Mining History: The Bulletin of the Peak District Mines Historical Society. Volume 17, No. 4, Winter 2009

Early Mining and Metallurgy in Zimbabwe's Eastern Highlands

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Precolonial gold mining in Zimbabwe has been dated to the 7th century from evidence found in the auriferous greenstone belts of the country's central plateau (Summers 1969). There is little mention of mining in oral tradition but over 95 per cent of Zimbabwe's modern gold mines were developed on the extensive open pits and deep-rock shafts of former workings. In the early 1500s the Portuguese who invaded the country to seek the gold mines witnessed little more than alluvial washing in some tributaries of the Zambezi. Over the next three centuries Portuguese activity was restricted, in conflict and by choice, to trading with the interior from Tete and Sena on the Zambezi and their Indian-Ocean port of Sofala.

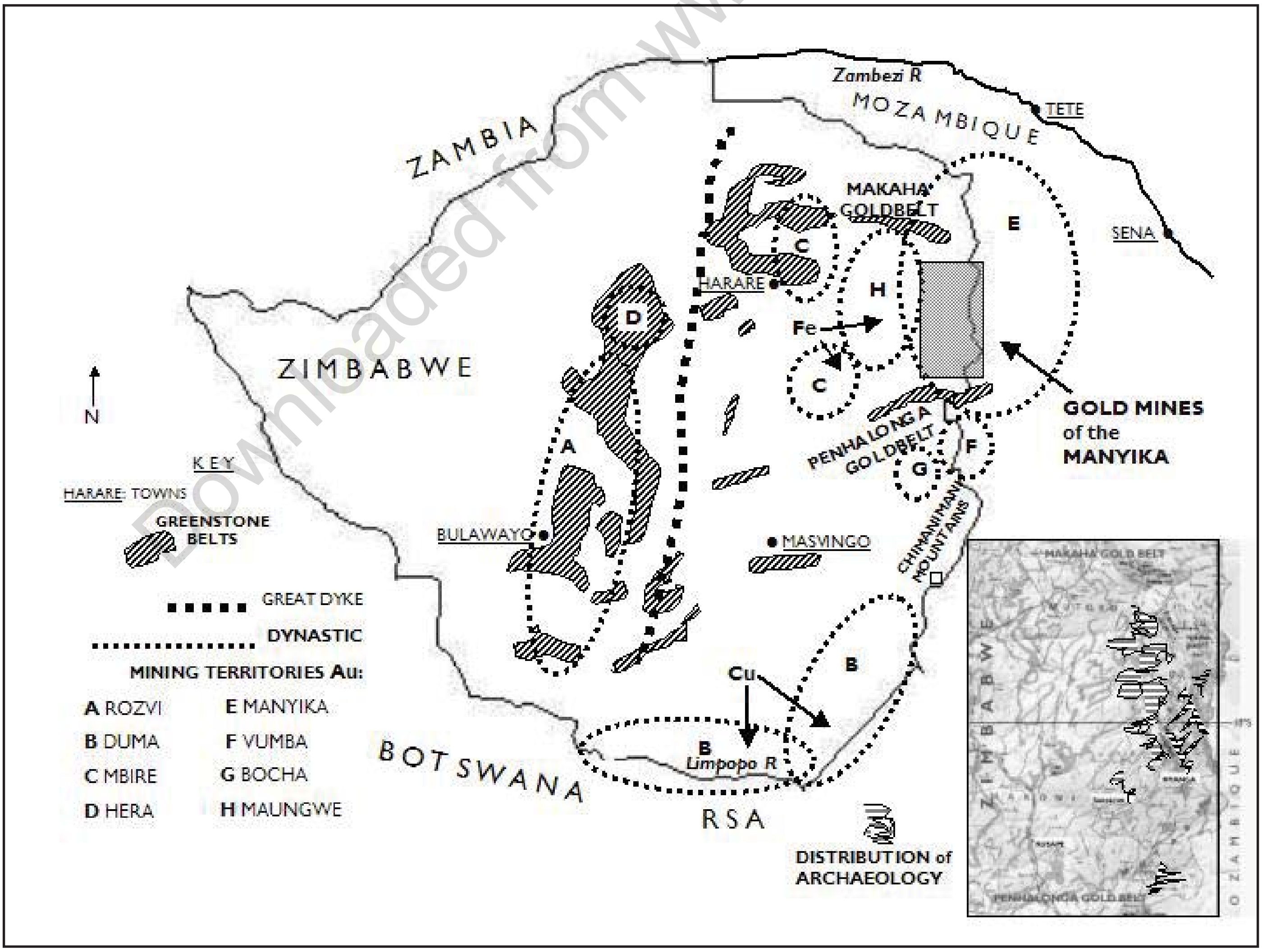
By 1857 the Portuguese had gathered enough information to publish a list of the gold, copper, and iron mining localities of eight Shona territorial rulers (Pereira 1857). Most of the names of the goldfields are traceable in the world-renowned greenstones of the plateau (Fig. 1), with the exception of much the largest holding, the 21 gold mining localities of the Manyika.

