“Highly informative, rigorous and commendable research which is written in a clear and approachable manner for the benefit of the ‘general reader’ … Heralds the need for more scientific research”
Daniel Gilbert, Dundee Africa Research Network
GOLD-MINING LANDSCAPES of NYANGA
Stone-built terraces up to 1900 metres on the steep scarp of Bende Gap in Zimbabwe’s Eastern Highlands of Manicaland, are the legacy of mining gold in a distant past. In the words of Nyanga’s pioneer gold miner Tendai Gungutsva pictured above, “Terrace walls trapped surface gold in runoff from the mountains.” Tendai is amazed that archaeologists see the terracing as fields for grain. “Farmers farm in stream valleys far below. Why would they climb up so high for growing millet?” University of Oxford Museum of Natural History Executive Officer Kevin Walsh found assay results showing gold anomalies in soil samples taken where Tendai was photographed to be “very interesting, and SHOULD be followed up.” His advice reflects the objective of the current research to follow the clues to Nyanga’s gold-mining heritage, the main subject of this publication.

Results of the 3 grab samples of quartz rubble taken from terracing near the gold miner, to which Kevin Walsh refers: 0.18, 0.20 and 0.22 grams per tonne (ppm) Au
GOLD MINING LANDSCAPES of NYANGA

discovering Zimbabwe’s hidden heritage
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The Hidden Heritage of Zimbabwe. Mysterious ruins lie among stone terraces across the hills of Nyanga. This montage capturing 0.2 sq km of York Forest Reserve is typical of mountain landscapes.
For more than a hundred years the landscape of the Nyanga mountains in Zimbabwe’s Manicaland Province has been misinterpreted, its cultural heritage lost to generations of Zimbabweans, and its rightful place in world history put on hold. Its remarkable legacy of hillslope terraces and associated stone ruins named ‘pit structures’ is downgraded to millet fields and cattle pens.

Called ‘intensive farming’ this theory is widely published in school textbooks, tourism literature and academic journals. Educated people keep to the power of written words. The less literate let ancestral walls keep their secrets.

When Carl Peters, the German prospector on an expedition from the Zambezi river to Nyanga in 1899, asked his guides from Katerere who built walls on deserted hills near Nani looking from a distance like a striped zebra, the answer they gave was, “Ghosts have done this.”

When Dr David Randall-MacIvor—who took Great Zimbabwe away from fantasies of Solomon and Sheba into a medieval African past in 1905—saw his first ‘pit structures’, he decided they were fortress dwellings. He was convinced that such masterly constructions in stone were not cattle pens.

The local name for a Nyanga ‘pit structure’ is ninga. A Shona word for ‘cave’ it is used, not for the function of these enigmatic ruins, but for the hide-hole nature of very long tunnels built into them. The tunnels are sloping, dark, narrow and invariably curved. But—pivotal to the farming theory—‘dwarf cattle’ had to make their way through the tunnels into a stone-built ‘pit’.

These dwarf cattle were permanently stall-fed because their “prime purpose” was to produce the manure seen as essential for farming the poor soils of the terraced hills. Although a very few bones excavated on Nyanga’s Mount Muozi in the 1990s were not considered “reliable predictors of height,” a faunal expert of Ditsong Natural History Museum, South Africa, estimated an animal standing 1m high at the shoulder. Therefore headless and hornless to fit through the regular 1.10m height of tunnel entrances into ‘pits’!

This stall-feeding idea is a Eurocentric concept of British archaeologists who, it seems, have never witnessed that cattle need to raise their heads when going down a slope, and that their conformation makes it impossible for them to swivel their bodies round bends inside stone-cased tunnels.

Two works committed to the ‘intensive farming’ hypothesis are listed in Further Reading p 47, under authors R. Soper and J.E.G. Sutton. The former records that horn cores in the small Mt Muozi sample indicate a horn span of 49-54cm—too wide to fit through most tunnels.
Hydraulic engineering in stone defined in topographic mapping by National Museums and Monuments of Zimbabwe. The plan shows the standardized curve in the tunnel (a). The cross-section shows the curve at 54° (a), the narrow uphill entrance (b), the slope of the tunnel (c) built into the freestanding platform (d). The features in the plan and cross-section are standard in all Nyanga’s remarkable constructions called ‘pit-structures’.

Diagram permission, chief curator Kundishora Chipunza & mapper Justin Magadzike

The cross-section above mapped by National Museums and Monuments of Zimbabwe in 2013 is the very first published in over 100 years of archaeological research in Nyanga. Its measurements prove that entry or exit of ‘dwarf cattle’ is impossible.
TUNNEL VISION

The idea that cattle entered a pen from uphill is foreign to cattle management in Africa. Gates for cattle are always made downhill to reduce risk of footrot by water-logging. Unlike a traditional danga or cattle kraal, water was brought into the tunnels by stone-built water channels tapping distant springs or streams, or by seasonal hilltop runoff—subject of the experiment on the left.

The uphill entrance of the tunnel pictured at b is only 44cm high from its lintel to its paving on which the bag c lies. Cows—or calves—cannot be found small enough to test the Eurocentric theory that cattle were herded in and out of very narrow dark tunnels. Every goat refuses entry, and no dog will follow its owner into a ‘pit structure’ tunnel.

SLURRY AND SYMBOLISM

In 2005 Dr Temple Grandin, professor of animal science at Colorado State University, revealed the bovine fear of walking into pitch-black space, or anywhere that is temporarily blinding. Her trailblazing research has introduced humane methods of slaughter to the international beef burger industry.

The British archaeologists’ conjecture that cattle were permanently stall-fed in the Nyanga ruins they name ‘pit structures’ is not only because they admit that the poor soils of the terraced hills would have to be enriched to enable cultivation. They also need an explanation for the invariable incorporation of the drain detailed on the topographic plan on page 8.

Cattle dung is their answer. Constantly lifted out of the ‘pits’ and taken to the terraces, dung was also mixed into a slurry with runoff in the rainy season,
or with water brought across the hills by skilfully-graded stone-built conduits. This slurry was flushed through the drains as liquid manure. “Something like a sewage farm”—an enterprise unknown throughout precolonial Africa!

It is assumed that some of the dung and/or the slurry fertilized ‘homestead gardens’ contained between two radial walls built upslope from tunnel entrances. These are the low walls Carl Peters described as “two wings, so as to catch the water that might run down in great quantities, and lead it into the pit.” Dung centuries old can be identified archaeologically, but not a trace has been excavated in any ‘pit structure’, ‘homestead garden’, or terraced ‘field’.

Because long-term settlement does not exhibit in dung, rubbish dumps or burials, and because many large grindstones are found on them, it is the platforms encasing the ‘pits’, tunnels and drains which are nominated ‘homesteads’. The features marked ‘circular structures’ on the platform of the plan by National Museums and Monuments on page 8 are present in varying numbers on every platform. They are seen as the ‘houses’ of these ‘homesteads’.

Enough post holes to define house construction have not been found in platform excavations. Finds of a few lumps of clay with impressions of thin sticks do not suggest the robust style of huts built on top of the atypically large platform of the Restored Pit Structure in Nyanga National Park. It is promoted widely as a model for schoolchildren, visitors and tourists, but the rafters and wall frames of the huts are not built of indigenous wood. They are made from wattle poles—the tall tree introduced to Nyanga from Australia in 1902!

Thatched ‘grain-bins’ accompany the ‘houses’ in the National Park restoration. They are modelled on the farming-theory idea of a “plastered wicker-work bin up to two meters in diameter and of unknown height”. The diameter is known from a stone substructure. The height is unknown because “much charcoal” is presumed to be “from the burning of the roof”. Unknown height of the superstructures commits every ‘grain bin’ to incineration—presumably in bush fires—but it doesn’t explain the charcoal.

National Museums’ chief curator Kundishora Chipunza points out that wickerwork and thatch burn to ashes, not charcoal. Furthermore, not a single carbonised seed of grain has been found in the plaster-like substance on the stone plinths and slabs presumed to have supported the burnt-out ‘grain bins’.

Invariably positioned in the largest circular structure on platforms is the slot shown in the plan and cross-section on page 8. It is skilfully engineered through the tunnel, but is known to academia as merely a hole for holding sticks. These would rattle an alarm—warning the head of the family asleep in the largest ‘house’ of escaping dwarf cattle, or of attempted theft.

