

## **How to Remove Calcified Muddy Prints**

By Jonathan B. Beard

Don't you just hate it when you find a really beautiful flowstone formation ruined by unsightly mud stains? Mud stains caused by the unwise choice by those before you to step onto the flowstone rather than around it or handle it needlessly with muddy hands?

Wouldn't it be great if you could somehow remove the mud stains? Loose mud is perhaps easy to remove, but what about the mud that is stuck in place? Specifically, these are mud smears or other man-made stains on dripstone or flowstone formations that are calcified in place or have been absorbed into the pores of the calcite formation to form a stain. Mere brushing with a plastic bristle brush won't remove the mud or the stain because it has either permeated into the calcite or additional calcite growth has permeated the mud, cementing it in place or encasing the mud.

There are two choices. Leave the stain and hope in xx years enough calcite covers the stuff that it completely hides it from view or you remove the unsightly blemish.

This essay is about the latter choice. In removing calcified mud from speleothems, you must etch some calcite away, just enough to expose the mud and remove it. It means that to remove the mud, you must remove the calcite growth that holds the mud hostage. It also means that you may be removing the natural patina on the surface. A patina is a thin coating, the result of many years of natural staining by suspended particles in water or air.

Question: Is the mud stain really manmade? Perhaps it is a natural stain as the result of impure water flowing from above, raging floodwaters, cave biota or prehistoric man. Make sure that the mud stains you are removing are indeed manmade and recent enough to be called "modern."

### **Try Other Methods Before Etching**

Before etching the calcified mud away, use softer materials such as plastic bristle brushes, squirt bottles or pressure sprayers to remove as much of the loose mud as possible. The only etching you want to do is to the calcified or stained stuff. Minimize the etching as much as possible.

No matter how you get the job done, you have to be careful. Too much etching, a job too swiftly done, can mar the calcite surface above and beyond what was needed and create its own unsightly blemish or scars. Chemical or physical etching can produce by products that are harmful to cave biota and the ecosystem not to mention being harmful to you.

### **Chemical Etching**

Okay, I had to mention chemical etching because it might occur to someone to use it. This is dangerous stuff. We're talking acid that is capable of burning you and harming the cave ecosystem. And in most situations, it's not even the easiest or fastest way to get the job done. Muriatic acid (diluted hydrochloric acid) has been utilized in the Breakdown Cave restoration laboratory in Christian County. It was used primarily as a "scientific standard" by which to compare with other experimental methods. That is, a diluted 5% to 10% acid solution was used to remove calcified muddy handprints from white columns. The man-hours accumulated to get the job done using acid was then compared with other methods to see which methods worked better, faster and safer than the acid. Other acids that have been used in experimentation in Breakdown Cave include dilute sulfuric acid and acetic acid (in the form of vinegar). Muriatic acid reacts with calcite to form the desiccant salt calcium chloride, a substance foreign to Ozarks caves and with possible ecosystem impact. Sulfuric acid reacts with calcite to

form gypsum (hydrated calcium sulfate), a substance that is often found in minute quantities naturally in Ozarks limestones. This only makes dilute sulfuric acid only slightly safer for the ecosystem than dilute muriatic acid, and doesn't make it any safer for the person using it. Personal protective equipment (PPE) – Goggles to prevent accidental splashing in eyes and 4H Silvershield gloves are used to prevent any burns to the hands. Even 5% muriatic acid will noticeably burn you. Any concentrations higher than 10% will excessively etch and pit the surface and pose a much greater hazard to you and the ecosystem.

In all acid cleaning, toweling was carefully placed under or at the bases of the speleothems being cleaned. The dilute acid was brushed onto the surfaces in small quantities to prevent dripping and excessive runoff. The solution was most likely neutralized before it reached the toweling, but in all cases, the toweling caught the solution. The cleaned areas were then rinsed just as carefully using water from the cave with the rinse water absorbed as well in additional toweling. At the end of the day, the toweling was taken out of the cave and laundered. However, the bottom line here: any kind of chemical etching is NOT recommended for restoration in caves. There are better, faster, easier and safer ways to do it with physical etching methods.

### Physical Etching

Physical etching is a method that employs a substance harder than the calcite that scrapes away the calcified mud. Etching tools like sandpaper or metal implements can be carefully used in small limited areas to etch away enough calcite to free the mud or stain, but it can be a slow, tedious process. To remove small areas, or small hard-to-reach areas, I have used plastic putty knives (purchased at paint stores), screwdrivers and other similar tools. These are used little bit by little bit so as to minimize damage to the calcite surface. You want to do only what is necessary to get the job done. Sandpaper will surely scratch the surface, but again, must be used as minimally as possible to avoid creating excessive damage. Remember, you're trying to make the speleothem look better than it was before you started.

### The Binford 9000

Okay, Binford was the mythical tool company featured on Tim Allen's TV comedy series, *Home Improvement* but, in defense, inside my cordless drill case is a label that says "Binford 9000 High Tech Graffiti Removal Device".



In reality, the Binford is a DeWalt 14.4 volt cordless drill. It is used in the repair of broken stalactites (see [How to Reattach Stalactites](#)) as often as it is used to buff away graffiti (See [How to Remove Graffiti](#)) and calcified mud stains.

The Binford is faster, easier, better and safer than the use of chemical etching agents and, in fact, beats acid in almost all situations. I use a 3M synthetic buffing wheel available in most hardware stores. But even so, I use it carefully, sparingly so that the damage to the flowstone is limited. It can't be stated too much – etch only what is needed to remove the mud and stains.

**Left: Jon Beard uses the Binford 9000 to buff a speleothem in Breakdown Cave.**

The following photograph was taken in Breakdown Cave by Charity Gramm-Hertzler. The calcified muddy handprints on the column on the right were removed with a paint brush using a 5% muriatic acid solution, taking four man-hours to complete. The column on the left was cleaned in 18 minutes using a 3M synthetic buffing attachment powered by a DeWalt 14.4 volt cordless drill.

Both columns were approximately equally stained by muddy hands. Both methods used to remove the brown stains did the job well, but the physical etching was several times faster and with far less potential harm to the people doing the restoration as well as being much safer to the cave environment.

