

CHINA'S EXPLOITATION OF TIBET'S MINERAL RESOURCES

Based upon the Book

*SPOILING TIBET:*

*CHINA AND RESOURCE NATIONALISM ON THE ROOF OF THE WORLD*

By GABRIEL LAFITTE

A COMPILATION OF A SERIES OF "EXPERT ON TIBET" PROGRAMS

For RADIO FREE ASIA

By WARREN SMITH

## SYNOPSIS

Gabriel Lafitte has done extensive research on mining in Tibet. His new book, *Spoiling Tibet*, is the best analysis to date of the history of Chinese state-sponsored mining in Tibet, its current status and its future in Chinese plans for Tibet. Lafitte's research demonstrates that mining in Tibet is just beginning on the large scale necessary for mining minerals such as copper, iron, lead, chromium, molybdenum and certain rare elements as well as silver and gold that are often the trace products of mining for other elements. He divides the history of mining in Tibet into four periods. The first period was characterized by the exploitation of oil and gas as well as a wide variety of other minerals such as chromium and bauxite in the Tsaidam Basin. The Tsaidam is the lowest-altitude area of the Tibetan Plateau and was the first part of Tibet accessed by railroad, a necessity for large-scale mining.

The second stage of China's exploitation of Tibet was an extremely environmentally damaging gold rush in the 1980s and '90s, mostly by small-scale private individuals in the rivers of Kham and Amdo. The third stage of China's exploitation of Tibet's natural resources began with the large-scale mining by Chinese government organizations such as the People's Armed Police or by state-owned enterprises. In the beginning, industrial-scale mining was mostly aimed at chromium because of the relatively large quantity of the mineral found in some mines and the high price of the mineral at the time. The fourth stage of natural resource mining in Tibet has only just begun, but this sort of large-scale mining is an essential part of the Chinese plan for the future of Tibet. Industrial-scale mining of more rare minerals, such as copper, require large amounts of electricity in order to do preliminary refining of the ore, and railroads to transport the ore to China.

The author emphasizes that large-scale mining in Tibet is just beginning, due to two factors. The first is that railroads are being built that make possible the transport of large quantities of ore to the Chinese interior for processing. The second factor is that China has such a great need for minerals that it has to access them from every source available. At the present time Chinese industries even in the interior provinces such as Sichuan and Gansu can acquire minerals like copper from sources as far away as Chile cheaper than from Tibet. However, as transportation is improved, minerals from Tibet will become relatively cheaper. In addition, the Chinese government has political reasons to subsidize mining in Tibet. For these reasons the author says that mining in Tibet is certain to increase in the near future far beyond what has taken place up to this time. This will have tremendous consequences for Tibet and Tibetans.

## CHINA'S EXPLOITATION OF TIBET'S MINERAL RESOURCES

China's exploitation of Tibet's natural resources is one of the most important issues for Tibet's future. China's ambition to acquire Tibet's natural resources was a primary motivation for the CCP to invade and annex Tibet in 1950-51. Exploitation of Tibet's natural resources has been a primary Chinese activity in Tibet ever since and is foremost among China's plans for Tibet in the future. This series of programs will analyze a new book on mining in Tibet. The book is by an Australian researcher, Gabriel Lafitte. The title of the book is *Spoiling Tibet*.

Tibet's mineral resources were a primary reason why China wanted to control Tibet. The Chinese traditionally imagined Tibet to be a treasure house of minerals, particularly gold, which had been found in small quantities, mostly in streams, for many centuries. Previous Chinese regimes had ambitions to control Tibet but were unable to actually do so. The Chinese Communists were determined to achieve China's long-held ambition to control Tibet, partly to keep other countries from doing so but also in order to exploit Tibet's natural resources for the benefit of China.

In the early 1950s Mao and other Chinese leaders quite openly told Tibetans, including the Dalai Lama, that Tibet had an abundance of territory and natural resources but insufficient people to exploit those resources. China had too little territory but an abundance of people. Therefore, he said, it would benefit both China and Tibet if China provided Tibet with people while Tibet provided China with resources necessary for industrialization. Mao saw no reason why Tibetans would object to being "assisted" in this way by millions of Chinese immigrants.

In the 1950s China was mostly able only to exploit easily available resources in Tibet such as forests. The forests of Kham were eventually so extensively exploited that in 2006 China finally had to prohibit logging in order to prevent disastrous floods downstream in the Yangtze River. Mineral exploitation in the early years of China's control over Tibet was mostly confined to the Tsaidam Basin, which was rich in oil and natural gas as well as many minerals. The Tsaidam Basin is the most accessible part of the Tibetan Plateau and was made more accessible by the construction of a railroad to Golmud. Railroads are necessary for large-scale mining operations since large quantities of minerals have to be transported to the interior of China for refining.