Stranger than this fiction is the “strong symbolism” that has been injected into the farming theory to explain why massive platforms were constructed to

Archaeologist R. Soper, in a letter published in 2005 by author of The Phantom Voyagers, Robert Dick-Read, admits, “A pregnant cow may have found the width a tight squeeze … am convinced they have a strong symbolic significance … wombs and fertility spring to mind”
permit cattle to enter and exit “through a restricted passage of significant length”. No explanation of the function of the ‘pits’ was given to the British ‘intensive farming’ theorists—“even by elderly men”—so they explain away this “massive investment of labour” as “indulging in expensive symbolism”!

As for the terraces, there is no collective memory that crops were grown on steep scarps and stony hillslopes in Nyanga. In his examination of the region the botanist Dr H. Wild found none of the weed species he expected to see from ‘fields’ assumed abandoned in the decade before colonial occupation.

AGAINST THE GRAIN
Terracing occurs intermittently across 7000 sq km, estimated from aerial photography of the 1960s. It touches on extents of today’s grain estates of the Lowveld and suggests population explosions. But “long occupation” has been rejected by archaeologists because “there is little to indicate” on “inhabited” platforms that “homestead occupation extended beyond a single generation.”

Significantly no grain is cultivated in present-day Nyanga apart from family subsistence plots, mainly for modern maize. Only exotic pines, wattle and fir for sawmills, orchards of foreign fruit and latterly introduced potatoes are grown with success. There have been no due-diligence tests for growing grain on the terraces in Nyanga. Experiments undertaken in the 2006 season in the research area of Sanyatwe are the first trials with and without cattle manure.

**FLAWS IN THE FARMING THEORY**

Top left: the pilot trial of munga (bulrush millet) by Agnes Samanyanga produced more chaff than seed at maturity. Top right: Leached stony soil on the steep terraces prevented rapoko from reaching an expected height when manured. Inset: farmer Tendai Mateta tries to find mature rapoko heads with typical ‘finger’ curl. Below left: terraces downslope, no improvement...
Soon after shoots appeared buck grazed the *rapoko* (finger millet) and hare the *munga* (bullrush millet)—animal degradation which revealed that the vast terraced areas would have to be fenced, a formidable task in past ages.

Although it is the British archaeologists’ “main grain staple”, sorghum was not trialled in accord with the universal view, shared by Dr Wild for Nyanga, that it does not do well in conditions of high rainfall. Significantly only one seed of sorghum was found in each of two 1990s’ archaeological excavations 60 km apart. Together with two instances of unquantified “specimens” recorded in 1958, this total cannot be representative of ‘intensive farming’.

MINUTE ROOTS IN MONUMENTAL BEDS

A third landscape feature—estimated to equal the extent of terracing when it was revealed by the 1960s’ aerial photography—is networks of cross-contour ridges. Commonly 2–4m wide and 30–70cm high, they run for several hundred metres down gentle slopes to streams. ‘Intensive farming’ theorists see them as beds for the root crop *tsenza*, a marginal crop as small as a radish.

*Tzenza* is grown, always alone, on short and narrow raised beds for eating raw, or to be cooked and mashed into porridge. It was introduced as “an imaginary crop” for the massive cross-contour ridges—clearly visible today in Google Earth—by one of the two British originators of the ‘intensive farming’ theory thirty years ago. It is now perpetuated as fact by the other.

Field walking confirms that nothing is planted on these ridges today.

**Locally called mihomba** cross-contour ridges and furrows photographed after a bush fire in Sanyatwe. *Inset:* common in these land modifications is the presence of much quartz rubble

LAST WORD

Linguistics prove conclusively that manuring and stall-feeding were not known in Zimbabwe before colonial times. In Shona, *manyowa*, *fetiraiza*, and *hei* for fodder, are words borrowed from the English language.
There is no word in the Shona language for gold. The Arabic *ndarama* is used or *goride* is borrowed from English. The latter tells of white prospectors seeking ‘ancient workings’ in return for a blanket in the late 1800s. Called blanket prospecting it was the single method of exploration leading to the development of nearly all modern gold mines in the celebrated gold-hosting ‘green-stone’ belts of Zimbabwe’s central plateau.

Many early colonial miners praised the skill of their unknown predecessors—“the work was as good as any we can do with all our modern appliances.”

The loan word *ndarama* comes from the much older historic connection of Zimbabwe with traders of Islam. Dating back to the 8th century, one of the earliest records tells of a boat which took refuge from a storm in the port of Sofala. Here, not far south of Beira, the seamen heard about gold brought from the interior to trade for cloth and beads shipped to the Indian Ocean coast.

In the 10th century the historian al-Masudi wrote about the abundance of gold in Sofala. Four centuries later the celebrated world traveller Ibn Battuta heard that the gold dust that was brought to Sofala came from a place a month’s journey inland “where white men would be killed before they got there.” By 1504 the Portuguese had invaded this land to wrest from Arab-Swahili control the goldfield they thought was the Ophir of the biblical king Solomon—with plenty of nuggets on the ground and even in the trees.

Ten years later they built a fort at Sofala as an entry point for the interior, but they soon discovered the much-vaunted mining was “a poor and miserable business.” The small quantities of gold they acquired in return for cloth didn’t support settlements or keep their forts of Sofala, Tete and Sena in repair.

United action by the Changamire and Mutapa dynasties expelled the Portu-
guese in the last decades of the 17th century. It appears the invaders were aware of their accountability in hastening the end of the once-flourishing gold trade. In 1667 a report to their viceroy in Goa blamed “bad conduct” and “violence” which so decimated populations that they fled to other lands.

In 1857 a list of ‘Mines Known in the District of Senna’ by a trader called Izidoro Correia Pereira was published in Lisbon in response to a royal decree calling for an inventory of all mineral resources south of the Zambezi. It reveals gold, copper and iron mines controlled by eight Shona mining dynasties which Pereira named ‘localities’ (A–H, top map on opposite page).

The dynastic rulers of these localities were the traders and the treasurers. Prospectors and miners are listed separately as ‘discoverers’ and ‘workers’ with, in many cases, names of today’s dynastic clans—like Hwata, Makoni, Svosve. The date given for Portuguese knowledge of all the mining localities is 1500 so it seems that, through the time of their occupation, the chiefs were as much in control of the mines as they were when trading with the Arabs.

**MINES OF THE MANYIKA**

Unlike the separate clans of prospectors and miners listed by Pereira for the other seven mining dynasties, those for the Manyika are all billed under the praise name Samaita. Nearest to Sena at 150 leagues, its 21 gold localities covering 340 sq leagues is seven times the number of the Mbire, the next largest mining dynasty with three goldfields totalling 282 sq leagues.

Three of Pereira’s gold localities carry the names of the Manyika houses of Mandeya, Muponda, and Nyakasapa. More can be traced in old family names easily identified among those numbered 1-21 on the list opposite. At the northern and southern limits of an extensive landscape, today’s place names of Makosa in the Makaha gold belt, and Zuira in Mozambique below the Penhalonga gold belt, closely match Mukaza and Ziuire, numbers 4 and 10 of the 21 gold mining regions of the Manyika identified by Pereira.

Between the two gold belts are the artificially terraced mountains of Nyanga where names for most of Pereira’s extensive list of Manyika gold mines are rooted in the landscape. But the geological formations of this landscape are not the internationally acclaimed auriferous greenstones of the central plateau.

In his geological bulletin of 1978 for Nyanga Dr V.R. Stocklmayer records little of economic importance. In his 1980 bulletin for Makaha he stresses by italics a gold rush to “ancient gold workings in granite terrain” in 1934—a surprise departure from the greenstone gold belts.

Stocklmayer reports that almost every modern mine in Makaha was pegged on precolonial workings. Further south he sees Nyanga’s stone-built terracing on “almost every hillslope” as “the Granary of Central Africa”. Here, eight
Early Shona mineral exploitation based on Pereira’s list of mining localities between the Zambezi and Limpopo rivers dated from 1500.

Top: map of Zimbabwe showing the greenstone belts, and eight Shona mining dynasties active after 1500, from a Portuguese record of 1897. Left: research area rectangle on a map reproduced from a colour plate in Location of Zimbabwe’s 16th-century mines (see Further Reading).

Above: a quartz heap like the hundreds seen by Peters on his march to Nyanga via Makaha and Nani in 1899: “artificially filled with débris of quartz … if they had no connection with mining, what then could their meaning be?” Peters had two heaps opened and found “the quartz at the bottom had been subjected to great heat to prepare the quartz for crushing.”
decades previously on field observation, Carl Peters identified long-forgotten gold mining. Laboratory results prove that Peters is correct.

