DRAWING ON WORDS AND IMAGES

COLLABORATIONS IN THE ANTHROPOLOGY OF THE UNDERGROUND

SABINE LUNING AND ROBERT JAN PIJPERS

Anthropology & Photography

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Introduction: the vertical turn and ways of knowing the underground

In recent years, scholars have argued that a 'vertical view' should undergird analyses of political forms of domination, the effects of technological innovations, and economic developments in resource extraction (Battaglia 2020; Luning 2022). Rather than merely examining surface fields, scholars are now taking into account three-dimensional space, moving from a focus on area to a focus on volume (Elden 2013) and from studies of the politics of mapping to cartographies that capture the politics of verticalism (Weizman 2002). Attention to subterranean volumes — but also to those of the seas and the air — raises new questions about knowledge systems, governance practices and technologies of access. How can we speak volumes (Billé 2017)?

Tim Ingold (2020:31) argues that the vertical dimensions of landscapes have long been disregarded due to the privileged place of seeing as the basis for knowledge: 'All eyes, then, are on the surfaces of things — of the land and of what is set there, as scenery on a stage — for it is these that meet the gaze of the spectator, and not the materials that lie hidden inside, above or below.' To move beyond superficial vision, Ingold argues, anthropologists need to become more active in their research practice. For instance, the use of methods involving drawing and walking — both acts of making lines — forge more sentient connections to the land, and its earth and air. Ingold's work brings methodological debates on multimodality, including the intersection of different communication media and ways of knowing, to the vertical turn. He connects communication methods to attention to depth by reminding us of the etymology for the term 'volume': a written work in the shape of a scroll of papyrus or parchment that had to be rolled out

(Ingold et al. 2019). Moreover, the etymological reference highlights that writing is a graphic practice; handwriting resembles drawing lines. So, why do we in anthropology often suggest such a big gap between writing and the visual? Ingold and colleagues propose creating bridges between various 'graphic' media.

In current methodological debates in anthropology, oppositions between words and images, and between 'writing culture' and making ethnographic films, have broken down. In contemporary anthropology there is mutual understanding that research is always mediated in different ways, and that verbal and visual modes of communication are interdependent (Pink 2011). As Haidy Geismar (2014:97) formulates it, in her analysis of the place of drawing in ethnographic research: 'While anthropology's relationship to drawing has changed over time, translating between images and words has always been a key part of our methodology. During fieldwork, ethnographers have to continually process what they "see" and translate their experience into documentary media of many kinds, from written notes, to audiovisual recordings, sketches, tables, surveys, diaries, and so on.' Geismar rightly argues that these discussions should be situated in the visual cultures and social contexts in which the research is taking place.

In our vertical field of research, underground small-scale gold mining in Ghana, paying attention to visual cultures and social contexts directs us to three topics. First of all, we need to think through the visualization of underground spaces. Underground extractive work goes together with a specific articulation of visibility and invisibility, as above ground one cannot see the underground, the presence of minerals nor how these may be extracted. However, in the process of accessing the underground to extract its mineral resources, this largely invisible space

becomes explored, carved out, experienced and known. This raises the question of how the modes of doing underground mining relate to how the underground is seen and represented in professional practices of visualization. Secondly, the 'politics of seeing' and policing gold miners is important, as small-scale gold mining often occurs in grey zones of informality and legality, and thus may be seen in negative ways (Pijpers *et al.* 2021; Spiegel 2019). How does this affect whether gold miners want to appear in photographs or films made by themselves or researchers? Thirdly, how does the fact that miners work underground affect interactions between researchers and miners: what are the characteristic features of our research collaborations, namely in the production of visual images and our verbal discussions, in terms of time and place? In short, what are the multimodal characteristics (Takaragawa *et al.* 2019) of research engagements when a research field is defined volumetrically?

This publication will address these three aspects of visual cultures, provide some political context of small-scale gold mining, and discuss the effects of a 'voluminous terrain' on research collaborations. It will then take up two cases of collaboration in Ghana. The first is situated in the mining town of Tarkwa in the south-west, the second in Kejetia (part of the Gbane mining community) in the north-east. Tarkwa has a long history of both artisanal and large-scale gold mining, with industrial shaft mining starting at the end of the nineteenth century (Tsuma 2010). In the late 1990s, industrial mines started to shift to surface mining, which opened up opportunities for small-scale miners to more easily access deserted underground systems. Our collaboration in Tarkwa is with small-scale miners who started to re-open and secure old industrial underground infrastructures in 2018. In Kejetia, underground mining is carried out by small-scale Ghanaian miners, but since 2008 there has also been a separate 'larger' Chinese mining operation with industrial shafts (Crawford *et al.* 2017). The Ghanaians' small-scale underground mines have been constructed by the artisanal miners themselves; often, the shafts are steep, the horizontal galleries narrow, and the wooden structures not always very safe. We analyse the place of photography, mapping and drawing in our collaborations with gold miners and outline innovative approaches for understanding vertical, voluminous fields of research.[1]

The underground: visual cultures, mining maps, and photographs

In *Seeing the Underground*, Nystrom (2014) analyses professional mining technologies and observes how practices of mapping the underground — the shape and location of the orebody and the infrastructure to extract from it — became part of mining operations in the second half of the nineteenth century (Figure 1). The visual abstraction of maps allows one to envision whole underground structures that cannot be grasped from a place-bound, embodied position. This development was important for a verticalization of national politics (Braun 2000; Marston 2019) and it led to a division of labour between miners and planners, i.e., the engineers who map and visualize above ground what is minable underground.

