Analytical Techniques in the Analysis of Rock Art

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rock art, methodology, techniques, recording

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INTRODUCTION

The study of rock art intrigues archaeologists, ethnologists, art historians, and conservationists for many different reasons. The ultimate hope is that art depicted on rocks will shed insight into the minds of peoples who came before us. Art is believed to be an expression of culture and conceptual processes not otherwise seen in functional tools or artifacts. Rock art is thus studied to hopefully unveil the oldest signs of culture in the oldest rock art sites; to ideally assign a point where our ancestors shared culture with us, *Homo sapiens sapiens*. This explains the intrigue surrounding Chauvet Caves in France, the oldest known rock art site to date. It is epitomized as a decoding key, unlocking the mystery of cognitive processes otherwise absent from us in the archaeological record. In essence, the study of rock art is the study of ourselves, to understand why art is a part of who we are and what it represents about us, all the while linking us to the past. Jones (1981:2) describes the cultural perception that highly structured social institutions such as religion dictate low variation in artistic style, giving us an example of the information that can be extracted from rock art sites.

Rock art sites appear throughout the world, from North and South America to Europe, Asia, Australia, and Africa. All rock art sites, however, invoke a feeling of spirituality inspired by the beauty of the scenery and majesty of the rock. Often the symbolism of the canvas, in this case the geological formation, is overshadowed by the obvious importance of the peoples who created this art. Although this is not always possible, ethnographic accounts can be used as an analogy for first hand knowledge and in this manner, aspects of nature are given qualities of life and power (von Werlhof 1986:1). Rock, as a symbolic element, has been cross-culturally included in origin myths of peoples around the world and thought of as a stable and permanent element (von Werlhof 1986:1). The Quechua of Peru believe humanity evolved from rock and the Christian bible symbolically names the apostle, Peter, as the rock on which God’s church was built. Leonard Crow Dog, a shaman of the Sioux, believed that rock was here when the world began and claimed it to be the very womb of mother earth (von Werlhof 1986:1). The Ojibwa Indians of Lake Superior maintained the natural world through respect and ritual observances where the pictograph sites record their native religious traditions that combine an understanding of the spiritual and physical landscape (Conway and Conway 1990:1). In some ethnographic instances, the power, or mana, within the rock cannot be released until the art, or spirit, is applied by a shaman (von Werlhof 1986:4). The study of rock art is therefore believed to be the spatial manifestation of the synthesis of the shaman and the rock (Conway and Conway 1990:1). Art involves a “selection from life experiences of the artist and a symbolization of this in a manifest form” (Jones 1981:2). In other words, studying rock art may divulge
information regarding daily life. Before interpretation, however, the art and the canvas must be scientifically analyzed, requiring accurate methods of recording the data as well as numerous ways to date this cultural resource.

Rock art refers to two-dimensional depictions on horizontal or vertical rock surfaces and for the purposes of this paper will refer to art on parietal or rupestral (immovable) rock surfaces (Jones 1981:1). The two major types are pictographs, also known as rock paintings, and petroglyphs, commonly referred to as rock engravings or carvings outside North America (Jones 1981:2). Pictographs are an additive process in which a substance, itself containing information, is added to the rock just as the pigment alone in a drawing, or with wet pigment used in a painting. It is nearly impossible, without chemical analysis, to determine if the pigment was wet or dry when applied (Bednarik 1992:279). Therefore, for the purposes of this paper, the terms painting and drawing will be interchangeable. The paint added to the rock surface contains one or more pigments, the substance providing colour. In some cases binders, extenders, and liquid bases are also included (Bednarik 1992:279). Petroglyphs are a created by a deductive process involving removal of part of the rock and it is through the pecking, abrading, or etching that most technical information regarding the feature is obtained (Jones 1981:1-2). Pictographs provide a substance that can be dated and in most cases the production of the pigment is concurrent with the painting in archaeological time. This element is missing in petroglyphs (Bednarik 1992:279). It is this major difference that leads to differences in recording and analyzing petroglyphs and pictographs. This paper will discuss the methods and case studies of discovery, recording, and dating of rock art.