The Portuguese inventory closely matches names of physical features and titles of dynastic houses, and identifies Manyika mining as much larger in extent than the area allocated to it by scholars, namely the Penhalonga greenstone belt, its sheer-zone extension in Mozambique and the alluvial Upper Revue valley (Kritzinger, forthcoming a). Landscape identification places a large part of the Manyika enterprise into a 7000-sq km region between the Penhalonga and Makaha gold belts known, not for the occurrence of gold (Stocklmayer 1978) but for its distinctive archaeology.

The archaeology has three key features (Fig. 2):

1. massive linear mounds formed contra-contour in the stream valleys, several hundred metres long, with a width approx 1-1.5m and a height 50-100cm;
2. narrow terraces (typically 1-3m wide) roughly following contours at 900-1700m elevations, labour-intensively flanked with stone walls often 1m high. The soil is thin, poor, and stony;

Fig. 1: Map of Zimbabwe featuring the auriferous greenstone belts (hatched). Early Shona mineral exploitation based on a Portuguese list of early mining localities represented by ellipses. Inset, approx distribution of the archaeology of the Eastern Highlands.



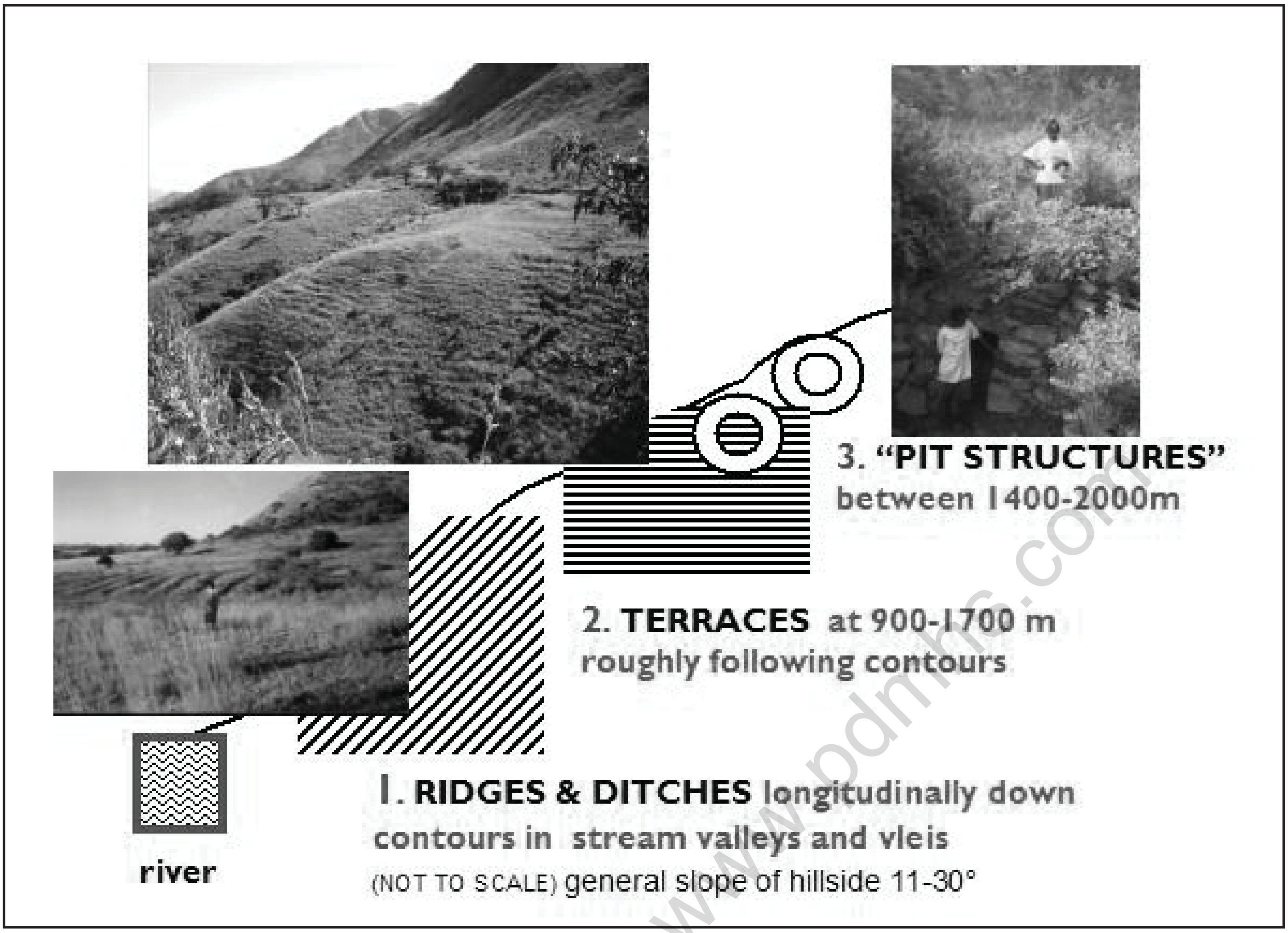


Fig. 2: Placing of three key archaeological features on the hillslopes: tank systems, terraces and linear mounds.

3. hundreds of stone-lined tanks built up from bedrock within laboriously built platforms through which are constructed an inlet tunnel and an outlet drain, all three features retaining the slope of the hill (Fig. 3).

Tank systems

The tank systems are built to a standardised hydraulic plan. In many instances radial walls direct hilltop runoff into the uphill entrances of the tunnels. The Eastern Highlands is a high rainfall area of Zimbabwe (averaging 800-1500mm annually) and skilfully engineered furrows carry water from springs or headstreams in many cases several hundred metres distant. They were not designed to irrigate terraces, but are 'planned in conjunction with groups' of tank systems (Summers 1958, p236). In contradiction to the marked hydraulic plan of the tank systems and the unsuitability of the