Reopening old mines

(appendix to ***"Small Scale underground Mining"***
by F. W. Bojesen)

1. EXPLORING

Much small scale mining as well as bigger mining is carried out in mines and orebodies that have been worked before, often more than once and over a long period. Sometimes a surface mine may turn into an underground one, other times the other way around. In fact only alluvial fields seem ever really to be mined out. Since valuable minerals often occur together while their relative values change - not to mention technology - mines are also reopened for the mining of other metals than the previous owners were looking for. It follows that as a prospector and small operator you will quite likely once or several times in your life need to reopen a small underground mine, even one that may have been “mined out” more than once.

To give some idea of the length of time during which mines may go on closing and reopening: Mrs. Leakey thought that the oldest flint mine she found in East Africa was 3½ million years old, while some archaeologists estimate the age of the worlds oldest known underground flint mine at around 30-35 thousand years. Whether you believe this is accurate or not, it is known that mankind (even “stone age” tribes) has mined metals for not less than ten thousand years, both on the surface and underground. Sometimes it is hard to tell the difference where people have simply continued to follow the ore down - what we call “gouging”. Numerous mineral fields - including by the way the mines where I worked in Sumatra - have been worked for the last four thousand years or more. Cyprus could well be the place where copper was first mined by our forefathers. One is named after the other; but it happened so long ago that historians of the development of languages are unable to decide whether the metal is named after the place or vice versa. Yet copper, along with other metals and minerals, is still mined in Cyprus. The situation is similar with many mines in South America, Asia, Europe and other parts of the world.

Apart from teaching us not to be gullible, whether as optimists or pessimists, all this history shows that we as miners inherit a tradition and a treasure of experience almost as old as the human species itself. So if people tell you that a mine or area you are interested in is mined out, be very sceptical and at least check carefully for yourself before believing them. Lots of mines in Australia have closed and reopened a number of times during more than a century and a half, as mining, milling and smelting technologies developed and metal prices boomed and busted. The borderline between ore and mullock in any given location changes every day, based on all the beforementioned factors, but especially on the ever-changing metal- and mineral prices.

Whenever you find yourself with this type of prospect; namely a mine that looks profitable although it has been worked previously, the first thing to do is to find and check any relevant old records: Maps, production reports and records, drilling maps, geological reports and maps and whatever else is available. Such records are most likely kept by your local mines department or wardens office. In W. A. it is also handy to get the maps and records printed out for a small fee from the Tengraph and Tendex in a mining warden’s office or directly from the internet. The particulars are obtainable from APLA or the mines department (under whatever name they wish to be known this year). It is also a good idea to get as much information as possible from locals, oldtimers and other miners and prospectors. Remember, though, that all such info should be crosschecked and often taken with a grain of salt. As I have possibly mentioned earlier, the grey-bearded "oldtimers" with corks dangling from their hat-brims sitting in pubs in tourist areas saying "there's gold in them thar hills, boy", in most cases wouldn't know what a mine looks like - or gold ore. Their mining expertise lies in extracting

free beer from the pockets of tourists.

All that detective work is crucial for both safety and economic reasons, so don't skimp on it. We don't want to mine airbodies instead of orebodies. It is amazing how many millions have been spent even by big companies on developing orebodies that have been gone for many years; which demonstrates again the selfish irresponsibility of not keeping and leaving accurate maps and records of one's work. Unfortunately such standards are becoming more common nowadays, even though the maintenance of mining records is supposed to be compulsory in most civilized countries.

To redevelop an old underground mine as an open cut and simply dig everything out is a simple way of reopening an old mine. In every case make sure this is not the best option before restarting it underground. If you do open cut an old underground mine, be careful not to fall through into old workings with either man or machinery. The opposite way is the most popular in this country at the moment, namely to redevelop open cut mines by starting a decline from the pit. The mines departments are very cagey about approving plans and giving permission for this, mainly due to fear of flooding. Six men drowned when the Emu mine was flooded here in W. A., so don't apply to start the decline from the bottom of the pit. And ensure first that the lay of the land is such, that the pit can not act as a catchment for rainwater runoff or flash floods.

