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Small-scale mining in China: Assessing recent advances in the policy and regulatory framework

Lei Shen [a,c], Tao Dai [a,d,*], Aaron James Gunson [b,c]

[a] Institute of Geographic Sciences and Natural Resource Research (IGSNRR), C.A.S., 11A Datun Road, Chaoyang District, Beijing 100101, China
[b] Department of Mining Engineering, University of British Columbia, Vancouver, Canada
[c] Communities and Small-Scale Mining Regional Network in China (CASM-China), Beijing, China
[d] Graduate University of Chinese Academy of Sciences (GUCAS), Beijing 100049, China

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ABSTRACT

This paper explores the background of a proposed revision to the Mineral Resources Law of China, why and how the law was amended in the past, its salient features and objectives. Of equal importance is an analysis of how this national law, with its attendant regulations and policies, formed the basis for the growth and continued development of China's small-scale mining industry. The Xiaoqingling Gold Mountain case study is shown to justify the necessity and feasibility for formalizing and consolidating small-scale mines in China, and to some extent, the success of the nation-wide ASM resource consolidation policy at a local level.

Introduction

Artisanal and small-scale mining (ASM) has long proved to be economically important in many countries (Davidson, 1993; Shen and Gunson, 2006). From a structural and technical perspective, the sector encompasses rudimentary operations extracting valuable minerals from primary and secondary ore bodies, using basic tools such as picks and shovels, and occasionally, mechanized equipment (Kambani, 2003), and is characterized by the lack of long-term mine planning and control. It can be illegal or legal, formal or informal and can include everything from individual gold panners to operations employing thousands of people (Hilson, 2002). The sector has provided millions of people with employment around the world while also contributing to national mineral exports and foreign exchange earnings. There is, however, an obvious need to address many negative aspects arising from ASM, including environmental damage (Crispin, 2003), an appalling mine safety record, low recovery of resources (Heemskerk, 2001), negative heath and social impacts on local communities, and widespread illegal mining. A clear and effective legal structure for ASM is necessary to mitigate these impacts (Maponga and Ngorima, 2003). Over the years, formal and informal international groups have drawn up agendas, guidelines and programs for effective regulation (Labonne, 1994), but few governments have implemented them with any measure of sustained success (Bugnosen, 1998). One obstacle is that small-scale mining requires a simple system of laws and regulations (Andrews-Speed et al., 2003a, b, c), in addition to institutional support from the government to implement these laws and regulations. Two good practices could be found in the cases of Colombia and Zimbabwe. The Colombian example shows how an intensive period of government action funded by royalties paid by large-scale mines brought great benefits to the small-scale coal mining sector in a relatively short period of time (Espinosa and Bula, 2000; Zamora, 2000). The Zimbabwean experience indicates how public pressure can impose self-regulation on small-scale mines, which reduces the cost of governmental regulation (Hollaway, 2000).

The size and importance of ASM in China developed a school of its own. In 2006, China's ASM sector employed more than 5 million people and produced over half its mineral production (see Table 1). ASM in China might be considered to make unique contributions to rural economic development. It could employ

* Corresponding author at: Institute of Geographic Sciences and Natural Resource Research (IGSNRR), C.A.S., 11A Datun Road, Chaoyang District, Beijing 100101, China. Tel.: +86 10 64889451 6; fax: +86 10 64889005.
E-mail address: dait.07b@igsnrr.ac.cn (T. Dai).

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Table 1
Some basic data about ASM in China, 2006.

	Number of Mine enterprises	Employment (persons)	Annual output (10,000 t)	Gross industrial production value (RMB 10,000)	Sale revenue of mineral products (RMB 10,000)	Production value of comprehensive utilization (RMB 10,000)	Total profits (RMB 10,000)
Total	126,696	7,691,566	524,896	56,077,933	3,523,225	48,628,098	7,200,042
LMEs	3331	1,448,242	178,490	22,484,824	1,282,610	18,924,580	3,031,398
MMEs	4341	1,206,428	69,955	10,888,259	373,926	9,641,358	1,552,327
SMEs	55,091	2,998,200	196,368	16,645,696	1,471,530	15,185,049	2,120,146
AMEs	63,933	2,038,696	80,082	6,059,154	395,159	4,877,111	586,172
ASMEs	119,024	5,036,896	276,450	22,704,850	1,866,689	20,062,160	270,6318
Percentage of ASMEs in total (%)	94	65	53	41	53	41	37

Note: LMEs stands for the Large-scale Mining Enterprises, MMEs for Middle-scale Mining Enterprises, SMEs for Small-scale Mining Enterprises, AMEs for Artisanal Mining Enterprises, respectively. ASMEs include the SMEs and AMEs.

millions of people in often remote areas, and often invests income in other local industry promoting diversification and provides mineral and energy raw materials to areas where transportation problems might otherwise make local industry prohibitively expensive. China's ASM, however, has also a staggering health and environmental impact. For example, small scale coal mines in China alone have thousands of deaths from accidents each year. They might degrade surface and ground water, soils, air, and could destroy valuable deposits through poor practice. As a result, ASM in China is often thought to be illegal, employ migrant workers, and contribute to smuggling and other negative social impacts. These negative impacts resulted in capriciously strict policies and regulations on ASM in China.

