The Kias gold mine, Philippines

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Introduction

Background

The Kias Mine occupies 11.4 hectares and is owned by the Kias Explorer's Association, a private mining association that was registered with the Philippine Securities and Exchange Commission in 1986. The primary aims of the Association, as set out in its constitution and by-laws are: "... bringing about self-employment, mutual understanding and to promote the welfare of its members."

The Association is said to have started with a membership of nearly 500, but membership has steadily declined during the years and, by the end of 1997, there were only 76 paid-up members. In May 1998 there were 40 members who were actively working.

All the current active members of the Association are adult males. However, there are also occasional women workers at the mine, mostly family members who help in various tasks. They also include other women who are often engaged by the miners to perform specific tasks (specially panning) during the milling process.

Most of the miners have basic mining experience from previous jobs in large mining companies. Business knowledge and practical skills on other operational aspects (exploration, gold processing techniques, etc.), however, are largely self-taught -- acquired through observation or by trial and error.

Legal status

The mine is covered by a small-scale mining permit under the provisions of PD 1899, which is one of the two main Philippine laws that provide the legal framework and licensing system for small-scale mining operations. Compared with the other small-scale mining legislation regime (7076), that is based on the concept of production-sharing with the government, the mining permit held by the Association under PD 1899 is a basically a two-year lease. The main features of the mining permits issued under these two separate pieces of legislation are shown in table 1.

The existing Small-scale Mining Permit of the Association is valid to February 1999 and is renewable. Although the official document shows that the permit was issued in the name of an individual (a former officer of the Association), it remains in the hands of the Association. The officers of the Association claim this arrangement was primarily to simplify and facilitate the granting of the permit.
## Table 1. Comparison of small-scale mining legislation

<table>
<thead>
<tr>
<th>Items</th>
<th>Provisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small-scale mining permit (PD 1899)</td>
<td>Small-scale mining contract (RA 7076)</td>
</tr>
<tr>
<td>Purpose</td>
<td>Mining of metals and non-metals in areas open for mining locations.</td>
</tr>
<tr>
<td></td>
<td>Extraction of minerals in declared small-scale mining areas.</td>
</tr>
<tr>
<td>Who can apply</td>
<td>Filipino nationals and corporations with at least 60% Filipino ownership.</td>
</tr>
<tr>
<td></td>
<td>Filipino and Filipino-owned cooperatives or associations; local resident miners have priority.</td>
</tr>
<tr>
<td>Size/area</td>
<td>Not more than 50,000 tonnes of ore/year.</td>
</tr>
<tr>
<td></td>
<td>Not more than 20 hectares.</td>
</tr>
<tr>
<td>Duration</td>
<td>2 years, renewable for the same period.</td>
</tr>
<tr>
<td></td>
<td>2 years, renewable for the same period.</td>
</tr>
<tr>
<td>Others</td>
<td>Transferable right.</td>
</tr>
<tr>
<td></td>
<td>Non-transferable; cannot be sub-let.</td>
</tr>
<tr>
<td>Workings limited to 50 m vertical depth.</td>
<td>Workings limited to a depth &amp; length stipulated in the contract.</td>
</tr>
<tr>
<td>Permit holder should start work within 12 months of issuance of permit.</td>
<td>Part of government share to go to People's Small-scale Mining Protection Fund for the benefit of small-scale miners.</td>
</tr>
<tr>
<td>Separate permit for ore processing required.</td>
<td>Separate permit for ore processing required.</td>
</tr>
<tr>
<td>Permit issued by national government via regional offices.</td>
<td>Contract awarded by local mining regulatory board.</td>
</tr>
</tbody>
</table>

## History

The short history of the Kias Mine typifies the general early development stages or formalization process of small-scale or artisanal gold mining in a developing country. It was established at an abandoned gold mine and went through an illegal gold-rush stage before the area was eventually legally recognized and covered by a mining permit. The mine is part of one of the pioneering gold mines (Demonstration Mine) which operated in the Philippines in the 1930s. The Demonstration Mine also grew from old workings -- those of the indigenous Igorot small-scale gold miners who originally worked the area.