The methods and systems for developing and mining orebodies in old workings and old mines are the same as those used in newly developed ones. There are, however, many additional difficulties, risks and dangers involved. Some have already been touched on elsewhere in the book. These and others are spelled out in detail in the following pages.

Where the old mine is next to your already operating mine, the easiest way to explore and develop it will nearly always be through making it an extension of the existing one. The same applies if the nearest safely accessible underground workings are less than say a hundred meters from any new ones. Even fifty meters of drive development is a lot cheaper than developing a new shaft, adit or decline; more so if you can do it on ore, in which case the distance shouldn't matter a lot. Only very special local circumstances with no way around them should be able to reverse this policy - or being forced to carry out separate development by mines departments or legislation.

In such cases most new exploration work would be handled as part of the ongoing exploration in the already going mine and using the same methods, just as explained in chapter 19. Always remember the dangers of bad air when you go into old workings and be sure to install good ventilation beforehand, or at least use breathing apparatus with sufficient air for the expedition. Fans and ventbags are far superior to breathing apparatus and usually cheaper too. The details of all these questions are outlined in the chapters on ventilation and safety and elsewhere throughout the book. One of the main dangers is the accumulation of methane from timber and other organic matter having rotted in stagnant water. Remember that methane is also explosive. Exposed faces of ore gobble up the oxygen as the metal oxidises and the rock itself can breathe out any number of poisonous gases. Many dangerous gases have no smell and can act in seconds - as can lack of oxygen - so never treat this matter lightly; your survival depends on always being alert to the possibility of bad air.

Likewise with regard to all the other important safety precautions stressed throughout, above all alertness and keeping your eyes - and ears - peeled for bad ground, rotten timber and so on. "One hand for the ship, one hand for yourself" - not to forget your mates. Good barring down is even more important in old workings, while cracked ground is harder to spot due to oxidisation, salt deposits and other encrustations on the rock surfaces. Therefore bring good bars and check the ground ahead for drumminess by gently tapping it with the end of the bar. Experience will teach you to distinguish the flat crack given off by solid rock from the hollow drumming of broken ground just as in the rest of the mine - provided you don't stand directly underneath while doing it, of course. In other words, make sure (as always) that your bars are

long enough for the job in hand. And never go alone. Should that be completely unavoidable, at least ensure others know where you are and when you expect to return. Where bigger mines, especially trackless diesel declines, are reopened and redeveloped, it is nowadays common practice to bolt and mesh them again regardless of the condition of existing ground support. However, the mines department here will still play it by ear with prospectors, tributors and small miners and mines, so long as they are skilled and experienced and work and operate safely.

This reminds me: According to plan, standardised or universal underground and open cut safety regulations, -organisation and -systems are on the way for the whole of Australia within the next couple of years. Whether this is a good or bad thing I don't know, since most governments and political parties in the eastern states hate the mining industry, so I strongly hope we will still have our own mines department here in W. A.

2. GETTING DOWN THERE

When developing towards old workings, the procedures for breakthroughs detailed in chapter 10, section 3; chapter 15, section 3, and chapter 18, section 1 should be followed, together with the additions made necessary by the target's age. It will be more difficult to clean the face in the breakthrough area because of the age of the dirt. All broken rock and other dirt will have set hard through water seepage, oxidisation and other chemical processes; some of it may have set into a solid mass and surfaces are sometimes "painted" with mineral or chemical deposits. You might even have to fire some of it to break it up. But don't skimp on the job or get slack. People have been killed by 50 year old explosives or detonators before today.

Anywhere there is the slightest chance of hitting dangerous water, take the precautions explained in chapter 12, section 2, and follow the rules laid down in your local mines regulations. In ideal circumstances these should be identical anyway. You may remember from the ventilation chapter, that any breakthrough can badly affect the ventilation airflow, even to the extent of reversing the "wind" direction. This is still more so with breakthroughs into old workings or old mines. Although this may not happen, be prepared for such an event and correct it with ventdoors, bulkheads, vent brattices or baffles (see chapter 11 and figs. 45-47). You may need to shift your fan, or it could prove necessary to get one more.