In the 1960s some mining for chromium was also done in the Changtang at a place called Tsala Karpo, using Tibetan prisoners, many of whom were worked and starved to death. Chromium is used to harden steel and to make stainless steel. The exploitation of easily available resources such as forests and the beginning of industrial-scale mining in the Tsaidam, is described in the book as the first stage of China's exploitation of Tibet's natural resources.

The second stage of China's exploitation of Tibet was an extremely environmentally damaging gold rush in the 1980s and '90s, mostly by small-scale private individuals in the rivers of Kham and Amdo. Gold was found in the stream beds and banks of rivers, but mining required huge quantities of dirt to be sifted in order to find tiny quantities of gold. Streams were irreparably damaged by Chinese who cared little for their destructive effects or for the sentiments of local Tibetans, who protested in vain to local officials. Government officials were often either bribed by the miners or were themselves involved in the mining operations.

The third stage of China's exploitation of Tibet's natural resources began with the large-scale mining by Chinese government organizations such as the People's Armed Police or by state-owned enterprises. In the beginning, industrial-scale mining was mostly aimed at chromium because of the relatively large quantity of the mineral found in some mines and the high price of the mineral at the time. Because it did not involve huge quantities of material to be transported, it could be exploited using only trucks and dirt roads. However, this was still mining on a small scale compared to mining operations in other parts of the world. In order to exploit other minerals, such as copper, much larger mines are necessary as well as much more infrastructure such as electric power and railroads to move ore to the Chinese interior.

The fourth stage of natural resource mining in Tibet has only just begun, but this sort of large-scale mining is an essential part of the Chinese plan for the future of Tibet. Industrial-scale mining of more rare minerals, such as copper, require large amounts of electricity in order to do preliminary refining of the ore, and railroads to transport the ore to China. Copper is found in typical concentrations of less than one percent of any ore body. However, copper mines usually also produce small quantities of other valuable minerals such as gold and silver.

In order to economically exploit these minerals, China plans to construct hydroelectric dams for electricity and railroads for ore transportation. The Qinghai to Lhasa railroad has allowed China to begin exploitation of Tibet's mineral resources on this scale but many more rail lines will be needed to reach already identified mining areas. China has prioritized the extension of the Lhasa railroad to Shigatse in order to exploit a copper mine there.

In his preface the author emphasizes that mining is only just beginning on a large scale in Tibet and that such large-scale mining is therefore very important for the future of Tibet. He emphasizes that Tibetans are already well aware of the destructive effects of mining and have protested against many mining activities, usually with little effect. Mining is an inherently disruptive and destructive activity. Mining involves turning rock into metal. Minerals are usually present in ore in very small quantities, often less than one percent. Huge quantities of ore have to be removed and refined in order to produce only small quantities of minerals. Often equally huge quantities of earth have to be removed just in order to get to the ore bodies that are often far underground.

Tibetans have protested against Chinese mining activities in Tibet not only because they cause pollution of local water and land and often require confiscation of farming and grazing land but also for spiritual reasons. Mining sites are often the residences of local earth spirits, who are thought capable of causing misfortune to locals if they are disturbed by mining. These spiritual traditions are routinely disregarded by Chinese miners and the Chinese government.

The author emphasizes that the Chinese Communists thought that China had fallen behind the rest of the world because it had failed to industrialize. Their priority was therefore to create heavy industry and to promote mining in order to supply the raw materials for China's industrialization. The geologists who went to survey the mineral resources of Tibet were regarded as pioneers and heroes. The Communists thought that China had been hindered by feudalism and feudal beliefs in the past. They were therefore dismissive of Tibetans' concerns about disturbing earth spirits or mountain gods by mining. Private mining in Tibet, particularly for gold, was done in total disregard for its environmental impacts, which were tremendously destructive to streams and rivers. However, mining has now transformed into larger-scale and government-controlled or supervised mining.

Chinese state-owned enterprises have occasionally partnered with foreign mining companies that have to adhere to international environmental standards. At least one state-owned enterprise partnered with an international mining company to exploit a copper deposit in Tibet. This mine was promoted as more environmentally sensitive and less harmful to the local environment. However, even this mine later proved to be environmentally destructive and was the site of a large landslide that killed many miners. On 23 March 2013 a massive landslide buried 83 workers at the Gyama mine in Medrogungkar County of the TAR, 68 kilometers east of Lhasa. When the mine was taken over by the state in 2007 it was designated a pilot project of the National Green Mines Project, established by the Ministry of Land and Resources.

