

# stonexus

## MAGAZINE

Summer 2004

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Tomas Lipps

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### COVER:

The ruins of Takeda castle aka Torafusu-jo, or Crouching Tiger Castle, in Hyogo Prefecture. A Japanese cinema company wanted to use the remote ruin of this 15th Century stronghold to make a historical film, "*Ten to Chi to*." They offered to let the village keep, as a tourist attraction, the facsimile castle that they planned to construct on the old foundations. The ensuing controversy divided the villagers but finally the preservationist element prevailed and the company was allowed to use the site—with the condition that they remove the movie set completely and restore the site to its earlier condition.

*Photo courtesy of Department of Tourism, Wadayama-cho, Hyogo Prefecture.*



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#### stone (ston) n.

1. a. Concreted earthy or mineral matter; rock.  
b. Such concreted matter of a particular type.  
Often used in combination.
2. A small piece of rock.
3. Rock or piece of rock shaped or finished for a particular purpose, especially a piece of rock that is used in construction.

#### nexus (nek' sas) n., pl. nexus or nex-us-es.

1. A means of connection; a link or tie.
2. A connected series or group.
3. The core or center.

#### mag-a-zine (mag-úh-zeen), n.

1. A periodical containing a collection of articles, stories, pictures, or other features



## from the editor

*Friends and fellow Lithophiles, greetings.*

*Here it is—STONEXUS IV, the latest installment in this continuing compendium of stone lore. I hope you enjoy it; I've enjoyed putting it together; editing is a different craft than stonework, but related—selecting shaping and composing stone stuff (and, in the wide variety of material assembled, I notice that it's consistent with my tendency to use a wide variety of stone types in the walls I build*

*STONEXUS continues to morph. For one thing, you may notice some stylistic experimentation with different fonts and layouts, and . . .*

*T & T is now tips and techniques (tips and tidbits, where did that come from?) and will vary in length accordingly to what is sent in, and . . .*

*There are two new features that should add interest to the magazine:*

*STONESTONE IN RESIDENTIAL ARCHITECTURE, a series of articles exploring that subject by a succession of notable design professionals and craftspeople; and...*

*I. M. H. O. (in my humble opinion), an Op-Ed column in which guest columnists are invited to expound on issues important to them. I've initiated that with an opinionated rant of my own.*

*AND, we got MAIL! The hope was always that STONEXUS would be a forum of sorts, and it may well become one; the surge of letters was most welcome. This kind of dialogue will be better served if STONEXUS was produced quarterly. Fewer pages, appearing more often? What do you think?*

*Again, much of the material in this issue was written by –or suggested by- member/subscribers. Thanks are due, in no particular order, to RICHARD SAMMONS, who wrote the first Stonework in Residential Architecture article (Richard is an architect who strives to incorporate structural, load-bearing masonry into the buildings he designs, an admirable ambition); to IAN CRAMB, the venerable old master stonemason who contributed his personal account of his first major commission; to BOB the Canadian WALLER for providing the poem about the old dry stone waller; to ALAN COUNIHAN, a friend from the past that I recently encountered out there in cyberspace, no surprise that his lithical path continued to evolve –as described in "in Stone, a Life;" to VITO HEMPHILL, the fellow who, years ago, saved me acres of back-ache by telling me about that little exercise for the sacroiliac that is to be found in the T & T section; to MILES CHAFEE for passing along the issue of Aramco World Magazine from whence came the interesting article about the ancient Roman porphyry quarries in southern Egypt; to JULIET GOLDEN for sharing the photographs she took on her travels with her stonemason companion, TADEK through a province of Poland remarkable for its stonework, to JAMES CRAWFORD, for finally yielding to my entreaties to write about his escapade in Sardinia; to JIM UNDERWOOD for sending me the article, "The First Stone." Thanks, too, to all those who contributed Photos to the Editor — there were too many to print. Keep 'em coming; if you want to be sure they come back, include a self-addressed envelope.*

*Finally I must say that I'm gratified, and encouraged, by the appreciation expressed by many of you for the eclectic mix of material that finds its way into the magazine, OUR magazine. Now, excuse me, I've got to get to work on STONEXUS #5.*



a boy and his rock

*Thomas*

Dear Tomas, I enjoyed the article, "Birth of a Bridge". It brought back happy memories of repairing and rebuilding many old bridges around my area in Perthshire, Scotland. One old bridge I remember, the actual foundation was bales of wool. Seems this was quite a common method at one time. The bridge was built around the late 1700's, still standing it was, and much used.

Re slip-form stonework: I remember during my apprenticeship thinking I would try out this idea, unbeknownst to my father. After I took down the forms, though it looked not too bad, I was told to demolish it. I did not think my father and grandfather knew so many swear words. Ever since I've stuck to the traditional method of building with stone.

You have some very interesting articles, I especially enjoyed the Brother Book of 1563. My grandfather must have known about this; he was very strict regarding my behavior during my apprenticeship. All the very best and keep up the good work.

Ian Cramb, Bangor PA

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#### VENEERREALITY

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Spider-Man may appreciate the opportunity to take a gravity-defying stroll across a vertical flagstone patio, but we mere mortals wonder what would possess someone to ignore the simple wisdom of laying heavy things flat so they do not fall down. Pardon my visceral reaction, but youthful experiments with dozens of garage-sale domino sets left an indelible impression: unless constructing a tower with the prior intent of watching it fall down just for fun, structures made of slab-shaped components are much less likely to spontaneously collapse when said components are stacked flat rather than balanced precariously in any other orientation. Granted, I was using only friction and inertia as mortar to hold the dominoes in place, but the principle is a general one, and even modern theories of structural engineering and the building codes derived from them recognize the fundamental relationship between the ratio of the height of an object to its smallest horizontal dimension and the tendency it has to fall over.

Stone is characterized by its hefty mass, great compressive strength, and proven structural longevity when stacked properly, as well as for its aesthetic appeal. By using it non-structurally in a cyclopean mosaic, the veneer introduces a vertical running joint the entire breadth and height of the wall between the veneer and the wall itself. A thin but massive vertical slab tends to be unstable and more likely to topple if the wall shifts out of plumb, and if too much weight is put upon it, even a small fraction of what the stones can handle compressively, the wall may ripple and buckle enough to begin to lose its stones before it fails.

But the wall stands, holding its facing stones up on edge, at least for now. One can only assume behind its face is hidden some kind of structural network to counteract the visible instability, a web of tensile forces holding tenaciously to those stones balanced so precariously on end. Mortar alone is not adhesive enough, but strands as strong as steel can hold the wall together for a time. Perhaps Spider-Man was involved after all.

David E. Wagner II, San Antonio, TX

On the subject of stone cladding versus

solid masonry, why would anyone want to represent one as being better than the other, for any reason?

If a person is going to be completely stuck in the middle ages forsaking all forms of advancement within the craft, they may well want to continue building solid walls. (solid stone masonry: walls built with a 'fair faced' outside skin of stone, and a fair faced inside skin of stone, and filled with loose bits and pieces of stone chips and mortar. Inner and outer faces are integrated at openings and within the body of the wall at regular intervals with 'through stones').

Stone clad walls, on the other hand, are a single skin of fair faced stonework laid up against a backing material which can be concrete or steel, (as in the Empire State Building and it's like), brickwork or timber. All clad buildings allow for an air space between the backing material and the stone allowing moisture to evaporate. This is a good thing.

In the case of building in wet or cold climates, the combination of timber frame clad with masonry has long proven to be the best form of construction. The beauty of a stone house that is properly insulated and has within the building envelope a breathable vapour barrier on the outside of the frame behind the stone and an impermeable vapour barrier on the inside of the frame behind the drywall provides for a comfortable existence for the inhabitants. No moulds or mildews to promote asthma amongst the children, no drafts in the winter, a sound exterior tied to the frame that will age gracefully. What could be better?

It will only stand as long as the frame holds up though so don't expect 'cathedral' longevity!

I can almost hear you muttering Tomas! You are asking how the traditions of the craft can be kept alive in such a structure. Easily! Wisely chosen stone, ledge-rock type material, limestone or sandstone cut with a maximum 5" bed width is a better than granite fieldstone. Although, having said that, we have built many clad buildings out of split then squared boulders with great success).

You can then trim the windows and doors with ashlar sills, jambs and lintels or voussiors (arch stones). These can be cut from Indiana limestone or Ohio sandstone to accent your stone walls.

NEVER mix sedimentary stones on any building.

Robert Watt, Toronto, Canada

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Hello, I am a self-employed stonemason in South Carolina. I am writing this letter as a call to arms to all stonemasons who believe in our craft. Where I live, 90-95% of the stonework being done is manufactured stone or even worse- thin, irregular stones randomly stuck on the wall with no pattern or concern for neatness whatsoever. When this method of adhered veneer is used, there is no way to lay your corners plumb to a string or keep your wall line consistent. Because these stones must be pressed and squeezed against the wall so they will adhere, the face of the wall and corners are in and out as much as 2 to 3 inches. When these so called "stonemasons" have massacred this wall at a rate of 100 square foot per day per man, they just fill all the joints with a grout bag and scratch them with a stick. Most of these workers have never been an apprentice or

learned the trade from an experienced stonemason working with them. They are hired by local stoneyards who sell the stone and line up the job. They teach them to make a super rich cement (6 shovels of sand to half a bag of portland cement) and show them how to stick the stone on the wall. "OK, you're a stonemason now. Go veneer that \$500,000 house and call me when you're finished."

This is not happening because of lack of good stone. Winnsboro Blue granite is the state stone of South Carolina and is readily available. But thin veneer masons do not know how to lay it because it is too heavy to stick on the wall. I know this publication is read by serious masons who love this trade who may think I am joking, but believe me I am not exaggerating.

I learned my trade in New Hampshire and spent years of laboring and apprenticed until I got the opportunity to lay stone. Here in South Carolina I have struggled to get work using the traditional methods I was taught because these thin veneer masons have priced their services to compete with stucco and brick. All true stonemasons need to be aware that this is happening everywhere. This method of masonry will affect the livelihood of the qualified stonemason who cares about and takes pride in his/her work. It is up to us as craftsmen to educate consumers and builders about the differences between natural and manufactured stone and self-supporting stonework and thin, stick-on veneers.

Anthony DiLiegro, SC

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#### SLIP-FORM STONEWORK

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Hey, Tomas, I liked your potpourri issue. Loved Mr. Underwood's article on slip-form stonework. He has taken the method to a fine art, but is defensive about the slip-form method because he must know the room is full of purists. Yet even the most artistic mason knows, competitive job bidding requires innovation. My observation about slipform stone masonry is that its best use is with those squirty river cobbles that defy tie-wiring. The finish contrast of softly rounded stone and crisp edges slays me. Whatever shaped form can be created in wood can be recreated in rock. Jim's inclusion of two visible details, a Buddha statue and a recessed shelf with projecting sill is excellent. A chunk of wood or hard foam in the casting can be removed later to create the negative space for embellishments such as these. I look forward to Jim's elaboration of this method. Let me just say, in case he doesn't touch on the casting of smooth cobbles, that a viscous, lime-heavy mortar can be used with cobbles for a more plastic initial set that aids in green striking and washing (and even the occasional need to insert a small rock) after the form is gone. The absence of crags on the cobbles means cleanup is easier and neater than with coarse rock. As far as forming goes, thin plywood can enable the building of radiused work. Sono tube sections, flower pots; any brace-able, found object can guide the formwork. When forming over a toothy substructure, it is possible, even, to build from the top down by applying temporary supports beneath each lift until initial set is realized. Scary, but possible.

Where the costs of supplying the world's most abundant resource alone are prohibitive. The need to use "the local stone" has caused us to explore methods like slip-forming river cob-

bles or mounting rocks on edge instead of on bed to get more economical coverage. We could never do it without mortar. Another response to material and labor cost is to use phony stone, but that's a subject that makes me cranky. I am particularly intrigued by the on-point and herring-bone drystack walls and would love to see more of them in your outstanding photo gallery.

Todd Campbell, Utah

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UNCLASSIFIED

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Tomas, in the article "The Wrong Stone" in the inaugural edition of STONEXUS the author talks about the original stone used for the Houses of Parliament and how in 1860 it was described by Charles Dickens as "...being the worst ever used in the capital." Today "50 % of the visible masonry has been replaced during the last 130 years" with Clipsham stone.

The question arises in preservation: when should you change from the original material to a new replacement material. The houses of Parliament is a relatively new structure and the historical need to be accurate is perhaps less intense. However Wells Cathedral, England, had a similar problem but with a much older building. It was known over a hundred years ago that Douling stone was not an ideal building material but it has been used for the Cathedral for hundreds of years. So to overcome the problem of a poor quality material but not lose the historical connection to the local stone it was decided to use Clipsham stone (a much harder and durable material) in the areas which received most weathering but to continue to use Douling stone for the majority of the building.

So sometimes the wrong stone can be the right stone. At least it keeps the stone mason busy.

Simeon Warren, Charleston SC

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Tomas, I am the State Park Superintendent at Stonewall Jackson Lake State Park in West Virginia. The park is only 12 years old. During that time we have been developing the various facilities. Recently we started our trails construction project. A few years ago I discovered some dry stone walls in an area that I wanted to put a trail. Since that time I have discovered more walling in and around the park. Now I am looking for history and information about the walls. Can you help me? I can describe these more or send digital photos if you are interested.