Most of the previous advice also holds good for entering and opening old mines not connected to new workings; but much more needs to be done in that case. Di-Di McEwan of Norseman, W. A. recommends the following procedure for approaching an old shaft before entering it for the first time: As you get to a few meters from it - stop, look carefully beneath the brow on the opposite side and note whether the wall, timber, concrete or other ground control has collapsed, caved in or been mined out below the brow. If necessary shine a powerful light at the area. Then slowly circle the shaft until you have done the same to the entire circumference. If you decide that it is safe to do so, then go closer. An identical procedure will in some cases work for an adit as well. Where a shaft is not properly covered, you might be able to throw a ladder or timber across the opening before reaching it. When entering old shafts or adits, never use the existing steel or timber ladders unless you know their age and have personally checked their safety. Climbing down old timbers is even worse. Unroll a rope ladder down the shaft, then test the old timbers, ladders and rungs while standing on your rope ladder, preferably a steel one. First tie yourself to your own rope ladder, though, with a safety rope, then check the old installations with bars, hammers, hands, boots and whatever. In fact much the same methods we use for shaft inspections. A young geologist was killed at Lebong Tandai in Sumatra by running off up an old ladder in a raise after the manager had told him not to. He returned at great speed in a shower of splinters and rusty ladder rungs. His actions were even

more foolish because the raise probably was a "blind" one, with the added danger of bad air.

Check all shaft sets and ground support sets on levels and in stopes and raises; if required advance step by step while replacing them one by one as you go. Be aware of the great risk of bad air in blind raises and other dead ends - particularly if you don't know if they are dead ends - and take effective precautions as I have outlined. Don't forget to check the ground with a scaling bar, scaling as you go. Remember weathering of exposed surfaces when scaling, particularly in mines which have been closed a long time or where the ground is soft. It will not often pay to be lazy or "save time" by building inside the old sets, as this will make the working space too tight and cost a lot more time and effort in the long run. Only rarely will this be feasible where the previous mine was big, while you only intend to reopen it on a smaller scale. Check also the condition of concrete or grout, mesh and rockbolts. Old rockbolts almost corroded away by groundwater or chemicals can sometimes bear many tons, but don't trust them. Bore new holes between them and install new ones while standing under the ones you have already done, in the way explained in chapter 8, section 4. You will then in addition have the extra safety provided by the old bolts while the task is in progress.

In old shafts where the ground proves strong and solid ("competent", if you want to be fancy and impress the multitude) and generally in good nick, it may well turn out to be safe enough to replace rotten old furnishings with nothing more than rockbolts, possibly meshed and strapped - of course after careful barring down. You can then use guide ropes with the monkey on your kibble instead of skids (see chapter 4, 4 and fig. 40). If you on the other hand hope to re-use old shaft gear, such as headframes, winders, shaft furnishings or movable equipment, you will in many cases have to get it tested and cleared by the mines department first.

Death can strike from below as well as from above, when it comes to bad ground. Years ago a bloke was buried in his ute while driving along at Scotia on the Carr Boyd road north of Kalgoorlie, when a worked out stope collapsed under the road. Yet another demonstration of the importance of both accurate and up to date record keeping and backfilling of stopes. Such an event can equally well happen underground.

Most old mines will need to be pumped out before they can be reworked, particularly shafts. The methods and machinery are much the same as in the chapter on de-watering. In deep shafts or with lots of water coming in, it is especially important to remember not to install successive pumps in one pipeline as it says in part 3 of that chapter. When the water level drops too low for your pump to lift it any further, build staging dams on convenient levels as the need appears, each with a pump and outlet pipe (see chapter 12, 3). Any electrical equipment or cables from under the water should be salvaged but not used. Other gear can be restored and used if it is safe and serviceable. Mud from dams and sumps is often high in metal content and should be collected and sent to the mill. Shovelling or bucketing it into 200 liter (44 gallon) drums and hoisting these up the shaft is one popular way of doing that. Make sure the drums are clean, without any fuel, oil or grease on them, particularly the inside. Gold hates grease, diamonds on the other hand love it, so greasy drums may cost you your gold but catch any diamonds from the dirt. More loss than gain for most Australian miners, I imagine.