The Gyama mine was supposed to adhere to high standards of safety and environmental protection and was to avoid any pollution of local water sources. Despite evidence that the

mining activities were directly responsible for the landslide, local government officials denied responsibility. This example demonstrates that mining is inherently destructive and that Chinese proclamations of environmental sensitivity and respect for local welfare are contradicted by official corruption and actual disregard for environmental impacts.

After the disaster, Chinese media reported on the heroic efforts of rescue workers but said little about the cause of the landslide. Eventually a Chinese team of experts said that the landslide was a natural geological phenomenon. However, aerial photos of the site showed a huge open-pit mine at the top of the mountain. Waste rock pushed over the side of the slope was clearly visible. The Chinese authorities claimed that the rocks involved in the slide were pulverized by glacial action, but it is obvious that they were created by the mining operation. The mining operation was obviously the direct cause of the landslide, a fact that the Chinese authorities tried to cover up.

Despite Chinese claims that this mine would have no negative environmental impact on the local area, the photos show widespread environmental harm to the landscape. In addition, local nomads were reportedly deprived of pastures and villagers were forced to move. Water sources were diverted and polluted. Protests by local Tibetans were met with repression by Chinese security forces. This example shows that mining is an inherently damaging and destructive activity and that harmful effects on local Tibetan communities will be difficult to avoid, especially considering the official corruption endemic in China.

The author says that the two main enterprises in China's development plan for Tibet are mining and tourism. The traditional Chinese method of assimilating frontier territories by means of colonization by peasant farmers has not been possible in Tibet because of the extreme altitude. Other parts of the Chinese traditional method were more successful, such as promising a high degree of autonomy and then gradually circumscribing that autonomy until complete Chinese control was achieved.

China has also gradually been able to support a greater number of Han Chinese in Tibet through administrative roles and as experts and workers in infrastructure development. The development of roads and railroads has now allowed China to pursue the economic development that it regards as the ultimate solution to the problem of Tibetan separatism. Tourism and mining are the two primary economic activities which China imagines will finally integrate Tibet with China economically, socially and culturally.

Infrastructure development in Tibet, which includes not only roads and railroads but power and communications facilities as well, has facilitated large-scale mining and has also helped China to increase tourism to Tibet. Recently released statistics for tourism to Tibet in

2013 reveal that there were almost 13 million tourists, of whom only a little more than 200,000 were from overseas. Chinese tourists made up more than 98 percent of total tourists while foreigners were less than 2 percent. Tourism in Tibet has now been developed specifically for Chinese, with theme parks and fake Tibetan villages meant to cater to Chinese tourists and to promote the Chinese version of Tibetan history and culture.

If China cannot submerge Tibet with Chinese colonists then it seems they will try to do so with Chinese tourists. Chinese tourism will further the assimilation of Tibet by turning Tibet into a huge theme park where Chinese can go to indulge their fantasies about the poor Tibetan barbarians graciously liberated by China and now content to sing and dance to express their gratitude to their Chinese liberators. Lhasa and other cities now have to cater to the taste of Chinese tourists, and Tibetans will be further marginalized. The population of Lhasa was said to already be about half Chinese, but the constant presence of so many tourists will make it even further Chinese in population and character.

The other primary industry in the Chinese plan for the development and therefore assimilation of Tibet is mining, which is only now just beginning to be done on a large scale. Until the development of sufficient infrastructure, mining on the Tibetan Plateau was done on a large industrial scale only in the Tsaidam, which is most accessible to lowland China. Mining on the high plateau was until recently done only on a small scale, such as the disorganized mining for gold in eastern Tibet. The author says that Chinese industry has slowly shifted to the interior from the coastal regions, so it is natural that China would begin to exploit the resources of Tibet to feed the factories of Sichuan and Gansu. That coincides with Beijing's hope to more closely integrate Tibet with the Chinese economy by means of mining and to thus further the ultimate assimilation of Tibet.

However, the author reveals that there is a paradox involved because Chinese state-owned industries are now global companies that can acquire raw materials from anywhere in the world. The only consideration for these enterprises is price, and often raw materials from places like South America are cheaper than from Tibet even though Tibet is much closer. Presently, copper from Chile is cheaper to mine and transport to Chengdu in Sichuan than copper from mines in Tibet. The Chinese state-owned enterprises do not have the same political interests in promoting mining in Tibet as does the Chinese government, so they have to be enticed with incentives in order to use copper from Tibet. Typically these incentives include exemption from environmental regulations and permission to disregard the wishes and even the welfare of local Tibetans.

