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# *Andy deGruchy's full original response made to the Chicago Tribune/Washington Post*

Interview done by: Diana L. Strzalka

**Is the importance of lime putty understood throughout the construction industry? Why or why not?**

Yes, mortar mixes that are composed completely of slaked quicklime and sand are known by various groups of people. Some of these people may or may not know of their importance. There are still people alive who know first hand of the material who never were masons but were familiar with its use. These people have now become very old folks if they still remember slaking lime when they were young if they either watched or labored for a then old-timer mason. Others may remember the routine on the farm where the barrel of slaked lime was kept for making whitewash and the process which followed whereby everything got its annual whitewash, from the barn walls to the eye level height of tree trunks that lined the driveway, etc.

Having lime in a mortar mix is completely understood by most all masons. However, the lime that most masons are completely familiar with is bagged hydrated lime. Without the addition of a plasticizer such as hydrated lime, to a mortar mix, the mix is 'dead' on the trowel. Lime adds plasticity, allowing mortar to flow, controls the mortar's setting time and shrinkage. The word "hydrated" is simply the introduction of water to the quicklime, in advance, at a building lime production plant. The process when water is added after burning a limestone is called slaking, as in "slaking one's thirst." The thirsty one here is the burned limestone which had the carbon dioxide driven out of the stone by the heat of kiln firing. This burned stone is called by three names commonly. It is called quicklime, hot lime and lump lime. When the burned limestone, whose composition is mostly the compressed sediment of marine life remains, has water newly reintroduced to it, a volatile exothermic reaction occurs whereby the now cooled stone, which had been previously burned, draws the carbon dioxide from the slaking water back to itself in a chemical reaction. This chemical reaction causes the water bath that the burned limestone is slaked in to boil in approximately two to five minutes.

Slaking quicklime was and still is dangerous and time consuming to perform on a job site. The process of doing the slaking in advance for you, by way of an automatic hydrator, was invented. The automatic hydrator was invented in my home town of Plymouth Meeting, Pennsylvania by two men in the Corson family who owned and operated the Corson Lime Company, and it was patented in 1930. The Corson Lime Company operated from 1860 to 1997. However, it is along with the advance of making today's pre hydrated lime that the loss of some of the performance properties of the traditionally slow burned, wood or coal fired limestone, which is manually slaked into lime putty, may have also resulted. This lack of performance may be known by every mason who ever tried to use pre-hydrated lime and sand to make a mortar. The strength and durability does not come up to that of the best traditionally made historic lime mortars. What masons may not know is that a loss in the reactive properties of lime may be happening because of the higher temperatures that limestone is being burned at today in modern production facilities.

This is the part that many masons and historic restoration specification writers don't seem to know. When this convenient, packaged, hydrated lime material was produced for the building industry it was intended to be readily available in a bagged form so that the plasticity and other properties first mentioned could be added to a mortar mix without the need for the lime to become the primary cementing material. So, no one seemed to miss certain performance properties that the old slow burned wood-fired lime putty had since they were probably more fascinated with what a new union of materials could now do. Portland cement started being made commercially in the 1870's in the Lehigh Valley, nearer to where I now live. Lime as the primary binder faded from use in the United States slowly from the 1870's, when Portland cement began being looked at as the primary binder or cementing material in a mortar mix. Portland cement became even more popular as the mainstream binder in masonry when its bagged contents could be matched with the newly bagged pre-hydrated lime. I use the term "bagged" to mean "packaged" even though "barrels and sacks" may have been the correct terminology back then. Portland cement mortars had strength properties which could be made in great excess of lime putty mortars and these new mixes had fast setting abilities so that more work could be done more quickly.