Should you decide to mine trackless and use rubber wheeled equipment, pull all old rails and sleepers out, even if they are buried, to provide ample space for the equipment and safety for yourself and your mates. Where railways are to be used instead, it is very unlikely that the old rails, sleepers, fish-plates, dogs and so on are still in good enough condition to use again. But by all means check and decide for yourself. Maybe the rails are OK, but most sleepers are rotten and the dogs and fishbolts rusted away. Replace what is bad and use the rest again. When re-installing the railway, make sure it is the same gauge as your equipment and follow the instructions in chapter 8's section on plate-laying exactly in every detail, for the same reasons as explained there. Do it right the first time or you will pay tenfold later - and over and over - I guarantee you. After removing the old ballast if possible, level it up with new stuff. Or use the

old ballast again, but loosened up.

On no account ever just drop the new line on top of the old, regardless of whether it is done to "save money" or to get into the ore quickly. Not even where it is buried and hidden. In the life of the mine this practice will cost you many times more than you expected to save, in terms of money, time, frustration, heartbreak, danger, accidents and more. I have worked in a mine where they did just that. We had drains deep enough to break our legs, whilst we had to walk around folded like pocket knives. Trucks and trains bumped the walls and jammed or jumped the rails, locos derailed into the deep drains. We didn't get bored; but neither did we get a lot of boring done. This brilliant, innovative transport system had of course been designed by a company with no previous experience of underground mining. "The greenfields approach" in modern management jargon, "the blind leading the blind" in oldfashioned management jargon. They didn't last long either. So dig the old railway lines out and remove every scrap of them.

Something else that did them in was their refusal to "waste" time or money on improving the previous mine's hoisting and haulage system by developing ore passes between levels all the way to the bottom of the shaft (see chapters 9 and 10), by which means they made sure the mine remained nothing but a collection of transport bottlenecks. So it is not necessarily a good idea to blindly accept and continue the operating design of the old mine. The oldtimers may not have been experts or very brainy. Don't reject out of hand what they did, though; there could have been good reasons for it. On the other hand, methods and equipment change over the years. Think carefully and seek experienced and trustworthy advice before designing and developing your mining system to fit both the case and your wallet. This applies just as much to a second hand mine as to a new one. That includes the possibility of reworking old shaft mines with diesel gear and jumbos through a decline (see chapter 6). What I have said elsewhere about the establishment costs when using such methods being far too high for small operators remains true. Nowadays some blokes are, however, lucky or smart enough to buy gear in reasonable condition dirt cheap at "closing down" auctions or from salvage yards. So cheap in fact, that decline mining can sometimes become the most competitive option. Bear that in mind when you work in areas where this option might be feasible, in particular if one of you is a good mechanic.

With regard to the construction of grizzlies on orepasses and brow-bins and the placement of rails on these, please note that all drawings and diagrams in the book show the rails placed for end-tipping trucks, such as bendigo trucks. The photos on the other hand show side-tippers with rails placed for those. On the diagrams you therefore see the rails across the middle of the grizzly, whereas the photos show them running to one side, but off the grizzly. Either way is right for its particular type of truck, and in every other case you will likewise have to build the grizzly and place the railway to suit the type of equipment you intend to use. And of course design and develop your plats and drives to allow for the system you will use. These observations also hold equally true, whether the mine is new or second hand.

3. TO THE OREBODY THROUGH OLD STOPES

In many old mines a new operator will have to go through stopes that have already been worked out, in order to gain access to the ore he is after. The profitability of the mine will depend very much on how difficult that turns out to be, after all the problems and costs already dealt with have been added in. So be sure to make a realistic assessment of the time, cost and risk involved in this stage of the operation when you try to calculate whether the mine is worth

reopening. You may face one or a combination of a variety of situations, for instance: a) There is a solid pillar under the floor of the level, and the stope above is mined with finger raises - or pillars if the orebody is fairly flat; b) the worked out section has been completely backfilled or collapsed, below and/or above; c) the level is still there, but the stope above is open; d) the same, but with the stope lagged off without backfill; e) the same with backfill; f) the stope is open above and below.

