

# RED HANDED: An Inquiry Into the Meaning of Prehistoric Red Ochre Handprints

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## Contents

- I. Introduction
- II. Red Ochre – What does it mean?
  - a. What is red ochre?
  - b. Why use red ochre? (Symbolic associations & physical properties include: fire & blood; magnetism)
  - c. Where is red ochre and how was/is it used (Geotemporal red ochre art)
- III. Hands – What do they mean?
  - a. Ways of using the hand
  - b. Presence of Self & Others (Kinship & Mutilation)
- IV. Conclusions – What do Red Ochre Handprints mean?
- V. Appendices
  - 1. Types of Red Ochre
  - 2. Time Line for Hominid Activities
  - 3. Time Line for Hominid Use of Red Ochre
  - 4. Acoustical Engineering

Notes

Bibliography

## I. INTRODUCTION



### **RED OCHRE HANDPRINTS –PATAGONIA**

Red ochre handprints are a preliterate, pan human heritage which has come down through tens of thousands of years and are found all over the world.<sup>1</sup> To mosaic their possible preliterate meanings we use interdisciplinary scholarship to first look at red ochre, then the human hand.<sup>2</sup>

### **The slide you are looking at is wild llamas and hands in CUEVOS DE LOS MANOS Patagonia**

Human art is rooted in knowing from inside our bodies, i.e., in our biologically programmed senses and neurological processes. I am assuming that this was just as true for our ancestors as it is for us, because Homo sapiens of one hundred thousand years ago was arguably similar if not the biologically the same as you and me. Then and now we see, touch, breath & hear; we connect meanings to colors, images, sounds, and places. We remember these connections.

## II. RED OCHRE



### **SAMPLES OF RED OCHRE RANGE OF COLORS)**

Red ochre is made of silica, clay and iron oxide, comes in a range of colors from yellow to red, purple and brown, is plentiful all over the world and one of its properties is excellent permanence. Iron oxide pigments have continued as basic palette from prehistory through the present.

For humans red is a primary color of emotion and attraction. Red has the longest wavelength and the nearest visible wavelength to infrared, which actually produces the sensation of heat, but time limitations, let us put aside connections between warm blooded mammals and fire. Upon experiencing restored vision after blindness, or even extended time in darkness, the first color humans see is red. If I say, “He saw red when I told him the bad news,” most people know it means the person ‘seeing red’ was filled with intense emotion. To be caught ‘red handed,’ a particularly apt saying for our purposes, originally meant that blood was still on your hands, which is to say you had killed an animal, (human or otherwise).

This emotional relationship to red also relates to human blood, which is red in color and without which we would not be here at all. Many languages, including Hebrew, use the same root word for red and blood.<sup>4</sup> Among the many current ethnographic references to the red ochre, the most extensive is for puberty rites (Bahn, Lawlor).



Red has a significant role in every culture on earth and its ritual representation as blood or red paint pervades human society. When we see blood we are apt to react and many people literally cannot stand the sight of blood. We know blood is a life fluid in our bodies, hence expressions like: “Blood curdling” and “Cold Blooded killer” When do YOUR hands touch blood? Menstruating? Birthing? Butchering? Cooking dinner? The battlefield?

To further connect red ochre and blood, let’s look at both the most ancient human practices and our own more recent scientific ideas. The Aboriginal Australians’ 50,000 year cultural history is the longest of any human group, so their belief system about blood is particularly instructive the further back we wish to explore human art making in general and red ochre in particular. For them the spiritual state of dreamtime is invisible and the physical correlate which communicates between the dreaming and the perceivable world is BLOOD. They believe that veins of ochre are the blood circulation

system of the earth (Lawlor p 2). Their word for red ochre means clay mixed w/ blood. Red ochre may be rubbed over entire naked body for ritual and may be mixed w/ blood, which is used to fasten feathers onto people's bodies.