Historically, both mapping and photography have played an important role in mediating knowledge about the invisible underground. Félix Nadar, one of the major figures in early photography in the mid-nineteenth century, for example, became famous as a pioneer of low-light photography in Paris's underground

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1 See also the on-line exhibition of the 'Gold Matters' project: www.exhibitiongoldmatters.com.
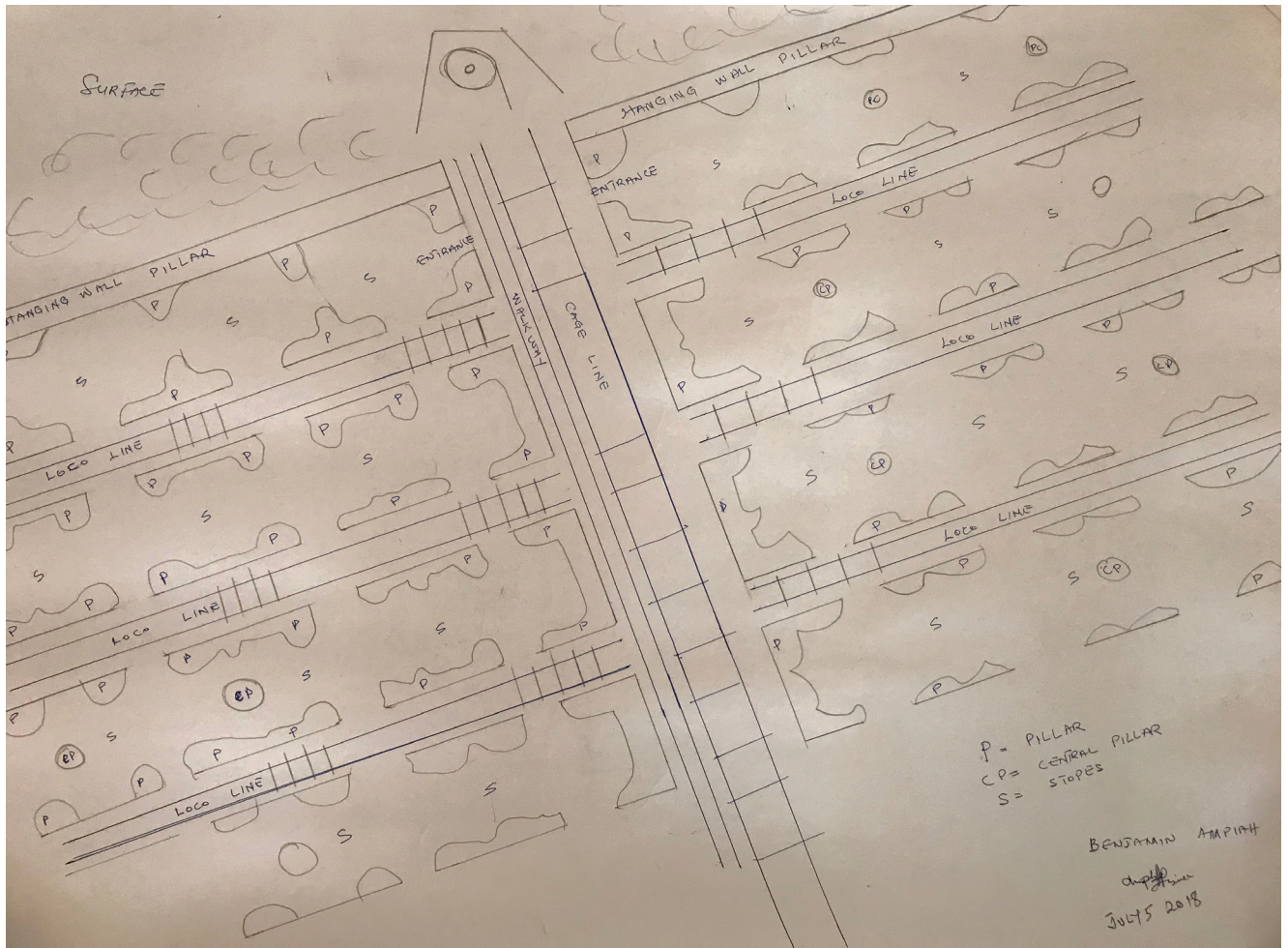
Figure 1   Drawing made by Benjamin Ampiah based on conventions in professional mapping of the subsurface. Tarkwa, 5 July 2018.[2]

catacombs and sewers (Macfarlane 2019). Walter Benjamin mentions Nadar's photography: 'for the first time the lens was deemed capable of making new discoveries', making it possible to show Paris and its underground 'invisible city' (Benjamin 2006:34; see also Gandy 2014:32).

