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Mining 'Waste'

Repurposing Residues in Artisanal and Small-Scale Gold Mining

Robert Pijpers
University of Hamburg, Germany

Jorge Calvimontes
University of Campinas, Brazil

Esther van de Camp
Leiden University, The Netherlands

Lorenzo D'Angelo
University of Hamburg, Germany

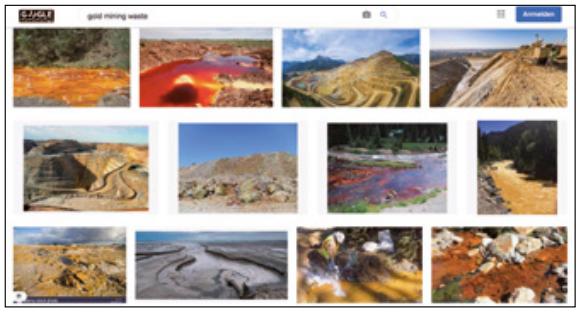
Eleanor Fisher
Nordic Africa Institute, Sweden

Cristiano Lanzano
Nordic Africa Institute, Sweden

Luciana Massaro
University of Campinas, Brazil

Gold mining, like all other forms of mining, is strongly associated with the production of a wide range of residues, whether this concerns (toxic) waste materials or the environments transformed in pursuit of gold.[1] This also applies to artisanal and small-scale gold mining (ASGM), originally understood as low-tech, labour-intensive gold mining and processing, but taking place on an increasingly large scale, involving significant capital and advanced technologies.[2] Frequently, these residual products, such as soil, mud, rocks, and water, as well as the environments from which they are extracted or where they are deposited, appear as waste, cast aside or abandoned, rendered as useless by-products or destroyed lands. This perception, as a simple online image search reveals, is reflected in photographs portraying gold mining waste, which depict devastated landscapes, abandoned piles of rock or polluted red- and brown-tainted water bodies. Moreover, as Spiegel (2020) discusses in an analysis of visual storytelling in resource frontiers, such images are at the forefront of negative media coverage and anti-mining campaigns (for example the 'stop-*galamsey*' campaign in Ghana), which criticise, stereotype, and often criminalise ASGM and the miners it involves.[3]

It is critical to interrogate ASGM's wasteful practices, not least considering its concomitant social and environmental burdens, which often take centre stage in (visual) narratives. However, caution is warranted to



Screenshot online image search result, 23 May 2021.

Billboard in Tarkwa, Ghana, depicting a campaign against small-scale mining (galamsey) launched by civil society groups and media platforms in 2017.

avoid oversimplifying a sector marked by great heterogeneity (see Fisher et al. 2021; D'Angelo and Pijpers forthcoming) *and* to stay attuned to another side of the story: the multifaceted ways in which different actors in ASGM perceive and handle 'waste'. Indeed, aside from environmental damage, when zooming in on gold-mining environments, one observes a multitude of processes of repurposing 'waste'; that is, (sets of) practices through which different actors re-incorporate 'waste' into the socio-economic spheres of ASGM and beyond, thereby transforming it into new resources and spaces of production.

Recently, these processes have prompted scholars to analyse mining residues beyond waste, scrutinizing how male and female miners use leftover materials that look like waste to 'make sense of their lives and the future', considering their potential economic value (Jaramillo 2020: 48, see also Buss et al. 2021: 34 for the position of women specifically) or how new technologies change the values and gendered production relations related to specific types of leftovers (Lanzano and Arnaldi di Balme 2021). In line with an anthropological tradition that draws attention to the dynamic and socially constructed character of 'waste' (Douglas 2003 [1966]), mined resources (Richardson and Weszkalnys 2014), and materials more generally (Ingold 2011: 31), these works invite us to approach the issue of 'waste' (and its associated social/power dynamics) with care. After all, as is echoed in expressions such as 'gold never finishes' (that is, never runs out) or 'there is no waste in gold mining' which can be heard across the settings discussed in this essay, what appears as 'waste' at one point in time and/or to some people, can be(come) a resource at other points in time and/or to other people.