Large-scale mining in Tibet is promoted by the government for political reasons in order to more closely integrate Tibet, but Chinese companies have to be given permission to ignore

pollution regulations in order to get them to acquire their raw materials from Tibet rather than from other sources. The paradox of Chinese mining in Tibet is that by the time China had developed sufficient infrastructure in Tibet in order to do large-scale mining there, minerals were available at lower prices from overseas because the world infrastructure had developed even faster. Now, therefore, political imperatives are more important than economic needs in Chinese plans for mining in Tibet.

Mineral deposits in Tibet are far smaller and far less rich than some of those available in other countries. The Chinese state has a political interest in the development of mining in Tibet but Chinese state-owned enterprises have little interest in investing in Tibet. The government wants to consolidate Chinese control over Tibet by means of economic development in which mining is a major aspect. However, the Chinese government also wants its state-owned enterprises to be competitive internationally, so it wants them to be able to acquire the mineral resources they need at the lowest price. This is the paradox. As Chinese industry further develops it will need resources from Tibet as well as from abroad. However, to make resource exploitation in Tibet comparable in price to resources acquired abroad the government has to provide incentives for mining in Tibet. These incentives usually include exemption from most environmental regulations and permission to ignore the welfare of local Tibetans.

The author predicts that China will continue to acquire mineral resources it needs for its industries internationally but it will also increasingly acquire them from Tibet. The impact of large-scale mining on the traditional Tibetan lifestyle will inevitably be very destructive, he says. Mining is essentially incompatible with the Tibetan traditional lifestyle, particularly nomadic pastoralism. The Tibetan pastoral lifestyle has little impact on the environment. Mining is just the opposite. Where mining has taken place the land is destroyed for any type of agriculture or animal husbandry. Mines have a large impact on the landscape and they use up or pollute most water sources. Mining sites become small cities populated almost exclusively by Chinese.

The Chinese government has already removed most Tibetan nomads from their grazing lands, ostensibly because they have degraded the grasslands through overuse. The removal of the nomads allows the Chinese to use the land for their own purposes, whether it is to preserve water sources for China or to make all of Tibet available for mining.

Tibetans are well aware of the threats that mining poses to their lifestyle and they have actively protested many mining operations. Tibetans often protest mining activities due to spiritual considerations, such as that traditional protective deities will be offended by the despoliation of the land and that harm will befall the local people as a result. The Chinese have usually had little regard for such Tibetan beliefs. Tibetans have also protested Chinese mining activities because of the environmental destructive effects, such as air, land and water pollution.



They have also protested against illegal mining activities, such as gold mining that has caused huge destruction to many streams and rivers. However, their protests have usually been unsuccessful in stopping the mining activities. Even Chinese miners without any legal permits often have the protection of local officials who have been paid off to allow the mining. Gold mining in eastern Tibet was essentially unregulated, with Chinese miners having little regard for the environmental effects of their mining or the sentiments of local Tibetans. The Chinese government eventually put the People's Armed Police (PAP) in charge of gold mining. The PAP was also unsympathetic to any Tibetan concerns and it had the authority and the means to pursue gold mining without any regard for the environment or the welfare of local Tibetans.

The Chinese attitude toward mining in Tibet derives from China's national resource needs; therefore, they have no inclination to stop the exploitation of the natural resources of Tibet. Their typical attitude toward Tibetans is just that they are in the way. Ultimately, the Chinese attitude is that Tibet's resources belong to China, not to Tibetans. The Chinese regard Tibet not as the home of Tibetans who have any rights to protect their environment or exploit it as they wish, but as a territory where China has the exclusive right to exploitation according to China's needs. Given the importance of natural-resource exploitation to China for its economic development, it will be extremely reluctant to acknowledge any Tibetan rights to their own natural resources.

The author divides China's exploitation of Tibetan natural resources into four periods. The first period was that of the 1950s, 1960s and 1970s, when only easily accessible resources could be exploited. These were located mostly in the Tsaidam Basin, the most easily accessible part of the Tibetan Plateau in what is now Qinghai Province. The exploitation of Tibet's forestry resources was also concentrated in this early period.

The Tsaidam is the lowest part of the Tibetan Plateau, the traditional route from northern China to Tibet and the only part of Tibet where Chinese can live without being affected by altitude sickness. It was also the first area reached by road in the early 1950 and by railroad in the early 1980s. China concentrated its mineral exploration efforts on this area in the 1950s and its development of mining activities there in the later two decades. Chinese geologists quickly found easily exploitable quantities of coal, oil, natural gas and salt in the Tsaidam. They later found deposits of iron, lead, zinc, asbestos, lithium, magnesium and potash. Potash, which is used in the manufacture of agricultural fertilizers, became increasingly important as China's use of human waste as fertilizer decreased.