TRAPPING GOLD

The Peters’ 1899 expedition was struck by the amount of quartz debris and the numerous heaps of quartz on their road from Katerere via Makaha and Nani to Nyanga. The previous year the mining engineer Telford Edwards reported “ancient terraces” which “owed their existence unmistakably to washing the ground for alluvial gold. Large quantities of quartz débris are everywhere.”

Few visitors to Nyanga see tightly terraced slopes like those of Bende Gap pictured below. Fewer still walk on the terraces, notice the quartz rubble and poor vegetation. On the picture below, the rock on which Tendai Gungutsva sits in the frontispiece is circled. From here, looking up at the highest terraces, he said no one climbs up there to plant millet. There has to be a goal.

In the past the goal was gold. In 1912 a South African mining engineer, F. Fripp, sampling behind long ridges of stones that he found below abandoned mine workings in the central plateau saw colours of gold in his pan. It suggested to him that these precolonial stone lines acted as “riffles for catching shed gold after rain.”

Nyanga’s terracing is on a much more massive scale. Tendai Gungutsva believes it trapped gold in runoff on the mountains for his ancestors—just like riffled fabrics catch gold on sluices for him today.

Fripp’s ‘shed gold’ of the early 20th century is called ‘placer gold’ today. Placer
GOLD MINING LANDSCAPES OF NYANGA

Gold is the secondary enrichment that forms on hillslopes by weathering of a primary source. Nyanga terracing at documented limits of 1300m and 1900m above sea level occurs within likely levels for placer deposits. At about asl 1530m primary sources of gold were discovered underneath the terraces that circle a hill called Nyadenje.

Like thousands of Zimbabweans surviving economic hardship in the late 1990s, Tendai and his brother Samuel illicitly panned a river which flowed from this hill. One day, with no formal training in geology, they followed a hunch that the tails of gold in their traditional wooden pans came from Nyadenje itself. Sampling uphill, they found quartz “contaminated with gold”.

THE GEOGENESIS OF GOLD

Because gold is a very heavy metal, it migrates from the placer deposits into the streams and rivers below. Nyanga’s illegal panners bear living testimony to the presence of ‘fluvial’ gold at the lowest elevation in the three-tier geological profile of its geogenesis.

Easy surface mining of the secondary enrichment was the target in Nyanga’s ancestral times. Stone-built terracing identifies the trapping of placer gold. But there was no technology to find the primary ore bodies hidden below.

Developing a gold mine today is very expensive. Apart from capital investment for equipment, costs in 2015 included registration $1500, environmental certificate $3000–10 000, licensing from the local Rural District Council $200–1000. In spite of the financial burden, a block of ten claims was registered as the Gungutsva Mine in 2005.

It has been a difficult road for Tendai and his team, on their own with no capital investment. He has great respect for the former miners—not least their erosion control on his steep hill. Although he is an untutored artisanal small-scale miner his shafts sunk through the terraces are carefully lagged with exotic gum poles. Future mining of bedrock gold by much deeper shafts will not destroy archaeology on other hills.

‘Lagging’ is strips of wood covering the walls of shafts. It should precede pit props in the Artisanal and Small-scale Mining now operating on terraced Nyanga hills: blasting licences are required before driving underground. But ASM mines are seldom monitored in Zimbabwe
Because its rock formations are not the world-renowned greenstones of the central plateau, commercial exploration will be slow to start in Nyanga. Ministry of Mines’ senior geologist Forbes Mugumbate welcomes results of the new research for exposing the need to re-evaluate Nyanga’s mineral potential “that has been largely overlooked.” In the souvenir magazine for the centenary celebrations of his ministry’s Geological Survey Department in 2010, among non-traditional exploration targets for a country that he maintains is seriously “under-explored despite generations of mining activities,” he introduced a new topic. The prospect of gold in granitoid terrains.

In the early months of the author’s research a simple exercise discovered the association of terracing with granitoid formations. ‘Ancient Terracing’ is marked on the Surveyor-general’s 1:50 000 topographical maps for Nyanga. This information transposed on a Google Earth image and superimposed with information on types of rock from the maps in Stocklmayers’ geological bulletins 1978 and 1980, reveals that granitoids are the dominant formation of terraced terrain.

The early miners stole a march on science by exploiting the surface gold in hills of altered granite formations like tonalites, leucocratic granodiorites, and adamellites.

Unlike the central plateau, outcrops are rare. It will take remote-sensing surveys to detect the ore bodies—at exorbitant cost.

A GLIMPSE OF COINS

Apart from their skill in stone-engineering revealed in the expert construction of hundreds of so-called ‘pit structures’ associated with terracing, the early miners left few signs of themselves.

Broken pieces of pot are thick, coarse and functional, with little or no decoration. A few beads and some rusting pieces of iron might or might not be connected with them. Some arrowheads, smelting furnaces, and blowpipes of...
styles similar to those in other regions of Zimbabwe appear to be of a comparatively late date.

Curiously, in 1896, a Roman silver coin of 138–161 AD was found 24m down in a precolonial shaft at Odzi in the Penhalonga gold belt. Between 1929 and 1957 a Roman silver coin of 244–249 AD was found in the Makaha gold belt, a copper coin of 130–150 AD in an unspecified location of Nyanga, Manicaland, and a Roman bronze coin of 268–270 AD in the Bindura gold belt of adjacent northern Mashonaland.

Provenance for these finds is poor, but the time scale becomes interesting when they are added to six copper coins that were handed to Carl Peters in 1899 by the chief-of-police at Mutare, who told him that they all came from Nyanga. Two years later the London Numismatic Society dated these coins from BC 180 to 215 AD. They include three rulers of Indo-Greek kingdom states—Alexander the Great’s generals who were his successors in Asia.

The centuries of BC 180–270 AD for all ten coins coincide with exhaustion of immense riches from Roman mining in Spain before a sudden increase for the Empire between 300 and 350 AD. Nothing is known of new mining areas. Do the Zimbabwe coins hide prospecting and exploitation by adventurers?

ROMAN EXPLORATION

In the first century of the first millennium Marnious al-Soury, the Arab master scientist known as Marinus the Tyrian who lived from 70 to 130 AD, reported a four-month expedition of 3620 miles under his contemporary the Roman general Julius Maternus to a country called Agisymba in Libya—their name for our continent of Africa. It had many rhinoceroses, elephants, and mountains, and was 24 degrees south of the equator. Allowing for a 5-degree discrepancy of the time, this latitude coincides with the gold belts of Zimbabwe.

The better-known Greek master geographer called Claudius Ptolemy paid professional tribute to his predecessor Marinus and relied heavily on his calculations of latitude and longitude. But he reduced the distance to Agisymba by 20 per cent on grounds of exaggeration. In spite of this, al-Soury’s work went into three editions and became a bestseller. Tragically it is lost to us, but when the Arab historian al-Masudi saw a copy, he rated it better than Ptolemy’s famous Geographia, with more detail and better maps.

The distance of the Maternus march, setting off from one of the Roman’s possessions on the North African Mediterranean coast would have been measured in Roman miles, which are only a little longer than ours. It makes ‘Bulawayo to Cairo 3,500 miles’ proclaimed on the facade of a colonial-style building in the Matabeleland city, a strange coincidence.

All the ten finds of early coins pre-date the sudden increase in Roman gold
of 300–350 AD. The Maternus expedition was somewhere between 107 and 115 AD. What was their goal in the far south? Certainly not big-game spotting. Maternus is believed to have been a merchant as well as a general. Was he spying out exploitable realms of gold? After walking Nyanga terracing for ten days to study its archaeology in September 2014, Dr Martin Strassburger, a German mining archaeologist, wrote in his field report, “All in all the similarities to Roman gold mining in Spain and Portugal are striking.”

With its 200 years of operation very many centuries later than the extensive Egyptian gold mining of Nubia, the dramatic mining of Las Médulas begun in the 1st century AD in northern Spain was the largest gold exploitation in the Roman Empire. At around the same time the large Hutti goldfields were exploited by unknown miners in southern India. All three international gold belts were developed independently by comparable techniques.

Principles for extracting and recovering gold are precise and predictable. The solutions of the Nyanga miners described in the following pages can be recognized in methods employed across the globe in every era.

ENIGMA OF THE NINGA

Nyanga is one of the world’s few regions where the work-in-progress of gold recovery can be found intact at the deserted ruins locally known as ninga. It follows the sequence recorded by Roman historian Pliny the Elder, a contemporary of Marinus. His mantra below connects with the quartz which surprised Telford Edwards and Carl Peters in the field in the late 1890s.