Over the last two decades there has been an explosion in the number of laws, regulations and subordinate administrative measures implemented in China, but there has been no clear and specially tailored policy or system of regulation for ASM. Chinese laws and regulations typically refer to township and village mines (TVM) (Gunson and Veiga, 2004), which encompass most ASM in China. However, the term TVM does not include small provincially or nationally owned state mines, foreign-owned small mines, or outright illegal mines. Both the system of laws and regulations and the institutional structure in China did not include adequate or appropriate nature of national regulatory regimes for small-scale mines. This raised many concerns about the creation and improvement of policies and regulations specific to ASM within the system of China's mineral law. The opportunity came to change these regulations in late 2003, when the national government initiated a process to bring a second revision to its mineral resource law. Over 2000 experts and officials in 80 seminars provided inputs to the process and a preliminary research report appeared at the end of 2004. Yet the new revision had not been implemented by 2008.

This article provides a brief review of the regulatory system of China's mining sector, focusing on its implications for ASM in particular. The analysis is mainly based on the 1986 and 1996 Mineral Resources Laws but is informed by interviews with local ASM representatives. Field case surveys were carried out at Xiaoqingling ASM area in Henan Province in 2005, in addition to a literature review of official documents and academic papers.

Recent developments in China's mining policy and laws

The extended period of present mineral resource legislative revision in China may be a result of its unique law-making process. In theory, a simple hierarchical structure of laws and law-making institutions in China has been characterized by Chen, Shen and Andrews-Speed, and others as a four-tier framework (Chen, 1999; Andrews-Speed et al., 2003a, b, c): first, the National People's Congress (NPC), the equivalent of a parliament or legislature, holds the power to make national laws; second, the State Council (the equivalent of a cabinet) can draft implementation rules, regulations, decrees and orders; third, subordinate Commissions and Ministries can issue orders, directives and regulations, which are consistent with national laws and State Council regulations; and finally, People's Congresses at the provincial and city levels may enact local regulations consistent with all of the above national laws and regulations.

In practice, however, the State Council, holds the real power in the development of laws and regulations, and receives substantial input from relevant Commissions and Ministries, especially in the economic sector (Scott, 1995). The State Council usually retains control of the drafting and review process before a law is sent to the NPC for approval. If the law is not approved, it is usually returned to the State Council for redrafting. Once approved, either the State Council or the relevant government department is charged with devising and implementing regulations and measures. Local governments may then draft additional regulations. The mineral resource law, as one of many economic laws, usually emerges from either the State Council or from a relevant Commission or Ministry. This specific formation process results in a body of law, which has widespread inconsistency, conflict and ambiguity (Potter, 1997).

The implementation of laws and regulations in particular relating to ASM, moreover, runs into a further series of obstacles such as inconsistency, conflict and ambiguity resulting from law that reflects the various interests of stakeholders. The inconsistency and conflict between the various legal documents results from contrasting interests of the different sponsors of the legislation; from the relative impotence of the National People's Congress; and from the failure of the Legislative Bureau of the State Council to strive for consistency. The ambiguity in most laws probably reflects, on the one hand, the need to achieve compromise between competing agencies and, on the other hand, the power which ambiguity grants to bureaucrats at the stage of implementation.

The above features led to some strong desires for legal revisions in the history, aiming to encompass some specific articles and establishments on the ASM. As a result, China has undertaken two large-scale legislative efforts on mineral resources since the mid-1980s. The first involved the formation of the Mineral Resources Law in 1986, with implementation rules appearing in 1994. The second was a major revision to the 1986 Mineral Resources Law in 1996, and a package of regulations was issued in 1998. For the first time in its history China had a systematic set of rules concerning mineral exploration and production rights, and the transfer of these rights.

With respect to the artisanal and small-scale mining sector, a substantial body of law relating directly or indirectly now exists in China. These may be grouped under the following four categories

Table 2
Laws, regulations and measures relating to ASM in China.