Sam England, WV

---

Sam, Tomas asked me to reply to your query to him, figuring that as I live nearby more or less I might know more about your walls. I don't think he is right, but I will hazard some words on it. I live in Franklin, Pendleton County by the way, on Rt.33 which would put me just down (though a long way down) the road from you. I don't know anything about your walls over there; but two good sources of help would be the WV Dept. of Culture & History which has large archives and lots of pictures, and your county surveyor along with the deed that almost certainly accompanied the establishment of your

state park. The latter will define who settled what when and also define old boundary lines. Defining fields and property boundaries was a common reason for putting walls where they went. I have lived and worked in quite a variety of places near stone walls and thought about why they are found in some farming areas and not in others. Here in Pendleton, for example, there are almost no stone walls anywhere; the few instances really stand out. Stone foundations, stone chimneys and stone dumps at the edges of fields, but almost no walls. I think it goes back to early settlement and agriculture patterns here. The flat valleys were cleared and farmed by the English and the rock littering their fields was river-rounded and hard to build with. They tossed it into the river, or into stone dumps at the edge of a hill where you see it still; easier to split rails and build boundary fence that way. The second settlement wave here was the Scotch Irish who settled the steeper hillsides (the flat valley land already taken); they were herdsman, not "dirt farmers" and didn't need to clear rock except for small gardens and an occasional field. Again they used stone dumps when they did clear because their stock ranged all over and could hop low stone walls easily - easier again to build with split rail. Remember, these folk often had no wagon, or if they did the work was very hard on both body and equipment.

In the early Appalachian settlement the population density was relatively low, so there was less need to develop land intensively. Move down river to Round Hill, VA, to the mountain just north-west of there and you will find stone walls 4-5 feet high and as much as 12 feet wide, and still bedrock showing frequently in the now overgrown fields. People were desperate for any land at all. This was pasture (it is not plowable) and the literally "dirt poor" herdsman had nothing but scrub forest, so no rail material. They built stone walls to hold sheep, cattle and horses, often, it seems, along roadways. The rock there is also more angular than here in Pendleton's valleys, so easier to lay up. This desperation for land and intensity of use is more akin to the New England situation, though New England rock is often more like ours and hard to lay up.

A recent book, Stone By Stone by Thorson ([www.sciencenewsbooks.org](http://www.sciencenewsbooks.org)), covers New England stone walls in depth. I have not been able to afford it; but the review refers to these walls being "primarily linear landfills" and claims that they were "the biggest investment (I assume he means time investment) in a farm, often exceeding that of land and buildings". This squares with my experience. Settlers did not build stone walls on a whim, only when they had to. I don't know where this leaves you in your quest, but I hope this reflection helps. One last thought - the only old stone walls I know of here in Pendleton were built as corrals and were next to little cliffs of very angular rock.

Jim Underwood, WV

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*On the subject of rural walls: when I was hanging out in North Carolina some time back, I noticed these long walls running back into the forest. As they weren't enclosing anything I assumed they were boundary walls. "Not so," I was told, "them's hawg walls." Farmers would put pigs out to forage in the woods. Mast, that is to say acorns, was a staple of the pigs diet, but this made the meat somewhat bitter. Pigs*

*are notoriously hard to catch, so as many people as could be mustered would spread out and they drove the pigs against the walls and herded them towards the farm into a holding area where they would be fed corn to "sweeten them up for slaughter". T. L.*

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Dear Sir, I am a young Architect in Michigan and a few years ago purchased a home that was built in the 1870's. I am enjoying restoring the house and recently have needed to rebuild some portions of the stone foundation that had been removed or damaged over the years. It has truly made me appreciate and love stonework and left me almost disappointed when I was finished that there was nothing more to do. I have a very typical stone basement from the time period and would like to make the space usable as a studio for myself. The site has mostly clay soils to the bottom of the basement and then it is clay sand mix on to the water table a few feet below. I have spent the last couple years correcting gutters and rebuilding window well/drywell systems to drain the water away from the foundation as much as possible. As a last line of defense I was hoping to be able to waterproof the inside of the foundation to prevent any stray infiltration. I was thinking of tuckpointing all the stone again since the original mortar has mostly fallen to the floor. I know with stone this will become a maintenance issue as it will always continue to crack. I was hoping then to seal/waterproof the walls. I have looked at the Dry-lok product and they do not recommend the product for stone. I was also hoping to use a clear finish to allow the natural beauty of the wall to show through. I was wondering if there was any product or system you could recommend. Thank you for your help.

Tim McCotter, MI

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The issue is terrific! I just got STONEXUS II today and am poring over the good things to come as I savor the articles and photos. I do want to respond to Pat's challenge of a competition for the best description of a useful masonry technique. A great idea, and I want to nominate Pat himself. The chapter entitled Pointing in STONE BUILDINGS is by far the clearest, most sensible and most useful description of the technique that I know. Whenever I am asked about re-pointing I refer people to Pat's chapters on lime and on re-pointing. Hands down, the winner already. Now all we have to do is come up with another prize. The next time we get in conversation, Tomas, I will have to tangle with you on the materials of the Hakka houses in Funkian. To my knowledge, the majority of them are of earthen material, but I am very interested to know that some are made of stone. Thanks again for the great issue of STONEXUS,

Mac Watson, Santa Fe NM

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Bonjour colleague tailleur de pierre.  
I was a bit impatient to get your magazine, that's right. But I finally got it yesterday, and I am absolutely delighted to read it. And without any doubt and regret I will become one of your member. Our profession need a foundation like your! Stone have been my passion for 12 years now, and a fascinating reason to travel in country like India, Israel, Egypt, Syria, Ukraine, and

mainly Europe. And I found out whatever the country, the politics, the language, the culture, stonemasons always find each other, sharing the same passion and interest!!!

So I said thank you for showing the beauty of this wonderful worldspread material, STONE, And BRAVO. PORTEZ-VOUS BIEN, ET TRAVAILLEZ-BIEN (keep well and keep up the good work).

Vincent LeMacon, France

p.s. Le Macon (pronounced mah-son) means the mason. Really it's my name, but my father and his father was woodworkers, I'm making it true again. I wish I could write a much better english, to be able to share my experience and feeling about stone.

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Tomas, What a great magazine...and great format. Congratulations. And thanks for considering me with my Stonemason's Journal piece. Years ago there was a great spiritual mag called Gnosis (the one called Gnosis today is a mere shadow of its former self). It had in -depth articles, poetry, zen, stories of true transformations. and arcane mystery. Its challenge as always was to keep things fresh and interesting; it did so though often at a financial loss. It was always a little high-brow in an enlightened way, the kind of magazine you discovered your most favorite professor was reading and therefore you had to have it. It was obscure and not everyone could get it but that led to its success. But that was then and publishing and marketplace is most different now. My take is that you want both high standards and broad appeal and I'm sure mass market is what your advertisers want. And to do that you need to compete with the garden mags or Stone World or Slippery Rock Gazette (that has a great penny pincher tool and employment section for the counter top

trade). The problem is when you go down that road you begin to publish stories that are really advertisements, as both Stone World and Slippery Rock do.

Stonework as a trade is, and has always been, sundry and pedestrian. The working class of Britain and Europe found pride in what they could achieve in their guilds, but it was always (with the exception of great sculptors and carvers) bound by class. This was so only until a few years ago; it was really America that began to make crafts from boat building to tin knocking sexy and uncommon. Skilled masons from Europe and China could come here on tourist visas and be paid a years salary in a few months plus be lauded as kings. Technology of course has changed things a lot; the banker mason system (where I learned) was of the shop guild system and the yearly advancement depended on what was done by hand tools. Now you can teach a student to cut a straight line with finished kerf in one day on granite with a diamond saw in what it took months of practice to learn and make perfect by hand. It's not exceptional to hear journeyman masons talk of their work and know that little but the setting was done by hand. This is not boasting, but for the first 6 months of my training I was not allowed to use any electricity at all; today that would be not be considered practicable. What is lost I fear is true knowledge of the material, how it breaks and where it gives. This is an intimacy that stone masons have, or had, with their craft. Mortar making is the same thing. The alchemy of historic mortars is a wondrous craft; the burning of the oyster shells, chalk and limerock; the selection of sands; the making of coarse stuff; the secret additives (marble dust, hair, ox blood, green grass for color, dung); the uses of hydraulic and non hydraulic lime in setting; manufacture of home grown lime paints and waterproofing with natural materials. The fat sticky mortars and putties have a far superior

range for setting than the best bag of 25\$ white Portland. We have to make a living, but you must live your heritage before you claim it as your own. I was once asked if I was a master mason; I quickly responded that a master mason is one who, if they lived long enough could build a cathedral by himself. I'm not there yet, but I have met some who are. Best to you and the magazine

Michael Drummond Davidson, Alabama

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*Michael, thanks for your encouraging letter. I'm glad that you—and so many others—appreciate the content—and character—of STONEXUS. As I had no way initially of knowing what the response would be to such a wide range of "material," I'm gratified to learn that folks have a lively interest in other aspects of stone, stonework and stone art than the ones in which they are involved.*

*STONEXUS is still evolving, finding its identity—and improving, I hope—but I doubt it will ever have much presence in the "mass market". It's an in-house publication and is likely to remain so for some time. At present advertisements are a way for stone suppliers and tool manufacturers to support what they see as a worthy enterprise and one that could have a positive effect on the craft—and the industry. Given the magazine's modest distribution I doubt that they expect much in the way of direct returns.*

*I have been told that STONEXUS is quite "professional." I've also been told it should be more professional. Frankly I will settle for it being a quality semi-professional publication. This is appropriate, I believe, for an in-house publication in which, except for the reprinted material, the articles are not written by professional writers, and many of the interesting photographs sent in are not of professional quality. So be it.*

photos to the editor



J.U.  
cool!



J.B.

Bisbee AZ



S.S.



R.T.

in response to the Balearic survey in the last issue: the exterior and interior views of another, stylistically different, Minorcan barn.



R.T.



one of Patrick McAfee's workshops in Ireland - there's pizza in that oven and beer is on the way

#### Contributors:

Jim Underwood  
 John Shaw-Rimington  
 Sandy Sorlien  
 Robert Tully  
 Todd Campbell  
 Pat McAfee  
 Scott Murase  
 Richard Tufnell  
 Jesse Biesanz





## T & T - tips & techniques

Back in the days when my back troubled me, I had the good fortune to receive some valuable advice, an exercise that, if done regularly, could relieve and prevent back problems. I think it comes from some esoteric bodywork practice which initial research hasn't revealed, but knowing that is not necessary. What is important is that it works.

What this does, as I understand it, is to flex and strengthen the *Psoas* muscle which attaches to the lumbar region of the spine, goes through the pelvis and attaches to the upper part of the femur (that's the large single one in your upper leg. If this muscle is strong and supple you're less likely to "throw your back out" and/or suffer back pain. And it's okay to do this if you're suffering pain, at least I've done so and it seemed to help. Standing up and alternatively raising each leg so that the thigh is against your chest is also said to help strengthen the *Psoas*.

Here's what to do:

Lay on your back on the floor and bend your legs. Feet slightly apart. Knees in the air.

Feel the arch of your spine? Flatten that arch. Let it spring back. Flatten it. Let it spring back. Got that?

Now, as you lay there, imagine your pelvis to be a box. Let's call the four corners of the bottom of this box A, B, C, and D.

A      B

C      D

When your spine is arched, the lower corners, C + D are touching the floor.

When you flatten the arch the upper corners, A + B come down to touch the floor. Got that? Okay, let's rock:

Begin by arching your spine, C D.  
Flatten it, A B; arch it, C D. That's 1.  
Flatten it, A B; arch it, C D. That's 2

Do 25 or more of these.

Next, let's rock and roll.

With your back arched turn your pelvis to the left so it rests on corner D.

Keeping it arched, turn your pelvis to the right so it rests on corner C.

Now, keeping turned to the right, flatten the arch so your pelvis rests on corner A. Keeping the arch flat, turn to the left so your pelvis rests on corner B.

That's 1.

Now again - D, C, A, B, That's 2. Repeat this 25 or more times.

Then, reverse the order, rotate counter clockwise, C, D, A, B. And again, and again. 25 or more times.

T.L.



# Stonework in Residential Architecture

by Richard Sammons

## *Odd isn't it,*

that the wealthiest country in the world builds in the cheapest and most shortsighted way. Nowhere is this manifested more than in our phobia of load-bearing masonry construction.

Since World War II it is hard to find any use of load-bearing masonry, especially in residential work. Here, the standard has been wood frame construction with whatever façade treatment you choose: wood, stucco, brick, or stone veneer.

This method has historical roots that reach back through the centuries. Northern Europe is, for the most, part a *dry-trade* construction culture—meaning timber framing, whereas Southern Europe and the Middle East are primarily *wet-trade* construction cultures—meaning masonry.

An explanation, perhaps over simplified, may be that although brick masonry became popular in England after the fire of London in 1666, Anglo-America inherited both traditions. With our abundance of timber and the bitterness of our winters, wood construction won out.

The logic of the frame permeated the engineering structures of the nineteenth century in the United States as evidenced by bridge trestles and steel frames for building. When concrete became available, we then formed it also into posts and beams (with steel reinforcement) rather than walls, arches and vaults, the natural forms of masonry which generally require no reinforcement.

