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Community without solidarity: mercury pollution from small-scale mining and Colombia's crisis of authority

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Abstract Colombia is the highest per capita emitter of mercury pollution in the world. Ground-level concentrations of atmospheric mercury from small-scale mining in Antioquia, Colombia, are so high that experts fear an environmental health crisis worse than any caused by mercury since Minamata, Japan, in the mid-twentieth century. Gold mining is Colombia's fastest growing industry. While foreign direct investment in gold mining is projected to increase exponentially over this decade, small-scale mining is the major force in the gold sector, generating 50–70 percent of national gold production, 70 percent of which comes from Antioquia. Federal and departmental law calls for miners to curb public exposure to mercury by removing processing activities from urban environments, but the laws are not enforced. This paper examines the political and historical obstacles to enforcing these laws, and explores the dilemmas of solving acute environmental health crises in places where violence, social exclusion and state-failure have crippled institutional legitimacy and authority. The paper addresses uncertainty around whether environmental health and sustainable resource extraction can be vehicles for progressive processes, or if instead, the increased economic emphasis on mining is inseparable from the social and political afflictions that impede environmental policy enforcement.

Introduction

On the morning of 14 September 2010, the Mayor of Nechí – a gold mining town in northeastern Antioquia, Colombia – addressed a forum of more

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than fifty public officials, gold miners, and gold processors gathered in the departmental capital, Medellin, issuing a sober tale of his state's mercury pollution crisis. 'The responsibility for managing mercury pollution falls on us, the mayors', he said. 'But behind the gold market, there is violence, and public officials – *se estan haciendo los ciegos con este problema* – they are turning a blind eye to this problem. We have fear'.

The response of the attorney general – 'Comply with the law' – was greeted with discontent, efforts to interrupt her as she continued speaking into a microphone and, finally, the departure of the Mayor of Nechí, who exited the hall followed by a handful of municipal leaders. Even as they left, the attorney general jabbed the air, repeating, 'Get the *entables* out of your cities, or I will throw you in prison'.

Entables are factories where gold miners bring their minerals to be processed and refined. Ordinarily, gold processing around the world occurs in rural districts or industrial zones, away from densely populated areas. But in Colombia, where security forces are preoccupied with battling violence from all directions, risks in the bush are too extreme to operate unprotected. Instead, gold refiners seek the security of city centres, and miners cart their ore to town to be processed at *entables*.

Operating *entables* inside city limits has been illegal in Colombia since 1995, when a federal decree (948–95) gave mayors a ten-year window to relocate all mercury amalgamation and cyanidation activities from the urban environment. Ten years turned into fifteen. The federal government pointed to the state agencies, the state to the mayors, the mayors to the miners, all to no effect. The mayors did not want to lose their votes. They also did not want to lose their lives.

After the mayors failed to implement Decree 948, the attorney general attempted to enforce the use of retorts for capturing mercury emissions. This, too, proved impossible: It conflicted with the unimplemented law. 'Colombia is very rich in laws', an official from one of Antioquia's environmental agencies said. These laws clearly distribute roles among federal, state, and municipal government. Public institutions have their responsibilities. What they do not have is authority.

Around the world, gold mines are frequently points of conflict, but, today and historically, conflicts over resource control in northeast Antioquia – the *Oriente* – are extreme. Gold mines and refineries are used by narcotraffickers, guerrillas, and paramilitaries to launder money, exact taxes, and lease heavy equipment, resulting in the satirical description of mines as *paramineria*. The centre, both for resource conflict and mercury pollution, is the city of Segovia.

'Hell on earth' is how the writer, Alma Guillermoprieto (1994, p. 343), described Segovia where, in 1988, paramilitaries murdered forty-eight people at dusk in the town square – the hour people arrive from their

farms and jobs to sit in cantinas lining the perimeter of the square – a massacre that remains an open wound across Antioquia. At that time, Segovia was occupied by guerrillas, death-squads, drug runners, gold miners, and rampaging soldiers. In the early 1980s, guerrillas introduced the tactic of kidnapping relatives of narcotraffickers, who created and financed paramilitaries to strike back at anyone believed to be associated with guerrillas.

