

Small-scale mining in Bougainville: Impacts and policy responses

Interim report on research findings
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1. Introduction

This Report presents interim research findings from a research project on small scale mining (SSM) in Bougainville. An Interim Report has been produced because while the project is still under way, substantial information has already been compiled that will be of interest to researchers and to a range of stakeholders, including those directly involved in SSM, the Autonomous Bougainville Government (ABG), and the funding agency, Australia's Department of Foreign Affairs and Trade.

Drawing on field research conducted during 2014–2016, the Report provides a high-level but comprehensive review of the current status of the (less than 20 year-old) SSM industry in post-conflict Bougainville. It focuses on the location of SSM activity and the modes of production and methods of mining used; the identity of miners, the nature of their participation in SSM and the economic motivations driving them; the wider economic networks created by SSM; and the risks associated with SSM, including safety, health, cultural, environmental risks, and the possibility that SSM might foster tensions in still-fragile post-conflict Bougainville. The Report concludes with a discussion of informal mechanisms for regulating SSM, and a review of a unique policy and regulatory response to SSM introduced by the ABG in 2015.

Despite the comparatively brief history of SSM in Bougainville, its experience is highly relevant to a number of issues that arise, and in some cases receive inadequate attention, in the international SSM literature. These include the critical matter of how small scale miners gain access to land and minerals, and the economic, social and cultural implications of the ways in which they do so; and how local knowledge and governance capacity can be mobilised to help regulate a form of mining that is highly dynamic and typically occurs in remote areas far from administrative centres.

2. Background

The Autonomous Region of Bougainville (ARB) is a politically autonomous region of Papua New Guinea (PNG). Prior to PNG independence in mid-September 1975 the Australian colonial administration approved construction of one of the world's largest copper mines at Panguna in central Bougainville, by a subsidiary of the multinational mining company Conzinc RioTinto of Australia Ltd (since the early 1990s Rio Tinto Ltd). Development of Panguna encountered substantial resistance from local landowners. Bougainvilleans had no role in approving the project and received few of its benefits after it commenced operating in 1972. Moreover the landowners bore many of the mine's costs, including environmental destruction caused in particular by riverine disposal of tailings (mine waste), social disruption caused by village relocation and the influx of thousands of outsiders, and unequal distribution of the limited benefits that did reach landowners. This situation changed little after independence. The PNG government did renegotiate the Bougainville Copper Agreement with Rio Tinto, which greatly increased central government revenues from the project, but this only served to increase the sense of deprivation and resentment felt in Bougainville.

In 1988–1989 these circumstances led to destruction of mine power supply lines and other infrastructure by Bougainvilleans seeking temporary mine closure to force a re-negotiation of a fundamentally unfair mining agreement. A protracted civil conflict followed attempts by the National Government, which relied heavily on Panguna for its revenues, to suppress by force what it

initially saw as a serious law and order problem. The violence rapidly transformed the conflict into a broad-based secessionist rebellion which resulted in thousands of deaths, led many educated Bougainvilleans to flee the island, and resulted in the 1989 closure of Panguna, and the destruction of much of Bougainville's physical and social infrastructure. Panguna remains closed in early 2016, with little imminent prospect of re-opening. The conflict ended in 2001 with the signing by PNG and Bougainville of the Bougainville Peace Agreement, and the establishment in mid-2005 of the ARB and the ABG. Under complex constitutional arrangements giving effect to that Agreement, the ABG has available to it considerably wider powers than are vested in provincial governments elsewhere in PNG.

Before the conflict began in 1988, although Bougainville's economy was dominated by the Panguna mine and associated industries, there was significant small-holder cash crop production, mainly of cocoa and copra, but no SSM since before WWII. Small scale mining of gold had been undertaken in the 1930s by Australian and other 'expatriate' miners at Panguna and Kupei in the Crown Prince Mountains, popularly known as 'Gold Moni'. The remains of equipment used by these miners, who left Bougainville before the Second World War, can still be seen, as can tunnels they dug in pursuit of veins of gold bearing ore.

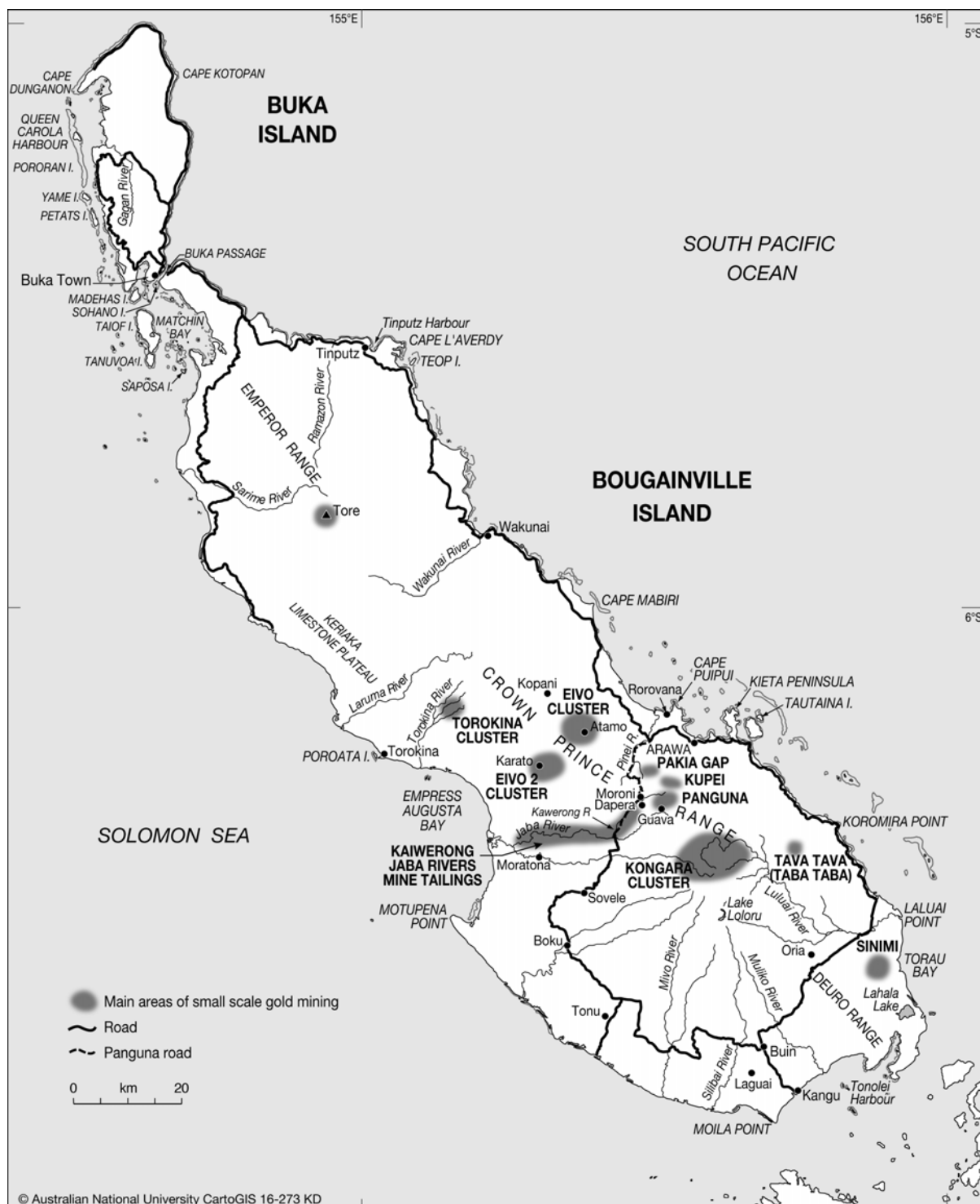
In 1997-1998, faced with the absence of income-earning opportunities in the wake of the Bougainville conflict (it took several years before commercial cocoa and copra production resumed), people started to engage in SSM. It began at the abandoned Panguna Mine Concentrator, Kupei and Karato, expanding to BCL's tailings disposal area in 2001. As news spread about gold's potential value as an income source, and as knowledge of SSM methods was obtained from miners from Panguna and the tailings area, SSM spread to Kanavitu, Atamo and Kopani, and then into other areas, mainly in central Bougainville. Its spread was accelerated in the mid-2000s when the pest cocoa pod borer devastated many recently re-established cocoa blocks, forcing cocoa farmers to find an alternative source of income. As we shall see, SSM now occurs at dozens of sites, all on land held under customary title, mainly by small, and mostly matrilineal clan groups. It provides a livelihood, or supplementary incomes, for thousands of Bougainvilleans, and constitutes at least the second largest sector of Bougainville's cash economy after cocoa production.

3. SSM: Places, Methods, People

3.1 SSM locations in Bougainville

SSM occurs at more than 50 distinct sites, some in close clusters, and most in Central Bougainville, one of three regions of the ARB (South, Central and North)¹ (see Map 1). As we explain in detail below, the extent of activity at individual sites at specific points in time can vary significantly depending on climatic conditions, exhaustion or discovery of gold bearing ore, site accessibility and family, economic, social and cultural factors that influence miners' behaviour.

¹ These regions are not truly geographic, but rather are the names of the three Open electorates for national elections. The boundaries of 'South Bougainville' go a long way north on the western side of the island, while 'Central Bougainville' stretches a long way north on the east coast. Thus while the Tailings area discussed in the next paragraph is close to the geographical centre of the island, much if it is technically located in 'South Bougainville' (for a detailed discussion see Regan 2005).



Map 1. Small scale mining locations in Bougainville.

In South Bougainville, mining occurs at Sinimonoi (Sinimi) and at 12 or more sites in the Torokina area. Sinimi involves an industrial-style operation organised by former Bougainville Revolutionary Army (BRA) commander Damien Koike. In Central Bougainville several thousand people are engaged in mining in and around the abandoned Panguna mine and associated facilities, and between Panguna and the West Coast, referred to here as the 'Tailings area', where processed waste material from the mine was deposited between 1972 and 1989.² Washing or mining of gold from materials in old stockpiles, from tailings and from unmined 'hard rock' deposits occurs along the Kawarong River (upper, middle and lower tailings); at the Jaba Pump Station; at the concentrator, Moroni, Mosinau Area, and Panka'a Area (all at Panguna); Kupei; and at Moroni and at the Kumo Crusher near Morgan Junction, both on the route from the East coast to Panguna. Gold washing also occurs at BCL's former port area at Loloho. Other SSM sites in Central are Kanavitu (with about eight separate locations); Atamo; Avaipa (or Awaipa), also known as Eivo 2; Tabataba in Kokoda; and Kongara 1 and 2. In North Bougainville SSM occurs at Tinputz.