Unfortunately even though this bigger and faster approach gave us many of the modern construction marvels, not all this bigger, stronger, faster mentality is beneficial to repairing historic structures. Most historical buildings had bedding and pointing mortar made in the old fashioned and time proven method of using slow, lower temperature fired limestone. Masons in all ages past may not have known these truths but knew that certain ways of making mortar worked. Failures in anything cause people to make a change. I sought out to understand as much as I could, even though I am not a chemist but just a ordinary bricklayer, in the attempt to pursue excellence and do my job better.

**More on Lime and Lime burning**

There are only three kinds of lime in the world: Dolomitic, Magnesium and High Calcium. Dolomite is a mineral consisting of a calcium magnesium carbonate. Magnesium lime is just Dolomitic limestone with a higher Magnesium content to deem it High Magnesium or "Magnesium lime." High Calcium is the purest form of calcium carbonate, about 95%, just bones, shells, plant ashes with fewer other elements which deem it "High Calcium."

If I am making mortar, I am going to try to choose high calcium lime over the others because I believe that the more the limestone tips toward the magnesium side, the harder it is to manually slake. The burned high calcium limestone will now follow through with what is called the "lime cycle" whereby one starts with limestone, burns the stone to push off the carbon dioxide, reintroduces carbon dioxide in the process of adding water during slaking and therefore causes carbonation in which the lime, the now called calcium hydroxide, is turning back into calcium carbonate or limestone. You may think that this is a lot of trouble to make mortar! The reason it is worth the trouble is that good lime mortars that were used to build with throughout the majority of all building history can absorb water and also allow it to evaporate from the building via the joints and not the brick or stone. Also, a crystalline bridging phenomenon occurs when movement happens in a wall and whereby good reactive lime uses the carbon dioxide that the lime is continually taking from exposure to water vapor and air to bridge or close minor fissures making it the ultimate flex material in a massive masonry building.

The issue of "good reactive lime" and its relation to low temperature firing is a 'hot' issue in itself. Burning a limestone disassociates from the stone the water found in the stone. The stone starts out as a calcium carbonate rock and ends up being a calcium oxide or quicklime lump. So, after burning, the

calcium carbonate stone which became a calcium oxide stone, the weight will now be about half as much because of the lack of water content which was driven off.

Since I know that in most cases I would prefer to use high calcium limestone for making lime putty, the question remains about which method of kiln firing will I choose. Like baking a cake, you can underburn or overburn but you want it "just right." Just right for lime which is intended to be used as the principle binder in a mortar mix, is a lime burning that creates the most reactive form of quicklime. The old wood-fired kiln may only reach temperatures of 1650 degrees Fahrenheit because the steam produced from the water in the wood keep the fire cooler. However, it also happens that the water in the wood aids in keeping the water's carbon dioxide pressure low enough so it can diffuse through the lump of lime at a slow enough rate to make it "just right" in reactivity. High heat may close the pore structure of the stone, not letting this happen optimally. A modern lime burning kiln is not a crematorium, but if you think of an example like a crematorium, and how if one were to increase heat immensely, a material would if incinerated, become dead and practically losing all its good reactive properties. Good quicklime needs to remain reactive. In my opinion and by evidence of thousands of years of low-temperature fired lime putty still in existence and working, I am going the low-temp fired route.

**Part 1: The Big Question about repointing mortar for historic buildings**

So what then is the cheapest and best alternative to use to repoint over historic lime and sand bedding mortar? That has been the question for many since the majority of those attending to repointing in the United States have been sort of stuck for years with knowledge of what we were ultimately looking for in properties for good mortar but somewhat limited in our range of available materials. In the past, every knowledgeable specifier new that too hard of a Portland cement based mix would impede vapor transfer through the mortar joint and cause the moisture to damagingly go through the face of the masonry unit or between a small crack that develops when the rigid mortar doesn't yield during building movement and the final result was a leaching out an unsightly deposit and worse. So the next logical thing to do, which has been done and is still being done for at least the last thirty years, was to make the mortar "high in lime content". The theory is to take the setting properties of a Portland cement and add more lime to the mix so as to aid in the mortar's ability to yield in movement and still allow vapor movement to go through the joint.