DISCOVERY

The first step in recording a rock art site is the discovery. This term, however, implies that most sites are lost but in reality, many sites are still considered spiritual and sacred places by the descendants of the artists. To discuss the “discovery” of the site is to disregard indigenous knowledge (Conway and Conway 1990:8). It is possible, however, to bring a site to national attention like the national explorer, Selwyn Dewdney, who brought national acclaim to the Agawa rock art site on Lake Superior in 1958 (Conway and Conway 1990:8). Like most other “discoverers” of rock art sites, Dewdney used historic accounts of early explorers to find his way (Conway and Conway 1990:8). Other common and frequently used methods are sources who know the landscape like indigenous peoples or tour guides, documentation from archaeological societies of a given region, and local newspapers (Jones 1981:7).

Another direction to follow is the use of ethnographic information. Certain geological formations are often considered sacred sites to aboriginal peoples. For example, the Ojibwa view the cliffs of Agawa Rock as ‘cut rock’, places where the earth’s energy is exposed (Conway and Conway 1981:11) and von Werlhof (1986:2) describes the practice of Australian Aborigines applying art to rock surfaces precisely because of the peculiar qualities ascribed to the rock. Understanding the spirituality of indigenous peoples may provide clues to a geological pattern of sites. However, not all sacred sites of the Ojibwa have rock art, but it is this method of looking for patterns that can aid in the search for sites. A similar pattern was used for the Churchill River sites, Saskatchewan, where the archaeologists looked for geological patterns such as site location, type of rock (granite versus basalt),
and formation of the rock itself (crevice, cave, or outcropping) (Jones 1981:8). The Chauvet Caves site in France was discovered by speleologists and archaeologists exploring different caves in their spare time (Chauvet et al. 1996:20).

**RECORDING**

Selwyn Dewdney was the first rock art researcher in Canada and in his writings discusses some of the first known recordings of petroglyphs in Atlantic Canada (Lundy 1977:1). George Creed was a village postmaster who recorded these petroglyphs by filling in the delicate grooves with indelible pencil and pressing damp paper into the engravings, thus transferring each figure (Lundy 1977:1). Site reports until the 1950s included crude freehand sketches by field assistants or hasty sketches by passing geologists (Lundy 1977:2). New techniques for recording pictographs and petroglyphs have been developed due to the technological innovations developed in the most common forms of recording rock art such as tracings, rubbings, and photography.

Within academia, two audiences exist requiring different types of information: the archaeologist, ethnologist, and the conservator (Rosenfeld 1978:11). The basic premise of the archaeologist in any archaeological investigation is to obtain as much information as possible in the advent of destruction of a site resulting from excavation or natural disaster. As well, future research endeavors are not known and it is therefore ideal to collect information pertaining to the original research question. It is Rosenfeld’s (1978:10) opinion that accuracy fulfilling future research requirements can amount to no less than an obviously impossible complete replica at the atomic level. Hence, his solution is conservation and preservation. The archaeologist is concerned with past human behaviour and, therefore, focuses on artifactual and non-artifactual features resulting from human behaviour. This is in contrast to the conservator who requires chemical, physical, and mineralogical data focusing on the colour, surface texture, porosity, and form of the rock and art for deterioration studies (Rosenfeld 1978:11). The needs of each are not exclusive, and can be facilitated in the same recording system while maintaining efficiency and economy.

In the recording of rock art sites, another issue to be addressed is the degree of detail or accuracy. A common frustration in rock art literature is the misrepresentation or inaccurate representation of images (Dewdney 1979:325-6). Rosenfeld (1978:1) asks the question, “What levels of detail and accuracy are required, how comprehensive should records be?” To answer this question, the purpose of research needs to be addressed. He does, however, feel that sites in immediate danger should be recorded as accurately as possible and although this may not be the most economical solution in which funding is concerned, unexpected natural or human-induced disasters may result in the obliteration of inappropriately recorded sites that were assumed to be safe. Rosenfeld (1978:10) does recognize a feedback relationship between information recorded and research developments: that an increase in data recorded facilitates and inspires more specific areas of inquiry.