Our classical architecture, filtered through Roman and Renaissance practices, is largely an art of masonry construction. The illogical act of frame and cladding construction techniques for masonry forms could be argued to have led largely to an abandonment of the classical tradition in favor of modernism. The loss of this masonry tradition is one of the great cultural tragedies ever to befall the human race. Frame construction is expedient, but for longevity and sustainability, traditional masonry construction is clearly superior.

Proponents of load-bearing architecture do exist, England's Quinlan Terry being the most visible. Terry inherited the office of the unrepentant classical architect, Raymond Erith. He continued Erith's work, building seven-story load-bearing brick office buildings and country houses through the dark ages of the 1960s, '70s and '80s.

Other architects such as Julian Bicknell, Robert Adam, Demetri Porphyrios, John Blatteau and Alvin Holm, led a growing revival of classicism from the 1980s forward. Julian Bicknell's Henbury Rotunda is most notable; Demetri Porphyrios is now designing a new Gothic quadrangle in fieldstone for Princeton University.

Our architecture firm joined this movement in 1992. As a young architect, I also couldn't see the logic of building in frame while express-



ing the construction in masonry. The *honesty* issue didn't bother me, as the entire history of architecture is full of one material imitating another, usually to delightful effect. No, the problem I had was one of longevity and robustness of the construction. For example, with brick veneer, all of the thermal stress of the structure is concentrated within the 4 inches of isolated exterior "skin," thus requiring expansion joints, weep holes, internal water proofing, etc. Thick-walled masonry buildings provide a heat sink, which disperses thermal stresses. An exception to this is the "packed" frame. In prewar steel construction, it was typical to pack masonry between the steel framing so that the masonry veneer was backed up by masonry, thereby stiffing the frame.

Another determining issue for my preference was that masonry, once freed by its hidden supporting structures, has a tendency to be used in ways totally irrational to masonry construction. From McMansions to strip malls to the recent Federal Building in Washington D.C., masonry is used in ways that it could never hold itself up.

Therefore, not wanting to fall into these practices, it was my job as an architect to convince the client to spend the extra money to build in a more permanent way.

The first job where we succeeded at this was a house on a hill in Washington, Connecticut called Litchfield, a diminutive Georgian baroque villa. The plan is based on a plan of the eighteenth century architect Robert Morris from his book *Rural Architecture*. However, the character was inspired by the Scots architect William Adam, the father of the more famous sons. The construction is a bonded 12" brick and block wall with independent wood framing on the interior. Having won the argument for load-bearing masonry, we lost the argument for cut stone. The detailing here is an acid-washed cast stone, and the castings are full depth and solid. The skewbacks at the pediment corners are well over 500 pounds each but mostly the stones are in the "two man" weight. Texas Carved Stone Company made a fountain for the courtyard from



*"Okay, everybody look busy. But don't move, we're going to take a photograph now."*

Tomas,

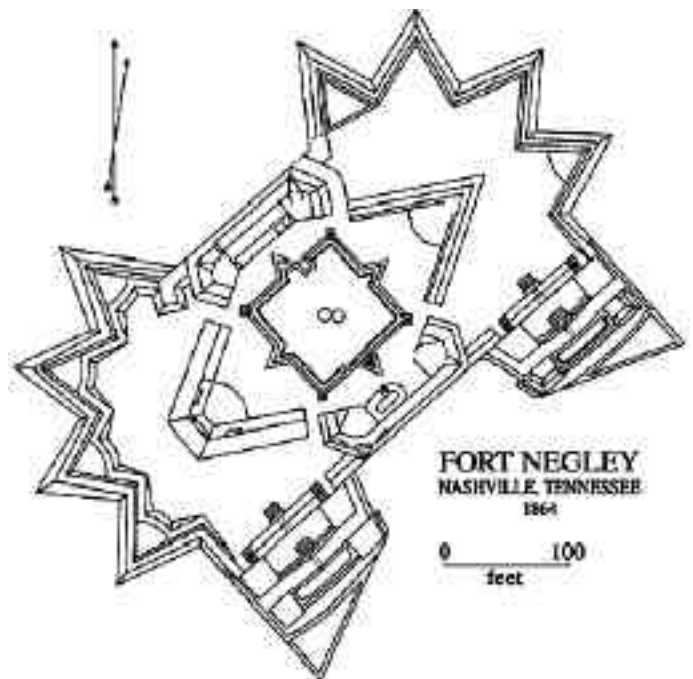
The picture is of Fort Negley here in Nashville, as it was being restored by the WPA in the 30's (then closed in the mid 40's and left to decay).

It is from the Civil War period and was the only inland stone fort built for that conflict. Many coastal stone forts, but they were all built earlier and reused. Nashville was part of the confederacy and was eventually taken and occupied by Union troops who soon after, constructed the fort.

It is very unique design and shows a strong connection to European fortifications. The designer/builder was a Capt. Morton who studied the topic at West Point under professors well trained in the works of 17th century "genius" French engineer Sebastien le Prestre de Vauban.

The city is working to reopen the site and allow it to be interpreted as a ruin. There have been attempts to restore the stonework in the recent past, but they did not work out so well. Still a lot of standing stone left to give people the idea.

Fred Zahn  
Metro Historic Zoning Commission  
Nashville, TN 37204



footnote:

The fort was built in 1862. Construction required three months for 13,000 Union soldiers and "many" blacks to complete. The fort is 600 feet long, 300 feet wide, and covers four acres. It used 62,500 cubic feet of stone and 18,000 cubic feet of earth and cost 130,000 Yankee dollars.

Diagram & footnote courtesy of the  
Battle of Nashville Preservation Society

# TEKTONIKA

## photo gallery

currently showing: STONE IN OUR WORLD  
an exhibit of photographs of the stonework  
of Lower Silesia

visit the TEKTONIKA gallery page at [www.stonefoundation.org](http://www.stonefoundation.org)  
to see these photographs in color

### *In the heart of Europe,*

tucked in the southwest corner of Poland, is the historical region of Lower Silesia. It shares a 270-mile border with the Czech Republic and a 50-mile border with Germany. This region, the heart of Europe, is vastly diverse in terms of natural resources, in particular stone. Granite, basalt, syenite, serpentine, quartz, marble and alabaster, along with a wide variety of sandstones, are the mainstay of the region's stone industry. Other significant deposits of gold, silver, uranium and lignite have all been quarried here throughout the centuries. The discovery of copper in the region as recently as the 1950s placed Poland center stage among other major world producers of this raw material.

All This natural wealth has meant that throughout the ages Lower Silesia has been a coveted prize for rulers near and far. Over the last thousand years the region has changed hands (and national identities) several times; it has been ruled from Cracow, Prague, Vienna, Berlin, and, presently, Warsaw.

Large sculpted granite figures found on the slopes of Sleza, a solitary, somewhat mysterious mountain rising from a stretch of fertile plain in the middle of the province, date back to at least 4,500 BC and best attest to the long, special relationship local inhabitants have had with stone. In the Middle Ages, as a common form of punishment, convicted murderers carved large crosses from granite at the site of their crimes; they also were required to sculpt their murder weapons on the crosses. In the 18th century, the Prussian monarch Frederick II set his eyes on Lower Silesia. He was particularly interested in gaining control over the natural resources, especially the extremely rare greenish semi-precious stone, chrysoprase, which he later used to decorate the halls of his favorite palace at Sans Souci in Potsdam, near Berlin. (The world's first commercial mining of chrysoprase occurred in Lower Silesia following its discovery in 1740 near the town of Frankenstein.

Throughout this region, stone has been a favorite building material used to construct everything from simple farmhouses to ornate cathedrals. As one travels through Lower Silesia, it is easy to discern what stone is available where by studying the buildings, churches and cemeteries found in any given area. The diversity in styles and quality of the stonework makes the region an open-air handbook on the art of stonemasonry.

Stone also recounts the region's brutal history. During a long

*By Juliet Golden and Tadeusz Włodarczak*



siege in the final months of World War II, Lower Silesia's capital—known then as Breslau and today as Wrocław—was largely destroyed; even today, many of the remaining buildings bear stark battle scars. As a part of the re-shuffling of borders that happened after the war, two hundred years of Prussian and German domination of the area came to an end. As a result, in one of the largest population transfers in history, approximately three million Germans were resettled from Lower Silesia to make way for Poles leaving their homes in towns and villages, located further east in today's Ukraine.

But even though the Germans were gone, their material culture remained. In the aftermath of post-war settlements, Poles set out to make this land theirs. German inscriptions were scratched from buildings, museums and market halls were blown up, and cemeteries were razed to the ground. Of the more than 70 pre-war cemeteries in the city of Wrocław, only two remain today. The gravestones were used for anything from paving streets to building animal runs at the local zoo—some were simply buried in mounds at the edges of the city. In the countryside, many of the more than 160 castles and palaces of the region were converted into multi-family dwellings to house workers of collective farms. Other historic monuments were left to the elements; many have decayed beyond repair.

With the fall of communism, attention is being focused on preserving the region's heritage. Many noble refuges has been restored and converted into swank hotels and rural retreats. There has also been a revival in interest in stonework. Mom-and-pop stone workshops have mushroomed in cities and towns across the region. Lower Silesian quarries churn out stone to cover the facades of new buildings and to build the streets in Warsaw and Berlin. The advent of the free market in this region has also rekindled the allure of carved stone. But this modest renaissance is a far cry from the grand traditions of Lower Silesian stonemasonry that flourished in the second half of the 19th century. Even today the Polish carvers

who rebuilt Wroclaw and Warsaw, and reconstructed many historic buildings across Europe in the post-World War II era, are dying off, making the Lower Silesian carver an increasingly endangered species. □

*Tadeusz Włodarczak and his companion, writer/photographer Juliet Golden, live near Wroclaw in Lower Silesia. "Tadek", an accomplished stonemason/carver is the instructor of the Stone Carving Workshop in Charleston in November, and together they will make a presentation at the Symposium about the stonework of Poland and the Czech Republic*

Large prehistoric granite figures dot the slopes of Sleza, a solitary, somewhat mysterious mountain rising from a stretch of fertile plain in the middle of the province. These sculptures may date back to the Iron Age but there is no certainty about this, or about their significance.

In the Middle Ages, as a common form of punishment, convicted murderers were forced to carve large crosses from granite at the site of their crimes





*The Grodziec castle is perched on a hilltop.  
Here is the outer gate with the guard tower.*

*View of the inner gate leading to the courtyard.  
Note the carved Green Man to the right of the arched entryway.*



*Hand carved sandstone is used here to create a structural arch.*



*The tunnel-like outer gallery commands a view of the valley below.*

*The galleries were equipped with "air toilets." They were convenient, and fairly hygienic, given the lack of what we would call modern plumbing. But they offered little privacy.*







*In the Renaissance, castles were not so important as defensive structures. Here in the entryway to the Grodno castle stone plays only a decorative role,*

*In the interior even the structural elements are highly ornamented.*



*A romaneseque lion on deposit in the castle's lapidarium*







*This water tower, constructed following devastating flooding in 1903, is a good example of how brick work can be effectively combined with stone. While carved stone is used sparingly here, imagine how different this building would look without it.*





*This former official administrative building dates back to the second half of the 19th century and represents the height of achievements of Lower Silesian stone carvers. The W stands for Wratislavia, the Latin name for the city today called Wroclaw; the large Eagle in the center represents Silesia; above that, the next eagle represents Prussia.*

*Exquisite stonework is evident on this pilaster situated at the entryway of an early 20th century building located in the old Jewish Quarter.*



*This naturalistic lion's head is peering through a curtain of renaissance ornamentation.*

*Façade of the Kreszow Abbey. Built by the Cistercians, this is one of the best examples of Baroque art in Europe and remarkably different from the austerity of earlier Cistercian buildings. The abbey is slated to be added this year to UNESCO'S World Heritage List.*

*The author of this façade was a Czech sculptor Ferdinand Maxmilian Brokof, whose credits include some of the statuary Prague's Charles Bridge.*

*The façade reflects the deep religious discussions underway in 18th century Europe. The "saints" shown here are not depicted in the usual states of religious ecstasy.*

*Here Moses is shown negotiating with Jehovah.*



*Saint Ludgarda appears to be caught up in earthly contemplations.*



*A local swimming complex dating back to the early twentieth century was richly decorated with statuary and fountains. Unfortunately many of the most spectacular works disappeared in the immediate post-war years.*

*The photo at the right shows a fragment of the building's vaulted entryway. These fish were carved from Lower Silesian sandstone. The gold coloring and wavy sedimentation provides very warm, expressive material for carvers and masons.*

*These mascarons could be right out of Star Wars. They gaze down on passersby from the façade of an indoor swimming complex that dates back to 1895-1897. Very little of the richly decorated interior décor has survived to today. Lavish statuary and other ornamentation disappeared sometime after the end of the war.*





## THE OLD WALLER

I see him now, the rangy, dry-stone waller,  
his long, lean frame and shabby greening hat;  
his twinkling eyes; the way he'd greet a caller  
with friendly nod, content to work and chat.

His long, sinewy fingers, scored and calloused,  
selected stones with judgment long matured  
and placed them firmly, neatly - and unharassed -  
where the perfect stability ensured.

The wall and he seemed almost kin together,  
dun-coloured, earthy, with a touch of green,  
elemental and piquant as the weather  
that sweeps the rugged, Lower Pennines scene.