The Tsaidam was the first area of Tibet opened to large-scale mining and it remains an important source of many minerals. China's colonization of Tibet followed the development of

mining in the Tsaidam. The area was the site of many prisons and labor camps for both Chinese and Tibetans who were forced to work in the mines. Some Chinese came to the Tsaidam voluntarily to help China develop its mineral resources but many more were sent there involuntarily. It has become the largest area of Chinese habitation on the Tibetan Plateau. It has also been greatly polluted by mining activities, as in most of China, because of the unrestrained search for the resources necessary for economic development without any regard for the negative environmental consequences. The importance of the Tsaidam is not only that China first developed large-scale mining here but that this is the model for what the Chinese plan for the rest of Tibet as infrastructure is gradually developed.

The first stage of China's exploitation of Tibet's natural resources also involved logging the forests of eastern Tibet, mostly in the part of Kham now in Sichuan but also in the eastern Tibet Autonomous Region (TAR). Logging of Tibet's forests was possible once roads were built into this area in the early 1950s. The forests of Kham were extensively exploited, beginning with areas closest to China, until much of eastern Tibet was substantially deforested, despite some efforts at reforestation. China finally had to prohibit all logging in the upper reaches of the Yangtze River due to flooding in Sichuan and further downstream due to deforestation in Tibet.

The second stage of China's exploitation of Tibet's natural resources began in the 1980s when the Chinese people were released from residency requirements and were allowed to go to remote areas like Tibet to pursue their own economic opportunities. The result was a gold rush in the streams and rivers of eastern Tibet. Small-scale gold mining can be done by individuals without a lot of equipment and without the need for good transportation facilities. Therefore, gold mining on this small scale preceded the development of the infrastructure necessary for large-scale mining in Tibet. Despite its small scale, this type of mining was very destructive of streams and rivers. Gold mining was later taken over by the government, including the People's Armed Police, and now has become only a secondary product of large-scale mining for other minerals like copper.

The liberalization policies of the 1980s saw the devolution of political authority from Beijing to provinces and local authorities. Local officials were therefore able to allow gold mining in their areas in exchange for a fee or a percentage of the profits. Just as individual Chinese saw an opportunity to become rich by mining gold, so did poorly paid local officials see the opportunity to strike it rich by allowing the miners to operate without restrictions and without any regard for the wishes of local Tibetans. Local officials also played a role in repressing any Tibetan protests against the mining activities. The motives of the miners as well as the Chinese officials were essentially predatory; they were interested only in extracting profits for themselves without any regard for the environmental consequences. Local Tibetans did not receive any

economic benefits from gold mining of their streams and rivers but were left to suffer all the destructive environmental consequences.

Gold mining in streams and rivers is a hugely damaging and destructive process. The river or stream banks are excavated by hand or machine or by water hoses that remove the earth that is then sifted for the minute quantities of gold that may be present. Whole streambeds are destroyed in order to find tiny quantities of gold. Gold miners sometimes operate alone or in small groups and simply try to pan for gold in streams. Other times large mechanical dredging machines are transported in pieces to mining sites where they are assembled and then crawl along streambeds on tank tracks, chewing up the earth on all sides and then turning it all into mud that is sifted for gold.

The result is an entirely devastated stream that in the harsh Tibetan climate may take years to be restored. Cyanide and mercury are often used to separate the gold from other materials. These chemicals then flow downstream and poison wild animals, livestock and people. The Chinese miners are usually protected by local officials and Tibetans' protests are dismissed or repressed as separatist activities.

Tibetans' protests against gold mining are often repressed by the PAP, whose responsibilities included guarding China's natural resource extraction activities in minority areas. But the PAP is also supposed to support itself through economic activities and so it evolved from a protector of gold mines into a miner itself. Gradually the PAP became the primary gold miner in Tibet both in order to repress Tibetan protests but also because the PAP has the authority and the force to take mining away from individuals and local officials. The motives of the PAP, like those of local Chinese officials, are essentially predatory. They simply want the profits to be gained by gold mining and are willing to repress all those who oppose mining, like Tibetans, or those who compete with them, like local officials.

The fact that the PAP is involved in gold mining exposes China's most fundamental interests in Tibet. China is in Tibet to exploit it for the benefit of China, not to benefit Tibetans. The PAP is responsible both for repressing Tibetans and for exploiting their gold resources. China employs the PAP in Tibet to simultaneously repress Tibetans while stealing their wealth. The PAP performs China's most fundamental roles in Tibet of repression and exploitation.