Name of instrument	Year
Category 1: Laws and regulations of rights to mineral resources	
The Mineral Resources Law, amended	1986,1996
Rules for the implementation of the Mineral Resources Law	1994
Regulations for registering to explore for mineral resources using the Block System	1998
Regulations for registering to mine mineral resources	1998
Regulations for transferring exploration rights and mining rights	1998
Category 2: Regulations of coal mining operations	
Law on safety in mines	1992
Administrative measures for coal production licenses	1994
Implementation rules for management of coal production licenses	1995
Regulations for coal businesses and operations	1996
Law on coal industry	1996
Category 3: Laws, regulations and measures of environmental protection and land management	
Law on land administration, amended	1986,1998
Law on water	1988
Regulations on land reclamation	1988
Law on environmental protection	1989
Law on water and soil conservation	1991
Temporary measures for management of environmental protection in the coal industry	1994
Amended law on prevention and control of water pollution	1996
Implementation measures for regulations on land reclamation	1998
Category 4: Regulations of township and village mines (TVMs)	
Circular of the State Council on implementation of industrial management of township and village enterprise mines	1986
Administrative regulations for township and village coal mines	1994
Implementation measures for administrative regulations for township and village coal mines	1994
Regulations for small coal mine safety	1996
Law on township enterprises	1996

(Andrews-Speed et al., 2003a, b, c): first, the laws and regulations of rights to mineral resources; second, the regulation of coal mining operations; third, the regulation of environmental protection and land management; and finally the regulation of township and village mines, with particular reference to coal mines (Table 2).

The first category was promoted by the former Ministry of Geology and Mineral Resources, which was restructured in 1998 into the Ministry of Land and Resources (MOLAR). MOLAR now has the responsibility of implementing these rules and issuing exploration and mining licenses. The second category covers everything from development and production plans, to safety and marketing. The third category, relating to general environmental protection and specifically, to water and soil, fall under the remit of the State Environmental Protection Agency (newly restructured as Ministry of Environmental Protection in 2008), but parts of laws and regulations relating to land administration and reclamation were promoted by MOLAR. The final category of regulations applies specifically to small-scale mines, and not to large-scale, state-owned coal mines. These address a wide range of issues such as engineering and safety standards, inspection procedures, the role of different levels of government, the responsibilities of mine managers, employee contracts, and the legal status of TVMs (see Table 2).

The next section briefly reviews some historic changes in regard to policy and legal structures of ASM, focusing on the 1986 and 1996 Mineral Resources Laws.

Changing policy and legal structures for artisanal and small-scale mining

The 1986 mineral resources law

Since the late 1970s the Chinese economy has achieved rapid development. This has led to an greatly increased demand for energy and raw materials, and it has simultaneously promoted the rapid development of mineral exploration and mining in China, especially from TVMs (Shen and Andrews-Speed, 2001). In this period, the Chinese government has found it increasingly difficult to manage the mining industry effectively through the old command and control administration. As a result, creating a legal regime for the mining industry was placed on the agenda of the central government, with the aim of enhancing the construction of a socialist legal system. In September 1979, the State Council charged the Commission of Economy and Trade and the Ministry of Geology with organizing experts and officers from eight related departments to draft a new mineral resources law. After 5 years of investigation and discussion, a draft law with 13 revisions was handed over the Standing Committee of the NPC. Promulgated on March 19, 1986, the new Mineral Resources Law went into effect on October 1, 1986.

Although the 1986 Mineral Resources Law was issued and implemented, it contained several points of dispute, including

- whether the actual title of the law was the Mineral Resources Law or the Mining Law;
- whether the overall rationale or justification for the law was to protect mineral resources, or to develop the mining sector vigorously, or to do both;
- whether the law regulated all mineral resources or only solid mineral resources, with a separate law for petroleum;
- whether the legal system was to establish a central administrative agency or to maintain the existing structure of separate departments; and finally;
- whether strictly to curtail or liberalize ASM further.

With respect to ASM in particular with TVMs, the 1986 Mineral Resources Law clearly affirmed their legal status and required them to formalize their mining activities. Owing to a lack of legislative experience, however, the new law had major deficiencies, including vague articles, unclear procedures for executing the law, unclear definitions of institutional structures, and there was a lack of effective environmental regulatory bodies. Local counties and cities struggled to adopt suitable legal structures, adapted from the law, into their jurisdictions.

The 1996 mineral resources law

Since the promulgation of the 1986 Mineral Resources Law, China has made rapid advances in building what it refers to as a 'socialist market economy'. The opening and reform of the mining sector in China has steadily advanced, and both demand and supply of mineral resources has expanded rapidly. Different types of ownership structures have emerged in the mineral exploration and mining sector. To improve further the legal system for mining, the 1986 Mineral Resources Law was revised on August 29, 1996. The 1996 Mineral Resources Law stipulated the following new structures and systems:

- A management system for the ownership of mineral resources.
- A management system for exploration rights.