I shall not forget the rangy, dry-stone waller,  
his long, lean frame and shabby greening hat:  
where is he now, and what celestial caller  
hails him today and pauses for a chat?

Gordon Allen North

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### To Harden the Earth

To harden the earth  
is a stone's occupation -  
till stone became  
winged  
and flew.  
Those that survived  
climbed the lightning,  
cried out in the dark:  
a watery token,  
the violet light on a blade,  
a meteor.

Our succulent sky  
holds more than the clouds  
and the void, with its odour of oxygen -  
it holds a terrestrial stone,  
it flashes out here and there  
with its look of a dove  
or a bell,  
takes on magnitude,  
the cutting edge of the wind:  
an arrow in the phosphorous, a facet  
of salt on the sky.

### Silence Packs itself

Silence packs itself  
into stone:  
the great circles close  
and a whole tremulous world  
with its wars, birds, houses,  
trains, forests, cities,  
the wave that repeats the enigmas of ocean  
the consecutive journey of dawn -  
all come to stone, the nut of the firmament,  
to offer their witness.

The stone in the dust of the road  
knows the old generations of Pedro,  
the water that broke at his birth  
the mute word of earth:  
it inherits primordial silence,  
the sea's immobility,  
the void of creation, and has nothing to say.

Before man was, or dawn, before  
wind was, stone was:  
the first movement of stone  
and the music of rivers were one.

# announcements

## INTERNATIONAL STONE CARVING WORKSHOPS

THEGLOBAL STONE WORKSHOP hosts stone-carving workshops throughout the year in Croatia, Italy, Portugal and Sweden. For information: <http://www.globalstoneworkshop.com>

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October 15-16, October 29-30, and November 6-7  
**DRY STONE MASONRY TRAINING OPPORTUNITIES**  
DRY STONE CONSERVANCY, CENTRAL KENTUCKY

The Dry Stone Conservancy announces its Autumn 2004 schedule of dry stone masonry workshops. Join the Conservancy's staff of professional dry stone masons for a two-day introductory workshops on the fundamental techniques involved in dry stone masonry construction. Advanced training opportunities are also available for experienced dry stone masons and include instruction on various special features. A limited number of apprenticeships are offered at various times throughout the year to stone masons who have successfully completed the workshops and are interested in professional certification. All currently scheduled workshops are hands-on and located in central Kentucky.

October 31  
**DRY STONE WALLERS CERTIFICATION DAY**

For more information, please contact:  
Dry Stone Conservancy, Inc.  
1065 Dove Run Road, Suite 6  
Lexington, KY 40502  
<http://www.DrystoneUSA.org>  
Email: [DrystoneKY@aol.com](mailto:DrystoneKY@aol.com)  
Phone: 859-266-4807

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OCTOBER, 21-24  
**2004 INTERNATIONAL PRESERVATION TRADES WORKSHOP**  
MOBILE, AL

OCTOBER, 22-23  
**2004 ALABAMA PRESERVATION CONFERENCE**  
MOBILE, AL

Building Craftsmanship: Educating a New Generation  
For information about these events visit [www.iptw.org](http://www.iptw.org) or contact:  
Preservation Trades Network, Inc.  
PO Box 10236  
Rockville, MD 20849-0236  
Phone: 866-853-9335  
Fax: 866-853-9336  
For information about scholarships for students, teachers and apprentices involved in the building arts contact the Mobile Historic development Commission at: 251-208-7281.

OCTOBER, 28-31  
**TIMBER FRAMERS GUILD 20th ANNUAL EASTERN CONFERENCE**  
SEVEN SPRINGS RESORT, CHAMPION, PA

Highlighting the program will be the first International Timber Frame Workshop. Timber framers from Germany, France and Japan will design, plan and execute a small timber framing project. For information check out the website: [www.tfguild.org](http://www.tfguild.org)

For information email: [will@tfl.org](mailto:will@tfl.org)  
**Stonemasons, tell your wood-working friends about these events.**

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November 13-15  
**STONework SYMPOSIUM 2004,**  
CHARLESTON, SC,  
Presented by THE STONE FOUNDATION, in association with the  
AMERICAN COLLEGE OF THE BUILDING ARTS

This the fourth annual gathering of the stone "tribe" organized by the Stone Foundation will feature interesting and informative presentations by professional stonemasons (including Ian Cramb, author of "The Art of the Stonemason" and Patrick McAfee, author of "Irish Stone Walls" and "Stone Building"), stone artists, architects, historians, and folklorists.

Demonstrations, lively discourse, camaraderie, and a stone-building "event" are all to be expected.

As in previous symposiums, Stonework in Architecture is a subject to be explored. The Stone Foundation is an AIA Approved Provider of Continuing Education Credits (AIA/CES # Z206)

On Monday morning, November 15th there will be a general meeting of Stone Foundation members when the future form and function of the Stone Foundation will be discussed and to some degree determined. All members are invited to attend.

November 8-12  
**STONEMASONRY WORKSHOP**

Fundamentals and Fine Points of the Craft. An intensive hands-on course taught by a team of five professional stonemasons with more than 150 combined years of experience.

November 8-12  
**STONE CARVING WORKSHOP** Traditional Figurative Architectural Stone Carving (the Green Man, faces and foliage) taught by a traditionally trained Polish stone carver.

The WORKSHOPS will run concurrently from November 8th to the 12th with a break for the Symposium. For information about these events or about the Stone Foundation visit [www.stonefoundation.org](http://www.stonefoundation.org), email: [tomas@stonefoundation.org](mailto:tomas@stonefoundation.org), phone: 505-989-4644, or write: The Stone Foundation, 116 Lovato Lane, Santa Fe, NM 87505.

For information about the American College of the Building Arts, visit [www.soba.us](http://www.soba.us), e-mail: [warren@soba.us](mailto:warren@soba.us), phone: 843-577-5245, or write: The American College of the Building Arts, 21 Magazine Street, Charleston, SC 29401



# REBUILDING THE CLOISTERS OF IONA ABBEY

by Ian Cramb

## The holiest place in Scotland

*is a small island off the western coast called Iona. For centuries it has been the burial place of kings, Scottish, Norwegian, Irish and French, as well as chiefs of the clans and princes of the church. In 563 Saint Columba and a small community of monks established a monastery there. In the 8th and 9th centuries it was raided, plundered and destroyed by the Vikings several times. It was abandoned then, but after 350 years a monastic community returned to redeem and rebuild it. It was rebuilt again in the 13th century, only to be dismantled by the Reformers in the 16th century.*

*Early in the 20th century the Abbey church was restored by the Church of Scotland through public subscription. Restoration of the remaining Abbey buildings has been going on since 1938. In 1959 young Ian Cramb was commissioned to rebuild the 13th century cloisters.*

The coursed random rubble on the Abbey and its adjoining buildings differed in style from anything I had undertaken before. It was a hard red granite with a black slate infill; the white sand used for the mortar was from the seashore. All the corner stones for windows, doors arches, etc. were of dressed sandstone.

The Cloisters were to consist of 57 Depressed Gothic arches (a depressed arch means that the span is greater than the rise) made up in four arcades, and the layout had to follow the original foundation lines, indicated by the remaining stones that showing above ground.

A number of years back they had reconstructed two of the original arches from bits and pieces they had gathered together, and these two arches gave an idea what the original cloisters

## ...nothing is at right angles...

looked like.

I spent a few days going over the drawings and the whole area alone. On the layout drawing I checked the sizes, angles and levels against the existing structure. In old church buildings such as



Ian Cramb, Iona, 1960

this one nothing is at right angles and dimensions are inconsistent. For one thing, the span of the arches in each of the arcades was different than that in the others.

Then I worked out the procedure to be used to put it all together and a picture formed in my mind of what the finished Cloisters should look like. This is, I find, the real secret of building with stone, being able to picture the finished job. This mental picture, along with reading the drawings, gives me a general idea on how to go to put it all together.

It all sounds so easy, from the mental picture to the setting of the last stone. There would certainly be problems to face, but I knew I'd never get stuck if I tackled it with a glad heart. The power of prayer was to be my greatest help. All I had to do, I found, was to go into the little chapel and say, "Please God, I do need your help", and he would give me something to guide me along.

The area that was to be enclosed was being paved by three of my mates in heavy Caithness stone slabs, all to the lines I had set out. It's amazing what you can do with a piece of string. My levels were all done with a board ten foot long, using a small spirit level on top. The secret of the small level is to reverse its position each time you use it. All my plumbings and squarings were made using the old-fashioned yellow pine five foot plumb rule, no fancy modern leveling instruments or setting-out gadgets on this site.

After the stone slabs were all set the area looked good and I proceeded to excavate down to the original foundations to see what condition they were in. All seemed solid; they had had at least 700 years to consolidate. Once I had tested in a few areas the other men started to clear out the foundation track.

During the excavation one of the men came running to tell me they had discovered a large flat stone that had a hollow ring to it when it was struck with the pick. The men, being from the surrounding area, were very superstitious and stood back to let me get

in to see what all the fuss was about.

I cleared the top surface and removed one part of the large cut slab and came across a skeleton. It had been placed in a stone coffin. There were two coffins. The skeletons' bones were white, so they were said to be Saints. The stone coffins had been used as part of the foundation for the original cloisters. They must have been Saints to be able to carry the load of stonework that was resting on top of them.

You are supposed to get the experts in to study them with all the time-wasting procedures they have. My principle is, What God has put together let no man pull asunder. Therefore I left them in peace, surrounding their old bones with a rich lime concrete mix and replaced the old stone slabs on top. What better foundation could one get?

On top of the existing foundations I started to build the walls that would form the foundations for the four arcades. Fifteen inches higher than the slabbed area, they would be the base on which

## ...the "founding pint"...

the large stone sills would be set.

Before starting the Cloisters, I had one traditional stonemasons' ceremony to perform, the "founding pint". You put the names of all involved in the building, also a newspaper and some other details of our way of life at that date into an empty whisky bottle, after we had consumed the contents.

It was all blessed by Lord MacLeod and placed within the foundations. I knew then everything was going to be alright. A little party was given in the evening to celebrate this historic occasion. This was to be the last time I would celebrate this old custom.

I decided at this point I would bring up my dad and mum for a visit, also to see if he would be willing to give me a hand, as two heads are better than one. With his building experience, he might decide to spend some of his time with a trowel in his hand.

I arranged for them to stay in one of the island's hotels, as it would give my mother a good rest. When they arrived it was one of the most glorious Mays I ever remember. Iona was looking its best. I got them settled in, then went back to the Abbey, as I had been left to look after the building along with the cook and some visitors. The rest of the team had gone off to the Moderator's Ball in Edinburgh because my boss, Lord MacLeod had been appointed Moderator of the Church of Scotland.

Monday morning arrived and my father appeared as promised. I was all set up for his visit, with stone laid out. He talked about my doing the cloisters and praised my efforts, but informed me that the cloisters were my own challenge in life, and that he couldn't help, as he hadn't done many arches in his building career. He only introduced me to the bad habit of smoking by sticking a cigarette in my mouth with a few words of wisdom, "smoke it and allow yourself time to think on what you're doing" then walked off into the chapter house and fell asleep.

He did wake up in time to walk down to the jetty for the arrival of the steamer, where he would spend an hour in the bar of the ship, filling up with as much as his stomach would hold. He was like a camel, storing enough water to carry it through for

twenty four hours. Before the steamer left he would fill his pockets with bottles of beer and a half bottle of whisky and return. This would keep him going until the steamer arrived the next day. I remember one day while everyone was sitting in the hotel dining room waiting for father to appear and he was spotted standing on the deck of the steamer waving to everyone as it passed by on its way to the island of Staffa. Mother was not very happy with him, or the state that he was in when he arrived back,. He never ever got drunk, only happy with a little lilt in his footwork. His good jacket seemed to have stretched in length owing to the amount of liquid refreshment in bottles sticking out of his pockets. As long as he was happy and enjoying his break that was all that mattered.

Then the day came for them to leave. We went down to catch the early morning ferry. It was a glorious morning and the sea was very calm, thank goodness for my mother's sake. She was like me, the slightest wave and it upset her. My mother told me how lucky I was to be working on such a beautiful island and she was very proud of what I was doing. My father was never one to give much praise, but told me I was a great craftsman. Coming from him that was a great honor.

The next part of the cloisters to be done was the setting of the heavy stone sills. These sills could be termed the main load carriers of the arches and everything depends the accuracy with which they are set and leveled. The main point in setting any sill is to spread your mortar allowing only the six inches in from each end of the sill to be resting on the mortar. This is termed hollow bedding and allows for any settlement that will occur. If a sill is solid bedded, then when the weight it bears settles, as it will do, it could split the sill. This (hollow bedding) is the traditional and only method to use.

Next, your sill joints, and again these had to be accurate and filled solid with your lime-based mortar. I used twisted strips of paper, pushed in from the face of the stone about a quarter of an inch. This prevents any leakage when you pour in the liquid grout. After about ten minutes you can remove the paper.

Having now set the sills in the first arcade I decided I would just carry on with this arcade, which would give the carpenters a chance to do the roof while I was working on the second arcade.

I decided to do two arches as a sample just to get the feel, also to see if it all balanced out. After getting it set up I found that the arch stones looked top-heavy for the slim columns. You have to satisfy the eye for balance.

I cut down the height of each arch stone; this also reduced the weight a little, a good thing because all the arch stones had to be lifted into position by myself. It helped my overworked back muscles a little.