In this photographic essay, we build on recent insight regarding the fluid character of waste by extending analysis into both the domains of materials *and* of space because not only can specific materials be repurposed as resources, but also specific spaces can be transformed from sites of abandonment to sites of production (or vice versa), whether for mining or other activities. To emphasise this dynamic character and 'the centrality of potentiality' (Jaramillo 2020: 56), we will use the term *residues* – namely the remainder, the things that are left. We will present five photographic series from five countries in which we have conducted long-term ethnographic research in the context of various research projects including our joint Gold Matters project, which explores the ASGM-sustainability nexus and allocates a central role to photography as a tool of both data collection and representation.[4] Critically, all of these countries have an important ASGM sector, but also feature different social, political, economic, technological, environmental, and historical characteristics, which enables us to interrogate comparative patterns while staying attuned to contextual specificities. Moreover, the five countries also illuminate different domains of connection in which repurposing takes place: Guinea and Ghana draw out connections between large-scale/industrial gold mining and ASGM, though the former on the surface and the second underground; Uganda centralises ASGM's internal dynamics of repurposing; whilst Sierra Leone foregrounds connections between ASGM and artisanal and small-scale mining (ASM) more broadly, and Brazil those between ASGM and non-mining activities altogether.

These photographic series show how different ASGM actors repurpose material and spatial residues. By centralising *images* of processes of repurposing, this essay nuances and offers a counterweight to dominant visual narratives. These typically focus on environmental and social damage, and often take a perspective 'from above' as they largely draw on aerial images. In doing so, these narratives tend to flatten or even erase local complexity and heterogeneity, and risk reproducing received negative stereotypes about artisanal and small-scale mining and miners (Spiegel 2020; see also Fisher et al. 2021). Our five photographic series, however, all take a perspective 'from below', using the miners' rather than the bird's eye as a point of departure. Importantly, as will transpire throughout the essay, the phenomena and processes depicted in our images shape and are shaped by different social, political, economic, technological, environmental, and historical relations and dynamics. These include, for example, former mining trajectories, gendered production relations, miners' socio-economic positions, the involvement of external actors, and the introduction of new capital, knowledge and technologies. Ultimately, this illuminates the necessity of approaching 'waste' in fluid, relational, and transformative terms as material and spatial endings are turned into new beginnings. To do this, let us now turn to our five countries, starting with Guinea.

Guinea – Repurposing material into new resources [5]

The eastern region of Guinea has hosted gold mining activities for centuries. The territories of Bouré and Siéké, in the *préfecture* of Siguiri, historically provided gold to the medieval empires of West Africa (Condé 2017). Colonial administrators tried to regulate mining activities (Luning, Jansen and Panella 2014), and later foreign investors started industrial exploitation, relegating local miners to the realm of the informal and the 'artisanal', which often criminalised them (d'Avignon 2018).

Relations between local miners and industrial companies are complex. The presence of large-scale mining generates conflict and resistance, but compen-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sation policies and corporate social-responsibility programmes simultaneously create strategic – though precarious – alliances and rent-seeking. Competition for mining space is intense: amongst artisanal miners this often reinforces perceptions of the finitude of gold and the anticipation of its exhaustion in the near future, thus posing an existential threat to communities historically dependent on mining.

While it is common for customary authorities to identify mining spaces and to organise extractive activities (photo 1), technological innovation has brought change (Lanzano 2020). New types of spaces, such as areas abandoned or left unattended by industrial mining companies, have become attractive for artisanal miners (photo 2). In the last decade, the diffusion of so-called *laveries* (laundries), that is, electric grinders that simultaneously 'wash' the ore (a task which used to be performed manually, often by women), has enabled quicker processing of large quantities of ore, while increasing water consumption (photo 3, 4). Old open-pit mines, usually seen by external observers as waste dumps requiring remediation, have been repurposed as water reservoirs by artisanal miners.

In the eyes of artisanal miners, spaces previ-

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ously mined by industrial companies often bear the promise of residual – but still significant – geological and economic potential. After all, in artisanal mines it is not uncommon to resume excavations in abandoned shafts or to reprocess the residues generated by previous industrial activities. Many artisanal miners thus choose to install their machines and establish their processing stalls near open-pit mines abandoned by industrial companies (photo 5). Some dedicate themselves to *yemasu* (panning and superficial scratching) or use portable metal detectors, which have become increasingly popular, to locate residues. This has gender dimensions; women mainly carry out *yemasu*, while men mainly use metal detectors. Others dedicate themselves to digging horizontal tunnels in the vertical sides of the mines, exposing themselves to the danger of collapse (photo 6, 7, 8). Despite efforts deployed by local authorities and by private companies to discourage and repress these activities, old industrial mining spaces continue to attract artisanal miners. In their view, these spaces are not worthless waste dumps. Instead, they are recent manifestations of a longer history of extraction in the region, where local miners and foreign companies compete for the same resource. In effect, past industrial closures are turned into future opportunities as residues are repurposed as new resources and working spaces.