In our collaborations and conversations with gold miners in Ghana, the media of mapping and photography have an important, but contrasting,

place. Mapping is foremost an abstract and disembodied form of mediation, one that allows for overviews of mines and geological formations. Photography, on the other hand, is an embodied practice, one that captures physical features of the underground spaces, yet always partially (see Figures 2 and 3 from Kejetia, 4 and 5 from Tarkwa). The darkness underground, even when there is electricity and even if one walked the whole perimeter, makes it difficult to get a sense of the whole site (Himley and Marston 2020:176). The embodied position of

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2   Photography credits: Sabine Luning, Figures 1, 6–13, 15–18 and 20–3; Ebenezer Mannah, Figures 2 and 3; Robert Jan Pijpers, Figures 4, 5, 14 and 19.

Figure 2   Goldminer Haruna Bashiru takes photographs underground. Kejetia, January 2020.

Figure 3   Blastman descending in the mine. Kejetia, January 2020.

Figure 4   Filming with goldminer Ebenezer Mannah. Tarkwa, November 2018.

Figure 5   Small-scale mining in abandoned industrial mine. Tarkwa, November 2018.

a photographer limits what images can show: parts of mining workplaces.

In our analysis, we take stock of discussions on the 'truth-value' of the image and the forensics of photography (Pinney 2012), and refrain from a realist reading of photographs. Just like maps, photographs of underground situations are representations. Not only do they frame spatial glimpses, as stressed above, they are partial in other ways too. Anthropologist and filmmaker Rosalind Morris (2008) elaborates on the obscurity in which miners work underground in Johannesburg's gold mines. She pays attention to the senses: what do labourers see and hear? How do they communicate in the dark spaces in the deepest underground mines in the world? Limited vision makes the miners more dependent on their hearing, but the roaring noise of drilling forces them to use earplugs. These sensory characteristics can partially be rendered in film – the preferred medium for Morris – but not in photography. The photographs that result from our collaborations are partial in yet another way: looking at them is no guarantee of seeing (Causey 2017). In order to understand and interpret visual media, verbal explanations are indispensable.

The dependency of images on words is expressed in methods such as 'photovoice', which can illuminate environmental debates on mining under the rubric of 'visual storytelling' (Spiegel 2019). In this method, words and images are put together in the same moment. By contrast, in our research interactions, words and images were often disconnected in time and place. Many photographs were taken underground, but only explained later above ground. The specific vertical field of our research demands attention to the place of conversations, the making of images, and how words and images are brought together in verbal and visual interplays.

The following sequence of photographs illustrates this process. Figure 6 is a still from a video Sabine Luning shot of miners chiselling a pillar[3] (to make holes for inserting dynamite) in an underground gallery in Tarkwa. Figure 7 shows a feedback session held the next day, in which we discussed the details of the mining activities we had witnessed. In Figure 8, one of our collaborators, Ebenezer Mannah, is portrayed using a pillar on a pub terrace to demonstrate how to chisel holes in preparation for blasting dynamite.

The underground: the politics of (not) being seen, and photography of gold miners

Tarkwa's gold-mining situation, with its small-scale mining in abandoned underground infrastructure, resembles Morris's research field in Johannesburg. She calls its small-scale gold mining 'informal secondary extraction' that 'follows industrialization – in the sense of both coming after and pursuing the routes and paths laid down by industrialization' (Morris 2018:107). She discusses the place of filmmaking in a wider 'politics of seeing', where small-scale gold miners (locally called *zama-zamas*) operate in the shadows of the law and may want to remain under the radar of state authorities. However, Morris relativizes the need to remain out of sight, as the 'police rarely appear in the vicinity, and when they do it is mainly to threaten a future arrival and an imminent enactment of those laws enabling the arrest and deportation of the undocumented migrants. Daily bribes defer this promised intervention and ensure for the *zama-zamas* a condition of visible invisibility.' (ibid.:120).

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3   Before mining a pillar, a new support post is constructed (heap of stones, left side of photograph).

Figure 6   Chiselling an underground pillar. Tarkwa, March 2022.

Figure 7   Feedback discussion session. Tarkwa, March 2022.

Figure 8   Ebenezer Mannah explains chiselling pillars. Tarkwa, March 2022.

