

A Modern Approach to Cave Painting such as those found in Lascaux using the pigments of Charcoal, Hematite, Goethite, and Magnetite

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## Introduction

Cave paintings of the Paleolithic period, particularly at Lascaux (pronounced: “la’skəʊ” or “lasko”),<sup>1</sup> provide a lens through which to view ancient civilizations: through a creative medium. Parietal art (art on walls or ceilings, usually of caves)<sup>2</sup> could have been used for religious purposes, ceremonial purposes, enjoyment, story-telling, or any other type of communication. Speculation is broad, but there is very little known for certain about ancient people or their cave paintings other than what can be directly observed in modern times.

The Lascaux caves are found in the Dordogne region of Southwestern France, as shown in the map below.<sup>3</sup> Of the thousands of images painted on caves found in the



Vezere Valley,<sup>4</sup> Lascaux is both unique and undoubtedly impressive. Specifically, the Hall of Bulls is worth mentioning. Four black bulls, one of which reaching 17 feet in length,<sup>5</sup> dominate this area of the cave, lending the Hall of Bulls its name. An image of the Hall is provided below, showing how massive a scale

these paintings were on.<sup>6</sup> Carbon-14 dating of artifacts found in the stratigraphy of the cave floor has given scientists an approximate date of 15,000 BC for the age of the paintings,<sup>7</sup> and the painters are placed securely in the Magdalenian period.<sup>8</sup>

In Lascaux, there are a few methods that researchers have found to be most likely for the people of the time to have used. Researchers were able to recreate potential methods of painting in Lascaux caves by creating brushes



out of twigs and bound bison hair.<sup>8</sup> They achieved successful painting by transferring powdered pigment directly onto damp stone, and found that colors transferred well with the use of a tamping pad.<sup>8</sup> Other research has shown a propensity for these early artists to paint with matted moss and hair, in addition to blowing paint out of their mouths or through a tube.<sup>9</sup>

The animals shown in this way are often shown in a “twisted perspective,” with horns or antlers shown as if from a frontal view.<sup>9</sup> Some speculation has been made in regards to the purpose for this, in that it may include some ritual or ‘magical’ properties in the ancient religions of these artists.<sup>9</sup> This twisted perspective and speculative purpose does not, however, get in the way of artistry. The animals drawn as parietal art are often shown in a linear fashion, with lines contouring the animals themselves,<sup>10</sup> showing a grasp of the animals’ anatomy and muscle structure. In other cases, however, the animals are shaded, blended, or colored in, often by the technique of blowing paint through one’s mouth.<sup>10</sup> There were a myriad of styles and methods used by early painters in regards to the craft itself, but there was even more detail that went into the construction of the actual medium of art, that is, the pigments.

In Lascaux, four basic pigments were found: black, red, yellow, and white.<sup>11</sup>

Pamela V. Vandiver, who was a graduate student at the Massachusetts Institute of Technology at the time, used “scanning electron microscopy” to analyze 158 fragments of paint found on the floors of Lascaux.<sup>11</sup> Of those, 105 were shades of black, 26 were shades of yellow, 24 were shades of red, and 3 were a porcelain white.<sup>11</sup> Deposits of the manganese oxide that was used to make the black pigment were found approximately 5 kilometers from Lascaux, making a relatively easy access point for the popular color, and there were ochre deposits that would give both red and yellow colors within a half kilometer.<sup>11</sup> There was great diversity, however, in the shades of the pigments. This could have resulted from a wide collection of things, from impurities in the minerals that were ground up to make pigments, to the proportions of pigment mixed with the cave water used to make paint.<sup>11</sup>

Mortars and pestles were found in the stratigraphy of the cave floor, some containing trace amounts of pigment still inside.<sup>11</sup> This shows one form of technology that was used by early artists, in that they ground their pigments before mixing them. There is also evidence that was found in Lascaux promoting the idea that this cave water mixed with pigments acted as both a vehicle and a binder. The cave water present in Lascaux is naturally high in calcium. This would provide “good adhesion and great durability.”<sup>12</sup> Early paints were made right in the Lascaux caves, by grinding minerals found nearby and mixing them with water found in the cave itself. This environment allowed for relatively easy access to all the necessary ingredients to result in some of the world’s most famous prehistoric artwork, and prehistoric humans took full advantage.