- A management system for implementation of block registration.[1]
- A management system for mining rights.
- A system of obtaining compensation and transferring exploration and mining rights.
- An examination and approval system for mineral reserves.
- A planning and distributing system for mineral resources.
- A management system for the collection and submission of geological data.
- A registration and statistic system for mineral reserves.
- A supervision and management system for the development and utilization of mineral resources.
- A system for mining mineral resources with compensation.

Generally, the 1996 Mineral Resources Law only partly amended the 1986 Mineral Resources Law, maintaining the previous framework and principles. Some changes were made as follows:

(a) Fifteen articles of the 1986 Mineral Resources Law were amended, including Article Nos. 3, 4, 5, 10, 13, 14, 16, 26, 34, 36, 39, 42, 45, and 46.
(b) Three articles were added, including Article Nos. 47, 48 and 50.
(c) Article No. 33 in the 1986 Mineral Resources Law was moved into the general principles section.

One of the major changes in the 1996 Mineral Resources Law was a historic breakthrough in the property management of exploration and mining rights, separating them from the ownership of the mineral resources. The 1996 Mineral Resources Law established a clear structure for the acquisition of mining rights and allowed for the transfer of these rights. As a result, the mineral exploration and mining industry moved firmly into a market-oriented structure, allowing the development of a mining industry with strong legal safeguards.

Unfortunately, the 1996 Mineral Resources Law also had several unresolved issues. For example, a classification management institution for mineral resources was not established; mineral property rights were not put in the core of the law.[2] In addition, different owners of mining bodies, including ASM, did not have equal legal status; and the responsibilities and rights among different departments in the central government and between the central and local administrative bodies were not clearly defined.

Other regulations and rules

Over the last two decades some additional related regulations have been introduced. A comparatively integrated legal system has been established, including the laws, administrative regulations, departmental rules, local regulations and local rules. Of the administrative regulations, three are closely related to ASM activities: They are

(a) the 1998 Regulations on Registration for Exploitation of Mineral Resources (Decree 241, dated on 12 February, 1998);
(b) the 1998 Regulations on Registration for Mineral Resources Exploration (Decree 240, dated on 12 February, 1998) and
(c) the 1998 Regulations on Transfer of Exploration Rights and Mining Rights (Decree 242, dated on 12 February, 1998).

At the local level, local people's congress and their standing committees across China, with the exception of Shanghai, have gradually set up their own local regulations, ordinances or statutes. Fujian, Hubei and Guangdong provinces have also stipulated their own regulations on quarries.

The feasibility of regulatory reform of ASM in China

Advances and problems in the implementation of the mineral resource law

Since the 1986 Mineral Resources Law was implemented, there has been progress in six broad areas: First, all types of mineral exploration and mining activities were brought into the legal system; Second, the constitution clearly established that the State Council has ownership over all mineral resources. Third, the state undertook central administration of mineral resources. The MOLAR was responsible for administration, approval, and registration of mineral exploration, mining, reserves and geological data. Fourth, a mineral tax and fee system was established ensuring benefits to the state and holders of exploration and mining rights. Fifth, a system was established for the acquisition and transfer of exploration and mining rights with compensation and under some conditions provided a legal foundation for a market in mining rights. Finally, a supervision system for mineral resources was established to formalize the legal responsibilities of mineral administrators and mining right holders.

Along with these legal developments, the management and allocation of mineral resources significantly changed and its legal administration was greatly enhanced. The functions and responsibilities of MOLAR were gradually strengthened and many studies on mineral resource strategies, policies and planning management were carried out to allow better macro-level control by MOLAR. In the context of legalization, the liberalization reforms achieved great progress in the field of exploration rights and mining rights with compensation. Mineral exploration and mining is now under strict judicial administration, and other functions of resources management and public services have changed substantially.

Nevertheless, some problems remain with the implementation of 1996 Mineral Resources Law, particularly with respect to legalizing and creating an effective legal regime for ASM. Because China's demand for energy and mineral resources has grown enormously, the availability of these resources is an absolute limiting factor of Chinese economic growth. Further integration with the global economy and continued investment in overseas mineral production require China to enact a new and effective law for mineral resources in order to sustain its economic growth and institutional reform.

ASM considerations are inadequately developed in current mineral resource laws and regulations. This has been a key reason for the difficulty encountered in attempts to formalize and

[1] The 1996 Mineral Resources Law in Article 12 established that the State practices a unified regional registration system for exploration of mineral resources. Article 3 in Measures for the Area Registration Administration of Mineral Resources Exploration and Survey, promulgated by Decree No. 240 of the State Council of the People's Republic of China on February 12, 1998, established that an area (block) with the delimitation of 1′ longitude × 1′ latitude shall be the basic unit area of the scope of a work area in mineral resources exploration and survey, and that the maximum scope of each exploration and survey project permissible for registration shall be: (1) a 10-basic unit area for mineral water; (2) a 40-basic unit area for metal minerals, non-metal minerals and radioactive minerals; (3) a 200-basic unit area for geothermal energy, coal and fluid and gaseous minerals and (4) a 2500-basic unit area for petroleum and natural gas minerals.