While some SSM sites, especially those in the Panguna and Tailings areas, are relatively easy to access, others are very remote. For example there are no roads to the sites in the Avaipa and Torokina areas. They are located in rugged terrain, with precipitous mountains, dense forests, and fast flowing rivers, accessible only by foot, often taking eight to nine hours to reach from the main access points.

3.2 Modes of production and mining methods

A range of different modes and methods of production are employed in Bougainville SSM. Panning and sluicing using basic tools (picks, shovels, wheelbarrows, pans and buckets) and homemade sluicing boxes which employ carpets to recover the gold are common, especially in the Tailings area and in river bed gravels. Gold-bearing material is often dug out from beneath river banks or cliffs where it has been deposited by river flows, sometimes a risky process (see section 5.3.3). At Panguna ore is taken from the former mine stockpile at the concentrator and processed at peoples' houses in Dapera, Moroni and other villages using panning dishes and sluice boxes. In hard rock mining, the primary stage involves 'chipping' gold bearing ore from rock faces using crowbars and picks, with the ore then being crushed in (usually homemade) crushers made up of pieces of metal sufficiently heavy to reduce the ore to fine sediments. Water from nearby creeks is used for sluicing of the crushed ore, which leaves the gold and heavier particles behind. Metal detectors are used to search for gold nuggets in some areas, while diving is used in certain creeks, where miners locate gold bearing material below the water and bring it to the surface for processing.

² The Tailings area is divided into Upper, Middle and Lower Tailings as one moves from Panguna towards the West coast. While the amount of gold remaining in the tailings generated by BCL was small, many years of rainfall and weathering have created areas where concentrations of gold are sufficiently high to make SSM viable.



Tunnelling for gold ore at Moroni.



Group working in tailings area.



Sluice box made with scrap bush materials and carpet.



Sluicing method adapted from sago processing at Sinimi.

In larger scale operations water pumps combined with generators are used to clear overburden, direct gravels into sluice boxes and wash the gold bearing material. In some cases rough stone walls are constructed to divert creeks or create simple dams to provide a water supply. Small commercial crushers and other equipment are also employed. For example a new commercially purchased crusher is operating at Kupei, having been carried there by several men via Panguna. There are different reports about who owns the crusher, but the apparent intention is that it will be used to crush all the ore mined at Kupei, with the gold recovered being sold to the owner of the crusher at an agreed price, and with a percentage of the proceeds given to the local village assembly to assist with community development.

The most 'industrial scale' SSM operation in Bougainville occurs at Sinimi in the isolated and sparsely populated Konnou area of the eastern part of Buin, in South Bougainville. The operation there is controlled by Damien Koike, and employs a unique, semi-mechanized mining method. According to Koike, the method has been adopted from the traditional method used in that area to process sago in large quantities, mainly for feasting ceremonies. After several years of using small scale panning and sluicing to obtain only modest quantities of gold, the Sinimi miners developed a home-grown, cost-effective method of mining to produce gold in much larger quantities.

The machinery used in the process includes a generator-powered water pump, and an excavator and bulldozer occasionally hired from Kompaini, a civil works company owned by an Australian man and his Bougainvillean wife, based in Arawa. The equipment also involves a large box made out of wood, mesh wire and galvanized roofing material; hoses; and several other sluice boxes positioned and assembled below the main box, all strapped together with nails and vines (bush ropes). Tarpaulins are stretched over wooden frames to shade the whole operation. The excavator and bulldozer do the chipping, crushing and piling of the ore next to the main box. The miners then shovel the ore into the box, water is pumped from a small creek and transported to the box via hoses strapped together with old car tubes. The water is sprayed onto the box containing ore, and with shovels and bare hands and using the force of gravity the men push the material downstream to the galvanized roofing iron and finally to the sluice-boxes where gold is trapped in carpets. The carpets are then taken to another box made out of canvas and banana stalks and the gold is extracted. The gold amalgams mixed with water are then moved to a conveyor belt using buckets where they are collected ready for separation and purification by employing mercury.

Plans are afoot to develop larger scale operations elsewhere in Bougainville. For example, at the Tore sites in Tinputz Joseph Gitovia, a senior traditional leader from the area, hopes to develop extensive mining activities. His plan is to depart from the type of SSM typically conducted in Bougainville. He has commissioned, in cooperation with landowners, an independent geological assessment of the area, with the intention of developing its gold resources through a single large-scale operation. Due to this plan, and at his direction, all small scale mining activities have ceased.

In terms of gold processing, as explained in detail in a later section, mercury is used to recover small gold particles, which attach to the mercury and form an amalgam. This is later 'cooked' over a fire to evaporate the mercury. The gold recovered is then sold directly to buyers, often to be further processed at one of three small gold refineries, one in Buka and two in Arawa. For example Golden Valley Limited, which specialises in buying and smelting, smelts gold using a furnace and the chemicals borax and soda ash.

3.3 The miners

Field work to date indicates that all SSM is conducted by Bougainvilleans, though people from elsewhere in PNG and overseas are involved in purchasing gold and supplying specialised inputs for mining. Individual men and women, family groups (father, mother, children), related families and clan groups, church and youth groups, and the unique military-style corporate organisation at Sinimi, are all involved in SSM. The proportion of males and females at mine sites varies considerably, depending on the type and location of SSM sites. Children are frequently involved, but are less likely to work at sites distant from villages and/or where levels of danger are high. Outside Panguna, the Tailings area, Torkina and Sinimi, most miners are landowners working on their own land, though it is not unusual for landowners to allow involvement of non-landowners in return for some form of payment (see Section 3 for details). In most cases the fact that miners are landowners means that they are mining close to their place of residence, but there are exceptions. For instance it takes approximately three hours to reach the Birepan site, where mining started in 2014, via a track following the Naniuka River uphill from the closest hamlet, Maro. Due to the long hours it takes to reach the site and the difficult terrain, miners have built family camps at the site and sleep there from Monday to Friday, returning to their villages for the weekend. In late 2015 there were seven camps, housing on a daily basis between 50 and 100 men, women and (especially during school holidays) children, while additional camps were under construction.

In terms of work roles, it is more common for men to undertake heavier or more dangerous tasks such as chipping through the rocks with picks and crowbars, or shovelling and pushing of loads of gravel and sand, while women and children do the washing. However, rotation of work roles between men and women is also observed.

The major point to make in relation to all of the groups engaged in SSM is the dynamic and shifting nature of their involvement, reflecting a variety of factors. Some are environmental, with mining having to cease in river beds either because of excessive water flows due to heavy rain or inadequate flows due to absence of rain. For example in June/July 2015 continuous heavy rainfall and a cyclone resulted in numerous landslides in some SSM sites in Central Bougainville, including Pakia, Moroni, Panguna mine pit, Pirurari, Guava and the upper and middle Tailings, forcing some of these sites to close temporarily for safety reasons. Mining stopped abruptly at the Vuakovi small scale mining site in the Torokina area, as an eruption of the Mt Bagana volcano forced people to relocate and focus on building new homes, with the assistance of the ABG and aid organisations, in a location more secure from future eruptions. Geology also plays a role, with numbers at a site declining as accessible gold bearing ore is exhausted, while the discovery of a new, rich source of ore resulting in a spike in mining activity in the area concerned (occurring in the Torokina area early in 2016). Fatal accidents can lead to the closure of sites for an extended period of time. The SSM site at Asimana in the Siuema Village Assembly area, where some 200 people were regularly mining, was closed in late 2015 due to a death caused by a large landslide. According to custom, people from the surrounding villages and hamlets or visitors were prohibited from going to the site, which was expected to remain closed until March 2016 when a customary feast was planned by grieving relatives to end the period of mourning. In part the length of the closure reflected the time needed by relatives to make gardens and raise pigs for the feast.



Family group washing gravel.



Woman panning for gold.



Miners and guards at Sinimi.



Child miner.

Commercial factors including fluctuations in the gold price and the motivations driving individuals and groups can also affect the level of activity. In the latter regard, some families engage in SSM periodically, especially during school holidays, to accumulate a specific amount of money, for instance to pay school fees. Individuals living in an area which lacks SSM may move elsewhere for a number of months to accumulate funds, for instance to settle court matters, help pay for a feast, build a house or purchase a vehicle. Church and youth groups may engage in SSM to accumulate funds to travel to a sports event, or to purchase community water tanks or build houses. Young people may engage in mining sporadically in order to purchase consumer goods. Some landowners undertake SSM steadily but on a part-time basis, combining mining with gardening and cash cropping and varying their mining 'effort' depending on the time demands of these other activities.

Family, social and cultural factors also play a role. For instance, the community in the Siuema area is mainly Catholic, and during October 2015 SSM activity declined as Catholics celebrated the feast of the Virgin Mary, in part by travelling from hamlet to hamlet with a statue of Mary.

The complete absence of women and children in the SSM operation at Sinimi in South Bougainville is unique. The only exception there with children concerns young males still attending school and old enough to work, who are allowed to participate during the school holidays to help pay for school fees. This aspect of the Sinimi situation reflects a number of factors including the leadership of Damien Koike and his long involvement in militaristic groups, and his adherence to the principles of the strongly secessionist Me'ekamui group. Also relevant is the location of Sinimi in a very isolated place, part of a wider area where localised armed conflict, the 'Konnou Conflict', occurred from 2006 to 2011. There are still concerns that localised conflict could reignite due to the illegal possession of firearms by members of the Wilmo Force, Bougainville Freedom Fighters and Me'ekamui armed factions, or due to local landowner resentment about their exclusion by Koike from the Sinimi SSM. The non-involvement of women and children at Sinimi may also, in an area where land systems are patrilineal, reflect a dominant belief that heavy industrial labour is inappropriate for women and children and that men should provide for them, and not be regarded as 'Les man' or lazy person in the community. Miners at Sinimi are generally associated with the Me'ekamui group. Though a majority are from the Konnou Area, they come from many parts of Bougainville. Indeed any Bougainvillean can go and engage in mining there as long as they adhere to Koike's militaristic rules.

In summary, at any one time there will be a core of 'full time' miners, especially in the Panguna and Tailings areas and in Sinimi. Around this core, however, SSM participation is hugely diverse and variable. Given this reality, it is very difficult to state how many people are engaged in SSM. On the basis of visits to many sites and information provided by knowledgeable informants, we estimate that over a period of 12 months there are likely to be some 8,000–10,000 people involved, with as many as 1,500 to 2,000 working in the Tailings area, 300 or more at Sinimi, and about 500 at Kupei. However this does not mean that if it were possible to count everyone engaged in mining on a single week day it would come close to this total. Depending on the range of factors listed above, this number could be as low as 1,500, or as high as 3,000 – 4,000.