“When they have dug out the ore, they crush it and wash it and burn it and reduce it to powder.”

Pliny’s sequence titles the next four chapters. Quartz is Pliny’s ‘it’ factor. It is the clue to Nyanga’s lost heritage but, apart from stone tools and ‘white stones’ of a caption, British archaeologists do not mention it in their research.
“Gold weathered out of host rocks and transported and deposited elsewhere” is the definition of placer deposits by Professor Bruce Cairncross, chairman of the geology department at the Rand Afrikaans University, Johannesburg.

“There are indications that the soil layers except for the lowest ones in most terraces, have been transported and deposited,” is the conclusion about the soils of Nyanga terraces made by K. Verbeek, Department of Soil Science and Agricultural Engineering, University of Zimbabwe. In 2002 she published her recommendation for a mineralogical study to clarify this geomorphological issue which is at odds with a concept of ‘intensive farming’.

Also anomalous for farming is the very high coarse sand fraction in the tested soil which she says, “contains mainly quartz”. No follow up has been made to examine the inconsistencies noted by this experienced soil scientist—which she annotates with comments like “very difficult to explain,” “inconsistent,” and “normally the opposite trend is expected”.

QUARTZ IS THE KEY

Stone troughs built to hold quartz rubble are constant features of the landscapes of artificial terracing in the mountains of Nyanga.

No farmer collects white stones. These are the ore stockpiles of precolonial miners. Two more are pictured on pages 34 and 37.

Quartz is piled in closely spaced heaps in the field, and quartz rubble is widespread. Why have the archaeologists ignored such vital evidence?

Quartz rubble and quartz stockpiles on the terraced hills are signs of placer mining that signify areas for exploration. Visible in immeasurable volumes, this geological clue is allocated by ‘intensive farming’ theorists to the practice of “clearing the fields” for planting.
Assays averaging 0.45 g/t Au from 14 grinding sites across 25km is industrial evidence. In addition quartz rubble and stockpiles associated with the hillslope terracing are valuable clues to surface extraction of placer deposits.

In 1957 Dr A.M. MacGregor, a director of the Geological Survey Department, recorded “ancient terraces” at the Ivanhoe gold claims in Makaha where “the stony surface resembles a rubble left by the removal of soil and sub-soil.” He presumed that climatic change was the cause—“permitting the underlying soil to be washed away by rain.” Inadvertently, his two sentences describe placer mining and surface runoff.

In 1969, Dr Roger Summers, then curator of National Museums, includes two references to terracing in his book *Ancient Mining in Rhodesia*, the definitive record of the precolonial mines of the central plateau. His first instance of ‘ancient terracing’ is at the Ivanhoe gold claims, Makaha. Far from the central plateau, his subject for the book, it is north of the terraced terrain of Nyanga—which was not known as gold country in the 1960s.

His second reference is to “Terracing and walling beside ancient workings” on Laing’s farm in the Belingwe gold belt not a great distance from Great
Zimbabwe Ruins. Terracing is so rare across the whole extent of the central plateau that its location here with precolonial workings is noteworthy. Laing’s Syndicate reported that “Most of the surface rock had been removed by the ancients ... very rich rock.” Being a sign of placer mining, precolonial removal of the surface rock “beside” Nyanga-type terracing is significant. It is also possible that the Laing claims pegged in 1894 is the place where, 18 years later, Fripp panned along “ridges of stones, six to twelve inches in height and running often for several yards in horizontal lines along the slope.”

*Ancient Mining in Rhodesia* holds another clue for Nyanga in its reproduction of the sketch plan of the Ivanhoe claims from MacGregor’s geological bulletin of 1935. Approximately 200m west of its identification, “Ancient terracing”, is that of “A/WS”. It stands for 35 Ancient Workings that are “open stipes covering 2,000 ft”—nearly 700m of work to “remove the reefs bodily.”

There are indications of a few shafts sunk on reefs in Nyanga’s terraced hills. Round, and small in diameter, they are similar to the shafts that peppered the greenstone belts of the central plateau before they were obliterated by modern development—completely unlike the very large square shafts of Hotti or Pliny’s ‘ruined mountains’ of Las Médulas. But in the diagrams of ‘open
stopes’ published by Summers there is a new subject for Nyanga research.

REVEALING OPEN STOPES

Among Mines Department records and recollections of miners and prospectors that “378 workings contained 1035 stopes of various sizes”, Summers publishes 233 sketches of open stopes made at 13 modern mines before they were destroyed in development. They all have elliptical heads that are comparable to the numerous ‘gullies’ of Nyanga designated ‘sink holes’. Quartz fragments from 11 gully walls across 22km assayed gold at 0.03–0.36 grams a tonne. Averaging 0.17 g/t, this is direct evidence of a different explanation.

In his book, Inyanga, majoring on his early 1950s’ studies at Ziwa National Monument, Summers records that erosion for the “extensive gullying” evident during occupation “is not now active”. His suggestion of very heavy rains at the occupation period is refuted by Dr Wild because it would “prevent the growing of most of the traditional local grains.” These gullies have elliptical heads like the diagrams of the open stopes in Ancient Mining of Rhodesia. It is an unlikely profile to have been created by erosion, wetter seasons or not.

In June 2011 correspondence was started with UK early mining expert David Cranstone, with the field observation that heads of this recurrent type of gully in Nyanga are invariably elliptical. Immediately Cranstone replied:

“your elliptical-headed gullies have similarities to our hushing features (often mistaken for natural erosion gullies in the past) … this is very interesting! It does seem to me you may well have a hushing landscape, with ‘furrows’ feeding the hush-gullies … we have no idea if the Romans invented it or adopted it from earlier practice … or how widespread in the ancient world.”

This brought a new angle to the research. Cranstone defines ‘hush’ as “a
linear gully or cleft, excavated at least in part by artificially-controlled torrents of water, for the purpose of locating, exposing, or exploiting a mineral vein.”

‘Furrow’ is a term Summers uses for an artificial water-course. Some, stone-lined, are marked on the Surveyor-general’s 1:50000 maps. But features like the two arrowed on page 24 and shown as black lines in the diagram on this page are monumental earthen banks. Many are in the national park—expertly graded for up to 2 km from their sources. Invariably field walking reveals the proximity of large gullies with elliptical heads that do not look like open cuts and are very dubious as ‘sink holes’. Were these water channels designed for creating ‘hush-gullies’?

Emailed the picture of the two large elliptical-headed gullies taken in Nyanga National Park (far left on opposite page) Cranstone replied:

“If the picture was in Britain, I would immediately think ‘hush’—though I would then look for a dam and/or leat to its head before I was certain … But I would now take the possibility very seriously!”

Left: gullies and ‘furrows’ in Nyanga National Park

A and B are the gullies in the foothills of Zimbabwe’s highest mountain, Nyangani, pictured on page 24, where D is the arrowed channel and channel C remains hidden. These water channels are huge earthen banks with stone foundations occasionally revealed. Note the similarity of the two channels 8km apart that are arrowed on page 24. The gully of the centre picture is near the Nyangombe river source (off top right of the sketch map on this page). Inset: it is unrealistic to assign these water channels for irrigating the national park’s stone terraces walked by Gift: average annual rainfall for the national park taken by Nyanga Research Station over 53 years is 1156mm linear gully or cleft, excavated at least in part by artificially-controlled torrents of water, for the purpose of locating, exposing, or exploiting a mineral vein.”

Soper records “massive erosion gullies” along the “skilfully graded” and “massive earthen banks” of Nyanga National Park (sketched above). He is describing ‘hush-gullies’ created by ‘torrents of water’ released from ‘leats’ to expose mineral veins.
The Oxford Dictionary definition of ‘leat’ is “an open water course to conduct water for mills, mining works, etc.” The mysterious long-distance earthen banks of Nyanga named ‘furrows’ can be seen from space. Are they leats?

There is circumstantial evidence to suggest that the early miners enlisted the power of water to assist them in the manner introduced by Cranstone, based on his experience of Roman gold mining in Britain. In the mid-1930s two new gullies were created in Nyanga National Park when two ‘furrows’ suddenly burst their banks on separate occasions—three decades after Peters had registered 80 gold claims on what was Cecil Rhodes’s farm. Figuratively speaking, did this echo the function of Cranstone’s leats that created ‘hush-gullies’ by torrents of water to locate, expose, or exploit mineral veins in a distant past?