[2] The Property Law of People's Republic of China was promulgated on 16 March, 2007 and was into effect as of 1 October, 2007 by President's Order (No. 62 of the 10th NPC). Before this, no laws or regulations in China did clarify the ownership of things and leverage the utility of things in order to protect the rights *in rem* of rights holders.

manage ASM, especially with regard to environmental protection and safety requirements.

The feasibility of ASM legal reform

In China, as in many countries, small-scale mining legislation has been included as part of the provisions of the general mineral resource laws. But, as noted by Bugnosen et al., (2000) for other developing nations, this approach has not necessarily helped to promote the sectors' growth, or made significant improvements to the social and environmental problems associated with the sector.

The general goals of existing Chinese mining legislation are broadly covered but those for ASM regulation should be specified as follows:

(a) to curb illegal mining, trading and smuggling of mineral products and to stop supply of minerals to the black market;
(b) to protect and rationalize viable small-scale mining activities;
(c) to minimize environmental destruction in mining areas and improve miners health and safety;
(d) to develop and exploit small mineral deposits that are not feasible for large- and medium-scale operations to mine;
(e) to create more employment opportunities, and;
(f) to provide a fuel substitute for wood with respect to coal, thereby alleviating poverty and minimizing deforestation in remote and rural areas.

The 1996 Mineral Resources Law includes one chapter which primarily addresses ASM. The law encourages government support, planning, and effective administration of collective-owned mining enterprises and privately owned mining undertakings. It encourages ASM operations in areas designated by the state. Individuals are allowed to mine scattered and dispersed resources, as well as sand, stone, and clay for building materials. Resources suitable for mining at a larger scale are not to be mined by individuals or ASM miners. Non-individual ASM should be guided and assisted by the state to improve their technical level and utilization rate of mineral resources and to achieve better economic returns. Departments in charge of geology and mineral resources, geological units, and state-owned mining enterprises should provide geological data and technical services to ASM, with compensation, under mutually beneficial terms. ASM in mining areas assigned to other enterprises should cease or conducted in other designated areas, but some reasonable compensation shall be given to close such enterprises if they were being conducted legally. Larger mining enterprises may also enter into joint operation with ASM. Generally, ASM should increase their technical expertise, stop unauthorized and wasteful mining, and survey and map their mining activities. Governments at county levels or above must provide guidance and assistance to ASM in updating technology, improving business management, and improving safety.

Recent change in the Chinese government's attitudes toward the mining industry at different levels, in addition to the experiences of other countries where ASM is prominent, provides some useful examples for formalizing ASM in China. The central government has held frequent symposia with the aim of improving policy toward China's population, resources and environment. One emphasis has been to strengthen mining management and to transform governmental functions in mining from management to regulation. China's past experience in reforming the mining legal structure, combined with lessons learned from other national laws and experiences in legal reforms, can also provide reference for the latest mineral legal revision.

After 1985 more than a hundred nations introduced or worked on new or major revisions to legislation pertinent to the mining industry (Otto and James, 1997). In many of these countries, however, regardless of their economic structure or stature, the reform of mineral regulatory systems has been slow to proceed.[3] This is partly because mining law is only one component in a body of regulations impacting the minerals sector. Major reforms may require changes in other laws dealing with issues such as land, taxation, imports/exports, water, foreign investment, foreign exchange, labor practices, safety and the environment. In the context of domestic concerns, a large number of influential officers and experts have been lobbying for a comprehensive amendment to the past mineral resource laws.[4]

Objectives of the recent legal revision

The most recent revision of the mineral law of China started in 2002 and it has been advancing slowly. In 2002 the Standing Committee of China National People's Congress (CNPC) carried out a wide-ranging examination on the implementation of the law, affirming the substantial achievements over the preceding 20 years and indicating major tasks for further revision. In 2003, the MOLAR initiated a series of preliminary investigations and studies. More than 60 experts from Chinese government departments and institutes were appointed as advisory commissioners with the establishment of a leadership group, a working office and a drafting group for revisions on the land resource law and mineral resource law. A comprehensive research project was approved to start in 2004, completed in 2005 and submitted to the MOLAR in 2006. In 2007 and 2008, a series of symposiums and workshops on the related issues of the legal revision and the comprehensive report was held at different levels of governments and academia.

Main issues

Based on suggestions from various government departments, organizations, and experts in China, a proposed new mining law revision will be comprehensively amended to the 1996 Mineral Resources Law.

The main purpose of the new amendment is to improve the mining by enhancing mineral resource management, implementing a methodical science-based mining strategy, improving the Chinese mining investment environment, and realizing more sustainable development in mining.