It was in Segovia, in 1981, where the FARC kidnapped and killed the father of a small-time drug dealer, Fidel Castano. Castano, who was from Amalfi, commissioned a group of men to sweep riverside villages near Segovia. This group became the *Autodefensas Campesinas de Cordoba y Uraba* (ACCU), one of Colombia's most influential paramilitary forces. Castano's forces killed 22 people with merciless brutality, pulling babies out of their mothers' arms and shooting them, nailing a child to a plank, impaling a man on a bamboo pole, and hacking a woman to pieces with a machete. 'It was the first time since the brutal civil war known as *La Violencia* . . . that a massacre of such size had taken place in Colombia' (Guillermoprieto, 2001, pp. 31–32).

While the bounty for this war – control of the drug trade – was new, formation of militias and the source of the conflict were not. The formation of paramilitaries to repress dissidence replicated the *contrachusmas* of the late 1940s, militias supported by the Conservative party to attack, among others, unionized Liberal gold miners. 'The precedent', writes Mary Roldan (2002, pp. 291–292), 'for the current right-wing paramilitary phenomenon in Antioquia – which has now spread to other parts of Colombia, but which was first explicitly endorsed and supported by an Antioqueno governor and other regional officials and members of the departmental bourgeoisie as a quasi-official policy – may be traced back to the endorsement of the *contrachusma* and the legal arguments made by the Antioqueno governors to justify the arming of independently organized civilian groups during *La Violencia*.

The persistence of semi-official violence is not the only thread connecting the conflict of the 1940s with more recent violence. When narcotrafficking emerged as a dominant force in the late 1970s, caciques like Pablo Escobar and Rodriguez Gacha looked towards resource-rich areas for land and capital through which money could be laundered – areas where older conflicts between large property owners of land and minerals and leftist and peasant dissidents remained unresolved. Narcotraffickers soon allied with landowners to form paramilitaries, replicating the counter-insurgency method implemented to suppress protest during *La Violencia*.

Two forces, Roldan argues, catalyze terror and chaos in eastern Antioquia: 'weak public authority marked by lack of identification with the state, and defense of strategically located valuable resources' (ibid.). Miners and ranchers in cities like Segovia, Remedios, and Puerto Berrio 'still identify with dissident political parties and militant labour unions just as they did

at mid-century. They still consider themselves to possess a cultural identity different from that of Antioqueno officials based in Medellin, and they still appear to those officials as defiant, godless, and rebellious peoples who invite massacres and repeated political assassinations that have been their recurrent fate' (ibid).

Against this backdrop, this paper examines social and historical obstacles to implementing environmental health policies for curbing toxic mercury pollution from small-scale gold mining. The impacts of this pollution expose local communities in densely populated areas to the world's highest per capita mercury emissions. Yet involvement of numerous parties, public and private, domestic and foreign, and often violent, necessitates coordination across municipal, state, and federal institutions operating in a fractured political and social climate where there is a crisis of authority. Community-level environmental health concerns cannot be addressed in isolation, but instead are dependent on unified political processes. Progressive environmental policy-making to benefit local communities, including international technical assistance programmes, must be addressed in the context of political identity and social cohesion, including complex questions about the relationship between the nation-state and the community and the tension between foreign direct investment (FDI) and community-based small-scale mineral economies.

World's highest per capita mercury pollution

Colombia is a country of *high* mineral dependence, a categorization based on the United Nations Conference on Trade and Development's 10 percent baseline that classifies any country whose mineral exports exceed 40 percent of total exports as highly dependent on minerals (Hinojosa *et al.*, 2010). Colombia's resource wealth includes all the main economic minerals, metallic and non-metallic, with gold mining growing rapidly.

Foreign investment in Colombian mines was active from the late nineteenth century until as recently as 40 years ago, before the country became too insecure for investment. In his 2010 inauguration address Colombian President Juan Manuel Santos defined five engines of economic development: agriculture, infrastructure, low-income housing, research and development, and mining. The inclusion of mining as an economic pillar builds on the Democratic Security policy of President Alvaro Uribe, which attracted resource investors by reducing security risks, profiling Colombia's underexploited natural resources, and lowering corporate tax rates from 38.5 to 33 and 15 percent in Free Trade Zones. In 2009, 80 percent of FDI was in natural resource extraction, 37 percent in oil and 43 percent in mining. Even as overall FDI

decreased 10 percent between 2007 and 2009, mining investment grew from US$2.1–to $3.1 billion (Betancourt, 2010).