**Part 2: The proposed problem in using any Portland cement for what we are trying to repair**

A current existing argument in the industry about why not to use any Portland cement is that the presence of tricalcium aluminates, which is found in all Portland cement, when mixed with moisture, (which by the water can be egregiously trapped in a wall built with lime bedding-mortar when high Portland cement content mortars are used to repoint over the top of them), then forms damaging salts. A sulfate attack from this reaction is caused whereby an overall expansion occurs in the mortar and if allowed to go on will eventually disintegrate the mortar and even topple out sections of wall. So mortars containing any Portland cement may have this adverse reaction. This reaction is controlled in a high lime content mortar containing Portland cement by a very tight pointing job and a building that moves very little and therefore shows little evidence of open voids from the movement. In the past most everyone in historic masonry restoration was working with what they had and with what they knew even though most all restoration masons knew that the original lime/sand mortar joints may have been working very well for better than 100 years and couldn't argue that they would use the same if they could recreate all of what worked about it. Many of us in the industry were just not sure of the

performance of high lime content mortars which contained Portland cement, but it seemed like a good fix until we find something better that would not also blow the job budget.

**Part 3: The great solution that I found**

Thank God I was introduced to St. Astier Natural Hydraulic Lime. When I found out all of its properties and its cost of approximately $26 per 55 lb. bag, not only did we get along, we got married. Like the commercial on television a few years back where the guy who enjoyed using a certain razor for shaving liked using it so much that he decided to just buy the company, it took very little convincing for me to jump right on board with the International St. Astier Lime Network.

St. Astier Natural Hydraulic Lime is High Calcium limestone burned at a low temperature using a low sulfur anthracite coal for fueling the kiln. The high calcium limestone they use naturally contains just enough reactive silica to cause it to become a hydraulic lime when it is burned and slaked and packaged dry, ready for the addition of sand and water to make great mortar. The term "Hydraulic lime" means that it sets up with the addition of water much like what all masons today are used to having happen when they make cementicious mortars. Lime putty made in the old fashioned way first described above needs six weeks of exposure to air in order to cure.  Masons today, for the most part, may not understand how to properly handle a good fat, wood fired high calcium lime putty until it is properly cured. Today's masons are mostly used to Portland cement mortars which are set in about two hours while this great solution that I found in Natural Hydraulic Lime sets in about two days. The word "Natural" hydraulic is important because lime can be made to become hydraulic by various methods, two of which are either adding Portland cement or slaking with sulfuric acid. All these things should be considered when choosing which lime to use.

I like The St. Astier Natural Hydraulic Lime company so much because they simply disclose everything they have and know about their material on their website so that anyone who wants to make an informed choice in specifying their product can do so by having this information readily available. So now I sell it in my exclusive territory from Pennsylvania to Maine and west for a total of 16 states. In just a short time I've been on the horn with international architects working on major national museums and world renowned universities for their historic restoration projects as well as their new build applications.

**What should the owner of a historic home do if he needed work on this masonry?**

Contact their local historic resources conservancy and ask for names of qualified architectural conservators who can first diagnose what intervention should occur in order to attempt to properly conserve his historic home and not introduce irreversibly damaging materials or methods of work. If the conservator or the mason does not know of St. Astier Natural Hydraulic Lime, he may want to become familiar with it by visiting www.stastier.com and see if the material is appropriate for any of the fixes that the conservator suggests.

**Do you have any examples of buildings that have deteriorated because of faulty repointing?**

Examples are everywhere in the United States of faulty repointing. These examples are most prevalently seen and understood as a recognizable form of rapid deterioration, even by the untrained novice, where the faces of brick have hollowed out on a repointed building and the mortar remains protruding from

the hollow, still intact as a "picture frame" around the brick. The mortar which "picture frames" the brick evidences high Portland cement content in the mortar by its very grey color and the deterioration that results is caused by the wetting and drying cycles occurring though the brick unit and not the mortar joint.