4. Access to Land and Gold

The international literature contains little detailed analysis of how SSM miners get access to land, particularly to land held – or regarded as held – under customary group title (Corbett and O’Faircheallaigh 2015). The Bougainville experience sheds light on the complex issues that can be involved in such situations, issues that can have marked impacts on the way SSM is organised and conducted and its financial returns distributed, and on the possibilities for its regulation, informal and formal (see section 6).

Having said that, the issues involved in land and related social systems are highly complex and cannot be fully explored here. A brief discussion of four inter-connected issues will illustrate this complexity.

First and most fundamentally, ethnographic evidence shows that across Bougainville human-land relations are intertwined into complex configurations where it can prove difficult to draw distinctions between or to untangle the co-constitution of land and persons (Dove et al. 1974; Kenema 2010; Oliver 1967). This creates a problem if terms such as ‘access’ and its conceptual cousin ‘exclusion’ are premised on a dissociative relationship between humans and land, that treats land and persons as distinct entities or domains. This is especially so in relation to land or activities undertaken on it. In such a formulation land is seen as a separate domain, object or commodity that needs to be ‘accessed’, in this case to recover gold. It becomes an entity from which particular people can be seen as ‘socially excluded’, if the economic and political arrangements emanating from its use are discriminatory, for whatever reason. The danger is that the use of ‘access’ and ‘exclusion’ as analytical frames sets up a division between land and humans which is not at all obvious in the vernacular registers through which that relationship is conceptualised and articulated in Bougainville. This does not of course deny the existence of monetised transaction of land between specific parties, or that such transactions may favour some people and marginalise others.

The second issue involves the fact that land across many Bougainvillean societies is not merely viewed as the physical surface and subsurface soil. Rather, it only makes sense to talk about land by also including the stories, histories, myths, and legends that anchor individual communities to land. Indeed it is not far-fetched to suggest that the physicality of the land is far less important than the societal narratives that constitute and define land for certain groups. This has significant implications for the ways in which land boundaries and ownership issues are contested and negotiated. Because land stories change over time and across generations this feature renders landholding inherently fluid and a matter of intense political activity.

The third and related issue involves matrilineal inheritance, widely identified as a distinctive feature of land ownership systems in much of Bougainville. Matrilineal inheritance in and of itself conceals a range of complexities and is far from providing a simple explanatory model for the organisation of land tenure. Stories about land are distributed across both men and women in matrilineal societies, and in many cases the land stories under senior men’s custody bear more force and weight when land disputes arise and in their settlement. Thus the distribution of land stories across both sexes problematizes the simple model of matrilineal inheritance.

The final issue relates to the minerals for the extraction of which access to land is sought. It involves the fact that the history of mining in Bougainville is deeply intertwined with local

cosmological beliefs. This is no different in relation to small scale mining. People's understanding of geology is nested in various configurations of origin and mythical stories of powerful spirit beings or animals. This problematizes simple and straightforward notions of resource ownership. It also indicates that despite the social transformation brought about by modernity, many people's understanding of economic wealth production is informed through a cultural lens that views wealth production as a matter of ritual and magic (for a detailed discussion of these themes in another Papua New Guinea context, see Biersack 1999).

Against this background, the following brief discussion of land access seeks only to sketch in broad outline a number of current access arrangements. Developing a deeper understanding of these arrangements, and of their economic, cultural and social implications, is a major focus of our ongoing research.

In many parts of Bougainville landowners determine who is to mine and whether or not to give permission to non-clan member miners to do so, and they also control arrangements for buying and selling gold. The extent to which this control is exercised by women as a result of their role in matrilineal land systems, or by men as a reflection of their tendency to dominate many aspects of public life in Bougainville, is as yet unclear, and may vary. But in several SSM sites in the Eivo area of central Bougainville where we have conducted interviews, senior women members of the clan group involved claimed to have central authority in deciding access to the SSM areas. In many cases SSM is undertaken by the landowners themselves, and members of 'landowning' clan-groups make their own arrangements in relation to organisation of SSM and sharing of the benefits it generates, if this occurs. The available evidence indicates that mining on land regarded as belonging to the clan-group of which a person is a member does not usually require permission from other clan-group members, though it may require authorisation from the senior clan leader, who may often be a woman. There is usually no agreement in such cases to share SSM revenue with other clan-group members, given that most mining work is based the hard labour of individuals or small groups. Larger numbers of clan-group members may participate in SSM when communal needs arise, such as feasting ceremonies.

Landowners also enter arrangements, almost always verbal, for others to conduct SSM on their land. In some cases they will permit people with whom they have family links, including through marriage, or complex historic clan or family connections (often derived from clan migration stories) to engage in SSM, as part of broader, reciprocal economic and social relations. In other cases landowners, particularly in the Panguna and Tailings areas, may pay individuals or groups, for instance church or youth groups, to extract and process gold-bearing ore on their behalf. Youths may provide individual labour at a cost of K20 to K50 per day to do washing for gold. For groups, depending on the numbers involved and the amount and type of work undertaken, daily charges vary from a minimum of K100 to a maximum of K1000. Alternatively, landowners will permit miners to access their land in return for a specific number of grams of gold, or on condition that the miners sell all the gold they win to the landowners. In the latter case the landowners' profit consists of the difference between what they pay miners for the gold and the price the landowners achieve when they on-sell the gold to major buyers, usually in Arawa or Buka (see Section 4.2 for a discussion of gold pricing).

The situation is different in the Panguna and Tailings areas. Here there appears to be acceptance by most landowners that all Bougainvilleans have some rights in relation to land as a result of post-conflict reciprocity principles based in 'custom'. There is broad agreement amongst the multiple linguistic and cultural groups of Bougainville that they share long-established principles concerning the rights gained by allied groups supporting landowners in conflict and whose blood is spilled as a result. The allied group gains some rights over the land involved. During the Bougainville conflict, the origins of which lie with the Panguna mine and its forced closure in 1989, the original BRA leaders from the mine lease areas actively sought the support of traditional leaders from other areas. Young men from all areas joined the BRA. Several thousand people from all over Bougainville died as a result of the conflict, and many more were injured or suffered trauma. Most landowners interviewed on the subject referred to the claim that because blood was spilled all over Bougainville as a result of mining, and often at the request of leaders from the Panguna mine lease areas, any Bougainvillean had the right to come to the Panguna and Tailings areas to pan for gold. Some also mentioned that because other means to earn an income were destroyed by the crisis, there was an acceptance that people from outside the areas should be allowed to earn a living by panning for gold. Others stressed that in the aftermath of the crisis there was no effective government or police presence, that the influx of outsiders was large and that some of them had weapons, and that in this situation landowners had little choice but to allow them to engage in SSM. Most of those interviewed stated that no agreements were in place with landowners allowing people from other areas to engage in SSM, though a small number did refer to the existence of verbal agreements requiring the sale of gold won to landowners.

The precise nature of rights generated by the 'blood spilled' concept ('blut I kapsait' or BIK) requires further detailed investigation. Looking at the ethnographic and social logic that informs the BIK idea, the notion essentially speaks to the inseparable and reciprocal nature of the relationship between land and person. The BIK claim recognises a 'conceptual equivalence', perhaps even a co-constitution, in the relational form between land and person. Amongst the Nagovisi the vernacular term for BIK is '*Ele Laka*', blood cover or to cover the blood. It is a very specific form of recompense for the spilling of blood. *Ele Laka* exchange constitutes the payment and exchange of land as a mode of compensation for someone killed in a tribal conflict or an accident. The term 'compensation' is used with reservations here, because it doesn't fully capture the term's rich and nuanced understanding in the vernacular register. An *Ele Laka* is only possible because at a fundamental level there is a mutual recognition and acceptance of the value that conjoins land and persons as exchangeable and substitutable entities. As a customary mode of compensation *Ele Laka* constituted a full transfer of the rights to own and use the land. The use of the BIK concept in the Tailings area appears more a political device to control decisions over who can and cannot participate in SSM, while the actual ownership of the land remains with its original owners.

Whatever the precise content and significance of the 'BIK' idea, it is clear that certain landowners are far from accepting the presence and activities of at least some of the miners from other areas, particularly if they lack any family or clan links, recent or 'historical' (see Section 5.1). In addition there are places in the upper tailings area where permission has to be sought from the landowners to engage in SSM, and in the mid tailings some landowners are selling access to blocks of land they have allocated for SSM for between K2000 to K3000 per block.

The situation at Sinimi, in the patrilineal Buin (Telei) language and culture area is different again. Mining at Sinimi started in 2004 when an agreement was reached between the miners, led by

Damien Koike, and the landowners covering all aspects of mining that would be taking place in the area. However at some point, according to Koike, the landowners breached the agreement and have now been prohibited from entering the area which is controlled by Koike and his armed men. As mentioned above other Bougainvilleans are allowed to mine but only if they adhere to the rules and regulations of Koike's 'company'.

5. Rewards

5.1 Motivations and economic incentives

While SSM is arduous and at times dangerous, it can be highly rewarding relative to the alternative income-earning opportunities available in Bougainville. The returns from mining obviously vary greatly depending on the area involved, the skill and good fortune of the miner, the way in which mining is organised and gold is sold and the purity of the gold involved (see Section 4.2). Purity ranges from as low as 60 per cent, to around 99 per cent (reported for the Tava Tava area). It is not unusual for a miner to win 2 or 3 grams of gold in a day. With prices paid by buyers at SSM sites typically in the region of K30 – K50 per gram, this equates to K90 – K150 per day, constituting a highly attractive income. One benchmark in this regard is PNG's statutory minimum wage which is K140 a week, though of course the reality is that in most of Bougainville opportunities for formal wage employment are absent. Adding to its attractiveness, income from SSM is realised almost immediately, whereas in cash cropping (the main alternative means of generating income other than the few available formal sector employment positions) there can be a long delay between when work is undertaken and crops are harvested and sold.

Based on information obtained from both site visits and knowledgeable informants including gold buyers and smelter operators, we estimate that gold with a minimum value of K75 million per annum, and possibly more than K100 million, is being produced from SSM in Bougainville. These figures, which would make SSM the second largest sector in Bougainville's cash economy after cocoa, relate to direct income from gold mining only, and do not include the 'multiplier effect' generated by SSM's demands for goods and services (see Section 4.2).

Given the wide range of ways in which individuals, and family and clan groups, engage in SSM, their specific motivations and economic incentives are likely to be varied. Some rely solely on gold production for income. That includes non-landowners or 'settlers' mining in the Panguna and Tailings areas and more generally people from other areas of Bougainville given permission by landowners to undertake SSM on their land. This reliance on SSM income may be necessitated in part by the ongoing (though diminishing) impact of cocoa pod borer on income from cocoa production, or to land pressures in their home areas, or to the need to accumulate cash for some specific purpose. As one settler explained when asked what motivated them to come to the Tailings:

I am here to find money to meet my family needs back at home. Firstly, I am working on building a new house, and also buying gold to meet my children's school fees.