STREAMING OF THE PRECIOUS METAL

Grab samples taken from the gullies pictured top left and bottom right on page 23 assayed 0.15 and 0.36 g/t respectively. The results represent residues of past extraction. Included in the total of 11 results given on page 24, they identify these landscape features as open cuts of past gold mining, not ‘hush-gullies’. There are no leats for water power: they are manually executed.

In visual terms, ‘5 g/t Au’ means extraction of the weight of a gold wedding band from a tonne of ore. Hard labour. But, like the hydraulic hushing revealed in the association of water channels and elliptically-headed gullies in the national park, there is also evidence of the harnessing of water in stream valleys across a much greater extent of the region. Called ‘streaming’, lighter silts and sands of waste were washed away from the heavy gold ores.

Extensive streamworking in Nyanga recognized in Google Earth images by French mining archaeologist Dr Béatrice Cauuet is part of a full programme mounted by University of Toulouse. Where primordial tree ferns parade

Dr Béatrice Cauuet is renowned across Europe in the scientific discipline of mining archaeology. She saw the p8 mapping of the Nyanga tank by NMMZ displayed at a 2016 archaeological conference at University of Toulouse. She is applying for funding for Nyanga research
Gold streamworking seen from space. Top: Google Earth image of landscape features called mihomba (see page 12). Centre: blow up of the pattern of parallel linear banks characteristic of the streaming of a heavy metal—in this case gold. The lighter sands and silts were separated downstream from the heavier ore which was banked up to form the ridges.

New research in Australia suggests that the ancient Cornish technology of tin streaming was transferred for their modern gold rush.* In Cornwall 300 previously unrecorded tin-streaming sites have been revealed by Google Earth. The Google Earth image titled ‘Gold streamwork’, opposite, is from Dr Béatrice Cauuet, senior mining archaeologist of University of Toulouse, researching in Nyanga from 2017.

Below: walls of a ruined ninda, one of four off left of mihomba, bottom right

among unexplored ruins, and indelible footprints of gold mining tread a forgotten past, groundtruthing from field walking is pivotal.

Missed by previous researchers is the footprint of quartz. Its profusion in the national park landscape pictured opposite was dismissed in a Prehistory Society of Zimbabwe journal with the euphemism “relatively gravelly”. The world’s best-known host for gold, Pliny’s ‘it’ factor, quartz called for specialised treatments well known to the early miners.

* Susan Lawrence and Peter Davies, 2015. *Cornish tin-streams and the Australian gold rush: technology transfer in alluvial mining.* www.academia.com
“They crush it …

The first requirement in mining mineralized quartz is to liberate the gold by crushing—with ball mills and stamp batteries today, by hammering stone upon stone in pre-mechanical times. There are many rock outcrops in Nyanga with their surface worn into hollows by attrition, and which are scattered with flakes and flecks of quartz. Values of gold assayed in grab samples from the perimeters of these rock outcrops define them as sites where manual crushing liberated the precious metal from the quartz host rock, called the gangue.

It is surprising how many people are unaware of this technology, called ore dressing. A report sent to Dr Summers of an excavation for the Historical Monuments Commission of Rhodesia by the author, assisted him to recognize outcrops marked with hollows as ore-milling sites—as he acknowledged:

“As a result of the crushing both the fixed stone and the moving one would show the wear which you have described. Although I was sceptical at first I am now convinced that this is a discovery of considerable importance in determining the methods used in extracting gold in pre-European times.”

Summers’ letter included a request to get “good photographs” suggesting “the use of rocking stone in a primitive crushing mill”, which he called a mullocker. In Ancient Mining in Rhodesia he referred to it as a method used in India, and had a sketch by Thomas Baines of the process copied for the cover.

In fact the sketch depicts a technique of around 1870 devised by William Pigg at the Eersteling gold mine in South Africa where, Baines explains, a 500-kg boulder resting on “a hollow in a flat rock outcrop” was rocked to and fro by “Bantu labourers” riding see-

Mount Ziwa overshadows an ore-milling site.
Tendai Gungutsva points out ‘ziwa’ is ‘knowledge’.
“What does the sacred mountain know of crushing? Who was the big syndicate working here?”
saw on a tree “bolted across the top”, “while it was fed with small pieces of quartz” by white miners.

In Zimbabwe there is no sign of ‘mullocking’ as a pre-mechanical technology and therefore no photographs. But Summers deduced that because no boulders for rocking “have been found in situ,” either “natural forces or human prudence are likely to have removed the ‘mullockers’ from the grinding sites and today’s archaeologist is deprived of direct evidence” (!)

PRE-MECHANICAL MILLING

Although the spectacular Nyahokwe milling site pictured below on a hill that is almost as high as Mount Ziwa is only about 7 km from his major work at the ‘Van Niekerk Ruins’, now Ziwa National Monument, Summers doesn’t photograph or mention it in his book *Inyanga*. If he had, with Nyanga not known as gold country at the time, he would undoubtedly have explained it in the popular view of bands of wives grinding grain in a polygamous society.

The assay results in the caption above tell a different story. Tendai Gungutsva sees ancestral mining syndicates working here, and he knows all about crushing with stone upon stone. While he waits for funding to be able to mechanize, the ancient method of ore dressing is used on his mine.
On the right, the late Samuel Gungutsva up-grades crushing by stone with a steel hammer. After the crushing is panning. In the picture below UZ metallurgical engineer Mainford Toga and UZ mining engineer Laurence Madziwa estimate a tail of gold panned by Samuel in a drum of water on Nyanga’s Nyadenje hill.

Until a recent rise in the water table flooded one of the shafts and it was converted to a well by Tendai, water had to be carried up the hill to fill their 100-litre drum.

**UNDER TERRACE WALLS**

The Gungutsva Mine is founded on stockworks of narrow but rich quartz veins that underlie the terraces on Nyadenje hill. On the next hill east of Nyadenje is the

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**Key roles in the research** were taken by Tendai and Samuel Gungutsva and Laurence Madziwa, but Mainford Toga and the two men behind the panning drum, Robson Bhovhenzi and Tendai Mateta, were instrumental at the outset: Mainford, metallurgist and mentor, Bhovhenzi, rural guide and interpreter, and Mateta, farmer of the due-diligence crop trials pictured on page 11.

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First release of pictures of pioneer Gungutsva gold mine in Nyanga South. No hardhats or boots: safety and professional expertise take second place to enterprise and development. In 2017 the record rains flooded shafts and open cuts. Funding is sought for pumps.
ORE DRESSING THROUGH THE REGION

The expansive Ruchera milling site pictured below left and centre is a 16-km straight-line distance from Nyahokwe and 20 km from the small Pangara river site, inset. Grooves always conform, and round ‘dolly holes’ of the central plateau are very rare. Structures with the misnomer ‘pit’ are always nearby.

* Assaying for gold is subject to the ‘nugget effect’, meaning that the grades of samples taken spatially close to one another can be very different. To date 114 samples show residues of 0.01 –4.0 g/t Au with only 3 zero values (Nyanga background levels <0.005 g/t Au.) Fallen sticks at the tunnels coincidental. The pot (top) has the rare Nyanga design of a lattice of raised clay ribs.
After crushing the quartz to liberate the gold, water is needed to separate the particles into a concentrate: the heavy metal to sink and the lighter waste material’ to be flowed away as ‘tailings’—similar to streaming.

There is no shortage of water from hilltop runoff in the rainy seasons of Nyanga—caught in spate below by Kim Spanoghe, and in verse by the Zimbabwean poet Bonus Zimunya:

I like the northern mountain
of my home,
Crouching like a monstrous lion
With a brown bald head
That shines with summer’s water patches

In his 1958 study of the Nyanga hills, Summers’ stone “furrows, often several miles in length, which run from perennial streams to groups of pits” are the same structures studied by Peters in 1899. He named them “strange buildings connected with ancient aqueducts”.

**Expertly graded channels feeding water to so-called 'pit structures'.** Below: side view and top view of conduit in Sanyatwe. **Far right:** water channel from a mountain on the way to Ziwa once fed several ‘pits’. Restoration leads it to farms in the valley.
The three connected features on the left repeat by the hundreds on the terraced hills. They reflect the ore stockpiles, water channels, and built structures for the gravity concentration of heavy metals that are present in texts of world mining history.

The Ancient Greek cisterns complete with water recycling devices for the washing of silver in semi-arid Laurion, and the shallow stone-lined tanks fed by ‘launders’ of 17th-century lead mining in Derbyshire, UK, are tourist attractions. But ‘farming’ misinterpretation has prevented this role for the Nyanga ninga.