Over the next decade, Colombia projects an increase of foreign investment in gold mining from US$400 million to $4.5 billion, and expects gold production to double (Reuters, 19 April 2010). The best known foreign-owned claim is AngloGold Ashanti's (AGA) *La Colossa* exploration concession near the town of Cajamarca in the mountains of Tolima, where the company is investing US$100 million and has announced unproven reserves of 12.3 million ounces. AGA also holds a 21 percent interest in the Gramalote mining area in San Roque, Antioquia, a mining area east of Segovia where small-scale miners are active. Canada's Greystar Resources plans to invest nearly US$40 million in the Angostura gold and silver project, more than doubling its investment, and Medoro Resources is investing another US$100 million in its recently acquired gold companies – Frontino, Mineros Nacionales, Colombia Gold PLC, and Colombia Gold.

This expansion of FDI in extractive industries has been so rapid that as recently as 2003 the World Bank's economic analysis, 'Colombia: The Economic Foundation of Peace', had no chapter dedicated to mining (Giugale *et al.*, 2003). Expansionary periods of FDI in extractive industries support high exports and growth of GDP, and an inflow of foreign currency and capital. But the Colombian statistics department, DANE, estimates that 62 percent of the rural population – where nearly all mining occurs – lives in poverty (Perfetti, 2009). While expansion of FDI in large-scale mining dominates reports about Colombia's extractive industries growth, absent is the role and fate of the small-scale mining sector. Small-scale mining generates 50–70 percent of national gold production, and the ascendant price of gold over the past decade caused the number of miners to swell to an estimated 200,000.

Worldwide, the small-scale mining sector is expanding faster than at anytime in history. This global gold rush began in Brazil in the late 1970s, before sweeping every mineralized country in South America, Asia, and Africa, with tens of millions of prospectors active in more than sixty countries. After the birth of industrial-scale mining in the late nineteenth century, small-scale mining receded to the corners of crumbling, impoverished states, offering a refuge for the global poor – 'drought-driven work' – during periods of privation and crop failure. Unlike industrial mining operations, small-scale mines never abandoned the process of mercury amalgamation.

Today's small-scale mining industry is often poverty-driven. Miners rely on outdated, relatively inexpensive mercury amalgamation, having health and environmental consequences which include the poisoning of the brain and kidneys, and bioaccumulation in the foodchain. When the price of gold increases – as it has since 2001 – so does mercury pollution. The source of

this pollution is small-scale gold mining, found throughout rural districts of the developing world. Cheap, abundant, and easy to use mercury used in gold mining causes 30 percent of global mercury pollution, eclipsing all sources except mercury gas emitted from coal-fired power plants. The perception that small-scale mining was no longer a global force, meant that serious efforts to document and curb these toxic emissions only began in the last decade.

Nowhere is the problem of mercury contamination more urgent than in Colombia. The growth of small-scale mining has turned Colombia into the world's leading per-capita emitter of mercury, especially in Antioquia. In just five cities – Segovia, Remedios, Zaragoza, El Bagre, and Nechí – there are more than 350 *entables*, operating next to public schools, busy markets, and residential neighbourhoods, producing 10–20 tonnes of gold per year. Data collected by the University of British Columbia and United Nations Industrial Development Organization show that this corner of Colombia emits 50–100 tonnes of mercury each year – the world's highest air concentrations of mercury per-person in the world (Veiga, 2010). Ground-level concentrations of mercury gas in the city centre of Segovia are 1000 times higher than World Health Organization limits (Simpson and Walsh, 2012; Delgado 2010). Urban background air mercury levels range from 300 ng Hg/m^3 (background) to 1 million ng Hg/m^3 (inside gold shops) – the WHO limit for public exposure is 1000 ng m^3 – with 10,000 ng Hg/m^3 common in crowded areas (Cordy and Lins, 2010).

