STONEZINE 18

THE DIGITAL COUNTERPART TO STONEXUS MAGAZINE,
A TRIBUTE TO STONE, STONEWORK AND STONE ART

STONEZINE 18

EDITOR: TOMAS LIPPS

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Entryway, fortified settlement at Mons Porphyrites,
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photo courtesy of Egypt Travel Link Tours:
www.etltravel.com

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Mons Claudianus by Per Storemyr

Notice: This issue has been altered from the usual horizontally oriented format to one resembling the print magazine STONEXUS. This is an experiment. We would like to know what your preference is. Please register your opinion in an email sent to stonexus@earthlink.net. Thank you.

Editorial. . .

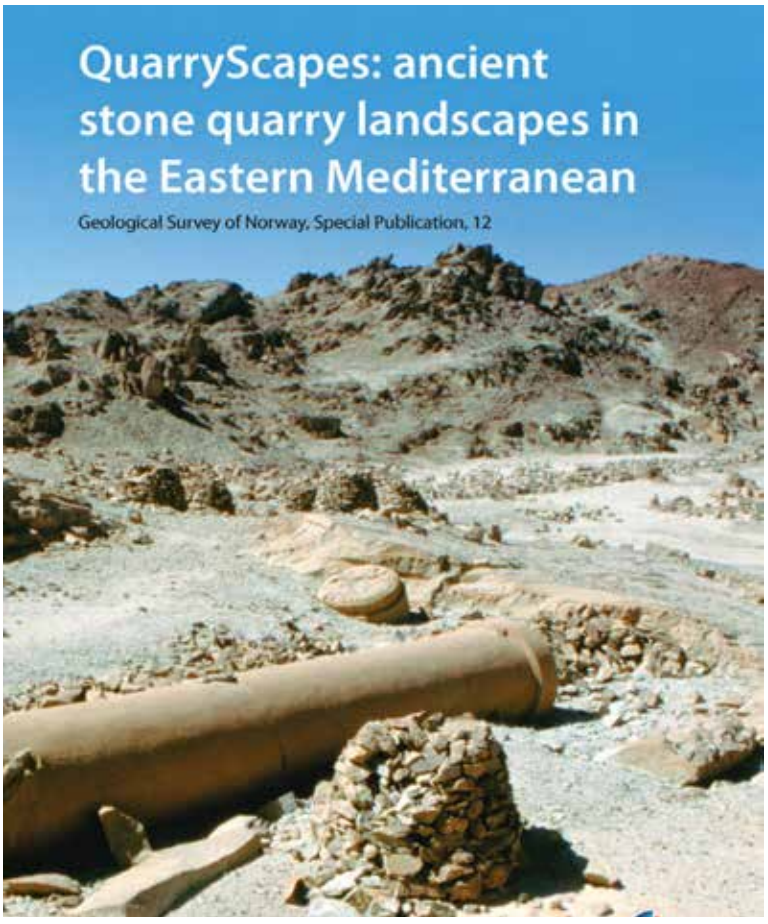
I have been infected, not by the coronavirus, but with a fascination for a particular historical phenomenon—the Imperial Roman quarries in the Eastern Desert of Egypt. These remote industrial colonies established in inhospitable environs on the farthest fringe of the vast Roman Empire were dedicated to extracting and shaping the prestigious native stone and transporting it to the capital.

It was a massive, challenging, costly, and successful enterprise conducted in the service of the Imperial Roman taste for art and architecture. It required, and received, the full measure of Roman organizational skill and technical ingenuity.

Equally amazing, though, was the logistical efficiency of the supply line to the quarry settlements, the volume and variety of the inflow of provisions and materiel necessary to maintain the operations of these remote quarries and sustain the lives of those who lived and worked there.

Researching this subject turned out to be a time-consuming obsession and there has been endless editing which has somewhat delayed publication of this the 18th issue of the STONEZINE and for that I apologize. I hope that you enjoy it.

Tomas Lipps, editor, etc.



P. S.

If the subject of Egyptian and Roman quarries, the stone taken from them and the way that was done fascinates you half as much as it does me, then open this interesting and informative scholarly paper, if only for the many excellent photographs.

Thanks to geologist/archaeologist/authors James A. Harrell and Per Storemyr for their permission to share this.

Click on this link.

https://www.ngu.no/upload/Publikasjoner/Special%20publication/SP12_s7-50.pdf

Stein auf Stein Kragkuppelbauten

STONE ON STONE, Corbelled Dome Buildings

by Renate Löbbecke

I have been traveling the world for more than 30 years in search of corbelled dome constructions. Corbelling is an elementary technique of building that makes it possible to enclose a space using only stones found on-site—and without auxiliary materials such as mortar or wood.

This type of domed construction is ancient. It is known to have been used for burial chambers as early as the 5th millennium BC. Largely ignored, however, is a phenomenon that occurred about 200 years ago, what might be called a 'construction boom' during which many new corbelled dome structures were built—mostly for agricultural shelters. In distant regions completely independent from each other, regions like Ireland, Spain, France, Italy, Greece and Morocco, domed stone structures with comparable yet distinctly different designs emerged.

I have documented around 60 different regions in 20 countries that I visited. In 2012 my observations were published by the Walther König company in the book *Kragkuppelbauten* (now available in English as *Corbelled Domes*), but the topic did not let go of me and I kept exploring, visiting new areas such as the Outer Hebrides in Scotland, the Wachau in Austria and the Alto Alentejo in Portugal.

I have great respect for the physical performance and complex creative powers of anonymous farm workers that has resulted in these structures. In many regions where they transformed the landscape but are no longer being built or used, nature has started to reclaim them though you can still clearly see where people have designed and built and where they have not. The working symbiosis of Man and Nature that converted stone material into useful structures was based upon a relationship determined by ambivalence, by initial creativity and then, subsequent neglect.