SETTLING TANK

In his mid-1500s’ treatise on mining, Georgius Agricola has a description for gold recovery:

A wooden stave set with pieces of turf in rows where the particles of gold settle. Afterwards they are washed down to the settling-pit by a strong current of water, which is let through a small launder. Finally the concentrates are collected and washed in a bowl.

Agricola’s “large settling-pit … eight feet [2.4m] in length, breadth and depth” is not far removed from the dimensions given in the diagram of a Nyanga ‘pit structure’ on page 34. Exactly like the cross-section on page 8, this diagram reveals the structure of a ninga, not as a subterranean ‘pit’, but a freestanding tank built up from bedrock with massive input of labour.

In terms of heavy metals, Agricola’s extensive work majors on the processing of lead and tin. He has no illustration of his settling-pit for gold. With nothing like it found worldwide across the centuries to date, the impressive construction of the freestanding Nyanga tanks pictured above and overleaf for processing the precious metal remains unparalleled.

The medieval description of gold particles moved by a strong current of water let through a small launder recalls the ‘slot’ of a ninga described on page 10 and pictured on page 44. In his concluding sentence about concen-
Typical tank with flume running through the platform, tank 4 in a row of six on Manguruve plateau West. *Insets*, two features of Mateta Road north tank: uphill entrance to flume (H 66cm x W 58cm), and a quartz heap in stone trough on its platform. Quartz heaps on or close to platforms are very common.

**UNIQUE TO NYANGA: FREESTANDING HYDRAULIC TANKS**

Cross-section of a tank by the author published 2008 doesn’t show the entire length of the tunnel (flume) like the NMMZ 2013 cross-section on p8. But it was a significant advance on the sketches by archaeologists, limited to a segment of tunnel entrance into a ‘pit’
trates washed in a bowl, Agricola is describing gold panning. With precolonial miners not known to employ any mercury amalgam method in Zimbabwe, and before the invention of cyanidation, panning in a stream or a river was the pollution-free practice for producing the final product—refined gold.

Washing in a settling tank reduced the bulk of waste in the material to be carried to a source of water for panning. In Nyanga all the hydraulic tanks are built within easy reach of streams or rivers. Richard Dollar, geologist with a long history of active gold mining in Zimbabwe, believes that a practice of ‘hindered settling’ took place in the tanks, an ore-classification method mechanised today by piston jigs:

“Once the material to be sorted is placed in the tank and then filled with water (when it is available), preferably from the bottom because this helps to lift the whole content and start the sorting process, then the process of jigging or puddling could begin using wooden poles”

Running in water through the tunnel acting as a flume would explain its low entry position into the tank. Richard Dollar’s description also conforms with Peters’ conclusion—accounting for “all peculiarities of these strange buildings”—that they were built for washing quartz:

“crushed quartz was heaped up in the entrance tunnel, and also at the bottom, and that water was poured over it, which carried away the dust and left the gold behind”

Laboratory results support Dollar and Peters. The 13 results given below are from a total of 30 samples taken from tunnels and drains across 65 km. The

<table>
<thead>
<tr>
<th>coordinates</th>
<th>location</th>
<th>sample</th>
<th>lab</th>
<th>assay result Au (g/t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0460825</td>
<td>Mhokore Hill 1</td>
<td>TUNNEL</td>
<td>ZL</td>
<td>0.06</td>
</tr>
<tr>
<td>0447550</td>
<td>Fox Rock 1</td>
<td>DRAIN exit</td>
<td>IMR</td>
<td>0.20</td>
</tr>
<tr>
<td>0453677</td>
<td>Bhovhenzi 2</td>
<td>TUNNEL</td>
<td>ZL</td>
<td>0.07</td>
</tr>
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<td>Bhovhenzi 3</td>
<td>DRAIN entr</td>
<td>ZL</td>
<td>0.05</td>
</tr>
<tr>
<td>0454550</td>
<td>Bhovhenzi 8</td>
<td>DRAIN entr</td>
<td>DM</td>
<td>0.72</td>
</tr>
<tr>
<td>0461276</td>
<td>Derry 3</td>
<td>TUNNEL</td>
<td>ZL</td>
<td>0.06</td>
</tr>
<tr>
<td>NB Derry renamed Manguruve East</td>
<td>DRAIN entr</td>
<td>ZL</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
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<td>ZL</td>
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</tr>
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<td>ZL</td>
<td>0.08</td>
</tr>
<tr>
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<td>Uppr Tsanga 1</td>
<td>TUNNEL</td>
<td>ZL</td>
<td>0.04</td>
</tr>
<tr>
<td>0457600</td>
<td>Mateta Rd W1</td>
<td>TUNNEL</td>
<td>ZL</td>
<td>1.49</td>
</tr>
</tbody>
</table>

Method of testing all samples: fire assay, lead oxide fusion & AAS finish. The main laboratory used is SADCAS-accredited test laboratory Zimlabs, Harare, for its unrivalled service and quality control. The number of samples for assay has been restricted by the author’s self-funded budget.
Above: the flume at its entrance into Ruchera tank 1. "Filled from the bottom helps to start the sorting process" RICHARD DOLLAR. Right: sketch after his concept, see p35***

maps a, b, and c are the Surveyor-general’s maps of Nyanga, Troutbeck and Juliasdale. Testing laboratory ZL is SADCAS-accredited Zimlabs; IMR, the Institute of Mining Research; DM, the Department of Metallurgy. All results ranged 0.04–1.78 g/t Au, with an average grade of 0.31 g/t Au.

L to r, Tunnel* uphill entrances at Manguruve East 4, Tizai 1, Mhokore 1, Nyatsundzuru 1, sampled by Tendai Gungutsva and, far right, John Kangayi.

Below l to r, the Drains,** of National Park 6 (exit), Bhovhenzi 2 (exit), Ziwa SN113 iii (entrance), York Forest S1 (exit), Manguruve E 3 (exit). Sampled by Kudzai Musiwa, Mainford Toga, Gungutsva and Kritzinger respectively.

* Tunnels from l to r assayed residual gold values of 0.09, 0.45, 0.06 and 0.52 grams per tonne
** Drains from l to r assayed residual gold values of 0.32, 0.72, 0.20, 0.25 and 1.78 g/t Au
*** See p48 for Geoff Park’s ‘layered cake’ method to separate low- and high-grade material

Empirical evidence is not the friend of ‘dwarf cattle’ theorists, notably quartz grains visible by eye present in tanks, tunnels and drains; the entrance restrictions, the tunnel incline and curve, are all observed obstacles to enticing, then guiding cattle through such construction
“And burn it and reduce it to powder”

Signs of the burning and grinding of crushed and washed quartz described in Pliny’s last sequence are evident on, or close to, tank platforms at countless Nyanga gold-processing sites. All the subjects of the photographs below are depicted in the sketch on page 36. The stars in this sketch represent positions of samples taken for laboratory assay from 33 tank sites.

The material remains of so much activity identifies the platforms as spheres of industry, not domestic living space. Crushed quartz in heaps or piled into stone troughs, heavy-duty grindstones, low hard-baked clay walls dividing work-bay floors, and natural-draft ovens, are all found on the platforms or near tanks. Interior tank walls are carefully faced and chocked with small stones. This defines professional mastery for achieving one purpose.

The purpose is repeated across Nyanga. Wherever there are tank complexes, complete with flumes and drains built within platforms, all the stages of gold recovery are in evidence.

Burning increases the friability of quartz. It can also eliminate the impurity of sulfur. In a sequence slightly different to Pliny’s burning stage, the South African mining engineer Geoff Park suggests drying followed the washing that concentrated the gold and reduced the

Abandoned work-in-progress on or near platforms

Clockwise from the top: quartz in stone trough, Mateta Road East tanks; 60-cm grindstone at uphill entrance of Mateta Rd West 1 tank; cross-wall and grindstone at Mateta Rd East tank 2 platform; Bhovhenzi tank 8 natural-draft oven; inside wall of Manguruve W6

None of the features pictured here have illustrated archaeologists’ records of ‘pit structures’. Each feature takes its place in a clear sequence of work-in-progress repeated on, or in close proximity to, platforms. It is industrial work, with laboratory proof of gold mining
amount of waste—the gangue:

“After removal from the tanks the upgraded product is followed by drying, manual crushing and grinding and finally panning … based on my recollection of the tank structures, and hopefully some common sense”

A drying stage might define the clay-like matrix daubed on the natural-draft ovens as industrial ‘slimes’—interpretation as floors for ‘grain bins’ is eliminated from Nyanga research on page 10. A possibility for drying miniature slimes’ dumps was also expressed by Kudzai Musiwa, chairman of University of Zimbabwe’s departments of Mining and Metallurgical Engineering, and long active in support of Nyanga research. Senior metallurgist Dr Shoko sees a process of slow drying because the structures show no signs of naked flame, yet there is charcoal.