I started to rebuild the sample arch and found that I was the thickness of a piece of paper out from my string line and this threw the keystone on the arch out by half of an inch on twist. There was no margin for error; it had to be perfect the first time. And in each arcade the spans of the arches were different; it all had to be worked out carefully so as not to get the different arch stone sizes muddled up.

The sample arch was now complete to my satisfaction. I next started to set the stools, or base stones, for the columns to rest on. Before setting the stools I cut a hole in the top of the sill and fitted in a piece of gravel, then cut a corresponding hole in the bottom

# MASONRY VARIATIONS:

## THE STONE CURTAIN

by Matthew Redabaugh

### **Industrial stone technology,**

the thinner and thinner material it produces, new methods of application and the modern designs deriving from these have transformed our illustrious craft of stonemasonry in many respects. As a member of the Stone Foundation, I fully understand, appreciate and share this group's love for traditional structural stonework. Even so, I want to share with you my recent involvement in an interesting and technologically challenging project in which our revered stone was turned on its ear, pushed out of its usual context and taken to a place where, until now, it had never been and given a whole new function.

Last year I had the opportunity to participate in what proved to be a once in a lifetime experience, a unique event called *MASONRY VARIATIONS*. Sponsored by the International Union of Bricklayers and Allied Craftworkers and the International Masonry Institute in conjunction with the National Building Museum, this was a remarkable exhibit/demonstration of masonry design and craft skills, a challenge to traditional materials and the ways we traditionally use them. *MASONRY VARIATIONS* could be considered a logical progression or extension of IMI's Masonry Camp, a program wherein architectural students and apprentice masons are given the opportunity to work hand in glove, exchanging the designer and builder roles.

Four architects were paired up with four masons and given the goal of creating structural/sculptural pieces in four masonry materials—stone, brick, terrazzo and aerated autoclaved concrete—that would be installed and exhibited at the National Building Museum. I was partnered with Jeanne Gang, AIA, of Studio Gang from Chicago, to work with our assigned material, stone. The task, as presented by the exhibit curator, Stanley Tigerman, AIA, was to take the assigned masonry material and push it into the next millennium. The parameters of the challenge were quite loose: Design and construct a hut-like structure (with an inside and an outside); give your masonry material a futuristic application; push the envelope. The project took nearly one year.

Jeanne Gang's design took stone, a material that performs best when subjected to compressive loads, and put it in tension, linking piece to piece in a series of chains to create a shell-like form, her *Stone Curtain*. The entire construct, comprised of 620 individual pieces, is 18' tall and weighs 2000 pounds. It hangs in tension from the brick dome of the ceiling, stone from stone, without any sort of support or frame!



She chose to use thin material, nominally 3/8", not only for the weight factor but because she wanted to exploit/explore its translucency and use that to enhance her design. By our second meeting, she had the dream-inspired design concept of a "stone curtain". The basic mechanics would be modeled on a jigsaw puzzle, with individual interlocking elements (key and key-hole) in this particular case hanging stone to stone from the ceiling with no frame or back-up walling system.

It was imperative to conduct a battery of tests to determine if we could in fact hang stone in tension. Initially the professor of Materials Testing at the Illinois Institute of Technology was certain that we were wasting our time. According to him, stone in tension "would fail at a force of 100 pounds". When push came to shove, or in this case to "pull", we proved him wrong—when we pulled the stone, it failed but at 700 pounds of force! That exceeded everyone's expectations and satisfied Thorton-Tomasetti Engineers, Inc., the engineers for the four individual projects of the exhibit. When word got out that we were "pulling stone apart," students and faculty alike stopped by for a peek. No tests existed to determine stone's strength in tension; there had been until now no need for such tests.

As a fail-safe in case of individual stone fracture, however, we were directed by the engineers to reinforce the backs of the pieces with epoxy resin and fiberglass. One of the many things the architect had brought to my attention is that historically humans have always, until fairly recent times, built with composite materials such as adobe or plaster adding horse hair and other substances. As, more and more, we incorporate such modern materials as epoxy/fiberglass and carbon-fibers, we could be said to be returning to this mindset.

To achieve translucency, the architect wanted to use onyx but that was too expensive and too unstable. Ultimately, a marble called *Bianco Limone* from Turkey was chosen, a tightly constituted, fine crystalline calcium carbonate that gave out a resounding ring when struck with the knuckle. Gang appreciated this age-old technique, which she called "thumping," for sounding the stone to determine its quality.

For a time it seemed that desired level of translucency would not be attainable because of the epoxy/fiberglass reinforcement. To solve this dilemma, I deduced that if we were to hone the backs of the pieces, the degree of translucency would increase. The resulting level of consistency would, in effect, reduce the surface area, therefore allowing more light to penetrate the stone, rather than being refracted by an erratic and coarse-sawn surface. A simple test using a light meter and a halogen lamp proved this point. Before and after honing readings proved that we could achieve 30% more light penetration, and translucency was now back in the mix.

But what effect would the resin and fiber-glass backing have on this hard earned translucency? We applied a very transparent epoxy and finely chopped fiberglass to the honed surfaces and were relieved to find that the translucency was still considerably greater than that of the original stone before treatment.

The clock was ticking. We were introduced to the project in late November 2002, with a scheduled opening date of October 16, 2003. There were less than 11 months to carry out all of the testing, evaluations and changes, the drawing of each piece for cutting, the material fabrication, building a centering and removing it after hanging the stone. With so many uncertainties and so very little time for all that needed to be done, this design challenge had high potential for failure.

In the Middle Ages, a form of applied geometry called *Stereotomy* evolved that was specific to the cutting and shaping of building stones. Fortunately we had access to the modern day version of this process, *Computer Aided Designs* or CAD. With the use of this computer technique, the architects were able to translate information from their drawings to fabrication tasks such as cutting the intricate pieces and helping to configure the wooden shell. Bear in mind that although the computer speeds up the process, the knowledge and skills comparable to those of the ancient cathedral builders are still demanded.

Given the time constraints, the complexity of the process and all that was required to fabricate each element of the stone curtain, I wanted to have a certain level of indigenouness. That is to say, I needed all the principal players to be close to the National Building Museum, the installation site. The stone was secured from a distributor 20 miles east of Washington (ARC Stone, who donated nearly half of the material), the fiberglass and resin came from Fox Industries, 56 miles to the northeast and the water-jet cutter, LAI

Laser Applications, Inc. was not far from Baltimore. Given the potential for breakage and/or miss-cut stones among 600 individual pieces, we needed to be able to get our hands on replacements immediately. There were no extras made because each piece was unique unto itself and could not replace nor be replaced by another.

The *Stone Curtain*, being a shell or arch-like structural form, would necessitate the use of a temporary wooden frame similar to the centering used in arch or dome construction. This centering would have to adhere to the dictates of a grid with level and plumb, yet still reflect the exact complex curving configuration of the stone form.

#### MODUS OPERANDI:

##### **Selection for Quality:**

The stone tiles from Turkey were 16" x 16" x 3/8". Each one was "thump" tested, sounded to determine if there were any hidden cracks. Those that failed to resound with a definite ring were discarded. (With over 600 pieces, we used a metal chisel, not the knuckle.)

##### **Sorting/Shuffling:**

The stones were held up within inches before a strong halogen lamp to determine translucency level and color. Those stones that were 80% translucent (some pieces had inclusions which were very opaque—these were discarded if more than 20%) were sorted by color. We had 5 distinct colors occurring: blue, blue-green, white, yellowish and beige. These color separations were then "randomly" shuffled to avoid the potential for any single color based splotches or areas to occur within the fabric of our curtain.

##### **Honing:**

The stones were placed face down on area covered with wet sheets of gypsum boards (this gave a surface with suction to hold the pieces fast to the ground). Then, using a Clark floor re-finisher with open screen abrasive pads, the backs of the stones were ground to a honed finish.

##### **Lamination:**

The honed stones were then delivered to Fox Industries for fiberglass lamination. By adapting their techniques to our needs[,] we were able to accomplish this in 30% less time than would normally be required. This helped keep us on schedule.

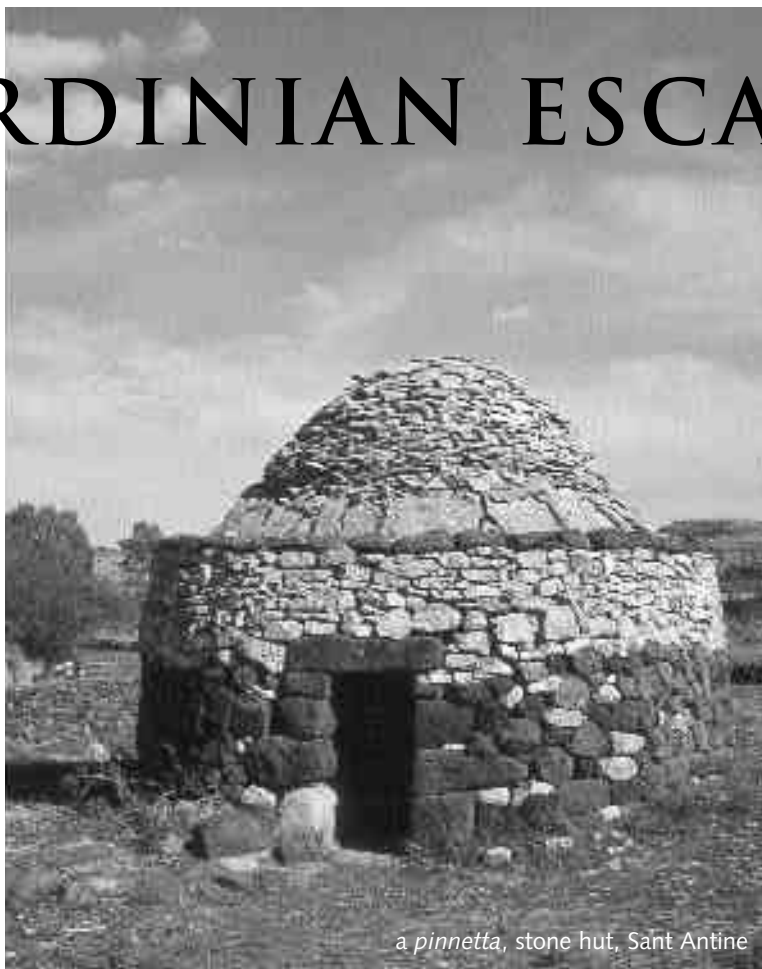
##### **Centering:**

Construction of the centering began off site. Drawings for the centering were developed by Yu Ting Chen in Chicago and emailed to a print shop in DC where I would pick them up. These drawings were unique in that they were printed full scale on 3' x 10' sheets of paper. These were adhered to 3/4" and 1" plywood and the forms cut and assembled. At some point, I discovered that the drawings were off by over 2"! Frantic to locate the error, I called Yu Ting and then the printer before finally realizing that the culprit was—the weather. It was August in Washington, and the extreme heat and humidity were causing the paper to expand as much as 3/4" in 3'! Subsequently all drawings were rolled and covered with plastic.)

##### **Water-jet Cutting:**

The laminated stones were delivered to LAI to be cut with water-jet. This is a company that primarily does government contracts for aerospace, but I was able to convince them to participate.

# SARDINIAN ESCAPE



a *pinnetta*, stone hut, Sant Antine

## *Sardinia, stoney isle,*

so many times I had planned to go there, and so many times been thwarted by events, people, and things seeming to conspire to keep me from going. Finally, however, there I was, strapped into the seat of a plane, airbourne and actually en route to Alghero, its capital.

My primary objective in travelling to this island was to see what it had that might contribute to the research of the corbelled stone huts in quest of which I've travelled all over Europe. The use of these humble structures was widespread throughout Europe, particularly in the Mediterranean basin. The most basic of shelters, they were assembled mainly by pastoral peoples for use when their flocks were taken to pasture and forage away from the villages. Built without mortar, using whatever stone there was at hand, these simple stone huts were known variously as the *both* in Scotland, *clochain* in Ireland, *cabanne* and *borie* in France, *barracca* in Spain, *trulli* in Italy, *penetta* in Sardinia, *gima* in Malta, *kuzan* in

Croatia, *kuja* in Slovenia and *kummoi* in Greece. Some have been built by men still living, many have stood for centuries; one *both* in Scotland that I am at present studying was lived in until quite recently, yet may date originally back to the Neolithic period!

Some express the simplest spatial arrangement, like an inverted bird's nest, whilst others are quite complex; yet even the most basic of these structures demonstrates a sensitivity to the nature of the material and an innate respect for the law of gravity. One wonders if these forms evolved by cultural borrowing (they were commonly used for monastic shelters, particularly in the Celtic Church which had a very close connection with the Mediterranean and the Coptic Church) or, more simply, were they indigenous developments arising here and there in response to local needs using the material available with native ingenuity? Well, we would see what Sardinia had to offer.

Also there are the Nuraghi. These massive stone towers came into being some

three and a half thousand years ago in the Bronze Age. Simple singular towers at the outset, they were to evolve into complex royal palaces surrounded by settlements. "Truly spectacular," raved an archaeologist friend of mine. The agents of this development were the Bronze Age people who invaded Sardinia, conquered Corsica and then the Balearics, taking the tower culture with them.