**When/how did you learn of lime putty?**

The entire history and theory of what was the everyday way to make mortar, with good, fat lime putty in all the ages of masonry past, was discussed at the trade school I attended. However, after we learned why every town in Pennsylvania seemed to have a road named something like "Limekiln Pike" where our forefathers cleverly named the road to lead masons to the lime, we went on to use only hydrated lime and sand to build shop projects. We used lime and sand mixtures exclusively for three years. We would talk to each other about the upcoming time when we would graduate and one day make mortar using Portland cement and hydrated lime instead of using just sand and hydrate.

The shop projects were temporary and were knocked down every couple of weeks so we didn't add Portland cement and create some homogeneous rock of masonry that we would have to tear down with much greater effort. Instead, we recycled the lime and sand and used it again and again on new shop assignments. However, may I note that if you finished a project the last week of school and no one knocked it down, and it stayed for the summer in the shop, the lime did get much harder and the project was much more difficult to knock down in the fall when we returned to school. You see, at the Williamson Trade School where I lived for three years to learn my trade, we had instructors who were there thirty years or better. So, my instructor was there from 1960 something and his instructor was there from, I think, 1930 something. Therefore, we did not feel far removed from the old ways of doing things in the trade even though the use of Portland cement was taught to us because it is now the staple binder of all modern construction mortar used for modern construction work.

Lime putty, not hydrated bagged lime, was reintroduced to me at various masonry restoration seminars as an option over 10 years ago, but more like an eccentric idea of a way to properly repoint buildings. Ten years ago it was just thought of as more limited than mainstream way of repointing buildings and just "some purists" were going back to using lime putty and the word on the streets was with failures and other varying results in final outcome. What I know now is a world away from those darker days. Now I know how and why it works, where to get it and how to use it and when Natural Hydraulic Lime can also be used as a substitute for wood fired high calcium lime putty. I am changing the way I do everything and it turns out I am going back to what we did for the first three years of trade school…using mixes with just lime and sand in them. The only difference is that Natural Hydraulic Lime/sand mixtures reach durability strengths much like that of the original lime mortars used to build historic buildings where hydrated lime/sand mixtures does not.

**Is there any resistance in the construction market to the older mortar?**

I think I answered that question in my long dissertation first composed. Wood fired high calcium lime putty is expensive and therefore resistance to its use in historic restoration has been the norm. The other inhibiting factor is that people are afraid of what they don't understand. This is why I am posting this information on my website. Natural Hydraulic lime is relatively cheap, available, and has the right properties for many applications such as repointing over historic lime/sand bedding mortar. I think no-nonsense masons everywhere will come to find these things out and will then have less and less resistance to going back to using lime.

**Could you describe your background, when you started, your current position, what town is your business, what town do you live, how long have you been in business, etc ?**

For three years I lived at America's oldest private free trade school, The Williamson Free School of Mechanical Trades in Media, PA. I was enrolled to learn only the masonry trade. When I graduated I worked for two contractors over a two year period as their mason. I felt I could do a better job in running my own business so I started it in 1984.

Only six months into business I was asked to repoint a Pennsylvania Stone Farmhouse. My helper and I loved doing the work so I began taking courses and seminars on the subject of masonry restoration, collecting books about the subject, and soon found that this was the full direction our business took. I still have the same helper who started with me about 18 years ago. He is now an unbelievably good stonemason and restoration professional. I also have other men with me over 15 years. We are like brothers. I am not one to change much. I married the girl I met and dated from 11th grade until she graduated from college. Audrey, my wife, does my company's books along with two other secretaries. Audrey would never ever ask me about lime anymore - she knows better. This is the sort of long winded response I tend to give so I thank you for allowing me this wonderful opportunity to type these responses and have a sounding board. Seriously, she and the whole company know that I love what I do and I feel very well supported in this my life's work. I am truly grateful for great friends and family. I was born in Philadelphia, raised in Plymouth Meeting, and then shortly in Lansdale, PA. I moved to Quakertown when I got married and have lived and worked here ever since.