Lascaux itself is impressive, if based solely on the scope of the paintings, as they reach all the way to and onto the ceilings of these caves. Evidence was found on the cave walls of carved ridges into which tree branches could be fit to build a scaffolding on which an artist would be sufficiently comfortable.<sup>13</sup> These lengths that early people went to in order to be able to paint were enormous, drawing even more questions of why they would bother to go to such trouble.

Regarding attention paid by early artists, the idea of mixing colors and pigments is not a modern invention. Cave painters at Lascaux were quite experienced as mixing colors and pigments, as well as processing them in complex ways.<sup>14</sup> For example, a white porcelain material found, when analyzed, turned out to be clay, powdered quartz, and calcite combined to create the white pigment.<sup>14</sup> Structural differences were also found between different colors. While red ochre had a “platy structure,” black manganese oxide was found to have a “fibrous structure.”<sup>15</sup> These differences in structure were found using various techniques using x-rays and optics.<sup>15</sup>

Lascaux, though never inhabited, was used for only a few hundred years:<sup>16</sup> a relatively short time period in the scheme of prehistory. However, it remains one of the more awe-inspiring of the cave paintings, and still affects archaeology and the way history is studied. Ancient cultures used Lascaux, whether for cultural or religious reasons, or perhaps something we have not yet discovered. Regardless, there is history preserved on the walls of the Lascaux caves, and we will continue to study it for insight and understanding.

When we did our own cave paintings, it was exciting. We used charcoal and iron oxides for pigments, clay for a binder, and water for a vehicle. This is not a significant difference from what was done at Lascaux, in using water as a binder. In the caves, the natural calcium deposits in the water were used as a binder,<sup>17</sup> but otherwise, it is a similar process: Mixing pigments with a binder and a vehicle in order to create artwork of some kind. This we were able to accomplish. As for historical accuracy, we have a long way to go, but it is a step towards understanding the processes demonstrated at Lascaux.

## Experimental

### *Charcoal*

In order to make charcoal, we walked around outside looking for sticks of a 'manageable' size. This was essentially anything we could comfortably hold in our hands that would fit in a bundle of about 12 sticks. We used various types of wood, and just picked them off the ground.

After going inside, we broke the sticks, making them, at longest, approximately 8 inches, and wrapped them all in aluminum foil, as seen at right. We then wrote our names on the foil and placed them in the kiln. The aluminum foil was keeping out as much oxygen as possible to create charcoal out of wood, and the kiln was fired to 500 degrees Celsius overnight.



The next class, when we went to pull our charcoal out of the kiln, we opened our aluminum foil wraps and found the sticks in the exact formation which we had left them in, except that now they were entirely black and crumbly.

We used these sticks to draw on printer paper, imitating cave paintings, as well as whatever we felt inclined to draw. The very small sticks were difficult to draw with, as they were overly crumbly, and the very large sticks made it difficult to be precise.

I attempted to draw two hedgehogs, which were a fabricated cave painting, but were drawn in a similar style to cave paintings.<sup>18</sup> I also attempted to draw a bison, while imitating the style of the Chauvet caves.<sup>19</sup> This was very difficult, as the shading was complex and impressive, and charcoal was not an easy medium. Finally, I drew people, most likely hunters per their bows and arrows and the animals at which they were aiming. The inspiration for my charcoal drawing was Valltorta-Gassull, near the Spanish Mediterranean.<sup>20</sup>

After we were finished drawing, we sprayed our papers with a binding spray. It was a general craft spray which was made for use on charcoal, to keep it on the paper where it was placed, since it would have the tendency to blow away at the slightest breeze, being essentially a powdered substance in and of itself.