Geoff Park’s manual crushing and grinding of the upgraded product following drying recalls Pliny’s reduction to powder after burning. His “finally panning” is “finally the concentrates are washed in a bowl” of Agricola. It is not yet known if the aim of drying was to burn off unwanted sulfur by a heap-roasting method, or to make the quartz more friable and therefore easier to grind to fines—Pliny’s powder, Agricola’s concentrates.

Before the arrival of colonial miners the Shona were known to be familiar with the technique of roasting quartz to make it more friable for crushing. Baines painted this scene in the goldfields of the central plateau in the 1860s:

“a heap of roasted quartz, another pile laid with wood between the stones ready for firing, and crushing stones, like a painter’s slab and muller, lay in a hut not far off.”

Whether this heap of roasted quartz was to be crushed prior to the washing stage described in the previous chapter, or ground for the final panning of this chapter is not known because, next visit:

“When we arrived … the crushing stones had been taken away, and the probability was that the operations were conducted at a village 4 or 5 miles further north.”
Roasting with access of air from natural-draft ovens like those of Nyanga would produce chemical change to eliminate sulfur, or physical change to make quartz more friable for crushing. It is an early pyrotechnical method whereby wood mixed into beds of ore was lit and kept burning for several weeks—described by Agricola in the 1550s. Roasting explains the flecks of charcoal and the stick impressions in the matrix that have led archaeologists to misinterpret ovens as grain bins burnt to ashes in bush fires.

Heap-roasting heats ores below their fusion point. But evidence of intense heat was revealed in a rescue excavation of two ovens found after a bushfire inside Manguruve West tank 7 before it was destroyed by squatter farmers. A granite slab was unearthed near the trowel resting against one of the upright stones pictured below. It had a lump of the quartz-grain matrix fused to it.

It represents sintering by heat and the removal of moisture. It is unlikely that the natural-draft ovens could reach the 1650° required to fuse quartz, so the find doesn’t help to clarify the purpose of the ovens. But this evidence of burning adjacent to an oven has been dated to nearly a thousand years ago. The position of the slab in the excavation is marked with an X on the picture on page 40. A piece of hard-baked clay suitable for dating was found at position Y. Covered by 54cm of humus and soil, it had not seen the light of day since it was dropped there, and so was a suitable sample for thermo-luminescence dating.

A THOUSAND YEARS AGO

The sample, carefully packed in a lightproof container with a necessary 30cm of the soil surrounding it, was air-freighted with National Museums’ permits to the dating laboratory of University of Washington, Seattle. Dr Jim Feathers obtained an unexpected result: AD 1130 ± 50 years. The tank—in which the two ovens were buried with only the matrix tops showing—will be older.
The most suitable substance for this accurate method of dating is quartz. Quartz grains deep inside tank drains, like the sample confirmed in the picture on page 39 by South African geologist Anthony Harding but missed by British archaeologists, will not have seen the light of day since the time they were deposited. When funding for a minimum USD400 per sample can be found, quartz grains taken from the darkness of the drains will bring to light the date of Nyanga’s precolonial mining.

ANSWER FOR A BURNING QUESTION

The hard-baked matrix of quartz grains and charcoal is mineralized: matrix from six natural-draft ovens sampled across a straight-line distance of 20 km assayed gold from 0.03 g/t to a high result of 0.27 g/t—for the oven on the platform of the Bhovhenzi no 8 tank, pictured on page 37.

In his experiment on the hard-baked matrix of two natural-draft ovens of 2013 (above), Principal Economic Geologist for Zimbabwe Geological Survey, Ernest Mugandani proved beyond doubt that finely crushed quartz is the substance subjected to the heat. Each matrix on ovens conforms but there is no mention of the diagnostic quartz grains in any previous research.

**Lumps of clay, slimes, or quartz crushed to fines?** Tiny quartz grains among flecks of charcoal prove that the structures above are natural-draft ovens for roasting quartz. Top right: the author shows NMMZ tour guide Johannes Mopana the two sets of sachets with soil separated from quartz grains. Right: second oven on Tank 3 platform
Ernest Mugandani proved that the quartz was ground into fine grains before sticks were laid among it and then lit for roasting or drying. This explains both the stick impressions and the charcoal in the hard-baked matrix. The page 39 diagram shows the arrangement of slabs overlying upright stones of ovens that, in most cases, are fixed deep into the ground. Ovens have at least one aperture and some have the remains of a central flue. The oven pictured on the left has a flue and two draft holes, their slabs shaped into the curve that is characteristic of many ovens.

A HILL TO CELEBRATE

The oven in the large picture in the montage above is one of eight encircling a hill in Nyanga National Park. It has apertures and stone plinths supporting wide slabs which are covered by the typical hard-baked matrix of quartz grains and charcoal. The site has held the interest of Harare architect Keith Skinner ever since he discovered it as a boy two decades ago. This oven is next to the two, centre and bottom left.

Another oven, pictured right, has a grindstone built into the layer of slabs. Not far distant is an oven inside a tank—like the two in the Manguruve West tank no 7 described on page 39. It is pictured bottom left of the montage above. Top right in the montage is an enclosure on the same hill. It protects what may be a crucible furnace for refining gold under charcoal. This pot-plant lookalike once had a diagnostic spout and is due for laboratory analysis.
Quartz was not only ground into tiny grains before a natural-draft process involving heat, which requires funding for metallurgical tests to identify exactly which process—burning, roasting, or drying. There is evidence that fines were also ground straight into hydraulic tanks. Grindstones lying on the surface of tank platforms are frequent finds, but recently eight were discovered among the coping stones of the very rims of the tanks at the three undisturbed, unconnected, sites named above.

Also waiting for examination by metallurgists is the feature that has taken a present role of pot plant on page 41, but is hard-baked, and protected within the walls of a small enclosure. Its shape—and its once-present spout—is typical of early crucible-furnace technology for extracting impurities from ore heated under charcoal.

The inset, right, from a frieze on the walls of the Theban tomb of Puyemra* shows an Egyptian goldsmith blowing air through a reed held with one hand, while he stirs the contents of a crucible furnace with another.

SIGNS OF INTENSE HEAT

Top and centre on the right are photographs of a crucible furnace found in the rubble of a ruined natural-draft oven, Mubvumira no 3. The signs of intense heat inside the feature, and also in its wall, suggest that something was heated under charcoal, like the gold-ore reducing process described above. This is different to the oxidizing technology of heating by a natural-draft process of page 41.

Compare the photos of this feature with the one below it taken by Margie Tredgold at Ziwa, and with the one in Nyanga National Park on page 41. They are comparable in shape, in size, and also the clay of their construction. It is regrettable that a very similar feature in a wattle-pole ‘house’ at the Pit Structure Restoration for visitors in the national park is displayed as a potstand!

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* From Ancient Egyptian Materials and Technology by Jack Ogden, 2016, www.farlang.com
Standardization is an outstanding feature of tank design and construction across the length and breadth of Nyanga’s artificially terraced hills. The stone-walled terracing faces all points of the compass, but it conforms in having a generally sloping course. The narrow width between the walls is tilted downward, and it is invariably inclined along its length.

Pliny’s crushing, washing, burning and pulverizing of ore is a 1st-century pattern that survives intact at Nyanga’s more remote and undisturbed tank sites. Each tank is constructed to the same plan, and has a flume and drain. Stones of interior walls are carefully selected and dressed while the exterior walls of the platform are roughly built. Traces of plaster survive, like the remnant on the right.

The same design of flume entrances into tanks. From l to r: Claremont Golf Course Green 3, Manguruve West tank 6, Manguruve East tank 3, Bhovhenzi tank 1. Robson Bhovhenzi reveals the inclined slab of stone found at many flume entrances into tanks. It recalls ‘buddling’ of medieval Europe whereby ore was pushed against a running stream of water to separate lighter waste from a heavy metal. The first and last pictures show the very narrow footing of the sloping ‘batter’ also common to flume construction.
There are numbers of work bays on the tank platforms marked out by rings of stone—a conspicuous absence of post holes eliminates a role as huts or houses. When excavated, roughly one half of the largest work bay is seen to be paved and the other half plastered with dhaka. Where it survives, a hard-baked wall divides the two types of floor.

