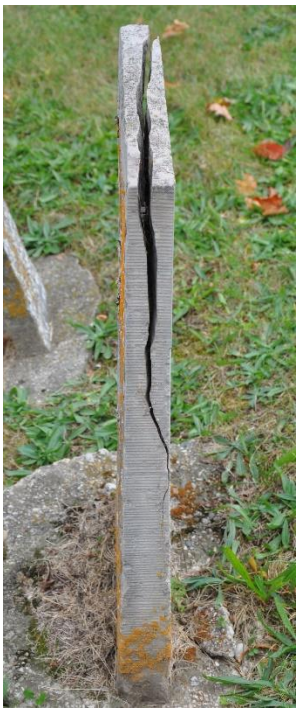
Why removing the outer layer of a grave marker is a very damaging thing

An article by Geologist Don Hilton



All rock begins to weather from the moment it is removed from the earth. It doesn't matter what kind of rock it is, or how tough it is, it begins to weather.

It's easy to find grave markers heavily damaged by the environment. Low-quality marble is regularly mentioned as a stone type that is quickly ruined by exposure to acid precipitation. Alternatives are just as easily found: Sandstone that spalls due to water infiltration or slate that splits because of uneven heating from the sun. But something else is going on beside the obvious damage that we can see with our eyes.

Imagine a loaf of freshly-baked bread. Why does it have a crunchy crust? Really... the whole loaf was in the oven. There was nothing special about the outside layers of the dough. Why is the outside of the bread so different than the inside?

You know the answer. The outside was exposed to the heat and dryness of the oven. As the crust formed, the inside was protected from the worst of the extreme environment. In a properly baked loaf, the hard crust and soft bread are easy to tell from one another. They are made up of the same stuff, but different due to environmental exposure. They are all part of one thing and, while attached, they can be pulled apart, one from the other.

The rock that makes up a grave marker is the same way. When it's pulled out of the ground, it's all the same thing. The face of a commercial stone is worked: honed, polished, and carved. Then, it's stuck out in the open, just like kneaded bread dough is put in an oven.

Just like bread dough in a hot oven, being exposed to the environment changes the surface of the rock. Sometimes the change is rapid, like a dissolving marble. Sometimes the change is slow. Sometimes you can't even tell if it's taking place, but it is. In fact, you can bet on it.

What happens depends on the kind of stone. The surface may become soft and brittle, or it may develop a protective "skin" or patina. These changes are the result of the rock trying to come to a physical and chemical equilibrium with its environment. Like baking bread that forms a crust.

The white marble stone to the left carved in 1877, is showing some signs of dissolving with its natural exposure to the environment.

These altered, outer rock surfaces are easily damaged by **abrasive mechanical or improper chemical cleaning.** When created, grave markers are frequently "dressed" with tools to give them a specific texture that contributes to their historic character as much as any ornately carved stonework. Such detail is damaged by harsh cleaning techniques, either abrasive and/or chemical. The pattern of tooling or cutting is erased, and the crisp lines of carving are worn. Aggressive cleaning removes the polished or honed surface of marble or granite, almost like your "frosting" a clear glass.

The white marble stone above was mechanically cleaned with what is known as a "Nyalox" wheel used on the end of a drill. These wheels are advertised as "abrasive impregnated nylon brushes" with bits of metal that are supposed to last 10 times longer than a wire brush. This stone, once very legible before this mechanical cleaning, is an example of what happens when the protective skin/crust of a stone is removed by harsh or abrasive means, as stated below. This accelerated deterioration took under 4 years to happen.

A cleaning procedure that is too strong removes the protective "crust" or "skin" of the stone. This exposes a new and increased surface area to collect moisture, dirt, and bio-growth. This accelerates weathering. This speeds damage.

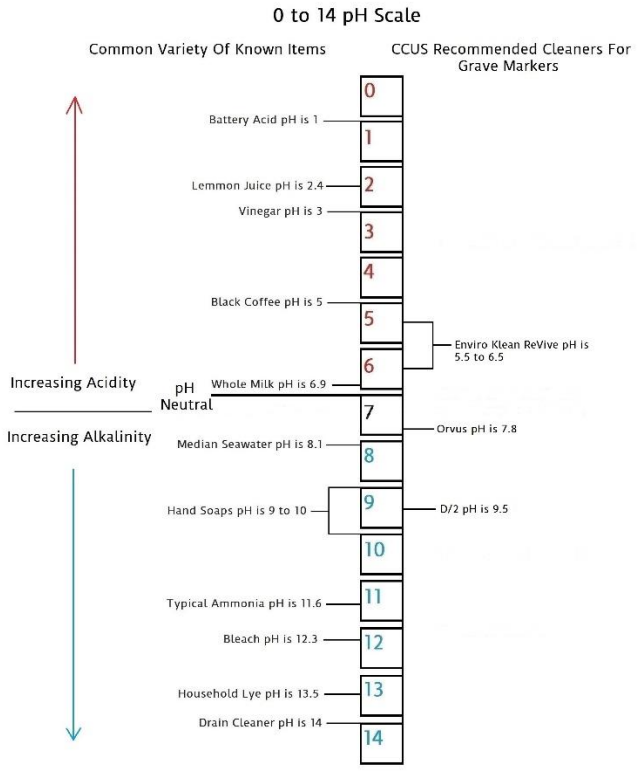
Think about it... If halfway through the baking process, what would happen if you pulled the bread from the oven and peeled away the crust? Would you end up with bread without a crust? Nope. You'd end up with a ruined loaf of bread.