No mining activity was reported in the area after the closure of the Demonstration Mine until the mid-1970s when the site was worked by small-scale gold miners. Some of them recall more than 500 miners working in the area at any one time during the peak of activities in the early 1980s. At that time, mining was mainly undertaken at the night and the ore removed for processing elsewhere in order to avoid law enforcers. Despite the efforts of the different government authorities (police, military and the Bureau of Mines) to stop illegal mining, it continued. That it did so was partly due to the "tolerance policy" of the different enforcing authorities as well as the intervention, on a number of occasions, of local politicians on behalf of the miners.

The miners apparently made a number of attempts to organize themselves into an association as an initial step to secure their livelihood and to formalize their mining operation. However, it was only in 1986 that the Kias Explorer's Association was finally formed.

As in most small-scale mining operations, the continuity of mining activities in the area largely depends on the ability of the miners to develop and mine at deeper depths. Unfortunately, some of the main provisions (limited depth, non-use of explosives, etc.) of the small-scale mining permit restrict the extent to which small-scale miners can develop their underground workings.

The proximity of the mining site to the centre of the city of Baguio makes the area attractive for suburban housing and many houses are being built close to the mine site. There is, therefore, a potential land use conflict should housing development encroach further on the actual mining site.
Location and accessibility

The Kias Mine is within the Baguio gold mining district in the northern Philippines -- one of the several areas in the country where there are active small-scale gold mining operations (figure 1). The mine at Kias in the jurisdiction of the municipality of Itogon, Benguet and the city of Baguio. Kias is about 30 minutes from the heart of Baguio by taxi or by local public transport (jeepneys) that regularly services the area. The actual mining sites and milling/processing areas, however, can be only reached on foot.

Figure 1. Small-scale mining in the Philippines

Mine output and gold production

Information on mine output (in terms of the quantity of ore mined and/or processed) is not readily available. Even the production report forms of the Mines and Geosciences Bureau, to be completed by small-scale mining permit holders, do not contain this information. Production at the Kias Mine can, however, be estimated in the basis of the number of ball/rod mills (six units) and their aggregate total capacity (500 kg per batch). Assuming that all the units are used for four days a month, the mine is producing at least ten tonnes of sorted ore a month.

There are no records of gold production in the area during the early years of exploitation (gold-rush stage) due to the illegal nature of the activities at that time. The records of the Mines and Geosciences Bureau show that official reporting of production commenced only in 1994, in compliance with the provisions of the permit. However, the early reported figures of 500-3,000 gm
of gold per quarter should be considered "guesstimates" at best, since the information is mainly based on data provided by individual members, with no verification. The 1997 reported production of 5.93 kilograms is perhaps a better reflection of mine output, but this figure does not include the gold produced from the four cyanidation units.

The average annual gold production of the Kias Mine since 1996 is estimated to be 7-10 kilograms. This quantity constitutes about 1% of the reported national 1996 gold production (8,480 kilograms) from small-scale gold mines. The Mines and Geosciences Bureau reported that total gold production in 1996 was 14,523 kilograms. Thus, according to published figures, 58% of the Philippine's gold production came from the small-scale mining sector. It is likely, however, that output from small-scale mines is considerably understated in official statistics. Moreover, it is unlikely that a small-scale mining operation as small as the Kias Mine could contribute 1% of the total gold production from small-scale mines.

Organizational structure

The Association identifies itself as a "private mining association" with a defined organizational structure in terms of officers and their duties and responsibilities. The actual operational structure, however, is rather complicated. It involves different forms and various levels and includes formal, semi-formal and informal arrangements.

Ownership

The mine as a whole (and the small-scale mining permit) is owned by all of the members of the Kias Explorer's Association. The Association provides the main formal organizational structure within the mine. It is a legally constituted and registered entity and it is the focal organizational body of the mine, but it plays no direct role in the actual production processes or operations. In practice, the main roles of the Association include:

- to maintain legal ownership of the property by complying with reporting requirements, and to renew the permit when due;
- to liaise with appropriate government agencies and other organizations on behalf of the group;
- to coordinate group activities of the Association especially in relation to environmental protection such as tree planting and forest fire prevention; and
- to settle disputes that may arise within the membership.