The third stage of mining in Tibet according to the author was mostly for chromate ore, which is refined into chromium and used in the hardening of steel and for making stainless steel. The elemental metal chromium is found in the earth as chromate ore. It often occurs in rich deposits of as much as 30 to 40 percent of the ore. The quantities of minerals needed to be mined and transported in chromate mining are not large; therefore, mining for this mineral was how

China began its development of fairly large-scale state-controlled mining in Tibet. Chromate concentrations occur in Tibet at Tsala Karpo in the Changtang area near Nakchuka and along the banks of the Yarlung Tsangpo River. The Tsala Karpo deposit was mined during the 1960s using Tibetan prisoners who were often worked and starved to death. The Changtang mine has now been closed but the Yarlung Tsangpo mine, known as Norbusa, is still open.

Chromium has many uses involved in the hardening of steel and prevention of corrosion of all sorts of steel products. China has vastly increased its production of chromium in recent years in an attempt to become the world's biggest manufacturer of stainless steel products. China also became the world's biggest importer of chromate ore from other countries. China has undercut the stainless steel manufacturing industries of other countries by monopolizing the ore resources and by selling the finished products at low prices.

Tibet is China's only domestic source of chromate but it supplies only 3 percent of China's total use of the metal. Tibetan chromate is now a small part of what China uses, but that could change with the discovery of larger deposits within Tibet and the development of infrastructure, especially railroads to facilitate the transportation of the ore to the Chinese interior.

The refining of chromium from chromate ore causes poisonous pollution of air, ground and water and has become a major pollutant in interior China. No chromate ore is refined into chromium within Tibet; therefore, Tibet has at least escaped the pollution that comes from refining of this metal. Chromate is a natural mineral, but the refined chromium is a highly toxic element that is very harmful to human health. The human body has no natural defenses against it and therefore it is extremely toxic when breathed or ingested in water or in food grown on soil polluted by the metal.

Chinese refiners of chromate ore and producers of stainless steel products number more than 150 and are mostly unregulated and highly competitive and therefore usually ignore environmental regulations. Areas near chromium manufacturing enterprises are often highly polluted. The chromium manufacturing industry is one of the world's biggest and most toxic polluters, even more than far bigger industries involving more well-known minerals like iron, aluminum or copper. The reason is because chromium is so highly toxic. Some areas near the chromium industry in China have now experienced increased rates of cancer and are known as cancer villages.

Chromate was one of the first minerals extracted from central Tibet on an industrial scale. Mining in the Changtang began as early as the 1950s and was important to China for the production of many items like military hardware. China used forced labor in the Tibetan mines

after the 1959 revolt and many Tibetans died mining for chromate. Now, China is less dependent upon Tibet as a source for chromate ore, but that could change as world conditions change.

The author devotes one chapter in his book to the story of a gold mine in Qinghai that falls between the third and fourth stages that he has described. The gold mine is named Dachang and is near the headwaters of the Yellow River, in Chumarleb County, Tsonup Tibetan Autonomous Prefecture (TAP). It is west of the lakes Ngoring and Kyaring, which are usually regarded as the source of the Ma Chu, or Yellow River, but actually it is the small streams that flow into the lakes from the west that are the real source. A source of gold was found there that is far larger and richer than usual and is close to the surface and therefore relatively easy to mine.

These factors make it larger than most gold mines in Tibet and therefore require a large-scale mining operation, but different from what the author describes as the fourth stage type of mines that are mostly for copper and other minerals, with gold found only as a side product in small quantities. As much as 4 million ounces of gold is expected to be found at the Dachang site. The price of gold on the international market is now about 1350 U.S. dollars per ounce, and the cost of producing the gold from this mine is estimated to be \$400 per ounce. Therefore, a profit of almost \$1000 per ounce is possible and the mine could have a total profit of 4 billion U.S. dollars.

Even with the relatively high concentration of gold at this site, this is still a tiny amount relative to the huge amount of rock that will have to be dug up, crushed and treated with poisonous chemicals in order to extract the gold. The mine will need a huge amount of water in an area that gets almost no rainfall. Then the gold will have to be washed with cyanide. The huge amount of waste rock will have to be piled up in a safe place so the chemicals within do not leach out into the local streams that are the source of the Yellow River.

The mine site covers an area 15 kilometers wide from east to west and 12 kilometers wide from north to south. It is in the Burhan Budai mountains, which are part of the Kun Lun mountain range. The site is also within the Sanjiangyuan Three Rivers Source Protection Area, although the mine owners have petitioned the Qinghai government to change the boundaries to put it outside the protected area. However, since that time the boundaries of the mine site have expanded. Tibetan nomads have been excluded from this area supposedly in order to protect the grasslands.