When I'm in one of these typical stone-designed landscapes I am aware of the hardships the builders experienced but what I see pleases me. I find it beautiful. The tension between rough labor and the resultant aesthetic appearance affects me and I am always in a condition of highest sensual and spiritual attention for everything I see. These unique man-made forms composed of raw rocks may have been abandoned but the objects they contain—old tools, broken chairs, dusty bottles, etcetera—are testimonials to the pleasure they must have given to their builders.

The designs of these structures depend on the physical properties of the stones used and the skills of the builders. Horizontal rings of stone are layered one above another, each layer projecting slightly beyond the one below it. In this way the interior space is incrementally narrowed until the rings meet at the apex of the vault and can be covered by a single capstone which *(unlike the keystone of a 'true arch')* has no static function and might be missing.

France, Vaucluse, 1996

Spain, Lanzarote, 2010

Oman, 1996

France, Dordogne, 2009

Italy, Apulien, 1995

Spain, Valencia, 2008

Italy, Apulia, 1995

Italy, Apulia, 2008

Spain, Menorca, 2006

Oman, 1996

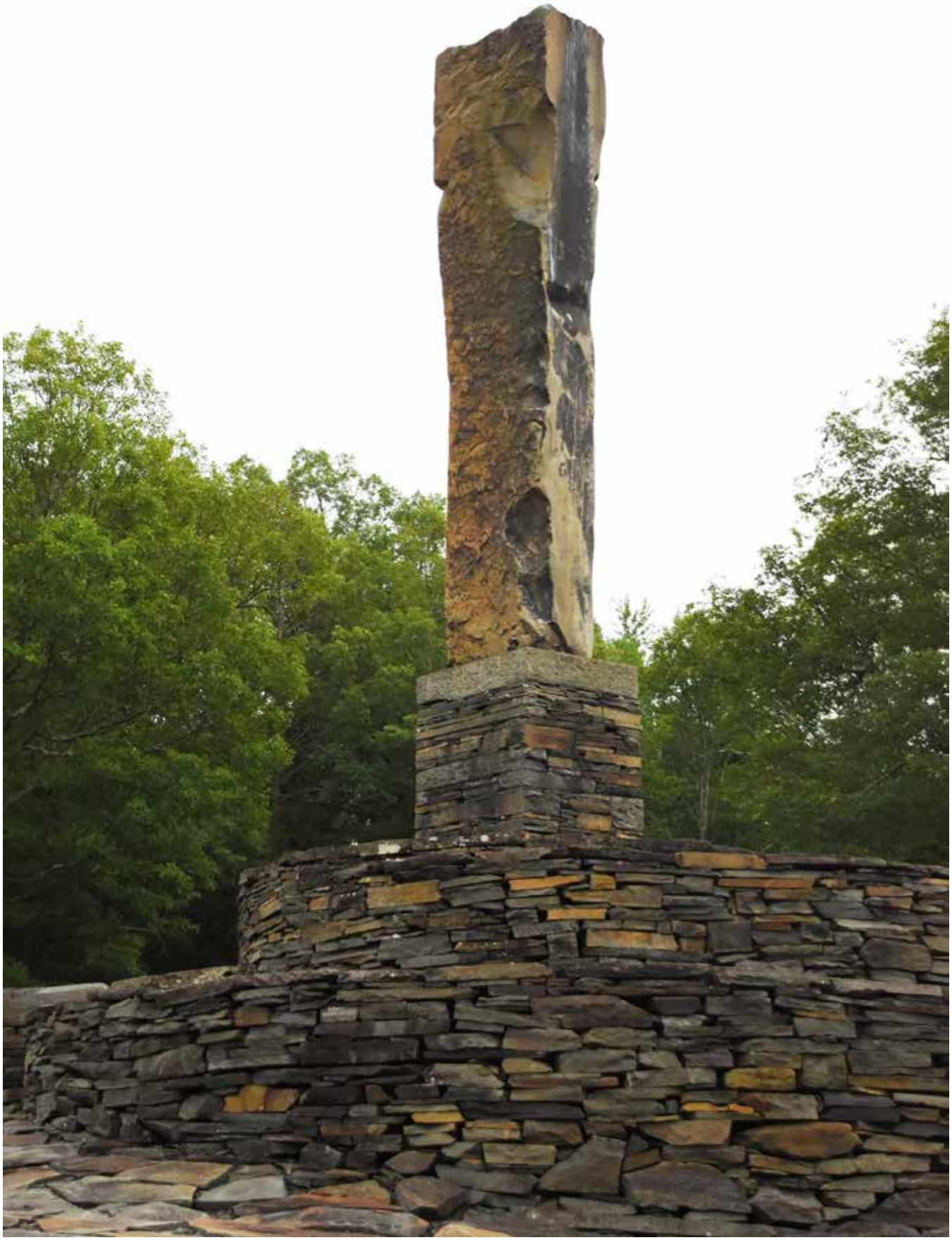
LITHIKOS GALLERY

Photos by David F Wilson that were not used in his article *CREATIVE SPACE* in stonexus XVIII

Dry stone garden walls by John Scott in Ontario

Japonesque stone ramparts, Rolex Building, Dallas, TX, detail. By Suminori Awata, Kyle Schlagenhauf and others