The trip in a rental car from the airport to the rented villa that awaited us in the north of the island was made interesting by the intricacies of the instructions provided to us by somebody who obviously had great difficulty in telling the difference between left and right. And where were all these Nuraghi that were supposed to abound in the areas that we traversed? There was nothing to be seen of them until, just as we were passing the town of Castlesardo, an hour and a half from Alghero, one appeared in splendid isolation on the brow of a small hill as if posing for its portrait. It seemed a not-so-distant cousin of the Talayotic towers of Menorca, which of course the Nuraghi culture shares with Menorca. Nor was it all that different proportionately from the *brochs*, the stone towers of our Scottish homeland.

Carrying on, we reached Costa Paradiso and our destination, a villa nestling amongst a dramatic backdrop of spectacular granite rocks. Our pleasure in the setting was tempered somewhat by the fact that we were in a quite isolated area and just about everything was closed in the off-season. Still, we weren't here for a holiday—there were corbelled stone huts waiting to be seen and studied, and my wife, a first-rate cook, could make do with a scarcity of supplies.

Preparatory research indicated that a





good area to explore was in the nearby northeast of the island. *Li Muri*, the oldest megalithic site in Sardinia is located there, so this seemed a good place to begin our exploration. We found a substantial information centre staffed by not one, not two, but three very bored female attendants who were more interested in their appearance than in providing information! The site was underwhelming; ruins they were, but hardly

Megalithic. We could understand why mainstream archaeologists do not rate them as highly as the Sardinian Tourist Board does—evidently they contribute more to the economy than to archaeology. Nor did the neighbouring Megalithic sites live up to expectations, which left both of us feeling rather deflated. Several of the Nuraghi sites we sought thereafter were, despite sign posts in plenty, impossible to find and the

ones we did find turned out to be closed.

To break out of this cycle of disappointment, we fled the beaten track and meandered cross country and up into the hills to *Nuraghi Maiori* near the town of Tempio. Here we got our first taste of the cyclopean magnificence of the Nuraghi, a single tower surrounded by trees, but well worth the effort to get to. The awesome immensity of the stones corbelled over the passageways impressed one with the construction skills of those ancient builders.

So, stimulated and refreshed, off we went on to Nuoro, the most mountainous area of Sardinia. Two days later, in the town of Dargalli, situated in a really spectacular setting in the mountains, I spotted my first huts, the 'Cuilles' variety, not corbelled with stone but roofed in a very artistic manner with timber.

In Dargalli, we had a authentic Sardinian experience. Until quite recently, Dargalli and the Nuoro region suffered from serious banditry. Kidnapping tourists for ransom was a quaint local custom. But not to worry, we were assured, all that was at an end. According to the notice board, the museum was closed for lunch and would reopen at three and so, with two hours to kill, we wandered around the deserted town until about two thirty when it started to come to life again—everything, that is, but the museum! There was a stream of officials coming and going to and from the municipal building next door and, with everyone staring at us, we began to feel like aliens from outer space, from the distant planet Scotia. Three-thirty came and went and we were wondering why museum officials needed a much longer siesta than everyone else. Then a passerby enlightened us. Masking his eyes with his hands and imitated gunplay, he managed to communicate that just one week earlier, the museum had been broken into and robbed of every single valuable artefact. Kidnapping and ransom were no longer on the agenda, but banditry was not yet dead.

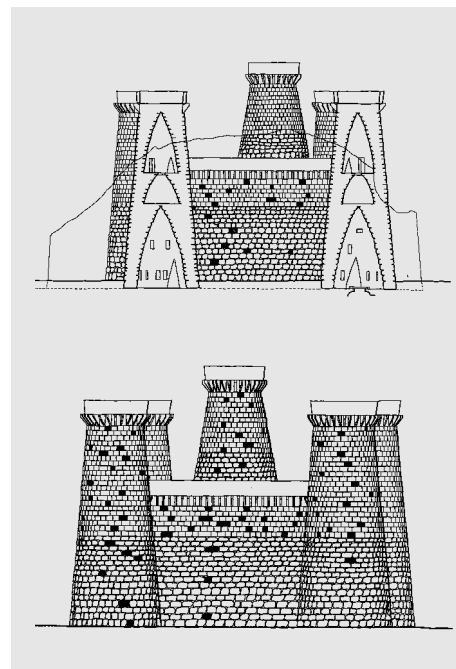
Well, the museum was closed, but the entire island was virtually a museum. We set again across-country to visit the first of the Royal Nuraghi sites on our agenda, St. Antine. Here my appreciation for tectonic vision and the masonry skills of the ancient builders was consummated. The multi-towered Royal Palace architecture had developed from solitary towers built of large

polygonal basaltic stones. In form, these are truncated cones with three separate corbelled chambers, a rooftop terrace and basement entrance. In the second phase, four more towers would be added and connected by corridors five meters high and higher, leading from tower to tower. These open into the tapering, corbel-domed, main chambers of the towers, some of them ten meters high. The massive basalt blocks of the lower courses become progressively more carefully shaped as they approach the apex. The corbelled battlements of the towers inspired the anachronistic vision of a medieval castle built some two and a half thousand years before the medieval castle period. We were so attracted to St. Antine that we returned on several subsequent occasions in our travels around the island. Over winding mountain roads we logged some three and a half thousand kilometres, stopping here and there to photograph and record huts.

My wife's boredom was relieved during one of these interludes. "Ceit," I told her, "I just spotted an extremely interesting hut back there. Won't be long." "Right, okay then," she replied. A few minutes later, having negotiated a ramshackle gate,

I was wandering up a mountain pathway feeling rather content with life when I rounded a bend to be confronted with three rather large dogs and a pup about a hundred meters away. Well, as they say, discretion is the better (or wiser) part of valour—or, more appropriately, get the hell out of it and quick!! Who knows when those dogs were last fed! The return journey to the car became one of the world's fastest four hundred meter runs, culminating with a high hurdle leap over the gate. The clatter of my rapid approach startled Ceit, who turned round to see me panting, the small pup, which had managed to squeeze through the gate, snapping at my heels. She dissolved with laughter, totally disbelieving my protests that there were huge man-eating mongrel monsters behind the gate!!

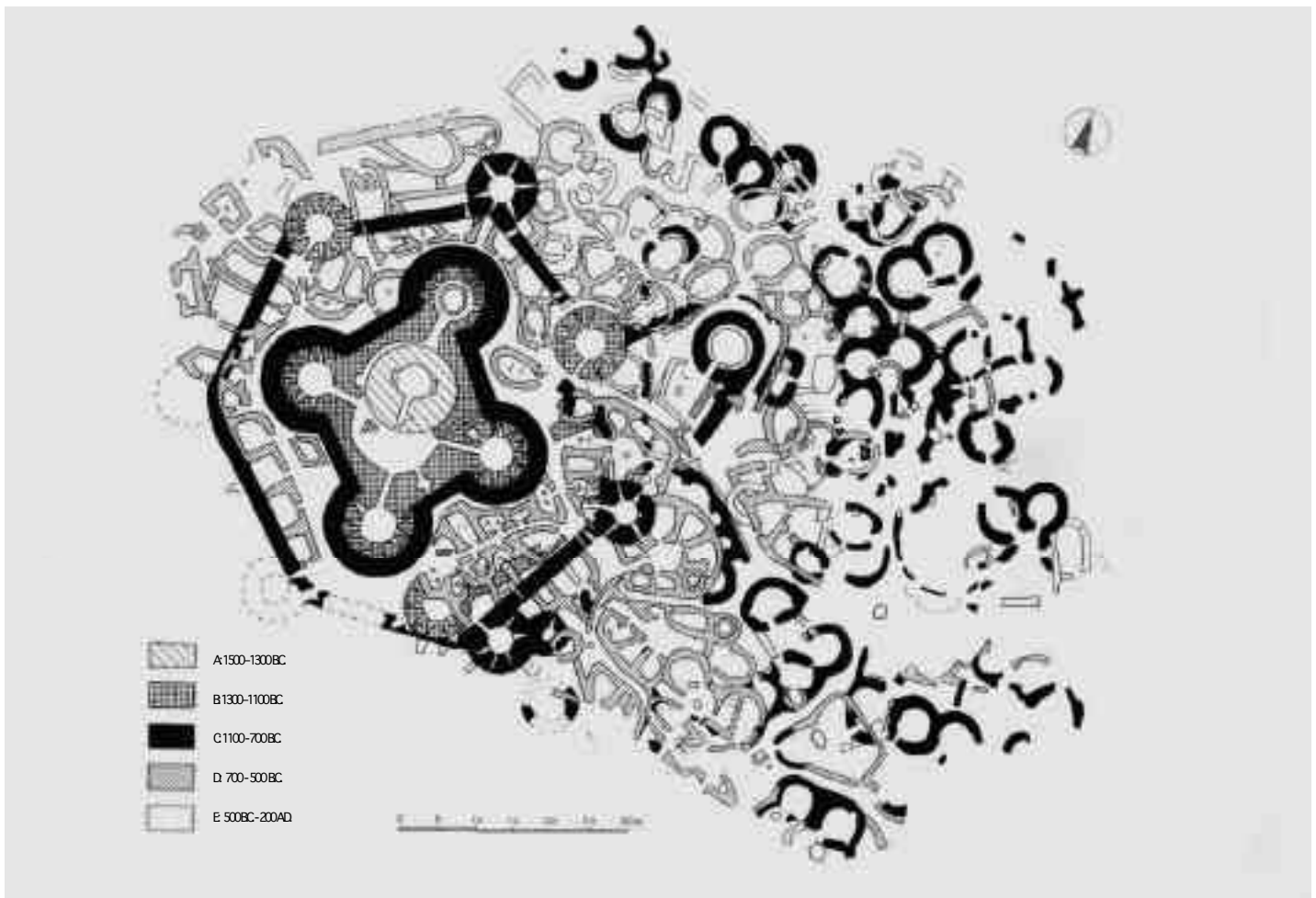
But there was more excitement to come that day. Rounding a corner some kilometres along, we were startled to see a helicopter parked in the middle of the road and some rough and ready policemen with machine guns commanding us to pull over! A surly Sardinian policeman waving his machine gun at the car window with his finger on the trigger though amusing to recall



was quite distasteful at the time. Communication was complicated by mutual misunderstanding, but finally we overcame any suspicions they had that we were the museum bandits, and were deemed to be harmless and allowed to go on our way. Our journey through the Sardinian country-







side was certainly proving to be very interesting. Italians have always, in my experience, been a very hospitable and friendly people but Sardinia is a totally different kettle of fish. To get all my grumbling out of the way, I must say also that the standards of food—and wine—were well below those of mainland Italy.

The next Royal Nuraghi site we visited, *Su Nuraxi* at Barumini, was an excellent example of a later stage of the development of these tower structures. The massive central tower built about 1500 BC was surrounded by four smaller towers dated at 1200 BC and this was followed by the development in 700 BC of the village which in itself shows an extremely interesting developmental pattern (see schematic plan view above). The masonry skills of the ancient builders are exemplified in the projecting corbelling pieces which once sat at the top of the towers but are now displayed at ground level. Here one can appreciate at close quarters the quality of workmanship with which the extremely obdurate basalt

was shaped. A group of young women guides who were very knowledgeable about their subject made our visit even more pleasurable by bringing to life the structures' past.

Travelling back up the motorway, I had plenty to muse over. It seemed remarkable that northern Europe, for reasons that can only be guessed, would have to wait some further fifteen hundred years before the advent of the medieval castles comparative in scale and sophistication to the Royal Nuraghi. Pondering this while whipping round an intersection almost made me lose out on what was the highlight of the Sardinian trip—*Nuraghi Losa*. By this time, we had found out that the Nuraghi abound everywhere from simple tower examples to the Royal Palace complexes. At *Su Nuraxi*, some 25 other Nuraghi exist within the vicinity of the palace complex as they do at St. Antine, but here at Losa the scale of the walls is quite magnificent. Gigantic stone blocks, some of which weigh in excess of ten tons, were manoeuvred into place.

Course after course mount skywards for some twenty meters, creating what is the most impressive unmortared structure I have ever seen. Though it has been somewhat clumsily restored, Palmavera, outside Alghero, is reputed to be the most advanced of its type, but Losa is the most impressive expression of the Tower Cultures of Sardinia, and of Menorca.

It is an interesting historical coincidence that around 500 BC, as the Sardinian Tower Culture was winding down, a tower culture was just commencing in Scotland, and the tower structures of the two cultures bear an extremely similar profile. The outer walls of the brochs of Scotland are double, however, as those in Sardinia might have been had the Nuraghi builders continued to develop tectonically. Not that there is any evidence of a connection. Still . . . □

*James Crawford is, in alphabetical order, an archaeologist, a fisherman and a stonemason. He lives on the Isle of Lewis in the Hebrides off the coast of Scotland.*

# in Stone, a Life

by Alan Counihan

## *There is a stone*

on the desk beside me as I write. I came across it some twenty-five years ago high on a hill in the southwest of Ireland. It had fallen from the wall of an ancient hill fort and when I picked it up from where it glowed on the slope, it fit my hand so perfectly that I kept it. Even as I hold it again now, the shape is perfectly moulded to my palm and I wonder, as I did years ago, whether the builder of the Iron Age fort who placed it in the rampart also felt it to be so remarkable. This piece of Old Red Sandstone is charged with more than a particular moment of my life but with its own condensed witness, its mute testimony, to the shape and passage of time, aeons long, which my imagination can only touch like a breeze.