Moving from how artisanal miners repurpose the residual material and spaces of industrial surface mining operations in Guinea, we now turn to how spatial and material residues are repurposed under very different forms of socio-spatial organisation in southern Ghana.

Ghana – Repurposing space and material from industrial to small-scale mining [6]

Ghana has a long history of artisanal and small-scale as well as industrial large-scale gold mining (Pijpers 2020). The latter emerged out of smaller foreign operations that started in the nineteenth century and which amalgamated into large industrial operations. Until the 1990s, these operations predominantly took place underground. This was also the case in Tarkwa, a major gold-mining town that forms the setting for this section.

The presence of large-scale mining in Tarkwa is crucial for some of the processes of repurposing interrogated here. With the abandonment of industrial underground systems in the 1990s due to a shift to surface mining enabled by cyanidation technologies, artisanal and small-scale miners gained increasing access to these spaces. This process was further facilitated by the influx of (Chinese) capital and technology from about 2006 onwards (Hilson, Hilson and Adu-Darko 2014). As a result, and much to the dislike of large-scale companies who fear encroachment on their operations, teams of male miners (women typically face restrictions to entering and working in underground spaces) increasingly extend their operations within the former domains of industrial mines. Consequently, and resonating with the case of Guinea, the end of industrial mining offers new beginnings as abandoned underground environments are turned into new spaces of extraction (photo 9, 10, 11).

Once gold-bearing hard-rock material (ore) has been unearthed from a repurposed industrial space, it travels through the production chain and is further


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processed to extract the gold. Every step in this process is accompanied by the production of residual material. For example, on its way to a processing site, small particles of ore may be lost and end up on footpaths. Sometimes, people other than miners, usually women, collect this residual material, carefully scraping the surface of paths near the entrances and exits of mine-shafts, and in the process turning this waste into a resource (photo 12).

The bulk of the mined material is ground to a powder and washed in sluice boxes by individual or small groups of male miners. After washing (and rewashing),

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the material left in these sluice boxes is collected and gold is extracted using mercury. However, a residue is also produced: a kind of mud or slurry, locally termed *over* (or *shump*). Until about a decade ago, this *over* was either used outside the mining economy, in, for example, construction, or was sold to large-scale companies that further processed it using cyanidation technologies. Yet more recently, cyanidation technologies have entered the artisanal and small-scale mining sector, a development that has transformed the status and social articulation of this type of residue. Indeed, in contrast to those scraping the surface, miners with access to capital can now buy and further process this increasingly valuable *over* for gold extraction. As such, processes of repurposing are drawn back into the small-scale gold-mining economy and small-scale miners' relations with large-scale companies are reconfigured again, as they are now able to sell it to other bidders or even process it themselves (photo 13, 14).

The processing of this *over* involves treatment with

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cyanide and different acids in cyanidation centres (photo 15). The owner of such a centre (usually a man) oversees the whole process in exchange for a percentage of the final product. In addition, all residual material belongs to the centre owner, who can re-process this for his own benefit. Consequently, centre owners can develop an interest in producing as much residual material as possible; a situation that creates suspicion between customers and centre owners and requires all parties involved to closely observe the processes and one another (photo 16, 17).

Following the industrial-ASGM connections of West Africa, we now turn to a locality in Uganda where ASGM and residential settlements are closely interconnected. Here, transformation is occurring in how waste is repurposed and who benefits. These processes are, as in Guinea and Ghana, predicated on technological innovation.

Uganda – Repurposing mining materials and spaces, reshaping relations[7]

Mining in Busia District (Eastern Region, Uganda) takes place in residential areas, which makes the issue of mining residues – both in terms of space and material – a pressing one. Gold mining in Busia dates back to colonial days in the 1930s (ACEMP 2015: 8) and, at times, occurs in the exploratory sites of these old colonial mines. Since the early 2000s, gold mining in Uganda has seen rapid developments. A nationwide Sustainable Management of Mineral Resources Project (SMMRP) (2004-2012) spurred a mobilisation of people, technology, and capital in Uganda's mining sector (Crawford, Disney and Harris 2015: 6). An associated presence of NGOs stimulated new expertise and investment in Busia. This led to the redesign of mines, the introduction of mechanical ore crushers, a reduction in mercury use, and the extraction of gold from tailings (that is, residual material after the first stages of processing) through cyanide leaching (Fisher 2018: 84-87).