There is population increase back at home causing pressure on limited economic resources such as cocoa. Income from gold is anytime unlike cocoa which is seasonal. Gold is our main source of income used to meet customary obligations, school fees etc.

Another settler stated:

I am here to find money to support my family. Cocoa Pod Borer devastated all cocoa blocks in the area where I am married to in Aita [in the north of Bougainville Island].

A single mother of four children from Aita explained:

I was struggling to support my four children because my husband left us for another woman. I am struggling to find money to feed, clothe, and pay for my children's school fees.

Declining income from cocoa has certainly been a major incentive to become involved in SSM in some areas. For example, it was reported to us that when the cocoa pod borer virtually destroyed many cocoa plantations in the Torokina area in the mid-2000s, which had been the only source of cash income to supplement subsistence food production, between 1000 to 2000 people turned to gold panning at Tsitovi and Korovi creeks and Sipirika. Gold mining has other advantages over cash crops such as cocoa and copra. It can generate income quickly, and over recent years its price has been rising whereas prices for cocoa and copra have been unstable or falling. Rising gold prices have been especially important given the increasing cost of living in PNG. A major advantage in remote areas is that buyers often buy gold directly from miners where they live and/or work, so the miners do not have to go to town. This situation is unlike other sources of income such as cocoa and copra, often expensive to transport to town or port due to difficult terrain and lack of road access.

For other people mining constitutes a supplementary source of income which adds to food they produce or/and proceeds from cash cropping. This may involve regular, part time involvement in SSM, or periodic activity designed to generate income for specific needs, including school fees, paying for a feast or building a house. For example miners at sites in the Eivo area (Kanavitu, Atamo and Kopani) told us that they continue to allocate enough time to work in their gardens to secure an ongoing supply of nutritious food, while using their part time mining work to purchase 'market' goods and services.

Income from mining is used to pay for food, housing materials, school fees, and PMV fares, to settle disputes and to purchase food and other items for customary obligations. Young people exchange gold for goods such as keyboards, radios and electrical instruments. We heard of a few cases where an individual accumulated enough gold to purchase expensive items, such as new 4 WD vehicles. While for some people mining income must be spent immediately on the necessities or pleasures of life, for others gold is a form of saving. We were informed that in the Torokina area some family and clan-groups hold a stock of gold, generally used only when a specific family or clan-group need arises. In this situation all family or clan-group members will need to agree to sell some or all of the gold stock. Gold is also used to generate capital to invest in small businesses. A number of businesses operating shops in Arawa or PMV services from Arawa to Buka have been established with start-up capital from the sale of gold.

Where youth or church groups engage in SSM the motivation usually involves pursuit of group objectives rather than individual gain. Individuals contribute their labour, income from wages or gold sales flow to the group, and the group usually expresses its appreciation by providing workers with a communal meal at the end of the day. This practise is common throughout Bougainville, except in the South.

For Damien Koike, there are wider and more systemic motivations for engaging in SSM. Consistent with his Me'ekamui group orientation, including strong support for Bougainville's independence, he claims that 'true Independence' means that Bougainville produces its own income rather than depending on 'aid' from the National Government and foreign donors. Koike wants to install a mentality among his men that they should work hard digging for gold to sustain their livelihood. He believes that most or all of the other former BRA commanders have deviated from the original focal point of the Bougainville crisis, which was to fight for independence. 'Being independent means standing on your own two feet and sweating your guts to make a living', Koike emphasized in speaking with our project team. In his view other BRA leaders are now receiving money from outside which they are keeping to themselves. Koike also claims that there is a lack of government services in the Konnou area, and that he engages in SSM mainly to assist youths who have never had access to education to support themselves.

Encompassing and underlying many of the specific motivations discussed above is a general trend towards monetization of economic, cultural and social life in Bougainville. As in many other parts of the developing world (see for example Bryceson *et al* 2014 on Tanzania), over time cash is playing an increasingly important part in people's lives. Factors involved include long-term decline in subsistence food production, and its increasing replacement by store-bought foods. A related factor involves changes with cultural and social activities and events such as marriage arrangements, conflict settlements and mortuary ceremonies. Previously conducted within the subsistence economy, they increasingly require mobilisation of cash and store purchased goods. As this trend increases, demand for cash grows. Given the paucity of available alternative income earning opportunities, SSM is likely to continue to expand as long as readily winnable gold remains available.

While a comprehensive analysis of such underlying social trends is beyond the scope of our Project, our research can hopefully contribute towards an understanding of how their impacts are manifesting themselves on the ground.

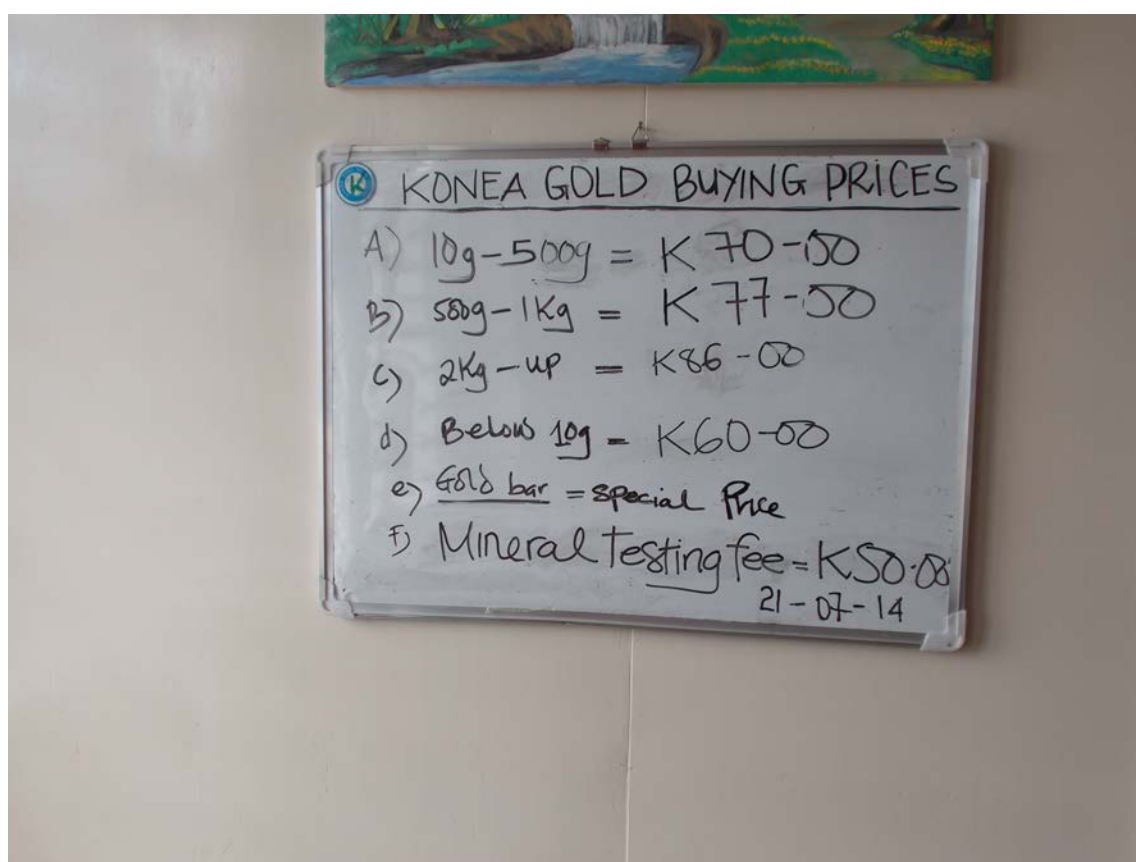
5.2 Wider economic networks

SSM yields a product that must ultimately be sold on international markets, and mining requires the purchase of a range of inputs. For these reasons SSM creates or relies on economic networks that must be understood if the nature and impact of SSM is to be fully appreciated.

Looking first at pricing and marketing of gold, there is no 'official' market for gold in Bougainville and the ABG plays no role in this regard. A wide range of informal arrangements are practiced by sellers and buyers. In areas where mining is undertaken by or with the consent of landowners, at the primary stage of gold extraction buyers are usually SSM landowners and they largely determine prices. Miners, especially those from outside the area, have little or no choice in setting the price and are not free to sell to a different buyer under the buying arrangements agreed with landowners (see the earlier discussion of access arrangements). This type of local pricing arrangement is currently the most widely practised in Bougainville. At the next stage the original or primary buyer, or miners who have freedom of choice in selling their gold, are free to choose which 'middle buyer' to sell to, and usually sell to the buyer offering the highest price. In most cases in central Bougainville, that is Golden Valley Limited, in Arawa. These middle buyers then usually sell to large national gold purchasing businesses based in Port Moresby.



Gold nugget.



Gold price list from Konea.



Furnace operator.



Containers of mercury.

Prices paid for gold vary widely depending on the 'level' at which the transaction occurs; the quantity and quality of gold offered for sale; the number of potential buyers operating in an area; and timing issues, for example proximity to Christmas and dates when school fees are due. The interaction and operation of these factors can be complex. For example, more people may wish to sell gold leading up to the time when school fees are due, which would tend to depress prices, but if a family or clan have saved gold and have a substantial quantity to dispose of, this will have the opposite effect, as will the presence of additional buyers who may travel to an area because they know that substantial quantities of gold will be for sale.

The net result of the factors just discussed is that prices paid for gold vary considerably, from as little as K30/gram paid to a miner compelled to sell to a landowner; to K50/gram for an 'outside' buyer purchasing directly from a miner not compelled to sell to them; to a maximum standard price of about K80/gram paid by large local buyers in Buka or Arawa; to K100/gram paid for purchases of large quantities of high purity gold.

Provision of credit may also play a role in selling arrangements. Miners may borrow or purchase tools and equipment, in return for a fee or promises of later payment of gold. Credit purchase of store goods is common in the Panguna District, especially in the Panguna and Tailings areas, where landowners who own small trade stores allow miners to get goods on credit, which they have to repay after they sell their gold. Some stores in Arawa provide materials such as carpets, tools and equipment, and in return the miners undertake to sell their gold to the supplier. A dredge combo being used by the people of Kanavitu (in the Eivo area) was supplied upon a similar arrangement, recorded in a Memorandum of Understanding between the parties, by people involved with Invincible Resources Inc. or Morumbi Resources Inc., Canadian companies seeking access to minerals in Bougainville through links with local factions (Regan 2014a).

Against this general background, it should be noted that the situation with gold marketing is highly dynamic. For example landowners have expressed concerns that outsiders or 'settlers' entering their area are not adhering to arrangements made for sale of gold to the landowners. One landowner from Konuku Darenai informed us that:

The settlers are more organised when it comes to washing for gold. They are coming in big family groups and are always working together, compared to us. As a result they are producing more gold than us. They also have arranged buyers who come and buy their gold and often get support from their home-grown business owners over some form of deal.