Another potential danger exists in the verbal description of rock art (Dewdney 1979:326). Verbal descriptions are often culturally loaded, implying images of typologies rather than descriptions of the actual image. For example, Dewdney (1979:326) describes the danger of descriptive terms such as ‘man’ to an androgynous figure. Typological classification systems allow a uniform manner in discussing images despite variations. Unfortunately, this brevity in description leads to inadequate representations and affects the interpretations.
of future researchers. The assignation of types results in premature interpretations rather than descriptions (Rosenfeld 1978:9). Dewdney (1979:328-30) discusses the clear presence of distinct styles in some pictographic assemblages, but also the almost complete lack of symptomatic or diagnostic features in others. Failure to recognize this leads to loss of information. In effect, the issue is the information. Major discrepancies exist in using a coded typological classification. Alternatively, the use of gradation following the Munsell colour chart in which scales of style values and gradations between pairs of opposites are recorded is suggested (Dewdney 1979:328-30).

Dewdney (1979:328-30) advocates the multivariate use of visual and verbal descriptions in an attempt to holistically record data and avoid interpretation. Unfortunately, the lack of standardization in requirements decreases accuracy in most visual representations and offers examples of differences in visual representation of the same image. Overall, Dewdney’s (1979:328) position is that more accurate recording procedures and attitudes must be adopted to eliminate the inconsistencies seen in the archival rock art literature. Therefore, when recording rock art sites, one of the most important factors is the attitude of the researcher and his/her utilization of the methods described below.

**Tracings, Rubbings, and Castings**

The most common method of recording rock art sites includes a combination of techniques such as photography, tracing, rubbing, and moulding or casting (Taylor et al. 1979:310), all supplemented with extensive field notes (Dickman 1986:152). Tracings are the most common means of recording rock paintings because of the potential to produce more accurate results than freehand sketches, are economical, and allow control over which traits are recorded (Rosenfeld 1978:13). Jones (1981:8) developed his own specific tracing method used for the Churchill River rock art sites. In this case, transparent film material such as Saran Wrap was adhered to the wall using masking tape and to each other, if required, by transparent tape.

A fine felt of fibre-tipped pen with indelible ink was used to trace the figures. Care was taken to ensure that the outer edges on the tracings corresponded exactly with the outer edges of the paintings. Red pens were used for paintings, while blue was usually used to delineate lichen or moss growths, and black for cracks, chips, or other features in the rock face. Notations about special features were made on the margins of the tracing. (Jones 1981:8).

Items such as water level and direction were also recorded in the field notes. Tracings on mylar for petroglyphs have been used but are generally considered to miss important details of the petroglyph (Cameron 1979:366). Unfortunately, the reproduction that results from tracings is two-dimensional whereas the surface being recorded is three-dimensional (Rosenfeld 1978:11). This loss in dimension results in a loss of detail and accuracy. Tracing sheets require dimensional stability and transparency (Rosenfeld 1978:13). Alternatives to Saran Wrap are sheet polyethylene and acetate sheets. Unfortunately, the former stretches irreversibly and although the latter is durable and does not stretch, it is unsuitable for archival conditions due to long-term chemical instability (Rosenfeld 1978:13).
Rubbings for petroglyphs are the equivalent to tracings for pictographs. Walker et al. (1979:341) describes rubbings as the best method for recorded carvings. They provide ideal overall scale although they often include lines that are fissures and exclude shallow lines of the engraving. Another problem is the role of the archaeologist as interpreter. Factors such as width of the line are at the discretion of the interpreter and objectivity may be lacking (Cameron 1979:367). Differing depths of the grooves are also not conveyed in rubbings (Walker et al. 1979:342).