### *Hematite*

I took this pigment and mixed a small amount with some slip. Slip is a mixture of clay and water to make a liquid-like substance, which can also take on pigments. With the water as the vehicle, the clay as the binder, and the pigment as the color, I was able

to make paint. I did not use much hematite, so my red color turned out more peach-like than I had intended. I kept it, however, because I liked the pastel look it gave to my painting.

I used a q-tip, as well as my finger to paint on my rock, and created a background horse-figure as a backdrop for my bull which would be painted on top.<sup>21</sup>

I also painted my hand with the hematite, attempting to simulate the decorative body painting that may have taken place in the days when Lascaux was in use.

### *Goethite*

I used a very similar process for creating my yellow pigment as I did my red one, except I used a good deal more goethite. My yellow pigment turned out to be vibrant, which was nice complement to the peach pigment I had made previously. The rest of my process remained the same from the hematite.

I was just beginning to see how proportions were everything to a painter, especially when painting on a medium like rock. Pre-packaged paint would not have suited our purposes in the classroom and were certainly not available in prehistoric times. Every paint was made by hand, making it of the utmost importance, if any kind of consistency or control over color was to be had, to know proportions and control how much of any one thing made it into a mixture.

I used this goethite mixture to paint some splotches of yellow along the top of my stone, above the bull.<sup>21</sup> This was to attempt to imitate the original painting at Lascaux, which had some different colors encroaching, as well as layered paintings.

This reusing of space is an interesting aspect of the cave paintings, and under further study, could give insight into early people's outlook on life, possession, and art.

### *Magnetite*

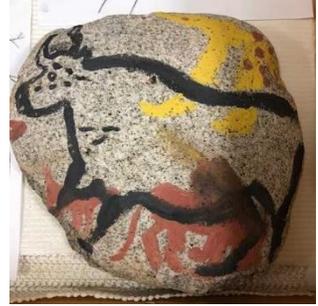
The magnetite process of mixing and creating a paint to use on stone was the same as those for hematite and goethite. I only used a small amount of magnetite, which resulted in a grey, almost clay colored, pigment until it was completely stirred in and combined. Even then, the color was muted, not a bold or dark black color, but more of a grey. I could have added more pigment to adjust the color, but I liked the color scheme I was developing, so I stuck with the light black/grey color, using it to paint the bull and the contours on its body, copying the Lascaux painting to the best of my ability.<sup>21</sup>

### Results and Discussion

The difficulty of cave painting, in my opinion, is often overlooked. It appears that it should be easy to take pigment, mix it with clay, and draw pictures. However, it is much more difficult than that. Charcoal flakes and the stick breaks while you are using it. Pigment to clay ratios are difficult to manage while getting any kind of consistency in color. Below I have included some of my artwork. The originals are on the left, with my drawings and paintings on the right. This should give some idea of how difficult it really is to accomplish some of these images:



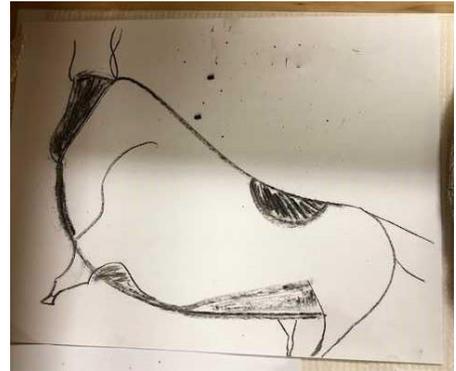
Bull from Lascaux<sup>21</sup>



Hedgehogs<sup>22</sup>



Chauvet Bison<sup>23</sup>



Valltorta-Gassull Hunters<sup>24</sup>



As enjoyable as it was to attempt to recreate the ancient techniques of cave paintings, my method was not very historically accurate. I used an electric kiln to fire my wooden sticks, which were wrapped in aluminum foil. I then

