Develop a Mine and Geology Park – The Best Choice for Large Open Mine When Completion

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SUMMARY

The Haizhou Open Coal Mine was put into production in July 1st, 1953 with a designed annual productivity of three million tons. As the completion of the coal mine, the enterprise was closed and interrupted. With 50 years of mining, a large pit was formed with 3.9 km long, 2 km wide, 350 m deep, and one billion square meters volume. How to deal with this large pit after completion of the mine had already put onto the agenda of local government even before its closure.

It is pointed in this paper that the formation of the pit experienced half century mining process. Its perfect rail transportation system, drainage system, power supply system, bottom inclined shaft mining heritage, water and sand refill heritage, different types of motor vehicles, mining machineries used for open and under mining all represented advanced international mining technologies. These heritages have extremely high scientific value. The mining bed cutting surface, geology structure, and fossil resources disposed in the mining process are precious for geosciences research. The mine pit and those drainage system, power supply system, transportation system, as well as heritages remain by mine bed geology cutting surface, refilling, sliding, slope strengthening, miner passenger path, inner and outer dumping area, and colliery waste mountain contain adequate contents systematically and completely. They are representatives even in the world. It is a record to modern mining industry history with extraordinary influences to the future. After a serious investigation, we think the completed open mine is a resource rather than a burden. The best choice is develop a mine and geology park on site.

The process of developing National Haizhou Open Mine Geology Park is also the process of comprehensive ecological treatment. The relationships of ecological and economic benefits as well as long term and short term benefits for comprehensive treatment are investigated at the same time in this paper. The plans for geology disaster prevention, vegetation restoration and rebuild, the general park construction, and land recovery in the mining area are proposed.

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1. INTRODUCTION

Haizhou Open Mine had been the main coalmine production base. At the same time of coal production, the mine also did a lot of social work such as forest planting and mine history museum development. As once the largest open mine in Asia and famous worldwide, it has attracted travelers and scientific researchers all over the world although large scale park development has not started. It is also one of the eight sights in Fuxin. Especially as one of the witness of coalmine industrial advancement in the past century, it has extraordinary influences.

Currently, the National Haizhaou Open Mine Geology Park (NHOMP) is in the planning the preparation phase. The China Geology Environment Monitoring Institute and Liaoning Technical University are consigned to plan and process the mine environment. Experts from China University of Mine and Technology, Beijing Yihe Garden, China Geology Environment Monitoring Institute, and Liaoning Technical University were invited to review the development of NHOMP. They have the common view that NHOMP has not only plenty of mine remain resources, but also large scale and outstanding features. It can be developed as a touring, scientific research, and educational thematic park. The project is in an area with good location and transportation conditions. The necessary infrastructure in the park is well. It has nice office, living houses and advanced communication facilities.

As the progress of the preparation work, the Fuxin government and Fuxin Mining Corporation will give support in human power, material resources, and financial founding. Developers from domestic and abroad also interested in the project. Some founding is carrying out.

2. NATURAL AND SOCIAL ENVIRONMENT

2.1 Natural environment

Haizhou Open Mine located at the southern part of Fuxin City. The Park is inside the urban area of Fuxiin City. Climate conditions are the same as Fuxin City.

Fuxin City belongs to northern temperate zone semi-continent and semi-drought monsoon climate area. The four seasons are clearly demarcated. Spring is shorter and summer is pleasantly cool. Rainfall is concentrate and comes together hot weather. Frost comes on early autumn and followed by severe winter. Southwest wind is mainly in summer while northwest wind in winter. The main climate features are listed in table 1.
The open mine pit area is seven kilometers. The northern side is two kilometers. Vegetation coverage is less than 10%. The mined pit is mainly wasted land consists of power sand rock,

conglomerate, and coal shale as well as filled up soil. According the investigation, the time from stopping mining is the factor which influences rock erosion, soil activity, and vegetation growing. The northern side is mainly immigrated area so vegetation recovered well.