Similarly, the way the police and other authorities may play with the timing of their absence/presence is highly relevant for how the state operates in Ghana, and in other mining contexts as well (Bainton and Skrzypek 2021). Here, we are interested in a parallel between Johannesburg and Tarkwa regarding how small-scale gold miners do or do not want to be seen in media such as photography and film. Given the potential repercussions, Morris wanted to understand why gold miners opted to collaborate with her in the film project, why they sought the spotlight. She explains that miners valued the film and photographic materials realized in their collaboration: 'The zama-zamas with whom I have worked long to be recognized; they often narrate their own predicament as a kind of being overlooked. And they have accorded me a certain function, of bearing the gaze that will grant them not only recognition but a kind of historical truth.' (ibid.:122).

In the two cases presented here, we render several individual gold miners visible in portraits, and identify them by name. We discussed a draft with the miners who feature in it, and asked if they would object to being seen in this public way. All of them reacted with surprise at the question: several were already prolific filmmakers before we met, using their mobile phones to film and photograph stages of their work process and aspects of their mining lives. They shared these clips with family, co-workers and Facebook friends, and also showed them to us. They saw themselves as public figures in their respective communities, who know that they work underground. To a certain extent, our collaborations around visual methods built upon the existing visual culture of the gold miners themselves. Of course, what they showed us was selective, and their collaboration with us did not imply that they were not also engaged in

any activities they may have wanted to conceal. Nor did our collaboration mean that they did not expect to ever be targeted by the state; while they would certainly recognize Morris's description of menacing state officials, they simply did not expect that photography of their work would trigger such state actions. Finally, unlike the miners in Johannesburg, who felt overlooked, the Ghanaian miners we spoke with were motivated to collaborate because they wanted to counter the negative image of small-scale mining in the public debate and to foreground the expertise that is required for underground mining.

Underground: research collaborations

The gold miners' wish to demonstrate their expertise through our visual collaboration fitted well with our aims as researchers, as our central goal was to learn about underground work practices. In anthropology, participant observation — a combination of doing and seeing — is a major learning strategy. Yet, only very few anthropologists have engaged in participant observation of underground mining, notably in formal industrial mines: for example, June Nash's seminal work (1979), but also recent research in the WORKinMINING project.[4] Our research situations did not allow us to actually participate in mining work. In Tarkwa, we could access the old underground mining infrastructure, as the paths are often wide and lit by electricity, and there are large excavated galleries on different levels (see Figures 6 and 14). However, just moving around in the steep, dark and slippery parts, with running water underground, required all our attention. Moreover, with many groups of miners dispersed in vast galleries, it was difficult

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4   This is a collective and comparative research project on how labour policies are currently negotiated in industrial mines in Congo and Zambia. See: www.workinmining.ulg. ac.be.

to know where and when dynamite blasting might occur. The underground visits were invaluable experiences, but in order to grasp the underground tunnel system and to learn details of actual underground mining, we were always in need of verbal explanations, as well as watching and discussing photographs and films above ground. In the underground mines built by the small-scale miners in Kejetia, our options to learn were even more constrained. We could not observe directly underground because we lacked the skills to enter the deep, narrow spaces. Our options for learning by doing were thus limited, and were largely mediated by verbal and visual exchanges. In the study of artisanal underground mining the conditions push anthropologists towards observation, while their interlocutors are people of practice.

However, our collaborations did entail hybrid practices. Indeed, in both cases, photography, filming, mapping and drawing all played prominent roles in our verbal knowledge exchanges during several fieldwork periods between March 2018 and March 2022. Importantly, most mining visualizations were made by miners.

In Tarkwa, we analyse our collaboration with a miner who drew maps of mining spaces that he complemented with verbal explanations. Miners working in small-scale mining in Ghana have often also worked in industrial mines, or they may operate in (former) industrial mining spaces for which maps are still available. They may be knowledgeable about professional conventions for mapping mining spaces or they may use historical mining maps to re-work these former industrial spaces. So, miners who actually make mining spaces may also be experts in mapping and explaining maps.

Our research activities with gold miners in Kejetia utilized the hybridity of seeing and doing

in innovative visual methods that stretch the meaning of 'drawing'. Ingold (2010) proposes a graphic approach that defines drawing as an activity of movement and line-making that has parallels with walking, as both trace lines. Sarah Pink (2011) takes up this suggestion in a most interesting manner: if we want to see how methods – drawing, walking, drawing on words – work in tandem, why not walk while making videos? These methodological developments inspired us to connect the drawing of lines to the issue of volume, prompting us to ask: how can we speak volumes while walking? Our second case of collaboration consists of making maps while walking. Together with a miner we walked, above ground, the lines of ore underground, thereby bridging seeing and doing, as well as making underground mining spaces visible. We will describe how this led to invaluable conversations about surface and subsurface connections.