used those sticks to write on paper and sprayed them with a craft holding spray. None of those things would have happened in the paleolithic period. Instead, people most likely would have used fires. They could have buried the sticks in sand or earth to keep oxygen away from the sticks as a fire burned above them. There is evidence of charcoal surrounding fires in places like Bilzingsleben, and Le Lazaret, two other ancient sites.<sup>25</sup> Ancient people would have used that charcoal to then write on caves, walls, stones, or each other, rather than a piece of paper, which didn't exist. As for a binder, they would not have had a craft spray, but instead would have had to use water, clay, or some other binder to keep the charcoal dust from blowing away. It is also possible that they wrote with charcoal, expecting it to blow away. It is impossible for us to know for sure.

As far as painting on rocks with iron oxides, there were some discrepancies that proved how modern my techniques were. I used processed wood to mix the clay and the pigments, I mixed the pigments in small plastic bowls, and I applied some of the paint with a q-tip. Those things would not have existed to help ancient civilizations. They could have used a stick, or maybe their finger, to mix pigments and binders. They used palettes according to the archaeology completed in Lascaux, where palettes were found. Those ancient artists could have used brushes, and most likely did, only they weren't q-tips, but most likely hair, moss, or bark.<sup>26</sup> They also would have used their hands, and most likely even their mouths to put paint on the walls in the patterns and designs which they wanted.<sup>26</sup>

In some ways, however, I did echo ancient techniques. I found sticks and fired them to make charcoal. I mixed the pigments with the clay and water to make my own paint, and for the most part, I did paint with my fingers. I painted similar scenes, with large game and animals, whether those game were predators or prey. In many ways the prehistoric artistic traditions are still in use today, even if modern materials are used to make those traditions a little bit easier to manage.

The chemical formulas are as follows:

Charcoal: C

Hematite:  $\text{Fe}_2\text{O}_3$

Goethite:  $\text{FeO}(\text{OH})$

Magnetite:  $\text{Fe}_3\text{O}_4$

The pigments used in the Lascaux cave paintings were similar to these, however, instead of magnetite, which is an iron oxide, a magnesium oxide was used at Lascaux.<sup>27</sup> Ochres were used for red and yellow pigments at Lascaux, however, so they would have very similar if not identical chemical structures.<sup>28</sup> Charcoal would remain the same, as it is simply a form of the element Carbon. It can change based on the structure of the atoms, but since it is in its most basic elemental form, it is difficult to alter beyond its crystalline or amorphous structure.

Conclusion

This experiment in ancient art has taught me a good deal about culture. It takes a lot of knowledge to be able to successfully accomplish something like a 17-foot bull painting on the side and ceiling of a cave. It takes a lot of infrastructure, confidence, and understanding of elements, structures, and how to combine them to get what you need. It is difficult to mix the correct proportions of clay and pigment, and to get that pigment to hold on a stone for thousands of years seems nearly impossible. I doubt my stone drawings would survive a year, much less more than 15,000 years. I suppose it helps that cave paintings are not exposed to all the elements such as wind and rain, but the paintings also seem to have survived mold and excessive erosion, which is incredible. I have learned through this experiment not to take people for granted, even if they lived a very long time ago. We don't know very much about the people living during the paleolithic period, but we have a lot of clues about them, and through those clues we can see how they developed culture, most likely religion, and definitely art, allowing us to learn more about them as a people as well.

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- <sup>6</sup> Looney, "Hall of Bulls."
- <sup>7</sup> Leroi-Gourhan, "The Archaeology of Lascaux Cave," 107.
- <sup>8</sup> *Ibid.*, 110.
- <sup>9</sup> Tedesco, "Lascaux."
- <sup>10</sup> Looney, "The Hall of Bulls."
- <sup>11</sup> Leroi-Gourhan, "The Archaeology of Lascaux Cave," 109.
- <sup>12</sup> *Ibid.*, 110.
- <sup>13</sup> *Ibid.*, 108.
- <sup>14</sup> *Ibid.*, 110.
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