Other combinations of these circumstances may exist. In such cases other combinations of the solutions suggested below will have to be used. These are as follows:

a) Solid floor pillar with pillars overhead: The easiest, fastest and cheapest one to fix. After, or possibly while replacing or repairing the railway, clean up the floor of the level with a bogger as you go; provided you need a railway and the old one is unserviceable. For safety reasons bulkheads or platforms to block off the finger raises may have to be installed or replaced during the advance. During this rebuilding it is best to allow for ventilation considerations, return airways, splits, leaks and the prevention of these, the best placement of fans, ventdoors, brattices, etc. as the job progresses. That applies to all of the following scenarios too. Use chapter 11 and the stoping chapters for more detailed instructions on how to solve the various ventilation problems. If your facilities allow it and the dirt is rich, you may be able to clean the level with a super sucker, either rail mounted or on rubber wheels.

b) Stope completely backfilled, drive totally blocked: Faced with such a situation you can pretend that you are advancing a new drive through soft ground, as in a way you are. The techniques for mining through soft ground are explained in a number of places in the book; in most detail in chapter 8, sections 2 and 4, and where chapters 4 and 6 explain how to build collars in shafts and portals in adits and declines. Here it may be necessary to stand sets one at a time, lag them off and hammer lagging over the top of the sets into the broken dirt ahead, possibly along the sides as well. Then after bogging out part of the dirt underneath, stand the next set under this lagging and continue on in the same fashion (see also chapter 16, 1 and figs. 53 and 54). Second hand railway line may be best for lagging ahead like this. The old railway removed during the rehabilitation might be used if it ain't too rotten, so as to plug the leak in your wallet a bit. The collapsed ground or backfill may have set as hard as concrete or be in big lumps. So in some cases it has to be bored and fired like a new drive - although softer - while in others it can be dug out by hand or with a bogger. If the ground is broken below the level as well, this and the railway line has to be rebuilt as you advance, in the same way as in chapter 18, although in this case starting from the near end and working forward. The legs for the sets have to stand on the bearers supporting the level and the railwy. All bearers, floor-lagging, sleepers and rails must therefore be placed to allow for this. Also sufficient space, both horizontally and vertically, must be allowed between the timbers for boggers, trucks, all other equipment and the operators thereof.

c) Solid floor, either bedrock, old backfill or partly each with open stope above: Rebuild the level through the stope, one set at a time, lagging over the top of the sets, and on the sides too where needed. Try to work from underneath the timber already installed. Otherwise push ahead a portable, covered frame, possibly on wheels and carrying a chainblock for swinging caps and other timber. It is best to fasten the lagging to the sets, but too dangerous to climb on top of the timber to spike it, so try to tie each stick or every second one to the caps or legs with wire or chain from beneath, in the way explained in chapter 18, section 3. Once the timbering has been completed to the far side and the lagging secured, it will be made safer by covering it with backfill. The entire level will be safer if the stope is completely backfilled to the next level or the surface, as the case may be. Dump dry sand and/or mullock either from the surface or the level above, if this can be achieved without danger. Be very careful in the early stages of the operation not to damage your timber (see chapter 18, 3 for instructions). Slime or wet fill is

probably never economically or safely usable by a small prospector in such a situation - and never use mill tailings, wet or dry. The economic and safety reasons for that were explained in chapter 14, section 2. On top of these, because the individual grains of mill tailings are so fine, tailings are not only easily washed out - they clog up pipes and drainage systems and can thereby cause buildup of dangerous water (chapter 12, 2) and semi-liquid mud, either of which have at times got away and killed people.

d) Solid floor as in the previous case, lagging overhead: The best method is the same as in "c", but slowed down a bit by the removal of the old sets one by one as you build the new ones forward. Don't trust the old timber, unless it was put in during the last few years by yourself or somebody you know, and you are totally convinced of its soundness. Try to do all the work from under the sets you have already built or use one of the other ways I suggested before. If you are certain the old caps and legs are sound enough for this, you may be able to push lagging over them temporarily, while you stand the new sets to support it.

e) Solid floor, overhead lagging, stope backfilled: This is a hairy one, which I have never personally come across or heard of any case in practice; but it could well happen. Normally the timber would have collapsed under the weight of the fill. In such a case you can proceed as in "b", with the added difficulty of having to bog the pieces of rotten timber out together with the broken dirt. In case the timber is still standing, but not strong enough to keep on using, the same situation can be brought about by firing it down and then carry on as in "b". As mentioned above, backfill and old mullock often sets hard, almost like cement. When that has happened, it might in some case be safe to do the job as in "d", slowly and carefully, stick by stick, while leaving the fill in place. It would be safer, though, to install new bearers under the old timber in all cases where the drive is high and wide enough to allow that. To accomplish this in safety the lagging will have to be pushed ahead like in soft ground and temporarily supported, perhaps with a prefabricated, portable square steel set. The miner can then stay under that to install the permanent cap (check also figs. 53, 54 and chapter 16, section 1). But whenever there is the slightest doubt in yours or anybody else's mind, always err on the side of safety and fire the dirt and timber down and start from scratch.