In residential areas of Busia, small-scale mines and their 'overburden' (piles of topsoil) take up substantial amounts of land. Typically, miners with little capital, including women, in search of small pieces of ore, mine this overburden. Moreover, mining associations occasionally redesign and repurpose the opencast mines. For

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example, the NGO Environmental Women for Action in Development (EWAD) has facilitated peer learning in Tanzania to teach Ugandan miners timbered-shaft mining, a safer method requiring less land. In this light, one miners' association, in collaboration with an external investor, hired two engineers from Tanzania to build a timbered shaft in a former opencast mine. By going underground, such methods (which are more feasible for associations than for single mining teams) enable miners to recover and reclaim residual open space, for example for the planting of trees (photo 18, 19, 20, 21).


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Furthermore, new technologies and methods have stimulated two changes related to gold mining's material residues. Firstly, a reduction in the quantity of residues and a change in their value using ball mills and *gold kachas*. Ball mills (crushers) are crushers that are sealed in order to prevent exposure to *powder* (crushed ore) and their number has increased enormously since 2015. The *gold kacha* is a form of technology that incorporates a centrifuge to wash *powder* efficiently and effectively. EWAD has facilitated the usage of *gold kachas* for two mining associations, and one of these associations has also lent its *kacha* to neighbouring miners. This association has also built a cyanide plant and neighbouring miners have started to bring their residues to the association for gold cyanidation. This brings us to the second form of change: a repurposing of tailings through cyanide leaching (photo 22, 23).

Gold cyanidation is preceded by the usage of sluice boxes, which are widespread in Busia. Miners take their gold-bearing material to a sluice box and (re)wash it up to four times. A sluice box concentrates gold by separating it from the rest of the material; weight differences cause the gold to settle in a carpet placed on the sluice or washboard, while the residual material washes down with the water. The final residue is often given to the owner of the sluice box as a form of payment. Previously, after washing, residues were rewashed by miners – often women or children – who lacked the capacity to access gold in other ways. Nowadays, however, sluice-box owners sell their residues to owners of cyanide plants, who are usually men (photo 24, 25). Gold cyanidation, which is only accessible to a few people because it requires capital, extends the time during which profits can be made over the year: in the


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rainy season – when extraction is low for most miners – cyanide plant owners can continue the business of processing residues.

From Uganda, where technological innovation is rapidly affecting processes of repurposing, we return to West Africa by zooming in on an area in Sierra Leone where, unlike the examples given so far, artisanal mining of gold and other resources takes place in and along a river that has not been a site for past industrial mining.

Sierra Leone – Repurposing material within artisanal and small-scale mining [8]

In Sierra Leone, colonial geologists discovered gold in the mid-1920s within parts of the territory administered as a protectorate of the British Empire. In those same and subsequent years, geologists also discovered other commercially exploitable deposits of minerals such as iron, platinum, chromium, and diamonds. In the mid-thirties, alluvial gold deposits were at the centre of a 'gold rush', which also attracted foreign investors. After the end of the Second World War, the attention of a great number of local miners shifted, however, to the most profitable diamond deposits in the south-eastern region of Sierra Leone. Here, the Bagbe and Bafi rivers join and form the Sewa River. All these rivers, and some of their tributaries, contain both gold and diamonds (photo 26, 27). Over the years, diamond mining has been particularly intense, and this has led to an inevitable depletion of deposits, which

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was particularly felt by miners after the end of the civil war (1991-2002).

Along the banks of the Sewa River, local artisanal miners articulate the extraction of gold and diamonds with that of sand and stones (D'Angelo 2018). Men are mainly the ones who carry out the extraction of diamonds and sand, while both men and women, often from the same family, extract stones. Gold mining is less profitable than other mining activities and is mainly carried out by women, usually by digging with shovels and sifting the sand from the bottom of the river. Unlike the gravel collected by diamond divers in the deepest parts of the river, this type of sand contains miniscule amounts of gold. Thus, it happens that women sift the residues of the diamond prospectors after the latter have finished their sieving operations (see also Pijpers 2011). In these residues, women can also find small pieces of diamonds that have been mistakenly discarded by diamond miners.