The other components and features of the mine -- such as mine workings, housing, processing plants, water supply systems and aerial tramlines for ore transport -- are generally owned separately by individual miners, or by a group of miners.

All the existing mine workings (adits, drifts and stopes) are developed separately and independently and are used or worked exclusively by the owners. The only exception is during "sagaok" occasions. Sagaok is a practice unique to small-scale gold miners in the Baguio mining district, whereby the more fortunate miners share their good fortune with other miners. Sharing is either done directly, by giving extracted ores, or indirectly, by allowing other miners to do the mining themselves in the donor's workings for a given period.

The processing plants, which include gravity concentration units (ball/rod mills and accessories) and cyanidation circuits, are also owned independently. Unlike the cyanidation circuits, which are used solely by the owners, the gravity concentration units also serve as custom milling plants for other miners. The existing aerial tramline for ore transport is also independently owned and is available for hire by other users. The water source is owned and maintained by the whole group and
all members have equal access to it. However, there is no common distribution system, each of the miners, especially the mill/plant owners, provide their own pipe lines and related fixtures. Despite its proximity to the city, there is no electricity supply at the mine. Power is supplied independently by the miners themselves, using diesel generators.

Financing

There are two distinct and separate financing arrangements in relation to the mine's operation -- the funding of the Association and the financing of the production units. The financial resources of the Association come mainly from the contributions of the miners in the form of membership dues and from "milling fees". This milling fee is a kind of production tax; a fixed amount paid by members each time they process their ore. The Association has no paid employees and the services of the officers (and members) are offered on voluntarily. The Association's money is mainly used to cover expenses related to mining permit fees, documentation and processing, as well as the cost of hosting visitors, meetings and general communications.

The production units are financed independently. Financiers include the miners themselves, gold buyers and other entrepreneurs. Funds are mainly derived from the financial assets of the financiers and the proceeds of gold sales. In practice the financier provides the funds to cover the basic costs of operations, such as accommodation/housing, equipment, tools, supplies, food and other operating expenses such as the rental of ball mills for processing. Other financiers also shoulder the costs of tobacco/cigarettes and spirits. The production units are also initially "financed" by the labour contributions of the workers.

Working arrangements

The main production unit at the mine is a compagnia -- a separate and independent body that is an informal cooperative partnership. It is made up of 4-8 miners who are typically relatives or friends of the financier. It is the prevailing organizational structure in almost all the small-scale gold mining communities in the Baguio mining district.

The members of a compagnia operate as a team with everybody sharing the work in all stages of the production process. The financier often works too, just like the other partners, which entitles him or her to the same privileges and financial rewards due to the other working partners.

Apart from the procurement of supplies and equipment, which is normally done by the financier, other tasks, such as camp maintenance, guard duty and food preparation, are also shared proportionately by the members of the compagnia.

The proceeds from gold sales are divided equally (computed on person-days worked) among the partners, after the expenses of the financier have been deducted. The financier automatically gets one share for providing the finance, and is entitled to another share if he has worked like the other partners.

Although work schedules and working hours are not strictly set, it is common among compagnias to operate two working shifts, with the first shift working from early morning to mid-afternoon, immediately followed by the second shift to midnight.

There is a continuous activity at the Kias Mine throughout the year, but most miners stop working underground during heavy rains as a safety precaution, or are forced to abandon their underground workings due to flooding. The miners generally do most milling and processing during the rainy season to take advantage of the availability of water. High grade ores, however, are processed almost immediately with lower-grade ores being stockpiled for processing during the rainy season or during other periods when there is little mining to be done.
Remuneration

The different methods of compensation practised at the Kias Mine do not include the conventional arrangement based on employer-employee relationship. The common arrangements, which are also common in nearby small-scale mining communities include:

*Profit sharing.* This is the most common practice, the typical application of which is described above in the case of a *compania*. Without this scheme it would be difficult for the miners to maintain their operations. On the other hand, it is also an attractive arrangement considering that alternative employment, if any, might not provide subsistence income. But because there is no guarantee of regular income, most of those who are work under this arrangement are unmarried miners.