"Silence packs itself into stone... " wrote the Chilean poet Pablo Neruda. But stone seems to contain the noise of its creation as well, the rise and fall of seas and the crush of continents. I remember a moment early in my life as a stoneworker when I split open a sandstone flag along its bed and there couched in the heart of it lay a small, black, egg-shaped stone, a meteorite, judging by its weight. Just to imagine its flight across the galaxies millions of years ago, the conflagration which might have accompanied its arrival, made the laying of a simple hearth stone a magical experience.

There have been many little epiphanies over the years such as when a hammer blow opened a window onto a forest fire by a dry riverbed in ancient times, or onto a school of fish left high on the shale. I wonder, as I write, whether the finger ring which I lost at sea will ever make its way into the light again.

I think this sense of universal process is what I have most enjoyed in my work with



*IDIR CRUAICHE IS NA CARRAIGE Granite, beach stones. County Wicklow, Ireland 1997*

stones over the years, as though time itself is incarnate in the grain and each one has a story to tell. Their passage through a mason's hands only adds to their history.

They absorb everything. The trace of the chisel's point will hold on their surface for centuries and any change I might make to a stone's shape will last as long as ever lasts.

No wonder we have used it for so many of our great religious and secular monuments or as markers for our dead. It is a remarkable material, the very stuff of the world and it seems that if in our work we give it the best of ourselves, it will absorb that, too.

An undeniable attraction of stonework has always been its unpredictable nature,

no two stones ever being the same. They are rather like people in that regard, some being slippery and hard to get hold of while others can be edgy and awkward, uncooperative and most reluctant to reveal anything of their inner nature. The best are true to themselves and responsive while the worst are downright nasty and best avoided. A good stoneworker will quickly recognise a stone with which he or she can work and each stone with which we work should help us work the next one. I have also long enjoyed stonework because it is a muscular and creative process which can engage all of one's being, whether that is building a dry stone wall for a farmer on a mountain-side or carving a sculpture in a studio.

Looking back over almost thirty years of work with stone, I realise that the practice of the former led me inevitably toward the latter

It was by mere chance that my hands discovered facility for stonework. As a boy born into the constrained world of middle-class privilege, where people who worked with their hands were perceived as being of a lesser social caste, I had few opportunities during my formative years to discover any latent ability I might have had for skillful work and, in fact, the only stones I ever touched would have been stones for skimming at the seashore. It was not until I was in my early twenties and on short holiday in the southwest of Ireland that I happened to meet someone who needed help in the building of his stone house. I was fortunate in that the wonderful man with whom I worked was a self-taught carver and mason who, while he took great pride in the work of his hands, was not so proud that he would long keep the tools of his trade from my own. One house led to another and another and the work seemed to grow more enjoyable as my confidence grew. The work came easily as though I already had it in the hands. I recall to this day being asked once to cut a chase down a wall with a maul and chisel. No sooner had I started the work than I had found the rhythm—one which I still use when carving to this day—and it felt so familiar that I was certain I had done this work before. In another life, perhaps? An

atavistic skill passed along the genes? No matter from whence it flowed, I knew I had found a work in the world, had been given a gift and the ability to shape my time with the work of my hands.

If my facility for stonework was intuitive, the discipline it required was not. Fortunately the landscape in which I lived at the time was as fine a place to learn as any, veined as it was with a myriad of walls through which coursed the personal and collective histories of our tribe. They crisscrossed the hills like the threading in a patchwork quilt, sewing lives and times tightly together. The walls of a new pasture might flow into those of a pre-Christian fort, although there was nothing in their lichened surfaces which might tell one from the other. With more experience, it became possible to read the story of the growth of a particular house or settlement in its walls and to recognise how, over the generations, the style of one mason knitted into another's, or not, like a careful script beside a hurried scrawl. It did not take me long to learn that the principles of good stonework have not changed for millennia, nor are they likely to, governed as they are by the laws of gravity. As many a ruin will testify, careless work does not last. Good work, however, endures and this is due as much to the character of the mason as of the stone he uses. In our work can be read our measure.

Hopefully also in our work can be read the joy and the pleasure of its doing, that

*Lakeside pier, 1991*

process which makes it all worthwhile. I have spoken to so many wallers over the years who speak of those wondrous days when the eye finds and the hand sets the right stone in the right place every time and, even if they are rare enough to be memorable, such times far outweigh those others of awkward struggle which can blacken a heart with frustration. For my own part, it was the enjoyment of the work which kept me at it and most especially in those times when I knew the play of shape and colour would be appreciated. The making of a wall can be artful work. It is the combination of care, skill and joy which can raise any work to the level of craft.

How many walls, or miles of wall, I have built over the years I could not estimate, although I have begun to feel them in the bone. I do know that the more I worked with stone, the more I came to realise my ignorance of the craft. I was shocked to learn that in other European countries there were guilds of stonemasons and years-long apprenticeships required for stonecutters and carvers, and that for all my short time as a stonewaller, I could probably not lay as much as a flagstone on the floor of Chartres Cathedral. It was only when I went to live in America that I really began to explore the many different ways of working with stone and their associated skills.

I had been living in California for a few years working for small masonry contractors and in the gardens of friends who indulged and encouraged my lithic tendencies when I was shown a photograph of a pair of stone pillars built by a couple of stonemasons from somewhere north of San Francisco. I was in awe of the skill embodied in the work which was executed in a polygonal style and which did not seem as if it would allow a blade of grass to be passed between each constituent stone. I was equally awed by the possibility that a living could be made creating work of such a standard and so I set about trying to improve my own skills.

It was pure happenstance and good fortune that led me to discover that those same two stonemasons whose work in that photograph I had so admired, Tomas Lipps and George Gonzalez, were at the time building something known as the Wave Organ, a remarkable sculptural work of stone and sound on the shores of San Francisco Bay, not far from where my wife



### ***This is the Wave Organ***

mentioned by Alan Counihan in the foregoing article. Built in San Francisco in the winter and spring of 1985-86, it was a remarkably unique large-scale structural/sculptural artwork project. The concept was that sound generated by sea water washing into and out of pipes would travel through pipes to a listening station on the shore, creating aquatic "music". The material for the construction was conveniently to hand - tons and tons of hand-carved architectural stone fragments.

In the 1950s a San Francisco cemetery was relocated. Bodies were disinterred and transferred along with their head stones to another site.

The architectural structures, however, mausoleums monuments and tombs, were bulldozed, loaded on trucks and distributed along the breakwater of the jetty protecting the yacht marina from the waves of San Francisco Bay. At the end of the jetty was the project site. Thirty years of wave action had softened the broken edges of the hand carved granite blocks, giving them an ancient appearance. Also available for use were granite cobblestones and curving curbstones which had been removed to provide wheel-chair access at street corners throughout the city.

Assembling this chaotic wealth of material into a coherent structure, an archetonic spatial environment was the task of sculptor/stone mason George Gonzalez and myself. The project cost \$160,000 and took nine months to complete during which time we learned a great deal about worksite management and became proficient at shaping, moving and placing massive stones.

T.L.





# Technological Originality Seen in the Construction of Himeji Castle

## Maze-like Complicated "Plot Plan"

In 1601, right after the Tokugawa brought down the Toyotomi government, the construction of Himeji Castle was started amidst public unrest.

Ieyasu Tokugawa continuously had maneuvered to suppress Toyotomi's influence, and ultimately succeeded in establishing a feudalistic shogunate administration throughout Japan.

Thereupon, Terumasa Ikeda of the Tokugawa side appointed Takahige Igi in the position of "Sobugyo" (general magistrate) for the construction of Himeji Castle. A devoted chief retainer of Terumasa Ikeda, with abundant combat experience, he was also well-known as a strategist and a man of military science.

Igi organized such staffs as "Fushin bugyo" (manager of engineering works), "Sakuji bugyo" (manager of construction works), "Kanjo bugyo" (manager of accounting and finance), "Ometsuke" (guarding superintendent), "Yuhitsu" (secretary) and "Shobugyo" (manager of personnel affairs, procurement of materials). And he lost no time in undertaking "Nawabari" (plot plan), a vital point of castle construction.

The decision of "Nawabari" was carried out by a council system with the presence of the lord of

the castle, Terumasa Ikeda. Particularly, the chief of a group of free technicians called "Chikujoshi" (fortifier) joined it.

The principal object of "Nawabari" was to make the most of geographical features including the surrounding flatland, centering on Mt. Hime 45 meters above sea level. Namely, the point of this plot plan was to encircle Mt. Hime as an axis with threefold "Kuruwa" in an anticlockwise spiral.



A view of "Seikaido Yagura" ("Spiritual Tower").



West view of "Daitenshukubo" from path to "Hin-no-Mura" ("Himeji" gate).



The first round called "Uchi kuruwa" is divided into "Honmaru" (donjon), "Ni-no-maru" (the outworks of a castle), "San-no-maru" (second outworks of a castle) and "Nishi-no-maru" (western outworks of a castle). The administration office and residence mansion of the castle lord were there. The second round was called "Naka kuruwa," which was the residential quarters for high-ranking warriors. Along the third round called "Soto kuruwa," row houses for middle- or low-class warriors, and also temples were built. Threefold moats were encircled around each kuruwa.

The plot plan of Himeji Castle constructed after a spiral shape is just like a maze. There has been no such precedent in the world for its complexity. Only in Edo Castle, the design of a slightly simplified threefold spiral may be discerned.



An inside view of "Nishiki yagura"



An inside view of "Wafuri yagura" ("Wafuri" turret) in "Nishi no Maru"

### Unique Castle Stone Wall of Japan

The five-storied pagoda of Horyuji Temple built in the seventh century and the three-storied pagoda of Yakushiji Temple built in the eighth century are said to be the masterpieces of wooden buildings of Japan and radiant with sublime beauty. In contrast, the building of Himeji Castle, which offers a comprehensive survey of studies on modern castle technology, gives full play to the traditional Japanese aesthetic sense in its structural scheme arranged around "Tenshukaku" (castle tower) and all-embracing formative beauty is freely and boldly made the best of.

One of the keys to unravel the beauty of Himeji Castle is the stone wall.

This wall has a deep, arc-shaped warp, while curves of earlier castle stone walls are shallow. Amidst the rush and hurry of castle construction on the battlefield, the constructors had no spiritual composure and were pressed for time in building the more elaborate stone walls which required much time and labor. It cannot be denied that a sense of formative beauty as a "show castle" began to work, since the role of a castle as a mere fortress showed a gradual decline and there were signs of bringing awesome pressure to bear upon the people even in time of peace.

It goes without saying that the construction method of Himeji Castle, which was built in the final stages of the age of civil wars, is truly the highest masterpiece, as the stone wall looms over one's head so that one cannot see the sky.



Stone Wall



SIGNIFICANT OTHERS,  
by Jeanne Marie Laskas

## THE FIRST STONE

Mack, the builder of walls, is out in the front yard looking down at about 300 hunks of sandstone. He's a slim man with a ponytail, and a tattoo that makes his arm appear encircled with barbed wire. He's got a cigarette in one hand, and with the other he's rubbing his chin, examining the stone. Perhaps he's thinking about what I told him when he arrived this morning. "This is an important stone wall," I said. "This is the wall that will announce our front yard! This is the *gateway*, the *approach*, the point of *entry* into the land of us!"

He nodded a few times. I went on to explain that, due to the importance of this wall, we should probably think in terms of a focal point, one stone that can speak on behalf of all the other stones. We should pick the most beautiful stone and feature it somehow.

"Right," he said. "So why don't you pick out your favorite stone here and I'll set it aside."

Great idea. I walked among the stones. Wow. They were all so beautiful. I couldn't pick a favorite. I just really couldn't decide. So I changed the subject, slightly. I said basically we wanted this stone wall to be a wall that *invites people in*, not a wall that acts as some cranky fortress, so somehow we wanted to communicate *warmth*, a kind of familiarity and approachability.

"Okay," he said cheerfully. He then asked me to pick out the warmest, most familiar and approachable stones I could find and he'd set them aside. I walked among the stones. It was hard to decide. I told him this could take days.

"Right," He said. "So I'm just going to get started here, okay?"

I smiled at him, tilted my head, said I'd



be up in the house if he needed anything.

And so here I am in my office watching Mack, the builder of walls, from my window. He crouches like a toad. He lights another cigarette, stares for a moment, then bounces up, picks up a flat, bluish stone. *That one?* No, not *that one!* I dash down. "The steps!" I say. "Wouldn't that make a better stone for the steps?"

He puts the stone down, looks at me.

Hmm. And why do I get the feeling I'm telling a musician how to play his instrument?

I'm just going to get started here okay?" Mack says.

Righto. I can take a hint. I go back to the house, climb the stairs to my office, sit at my computer. A blank screen. A new chapter to begin. A chapter in a book with a lot of chapters with lots of characters and lots of bits of dialogue. It's like one giant heap of sandstone, is what it is. Making order out of chaos, we're all in the same lonely game. I wish I had someone here to ask me questions, to wonder with me what this story is about, to inspire me with questions about a focal point, to wail and whine and groan. Oh, the angst! If you're a painter or a quilter or a carpenter or anyone who has ever made anything, you know it too. My mother and I used to do this. She'd be downstairs staring at a blank canvas. I'd be upstairs staring at a blank screen, and we'd meet for tuna fish at noon and moan. Afterward the magic would hit her, or hit me. It didn't matter who got the courage to start first. One would start and

the starting would inspire the other to get started.