A UN health report warns that all 150,000 residents in the five cities are at risk of severe mercury poisoning. This is the highest mercury hazard in one region since Minamata, Japan, where releases of mercury from a factory in the mid-twentieth century killed more than 1700 people. While the acute environmental health threat is from the vapour burned in crowded populated areas, air pollution accounts for only 3.76 percent of mercury losses; the average loss of mercury in tailings, pulverized with the ore in ball mills, is 46.3 percent. Meanwhile, evidence is accumulating that more chronic varieties of the mercury poisoning are affecting the most vulnerable segment of the population. In neurological tests administered to 196 children in Segovia – ages 7 to 13 – 96 percent failed at least one measure of intoxication, whose indicators include attention, memory, language, and executive functions. 'It is no exaggeration', the report concludes, 'that in Segovia and Remedios' – the towns are adjacent – 'the proportion of the population exposed to a high risk of mercury intoxication approaches 100 percent' (Montoya, 2010).

Technical assistance: the case for intervention

Two modest technical adjustments – adding mercury after rather than during the grinding of whole-ores, and capturing mercury vapour in retorts – could

eliminate nearly all mercury emissions from *entables*. The mercury pollution emitted and released occurs at two stages of the mineral processing: during the concentration of ores and the roasting of amalgam. The former produces terrestrial and aquatic pollution, while the latter contaminates air, and eventually land and water, when mercury precipitates. A person breathing air contaminated by mercury may be poisoned by toxic vapour, especially if the exposure is chronic or if the balance of mercury in the air is excessive.

Most small-scale miners do not possess efficient equipment for grinding ore. To hasten concentration, miners add liquid mercury to the whole-ore. This inefficient milling method restricts miners to the recovery of the coarsest gold particles; the rest of the gold remains trapped in tailings discarded near the mine or dumped into the closest waterways. These tailings contain 80–90 percent of the mercury lost to the environment, and, depending on the deposit, retain 50–70 percent of the gold carried in the ore.

There are two approaches to reducing mercury emitted from gold mining: recover mercury by retorting of mercury–gold amalgam, or minimize its use during mineral processing. Most international technical assistance projects dealing with this pollutant focus on the first approach to mercury pollution, by introducing simple ovens – retorts – to close the pollution loop and recycle mercury that is vapourized when amalgam is refined. Use of well-designed retorts reduces occupational hazards for miners, who inhale the volatilized mercury vapour; it also minimizes public health risks for neighbours of mines, who breathe mercury transported in the air. But the introduction of retorts only addresses the 10–20 percent of mercury lost to the environment during refining, and does not reduce the 80–90 percent mercury lost during mineral processing.

To reduce their inputs of elemental mercury during mineral processing, miners need knowledge, organization, and technology. They need more precise knowledge to analyse the properties of their ore, and design more efficient, cleaner concentration plants; and they need modern equipment, especially mills, to process ore into concentrates. Finally, to acquire this knowledge and technological modernization, miners need access to credit.

Most small-scale miners – in Colombia and around the world – work and live in a legal no-man's-land where they possess deeply rooted informal customary title, but lack formal statutory land and mineral titles (Siegel and Veiga, 2009). The outcome of this informality is an awkward relationship between miners and the state: the state does not collect significant revenue from the mines, yet this mining economy is a driver of local, regional, and even national economic growth. For example, between 2000 and 2010, foreign investment in Peru's large-scale mining doubled to its current portfolio of US$4–5 billion. Meanwhile, mining in the country's top small-scale mining district, Madre De Dios, produces US$600 million in gold, suggesting aggregated

national production could be worth near US$1 billion, or one-quarter the value of large-scale investment. Yet the regional government in Madre De Dios reports revenue collection of just US$42,000 from small-scale mining.

But if revenue is the reward of formalization for the state, what do miners gain by entering the formal economy? A recognized mining claim – title – is an asset. The value of an asset is its potential as capital. Without title, no investor can securely finance a mining operation. With title, a miner has an asset against which to borrow. As a mining organizer in Peru said, 'Formalization is the soul of sustainable development in mining, but formalization must occur alongside capacitation and organization'. In instances where international technical assistance programmes prescribe changes to mineral processing methods, these prescriptions fail to trigger mini-industrial revolutions, as they ought to. Usually, the technology is donated. This method does not promote development of a mature supply chain. How will miners repair the equipment when it breaks? Can they purchase new models or upgrades if they want to expand their businesses? Even more fundamental: How will miners learn to operate the equipment?