Remember that the lagging on the first 2 bearers goes directly on the timber, on numbers 3 and 4 the same, again on 5 and 6 and so on. The lots in between goes on top of this lagging both ends. Don't install the lagging with opposite ends of each set alternately over and under, which both weakens the sets and can cause them to tip or slide off when falling dirt hits the sticks. To achieve this result you may need to push each stick of every second set over the previous cap, but under the loose ends of the last set. You then lay the sticks of the alternate set on top of this bottom lot from under the last bearer or cap and slide them forward when ready, repeating this process for every pair of sets as you go. A couple of sticks of lagging might be left out temporarily from the last set to allow the ones of the following set to be laid on top of this set.

f) Rebuilding a drive through thin air: A flat reef with a strong hanging wall and pillars is quite simple to re-activate, much as if it was in a new mine (see ch. 15). Protection against falling or sliding dirt and rocks rolling down the footwall may have to be installed. With a weak hanging wall you may need to proceed as in "b", "c" or "e", depending on how weak it is. But your mine would have to be exceedingly rich to justify the expenditure of time and money demanded by such a scenario in a steep orebody. Not only that, but you or your helpers will need a high level of skill and experience to be able to carry a project like that through safely and successfully. It will also require a fair amount of gear and ample finance to see you through to production. So my advice would generally be: Don't do it! Develop another access from a different direction. Or sell the lease or share it with a company and let them do it. In all of the abovementioned cases consider the possibility of developing access of any angle, horizontal, vertical or in between through virgin ground to reach new ore, while staying clear of the old

workings. In lots of cases, this will be simpler, safer and cheaper.

If you decide to go ahead with such a project anyway, begin by backfilling the open stope below, provided it can be done safely without interfering with future mining. Perhaps do it in stages during the advance of the timbering. Then rebuild the level in the way described in chapter 18, section 1 and as a variation of case “b” above (stope filled below, but not blocked or filled through or above). Remember to always work under cover. Without any backfill at all the rebuilding will have to be done through open space, making the job more dangerous and requiring the constant use of safety ropes, the building of stages and platforms, use of chainblocks etc. You will need to install caps, overhead lagging, probably legs, bearers, floor lagging, railway and more. All in all slow, expensive, risky, highly skilled work, only to be recommended to people with lots of money, patience, skill and experience. Much easier with fill underfoot.

4. MINING AND CLOSING

Whichever of these methods you use to get through a worked out stope, don’t leave old fill in place as fill until you have sampled and assayed it. The old timers’ mullock may well be valuable ore to us, to be mined and bogged out instead. Copper ore below 20-25% was mullock to prospectors in northwest Queensland a hundred years ago, due to the high cost of transporting it out on the backs of camels. Old “backfill” could also contain other payable minerals besides the one you are or they were after. I have also known people to use high grade ore as road or stope fill. Those who went before weren’t infallible any more than we are. Lots of ignorant people get into mining too (but I hope "Small Scale Underground Mining" will help to improve that situation). Mined out stopes are also sometimes left full of broken ore, ready to go but left behind due to a sudden drop in metal prices, bankruptcy, take-overs or other catastrophes. I know of a few thousand tons of rich ore like that, which I would like to get my hands on. Thus you may receive an unexpected bonus of lots of ore already mined, waiting for the bogger. However, where the fill is needed as fill, be sure to replace any valuable stuff taken out with worthless rubble, either during the operation or immediately afterwards.