terrace soils, the dominant theory to explain the archaeology is a practice of intensive farming from the 13th to 19th centuries. The hypothesis requires the penning of cattle in the tanks to provide manure essential for raising the fertility of terrace soils (Soper 2002, p126) in order to cultivate millet on the terraces, and grow an 'imaginable' root crop on the linear mounds (Sutton 1983, p14).

Terraces

There is 'nothing to say on local beliefs as to who built the terraces and when' (contemporary historians Matowanyika and Mandondo in Soper 2002, p4) but the hypothesis of agricultural land use has been well documented over many decades, its principal exponents being Dr Roger Summers (1958) and Prof Robert Soper (2002). Convincing direct evidence to support it is notably absent. Shona cattle are small but not small enough to pass through the tunnels, particularly the uphill entrances, restricted in many instances to a height of 30-50cm. No bones of cattle with a conformation less than 1m at the shoulder have been found (Soper 2006, p27); 'no dung deposits found' in the tunnels or the tanks (Soper 2002, p126). Pigs are not known to have been domesticated in the region in precolonial times. Goats and sheep have been eliminated because their pellet-like droppings would block the drains hypothesised as channels to 'catch the effluent' in 'dammed basins' at drain exits (Soper 2002, p180). Stall-feeding to provide manure and slurry are practices of the continent of Europe, not the continent of Africa in precolonial times.

Little evidence of settled communities and 'single generation occupation' (Soper 2002, p133) are further indictments of intensive farming, verified by an extreme rarity of carbonised seeds found in excavations (Soper 2002, p249; Summers 1958, p176). Additionally there is 'sparse' evidence of 'iron hoes … imperative for terrace construction' (Soper 2002, p129). However iron working is not absent in the region. Iron furnaces, blow pipes, slag, and occasional manufactured items such as arrow heads and shovels of a type attributed to early mining in the plateau (Summers 1958, p169) have been found, also beads and copper wire, and bronze and iron bangles.