Table 1. The climate features of Fuxin City

Annual average temperature	**Highest temperature**	**Lowest temperature**	**Daily largest temperature difference**
7.6 ^{0}C	40.3 ^{0}C	-29.8 ^{0}C	18 ^{0}C
Annual average sunlight	**Annual rainfall**	**Annual evaporation**	**Largest snow thickness**
2826 hours	520 mm	1942 mm	80 mm
Largest frozen thickness	**Annual average wind speed**	**Largest wind speed**	**Main wind direction**
1300 mm	2.7 m/s	29.7 m/s	NW
Frost-free days	**Earthquake basic intensity**		
153	6^0		

2.2 Social conditions

Haizhou Open Mine is inside Taiping district of Fuxin City where is the main coal production area. The east, south, and west is surrounded by underground mines. Southeast is Gaode underground mine. Southside is Sunjiawan Street. Southwest is number one and number seven entrances of Gaode mine as well as Wulong mine. West is Pingan mine. 500 meters of northwest side is Fuxin Power Plant and Fuxin Mine Corporation Machinery Factory. North side is Taiping and Gaode Streets. The national railway line from Xinlitun to Yixian passes through the north side of the open pit 500 meters away. Fuxin city is connected to nearby cities with highways. And there are two railways inside the mining area connected with other mine. There are 50 000 residents living around the mine with four primary schools, three middle schools, more than twenty factories, and 8 600 000 square meters civil buildings distributed in Taiping and Haizhou districts. Immigration has to be taken due to mining caused subsidence. Haizhou Open Mine currently has staff 16369. It declared bankrupt in 2005 due to mine completion.

Fuxin is a city with agriculture and mine. The total area is slightly more than one million hectares. Annual grain production is about 1.3 million tons. There is also forestry, stockbreeding, and freshwater fishery.

With the steady development of energy industry, multiple industries gradually developed which include machinery, chemistry, electronics, construction material, spinnery, light industry, and medicine. There are nearly thousand types of products. Some of them take certain proportion in the whole province. Improving local industry with the advantage of energy is one feature of rapid Fuxin industry development.

3. MINING HISTORY

3.1 Mining with national capital (from 1915 to 1933)

From 1913, there was a lot of Chinese capital invested in small scale mining in Fuxin. In December 1915, Wealthy Mining Company was developed by Feng Yanchen and bought by Han Ruilin in September 1919. The company was changed to Yufu Mine and then Yufu Mining Bureau in 1930.

The Japanese South Manzhou Corporation Ltd. (JSMCL) conspired to mining in the area. To resist the conspiracy, Zhang Xueliang developed the Sunjiawan Mine of Northeast Mining Bureau in February 1928. After March 1931, the Sunjiawan mine field was contracted to Tongyichang, Dexingshun, Ruizongxiang, and Tongxingshen. Zhang Xueliang and Han Ruilin were the largest mine owner at that time.

The mines were in small scale at that time. Mining depth was around 30 meters. Only the superficial coal could be mined and the operation was mainly manpowered. In 1919, the daily mine production of Han Ruilin was 75 to 85 tons. It was recorded that Zhang' and Han's mine production took 49.49% and 41.26% of the whole production in Fuxin respectively.

3.2 Japanese governing period (from 1933 to 1945)

From March 1, 1933, the mines of Zhang Xueliang were confiscated by the Second Army Corps of Bogus Manchuria and transferred to the secret agent of Japanese Northeast Army in October the same year. In May 1934, Manchuria Mine Corporation Ltd. (MMCL) was developed. In October 1936, Fuxin Agency of MMCL developed.

Haizhou Open Mining Agency was developed in March 1944 and the open mining was designed.

For the purpose of grazing coal mine in large scale, Japanese surveyed the whole mine area in 1935 and seized the whole field. Several underground mines and open mines developed by Japanese from 1935 to 1936.

Haizhou Open Mine was started in August 1944. Machines were used for mining in different mines. From 1936 to 1945, the total coal production was 9.5 million tons. Nearly half of it was from Sunjiawan Open Mine.

3.3 Kuomintang governing period (from August 15, 1945 to March 18, 1948)

After World War II, the Northeast Agency of Kuomintang Nanjing Government Economic Department received the mines in Fuxin in January 1946 and Fuxin Coal Mine Management Committee was developed. On October, the government developed Resource Committee

Fuxin Corporation Ltd. Several mines were restored but the production was only 28.1% of the Japanese governing period.