These are questions about whether an economy has the specialized services required for industrialization. It is beyond technical assistance programmes to address all these questions, but technical assistance can catalyze an exchange for industrial goods and services, so that the people catering to the needs of miners – retailers, suppliers, manufacturers – are organized economically to the benefit of the miner. To reduce pollution emissions, a miner must have access to credit. The credit required may be no more than US$10,000, but without this investment for purchasing equipment and job-training a typical small-scale miner subsists but does not build capital. If miners are formalized, the obstacle to meeting their need for credit is less a question of technology than one of organization. Along with title, a miner needs record keeping, production data, business planning, and knowledge of geological potential; for the loan to finance sustainable development, the miner also needs environmental and occupational health training, especially instruction in responsible management of chemicals.

Even when miners are organized, however, financial partners are needed to provide low-interest loans. For investors, the obstacle to financing small-scale mining is the absence of loan guarantees. This guarantee is the assurance investors need to keep interest rates low. International technical assistance programmes can, therefore, attempt to catalyze micro-credit and sustainable mining development through three activities:

(1) Strengthening the organizations of miners.
(2) Constructing sustainable mineral processing plants.
(3) Establishing paths for accessing micro-credit.

These three objectives are interdependent. Small-scale miners lose 50–70 percent of the gold they mine. These losses are caused by the failure to recover fine gold trapped inside ore. Recovering this ore requires acquisition of and training in higher cost equipment. Persuading miners to use less mercury is hastened by more efficient methods for processing ores; reducing human and ecological risks from mercury exposure is a function of cleaner technologies diminishing the need for mercury. When miners practice whole-ore amalgamation, the highest concentration of mercury pollution from mining is in the tailings (rather than in amalgam). Using industrial techniques such as gravity and flotation, miners would have to pre-concentrate ores prior to cyanide-leaching or mercury amalgamation. These innovations reduce the mass of material that needs chemical treatment by a factor of ten (Veiga *et al.*, 2009). But technology transfer and technical assistance are effective only if miners are sufficiently organized. To apply for loans, miners need institutions to keep records, administer loans, generate production data, write business plans, possess knowledge of geological potential, and be trained in procurement. For the loan to finance sustainable development, the miner also needs education in environmental and occupational health training, mass-balance calculations, and responsible management of chemicals.

Social and historical obstacles to technical assistance

Human exposure to mercury vapour – which seizes the kidneys and brain – is a hazard with few remaining pathways in developed countries. Yet because of its continued use in small-scale mining, mercury remains a great risk in the developing world. Although gold mining has been a constant in Antioquia for centuries, the scale of mercury pollution in Antioquia was only recently discovered. In 2006, the Government of Antioquia approached the United Nations Industrial Development Organization (UNIDO) for support to address mercury pollution emanating from the department's mining areas. From 2002 to 2008 UNIDO administered the Global Mercury Project, a six country technical assistance programme for small-scale miners financed by the Global Environment Facility and including the United Nations Development Program and University of British Columbia as implementing partners. The GMP operated in Brazil, Indonesia, Laos, Tanzania, Zimbabwe, and the Sudan working with miners and local counterparts to reduce mercury pollution through technology transfer, education in mineral processing and refining, and public health awareness.

While similar technical assistance measures could eliminate most mercury pollution from *entables*, neither technology nor law is the obstacle to remediation. Most miners and processors lack the resources to change, while the country's culture of conflict makes easy solutions difficult. 'Mercury is not

just an environmental problem', an official from UNIDO explains. 'The mentality we face is that everybody believes he lives only for his own gain. Our problem is the absence of solidarity'.

Geographically, Colombia is like an Afghanistan of the southern hemisphere. Transport through the tortuous cordilleras may require six hours to travel 60 km on roads no wider than a city sidewalk; drivers must guard against boulders tumbling down the unstable hillsides, or steer around craters where the concrete has fallen 2000 m to the valley below. One result of this geographic impenetrability is radical regionalization: every pueblo and city seems, and often is, isolated from every other pueblo and city (Simons, 2004).

