resources. They outline *what* an agency's responsibilities are with respect to these resources. But they do not in all cases specify *how* management and protection are to be achieved. The DoD tacitly recognizes this fact by requiring the development and periodic updating of Integrated Cultural Resource Management Plans (ICRMPs) for each of its facilities. Special management approaches and techniques, rarely considered in ICRMPs, are required to assess the significance of rock art sites, evaluate their integrity, and ensure their long-term sustainability.

The distinction between regulatory compliance versus the procedures and methods for ensuring long-term preservation and protection is particularly important for rock art sites. This is partly due to their different characteristics relative to other aspects of the archaeological record. Petroglyph panels, as noted above, are exposed on open-air rock surfaces that potentially may be destroyed due to rock spalling or flaking; may be damaged by lichen growth; obscured by a hard-fixed dust coating; or vandalized by graffiti. Public site visitation can also create visitor pressure increasing the likelihood of vandalism and/or the generation of dust. An archaeological midden deposit or surface lithic scatter, in contrast, may be threatened by very different natural or cultural processes of degradation, and there may be little or no (legitimate) public interest in visiting these kinds of sites. Passive preservation—i.e., leaving archaeological resources undisturbed, in the same condition that they were found—may be appropriate for most middens and lithic scatters, this approach may be inadequate for many rock art sites, especially rock art sites experiencing visitor pressure. As Swadley (2009:219) has noted:

“The single most important guiding principal to conserving and managing rock art sites is to become proactive instead of reactive to anticipated threats” (see also Sullivan 1984).

Rock art site management often then requires procedures that go beyond inventory and NRHP evaluation alone. The NHPA Section 106 and 110 compliance processes identify and tabulate the resources that require preservation or treatment. But they do not specify what steps are required to ensure these outcomes, if more than passive preservation may be necessary. Indeed, as federal regulations explicitly state, “The National Register was designed to be and is administered as a planning tool” (36 CFR 65.2c1). The regulations concerning NRHP eligibility and listing are intended to identify what needs to be managed, in other words, but not necessarily how preservation is to be achieved, as is required by 36 CFR 800.9(b).

The purpose of this chapter is two-fold. First, it outlines the principles and concepts that underlie management planning for rock art sites. These principles are international in origin, and provide guidelines for developing a facility-specific management plan. Second, a widely-employed model rock art site management plan, developed by Loubser (2001), is presented. This describes the steps that may be followed in comprehensive site management. The specific procedures employed when an individual plan is developed and implemented should be appropriately tailored to a local facility’s circumstances and conditions.

MANAGEMENT PLANNING PRINCIPLES

Effective and proactive resource management requires investigative and assessment steps that are operationalized in a practical and cost-effective fashion, in order to realistically achieve preservation goals. This is best realized using procedures that have been developed following international heritage management standards and guidelines, and that have been proven effective in previous projects. Federal laws and policies in fact reflect the standards of an international group of heritage management organizations. The most active of these include the United Nations Educational, Scientific, and Cultural Organization (UNESCO), especially its World Heritage List program; the International Council of Monuments and Sites (ICOMOS); the U.S. National Park Service (NPS); the Australian National Parks; and the Getty Conservation Institute. The best known and most widely cited of these guidelines is the Burra Charter, which

was adopted by Australian ICOMOS in 1999 (ICOMOS Burra Charter 1999), and has served as an international standard ever since (e.g., Qian 2007).

These international and national heritage management principles (e.g., Lee 1991; Pearson and Sullivan 1995; ICOMOS Burra Charter 1999; Dean 1999; Loubser 2001; ARARA 2001; Magar 2012; Mazel 2012) provide standards for rock art site management. These are the guidelines that are used by heritage managers worldwide to develop the specific conservation measures that comply with applicable local regulations, and that are commonly employed to ensure long-term site preservation.

It is useful to define a series of heritage management terms that, while related, imply different issues that are best kept distinct. Following the ICOMOS Burra Charter (1999):

- *conservation* includes all of the processes and procedures employed to retain the significance of a cultural resource. This includes:
 - *maintenance* (upkeep),
 - *restoration* (repair),
 - *reconstruction* (rebuilding), and
 - *preservation*—maintaining a resource in its existing state and retarding further deterioration.

It is worth emphasizing that a goal of most management plans is long-term *preservation*. This follows widely agreed heritage management principles: the aim of conservation should be the retention of the significance of the resource, using the most cautious and conservative approaches feasible. These are approaches that result in as little change as possible (ICOMOS Burra Charter 1999). *Compatible uses* of cultural resources (e.g., potential tourism to a site), following this first consideration, are those that involve no, or at best minimal, impact to the resource.

Two key heritage management principles that underlie all rock art site management plans can be summarized as follows:

1) Significance values and the role of stakeholders:

Many different social and governmental groups may have vested interests in cultural resources (Table 2). These include archaeologists, landowners, governmental agencies, Native Americans, educators, and local schools, museum groups or historical societies. Local businesses may also be stakeholders due to recreation/tourism related to or affected by the resources. The development of a management plan should involve consultation with each of these different stakeholder groups. This is important in order to identify the *significance values* of the cultural resources in question.

Table 2. Stakeholders and Significance Values

Stakeholders: Those with Ties to or Interests in DoD Facility Cultural Resources		
Department of Defense Facility Managers	Native Americans	Archaeologists
Educators and Students	Businesses (due to economic impacts of tourism)	Local organizations (museum, history societies, schools)
National organizations (rock art associations)	Tourists	Individuals with family ties to area, etc.
Significance Values: Why the Resource is Important, How They Would Like to Use It		
National defense mission	Religious rituals, education	Archaeological research
Education	Tourism	Photography, etc.

“Significance values” in heritage management terms include significance as defined in Section 106 of the NHPA (i.e., potential eligibility to the NRHP). But “significance” in heritage management is not limited to the Section 106 definition alone. Section 106 significance, for example, does not consider the needs and concerns of a land managing agency like the DoD relative to its national defense mission and the implications of this mission for managing cultural resources. Nor does the Section 106 definition accommodate the possible business interests in archaeological sites, resulting from potential cultural tourism. Yet these kinds of significance are important in the development of a management plan that meets international heritage management standards and guidelines, and accommodates local needs and constraints.

The *significance values* of cultural resources may then involve a wide array of concerns, including some or all of the following:

- Research potential and importance;
- Religious significance for Native Americans;
- Family or heritage ties (e.g., for Native Americans or early settlers);
- Religious importance for other groups (e.g., New Agers);
- Aesthetic/artistic values;
- Economic potential or importance (e.g., for tourism);
- Historical significance;
- Educational value; and,
- Economic or other values of the land containing the resource, including national defense-related uses.

Information on significance values is necessary to understand *why* a resource is being preserved (beyond rote compliance with regulations). It is also critical for understanding *how* the resource should be managed.

This last point is illustrated with respect to a widely held but sometimes ignored significance value. Studies at heritage resources have demonstrated that, for a majority of tourists, a “wilderness experience” is one of the key reasons for their site visits (Whitley 2001a, 2011). That is, the natural landscape around and the setting of the sites is cited as one of the main reasons why visitors travel to see these resources. Many early rock art site management

approaches attempted to control visitor behavior simply by fencing-off sites and panels. This visibly impinges on the site's natural setting, one of the most important values of a resource, which management practices should protect and promote. Informed site management takes this perspective into consideration. Current approaches to heritage tourism may require some form of visitor control measures (discussed below), but these are designed to be as subtle and unobtrusive as possible, to maintain the natural site environment. A balance should be achieved between retaining a "natural" feel and adequately controlling visitation (Loubser and Whitley 1999). Low "psychological" barriers and defined pathways are two means for managing visitor movement without significantly detracting from a natural setting (H. Sullivan 1984, 1995; K.M. Sullivan 1984).

Following recognized international heritage management principles, one of the initial actions in developing a management plan should be the determination of the significance values of the site(s) in question. This is obtained through consultation with relevant stakeholders. The purpose is to use the resulting information in determining how a site will be used and managed.

2) Condition Assessment:

A second requirement for any management plan is an evaluation of the current status (including integrity) of the cultural resource(s). Condition assessments are critical to management plans because they:

- ♦ Provide the base-line information that establishes the existing status of the resources;
- ♦ Identify potential problems or threats that endanger or are degrading the resources; and,
- ♦ Result in data needed to guide long-term preservation and management programs.

Condition assessments, for example, can be used to:

- Prioritize which sites (or rock art panels) need active conservation actions, thereby contributing to the best-use allocation of future funds and resources;
- Help determine where scientific research should be focused, in the best interests of site preservation; and
- Establish which sites are safest for human visitation.

Condition assessments are essential to the rational and economical allocation and use of management resources. Absent this kind of base-line data, site conservation reduces to "fighting forest fires," or reacting to high-visibility immediate threats. Meanwhile proactive procedures that could prevent such incidents from developing are ignored.

Central to any condition assessment, in this last regard, is a fact about rock art site management that is often misunderstood and warrants re-emphasis. Long-term site preservation depends upon a number of factors and circumstances. Certain of these involve human or cultural issues, such as site visitation, vandalism, destruction through land development, potential acid-rain degradation, among others. These can be significant factors, and it is important that they be considered in management planning. But there are also a large number of natural processes, conditions and events that effect sites. These include weathering, run-off, rock spalling and flaking, cliff undercutting, tectonic instability, dust accumulation, salt or lichen encrustation, and fire damage

(Dorn et al. 2008; Kelly and McCarthy 2001; Pope 2001; Tratebas et al. 2004). Biological activity, such as bird droppings or wind abrasion from moving branches, can also be destructive. Proper site management involves more than the control of human visitation and impacts (Swadley 2009; Whitley 2001a). Condition assessments, and practical experience, demonstrate this fact.

MODEL MANAGEMENT PLAN

A widely-used model management plan, developed by Loubser (2001), is useful for two purposes. It provides a description of an ideal plan that can be used (and modified) by facility CRMs to guide their own management programs, based on local needs and constraints. It also serves as a metric against which existing management programs can be assessed.

According to accepted heritage management principles, a management plan must be fully compatible with relevant laws and regulations. It also must accommodate the interests and needs of all of the stakeholders, insofar as this is possible or practical (Table 3). Business interests, for example, might prefer complete access to a site, to promote a heritage tourism industry. Native Americans, in contrast, might advocate limited access based on their religious concerns and practices, which could include the desire for privacy at the site. Over-riding each of these stakeholders might be the interests, constraints and/or resources of the landowner—in this specific case the need to satisfy the national defense-related mission requirements of DoD facilities. Accommodating stakeholder interests requires both negotiation and compromise, in order for a plan to be compatible with existing context, conditions and restrictions.

Further, management plans should involve actions or programs that are both *minimal*, and *reversible* (Loubser 2001). The long-term effects of management and conservation efforts are difficult to gauge, and they can have unintended consequences (as the Lascaux case described above illustrates). Management and conservation actions should be cautious and conservative rather than extreme or elaborate, to the degree that this is possible. A common early approach to site management, noted earlier with respect to site treatment, involved removing rock art panels from their natural setting and putting them in museums. This was thought to ensure their long-term safety. In fact, changing the environmental context and condition of these panels, and especially mounting the panels in concrete foundations (as typically occurred), often destabilized and proved detrimental to the art. (Among other problems, contact with concrete in some cases promoted the migration of salts into the rock art panels, which ultimately led to the exfoliation of the panel surfaces containing the art; cf. Loubser 1994.) The result was that the removed and ostensibly protected panels degraded more rapidly than those that were left in their natural setting.

Table 3. Rock Art Management Plans

Management Plans Should:		
Comply with Relevant Laws and Regulations	Accommodate Stakeholders' Interests as Much as Possible	Involve Minimal and Reversible Conservation Actions
Three Primary Management Plan Strategies:		
Conservation Strategy:	Visitor Strategy:	Reassessment/Monitoring Strategy:
Evaluation, Maintenance and Conservation Intervention	Visitor Control, Site Presentation, and Public Interpretation	Periodic Review, Reporting and Adjustment

Practical rock art management plans and approaches, developed from these international heritage management standards, have been published in a variety of papers and monographs (e.g., Sullivan 1984; Lee 1991; Pearson and Swartz 1991; Fortea Perez 1993; ARARA 2001; Agnew and Brigdland 2006). These have been synthesized into a general rock art site management plan model by Loubser (2001). The principles that guide the following model plan, and the essential elements of the plan itself, have also been summarized in a series of recent papers, studies and management documents (e.g., Loubser 1993, 1995a, 1997, 2002, 2006; Loubser and Whitley 1999; Whitley 2004a, 2004b, 2005a, 2005b; Whitley, Simon and 2008; Swadley 2009).

As synthesized by Loubser (2001), the primary elements and structure of this model plan (Figure 5) start with a series of required *background studies*. These include a:

- Synthesis of previous research, intended to determine the state of knowledge about the resources that are to be managed;
- Records search, directed at establishing the nature and range of variability of the resources, the degree of inventory that has been completed, and the status of the records themselves;
- Condition assessment, which identifies the status and integrity of the resources, makes conservation recommendations, and aids in the periodic reporting required for adaptive management and regulatory compliance; and,
- Stakeholders meetings, necessary to specify the significance values of the resources.

The *management plan* itself has three primary components or “strategies:”

- ♦ The conservation strategy, based on the condition assessment, which identifies intervention procedures needed to ensure long-term resource sustainability;
- ♦ The visitation strategy, which is responsive to the stakeholders’ needs and includes visitor control, site presentation, and public education; and,
- ♦ The reassessment and monitoring strategy, consisting of a program for periodic reevaluation of the ongoing management plan and condition of the resources, potentially including recommendations for plan adjustments.

A fourth component is also required to adequately protect the managed resources. This is an *implementation plan*, which establishes conservation priorities and a logical progression of management steps.

Management Plan Concept and Structure

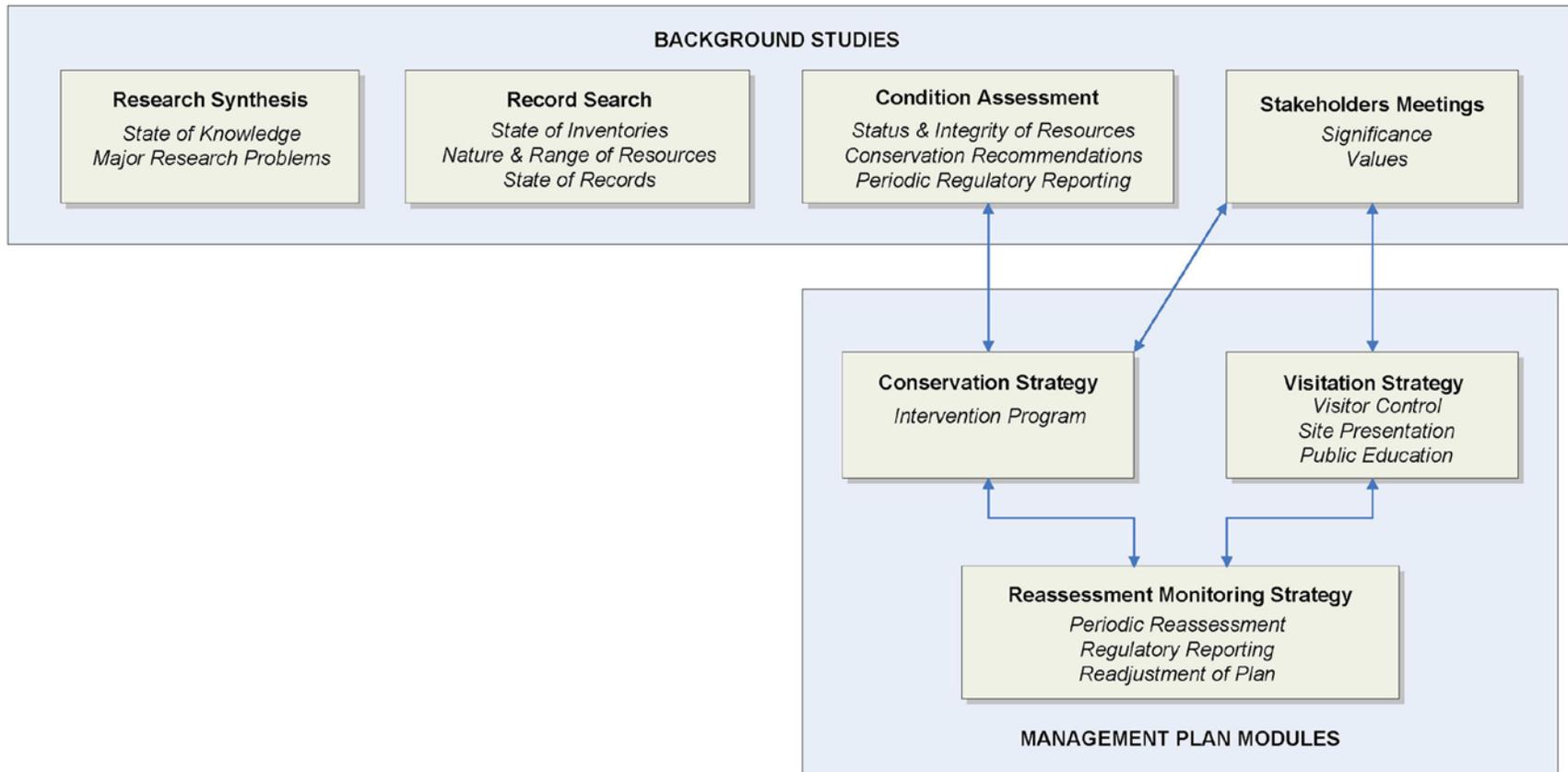


Figure 5. Flow chart of background studies and management plan strategies.

Conservation Strategy

The conservation strategy involves a program for ongoing evaluation, maintenance and (if necessary) conservation *intervention*—repairs, but not reconstructions—on sites. Elements of a conservation strategy should be based on an initial condition assessment, which identifies needs and priorities. If justified, it might include a program for graffiti re-integration. This involves the masking of existing graffiti so that it is less visible, because (as the saying goes) “graffiti begets graffiti;” that is, visible graffiti serves to promote subsequent individuals to create more. Or a conservation strategy could include efforts at dust monitoring and control, to cite another possibility. Dust can become hard-fixed on (even vertical) rock art panels, thereby obscuring the art.

The condition assessment is a key element in the development of a conservation strategy (Loubser 2001; Harry et al. 2001:154). An ideal condition assessment does two things. It provides an accurate assessment of the status of the resource at a specific moment in time, and it provides a database that can be used for future site monitoring. Condition assessments should be completed by individuals trained in archaeological conservation, inasmuch as the issues involved in rock art condition involve complex physical and geochemical processes that are beyond standard archaeological training. As discussed in Chapter Four, currently there are two approaches that can be employed to complete condition assessments: a conservator-specific approach; or a standardized approach that employs archaeological professionals trained in rapid site condition assessment. The second approach is especially cost-effective for facilities with multiple rock art sites. Regardless of approach employed, the condition assessment should identify existing or imminent threats to the resource, prioritize those threats in terms of their significance and degree of danger, and suggest intervention steps to avert the threats or stabilize the resource.

A conservation strategy is intended to identify and implement the intervention procedures needed to repair or stabilize a resource, then, but not to reconstruct it (Stanley Price 1994; Loubser 2001; Table 4). From the regulatory perspective, the importance of the conservation strategy reflects the acknowledgment that neglect of a historical property resulting in deterioration or destruction is a potential adverse effect that should be avoided and, if necessary, treated (see 36 CFR 800.9[b]4). The goal in this case is long-term preservation using minimal, reversible, and fully documented procedures. That is, intervention should be:

- As conservative as possible, rather than elaborate or complicated;
- Should involve the use of procedures and materials that can be reversed or removed, if necessary, due to potential unintended adverse long-term consequences; and
- All conservation steps taken should be documented and this information archived, because it may prove important for later conservators to know what actions were taken in the past (cf. Sease 1987).

Table 4. Conservation Strategy

Prerequisites		
Site Inventory:	Rock Art Documentation:	Condition Assessment:
Complete or Statistically Reliable Sample	To Current Professional Standards	Conservator-Specific or System-Based Approach
Site Recording Using Current Standards and Forms	Systematic Photography or Panel Tracing	Condition Documentation Suitable for Panel Monitoring
	Panels, Vandalism, and Condition Factors	
	Panel Mapping	
	Panel Record Forms	
Conservation Approach		
Responsive to Recommendations from Condition Assessment	Goal is to Repair/Stabilize Resource, Not Reconstruct	Use Minimal, Conservative and Reversible Conservation Techniques
Address Human and Natural Adverse Effects and Processes		Document All Conservation Interventions

Lichen removal, to cite a hypothetical example, could be achieved in three ways: mechanically, passively, or chemically. Mechanical removal (using, e.g., a small wooden pry), if done carefully, can eliminate the litho-bionts without seriously damaging the underlying panel surface. Covering the lichen with an opaque plastic film for an extended period can also “kill” the lichen, allowing it to (in essence) be brushed off. Chemical treatment, in contrast, could have a series of unknown but potentially dangerous consequences, including not immediately apparent long-term effects on the stability of the panel face (Poetschat et al. 2010).

Similarly, graffiti can be treated in two fashions: removal, or masking. Removal can be achieved chemically (using poultices and/or various kinds of paint removers for painted vandalism). It can also be removed mechanically—in essence, “erasing” the damage by rubbing or sand-blasting it off. This is a permanent fix whereas masking the graffiti through re-integration hides it for a few years, until the acrylic coating starts to fade. Although the permanent solution might then appear to be preferable, in some cases it is not. The removal process itself can be dangerous (especially when sandblasting adjacent to rock art motifs. Rubbing off the vandalism or removing it chemically can de-stabilize the rock panel weathering-surface, promoting the more rapid destruction of the art. In both of these examples, the simpler, “low-tech” intervention procedures are safer, and are usually preferred.

Regardless of the approach implemented, any intervention (repairs) on a rock art panel should only be undertaken with the guidance of a trained archaeological conservator.

Visitor Strategy

A visitor strategy is sometimes necessary due to public demand to visit rock art sites, especially well-known sites. This demand may include requests from the general public (including school groups), access sought by archaeologists for research purposes, or Native American visitation, combined with potential “incidental” visitation by facility personnel. Visitation demand will obviously vary based on local circumstances. The Coso NHL Rock Art District, within the China

Lake N.A.W.S., California, for example, contains a world-renowned concentration of petroglyphs, probably the largest in North America, with a resulting high visitation demand. This is partly accommodated by an arrangement with a local museum that takes tours led by trained docents to one of the sites. Although constrained by range testing schedules, weather, remoteness, and security concerns (e.g., only U.S. citizens are admitted, and photography is restricted to the rock art panels themselves), these tours nonetheless lead approximately 600 visitors per year to Little Petroglyph Canyon. Total visitation to the site (including official and other kinds of tours and visits, such as school groups) likely exceeds 800 visitors per year, but demand is so high that total visitation would likely double if all of the constraints could be relaxed. The importance of this rock art tourism to the local civilian economy, resulting from the hotel accommodations, gasoline purchases and restaurant use of the site visitors, is very significant, and is recognized as such by the municipal authorities.

The Coso petroglyphs represent an unusual circumstance, but demand for rock art site visitation exists, to varying degrees, at other DoD facilities. Regardless of demand, site visitation has the potential to be destructive, and a consideration of this issue should be included in any management plan. A visitor strategy typically has three elements:

- Public interpretation;
- Site presentation; and
- Visitor control.

Each of these elements varies depending upon the visitor group in question. School groups, for example, will likely require guided tours, both for interpretation and to ensure visitor control (including safety). Native Americans are unlikely to need (or want) interpretation provided by outsiders, but they may have very specific requests for site presentation, though this too can vary from group to group. While many Native Americans, for example, prefer a minimum amount of visible infra-structure (such as walkways, protective barriers, or interpretive signage), in other cases tribes have specifically requested walkways to DoD facility sites to accommodate visitation by their elders. This last circumstance emphasizes the importance of identifying the significance values and preferred uses of rock art sites during the development of a management plan.

Although there is no single approach appropriate for all visitation strategies, some general points are important to keep in mind. The first involves public presentation. This concerns the fact that people respect and care for places that are themselves well-tended. In contrast, the public tends to disregard locations that are in disarray, e.g., due to visible trash or graffiti, or that may be over-grown with vegetation (Loubser and Whitley 1999). If site visitation to a rock art site is to occur, the site area should be well maintained, in part to foster public respect and concern for the resource.

That said, bigger is not always better with respect to site infrastructure. Obtrusive infrastructure (such as large fencing or walkways) tends to detract from the natural setting of the sites (as noted earlier). Low psychological barriers rather than large fences, and defined ground surface pathways (as opposed to walkway structures), if possible, are preferable for crowd control.

Similarly, parking areas (and rest rooms, if required) ideally should be placed in a location that does not impinge on the viewshed of the rock art site.

Public interpretation is always important for sites that receive regular visitation, partly because this serves to emphasize and promote the importance of the resource: the more visitors know about a site, the more they will value it. Interpretation can take many forms, both in terms of presentation (e.g., leaflets, signage, guided tours), and contents. It is important to remember that the interpretation is intended for the general public and, for that fact, it can be very general, without necessarily emphasizing the origin or symbolic meaning of the art, which may be unknown (Whitley 2011). Background on local prehistory and ethnography should always be the starting point. How deeply an interpretation delves into the art itself will depend on the existing state of knowledge for that region or locale.

On the other hand, public interpretation can be more detailed where significant research has been conducted, and more is known about the art. A ‘walking tour’ guidebook has been published for Little Petroglyph Canyon in the Coso Range, for example (Whitley 2006), facilitated by the fact that the Cosos are one of the best and longest researched rock art localities in the country. This guide starts with an introduction that answers a series of basic questions about the local ethnography and prehistory. It then provides descriptions and discussions of a series of key petroglyph panels along the canyon walls. The locations of these panels are identified using photographs and a series of brass surveyor’s markers that were placed in the canyon bottom during a detailed mapping program. Although these markers are ideal, in the sense that they are only visible to those who are looking for them, small, low numbered signs could serve a similar purpose, and would also be minimally intrusive on the landscape.

Visitor control is obviously an important issue for rock art site protection, and this is especially true in the case of DoD facilities, given their general security requirements. In certain respects, facility security measures prove ideal because general public visitation is necessarily controlled. The remarkable integrity of the Coso NHL district petroglyphs, for example, is widely acknowledged as a result of the fact that they are located within a test range facility (Bahn 1988:ix; Meighan 1998:177). But “visitors” can include more than just the general public, school groups, archaeologists or Native Americans. Fort Irwin N.T.C., California, provides an example here. In this case a series of petroglyph sites are located not only within an armored training facility, but (naturally enough, given the nature of rock art sites) on the strategically-important rocky high-ground of the training range. The issue in this case is not visitation by the public, but (in a sense) ‘inadvertent’ visitation to the sites by the troops during training, including during live-fire exercises. The creation of exclusion zones through command directives, combined with highly visible signage that prohibits entry into the immediate site areas, has proven as an effective ‘visitor control’ strategy in this specific case. The differences between the necessary visitor control strategies between China Lake N.A.W.S. and Ft. Irwin N.T.C. illustrate again the importance of determining stakeholders’ interests in the sites. This includes the specific defense mission of a DoD facility, in order to understand how to best manage the sites.

Monitoring and Reassessment

The monitoring/reassessment strategy reflects the fact that conditions can change over time, sometimes requiring adjustment to a management plan. Even the best conservation or

management actions can have unintended consequences, especially when truly long-term preservation is concerned (Loubser 1999, 2001; Loubser et al. 2000). Adaptive management, requiring periodic review, assessment, and, if necessary, changes in procedures, is therefore an essential aspect of any successful management plan (Table 5). The DoD explicitly recognizes this fact with respect to its ICRMPs, which are updated yearly and undergo major review every fifth year, in part to ensure that a facility's mission has not changed in a fashion that has implications for cultural resource management. Equivalent principles and needs pertain to rock art management plans specifically.

Table 5. Reassessment/Monitoring Strategy

Baseline Empirical Data:	Monitoring:	Reassessment:
Systematically Collected During Condition Assessment	Periodic Assessment of Status for Plan Reassessment and Reporting Compliance	Evaluate Effectiveness of Existing Management Plan
Information on Individual Panels and Existing Damage	May Emphasize Vulnerable Resources/Panels, Sample Remainder	Identify Changes in Status Over Time, Based on Condition Assessment and Prior Monitoring
Emphasize Condition Issues and Vandalism/Graffiti	Should Replicate Condition Assessment Approach	Evaluate Adequacy of Conservation and Visitor Strategies
Data Format Should Facilitate Comparative Analysis During Monitoring	Monitoring Must Be Documented	Make Recommendations for Plan Modification, If Needed

In the case of rock art, for example, graffiti re-integration—"masking" graffiti by infilling or coating it with an acrylic pigment that matches the color of the surrounding rock—usually lasts about a decade, after which point the acrylic fades (cf. Loubser 1995b). Hence the process should be repeated, rather than treated as a permanent solution. The nature of visitation, similarly, could change, yielding new kinds of impacts (increased dust generation, for example, as a result of more visitors). A pathway established to control visitor movement, to cite another hypothetical example, might result in accelerated erosion that washes sediment onto a site area, and may thereby result in an unintended adverse effect, requiring a re-routing of the walkway. A program for periodically evaluating the status of the sites, the effectiveness of the existing management and conservation strategies, and for identifying new problems is essential for long-term site preservation. Monitoring programs of this nature are most successful if they involve structured data collection and analysis, and have ample base-line information, allowing for the ready identification of changing conditions.

For DoD facilities, a periodic rock art re-assessment and monitoring program is best designed to determine:

- ♦ Whether the facility mission or its needs have changed since the previous assessment in a fashion that might result in new or unforeseen potential adverse impacts to the resources;
- ♦ Whether the status of individual resources has changed to a degree that imperils their integrity and/or long-term preservation;
- ♦ Whether the conservation program and techniques are still satisfactorily ensuring the long-term preservation of the resources, and not themselves yielding unintended adverse consequences;

- ♦ Whether the visitor strategy continues to operate adequately from the perspective of stakeholders' needs as well as resource protection and preservation, and the facility's mission; and
- ♦ Related to the visitor strategy, whether any existing site infrastructure (e.g., kiosks, signage) is adequate, and whether any incidental human impacts are occurring.