3.4 After liberation (from March 18,1948)

Fuxin was totally liberated in March 18, 1948. The management committees were developed in all mines and PLA representatives were sent to the mines. The Northeast Industry Department Mine Bureau pointed Huang Yuzhong and Zhang Mingyun as mine managers. Several small scale mine were joint to Haizhou and the open mine was restarted.

3.5 Figures of Haizhou Open Mine

In the first five-year-plan, Haizhou Open Mine was among the 156 national key large scale economic development projects. Designed productivity was three million tons annually. It was the largest in Asia and famous worldwide. Till the end of 2002, the investment in the mine was more than 398 million RMB (about 50 million US$). The total coal production was 208 million tons with peel off of 869 million cubic meters. The mine was bankrupted in 2005 due to completion of coal.

After bankrupt of Haizhou Open Mine, one seven square meters hole with depth of 350 meters was formed. There are also three cumulated coal rock mountains with volume of hundred million cubic meters, four with volume of ten million cubic meters, five with volume of one million cubic meters, and 340 smaller ones.

4. RELICS IN THE OPEN MINE

4.1 Mining relics

4.1.1 Mining pit relics

Apart from the seven square kilometers pit, there are railway motors, road motors, strap transportation system, drilling and blow up tools, collection equipment, power lines, and drainage systems near or inside the pit. Landslide prevention systems as well as other artificially formed sights are also inside the pit.

4.1.2 Mining area drainage system

The whole open mine drainage system consists of surface water block groove, in pit groove, drain pit, and canals.

4.1.3 Inside dumping areas

The inside dumping areas are located at the east and west sides of the pit. A natural slope rest delta is formed due to coal rock dumping and natural slide. The three levels in the east side

are 86, 34, and 14 with height difference of 70 meters while two levels in the west side are 82 and 34 with height difference of 50 meters. The total inside dumping volume is nearly 20 million cubic meters.

4.1.4 Underground relics

In the northern part, the former drainage pit had a inclined mine entrance. Workers could go down to –200 meter level with trolly.
Near the sorth side and the west side, there are also water and sand filling mining relics by Gaode and Wulong underground mines.

4.1.5 Transportation systems

The transportation systems include transport coal from mine to storage area, transport peel off soil and rock to dumping areas, as well as transport workers, equipments, and materials required. There are different ways of transportation include train, trucks, straps, and lifts. Railway is the main transportation mode for coal and dumping movement.

4.1.6 Power system

The power systems include supply to inside the pit, transportation, drainage, and dumping as well as to outside supplies. The power supply lines at the north side form a cobweb-like dense network.

4.1.7 Motors of different types

There are different types of motors of different models from different time and made in different countries such as Germany, Czech, former Soviet Union, and domestic.

4.1.8 Out side dumping area

The outside dumping area is six kilometers north of Fuxin City which takes 14.8 square kilometer. The dumping area is planning to reclaim for large-scale agriculture, forestry, and stock raising purpose.

4.1.9 Special mines

As the coal mine forms in the history, other special mines such as basalt, agate, and different kinds of animal and plant fossils are also formed around the basin.

4.2 Other mining related sights

4.2.1 Geology relics

There are large amount geology phenomenon appear with the mining process such as typical deposit geological sections, stratum structures, olden biology, typical terrain and topography, and geological disaster remains for scientific research.

4.2.2 Mining historical materials

With century's mining, Fuxin mining area and Haizhou Open Mine reserved large amount of rare culture materials and relics. Different types of tools and souvenirs recorded the prosperous and decline and also part of the history of mining in China and the world.

4.2.3 Mining related products and buildings

The special mines such as basalt and agate formed with the coal are used to make arts and crafts. Fuxin is now one of the main agate arts production areas.

5. CONCLUSION

For a coalmine industrial city in history, what can do after coal resources completed? The only way is transform to other industries. In this process, the mining remains can still play important role. The development of mining and geology park is the best choice for large open mine like Haizhou Open Mine when completion. It is not only making use of the mining remains, but also encouraging the economic, ecological, and social development through tourist industry.

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BIOGRAPHICAL NOTES

Professor **SHI Jingfeng** works as Professor and president in Liaoning Technical University, China. He is member of ISM, council member of The Liaoning Surveying and Mapping Society as well as Liaoning Geology Society. His main research areas include Mining Surveying, Geodesy, Surveying data processing and GIS

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