The procedure followed by Walker et al. (1979:342) is to first photograph the petroglyph, make an initial rubbing, photograph the rubbing, and compare the photograph with the site. Corrections are marked on the photograph and the petroglyph was then rubbed again using the photograph as a guide. This process is then repeated as necessary while dealing with factors such as weather, seasonality, and isolation of the site and can take up to two years to complete one rubbing suitable for archives (Walker et al. 1979:343). Cameron’s (1979:366) preferred technique for recording petroglyph sites is surface printing with cloth and wax. An unbleached, clean, cotton cloth such as muslin is adhered to the surface with masking tape. The fabric is then sprayed with water, readjusted, re-taped, and allowed to dry slightly (Cameron 1979:367). The wax is best applied when the cloth is slightly wet and is usually cobbler’s wax for larger abraded glyphs and harder stick wax for incised designs. A supplementary photographic record is used to compare the rubbing and the original surface. The final rubbing is easily stored, photographed, or dry-mounted for display (Cameron 1979:367).

Some factors that could impede the wax-and-cloth rubbing method are exfoliation of the wall, sunlight melting the wax, and humid conditions preventing adherence of the tape. The translation of the rubbing is affected by variables such as weather conditions, attitude of the researcher, and variation in slant or direction of wax as it is applied to the cloth (Cameron 1979:367). There is also the danger of drawing rather than interpreting in the accentuation of nuances.

Another method for recording petroglyphs is aluminum foil casting and is based on its malleable nature (Clegg 1978:22). The premise is that when applied to a figure, the side of the aluminum foil that is in contact with the material under study provides a very close negative reproduction of the surface detail with an accuracy of one part in one thousand for a metre-sized engraving (Clegg 1978:22). The method basically consists of loosely covering the area with tin foil and tamping it. The action is perpendicular to the surface which helps avoid tearing while maximizing details by stretching and moving the foil until it settles into the grooves. The thickness is built up to three or more sheets of foil and the deepest grooves are reinforced with masking tape. The next stage strengthens the aluminum foil for transportation by gluing on three or more layers of cloth or paper before removal from the rock (Clegg 1978:23). The cast is protected with foam plastic on both surfaces and transported on a carrying board. The cast is then used to produce a fibreglass or other type of permanent and robust positive reproduction of the engraving (Clegg 1978:25). However, areas larger than 1 m² and grooves deeper than 1 cm produce problems in transportation. The advantage, aside from cost, is that detail otherwise unnoticed is accentuated by the shine of the foil (Clegg 1978:25).

Photography

Photography is first used as a descriptive tool but can also be used as an aid to evaluation and observation (Rosenfeld...
1978:2). When photographing a rock art site, it is important to remember to not only photograph the technical aspects of the site, but also the site with the distortion as perceived through the observer as this may be the artists' intended effect. Photographs that should be taken are: general site views, surrounding of the site, specific areas of the site, groups of figures, individual figures, and details within figures. Control of the equipment, angle, lighting, and filters can allow photography to record details not otherwise visible to the naked eye. Polaroids are excellent in preliminary site evaluation and as a supplement to field notes, and macrophotography has also been used in studies of technical aspects of engravings (Rosenfeld 1978:12-13). The basic premise of nightlite petroglyph photography is the control of the light source at night to accentuate the details of the carvings by manipulating the shadows in the grooves (Walker et al. 1979:341). An added benefit is the “animation” of the petroglyphs as the light source is moved along different angles. Unfortunately, photography may not always produce satisfactory results when used in petroglyph sites that are highly eroded or pictograph sites lacking distinct contrast (Cameron 1979:366). However, experimentation with equipment and lightsources by Walker et al. (1979:341) during the rescue excavation of the petroglyphs of Ringbolt Island, B.C., improved the accuracy of the rubbings by clearly identifying groove widths and depths.

Photogrammetry is a plotting technique using stereoscopic photographs to provide a precise, three-dimensional record (Taylor 1979:310). It is often used in site survey because maps can be redrawn with different selection of traits or scale from the same photos without returning to the site and the actual fieldwork is quick and uncomplicated (Rosenfeld 1978:13). Unfortunately, the equipment can be difficult to handle in confined spaces, photographs at horizontal angles are difficult to use, complex rock morphology can contain projections obliterating areas from the camera's field of view, and the special skills of a photogrammetric plotter are required (Rosenfeld 1978:13). Another disadvantage is that because the area covered by each set of stereophotographs depends on the length of the baseline where detailed work requires a short baseline and vice versa for more general views, a wide range of camera equipment is required to provide an exhaustive photogrammetric record of the site (Rosenfeld 1978:14).