The last point concerns the fact that a monitoring program ideally looks beyond the immediate resources alone to the potential larger effects of the human use of the site area in a larger sense. Littering along access roads or trails, and vandalism in any parking or picnicking areas, are examples of adverse impacts that may not immediately threaten the cultural resources. But, in the longer term, they degrade the quality of the resource, and detract from its perceived significance. Re-assessment should accordingly determine whether these kinds of "off-site" impacts are occurring.

In addition to these general aspects of reassessment and monitoring strategies, a series of practical concerns also may be considered, as follows.

Baseline Data

Reassessment and monitoring are only successful if they start with baseline empirical data that were logically and systematically collected, that adequately reflect the status of the resource at a specific point in time, that identify significant resource threats, and that evaluate the results of conservation actions. In the case of rock art sites, baseline data should be collected on a panel-by-panel basis (analogous to individual features within other kinds of archaeological sites), and should also include all known examples of adverse human impacts (such as graffiti, trash or other kinds of vandalism) that are present on or adjacent to the site, including graffiti not directly on a rock art panel.

The purpose of baseline data collection is to create a resource status record as of a certain date, to facilitate comparative analyses during the monitoring process, and to chart any changes that are occurring over time in order to estimate any rates of deterioration. The baseline data, therefore, needs to be translated into a format that facilitates subsequent, on-the-ground comparative evaluation, intended to determine whether the condition of an individual panel, e.g., is deteriorating or improving. Typically, usable data formats for rock art monitoring include photographic imagery of the panels (such as field flip-charts), along with condition notes and explanations.

Documentation

Each episode of a re-assessment and monitoring program should be fully documented, and a record of this activity archived. This should include photographic documentation, as well as notes on panel condition. Ideally, the process used for the initial condition assessment would be duplicated. The purpose of this documentation is to ensure that, over time, the status of the resource is not systematically deteriorating but, if so, to estimate its rate of deterioration. This is important partly in terms of allocating future management resources and initiating conservation actions.

Prioritization and Sampling

Depending upon the size and number of a facility's rock art sites, re-assessment and monitoring strategies may need to prioritize efforts based on resource vulnerability. Vulnerability may be understood at two different levels. Certain specific sites, first, are more vulnerable than others, for a variety of reasons (including visitation, proximity to roads/accessibility, and natural weathering processes). Second,, some specific panels within given sites are relatively more imperiled and potentially, for example, might be destroyed in the next freeze-thaw cycle or major storm, whereas other panels may be more stable and much less threatened.

Some form of a systematic sampling approach to reassessment and monitoring may also be required, for practical purposes, at very large rock art sites or localities. The Coso NHL Rock Art District, mentioned above, is an example. This contains a concentration of petroglyphs plausibly estimated to include somewhere between hundreds of thousands and millions of individual motifs. Another example is the Pinon Canyon Maneuver Site, Colorado, which also has a large number of rock art sites. In both cases it would be very difficult, if not impossible, to monitor every individual panel on a regular basis. If a sampling approach is necessary, monitoring and reassessment, instead, should be structured to emphasize the most threatened site(s) first, followed by a sampling strategy that would, over a period of time, canvas a representative number of additional sites and panels. As is clear, the greater the number and the larger the size of a facility's rock art sites, the more difficult the re-assessment and monitoring task becomes. But this circumstance also makes these procedures increasingly more important.

SUMMARY

Unlike many other types of cultural resources, managing rock art sites for long-term preservation may require pro-active procedures. These are intended to identify potential natural and cultural threats or damage to the sites, and that attempt to remedy these problems. An ideal model for such a process involves a series of steps, outlined above, that can be tailored to specific local conditions and circumstances. These include the completion of condition assessments, and the implementation of possible intervention efforts that repair but do not restore the damage, or eliminate the threats. Determining the reasons why a resource should be preserved, by determining the significance values of the site, is an important part of this process. Adaptive management, which includes re-assessment and monitoring strategies, is a critical component of any effective management approach, due to the fact that conditions commonly change over time.

4. ANALYTICAL APPROACHES TO ROCK ART

CHAPTER SUMMARY

- Rock art research is a new and rapidly expanding sub-discipline
 - A variety of new techniques have been developed
 - Specialized rock art literature has appeared
 - Most archaeologists lack knowledge of these advances
- Two analytical issues are especially important to management
 - Chronology and determining a site's period of significance
 - Ethnography and tribal consultation and compliance implications
- Chronology
 - A variety of relative dating techniques exist
 - Best used in conjunction with one another
 - New direct chronometrics techniques also now available
- Ethnography
 - Widespread evidence exists for proto-historic/historic rock art
 - Understanding ethnographic accounts requires special analyses
 - Much rock art religious in origin
 - Statements about religious beliefs often appear counter-factual from a western scientific perspective
 - Tribes may be reluctant to discuss religious topics with outsiders

NRHP eligibility evaluations are partly based on establishing the historical context, including period of significance, of a property. Site management also requires an understanding of the archaeological and potential ethnographic importance of a site. This is necessary to guide potential research projects, to understand possible indigenous claims to access and use, and more generally to identify the significance values of the resources. Rock art sites can present problems for archaeologists because rock art research is a relatively new professional subdiscipline. Although rock art motifs are commonly used as cover art for archaeological textbooks and monographs, substantive discussions of rock art are rarely included inside the books themselves. Field courses, similarly, only include rock art methods in unusual circumstances. Further exacerbating this situation, the professional rock art literature is specialized and only occasionally appears in mainstream journals. Meanwhile the subdiscipline has expanded very rapidly in the last two decades. The result is a multitude of new analytical approaches, intellectual models, technical methods, and literature, and the traditionally trained archaeologist may only be vaguely aware of these developments.

The outcome of this combination of circumstances is a fundamental difficulty for archaeologists and managers who have received standard professional training and are at some point confronted with oversight of a rock art site. The previous chapter outlined some of the management concerns that are unique to rock art sites as part of the archaeological record. It also suggested management approaches that can help to ensure long-term preservation of these resources. This

chapter addresses the analytical side of rock art research by providing a quick summary of two key management topics: chronology, and ethnography. “Style” as used (and mis-used) in rock art research is included in the discussion of chronology, reflecting the fact that it is the most common approach to cultural-historical classification—and thus, partly, age determination—in rock art analysis. Chronology more generally is critical to defining the historical context of a site and, for that reason, is an important variable in evaluations. Ethnographic analysis, where appropriate, is increasingly important to managers because of the importance of Native American and Native Hawai’ian participation in the management process, including the identification of TCPs. The significance of both topics to site regulatory compliance warrants a quick outline of pertinent issues, approaches and concerns.

CHRONOLOGY

Temporal placement is fundamental to archaeology, and the difficulty in obtaining chronological control over rock art sites and motifs has been an impediment in the development of the subdiscipline. Although far from fully resolved, the last few decades have witnessed a number of new dating approaches, and the refinement of some old ones, that have greatly improved our understanding of this aspect of the archaeological records (Dorn 2001; Rowe 2001a, 2012; Whitley 2011, 2012). Because dating is fundamental to all archaeological concerns, a brief update on these new and improved methods, as well as the relative dating techniques that are most commonly employed to study rock art, is useful for heritage managers.

Relative Dating Techniques

Relative or correlative dating techniques place a site, artifact, or motif within a general time frame, either with respect to an established cultural historical sequence or in a specific temporal position with respect to other such sites, artifacts, or motifs. Recent discussions of these approaches for rock art research are provided by Keyser (2001) and Whitley (2011). They can be summarized as follows:

◆ **Style** -- The definition of rock art *styles* is perhaps the most common, and often most confused, approach to cultural-historical classification (cf. Francis 2001; Francis and Loendorf 2002; Keyser and Klassen 2001; Lorblanchet and Bahn 1993; Whitley 2000, 2011). Style definition (especially in the amateur rock art literature) is commonly inconsistent and analytically unusable. Typically, to cite one frequent error, differences in manufacturing techniques (such as painting versus engraving) are used to distinguish putatively different styles, and these are somewhat arbitrarily assigned or assumed to have different ages and cultural affiliations. Heizer and Baumhoff (1962), for example, defined Great Basin Pecked versus Painted styles, and argued that the first was generally older than the later. But three decades of subsequent research have demonstrated that, at least for the last 5,000 years, petroglyphs and pictographs fully overlap in age in this region (Whitley 2000).

The fundamental problem in this case results from a failure to recognize the important difference between a *descriptive art style*, based on perceived artistic and typological distinctions, and a true *cultural-historical style* that is distinctive of a specific archaeological culture and time period. A properly defined Great Basin rock art style, using the example above, would include

both pecked and painted motifs, reflecting the fact that cultural-historical styles comprise *all* of the potential artistic variations characteristic of that time period (Schapiro 1953), which may be quite substantial (Whitley 1982, 2000). Stylistic rock art analysis is much more complex than many archaeologists appreciate, and there is an existing multitude of supposed stylistic rock art chronologies of dubious chronological or cultural merit.

Two useful analytical suggestions have been offered with respect to the use of rock art styles for cultural-historical assignment. The first is that all stylistic sequences are hypotheses. Their temporal and cultural-historical significance must be demonstrated on the basis of independent archaeological evidence, not assumed (Francis 2001; Francis and Loendorf 2002). Second, the regional archaeological record, and its cultural-historical sequence, provide a starting model for stylistic analysis. If significant regional cultural-historical changes have occurred, they are likely identifiable in the rock art record. In contrast, if no such major cultural changes have occurred within an area, distinct cultural-historical rock art styles are less likely (Whitley 2011). The western versus eastern Great Basin provides an example of this circumstance. Beyond shifts in subsistence practices, minimal cultural change occurred in the eastern California for roughly the last half millennium. The rock art record, accordingly, shows long-term continuity on a number of levels: the motif assemblage itself, specific iconographic characteristics of key motifs, long-term use of the same rock art sites, and the tools used to create petroglyphs (Whitley et al. 1999a). Eastern Utah, in contrast, experienced a change from Archaic hunter-gatherers to settled Fremont farmers circa A.D. 600, and a dramatic (and very visible) change in the nature and contents of its rock art (Simms 2010). It is clear that valid and distinct cultural-historical rock art styles are present in eastern Utah. But no clear evidence, or underlying archaeological justification, exists for changes in cultural-historical rock art styles in eastern California during this same period.

It is important to emphasize, in this regard, Francis's (2001) argument that cultural-historical styles must be demonstrated with independent evidence, not assumed. While the regional archaeological record will provide clues concerning whether distinct cultural-historical rock art styles may be present, it is important not to simply link descriptive styles to this sequence in an ad hoc fashion. Cultural-historical rock art styles should be defined using empirical evidence, not untested assumptions.

◆ **Associations** -- Archaeological associations are locational correlations between two or more artifacts, features, and/or sites. They are frequently used to infer chronological and/or functional relationships. Artifact types that are consistently found together may constitute a functional tool kit, for example, and the age of a habitation deposit containing dated projectile point or ceramic types may be inferred from those artifacts. In certain cases, with analytical caution, rock art may be dated by associated archaeological sites or features. In a classic study, Turner (1963) defined and dated a series of Puebloan petroglyph styles based on their consistent association with specific ceramics. Chumash-style pictographs on the Carrizo Plain National Monument, California (part of the Carrizo NHL Archaeological District), similarly, consistently occur at Middle-period villages dating from about 4000 to 800 B.P., and are assumed to be of that same age (Whitley and Whitley 2012; Whitley et al. 2007).

Inferring site age or function from locational associations, however, is not always a straightforward process. This is partly because of the stratigraphic discontinuity that characterizes rock art panels, which are not part of the “dirt” archaeological record. Yet it is intact stratigraphy that provides the analytical justification for archaeology’s standard associational logic, which assumes that the associated artifacts or features occur in the same *primary depositional context*--that is, a context that is undisturbed and represents a specific time period. By definition, rock art panels never satisfy this assumption because exposed rock surfaces are always distinct contexts from archaeological deposits. (Even very rare buried rock art panels were necessarily created prior to their entombment, with the overlying deposit thereby providing a useful minimum age for the panel, but not a direct association with the deposited artifacts.) Indeed, a rock art panel with multiple motifs itself may not represent a single chronological episode, since motifs can accumulate over very lengthy periods (discussed below). Archaeologists are aware of the importance of primary deposition with respect to ground surface artifact scatters, which may or may not reflect single or multiple use episodes, and researchers are generally cautious in their interpretations of these kinds or components of sites. Similar caution is required with respect to rock art panel associations found within larger archaeological sites.

The use of associations to determine the function or age of rock art relies then on *indirect* juxtapositions, rather than associations involving primary archaeological contexts. Inferring from locational associations is, accordingly, much trickier than many archaeologists apparently recognize. Rock art panels in many regions are found within or adjacent to habitations, e.g., and these contain a wide range of archaeological evidence: lithic debitage from tool production; formal tools that themselves may have been used for specific tasks; dietary remains; and features such as hearths, bedrock mortars, and/or housepits. These kinds of sites, in other words, are multi-purpose in nature. The most conservative functional interpretation of rock art panels in such cases is that they represent one of a series of functions and activities on that site, but how they relate to the other functions may not be identifiable.

How then can locational juxtapositions be used in rock art research, to infer site age or function? Two methodological requirements appear most important. The first is that associational inferences require statistical rigor in both sampling and analysis, because these inferences involve the identification of patterning in the archaeological record. Ideally, in fact, they should include statistical correlations (including probability confidence levels). Absent rigor in defining the sample population, attempting to make inferences about the art based on “obvious” associations often results in “counting the hits and ignoring the misses” (Whitley 2011); that is, exclusively using evidence that fits a preconceived interpretation, meanwhile ignoring everything else. This reflects an inappropriate sampling design yielding results that are not simply anecdotal, but entirely misrepresentative of the archaeological record.

Second, logical bridging justifications are also required to support the inferential significance of any identified associational patterns. Human burials are commonly found within midden deposits in many North American regions, for example. Based on this fact, they occur in locational juxtaposition with other aspects of the archaeological record, including dietary remains. But for good (even if implicit) reasons, archaeologists do not infer that intact burials are evidence of cannibalism, despite their co-occurrence with fauna and shellfish. In this case our conventional

wisdom tells us that locational associations between aspects of the archaeological record may involve more than simple chronological or functional equivalence. These include the possibility of multiple functional activities at a given site, the co-occurrence of both ritual and mundane actions at the same place, and the potential minor but significant temporal distinctions between individual prehistoric events. Most of these fine-grained temporal distinctions are archaeologically invisible, even within a single site deposit.

Rock art sites potentially could always be found in association with bedrock mortars. But is this because rock art panels and mortars both require bedrock exposures, with their locational correlation entirely coincidental and related to the distribution of bedrock, rather than chronology or functional association? Or is it due to the fact that the art and mortars are both correlated with another variable, such as villages, but not otherwise functionally related to each other? And some rock art sites may be associated with datable surface artifacts, but is this coincidence or instead a useful temporal clue? How would the creation and use of rock art logically relate to the deposition of debitage at the same location? In each case, the contextual discontinuity between the art and the remainder of the archaeological record makes analytical inference difficult. Although the use of locational associations has potential for chronological and functional interpretations in rock art research, these kinds of studies must be carefully planned and executed, with their assumptions made explicit, if they are to provide useful research conclusions.

◆ **Superimpositioning** — The placement of one motif on top of another on a rock art panel is another type of locational association that can be inferentially useful. Superimpositions can have two origins: symbolic or conceptual associations (e.g., Lewis-Williams and Dowson 1988; Wellman 1979a); or significant chronological distinctions. In the first case, for example, Wellman (1979a) demonstrated that bighorn and anthropomorph motifs are commonly superimposed in the Coso Range, but that there was no clear pattern of one consistently overlying the other. The implication is that both were made during the same general time frame and that they were juxtaposed because of related cultural meanings. An example of the second type of superimpositional pattern occurs in the Carrizo Plain pictographs, where a three phase chronological sequence has been identified (Figure 6). This starts with two phases of Chumash-style motifs, capped by “intrusive” Yokuts-style paintings (Whitley et al. 2007). Because the Yokuts-style pictographs are commonly associated in that ethnographic region with Late Prehistoric and Historical villages (postdating about A.D. 1200), the Chumash motifs are believed to be 800 or more years in age.

Superimpositions in this second case are analogous to stratigraphy, and can provide very useful information about relative chronology, both internal to a site and potentially for a region. Borrowing from methodological techniques used for stratigraphic analysis, a Harris matrix can be employed as a graphic tool to help chart and understand a sequence of superimpositions (e.g., Loubser 1997). In the Carrizo Plain case, a Harris matrix analysis was extended beyond the superimpositions of specific motifs alone to include their size, style, and placement on the panel. The first phase involved small Chumash-style motifs, generally at lower, inconspicuous places on the rock art panels. The second (later) phase comprised similar Chumash-style paintings, though rendered much larger, and concentrated in “scenes” at higher and more visible panel

locations. The final phase involved smaller, randomly distributed pictographs typical of the Yokuts-style rock art normally only found in the Sierra Nevada to the east.

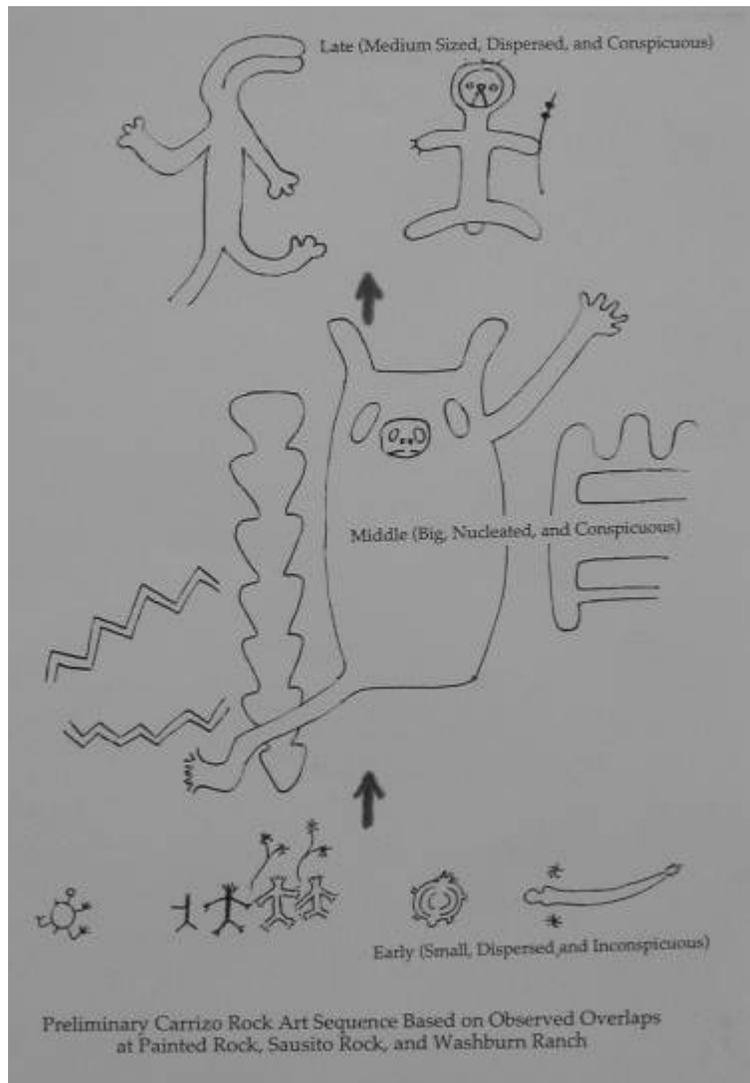


Figure 6. A superimpositional sequence for pictographs from the Carrizo Plain, California.

The applicability of superimpositional sequences obviously is tied to the size and nature of any individual rock art corpus. Larger sites with more complex imagery are likely to be most useful in this regard.

◆ **Subject matter** — Identifiable objects, artifacts, or species depicted in the art may also prove useful for relative chronology (Figure 7). Depictions of extinct mammoths, rhinoceros, and other species, for example, were important in verifying the Pleistocene age of the Upper Paleolithic cave paintings of France and Spain. Depictions of the atlatl, replaced in far western North America by the bow and arrow circa A.D. 500, have been employed for chronological control in the far west. Similarly, historical motifs, including horses, guns, and various kinds of horse tack,

have also been cited (e.g., Keyser 2004), along with ships on Hawai'i (Lee and Stasack 1999). Although historical motifs are relatively common on the Plains, they tend to be rare elsewhere. The ability to date sites, panels, or motifs based on subject matter then will depend upon regionally specific circumstances.

Chronometric Dating

Chronometric or scientific techniques that provide direct calendrical ages for rock art motifs have been developed in the last three decades (Dorn 2001; Rowe 2001a; Steelman and Rowe 2012; Whitley 2011, 2012). Although still being refined and in some cases still experimental, these techniques promise to greatly improve our understanding of rock art chronology. These are all destructive techniques that require the removal and analysis of samples, however, and hence they should only be applied under appropriate circumstances.



Figure 7. Horse and rider motifs indicate historical period production. This example is from the Coso Range, California.

The requirements and techniques for pictograph versus petroglyph dating vary significantly. Chronometrically dating pictographs requires the removal of a pigment sample, followed by the analysis of remnant carbon within that sample using a nuclear accelerator-mass spectrometer (AMS) system for radiocarbon dating. AMS ^{14}C dating requires small enough samples to (theoretically) accommodate the amount of carbon that may be present within a pictograph (Rowe 2001a; Steelman and Rowe 2012). Two approaches have been applied in this regard. The most common is the AMS dating of black pigment, which was commonly made with charcoal, and can follow standard AMS dating procedures. Dating other paint colors is more complicated. Carbon in reds, yellows, and other colors is presumed to have been added to the mineral pigment

as an organic binder (such as egg yolk or blood). Marvin Rowe and his students have developed a plasma-gas extraction system that can isolate this carbon as a gas, allowing it to be AMS ^{14}C dated. Whether or not a specific motif can be AMS dated requires a bit of luck; sometimes sufficient carbon has been preserved, but at other times it has not.

Petroglyph techniques, in contrast, have been developed to date the rock (or desert) varnish coatings that develop on exposed rock surface in arid and semiarid environments. Rock varnish itself is a paper-thin coating of clay, manganese, and other minerals, originating in dust that becomes hard-fixed to the rock face over time. (Rock varnish is not a patina, which is a very different kind of chemical crust: a chemical reaction on an exposed surface, like the rusting of iron, or the tarnishing of silver) The two primary techniques that they have applied are Cation-Ratio (CR) and Varnish Microlamination (VML) dating. Both techniques require the removal of one or more small fragments of rock varnish coating which are subsequently analyzed in a lab. CR dating is based on the fact that the 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. Basalt flows in the Coso Range that had previously been dated by the potassium-argon method were used to calculate the first regional CR curve (Dorn and Whitley 1983). CR dating has subsequently been independently replicated by six laboratories worldwide (Bull 1991; Dragovich 1998; Glazovskiy 1985; Patyk-Kara et al. 1997; Pineda et al. 1988, 1989, 1990; Plakht et al. 2000; Whitley and Annegarn 1994; Whitney and Harrington 1993; Zhang et al. 1990), and has been successfully subjected to blind tests (Loendorf 1991, 2008; Faris 1995; Francis and Loendorf 2002).

VML is a relative or correlative 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 (Figure 8). VML has also been replicated internationally (e.g., Cremaschi 1996; Dietzel 2008; Lee and 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 petroglyphs as well as for other kinds of chronometric research, are obtained when multiple techniques are combined (Dorn 1994, 2001). This follows a general principal of scientific method which holds that increases in the kinds and numbers of independent data, especially when obtained using different techniques, greatly improves inferential confidence in the results.

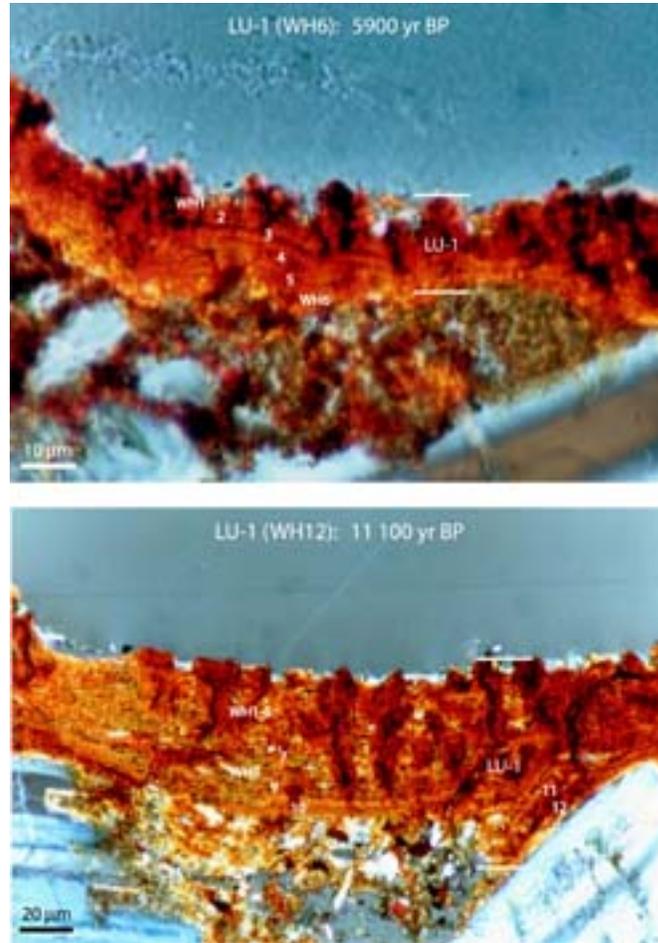


Figure 8. Varnish microlamination thin-sections, both from Coso Range petroglyphs. Upper dates to 5900 BP; lower to 11,100 BP.

ETHNOGRAPHY AND ROCK ART

Many North American archaeologists have long assumed that historical and ethnographically documented Native Americans effectively knew nothing about their regional rock art, and that the vast majority of the art therefore was prehistoric, not potentially historic, in age (e.g., Cain 1950; Castelton 1978; Cressman 1937; Grant 1968; Heizer and Baumhoff 1959, 1962; Heizer and Clewlow 1973; Swartz 1978). This chronological interpretation has important implications for issues involving most likely descendants, tribal patrimony, and TCPs—topics that are directly relevant to contemporary cultural resource management. The interpretation was based on a putative reading of the ethnographic record and a resulting claim that this was devoid of information about rock art. But ethnographic research in the last two decades has developed a substantial amount of rock art data for many North American regions (e.g., Francis and Loendorf 2002; Hays-Gilpin 2008; Keyser et al. 2006; Keyser and Klassen 2001; Sundstrom 2004, 2006; Whitley 1992a, 2000, 2006). Significant ethnographic information on the rock art of many regions in fact exists, but these data were simply never systematically examined, or were not understood by archaeologists. In part, misunderstanding resulted because many of the

discussions about rock art involved religious beliefs and practices. These were esoteric in nature and, on first reading, seemingly confusing. Systematic and careful analysis of this ethnographic record, however, demonstrates a century and a half of consistent Native American commentary on the art (Whitley and Whitley 2012).

Aspects of the ethnographic interpretations of rock art are provided in the regional historical contexts presented below. But because the lengthy archaeological confusion over this issue partly involved methodological difficulties, a brief summary of key points important for the use and understanding of ethnographic rock art data are included here. Recent methodological discussions on this topic have been provided by Taçon (1992), Sundstrom (2004, 2006), Layton (2001, 2012), Whitley (1994b, 1994c, 2001c, 2005a, 2007b, 2011), and Hays-Gilpin (2004).

Understanding and employing ethnographic data requires appreciating the nature and status of indigenous knowledge in traditional, non-Western cultures. Aside from the starting fact that few anthropologists directly asked informants about rock art, access to knowledge about certain topics is often restricted in traditional cultures. Certain kinds of knowledge may only be available to specific individuals; for example, those who have received the correct training, have reached the required age, and/or are the appropriate gender. Barth (1975) has referred to this tendency as an “epistemology of secrecy,” and it widely characterizes traditional non-Western cultures (e.g., for the Numic-speakers, see Kelly 1932:68, 190, 199, 1939:151; Opler 1940:141; Whiting 1950:31).

The reticence to discuss certain topics, especially religious matters, is common among many traditional non-Western peoples. But this does not necessarily imply ignorance about the subject, as archaeologists sometimes infer. (As the saying goes, “absence of evidence is not always evidence for absence.”) Instead, minimal, ambiguous, or potentially contradictory ethnographic accounts may reflect different perspectives on the appropriateness of revealing information about culturally sensitive issues.

Despite this first limitation, traditional knowledge may persist into contemporary times, co-existing alongside contemporary Western ideas, beliefs, and practices. Indeed, as White (1963:355), Elkin (1964), Bean and Vane (1978:670), and others have demonstrated, this is particularly true with regard to religion. Even though other aspects of culture and society, such as technology and subsistence, may change quickly and be completely different from pre-contact life-ways (cf. Sahlins 1985), traditional religious beliefs and practices may continue, even in light of the outward adoption of Western religions.

The nature, limitations, and proper uses of ethnographic data must also be understood. Ethnographic statements and observations themselves are “raw data,” rather than full explanations or complete interpretations. To use an archaeological analogy, a compilation of ethnographic statements is similar to a table of artifact data measurements. Understanding the implications of the measurements, or of the ethnographic comments, requires identifying the underlying patterns within the raw evidence and deciphering their significance. Related to this point is the fact that ethnographic statements, as raw data, may be expressed metaphorically, symbolically, or even analogically, especially when they concern esoteric topics like religious belief and symbolism. Such comments require synthesis and interpretation and cannot

necessarily be assumed to represent literal statements or complete exegesis. Further, ethnographic facts may be anecdotal, but good ethnographic interpretations are systematic; they employ multiple lines of evidence, ideally from multiple ethnographers and a variety of indigenous consultants. This evidence might include direct responses to questions, volunteered statements, place names and word lists, and accounts of events or circumstances, all of which may contribute to a well-contextualized, emic (or insider's) understanding of the data.