Once you have worked your way through shafts, levels and stopes in the ways I've explained and made everything safe, the remaining ore waits to be attacked. From now on the mining should be much the same as in a new mine. Just like in the rest of the book, while always remembering to keep an eye on the new timber and the scaling. Ventilation demands constant watchfulness too, what with all the old holes and mined out spaces broken through everywhere. It is best to prepare yourself for some difficulties in this area, so you won’t feel too dejected when they happen or get caught with your pants down. Which reminds me of Delhi belly and similar matters. Don’t forget to install toilets of a good underground type (chapter 20, 3) and to fulfil the other hygiene and health requirements decribed in chapter 20 and elsewhere in the book. These are no less important in an old mine than in a new one - rather more so. You would for instance be less likely to find rats, mice and cockroaches in a new mine than in an old one. As for myself, I once found a Python in a second hand mine in the Northern Territory and I've caught other snakes in other mines elsewhere - who may have been living off the abovementioned local wildlife.

After the mining phase itself has been completed and all payable ore extracted in a safe and profitable manner in the ways explained in the earlier parts of the book, we have to close the joint down again, returning to chapter 21. When an old mine is reopened, it is a good idea to only disturb as much prior closing down work as you need to for the current spell of operation. You will only have to re-do it yourself later anyway. As part of the calculation of potential profit and loss from the mining, include the possibility of having to do rehabilitation and

closing down work on the previous operation too, and not just on your own work. Try to get clauses in your leases, tribute agreements, mining permits or whatever to specifically exclude such obligations, except for safety reasons. In most cases modern rehabilitation requirements will be a lot stricter than last time the mine was open, and the work must be completed to a higher standard. It is also a good and responsible practice to try to design as much of the rehab and closing down work as possible - bunds, barricades, fences, backfilling, shaft doors and whatnot - so as to facilitate any future reopening of the mine. This also is equally true with regard to a new mine as to an old one, even when you think there is nothing left to mine.

Dismantle all buildings, plant and equipment you want; or that mines departments, local governments, other bureaucrats or new owners require you to take with you or remove from the site, then skedaddle with your gear. Settle or collect all outstanding fees, licences, bonds, taxes and other accounts. And don't forget to complete all bureaucratic and paper work obligations before leaving the project. Deposit updated maps, production records, statistics and the like with the appropriate authorities, fill in and hand over all required forms and so on. Don't forget to keep your own copies of it all, including receipts.

5. SUMMARY

I: Check records, maps and all available information from all sources before proceeding - for safety, legal and bureaucratic reasons.

II: Ensure somebody outside knows you are there.

III: Legislation and regulations change. In this country probably even more than usual in the next few years. Keep up to date with such changes.

IV: Remember especially the following dangers when entering or reopening an old mine:

a) Cracks in the rock hidden by a salt encrusted or weathered surface. Check the ground carefully for drumminess with your scaling bar and bar down safely.

b) Bad air. Install and activate ventilation before entering, or wear breathing apparatus or other appropriate safety equipment.

c) Rotten timber and shaft furnishings. Check before and during entry, also with scaling bars, hammers etc from a safe position. Don't stand, climb or walk on or under it. Use rope ladders (preferably steel- or wire ones), safety ropes and all other relevant safety equipment discussed earlier.

d) Rusty, corroded rockbolts, mesh and other fittings. Check as in "c", rebolt, remesh and make safe, following the methods outlined in this chapter and chapter 8, section 4.

e) Rotten or rusty ladders, rungs, bearers, J-pins, wedges (wood or metal), ladder-hooks, tie-wires, chains and other ladder parts and fittings. Proceed and check as in "c" and "d" and make safe and/or replace as you advance. Use (wire-) rope ladders initially.

V: Work your way through the old workings with the safe and efficient methods explained here and in the book; but always consider if it would be safer, faster and cheaper to develop new access through virgin ground, whether mullock or ore.

VI: When the mine is safely rehabilitated and redeveloped as outlined here, mine the ore out by using the safe and efficient methods described in this appendix and the rest of the book.

VII: Once you consider your mining completed, rehabilitate the mining lease safely as required. Remove all equipment, plant and property you need to take with you and settle all debts. Complete and deposit the necessary maps, records, documentation, forms etc. with the relevant authorities. Keep copies of all paperwork for yourself and your partners.

F. W. Bojesen, 19/10/12, 20/11/12