The Sanjiangyuan protected area is to the south and downhill from the mine site. The huge amount of detritus from the mine will therefore have to be carried to the north to a higher elevation site. Mine detritus sites are usually placed in a low area so they cannot spill out; however at this site they will be perched in a very precarious site above the mine. If the storage

site were to fail to contain the mine detritus it would flow into the local streams and from there into the protected lakes Ngoring and Gyaring and from there into the Ma Chu or Yellow River.

The most significant fact is that Tibetan nomads have been removed from the protected area while a huge gold mine is allowed to operate. The presence of Tibetan nomads in this area is certainly far less harmful to the environment than this mine will be. The exclusion of the nomads while at the same time a mine is allowed to operate demonstrates that China's priorities in Tibet are exclusively for the benefit of China and not for the benefit of Tibetans or for the environment of Tibet.

The fourth stage of large-scale mining in Tibet for minerals like copper is just beginning. Copper occurs in very small concentrations, usually less than one percent, and thus requires the digging, crushing and processing of huge amounts of rock in order to separate the tiny amounts of copper. This process requires large companies, usually state-owned enterprises, with large financial resources in order to get a mine up and operating. Profitable copper mines are always open pit since that is the only way to produce large enough quantities of ore. Open-pit mining requires the removal of huge quantities of soil and rock in order to reach the copper ore below.

It also requires the storage of that mass of rock as well as the amount removed during mining. Storage sites are hard to find in mountainous areas. The landslide at the mine at Gyama east of Lhasa, one of the first large copper mines in Tibet, was caused by detritus from the open pit being piled at the edge of the mine, all of which was at the top of a mountain. The detritus slid down the valley and killed many Chinese miners.

Copper mines require large amounts of electricity and infrastructure like roads and railroads to transport the ore to the Chinese interior. Even when some of the processing is done at the mining site, huge quantities of ore have to be transported to the interior for final separation of copper from the rock. Therefore, railroads are almost essential for copper mining on a large scale. Infrastructure development in Tibet has only recently allowed such large mining operations to be begun. However, the economics of mining for copper in Tibet are still marginal.

Chinese industries can source copper from other countries more cheaply than from Tibet. Tibet's copper deposits are small compared to others in the world. Chile has some of the largest and most easily accessed copper deposits in the world. China can now get copper from Chile cheaper than copper from Tibet. Mongolia also has copper deposits far larger than any that have been discovered in Tibet. China has invested in copper mines in Peru and Afghanistan and is the most likely buyer of copper from very large deposits in Mongolia.

The Chinese state has a political interest in the development of mining in Tibet. The government wants to consolidate Chinese control over Tibet by means of economic development, in which mining is a major aspect. The author emphasizes that even though the economic situation does not favor mining in Tibet at the present time, this does not mean that Tibet's natural resources will not be exploited by China. The economics of world supply of minerals can change rapidly, perhaps making copper from Tibet more advantageous to exploit.

China also needs to be able to develop the infrastructure to access minerals from Tibet for national security reasons. If the world situation were to change in such a way that China were cut off from the resources of some other country or some other area of the world, then China would need mines in Tibet ready to supply its needs. Tibet may supply a small portion of China's mineral needs at the present time because many minerals are available at lower prices on the global market. However, this does not mean that China will not eventually exploit Tibet for all the natural resources available there.

China's current Five-Year Plan for mining in Tibet concentrates on copper and gold. The plan intends to achieve 30 percent self-sufficiency in copper: that is, 30 percent of the copper refined in China should be produced by domestic mines. In 2009 China had a 25 percent self-sufficiency rate for copper production. In that year China produced a little over 4 million tons of copper. However, by 2015 China plans to have produced 7 million tons of copper. If 30 percent of this is produced domestically then domestic production will have to almost double.

Therefore, although China has invested in larger, richer and cheaper sources of copper in other countries, domestic production will also have to vastly increase. Most of that increase will have to come from Tibet since most of China's unexploited copper resources are in Tibet. International copper prices are now relatively low. However, price rises are expected as the world economy improves. Even greater emphasis will therefore have to be put on domestic resources.

China has so far developed three main copper mines in Tibet. These are the Shetongman mine near Shigatse, Gyama mine east of Lhasa and the Yulong mine near Jomda. Each of these mines also has exploitable concentrations of gold, silver and other valuable metals in addition to the copper. The Gyama mine is close to Lhasa and can send ore to the interior via the railroad. The Shetongman site has just been made more accessible due to the completion of the railway extension to Shigatse. The Yulong site probably cannot be profitably exploited until better transportation reaches that area.

All of these copper deposits lie along the fault line where the Indian and Asian continents collided and caused the Tibetan Plateau to rise to such great heights. Geological pressures in

such fault zones are known to create valuable minerals like copper and gold. Chinese geologists thus have hopes to discover more resources along this fault line, which runs parallel to the Yarlung Tsangpo River.