Gold panners working rivers downstream of terraced hills are living testimony to the presence of gold in the region. Known as *makorokoza* their undercover activity has expanded in the recent economic collapse. In 2005 two *makorokoza* brothers decided that the gold in their pans came from a nearby terraced hill. Prospecting the terraces they discovered their pannings increased in grade the higher they went, with finds of quartz 'contaminated all over with gold' (Kritzinger 2008a, p59). In the topmost terraces they opened two shafts on a stockwork of narrow quartz veins assaying at the high values of 13-25

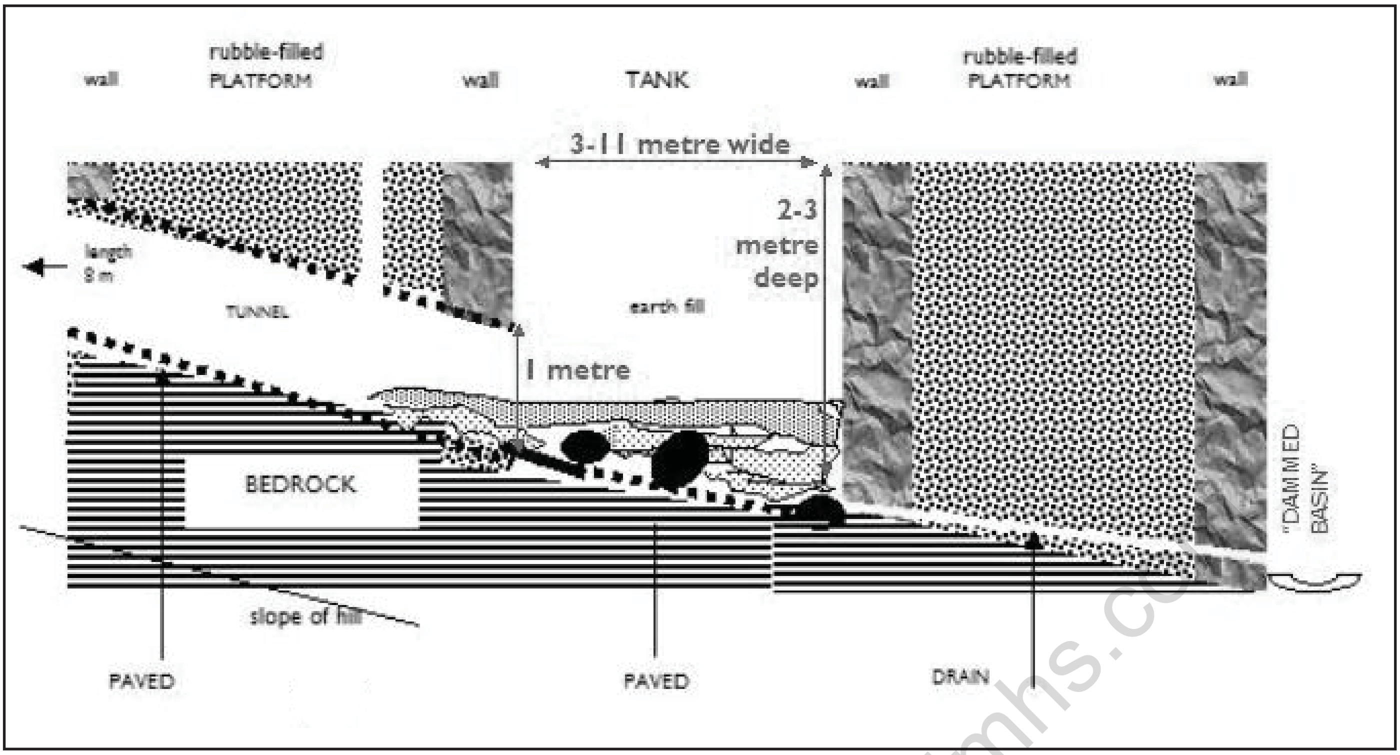


Fig. 3: Section of tank system illustrating the hydraulic plan.

grams per tonne (g/t). In the first few months their output was sufficient to legally register four claims under their family name Gungutsva (UTM 36K 045779E/797696N).