Some gold miners interviewed in 2016 reported storing the black sand (which is mainly made of a mineral known as magnetite) that deposits on their gold pans (photo 28). There had in fact been a period in which some unspecified 'foreign miners' passed by the villages to buy this black residue, which was locally considered worthless. Their reason for purchasing and their potential use for the repurposed black sand remained unknown to the people interviewed.

In this period, there was a renewed and growing interest in rare earth minerals and coltan, a heavy black stone that can be found in association with

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gold deposits. Before foreign investors (particularly Chinese) arrived in Sierra Leone to search for coltan, gold miners discarded it (photo 29). In 2016, there was a brief 'coltan rush' in the south-eastern region of the country. As with the search for diamonds, female gold miners sifted the leftovers from coltan miners to find gold dust. Again, it was not uncommon for women to find small black stones discarded from previous washes, thereby turning them into resources to make a little profit (D'Angelo and Akiwumi 2018).

Finally, what is considered a by-product by diamond, coltan, and gold miners, that is, sand and soil, can be collected by sand miners and sold as raw construction material or used to make bricks. In fact, in the years following the civil war, mine waste repurposed for building materials supplied demand for the

(re)construction of houses and roads in urban centres (D'Angelo 2018) (photo 30, 31).

While the case of Sierra Leone largely demonstrates how the repurposing of mining residues needs to be situated in a wider small-scale mining economy, our final photographic series of the Brazilian Amazon picks up on the final point made above. In this context, where artisanal and small-scale mining takes place on a very large scale, there are also connections of repurposing between mining and non-mining activities.

Brazilian Amazon – Repurposing within and beyond ASGM [9]

Since the early 2000s, the ASGM sector in the Brazilian Amazon has seen important social and technological transformations. Heavy machinery has opened up new opportunities for small-scale mining that are not used in artisanal forms of mining (*garimpo manual*). The process of technological innovation has resulted in highly mechanised small-scale mines (*garimpo de maquinário*) and has built *garimpeiros*' (miners') confidence in reprocessing. Indeed, they anticipate that the gold they cannot extract fully today will be extracted in the future through reprocessing (photo 32).

These more mechanised small-scale operations also produce growing quantities of residues: powerful tractors clear large amounts of forest, excavators dig deep pits, and motor pumps wash away enormous

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quantities of fertile soil. This is environmentally destructive and may appear wasteful. However, most residues are not simply abandoned, but are repurposed as they form potential sources of new profit. Outside the mining space, for example, material residues such as wood, topsoil, and tailings are reused by local entrepreneurs. This includes landowners who buy the topsoil for agriculture (photo 33, 34).

Also within the mining space, residual material and equipment is subject to processes of reuse and repurposing. An example of the repurposing of equipment is the *paco-paco,* a type of 'car' invented by *garimpeiros* in Peixoto de Azevedo (Mato Grosso). *Paco-pacos* are named after the loud noise made by their front-situated

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engines: these come from motor pumps formerly used in the mining pit. They are used for the transportation of material within a mining site as well as for other small activities (photo 35).

An example of the reuse of materials relates to gold mining more directly and derives from the introduction of new technologies. Commonly, *garimpeiros* wash gold-retaining carpets within a sluice box with a mixture of water and mercury. The mercury captures the gold from the mud and forms an amalgam, which is subsequently burnt in open air to obtain the gold.[10] However, *garimpeiros* can also use a retort, a tool that keeps toxic vapour inside whilst recycling the mercury for future reuse. By containing the mercury, the retort enables its value to be retained and prolongs its use. It also protects the miners' health and the environment by limiting the creation of toxic residues (photo 36, 37).

Aside from mercury-based processes, gold is also recovered from residues using cyanide leaching. The


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residues are transported away from the mining site, as cyanide-plant owners buy tailings to extract even the finest gold particles. Gold recovery beyond the mine by different groups of workers not only points at processes of repurposing, but also indicates a specialisation of labour and offers an important development opportunity for different categories of miners in the Amazon (Massaro and de Theije 2018).