It is also the case that quite specific commercial arrangements are in place for some SSM sites. At Sinimi external buyers are involved, including expatriates who come across the border from Solomon Islands. They supply mercury, 'free of charge', and expect the miners to have gold available for them to purchase. As Sinimi mining is done co-operatively, the miners are able to influence the market price depending on how much gold they have in stock.

Miners at Birepan have their own buying and selling arrangement which is rooted in the clan. Two main buyers from the Marata sub-clan buy gold from the miners. These two buyers charge a small tax which goes towards the community from every seller depending on how much gold they sell. These buyers then sell to the main clan buyer who is currently chief Paul Alopa, who also deducts a small tax which goes towards Siuema Village Assembly. Recently the miners have started working

with an investor, a businessman from Nagovisi who operates a sub-contracting logging company in East New Britain. The investor has provided the miners with a 150 metre hose and a smelting machine. The miners stated that in order to prevent stealing or crooked deals, the buyer/investor will smelt and buy their gold at the village. The gold price will be agreed once a machine to test the purity of the gold is brought in by the investor. The miners have promised that in return for providing them with mercury and capital equipment, they will only sell to the investor and to no other buyer, and neither will they allow other arrangements such as exchange of gold with store goods.

From late 2015, a gold buyer and equipment supplier called IMJ Solutions, based in Arawa and run by three Australian men, has been offering both gold purchasing and equipment supply services. In early 2016 the gold price offered was K80 per gram. IMJ imports mining equipment from the United States, and accepts the exchange of gold for machines, with most of the equipment supplied ranging in price from 200 grams to 600 grams of gold. IMJ requires a percentage deposit in grams of gold before the machine is ordered from its USA supplier. The company reports that Damien Koike has already bought two gold crushers in exchange for 300 grams of gold each, and ordered another ten of them. The company claims that the miners selling it gold come from all over Bougainville, but mostly from Simini, Panguna, Atamo, Karato, Torokina, and the Tailings area. IMJ plans to set up its own gold refinery in Bougainville in the coming years.

These last two examples raise the issue of purchases of inputs used in mining. Some of the inputs required include food, often prepared by local residents and sold to miners; tools and equipment such as wheelbarrows, carpets, sluice boxes/beds, containers, panning dishes, hoses, crowbars and picks; and larger mechanical equipment such as water pumps, electricity generators, small crushers, and smelters. Some equipment is made by miners themselves from bush and recycled materials and scrap, while tools and items such as pumps and generators are usually purchased from stores in Arawa or Buka.

Mercury and to a lesser extent nitric acid are important input items. There are three major locations for the sale of mercury and nitric acid in Bougainville, Arawa, Buka and in the villages and trade stores close to the mining sites. For instance, at the middle tailings, mercury is often sold at the trade stores located near the Pump Station and in the surrounding landowner and settler villages at Toku, Konuku and Darenai. Mercury is sold by miners, gold buyers and trade store owners (who may also be either miners or buyers), commonly at a rate of K30–35 per ml, though it can be purchased in Port Moresby and Lae at as low as K3 per ml.

Mercury and nitric acid buying and selling arrangements can be classified into four main categories. The first is bulk buying at wholesale prices from the main chemical suppliers in Port Moresby, Lae and Rabaul (Bell Tech, Brian Bell and Chemica). Purchases are usually made by large retail businesses in Arawa including those involved in gold buying, such as XYZ Limited, Gold Dust Limited and Golden Valley Ltd. Dealing in bulk mercury can be remarkably lucrative. One of us witnessed a purchase by telephone contact of mercury for K2000 at a rate of K3 per ml, the buyer claiming that he would be able to sell it at a profit of about K26,000. Part of the reason for the high mercury sale prices involves the difficulties involved in transporting it by air, as the two airlines flying into Bougainville have strict regulations regarding its transport.

The second category is when the retail shops re-sell in substantial quantities to gold buyers, usually at a price ranging from K30/ml–50/ml for mercury and K700 per 2.5L bottle on nitric acid. The

third category is when the gold buyers re-sell in smaller quantities to the miners who use mercury during the SSM operations. The fourth category involves the selling of mercury through informal arrangements on the streets, especially in Arawa. A seller may put up notices on shop walls or pass the word around to the miners and buyers.

Suppliers in Arawa often provide mercury to regular customers 'for free', who in return will sell their gold back to the suppliers in order to get a further 'free' supply of mercury. Another arrangement involves the exchange of gold for mercury, an approach practiced for example by Golden Valley Ltd, which is reportedly the largest buyer of gold in Bougainville. Some mercury is smuggled into Bougainville by foreign gold buyers who come across the border from Solomon Islands. For example buyers who regularly cross the border to purchase gold from Sinimi often supply mercury in large quantities.

6. Social and Environmental Risks

6.1 Social issues

SSM can generate a range of social issues and impacts. In recognising this fact, it is also important to stress that their incidence and severity can vary greatly from site to site, depending on location, who is involved in mining, and what sorts of governance arrangements are in place. Social impacts are likely to be less substantial where mining sites are remote, mining is conducted by local landowners, and local community or/and landowner leaders exercise effective administrative control. They are likely to be more serious where sites are easily accessible, involve outsiders as well as local landowners, and lie in areas where governing structures are weak or contested. It is also important to recognise that SSM can generate significant social benefits that must be set against any social problems that do arise.

Small-scale mining is labour intensive and so requires a substantial commitment of time by those involved. This can prevent miners from attending to food production and to family matters and community activities related to local schools, churches, and Councils of Elders. Particularly when miners are absent from their home villages for extended periods of time, the result may be theft of food from gardens when they return, and neglect of children, including a failure to ensure that they attend school. On the other hand, in some areas miners are required to devote one day of the working week to community activities, or the gold won during a day each week is allocated for community purposes or, as mentioned earlier, local authorities may impose a tax on gold sales which is then used for community purposes. For example at Siuema in the Avaipa area the community chiefs have agreed that gold washed on a Wednesday will go to their local level government, the Siuema Village Assembly, to be allocated for schools, churches and other community organisations. These examples highlight the importance of local governance arrangements.

In addition, in at least some cases SSM is substituting for alternative economic activity (for instance cocoa production) that would have involved substantial labour demand in any case. Also important is the fact that in many cases SSM is a family-based activity and as such is unlikely to undermine, and indeed may strengthen, family bonds.

A more specific issue involves the use of child labour. As we note below in dealing with safety issues, this sometimes exposes children to risk of injury or death. It may also result in failure to

attend school, which would obviously have negative impacts not only on the children concerned but, in the longer term, on their potential social and economic contribution when they reach adulthood. We were informed that mining has affected literacy levels in small scale mining areas as many school aged children no longer attend school, because they or their parents are attracted even by what may be quite small amounts of income they can gain from the sale of gold. We have certainly observed many school aged children washing for gold with their parents around the Kwarong River, some as young as six years of age. However in some areas children are only allowed to work after school hours or during weekends and school holidays. In addition, as mentioned above we observed cases where parents engaged in SSM in order to gain the income to pay school fees, serving to support children's access to education.

Disputes over land or access to gold bearing minerals can constitute a substantial social impact of SSM. At Kupei, fighting has erupted between miners over stolen piles of rocks. At Kopani, a new mining site has generated disputes over land issues and concern over environmental impacts on the river system. In the lower tailings, a Nagovisi village has been burnt down over stolen gold and related issues, and indeed reports of gold theft and subsequent social tensions or violence are common. Serious tensions between landowners and miners have arisen at Sinimi, with Koike's group now using force of arms to maintain its access to land for mining.

The availability of cash, in some cases in large amounts, can result in over-consumption of alcohol and illicit drugs, resulting in violence, including domestic violence, family breakdown, and death. There are reports of prostitution involving young girls and women and miners and gold buyers. A number of our informants expressed the view that miners need to be educated about how to put money gained from mining to good use, including by investing it for the future.

At Sinimi, Koike has responded to the risk of social conflict by establishing strict rules and disciplinary measures for his mining workforce (or 'the company' as he calls it). Koike claims the rules are there to safeguard the miners from getting involved in any disciplinary or unlawful act that would tarnish his name and the name of the company. The rules prohibit alcohol consumption, use of marijuana, stealing, and prostitution. The penalty for those involved in any of the above act is total exclusion from the company if reports reach Koike. A number of people have already been banned from Sinimi after they breached the rules. Koike allocates time, normally during morning assembly before work begins, to emphasize discipline and respect for Christian and customary values.

Movement of people out of their home areas to engage in SSM has the potential to create its own social problems, related to land shortage; possible changes to social and cultural practices of host communities; demands on community services; impact on the environment; and health and safety practices around SSM. The Tailings area (and to a lesser extent Panguna) constitutes by far the largest concentration of what are often referred to as 'migrants' or 'settlers' engaged in or associated with SSM. It tends to be assumed that people not obviously belonging to clan-groups owning land in the Tailings or Panguna area are migrants or settlers with no rights in the areas other than those under the post-conflict reciprocity principles outlined in Section 3. In fact many are understood to have connections with local landowners through clan migration histories and other links that ensure that they are not seen only as outsiders. While such links are more likely between people from the same language group, they can also involve individuals from other language groups. For example, although the clan-groups holding land in the Tailings and Panguna areas are mainly

Nasioi or Nagovisi speakers, they may have links with people from neighbouring Eivo, Piva, Banoni, Baitsi and Siwai language groups.

A small survey undertaken in late 2014 in one part of the Tailings area for our Project found that some 80 per cent of the surveyed 'settlers' was from the Nagovisi area. Ten per cent were from the Aita area in northern Bougainville and another ten per cent from the Buin, Siwai and Torokina areas. Much of the Tailings area, especially in what are known as the 'mid-tailings' and much of the 'lower tailings' are in the area occupied by the people of the Nagovisi culture and language, and so most of the surveyed settlers were on land of people of the same (Nagovisi) language and culture. Fully 90 per cent of the settlers were in the ABG's Bolave constituency. These figures underline the significant point that customary relations may exist between so-called 'migrants' or 'settlers' and the landowners on whose land they mine. The comments of a settler from Bolave are interesting in this regard:

I came as an individual buyer based on my individual needs from just across the border which has very easy access to this area. Our culture is also almost the same. Gold is our only source of income. There are no laws to regulate this activity and since everyone is involved, as a result of the gold rush, we call this place home, because we share the border together.