**Could you name any big projects you've been involved in?**

Every project whose owner wants correct historic restoration work is "big" in my book. We take pride, like anyone would, on bidding jobs over one million dollars or for famous people. However, we take greater pride that we are not too proud to do a small repair if we are able to it. I think it is an honorable thing to perform the trade correctly at any level whether it be for a little old lady living in a pristine brick Victorian home here in town, or for a television personality dropping a couple of million into a weekend getaway pad built in the 1800's nearby. We have worked for both of these type characters.

**Could you explain your part in helping to create specifications for state and national landmark laws? I think that's what I read on your web site.**

Well, I have helped to simply write or re-write specifications. I explain the contents of my first dissertation, written above, to any and all captivated architects and conservators. I find that well educated and caring conservators seem to like helpful advise from a mason who makes a lot of empirical observations while attending to the work. This advice is then better supported because I also filter what I read about the subject and can then draw tangible conclusions on what I believe will and will not work or what may or may not be appropriate intervention. If I make a great suggestion that has any merit, often the specification gets rewritten. I try to practice being helpful in this manner at every opportunity I get in order to make the best outcome of the job. In one set of examples we won the award to work at William Penn's home, the founder of Pennsylvania, and also at the Pennsylvania's Governor's homestead of colonial days and I made certain masonry restoration suggestions. The architect gave me a written referral letter about this. I quote:

*"I recommend Mr. deGruchy for any masonry work you'd envision. I have confidence in his skills and I trust his judgment. During our two projects, he was not shy about offering suggestions to make the jobs better, and I listened carefully and took his advice. In the end, I appreciated his willingness to share his expertise, and I believe it made the jobs better than if he'd simply "stuck to the specification.*

*--John R. Bowie, A.I.A., Historical Architect*

This is just one example. Your question, Diana, does however encourage me to post on my website other reference letters which we have collected from those who have stated how much they enjoyed working with us. I should do this because potential new customers like to see all our review letters. They usually ask me how we keep those who become our customers so happy that we get a lot of shining reviews. I always tell them that I simply attempt to completely fulfill my duty and do exactly what I say I am going to do. That may be what is always expected from a contractor, but for some reason many contractors are known to do the opposite. I believe that by not quickly entering into every agreement but by first making sure a good environment is set in which to do this labor of love, better than expected restoration work results.

Over and over again I read what is written in a specification and I will ask the specification writer why we are not doing it this way or that. This costs me jobs sometimes. I think it is for the best, at least for me. I always worry if a specification writer can not be open minded and work with me when I point out what I think is a questionable intervention. I don't want to usurp anyone's authority. I just want to start a healthy dialogue for the good of the work we will soon endeavor to do. An atmosphere of cooperation among all involved parties in a restoration project makes a better job in my opinion. I often suggest that if it is ever possible, an owner should choose to work in an open-ended-agreement with a good masonry restoration company and a qualified conservator rather than poise a low bid winning contractor against an unqualified specification to accomplish a very expensive mess.

On a national level, I am very proud to say that I've even been elected by my peers along with 59 other people to take part in an intense dialogue planned in New England in the early summer to discuss how to positively impact the next 25 years of our nation's historic built environment. This formal session is being modeled after a similar forum which was guided and funded by the same private foundation in another country with great success upon conservation of their historical heritage. Since I am not sure that I have the liberty to disclose the name of this private group I think I should just say that in any event I am honored to be considered among what appears to be a very select group of architects, engineers, academicians and public policy influencers. I intend to do my best to serve God and country with the grace that our dear God allows.

Sincerely,
Andrew deGruchy, President

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Quakertown, Pennsylvania