Proper use of ethnographic sources also requires caution with respect to the kinds of biases that often flavor early anthropological writing. Perhaps the two most common of these resulted from the failure of many male anthropologists to adequately consider female roles in ritual and lifeways, combined with the pervasive Colonialist attitude holding that traditional non-Western cultures were somehow childlike and necessarily unsophisticated, if not primitive. From this perspective, traditional non-Western cultures were thought to lack the intellectual and cognitive "sophistication" of contemporary Euro-Americans.

Despite many decades of archaeological assertions to the contrary, ethnographic information on the making, meaning, and use of rock art exists in many areas. Accessing this information requires both a thorough review of the ethnographic record and an understanding of how to interpret the kind of evidence that it contains. Contemporary Native Americans may also retain traditional knowledge, again perhaps to the surprise of many archaeologists; where appropriate and possible, information can be solicited from contemporary Native Americans as well. Such information may be critical to understanding Native Americans' concerns as rock art stakeholders in certain regions, and determining whether a site or series of sites may qualify as a TCP.

5. HISTORICAL CONTEXT OF NORTH AMERICAN AND HAWAI'IAN ROCK ART

NRHP eligibility evaluations are partly based on establishing the historical context, including period of significance, of a property. This chapter addresses this substantive side of the rock art equation by looking at the historical contexts of rock art across the 50 United States. Included in these summaries are details on the recent regional rock art literature, providing background sources for specific regions. Despite the public appeal of rock art, the last major synthesis for North American rock art was published in a limited-edition volume by Wellman (1979a). This was updated for North American farming cultures by Bostwick (2001) and for hunter-gatherers by Turpin (2001). These and additional recent research monographs and papers are employed below to provide regional historical contexts for North American and Hawai'ian rock art. In general, common literature sources include articles in regional journals, as well as the American Rock Art Research Association's *American Indian Rock Art*, and the San Diego Museum of Man's annual *Rock Art Papers* series.

Within North America, Kroeber's (1939) concept of "culture areas" is employed to structure the discussion (Figure 9). The resulting regional descriptions, accordingly, include California, Great Basin, Columbia Plateau, Southwest, Great Plains, Pacific Northwest and Arctic, Northern Woodlands, and Eastern Woodlands. Although not included in Kroeber's North American culture areas, Hawai'i is also considered, as part of the 50 United States.

Regional use of the concepts of styles and traditions is employed in the following, as outlined in the existing literature for each of these cultural areas. In certain cases, these typological systems may not be consistent with the discussion provided above.

CALIFORNIA

Literature

The first major synthesis of California rock art was published by Steward (1929), which was partly revised by Heizer and Clewlow (1973) almost a half-century later. The most recent synthesis is by Whitley (2000), which is followed here (see also Whitley 1992a, 2006; Whitley and Whitley 2012; Whitley et al. 2007). Important earlier regional monographs and papers were published by Fentress (1992), Grant (1965), Hedges (1973, 1976, 1983), Heizer (1953), Hudson and Lee (1984), Hudson and Underhay (1978), Hyder (1989), Minor (1975), Parkman (1986, 1988), Payen (1966), True (1954), and Smith and Lerch (1994), among others. Considerable research has been and continues to be conducted on California rock art.



Figure 9. Culture areas of North America.

Description

California culture area rock art extends from the Mexican border north to the upper reaches of the Sacramento River and east from the coast to the crest of the Peninsular Range and Sierra Nevada. This region was occupied, to historical contact, by hunter-gatherers, and hunter-gatherer-fishers. Naturally enough, the distribution of the rock art follows the distribution of exposed bedrock, with understandable resulting voids in the Sacramento and San Joaquin valleys, the Los Angeles Basin, and along the coastal plains. Notable concentrations of sites are present in the southwestern portion of the state, in the south-central coastal ranges and mountains (Chumash region), and in the southern Sierra Nevada (Yokuts region).

Two major rock art traditions are recognized within this broad area (Whitley 2000). The first is the Pit-and-Groove tradition (Figure 10). This is present across this culture area, but also extends northwards onto the Columbia Plateau and east into the Great Basin. Cupules are common, especially at village sites, roughly from the San Francisco Bay region southwards. True pit-and-groove boulders, essentially an elaboration of cupules, are most common north of the bay. Three ethnographic origins for this kind of rock art have been described. In the northern portion of the state, pit-and-groove motifs were reportedly made either to control the weather (“rain rocks”), or as a fertility aid (“baby rocks”) by women or couples; in the southern part of the state, cupules more generally were created during girls’ puberty initiations (Heizer 1953; Minor 1975; True 1954; Whitley 2000, 2006).



Figure 10. Pit and Groove Tradition boulder, northern California.

The second tradition is termed the Californian tradition, proper. It includes examples of pictographs and petroglyphs (Figure 11). Pictographs are present throughout this region, but are particularly common in its southern half (very roughly, south of Fresno). Much of the pictograph imagery consists of geometric designs, but examples of anthropomorphs, zoomorphs, aviforms, and handprints may be present, sometimes in regional concentrations. Red monochrome paintings are most common and widespread, but sites and concentrations of sites with bichrome and polychrome paintings are locally present, most notably in ethnographic Chumash and Yokuts territories, which contain many spectacular rock paintings. Petroglyphs are relatively rare but are sporadically present throughout the area of the tradition. These typically consist of simple geometric patterns. In rare occasions, pictographs and petroglyphs occur at the same sites.



Figure 11. California Tradition pictograph: Painted Cave, Santa Barbara, California.

Although California rock art encompasses substantial variability (see Whitley 2000), two primary variants, representing localized elaborations of the more widespread and general pattern, are recognized within this diverse tradition. The South-Central Painted variant includes the well-known pictographs of the ethnographic Chumash and Yokuts region, roughly stretching from the coast in the Santa Barbara area through the southern coastal ranges into the southern Sierra Nevada. Many though not all of these sites include bichrome and polychrome motifs and panels, some of which are very elaborate and spectacular. According to ethnographic accounts, rock art sites in this region were created and owned by shamans, and depicted the visionary images of their supernatural experiences (Whitley 1992a, 2000). Some sites appear to have served archaeoastronomical functions (e.g., Hudson and Underhay 1978).

The Southwest Painted variant is located in the southwestern corner of the state, primarily north of and inland from San Diego. Common in this art are red painted sites, predominated by zigzags, diamond chains, and handprints. Some of these sites were created by girls during their puberty initiations into the late nineteenth-century (True 1954; Whitley 2006). Black, bichrome and polychrome sites are also found in the region. These have been interpreted as the creations of shamans (Hedges 1973, 1976), similar to those in the South-Central Painted variant.

Chronology and Period of Significance

Almost no chronometric dating has occurred at California tradition sites, and the chronology of the art is poorly known. Two facts link much of the painted art to the Late Prehistoric (post-A.D. 1200) and Historic/ethnographic (post-A.D. 1769) periods. First, substantial ethnography exists on the making and meaning of the art, especially in the southern Sierra Nevada and southwestern regions. Second, many sites in these same two areas are associated with Late Prehistoric and Historic villages. Rock art in at least portions of Chumash ethnographic territory, in contrast, are found at Middle-period villages (4000-800 B.P.) and are believed to date primarily to that phase (Whitley et al. 2007). In part, this chronological interpretation is based on a superimpositional study that suggests that the Chumash style motifs are capped by later Yokuts paintings.

GREAT BASIN

Literature

Steward's (1929) early monograph included the first major systematic study of western Great Basin rock art. This was followed a few decades later by Heizer and Baumhoff's (1959, 1962) influential studies. These introduced the hunting magic interpretation of the art, and presented a stylistic chronology that has served as a model for much research across the continent. Unfortunately, Heizer and Baumhoff misinterpreted their source (Schapiro 1953) concerning the nature and significance of style in rock art studies, which has contributed to substantial subsequent confusion in the rock art literature. Grant (1968) provided a more detailed study of the Coso Range. While he accepted the hunting magic interpretation, Grant rejected Heizer and Baumhoff's stylistic chronology and the principles upon which it was based. More recent significant studies in this culture area include Carroll (2007), Castleton (1978, 1979), Christenson (1993), Clewlow (1981), Dickey (1994), Garfinkel (2006, 2007) Garfinkel et al. (2009, 2010), Gilreath (1999), Gilreath and Hildebrandt (2008), Hedges (1982), Hildebrandt and McGuire (2002), Keyser and Whitley (2006), Loendorf (1999), McGuire and Hildebrandt (2005), Nissen (1982), Quinlan and Woody (2003), Rector (1975, 1985), Reichert (1998), Ritter (1994), Stoffle et al. (1995, 2000, 2001, 2004), von Werlhof (1965), Whitley (1982, 1994a, 1998a, 1998b, 2000, 2006a), Whitley et al. (1999a, 1999b), and Woody (1996). Papers dealing specifically with Great Basin rock art chronology include Dorn (1994, 1998), Dorn and Whitley (1983, 1984), and Whitley and Dorn (1987, 1988, 2010). As this long list suggests, considerable research on Great Basin rock art has been conducted and continues to occur.

Description

As used here, the Great Basin culture area includes the physiographic Great Basin in California, Nevada, Utah, and Oregon, and the Mojave and Colorado deserts in California. This is primarily a region of hunter-gatherers, although with some variability: marginal horticulturalists occupied

portions of the Colorado Desert during the last ~800 years, and farming villages spread into the southern edge of the Great Basin and central Utah after A.D. 600.

The rock art of this vast region includes a series of rock art traditions. The first of these, in addition to the Pit-and-Groove tradition described above, working from west to east, is the so-called Great Basin tradition (Whitley 2000; see Figure 1). Petroglyphs predominate, with a myriad variety of geometric designs. Mixed with the geometric peckings are occasional representational designs. The most common of these are bighorn sheep, followed by stick- and solid-bodied anthropomorphs, and sometimes including deer, weaponry, “medicine bags,” canids/felines, snakes, hand and paw prints, and vulva-forms. Great Basin tradition sites extend from the Mojave Desert of eastern California across Nevada, to southwestern Oregon and southern Idaho, and into Utah. They also extend slightly westward, across California’s central Sierra Nevada. Pictographs and fine-line incised petroglyphs also occur, sometimes in combination with the more heavily pecked engravings. Local concentrations of sites and motifs, with regionally distinctive stylistic emphases, also are known, including in and around the Coso Range of eastern California, and in the Paranaghat Valley in Nevada. Existing interpretations of this tradition’s art are divided between those who, based on ethnographic evidence, interpret the motifs as shamanistic in origin, versus those who, based on the bighorn sheep motifs, contend that much of it was created as part of a hunting cult. The first group sees continuity between the prehistoric and ethnographic pasts; the second argues that there is a disjunction between the ethnographic and prehistoric periods, because ethnographic informants denied the existence of bighorn sheep hunting magic.

The Earth Figure tradition, the second major Great Basin rock art tradition, is primarily but not exclusively located in easternmost California, western Nevada, and western Arizona (strictly, part of the Puebloan Southwest). The tradition includes two distinctive types of motifs. Along the Colorado River corridor, large intaglios have been scraped into the desert pavement at the locations of mythic events, with the motifs representing the relevant actors and events associated with that location (see Figure 4). These are used by Yuman-speaking tribes in pilgrimages that are conducted to reenact the mythic creation of the world (von Werlhof 2004; Whitley 2000). Rock alignments or geoglyphs and cairns are present away from the river corridor, with an especially large concentration of these in the Coso Range–Death Valley region (Figure 3). These are believed to have been created as part of shamans’ vision quests; commonly but not invariably, they lack a specific form or pattern, instead comprising “instrumental” ritual actions without direct iconographic intent (Whitley 2011).

Chronology and Period of Significance

Considerable chronometric dating research has been conducted on the Great Basin tradition petroglyphs. Combined with datable subject matter in the art, this is perhaps the best-dated regional rock art corpus in North America. CR and VML dating indicate that, most conservatively, the petroglyphs date from earlier than 11,200 to less than 250 B.P. (Whitley and Dorn 2010); that is, from the Paleoindian to the Protohistoric period. Plausible but not as certain chronometric evidence pushes the early limit back to 12,000 or more years. Temporally diagnostic subject matter includes a motif interpreted as an extinct Terminal Pleistocene camelid, chronometrically dated to about 12,000 B.P. (Whitley 1999b); atlatls, and bows and arrows, respectively predating and postdating A.D. 500; and horses with riders and humans with cowboy

hats and boots, probably postdating roughly the 1770s (Whitley 2000). Combined with ethnographic accounts, these last motifs indicate continued art production into the historical period, possibly into the twentieth century.

Great Basin tradition pictographs have also been dated by a variety of means, using chronometrics, subject matter, and stratigraphically buried panels (Whitley 2000). A Mojave Desert pictograph has been AMS-¹⁴C dated to approximately 9000 B.P.; excavated panels in central Nevada are about 4,500 years old (Thomas and Thomas 1972); the Newberry Cave paintings (discussed above) have been reliably dated to 3,000–3,800 years; and horse-and-rider motifs indicate historical pictograph production.

A series of experimental chronometric techniques have been applied to the Earth Figure tradition (von Werlhof et al. 1995; Cervený et al. 2006). These studies suggest that rock alignments may be as much as 11,000 years old, with the intaglios dating as early as 1800 B.P. In both cases, contemporary Native Americans continue to create and use these kinds of sites in rituals, and they have been included as components of TCPs.

COLUMBIA PLATEAU

Literature

Important early monographs on Columbia Plateau rock art include contributions by Cressman (1937), Cain (1950), Corner (1968), Keyser and Knight (1975), Swartz (1978), and Loring and Loring (1982, 1983). The latest areal synthesis was provided by Keyser (1992; see also Boreson 1998), and is summarized below. Recent site or localized region-specific studies have been provided by Loubser and Whitley (1999), Whitley et al. (2004), David (2005, 2012), Hann and Bettles (2006), and Keyser and Whitley (2006), among others. The Oregon Archaeological Society has also published a series of important recent regional monographs (e.g., Keyser and Poetschat 2010; Keyser and Taylor 2002; Keyser et al. 2004; etc.).

The Columbia Plateau has been cited as having the best ethnographic record on rock art in North America (Layton 2006). The foundation for this record was provided by James Teit (e.g., 1896, 1900, 1918, etc.), but numerous subsequent anthropologists have included rock art data in their ethnographic monographs (e.g., Cline 1938). Recent studies have demonstrated that traditional rock art knowledge persists into the twenty-first century in many portions of this region (e.g., David 2012; David and Keyser 2008; Keyser and Whitley 2000; York et al. 1993).

Description

The Columbia Plateau includes rock art in the interior portions of British Columbia, western Montana, Idaho, Washington, Oregon, and northeastern California. Based on the consistency of motifs and style across this broad region, Keyser (1992) has defined the Plateau tradition, with a series of geographical variants. Seen broadly, this tradition includes both petroglyphs and pictographs, with simple motifs predominated by stick-figure humans, block-bodied animals, rayed-arcs, tally marks, sun symbols, and other geometrical motifs. One or (often) two humans standing under rayed-arcs are the hallmark of the region (Figure 12), but mythic animals (Figure 13) and humans (Figure 14) also occur. Differences in motif distributions suggest western versus eastern style zones.



Figure 12. Columbia Plateau Tradition petroglyphs: “twin” anthropomorphs under rayed arcs.



Figure 13. Columbia Plateau Tradition petroglyph: “Spedis” Owl and anthropomorph.



Figure 14. Columbia Plateau Tradition petroglyph: “She Who Watches,” mythic being.

Five distinct styles have been defined for the western zone:

- Long Narrows, which is stylistically linked to Pacific Northwest rock art (discussed below), and consists of stylized “grinning” faces and skeletonized humans and animals, overall rendered to emphasize curvilinearity;
- Yakima Polychrome, which is a localized painted style primarily consisting of red and white arc faces, rayed arcs, rayed circles, occasional stick-figure humans and geometrics, with some petroglyphs (including painted petroglyphs);
- North Oregon Rectilinear, predominated by simple red pictographs, including stick-figure humans, rayed arcs, circle designs, block-bodied humans, hunting scenes, tallies, lizards, and especially geometrical motifs;
- Western British Columbia, again primarily red pictographs but sometimes including large panels showing repeated uses, and portraying stick-figure humans, “spirit” figures, animals, geometrical motifs, tracks, tallies, rayed arcs, and fir trees; and
- Central Columbia Plateau, which includes a mix of petroglyphs and pictographs emphasizing humans with rayed arcs, often paired; bighorns and other animals; tallies; and geometrical motifs.

The last style is transitional to the eastern zone, which includes four regional styles:

- Southeastern Columbia Plateau, which is an extension of the Central Columbia Plateau style;
- Western Montana, which primarily consists of simple paintings of stick figure humans, animals, including bison, tally marks, and geometrical motifs;
- Hell’s Canyon Scratched, localized along the Snake River canyon and consisting of fine-line incised petroglyphs; and
- Hell’s Canyon Great Basin Abstract, which is a northern extension of the Great Basin tradition petroglyphs, described above.

Columbia Plateau rock art was created during vision questing, shamanic rituals, mortuary rites, and for hunting magic. Personal vision quests, conducted by boys and girls at puberty as well as by adults during life crises, were probably the most common reasons for painting and engraving the art, but shamans also undertook vision quests, and created rock art for various reasons, including sorcery. In some cases, rock art sites are associated with mythic actors and events. The Yakima Polychrome and Long Narrows styles are commonly associated with talus burials and cremation sites, and the images in the rock art are sometimes duplicated in carved or painted mortuary offerings in protohistoric and historical contexts.

Chronology and Period of Significance

Although very limited chronometric dating has occurred on Columbia Plateau rock art, a variety of lines of evidence suggest that the Plateau tradition is long-lived and dates as early as the Archaic. Pictographs and petroglyphs have been uncovered in excavations below Mount

Mazama ash, indicating an age of circa 7000 B.P. or older (Ricks and Cannon 1985). A few paintings of atlatls and Archaic projectile point types have also been identified, supporting an early age for some of the art. The appearance of the Yakima Polychrome and Long Narrows styles along the Columbia River, in contrast, has been linked to the movement of Chinookan-speaking peoples into this region. Based on similarities with motifs in portable art, these two styles are believed to postdate A.D. 500. Three AMS ages have been obtained on pictographs in Lava Beds National Monument, all postdating A.D. 1000 (Armitage et al. 1997). Occasional horse-and-rider motifs, and the very substantial amounts of ethnographic data on Plateau rock art, demonstrate that this continued to be an active cultural tradition into the historical period.

PACIFIC NORTHWEST AND ARCTIC

Literature

Although the complex hunting-gathering-fishing cultures of the Pacific Northwest are renowned for their art, rock art is a small part of their remarkable aesthetic corpus. Rock art research accordingly has been limited, instead focusing on other kinds of often-spectacular, sometimes-monumental art of this region, including wood-carvings, masks, and paintings. Primary rock art sources for the Pacific Northwest include Hill and Hill (1974), Lundy (1974, 1983), Poetschat and Keyser (2005), and Keyser and Poetschat (2012).

Rock art of the vast Arctic region is even less studied, and only a small number of sites are known—though whether this is due to limited research or a true paucity of sites is currently uncertain. Typically, discussions of Arctic rock art are included, in passing, in more general monographs (e.g., deLaguna 1934), but focused rock art studies have been published by Heizer (1947), Clark (1970), Kennedy (in Hill and Hill 1974), and K. Stevens (1974), among others.

Description

Like the other expressive forms in this region, Pacific Northwest rock art can be characterized as highly conventionalized, with a strong iconographic coherence (Figure 15). The Northwest Coast tradition, as defined by Lundy (1974), includes both petroglyphs and (less commonly) pictographs. This tradition is divided into the Basic and Classic Conventionalized styles, and the Curvilinear Abstract style. These three styles are often found at the same sites, and hence should be recognized as descriptive but not necessarily cultural-historical styles. The Long Narrows style, primarily found in The Dalles region on the Columbia Plateau (described above), also extends north and west into the Pacific Northwest.

Faces/masks are the most common motifs as a whole, along with other forms of anthropomorphs, followed by zoomorphs and geometrical motifs, in roughly descending order of numerical importance. Faces include a continuous spectrum of varieties, from simple and “gull-wing,” to full-outline and elaborated, to spiral-eyed motifs. Zoomorphs include bears, birds, fish, and sea mammals. Material culture items (“coppers,” canoes, and ships), are sometimes present, as are occasional geometrical motifs.



Figure 15. Pacific Northwest Tradition petroglyphs: mask faces and killer whales.

The “classic” Pacific Northwest tradition site consists of petroglyphs on boulders and outcrops at the shoreline. These are often associated with villages located at the mouths of salmon-spawning streams. The tidal submersion of these petroglyphs potentially may be intended to “carry” their symbolic message into the waters, and the spirits and creatures that inhabit that realm. Ethnography indicates that Northwest Coast rock art functioned in a variety of contexts. These include mythology, specifically the portrayal of mythic actors; shamanism, with some sites created by shamans during vision quests to depict their visionary imagery, and used for various shamanic activities (including inducing the salmon to run); and for social reasons, including documenting personal and group status, land ownership (as portrayed by clan crests), and commemorating potlatches and slave sacrifices.

Only a few dozen Arctic rock art sites are known. These include both petroglyphs and pictographs. Typical motifs include faces/masks, stick-figure humans, sea mammals, fish, birds, and boats with passengers. (Although the motif assemblage superficially may appear to resemble Pacific Northwest rock art, Arctic motifs lack the conventionalization and iconographic regularity evident in the southern region, and clearly represent a distinct tradition.) Arctic rock

art appears to have been related to shamanic practices and beliefs, with the faces/masks likely representing spirit helpers. Some rock art may also have been created for hunting magic.

Chronology and Period of Significance

No chronometric studies have been completed on Pacific Northwest rock art, but Keyser and Poetschat (2012) have combined a variety of lines of indirect evidence to develop the latest update on the ages of this art. This includes buried petroglyph panels, relative erosion, comparisons to archaeologically dated portable art, and historical subject matter. Their synthesis suggests that the Basic Conventionalized style predates the Classic Conventionalized style (as previously inferred by Lundy [1974]), and may have been pecked as early as 4000-2000 B.P. The Classic Conventionalized style, in contrast, developed between 2000 and 1000 B.P., and continued into the historical period.

Arctic rock art, similarly, is all but undated. Comparability between the motifs and portable art recovered from archaeological contexts, including Dorset maskettes, indicates that some petroglyphs likely dated between 1200 and 300 B.P., however.

SOUTHWEST

Literature

The American Southwest is culturally defined as the region containing prehistoric Puebloan cultures, primarily found in Arizona, New Mexico, Utah, and western Colorado, with westernmost Texas and southern Nevada sometimes included: the prehistoric Anasazi, Mogollon, Fremont, and Hohokam areas, and their peripheries. Farming societies developed in much of this region in the last two thousand years, resulting in a complex rock art record that includes earlier hunter-gatherer, then agriculturalist, and subsequently, in some areas, pastoralist art. Despite the resulting complexity of the art, only limited research has been conducted on it. Regional syntheses, nonetheless, have been provided by Bostwick (2002), Castleton and Madsen (1981), Cole (1990), Grant (1968), Hartley (1992), Hartley and Vawser (1998), Altschul et al. (1993), Munson (2002), Olsen (1985, 1989), Schaafsma (1971, 1975, 1980, 2000), Turner (1963, 1971), Wallace (1983, 1989), and Wallace and Holmland (1986), among others. Young (1988) and Hays-Gilpin (2008) have summarized ethnographic research, Bostwick (2005) has written a detailed history of regional rock art research, and Munson (2011) has published a useful methodological study. A variety of shorter papers have also appeared recently, primarily in the *American Indian Rock Art* monograph series, that address specific topics or sites (e.g., *American Indian Rock Art* volume 27, 2001, has a series of articles on Navaho rock art).

Though conventionally outside of the Southwest, west Texas is often included as part of this research domain. An important, and quite distinctive, pictograph tradition from this area, localized along the Pecos River, warrants mention. The initial monograph on this art was provided by Kirkland and Newcomb (1967). More recent studies have been provided by Bass (1989), Turpin (1994), and Boyd (1996, 2003), among others. Hampson (2011) has also looked at the rock art peripheral to the Southwest and the Plains (see below).

Description

Southwestern rock art includes a wide array of pictographs and petroglyphs, although, overall, petroglyphs are generally more common. Southwestern rock art can be grossly characterized as comprising a series of localized, fairly conventionalized and repetitive iconographic corpora. Human figures are widely common, sometimes as stick-figures, in certain cases conjoined (likely portraying dancers or, in much rarer instances, couples copulating), and in other examples wearing elaborate costumery/regalia and/or headdresses (Figure 16). In portions of Utah and southwestern Texas, the anthropomorphs may be large, approaching near-life-size (Figures 17 and 18). Masks/faces are also common in some regions (particularly along the Rio Grande) and, in some cases, have been identified as specific *katsinas* (ritual performers). Typical zoomorphs are lizards, snakes, bighorn sheep, and birds, including parrots (Figure 19) and turkeys, in most areas, with mountain lions and deer in the Pecos River region. In some cases, animal conflationations are depicted, especially “horned serpents.” Conventionalized signs, such as bear paws or corn stalks, are also common on certain regions, especially northern Arizona, and historically these served as clan symbols (Figure 20). Star and war symbols are also stylized in some regions. Geometrics are frequently present and, in some areas, dominate the local corpora. Spirals are typical, but, overall, rectilinear forms (such as step-frets) are most common. This last circumstance reflects the correspondence between the iconography of the rock art and other media, including textiles and ceramics. Comparisons between the rock art iconography and archaeologically dated media (such as ceramics and wall murals) have provided the primary means for dating Southwestern rock art.



Figure 16. Gila (Hohokam) petroglyphs, Arizona, showing “lizard-like” anthropomorphs and geometrics.



Figure 17. Archaic anthropomorph pictographs, Barrier Canyon, Utah.



Figure 18. Pecos River Style Archaic anthropomorph pictographs, Texas.



Figure 19. Parrot petroglyph, Petroglyph National Monument, New Mexico.



Figure 20. Bear paw Hopi clans signs, Willow Springs, Arizona.

The complex culture history of the region, involving changes from hunter-gatherers to settled farmers to (in some areas) pastoralists, and even back to hunter-gatherers in others, has contributed to a dizzying array of descriptive rock art styles. The primary synthesis for the Southwest as a whole has been presented by Schaafsma (1980), who lists over two dozen styles (Table 6). Cole (1990) has added another, the Uncompahgre style, expanding the classifications into southwestern Colorado. But the nature of these styles varies greatly, and, for that reason, the styles are not necessarily taxonomically equivalent. Whether certain of these styles represent cultural-historical units, or functional/social distinctions, is not yet established.

Table 6. Southwestern Rock Art Styles
(Bostwick 2006)

So-Central & SW Arizona
Apache
Gila Petroglyph
Great Basin Abstract
Mogollon Red
SW New Mexico Mountains
Apache
Jornada
Reserve Petroglyph
Mogollon Red
SW & So-Central New Mexico (Chihuahua Desert)
Apache
Jornada
Mogollon Red
Great Basin Abstract
Chihuahua Polychrome
El Paso - Carlsbad, West Texas
Apache
Jornada
Mogollon Red
Diablo Dam
Candelaria Painted
Pecos River
Chihuahua Polychrome
Great Basin Abstract
E Utah (W of Colorado River)
San Rafael
Classic Vernal
Barrier Canyon Anthropomorphic
Chihuahua Polychrome

N. Arizona & S. Utah
Navajo
Rio Grande
Tsegi Painted
Kayenta Representational
Virgin Representational
Cave Valley
Chinle Representational
San Juan Anthropomorphic
Glen Canyon Linear
Chihuahua Polychrome
NW New Mexico
Navajo
Gobernador Representational
Rio Grande
Anasazi
Rosa Representational
San Juan Anthropomorphic
No-Central New Mexico (Rio Grande Drainage)
Rio Grande
Anasazi
Great Basin Abstract

Despite this complexity, four very general Southwestern trends can be identified. First, there is an Archaic/hunter-gatherer substrate throughout the Southwest, with regional variations that were apparent by the Mid-Holocene. Although these styles may not be exclusively restricted to the Archaic period, this substrate likely included the Great Basin Abstract, Chihuahua Polychrome, Barrier Canyon Anthropomorphic, Uncompahgre, and Pecos River styles. The hunter-gatherer styles are commonly believed to represent shamanistic beliefs and practices.

Second, a great proliferation of regional styles appeared during the Puebloan period. These appear to reflect the development of relatively localized ritual traditions, including priestly religions and cults. Certain of these terminated, with the end of the Puebloan period at circa 1300 B.P., and the retraction of the Puebloan world.

Third, where the Apache, Navajo, and Ute moved in, the regional Puebloan styles were replaced by hunter-gatherer and/or pastoralist art (Figure 21). The purposes and symbolism of this art varied, depending upon the specific group and their religion, in some cases involving shamanism (e.g., among the Ute) and, in others, the more formalized religions of the Navajo and Apache. In both cases, horses with riders and other historical motifs signal the relative recency of their art.

Fourth, where Puebloan peoples continued to reside (e.g., on the Hopi and Zuni mesas, and along the Rio Grande drainage), there was, in contrast, a proliferation and elaboration of the art, beyond its previous components and qualities. A key element of this later Puebloan art involves the development of the *katsina* cults, indicating religious continuity for almost 1,000 years (cf. Adams 1991; Cole 1990). At least some Hohokam (Gila style) rock art appears to have been

associated with shamanism, however, and a number of examples of rock art, across the Southwest, appear to have had archaeoastronomical functions (Bostwick 2002, 2005).