**(Slide of Image = 2<sup>nd</sup> RED COLOR FIELD)**

Western traditions, too, believe in the power of blood across generations. Ancient Romans believed in the ancestral spirit which traveled in families via 'bloodlines' and we still hear it said that 'blood is thicker than water.' Today we believe in the power of blood to transfer potency and even disease across generations, as the presence of babies born addicted and with AIDS demonstrates. Nor does a small drop negate the power of blood for dilution makes a substance more powerful in both homeopathic medicine and aboriginal practices. For the latter a minute quantity "intensifies its need and ability to bond with others and imprint its energetic qualities on the surrounding shell of difference." (Lawlor p.335)

Today we know there are physical and chemical similarities between blood and iron. Blood is an electrochemical magnetic field wherein blood cells do, as the Aborigines in Australia have long maintained, act as magnets near a lodestone. (Lawlor p. 333). Invisible electromagnetic force fields pervade the universe from interstellar to intracellular worlds. This electromagnetism is a fundamental component of matter's self organizing principles @ every level and in the iron content of blood and red ochre this field is both conducted and amplified.

So far we know that red ochre is iron oxide with silica and clay, that it bears a relationship to intense emotion, blood, and magnetism, that is is found all over the world in many shades and that one of its properties is permanence. The oldest carved red ochre

are nine pieces that are seventy seven thousand years old, found in January of last year in South Africa. They resemble the prehistoric lunar calendars carved in stone that Alexander Marshack decoded. Rock art scholars Lewis-Williams and Anati view such marks as entoptic art indications of a world wide visual symbol system derived from our pan human neurological processing system. (Devereux, Lewis-Williams, Anati)



### **APPLICATION OF PAINT – 3 slides of Lorblanchet recreating**

#### **Lascaux and Peche Merle**

Humans have a long history of using and processing red ochre and applying it to various surfaces. Besides uses for body paint, red ochre was rubbed on teeth.<sup>7</sup> Ochre was mixed with binders, such as vegetable juices, urine, animal fat, bone marrow, blood or albumen from eggs, whereupon one has a red liquid similar in look and magnetic properties, to blood. Let us call this red liquid paint. Given paint, various applications are possible, such as brushes from animal hairs, feathers, twigs, pads of lichen, or moss, and of course, fingers to smear, dab, or draw,. From the work of Lorblanchet (Bahn p 126) we know that red ochre was mixed with blood as a binder and this spray went either directly from the mouth or through hollow bones to the rock surface. Surely making a

paint and blowing in from the mouth is more trouble than simply picking up a piece of red ochre and drawing with it, so we must ask what is the significance of processing it, making a paint, and blowing it on the walls? Human breath indicates life and its use in applying red ochre paint to cave walls may suggest the importance of the breath as an activating power, perhaps connecting the painter and the image, or giving a kind of life link to the painting.

Is there a sonorous relationship between these ideas and the early bone flutes that have been found?

**SLIDE IMAGES = 3 cave slides Cosquer Caves France**

The sounds and echoes of caves make them a distinct location and perhaps this is part of the reason they were selected for early paintings and why paint was blown on the walls. Relating to this air-based and audio component of cave painting is the independent research of two scientists: Hans Jenny and Steven Waller. Hans Jenny's engineering work is now a field of inquiry called cymatics, which shows how different tones actually produce different forms of matter. Thus, clapping or singing in the caves could have effected not just the state of mind of the participants, but also the form of matter itself.

Steven Waller's controversial work involves making acoustical recordings in thousands of painted caves around the world. He argues that the convexity of the surfaces generates different sounds and echoes. These relate to the sound the animals paws or hooves made. For example, the sounds off of the cave walls with hoofed animals sound like hooves and the walls with cats are less convex and make a much quieter sound. When I emailed him making inquiries about his work he said human hands clapping is among the most dramatic sounds he has ever recorded in a cave.

**(Slide of Image = 3<sup>rd</sup> RED COLOR FIELD)**

The idea of life is present when its opposite, death, is realized. Thus, it is no surprise that at this time there are plenty of Neolithic graves where hunter-gathering societies of humans are buried with up to ten kilos of red powdered ochre. Just imagine being buried with twenty two pounds of red pigment! French sites from two hundred thousand years ago have red ochre floors that are eight inches thick. From two hundred thousand to thirty thousand bce (the period of the Neanderthals), the pigments increased in frequency in occupation deposits and in burials. Indeed, when skeletons are found sprinkled with red powder, one wonders if it was on the skin as a remnant of tattoos, applied as funeral rites, such as to suggest the blood of new life, or to perhaps to ‘mask’ the odor of death. In any case, when the body decomposed, what was left in hundreds of burial sites was the skeleton and the red ochre pigment. From twenty thousand years ago most base-relief and portable sculptures were painted red, including the Venus figurines. By fifteen thousand years ago in Lascaux, France, paleolithic paintings are made with ochre from 25 miles away.