*Daily casual employment.* The *por dia* arrangement is applied to occasional work, such as hauling of ores, construction, etc., where profit sharing is not appropriate. Compensation under the *por dia* arrangement normally includes a fixed daily rate of pay and provisions for food and accommodation.

*Piece-work.* This is similar to the *por dia* scheme with payment based on output. For example, some adits were driven and paid for under this scheme, the workers being paid at an agreed rate per metre of progress. Normally, equipment and supplies, including food, are provided to the workers.

*Ore sharing.* The most common application of ore sharing is during the final panning of sluice concentrates, when a miner or a *compania* engages the services of experienced panners (normally women). The panner is "paid" in tailings from the panning, locally called *linang*. The *linang* is then reprocessed by the panner to recover any remaining gold. The panner also gets free food under this arrangement.

*Rentals with cash and ores.* Ball/rod mill owners are paid a fixed amount for each batch of ore milled and processed. In addition, the ball mill owner gets the gravity concentration tailings as part of the rent.

*Selling of mine workings.* Some miners also get compensated by selling their adits, drifts or other underground workings to other interested miners. Modes of compensation include a one-off payment, or an undertaking to share future production.

Collaboration with large mining companies

There are three gold mines (currently not producing) and one copper mine near the area, but there is no formal link or collaboration between them and the Kias Mine. The large mines, however, were the training grounds (through employment) for many small-scale gold miners, including some of the miners at Kias. Other interactions between the small-scale gold miners and the large mining companies include:

*Tailings buying.* Two of the large gold mines (Benguet Exploration and Benguet Corporation) used to buy the gravity concentration mill tailings from the miners at Kias. Prices were based on volume/tonnage and on the gold assay values. Tailings buying and transactions were mainly through middlemen.

*Assaying.* Small-scale gold miners using cyanidation processes sometimes use the assay facilities of the large mines. These services, however, are not openly offered by the mining companies to the small-scale gold miners but are mainly arranged through personal contacts at the mine.
Large mining companies could usefully assist the small-scale gold miners at Kias, as well as other miners in the nearby small-scale mining communities, in a number of ways, including:

- providing affordable assaying services;
- sharing geological and other technical information;
- providing practical training and technical advice;
- assisting in the sourcing and procurement of supplies, tools and equipment;
- managing the procurement and storage of explosives (should their use by small-scale miners eventually be allowed);
- making larger equipment, tools and workshop facilities available for hire;
- providing emergency assistance and mine rescue.

**Relations with authorities**

Inspections of the mine for safety purposes, and to verify compliance with other provisions of the mining permit are undertaken by the regional office of the Mines and Geosciences Bureau. But the inspections are limited and infrequent due to a lack of resources in the Bureau. It is hoped that the implementation of the newly enacted Small-scale Mine Safety Rules and Regulations will improve inspection procedures, as well as safety and accident record keeping.

The Kias Mine, like small-scale mines in other areas, is not serviced by extension workers from government, NGOs or other groups. Although the plans of the Mines and Geosciences Bureau include provisions for technical assistance to small-scale miners, it does not occur because of the lack of resources and experienced personnel. The officers of the Association are examining the possibility of getting assistance from the Department of Labour and Employment, through its livelihood programmes. The Association had also collaborated with the British Geological Survey (BGS) and the Mines and Geosciences Bureau in the field testing of low-cost gravity separation tables, developed by BGS for use by small-scale gold miners.

The major administrative problem affecting the miners relates to the issuing of processing permits. Unlike the mining permit, which covers all the mining activities, separate processing permits are required for each plant, be it gravity concentration or a cyanidation circuit. The miners find it difficult to comply with the various technical and environmental requirements of the application. Also, some of them find it illogical for the government to grant them a permit to mine then, in effect, tell them not to process their ores because another permit is required. Consequently, the processing plants do not have the appropriate permits. A simpler licensing, system which covers all aspects of gold mining and production, would resolve this issue. In the meantime, assistance from the relevant government offices should be provided in order to help the miners comply with the technical requirements for obtaining a processing permit.