Ninety per cent of landowner respondents to the survey indicated that they had experienced some conflict with settlers, and many wished to remove the settlers due to social problems they generate or to have the ABG and police step in to sort out the issue. Conflict was attributed to difference in social norms and customary beliefs; unhealthy and unhygienic conditions in which settlers supposedly live; tensions among migrants themselves; and an increase in prostitution. Some landowners also claimed that settlers were creating law and order problems, with use of homebrew and marijuana, uncommon in the area before settlers arrived, becoming widespread, and settler youth getting involved in fights after drinking homebrew. As one landowner commented:

Yes there have been major problems. The settlers from Nagovisi have been fighting amongst themselves and have killed five already. They are bringing in conflicts from their homes here to the tailings and are slaughtering themselves. This is creating fear among the landowners. Another problem is that prostitution has become an issue amongst the settlers. We have observed cases of sex along the tailings among the migrants which leads to problems among themselves. It has happened that some young women are selling their bodies to the buyers who normally come in with huge sums of money to buy gold here.

Other landowners complained that while the settlers have abundant land in their areas of origin, they are exhausting gold reserves and occupying land which the landowners could utilize for other purposes. One stated:

Before, we used to get 1 gram to 5 grams per day when washing for gold. However, today due to the increasing number of settler miners into our area, who are now washing for gold everywhere we are now only getting 0.2 gram to 0.5 grams per day. This has made it difficult for us landowners to get money because the settler miners are more experienced and they know exactly where the reserves of gold are found.

Another said:

The settlers are working on blocks of land belonging to the landowners. These blocks could be mined by the landowners themselves and the gold obtained could be used to venture in business. These settlers need to go back to their homes so settlers can sort out their own issues first. Land is already short in the tailings and with the influx of migrants nowadays, this could create conflict in the near future.

Landowners also claimed that settlers steal from their food gardens and harvest their forest for building material and firewood without their consent. It should be noted that accusations of food theft are not limited to settlers. We were also informed that other families have resorted to stealing from gardens when heavy rains force mining activity along rivers to cease. Theft of food is also reported to occur when 'migrant' miners make return visits to their home areas, when as a result of having no food gardens of their own some steal from those of relatives and neighbours. This situation is part of a wider reported pattern of migrant miners who are absent for extended periods of time neglecting their social duties and obligations to kin in their home areas.

Some landowners indicated that they had tried to engage with settlers to sort out issues of concern to the landowners, but that the settlers respond by stating that the land was washed by the blood of the settlers' people and that there is nothing further to be said.

While tension is clearly generated by the presence of at least some settlers, we are not aware of violence occurring between them and landowners, though at one point a number of settler houses were burnt down by disgruntled youths. We should also note that not all landowners expressed a negative view of settlers. Some owners of stores indicated that settlers are their customers and are good for business, and should be allowed to stay.

6.2 Contribution to Localised Conflict

While the danger of SSM contributing to localised conflict might elsewhere be regarded as part of the broad category of 'social issues', in the particular circumstances of post-conflict Bougainville there are good reasons to regard it as a distinct category of risk. Of some importance here is the significance of economic inequality as a cause and driver of localised conflict in Bougainville. The very uneven economic inequality associated with rapid expansion of small-holder cocoa production from the 1960s and with the Panguna mine from 1969 was a significant factor in the origins of the Bougainville conflict (Regan 1998). Further, not only was localised conflict related to economic activity a major dynamic within the overall Bougainville conflict, it has emerged for extended periods and in various forms since the main conflict ended in 1997. The localised Konnou conflict (2006–2011) originated in and was driven by multiple factors, but inequality was undoubtedly a significant cause. During much the same period similar conflict occurred in neighbouring areas of central and western Buin, as well as Siwai. Inequality in these cases is the result of unequal patterns in land distribution originating in pre-colonial migration and land allocation patterns (Mitchell 1982), which led in turn to unequal access to income earning opportunities, especially from cocoa production.

SSM at Sinimi was probably a factor in the Konnou conflict. It was widely reported at the time that Koike's group used revenue from gold sales to buy and even rent firearms for use in the conflict, mainly from members of Me'ekamui factions elsewhere in Bougainville.

Risks exist that SSM will contribute to new local conflicts as a result of its impact on inequality. Intense resentment has been a major factor in murders of relatively well educated, wealthy and prominent Bougainvilleans in recent years, who were accused of causing deaths, illness and other problems through sorcery. Other ways that SSM may contribute to violence and local conflict include the tensions it creates between 'settlers' and landowners and thefts of food from subsistence gardens.

6.3 Health and safety issues

6.3.1 Mercury

Use of mercury and to a lesser extent of nitric acid is a major concern in relation to health and safety issues and also the environment (see section 5.4). Mercury is more commonly used in SSM than nitric acid because mercury efficiently extracts fine gold particles from concentrates obtained by small scale miners, where gold and mercury form an amalgam and the mercury is then evaporated, leaving the gold behind. Nitric acid on the other hand, can only be used to dissolve iron particles before smelting and is more dangerous to handle than mercury.

Normally, sluice-boxes and panning dishes are used to initially recover gold particles. In most instances, some of the gold particles and especially the fine gold, do not settle in the panning dish during the separation process and so mercury is placed in the dishes to accumulate these gold particles. The next stage, which is often the most dangerous practice employed during the gold recovery process, involves evaporating the mercury over an open fire through a process commonly known as 'cooking'. The harmful impacts of this process are inhalation of mercury vapour which results in vomiting, gastroenteritis, complaints of the kidney and urinary tracts, ulcerations in the gums, and extreme light sensitivity known as 'photophobia'. If inhaled over a long period, it can cause chronic mercurial poisoning resulting in kidney ulcerations, HgS deposition in the body, speech disturbances and lack of concentration (Bordia 2016). However, these effects are difficult to document in Bougainville due to lack of proper government regulation and ineffective health monitoring systems, especially given that many mining operations occur in remote locations where health services are inaccessible. What appears certain is that miners have little or no information about safer methods of using mercury, such as the use of retorts to capture mercury fumes and return them to liquid form for reuse.

Mercury is not used at all SSM sites. It is generally not needed in areas where the gold extracted comprises nugget; even if they are very small nuggets, they are readily separated from gravel and dirt. In contrast, sites producing fine gold dust make heavy use both of mercury and nitric acid. Site clusters which use mercury and nitric acid are those at Panguna (19 sites), Paruparu (5 sites), Kongara (3 sites) and Wisai (1 site). Those not using mercury are Tabataba (6 sites), Evo area (11 sites) and Torokina area (9 sites).

Some village leaders have used their authority to ban use of mercury. Such cases have been reported from Torokina, Karato and Tabataba. At certain sites, for example Avaipa, miners are mindful of the dangers involved and use mercury and nitric acid away from the mine site and from villages where women and children live. However we have observed situations in which mercury and acid handling is done very dangerously, without safety gear and protective equipment. We estimate that as many as 80 per cent of the miners who use mercury and nitric acid do so in unsafe and

unhealthy ways, with women and children constituting a substantial proportion of those most at risk. For example, at the tailings area, Panguna, Moroni and Kupei we observed miners handling mercury and nitric acid with bare hands and no gas masks to protect them, with the result that they are directly exposed to inhalation of mercury. We also observed careless handling of mercury, causing accidental spillage. What is especially alarming is that pregnant mothers and children who accompany their parents to wash for gold are directly exposed to these dangerous practices.

In the Tailings area and Panguna and Kongara miners have reported a number of suicidal deaths as a result of nitric acid consumption associated with marital problems. For example during a recent field trip to Kongara, a report was received of a miner who had an argument with his wife and consumed a quarter-filled bottle of nitric acid and died instantly.

Not only miners and their families or neighbours are potentially affected by mercury use. Mercury is sometimes discarded directly into rivers and creeks, or on land. More generally, after 'cooking' the mercury vapour can be assumed to infiltrate into soil and be transported into river systems. This poses serious potential health risks to downstream and coastal communities. The township of Arawa falls in the downstream category. Its residents rely on untreated water sourced from a river where small-scale mining is taking place up stream, and children may accidentally consume contaminated water as they play and bathe along Bovo River which is connected to the Kupei mining area. To date, no research has been carried out on the extent of mercury infiltration, and its accumulation in both fresh water and coastal fish stocks. There is growing concern among people in areas affected by SSM about the extent of the risks involved.

Some miners are aware that mercury and nitric acid do cause health risks but do not have the information or resources to avoid or minimise these. They express the need for the relevant authorities to assist them with capital inputs and by conducting awareness training at mining sites. For example Damien Koike wants immediate action taken to raise awareness of the need for proper use of mercury. None of the miners, gold buyers or community members we spoke with reported any awareness programs being conducted on the impacts of, or safer methods of using, mercury and nitric acid. While the then Bougainville Minister for Health, Rose Pihei, made a strong statement in the Bougainville legislature about the dangers of mercury use in March 2015, that has been the only significant attempt so far to raise public awareness of the issues involved. All miners interviewed advise of the complete absence of visits by regulatory bodies such as the ABG's Department of Mining or Department of Health to conduct awareness.

Miners in Bougainville use mercury and nitric acid because they say it is efficient, fast, simple to use, cost effective and easily obtainable through local buying and selling arrangements. In the absence of appropriate regulatory and awareness interventions by government, the illegal sale, distribution and unsafe use of mercury and nitric acid in Bougainville will continue, and miners will put their own lives and their families' lives at risk while trying to make ends meet.

6.3.2 Other Health Issues

Other health risks arise from the long hours that small scale miners spend in the rivers where they are panning for gold. Miners have reported itching of the legs and skin, which later developed into ulceration of the skin and other skin diseases. Some miners have reported very sharp abdominal and chest pains after they have been involved in SSM for some time. It is possible that some of these effects are associated with disposal of mercury into the rivers. Severe weather conditions

combined with inadequate access to appropriate clothing and food and water can also cause illness. Settlers in particular may lack access to reliable food supplies. Lack of access to health services may mean that health problems are not detected or treated until they have already become severe.

The Kowarung River has high concentration of copper sulphates resulting from run-off from the Panguna open pit and from waste dumps, and health risks are associated with exposure to these chemicals. Dangerous food handling practices occur along the Kowarung River due to lack of clean water for miners to wash their hands before consuming food provided by local vendors. Some children have been observed playing and diving in the creeks along the Tailings, and while doing so consuming water contaminated with chemicals. There are also reports that some babies have been born deformed in the Tailings area, which is believed to have been caused by exposure to the chemicals.

Aquatic protein such as prawns are also exposed to levels of mercury and nitrate which when consumed by people would be detrimental to their health. At a market near Panguna, people in the surrounding villages have stopped buying fish sold by the people of Marau in Nagovis after school students implemented an awareness program which persuaded the people that fish from seas affected by outflows from the Tailings area have high concentrations of chemicals left by the mine.