With no formal training, the Gungutsva brothers had acted on the geological fact that alluvial gold originates from an uphill bedrock source. In a continued process of weathering, primary bedrock ore at the highest elevation in the profile commonly forms eluvial (placer) deposits downslope, from where the gold migrates to rivers. Today four rivers within 3km of the Gungutsva's hill are being panned and the bedrock source is being mined. Between this primary source and the rivers are flights of terraces. Placer deposits are missing, suggesting exploitation in the past was a form of strip mining that has left a benched (terraced) effect on the hillslopes, the riser walls trapping freed gold in seasonal hilltop runoff. This surface-mining method was well known in antiquity (Agricola 1556, pp300-50), and is still practised using modern technology.

Across the region numerous quartz heaps are associated with the archaeology. Two of these were opened in 1899 by a German prospector-explorer who found the 'quartz at the bottom had been subjected to great heat … a kind of stove … to prepare the quartz for crushing' (Peters 1902, p161). Sampling quartz heaps contributed to the discovery of Gungutsva Mine. Recently finds of visible gold and results of 1.34-1.43g/t have initiated a study of quartz heaps on a wide axis, in tandem with geochemical testing of ore-milling sites in flat outcrops near tank systems. Heavy-duty crushing and grinding stones are common finds on tank-system platforms (Plate 1). In many cases evidence of work-in-progress is preserved. A 2-kg sample taken from the quartz rubble visible behind the grinding stone in Plate 1 assayed at 2.04g/t Au (ZimLabs, Harare, 21 Oct 2009).

Of 54 samples assayed to date only three have registered a negative result: one sample of slag (Cu and Fe), a sample of ?flux, and an associated clay artefact. The primary-source quartz veins continue to give high results, with 13 rock samples averaging 11.38g/t. Twelve grab samples from the Gungutsva terraces range from 0.10-7.54g/t, averaging 1.59g/t. A commercial company is currently undertaking a geochemical survey over an area of 60,000 hectares of terraced hills across the region.

In addition to ore sampling in the field, the following brief table is presented pending publication of detailed analysis (Kritzinger, forthcoming b).

Tank infill (5 samples from 1 tank): 0.14-0.21g/t
Tunnels (5 samples from 5 tunnels on a 40-km axis): 0.04-1.49g/t; av 0.35g/t
Drains (9 samples from 8 tanks on a 35-km axis): 0.01-1.78g/t; av 0.34g/t (a high 12-g/t result omitted)
'Ovens' (3 samples from 3 features on a 16-km axis): 0.08, 0.09, 0.27g/t
Slag (9 samples from 4 sites on a 6-km axis): 0.03-46g/t; av 11.68g/t

The above residue results are significant enough to identify the tank systems as gold recovery plants. Were they settling tanks? Gravity concentration is indicated, whereby tailings would be trapped in the 'dammed basins'. Was buddling employed? Notable on or near tank platforms are oven-like features (Plate 2), first tests exhibiting the residue values given above. Finely crushed quartz is present in samples, with ash and small pieces of charcoal indicating pyrotechnic function.

Conclusion

Preliminary findings of Kritzinger's research demonstrate that mining activity explains the archaeology of the Eastern Highlands. The conclusion is supported by commercial geochemical surveys which are currently confirming the geological presence of gold in the region. It is in sharp contrast to existing assumptions that agriculture was the reason for the development of the hundreds of tank systems and the many hectares of labour-intensive terrace construction. Primary bedrock sources of gold in the terraces, gold discovered in the tank-system soils, 'slag heaps, crushing stones, and some crucibles discovered in the area of study' (Kritzinger 2008b) provide direct evidence of precolonial gold exploitation and recovery. Conducted under a permit issued by the Research Council of Zimbabwe the research is in its infancy, with self-funding a limiting factor on the number of samples sent for analysis. There is a pressing need for in-depth study by professional mining archaeologists, metallurgists, and geologists.

Comment on assay results from the tunnels, drains and 'ovens' (listed on p81): "too high to be background gold levels, they are definitely ore and residue type results ... thus it does seem they were doing something along the lines of processing gold there" *(Australian biometallurgist Lee John, email 02/02/09)*

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Plate 1: Heavy-duty crushing equipment (scale 50cm). Pieces of quartz in situ in the background. Shadow on left is the uphill tunnel entrance to the associated tank.

Plate 2: Oven-type structures. Built on rings of embedded stones that project for about 20 cm, leaving natural-draught or tapping apertures. Slabs laid across the stones are plastered with hard-baked clay.