Outside I can hear the skip loader. I see Mack zooming back and forth on the nimblest wheels. He's got a giant hunk of sandstone in the bucket, he's placing it just so, he hops out of the skip loader and leaps toward the wall, touching it, marveling at the position of this,

his latest, greatest stone. He continues moving around like a bumblebee buzzing among flowers with a purpose as pure as it is mysterious. He's in the zone, all right. I know better than to interrupt him now. And what if I just sat here at my blank screen and put down one word? One tiny word. How hard can it be?

Nine hundred words later, I go out see. Mack is covered in sweat, he's breathing hard, he sees me approaching and has a look of fear in his eyes. I'm his reader, I'm his listener, I'm opening night, I'm his only hope for applause.

It's gorgeous!" I say to Mack, because it is. There's on stone pinker than all the others announcing the curve. There's a duet, two thin slabs sitting amid a circular pattern of fat bulbous rocks as if mocking them. A stone joke! This wall isn't even half finished and already it's about the most intriguing stone wall I've had the occasion to meet.

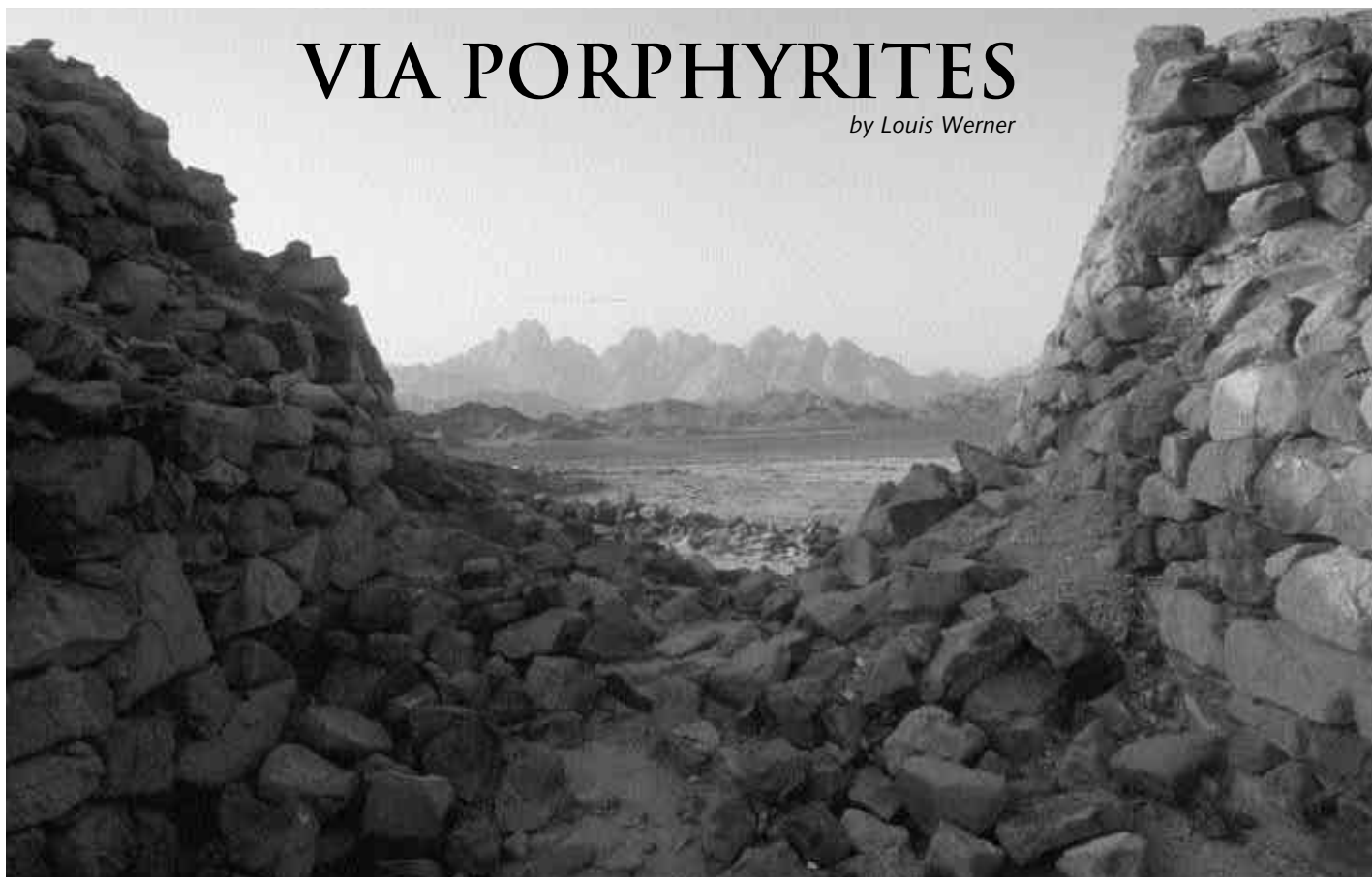
I ask Mack how he did it. How did he know what stone to put where, how did he come to create order out of this heap of chaos?

"You start with one stone," he says, rubbing his brow. "Then you put the next one on. After that, you put another. The thing of it is you can only put one stone at a time." ■

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# VIA PORPHYRITES

by Louis Werner



*This gateway opens into the fortress at Badi'a, one of seven hydreumata, or Roman watering stations, along the 150-Kilometer (nearly 100-mile) trek from the quarries to the Nile.*

## In the year 18, in Egypt,

a Roman legionnaire named Caius Cominius Leugas found a type of stone he had never seen before. It was purple, flecked with white crystals and very fine-grained. The latter characteristic made it excellent for carving, and it became an imperial prerogative to quarry it, to build or sculpt with it, or even to possess it. This stone soon came to symbolize the nature of rulership itself. We call it imperial porphyry.

The Romans used this porphyry for the Pantheon's inlaid panels, for the togas in the sculpted portraiture of their emperors, and for the monolithic pillars of Baalbek's Temple of Heliopolis in Lebanon. Today there are at least 134 porphyry columns in buildings around Rome, all reused from imperial times, and countless altars, basins and other objects.

Byzantium, too, was enamored of porphyry. Constantine the Great celebrated the founding of his new capital, Constantinople (later Istanbul), in the year 330 of our era by erecting there a 30-meter (100') pillar, built of seven porphyry drums, or cylinders, that still stands. Eight monolithic columns of porphyry support Hagia Sophia's *exedrae*, or semicircular niches. Justinian's chronicler, Procopius, called the columns "a meadow with its flowers in full bloom, surely to make a man marvel at the purple of some and at those on which the crimson glows." Anna Comnena, daughter of the 11th-century emperor Alexius I, described the *porphyra*, a porphyry-veneered room in the palace where women of the ruling family were taken to give birth. The choice of por-

phyry for this room in particular was no accident: It ensured that members of the imperial family were literally *porphyrogenitos* or "born to the purple."

The room is in the form of a perfect square from floor to ceiling, with the letter ending in a pyramid. The stone used was of a purple color through with white spots like sand sprinkled over it.

Porphyry served the *imperium* in death as well as birth. Nero was the first emperor to be entombed in a porphyry sarcophagus, according to Suetonius. Constantine's porphyry sarcophagus has been lost, but that of his wife Constantia, decorated with peacocks, lambs, and grapes and thought to be a copy of his, is now in the collection of the Vatican Library. Those of the Holy Roman Emperors Frederick II, Henry IV and William I, and that of the Empress Constance, all porphyry, are in Sicily's Palermo and Monreale cathedrals.

In later centuries, porphyry columns and other pieces were widely reused in new constructions, often reappearing far from their original Roman context. In 786, Charlemagne received permission from Pope Hadrian to remove classical columns of porphyry from Rome to build his cathedral at Aachen. The renaissance Medici family commissioned portrait busts carved from porphyry blocks that had been warehoused in Rome since imperial times. Other sources are unknown and unguessable: The Victoria and Albert Museum in London contains a pair of fine porphyry earrings. A church in Kiev is decorated with porphyry wall and floor revetments; how the stone made its way there is probably

an interesting story, but unrecorded.

What makes imperial porphyry so precious and rare is that it is found at only one place on earth, atop a 1600-meter (mile-high) mountain in the eastern province of Egypt. The Romans named the site Mons Porphyrites, or Porphyry Mountain, and the Arabs today call it Jabal Abu Dukhan, or Smoky Mountain.

Thrust to the earth's surface in the same volcanic action that once formed the Red Sea, the porphyry found at Mons Porphyrites is, as far as specialists know, geologically unique. But the site is so barren and so remote that only slave labor could ever have extracted the stone, and even then only for the relatively brief historical moment when Roman power was at its zenith.

*Imperial porphyry —  
glowing purple flecked with white — is  
found in only one place:  
atop a few barren peaks in Egypt's Eastern  
Desert. At the apogee of Roman power, the  
beautiful stone became a jealously guarded  
symbol of rulership itself. It was quarried in  
Egypt under appallingly difficult conditions  
and carted to the Nile along the Via  
Porphyrites, the Porphyry Road. Today, the  
area is a fascinating — and still very harsh  
— early industrial landscape.*

When George Murray, chief of the Egyptian Geographical Survey in the 1930's, visited the quarry, he found a place so barren that it made him shudder. A ruined fortress, three lifeless villages, abandoned temples and shrines, dry wells, broken pillars, cracked stone baths—"the fossil whims of three centuries of Emperors," he called it. The local Ma'aza Bedouin have a similar saying about the place: "The Romans left; only the ibex remained."

But geographers and Bedouin see things differently from archeologists. David Peacock of the University of Southampton in England is co-director of the Egypt Exploration Society's Mons Porphyrites Project, and he finds it "the most remarkable Roman industrial landscape in the world." Some of his recent finds, including the stela inscribed by the Roman discoverer of the quarry, help to explain how the work was carried out under conditions that would be daunting even today.

Among the more startling finds are a hair-pin, cosmetic brush, and

toy comb made from oyster shell—evidence that women and children may have lived here alongside the men. Also surprising is written evidence, on inscribed pottery shards, or ostraca, that work proceeded here even during the sun-scorched summer.

Labor involved more than mere quarrying. After cutting and rough-dressing the blocks and column drums—and apparently also such larger pieces as the monolithic pillars eventually used in Hagia Sophia—the pieces were loaded onto ox carts, which were driven 150 kilometers (about 100 mi) to the Nile at Qena (Kainopolis of the Ptolemaic era), where they were shipped downstream by barge and then by sea to their final destinations. Byzantine poet Paul Silentiarius refers to this in his ode to Constantinople's porphyry, "powdered with bright stars, that has laden the river-boat on the broad Nile."

The road from the quarry westward to Qena, which Ptolemy the Geographer put on his second-century map, was a route described first by Strabo, and it is to this day known as the Via Porphyrites, the Porphyry Road. Along the way are seven *hydreumata*, or fortified wells, each one a day's march from the next. Outside the fortifications are lines of large stones to which oxen were tethered at night.

Archeologist Steven Sidebotham of the University of Delaware, an authority on the Roman roads of the Red Sea mountains, surveyed the Via Porphyrites in 1989. He concluded that from the first to the third centuries of our era, the *hydreumata* were used as watering stations for the porphyry carts, and that in the following three centuries, when quarrying had ceased and tribal raiding from the south had commenced, they became Roman border posts and strong points along the line of communication between the Nile and the fort at Abu Sha'ar on the Red Sea coast.

Today the area is uninhabited except for the occasional Ma'aza Bedouin grazing his camels. Ibex, hyrax, and rabbit live here now. Around water holes, trumpeter bullfinches, desert larks, and mourning chats flock in *sayaal* trees (*Acacia raddiana*) and the wispy-needled *yasar* trees (*Moringa peregrina*). In the fall, thousands of white storks cross overhead, riding thermal currents on their way from the Sinai to central Africa.

The Via Porphyrites follows three major systems of *wadis*, or streambeds: Wadi Belih, Wadi al-Attrash and Wadi Qena. Between the first two it crosses the divide between the Red Sea watershed and that of the Nile. From Wadi Belih, there are two approaches to the quarry. One is a winding route up Wadi Umm Sidri and into Wadi Abu Mu'amal ("Workplace Wadi"), and it is this route that the ox carts followed. The other is a steep but more direct footpath over a 950-meter (3000') pass.

A late-winter trek along the route in the company of two Ma'aza Bedouin, 72-year-old Salaama Mir'i and his 18-year-old son Suleiman, provides ample opportunity to reflect on the hardships faced nearly 2000 years ago by Rome's mostly Christian slaves, the thousands *damnati ad metalla*, or "condemned to the mines" in Egypt. In walking to Mons Porphyrites, I follow in the footsteps of two British explorers, Sir John Wilkinson, a former president of the Royal Geographical Society, who rediscovered the quarry in 1823, and Leo Tregenza, a Qena-based schoolteacher who, in the 1940's, spent his summers in these parts and wrote of them in his classic account *The Red Sea Mountains of Egypt* (Oxford University Press, 1955).

When I tell Salaama of my intended route, he startles me by saying, "Yes, I know it, I came this way years ago with an *ingilizi* named Genza." "Leo Tregenza?" I ask. "Yes," he says, "A man always writing