Conformity of design can be seen in the examples below. The same type of wall was revealed in a rescue excavation of the largest ‘circular structure’ at the ‘Green 3’ site mapped by National Museums (page 8). It was completely hidden by half a metre of natural infill until a fallen tree was cleared away for firewood by Claremont green keepers. When funds permit professional excavation to floor level, it is expected that it will divide a plastered/paved floor.

FIXED MASTER PLAN

The enigmatic slot, sited in the paved half of the largest bay, connects with the tunnel. The tunnel floor is always paved. Cobble stones are used—a well known early trapping mechanism in the world history of gold mining. Tunnel, tank, and drain all take the slope of the hill. The tunnel is paved, the tank is paved where it is not surfaced by bedrock, and the hidden passage of drains has been recorded as paved.

A heavy stone found inside tanks at the entrance of drains has the appearance of a blocking device. Entrances of drains are expertly lintelled—superb craftsmanship that is also visible at the drain exits on page 36 where platform walls have not collapsed.

Every component of tank
structures has its place and is designed for a specific purpose. In the very near future the conclusions of mining archaeologists, mining engineers, and metallurgists originating from one tank will answer the questions arising from all the others, no matter what great distance they are apart.

**DISCOVERING LANDSCAPES**

It has been estimated that terracing has been built intermittently across 7000 sq km of the Eastern Highlands. Terraced gold-hosting terrain has been walked by few geologists. But local people are making valuable discoveries.

On the right Shepherd Manyande looks at distant Mount Ziwa before he slashed into thick overgrowth and found three new tanks—two with intact cross-walls.

There are small-scale discoveries to be made at the Nyanga gold-mining heritage museum. Some of these need to be investigated by experts, such as a long-lasting piece of plaster and the bangles pictured below. The plaster was taken from a wall of the precolonial water channel featured on page 32, and the bangles were found near a tank platform.

The plaster needs to be analysed for the components which have made its fabric so strong that it has survived the centuries. Metallurgical tests will identify what the bangles are made of, and exactly how they were made.
Acknowledgements

First an acknowledgement to the German explorer/prospector Carl Peters for his 1899 recognition of gold mining in the ruins of Nyanga quoted in these pages. It heralds my landscape identification which comes from three years of hands-on gold mining and prospecting in Matabeleland.

To the late Dr Roger Summers for the many valuable observations I have included. Although he vilified Peters for “tanks for water to wash quartz” as a theory “so wild as to excite derision,” he doubted that “such animals as pygmy cattle could pass through” the “extremely small passage” of the tunnels designed to feed water into these tanks which play a major part in the preceding chapters.

In contrast I have not named and shamed the two British archaeologists I quote in the text. For four decades they have had the Zimbabwe nation kowtowing to a fake agricultural heritage: cows kept in pits so that farmers could manure very poor soils for growing millet. They, and an instance each from their published work, can be found in Further Reading, on the opposite page.

My foremost thanks go to Dr Godfrey Mahachi, executive director of National Museums and Monuments of Zimbabwe (NMMZ), for unfailing encouragement for me to advance the new mining perspective in the face of strong opposition from several quarters. His suggestion that I write up my research for general readers resulted in this illustrated booklet.

For their most welcome commitment in the field to NMMZ chief archaeologist Kundishora Chipunza and Kudzai Musiwa, chairman of University of Zimbabwe’s departments of Mining and Metallurgy. And in particular to Forbes Mugumbate for always keeping his door open to my progress in his “new gold province of Nyanga” when he was deputy director of my institution of affiliation, Zimbabwe Geological Survey until his recent promotion to Mashonaland Central Provincal Mining Director, Ministry of Mines and Mining Development.

My gratitude to Francis Chiuta for being an informative host to many visitors—especially school-children—to my permanent exhibition of the Ancestral Gold of Nyanga. Not to forget willing help from Agnes Sanyatwe nyanga, and in memory of her late children, Winnet, Gerald and Daniel.

My final, but ongoing, thanks to Guy Cary for his enthusiastic commitment to promote Nyanga gold-mining heritage across Zimbabwe.

Ann Kritzinger
Sanyatwe, Nyanga, April 2017 email: ackritzinger@gmail.com
Further Reading


‘Nyanga archaeology as a proud, organic agricultural, architectural “tradition” is under challenge … the “pit structures as cattle pens” theory is ridden with loopholes that are difficult to plug’ Kundishora Chipunza, chief curator NMMZ

‘What an eye-opener … will open a pandora’s box on the issue of the pit structures’ Kenneth Zenda, Tourism Officer, Nyanga Rural District Council

‘Vitally important research which provides new insights into our history, and challenges previous finding and assumptions’ Sean Kelly, tourism representative UK

‘Insight into the rich mining heritage that hopefully will continue for a long time’ Friedrich and Mary Haag, Albert-Ludwigs-Universität Germany

‘Interesting, thrilling. Keep going and keep us informed about your further findings’ Martin Bloch and Barbara Müller, Development and Partnership Fund, Switzerland

‘Keep up the quest for an alternative past’ Professor Innocent Pikirayi, University of Pretoria

‘A new view of the indigenous economic and technological ancient history of the Manyika people’ Farai Kawadza, history teacher, Milestone College, Nyanga

‘Exciting and pathbreaking research that is going to destabilise the long accepted discourse on the original usage of the Nyanga terraces’ Njabulo Chipangura, PhD candidate, University of Witwatersrand

‘Inspiring work that you have already covered, so huge. I am looking forward to giving my best contribution’ Ezekia Mtetwa, PhD candidate, Uppsala University

‘Please keep on shedding light on the mining process. You are truly a hero and wish to follow in your footstep’ Shingirai Sakarombe, Curator, Ziwa National Monument

A slightly different method to Richard Dollar’s ‘hindered settling’ of page 35 is suggested by Geoff Park, where the drain hole is blocked during the settling process—as illustrated on page 44:

When the settling process was deemed to be completed, the drain, which is always very small, slowly drained the excess water from the tank in order to dry out the material in it. What was left in the tank after it dried out was in effect a ‘layered cake’. The top layer would be a low grade waste material and the bottom layer a ‘high’ grade product.

When dry enough, the contents of the tank could be removed manually layer by layer: the top layers discarded and the lower layers taken away for pulverising and panning for gold extraction. This method would allow visual judgement or panning to check gold content as they moved down through the layers.

The final process would be to ‘dry sweep’ the floor of the tank to recover the final gold content. What I have described is a batch process as opposed to a continuous process and would be better suited to the seasonal variations of wet and dry in Nyanga.
NYANGA ARCHAEOLOGY new research

Laboratory evidence defines Nyanga’s ‘pit structures’ as gold-recovery tanks

Ann Kritzinger’s "new perspectives ... will enhance our bid to inscribe the Nyanga cultural landscape ... as a World Heritage Site"

DR GODFREY MAHACHI, EXECUTIVE DIRECTOR
NATIONAL MUSEUMS AND MONUMENTS OF ZIMBABWE

Dr Paul Belford (chairman, international Historical Metallurgy Society): “... has the potential to totally revise our understanding of early metallurgy in this part of the world”

Dr Diane Douglas (SRI Foundation, New Mexico): “You have posed a strong argument for the use of the pits for ore processing, rather than the agricultural or pastoral functions proposed by others”

Dr Rosanne Hawarden (University of Canterbury, New Zealand) “I find [your papers] impressive and am even more convinced you are correct”

Mr Forbes Mugambate (Ministry of Mines, Zimbabwe): “The research ... is enhancing the geological and mineral resources database of the area”

Prof Peter Schmidt (University of Florida): “I look forward to learning more about your most interesting research”

Dr Martin Strassburger (mining archaeologist, Germany): “in June 2009 I could only guess the extent and importance of her subject”

Prof Robert Thornton (University of Witwatersrand, South Africa): “Ann’s work on gold mining in the Nyanga terraces is ground-breaking and certainly correct ... Excellent work”

Mr Mainford Toga (University of Zimbabwe): “Evidence of the existence of mineral resources is overwhelming”

“... too high to be background gold levels they are definitely ore and residue type results ... Thus it does seem they were ... processing gold there”

Dr LEE JOHN, BIOMETALLURGIST, AUSTRALIA

Front cover pictures clockwise, descending from the top:
Stone-built water channel: Hashneey Bhovhenzi; ore-milling site: Shingirai Sakarombe; stone-walled terracing: Robson Bhovhenzi; uphill entrance into hydraulic tank: Winnet Samanyanga; open cut, grindstone, and tank tunnel: Tendai Gungutsva

Nyanga, Zimbabwe