An inexpensive alternative to photogrammetry is the use of stereophotography. Clegg (1979:25) adapted a method of creating stereopairs using a normal camera in which the first picture is taken with his weight on one foot, then another with his weight on the other foot. Julesz (Clegg 1979:26) has shown that "stereopsis can be obtained perfectly well even if one picture is larger by 15%, out of focus, or tilted compared with its pair." In effect, the precise placing of the two viewpoints is not critical.

**DATING**

One of the difficulties in studying rock art is dating, for which there are two classifications (Bednarik 1996:1). Internal or direct dating takes the information required for dating from figures themselves through the pigment or the image or subject itself. The second is external or indirect dating and includes gleaning information from the archaeological layers covering the painting, topographical relation within the archaeological layers, and stylistic comparison (Bednarik 1996:1). The major consideration in each dating technique is what is being dated and how that date relates to the event resulting in the rock art. The following
is a discussion of several types of relative dating methods, the radiocarbon dating of the Chauvet Caves in France, and a review of the different methods used to date the Côa Valley petroglyphs of Portugal.

Relative Dating Methods

Lichenometry is the dating of lichen, a symbiotic relationship between fungi and algae that grows in harsh conditions such as the side of a rock face (Jones 1981:62). It has been proposed that it is possible to date lichen and therefore show that the encroached upon rock art is older than the lichen. This is extremely difficult, however, because the growth of lichen is dependant upon the microenvironment unique to each cliff face and growth of the lichen may be too minute to detect in a realistic time frame (Jones 1981:62). Another disadvantage is that conservation efforts or recording techniques such as tracings usually result in the removal of the lichen from the rock surface.

Dating using stylistic senahon assumes that change in style is a function of time, and that change in style reflects a change in the material culture. The possibility that change in style is a reflection of functional or individual variation would relate to site types rather than regional distribution of sites (Hyder 1989:4). The basis for determining which style is older is the use of superimpositions. When a picture is painted over another from which it is stylistically distinct, it is said to be younger than the first. This is an age relative to the other styles seen in the area (Keyser 1992:19). In many cases, like the Ojibwa rock art, there is not an adequate number of superimposed paintings to develop a style seriation (Conway and Conway 1990:53). Ethnographic evidence of the Wabemo medicine men illustrates different styles used at different times, but also used at the same time and the abstract style of animal paints was used only in vision quests (Conway and Conway 1990:53). Stylistic comparison has been used, however, in sites in France and Spain where rock engravings closely resemble engraved designs on animal bone found in dated archaeological deposits (Keyser 1992:18). It is the similarity in style that links the rock art to the dated archaeological layer. The possibility of independent innovation in two groups, however unlikely, is disregarded. It is also possible that the people responsible for one medium, portable or parietal, discovered the other and copied it onto their chosen form. Although proximity may indicate a relationship between the two stylistically similar items, it cannot be assumed that relationship is one of temporal continuity. Stylistic seriation assumes style is a function of time and cultural continuity, giving no credence to individual or functional variation, or reversion to a previous style.

It is sometimes possible to date rock art sites when the panel is covered by sediment containing dated archaeological artifacts (Keyser 1992:18). One situation involves the accretion of sediment against the intact panel, the other is the accretion of sediment over a panel that has fallen (Keyser 1992:18). In both situations, a minimum age boundary is given because it is logically older than the sediment covering it. A maximum age is not determined unless the panel fell on to a datable archaeological layer (Keyser 1992:18), and may be questionable even then. In some cases, the subject matter of the images is considered a direct dating method (Bednarik 1996:1). I am discussing them as relative dating methods, however, because rather than a time range given with radiocarbon dating, only a maximum time range is possible. Clearly represented historic items such as horses, guns, wagons, European Americans, and buildings are post-contact in age (Bednarik 1996:1). Depictions of people mounted on horses are dated to after A.D. 1720 on the Columbia Plateau when horses
were first introduced by Spanish settlements in New Mexico. Bednarik (1996:1), however, feels it is inappropriate to use depictions of animal species as a method to date rock art. Many purportedly “identifiable” animals are depicted in distorted manner. To assume knowledge of the proposed image or species is to first assume the cognitive processes of the artist and the observer are the same and that the archaeological distribution of a species accurately reflects the actual distribution (Bednarik 1996:1).