Two collaborations: drawing on words, walking with maps

Collaboration with Benjamin in Tarkwa: bringing the underground home

Tarkwa is a cosmopolitan mining town with residents from different parts of the country. It is home to major transnational industrial mining operations and, since the early 2000s, has a strong Chinese presence. Our key collaborator in Tarkwa was Benjamin Ampiah (Figure 9), a gold miner in his mid-fifties with a long professional mining career. He has established a wide network that encompasses different worlds of mining: large-scale and small-scale, within Ghanaian communities and with Chinese operators.

When we first met Benjamin in March 2018, he was leading a team that was opening up an old, abandoned part of a mine formerly exploited by the industrial mining company Goldfields.

Figure 9   Goldminer and mining-site leader Benjamin Ampiah. Tarkwa, March 2018.

He and his co-workers, including his three sons, were preparing for underground mining (Figures 10 and 11): cleaning out the old line along which locomotives used to descend, reinforcing the old support structures at the entrance, and reinstalling the winch.

We continued to meet with Benjamin regularly over the years, and witnessed that he was a key figure in organizing several teams that had started to mine (Figure 12). He was organizing the connections between specific mining teams, investors and authorities.

In July 2018, we asked Benjamin if he had any subsurface maps that could show us the different levels of the underground infrastructures, dating back to the industrial construction of the mine. The next morning, he brought a map he had drawn overnight of the underground situation (Figure 1). The drawing testifies to Benjamin's familiarity not only with the actual spatial

Figure 10   Renewing old infrastructure. Tarkwa, March 2018.

Figure 11   Filming renewing old infrastructure. Tarkwa, March 2018.

Figure 12   Getting out gold-rich ore. Tarkwa, January 2020.

Figure 13   Still of You Tube clip in which Benjamin Ampiah explains the map of the subsurface. Tarkwa, July 2018.

organization of the mine's infrastructure, but also with the professional conventions of mapping in mining. He told us that his drawing was based on old maps produced by the mining companies, still used by miners now to find their way and determine where mining teams might work.

Benjamin's map shows the main inclined entrance (called the cage line) down into the mine and the so-called 'drives' to the left and right on the various levels. These drives are the actual lines along which miners can start stoping, or excavating ore by drilling and blasting. Stoping must be done carefully: miners have to create rooms (called stopes) by leaving intact several pillars to prevent the excavated space from caving in.

When Benjamin showed us the drawing, he noticed that we could not immediately make sense of the visual details and so he started explaining the map to us. When we realized

the extraordinary way in which he did this, we asked if we could film his explanation (Figure 13, https://youtu.be/7gnU_3Gu29Y).

This clip is a perfect example of how verbal descriptions increase understanding. A 'mine is like developing a town', Benjamin says, as he explains the underground tunnel system and the workspaces – walkways, drives, stopes and 'locoroads' – by comparing them to surface phenomena, notably pavements, streets, houses and cars. Benjamin's explanatory efforts exemplify the hard work that is required in our research conversations, which are always and inevitably built on processes of (re)interpretations (De la Cadena 2015). We attempt to understand others in terms of what we already understand, and our interlocutors try to explain their lives and work according to what they think we may understand.

Figure 14   Pillar in the middle of underground room. Tarkwa, November 2018.

The filmed interaction illustrates two mediations: first, an abstracted mediation by means of a drawn map of the subsurface infrastructure; and second, a mediation through the use of metaphor. We are taught to look at the drawing of the underground by means of what can be witnessed on the surface: pavements, streets, houses, cars. Benjamin's explanation resonates with Walter Benjamin's (see Gandy 2014:32) comparison of a subsurface to a city, calling it 'the invisible city'. More than that, the words we needed would have to translate what we could not see into images we were familiar with and could imagine. The underground was brought home to us as a(n) (in)visible city; a metaphorical street-plan prevented us from getting lost in translation.

One detail on the map helps illustrate how maps and photographs are brought together in our research conversation. Benjamin told us that the pillars (marked 'P' in Benjamin's map) and central pillars ('CP', Figure 6 and 14) act as boundaries for dividing up workspaces. As we could access these underground spaces, together with our collaborators, we have been able to photograph aspects of these work spaces and mining practices.

Figure 14 represents the most extensive spatial 'glimpse' a photograph could capture of the dark underground gallery. Still, without Benjamin's map, it would be difficult to imagine the larger context of the subsurface infrastructure, just as one cannot see the larger contours of a city by only walking a street. Yet, the photograph does help 'to read' the map and, especially in conjunction with explanations (Figures 7 and 8), we could get a sense of what we were looking at. In other words, the combination of maps, photographs and words allowed us to move from merely looking to seeing.