Blue whale, sculpture by Kevin Carman, Gualala Arts Center, *Gualala, CA.*



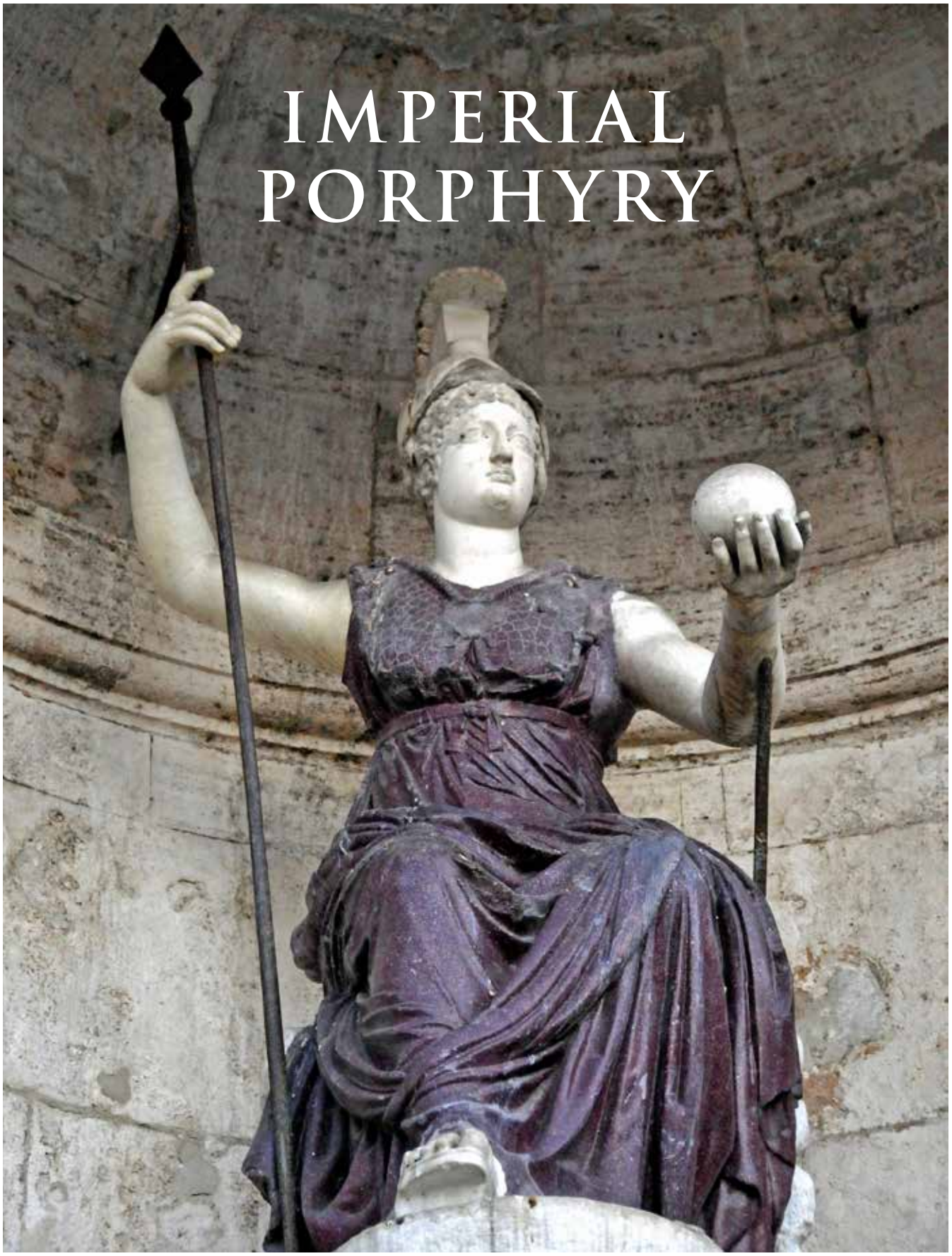
Opus 40, *the Monolith, early Land Art by Harvey Fite, Sauguerties, NY*
(The monolith is 14 feet long and weighs 9 tons. It is not pinned; it stands balanced on a thick plate of lead.)

The Sculpture Project, *Rapid City, South Dakota. sculptor, Masayuki Nagase*

Moon window in perimeter wall by Jared Flynn, the Stone Trust campus, Vermont.

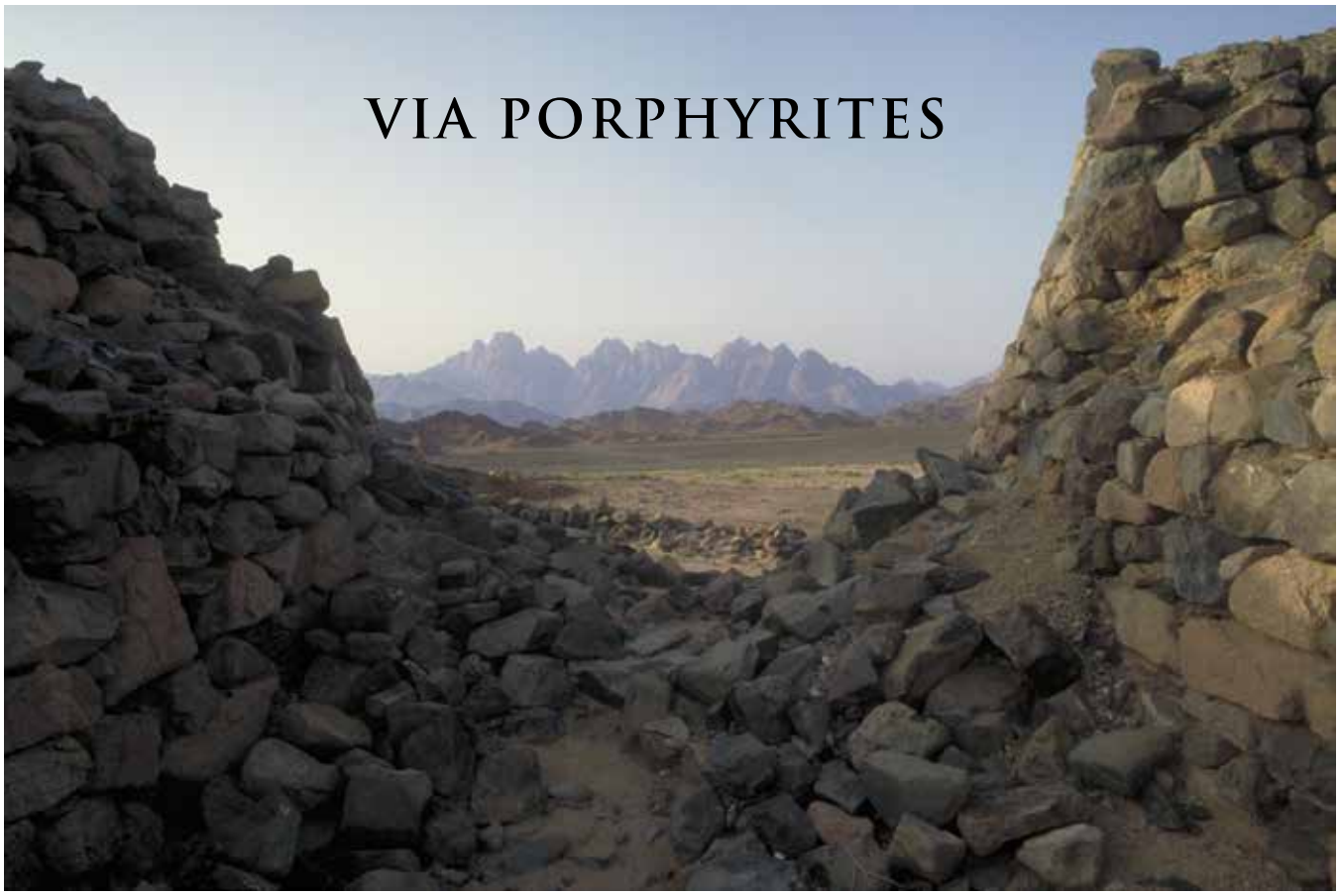
Mohonk Mountain House Resort Hotel, *New Paltz, New York.*

