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The "Urban Mine" in Accra, Ghana

As societies have recognized the need for sustainability, urban mining has become increasingly important. The phenomenon is derived from the reality that the planetary ecosystem is finite, non-growing, and materially closed, as well as from industrial ecology with its emphasis on materials and energy flows in products, processes, and economies. Urban mining refers to the process of reclaiming compounds and elements from products, buildings, and waste. It concentrates on recovering metals embodied in waste, especially e-waste. The practice of sending our waste elsewhere for processing has enabled urban mining to become a salient urban informal economic activity in e-waste processing sites across the developing world.

The conundrum of waste is that it is regarded as an aesthetic inconvenience in the developed world and a valuable source of income in the developing world. However, the two realms are not discrete but rather linked by an occluded web of flows. Waste can become invisible at a site in the developed world but it never disappears. Rather it is moved out of sight by trucks, containers, and ships only to reappear at informal processing sites in the developing world. There, waste is transformed again through a recovery process of urban mining, metals are recovered and made visible once more, and discarded components are left behind in final resting sites. In further travels, valuable metals are exported from the developing world and re-enter global production circuits where they disappear once again by their incorporation into new products. Importantly, waste is generally understood by imagined static discrete geographies, but its real geography entails a dynamic web of globe flows and complex waste component circuitry (Grant 2015).

We need a new and different perspective to capture these phenomena and the growing urbanization of mining that extends the modes of extraction via the recycling of e-waste, concentrated in particular city locales, and tied to international scrap circuits. Urban mining is, therefore, very different from traditional mining and its "holes in the ground," extraction sites generally located in the interiors of countries away from urban centers (Labban 2014).

Sourcing secondary raw materials as an alternative to primary ones is increasingly important. This has arisen due to urban ores expanding in tandem with consumption. The stock of urban ores is therefore distinct from the stock beneath the ground. Paradoxically, increasing demand for global electronics (and by association the metals incorporated into products) has depleted the primary stock but added to the urban mine.

Scholars such as Labban (2014) now refer to a planetary mine. There is a piling up of metals on the Earth's surface, embedded within the waste of decayed buildings, scrap vehicles, aircrafts, ships, broken infrastructure, and electronic devices. This planetary mine is now extended as well as constituted by burgeoning informal e-waste sites concentrated in specific African cities such as Accra, Lagos, Nairobi, and Johannesburg. Urban minefields extend across metropolitan areas, connecting resources that were once considered waste into a recovery and international reprocessing system. Increasingly, too, mining companies refer to the accumulation of materials containing toxic and valuable metals as the "mines in the city" and "the urban mining field" (Oteng-Ababio et al. 2014). Geopolitically, states (e.g., the US, the UK, and Japan) and regional organizations (e.g., the EU) are leaning toward the promotion of mining of e-waste as a sustainable solution to e-waste dumping abroad, simultaneously enhancing the resource security of the Global North while adding domestic green-technology employment.

E-waste contains high concentrations of valuable metals. UNU (2012) calculates that, on average, deposits of precious metals in e-waste are 40 to 50 times richer than ore deposits currently available from primary mines (see table 1).

Metal	Primary Mining	Urban Mining
Gold (AU)	5 grams/ton in ore	200–250 grams/ton in PC circuit boards
		300–350 grams/ton in cell phones
Platinum (PGMs)	2–6 grams/ton in ore	2000 grams/ton in automotive catalysts
Copper	4,500–9,000 grams/ton in ore	112,5600–131,250 grams/ton in cell phones

Table 1: Amount of metal available from primary and urban mining. Based on statistics in Umicore (2011).