The continued, recent creation of Southwestern rock art has been acknowledged since the nineteenth century (e.g., Fewkes 1892), although “surprisingly few [Southwestern] studies include ethnography or tribal consultation” (Hays-Gilpin 2008:124). Our understanding of the making and meaning of this art is, accordingly, not complete, although this partly results because most of this rock art is associated with religious beliefs and practices (even though there are a few examples of secular rock art; cf. Roberts 1932; Titiev 1972). Given the general Native American reluctance to share religious knowledge with outsiders (e.g., Fewkes 1892), relatively little rock art ethnography has been documented. Most of what has been recorded has been collected from the Hopi, Zuni, and other Puebloan groups.



Figure 21. Navajo pictograph panel of a Ute raid, Canyon de Chelly, Arizona.

In general terms, the Hopi specifically consider rock art to be “one of the most important records left by [their] ancestors because they include clan symbols and other markings that connect past and present” (Hays-Gilpin 2008:126). That the art includes clan symbols is well established, both for the Hopi and for other Puebloan tribes (see, e.g., Duff et al. 2008; Kuwanwisiwma and Ferguson 2004; Stevenson 1904; Waters 1963; Young 1988; Zedeno et al. 2001). This might imply that the art is secular in origin, because clan membership is ostensibly an aspect of social organization rather than connected to religious practice. However, clan symbol petroglyphs were created during rituals and were left at shrines, and they should be understood in this religious context.

This is especially well documented with respect to the Hopi site of Tutuveni, or Willow Springs, Arizona, which is a stop on the ceremonial Salt Pilgrimage (Colton 1946; Colton and Colton 1931; Michaelis 1981; Titiev 1937). Perhaps the best description of the rock-art-making ritual at this site, from the early twentieth century, is the following:

Traveling a little further, we arrived at the shrine where Hopi salt gatherers carve their clan emblems on the rocks. Our ancestors had gathered salt for many generations, and there were hundreds of clan emblems cut into the rocky base of the shrine. Every traveler, on each successive trip, had carved another symbol to the left of his original one. My father had carved eleven sand dunes in the course of his life and Talasvuyauoma had carved ten coyote heads. I selected a smooth surface nearby and carved my Sun symbol, also tracing my initials on the emblem; but I kept this a secret, fearing that my companions would object to it as something modern. When I had finished, I placed the breadth line of a prayer feather at the mouth of my Sun symbol, pounding it with a stone until it stuck, sprinkled corn meal upon the face of the emblem, and prayed: "My uncle, the Sun god, please notice that I have carved my clan emblem upon the stone. Direct our steps to the Salt Canyon and watch over us until we have returned safely" [Talayesva 1942:125].

The distribution of clan symbols can be understood partly as reflecting the movements of the ancestral Hopi. Bernardini (2005), for example, studied fourteenth-century northern Arizona villages, using clan symbol petroglyphs to identify ancestral Hopi villages and to study migration and immigrant groups. (For the Hopi and the Zuni, the spiral is said to represent migration; cf. Duff et al. 2008). He demonstrated that there was a long and complicated period of migration and aggregation prior to the establishment of the contemporary Hopi villages. But the clan symbols equally can be understood as delineating a sacred landscape. Their distribution is a geographical expression of the extent of Hopi ceremonies.

Not all Hopi (or other Puebloan) rock art consists of clan symbols, however, nor was the creation of these petroglyphs the only kind of ritual rock art. Petroglyphs more generally were associated with shrines—even though not all shrines have rock art (Fewkes 1906; cf. Stevenson 1904). Because there are a variety of different kinds of shrines associated with specific rites and practices, the function and meaning of the art likewise varies. For example, while on the Hopi Salt Pilgrimage, Talayesva also saw another rock art site with "tracings of chickens carved by the War Twins, a rooster daubed with red ocher, and drawings of hens and chicks." He was told by the War Chief leading the pilgrimage that "Here is a chicken shrine. If you wish to have success with chickens, make an offering and pray for good luck" (Talayesva 1942:139).

The implications of these statements are that some rock art sites were believed to have been created by mythic actors (the War Twins, in this case), and that offerings could be made and prayers said at such locations in order to promote certain outcomes. (Prehistorically, these "chickens" were most likely turkeys.)

This pattern seems to be generally characteristic of Puebloan rock art more widely. For example, some Laguna rock art is connected with hunting, though not necessarily with "hunting magic," in the sense of sympathetic magic, per se. As this was explained, "The purpose of the hunt rituals and magic is to make contact with all of the spirits of the elk" (Silko 1996:29). Within the Hopi

region, a petroglyph motif has been identified as possibly representing Tiikuywuuti, the Hopi mother-of-the-game-animals (Hays-Gilpin 2008:127), enhancing the likelihood that some Hopi rock art may be hunting-related. Other motifs and sites may be associated with war raids, warriors, and war deities (Schaafsma 2000; Stephen 1936); “love magic” (Hays-Gilpin 2004; Stephen 1936); initiation places for medicine societies (Zedeño et al. 2001); and as “trail markers” (Zedeño et al. 2001). According to some consultants, only initiated males created rock art (Zedeño et al. 2001).

Chronology and Period of Significance

A few chronometric rock art studies have been conducted within the Southwest (e.g., Armitage et al. 2000; Chaffee et al. 1994a; Dorn 2006; Dorn et al. 2012; Loendorf 2010), with the only systematic dating program conducted in the Pecos River region (see Boyd 2003 for a summary). Much rock art dating, accordingly, has been based on associations between rock art sites/panels and surface artifacts, habitations, or architectural features; occasional depictions of temporally diagnostic artifacts (such as atlatls, projectile point types, or horses); and similarities to motifs in other well-dated media, including wall murals. Using these various sources, a reasonable chronology has been developed, although it is still fairly general.

A series of possible mammoth/mastodon motifs have been identified at Southwestern sites (Agenbroad 1994). Though as yet undated, these may signal Paleoindian/Terminal Pleistocene rock art. This possibility is supported by a VML-dated petroglyph from Petrified Forest National Park, which is greater than 8,500 years old (Dorn 2006). A variety of lines of evidence indicate that the Uncompahgre, Barrier Canyon, and Pecos River styles all date to at least 3000 B.P., and probably terminated sometime between A.D. 1 and 500. At least some Gila-style (Hohokam) rock art is Archaic in age, based on depictions of dated weaponry (Bostwick 2002). Cole (1990) has suggested that the various geometric styles of pictographs and petroglyphs may constitute a widespread Abstract tradition dating from earlier than 1000 B.C. to A.D. 1000. Because of obvious regional discontinuities in the rock art and the cultural-historical record, the Fremont rock art of Utah also appears to be well-dated, from roughly A.D. 400 to about 1300. A series of regional chronologies have also been suggested for Puebloan peoples in the Anasazi, Mogollon, and Hohokam regions. These are capped by the proliferation of rock art after about A.D. 1400 in those regions that continued to be occupied by the descendants of the Anasazi. Finally, the late-arriving Navajo, Apache, and Ute art, most likely postdating A.D. 1500, includes horse-and-rider and other historic motifs, clarifying its ages.

GREAT PLAINS

Literature

The Great Plains stretches from the east side of the Rockies to the eastern Woodlands, and north-south from Canada to the Texas panhandle. Although commonly perceived as a broad, featureless (and rock-less) expanse, in fact it includes significant topographical variability and lithic exposures, resulting in substantial rock art. Although early rock art studies were limited in number, notable publications were provided by Renaud (1931, 1936), Malouf (1961), Gebhard (1969), Conner and Conner (1971), and Keyser and Knight (1975). Interest in Great Plains rock art has increased dramatically in the last two decades, with a series of significant overviews and studies by Francis and Loendorf (2002), Greer (1995), Keyser (2004), Keyser and Klassen

(2001), Klassen (1998), Loendorf (2008), Loendorf and Kuehn (1991), Tratebas (1993, 2000), Sundstrom (1990, 2004, 2006), and Wintcher (2005), among others. Keyser and colleagues (e.g., Keyser et al. 2012; Keyser and Poetschat 2008) have also recently published a series of detailed site monographs. The primary recent regional syntheses have been written by Francis and Loendorf (2002), Keyser and Klassen (2001), and Loendorf (2008). These are summarized below.

Description

Much as in the Southwest, the rock art of the Great Plains is complex and diverse, likely reflecting the fact that the region contained a changing mix of hunter-gatherers, farmers, and, historically, pastoralists (in the sense of the horse cultures that developed after Euro-American reintroduction of the horse). The art ranges from finely rendered, polychrome, figurative paintings to crudely created, pecked, curvilinear motifs. Rock alignments (including “medicine wheels”) are also present in some areas. Thematically, the art includes geometrical motifs, supernatural beings, animals, hunting scenes, war exploits, sex acts, and family portraits, along with substantial numbers of material cultural objects. Depictions of other 30 animal species have been identified, at least seven of which are illustrated by their tracks. The most common animal species are horse, deer, and elk, but bighorn, bear, and birds are also common. Bison are surprisingly rarer than expected, given their importance in Plains culture, except where illustrated by hoof prints. Humans are often shown on horseback and/or with ceremonial regalia, clothing, and/or weaponry, sometimes in battle scenes (Figure 22). Shields and shield-bearing warriors are common (Figure 23) as are, in certain areas, “spirit” figures—unusually elaborated anthropomorphs. Very specific regalia, weaponry, and horse tack details are sometimes included in the historical art, allowing for good chronological control and tribal identification.

Fifteen different rock art traditions/styles have been identified on the Great Plains (Table 7; Francis and Loendorf 2002; Keyser and Klassen 2001; Loendorf 2008). Despite some overlap, these may be generally grouped into northern versus southern (High) Plains traditions and styles. Some of these traditions/styles are widespread, whereas others appear to be fairly localized, and their relationships to specific cultures and tribal groups vary widely. The Dinwoody tradition, primarily found in the Bighorn Basin of Wyoming, for example, is clearly associated with the Wind River Shoshone (Figure 24). It reflects a much larger Numic (Shoshone and Paiute) symbolic system, more commonly viewed as Great Basin in origin (Francis and Loendorf 2002). Similarly, the Southern Plains Protohistoric style may be linked to the Apache, who replaced earlier Caddoan-speakers in the region (Loendorf 2008). Meanwhile, the Biographic tradition is widespread across the Plains and was produced essentially by the entire array of Plains horse cultures during the Protohistoric and Historical periods (Keyser 2004; Keyser and Klaasen 2001; Klaasen 1998).

These circumstances point to the taxonomic complexity of regional rock art corpora. Dinwoody, for example, is a “tribal style” with considerable time-depth (see below). The Biographic tradition, in almost perfect contrast, is a “pan-tribal style,” yet it is very limited chronologically.



Figure 22. Northern Plains incised raiding scene, La Barge, Wyoming.



Figure 23. Plains shield petroglyphs, Castle Gardens, Wyoming.

Table 7. Plains Rock Art Traditions

No. Plains Traditions	Type	Dominant Imagery	Chronology	Distribution
Columbia Plateau	Primarily paintings	Humans, geometrics	6000 BC - Historic	MO, ID
Foothills Abstract	Primarily paintings	Handprints, humans, geometrics, "mazes"	1000 BC - AD 1500	MO
Vertical Series	Primarily paintings	Repeated conventionalized images	Historic ?	MO, WY, SD
Ceremonial	Mixed	Humans (V-neck), shields, animals	AD 1 - Historic	ID, MO, WY, CO, NE, SD
Biographic	Mixed	Horses, humans, regalia/weapons	AD 1600 - Historic	MO, WY, SD, CO, NE, TX, OK, UT
Hoofprint	Incised & pecked	Bison hooves, genitalia, faces	AD 250 - Protohistoric	MO, WY, ND, SD, NE, CO, NM, TX
Early Hunting	Primarily pecked	Animals, humans, nets, atlats	Paleoindian - 500 BC	WY, SD, UT, NM
En Toto Pecked	Primarily pecked	Humans, animals	1000 BC - AD 1000	WY, MO
Dinwoody	Pecked	Spirit beings, animals	1000 BC - Historic	WY, UT
Pecked Abstract	Pecked	Geometrics	1000 BC - AD 1000	WY, MO, SD, CO, NM, TX
So. Plains Traditions				
Paleoindian?	Incised	Geometric	?9000 - 7000 BC?	CO?
Archaic	Primarily pecked	Primarily geometric	3000 BC - AD 100	CO, KA, NM, OK, NE
Purgatoire Pecked	Pecked	Deer, elk, humans, geometrics	AD 100 - 1450	CO, KA, NM, OK, NE
Purgatoire Painted	Painted	Animals, humans, geometrics, turkeys	AD 1050 - 1450	CO, KA, NM, OK, NE
Protohistoric	Primarily pecked	Humans, bison, animals, bows	AD 1450 - 1750	CO, NM, TX

The origins and symbolism of Great Plains rock art reflects the cultural complexity of the region. As noted above, the region includes hunter-gatherers, farmers, hunter-gatherers who became pastoralists, and farmers who likewise became pastoralists. While this is complicated enough, these circumstances are further compounded by the historical movements of different tribes in the region, especially during the Protohistoric and Historical periods. The result is an unusual and complicated mix of hunter-gatherer beliefs, which typically focus on shamanism and animals, and the more formalized rituals and beliefs of agriculturalists, where fertility and priestly cults ("medicine societies") are often emphasized. While the eastern horse cultures/pastoralists (especially) are typically described as hunter-gatherers, based on their subsistence practices, their religions reflect their earlier farming roots; in contrast, the Wind River Shoshone, on the west, retained their shamanistic hunter-gatherer beliefs, even while adopting the outward traits of the Plains horse culture. The full development of the horse cultures, with their endemic raiding and emphasis on male status achieved through war honors, added another layer of socioreligious complexity to these cultures, and to their rock art.



Figure 24. Dinwoody style spirit figures and geometrics, Wyoming.

Great Plains rock art, accordingly, was created for a wide variety of reasons. These included shamanic vision questing; other kinds of shamanistic rituals, such as hunting magic and sorcery; formal cult practices; and the commemoration of war exploits. Although raiding might seem an entirely secular activity, the fact that Biographic art was often placed at sites with other, more clearly religious, kinds of rock art has an important implication. Like the hanging of war victory banners in European cathedrals, the importance of religious beliefs even in combat was explicitly acknowledged. Like Native American cultures more generally, little if any distinction was made between the strictly secular and the entirely sacred.

Chronology and Period of Significance

Significant and systematic chronometric petroglyph dating has occurred in three areas within the Great Plains: Whoopup Canyon and the Bighorn Basin, Wyoming, and southeastern Colorado (including an important series of dates from the Pinon Canyon Training Center) (Dorn et al. 1990; Faris 1995; Francis 1994; Francis and Loendorf 2002; Francis et al. 1993; Loendorf 1991, 2008, 2010; Tratebas 1993, 1999, 2000, 2004, 2010). In combination with a handful of pictograph ages (Chaffee et al. 1994b; Scott et al. 2005), and more traditional kinds of temporal information (e.g., Sundstrom 1990), a robust rock art chronology has resulted.

Chronometric ages from Whoopup Canyon and the Bighorn Basin indicate that the Early Hunting style was produced as early as Paleoindian times, and continued to be made into the

Late Archaic. Paleoindian/Early Archaic rock art has also been tentatively identified in southeastern Colorado, roughly before 8000-7500 B.C. (Loendorf 2008, 2010). This style consists of heavily revarnished, fine-line incised geometrics that underlie Archaic pecked petroglyphs. This diversity in rock art styles/traditions by Paleoindian times suggests that cultural regionalization was already well under way between 11,000 and 10,000 B.P., especially when the evidence for Paleoindian petroglyphs from California (above) and early pictographs from South America (Roosevelt 1999; Roosevelt et al. 1996) are included in the discussion. This also indicates that the long emphasis on the widespread distribution of fluted projectile point types as putative signs of cultural/ethnic unity involved a gross oversimplification. That rock art regionalization was already in place by about 11,000 B.P., furthermore, better fits the growing evidence for pre-Clovis colonization of the Americas.

Much less ancient, but nonetheless important, the Dinwoody petroglyph style has been chronometrically dated from approximately 2000 B.P. to the protohistoric period (Francis and Loendorf 2002). These dates are especially significant in light of the linkage between this style and the Numic-speaking Wind River Shoshone. The relative antiquity of this corpus contradicts claims, based on glottochronology, that Numic speakers first dispersed northeastward from eastern California only about 700 years ago (e.g., Bettinger and Baumhoff 1982).

At the other end of the time spectrum, very good evidence places certain of the rock art traditions in the Protohistoric and/or Historical periods. This consists of a variety of kinds of weapons that were introduced after Euro-American contact, as well as the horse, combined with known changes over time in the introduced material culture; e.g., the replacement of bows and spears by guns, and shifts in specific characteristics of horse tack.

EASTERN WOODLANDS

Literature

The Eastern Woodlands extend east from the eastern margins of the Great Plains to the Atlantic Coast, and north from the Gulf of Mexico almost to the Canadian border; only Maine and northernmost Michigan and Minnesota lie beyond its limits. The Eastern Woodlands were, historically at least, viewed as a region with few rock art sites, resulting in limited study of this art, though important early reports were provided by Coy (1966), Ritzenthaler (1950), Roefer et al. (1973), and Swauger (1974, 1984), among others. While it is certainly true that rock art is more common in the western states, a dramatic increase in Eastern Woodlands rock art research has occurred in the last two decades. This has yielded an important series of regional monographs and edited volumes (e.g., Birmingham and Green 1987; Bozhardt 2003; Callahan 2001; Charles 2010; Coy et al. 1997; Diaz-Granados and Duncan 2000, 2004; Faulkner 1986, 1996; Lenik 2002, 2009; Sabo and Sabo 2005; Sherwood and Simek 2001; Wells 1996), as well as individual papers (e.g., Diaz-Granados 2008; Faulkner and Simek 1996; Loubser 2005; Loubser et al. 2008; Simek and Cressler 2001, 2005; Simek et al. 1998, 2009; Swauger 1992; Wagner 2002; Wagner et al. 2009), including the numerous chapters in the edited volumes cited above. This recent research florescence demonstrates that there is more Eastern Woodlands rock art than once believed, and more is probably present than currently understood, with field conditions (vegetation, poor contrast and visibility) and taphonomic factors (especially rainfall) contributing to the traditional failure to adequately appreciate the rock art of this region.

Exemplary of these circumstances are two cases. Prior to the 1980s, only a handful of rock art sites were known from the entirety of South Carolina; over 60 have been identified once systematic survey and documentation were initiated (Charles 2010). Similarly, the first dark-zone cave with rock art was not discovered until 1979; approximately three dozen of these kinds of rock art sites, centered on the Cumberland Plateau, have been identified and studied since that time (e.g., Simek and Cressler 2005; Simek et al. 1998, 2009).

Description

Perhaps the best quick characterization of Eastern Woodlands rock art is that our understanding of it has become more complex (not surprisingly) as more discoveries have occurred and more research has been completed. Very generally speaking, petroglyphs are more common than pictographs, and birds are often the most numerous single motif category, with thunderbirds the hallmark of the region (Figure 25). But even the dark-zone caves include pictographs, petroglyphs, and “mud glyphs”—images scraped into mud-covered walls (Figure 26)—with cupules also present in the region (Figure 27), resulting in a wide mix of techniques and contexts. Again, very generally speaking, Eastern Woodlands rock art sites tend to concentrate in three primary zones: the Upper Mississippi, near the intersection of Minnesota, Wisconsin and Iowa (the northwest portion of this region); from Missouri and Arkansas through the Tennessee River Valley to Georgia and western North Carolina, including the Cumberland Plateau (the southeast); and the upper Ohio River Valley (northeast). Occasional sites are found in intervening and surrounding areas, as well.



Figure 25. Thunderbird with heartline petroglyph, Jeffers site, Minnesota.



Figure 26. Mud scraper owl motif, Mud Glyph Cave, Tennessee.



Figure 27. Southeastern Pit and Groove Tradition, Judaculla Rock, Georgia.

The northwestern portion of the Eastern Woodlands, the “driftless area” of the Upper Mississippi, includes the renowned Jeffers petroglyph site, probably the largest single site in the eastern U.S. A mix of petroglyphs and pictographs are present in this region, however. Bird motifs are the most common at most sites (though not at Jeffers). Animal tracks are also frequent, whereas other species (bison, fish, turtles) are sometimes present. Heart lines may be depicted in the zoomorphs. Stick-figure humans are typical, though some humans have headdresses or mask-like faces, and some rectangular-bodied anthropomorphs also occur. Material cultural items are, overall, relatively rare, but may include weapons. Geometric images are the largest component of many assemblages. Grant (1967) and Wellman (1979) have referred to the art in this northwestern region as the Woodland Naturalistic tradition.

In the southeast region, petroglyphs are more common than pictographs. Dark-zone caves found in the Cumberland Plateau portion of this region contain true cave art, most commonly petroglyphs, followed by mud glyphs, and fewer pictographs. Animal motifs are frequently shown in the western portion of this region, with birds depicted everywhere, mostly representing variations on the thunderbird. Bird tracks are also common. Humans include round-headed, square-shouldered, or sometimes ovoid-bodied anthropomorphs. Material culture emphasizes weapons: ceremonial axes, celts, bilobed arrows, and projectile points. Geometrical motifs are also common, and occasionally mythological creatures are depicted. Due to iconographic similarities with decorated artifacts in the larger archaeological record, the rock art in this region is considered primarily an expression of the Late Woodlands and Mississippian traditions, including the Southeastern Ceremonial Complex (SECC). The southern portion of this region also contains a number of cupule sites. Grant (1967) and Wellman (1979) refer to this as the Southeastern Pit and Groove tradition (see also Loubser 2005).

The Upper Ohio River Valley region of western Pennsylvania, northern West Virginia, and eastern Ohio (including additional smaller concentrations in Rhode Island and Massachusetts), primarily contains petroglyphs. Birds of various species, including thunderbirds, sandhill cranes, turkeys, and wading/water birds, are especially common. Human images consist of mask-like faces, round-headed anthropomorphs, and lizard-like stick-figures with cupule heads (Figure 28). So-called mythological creatures are also occasionally present. Material cultural items are relatively rare and generally consist of weapons and headdresses. Grant (1967) and Wellman (1979) refer to the rock art of this region as the Woodland Stylized tradition.

Efforts have been made to define true cultural-historical styles in the Eastern Woodlands (e.g., Diaz-Granados and Duncan 2000), although they are still preliminary and speculative. The general cultural unity of the region, for the last 2,000 years at least, however, appears to have contributed to broad regional similarities in beliefs and practices, effectively resulting in “horizon styles” that cross-cut ethnic and linguistic distinctions. The three Eastern Woodlands rock art traditions suggested by Grant (1967) and Wellman (1979) may reflect this circumstance.



Figure 28. Petroglyphs of horned anthropomorph, bird and geometrics, Leo site, Ohio. (Petroglyphs have been painted-in for visibility.)

Interpretations of Eastern Woodlands rock art vary, in part because different aspects of this corpus likely had different origins, functions, and meanings. At least some of the art may be shamanistic in origin, especially the earlier (Archaic) art. With the appearance of the SECC, however, and the similarities between many of the rock art motifs and the imagery characteristic of this religious system, the rock art in the southeastern part of this region appears to have reflected the cosmology and mythology of this ritual and belief system—which is itself not yet fully understood. Despite this fact, depictions of mythic actors/spirits, including an underwater spirit, support the contention that much if not all of the art is religious in origin. The emphasis on birds in the dark-zone caves, similarly, suggests a symbolic inversion related to concepts of the upper versus underworld.

Chronology and Period of Significance

Eastern Woodlands rock art is reasonably well-dated, partly based on comparisons with iconography in other aspects of the archaeological record, and in part due to a developing suite of direct chronometric ages (e.g., Armitage et al. 2000; Diaz-Granados 2008; Diaz-Granados and Duncan 2000; Diaz-Granados et al. 2001; Loubser et al. 2008; Simek and Cressler 2005). Archaic ages, extending back as early as roughly 5000 B.C., have been obtained for both open-air pictographs and dark-zone cave sites; the Jeffers site is inferred to be even earlier (see also Steinbring 1999, 2010, for another possible example). The majority of the relative and directly dated art, however, was created during Woodland and especially Mississippian times—during the last 2,000 years, in other words.

NORTHERN WOODLANDS

Literature

Rock art of the Northern Woodlands or Canadian Shield only occurs in a narrow band of the continental U.S., in Maine and northernmost Michigan and Minnesota. The majority of the literature on this art, accordingly, concerns Canadian sites. Exemplary of this fact are the most significant early studies. These were published by Dewdney (1970; Dewdney and Kidd 1967), and Vastokas and Vastokas (1973). The Vastokas' research focused on the Petersborough, Ontario, petroglyphs, and emphasized ethnographic interpretation in the context of religious beliefs and practices, and is still very influential. The importance of ethnography to rock art interpretation has continued in the more recent monographs of Conway and Conway (1990), and Rajnovich (1995); graduate dissertations of Norder (2003), Weeks (2009), and Zawadzka (2008); and papers of Arsenault (2004) and Norder (2012; Norder and Carroll 2011), among others.

Description

Northern Woodlands rock art, with some important exceptions, is primarily monochrome painted. Common motifs include humans, often with upraised arms and hands, sometimes with round mask-like faces, and with a variety of body types, including stick-figures, and ovoid and hourglass-shaped torsos. Some anthropomorphs have headdresses of various kinds and/or drums; and vulva forms and phallic males have also been identified. Birds, including thunderbirds and stork-like birds, are common, as are snakes, turtles, lizards, miscellaneous quadrupeds, various tracks, and "mythological" animals (Figure 29). Geometrical motifs are present, though typically not in great numbers. In addition to headdresses and drums, material cultural representations emphasize canoes, often with human occupants. A key characteristic of the Northern Woodlands pictograph sites is their placement on the landscape. This is commonly on vertical or nearly vertical cliff faces that front lakes or river courses. In Maine, in contrast, incised and fine-line incised petroglyphs are found, often on horizontal bedrock exposures (Figure 30).

Substantial ethnographic research has been conducted on the Northern Woodlands art, in part based on comparisons with the pictography of Ojibwa birch bark scrolls, including those of the *Mide* cult, or "Great Medicine Society," which involved healing and the quest for individual spirit power. Ethnographic accounts and iconographic comparisons indicate that certain sites were made by *Mide* shamans during their vision quests and manipulations of supernatural power, with the art portraying spirits that resided inside the rock art site, as well as shamanistic events and circumstances.

Chronology and Period of Significance

Although no chronometric dating has occurred, Northern Woodlands is believed to date to the last 2,000 years. Historical motifs and ethnographic accounts verify that it continued to be made into recent times.



Figure 29. Agawa pictograph site, Ontario, Canada (Northern Woodlands). Canoe with humans on left; mythic creature on right; snakes below.



Figure 30. Incised geometric petroglyph, Bedford, Maine.

HAWAI’I

Literature

Despite some early historical anecdotes, relatively little research has been conducted on Hawai’ian Islands rock art. McBride (1969) wrote an early short monograph, and Cox and Stasack (1970) published the first synthesis. This was expanded and updated by Lee and Stasack (1999), following a major site recording and documentation project. Both syntheses focus exclusively on petroglyphs.

Description

Hawai’ian rock art overwhelmingly consists of petroglyphs, with just a handful of red pictograph sites on a few of the islands. Petroglyph sites range in size from less than a dozen to thousands of motifs, and occur in a variety of contexts: caves, open lava flows (especially *pahoehoe* lava), along trails, and, in a few cases, on constructed ceremonial *heiau* (altars/temple platforms). Motifs emphasize humans, zoomorphs, material cultural items, and cupules and other geometric patterns. Anthropomorphs have body shapes ranging from stick figures, to ovoid, to triangular-torsoed (Figure 31). Many of these have specific arm and leg postures, potentially related to ceremonial *hula* postures (Whitley 2004c). Zoomorphs consist of dogs, pigs, chickens and other birds, and lizards. Marine motifs are (somewhat surprisingly) relatively rare, and are typically limited to turtles, fish, and octopuses. Illustrated material-cultural items include both traditional and historical (Euro-American) objects. In the first category are canoes, fishhooks, fish traps, paddles, *poi* pounders, adzes, and ceremonial objects. Historical objects include ships, anchors, guns, horses, churches, and lettering/script, among other things. Geometric designs range from parallel lines to zig-zags, various circle designs (Figure 32), spirals, semicircles, and other such images, including cups and rings.

Lee and Stasack (1999) have identified an important locational pattern involving rock art motifs. Sites associated with trails emphasize circles, cupules, and other geometric designs. Sites not directly associated with trails, in contrast, contain greater numbers of representational images. These same authors have also concluded that Hawai’ian rock art is primarily religious in origin and nature, despite the fact that it sometimes depicts objects that, to Eurocentric eyes, may seem secular in nature. Although the specific meaning of most individual motifs remains unknown, it is clear that the art is religious in emphasis: “We can state that petroglyph sites were *wahi pana* (legendary places), many are manifestations of belief and power, prayer and offering, made by ritual experts, *kahuna*, in the process of working magic and offering prayers” (Lee and Stasack 1999:158).

More specific ethnographic information exists concerning cupules—small ground cups, known as *poho*—and cup and rings, which are common at many sites, and this provides an understanding of one of the ritual uses of petroglyph sites. At Pu’uloa, a major site on the island of Hawai’i with over 23,566 recorded motifs, for example, cupules constitute fully 70 percent of the assemblage total (Lee and Stasack 1999), and as much as one-quarter of the assemblage at other sites (Whitley 2004c).



Figure 31. Anthropomorphic and geometric petroglyphs, Island of Hawai'i.



Figure 32. Cup and ring and circular petroglyph motifs, Island of Hawai'i.

A series of early accounts link the *poho* to the child's umbilical cord, or *piko*. According to Beckwith's mid-twentieth-century summary (1970[1940]:89-90; cf. McBride 1969:35), cup marks surrounded by one or two rings "are used by the old Puna people as depositories for the child's navel cord. The subject has been studied by Baker, Stokes, Ellis, and mentioned by Dibble" (Beckwith 1970:89).

The purpose of this ritual act was to ensure the long life and health of the child. A stone would be placed over the cupule to ensure that the umbilicus was not removed by a bird or rat. One use of some Hawai'ian rock art sites, then, was in a private ritual, conducted by mothers, following the birth of their child. The implication is that the sites were places of power, and placing the umbilicus at these locations was essential to the child's well-being.