IMPERIAL PORPHYRY



Statue of the goddess Minerva clad in Imperial Porphyry, Rome. photo: Dennis G Jarvis via Wikimedia Commons.

VIA PORPHYRITES



The fortress at Badi'a, one of seven hydreumata, or Roman watering stations, along the nearly 100-mile trek from the quarries to the river Nile.

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, this 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.

Written by Louis Werner
Photographed by Lorraine Chittock

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 feet) tall 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."*

Three views of the slipway at the Lykabettus quarry at Mons Porphyrites. . .above, left: the quarry and workers' village. above right: the full extent of the slipway from quarry face to wadi level. photos Valerie Maxfield.
below: slipway with stone cairns. photo: J P Brun

The yellow brick of the fort's upper walls, showing the remains of finely executed barrel vaults, are a beautiful and conspicuous ruin against the sky.

It was here that Tregenza found a Roman love letter written on an ostracon. "*From Isadora to her lord and master, greetings. As I begged you before, please do not forget me. I want you to send the bottle and ink so I may write to you again.*" Here was additional evidence that Roman women, too, once traversed these desiccated parts.

It was here I had to leave Salaama and Suleiman. I would have to miss the last water station—which is said to be completely ruined—and take a truck down to Qena, where Rome's presence still resonates in the magnificent Temple of Denderah, a temple ironically, lacking any sign of porphyry decoration.

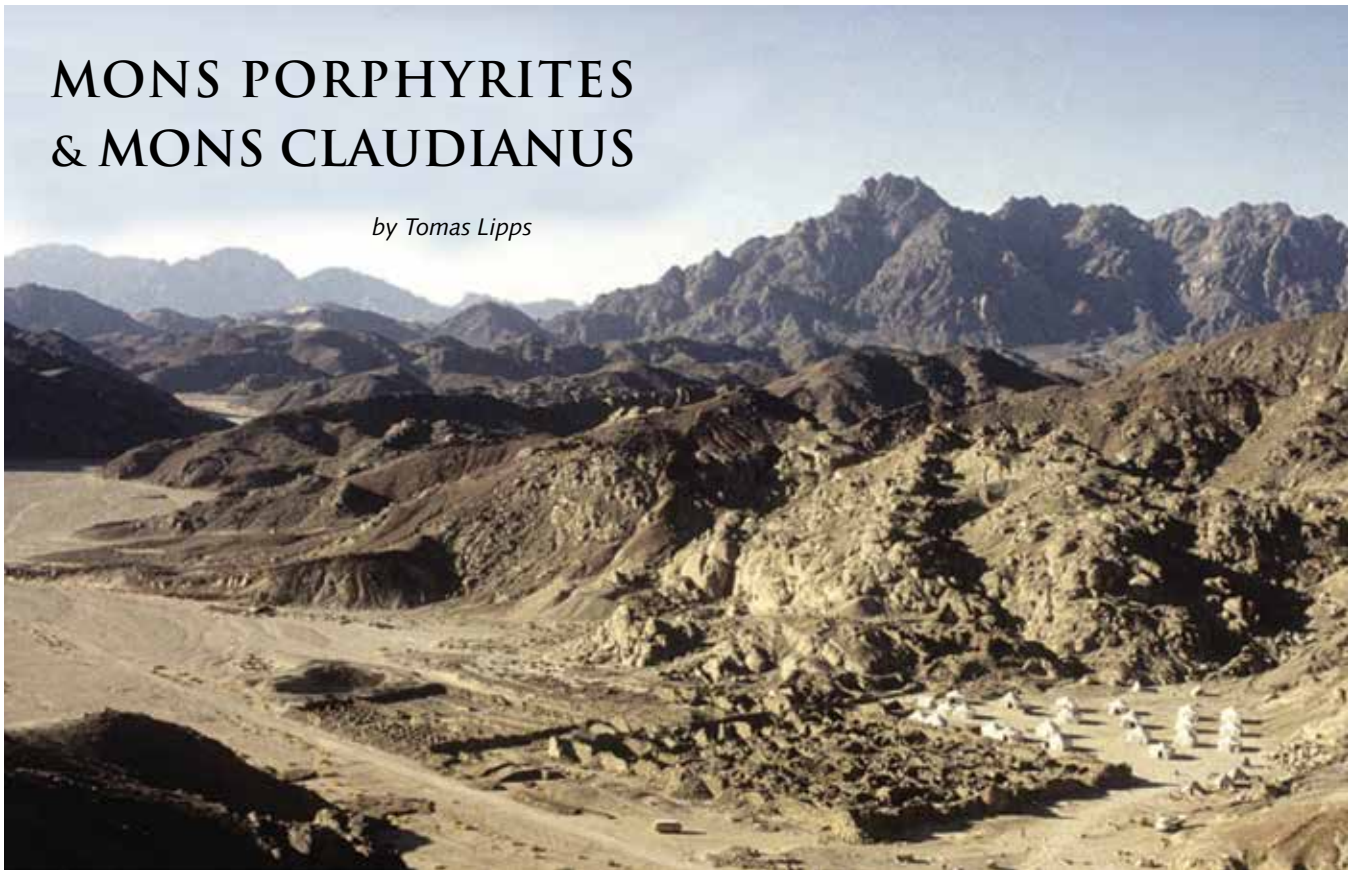
The two Ma'aza will return with the camels past Mons Porphyrites to their home range in the Wadi Umm Duheis above Hurghada. I wonder if they, like Isadora, might also leave a record somewhere of this journey. If so, I hope it will not resemble the message on papyrus recently found in the Fayoum, west of the Nile between Qena and Cairo. That was written in the year 163, 18 centuries ago, by Satabous of Dimai, and in it he complained bitterly that his camels had been unfairly requisitioned by the authorities—for "*draft service on the porphyry road.*"