In addition to the repurposing of residual materials, mining spaces also become subject to processes of reuse and repurposing. For example, *garimpeiros* may leave old pits unused, sometimes for years. However when new investment arrives, operations begin again and old pits are reopened. *Garimpeiros*' experience of the physical characteristics of the residual material and the knowledge they acquire by working in specific

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environments under complex eco/geological conditions guides this process. For example, *garimpeiros* recognise which areas will be flooded during the rainy season, allowing them to make better decisions about the specific timing of the use and reuse of space (photo 38, 39).

Sometimes mining spaces are repurposed entirely. When the land is privately owned and once operations cease for good, landowners may convert it for another profitable activity.[11] Such repurposing typically includes rehabilitation practices such as planting trees, keeping old water-filled mining pits as pools for cattle, or creating tanks for fish farming (photo 40, 41).

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Conclusion: Transforming wasteful endings into resourceful beginnings

Through five visual and textual glimpses into five different settings of ASGM, this essay has illuminated an important yet often concealed aspect of the story of waste in ASGM: the ways in which material and spatial residues can be, and frequently are, repurposed as resources by different (groups of) people. In doing so, we have drawn attention to how processes of repurposing are entangled in different, though intimately intertwined, social, economic, political, environmental, historical, and technological conditions and their associated social relations. These include: the presence of historical (industrial) mining trajectories which can offer new material and spatial openings; the arrival of new actors with new interests (such as NGOs or Chinese investors/miners) bringing in new capital and knowledge; people's need to scrape together any material that can be accessed and to give it value as a resource as a result of their precariousness; the introduction of new technologies (such as cyanidation processes or new machines) that can be put to use with the right knowledge and amount of capital; and, finally, the role of gendered production relations and miners' different socio-economic positions, which guide differences in access to specific residual materials and spaces.

Such insights are crucial, not only to account for the heterogeneity and complexity of ASGM (a sector all too often simplified into a messy, Wild-West, and polluting affair), but also to bring home the ingenuity of male and female miners who use what is available and possible within the conditions in which they live and work. Placing these processes centre stage *visually* enables us to offer important nuance and counterweight to dominant visual narratives that centralise waste and socio-environmental damage, often take a perspective 'from above', and tend to stereotype and criminalise artisanal and small-scale mining and miners. Indeed, notwithstanding the social and environmental issues related to ASGM, our photographic series 'from below' widens this perspective and adds local complexity and heterogeneity to the issue of 'waste' by accounting for what often remains invisible: the multifaceted processes of repurposing mining residues.

To conclude, what, when, and to whom specific material and spatial residues appear as waste or as resources and new spaces of production, is not a given. On the contrary, as we have shown, categorisations of waste and resources are subject to complex and highly socialised processes that ask for a conceptualisation of waste (and of resources) in fluid, relational and transformative terms. Only then can we stay attuned to how different people with different needs and possibilities carve out opportunities to transform mining's wasteful endings into new resourceful beginnings.

E-mail: Robert.pijpers@uni-hamburg.de

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Notes

1 Illustratively, it is estimated that to extract an ounce of gold, some large mines move up to half a million metric tons of earth a day (*New York Times*, Behind Gold's Glitter: Torn Lands and Pointed Questions by Jane Perlez and Kirk Johnson. 14 June 2010).

2 In each series, miners are variously referred to as artisanal/small-scale gold miners or *garimpeiros*, reflecting terminological differences in different places.

3 See also a recent BBC report on 'The illegal gold mines killing rivers and livelihoods in Ghana' (https://www.bbc.com/news/av/world-africa-58119653)

4 See www.gold-matters.org and our virtual exhibition www.exhibitiongoldmatters.com.

5 Section based on research conducted by Lanzano. Photos taken by Lanzano between 2014 and 2019.

6 Section based on research conducted by Pijpers. Photos taken by Pijpers in 2018 and 2019.

7 Section based on research conducted by van de Camp. Photos taken by van de Camp in 2019 and 2020.

8 Section based on research conducted by D'Angelo. Photos taken by D'Angelo between 2007 and 2016.

9 Section based on research conducted by Calvimontes and Massaro. Photos taken by Calvimontes and Massaro in 2017 and 2019.

10 Reducing mercury use is one of the major revolutions needed for ASGM. In Brazil, the retort is cheap and safe but its use faces several obstacles, because many *garimpeiros* don't believe that mercury is harmful (Veiga et al. 2014).

11 On public lands and protected areas, mining is illegal and/or under different regulations.

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