Chronology and Period of Significance

Hawai'ian petroglyph-making appears to represent a tradition that was brought to the islands by the first migrants as part of a pan-Polynesian tradition (Lee and Stasack 1999). Although there is controversy surrounding the earliest migration date, it likely occurred sometime between A.D. 300 and 500. The earliest rock art dates to roughly that time. Based on the analyses of Lee and Stasack (1999), stick-figure humans are more common at the earlier sites. Beyond that observation, Lee and Stasack identified a phase with triangle-torsoed stick-figure humans from approximately A.D. 1400 to 1600. This was followed by human figures with pronounced musculature, perhaps representing warriors or elite. The sequence is capped by sites and panels with copper-plate lettering, dating from the nineteenth century.

6. ASSESSMENT OF DEPARTMENT OF DEFENSE ROCK ART RESOURCES AND MANAGEMENT

CHAPTER SUMMARY

- Roughly 5% of DoD facilities have rock art sites
- Where present, rock art sites typically represent 1-2% of the archaeological record
- Total number of rock art sites within a DoD facility can vary from none to hundreds of sites
- 23% of surveyed installations with rock art have one or more NRHP or NHL listed rock art site
- Conflicts with defense mission needs are rare
- Facility security requirements appear to have benefited site preservation
- Few rock art sites overall have completed condition assessments

A primary goal of this project is an assessment of the rock art resources and management approaches on DoD facilities in the United States. This required establishing the nature and extent of rock art sites on DoD lands, and the identification of ongoing DoD rock art site management programs and methods. The intent is to evaluate the appropriateness of these approaches and to make recommendations concerning management issues that may be common to multiple facilities.

This chapter starts with a description of the assessment methodology, followed by its results. Recommendations for improving the cost effectiveness of ongoing DoD rock art management approaches are provided in the concluding chapter.

ASSESSMENT METHODS

The assessment included three steps:

- *Identification* of facilities with rock art sites;
- *Survey* of the number and nature of rock art sites and management approaches on identified facilities, using a standardized questionnaire; and
- *Case studies* involving detailed follow-up interviews with selected facility CRMs, to obtain more specific information on management approaches and problems.

Each of these is discussed below.

Facility Identification

The identification of facilities with rock art sites and the acquisition of information about them proved more difficult than expected. In part this was due to the fact that there is no central tabulation of DoD cultural resources, nor is there an available compilation of CRM/BHPO contacts (i.e., accessible by a civilian contractor without security clearance). In order to obtain the information required for the assessment, accordingly, a mixed data collection strategy was employed. This involved, first, a review of the existing rock art literature. In certain cases, studies of DoD facility rock art sites were available in either the professional (e.g., Grant 1968) or unpublished “gray” literature (e.g., Altschul et al. 1993). Included in the gray literature is a previous DoD Legacy grant study which assessed rock art sites on DoN LANTDIV installations along the east coast (Meighan and Williams 1997). This proved especially valuable with respect to that specific region. Where available, these sources were consulted to identify rock art sites on individual facilities.

An effort was also made to identify facilities with known rock art sites, second, and obtain contact information for their respective CRMs, by soliciting information from members of the Society for American Archaeology Rock Art Interest Group. This group has approximately 700 members and includes all of the active professional archaeologist-rock art researchers in the country. Because of the rock art sites knowledge of this group, this process proved to be the most effective and efficient means for acquiring broad-scale data on facility resources and staff.

Third, DoD facility CRM contact information was identified, where possible, using installation web-pages on the worldwide web, typically yielding telephone contacts. There are currently over 300 DoD facilities within the U.S. Obtaining CRM contact information on all of these would have been prohibitive from the perspective of time and cost, hence an installation selection procedure was followed. This was intended to yield information most useful for understanding the nature of rock art resources and management within U.S. DoD facilities. Although facilities from all regions in the U.S. were included in the assessment, the selection process involved soliciting information primarily from facilities that met a series of key variables. These are:

- Size, emphasizing larger installations (e.g., with roughly more than 2,000 or more acres of land), thereby enhancing the possibility of containing a wide array of cultural resources;
- Location and context, with coastal and urban installations generally (though not entirely) excluded, because of their lower probability of containing rock art sites; and
- Existing knowledge of rock art sites on specific facilities, or affirmative knowledge of the absence of sites therefrom.

In certain cases, fourth, contacted CRMs provided information about rock art sites on other facilities, including the contact details for those installation’s CRMs. The National Register of Historic Places (NRHP), finally, was also consulted in order to help identify NRHP-listed rock art sites on DoD properties.

The CRMs for a total of 60 DoD facilities were contacted (Table 8), representing (very roughly) 15% of the installations within the 50 states. The majority (38) of these was contacted by phone

in an initial effort to identify facilities with known rock art sites, and to obtain email addresses for the survey questionnaire (discussed below), if sites were present or suspected present. The remainder was contacted by email and, in certain bases, by both phone and email. Multiple efforts (repeated phone messages and/or emails), where necessary, were made to contact CRMs at installations with known rock art sites in the hopes of obtaining responses from them.

Responses were obtained for 20 DoD installations, either by phone or questionnaire, representing 33% of the sample. Although responses were not received for all installations with rock art, sites are known to be present on twenty-three facilities, and 11 were verified as not having rock art sites present. No information could be obtained for the remainder. Lack of responses appears to have resulted for four potential reasons: the attempt to contact the facility CRM was unsuccessful (e.g., phone number no longer in service or phone never answered); the CRM was too busy to respond; the CRM did not receive authorization from command to respond; or, probably in certain if not many cases, no response was received to messages left because no rock art sites are present at the installations.

Table 8. Contacted DoD Facilities

Facility	Nature of Contact	Comments
Tooele AD	Phone	Known site. Left multiple messages, no response.
Yakima TC	Phone & email	Known sites. No response.
Arnold AFB	Phone	No response.
Cannon AFB	Phone	Left message, no response.
Ft Drum	Phone	Verified no sites.
Ft Eustis	Phone	No Response.
Ft Knox	Phone	Verified no sites.
Ft Rucker	Phone	Left message, no response.
Holloman AFB	Phone	Left message, no response.
Ft Greely	Phone	Verified no sites.
Ellsworth AFB	Phone	Verified no sites.
Offut AFB	Phone	Verified no sites.
Miramar MCAB	email questionnaire	Verified no sites.
Ft Lewis-McChord	Phone	Verified no sites.
Pope AFB	Phone	No response.
Malmstrom AFB	Phone	No response.
Lackland AFB	Phone	No response.
Kirtland AFB	Phone	No response.
Wright Patterson	Phone	No response.
Trinker AFB	Phone	No response.
Ft Benning	Phone	Left message, no response.
Elmendorf AFB	Phone	Left message, no response.
Fairchild AFB	Phone	No response.
Edwards AFB	Phone & email	Phone response; single site.
Minot AFB	Phone	No response.
Ft Bragg	Phone	Left message, no response.
Ft Campbell	Phone	Left message, no response.
Ft Riley	Phone	Verified no sites.

6. Assessment of Department of Defense Rock Art Resources and Management

Facility	Nature of Contact	Comments
Ft Hood	Phone	Left message, no response.
Camp Lejeune	Phone	Left message, no response.
Ft McCoy	Phone	Left message, no response.
Ft Sill	Phone	Left message, no response.
Ft Stewart	Phone	Left message, no response.
Ft McClellan	Phone	Left message, no response.
Ft Jackson	Phone	Left message, no response.
Camp Navaho ANG	Phone	Left message, no response.
China Lake NAWS	Phone & email	Questionnaire & interview. Multiple sites.
Ft Irwin	email questionnaire	Known sites. No response.
Vandenburg AFB	Phone & email	Questionnaire & interview. Multiple sites.
Luke/Goldwater AFB	email questionnaire	Known sites. No response.
Nellis AFB	Phone & email	Questionnaire & interview. Multiple sites.
Camp Guernsey WNG	email questionnaire	Known sites. No response.
MCGACC 29 Palms	email questionnaire	Known sites. No response.
Yuma PG	email questionnaire	Questionnaire; 19 sites.
Ft Carson	email questionnaire	Known sites. No response.
Pinon Cyn TA	email questionnaire	Known sites. No response.
White Sands MR	email questionnaire	Known sites. No response.
Ft Bliss	email questionnaire	Known sites. No response.
Camp Pendleton	email questionnaire	Known sites. No response.
Ft Hunter-Liggett	Phone	Known site. Left message, no response.
Ft Huachuca	Phone	Known sites. No response.
Ft Leonard Woods	Phone & email	Questionnaire & interview. Multiple sites.
Barstow MCL	email questionnaire	Questionnaire. One site.
Pohakuloa TC	Phone & email	Questionnaire. Multiple sites.
Makua MR	Phone & email	Questionnaire. Multiple sites.
Dillingham MR	Phone & email	Questionnaire. No sites.
Kahuku TA	Phone & email	Questionnaire. No sites.
Kawailoa TA	Phone & email	Questionnaire. No sites.
Schofield East & West	Phone & email	Questionnaire. Multiple sites.

Note that the facility identification process intentionally excluded DoD installations that, based on previously existing knowledge, were known to not contain rock art sites. These included the LANTDIV installations previously assessed by Meighan and Williams (1997), to cite one example, as well as a series of facilities in the far western U.S. that were known to lack this type of cultural resource. The statistics resulting from the identification process, as a result, should not be construed as indicative of the overall prevalence of rock art sites on DoD lands nationally. They instead reflect a focused study directed at those facilities that were known to have, or suspected to potentially contain, rock art sites.

Survey of Installations with Rock Art Sites

A standardized questionnaire (Appendix A) was emailed to the CRMs responsible for site management on 24 installations. (In some cases, single CRMs are responsible for the

management of multiple installations, based on command structure; e.g., US Army Garrison Hawai'i has a centralized cultural resources office that covers six installations.) This questionnaire solicited information on the number of rock art sites present on each installation; the sites that are NRHP or NHL listed; and the numbers that are documented and/or that have completed condition assessments. CRMs were also asked to describe existing site management practices, including the existence of a rock art management plan, any recognized management and preservation issues, and any conflicts between site management and installation missions. A series of definitions of terminology were included with the questionnaires, following those provided above, to ensure standardization in the responses.

Completed questionnaires for 13 installations were returned, reflecting a response rate of 50%. Nine of these facilities contain known rock art sites; the remaining four lack these kinds of resources.

Case Studies

Follow-up phone interviews were conducted with the CRMs from four installations to provide more detailed case studies of the nature of DoD facility rock art resources, the management approaches that are being currently employed, and the kinds of issues and concerns, if any, that exist. These installations are: China Lake NAWS, California; Vandenberg AFB, California; Nellis AFB, Nevada; and Ft Leonard Woods, Missouri. The project principal investigator had previously visited rock art sites at the first two installations.

ASSESSMENT RESULTS

The assessment results are best discussed in terms of the three processes involved in the study: identification, survey, and case studies.

Identification Results

A total of 23 DoD facilities were identified as having one or more rock art sites present. This suggests that rock art is present at (very roughly) 5% of the DoD facilities nationally. As noted above, however, the process of identifying installations with rock art sites strictly was not systematic, and the results do not necessarily provide an estimate for the commonness of these kinds of cultural resources on DoD facilities. (More likely is the possibility that this figure slightly underestimates the actual percentage of facilities with rock art.) That said, some general comments about the DoD-wide distribution of rock art sites can be made, based on a review of the existing North American rock art literature, including published and unpublished reports on DoD sites, and the survey results. As a general but well recognized national/continental trend (Grant 1967; Wellman 1979), first, rock art sites are much more common, overall, west of the Mississippi River, especially from the Rocky Mountains westward, and on the Hawai'ian Islands, than east of the Mississippi. Indeed, although a series of eastern US installations were contacted during the identification process, no DoD sites are known to be present in this region, confirming the results of the earlier Meighan and Williams (1997) assessment of east coast LANTDIV facilities.

For obvious reasons, second, rock art sites require the presence of rocks—boulders, cliff faces, caves and rockshelters (e.g., Meighan and Williams 1997). The distribution of these lithic exposures is not ubiquitous, either regionally or continentally, and this circumstance likewise affects the prevalence and distribution of rock art sites. Although exceptions always can occur, facilities in physiographic contexts that lack rock exposures, such as alluvial plains and deltas, are much less likely to contain rock art sites than installations that include these kinds of geological contexts.

There is also patterning in the association between rock art sites and coastlines, third, following regional patterns. Again, despite an occasional exception and contingent on the presence of suitable rock exposures, coastal or near-coastal rock art sites are most common in the Pacific Northwest (where they are especially common), Hawai’ian Islands, and the northeastern US. Outside of these regions, coastal installations, including DoN port facilities, therefore have a low probability of containing rock art sites.

As is generally understood by archaeologists, and as the questionnaire survey results demonstrate, fourth, rock art sites are typically not common components of the archaeological record, even when present in a region. Based on the completed questionnaires, rock art sites represent from 0% to about 10% of the recorded archaeological sites at DoD facilities but, typically, are less than roughly 1 – 2% of the site totals (cf. Whitley and Whitley 2012). Notably, the high proportion of rock art sites documented for two of the surveyed installations—China Lake NAWS and Nellis AFB—are very unusual, and reflect the fact that both facilities are located in a region containing the highest density of rock art sites in North America, if not one of the highest in the world. Probably more typical are the Hawai’ian installations, where rock art sites represent about 2% of the record; Ft Leonard Wood, 1.5%; and Vandenberg AFB and Yuma PG, at about 1%. But in part because of their relative rarity, rock art sites represent cultural resources requiring special management attention and methods.

Survey Questionnaire

Completed questionnaires from CRMs representing thirteen facilities were received, nine of which contain rock art sites (Table 9). These are discussed below in terms of a series of key topics.

Table 9. Returned CRM Questionnaires

Facility	# Sites	# Documented	# Condition Assessments	Comments
Vandenberg AFB	14	14	14	Award-winning management/conservation program
China Lakes NAWS	~480	see comments	2	NHL district; major canyons & some smaller sites documented
Nellis AFB	~300	none	none	Management emphasis: inventory & Native American consultation
MCLB Barstow	1	1	1	First published petroglyph site in California
Makua MR	10	10	none	Managed using passive preservation
Pohakuloa TA	7	7	none	Managed using fenced exclusion zones
Schofield	18	18	none	Mission conflict: Will bury petroglyph boulders after 3D recording

Facility	# Sites	# Documented	# Condition Assessments	Comments
Ft Leonard Wood	6	6	none	Management involving monitoring and access control
Yuma Proving Grounds	19	4	4	Site total includes 2 geoglyphs; passive preservation

Number and Nature of Sites: As noted above, the nature and number of sites varies widely. Total numbers of sites ranged from one to about 480 for those facilities with rock art sites. But these numbers need to be qualified because the nature of a rock art “site” itself varies regionally, in some cases quite significantly. Most commonly, rock art sites consist of one or at most a few panels (e.g., Vandenberg AFB). Rock art panels, furthermore, can constitute components of larger archaeological sites and thus represent only one aspect or feature of more complex cultural resources (as is the case, e.g., with a number of sites on Nellis AFB). In contrast, the Coso Range, within China Lake NAWS, has the densest and largest concentration of petroglyphs in North America, and one the biggest in the world. Petroglyphs, in some cases, are present along basalt canyon walls that, literally, stretch for miles. The definition of a rock art “site,” in this instance, is problematic (or at least not self-evident), and may represent just a contemporary clerical rather than a prehistoric behavioral distinction. It is difficult to equate or compare one of the major Coso canyons with sites on other installations.

This definitional issue might appear to be primarily a problem for site tabulation and resource accounting, but in fact it has significant implications for management. While the documentation of a site (or a condition assessment on it) with just a handful of panels is a relatively straightforward enterprise, from the perspective of time and cost, the same, using equivalent documentation standards, at one of the major Coso petroglyph canyons would require a massive outlay of resources (regardless of how that canyon may be divided into “sites”). In this case either an expedited documentation process, or a sampling strategy, would likely be required.

There is, thus, a wide range of variation in the numbers of rock art sites on DoD installations nationally, with the nature of these sites likewise varying substantially. These variables appear to follow more general regional trends in rock art density, site size and distribution. The two primary patterns are the following. Rock art sites, first, tend to be most common in regions that have long records of occupation by hunter-gatherer groups (primarily but not exclusively far western North America). Sites themselves, second, are not ubiquitous across the landscape, but tend to cluster into relatively distinct geographical patches. The rock art on China Lake NAWS is an extreme example of this tendency. Rock art sites east of the Mississippi, third, are rare relative to the remainder of the 50 states.

Condition Assessments: To date, very few condition assessments have been completed for rock art sites on DoD installations, with the completion rate varying widely between facilities. Assessments have been completed for all 14 sites on Vandenberg AFB; two of the sites within China Lake NAWS; four sites at Yuma PG; and at the single site on Barstow MCLB. Condition assessments are required to efficiently identify preservation issues, as well as to allocate management resources. Given the rarity of these studies, and their importance for the efficient allocation of resources, the completion of rock art site condition assessments is recommended for DoD facilities.

Management Planning and Approaches: Management approaches also vary from facility to facility, in part reflecting local circumstances and the nature of the resources present. China Lake NAWS has a stand-alone rock art management plan; Yuma PG has a management plan for one portion of the installation that includes four of its rock art sites; and most of the other facilities include rock art management within their ICRMPS.

Management approaches typically involve some combination of passive preservation, site monitoring, and the use of exclusion zones and/or fencing. In one case, no access is allowed to the facility ranges whatsoever, due to security concerns, and sites are managed using passive preservation. Another facility, which allows seasonal hunting, has placed most of its sites in exclusion zones but regularly monitors the one site that is open to the public, following the hunting season. Other facilities have occasional, controlled visitation. Overall, site access is predicated on general installation security and access concerns and hence is well-controlled.

Approaches to site protection, beyond general control of facility access, also vary. In one instance, where the rock art is in caves, the entrances to these features have been closed. Rock art at another installation is protected by fencing, whereas a third installation has removed previous fencing to enhance the visitor experience. Exclusion zones at a number of installations are created for both archaeological and endangered species issues. These can be established, signed and/or fenced as general exclusion areas, accordingly, without revealing sensitive cultural resources information.

Two installations have implemented somewhat unique approaches to site management. A small painted panel at Vandenberg AFB is located in a low rockshelter that, previously, had restricted accessibility, due to a thick (85 cm deep) cultural deposit. Data recovery of the entirety of the deposit, conducted in consultation with the local federally recognized tribe, has made the panel much more accessible and visible to visitors, allowing them to view the panel without hazard to the pictograph. For reasons discussed below, Schofield Barracks will be burying 18 petroglyph panels, following 3-D documentation, as a form of preservation.

In all cases, active Native American consultation is occurring at the facilities. In some cases, as discussed below, this is based on long-term relationships with federally-recognized tribes.

Very limited numbers of facilities have rock art sites that are NRHP/NHL listed. Based on the returned facility questionnaires, only China Lake NAWS has taken the step of listing sites, in this case resulting in an NHL district. More broadly (i.e., beyond the returned questionnaires), five additional installations with known rock art have NRHP listed sites. This represents a 26% listing rate for the 23 facilities with known rock art. Instead of NRHP evaluation, nomination and listing, facilities are typically assuming NRHP eligibility for their rock art sites, and managing them accordingly.

Management Issues: Management issues likewise varied, depending upon the nature and quantity of a facility's rock art sites, combined with specific defense-mission requirements. Conflicts with mission needs are currently not common or widespread, with the exceptions of Makua and Schofield Barracks. At Makua, in addition to creating site exclusion zones, left and right live-fire parameters have been established to ensure that the sites are not damaged during

training. The circumstances are more complicated at Schofield Barracks. Following consultation with Native Hawai'ians, eighteen petroglyph boulders will be buried after 3-D documentation, to accommodate training needs and prevent damage to the art. Generally, however, rock art site protection can be accommodated despite facility defense mission requirements. The generally large size of most installations likely facilitates this outcome, allowing for the establishment of exclusion zones and the shifting of activities away from sensitive areas. Areal constraints are much greater on the Hawai'ian installations, however, probably contributing to the conflicts at those locales.

Natural degradational problems have been observed at Vandenberg, Yuma PG, Makua, Ft Leonard Wood, and China Lake. Typically these involve natural weathering. In an extreme case at Makua, a sandstone petroglyph boulder is weathering rapidly; Native Hawai'ians have requested that this process be allowed to continue unimpeded, without conservation intervention. This reflects the previously documented fact that attitudes about the appropriateness of preservation and intervention may vary culturally (Whitley 2001b), with some groups favoring complete preservation and others preferring to allow sites to naturally decay. Partly for this fact, consultation with stakeholders is recommended as an essential step in resource management. Vegetation issues (abrasion from limbs; potential wildfire hazards) specifically are acknowledged at Vandenberg AFB. A vegetation management program periodically thins or removes brush to prevent this kind of potential damage to pictographs at that facility.

Human vandalism is not generally a current problem, although older graffiti is present at China Lake NAWS, Vandenberg AFB, Barstow MCLB and Ft Leonard Wood. Inadvertent encroachment on sites was cited as an occasional problem at Yuma PG, and a recent paint-ball incident occurred at one of the Ft Leonard Wood sites, although this did not directly impact the art. The security and access control required for DoD installations appears to help control these kinds potential adverse effects, and keeps them to a minimum.

The authenticity of a possible geoglyph (intaglio) at Yuma PG is a final, unusual management problem. This feature is located in the middle of a World War II training area and, like a few other such features in the California Desert, may have resulted from military groundsurface disturbance, or may be aboriginal in origin (Whitley 1996).

Case Studies

Follow-up phone interviews were conducted with the CRMs or Resource Chiefs at four facilities, to obtain greater details about management approaches and concerns. These are China Lake NAWS (Michael Baskerville); Vandenberg AFB (Robert R. Peterson, Jr.); Nellis AFB (Keith Myhrer); and Ft Leonard Wood (Stephanie Nutt and Thomas Glueck). These interviews are summarized below; common issues and concerns for all of these installations are discussed in the final chapter.

China Lake NAWS, CA

The circumstances with respect to China Lake rock art are unusual because it contains the largest concentration of rock art in North America, a major portion of which has been designated as the Coso Rock Art NHL District—one of only three rock art NHLs in the country, making China

Lake the only DoD facility with a rock art NHL. The majority of the art within the installation consists of petroglyphs, but occasional pictographs and geoglyphs are also present.

Uniquely among DoD facilities, China Lake has a stand-alone rock art management plan for its NHL district. The need for this plan results from the size, complexity and widely acknowledged international significance of its rock art. This has resulted in global visibility, with management issues and preservation concerns not experienced by other facilities. The China Lake management plan includes conservation, visitation, education, and research components, and is similar to the model plan outlined above. Development of the plan included consultation with all pertinent stakeholders, including a series of workshops with Native American tribes and organizations.

Public demand for visitation to the Coso petroglyphs is, and historically has been, very high, and the visitor strategy is a significant component of the management plan. Three primary groups are interested in visiting the sites: Native Americans, researchers, and the public. Native American and researcher visitation is handled on an individual request basis. Demand for Native American visitation involves not only the petroglyphs, but also Coso Hot Springs, a separate NRHP district. The hot springs district is widely acknowledged as one of the spiritually most powerful springs in the western Great Basin; it figures in Numic mythology (“The Race to Coso Hot Springs,” recorded by a number of ethnographers); and shamans traveled from as far as northeastern Utah to conduct rituals at this locale (Whitley et al. 2006a). It continues to be used for healing and prayer. Although the hot springs district was listed in 1978 for its connection to historical events and research values, it would likely currently qualify as a Traditional Cultural Property due to its continuous documented use by Native Americans for healing purposes and prayers (Brooks et al. 1979). A single staff archaeologist is assigned to coordinate all Native American visitation requests, to both districts.

The current Native American visitation program is working effectively, and largely to the satisfaction of the tribes. These include a number of federally recognized Shoshone and Northern Paiute Bands, as well as affiliated but unrecognized tribal organizations from the region. In part this success results because of the coordinated request process (channeled through a specific staff member), and the ability to accommodate the majority of the desired visits. Periodic communication with the tribes, including meetings with the commander, has also helped develop an understanding of potential conflicts between mission requirements (especially the range testing schedule) and visitation, resulting in a recognition of the need to make the requests far enough in advance so that potential conflicts can be avoided (e.g., by changing the visitation date). There are, however, some tribal requests that currently cannot be accommodated, due to safety and security reasons. These include overnight visits, and travel to the petroglyphs alone for rituals, without outside observers. In the last case, Native American visits are now planned on days when other public tours will not occur, but an official tour guide still must be present (although staying in the background and avoid being intrusive on the ceremonies).

An existing visitation program, conducted in collaboration with a local museum, takes approximately 600 members of the general public to one of the main rock art sites, Little Petroglyph Canyon, per year. Because of potential inclement weather and road conditions, these tours are only conducted in the Spring and Fall, and they are almost invariably fully-booked.

Were logistical circumstances different, public demand for these tours would likely double the visitation to this site. The resulting heritage tourism is estimated to generate over \$400,000 per year for the local civilian economy in hotel rooms, gasoline, meals and purchases at the museum gift shop, hence access to the rock art is an important aspect of community relations for the facility. School tours and visits by journalists and film-makers, as separate components of the public visitation program, are arranged through the Public Affairs office.

The current public visitor restrictions include the requirements that:

- ♦ All visitor groups must check-in and –out with the China Lake Police Department, Range Control, and/or a security gate;
- ♦ All visitors must be accompanied by guides/designated facility personnel;
- ♦ Non-U.S. citizens are not allowed on public tours;
- ♦ Camera use is restricted to Little Petroglyph Canyon;
- ♦ Vehicle use is limited to existing roads;
- ♦ Visitors must stay off the canyon walls and rocks (and thus off of petroglyph panels); and
- ♦ With the occasional exception of official visitors/tours, public visitation is limited to a single site, Little Petroglyph Canyon.

Currently there are a parking lot, outhouses and sheltered picnic area for visitor use at the top of this canyon. At the request of a local Native American tribe, a removable plastic walkway has been emplaced from the parking lot to the top of the canyon, to facilitate visitation by elders. No other infrastructure has been placed at the site, however, including within the petroglyph canyon itself.

There are positive and negative aspects to this lack of infra-structure. On the positive side, this retains the natural setting and feel of the site area which, as noted previously, is an important value for many visitors (including Native Americans). On the negative side, the canyon is rugged and, in certain areas, very rugged. The lack of a walk-way or improved paths prevents some individuals from entering the canyon, and restricts a large proportion from visiting the entirety of the site. While the plastic pathway to the top of the canyon was constructed to provide at least a view-point for the less-mobile or disabled, there is no simple solution to the question of infrastructure within the canyon. Which stakeholder value is more important, the natural setting, or ease of access? This emphasizes the fact that management decisions often involve compromises, and should be based on careful consultation with stakeholders.

The educational component of the China Lake plan is partly tiered-off the existing program of museum tours, which include a brief introductory film. Other aspects of the educational component of the plan are being implemented this year, and will likely include an educational kiosk near the parking lot, brochures and an updated film.

The emphasis in the research component of the plan is non-destructive studies and analyses. More research has been conducted on China Lake's Coso petroglyphs than the rock art at any other DoD facility, with publications on the corpus dating as early as the first-half of the last century (e.g., Steward 1929), and at least two Ph.D. dissertations addressing the Coso rock art (

Hillebrand 1972; Whitley 1982). Indeed, the Coso petroglyphs arguably may be the best-studied rock art in North America, and are internationally renowned partly as a result of that fact.

Beyond the NHL district, China Lake rock art sites are managed passively, although condition assessments have been completed on two of these sites, due to their visibility from existing roads. NRHP evaluations and nominations are considered essential to the program, because funding is partly based on the numbers of these completed yearly.

Although vandalism (in the form of graffiti and petroglyph panel theft) occurred previously, this has been essentially stopped through visitor control and education. Mission activities are restricted within the boundaries of the NHL district and no recent mission conflicts have developed. The current preservation of the Coso petroglyphs, in fact, has been widely acknowledged as resulting from their location within a DoD facility with controlled access (Bahn 1998; Meighan 1998).

Ft Leonard Wood, MO

This installation is the easternmost identified DoD facility with rock art and, unlike most rock art sites on western DoD installations, the art at this facility is found within caves. Ft Leonard Wood has six rock art sites, all of which have petroglyphs, with one including pictographs. All of the sites have been documented, but no condition assessments have been completed.

Five of the six sites have restricted access (gated cave openings). Entry control was created for NAGPRA purposes (which includes sacred artifacts and items of cultural patrimony, as well as burials and funerary objects). The facility consults with five federally recognized tribes, with the local Osage providing the most active involvement.

The sixth site is a well-known and accessible cave, with no visitation restrictions (i.e., to individuals with facility access, including recreational access). Management issues have resulted from visitation during the hunting season, including graffiti and a paintball incident at a site two years ago, though these did not damage the art itself. Management for this resource has involved periodic monitoring (every 6 to 8 weeks), including increased monitoring before and after hunting seasons, and increased frequency of game warden patrols. A damage assessment and ARPA violation report are completed for vandalism incidents.

The site monitoring plan is included as a component of the facility's ICRMP. No conflicts with the installation's mission have occurred.

Vandenberg AFB, CA

Fourteen rock art sites (primarily small pictograph panels) are present, fully documented, and have condition assessments at Vandenberg AFB. Essentially complete (~100%) inventory coverage of the approximately 100,000 acres facility has occurred. This has included surveys specifically of rocky areas that might have rock art sites, and which resulted in the identification of small but previously unknown painted sites, making the discovery of additional sites highly unlikely.

Rock art has featured prominently in Vandenberg's cultural resources program, and the facility and staff have received a series of DoD awards in part based on this fact. The active rock art management program has been facilitated by a local contracting group that includes archaeologists with rock art specializations, and a trained rock art conservator. Substantial financial resources have also been provided to support the rock art management program including, in one year, roughly a half-million dollars.