Weathering offers a relative chronology of pictographs and petroglyphs exposed to the same microclimate; images on the same panel can be placed in relative chronology bases on the degree of weathering to which each has been exposed (Keyser 1992:20). This is based on the assumption that each image had the same origin; the same thickness of paint applied, the same dilution of pigment in the paint, the same weather conditions, and that the weather over time is the only factor affecting differences seen in the art today (Keyser 1992:20). A major component of using weathering is rock varnish. Small amounts of dissolved or suspended mineral ions such as silicon, aluminum, and calcium in the water form a durable, protective coating on the rock after evaporation (Dolanski 1978:32). This semi-impervious layer is formed by the physio-chemical reaction of water evaporation causing concentration of silica at the rock surface. The silica is then nucleated by metal oxides on existing quartz grains as overgrowths resulting in the pigment becoming part of the rock, interjacent to the silica and the rock. In rock paintings, this decreases the weathering process, thereby hindering dating using the weathering process. In petroglyphs, however, it can be used as means to differentially date images on the same rock face (Dolanski 1978:32). When the petroglyph is created, rock with the silcrete skin is chipped away and the clock is ‘zeroed’, allowing comparisons of silcrete skin development.

**Radiocarbon Dating**

Radiocarbon dating has long since been a valued tool in dating archaeological finds. Its application in rock art sites, however, has been limited until recent advances have decreased the amount of organic material required (Conway and Conway 1990:51). In the past, the amount required was usually more than available in a single pictograph and meant the destruction of the painting. Or, if the samples from more than one pictograph were used the dates were criticized as being contaminated because each pictograph may not have been drawn at the same time (Chauvet et al. 1996:12). This could result in an interpretation stating that the picture was later redrawn. In any event, the date produces a maximum age for the pictograph, which is valuable in itself. I will use the dating of the Chauvet Caves in France to illustrate the application of this technique.

The dating of the pictographs at Chauvet Caves has been made possible first by advances in analysis of the paints form the original chemical analysis to scanning electron microscopy, X-ray diffraction, and proton-induced X-ray emission (Chauvet et al. 1996:11). Originally, the black paint was believed to be manganese dioxide. These chemical tests have since shown that, in most cases, the black paint is charcoal and only in some instances is it coated with layer of manganese dioxide (Chauvet et al. 1996:12). The second advance was the development of Accelerator Mass Spectometry (AMS) which requires much less of the sample than conventional radiocarbon dating. These advances have resulted in dates showing Chauvet Caves to be the oldest known rock art site. The problem remains in interpretation. In addition to the debate regarding the dating of the charcoal discussed
above, problems of calibration and contamination in the sample from the time it was collected through to analysis in the lab still exist (Chauvet et al. 1996:12). At the time of publication in 1996, the radiocarbon dates were uncalibrated and the given confidence interval translates to the true age having a 68% chance of falling into the time span given. In other words, one third of the dates may be false. The result is a reluctance to rely on one date. In this instance, Chauvet Caves has challenged these criticisms in that a series of congruous dates has been provided (Chauvet et al. 1996:12).