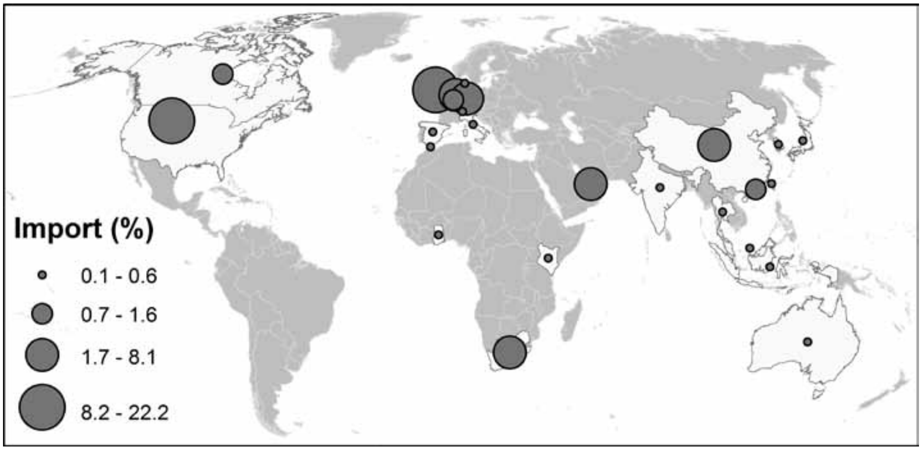
Some scholars (e.g., Schluep et al. 2009) calculate that several billion dollars' worth of metals are incorporated into global electronics. For example the combined sales of mobile phone and personal computers in 2007 accounted for 3% of the world mine supply of gold and silver, 13% of palladium, and 15% of cobalt. Importantly, in theory, this metal accumulation could be reclaimed and harvested at the end-of-life of the devices, potentially making 40 million tons of metals available for reuse.

Geographies of Ghana's E-waste and E-scrap

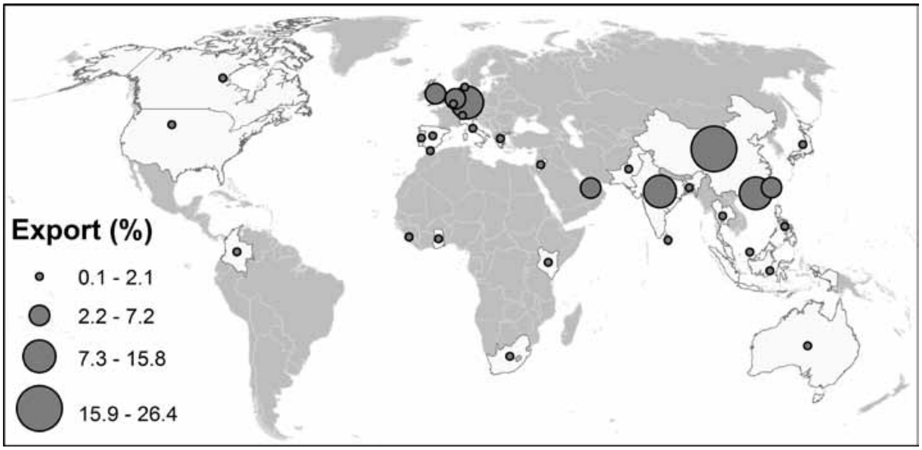
The main feature of the economic geography of e-waste imports versus e-scrap exports is the huge imbalance in global e-waste flows. Shifting our focus to Accra, Ghana enables us to understand waste and revaluing from a very different lens. It also enables us to situate Accra's urban mine within a global system.

On the ground in Accra there is a large and well-organized recycling sector involving rich and diverse practices of reuse, repair, and refurbishment as well as recovery of metals and plastics from electronic discards. Some firms and individuals make enormous profits from the e-waste refurbishing and recycling, but typically informals only eke out a living. Imports into Ghana originate mainly from Europe and the United States. By contrast, outflows from Ghana show a high concentration to Asia with two smaller concentrations to Germany and Belgium. Noticeably absent are outflows to the United States.

Ghana imports used electronic devices from 147 countries. Electrical and electronic equipment importing commenced in 2004, and by 2009 the level of imports had risen to 215,000 metric tons, 70% of which is e-waste. Another 984,000 tons of working electronic devices are in circulation, much of which is comprised of refurbished devices with a shorter life span (Schluep et. al 2012). This domestic stream is quickening: Ghana's participation in the IT revolution is considerable; mobile phone subscriptions in 2012 (per 100 people) surpassed the number in the United States. Scavengers operating at very high collection rates for electronic devices enable the urban mine to function.