Written by Louis Werner.
Photographed by Lorraine Chittock.
Reprinted from AramcoWorld*, Volume 49, Number 6, November/December 1998, www.aramcoworld.com*

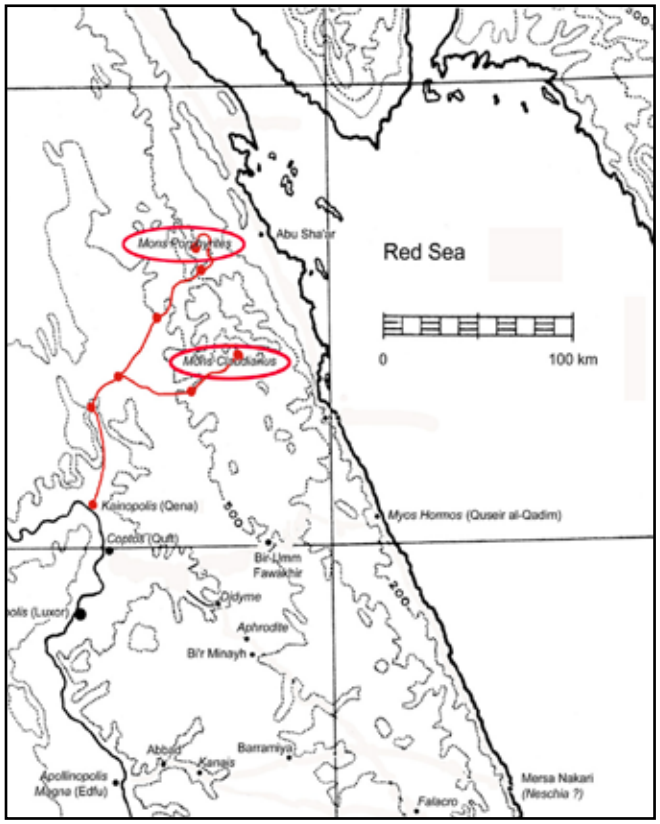
Rough-dressed blocks of imperial porphyry lie near Deir al-Attrash, where they fell from their carts -- perhaps the result of a broken wheel, a collision, or an ox maddened by a snake. Far from the quarryside loading equipment, the Roman carters had no choice but to abandon the hard-won stone to the desert.

MONS PORPHYRITES & MONS CLAUDIANUS

by Tomas Lipps



above: The fortified settlement at Mons Claudianus and the tents of the international archaeological team during their excavation campaign in 1987. photo: Adam Bülow-Jacobsen.
below: Map (detail) of the Eastern Desert during Roman occupation.



The igneous mountain range

dominating Egypt's Eastern Desert between the Nile River and the Red Sea is the sole source on the planet of a rock known as Imperial Porphyry.

Vessels and animal figurines carved from this porphyry have been dated to the Old Kingdom (2613-2181 BC) and the ruins of an early dynastic building were discovered near its singular source. The ancient Egyptians evidently sought and removed pieces of this porphyry but they did not exploit it to any great extent.

The Romans, however, did exploit it, and on an industrial scale. In the summer of AD18 a Roman 'prospector' named Caius Cominius Leugas came upon this marvelous rock and recorded his discovery and the date thereof on a stele of black porphyry. Before long quarried blocks were on the move overland, south and west to the Nile, then downriver to Alexandria and finally Rome—from the empire's farthest outpost, *Mons (Mount) Porphyrites*, to its very heart.

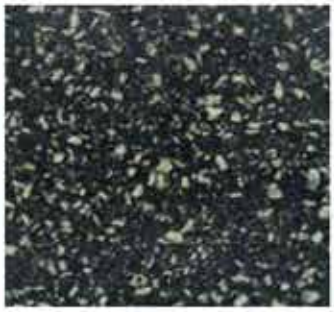
Later, 50 kilometers to the south, a source of tonalite gneiss rock was discovered—the ideal material for the tall columns needed in the monumental architectural structures that were about to be built in Rome—and a quarry was established there, *Mons Claudianus*.

This is the story of those quarries. . .