The scope of the new legislation will include public welfare geological activity,[5] commercial mineral exploration and mining production, environmental protection in mining areas, the marketing,import and export of mineral products.

[3] Three examples of nations where regulatory reform has been worked on for substantial time periods but has not yet implemented are the US, Russia and Venezuela.

[4] According to our estimate, more than 98% people including Chinese governmental departments at various levels of land and mineral administrations, geological exploration units, mine enterprises, and experts and social groups agreed to amend the current mineral resources law.

[5] It indicates all geological tasks that focus on basic geological survey and raise the work extent of basic geology for meeting national strategic requirements and industrial or individual demands. At the national level, these include three aspects: (a) nation-wide prospective surveys and potential evaluations on major energy and mineral resources, integrated geological survey and special investigations on key geological issues at the levels of nation, trans-regions or sea areas; (b) research and establishment of technological standards, theoretical studies on geology and mineral resources, methodologies, some technology introduction and promotion, and international cooperation on geosciences and geological survey; (c) other demonstration and pilot geological works.

The new law will be amended by adding and modifying chapters and articles on topics such as mining rights management, mineral resource planning, reserve management of mineral resources, management of mining lands, environmental protection in mining areas, ASM, and geological data submission.

The revision methodology is based on democratic and scientific decision making, open consultation, integrating theoretical studies with practical surveys, maintaining continuity where reasonable and implementing new innovations as necessary.

It is proposed that the new law start with the scientific classification of mineral resources, and with a hierarchical management structure, emphasizing a property-based system for exploration and mining rights and promoting the rational development and utilization of mineral resources.

Key objectives

These are to consolidate, focus, and improve a unified management system for mineral resources in China, by establishing a classified and hierarchical management system for mineral resources, a strong mineral resource property system and a comprehensive environmental protection system for mines. The proposed amendment also seeks to improve the legal system for mineral resource planning, the reserve management system for mineral resources, the management system for lands designated for mining, the management system for ASM and the management system for geological data submissions. It will strive to adjust and improve the management system for exploration and mining of mineral resources and for assigning and managing mining taxes, fees and economic benefit allocations, cancel past arrangements which are unsuitable to accommodate new situations and development trends of the mining industry in China, and clarify legal responsibilities of all stakeholders. Its ultimate goals are the establishment of a market-oriented management system for exploration and mining rights and formalization of the legal system of supervision management.

Although the new draft law for ASM was still under open discussion in 2008, the majority of the above objectives are likely to be fully integrated. To show what sort of provisions should be in the revised laws and regulations with particular reference to ASM and potential implementation at local level, a field case survey on the Xiaoqingling area is provided and analyzed in the next section.

Case-study: the Xiaoqingling ASM area

Background

The Xiaoqingling ASM Area is located at the junction of Henan, Shaanxi and Shanxi provinces, southeast of the Qingling Mountains. Lingbao City, in western Henan province, is the core of the area (see Fig. 1). Lingbao is referred to as 'a Gold City' in China, and is also well known for its apple production and as the origin of Taoism. In addition to Lingbao City, the county includes ten towns and seven villages. Lingbao City County's population is approximately 723,000, and covers an area of 3007 km^2. In 2003, it was officially approved as a national tourist destination.

By the end of 2004, 24 of the 45 mining rights permits issued by the city were held by ASM operations. ASM employed 1363 people, mining 317,500 t of ore with a value of RMB 36,000,000 (about US $5,000,000), accounting for 3.5% of the total county industrial production. There are five major types of mining operations: gold, iron ore, limestone for cement, aggregates for building material, and mineral water. Gold ASM accounted for one-third of the value of ASM production.

Between 1978 and 2007, Lingbao produced over 4,200,000 liang,[6] or 6,752,412 ounces, of gold and was the second largest gold-producing county in China after 1986. The local gold industry, including large-scale mining and ASM, has represented up to 80% of the city's GDP. However, in 1996, a large program was implemented to reduce ASM production. In Lingbao, the program closed 358 mines, destroyed 9023 pieces of ASM equipment, and forced thousands of ASM workers from other regions out of the city.

Intercommunication, regularization, and standardization—regulating ASM in Lingbao City County

The Xiaoqingling area was notorious for illegal ASM in the late 1990s and early 2000s, but now it has become a successful example for ASM regulation in China. This transformation was achieved successfully in at least following three aspects.

First, a stakeholder association was established to provide a forum for mutual support and intercommunication, linking together the local government, mine enterprises and community residents. The association was based out of eight central stations, each with subordinated offices at local ASM mining sites, effectively linking all mine enterprises with the city administration.