The Côa Valley Petroglyphs

The Côa Valley petroglyphs of Portugal were discovered in 1994 and have since become a major area of debate in an effort to save the petroglyphs from the flooding they will be subjected to if the proposed Côa Valley dam proceeds (Dorn 1997:105). For this reason, there has been pressure to assign a date to these petroglyphs to establish an origin of Holocene Pleistocene age. Radiocarbon dates of the rock coatings relatively date the engravings as younger than 1700 B.P. whereas micro-erosion and style suggests a maximum date of 7000 years ago (Dorn 1997:105). Dorn (1997:105) attempts to constrain the dates by using a combination of radiocarbon dating, micro-erosion, and geomorphic instability. The silica glazes contain the only organic carbon available for dating petroglyphs and because the silica glaze forms over the glyph, the dates will provide a minimum age. Carbon was extracted from five contexts associated with the carving; pore spaces of rock weathering rinds on exposed panel surfaces, within weathering rinds within the petroglyph grooves, weathering rinds collected from the unexposed rock crevices, organic matter between the rock and the coating, and a sample from within the silica glaze. Control samples were also taken outside of the petroglyphs (Dorn 1997:106). The previous assumption was that the silica coatings are closed systems; there is no exchange between the atmosphere and silica coatings. However, Dorn (1997:113) found that there is a slow organic carbon exchange between the silica glaze and the contemporary environment and that using a formula to compensate for this rate of exchange results in a measured age of approximately 5000 years ago equaling a true age of 18 000 years B.P. This system of open-air radiocarbon dating has so far only been used in soils, but Dorn applied this to petroglyphs and found that the grooves could have received a large influx of then-modern carbon in the Palaeolithic when rock faces were exposed to a subaerial environment. Subsequent slow rates of post-engraving carbon exchange would have produced the Holocene ages previously observed (Dorn 1997:113).

Dorn (1997:112) also looked at micro-erosion of the quartz and found that it could not be used as a dating technique because of the presence of the silica glaze. The basic premise of micro-erosion is optical observation, in which chemicals have not “…accelerated or retarded the development of erosion phenomena, petroglyphs to be analyzed must be of mineral accretions, or other natural deposits concealing them” (Bednarik 1992:281). This describes silica glaze and assumes that the quartz on which the carvings were engraved was previously unweathered. Quartz weathers internally before it is exposed at the surface and the dates would then be overestimated (Dorn 1997:113). As well, the complexity of the quartz grain as it becomes weathered is not completely understood.

Geologically, the Côa Valley is claimed by Watchmen and Bednarik to be “…too unstable to support Palaeolithic art on the grounds of 4000 to 6000 B.P. luminescence ages [due to] inset river
sediments, close proximity to the river channel and flooding, and slope instability” (Phillips et al. 1997:100). Chlorine-36 analysis was used to date the exposure of the rock faces; if the faces were only exposed in the Holocene, the engravings could not be Palaeolithic (Phillips et al. 1997:100). Chlorine-36 dating is based on the amount of cosmogenic nuclides in minerals at the rock face produced by reactions of cosmic-ray particles with elements in the atmosphere or rock. This phenomenon occurs only in the first 1 to 2 m of rock. Therefore, newly exposed rock surfaces will have less cosmogenic nuclides than those exposed for longer periods of time (Phillips et al. 1997:100). The results of this study show that the engraved panels were exposed and available for carving during the Palaeolithic (Phillips et al. 1997:100). In summary, the Coa Valley petroglyphs have undergone many different dating techniques and as of yet, the only definitive answer is that a Palaeolithic age could not be falsified. The example of the Coa Valley petroglyphs shows the wide range of techniques available to date a particular site and that these techniques do not guarantee answers.

**CONCLUSION**

Rock art is studied as a means to understanding past spiritual relationships of the artist with the landscape and as a method of extracting information regarding daily life. Art is also generally believed to be a trait specifically reserved to humans with culture. Although highly debatable, this premise is used in trying to determine the earliest signs of culture. The methods used to extract this information have a direct relationship with the information available for study and for this reason, improving and standardizing recording and dating techniques are believed to be imperative by many researchers in this field. The methods discussed in this paper are but a few means that have been developed in a field of study that advantageously incorporates many disciplines in its analyses and the development of new and accurate recording techniques illustrate different perspectives on the purpose and meaning of the sites that can be explored.

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