**RED OCHRE HAND PRINTS IN CAVES – cave of gargas, pyrenees**



Red ochre use in caves, which is a hallmark of ice age art, begs the question, what is the significance rock and cave as locations for the red ochre handprint? We have already mentioned the auditory and echo like properties of the caves. But many later paintings are outside. In the Canadian Shield, the vision site such as the mountain itself are considered sacred, not just the rock art. Our ancestor's often used red ochre to indicate the importance of a location, thus one finds entire areas where the pictographs are entirely red ochre 'wash'. (Selwyn Dewdney 1971, Royal Ontario Archaeology Museum Newsletter). Today there is considerable talk about creating a 'sense of place;' our ancestors often used red ochre. In his book, Mind in the Cave, noted Rock art scholar David Lewis-Williams has suggested that the rock was the 'presence' itself of spirit and by putting one's hand to the stone one connected with that spirit. He argues that the pigment was a membrane-like veil which connected the spirit world behind and within the rock to the spirit of the person who touched it. (Lewis-Williams p.190)

### III. The Hand



### **Southern Patagonia**

We know red ochre is found all over the world, has been used by humans for at least a million years and has been made into paint for about a hundred thousand. But why during the last ice age did the human hand become a symbol on permanent surfaces? As neurologist Dr. Frank Wilson noted, 'our hands, complete with opposable thumbs, traditionally have been and continue to be, instruments for human arts and simultaneously symbols of content rich remembrance.'(Wilson 1998).

**(Slide of image = 18<sup>th</sup> century Maori chief WITH TATTOOS)**

Presumably there were many years of working with red ochre on fugitive materials. Tattooing, which is presently a popular form of body art, has long been used by our species, as the uncovering of the Ice Man in Italy in the early 90's showed. His tattooed skin had been preserved by his entombment in ice for thousands of years.



**2 slides – above = pima Indian.**

**Mandan chief (Sioux in n. Dakota)**

If ethnographic analogies are considered a useful indication of our species' history, it is well to note that decorative hand prints placed all over the body are well documented all into the 19<sup>th</sup> and 20<sup>th</sup> centuries. Perhaps our ancestors painted or tattooed hand prints on their bodies. Tattooing and painting red ochre hands on human skin likely went on for many tens of thousands of years before so called 'creative explosion' 35,000 or so years ago.

This 'creative revolution' was an intensified interest in permanence generally and in the human hand specifically. This is when our species outlines objects on stone surfaces. This outlining seems to me to be a kind of making permanent or 'binding'.

We already know that hands were ‘outlined’ as stencils by diluting pigment blown around edge of hand as air brush technique. This was done both directly from the mouth and through hollow bones. Besides outlines of hands there are handprints, where the hand is covered in red ochre paint and then pressed to stone and finally, the image of hands is engraved into the stone.

**SLIDES – Hand Tlingit of British Columbia. The eye like motifs mean ‘spirit energy from the knuckles’**

**2<sup>nd</sup> slide = Taiwan on the left and borneo on the right)**

The hand occurs as a popular and ongoing motif in tribal art from very early times and everywhere in the world, from the Americas to Africa and Australia. Tribesmen “often painted or stamped directly on the human body” (Carpenter p. 150). “Among the Plains Indians, few body decorations were more important than the human hand motif, painted or tattooed on the chest.” They also occur in many tribes of Pacific North west. (e.g., Tlingit, Tsimshina, Haida). The hand, like the bear track and the thunderbird, are found “in almost every major rock drawing area in north America.” (Grant p.54) this includes 230 caves in Baja California, dating from 1500 bce and rock panels in the 4 corners region where the blown stencil resembles Australians and Paleo-European examples. In Buttriss Canyon, AZ the hands were first dipped into paint, then ‘stamped’ on the walls, then the palms re-worked to create a spiral print. There are spectacular collections of hand stencils in Patagonia. (Argentina coast/Cambridge p115).