As important as geography may be, gold mines cannot be ignored as a principal cause of conflict. As Roldan (2002, pp. 291–292) writes, 'The catalyst for the emergence of privately organized terror groups both during *La Violencia* and now, moreover, are nearly identical: the defense of strategically located valuable resources in areas where the state exerts little authority and does not command the loyalty or identification of the majority of the local population'. Approximately 70 percent of the gold produced in Colombia comes from Antioquia, 60 percent of which is produced in the northeast. The region was colonized by gold seekers, starting with the gold veins of Buritica and founding of Santa Fe de Antioquia in 1541, followed by the establishment of Remedios, Segovia, Zaragoza, and other mining communities still active today. The colonists conscripted indigenous labour to placer mine in Popayan, and shortly after for hardrock mining 50 miles south in Almaguer. Gold brought settlements to the Middle Cauca (Cartago, Caramanta, Anserma, and Arma); Eastern Cordillera (near Bucaramanga); and gold deposits in tributaries of the Magdalena river contributed to the founding of Tocaima in 1545, Ibague in 1550, Mariquita in 1551, La Victoria 1557, and La Palma in 1560 (Safford and Palacios, 2002, p. 36).

Until the growth of the coffee economy in the nineteenth century, gold was New Granada's only significant export, providing the means for imported slave labour and luxuries. In Antioquia, a commercial bourgeoisie developed around the exchange of gold for cotton and woollen textiles, salt, and tobacco from the Eastern Cordillera, with Cartagena as the commercial hub for exporting gold and importing slaves and goods. Although the mines were the largest producer of gold in Spanish America, this mineral wealth was modest compared with Mexico and Lima. From 1735 to1800, gold registered in New Granada's western mining regions produced less than 1/13th the value of Mexican bullion mined over the same years (ibid., p. 45).

By the mid-twentieth century, Antioquia was Colombia's most populated and economically influential department, a leader in commerce, finance, industry, and coffee, as well as the nation's main gold producer. Between 1938

and 1951, economic disruptions caused mining employment in peripheral towns like Zaragoza, Caucasia, and Puerto Berrio to decline by nearly 50 percent, and the loss of 200,000 agricultural jobs. Meanwhile, the expulsion of thousands of peasants from their land in the 1930s and early 1940s aroused support for the populist Liberal presidential candidate, Jorge Eliecer Gaitan, in the 1946 election. 'Miners and road workers', Roldan writes (2002, p. 10), 'who constituted an important presence wherever support for Gaitan was statistically significant, formed the vanguard of Liberal resistance to Conservative electoral intimidation in many of these towns'.

Compared with other regions, the economic importance of Segovia, Remedios, Amalfi, and Zaragoza gave unionized mining and oil workers – allied with public sector road and railroad workers – considerable power. Mine workers were mostly migrants from the Caribbean, Santander, and Norte de Santander, almost exclusively Liberal, and viewed as potential candidates for popular uprisings against Conservative authority (ibid., p. 66). In October and November of 1946, the Colombian Petroleum Workers Union staged strikes to protest the rising cost of living conditions in towns dominated by Shell Oil and Tropical Oil. When a labour uprising started in Shell Oil's Casabe camp in Remedios in August 1947, the Conservative government refused to send reinforcements to avoid the appearance of supporting foreign capital over local labour. Instead, top officials in Medellin recommended that Shell copy a practice used by other companies of hiring off-duty policemen to provide security. In April 1948, following Gaitan's assassination, uprisings broke out again in the area's mining camps.

Throughout, relations between local communities and foreign mining companies were at the centre of the conflict between Gaitanista Liberals and Laureanista Conservatives. Many towns in eastern Antioquia were company towns run by British and Canadian mine managers. In 1939, 40 percent of Segovia's 7000 inhabitants worked for the Frontino Gold Mines Company, and the majority were members of the Frontino Gold Mines Union. As early as 1949, the Frontino concession in Segovia was a hot spot for conflict between local and foreign stakeholders. The Frontino Gold Mines Union 'complained that the mayor appointed by the governor was "an Anglophile" who defended the company interests instead of being "a safeguard for the people [pueblo]"' (ibid., p. 80).

Conclusion: environmental policy in a crisis of authority

Mercury pollution in Colombia presents the vexing dilemma of an acute environmental health crisis that demands immediate intervention, yet sustainable solutions lie in healing deeper social and political afflictions. There

is, at times, a conceit among environmental practitioners that environmental policy can be implemented with political neutrality, based on sound science and pure intentions. But international environmental intervention is part of a political process, which, in the absence of a functional state, depends on what Jouvenel (1993) calls 'government by folkways'. The execution of political decisions depends on the cooperation of the public and moral cohesion, which Epstein (2007) describes as the 'sense of solidarity, compassion, and mutual aid that brings people together to solve a common problem that individuals can't solve on their own'.