Similarly, the restrictive provisions (limited depth of underground workings, non-use of explosives and machinery, etc.) of the mining permit also contribute to the technical problems faced by the miners. These provisions do not encourage proper and long-term planning. They also stagnate operational development and limit productivity.

**Operational practices**

The production process at the Kias Mine is similar to that of other small-scale gold mining operations in the Baguio mining district (table 2). The only difference in the case of the Kias Mine is that most of the sluice tailings are processed on site instead of being sold to large mining companies.
Prospecting and exploration

The general prospecting and exploration methods used by the miners at Kias are simple but effective, involving the collection of samples of exposed vein materials from outcrops and old workings. The samples are then ground manually and panned to get an idea of the gold content. Based on the observations from the panning process, the source of the sample is either followed with test pits, drifts, or basically abandoned. Known vein structures are also reached or intercepted by driving cross-cuts at different elevations. This is a common practice especially when high grade ores are encountered by other miners who are already on the vein structure. Most miners are thus mining the same vein deposit but at different levels.

The miners also value the importance of maps and other information on the old Demonstration Mine area, in the hope that it would guide them to old but still promising workings. Some of the miners go to the trouble of seeking out former miners from the Demonstration Mine to obtain guidance.

Mining

Extraction of the gold-bearing ore is by directly following the vein structures with drifts, raises and winzes (steeply inclined shafts). Ventilation is mainly natural; fans are seldom used. Timber is scarce and expensive, so underground support is mostly in the form of pillars. Concrete posts are also used as timber substitutes.

Pulleys, improvised windlasses and locally fabricated mine cars are used to transport ore from the underground workings to the surface. Ore transport at the surface, on the other hand, is manual (in sacks on backs) and then by aerial tram line.

Processing

Gravity concentration and cyanidation are used. Most of the companias have their own gravity concentration plant, which is mainly composed of a ball/rod mill and sluice boxes. Cyanidation circuits include temporary leaching ponds with zinc extraction mechanisms and agitation tanks for carbon-in-pulp and carbon-in-leach treatment. Other facilities used in ore processing include fabricated stripping columns, electrowinning cells that are made from used car batteries, and blowers for gold melting purposes as well as for blacksmithing.
Table 2. Typical flow sheet of small-scale gold mining, milling and melting operations as practised in the Philippines