Map 1: Imports of used computers into Ghana, 2004–2010 (by source country)



Map 2: Exports of metal scraps from Ghana, 2004–2010 (by destination country)

The main processing site in the country is located in Accra at the Agbogbloshie site, a slum community in the vicinity of the center of the city. However, as the e-waste business has been consolidated it has expanded to secondary sites in Accra as well as to sites in other cities. E-waste scavenging plays a pivotal role in Accra's economy, employing 4,500 to 6,000 individuals directly, and approximately 30,000 within the broader e-waste chain of activities. Oteng-Ababio et al. (2014, 164) calculate that Ghanaian e-waste activities generate US$105 million to US$268 million annually.

Europe is by far the most important exporter of used computers to Ghana, followed by the United States. Much of this trade is considered donations to accord with the Basel Convention (which regulates the transport of hazardous waste), but non-working devices are often included in exports. Flows into Ghana from Asia, the Middle East, and elsewhere in Africa are also rapidly increasing. Some of this regional traffic is European and North American traffic that is concealed by routing container traffic to Ghana via Hong Kong, Durban, Mombasa, and Dubai. Another component is circumvented traffic from China and other countries that have received negative media exposure (Grant and Oteng-Ababio 2012). Moreover, the IT revolution has meant that countries such as China, India, and South Africa have also become both a source as well as destination for e-waste.

At the apex of the e-waste export economy are a handful of formal recyclers, most based at Ghana Free Zones in Tema, but since 2010 a few foreign firms have established operations outside the free zone. The most prominent firms on the Ghanaian e-scrap scene are Success Africa, Gravita, Commodities Processing, and N.N. EST Meta, all registered as Indian companies, and Goldline, which is a Saudi Arabian-registered enterprise. These free zone companies enjoyed exclusivity in e-scrap exports from 2004 until 2010 due to specific national policies that granted these firms sole rights to export scrap metals, virtually permitting a "state-sponsored monopoly." Their dominance was further bolstered by virtue of the Ghanaian scrap sector being largely comprised by survivalist informal operators.

As a direct result, domestic scrap firms had to engage middlemen scrap brokers and/or free zone companies if they wanted to participate in legal export trade. In time Ghanaian firms opted to bypass the middlemen and participate in export scrap trade by circumventing trade policies and outwitting customs officials. Grinding motherboards into fine powder for export became common. As profits rose from this practice, especially compared to profits earned from domestic scrap (e.g., with the exception of steel, local prices for scrap materials are 40%–150% below international market prices [Amankwaa 2013, 563]), non-zone firms began to call for greater freedom to export.

Ghana trade policy on scrap metal exports is murky. A trade ban on export metals was imposed by the Ghanaian government in the 1980s but weakly enforced and relaxed to entice free zone investment and to permit export exclusivity. Considerable flexibility prevailed until 2009, when a change in government coincided with a reconsideration of the monopoly of free zone companies in scrap exports. The government enacted a legislative instrument, LI 1969, the Exportation of Non-ferrous Scrap Metal Regulations, in 2010, permitting local companies the license to export scrap metals without having to engage free zone companies and/or their agents. Free zone companies responded to the increase competition by pre-financing their “agents” to undercut incentives for local scavengers not directly connected with their operations, and pre-financing was extended to international agents in Burkina Faso, Togo, and Niger to extend the Accra urban mine by developing a secondary material supply hinterland. A stronger law—the Ferrous Scrap Metal (Prohibition of Export) Regulations (LI 2201)—was introduced in March 2013, but this law has not been fully implemented because of opposition from the Scrap Dealers’ Association.