**Patagonia detail cuervos de los manos Patagonia, no date**

Handprints occur on the rock shelter walls on the outskirts of Sydney and among red stick figures and boomerangs depicted at rarely visited sites on islands 5-6 miles off the coast of Queensland in the Great Barrier reef waters. (Creative p 153)

**(3 Slide of image = Boomerangs w/ handprints)**

**1. arnhemland**

**2 & 3 carnavon national park, queensland**

So we know handprints occur all over the world but what did they mean? Today we have many ideas about the hand, such as: Handwriting on the wall (the obvious); I have to hand it to you (obviously you win); Hands of a surgeon (skill); handshake to greet, seal bargain, say goodbye, (begin, confirm, conclude); Judge by handshake (character indicated); Hand it over (deliver, give, give in); Hand made (human created) and Red Handed (caught, especially committing murder)

Clearly the word hand (and in our case the image of a hand) can be used for multivalent meanings. One can imagine the hand prints on the wall indicating territory,

trading events, or rites du passage such as puberty or marriage. Sometimes the hands are seen with animals or human figures. Grant Campbell, noted rock art specialist, suggests that these handprints were a form of signature and where great numbers are found together may be an identification with a tribal unit.



### **Mutilated Hand Print**

#### **Additional Slide images: MUTILATED FINGERS, TATTOOED HANDS**

In or out of a tribal unit, once something or someone, is present, it can be ‘ac’count – (ed for). So it is not surprising that among the fundamental meanings given to human hands is the idea of Counting. And this human form of counting/accounting begins long before the written word. When you count your principle hand joints, you will find there are 28 of them, so perhaps this was a handy way for women to keep a lunar or menstrual calendar on their hands! Who among us did not, as a child, count on their fingers?

Kinship, which we may think of as a people one counts on, and Puberty Rites, which indicate we are counting time and have arrived at a certain point in our ability to generate kin, especially for women with the arrival of blood and child bearing, are also part of the

meaning of the human hand. We know from ethnographic analogies and decades long research that the handprint literally means kinship

**(2 Slide images = mutilation hand)**

**1. oceania**

**2. Australia**

In Australian aboriginal culture, when someone close to you died, you removed a portion of your finger at the joint. Which you removed was a function of your specific kinship relation to the deceased. In other words, when someone close to you dies, a part of you literally leaves with them. Severing digits, as Robert Lawlor reports in Voices from the Dreamtime, is a practice which aboriginal Australian men continued into the 20<sup>th</sup> century as a way of indicated when a close relative died. The hand conveys the connections and disconnections.

**2 slides from patagonia**

Mutilation's long history in many cultures includes Papua New Guinea, Borneo and Taiwan, Eskimos from Greenland to Siberia, and the Haida in British Columbia.

**2 slides cave walls france and spain.**

As long ago as 30,000 bce (upper Paleolithic) in France and Spain, many handprints show finger amputation identical to technique of Australian aborigines. Carpenter and Schuster believe that widespread use of these practices and the mutilated fingers going back as far as the 30,000 year old European hand painting, argues for very great antiquity of the practice. Others take a more gentle interpretation and hold that the bending of fingers in the making of the art represented a kind of sign language.<sup>8</sup>

## **SLIDE of PATAGONIA 7000 bce**

### IV. Conclusions

Given that red ochre relates to blood and the hand to relatives, what might red ochre handprints communicate, beside the obvious possibility of blood relative?<sup>9</sup> Here theories about cognition and semiotics are helpful. For example, we saw an animal track (we were hunters even as *Homo erectus*, long before *Homo sapiens*) and connected the track to the animal that made it. Thus, the animal's paw print is a sign, or "meant", the animal was present. To this day many humans celebrate the birth of a new member of the species by making a print of a new baby's hand or foot, making a permanent record of the new person's presence.