The local consulting group has an ongoing base contract which has provided continuity in the management and treatment of the sites. The initial site documentation provided baseline data for subsequent periodic monitoring, which is ongoing. As technology has improved, the documentation and baseline data have been improved and upgraded (e.g., with the addition of GIS data), resulting in regularly updated state-of-the-art data on the status of the sites. Importantly, the baseline data included documentation of the older graffiti at the sites, thereby preventing a potential confusion of old graffiti as recent vandalism (as sometimes otherwise occurs).

A variety of different approaches have been employed to protect and manage individual sites, based on their specific characteristics and needs. As noted above, 100% of a rockshelter deposit was archaeologically excavated, following Native American consultation, to allow for easier and safer visibility of a panel at one site. Another site had been fenced with chain-link as protective measure, at least three decades ago. Although this served as a safe exclusion barrier, high chain-link fences are obtrusive and detract from a visitor's experience; among other things, they make photography difficult, as well as affect the site setting. This fencing was removed and a visitor registry box was placed at the site. These establish an "official" yet unobtrusive presence, and are a useful way to handle occasional rock art visitation.

Access to 13 of the sites is handled by the base Public Affairs office. The other site is in a remote area but only 5 meters within the installation boundaries, and there is no real way to control visitation to it, although no issues have developed as a result of this fact. A more formal access plan for all of the base sites is currently being developed.

Native American consultation has been simplified, in a sense, by the fact that there is only one federally-recognized tribe in the region, the Santa Ynez Chumash. Consultation and coordination with their Elders' Council have been ongoing for over two decades, and this continuity and long-term involvement has contributed to a productive working relationship. Native Americans are allowed access to the base for religious purposes, plant gathering, and hunting.

No conflicts between Vandenberg's mission requirements and rock art sites and management have occurred.

Nellis AFB, NV

Nellis AFB and the Nevada Test and Training Range cover approximately 3 million acres, making this the country's largest DoD installation. The facility also has the strictest military security in the US, effectively eliminating visitor access and issues (with the exception of Native Americans; see below). Inventories have covered approximately 5% of the 3 million acres, resulting in the recording of about 2,800 sites. The current rock art site total can only be

estimated because pictographs and petroglyphs on the facility are commonly present as one or more panels within larger, multi-component sites. While the site recording process includes information on the presence or absence of rock art, resources are not defined as “rock art sites,” per se, in the site files; and these files are currently still in the process of being digitized. The total number of sites with rock art components cannot yet then be easily tabulated, but is estimated at about 300, representing a high proportion of all of the facility’s cultural resources. If the entirety of the installation were surveyed, it is further estimated that roughly 1,000 sites would include rock art components. These include a mix of both petroglyphs and pictographs. It is worth noting that, despite this high proportion of rock art resources, the size and density of the Nellis rock art sites differ from those on China Lake. Nellis rock art typically represents a component of larger resources; the opposite is sometimes true within the Coso NHL at China Lake—other kinds of archaeological features and remains are smaller components of the (much) larger rock art sites. Hence there is a significant qualitative and quantitative (e.g., number of panels and motifs) difference in the nature of the rock art resources at these two facilities, despite the fact that they are relatively close geographically.

Nellis has one NRHP listed multi-component rock art site, Tim Springs (26CK2611). NRHP eligibility evaluations and determinations are not considered a management priority, however. All recorded sites are treated and managed as eligible, and additional NHPA Section 110 inventory instead is considered more important than Section 106 evaluations. This circumstance has been facilitated by the fact that the cultural resources program has consistently received strong financial support from command, not linked to Section 106 evaluations. Rock art site management is included as a component of the base ICRMP.

Rock art site management at Nellis emphasizes passive preservation and site avoidance. The effective absence of site visitation, and the nature of the installation’s defense mission justify this approach. The defense mission is flight testing and training, with minimal ground disturbance combined with land available for the relocation of proposed actions to avoid adverse effects. To date, no site documentations or condition assessments have been completed on any of the rock art. A study has been conducted on the potential effects of sonic booms on rock art sites, however (White 1998; White and Orndorff 1999). This concluded that noise impacts would be minimal.

This same study included a comparison between the general condition of two rock art sites within the base security perimeter, and two on unrestricted public (BLM) lands within the base’s overflight zone. The two BLM sites had less extant surface artifacts and more evidence of vandalism (graffiti) than the sites within the base boundary.

A key component of the Nellis cultural resources program in general, including rock art, is Native American consultation and coordination. The facility consults with a variety of federally-recognized Southern Paiute, Shoshone and Mojave tribes/bands. Ethnographic studies have been conducted periodically since 1996, both by installation personnel and outside consultants, and a 30 minute video has been produced. The emphasis overall is frequent, friendly and continual communication, rather than formal consultation. This includes periodic field-trips (at least yearly) by a working group to visit portions of the installation and discuss their sensitivity. It also includes the participation of tribal members as crew on all environmental inventories, including

wildlife studies, the authorship of a Native Americans perspective in each technical report and, in essence, their involvement in all environmental compliance issues.

The success of the Native American consultation program is based on a variety of factors, including open communication and collaboration, and long-term continuity in this process by installations' staff. Put another way, continuity in personal relationships between the tribes and the cultural resources staff has been especially important in developing good collaborative relations. A corollary of this circumstance is the conclusion that the sometimes frequent DoD personnel changes at facilities could make the Native American consultation process less effective.

During the consultation and coordination process, a common Native American perspective has been expressed, which problematizes certain management issues. This is the widely stated opinion that "everything is sacred." Despite the legitimacy of this viewpoint as a cultural belief, it is difficult if not impossible to reconcile with practical needs and land-uses, potentially including mission needs. During consultation and coordination, the Nellis cultural resources staff has gotten beyond this potential impasse by emphasizing more "sensitive mountains" and "areas." This has allowed the identification of locations that are particularly important to Native Americans while avoiding the cultural semantics of the term "sacred."

Because of the ability to alter the locations of proposed actions within the base, rock art sites have been successfully avoided and preserved, and no conflicts with mission needs have occurred.

7. SUMMARY AND RECOMMENDATIONS

Rock art sites are unusual, although not always rare, components of the prehistoric and Native American and Native Hawai’ian archaeological record. Although statistics are difficult to obtain, they occur at roughly 5 percent of the DoD installations within the 50 states. Rock art sites are most common in the western states, , and are probably present at the majority of the DoD facilities with large land-bases, from the Rocky Mountains to the Pacific. The nature and numbers of these sites per facility varies, ranging from one or a few to literally hundreds, with densities and totals reflecting larger regional patterns in rock art distributions. The southern Great Basin/Mojave Desert in general is particularly renowned for its rock art sites. This region includes a series of large U.S. Army, Navy, Air Force, and Marine training and test facilities, with moderate to large numbers of these resources predictably present on each. sites are also found on facilities in the Pacific Northwest, Midwest, Southwest, Great Plains, and Hawai’ian Islands. The management of pictographs, petroglyphs, and geoglyphs is therefore a widespread (though not universal) concern for DoD CRM programs.

The appropriate management of rock art sites differs in certain respects from the procedures and treatments that are commonly utilized for other components of the archaeological record. Rock art sites are usually more fragile than other site types. Their evaluation requires techniques that differ from those employed for the “dirt” archaeological record. They are visible and generate general public interest and visitation, which can result in vandalism and degradation. And rock art tends to be especially important to Native Americans, many of whom consider the sites sacred. All of these circumstances result in management issues, concerns, and problems that require special attention and approaches.

The following summary highlights the primary results of this DoD-wide assessment of rock art sites. It starts with the general status of rock art sites on DoD facilities. It turns next to issues and problems identified as pertinent and/or problematic at the studied installations. It concludes with some recommendations for increasing the cost-effectiveness and efficiency of DoD cultural resources programs with respect to rock art, while improving the sustainability of these particular kinds of cultural resources.

STATUS OF DEPARTMENT OF DEFENSE ROCK ART SITES

One clear outcome of this assessment is the fact that few conflicts have developed with respect to the preservation and protection of rock art sites, despite the defense mission of DoD installations. Occasional inadvertent encroachment on sites has occurred in one case. In another, live-fire parameters have been established to ensure that sites are not damaged by gun-fire or artillery. In a third, slightly unusual, case, petroglyph boulders will be 3-D recorded and buried, as a treatment approach that avoids future potential adverse effects to the art. Avoidance and preservation are by far the most common management methods, however, and these are typically achieved by changing proposed project locations. The large land-base of many DoD facilities easily accommodates these kinds of alterations in the locations of undertakings.

The general preservational status of sites on DoD facilities, relative specifically to the problem of vandalism, can (and has been) described as good to excellent. This results in part from the existence of the DoD installations and the kinds of access and visitor control that they necessarily entail. This has been acknowledged in print by the professional archaeological community (e.g., Bahn 1998; Meighan 1998). It has also been verified by a comparative study of sites on a DoD installation with unrestricted-access sites on public lands (White and Orndruff 1999). It can be intuitively recognized by visits to rock art sites on DoD versus other public lands (e.g., the Coso NHL District versus the nearby Black Mountain NRHP Archaeological District, both in the Mojave Desert). DoD stewardship of rock art sites, despite occasional minor difficulties and although qualified below, overall can be considered to have been beneficial to the preservation of these kinds of resources from human impacts.

DEPARTMENT OF DEFENSE FACILITY ROCK ART RECOMMENDATIONS

This assessment is recommending a series of management practices which will be useful to many, if not all, DoD installations with rock art sites. Perhaps the most applicable of these involves NHPA Section 106 compliance, and specifically, the evaluation of sites and potential nomination of them for NRHP listing, and the implications therefrom. As the assessment demonstrates, despite the fact that there is a DoD NHL rock art district, only a handful of sites are otherwise NRHP listed or have been evaluated for eligibility. Based on the questionnaires and case studies, very few facilities are conducting evaluations of rock art sites. The resources instead are typically being managed as NRHP-eligible. In at least one case, this explicitly reflects the prioritization of program management goals, with additional inventory considered more important than site evaluations. In a contrasting example, one program's yearly funding is partly based on the number of NRHP evaluations completed in a fiscal year. Eligibility evaluations are therefore prioritized, and are being regularly completed.

The general absence of NRHP evaluations has two implications. The first is that it signals a related failure to fully document rock art sites, beyond the minimal recording involved in the completion of site forms (as also generally documented in the questionnaires). Yet as the American Rock Art Research Association (ARARA) has emphasized:

[I]t is the first responsibility of site management to fully survey and document these cultural resources. Documentation should begin with the most vulnerable resources, but should also include a complete inventory, mapping and descriptive record of the remaining sites [ARARA 2001:4; cf. Mazel 2012:520].

The second issue concerns the implications of passive site preservation. The justification for passive preservation for rock art site management rests on two assumptions. The first is that rock art sites may be responsibly managed in the same manner as other aspects of the archaeological record, such as subsurface deposits. The second assumption, which underpins the first, is that site visitation is the only significant threat to rock art site integrity. The control of visitation, common to all DoD installations, thereby ensures site preservation, and no additional management concerns necessarily need be considered.

The belief that passive preservation is adequate for all rock art sites, however, is false, and contradicts contemporary site management methods, models, and experiences (e.g., Lee 1991; Loubser 2001; Dorn et al. 2008; Mazel 2012; Magar 2012). As outlined above, a variety of natural processes can degrade if not destroy rock art motifs and sites, in certain cases very quickly. To quote Swadley (2009:219) again,

“The single most important guiding principal to conserving and managing rock art sites is to become proactive instead of reactive to anticipated threats.”

While passive preservation may be appropriate as a site management approach at certain rock art sites, it is not adequate for all sites or circumstances. The proactive rock art site management program at Vandenberg AFB is an explicit acknowledgment of this fact. Working for over a decade with rock art archaeologists and a professional conservator, this facility has commissioned full documentation and condition assessments for its 14 rock art sites. It regularly updates its documentation to ensure that it is state-of-the-art. And it uses the resulting data-base to periodically and systematically monitor its sites. It has also developed site-specific management treatments for its sites, despite the fact that they are all being preserved.

No single management approach is appropriate, or adequate, for all rock art sites. Very generally, passive preservation is more likely to be satisfactory for petroglyphs rather than pictographs. But the long-term survivability of petroglyphs too will vary, for example based on the strength and integrity of the underlying lithic support. Basalt, to cite a specific case, is typically harder and denser than sandstone, which tends to weather quickly. But even the weathering rind of basalt may have experienced case-hardening, leading to spalling (Cervený 2005; Dorn et al. 2008). For that reason, some petroglyph panels on basalt are less stable than others on sandstone.

The management of rock art exclusively using passive preservation, without site documentation or condition assessment, is thus based on a contradiction. A condition assessment, itself requiring site documentation, is required to determine what type of management and conservation approach is appropriate for a given site. And site documentation is essential to monitor the condition of sites and conduct true adaptive management. Passive preservation—that is, management without documentation, monitoring, conservation interventions, or other preservation actions—may prove fully adequate as a management strategy. But this conclusion can only be established with documentation and monitoring, and following, not prior to, a condition assessment. Even within a single installation, the assumption that one management approach is necessarily adequate for all rock art sites is unwarranted, as international standards, and the Vandenberg AFB rock art program, demonstrate.

A second key issue for all facilities involves Native American or Native Hawai’ian consultation. As the assessment makes clear, tribal (including Hawai’ian) consultation and coordination are important to cultural resource programs, with increasing amounts of time and energy directed towards this activity. The dynamics of DoD-tribal relations differ from installation to installation. The dynamics are necessarily based on the kinds of federal actions common to that facility, the nature of its cultural resources, the tribes themselves, and their internal politics.

A common theme about Native American consultation expressed by a number of CRMs is the importance of long-term continuity and personal relationships. These require years to develop and, ultimately, should be relationships of trust. Two factors are critical in developing this trust. The first is regular contact with the tribes, rather than perfunctory consultation immediately before a proposed action. The second is continuity in DoD personnel, with relatively frequent personnel turnover (as sometimes unavoidably occurs) hampering the development of good working relationships. In one case, a DoD facility has an archaeologist serving as a dedicated Native American liaison; in another, a working group has been established that meets regularly and provides input on a wide array of environmental issues, not just cultural resource concerns. Both approaches have proven effective in minimizing conflicts.

The exact parameters of Native American/ Native Hawai'ian consultation vary by installation, with locations with multiple federally recognized tribes necessarily involved in more complex relationships and issues. DoD installation consultation with tribal groups overall, however, appears to be successful and satisfactory.

Although there is significant variation in the numbers and types of rock art sites present on DoD installations, these kinds of sites are most common in the western states, where they may constitute 5-10 percent of an installation's cultural resources. Native American consultation with respect to rock art resources is ongoing and, judging from the questionnaire responses, apparently successful. At least superficially, most of these sites appear to be in good condition, but proper documentation and condition assessments have only rarely been completed. A "one-size-fits-all" management approach is widely employed. The best practice is for DoD installations to complete site documentation and condition assessments to implement adaptive management. Given the number and, in some cases, complexity of DoD rock art sites, the current outstanding need is for accurate and efficient means for documenting and completing condition assessments on these sites.

RECOMMENDATIONS FOR ROCK ART SITE MANAGEMENT

Based on the installation assessment, DoD rock art site management programs commonly have two areas that can be improved, both related to the fashion in which NHPA Section 106 compliance is conducted. Given the natural degradational processes that can result in their destruction or loss of rock art integrity, sometimes in relatively short periods of time, it is recommended that management programs document rock art sites, make complete condition assessments, and monitor site status over time to allow management to make a determination of NRHP eligibility. Other aspects of the archaeological record, such as subsurface deposits, may not need as much attention and a formal determination of eligibility since they do not tend to be subject to the natural degradational processes that rock art sites are exposed to. Whether passive preservation is appropriate for rock art sites depends on the nature, environmental context, and status of individual sites. The best practice for this passive management approach is that it is determined following site documentation and condition assessment, not prior to these procedures. International and U.S. rock art management standards, as a result, emphasize the fact that there is no single management approach appropriate for all rock art sites, as well as the need for

proactive management, including these two steps, as the initial procedures required for adequate site stewardship (e.g., ARARA 2001; Loubser 2001; Swadley 2009).

Site documentation and condition assessments are both potentially costly and time-consuming, especially given the possible large total number of DoD rock art sites that remain unstudied in these respects. The following procedures, accordingly, are recommended as the most cost-effective and efficient approaches. These will provide adequate site documentation and condition assessments that, combined with systematic site monitoring, will accommodate future adaptive management.

Site Documentation

There are currently two practical ways to obtain the level of graphic documentation currently required for professional standards: systematic and scaled high-resolution photography, and panel tracing on plastic film (Whitley 2011). Both also require some level of descriptive recording (e.g., panel record forms), as well as mapping. Panel tracing is accurate, but very labor intensive in the field, and results in data that are difficult to archive and cumbersome to translate into useful formats. Systematic photography, especially digital photography, is rapid, yields easily stored data, and can be manipulated in various fashions (e.g., image enhancement to highlight certain features or conditions).

Other, more technically sophisticated forms of graphic documentation exist, such as 3-D photogrammetry and 3-D laser scanning (Barnett et al. 2005; Simpson et al. 2004; Waslewicz et al. 2005). A pilot project employing 3-D laser scanning has been conducted on the western side of the Cosos (Waslewicz et al. 2005). This approach is perhaps ideal, but (as the pilot project demonstrated) it is currently impractical for large-scale applications, due to the massive computing requirements of and heat restrictions on the equipment. These approaches are generally more suited to the treatment of adverse effects rather than efficient site documentation, at this time.

It is currently possible to employ a high-resolution digital camera tied via Bluetooth to a GPS unit and laser rangefinder that provides decimeter-level mapping accuracy, however. This approach is recommended as a rapid, efficient, state-of-the-art approach to rock art documentation. The equipment set-up provides digital imagery that is accurately linked to locational data, and is encoded in the digital record. This system can be used to obtain photos (with graphic scale) of each panel, close-ups of significant features, data on condition issues and/or motifs, and overviews of the sites.

This system has a series of advantages over traditional rock art documentation techniques (see Loendorf 2001; Whitley 2011). It is fast and efficient. Its mapping capabilities are accurate to the decimeter scale. The graphic imagery can be easily stored and translated to other formats. The imagery can be digitally manipulated (e.g., with Adobe Photoshop) to improve visibility or highlight specific features. It includes potentially important factors for management and conservation, such as lichen growth and rock surface integrity, which are not normally included in hand recording. Locational data are encoded in the digital image files. It minimizes potential subjective aspects of documentation. Because it is seamlessly tied to GPS mapping data, it

facilitates and simplifies post-field GIS analysis. It can also be designed to expedite subsequent site monitoring (e.g., using graphic flip-charts tied to specific panels/mapped locations.)

Condition Assessment

Condition assessments are required to determine the status of rock art sites, to adequately monitor any changes that may be occurring to them over time, and to allocate management resources in the most efficient and cost-effective fashion. There are currently two approaches available for condition assessments. The first is conservator-based, and the second is systematically structured. Conservator-based condition assessments reflect the fact that there is no standard for rock art site condition assessments used by all conservators. Most conservators work independently, and have in essence developed their own personal and specific procedures and protocols for their condition assessments. Their assessments tend to be idiosyncratic and labor-intensive. Although most conservators employ standardized forms, the results are not fully comparable from conservator to conservator, nor from assessment to assessment. This is problematic for long-term monitoring strategies. Because there are only a handful of professionally trained rock art conservators in the country, conservator-based condition assessments can be difficult to schedule.

The second approach is systematically structured, and is known as the Rock Art Stability Index (RASI; see Allen 2008; Cervený 2005; Cervený et al. 2006; Dorn et al. 2008). Using a standardized form and a series of assessment criteria, its goal is to provide a rapid, replicable, and quantitative evaluation of each rock art panel—in essence a rank-ordering of each panel's degree of threat or stability. The phenomena it considers (each in terms of a series of factors) are: site setting (geological factors), rock art panel weaknesses, large erosion events on or below a panel, small erosion events on a panel, rock coatings, and vandalism and other human impacts. The result is a tabulation of the conservation problems (if any) present on any panel, and a listing of the relative status of each panel in relationship to the remainder of the site. Because these factors are evaluated quantitatively, the data can be coded digitally and included in a GIS system. Further, because the information is collected systematically, and is replicable among different analysts (Allen 2008), RASI facilitates long-term, systematic monitoring. Based on the rank-ordering of degrees of threat, recommendations can be made and conservation intervention procedures prioritized to best treat the resource and to optimize the allocation of management funds. RASI can be fully integrated with the systematic digital photography and mapping system suggested above, effectively allowing both to be completed simultaneously.

REFERENCES

- Adam, C.
 1991 *The Origin and Development of the Pueblo Katsina Cult*. University of Arizona Press, Tucson.
- Agenbroad, L.
 1994 Paleo-Indian Rock Art on the Colorado Plateau: 11,000 Years of Petroglyphs. Paper presented at the 1994 International Rock Art Congress, Flagstaff, AZ.
- Agnew, N. and J. Bridgland, editors
 2006 *Of the Past, for the Future: Integrating Archaeology and Conservation*. The Getty Conservation Institute, Los Angeles.
- Allen, Casey
 2008 Using rock art as an alternative science pedagogy. Unpublished Ph.D. dissertation, School of Geographic Sciences, Arizona State University, Tempe.
- Altschul, J. H., M. Cotrell, C. W. Meighan and R. H. Towner
 1993 The Garden Canyon Project: Studies at Two Rockshelters at Fort Huachuca, Southeastern Arizona. Statistical Research, Inc., Technical Series No. 39.
- ARARA
 2001 ARARA Guidelines for Managers of Rock Art Sites on Public Lands: Public Access. American Rock Art Research Association.
- Armitage, R. A., M. Hyman, J. Southon, C. Barat, and M. W. Rowe
 1997 Rock-Art Image in Fern Cave, Lava Beds National Monument, California: Not the AD 1024 (Crab Nebula) Supernova. *Antiquity* 71:715–19.
- Armitage, R. A., M. Hyman, M. W. Rowe, L. L. Loendorf, and J. R. Southon
 2000 Dated Rock Paintings at Red Cliffs, Arizona. *Kiva* 65:253–66.
- Arsenault, D.
 2004 Rock art, landscape, sacred places: attitudes in contemporary archaeological theory. In *The Figures Landscapes of Rock Art*, ed. C. Chippindale and G. Nash, pp. 69-84. Cambridge: Cambridge University Press.
- Bahn, Paul G.
 1998 Preface. In *Coso Rock Art: A New Perspective*, edited by Elva Younkin, pp. ix-x. Ridgecrest: Maturango Museum Publication 12.
- Barnett, T., A. Chalmers, M. Diaz-Andreu, P. Longhurst, G. Ellis, K. Sharpe and I. Trinks
 2005 3D Laser Scanning for Recording and Monitoring Rock Art Erosion. *International Newsletter On Rock Art (INORA)* 41: 25-29.

- Barth, F.
1975 *Ritual and Knowledge Among the Baktaman of New Guinea*. New Haven, Yale University Press.
- Bass, P.
1989 *The Pecos Project: Semiotic Models for the Study of Rock Art*. Ph.D. dissertation, Rice University.
- Bean, Lowell J. and Sylvia B. Vane
1978 *Cults and Their Transformations*. In *Handbook of North American Indians, Volume 8: California*, R. F. Heizer, editor, pp. 662-672. Washington: Smithsonian Institution.
- Beckwith, Martha
1970 *Hawaiian Mythology*. Honolulu, University of Hawaii Press. (original 1940, Yale University Press).
- Bernardini, W.
2005 *Hopi Oral Tradition and the Archaeology of Identity*. Tucson: University of Arizona.
- Bettinger, Robert and Martin Baumhoff
1982 *The Numic Spread: Great Basin cultures in competition*. *American Antiquity* 47:485-503.
- Birmingham, Robert A. and William Green.
1987 *Wisconsin Rock Art*. *Wisconsin Archaeologist* 68(4).
- Boreson, Keo
1998 *Rock Art*, in *Handbook of North American Indians, Volume 12: Plateau*, p. 611-9. Deward E. Walker, Jr., editor. Smithsonian Institution, Washington, D.C
- Bostwick, Todd W.
2001 *North American Indian Agriculturalists*. In *Handbook of Rock Art Research*, pp. 414-458, ed. D.S. Whitley. Walnut Creek: AltaMira Press.
2002 *Landscape of the Spirits: Hohokam Rock Art at South Mountain Park*. Tucson: University of Arizona Press.
2005 *Rock Art Research in the American Southwest*. In *Discovering North American Rock Art*, edited by L. Loendorf, C. Chippendale and D. Whitley, pp. 51-92. Tucson: University of Arizona Press
- Boyd, Carolyn.
1996 *Shamanic Journeys into the Otherworld of the Archaic Chichimec*. *Latin American Antiquity* 7(2):152-64
2003 *Rock Art of the Lower Pecos*. College Station: Texas A & M University Press.

- Bozhardt, R.F.
2003 *Deep Cave Rock Art in the Upper Mississippi River Valley Area*. St. Paul: Prairie Smoke Press.
- Brooks, C.R., W.M. Clements, J.A. Kantner and G.Y. Poirier
1979 *A Land Use History of Coso Hot Springs, Inyo County, California*. NWC Administrative Publication 200, China Lake Naval Air Weapons Station, Ridgecrest.
- Bull, William B.
1991 *Geomorphic responses to climatic change*. Oxford University Press, Oxford.
- Cain, H. T.
1950 *Petroglyphs of Central Washington*. University of Washington Press, Seattle.
- Callahan 2001
2001 *The Jeffers Petroglyphs: Native American Rock Art on the Midwestern Plains*. St. Paul: Prairie Smoke Press.
- Carroll, Kristen Jean
2007 Place, Performance and Social Memory in the 1890s Ghost Dance. Ph.D. Dissertation, Department of Anthropology, University of Arizona. Tucson.
- Castleton, K.
1978 *Petroglyphs and Pictographs of Utah, Vol 1*. University of Utah and Utah Museum of History, Salt Lake City.
1979 *Petroglyphs and Pictographs of Utah, Vol. 2*. University of Utah and Utah Museum of History, Salt Lake City.
- Castleton, K., and D. B. Madsen
1981 The Distribution of Rock Art Elements and Style in Utah. *Journal of California and Great Basin Anthropology* 3(2):163–75.
- Cervený, Niccole V.
2005 A weathering based perspective on rock art conservation. Unpublished Ph.D. dissertation, School of Geographic Sciences, Arizona State University, Tempe.
- Cervený, N.V., R. Kaldenberg, J. Reed, D.S. Whitley, J. Simon, J. and R.I. Dorn
2006 A New Strategy for Analyzing the Chronometry of Constructed Rock Features in Deserts. *Geoarchaeology* 21: 281-303.
- Chaffee, S. D., M. Hyman, M. W. Rowe, N. Coulam, A. Schroedl, and K. Hogue
1994a Radiocarbon Dates on the All American Man. *American Antiquity* 59:769–81.
- Chaffee, S. D., L. L. Loendorf, M. Hyman, and M. W. Rowe
1994b Dating a Pictograph in the Pryor Mountains, Montana. *Plains Anthropologist* 39:195–201.

Charles, T.

- 2010 *Discovering South Carolina's Rock Art*. Columbia: University of South Carolina Press.

Christenson, D. D.

- 1993 Rock Art and Its Archaeological and Environmental Context: A Study at Opal Mountain, Mojave Desert, California. *Pacific Coast Archaeological Society Quarterly* 29(2): 27-63.

Clark, D.W.

- 1970 Petroglyphs on Afognak Island, Kodiak Group, Alaska. *Anthropological Papers of the University of Alaska* 15(1):13-17.

Clewlow, C. William, Jr.

- 1981 Rock Art Research in the Great Basin: Some Historical Comments. *Journal of California and Great Basin Anthropology* 3:78-83.

Cline, W.

- 1938 Religion and World View. In *The Sinkaietk or Southern Okanagon of Washington*, edited by L. Spier, pp. 133-82. General Series in Anthropology 6. Menasha.

Cole, S. J.

- 1990 *Legacy on Stone: Rock Art of the Colorado Plateau and Four Corners Region*. Johnson Publishing, Boulder.

Colton, H. S.

- 1946 Fools' Names Like Fools' Faces. *Plateau* 19(1):1-8.

Colton, M-R., and H.S. Colton

- 1931 Petroglyphs: The Record of a Grand Journey. *American Anthropologist* 33:32-35.

Conner, S.W. and B.L. Conner

- 1971 *Rock Art of the Montana High Plains*. Santa Barbara: University of California Art Galleries.

Conway, T., and J. Conway

- 1990 *Spirits on Stone: The Agawa Petroglyphs*. Heritage Discoveries, San Luis Obispo.

Copeland, James M.

- 2008 From Curiosity to Cultural Treasure: The Rock Art of Dinetah. In *Set in Stone: A Binational Workshop on Petroglyph Management in the United States and Mexico*, edited by Joseph P. Sanchez, pp. 67-81. Petroglyph National Monument, Albuquerque.

Corner, J.

- 1968 *Pictographs in the Interior of British Columbia*. Wayside Press, Ltd., Vernon, B.C.

- Cox, J. H., and E. Stasack
1970 *Hawaiian Petroglyphs*. Bernice P. Bishop Museum Special Publication 60. Honolulu.
- Coy, Jr., F.E.
1966 Rock Carvings in Kentucky. In *Bulletin of the Jefferson County Medical Society*, Vol. 14 (6): 16-17, Louisville, Kentucky.
- Coy, F. E., Jr., T. C. Fuller, L. G. Meadows, and J. L. Swauger
1997 *Rock Art of Kentucky*. The University Press of Kentucky, Lexington.
- Crevaschi, M.
1996 The rock varnish in the Messak Sattafet (Fezzan, Libyan Sahara): age, archaeological context, and paleoenvironmental implication. *Geoarchaeology* 11:393-421.
- Cressman, L. S.
1937 *Petroglyphs of Oregon*. Studies in Anthropology No. 1. University of Oregon, Eugene.
- David, Robert
2005 Rock Art as Shamans' Tools: Testing and Redefining Landscape Symbolism Models in the Klamath Basin. MA Thesis, Department of Anthropology, Portland State University, Portland, Oregon.
2012 The Landscape of Klamath Basin Rock Art. Ph.D. dissertation, University of California, Berkeley.
- David, Robert & J. Keyser
2008 *A New Ethnographic Reference for Klamath Basin Rock Art: Shamans' Incantations and Sacred Rocks*. International Newsletter on Rock Art, 50: 26-8
- Davis, C.A. and G.A. Smith
1981 *Newberry Cave*. San Bernardino County Museum, Redlands.
- Dean, J.C. (editor)
1999 *Images past, images present: The conservation and preservation of rock art*. IRAC Proceedings, Vol. 2. American Rock Art Research Association.
- Dewdney, S.
1970 *Dating Rock Art in the Canadian Shield Region*. Toronto: Royal Ontario Museum.
- Dewdney, S., and K. E. Kidd
1967 *Indian Rock Paintings of the Great Lakes*. Quetico Foundation, University of Toronto Press.