Collaboration with Zakari: walking stone lines with maps on apps

Kejetia is a neighbourhood of Gbane, a small mining community with a long gold-mining history, and influenced by mobility of people, knowledge and technology between the northern and southern part of Ghana. Nowadays, fenced-off areas and visible iron headgears (structures for lifting the elevators) towering above mining shafts testify to the Chinese underground operations of Shaanxi Mining (Ghana) Limited (SMGHL). We only collaborated with small-scale miners who live in Kejetia, and Zakari Imrana (Figure 15) was our key collaborator. He is in his mid-thirties and in his early youth his parents moved from the Upper East Region to the industrial mining town of Obuasi in the south of Ghana. As a young boy, Zakari started to mine in Obuasi before moving back to the Upper East as a member of the mining team of his paternal uncle. We met Zakari for the first time in January 2018, and since then he has been a prolific filmmaker of mining life, both underground and on the surface, in Kejetia.

The Chinese mining presence came up regularly in our conversations and one day in February 2019, Zakari's paternal uncle drew us the following sketch (Figure 16).

This plan (view from above) shows entry points into the subsurface: headgears of Chinese mining operations at the top, squares for artisanal pit entrances at the bottom. We also see four pillars (*pila*). Pillars 2 and 3 in the middle of the drawing mark the boundary between the Chinese mining operations and the underground spaces worked by small-scale miners. The arrows pointing down indicate underground infringements by the Chinese into the zone where small-scale miners are working.

In this collaboration, we pursued conversations on the broader picture of geological circumstances
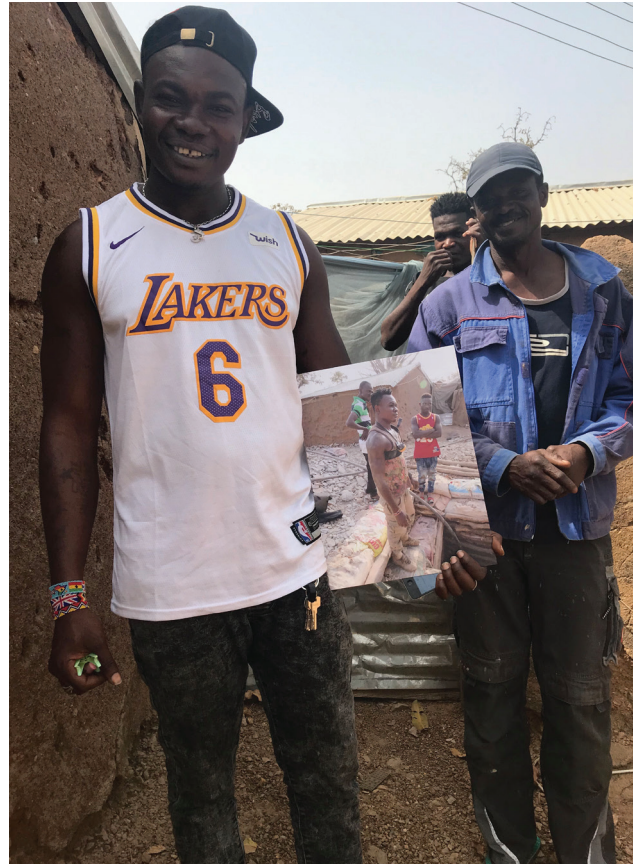
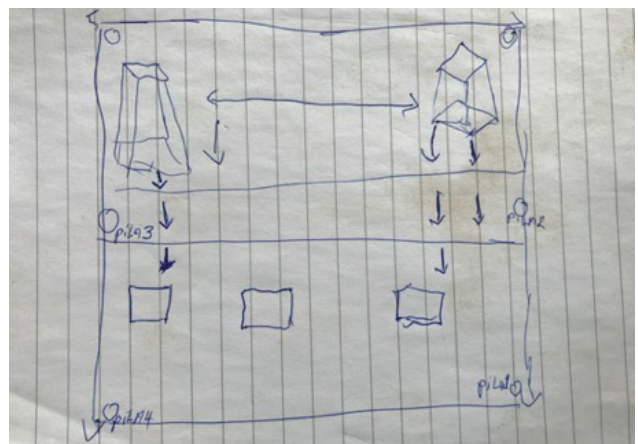*Figure 15   Zakari Imrana with his own portrait. Kejetia, January 2020.*

Figure 16 Map showing the underground infringement of the Chinese mining operation into the space of small-scale miners. Kejetia, March 2019.

Figure 17   Zakari Imrana looks at SW Maps on his phone. Kejetia, January 2020.

and possible underground encounters. Small-scale miners use their knowledge of how the orebody – locally called the 'stoneline' – is located underground to decide where and in which direction to excavate. These geological features, meaning the shape and direction of stonelines, influence possible encounters of mining operations underground. These encounters may lead to collaborative, neighborly connections,[5] or to tense situations of underground competition over the same ore (Luning and Pijpers 2017).

In January 2020, Zakari worked with us on a new method of 'walking lines' that could show

volumes, to paraphrase Ingold. Using a motorbike (Figure 17) we 'walked' the stoneline, using a free downloadable smartphone app called SW Maps.