<table>
<thead>
<tr>
<th>Process</th>
<th>Equipment/tools</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ore sources</td>
<td>Mainly quartz veins/veinlets; could also include mine waste from dump.</td>
<td></td>
</tr>
<tr>
<td>Mining</td>
<td>Compressor, water pump, explosives, drill/drill bits, picks, shovels, rock chisels/moils, blowers, sledge hammers, carbide lamps, hard hats, boots</td>
<td>Mining by pick &amp; shovel following the veins/veinlets with drifts, raises &amp; winzes (&quot;pabobon&quot;). Explosives &amp; timber supports used depending on nature and hardness of rock. Compressors sometimes used, but most drilling is manual. Ventilation by hand-driven blowers is common. Carbide lamps for lighting.</td>
</tr>
<tr>
<td>Waste</td>
<td>Mine waste (&quot;mullock&quot;) put back in mined-out workings or dumped at the surface.</td>
<td></td>
</tr>
<tr>
<td>Mined ore</td>
<td>Ore (&quot;nava&quot;) is free-gold-bearing quartz vein material associated with iron &amp; copper sulphides &amp; other base metals &amp; some wastes. Size: 15cm to sand.</td>
<td></td>
</tr>
<tr>
<td>Hauling</td>
<td>fabricated trackless mine cars, improvised aerial tram lines, fabricated flat carts (&quot;kariton&quot;), pulleys &amp; jacks</td>
<td>Hauling of ore from underground to surface is generally in trackless mine cars; hauling ore to mill plants generally manual, with help of aerial tram lines and flat carts.</td>
</tr>
<tr>
<td>Crushing/sorting</td>
<td>Fabricated laboratory-type jaw crusher, sledge hammer, rubber rings, goggles, screen sieve</td>
<td>Primary crushing by sledge hammer. Increasing use of jaw crushers. Simultaneous hand sorting.</td>
</tr>
<tr>
<td>Waste</td>
<td>Waste is discarded nearby.</td>
<td></td>
</tr>
<tr>
<td>Crushed ore</td>
<td>Size: 6 mm.</td>
<td></td>
</tr>
<tr>
<td>Grinding/milling</td>
<td>Ball/rod mill (&quot;gaidan&quot;), steel balls/rods (&quot;gaid&quot;)</td>
<td>Grinding or milling with ball or rod mill done wet by batch for 2 hrs/batch. Actual time through trial &amp; error &amp; observation. Petrographic analysis would help to determine optimum size for gold liberation and grinding time. &quot;Gaidan&quot; used for high grade ores &amp; for re-grinding small amounts.</td>
</tr>
<tr>
<td>Shuicing</td>
<td>Shuice box, screen riffles, jute sack, corduroy cloth</td>
<td>Shuicing in batches using sluice boxes of varying width &amp; length. Ore &amp; water flow by gravity through sluice box and gold &amp; other heavy metals that settle on fabric collected during washing of it.</td>
</tr>
<tr>
<td>Sluice tailings</td>
<td>Tailings settle in series of ponds and are collected for sale to mining companies. High grade tailings separated, re-ground &amp; sluiced again.</td>
<td></td>
</tr>
<tr>
<td>Sluice concentrates</td>
<td>Sluice concentrates contain free gold &amp; other heavy minerals -- sulphides and magnetites; latter removed using magnets.</td>
<td></td>
</tr>
<tr>
<td>Panning</td>
<td>&quot;Sabak&quot;: sample pan &quot;dayasan&quot;</td>
<td>&quot;Sabak&quot; best used for manual panning. Sample pan OK for small amounts.</td>
</tr>
<tr>
<td>Panning tailings</td>
<td>Panning tailings might contain free gold, so they are collected, re-ground &amp; panned several times for maximum recovery.</td>
<td></td>
</tr>
<tr>
<td>Free gold</td>
<td>Free gold in fine nuggets, flakes or powder is collected &amp; wrapped for melting.</td>
<td></td>
</tr>
<tr>
<td>Melting</td>
<td>Crucible (&quot;gangi&quot;), blower, charcoal, borax</td>
<td>Melting in crucibles or earthenware saucers (&quot;gangi&quot;). Borax added to lower melting temperature. Extra care during initial melting to avoid gold loss from dusting.</td>
</tr>
<tr>
<td>Used crucibles &amp; ashes</td>
<td>Crucibles &amp; ash crushed, ground and panned to recover any gold lost during melting.</td>
<td></td>
</tr>
<tr>
<td>Gold buttons</td>
<td>Final product, cleaned &amp; weighed ready for sale.</td>
<td></td>
</tr>
</tbody>
</table>

Mine waste and tailings disposal

There is no proper waste and tailings disposal system. Mine wastes are sometimes used as backfill materials for underground excavations, otherwise, the mine wastes and mill tailings are just dumped at any convenient location.

Gold trade

The gold is always melted into small ingots or buttons before it is sold. There are many gold buyers in the city and gold buying is very competitive. There are also gold buyers based at Kias, including some compania financiers. It is not uncommon for miners to offer their gold to several buyers before finally agreeing to sell it. A weekly local paper publishes the price of gold with small-scale miners in mind.
Health and safety

Although most of the miners live in the nearby community, which expanded as a result of the mining activities, some workers live at the mine site where health and sanitation conditions are generally unsatisfactory.

Neither accident reports nor safety records are prepared by the mine. The miners state that there were no fatal or serious accidents at the mine site, even during the height of illegal mining activities. Common injuries that occur are mainly cuts and bruises caused by flying objects, rock falls and slipping.