6.3.3 Safety Issues

Safety is a serious concern in SSM in Bougainville due to the arduous, labour-intensive work involved, the dangerous conditions in which much mining occurs, and the general absence of safety measures and the lack of proper working gear. Miners were observed handling tools with bare hands and feet and no proper head gear. Some miners engage children in dangerous places, including where chemicals are being disposed of. Miners are often exposed to extreme weather conditions which increase safety risks.

Even during the short life of our research project, we have become aware of a number of fatalities and numerous accidents. For example, a death occurred in 2015 after a landslide at the mine site at Asimana, in the Avaipa area, and in the previous year a miner was drowned after a dam failed upstream of where he was working in a creek bed. At Kupei where hard-rock mining occurs on a dangerously steep slope and partially dug-out tunnels left over from mining in the 1930s, seven people have already been injured by falling off rock edges and being hit by falling rocks. Similarly at Moroni, one person has been killed trying to dig for gold beneath a rock, which fell on them. At Kanavitu and Karato there are reports of people also being killed by this dangerous activity. In the tailings area a young girl was buried alive by a landslide as she and her mother were digging for gold along the river bed.

The semi-mechanised equipment used at Sinimi bears potential safety risks as vines or 'bush ropes', which could break any time since they are continuously exposed to extreme weather conditions, are used as straps to hold wood and metal together. At Birepan where miners are using hosed water to blast off the top soil layer to expose the gold-bearing rocks on a mountain side, washing occurs right at the foot of the mountain where there is a high tendency for rock-falls and landslides to occur. Children have been observed washing for gold with their parents in this disaster prone area. Our Project staff have spoken to miners about the dangers involved, and they responded by saying that they have already learnt the lesson from an accident leading to a death at Asimana. The death

resulted from undermining, so to avoid a similar incident, they ensure that the first task undertaken is to chip off and clear the top soil layer at a vertical angle, before any washing for gold can be done.

An issue relevant both to health and safety and the earlier discussion of social impacts involves the uncontrolled clearing of vegetation combined with driving of tunnels below and above sections of the road from Arawa to Panguna. This is creating an ongoing problem with rocks and gravel falling onto the road, creating safety issues for travellers, while the ultimate effect of this uncontrolled activity may involve the collapse and destruction of affected sections of the road. Quite apart from the immediate threat of loss of life, this would interrupt traffic from the Panguna district and beyond to Arawa and Buka, imposing serious economic and social costs, for example by increasing transport costs and reducing people's access to health facilities. Increasing the gravity of the situation, considerable time might elapse before the ABG was in a position to repair any serious damage, given its limited financial resources (see Section 6.3)

6.4 Environmental issues

There are clear indications that SSM is causing major environmental issues, though no systematic analysis of its impacts has been conducted to date. Large quantities of waste rock and processed gravels are being deposited into creeks and rivers and, as discussed above, mercury and nitric acid are also finding their way into river systems. Interviewees have observed that some rivers and creeks have become heavily polluted, with degraded aquatic ecosystems, altered water flows and declining water quality, resulting in reduction of fresh water protein sources such as prawns and fish. Communities downstream of mining areas can be especially affected during periods of heavy rain which erode waste rock piles and increase sediment load. Interviewees expressed concerns about the lack of knowledge regarding the exact extent and nature of environmental destruction caused by the miners, including the impact of mercury on food sources. They stress the need to find safer ways of handling and using mercury.

In the Sinimi area, the use of semi-mechanized mining methods without proper environmental management practices results in erosion of large waste rock piles into the river system, affecting communities downstream. At Kopani and Kupei, disposition of large quantities of waste rocks has heavily degraded aquatic ecosystems, causing reduction in prawns stocks which the local communities depend on for protein. Miners at Birepan have observed environmental degradation and pollution caused by the disposition of waste rock into the Naniuka River, causing it to turn milky and yellowish brown. While they have observed the pollution, miners lack the knowledge to fully assess the level and nature of environmental impacts, though they have noticed a decline in catches of the prawns, eels and fish which are an important food source for the surrounding hamlets. Whilst this could be accounted for by an increase in population, miners have also observed the Naniuka River and surrounding creeks drying up. We observed similar environmental changes during our field visit in this area, but are unsure whether reduced flows in rivers and creeks, which have been observed in areas of Bougainville where no SSM occurs, are due to the effects of the current *El Nino*. This uncertainty highlights the need for systematic monitoring of SSM's environmental effects.

There is no hard data on the impacts of mercury pollution. However as noted above it is clear that mercury spillage into rivers does occur, and this must affect communities downstream which depend heavily on streams for cooking and drinking water and as sources of protein. An example is

mercury spillage into the Bovo River and Tupukas River which run to the open sea adjacent to Arawa Town and where fish are caught and sold at the Arawa market.

7. Regulation

7.1 Informal Regulation

In most parts of rural Bougainville, considerable continuity is evident with pre-colonial social and leadership structures, including the role of clan leaders, hereditary in some areas. It is common for such leaders to play various 'regulatory' roles in relation to SSM. Examples include the role played by Joseph Gitovea in stopping SSM in the mountains of Tinputz, and leaders in several areas banning the use of mercury in their areas. Under the *Bougainville Council of Elders Act 1996*, local communities have been empowered to choose to have their local-level governments (Councils of Elders) comprised mainly of clan leaders, including 'chiefs' (see next section). These bodies also play a role in informal regulation of SSM in some areas.

7.2 The Bougainville Mining Act 2015

Until the ABG introduced its own mining legislation in 2014–2015, SSM in Bougainville was regulated by PNG law, and in particular by the *Mining Act 1992*. This situation created two fundamental problems. First, the *Mining Act 1992* was not enforced. Second, had its SSM provisions actually been applied, they would have rendered illegal and so precluded much of the SSM activity that has occurred in Bougainville, including most activity in the Tailings area. This is because the *Mining Act 1992* only allows 'alluvial' mining on customary land to be conducted by an owner of that land, and only in river beds (either wet or dry) or within 30 metres of river beds, and without use of any mechanised mining methods.

The significant changes to PNG constitutional laws enacted in 2002 to give effect to the Bougainville Peace Agreement empowered the ABG to develop its own regulatory framework for SSM through a process for the transfer of powers from the Government of Papua New Guinea to the ABG (Regan 2013:432–4). The powers made available included all those involving mining. In the period 2006 – 2014 the ABG undertook the process required to take control of mining. This included establishing a Department of Mining with administrative capacity in relevant areas such as mining engineering geology and tenement administration (for details see Regan 2014; forthcoming). The culmination of this process was the enactment in April 2015 of the *Bougainville Mining Act 2015* (the *BMA*). It contains provisions on SSM that build upon the experience of informal regulation (by proposing to incorporate local authority into a new formal regulatory approach), and are extensive and novel in an international context.

Our Research Project played a significant part in the development of ABG policy and legislation on SSM. An SSM Workshop in Buka in August 2014, organised as part of the Project, brought together over 40 people from a range of SSM stakeholder groups, including miners, gold buyers and processors and ABG Ministers and senior officers. We presented the Workshop with information available at that point regarding the status of SSM in Bougainville. Extensive discussion occurred regarding SSM's impacts and the policy issues it raises. Points emerging from the Workshop were:

- that PNG's narrow definition of what constituted 'legal' SSM would not be appropriate in Bougainville, given existing realities and the desire of the ABG to promote SSM, as long as its negative impacts could be minimised;
- that the diversity of SSM and of the local contexts in which it occurs meant that local knowledge, particularly concerning land 'ownership' and access to minerals in land, and local action would be critical to effective regulation;
- that urgent action was required to address some of SSM's impacts, particularly those associated with use of mercury.

After the Workshop, the Project fed additional information into the ABG's policy and legislative development process as it became available. Project team members were also, in their roles as the ABG's Negotiations Adviser (O'Faircheallaigh) and Constitutional and Legal Adviser (Regan) able to contribute directly to the development of policy and legislation, to facilitate negotiations among stakeholders on the proposed legislation, and (in Regan's case) to provide comments on draft provisions of the *BMA*.

A unique feature of the *BMA*, not to our knowledge found in national or provincial mining legislation elsewhere in the world, is that the minerals on customary land are owned by the landowners, and not by the state. Under Section 8 of the Act 'All minerals existing on, in or below the surface of customary land in Bougainville are the property of the owners of the customary land'. This provision 'reflects the general belief among Bougainvilleans that ownership of land extends to everything on or in it, including minerals' (Regan 2014b).

The *BMA* provides for grant of SSM licences, available exclusively to Bougainvilleans, through two distinct kinds of licences. One involves declaration of 'community mining licence reserve areas' (CMLRAs), and the subsequent grant within them of 'community mining licences' (CMLs). The other is the issuing of 'artisanal mining licenses' (AMLs). CMLRAs are identified and proposed within their local jurisdictions by Councils of Elders (COEs) and/or Village Assemblies (VAs). These local government authorities are established under the *Bougainville Council of Elders Act 1996* and operate as a two-tiered system (Regan 2000; Sasa 2013). Under the *Act*, a COE drafts a constitution which defines its structure and whether members are to be elected, or appointed from among clan leaders. About 70 per cent of the 43 COEs are comprised mainly of the latter. The primary function of COEs is to promote peace and maintain law and order in their council areas, and they are able to create rules to that end. The COE may also collaborate with the ABG to implement projects and programs and provide public services. The VA comprises of all persons living in a village and is responsible for promoting peace and maintaining law and order by assisting chiefs or clan leaders in their role of settling disputes. VAs are also responsible for determining COE membership every five years, whether by appointment or election.

A proposal for a CMLRA must include the location and boundaries of the area, as well as a management plan providing 'for the granting, administration and oversight of community mining licences within the reserve area...[and] training programmes regarding the use of mercury and other prescribed chemicals in the recovery of minerals' (s.55(1)). The Department ('of the Bougainville Public Service responsible for mining and minerals') must provide training to relevant members of the Council of Elders (COE) and/or the Village Assembly (VA) which must include:

- Best-practice procedures for the granting, administration and oversight of community mining licences;
- Instruction on practices to be followed or avoided when mercury or a prescribed chemical is used to recover minerals;
- Instruction on mining methods;
- Other subjects as may be decided by the Secretary [of the Department].

CMLRAs may be declared for a period of 5 years. After a CMLRA is declared a COE may 'make rules for the granting and regulation of community mining licences [CMLs] in the area', and they may be granted and otherwise administered by a COE or VA within a COE. While the CMLRAs are identified, proposed and managed at the local level, the Bougainville Executive Council (the ABG Cabinet) retains the power to suspend the right of a COE to grant CMLs, and may revoke single, multiple or all CMLs within a CMLRA. The *BMA* does not specify the grounds upon which the Bougainville Executive Council may exercise these powers, with the exception of section 62(2) which provides that a COE's authority to grant CMLs may be suspended and a CMLRA 'disestablished' if the COE fails to submit an annual report which meets the *BMA*'s requirements.