This app allowed us to inscribe the underground trajectory of the stoneline where the small-scale miners were working. The tyre tracks on the ground were first translated as a red line on the app on our mobile phone, and this was later transferred to satellite images on Google Earth and watched on a computer (Figures 18 and 21 are screenshots). SW Maps also has the option to pin photographs on Google Earth maps, using GPS localization. While plotting the stoneline on the bike, we stopped regularly to take pictures of places that indexed underground activities and mining encounters (cf. Pijpers and Eriksen 2018).

5   See, for examples: gold-matters.org/?p=763 (accessed 26 September 2022).
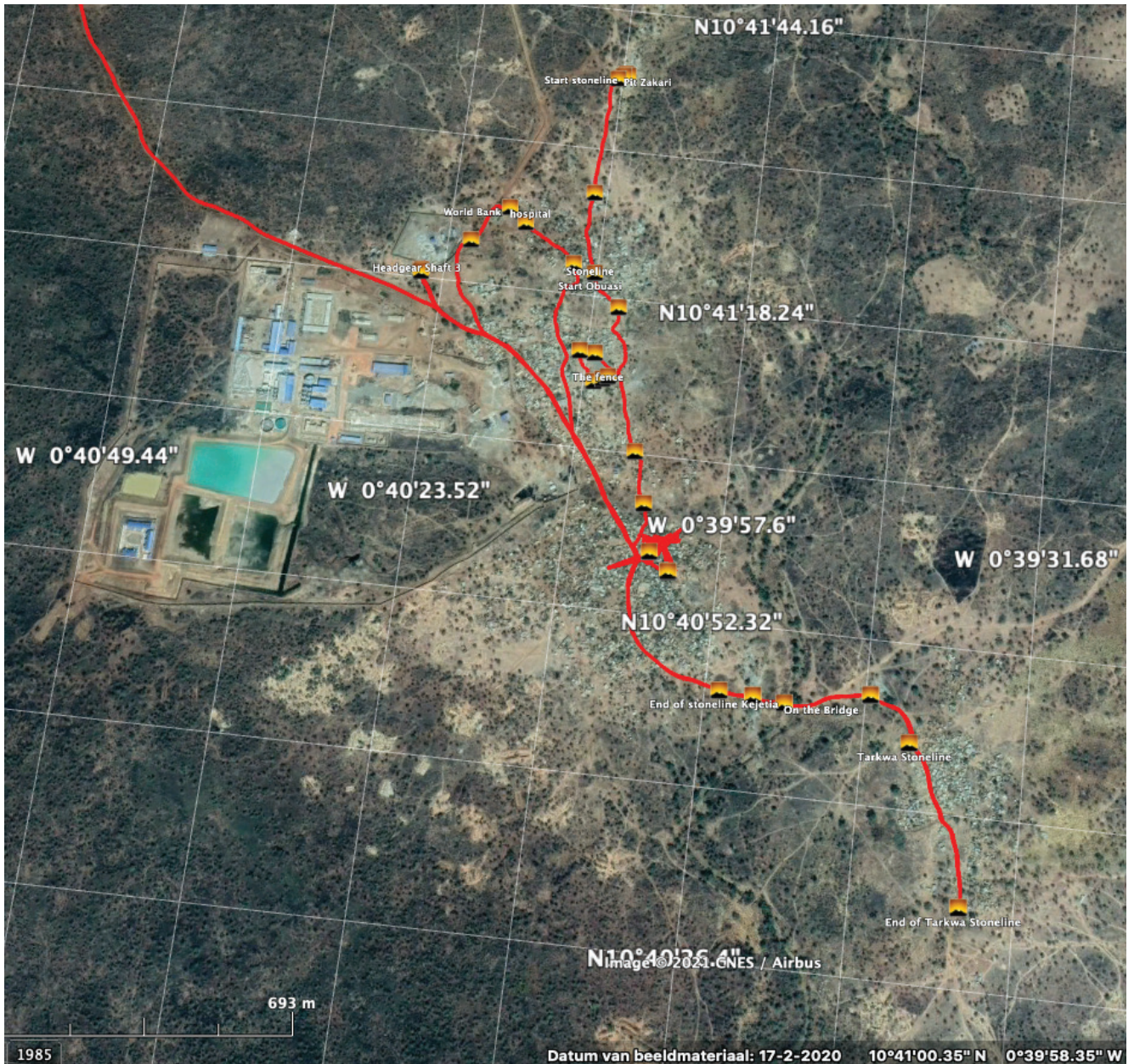
Figure 18   Screenshot of Google Earth image on our computer. Kejetia, January 2020.

Along the tracks of the motorbike, verticalized sights and stories materialized; in moving images and words the underground situation surfaced.