The miners generally work under dusty conditions, leading to the assumption that the risk of contracting respiratory illnesses, including silicosis, is significant. Backache is also a major problem among the miners -- largely due to their posture while working. With low adits and stopes, miners have to work underground without standing. They also tend to bend most of the time during sluicing and panning. In addition, they often carry heavy loads of ore. Personal safety and protective equipment is very basic. Some miners go underground with out hard hats or boots.

Unfortunately, there are no first-aid facilities and no formally qualified first-aid person at the mine. The miners mainly rely on whatever resources they have, or on the local government-run clinic for their health care and first-aid treatment. Private and government hospitals in the nearby city are also used by the miners.

Environmental concerns and issues

The main environmental issues arising from operations at the Kias Mine include deforestation, soil erosion, land slides, chemical (cyanide) spills and siltation.

Deforestation of the area due to the felling of pine trees for use as timber supports for underground workings is believed to have occurred mostly during the early illegal gold-rush stage. When the Association was issued with its mining permit, its members were asked to help police the area to save the remaining trees from felling and from fire. The Association is actively involved in tree planting activities with the Department of Natural Resources as part of a joint environmental protection programme.

Some of the miners use concrete posts and timbers they have "salvaged" from the large mining companies for roof supports. Without them, underground support is a major problem. Some miners have ceased their operations because of this problem.

Soil erosion and land slides are generally caused by unplanned workings and by the dumping of mine wastes along the slopes. River siltation is caused by mill tailings, which are just dumped along the creek and are eventually washed away during heavy rains.

Fortunately, mercury is not used at the Kias Mine. The amalgamation process for recovering gold is not a traditional practice of small-scale gold miners in the Baguio mining district. The use of mercury and amalgamation in the district is generally associated with the theft of high grade gold ore by workers in the large mining companies. Although the miners are aware of the health risks of using mercury, its non-use is mainly due to a lack of adequate knowledge and practical experience of amalgamation process itself, as well as the lack of a ready supply of mercury.

The risk of a cyanide spill is considered minimal since the cyanidation circuits are batch-type operations, and the barren solutions are continuously recycled.
Conclusions

The miners, especially the officers of the Association, felt they had solved the most difficult problem related to their mining operations when they were finally granted a mining permit. None the less, they have several issues and concerns that need to be addressed if their operations and general conditions are to be improved. These include:

- Less emphasis on safety inspection by the Mines and Geosciences Bureau and more practical assistance on the production aspects of their operations, particularly mapping of underground workings, assaying and the introduction of appropriate equipment.
- Simpler procedures for issuing processing permits, together with an easing of the restrictive provisions of the mining permit. The duration of the permit should be increased to ten years, and the use of machines and explosives should not be restricted. The restriction on the permissable depth of underground workings should also be lifted.
- Finance is a problem, but the Association has not put forward any specific ideas to resolve it. An old joint resolution from various small-scale miners' groups, however, calls on government banks or institutions to provide lending arrangements for small-scale miners, using any equipment or machinery subsequently purchased and the existing mine workings as collateral.
- The sourcing of timber supplies for underground mine support is a difficult issue in the light of an existing logging ban. The introduction of alternative underground supports (e.g. collapsible posts) and the development of appropriate mining methods that require less support are possible solutions.
- The provision of electric power to the mining areas and processing sites is desirable. It is understood that this could be addressed by the miners themselves (or by the Association).
- The lack of training opportunities could be addressed by the introduction of vocational courses.
- Legalizing small-scale mining operations is a vital factor in addressing the various issues and concerns that are related to the small-scale mining sector. In the case of the Kias Mine, it contributed to or led to:
  - greater environmental protection awareness and commitment;
  - less exploitive labour practices;
  - better relations with government agencies; and
  - enhanced cooperative working arrangements among the miners.

Legalization is only an initial step, however. The features or provisions of legislation need to be supportive and appropriate to the conditions of the sector in general. Small-scale mining also needs to be supported by an adequately funded and staffed, and effective, institutional structure that is administered by qualified and experienced personnel.

References

A. Bagamaspad; Z. Hamada-Pawid: A People's History of Benguet Province.


E. Bugnosen: Women miners are active in small-scale gold mining in the northern Philippines, unpublished article.