Second, a new and more efficient management system was created. By 2008, twenty-one regulatory systems were set up, including a uniform signature system for internal administrative affairs, a system for tracing administrative faults, and a dynamic inspection system for supervising the execution of applicable laws. Under the mutual supervision of the Geological Bureau and the network stations, a new system was implemented to allocate transportation resources and mined ore to different milling enterprises, and a monthly reporting system was instituted to provide a record of each truck. This allowed the creation of a daily record of all ore produced and transported. The management system ensures that mining enterprises are separate from milling and transportation enterprises and that every problem and fault in the whole process from mines to markets can be clearly identified and easily traced.

Third, the administration of ASM was standardized. The Geological Bureau of Lingbao City shifted its attitude and focus from trying to stop all ASM to leading ASM and ensuring supervision of all aspects from mine development, operation, and closure. As a result, supervision from the Bureau commences before mining and now entails ensuring strict justification for the operation before it is approved, providing miners with detailed explanations on application procedures, materials and registration before mining rights are granted. Supervision during operation includes approving ore allocation and managing the transport of mineral products to ensure ASM enterprises do not over produce. Mine closure administration insures mining permit owners carry out related procedures for bankruptcy, ownership transfer, and mine reclamations.

ASM consolidation—an effective and efficient ASM strategy

In conjunction with implementing the new regulations, Lingbao consolidated its gold ASM industry. This combination of administrative and regulatory improvement and industry consolidation was critical to the successful formalization of ASM. The practical consolidation was carried out as follows.

First, eight local state-owned gold mines were consolidated into three larger companies: the Lingbao Gold Joint-Stock

[6] The liang is a unit of weight and equal to 0.05 kg or 1.608 troy ounces.

Company, the Jinyuan Mining Limited Company and the Lingbao Gold Investment Limited Company. After the above consolidation, the three new companies operated 75% of the proven gold reserves in the area. Second, all the small gold mines were gradually merged into larger ASM enterprises. Third, ownership of the new ASM enterprises was reorganized through mergers and acquisitions. For example, the Shuangxin Gold Limited Company of Yuling Town was established, with a 55% ownership stake held by the Wenyu Gold Mine – an old state-owned large mine of China, a 40% stake held by the Mr. Guo Gold Mine – a ASM gold mine, and a 5% ownership stake held by the Henan Gold Company—a province-level of gold administration body. Shuangxin Gold Ltd., is considered the first example uniting large-scale enterprises with small-scale gold mines in China.

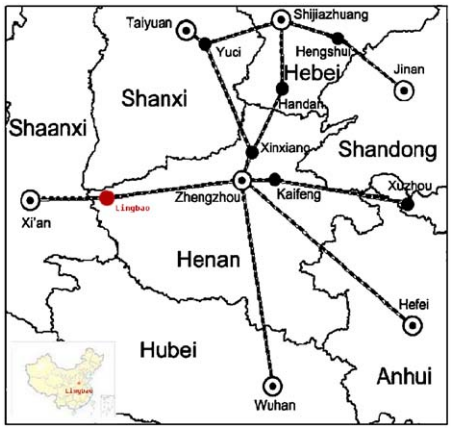

Fig. 1. The Xiaoqingling ASM area and Lingbao City, Henan province, China.

By way of consolidation all small gold mines in Lingbao were transformed into legal and formal mining enterprises. In conjunction with this formalization, the ASM operations, began integrating their development and improving their performance economically, socially, and environmentally. Several typical transformation cases in Lingbao are shown in Table 3.

The case of Mr. Guo Xiaohong demonstrates some of these changes. Mr. Guo, a local peasant from Chengcun village, became wealthy by the late 1990s through the local gold ASM industry. In 2004, he took over a bankrupt state-owned gold enterprise, keeping 200 workers employed and paying RMB 5,000,000 annually (about US$694,445) to the previous enterprise. In addition, he ran another gold concentration mill and a farming

Table 3
Several typical of ASM transformation cases in Lingbao City, Henan Province, China.