H10-Gebel Manzal el-Seyl
HCalcareous tuff

H-10 - GebeManzal el-Seyl
Tuffaceous limestone

H12a - Mons Porphyrites
Andesite-dacite porphyry

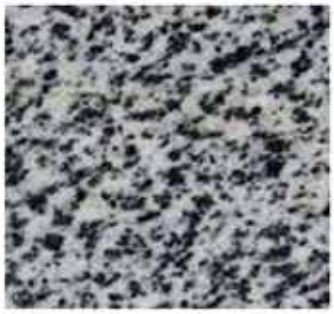


H12a - Mons Porphyry
Andesite-dacite porphyry

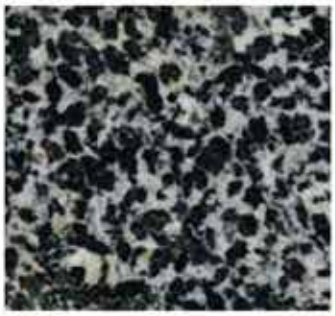
H14 - Wadi Umm Towat
Trachyandesite porphyry

H15 - Wadi Umm Balad
Quartz diorite

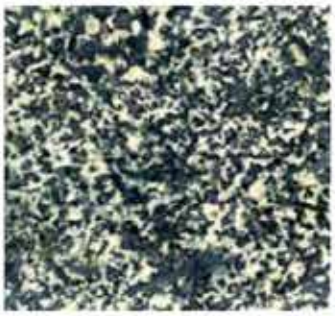
H17 - Wadi Umm Shegilat
Pegmatic diorite



H18 _ Mons Claudianus
Tonalite gneiss



H19 - Wadi Burud
Quartz diorite



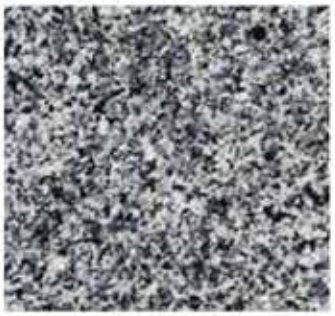
H22 - Wadi Umm Wikala
Metagabbro

H26 - Wadi Umm Esh
Serpentinite

H28a - Wadi Hammamat
Metagraywacke

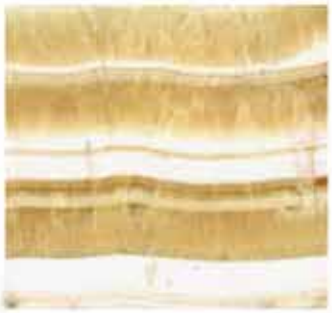
H28a - Wadi Hammamat
Metaconglomerate

H29 - Gebel Umm Naqqat
Pegmatic diorite

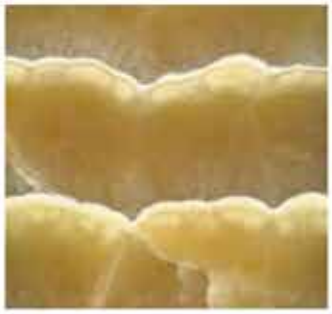


H30 - Wadi Abu Bokari
Granodiorite

H31 - Rod el-Gamra
Dolerite porphyry

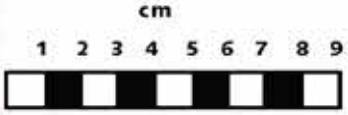


T 2 - Wadi Araba
Travertine



T3 - Wadi Umm Argub
Travertine

08 - gebel Rod el-Baram
Soapstone/steatite



Selected stones from ancient quarries in the Eastern Desert photos by James Harrell, *Ancient Eyptian Quarries*, page 21

WATER. . .

This vital substance was the life blood of *Mons Porphyrites* and *Mons Claudianus* and the many other Roman quarries and mines in the Eastern Desert.

Water was not completely absent in this desert terrain. It existed underground—in certain places. Rainfall was rare, but when it occurred it was captured and stored.

The original 1st century site of the *praesidium*, or fortified quarry settlement at Mons Claudianus was selected for its proximity to several prospective quarry sites.

The nearest water that could be found, though, was a kilometer away. A well was dug there and water carried to the *praesidium* and stored in several mortared cisterns lined with waterproof plaster. Later a new *praesidium* was built near the well and the original one continued to function to exploit the nearby quarries.

The entire Mons Claudianus complex relied on water from four wells: the one next to the newer *praesidium*, two other wells a kilometer away to the north and south and a major well three kilometers away. The wide-spread locations of the wells indicates the scarcity of sources and the difficulty in finding them.

Water in movement, water in reserve. . .

Pack-animals carried water in amphorae and waterskins from where it was found to where it was stored and from there to where it was used—from the wells to the cisterns—from the cisterns along zigzag paths to the dozens of quarry sites and the hundreds of thirsty humans and animals working there—to the tubs used by the blacksmiths to quench the tools they were constantly forging and tempering—to the *praesidium* for domestic use and the vegetable gardens—to the animal lines—to the bath-house of the Roman administrators.

Like blood, water flowed through the body of the quarry complex, sustaining it—but unlike blood, the water did not recirculate, it evaporated.

The numerous way-stations along the roads were built around wells or near wells and held water in reserve for the men and animals in passage and the Roman soldiers that provided security against indigenous marauders.

TRANSPORT AND SUPPLY. . .

Two simple words that, when applied to the quarrying enterprises in these distant desert mountains, involve challenges that can be likened to hypothetical human colonies on the moon or other planets.

The massive rock blocks, once separated from their lithic matrix (an act that was often unsuccessful, as evidence of many failed attempts at wedging shows) had to be manoeuvred from their elevated beds down sometimes precipitous slopes along narrow slipways—an arduous and dangerous feat during which lives were doubtlessly lost.

Evidently much of the stone shaping was done at the quarry face—even entire columns—and finished below, at *wadi* level, near the loading ramps. This, particularly in the case of the columns, makes sense as it would reduce the weight and make them less difficult to move.

The first stage of transport was difficult, especially at Mons Porphyrites where the porphyry was often quarried from very summits of mountains.

In both quarries the descent was managed in the same way—a system that involved closely spaced pairs of dry stone cairns standing opposite each other on either side of the slipways. The purpose of the cairns is a matter of conjecture, so allow me to speculate:

They were not substantial enough to anchor posts or ropes, chains, pulleys or winches, but they must have been used in some way to facilitate and control the downhill progress of large blocks or columns.