Generic scrap is the largest category of scrap exports, accounting for approximately one-third of exports in 2004–2010. The next largest categories are copper, lead, and mixed scrap. Copper is a significant export because of high global prices and no refinery capacity within Ghana; exports serve markets in the Middle East via Dubai and in Asia via Hong Kong. Customs officials in Ghana complain that they lack the resources to check every container. As a result, new subcategories of trade, e.g., mixed scraps, appear, and this generic invention in 2005 circumvented customs officials and provided a pay-off until customs surveillance was improved. There is also a portion of secondhand trade that is illegal. The media regularly report mislabeling and millions of dollars of scrap metals being exported as shea nuts, teak wood, cashews, and other products.

Informal recyclers use rudimentary technology, principally hand tools, and concentrate on the extraction of copper, lead, steel, and aluminum. There is no local capability to extract silver, gold, palladium, and cobalt. Some metal scraps are traded more in the domestic economy: steel scrap is mostly processed in electric arc furnaces (five of which are located in Tema).

Officially, Ghana exports metal scrap to 31 countries amounting to several million dollars of reported trade. Newly emerging economies such as China and India, which are in major need of metal inputs for their rapidly industrializing and urbanizing economies, are key export destinations. China is by far the largest importer of Ghana scrap (see map 2).

Numerous small companies also participate in scrap exports. Some exporters and importers appear to be fictitious enterprises (companies without websites that could not be traced via the Internet), which is hardly surprising given that the waste and recycling businesses are widely reported as attracting criminal networks and companies that circumvent taxes and duties.

A New Beginning for Urban Mining? A Global Sustainable E-scrap System?

Urban mining unsettles notions of bounded informal economies, national resource economies, and the core-periphery dyad, as well as conventional spatial oppositions, e.g., city-mine, consumption-production, and waste-resource. Instead, urban mining illustrates how informal workers are linked to global transformations of digital economy materials.

Urban mining shows that it is essential to keep multiple perspectives on devices and recycling in view simultaneously. This framing illustrates the considerable value in disassembly (in addition to assembly). The global transformation of materials links informal and formal firms in the e-waste and e-scrap circuitry. Positive aspects of urban mining include the conservation of global resources (saving the environment, reincorporating materials already enmeshed in the global material system, and turning residuals into resources) and providing local livelihood opportunities (although in its present form, scavenging and informal processing are far from decent work).

Moving the conceptualization of non-value electrical and electronic equipment waste toward a sustainable waste management centered around urban and planetary mining allows for the possible engagement of distant and hitherto separated economic actors—manufacturers, recyclers, users, waste re-claimers, scrap metal traders, and especially the communities where waste recovery is done.

The key challenge is to situate urban mining within a global sustainable network. Critical challenges for African interchanges include: 1) the establishment of a more sustainable collection and recycling system that ensures that high volumes of valuable and non-valuable waste fractions are collected equally and that the respective fractions are channeled to appropriate treatment and disposable facilities; 2) harnessing financial support from the global players in order to ensure that the valuable pays for the non-valuable; 3) implementing formal collection depots for discarded devices where trained e-waste workers operate in safe and more efficient environments for processing waste so that metal fractions can be improved; this formal collection system must at the same time integrate informal scavengers; and 4) situating informal urban mining within respective national development frameworks, which requires state, private sector, and civil society support for informals so that metal scraps are prioritized for domestic industries and exported only under fairer and transparent conditions.

The creation of a global sustainable system will require profound changes at various sites—the ore mines, the producer sites, the urban mines—as well an appreciation of the circulation of material transformations among spatially separated sites. One pathway to explore in production might be an eco-friendly design that would reconfigure electronics with an eye to their eventual transformation in faraway urban mining sites. Financial support for technical shredders and creating green jobs in metal extraction are badly needed to ensure that African incorporation into the global material transformation is enabled on improved terms. At present, the difference between informal and formal disassembly capacity could not be greater. For example, compare an Accra informal worker operating with a chisel and hammer versus a mechanical 9,000-horsepower shredder in the USA that can shred a car in one minute so that other technologies can be deployed to separate the ferrous from non-ferrous material.

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