CMLs are granted solely for the purposes of artisanal mining within CMLRAs, and only Bougainvillean landowners, or Bougainvilleans with approval from the landowners, are eligible to hold one. A major reason for the *BMA* vesting COEs and VAs with the authority to grant CMLs is that these local-level organisations are close enough to the communities to be able to determine issues about land ownership, or approval by owners. A person or group applying for a CML must submit a plan outlining mining methods and environmental protection measures, comply with CMLRA rules and guidelines and hold a certificate of training in artisanal mining (s.73). A CML may be granted for one year, renewed for one further year, and may not be transferred. The *BMA* requires that CML holders must:

- Use only non-mechanised methods;
- Use safe practices whenever mercury or a prescribed chemical is used to recover minerals;
- Not employ or use child labour;
- Not mine deeper than 5 metres below the natural surface of the ground;
- Not use explosives;
- Not discharge water from a sluice, pump or other equipment, except into a holding pond, settlement dam or similar structure or apparatus designed to protect a waterway from the discharge of silt, solids and other suspended matter;
- Keep the licence area free of alcohol and illicit drugs and ensure that miners are not in any way intoxicated while at the mine site.

A COE or VA that grants a CML has authority to revoke or suspend it if conditions of the CML are not met, and could then require further training before the licence is restored or granted anew.

An AML has many similar requirements to a CML including management plans, training, safe handling of mercury and chemicals, prohibition of child labour and explosives, and discharge of water. An AML differs from a CML in significant ways. It is granted and administered by the ABG under the auspices of a Mining Advisory Council established under the *BMA*; has an initial term of up to 10 years, with extensions for 5-year terms; and can be transferred under certain conditions. Other restrictions and requirements of an AML that differ from a CML are:

- Mining depth must not exceed 10 metres, preventing open cut extraction or tunnelling (possible only under a full Mining Licence);
- Area of land must not exceed 5 hectares;
- The holder must record the quantity and value of minerals recovered;
- ‘Substantial mineral production’ must commence within 6 months of the AML being registered and ‘continuous commercial production’ must be maintained;
- Mechanised mining methods are not prohibited, or more precisely, are not mentioned.

Together the provisions for CMLRAs, CMLs and AMLs constitute an attempt to design a regulatory framework that recognises the realities of SSM in Bougainville and at the same time helps to maximise its positive economic impact and minimise the risks associated with it. The vesting of mineral ownership in landowners is driven by the more general need, in the aftermath of Panguna and the Bougainville, to place landowners in a position to control mining on their land (Regan 2015). However along with the provision allowing grant of CMLs to Bougainvilleans from other areas with the approval of landowners, it recognises and supports the current practice of landowners, under complex customary arrangements, in negotiating with ‘outsiders’ to access their land for SSM. It also places landowners in a strong position to negotiate substantial rewards for allowing such access. The restriction of CMLs and AMLs to Bougainvilleans is designed to help ensure that the rewards of SSM accrue locally. The requirement for AML holders to record the quantity and value of minerals recovered, and to quickly commence and then maintain commercial production, should ensure that the ABG is in a position to share in the rewards by collecting royalties on these mining operations.

A number of provisions seek to address risks associated with SSM. These include, in relation to mercury, the requirement for CMLRA management plans to include provision for ‘training programmes regarding the use of mercury and other prescribed chemicals’ and for CML holders to apply safe practices in its use, and the powers for COEs and Vas to suspend CMLs. Environmental risks are addressed by these provisions, by those dealing with discharge of water and the limits on the use of explosives and the size of CMLs and AMLs, and by the requirement for applicants for CMLs and AMLs to submit a plan outlining mining methods and environmental protection measures. Some of the potential social impacts of SSM are addressed by the prohibition on use of child labour and on the requirement to keep licence areas free of alcohol and illicit drugs. These provisions are also likely to assist in improving safety, as is the requirement for licence applicants to hold a certificate of training in artisanal mining.

The emphasis on local level governance through the establishment of CMLRAs and grant of CMLs is significant. As noted earlier, given the diversity of SSM in Bougainville and the remoteness of many

SSM sites, local knowledge and ‘presence on the ground’ are likely to be critical if regulation is to be effective. The international literature certainly shows that regulation of SSM at the local level is often the most effective, due to limited central government capacity, SSM’s occurrence in remote locations, and its highly dynamic nature. Local regulation may for example involve powerful customary landowners, such as Ghanaian chiefs who control access to their traditional lands for ASM in return for payment. It may involve networks of powerful local politicians and merchants who regulate ASM in their territory in ‘informally formal’ ways, as occurs in the Philippines (Corbett and O’Faircheallaigh 2015). However what these and other modes of informal local regulation have in common is that they are, at least from the perspective of those engaged in SSM, an ‘unstable construct’ (Jonsson and Fold 2009: 218). The lack of an institutional base and formal legal powers, combined with a tendency for central government to intervene in ways that undermine local decision makers, leads to inconsistent policy and practice on the ground. This in turn deprives miners of the predictability they need to undertake longer-term investment, including in safety and environmental protection measures (see for example Hilson and Okoh on Ghana; and de Faily *et al* on the Democratic Republic of Congo).

The *BMA* institutionalises the regulatory role of local authorities including customary leaders and grants them formal powers, providing a mechanism to enable local control to occur in ways that are predictable and secure for all participants. At the same time, the *BMA* confers on the BEC the capacity to suspend the powers of local authorities if that predictability and security does not in fact materialise. This of course assumes that volatility in central (i.e. ABG) policy and practice does not itself create conflict with local authorities and so generate regulatory instability.

7.3 Implementation Issues and Policy Implications

The *BMA* appears to offer, in principle, an effective mechanism to help maximise the rewards, and minimise the risks, of SSM, both because of its substantive provisions and the regulatory role it affords to local authorities. However the ABG faces considerable challenges in ensuring that the *BMA* is effectively implemented and its potential contribution realised. This reflects in part the general paucity of resources and administrative capacity faced by the ABG. It has few sources of revenue as economic activity remains well below pre-conflict levels, and as the National Government has frequently failed to honour, or honour fully and in a timely fashion, the funding commitments it made under the Bougainville Peace Agreement. Other constraints on capacity arise from the exodus of skilled personnel and the widespread cessation of schooling as a result of the Bougainville conflict, and from the fact that parts of Bougainville are still controlled by armed factions in the aftermath of the conflict.

Against this background the tasks the ABG must undertake to effectively implement the *BMA* are formidable. For example, it is required to provide training to COEs, members of VAs and CML applicants in all aspects of ASM, including licencing administration and oversight, handling mercury and other prescribed chemicals, mining methods, and ‘other subjects that may be decided by the Secretary’ (s60(2)). The ABG will need to monitor and oversee COEs and VAs, and provide them with training needed to administer CMLRAs and CMLs effectively. It will also need to provide training to CML applicants and holders. COEs will need to be monitored in terms of correctly completing and lodging annual reports. Particularly given the dynamic nature of SSM and the extreme remoteness of some mining sites, ensuring that COEs and miners actually play their allotted roles and comply with the *BMA* is an onerous administrative task.

Another issue, just as important but more amenable to early action by the ABG, involves its Department of Mining. To date, the Department has been focused almost exclusively on potential roles in administration of tenements associated with large-scale mining and AMLs. It has shown no interest in SSM and has failed to develop expertise or capacity in its regulation. Indeed in a recent discussion with a member of our Project team, a senior Department officer indicated that the Department does not even have information on gold output from or numbers involved in SSM, or on its links with other economic sectors, indicating that this is due to 'the ABG's primary policy focus on large-scale mining'. Both this policy focus, and the Department of Mining's administrative effort, will have to shift to include SSM if the *BMA* is to be effective in maximising the rewards and minimising the risks of small scale mining. Early in April 2016, the ABG President expressed grave concern about the Mining Department's failure to work on the administrative and training arrangements for CMLRAs and CMLs (Momis 2016).

Focusing more broadly on the policy implications of SSM for the ABG and for other stakeholders including the National Government and DFAT, a full analysis will be provided as part of our final research report. However it is already clear that a number of policy responses are required as a matter of urgency, in addition to those arising from implementation of the *BMA*. One involves the need for more reliable information on the health and environmental impacts of mercury use in SSM, to serve as a basis for a comprehensive program to control its impacts, including through providing access to technology such as retorts. Much could also be done to encourage safer mining practices, including by providing a supply of basic, inexpensive safety equipment such as hard hats and face masks, and encouraging its use. Information on water quality in creeks and rivers affected by the abandoned Panguna mine and used by miners is also urgently needed. In the economic arena, provision of information to miners in relation to gold prices and available market outlet would increase transparency and assist them in obtaining fair prices for their gold. Where local dispute resolution processes are inadequate, the ABG may need to provide mediation support to help resolve conflicts between landowners and 'settlers' and between contending parties in disputes over land or access to gold resources. A policy initiative is also required to address the issue of child labour in SSM. The *BMA* prohibits its use on tenements granted under the *Act*, but given the extensive current involvement of children, this in itself is most unlikely to resolve the issue. The ABG needs to initiate a broadly-based discussion regarding whether there is any role for children in SSM and, if there is, under what circumstances and in what form their involvement is acceptable.

8. Conclusion

SSM in Bougainville, as in many parts of the world, is highly dynamic, with mining locations, methods and numbers of people involved changing rapidly, often over short periods of time. In less than two decades it has grown to become one of the most important activities in the formal sector of the Bougainville economy. It employs thousands of people on a regular basis, and supplements the incomes of many thousands more, often constituting their only means of generating cash. It allows miners to earn incomes that are high relative to the alternative opportunities, and in some cases those incomes help, for example, to ensure that children can continue their education. At the same time the methods used and the absence of safety equipment and safe work practices place miners at risk. SSM also creates significant health and environmental impacts not just where it occurs but also in downstream communities. It generates social costs through neglect of family and clan responsibilities, and by generating social tensions between landowners and so called 'migrants', and

between those who benefit from SSM and those who do not. This latter impact is a matter of considerable concern in a post-conflict society, and requires further study and a careful policy response, as do a range of other environmental, social and economic issues created by SSM.

One major issue involves access to land and minerals to allow mining to occur. Our research to date indicates the complexity of this issue in Bougainville, a complexity that the international literature on SSM has failed to address. Further research on the issue of land access and social and cultural impacts constitute a major priority for our research project. Another priority involves additional analysis of existing, informal regulatory mechanisms, and of attempts through the *Bougainville Mining Act 2015* to institutionalise and build on these mechanisms to achieve effective regulation of SSM. Success in this regard would render Bougainville's experience with SSM of enormous interest internationally.

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