And that's why you don't want to clean a grave marker too harshly and chance removing any of its surfaces. You're not making it cleaner. You're not making it better. You're ruining it.

Ammonia...aggressive cleanings other half of the 1, 2, punch that damages grave markers

An article by Geologist Don Hilton and Cemetery Conservator Mark Morton

For years ammonia has been viewed as a safe and inexpensive cleaner for grave markers. And the golden rule has always been to use it at a ratio of 5 parts water to 1 part ammonia. And to never go above that ratio by increasing the amount of ammonia. Ammonia on its own is very alkaline on the pH scale, coming in at 11.6. To at least begin to understand the effects of ammonia that we are describing, we need to look at some basic chemistry and have a basic understanding of the importance of pH and pH neutral. The scale and description below should do just that.



What Is pH Balance And Why Is It Important?

pH balance is a scale of 0 to 14 that measures acidic quantities and qualities against alkaline quantities and qualities. A pH less than 7 is said to be acidic and solutions with a pH greater than 7 are basic or alkaline. pH neutral is 7. Human pH neutral is 7.30 to 7.45 slightly alkaline. Being as close to pH neutral is important because this is the least caustic area of the scale between the two extremes.
This scale will give you an idea of how pH is measured using common items you may be familiar with.

Acidic and basic are two extremes that describe a chemical property of chemicals. Mixing acids and bases can cancel out or neutralize their extreme effects. A substance that is neither acidic nor basic is neutral.

The pH scale measures how acidic or basic a substance is. The pH scale ranges from 0 to 14. A pH of 7 is neutral. A pH less than 7 is acidic. A pH greater than 7 is basic.

The pH scale is logarithmic and as a result, each whole pH value below 7 is ten times more acidic than the next higher value. For example, pH 4 is ten times more acidic than pH 5 and 100 times (10 times 10) more acidic than pH 6. The same holds true for pH values above 7, each of which is ten times more alkaline (another way to say basic) than the next lower whole value. For example, pH 10 is ten times more alkaline than pH 9 and 100 times (10 times 10) more alkaline than pH 8.

Pure water is neutral. But when chemicals are mixed with water, the mixture can become either acidic or basic. Examples of acidic substances are vinegar and lemon juice. Lye, milk of magnesia, and ammonia are examples of basic substances.

Ammonia as an industrial fertilizer

Ammonia (NH_3) is the foundation for the nitrogen (N) fertilizer industry. It can be directly applied to soil as a plant nutrient or converted into a variety of common N fertilizers, but this requires special safety and management precautions. Ammonia has the highest N content of any commercial fertilizer, making it a popular source of N despite the potential hazard it poses and the safety practices required to use it. For example, when NH_3 fertilizer is applied directly to soil, it's in a pressurized liquid that will immediately become vapor if exposed to air after leaving the tank. To prevent such releases into the atmosphere, growers use various tractor-drawn knives and shanks to place it at least 10 to 20 cm (4 to 8 inches) below the soil surface. Ammonia will then rapidly react with soil water to form ammonium (NH_4^+), which is retained on the soil cation exchange sites.

Ammonia as a simple fertilizer by adding water

Ammonia is sometimes dissolved in water to produce aqua ammonia, a popular liquid N fertilizer. Aqua ammonia doesn't need to be injected as deeply as NH_3, which provides benefits during field application and has fewer safety considerations. Aqua ammonia is frequently added to irrigation water and used in flooded soil conditions.

Summation: When you take household ammonia and add water, you are making a form of "liquid N fertilizer". And even though this type of fertilizer does not need to be "injected deeply", the porosity of stones like marble, sandstone, limestones, etc. will in a way, self-inject this like a sponge due to the stones natural porosity. Most all cleaning that occurs on grave markers is to remove or kill biological

growth such as lichens and moss. Many of these biological growths attach themselves deep into the stone, making them very difficult to dislodge. So when you apply your homemade liquid N fertilizer in an effort to get rid of biological growth, you are actually fertilizing it at its core where it resides below the stones surface. If the stone already has a "protective crust or skin" as described above, it at least has some natural protection to begin with. But when you mechanically remove that layer as you spray down the stone with your water and ammonia solution, you are laying the stone bare to everything and greatly aiding by injecting this into the stone. This is why we refer to this as a 1, 2, punch that damages a porous stone forever.

Above left to right, are 3 white marble stones that were cleaned with the Nyalox wheel and ammonia. The first stone was already showing signs of natural dissolving, or as many conservators call it, "the melted candle wax effect". The middle stone represents the average amount of damage that occurs. The stone on the right is an example of how the Nyalox wheel has ground off most of the delicate detailed carving, and is beginning to show some biological regrowth. All 3 of these stones were completely white directly after the Nyalox method was completed. You never know for sure the severity of damage that will occur. Cloverdale Cemetery, Cloverdale Ind.

In addition to this, you have opened up the stone to a plethora of elements natural & manmade. Let's start with the natural elements. We have all of the biological growths that occur naturally in nature as the natural process that breaks down everything on earth. This is further accelerated as wind and rain leave soil deposits as part of this cycle. So you roughly have soil and seeds and seasonal growth patterns. Manmade elements can range from a wide variety of atmospheric pollutants and acid rains, to any sort of carry over used in the farming industry, from fertilizers to pesticides. So the grave marker becomes very much like a petri dish.

Preserving anything is always a fight against natural occurrences in nature. And the best way to combat this when it comes to grave markers is with the least invasive methods possible. It's a matter of not going too far in an effort to make something look brand new, but to make a "do no harm" improvement. And realizing where the tipping point is between the two. And also realizing when something is as good as it will get or to leave it alone altogether.

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