The Institute for Ice Age Studies, commenting on the evolutionary significance of material forms of representation, said recently, "all great inventors have thought not in words but in images." ([www.insticeagestudies.com](http://www.insticeagestudies.com)). That consciousness reveals itself in symbols and story is well documented (Sheerin) and we know that our emotions and state of mind often show in our attitude, behavior, handwriting, and art. Indeed, a premise of art therapy is that art work DOES communicate consciousness. We have used several strategies of categorization, including metonymics, metaphor and polysemics to explore the meaning of preliterate red ochre handprints. Metonymics is where a part stands for the whole. For example, the hand, or even a severed part of a finger, stands for the whole person. Metaphor functions by moving a symbol to a new context to expand its meaning. For example, we place our hand over our hearts or on a sacred book to indicate sincerity; as if our hand, once proximate to the heart or sacred book, gained credence through



touch. Perhaps we placed our hands on the cave walls to connect by proximity to the spirit of the rock or to those who had made the handprints long before us. What began as a sign, a 1:1 correspondence became a symbol with meanings that changed with time or place. For example, greetings, such as shaking hands or waving hello are no longer consciously thought of as proof that you are not carrying a weapon. Instead, as a variant on the idea of trustworthiness, we sometimes use a handshake as a way to judge a person's character. Polysemics refers to the multiple meanings for a word. By using all of these techniques we have looked at the meaning of red ochre handprints and are now ready to summarize our findings.

There are both practical and symbolic values supporting the use of red ochre, especially for handprints. We know that Homo began using red ochre at least a million years ago and its use continues today. Now we may partially answer why. First, it was and is THERE and is plentiful. Second, it has the property of permanence. Third, it was initially easy to use 'as is' and relatively easy to process and combine with other substances to increase its range of forms and uses. Fourth, it had practical benefits, such as covering the smell death and stopping bleeding. Fifth, red ochre came to be seen as having physical and metaphoric resonance with blood, so it became a meaningful symbol of relationships between people, the land, and the animals. These relationships are represented by the human hand, which is a defining characteristic of the species and itself a symbol of human family relations. Even the 28 joints in the hand may have been seen to correspond to a woman's menstrual cycle. The power of life may have activated handprints in the blowing of the paint upon the stone. Thus, perhaps we created kinship charts that demonstrated relationship. No wonder that ubiquitous red ochre became the

blood paint of human handprints. What better indicator that we are present than a show of hands?

## Notes

1. Which language should one use, 'prehistoric' or 'preliterate'? Many prefer 'pre-literate' to 'prehistoric' because they find the latter privileges writing over oral history in accuracy, relevance, importance, etc. Too, there are degrees of literacy and the shift from image to text is gradual and varied, so we seem to have a continuum rather than a sharp yes or no/history or no, literacy or no. Too, we cannot help but be drawn to the thoughts of children learning to read, of languages becoming transcribed; but these are other stories....For 100,000 years we, that is Homo sapiens were 'prehistoric' animals, meaning we lived without phonetic alphabets. The development of alphabetic writing is the convention we use to establish a 'time' line of before and after. Before the alphabet the human story is called prehistory and everything after alphabetic writing is history. In this way we symbolize the journey of our species as 'beginning' with abstract symbol systems

2. The study of world wide preliterate art has been largely ignored by art historians and the scant attention it has been paid has been largely "European prehistoric" art, much in keeping with art history's Eurocentric traditions. To wit: the first red ochre was transported for use in Africa almost a million years ago. Although the earliest hominid remains now date to a bipedal skeleton from six million years ago, we may conservatively ignore several million years of hominid adventures, and reckon that we ('modern' homo sapiens sapiens) have been around for a hundred thousand years. Even so, art history's traditional concentration on the last five thousand or so years ignores ninety five percent of human art making. Marilyn Stokstad's widely used Art History survey text gives about twenty five out of twelve hundred pages to prehistoric art. That's two percent of the educational space for ninety five percent of the time humans have been making art. Of course, even that is exclusively EUROPEAN prehistoric art. The contemporaneous rock galleries of Australia are not mentioned at all. There is ample evidence that art historians have not given much attention to tribal or preliterate art, compared with their devotion to the art of Eurasian Empires. For example, only 1 chapter in Stokstad is devoted to **all** the cultures of Oceania, compared with 25 chapters about Eurasian art. No wonder most of the scholars working in the field of preliterate and tribal art are social scientists, such as anthropologists and evolutionary psychologists. The text World Rock Art is a classic, but it was written by Emanuel Anati, an Italian archaeologist. Let us add our voice to theirs and consider the meanings of preliterate art and the consciousness of our distant, creative ancestors. As art historians we contribute and synthesize unique aesthetic understandings to prehistoric art scholarship.