Diaz-Granados, C.

- 2008 Picture Cave: The Study, Dating and Gating of a Rare Prehistoric American Indian Site. In *Cave Archaeology of the Eastern Woodlands: Essays in Honor of Patty Jo Watson*, ed. D.H. Dye, pp. 203-218. Knoxville: University of Tennessee Press.

Diaz-Granados, C., and J. Duncan

- 2000 *The Petroglyphs and Pictographs of Missouri*. University of Alabama Press, Tuscaloosa.
- 2004 (editors) *The Rock-Art of Eastern North America: Capturing Images and Insight*. Tuscaloosa: University of Alabama Press.

Diaz-Granados, C., M.W. Rowe, M. Hyman, J.R. Duncan and J.R. Southon

- 2001 AMS Radiocarbon Dates for the Charcoal from Three Missouri Pictographs and Their Associated Iconography. *American Antiquity* 66:481-492.

Dickey, J.

- 1994 The Piute Creek Petroglyph Inventory: A Rock Art Survey in the East Mojave Desert of California. *Pacific Coast Archaeological Society Quarterly* 30(4):3-32.

Dietzel, Martin, H. Kolmer, P. Pölt and S. Simic

- 2008 Desert varnish and petroglyphs on sandstone – Geochemical composition and climate change from Pleistocene to Holocene (Libya). *Chemie der Erde* 68:31-43.

Dorn, Ronald I.

- 1994 Dating petroglyphs with a 3-tier rock varnish approach. In *New Light on Old Art: Advances in Hunter-Gatherer Rock Art Research*, D. S. Whitley and L. L. Loendorf, eds., pp. 2-36. UCLA Institute for Archaeology Monograph Series No. 36.
- 1998 Age Determination of the Coso Rock Art. In *New Perspectives on the Coso Petroglyphs*, edited by E. Younkin, pp. 69-96. Ridgecrest, Maturango Museum.
- 2001 Chronometric techniques: engravings. In *Handbook of Rock Art Research*, edited by D.S. Whitley, pp. 167-189. Walnut Creek (CA), AltaMira Press.
- 2006 Petroglyphs in Petrified Forest National Park: Role of Rock Coating as Agents of Sustainability and Indicators of Antiquity. In *A Century of Research at Petrified National Forest: Natural and Cultural History*, ed. by W.G. Parker and P.A. Thompson, pp. 53-64. Museum of Northern Arizona, Bulletin No. 63.

Dorn, R. I., T. A. Cahill, R. A. Eldred, T. E. Gill, B. Kusko, A. Bach, and D. L. Elliott-Fisk

- 1990 Dating rock varnishes by the cation-ratio method with PIXE, ICP, and the electron microprobe. *International Journal of PIXE* 1:157-195.

Dorn, R. I. and D. S. Whitley

- 1983 Cation ratio dating of petroglyphs from the western United States, North America. *Nature* 302:816-818.
- 1984 Chronometric and relative age determination of petroglyphs in the western United States. *Annals of the Association of American Geographers* 74:308-322.

- Dorn, R. I., D. S. Whitley, N. V. Cerveny, S. J. Gordon, C. D. Allen, and E. Gutbrod
 2008 The Rock Art Stability Index (RASI): Improving the Sustainability of Rock Art Sites. *Heritage Management* 1:37-70.
- Dorn, R. I., G. Moore, E. O. Pagan, T. W. Bostwick, M. King and P. Ostapuk
 2012 Assessing Early Spanish Explorer Routes Through Authentication of Rock Inscriptions. *Professional Geographer* 64:1-15.
- Dragovich, D.
 1998 Microchemistry and Relative Chronology of Small Desert Varnish Samples, Western New South Wales, Australia. *Earth Surface Processes and Landforms* 22:445–53.
- Duff, A. I., T. J. Ferguson, S. Bruning, and P. Whiteley
 2008 Collaborative Research in a Living Landscape: Pueblo Land, Culture, and History in West-Central New Mexico. *Archaeology Southwest* 22(1). Tucson: Center for Desert Archaeology.
- Elkin, A.P.
 1964 *The Australian Aborigines*. New York, Doubleday.
- Faris, Peter
 1995 Petroglyph chronology in southeast Colorado. *Southwestern Lore* 61:7-35.
- Faulkner, Charles H. (editor)
 1986 *The Prehistoric Native American Art of Mud Glyph Cave*. University of Tennessee Press, Knoxville.
 1996 *Rock Art of the Eastern Woodlands: Proceedings from the Eastern States Rock Art Conference*. Occasional Paper 2, American Rock Art Research Association, San Miguel, California.
- Faulkner, Charles H. and Jan F. Simek
 1996 1st Unnamed Cave: A Mississippian Period Cave Art Site in East Tennessee, USA. *Antiquity* 70(270):774-784.
- Fentress, Jeffrey B
 1992 Prehistoric Rock Art of Alameda and Contra Costa Counties, California. M.A. thesis, California State University, Hayward.
- Fewkes, J. W.
 1892 A Few Tusayan Pictographs. *American Anthropologist* (o.s.) 5(1):9-26.
 1906 Hopi shrines of the East Mesa. *American Anthropologist* (n.s.) 8(2):346-375.
- Fortea Perez, F. Javier, editor
 1993 *La Proteccion y Conservacion del Arte Rupestre Paleolitico: Mesa Redondo Hispano-Francesa*. Principado de Asturias, Consejeria de Educacion, Cultura, Deportes y Juventud.

Francis, Julie E.

- 1994 Cation-Ratio Dating and Chronological Variation Within Dinwoody Tradition Rock Art in Northwestern Wyoming. In *New Light on Old Art: Recent Advances in Hunter-Gatherer Rock Art Research*, edited by David S. Whitley and Lawrence L. Loendorf, pp. 37-50. Institute of Archaeology, University of California, Los Angeles, Monograph 36.
- 2001 Style and classification. In *Handbook of rock art research*, D. S. Whitley, ed., pp. 221-246. Walnut Creek: AltaMira Press.

Francis, Julie E. and Lawrence L. Loendorf

- 2002 *Ancient Visions: Petroglyphs and Pictographs from the Wind River and Bighorn Country, Wyoming and Montana*. Salt Lake City: University of Utah Press.

Francis, J. E., L. L. Loendorf, and R. I. Dorn

- 1993 AMS radiocarbon and cation-ratio dating of rock art in the Bighorn Basin of Wyoming and Montana. *American Antiquity* 58:711-737.

Garfinkel, Alan P.

- 2006 Paradigm Shifts, Rock Art Studies and the "Coso Sheep Cult" of Eastern California. *North American Archaeologist* 27:203-244.
- 2007 *Archaeology and rock art of the eastern Sierra and Great Basin frontier*. Maturango Museum Publication 22. Ridgecrest.

Garfinkel, A. P., D. Austin and D. Williams

- 2009 Myth, ritual and rock art: Coso decorated animal humans and the animal master. *Rock Art Research* 26:179-197.

Garfinkel, A. P., D. A. Young, R. M. Yohe

- 2010 Bighorn hunting, resource depletion, and rock art in the Coso Range, eastern California: A computer simulation. *Journal of Archaeological Science* 37:42-51.

Gebhard, David

- 1969 *The rock art of Dinwoody, Wyoming*. The Art Galleries, University of California, Santa Barbara.

Gilreath, Amy J.

- 1999 The Archaeology and Petroglyphs of the Coso Rock Art Landmark. *American Indian Rock Art* 25:33-44.

Gilreath, A. J. and W. R. Hildebrandt

- 2008 Coso rock art within its archaeological context. *Journal of California and Great Basin Anthropology* 28:1-22.

Glazovski, A. F.

- 1985 Rock varnish in the glacierized regions of the Pamirs (in Russian). *Data of the Glaciological Studies* (Moscow) 54:136-141.

Grant, Campbell

- 1965 *The Rock Paintings of the Chumash: A Study of a California Indian Culture*. University of California Press, Berkeley and Los Angeles.
- 1967 *Rock Art of the American Indian*. New York: Crowell.
- 1968 *Rock Drawings of the Coso Range, Inyo County, California*. China Lake, California: Maturango Museum.

GRAPP (Groupe de Reflexion sur L'Art Parietal Paleolithique), editors

- 1993 *L'Art Parietal Paleolithique: Techniques et methodes d'etude*. Paris: Ministere de L'Enseignement Superieur et de la Recherche, Comite des travaux historiques et scientifiques, Documents Prehistoriques 5.

Greer, M.

- 1995 *Archaeological Analysis of Rock Art Sites in the Smith River Drainage of Central Montana*. Ph.D. dissertation, University of Missouri.

Hampson, J. G.

- 2011 *Rock art regionalism and identity: case studies from Trans-Pecos Texas and Mpumalanga Province, South Africa*. Ph.D. dissertation, University of Cambridge.

Harry, K. G., E. Billo and R. Mark

- 2001 *The Challenge of Long-Term Preservation: Managing Impacts to Rock Art at Hueco Tanks State Historical Park*. *American Indian Rock Art* 27:151-160.

Hartley, R. J.

- 1992 *Rock Art on the Northern Colorado Plateau*. Avebury, Aldershot.

Hartley, R. J., and A. W. Vawser

- 1998 *Spatial Behavior and Learning in the Prehistoric Environment of the Colorado River Drainage (South-Eastern Utah), Western North America*. In *The Archaeology of Rock-Art*, edited by C. Chippindale and P. S. C. Taçon, pp. 185–211. Cambridge University Press, Cambridge.

Hays-Gilpin, Kelley

- 2004 *Ambiguous Images: Gender and Rock Art*. AltaMira Press, Walnut Creek.
- 2008 *Rock Art Ethnography on the Southern Colorado Plateau, Arizona and New Mexico*. *Heritage Management* 1: 119-133.

Hedges, Kenneth

- 1973 *Rock art in Southern California*. *Pacific Coast Archaeological Society Quarterly*, Vol. 9, No. 4: 1-28.
- 1976 *Southern California Rock Art as Shamanic Art*. *American Indian Rock Art* 2:126–38.
- 1982 *Great Basin Rock Art Styles: A Revisionist View*. *American Indian Rock Art* 7–8:205–211.
- 1983 *The Shamanic Origins of Rock Art*. In *Ancient Images on Stone: Rock Art of the Californias*, edited by J. Van Tilburg, pp. 46–59. Rock Art Archive, UCLA.

Heizer, R. F.

- 1947 Petroglyphs from Southeastern Kodiak Island, Alaska. *Proceedings of the American Philosophical Society* 91(3):284-293.
- 1953 *Sacred rain rocks of Northern California*. University of California Archaeological Survey Reports, No. 20: 33-8.

Heizer, R. F., and M. Baumhoff

- 1959 Great Basin Petroglyphs and Game Trails. *Science* 129:904-5.
- 1962 *Prehistoric Rock Art of Nevada and Eastern California*. Berkeley: University of California Press.

Heizer, R. F. and C. W. Clewlow, Jr.

- 1973 *Prehistoric Rock Art of California*. Ramona, Ballena Press.

Hildebrandt, W. R., and K. R. McGuire

- 2002 The Ascendance of Hunting During the California Middle Archaic: An Evolutionary Perspective. *American Antiquity* 67:231-256.

Hill, B., and R. Hill

- 1974 *Indian Petroglyphs of the Pacific Northwest*. University of Washington Press, Seattle.

Hillebrand, Timothy

- 1972 The Archaeology of the Coso Locality of the Northern Mojave Desert Region of California. Unpublished Ph.D. dissertation, Dept. of Anthropology, University of California, Santa Barbara.

Hudson, D. T., and G. Lee

- 1984 Function and Symbolism in Chumash Rock Art. *Journal of New World Archaeology* 4(3):26-47.

Hudson, D. Travis and Ernest Underhay

- 1978 *Crystals in the Sky: An Intellectual Odyssey Involving Chumash Astronomy, Cosmology and Rock Art*. Socorro: Ballena Press.

Hyder, William

- 1989 Rock Art and Archaeology in Santa Barbara County, California. *San Luis Obispo County Archaeological Society Occasional Paper*, No. 13.

ICOMOS

- 1999 Burra Charter. Online at <http://www.icomos.org/australia/burra.html>

Jones, T.L., G.M. Brown, L.M. Raab, J.L. McVickar, W.G. Spaulding, D.J. Kennett, A. York, and P. L. Walker

- 1999 Demographic Crisis in Western North America during the Medieval Climatic Anomaly. *Current Anthropology* 40:137-170.

Kelly, Isabel

- 1932 Ethnography of the Surprise Valley Paiutes. *University of California Publications in American Archaeology and Ethnology* 31(3):67-210. Berkeley.
- 1939 Southern Paiute Shamanism. *Anthropological Records* 2(4):151-167.

Kelly, R. and D. McCarthy

- 2001 Effects of Fire on Rock Art. *American Indian Rock Art* 27:169-176.

Keyser, James D.

- 1992 *Indian Rock Art of the Columbia Plateau*. University of Washington Press, Seattle.
- 2001 Relative dating methods. In *Handbook of Rock Art Research*, edited by D. S. Whitley, pp. 116-138. Walnut Creek, Altamira Press.
- 2004 *The Art of the Warriors: Rock Art of the American Plains*. Salt Lake City: University of Utah Press.

Keyser, J. D., D. A. Kaiser, G. Poetschat, and M. W. Taylor (editors)

- 2012 *Fraternity of War: Plains Indian Rock Art at Bear Gulch and Atherton Canyon, Wyoming*. Portland: Oregon Archaeological Society, Publication No. 21.

Keyser, James D., and Michael Klassen.

2001. *Plains Indian Rock Art*. Seattle: University of Washington Press.

Keyser, James D., & R. Knight

- 1975 The Rock Art of Western Montana. *Plains Anthropologist* 21: 1-12.

Keyser, J. D., and G. Poetschat

- 2008 *Ute Horse Raiders on the Powder Rim: Rock Art at Powder Wash, Wyoming*. Portland: Oregon Archaeological Society, Publication No. 19.
- 2010 (editors) *Rock Art of the Oregon Country: Honoring the Lorings' Legacy*. Portland: Oregon Archaeological Society, Publication No. 18.
- 2012 *Clan Crests and Shamans' Masks: Petroglyphs in Southeast Alaska*. Portland: Indigenous Cultures Preservation Society.

Keyser, James D., Poetschat, George R. & M.W. Taylor

- 2004 *Echoes of the Ancients: Rock Art of the Dalles- Deschutes Region*. Oregon Archaeological Society, Publication 14, Portland: Oregon.

Keyser, J. D., and M. W. Taylor (editors)

- 2002 *Visions on Stone: Rock Art of the Columbia Plateau*. Portland: Oregon Archaeological Society.

Keyser, James, and David S. Whitley

- 2000 A New Ethnographic Reference for Columbia Plateau Rock Art: Documenting a Century of Vision Quest Practices. *International Newsletter of Rock Art* 25:14-20.
- 2006 Sympathetic Magic in Western North American Rock Art. *American Antiquity* 71:3-26.

Kirkland, F., and W.W. Newcomb

1976 *The Rock Art of Texas Indians*. Austin: University of Texas Press.

Klassen, M. A.

1998 Icon and Narrative in Contact Transition Rock Art at Writing-On-Stone, Southern Alberta, Canada. In *The Archaeology of Rock-Art* edited by C. Chippindale and P. S. C. Taçon, pp. 42–72. Cambridge University Press, Cambridge.

Kroeber, A. L.

1939 Cultural and Natural Areas of North America. *University of California Publications in American Archaeology and Ethnology* 38. Berkeley.

Kuwanwisiwma, L., and T. J. Ferguson

2004 *Ang Kuktota: Hopi Ancestral Sites and Cultural Landscapes*. *Expedition* 46(2):25-29.

Layton, Robert

1992 *Australian rock art: a new synthesis*. Cambridge University Press, Cambridge.

2001 Ethnographic study and symbolic analysis. In D. S. Whitley, editor, pp. 311–332, *Handbook of Rock Art Research*. AltaMira Press, Walnut Creek.

2006 Habitus and Narratives of Rock Art. In *Talking with the Past: The Ethnography of Rock Art*, ed. J.D. Keyser, G. Poetschat & M.W. Taylor, pp. 73-93. Portland, Oregon Archaeological Society.

2012 Rock Art, Identity and Indigeneity. In *A Companion to Rock Art*, J. McDonald and P. Veth, eds., pp. 439-454. Oxford: Wiley Blackwell.

Lee, Georgia

1991 *Rock Art and Cultural Resource Management*. Topanga: Wormwood Press.

Lee, M. R., and P. A. Bland

2003 Dating climatic change in hot deserts using desert varnish on meteorite finds in Australia. *Earth and Planetary Science Letters* 206:187-198.

Lee, Georgia, and Edward Stasack

1999 *Spirit of Place: The Petroglyphs of Hawai'i*. Bearsville Press, Los Osos.

Lenik, E. J. 2009

2002 *Picture Rocks: American Indian Rock Art in the Northeast Woodlands*. Lebanon, NH: University Press of New England.

2009 *Making Pictures in Stone: American Indian Rock Art of the Northeast*. Tuscaloosa: University of Alabama.

Lewis-Williams, J. David, and Thomas A. Dowson

1988 The Signs of All Times: Entoptic Phenomena in Upper Palaeolithic Art. *Current Anthropology* 29:201-245.

Liu, Tanzhuo

- 2003 Blind testing of rock varnish microstratigraphy as a chronometric indicator: results on late Quaternary lava flows in the Mojave Desert, California. *Geomorphology* 53:209-234.

Loendorf, Lawrence L.

- 1991 Cation-ratio varnish dating and petroglyph chronology in southeastern Colorado. *Antiquity* 65:246-255.
- 1999 Dinwoody Tradition Petroglyphs of Northwest Wyoming and their Relationship to Coso Mountain Petroglyphs of Eastern California. *American Indian Rock Art* 25:45-56.
- 2001 Rock Art Recording. In *Handbook of Rock Art Research*, D. S. Whitley, ed., pp. 55-79. Walnut Creek, AltaMira Press.
- 2008 *Thunder and Herds: The Rock Art of the High Plains*. Walnut Creek, Left Coast Press.
- 2010 Old Petroglyphs on the North American High Plains. In *Abstracts* (unpaginated), Palearte del Pleistoceno y de la transición hacia el Holoceno en las Américas, Arte Pleistoceno del Mundo, Congreso IFRAO 2010. Foix, France.

Loendorf, Lawrence L., and David D. Kuehn.

- 1991 *1989 Rock Art Research--Piñon Canyon Maneuver Site, Southeastern Colorado*. Contribution No. 258. Department of Anthropology, University of North Dakota Grand Forks.

Lorblanchet, Michel, and Paul Bahn, editors

- 1993 *Rock Art Studies: The Post-Stylistic Era or Where Do We Go From Here?* Oxford, Oxbow Books, Monograph 35.

Loring, J. M., and L. Loring

- 1982 *Pictographs and Petroglyphs of the Oregon Country, Vol I*. Monograph 21, Institute of Archaeology, University of California, Los Angeles.
- 1983 *Pictographs and Petroglyphs of the Oregon Country, Vol II*. Monograph 23, Institute of Archaeology, University of California, Los Angeles.

Loubser, Johannes H. N.

- 1993 The Conservation of San Rock Art. *Information Bulletin* 9:5-7.
- 1994 The Conservation of Rock Engravings and Rock Paintings: Removals to Museums or Selected Exhibitions in the Field? *South African Journal of Science* 90:454-456.
- 1995a The Tale of Two Sites: Contrasting Site Management Strategies in South Africa and Lesotho. In *Management of Rock Imagery* edited by G. K. Ward and L. A. Ward. pp. 22-25. Occasional AURA Publication No. 9, Melbourne.
- 1995b *The Reintegration of Graffiti at Four Sites in the Capitol Reef National Park, Utah*. New South Report submitted to the Capitol Reef National Park, Utah.
- 1997 *Conservation Management Plan of Twenty Places with Rock Imagery along the Snake River, Hells Canyon, Idaho and Oregon*. New South Report submitted to the United States Forest Service-Recreation, Portland.

- 1999 *The Establishment of a Rock-Art Monitoring Program at Two Sites on Miller Island, Columbia River, Oregon*. New South Report submitted to the United States Forest Service-Recreation, Portland.
- 2001 Management Planning for Conservation. In *Handbook for Rock Art Research*, edited by D. Whitley, pp. 80-115. AltaMira Press, Walnut Creek.
- 2002 Condition Assessment and Management Plan of Two Petroglyph Sites on the Nanea Golf Course, Ka'úpúlehu Ahupua'a, North Kona District, Island of Hawai'i. New South Report submitted to Rechtman Consulting, Kea'au, Hawai'i.
- 2005 *Graffiti Removal at Jackknife Cave, Butte County, Idaho*. New South Report submitted to the BLM, Idaho Falls Field Office, Idaho Falls.
- 2006 Conservation of Non-Western Rock Art Sites Using a Holistic Medical Approach. In *Of the Past, for the Future: Integrating Archaeology and Conservation*, edited by N. Agnew and J. Bridgland, pp.340-345. The Getty Conservation Institute, Los Angeles.
- Loubser, J. H. N., J. D. Keyser, and B. Yazzolino
- 2000 The Establishment of a Rock-Art Monitoring Program at Two Sites on Miller Island, Columbia River, Oregon, USA. *International Newsletter on Rock Art* 25:11-14.
- Loubser, J., S. Ashcraft, and S. Scott
- 2008 The Tale of Two Sites: Context-Specific Conservation and Management Strategies. In *Set in Stone: A Binational Workshop on Petroglyph Management in the United States and Mexico: Workshop Proceedings*, compiled by J. Sanchez, A. Sanchez-Clark, and E. L. Abreu, pp. 20-30. Petroglyph National Monument National Park Service, Albuquerque.
- Loubser, J. H. N., and D. S. Whitley
- 1999 *Recording and Conservation Management Plan of Eight Places with Rock Imagery in the Lava Beds National Monument, Northern California*. New South Report submitted to the National Park Service, Arcata.
- Lundy, D.
- 1974 Rock Art of the Northwest Coast. (Unpublished M.A. Thesis in Archaeology, Simon Fraser University, Burnaby, B.C.)
- 1983 Styles of Coastal Rock Art. Pp. 89-97 in *Indian Art Traditions of the Northwest Coast*. Roy Carlson, ed. Burnaby, B.C.: Simon Fraser University Archaeology Press.
- Magar, V.
- 2012 Managing Rock Art Sites. In *A Companion to Rock Art*, J. McDonald and P. Veth, eds., pp. 532-545. Oxford: Wiley Blackwell.
- Malouf, Carling
- 1961 *Pictographs and Petroglyphs*. *Archaeology in Montana* 3(1):1-13.
- Marston, R. A.
- 2003 Editorial note. *Geomorphology* 53:197.

- Mazel, A.
2012 Safeguarding a Fragile Legacy: Managing uKhalamba-Drakensberg Rock Art. In *A Companion to Rock Art*, J. McDonald and P. Veth, eds., pp. 515-531. Oxford: Wiley Blackwell.
- McBride, L. R.
1969 *Petroglyphs of Hawaii*. The Petroglyph Press, Hilo.
- McGuire, Kelly R., and William R. Hildebrandt
2005 Re-Thinking Great Basin Foragers: Prestige Hunting and Costly Signaling during the Middle Archaic Period. *American Antiquity* 70:695-712.
- Meighan, C. W.
1998 Conclusions. In *Coso Rock Art: A New Perspective*, E. Younkin, ed., pp. 177-181. Ridgecrest: Maturango Museum Publication 12.
- Meighan, C. W. and M. R. Williams
1997 *Rock Art Study on DoD Property Located in LANTOPS, EFA Chesapeake Bay, and NORTHDIV Areas of Responsibility*. Legacy Grant Report, R. Christopher Goodwin & Associates, Inc.
- Michaelis, H.
1981 Willowsprings: A Hopi Petroglyph Site. *Journal of New World Archaeology* 4(2):3-32.
- Minor, Rick
1975 *The Pit & Groove Petroglyph Style in Southern California*.- San Diego Museum of Man, Ethnic Technology Notes, No. 15. Ballena Press, Ramona, California.
- Munson, Marit K.
2002 On Boundaries and Beliefs: Rock Art and Identity on the Pajarito Plateau. Ph.D. dissertation, University of New Mexico.
2011 *The Archaeology of Art in the American Southwest*. Lanham, Rowman and Littlefield.
- Nissen, Karen
1982 Images from the past: an analysis of six western Great Basin petroglyph sites. Ph.D. dissertation, Anthropology Department, University of California, Berkeley.
- Norder, J. W.
2003 Marking place and creating space in northern Algonquin landscapes: The rock art of the Lake of the Woods region, Ontario. Ph.D. dissertation, University of Michigan.
2012 The creation and endurance of memory and place among First Nations of Northwestern Ontario, Canada. *International Journal of Historical Archaeology* 16:385-400.

Norder, J. W., and J. W. Carroll

- 2011 Applied geospatial perspectives on the rock art of the Lake of the Woods region, Ontario, Canada. *International Journal of Applied Geophysical Research* 2:77-92.

Olsen, N. H.

- 1985 *Hovenweep Rock Art: An Anasazi Visual Communication System*. Occasional Paper 14, Institute of Archaeology, University of California, Los Angeles.
- 1989 Social Roles of Animal Iconography: Implications for Archaeology from Hopi and Zuni Ethnographic Sources. In *Animals into Art*, edited by H. Morphy, pp. 417–39. London, Unwin.

Opler, M.K.

- 1940 The southern Ute of Colorado. In *Acculturation in Seven American Indian Tribes*, edited by Ralph Linton, pp. 119-203. New York, D. Appleton-Century.

Parker, Patricia L., and Thomas F. King

- 1998 *National Register Bulletin 38: Guidelines for Evaluating and Documenting Traditional Cultural Properties*. National Park Service, Washington, D.C.

Parkman, E. Breck

- 1986 Cupules Petroglyphs in the Diablo Range, California. *Journal of California and Great Basin Anthropology* 8:140-155.
- 1988 Further Notes on the Cupules Petroglyphs in the Diablo Range, California. *Journal of California and Great Basin Anthropology* 10:114-117.

Patyk-Kara, N. G., N. V. Gorelikova, J. Plakht, G. N. Nechelyustov, and I. A. Chizhova

- 1997 Desert varnish as an indicator of the age of Quaternary formations (Makhtesh Ramon Depression, Central Negev). *Transactions (Doklady) of the Russian Academy of Sciences/Earth Science Sections* 353A:348-351.

Payen, Louis A.

- 1966 Prehistoric Rock Art of the Northern Sierra Nevada. M.A. thesis, California State University, Sacramento.

Pearson, M., and S. Sullivan

- 1995 *Looking after heritage places: The basics of heritage planning for managers, landowners and administrators*. Melbourne; University of Melbourne.

Pearson, C., and B. K. Swartz (editors)

- 1991 *Rock Art and Posterity: Conserving, Managing and Recording Rock Art*. AURA Occasional Publication No. 4. Archaeological Publications, Melbourne.

Phillips, Fred M.

- 2003 Cosmogenic Cl-36 ages of Quaternary basalt flows in the Mojave Desert, California, USA. *Geomorphology* 53:199-208.

- Pineda, C. A., M. Peisach, and L. Jacobson
1988 Ion beam analysis for the determination of cation ratios as a means of dating southern African rock varnishes. *Nuclear Instruments and Methods in Physics Research* B35:463-466.
- Pineda, C. A., M. Peisach, and L. Jacobson
1989 The time-clock of aged patinas. *Nuclear Active* 41:17-20.
- Pineda, C. A., M. Peisach, L. Jacobson, and C. G. Sampson
1990 Cation-ratio differences in rock patina on hornfels and chalcedony using thick target PIXE. *Nuclear Instruments and Methods in Physics Research* B49:332-335.
- Plakht, J., N. Patyk-Kara and N. Gorelikova
2000 Terrace pediments in Makhtesh Ramon, central Negev, Israel. *Earth Surface Processes and Landforms* 25:29-30.
- Poetschat, G. and J. D. Keyser
2005 Mobiliary Carvings as a Key to Northwest Coast Rock Art. *Journal of Northwest Anthropology* 41(1):19-36.
- Poetschat, G., J. D. Keyser, and J. H. N. Loubser
2010 The Mill Creek Sites, Fremont National Forest, Lakeview, Oregon. In *Rock Art of the Oregon Country: Honoring the Lorings' Legacy*, edited by G. Poetschat and J. D. Keyser pp. 93-108. The Oregon Archaeological Society, Portland.
- Pope, G. A.
2000 Weathering of petroglyphs: direct assessment and implications for dating methods. *Antiquity* 74:833-843.
2001 Weathering Impacts on Petroglyph Engravings and Rock Panels. *American Indian Rock Art* 27:97-106.
- Qian, Fenggi
2007 China's Burra Charter: The formation and implementation of the China principles. *International Journal of Heritage Management* 13(3):255-265.
- Quinlan, Angus, and Alanah Woody
2003 Marks of distinction: Rock art and ethnic identification in the Great Basin. *American Antiquity* 68:372-390.
- Rajnovich, G.
1995 *Reading Rock Art: Interpreting the Indian Rock Paintings of the Canadian Shield*. Toronto: Natural Heritage.
- Rector, Carol
1979 The Function of East Mojave Rock Art. *American Indian Rock Art* 3:151-156.