Initiator	Name of the enterprise	Date of establishing	Investment (million RMB)	Description	Benefits
Mr. Guo Xiaohong	Changhong Wells and Lanes Company Ore Concentrating Mill	March 2005	12	The mill has a processing capacity of 200 (tons per day, hereafter as tpd) and encompasses an area of 21,000 m^2, including 3900 m^2 of buildings, 5 large transport trucks and 2 loading machines	Annual production is approximately RMB 30 million, with profits of RMB 2.8 million and providing employment for 300 local workers. The company was also rebuilding 3 km of village roads
	Chengcun West Comprehensive Farmland Development	1992	1.2	An undeveloped ravine was planted with 8.7 ha of apple trees, 1.3 ha of peach trees, 1.3 ha of almond trees, 1.3 ha of pear trees, 4 ha of fast growing poplar trees and 1.3 ha of vegetable fields. In addition, a commercial pig farm was built, raising 42 sows and 200 commercial pigs	The comprehensive farmland can sell about 600 pigs annually. The pig manure pit supplies 5 methane pool stations, linked by tunnels, with a capacity of 10 m^3. A 1 km road was rebuilt with hard surface In addition, 7 greenhouses for vegetables, covering an area of 0.34 ha, were to be built, along with 4 pools to be developed for aquaculture and several pavilions and towers to be built for recreational fishing
Mr. Zhao Ziyi	The Second Ore Concentrating Experiment Mill	2001	6.5	The mill has a processing capacity of 150 tpd. Ore is mined from 2 pits producing 120 tpd	The mine and mill employ over 40 local workers and pay RMB 400,000 in taxes annually
Mr. Zhang Jude	The First Ore Concentrating Experiment Mill	2000	8	The mine has three open pits and a mill capacity of 250 tpd. The mill processes low-grade gold ore (less than 3 g/t Au)	The mine and mill employ 60 local workers and produces RMB 20 million with profits of RMB 2.6 million
Mr. Guo Shanshui	The Iron Powder Agglomeration Mill of Sanlian Company	August 2004	8.9	The mill has a processing capacity of 200 tpd, producing 80 tpd of iron concentrate. The concentrate is pelletized at a plant with a 100 tpd capacity	The mill employs 100 local workers and produces RMB 26 million with profits of RMB 3 million. The pelletizing plant increases the value of the iron concentrate by RMB 120/t

Source: Authors' interviews from 28 July to 6 August, 2005 in Lingbao City County, China.

enterprise. He also developed some recreational businesses, including fishing and tourism. In Chengcun village, Mr. Guo played a leading role in improving rural infrastructure and reducing poverty. Following his example, others such as Zhao Ziyi, Zhang Jude and Guo Shanshui also expanded their own ASM entities.

The ASM consolidation in Lingbao supported local economic growth. The county achieved profits of an estimated RMB 239,000,000, or US$33,194,445, in 2004, a 36.5% increase over production previous to consolidation. Lingbao produced 530,000 liang (about 8,50,000 ounces) in 2004. The ASM safety and environment record also improved and investments in rural infrastructure increased.

Conclusion

The development of ASM in China is coming to a crossroad where ASM can occur either in an orderly way along the current consolidation strategy or it can develop illegally. The role of government is to set up effective, practical policies and a clear legal system. Past ASM regulations in China have had many deficiencies and left several unresolved issues. The 1986 Mineral Resources Law did not establish clear articles in regard to procedures for executing the law, clear definitions of institutional structures or effective environmental regulatory bodies. The 1996 Mineral Resources Law achieved breakthroughs in the property management of exploration and mining rights, clearly separating them from the ownership of mineral resources. In addition, it established a clear structure for the acquisition of mining rights with compensation and allowed for the transfer of these rights. However, the 1996 Mineral Resources Law still had several controversial areas, including unclear management institutions for mineral resources, the lack of mineral property rights, unfair and unequal legal status of large-scale and small-scale mines, and conflicts of responsibilities and rights among different departments in the central government and between the central and local administrative bodies.

The main challenges currently facing ASM in China are reducing frequent safety incidents and adapting to the state's resource consolidation strategy. ASM coal mines, in particular, accounting for one-third of China's total production but two-thirds of colliery deaths □ have been and will continue to be given to the most important concern about their consolidation and formalization. The nationwide consolidation campaign, which started at the end of 2006 and is expecting to finish by the end of 2008, aims to close almost all small mines. Along with consolidating smaller operations into larger coal enterprises, China will not approve new coal mine projects with an annual capacity of less than 300,000 t during the 11th Five-Year Plan period (2006–2010). The new emphasis of the central government is to consolidate the ASM industry, through its campaign of rationalizing the distribution of mine development, optimizing mine enterprise structures, raising resource utilization levels, improving mine safety and reducing the ecological impact of mining. The consolidation strategy will undoubtedly provide an opportunity to implement the proposed revision of the mineral resource law, creating a more formal place for ASM in China.

The case study in Xiaoqingling ASM area demonstrates how ASM can move from an illegal/informal mining framework, characterized by a lack of regulations, poor safety, and poor environmental practice to a legalized consolidated system, leading to improved investment, production, safety and environmental protection. Our survey result indicates that the key to successful ASM consolidation was strong local cooperation, regulation, and monitoring. We also found that local government bodies need constant communication and interaction with other local ASM stakeholders, need to implement transparent regulations and strict standardization, and need an effective and efficient ASM strategy. We realized that the final aim of ASM consolidation and legalization should not be the institutionalization of a primitive and inefficient ASM sector and thus strongly suggested that China's long-term aim should be the transformation of the ASM sector into a legal and dynamic small and medium-sized mining industry which can help to meet China's resource needs in a safe and responsible manner.

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