The Gyama mine is thus far the most developed of the three sites because it is close to Lhasa and can send ore to the interior via the railroad. Close to Gyama is another potential mining site called Chulong, which has even greater deposits. Both will become even more accessible if a planned Lhasa to Nyingtri extension of the railroad is completed. Because the Gyama mine was started with a foreign partner it was promoted as being sensitive to environmental concerns and to the welfare of local Tibetans.

The mine's developers promised that the mine would not pollute local land or water. However, as soon as the mine began to operate, tests revealed that water in the Kyi Chu that flows through Lhasa had high concentrations of toxic minerals and chemicals used at the mine. Lhasa's air was also polluted with the same toxic chemicals. Local Tibetans complained that despite the promises of the mine's owners, the nearby landscape had been damaged by the mining activities and that local air and water was already polluted.

In March 2013 disaster struck when a landslide of detritus piled up on the mountain top next to the open pit mine broke loose and roared down the adjacent valley where miners were camped. More than 70 Chinese miners died. Chinese officials immediately claimed that the landslide was due to natural causes even though aerial photos showed clearly that the landslide came from the detritus piled up at the very edge of the mine.

The Yulong site is near Gonjo in the Chamdo district. The Yulong site is said to be China's largest deposit of copper discovered so far. It is far from the nearest railroad and probably cannot be profitably exploited until better transportation reaches that area. However, it has an advantage of being close to power from hydroelectric dams. The author emphasizes that like railroads, hydroelectric dams are an essential part of China's plan for eventual large scale mining of Tibet's natural resources. There are other known concentrations of minerals nearby, at Malasumdo, Toshasumdo and Dralhaka. These mines have been known for some time; even before 1950 some small scale mining by Tibetans was done at these sites. The large number of potential sites in this area and their relative richness will ensure that they will eventually be exploited on a large scale.

In addition to copper deposits, China has also discovered a large iron ore deposit near Nyanrong, north of Nakchuka. This is said to be the largest and richest iron ore discovery in China. The iron ore there has a very high level of iron content, much higher than any other site in China. The resources are also near the newly completed railway so that they can be relatively



easily exploited. The highest and most remote areas of the plateau are yet to be surveyed and may yield even more natural resources.

In his conclusions the author says that a significant factor in whether or not China pursues mining in Tibet even when minerals from other countries are still cheaper is that gold is found in Tibetan mines. Mining in Tibet will be done by China's largest state-owned enterprises. These enterprises are owned by China's richest people. They are interested in projects where they are able to retain high levels of profits. Mines in foreign countries allow these enterprises to hide much of their profits in foreign bank accounts and other secret places.

However, China's state-owned enterprises can also treat Tibet much like a foreign country in that they can ignore environmental regulations and the welfare of the local people, and they operate with little government supervision, which means that they can also hide profits from their mines in Tibet. In addition, they are very much interested in the gold that is found in small quantities in mines whose main product is copper or some other mineral. Gold is easily portable and can be hidden easily or smuggled out of China and deposited in secret bank accounts in other countries. Tibet's gold resources are therefore an important reason why China will thoroughly exploit Tibet's mineral resources.

The author reiterates that China's development plans for Tibet concentrate on mining and tourism, but that tourism may offer the only hope that China will have to limit the environmental destruction of mining in Tibet. One of the primary attractions for Chinese tourists is the magnificent and unspoiled Tibetan environment. As Chinese tourists travel to more areas of Tibet they will eventually see the environmental destruction caused by mining and may be upset that the environment of Tibet is being destroyed in this way.

This raises the possibility of a Chinese movement to protect the environment in Tibet. Chinese environmentalists will no doubt be most concerned about the physical beauty of Tibet rather than the welfare of Tibetans. Nevertheless, some may see that the traditional Tibetan lifestyle was respectful and protective of the environment and they may see Tibetan culture as attractive and worthy of preservation for that reason.

Eventually, as more Chinese travel to Tibet for tourism and as they develop more identification with Tibet as a part of China worthy of preservation, they may put pressure on their government and state-owned enterprises to protect the environment in Tibet. The author emphasizes that Tibet will be mined for its natural resources and that large-scale mining is only just beginning. However, Chinese tourism to Tibet is growing faster than mining; therefore, there is hope that an environmental movement will be able to prevent some of the environmental destruction that is usually associated with mining.

Hopefully, Chinese tourists will also become somewhat respectful of Tibetan culture, and not just the artificial cultural performances put on for tourists, and China will allow Tibetans to once again assume some responsibility for their own environment and their own natural resources. Tibet's mineral resources may then become a reason for preserving the environment and culture of Tibet rather than a reason for destroying them.