- 1985 Rock Art as Hunting Magic: Anthropological Fact or Fiction? *Rock Art Papers* 2:127-132. San Diego, Museum of Man.
- Reichert, R. X.
- 1998 Rock Art Styles of the Coso Range: Some Considerations for Their Definition. In *Coso Rock Art: A New Perspective*, E. Younkin, ed., pp. 97-106. Ridgecrest, Maturango Museum.
- Renaud, Etienne
- 1931 Petroglyphs of Southeastern Colorado. In *Archaeological Survey of Eastern Colorado, First Report*, 64-87. Denver, CO: University of Denver.
- 1936 Pictographs and Petroglyphs of the High Western Plains. *Archaeological Survey of the High Western Plains, 8th Report*. Denver: University of Denver.
- Ricks, M. F., and W. J. Cannon
- 1985 The Lake County, Oregon, Rock Art Inventory: A data base for rock art. *American Indian Rock Art* 12.
- Ritter, Eric W.
- 1994 Scratched Rock Art Complexes in the Desert West: Symbols for Socio-Religious Communication. In D.S. Whitley and L.L. Loendorf, editors, pp. 51 - 66, *New Light on Old Art: Recent Advances in Hunter-Gatherer Rock Art Research*. UCLA Institute of Archaeology Monograph 36.
- Ritzenthaler, R.E.
- 1950 Wisconsin petroglyphs and pictographs. *Wisconsin Archaeologist* 31:83-129.
- Roberts, F.H.H.
- 1932 *The Village of the Great Kivas on the Zuni Reservation, New Mexico*. Bureau of American Ethnology, Bulletin 11. Washington, D.C.: Smithsonian Institution.
- Roefer, F., M. English and G. Lothson
- 1973 *The Jeffers Petroglyphs: A Cultural-Ecological Study*. Minnesota Prehistoric Archaeological Series No. 12. Minnesota Historical Society Press, St. Paul.
- Roosevelt, A.C.
- 1999 Dating the Rock Art at Monte Alegre, Brazil. In *Dating the Earliest Known Rock Art*, edited by M. Strecker and P. Bahn, pp. 35-40. Oxford: Oxbow Books.
- Roosevelt, A. C., M. Lima da Costa, C. Lopes Machado, M. Michab, N. Mercier, H. Valladas, J. Feathers, W. Barnett, M. Imazio da Silveira, A. Henderson, J. Silva, B. Chernoff, D. S. Reese, J. A. Holman, N. Toth, and K. Schick
- 1996 Paleoindian Cave Dwellers of the Amazon: The Peopling of the Americas. *Science* 272:373-384.

Rowe, Marvin

- 2001a Dating by AMS Radiocarbon Analysis. In *Handbook of Rock Art Research*, ed. David S. Whitley, 139-66. Walnut Creek, CA: AltaMira Press.
- 2001b Physical and Chemical Analysis. In *Handbook of Rock Art Research*, ed. David S. Whitley, 190-220. Walnut Creek, CA: AltaMira Press.

Sabo, D., and G. Sabo (editors)

- 2005 *Rock Art in Arkansas*. Little Rock: Arkansas Archaeological Survey.

Sahlins, Marshall

- 1985 *Islands of History*. Chicago University Press, Chicago.

Schaafsma, Polly

- 1971 *The Rock Art of Utah*. Papers of the Peabody Museum of American Archaeology and Ethnology No. 65. Harvard University, Cambridge, Massachusetts.
- 1975 *Rock Art in New Mexico*. University of New Mexico Press, Albuquerque.
- 1980 *Indian Rock Art of the Southwest*. Santa Fe and Albuquerque: School of American Research and the University of New Mexico Press.
- 2000 *Warrior, Shield and Star: Imagery and Ideology of Pueblo Warfare*. Santa Fe: Western Edge Press.

Schapiro, M.

- 1953 Style. In *Anthropology Today: An Encyclopedic compendium*, edited by A. L. Kroeber, pp. 287-312. Chicago: University of Chicago Press.

Scott, S. A., C. M. Davis, K. L. Steelman, M. W. Rowe and T. Guilderson

- 2005 AMS Dates from Four Late Prehistoric Rock Art Sites in West Central Montana. *Plains Anthropologist* 50:57-71.

Sease, C.

- 1987 *A conservation manual for the field archaeologist*. Institute of Archaeology, Archaeological Research tools, 4. UCLA.

Sherwood, S. C., and J. F. Simek, eds.

- 2001 Cave Archaeology in the Eastern Woodlands. Special issue of the *Midcontinental Journal of Archaeology* 26 (2).

Silko, L. M.

- 1996 Interior and Exterior Landscapes. In *Yellow Woman and the Beauty of the Spirit*, pp. 25-47. New York: Touchstone Books.

Simek, J. F., and A. Cressler

- 2001 Issues in the Study of Prehistoric Southeastern Cave Art. *Midcontinental Journal of Archaeology* 26:233-250.

- 2005 Images in Darkness: Prehistoric Cave Art in Southeastern North America. In *Discovering North American Rock Art*, edited by L. Loendorf, C. Chippendale and D. Whitley, pp. 93-113. Tucson: University of Arizona Press.
- Simek, Jan F., Jay D. Franklin, and Sarah C. Sherwood.
1998 The Context of Early Southeastern Prehistoric Cave Art: A Report on the Archaeology of 3rd Unnamed Cave. *American Antiquity* 63: 663-677.
- Jan F. Simek, Sarah A. Blankenship, Nicholas P. Herrmann, Sarah C. Sherwood, and Alan Cressler
2009 New Rock and Cave Art Sites in Tennessee: 2007. *Tennessee Archaeology* 4(1-2) pp. 194 - 210.
- Simms, S.R.
2010 *Traces of the Fremont: Society and Rock Art in Ancient Utah*. Salt Lake City: University of Utah Press.
- Simpson, A., P. Clogg, M. Diaz-Andreu and B. Larman
2004 Towards three-dimensional non-invasive recording of incised rock art. *Antiquity* 78:692-698.
- Smith, Gerald and Michael Lerch
1984 Cupule Petroglyphs in Southern California. *San Bernardino Museum Quarterly* 32.
- Stanley-Price, Nicholas
1994 *Introduction to the Management of Rock Art Sites*. Unpublished paper presented at the 59th Annual Meeting of the Society of American Archaeology, Anaheim.
- Steelman, K. L., and M. Rowe
2012 Radiocarbon dating of rock paintings: Incorporating pictographs into the archaeological record. In *A Companion to Rock Art*, J. McDonald and P. Veth, eds., pp. 565-582. Oxford: Wiley Blackwell.
- Steinbring, J.
1999 Early Rock Art of Mid-Continental North America. In *Dating the Earliest Known Rock Art*, edited by M. Strecker and P. Bahn, pp. 5-14. Oxford: Oxbow Books.
2010 Archaeology at the Hensler Petroglyph Site, An Early Engraving Site in the North American Mid-continent. In *Abstracts* (unpaginated), *Paleoarte del Pleistoceno y de la transición hacia el Holoceno en las Américas, Arte Pleistoceno del Mundo, Congreso IFRAO 2010*. Foix, France.
- Stephen, A.
1936 *The Hopi Journal of Alexander Stephen*. New York: Columbia University Press.
- Stevens, E. T.
1974 *Alaskan Petroglyphs and Pictographs*. M.A. thesis, University of Alaska.

Stevenson, M. C.

- 1904 The Zuni Indians: Their Mythology, Esoteric Societies, and Ceremonies. *Twenty-Third Annual Report of the Bureau of American Ethnology*. Washington, D.C.: Government Printing Office.

Steward, Julian H.

- 1929 Petroglyphs of California and Adjoining States. *University of California Publications in American Archaeology and Ethnology* 24(2). Berkeley.

Stoffle, Richard W., Lawrence Loendorf, Diane E. Austin, David B. Halmo, Angelita Buletts and B. K. Fulfrost

- 1995 *Tumpituxwinap* (Storied Rocks): Southern Paiute Rock Art in the Colorado River Corridor. Unpublished report prepared for the Bureau of Reclamation.

Stoffle, Richard W., Lawrence Loendorf, Diane E. Austin, David B. Halmo and Angelita Buletts

- 2000 Ghost dancing the Grand Canyon: Southern Paiute rock art, ceremony and cultural landscapes. *Current Anthropology* 41(1):11-38.

Stoffle, Richard W., M. Nieves Zedeño and D.B. Halmo, editors

- 2001 *American Indians and the Nevada Test Site: A Model of Research and Cooperation*. U.S. Government Printing Office, Washington, D.C.

Stoffle, R. W., F.P. Chmara-Huff, K. A. Van Vlack and R. S. Toupal

- 2004 *Puha Flows From It: The Cultural Landscape Study of the Spring Mountains*. University of Arizona, BARA report.

Sullivan, Hillary

- 1984 *Visitors to Aboriginal Sites: Access, control and management*. Canberra: ANPWS.
1995 Visitor Management at Painting Sites in Kakadu National Park. In *Management of Rock Imagery*, edited by G. K. Ward and L. A. Ward, pp. 82–87. Occasional AURA Publication 9, Melbourne.

Sullivan, K. M.

- 1984 Monitoring Visitor Use and Site Management at Three Art Sites—An Experiment with Visitor's Books. In *Visitors to Aboriginal Sites: Access, Control, and Management*, edited by H. Sullivan, pp. 43–53. Australian National Parks and Wildlife Service, Canberra.

Sundstrom, Linea

- 1990 *Rock Art of the Southern Black Hills: A Contextual Approach*. Garland Publishing, New York.
1996 Mirror of heaven: Cross-cultural transference of sacred geography of the Black Hills. *World Archaeology* 28:177-189.
2004 *Storied Stone: Indian Rock Art of the Black Hills Country*. University of Oklahoma Press, Norman.

- 2006 Reading Between the Lines: Ethnographic Sources and Rock Art Interpretation Approaches to Ethnography and Rock Art. In *Talking with the Past: The Ethnography of Rock Art*, J.D. Keyser, G. Poetschat and M.W. Taylor, editors, pp. 49-68. Portland: Oregon Archaeological Society.
- Swadley, Ben H.
2009 Actively Managing Rock Art Sites. *American Indian Rock Art* 35:219-237.b
- Swartz, B. K., Jr.
1978 *Klamath Basin Petroglyphs*. Socorro: Ballena Press.
- Swauger, J. L.
1974 *Rock Art of the Upper Ohio River Valley*. Graz, Akademische druck-und Verlagsanstalt.
1984 *Petroglyphs of Ohio*. Ohio University Press, Athens.
1992 Native American Rock Art in the Eastern United States. *Pennsylvania Archaeologist* 62(1):79-91
- Taçon, Paul S. C.
1992 'If you miss all this story, well bad luck': rock art and the validity of ethnographic interpretation in western Arnhem Land, Australia. In *Rock Art and Ethnography*, edited by M.J. Morwood and D.R. Hobbs, pp. 11-18. Occasional AURA Publication No. 5.
- Talayasva, Don (with L.W. Simmons)
1942 *Sun Chief: The Autobiography of a Hopi Indian*. New Haven: Yale University Press.
- Teit, J.
1896 A Rock Painting of the Thompson River Indians. *American Museum of Natural History Bulletin* 8:227-30.
1900 *Thompson Indians of British of Columbia.- Memoirs of the American Museum of Natural History*, Vol. II, Part 4.
1918 *Notes on Rock Painting in General*, by J. A. Teit, Spences Bridge, British Columbia. Unpublished manuscript on file at the National Archives of Canada, Ottawa.
- Thomas, D. H., and T. Thomas
1972 New Data on Rock Art Chronology in the Central Great Basin. *Tebiwa* 15(1):64-71.
- Titiev, M.
1937 A Hopi Salt Expedition. *American Anthropologist* 39:244-58.
1972 *The Hopi Indians of Old Oraibi: Change and Continuity*. Ann Arbor: University of Michigan Press.

Tratebas, Alice

- 1993 Stylistic Chronology versus Absolute Dates for Early Hunting Style Rock Art on the North American Plains. In M. Lorblanchet and P. Bahn, eds., pp. 163-177. *Rock Art Studies: The Post-Stylistic Era*. Oxford, Oxbow Monograph 35.
- 1999 The Earliest Petroglyph Tradition on the North American Plains. In *Dating the Earliest Known Rock Art*, edited by M. Strecker and P. Bahn, pp. 15-28. Oxford: Oxbow Books.
- 2000 Evidence of Paleo-Indian and Archaic Hunting Techniques. *American Indian Rock Art* 24:65-75
- 2004 Rock Art and the Peopling of the New World. In *New Perspectives on the First Americans*, edited by B. T. Lepper and R. Bonnicksen, pp. 179-186. College Station: Texas A&M University Press.
- 2010 Late Pleistocene Rock Art Traditions on the North American Plains. In *Abstracts* (unpaginated), *Paleoarte del Pleistoceno y de la transición hacia el Holoceno en las Américas*, *Arte Pleistoceno del Mundo*, Congreso IFRAO 2010. Foix, France.

Tratebas, A., N. A. Cerveny and R. I. Dorn

- 2004 The effects of fire on rock art: microscopic evidence reveals the importance of weathering rinds. *Physical Geography* 25:313-333.

True, D.L.

- 1954 Pictographs of the San Luis Rey Basin, California. *American Antiquity* 20:68-72.

Turner, C. G., II

- 1963 Petroglyphs of the Glen Canyon Region. *Museum of Northern Arizona Bulletin* 38, Flagstaff
- 1971 Revised Dating for Early Rock Art of the Glen Canyon Region. *American Antiquity* 36:469-71

Turpin, S. A.

- 1994 On a Wing and a Prayer: Flight Metaphors in Pecos River Pictographs. In *Shamanism and Rock Art in North America*, edited by S. A. Turpin, pp. 73-102. Rock Art Foundation, Inc. Special Publication 1, San Antonio.
- 2001 Archaic North American. In *Handbook of Rock Art Research*, pp. 361-413, ed. D. S. Whitley. Walnut Creek: AltaMira Press.

Vastokas, J. M., and R. K. Vastokas

- 1973 *Sacred Art of the Algonkians: a Study of the Peterborough Petroglyphs*. Mansard, Peterborough.

von Werlhof, Jay

- 1965 Rock Art of the Owens Valley, California. *University of California, Archaeological Survey, Reports* 65. Berkeley.
- 2004 *That They May Know and Remember - Vol. 2: Spirits of the Earth*. Ocotillo: Imperial Valley College Desert Museum Society.

- von Werlhof, Jay, H. Casey, R. I. Dorn, and G. A. Jones
1995 AMS ¹⁴C age constraints on geoglyphs in the lower Colorado River region, Arizona and California. *Geoarchaeology* 10: 257-273.
- Wagner, Mark J.
2002 The Archaeology and Rock Art of the Piney Creek Ravine. Illinois Transportation Archaeological Research Report No. 12.
- Wagner, Mark J., Mary R. McCorvie, and Charles A. Swedlund
2009 Buffalo Rock (11JS49): A Historic Period Native American Rock Art Site in Johnson County, Illinois. *Tennessee Archaeology* 4(1-2) pp. 211-228.
- Walker, D. E.
1991 Protection of American Indian Sacred Geography. In *Handbook of American Indian Religious Freedom*, edited by C. Vecsey, 100–15. Crossroads, New York.
- Wallace, H.
1983 The Mortars, Petroglyphs and Trincheras on Rillito Peak. *Kiva* 48(3):137–246.
1989 *Archaeological Investigations at Petroglyph Sites in the Painted Rock Reservoir Area, Southwestern Arizona*. Technical Report 89-5. Tucson: Institute for American Research.
- Wallace, H. D., and J. P. Holmlund
1986 Petroglyphs of the Picacho Mountains, South Central Arizona. *Institute for American Research Anthropological Papers*, No. 6, Tucson.
- Waslewicz, T., D. Staley, H. Volcker and D. S. Whitley
2005 Terrestrial 3D Laser Scanner: A New Method for Recording Rock Art. *International Newsletter On Rock Art (INORA)* 41: 16-25.
- Waters, F.
1963 *Book of the Hopi*. New York: Penguin Books.
- Weeks, R.
2009 Antiquity of the Midewiwin: An Examination of Early Documents, Origin Stories, Archaeological Remains, and Rock Paintings from the Northern Woodlands of North America. Ph. D. Dissertation, Department of Anthropology, Arizona State University. Ann Arbor: ProQuest.
- Wellman, Klaus
1979 *A Survey of North American Indian Rock Art*. Graz, Akademische druck-und Verlagsanstalt.
- Wells, Nova.
1996 *Petroglyphs of Saline River Valley, Kansas*. American Rock Art Research Association, Monograph No. 2.

White, Raymond C.

- 1963 Luiseño Social Organization. *University of California Publications in American Archaeology and Ethnology* 48:91-194. Berkeley.

White, William

- 1998 Data Review Pertinent to the Examination of Selected rock Art Sites on Nellis Air Force Base and Adjacent BLM Air Space Lands in Southern Nevada. Unpublished report on file, Nellis AFB.

White, William and Richard I. Orndorff

- 1999 A Cultural Resources and Geological Study Pertaining to Four Selected Petroglyph/Pictograph Sites on Nellis Air Force Base and Adjacent Overflight Lands, Lincoln and Nye Counties, Nevada. Unpublished report on file, Nellis AFB.

Whiting, Beatrice B.

- 1950 *Paiute Sorcery*. Viking Fund Publications in Anthropology, Number 15. New York.

Whitley, David S.

- 1982 *A Study of North American Rock Art*. Ph.D. dissertation, Department of Anthropology, UCLA.
- 1992a Shamanism and Rock Art in Far Western North America. *Cambridge Archaeological Journal* 2:89-113.
- 1992b Prehistory and Post-Positivist Science: A Prolegomenon to Cognitive Archaeology. *Archaeological Method and Theory* 4:57-100.
- 1994a By the hunter, for the gatherer: art, social relations and subsistence change in the prehistoric Great Basin. *World Archaeology* 25:356-373.
- 1994b Shamanism, natural modeling and the rock art of far western North American hunter-gatherers. In S.A. Turpin, editor, pp. 1-43, *Shamanism and Rock Art in North America*. Special Publication 1. Rock Art Foundation, San Antonio.
- 1994c Ethnography and Rock Art in Far Western North America: Some Archaeological Implications. In *New Light on Old Art: Recent Advances in Hunter-Gatherer Rock Art Research*, edited by D. S. Whitley and L. L. Loendorf, pp. 81-94. Monograph 36, Institute of Archaeology, University of California, Los Angeles.
- 1996 *Guide to Rock Art Sites: Southern California and Southern Nevada*. Missoula, MT, Mountain Press Publishing, Inc.
- 1998a Prehistory and Native American History in the Coso Range: Context for the Coso Petroglyphs. In *Coso Rock Art: A New Perspective*, E. Younkin, ed., pp. 29-68. Ridgecrest, Maturango Museum.
- 1998b Meaning and Metaphor in the Coso Petroglyphs: Understanding Great Basin Rock Art. In *New Perspectives on the Coso Petroglyphs*, E. Younkin, ed., pp. 109-174. Ridgecrest, CA: Maturango Museum.
- 1999a A possible Pleistocene camelid petroglyph from the Mojave Desert, California. *San Bernardino County Museum Association Quarterly* 46(3):107-108.
- 1999b Issues in the Commodification of the Past. Paper presented at the Society for American Archaeology meetings, Chicago.

- 2000 *The Art of the Shaman: Rock Art of California*. Salt Lake City, University of Utah Press.
- 2001a Rock Art and Rock Art Research in Worldwide Perspective: An Introduction. In *Handbook of Rock Art Research*, ed. D.S. Whitley, pp. 7-54. Walnut Creek: AltaMira Press.
- 2001b (ed.) *Handbook of Rock Art Research*. Walnut Creek: AltaMira Press.
- 2001c Science and the Sacred: Interpretive Theory in US Rock Art Research. In *Theoretical Perspectives in Rock Art Research*, ed. Knut Helskog, pp. 130-157. Novus Press, Oslo, Norway.
- 2004a Management Plan for Rock Art Sites on BLM Lands in California. In *The Human Journey and Ancient Life in California's Deserts: Proceedings from the 2001 Millennium Conference*, M.W. Allen and J. Reed, eds, pp. 225-228. Maturango Museum Publication No. 15, Ridgecrest.
- 2004b Rock Art Research and Management in the U.S.A., in *The Future of Rock Art - A World Review: Rapport fran Riksantikvarieambetet 2004:7*, ed. by U. Bertillon and L. McDermott, pp. 188-197. Stockholm, National Heritage Board of Sweden.
- 2004c Hawai'ian Cupules and Numic Vulva-Forms: Two Case Studies in Gender and Rock Art. Paper presented at "International Symposium on Gender and Rock Art: From cave art to contact." Foix, France, 2004.
- 2005a *Introduction to Rock Art Research*. Walnut Creek, Left Coast Press.
- 2005b Rock Art Conservation and Management in Guatemala: The Case of Naj Tunich, Poptún, Petén, Guatemala. Report submitted to IDEAH, Guatemala.
- 2006a Rock Art and Rites of Passage in Far Western North America. In *Talking with the Past: The Ethnography of Rock Art*, ed. JD Keyser, G Poetschat & MW Taylor, pp. 295-326. Portland, Oregon Archaeological Society.
- 2006b Ethnohistory and Rock Art in South-Central California. In *American Indian Rock Art* 21:241-259. American Rock Art Research Association.
- 2011 *Introduction to Rock Art Research*, second revised edition. Walnut Creek: Left Coast Press, Inc.
- 2012 In suspect terrain: Dating rock engravings. In *A Companion to Rock Art*, J. McDonald and P. Veth, eds., pp. 605-624. Oxford: Wiley Blackwell.

Whitley, David S. and Harold Annegarn

- 1994 Cation-ratio dating of rock engravings from Klipfontein, Northern Cape Province, South Africa. In *Contested Images: diversity in Southern African rock art research*, edited by T. A. Dowson and J. D. Lewis-Williams, pp. 189-197. Witwatersrand University Press, Johannesburg.

Whitley, D. S. and R. I. Dorn

- 1987 Rock art chronology in eastern California. *World Archaeology* 19:150-164.
- 1988 Cation-ratio dating of petroglyphs using PIXE. *Nuclear Methods and Instruments in Physics Research* B35:410-414.
- 2010 The Coso Petroglyph Chronology. *Pacific Coast Archaeological Society Quarterly* 43: 135-157.

- Whitley, David S., and Lawrence L. Loendorf.
2005 Rock Art Analysis. In *Handbook of Archaeological Methods vol. II*, ed. Herbert Maschner and Christopher Chippindale, 919-73. Lanham, New York, Toronto, and Oxford: AltaMira Press, a Division of Rowman and Littlefield Publishers, Inc.
- Whitley, D. S., R. I. Dorn, J. M. Simon, R. Rechtman, and T. K. Whitley
1999a Sally's Rockshelter and the Archaeology of the Vision Quest. *Cambridge Archaeological Journal* 9:221-247.
- Whitley, David S., Johannes H. N. Loubser and Don Hann
2004 Friends in low places: Rock art and landscape on the Modoc Plateau. In *The Figures Landscapes of Rock Art: Looking at Pictures in Place*, edited by C. Chippindale and G. Nash, pp. 217-238. Cambridge University Press, Cambridge.
- Whitley, David S., Joseph M. Simon and Ronald I. Dorn
1999b The Vision Quest in the Coso Range. *American Indian Rock Art* 25:1-32.
- Whitley, D. S., J. M. Simon, and J. H. N. Loubser
2008 *Condition Assessment of Saucito Rock, San Luis Obispo County, California*. W&S Consultants Report submitted by to the BLM, Bakersfield.
- Whitley, D.S., J. Simon and J.H.N. Loubser
2007 The Carrizo Collapse: Art and Politics in the Past. In *A Festschrift Honoring the Contributions of California Archaeologist Jay von Werlhof*, ed RL Kaldenberg, pp. 199-208. Ridgecrest: Maturango Museum Publication 20.
- Whitley, D. S. and T. K. Whitley
2012 A Land of Visions and Dreams. In *Issues in Contemporary California Archaeology*, T. Jones and J. Perry, eds., pp. 255-314. Walnut Creek: Left Coast Press.
- Whitley, D. S., T. K. Whitley and J.M. Simon
2006 *The Archaeology of Ayer's Rock, Inyo County, California*. Maturango Museum Publication #19, Ridgecrest.
- Whitney, J. W., and C. D. Harrington
1993 Relict colluvial boulder deposits as paleoclimatic indicators in the Yucca Mountain region, southern Nevada. *Geological Society of America Bulletin* 105:1008-1018.
- Wintcher, Amanda
2005 Rock Art and Landscape in the Piñon Canyon Maneuver Site, Southeast Colorado. In *Making Marks: Graduate Studies in Rock Art Research at the New Millennium*, ed. Jennifer Huang and Elisabeth Culley, 163-81. Occasional Paper No. 5, American Rock Art Research Association.

Woody, Alanah

- 1996 *Layer by Layer: A Multigenerational Analysis of Massacre Lake Rock Art*. University of Nevada, Reno, Department of Anthropology, Technical Report 97-1.

York, A., R. Daly, and C. Arnett

- 1993 *They Write Their Dreams on Rocks Forever: Rock Writings of the Stein River Valley of British Columbia*. Talonbooks, Vancouver, B.C.

Young Jane.

- 1988 *Signs from the Ancestors*. Albuquerque: University of New Mexico Press.

Zawadzka, D.

- 2008 Canadian shield rock art and landscape perspective. Ph.D. dissertation, Trent University.

Zedeño, Maria Nieves, and K. Hamm

- 2001 The Ethnoarchaeology of the Pahute and Rainier Mesas. In R.W. Stoffle, M.N. Zedeño and D.B. Halmo, editors, pp. 98-121, *American Indians and the Nevada Test Site: A Model of Research and Cooperation*. U.S. Government Printing Office, Washington, D.C.

Zerboni, Andrea

- 2008 Holocene rock varnish on the Messak plateau (Libyan Sahara): Chronology of weathering processes. *Geomorphology* (2008), doi: 10.1016/geomorph.2008.06.010.

Zhang, Y., T. Liu, and S. Li

- 1990 Establishment of a cation-leaching curve of rock varnish and its application to the boundary region of Gansu and Xinjiang, western China. *Seismology and Geology* (Beijing) 12:251-261.

Zhou, B. G., T. Liu and Y. M. Zhang

- 2000 Rock varnish microlaminations from northern Tianshan, Xinjiang and their paleoclimatic implications. *Chinese Science Bulletin* 45:372-376.

APPENDICES

APPENDIX A
CRM Questionnaire

DoD Rock Art Questionnaire

CRM Rock Art Questionnaire

Through the support of the Department of Defense Legacy Resource Management Program, an assessment of the state of knowledge concerning rock art sites on Department of Defense facilities is being conducted. Rock art sites are cultural resources that were created by Native Americans or Native Hawaiians. Rock art includes pictographs (rock paintings), petroglyphs (rock engravings and incisions), and earth figures (geoglyphs, intaglios and petroforms).

For the purposes of completing this study, we ask that you complete this questionnaire and return it by email or FAX to:

David S. Whitley, Ph.D., RPA
ASM Affiliates, Inc.
dwhitley@asmaffiliates.com
661-823-7690; 805-794-6037
FAX: 661-823-7897

If possible, we would also like to conduct a follow-up phone interview for those Cultural Resource Managers with facility rock art sites.

Definitions:

For the purposes of this questionnaire, the following definitions are employed:

“Site recording” is the completion of a standard site inventory form, minimally including a brief site description, locational information, and sketch map.

“Site documentation,” in addition to a site record, is a systematic record in the form of a rock art site report. It includes graphic illustrations (photos, tracings or scaled drawings) of, and locational information on, all rock art motifs or panels (clusters of motifs) at a site.

“Condition assessment” is a formal evaluation of the physical integrity and potential natural and cultural threats to a rock art site.

“Rock art management program” is the formal management and treatment plan intended to promote the long-term sustainability of a rock art resource. It may consist of a visitor access/control program, condition assessment and monitoring protocols, and/or a conservation plan.

“Conservation programs” involve physical treatments on rock art panels, such as graffiti removal or the alteration of a rock-shelter drip-line

Your support of this assessment, through the completion and return of this questionnaire, is greatly appreciated.

DoD Rock Art Questionnaire

DoD Rock Art Questionnaire:

1) Name of facility:

2) Name and position of questionnaire responder:

3) Date:

4) Exact or approximate number of prehistoric and historic-Native American/Hawai'ian sites on facility:

5) Number of rock art sites on facility:

If your facility has no known rock art sites, please return the questionnaire as completed, to ensure that our statistical compilations accurately reflect DoD-wide circumstances.

If your facility has one or more rock art sites, please complete the following additional questions:

6) If facility rock art sites or districts are NRHP or NHL listed, please provide the name of the site/district (and the number of sites included in districts):

7) Number of documented rock art sites on facility (see definitions above):

8) Number of rock art sites with condition assessments:

9) Does the facility have a rock art site management plan? (yes/no)

As a component of facility ICRMP?

As stand-alone plan?

10 Please briefly describe existing facility management approach for rock art (e.g., passive preservation, formal management program, etc.):

11) Recognized management/condition issues and problems: (yes/no)

a) Site access:

Public visitor access control?

DoD Rock Art Questionnaire

DoD personnel access control?

Native American/Hawai'ian access control?

b) Condition/preservation issues:

Graffiti or vandalism?

Weathering or erosion?

12) Have any conservation treatments been completed on the facility rock art site(s)? If "Yes," please describe:

13) Please briefly describe any site conservation and management conflicts with facility mission (e.g., need to use site area for training):

14) Please briefly describe any other management issues involving the facility's rock art site(s):

15) Please briefly describe the number and nature of rock art specific management studies that have been conducted on the facility site(s):

16) Please briefly describe the number and nature of research studies that have been conducted on the facility site(s):

17) May we call you for a brief, follow-up phone interview? If yes, please provide phone number and best time to call.

Thank you for your assistance.