The red line on this first — larger scale — map (Figure 18) shows our trajectory on the motorbike. Based on Zakari's knowledge, we followed the stoneline as closely as possible. We then matched these visualizations in SW Maps to the on-site objects and infrastructure corresponding to the underground features and workings. Along the stoneline, we could see testimony of entry points into the earth, notably the pits of the small-scale

Figure 19   Line of pits of small-scale miners situated on the stone line. Kejetia, January 2020.

mining teams (Figure 19), as well as the headgears (Figure 20) used by the Chinese. Together these constitute a skyline of visible witnesses of unseen extractive practices underground.

We also encountered indications of competition over underground ore. One shot zooms in on a site with grey waste stones (Figure 21). This large 'grey zone' is evidence of small-scale miners entering and working the underground near that site. Currently, the site is abandoned and enclosed by a fence (Figure 22). This fence is a testimony to how underground tensions and possible encounters have been 'solved' as it serves to deny small-scale miners' access at a spot where they could get to ore also targeted by the Chinese mining company. The owners of the abandoned pits have been compensated, but underground tensions continue.

However, not all 'solutions' can be read from the map. One spot on the stoneline – named World Bank to highlight the richness of the ore

Figure 20   Headgear above shaft of the Chinese mining operation. Kejetia, January 2020.

endeavours to find visual matches between above ground features and underground mining activities.

The trip on the motorbike allowed us to inscribe and translate tyre tracks as red lines in Google Earth's landscape representation, on a smartphone. These lines and photographic glimpses prompted us to dig deeper into underground encounters and their stories. Our specific take on walking maps, even though grafted on aerial views, allowed us to move beyond the 'flatness' of this medium. A two-dimensional mining map shows legal concessions as contiguous spaces, but our methodologies showed how mining operations tapped into 'a netherworld of rocks and reservoirs' at discontinuous sites (Bridge 2009). This is particularly important for the study of gold mining where distinctions between legal/illegal and formal/informal are vague and often intermingle, and where miners with different (legal) statuses and scales of operation negotiate and compete in vertical spaces of extraction.

Conclusion

The innovative ways of 'speaking volumes' in our research collaborations contribute both to the study of mining and to methodological discussions about media for communication and ways of knowing. Both cases exemplify how we can move from flat to verticalized representations of gold mining, and both show the multimodality and hybridity of research interactions in which words, maps and photographs bridge divides between seeing and doing.

The first case, with Benjamin's hand-drawn map, illustrates a methodological movement away from a flat view. Even though the drawing fits a convention of subsurface mapping (Nystrom 2014), together with Benjamin's explanation, the map served to bring home underground

Figure 21   Zooming in: screenshot of Google Earth image on our computer. Kejetia, January 2020.

— is a case in point. Nowadays, the situation underground is tense; the headgear of Shaft 3 (see Figures 18 and 20) indexes the entry point of the Chinese mining operation into that valuable part of the stoneline. Recently, a hospital (see Figures 18 and 23) has been built there, financed by the Chinese mining company: on the surface this health facility is to be applauded, but at the subsurface level it serves to deny small-scale miners access to underground wealth. These stories transpired in line with our mobile

Figure 22   Fence to prevent small-scale miners from entering pits they used in the past. Kejetia, January 2020.

Figure 23   Hospital positioned on top of rich gold to prevent miners access. Kejetia February 2018.

mining structures as (in)visible cities. It became a verbalized roadmap, which, together with photographic glimpses of underground mining practices, moved us from looking to seeing. The process of making and discussing the map lent nuance to the distinction between knowing by seeing, and knowing by doing, and how we worked with both in our 'vertical field' of research. Two aspects of our collaborations made them more hybrid. First, Benjamin embodies both types of expertise: the doing of miners and the seeing of engineers. Second, the terrain of Tarkwa allowed us as researchers direct – even though partial – access and sightings underground.

The second case of collaboration bridged knowing by seeing and knowing by doing in a different manner. In this case we could not access the underground. However, our mapping of lines to identify vertical surface-subsurface connections did allow us to bring out how mapping correlates with making movements, and do so more explicitly. This effort fits a broader development in 'graphic' anthropology that attempts to bridge the gap between writing and the visual by recognizing that both practices are concerned with drawing lines. Not only do we need to acknowledge that writing is a graphic practice, but also that seeing is more than the perception of images. Seeing requires movement, if only of the eyes. Acknowledging the graphic bridge suggested by Ingold, we can make new moves in visualization: as a practice of inscribing lines, as a practice of collaboration, and as pathways of rooting and routing in landscapes. Our aim with the second collaboration was precisely that, and it was enhanced by Geismar's advice: all discussions – about verbal and visual communication, about seeing and doing – need to be tied to the specific characteristics of a field of research. Hence our attention to three

topics that are relevant for underground gold mining: visual cultures in mining, the politics of how gold miners are (not to be) seen, and the characteristics of our verticalized research collaborations. This made it possible to portray small-scale gold mining in Ghana as an in-depth field in which volumes speak.

Acknowledgements

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