Presumably, sledges were used to transport stone from quarry face to *wadi* level (the columns might have required two sledges, one in front, one behind).

A likely scenario is that a large log was laid across the slipway, against the uphill sides of a pair of cairns, behind the descending sledge.

This log could act as a *cleat*. Multiple lines, from the sledge *belayed* around the log (secured by turns around the cleat) could control the rate of descent. Simply wrapping the rope(s) several times around the log and gradually releasing it—as the sledge was pulled from below—would, I think, work.

This way, only one large log would be required—repositioned in stages as the sledge descended (a companion log might be repositioned in advance of the sledge for security, a barrier, if needed, to arrest the momentum of an out-of-control sledge).

The sledge could slide over a succession of smaller logs. As it advanced these would be taken from behind and placed in front of it. These smaller logs, and the larger one, and the ropes belayed around it would have to be constantly lubricated, probably with palm oil (the palm tree was also a source of fibre for rope).

The process I've described is similar to that used at Carrara until modern mechanized equipment altered it—the ropes were belayed around groups of wooden posts, compound 'plugs' driven into stone crevices. This evidently wasn't feasible in the Eastern Desert.

At the quarry face, on the slipways, in the workyards and at the loading ramp, stone pieces were moved using spars or levers and log rollers. Were cranes in operation, gin poles? There is no historical record of them but Bülow-Jacobsen reports seeing large square holes that might have been made for the beams of a crane. Also holes in stones for lewis pins have been recorded.

Pack animals were the preferred means of transport but for moving stone from the quarries to the Nile, wagons were indispensable—and useful for hauling provisions and materiel on the return trips to the quarries.

above: Mons Claudianus. Two unsuccessful attempts at wedging.
below: Mons Claudianus. A whole wall has been squared off with a series of wedgings. photos: Adam Bülow-Jacobsen.

Watch-tower at Wadi Umm Diqal, three kilometers from Mons Claudianus at the site of the largest of the wells supplying it, one still used today.

The first four meters are solid.masonry so it was not a water tower. It is thought to have been built there after quarrying operations had ceased. The well and tower are part of an enclosure that may have been the center of of a monastic community established in the 5th century (there are ruins of hundreds of stone huts in the vicinity.
photo: Egypt Travel Link Tours.

INFRASTRUCTURE

Each fortified *praesidium* had a substantial perimeter wall with watchtowers situated at intervals. These walls, and the towns within them—living quarters and administrative spaces, cisterns, storehouses, shops and workshops, as well as the structures outside the wall but in close proximity, bath-houses, granaries and temples—were all built of stone and some of those structures were plastered. Piles of burnt and unburnt seashells indicate that the lime for plaster and mortar was made there although some must have been imported.

The plan view of the *praesidium* of Mons Claudianus, shown above, is remarkable in that the perimeter wall, similar to the perimeter walls of many of the fortified way-stations is not actually a rectangle, but a parallelogram. The rule of 3-4-5, used by the Egyptians since 3000 BC to establish right angles and well known to Roman carpenters and stonemasons, was, for some reason, not applied here.

Oddly too, the towers that are known to have been at the corners of the perimeter wall as well as flanking the main gate are not shown. See photo on following page.

The many cisterns, sunken and above ground, were built of mortared rubble masonry and were plastered or faced with fired brick.

Adjacent to the walled *praesidium*, and occupying a nearly equal amount of space, were the stables, constructed of stone and mudbrick.

The quarry workings also required stonework, the smithies, the slipways, the numerous cairns along them and the loading ramps were all built with stone.

Other stone-built structures included watch-posts, and towers. "*The whole Claudianus complex is overseen from a series of watch-posts,* skopoloi*, positioned so as to be inter-visible, and functioning as a sort of internal telephone system. In addition there are two larger towers, placed for long-distance communication and early warning of approaching visitors (above).*" [4]

A very large crew, or crews, of stonemasons and smiths must have been kept busy at all times building and rebuilding this extensive hardscape.

The infrastructure included the roads from the quarries to the river and the fortified waystations established at intervals along those roads with their wells and/or cisterns supplied from nearby wells. As each had a garrison of soldiers they functioned as *praesidia* or military bases. The stables and watering troughs often occupied more space than the forts themselves did.

Cairns were built along the roads and, occasionally, signal towers.

The *praesidium* Abu Zawal on the Mons Claudianus road to the river was typical of such waystations; it was rectangular in layout with towers at the corners and on either side of the entrance, nearby stables, a well and/or cistern in the center of the courtyard and small rooms arrayed around it.

It was unusual, though, as it was built on the site of an Old Kingdom gold mine where quartz rocks were broken and crushed for the gold they contained. The quartz tailings served as a foundation for the Roman fort and hundreds of ancient stone hand-mills were built into its walls.

Mud bricks were also used in the construction of some *praesidia*, often above a stone-built lower wall. There are remnants of mud-brick barrel-vaulted roofs at the El Heita waystation, the penultimate one before the end of the road at Qena on the Nile, though these might have been a post-Roman addition.

The Romans were well acquainted with stone arches, vaults and domes. Corbelled domes were widely used throughout the Bronze Age Mediterranean world and the true arch was common knowledge.

[4] *Maxfield, p 166*

ADDENDUM
to the article Mons Porphyrites and Mons Claudianus

There are two important aspects of this enormous industrial enterprise that can be classified as mysteries:

1) How were huge stones, quarried and hewn high in the mountains, brought down to the valley floor and. . .

2) How were the most massive of them (200 tons) then transported overland 120-130 kilometers to the river Nile *(and 3) how they were transferred to water craft, but that is beyond our purview here).*

There is no certainty among the archaeologists and scholars who have investigated these sites about how either of these feats was accomplished.

Regarding the first mystery:

The pairs of dry stone cairns flanking the slipways in both quarries were obviously integral to the process but how they were used is not known.

I theorize that a logs placed against the uphill sides of the pairs of cairns flanking the slipway acted as a horizontal stanchions.