Many miners are aware of the danger posed by mercury. Indeed, one common practice used by miners to keep from inhaling mercury vapour is to hold a large leaf over the roasting amalgam, later throwing the leaves into the forest so the mercury ends up in the environment anyway. Likewise, there is an increasingly vocal wing of development practitioners who view environmental needs as inseparable from questions of poverty and property, such that only when miners have access to credit and capital can they invest sustainably in pollution controls. Without formal mining claims, small-scale gold miners in Colombia, and elsewhere, have no collateral against which they can borrow.

One problem with instituting these environmental reforms is the breakdown of both public authority and traditional folkways. Mercury cannot be managed unless miners are legalized, but facilitating cooperation among miners faces serious obstacles. 'What you have to understand about us miners is that we don't trust', said one prospector named in Amalfi. 'What Colombia has is an environment of violence', Guillermoprieto writes (2001, p. 53). 'In Colombia peace has always been achieved by use of force, leading to exclusions that lead to more violence'.

A second problem is that mobilizing governments to recognize small-scale mining rights contradicts the dominant policy of promoting FDI in mining. Despite the centrality of small-scale production in the national economy, expanding the mining sector means securing the country for large-scale mining concessions. This tension between the growing small-scale mining economy and the emphasis on clearing mineralized land for corporate concessions typically leads (not just in Colombia) to efforts to clear the area of small-scale miners. In 2010, forty-eight illegal small-scale mines were shuttered through interventions implemented under the name Operation Shield. After seizing mines, helicopters, trucks, excavators, dredges, pumps, engines, weapons, chemicals, and fuel from illegal miners in Antioquia and Cordoba, Environment Minister Beatriz Uribe said: 'Today we propose going beyond the innocuous debate on whether to safeguard the environment and whether to allow mining activities. We want to ensure the conservation of our natural surroundings and the quality of the environment by

allowing mining that is ecologically responsible' (Herald Tribune Latin America, 9/23/10).

Similar declarations against the illegal small-scale extractive sector are increasingly commonplace across Latin America, as federal officials manage the economic and social pressures of extractive industries expansion. Expansionary periods such as this are precarious windows when fiscal, monetary, and social policies enacted determine whether a country builds a welfare state that reduces risk for citizens, provides security, alleviates poverty, diversifies the economy, and sustains economic development, or, if it goes the path of a permanently insecure state. How the economy is built now will have enduring intergenerational effects. Among small-scale miners, the perception is they are engaged in something that is rigged against them. 'The companies arrive and the laws are immediately changed to help them, while we have to wait ten years to get titles', said Roberto Lema Castro, president of a national miners association called Fenamicol.

Conflict and tension between the needs of small- and large-mining investment is critical to resolve for two reasons. First, a policy that prioritizes only large-scale extraction is guaranteed to result in irreconcilable conflict between foreign companies and local miners, and between the central government and powerful rural groups, including guerrillas, paramilitaries, and narcotraffickers. Second, continuing to marginalize or criminalize small-scale mining activities – rather than push towards progressive and peaceful economic solutions – is guaranteed to exacerbate Antioquia's environmental health crisis. For most small-scale miners, illegal or otherwise, gold is the only livelihood standing between them and poverty. Efforts to force them off the land will succeed only temporarily.

Mercury use and pollution is not new in Colombia: it was used by colonial placer miners in gold and silver mines (Lane, 2010), but the scale of the problem today is without precedent. In addition to providing miners with technical assistance, one intervention may be to impede the supply of mercury to the mines, essentially promoting conservation through market signals. In 2009, eleven companies in Colombia legally imported 130 tonnes of metallic mercury, much of it flowing to small-scale gold mines (Console and Veiga, 2010). Such measures, however, will not prevent an entire generation of Colombians from brain and kidney damage, and debilitating attacks on the nervous system caused by acute and chronic mercury pollution. A political solution is needed that removes *entables* from urban centres to industrial zones, and supports them with technical assistance to introduce clean technologies such as gravity concentration, controlled cyanidation, retorts, and gold shop condensers. It is unlikely that such solutions will come in a single action or law. 'We have too many problems to expect one big solution', a UNIDO official said. 'What we can hope for is to get a group

of entables, five or 10, to try a different way, and use mercury as an excuse, a tool, to create a progressive process'.

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