3. Nearly a million years ago pieces of hematite, (waterless ferric oxide) were carried into habitation sites in South Africa (Bahn p71). Four hundred thousand year old pigment and paint grinding equipment was found in Zambia. (BBC – May 2, 2000). In southwest France, at Terra Amata, A three hundred thousand year old beach site on the French Riviera, (Terra Amata), contained “stone tools and bones with over sixty pieces of red, purple, yellow, brown ochre, brought to the site for unknown purposes.” (Creative Explosion p86). Our oldest red ochre paint to date is over 120,000 years old.

Additional uses include treating animal skins to prevent decay, applying to corpses to control smell and preserve the body, to cauterize and clean injuries, to dry bleeding wounds and maintain warmth. Symbolic and aesthetic uses of red ochre include stripes and dots recorded as late as the 1850’s in Australia, with specific meanings to each location, # strokes and designs. Generally speaking, the use of the pigment begins in close proximity to the natural occurrence of the red ochre pigments, and is subsequently transported by the tens of kilos. My own hypothesis is that the commonly found small balls of red ochre found buried together in large numbers might have been thought of as ‘rock seeds’ and the way one ‘got more rocks.’ Given that our ancestors saw that seeds fell from plants and trees and produced more of themselves, why not the same for rocks? And certainly red ochre was the rock which symbolized blood and life.

Australian occupation sites date red ochre from sixty thousand bce; mines of hematite in South African date from fifty thousand bce, those in Hungary from thirty thousand bce. By the Upper Paleolithic (from 30,000 to 10,000 bce) red ochre is abundant and ubiquitous. Cave art and forms of personal decoration such as beads and pendants increase simultaneously. Obviously most biodegradable coloring materials such as those from plants are gone. Evidence found in June 2002 in England showing hominids there with stone and bone tools 200,000 years earlier than thought now push habitation back to 700,000 years ago. (BBC 6-5-02). I wonder if they will find red ochre there, too!

4. In Hebrew red is *dm* and *dom* means blood.

5. There are literally volumes of alchemical and symbolic meanings for the color red, as well as contemporary works, such as Primary Colors.

6. Perhaps our early attraction to iron oxide contributed to our discovery and use of clay as a material to work with the hands and with fire.

7. Was this like an oath or an indication of commitment, seriousness of purpose, true-blood as it were?

7a Today *The Red Ochre Award* in Australia is given to an Australian Aboriginal Artist for an outstanding contribution to the arts.

8. More recent handprints may be something like contemporary graffiti, but the present concern is with more antiquated handprints.

9. Our theoretical frameworks in general invokes questions of how meaning is constructed and more specifically asks how meaning is represented with symbols. The field has grown from the first semiotic writings of Charles Peirce to many specializations. These include: visemics (which combines visual and semiotic inquiries, synaesthetic research (where the crossing of senses and the knowing through multiple senses, Howard Gardener aside, are plentiful.) and categorization inquiries through cognitive sciences.

10. This line of thinking reminds me of a saying my father hand when he would shake my hand, “Shake the hand that shook the hand of Jimmy Walker, one time mayor of New York.” Clearly the belief in the transmission of contact via handshakes continues into our own times and places.

### Appendix 1 - Dating Methods

Below are three common interpretive methods anthropologists and archaeologists use to understand ‘signs from the past’ which are relevant to our inquiry. Beyond these, dating rock art may be relative or absolute. Relative = weathering, stylistics, superimposition, spatial analysis. Absolute uses more recent advances, such as accelerators and mass spectrometry, associations of amino acids, e.g., egg as a binder. Note – handprints seem to predate the stencil technique in Australia.

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1. **Stratigraphic contiguity**, carbon 14 dating and ethnographic analogy. (I am leaving aside dendrochronology aka tree ring dating, as it does not pertain to our ‘handwriting on the wall’). Stratigraphic contiguity means what else to we find at the same layer of excavation? What is above and below it? From this we may infer a date for the location and objects we are investigating.