If two or more ropes from a loaded sledge below the stanchion were belayed around it, the friction between the rope and the wood would hold the sledge and its load in stasis and—pulled from below as tension is released from above—its descent could be controlled.

A series of wooden slabs laid across the surface of the slipway and lubricated with oil would allow the runners of the sledge to slide easily over them. The ropes and the stanchion would also need to be lubricated.

To question this theory about cairns I ask: why are there so many cairns and so close together? And why do they occur also on relatively level ground? *(See Ancient QuarryScapes cover photo on page 2.)*

Good question(s). Perhaps the ropes/hawsers made in Egypt of palm fiber were not as good as those in Carrara and stages of descent had to be kept short?

Perhaps the cairns, which could be readily constructed anywhere, were used as counterweights to stabilize stanchions to which pulleys were attached?

Quarries in Carrara on the Italian mainland date back to at least 155 BC so quarrying was going on there and in Egypt's Eastern Desert (and elsewhere) simultaneously.

The Mons Porphyrites quarries ceased production and were abandoned in the 5th century, but in Carrara quarrying continued as it had been done for ages until the advent of modern equipment in the mid-20th century.

A significant difference: in Carrara the stanchions are short, vertical and compound, a grouping of logs or beams wedged tightly together in a socket carved into the rock. In Porphyrites and Claudianus pairs of dry stone cairns were used—why? Perhaps because the distance to be travelled from the quarry face to the loading ramps was considerably longer in the Eastern Desert than at Carrara—also, wood was scarce, and stone was plentiful.

above: At Carrara, a loaded sledge (lizzatura) *being lowered down a steep slope. The men are taking small wooden beams from behind the sledge and placing them in front of it. The beams were smeared with soap to facilitate the passage of the sledge runners.*

below: Men handling the hawsers, wrapping them around the stanchion posts (piri) *and gradually releasing the tension.*

below: A 'socket' carved in a rock outcropping into which the posts, are placed. From this photo it seems that taller posts were placed in the deeper center hole and shorter posts were hammered into place around those to tighten the 'bundle.' Obviously steel cables were employed here.

Regarding the second mystery, transporting the huge weighty columns:

Early tools, the lever and wheel, were employed extensively at these quarries. Levers raised and moved rocks and hewn stones. Wheeled wagons carried all but the heaviest loads from quarry to river.

The roller can be considered to be a wheel, but its ability to turn is affected by the amount of weight it bears and character of the surface beneath it.

If log rollers are placed between the runners of a sledge loaded with one of the immense columns and the track formed by parallel split log rails, it is ready to move.

Once the use of levers and the pulling power of men and animals overcomes the inertia of the sledge and momentum is achieved, it can be maintained by constantly pulling forward (and, as necessary, backwards).

Controlling the rate of movement is critical and by expeditiously removing rollers and rails from behind and carrying them to the front to extend the track forward, the sledge could be moved steadily along the straight, flattened roads that sloped slightly downhill to the river 120 kilometers away.This seems a more feasible mode of transport for the 200 ton columns than the 12-wheeled wagon mentioned on page 39 (which, Bülow-Jacobsen believes, were used for the30 foot long columns).

These are as stated, matters of conjecture and after months of research and speculation this is how I imagine they happened.

What are your thoughts?

ADDENDUM to the ADDENDUM:

I sent drafts of the article to several of my sources for review and comment and have been incorporating their responses.

Then, just yesterday, I heard from archaeological geologist James Harrell. He informed me about something that I had not read elsewhere: that the runners of some sledges at Mons Porphyrites were iron clad. This means they might have been pulled over the stone surfaces of the slipways.

This was a single reference though, a request for more iron as the supply was evidently erratic. Also, there must have been many sledges in operation at the numerous quarry sites at any one time so it seems that sledges with wooden runners sliding over relatively small (lubricated) pieces of wood as was done in Carrara would have been feasible and not dependent on a supply of iron.

Furthermore, he theorized that the cairns acted as bollards and that ropes from the sledges around their bases could have functioned to retard the sledges' descent as needed. No logs required. This would explain why the cairns were more closely spaced where the slipway slopes were steepest.

But most interesting were his thoughts about how the 50-foot columns might have been transported. What if the columns were *not* mounted on sledges pulled over rollers rolling on rails? What if the columns themselves were the rollers!

Oriented perpendicular to the track created by the parallel rails, they could be pulled, broadside, forward. Levers could help initiate movement but ropes wrapped around the ends of the columns would be used to pull, steer and halt the columns' forward progress.

Unlike other columns, those very long ones had wider rims or collars at the ends which Harrell speculates were to keep the ropes in place.

Fortunately the floors of the wadis were quite wide and flat so this could work. And there would be no need to return sledges and rollers to the quarry.

A brilliant theory, however. . .taking rails from behind the column after it passed and bringing them forward to extend the track would be problematic, given that 1) the space between the bottom of the column and the road surface would only be the height of the rails—and 2) that ropes around the ends of the very long columns would stretch fore and aft.

The rails would have to be carried or dragged in a wide path around the ends of the column which would take time and slow the rate of progress.

I've been puzzling over how this might have been done while wondering about the ropes and how they would have been 'attached' to the column.

Simple loops around the ends would involve friction and impede the rotation of the column. I imagine that if the rope from the front went over the top of the column and was belayed once or twice around it, then men and/or animals pulling forward would cause the column to roll ahead.

As the column advanced, however, the rope being pulled forward would lengthen and the end being held behind would shorten. At some point progress would have to be halted (ropes pulled backward and the column blocked with chocks) and the ropes adjusted.

This would be an opportunity to extend the track.

So the column would advance in stages (and the men and/or animals pulling it would have an opportunity to rest).

While I think that James Harrell's broadside rolling column theory and Adam Bülow-Jacobsen's belief that the columns were transported lengthwise on a sledge are equally credible, I am inclined to favor the former.

How about you?