In Australia, in the Western Arnhem Land, a complex sequence of changing art styles has been uncovered. Authors differ on the details of the sequences identified but generally agree on the principal stages. The earliest is characterized by large-scale, but static, images of animals and humans painted in red. Some unusual figures among these have been identified as extinct animals and, on this basis, an antiquity of up to 25,000 years has been suggested (Murray and Chaloupka, ‘The Dreamtime Animals: Extinct Megafauna in Arnhemland Rock Art’, *Archaeol. Oceania*, xix (1986), pp. 105–16)

2. **Carbon 14** looks at the rate of carbon decay but is often in error when found as a printed date, because we have discovered that the amount of carbon present on the planet was not constant for the entire history of the planet and so most dates cited before the 1980’s need to be recalibrated, sometimes by many thousands of years.
3. **Ethnographic analogies**. Rouletting marks on a piece of clay found in African may be dated to which is dated to thousands of years bc . When we see local peoples still marking clay with precisely the same pattern, we infer the same methods were used, and perhaps the same purposes and meanings operate.

### Appendix 2 – Types of Red Ochre as specific pigment sources

Hematite-no water	Limonite-has water	siderite	Ferric oxide
It is ferric oxide without the water	It is ferric oxide With water		
Red	Yellow to Dark Brown		
	Ochre=clay w/ hydrous iron oxide, usually opaque. Sienna=ochre w/ hi iron content, usually translucent. Umber=iron oxide w/ manganese. Burnt umber= calcined umber, a red hematite.		

The raw color is often yellow, which is easy to remember because both raw and yellow have a 'w'. Roasted ochre, often called calcined, is red, which comes from the loss of hydrating water. This, too, is easy to remember as there is an r in both roasted and red.

### Appendix 3 - Time Line Hominid Activity

Million years ago	Human Activity
6	Bi-pedal hominid
5	Australopithecus tool maker
2	Homo erectus has fire
1	Homo sapiens makes paint

### Appendix 4 – Time Line Hominid Ochre Use

Years Ago	What Happened with Ochre
1,000,000	Transported to sites in South Africa
400,000	Pigment and grinding equipment in Zambia
300,000	Stone tools and bones w/ 60+ pieces ochre many colors, French Riviera
130,000	Ochre rubbed on teeth and tusks
120,000	Red Ochre paint
77,000	Elaborately carved red ochre, South Africa

## Appendix 5 – Acoustical Engineering

The relationships between the senses, such as seeing red and feeling red heat or feeling matter and hearing sound are quite interesting and exploring them takes us to the idea of synesthesia and acoustical engineers, such as Steven Waller and Hans Jenny. The reader is encouraged to obtain and view a cymatics video for a first hand demonstration of the relationship between sound and matter. Oscillating chemical reaction of Belousov-Shabotinsky is a graphic example of the beauty of moving matter based which visually resembles the work of Hans Jenny. I wonder what the chemical reaction of the pigments with the binders looks like, especially when applied via blowing with air via the human mouth! Sound, like human life, is temporary and fugitive. If you were living 50,000 years ago, how would you capture and record a sound? How would you leave a permanent visual echo of your presence? Most of us, even as we sit comfortably in heated and air-conditioned rooms, feel a kind of superiority to our ancestors, whose short lives would challenge us even on the most brief and aggressive of camping trips.

Acoustical engineer Steven Waller uses sound to record the echoes in caves all over the world. (New Scientist p14). Interestingly enough, the sound that acoustical engineer Waller has found to create the strongest response in the caves is the sound of hands clapping. Though not everyone accepts his findings, he claims to have found direct correlations between the kinds of echoes and the images presented. Clearly our ancestors were aware of the sounds that happened in each space. Waller and since him other acoustical engineers, have determined that: the points of resonance have paintings on them; painted images recalling animals are echoed in the sounds. In other words, animal movements are recall by echoes of the animal being painted. Too, bone flutes of similar have been found in conjunction with European cave paintings, so the idea that sound was part of the experience with the paintings is not beyond consideration. Open air= 8 decibels. Deep in caves, such as France's painted chambers sound is between 23 and 31 decibels. Deep cave walls w/ cats at 1 – 7 decibels. Surfaces w/o paint are 'totally flat'. Australian artists appear to have used rock shelters like parabolic reflectors to focus echoes. (Dayton p14)

This is particularly interesting in light of what is called 'red shift.' "This refers to the change in frequency of waves of sound or light which occurs when the source and observer are in motion relative to one another. It is most often experienced in the sound of a passing siren. When the source and the receiver are approaching each other, just as sound becomes higher pitched, light becomes bluer. It becomes redder when source and observer are moving apart." (Color, p. 186, Varley, ed.)

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